Embedded Modules: Compliance and Compatibility

Global electromagnetic field standards and regulatory requirements

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Legal Notice

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Summary

This report examines the requirements for compliance with human exposure standards for electromagnetic fields (EMFs) that may affect the use of embedded modules based on the GSM family of technologies generally operating at frequencies in the range 700 MHz to 3.5 GHz. The report also examines the electromagnetic compatibility (EMC) and electromagnetic immunity (EMI) standards relevant to automotive and hospital environments as these are areas of proposed application of embedded modules and where historically there have been issues raised in regard to the use of mobile phones. It does not address other restrictions that may apply to the use of mobile communications equipment in vehicles.

The document provides outline information on the process for applying for certification in key national markets, however, it is not a substitute for examining the specific technical regulations applicable to each market.

The GSMA has published *Embedded Mobile Guidelines* which lists a range of issues to be considered and incorporated into the design of the module. In addition to the existing guidelines this report identifies four variables that can be manipulated by the designer to achieve compliance with the relevant human exposure limits and the EMC/EMI limits for medical and automotive environments. The four variables are:

- Power reduction.
- Reduced duty cycle.
- Increased separation between the antenna and human contact.
- Alternative antenna selection.

However, two key questions for the designer are:

- Will the device be used closer than 20 cm of the body? Different safety criteria apply when the device is used within 20 cm of the body.
- Will the device be used in the medical environment? There are several standards that address the immunity levels of electro-medical equipment in the bands of operation of cellular phones and these immunity standards are generally the most difficult with which to comply.

Given that key decision points dictate the type of safety compliance measurements it is recommended that suitable experts are consulted during the design and prototype process. In addition, because the various national regulatory arrangements can be complex and subject to ongoing change it is further recommended that early in the design process consultation should take place with experts in the regulatory and compliance arrangements for the particular target markets.

Table of Abbreviations

3G	**3rd G**eneration mobile telecommunications
3GPP	**3rd G**eneration **P**artnership **P**roject
ANATEL	**A**gência **N**acional de **T**elecomunicações (Brazil)
ANSI	**A**merican **N**ational **S**tandards **I**nstitute
AQSIQ	**G**eneral **A**dministration of **Q**uality **S**upervision, **I**nspection & **Q**uarantine
BRA	**B**ureau of **R**adio **A**dministration (China)
CCC	**C**hina **C**ompulsory **C**ertification Certificate
CDMA	**C**ode-**D**ivision **M**ultiple **A**ccess
CE (Mark)	**C**onformité **E**uropéenne or **E**uropean **C**onformity (Mark)
CNC	**C**omisión **N**acional de **C**omunicaciones (Argentina)
CNCA	**C**ertification and **A**ccreditation **A**dministration of **C**hina
CIS	**C**ommonwealth of **I**ndependent **S**tates
CTIA	**C**ellular **T**elecommunications **I**ndustry **A**ssociation (The Wireless Association)
DECT	**D**igital **E**nhanced **C**ordless **T**elecommunications
EED	**E**lectro **E**xplosive **D**evice
EMC	**E**lectro-**M**agnetic **C**ompatibility
EMF	**E**lectro-**M**agnetic **F**ield
EMI	**E**lectro-**M**agnetic **I**nterference
ESA	**E**lectronic **S**ub **A**ssembly
EU	**E**uropean **U**nion
E-UTRAN	**E**volved **U**MTS **T**errestrial **R**adio **A**ccess **N**etwork
FCC	**F**ederal **C**ommunications **C**ommission (USA)
FDA	**F**ood and **D**rug **A**dministration (USA)
GCF	**G**lobal **C**ertification **F**orum
GERAN	**G**SM **E**DGE **R**adio **A**ccess **N**etwork
GPRS	**G**eneral **P**acket **R**adio **S**ervice
GSM	**G**lobal **S**ystem for **M**obile communications - originally **G**roupe **S**pécial **M**obile
HIPERLAN	**Hi**gh **Per**formance **R**adio **LAN**
HSPA	**H**igh **S**peed **P**acket **A**ccess
IC	**I**ndustry **C**anada
ICNIRP	**I**nternational **C**ommission for **N**on-**I**onizing **R**adiation
IEC	**I**nternational **E**lectrotechnical **C**ommission
IEEE	**I**nstitute of **E**lectrical and **E**lectronics **E**ngineers
ILO	**I**nternational **L**abour **O**rganization
ITU	**I**nternational **T**elecommunication **U**nion
KCC	**K**orea **C**ommunications **C**ommission
KDB	**K**nowledge **D**ata **B**ase (US FCC)
LAN	**L**ocal **A**rea **N**etwork
LMA	**L**imited **M**odular **A**pproval

LTE	**L**ong-**T**erm **E**volution
ME	**M**edical **E**quipment
MHRA	**M**edicines and **H**ealthcare products **R**egulatory **A**gency (UK)
MIC	**M**inistry of **I**nternal **A**ffairs and **C**ommunications (Japan)
MIIT	**M**inistry of **I**ndustry and **I**nformation **T**echnology (China)
MRA	**M**utual **R**ecognition **A**greement
NAL	**N**etwork **A**ccess **L**icense (China)
NCRP	**N**ational **C**ouncil on **R**adiation **P**rotection & Measurements
NGO	**N**on-**G**overnmental **O**rganization
NHS	**N**ational **H**ealth **S**ervice (UK)
OCD	**D**esignated **C**ertification **O**rganization (Brazil)
OET	**O**ffice of **E**ngineering and **T**echnology (FCC)
PBA	**P**ermit **B**ut **A**sk Procedure (US FCC)
PBR	**Private B**usiness **R**adio
PDA	**P**ersonal **D**igital **A**ssistant
PTCRB	**P**CS **T**ype **C**ertification **R**eview **B**oard
RF	**R**adio-**F**requency
RLAN	**R**adio **L**ocal **A**rea **N**etwork
RRA	**R**adio **R**esearch **A**gency (South Korea)
RTA	**R**adio **T**ype **A**pproval Certificate (China)
R&TTE	**R**adiocommunications **T**elecommunications **T**erminal **E**quipment (Directive)
SAR	**S**pecific **A**bsorption **R**ate (unit of W/kg)
SDoC	**S**uppliers’ **D**eclaration of **C**onformity
SEPA	**S**tate **E**nvironmental **P**rotection **A**dministration (China)
SIM	**S**ubscriber **I**dentity **M**odule
TAB	**T**elecom **A**dministration **B**ureau (China)
TAC	**T**echnical **A**cceptance **C**ertificate (Canada)
TCB	**T**elecommunications **C**ertification **B**ody
TCF	**T**echnical **C**onstruction **F**ile
TETRA	**T**errestrial **T**runked **R**adio **S**ystem
UMTS	**U**niversal **M**obile **T**elecommunications **S**ystem
UN	**U**nited **N**ations
USB	**U**niversal **S**erial **B**us
UTRAN	**U**niversal **T**errestrial **R**adio **A**ccess **N**etwork
WCDMA	**W**ideband **C**ode-**D**ivision **M**ultiple **A**ccess
WHO	**W**orld **H**ealth **O**rganization

Scope

This document applies only to the GSM family of technologies primarily GSM, GPRS, 3G (WCDMA), HSPA and LTE. The content examines requirements for compliance with human exposure standards for electromagnetic fields (EMFs) that may affect the use of embedded modules based on the GSM family of technologies generally operating at frequencies in the range 700 MHz to 3.5 GHz. It primarily addresses the standards that apply to exposures of the public. Many standards include specific restrictions (often allowing higher levels of exposure[1]) for professional users of radiofrequency (RF) transmitting equipment, however, it is assumed that embedded modules will be mostly intended for non-professional applications.

This document also examines the electromagnetic compatibility (EMC) and electromagnetic immunity (EMI) standards relevant to automotive and hospital environments as these are areas of proposed application of embedded modules and where historically there have been issues raised in regard to the use of mobile phones. It does not address other restrictions that may apply to the use of mobile communications equipment in vehicles.

The document provides outline information on the process for applying for certification in some markets. It is not a substitute for examining the specific technical regulations applicable to each market.

Recommendations are provided for amendments to the GSMA *Embedded Mobile Guidelines*[2] and areas of work identified in regard to compliance standards and regulations that would provide greater clarity for compliance assessment and potentially simplify requirements.

The document does not address the potential safety issues of use of RF transmitting modules in specialist environments such as potentially flammable atmospheres or in the presence of electro explosive devices (EEDs). It also does not address management of public concern about the deployment of embedded modules, for example, the response to deployment of smart meters[3] in California. The GSMA has an active program[4] addressing concerns about exposures to EMFs.

[1] The higher levels are related to consideration such as the *healthy worker effect* and that exposures under occupational conditions are for shorter periods (up to eight hours per day, five days per week) than may apply to the public.

[2] http://www.gsmaembeddedmobile.com/

[3] California Council on Science and Technology Smart Meter Report, available at http://www.ccst.us/news/2011/20110111smart.php

[4] http://www.gsmworld.com/health

Chapter 1

EMF Compliance and Compatibility Standards

Overview

It is important to state at the outset that there is no standard for safe levels of human exposure to EMFs that is globally mandated with a uniform legal basis. However, there are scientifically based recommendations that are widely implemented and supported by the World Health Organization (WHO)[5], the International Telecommunications (ITU)[6] and the International Labour Organization (ILO)[7]. Regulation of human exposure to EMFs is undertaken at the regional (for example, European Union – EU) or national level. In addition the regulatory treatment may differ between type of sources (devices or antenna sites) and exposed population (workers or the public).

This paper primarily focuses on standards and regulation relevant to public exposures as embedded modules are expected to have widespread[8] applications. The paper will also focus on applications in devices, whether the devices are fixed (smart meter) or mobile/portable (medical monitor).

The key factors in assessing compliance with exposure limits include:

- transmitter power;
- frequency of operation;
- directionality of antennas;
- proximity to the body when transmitting; and
- duty cycle of the transmissions.

The requirements for EMC are more consistently applied based on international standards. In general EMC refers to the ability of two pieces of electrical equipment to coexist without interference. The extent to which EMC issues may exist will be primarily determined by the level of fields (intentional or unintentional) transmitted by one device and the immunity of the other device to the influence of externally incident EMFs.

EMF Safety Standards

In the western world there are two main standards[9] setting organizations which have developed standards and guidelines used as the basis for the various regional and national standards for human exposure to EMFs that are in use today. The two main organizations are:

[5] www.who.int/emf

[6] www.itu.int – ITU-T Study Group 5.

[7] www.ilo.org

[8] The GSMA Embedded Mobile Initiative has a short-term goal to trigger market expansion to achieve 500 million connected embedded mobile devices by 2013. http://www.gsmaembeddedmobile.com/

[9] Standards generally have no legal basis unless mandated through regulations. The terminology for the documents containing EMF exposure limits includes standards, guidelines and recommendations. These terms will be used interchangeably throughout this document.

1. The Institute of Electrical and Electronic Engineers (IEEE)[10] that developed a series of standards called C95.1 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
2. The International Commission for Non-Ionizing Radiation Protection (ICNIRP)[11] that published Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (up to 300 GHz) – ICNIRP (1998).

In regard to the IEEE C.95.1, the 1991 version of this standard was superseded in 1999 and again in 2005 by updated standards following further review of the scientific literature. One of the most important changes was to harmonise the IEEE and the ICNIRP recommended exposure limits relevant to wireless devices used close to the head and body, such as mobile phones. However, the US Federal Communication Commission (FCC)[12] adopted a combination of the C95.1-1991 limits and those of the National Council on Radiation Protection and Measurements (NCRP)[13] into document FCC OET 65 (1997) and FCC OET 65c (2001). To date the FCC has been reluctant to open the rule making procedure needed to consider whether to harmonise the regulatory requirements of the FCC with those of most other countries, including the European Union.

For the cellular band frequencies both the IEEE and ICNIRP have used a *basic restriction*[14] known as the *Specific Absorption Rate (SAR)* which is a measure of the rate at which energy is absorbed in tissue normalized to the mass of the mass of tissue – the unit is watts per kilogram (W/kg). In general there are two SAR limits to be complied with – the whole body SAR and the localised or part-body SAR. The former applies when the whole body is exposed from a distant source such as from a macro cell antenna, and the latter when partial body exposures occur such as when using a mobile phone. There may also be specific limits for extremities such as the limbs or pinna[15].

SAR measurements are difficult and complex to perform and generally require specialized laboratory based test equipment and are routinely used to measure wireless devices close to the body[16]. IEC 62209-2[17] introduces the separation distance of 20 cm or less for the requirement to perform SAR measurements which is a general demarcation distance in many standards for performing SAR or RF field strength measurements. Where the source is more distant from the body compliance may be determined by measurement of exposure limits in terms of incident electric, magnetic or electromagnetic field parameters such as power density. These incident field parameters are termed by ICNIRP *reference levels*[18]. The relationship between incident field parameters and the SAR is derived from studies establishing an envelope of incident field that is conservative relative to the whole-body SAR limit.

The conservative nature of the reference levels means that the compliance boundary may be larger than that determined by direct measurement of SAR. In this case SAR based compliance assessments may be chosen so that it can be demonstrated that no compliance zone exists external to the physical dimensions of the device. This may have operational advantages such as avoiding the need for instructions requiring separations to be maintained.

In determining the separation distance for compliance assessment purposes the standards may refer to *intended use* or other similar terminology. This makes provision for reasonable criteria for compliance assessment without needing to consider all potential misuses of an RF device. There has been some discussion within the GSMA operator community

[10] The Institute of Electrical and Electronics Engineers, Inc. 3 Park Avenue, New York, NY 10016-5997, USA.

[11] ICNIRP c/o BfS Ingolstaedter Landstr. 1, 85764 Oberschleissheim, Germany.

[12] Federal Communications Commission Office of Engineering & Technology, Washington, D.C. 20554

[13] NCRP Report No. 86 (1986), Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields, National Council on Radiation Protection and Measurements (NCRP), Bethesda, MD.

[14] Basic restrictions are based directly on established health effects and for the frequencies of interest here, the physical quantity used to specify the basic restrictions is SAR.

[15] External ear.

[16] http://www.emfexplained.info/?ID=25593

[17] IEC 62209-2:2010 Ed 1.0 Human exposure to radio frequency fields from hand-held and body- mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz).

[18] Reference levels are given in terms of electric field strength (**E**), magnetic field strength (**H)** and power density (**S**) and are provided for practical exposure assessment purposes to determine whether the basic restrictions are likely to be exceeded.

about interpretation of this requirement in regard to manufacturer intended use relative to typical use by some consumers or normal conditions of use.

In the case of embedded modules, if exposure during use can occur at a separation less than 20 cm a SAR measurement would generally be required. Design choice in the positioning of any external antenna or the positioning of the embedded module within the host may ensure that a field strength measurement is sufficient.

For the general public the localised SAR limits are given in Table 1.

Table 1: FCC and ICNIRP Localised-Body SAR Limits

FCC OET 65 (1997) & FCC OET 65c (2001)	1.6 W/kg averaged over 1 g of tissue
ICNIRP (1998)	2 W/kg averaged over 10 g of tissue

For localised SAR only four countries[19] have adopted the 1.6 W/kg/1 g limit and these are USA, Canada, South Korea and Bolivia. The majority of countries have adopted the ICNIRP limit of 2 W/kg/10 g which is promoted by the World Health Organization (WHO)[20] and ITU[21]. As noted above the IEEE C95.1 (2005) has harmonized the localised SAR with that of ICNIRP, that is, 2 W/kg/10 g but this has not yet been adopted by the regulatory authorities of the USA or the other three countries.

In eastern-bloc countries there are generally significant differences in the philosophy underpinning the development of RF exposure limits. Russia does not have a limit for the localised SAR but China has harmonized the mandatory standard for cellular phones with the 2 W/kg/10 g - GB 21288 (2007). For convenience, an English translation[22] of GB 21288 (2007) is included in Enclosure A.

As stated previously, there are significant differences in the philosophy underpinning the development of RF exposure limits in some eastern bloc countries and this is particularly evident when considering the limits applicable to field strength and power density. A consequence of the different philosophy is that the field strength limits in some eastern European countries and China are much lower than in western countries. Most western countries have field strength limits based on ICNIRP (1998) or IEEE C95.1 (2005) but lower limits for cellular networks do apply in some countries, cities and local government areas[23]. The WHO has the most comprehensive list of applicable human exposure standards for EMF[24] although this is not completely up-to-date.

EMF Compatibility Standards

For separation distances of less than 20 cm between the transmitting antenna of the embedded module and the public access boundary, the localised SAR limits of 1.6 W/kg/1 g or 2 W/kg/10 g will be the limiting factor to assess compliance for the embedded module. Indeed this will always be the case for the compliance assessment of the stand-alone embedded module.

For separation distances greater than 20 cm, interference limits for other electronic equipment may be a factor in determining where the transmitting antenna for the embedded module should be located or what separation distance should be maintained between the host device containing the embedded module and other possibly sensitive electronic

[19] During 2011 there has been discussion in India regarding potentially changing from the ICNIRP requirements (adopted in 2008) to the FCC requirements. This was not finalised as of the date of this report.

[20] http://www.who.int/peh-emf/standards/en/

[21] ITU-T K52 Guidance on complying with limits for human exposure to electromagnetic fields, 12/2004. Series K: Protection against Interference. Telecommunication Standardization Sector, International Telecommunication Union.

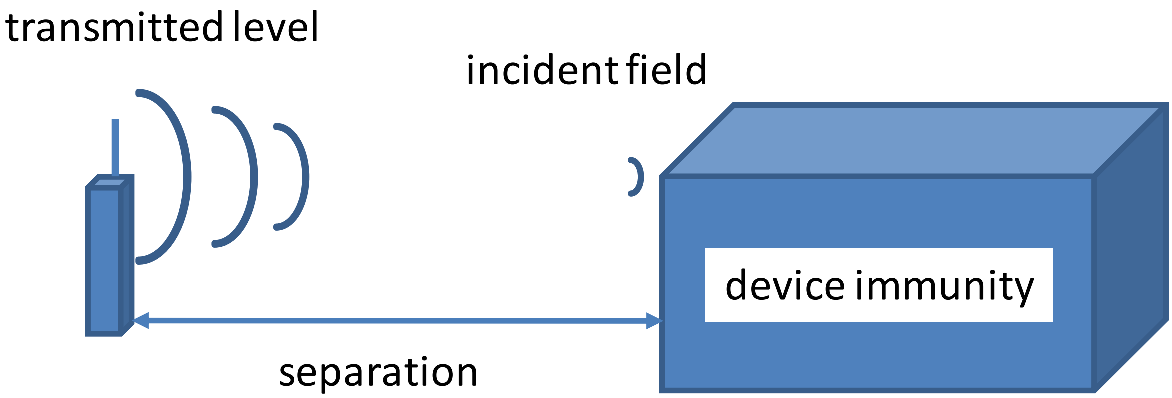
[22] The original Chinese language version is available on request.

[23] In some situations the application is backed by regulation (for example, Switzerland) and in others it is institutional policy and has no legal basis (for example, city of Salzburg, Austria).

[24] http://www.who.int/peh-emf/standards/en/

equipment. In the following section we consider the potential EMC and EMI issues associated with electro-medical equipment in the hospital environment and electronic sub assemblies (ESAs) in the automotive environment.

Figure 1: Schematic showing four of the main factors involved in determining EMC and EMI interactions.



As can be seen in Figure 1, one of the key factors to consider in determining whether an EMC issue may exist is the separation between the source and the electronic equipment as the field strength reduces rapidly with distance (see also Figure 2 on page 9).

Immunity Standards in the Electro-Medical Area

Several standards address the immunity levels of electro-medical equipment[25,26,27,28] in the bands of operation of cellular phones. Specifically Section 6.2.3 of IEC 60601-1-2 states:

- *Medical Equipment (ME) and ME Systems that are not Life-Supporting ME and ME Systems, shall comply with the requirements at an Immunity Test Level of 3 V/m over the frequency range 80 MHz to 2.5 GHz.*
- *Life-Supporting ME and ME Systems shall comply with the requirements at an Immunity Test Level of 10 V/m over the frequency range 80 MHz to 2.5 GHz.*

[25] AAMI TIR18:2010. Guidance on electromagnetic compatibility of medical devices in healthcare facilities. American Association of Medical Instrumentation, Arlington, VA.

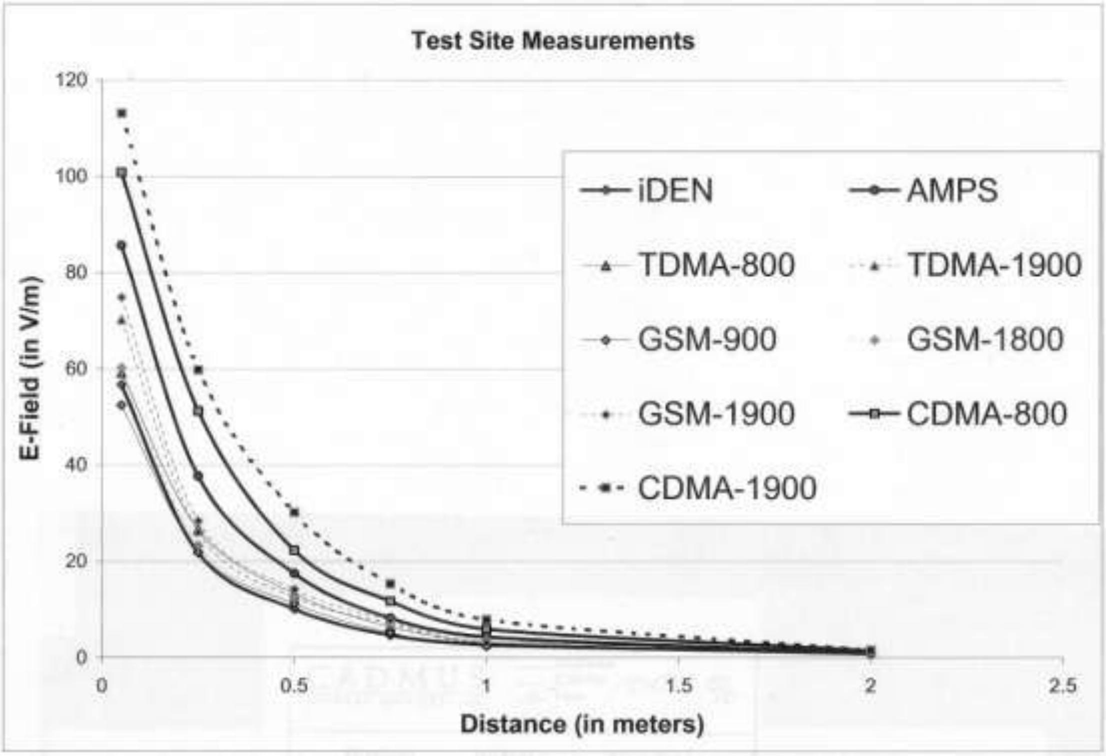
[26] IEC 61000-4-1 Ed 3.0 2006-10 Electromagnetic compatibility (EMC) – Part 4-1: Testing and measurement techniques.

[27] IEC 61000-4-3, Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test.

[28] IEC 60601-1-2 Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral standard: Electromagnetic compatibility - Requirements and tests.

Figure 2: Plot of electric field strength measurements at incremental distances from mobile phones of different technologies each transmitting at full power.

The measurements were performed in an anechoic chamber with an E-field probe and the phones set in test mode (Reproduced from Morrissey et al[29] & Morrissey[30]).



As can be seen from Figure 2 at distances less than 1 m, field strength measurements can exceed current immunity recommendations for both life-supporting ME (10 V/m) and not life-supporting ME (3 V/m). At distances greater than 1.5 m the field strengths fall off rapidly and are less than 3 V/m. These theoretical considerations are supported by measurements of the potential interference to medical equipment from mobile phones, including research[31] supported by the GSMA, which found that 3G-WCDMA handsets are unlikely to be a significant interference threat when compared to existing mobile communications technologies, even if a handset were to approach the surface of a medical device.

An approach to estimating the field strength from a mobile phone handset for medical equipment immunity testing has been proposed[32] based on the following formula:

$$E = k\frac{\sqrt{P}}{d} \qquad \text{Equation (1)}$$

where: P = output power of the transmitter in watts;
d = distance from the handset antenna in meters;
K = a constant in the range 0.45 to 7, dependent on the antenna.

[29] Morrissey, J.J. et al “Characterization of Electromagnetic Interference of Medical Devices in the Hospital Due to Cell Phones” Health Physics, 2002;82(1): 45- 51.

[30] Morrissey, J.J. Mobile Phones in the Hospital: Improved Mobile Communication and Mitigation of EMI Concerns Can Lead to an Overall Benefit to Healthcare, Health Physics, 2004;87(1):82-88.

[31] Potential GPRS 900/180-MHz and WCDMA 1900-MHz Interference to Medical Devices, Iskra et al., IEEE Transactions on Biomedical Engineering, 54(10):1858-1866, October 2007.

[32] Recommended practice for an on-site, ad hoc test method for estimating radiated electromagnetic immunity of medical devices to specific RF transmitters, ANSI C63.18-1997.

A value of k = 4.2 has been used in the GSMA supported research based on measurements of a GSM 900 handset leading to the following table.

Table 2: Estimated distance from handsets operating at peak output power level at which field levels occur.

	Test Field Levels			
Power Level (W)	**1 V/m**	**3 V/m**	**10 V/m**	**30 V/m**
2	6.00	2.00	0.60	0.20
1	4.20	1.40	0.42	0.14
0.125	1.50	0.50	0.15	0.05
	Distance from Handset (m)			

It is important to note that Table 2 is indicative only and is based on the use of k=4.2. However, k will vary for different handsets and depends on the efficiency and the gain of the device antenna. In particular if an antenna with significant gain is used with an embedded module than the separation distances could be substantially underestimated.

Alternatively Table C.7 in IEC 60601-1-2 provides recommended separation distances between mobile RF communications equipment and life-supporting and non-life-supporting equipment. The table is based on the following equations.

Table 3: Based on Table C.7 of IEC 60601-1-2 providing recommended separation distances.

Frequency Range	IEC 60601-1-2 Recommended Separation Distance	
	Life-supporting	**Non-life-supporting**
800 MHz to 2.5 GHz	$d = \frac{23}{10}\sqrt{P}$	$d = \frac{23}{3}\sqrt{P}$

IEC 60601-1-2 recommends a conservative approach based on the life-supporting medical equipment so the separation distances for each power level shown in Table 2 can be calculated as shown in Table 4.

Table 4: IEC 60601-1-2 Recommended Separation Distance for Mobile devices relative to life-supporting equipment.

	IEC 60601-1-2 Recommended Separation Distance (m)
Power Level (W)	**Life-supporting**
2	3.25
1	2.30
0.125	0.81

Recently health authorities have begun to relax the restrictions on the use of medical devices in healthcare facilities. As an example, the UK Medicines and Healthcare products Regulatory Agency (MHRA) in 2006 issued updated advice[33]

[33] http://www.mhra.gov.uk/

on the compatibility of medical devices with mobile communications. In summary the MHRA recommendations were as shown in Table 5.

Table 5: MHRA recommendations on the compatibility of medical devices with mobile communications.

Risk of Interference	Type of communication system	Recommendation
High	Analogue emergency service radios.	■ Use in hospitals only in an emergency, never for routine communication.
	Private business radios (PBRs) and PMR446. (two-way radios).	■ Minimise risks by changing to alternative lower risk technologies.
Medium	Cellphones (mobile phones). TETRA (Terrestrial Trunked Radio System). Laptop computers, palmtops and gaming devices fitted with higher power wireless networks such as GPRS and 3G. HIPERLAN.	■ A total ban on these systems is not required and is impossible to enforce effectively. ■ Should be switched off near critical care or life support medical equipment. ■ Should be used only in designated areas. ■ Authorised health and social care staff and external service personnel should always comply with local rules regarding use.
Low	Cordless telephones (including DECT). Low power computer wireless networks such as RLAN systems and Bluetooth	■ These systems are very unlikely to cause interference under most circumstances and need not be restricted.

The MHRA does not recommend a blanket ban on the use of mobile phones in hospitals, recognising that they are in everyday use and provide a practical means of communication for people. However, under certain circumstances, the electromagnetic interference from a mobile can affect the performance of some medical devices. Therefore, MHRA recommends that hospitals develop local rules to minimise the risk of interference with critical medical equipment and has produced posters that can be displayed to indicate areas in hospitals where mobile phones can and cannot be used.

This was followed in 2009 by advice from the UK government Department of Health[34] that states:

> *The working presumption should be that patients will be allowed the widest possible use of mobile phones in hospitals, including on wards, where the local risk assessment indicates that such use would not represent a threat to patients' own safety or that of others, the operation of electrically sensitive medical devices in critical care situations and the levels of privacy and dignity that must be the hallmark of all NHS care.*

The American Medical Association[35] has adopted a similar policy approach and there have been media reports that other jurisdictions are also relaxing restrictions.

Immunity Standards for Implanted Cardiac Pacemakers

The US Food and Drug Administration (FDA)[36] issues the following advice for persons fitted with an implantable cardiac pacemaker:

> *"But based on current research, cell phones would not seem to pose a significant health problem for the vast majority of pacemaker wearers. Still, people with pacemakers may want to take some simple precautions to be sure that their cell phones don't cause a problem.*

[34] Using mobile phones in NHS hospitals, Department of Health, January 2009.

[35] http://www.ama-assn.org/apps/pf_new/pf_online?f_n=browse&doc=policyfiles/HnE/H-215.972.HTM

[36] http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116311.htm

1. *Hold the phone to the ear opposite the side of the body where the pacemaker is implanted to add some extra distance between the pacemaker and the phone*

2. *Avoid placing a turned-on phone next to the pacemaker implant (e.g. don't carry the phone in a shirt or jacket pocket directly over the pacemaker)"*

However, the Japanese authorities recommend persons fitted with an implanted cardiac pacemaker to maintain a separation distance of 22cm from their mobile phones[37]. Embedded modules intended for cardiac monitoring while worn on-body may be required to demonstrate that they will not interfere with pacemaker function. Alternatively, such devices could be designed for use in a 'store-and-forward' mode, where the readings are taken and stored while the device is on the body and then transmitted with the device off the body.

Immunity Standards in the Automotive Area

The World Forum for Harmonization of Vehicle Regulations (WP.29)[38] provides a framework for globally harmonized regulations on vehicles. WP.29 is a permanent working party in the institutional framework of the United Nations (UN) with a specific mandate and rules of procedure. It works as a global forum allowing open discussions on motor vehicle regulations. Any member country of the UN and any regional economic integration organization, set up by country members of the UN, may participate fully in the activities of the World Forum and may become a contracting party to the Agreements on vehicles administered by the World Forum. Governmental and non-governmental organizations (NGOs) may also participate in a consultative capacity in WP.29 or in its subsidiary working groups.

Electrical equipment (including telecommunications equipment) intended to be fitted to a motor vehicle are considered to be 'Electronic Sub Assemblies (ESA)' and globally are required to meet WP.29 EMC and EMI limits[39] and the EMC and EMI limits contained in Directive 2004/104/EC[40] which forms part of European legislation for automotive type approval. The limits in both documents are harmonized and both documents also prescribe EMI limits for the vehicle as a whole. The annexes of both documents contain all the technical requirements necessary to demonstrate conformance which allows the ESA to be placed on the market.

The EMI limits to be observed for vehicles and ESA fitted to vehicles varies with the test methods selected which makes it difficult to give a specific EMI limit. However, for the vehicle as a whole the EMI limit for the test method specified shall be 30 V/m rms in over 90 % of the 20 to 2,000 MHz frequency band and a minimum of 25 V/m rms over the whole 20 to 2,000 MHz frequency band. For the ESAs, the free field test EMI limit shall be 30 V/m rms in over 90 % of the 20 to 2,000 MHz frequency band. It should be noted that the upper limit of 2 GHz excludes many of the bands used for 3G and LTE services.

[37] http://www.tele.soumu.go.jp/e/sys/ele/medical/index.htm

[38] http://www.unece.org/trans/main/wp29/meeting_docs_wp29.html?expandable=0&subexpandable=99

[39] http://www.unece.org/trans/main/wp29/wp29regs/r010r3e.pdf

[40] http://www.acero.ro/Directiva_2004_104_automotive_eng.pdf

Chapter 2

Low Power Exclusions and Compliance Assessment

Standards for Assessment of EMF Compliance

The IEC[41] develops standards for the measurement and calculation of EMFs. Specifically IEC 62479[42] standard is particularly helpful in providing generic guidance on simple compliance assessment methods to EMF exposure limits for low-power electronic and electrical equipment. Where such low power equipment cannot be shown to comply with the applicable EMF exposure requirements using the methods in this standard then IEC 62311 (2007) may be useful for compliance assessment. IEC 62311[43] is also a generic standard which applies to electronic and electrical equipment (not necessarily low power) for which no dedicated product or product family standard regarding human exposure to electromagnetic fields applies and provides assessment methods and criteria to evaluate electrical and electronic equipment against basic restrictions or reference levels for exposure of the general public.

Table 6 (page 14) adapted from IEC 62479 (2010) gives the low-power exclusion level P_{max} based on considerations of SAR. When SAR is the basic restriction, a conservative minimum value for P_{max} can be derived, equal to the localised SAR limit (SAR_{max}) multiplied by the averaging mass (m):

$$P_{\mathrm{max}} = SAR_{\mathrm{max}}\ \mathrm{m} \qquad \text{Equation (2)}$$

Example values of P_{max} according to the above equation are provided in Table 6 for cases described by ICNIRP (1998), FCC OET 65 (1997) and 65c (2001) and IEEE C95.1 (2005) where the various SAR limits are defined. Other exposure guidelines or standards may also be applicable depending on national regulations.

[41] International Electrotechnical Commission, 3 rue de Varembé CH-1211, Geneva 20, Switzerland.

[42] IEC 62479:2010 Assessment of the compliance of low-power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz).

[43] IEC 62311:2007 Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz).

Table 6: Example values of SAR-based *Pmax* based on methods of IEC 62479 (2010) for some cases described by ICNIRP, FCC OET 65 and 65c and IEEE C95.1-2005.

Guidelines / Standards	SAR limit, SARmax (W/kg)	Averaging mass, m (g)	Pmax (mW)	Exposure tier[a]	Region of body[a]
ICNIRP 1998	2	10	20	General Public	Head & trunk
	4	10	40	General Public	Limbs
FCC OET 65 & 65c	1.6	1	1.6	Uncontrolled environment	Head, trunk, arms, legs
	4	1	40	Uncontrolled environment	Hands, wrists, feet & ankles
IEEE Std C95.1-2005	2	10	20	Action level	Body except extremities & pinnae
	4	10	40	Action Level	Extremities & pinnae
	[a]Consult the appropriate standard for more information				

Recent research published by Ali et al.[44] and Sayem et al.[45], which was partly funded by GSMA, has shown that that the SAR-based low power exclusion levels specified in Table 6 for P_{max} are conservatively low. Annex B of IEC 62479 (2010) contains a Table (see Table 7 below) of some typical frequency bands of portable wireless devices and the corresponding predicted low-power exclusion levels P_{max}' which are significantly greater than Table 6 above.

Table 7 – Some typical frequency bands of portable wireless devices and corresponding low-power exclusion levels P_{max}' predicted based on a systematic study of canonical dipole antennas of different lengths and at different distances from a flat phantom.

f GHz	Free Space Antenna BW %	Air Interface	P_{max}' (mW)			
			s = 5mm		s = 25mm	
			m = 1g	m = 10g	m = 1g	m = 10g
0.925	7.6	GSM	41	129	185	375
1.920	7.3	GSM	11	44	132	302
2.045	12.2	UMTS	11	44	146	330
3.550	14.1	WiMAX	6.7	37	244	657
5.788	1.3	WiMAX	6.2	52	164	564

The relaxations in the low power exclusions supported by this research give rise to the possibility of significant simplification of the test requirements for embedded modules should the proposed exclusions be adopted into the normative text of relevant IEC and national standards.

[44] Ali, M., Douglas, M.G., Sayem, A.T.M., Faraone, A. and Chou, C-K. Threshold power of canonical antennas for inducing SAR at compliance limits in the 300-3000 MHz frequency range. IEEE Trans. Electromag. Compat., 2007; 49(1):143-152.

[45] Sayem, A.T.M., Douglas M. G., Schmid, G., Petric, B. and Ali, M. Correlating threshold power with free-space bandwidth for low directivity antennas, IEEE Trans. Electromag. Compat., 2009;51(1):25-37.

Chapter 3

Overview of Applicable Regulations

United States

All devices operating in the cellular bands have to be evaluated for compliance with the appropriate RF exposure limits and the US FCC has published a number of RF procedures and equipment authorization policies/rules[46] applicable to directly and indirectly to embedded modules. Title 47 of the Code of Federal Regulations applies to Telecommunications and Part 15 applies to Radio Frequency Devices[47]. Requirements for Modular Transmitters are specified in Subpart C Section §15.212. Of specific interest to this GSMA document are the following requirements:

(iv) The antenna must either be permanently attached or employ a “unique” antenna coupler (at all connections between the module and the antenna, including the cable).

(viii) The modular transmitter must comply with any applicable RF exposure requirements in its final configuration.

Limited modular approval also may be granted in those instances where compliance with RF exposure rules is demonstrated only for particular product configurations. The applicant for certification must state how control of the end product into which the module will be installed will be maintained such that full compliance of the end product is always ensured.

The Knowledge Data Base (KDB) contains policies, procedures and interpretations for the implementations of the regulations and specifically relevant is KDB 447489 Mobile and Portable Device - RF Exposure Procedures and Equipment Authorization Policies[48]. KDB 447489 should be used in conjunction with other relevant FCC policy and procedure documents found in the KDB materials including:

- KDB 628591 - Telecommunications Certification Body[49] (TCB) Exclusion List;
- KDB 388624 - Permit But Ask Procedure (PBA);
- KDB 178919 - Permissive Change Policies;
- OET Bulletin 65 and Supplement C 01-01, procedures at FCC OET Measurement Techniques[50].

The specific FCC test procedures, identified by KDB Publication numbers, are also available using links at the website (http://www.fcc.gov/oet/ea/eameasurements.html#sar). SAR measurement procedures presently available from this website are:

- KDB 248227- 802.11 a/b/g devices
- KDB 615223 - 802.16e/WiMax.

[46] These documents are revised periodically and the FCC website should be checked for the current version of relevant documents.

[47] http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=2aadad1540da90f1eb5488fb14e344c0&rgn=div5&view=text&node=47:1.0.1.1.14&idno=47#47:1.0.1.1.14.3.242.3

[48] KDB 447489 Mobile and Portable Device - RF Exposure Procedures and Equipment Authorization Policies, D01 Mobile Portable RF Exposure v04, 13 Nov 2009.

[49] A Telecommunication Certification Body (TCB) is an accredited organization with the authority to issue Grants of Certification for compliance with Federal Communications Commission Rules & Regulations.

[50] http://www.fcc.gov/oet/ea/eameasurements.html

- KDB 616217 - laptop computers.
- KDB 616217 Supplement - notebook/netbook and tablet computers.
- KDB 648474 - cell phones with multiple transmitters.
- KDB 865664 - 3 to 6 GHz devices.
- KDB 941225 - 3GPP/3GPP2 devices.
- KDB 450824 – SAR system accuracy verification.

A copy of KDB 447489 (v04, 13 Nov 2009) is included at Enclosure B of this document.

The FCC guidelines differentiate between *portable* and *mobile devices* according to their proximity to exposed persons. The FCC defines portable devices as devices whose radiating structures are designed to be used within 20 cm of the user and the RF evaluation must be based on SAR limits. A mobile device is a device whose radiating structure is designed to be used at distances of 20 cm or more from the body of the user and the RF evaluation can be based on field strength, power density or SAR measurements whichever is the most appropriate.

Where an embedded module is located in a fixed host such as a vending machine and the antenna is located 20 cm or more from user then the RF evaluation can be based on field strength, power density or SAR measurements, whichever is the most appropriate. As mentioned previously, 47 cfr §15.212 requires the antenna to be connected and RF exposure compliance established in the final configuration.

For portable exposure conditions, KDB 447489 specifies different SAR procedures for non-simultaneous and simultaneous transmissions. In the situation where multiple transmitters may be involved and they can transmit simultaneously, testing must be carried out with the multiple transmitters operating simultaneously.

Devices can be approved as either a transmitter or a module for use in stand-alone[51] portable exposure conditions and based on the SAR or output power level the following three conditions can be applied:

i) A device may be used in portable exposure conditions with no restrictions on host platforms when either the source-based time-averaged output power is $\leq 60/f_{(GHz)}$ mW or all measured 1-g SAR are < 0.4 W/kg. When SAR evaluation is required, the most conservative exposure conditions for all expected operating configurations must be tested.

ii) A device may be approved for use in multiple host platforms, each with similar family attributes, for example, PDA, laptop/notebook/netbook computers, and tablet computers, when each host platform is tested in the most conservative exposure conditions and the 1-g SAR is < 0.8 W/kg for all configurations.

iii) A device may be approved for use in a single platform when all hosts within the same platform have the same operating configurations and exposure conditions, with only minor configuration and construction differences. The most conservative exposure conditions among all host configurations within the platform must be fully tested (refer to Enclosure B for further details).

The above conditions are to be established using the specified SAR procedures in Enclosure B. There are a number of key requirements including but not limited to:

The antenna(s) and radiating structures must be tested for each host platform and device configuration according to the minimum separation distance expected for all applicable operations.

Installation and operating requirements, including restrictions, for the condition(s) above (i, ii and iii) and host platform(s) approved in the equipment authorization must be provided to OEM integrators and end users to comply with RF exposure requirements. See below.

The information required for approval is:

[51] Stand-alone portable exposure conditions apply to single or multiple transmitters that do not transmit simultaneously.

- Name, address;
- FCC ID;
- User/installation Manual;
- Circuit Description;
- Block Diagram;
- Schematics (when required);
- Measurement Reports;
- Photos internal, external & setup.

After assembling all of the information there are two approaches as shown in Table 8.

Table 8: Comparison between FCC and TCB Authorization Processes from Tannahill (2009)[52]

FCC Authorization	TCB Authorization
Electronically filed at: https://fjallfoss.fcc.gov/oetcf/eas/index.cfm	Electronically filed by TCB at: https://fjallfoss.fcc.gov/tcb/index.html
No login required to file	TCB login and password required to file
FCC Fee required	No FCC Fee payment
Initial review ~ 45 days	Grant issued in a few days
Info available to public when granted. Can approve all devices except computers and peripherals.	Info available to public when granted. No pre-grant FCC review. Can't approve new technology or devices without FCC accepted test procedures.

Canada

The Certification and Engineering Bureau of the Radio, Spectrum and Telecommunications Division of Industry Canada (IC) has developed the following procedures for the certification of radio equipment:

- The equipment must comply with the relevant technical standards.
- The equipment must have the appropriate Technical Acceptance Certificate (TAC) if required.
- The equipment must have the appropriate labelling to show that it meets the applicable standards.

Two key documents for Canada are:

- RSS Gen (2010)[53] which details general requirements and information for the certification of radio apparatus. RSS-Gen must be used in conjunction with the relevant RSS documents containing the technical requirements applicable to the type of radio apparatus concerned, and under which it must be certified. Except where otherwise specified in the applicable RSS, radio apparatus shall comply with the specifications and methods prescribed in RSS-Gen. A copy of RSS Gen (2010) is included at Enclosure C of this document.

[52] http://www.fcc.gov/oet/ea/presentations/files/may09/May09_Overview_FCC%20Regs_Licensed_Unlicensed_Devices.pdf

[53] RSS-Gen General Requirements and Information for the Certification of Radio Apparatus Issue 3December 2010.

- Safety Code 6 (2009)[54] which details the relevant RF safety limits for compliance.

Other relevant documents include:

- RSS-102 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands). Issue 4, March 2010.
- RSP-100 Radio Equipment Certification Procedure'. Issue 9, June 2007.

Two categories of equipment have been defined in the Canadian Regulations:

- Category I equipment must meet technical standards and requires a TAC. Cellular phones, portable radio transmitters and wireless computer links are included in Category I equipment.
- Category II equipment must meet technical standards but does not have to be certified.

RSS-Gen (2010) deals specifically with the modular approval for Category I or Category II equipment and permits the installation of the same module in a host device or multiple host devices without the need to recertify the device (refer Enclosure C Section 3.2).

Transmitters designed as modules for the installation in a host device may obtain equipment certification as a modular device provided that the applicable RSS is met and the following conditions with respect to labelling (Enclosure C Section 3.2.1) and Equipment Certification Requirements including a check list (Enclosure C Section 3.2.2) are met.

Section 3.2.3 of Annex C deals with Limited Modular Approval (LMA) which may be granted when one or more of the requirements of the check list in Section 3.2.2 cannot be demonstrated. LMA will also be issued in those instances where applicants can demonstrate that they will retain control over the final installation of the device, such that compliance of the end product is assured. In such cases, an operating condition on the LMA for the module must state that the module is only approved for use when installed in devices produced by a specific manufacturer. When LMA is sought, the implications for embedded modules are that the application for equipment certification must specifically state how control of the end product into which the module will be installed, and will be maintained, such that full compliance of the end product is always ensured.

The application for equipment certification must be prepared and submitted in accordance with IC document RSP-100, Radio Equipment Certification Procedure, or the equivalent Certification Body[55] document. A test report not more than one year old from the application date must be submitted with the application for certification. Before equipment certification is granted it must be demonstrated through accredited test reports that the equipment complies with all the relevant technical standards[56] in addition to those related to RF exposure.

Some countries in South America such as Venezuela, Peru, and Chile will accept test reports from foreign laboratories, but other countries such as Argentina and Brazil require testing to be performed by an accredited lab within the country.

[54] Health Canada Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz Safety Code 6 (2009).

[55] Certification Bodies can be Canadian or overseas laboratories and both must accredited either locally or via a MRA.

[56] RSS-132 Cellular Telephones Employing New Technologies Operating in the Bands 824-849 MHz and 869-894 MHz. Issue 2, September 2005. RSS-133 2 GHz Personal Communications Services. Issue 5, February 2009. RSS-139 Advanced Wireless Services Equipment Operating in the Bands 1710-1755 MHz and 2110-2155 MHz. Issue 2, February 2009. RSS-210 Issue 7, June 2007 Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment. Telecommunications Equipment Regulatory Process can be found at: http://www.ic.gc.ca/eic/site/mra-arm.nsf/eng/h_nj00055.html Certification and Engineering Bureau can be found at: http://www.ic.gc.ca/eic/site/ceb-bhst.nsf/eng/home Reference Publications: can be found at: http//www.ic.gc.ca/eic/site/ceb-bhst.nsf/eng/h_tt00011.html Information on Conformity Assessment Bodies can be found at: http://www.ic.gc.ca/eic/site/ceb-bhst.nsf/eng/h_tt00039.html and the Standard Radio System Plan: http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf06130.html

Argentina

The Telecommunications Regulatory Agency in Argentina is the Comisión Nacional de Comunicaciones[57] or CNC and they have indicated that CNC does not have any specific regulations for embedded modules and that from the certification point of view, such equipment would most probably be considered like any other radio equipment (GSM and 3G handsets) and this would apply to SAR and RF field strengths limits whatever was appropriate as well as all the other demanded certification procedures.

The Argentinean limits for SAR[58] and exposure to RF field strengths[59,60] are entirely consistent with those of ICNIRP.

Brazil

The Brazilian Agency for Telecommunications is Agência Nacional de Telecomunicações[61] or ANATEL. The latest information from ANATEL is that they currently treat embedded RF modules similar to other Category I[62] user access radio equipment and the "need for SAR certification would depend on the analysis of the final use/user conditions of the equipment, in relation to the public". Even though an embedded module may be mounted in a stationary/transportable host, a SAR test could be demanded if the module is installed where general access maybe within distances of 20 cm or less. If separation distance is 20 cm or less, ANATEL would formally demand an evaluation by a Designated Certification Organization[63] (OCD), which would define if SAR tests are needed. The Brazilian limits for SAR and exposure to RF field strengths[64] are entirely consistent with those of ICNIRP.

An English translation of the Regulation on the Certification and Authorization of Telecommunications Products, Annex to Resolution 242 of 30 November 2000 is included in Enclosure D.

ANATEL is currently considering the regulation of smart meters employed in the electricity distribution network.

China

In China the only products for which mandatory SAR regulations exist are mobile phones and the localised SAR limit is 2 W/kg/10 g. For convenience an unofficial English translation of the national standard GB 21288 (2007) can be found at Enclosure A.

From the radio perspective there are 3 relevant certificates required for the type approval of telecommunications products in China. These are:

- Network Access License (NAL) which is administered by the Telecom Administration Bureau (TAB) of the Ministry of Industry and Information Technology (MIIT).

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[57] http://www.cnc.gov.ar/

[58] Latin American Experts Committee on High Frequency Electromagnetic Fields and Human Health. Scientific review: Non-ionizing electromagnetic radiation in the radiofrequency spectrum and its effects on human health. 2010 Jun. Available at: <http://www.wireless-health.org.br/downloads/LatinAmericanScienceReviewReport.pdf>

[59] Ministry of Communications Resolution 530/2000 (Official Gazette No. 29,556, 12/29/1912) National Security standard mandatory for all telecommunications systems which radiate certain frequencies.

[60] National Communications Commission Resolution 3690/2004 (Official Gazette No. 30,524, 10/11/04) Provides that the authorization holders and radio stations licensees of broadcasting stations must demonstrate that radiation generated by the antennas of their stations do not affect population in the space surrounding them. Protocol for the evaluation of non-ionizing radiation.

[61] http://www.anatel.gov.br/Portal/exibirPortalInternet.do#

[62] http://www.anatel.gov.br/Portal/exibirPortalRedireciona.do?codigoDocumento=256431

[63] A Designated Certification Organization (OCD) is a legally constituted technical institution which, by delegation from ANATEL, conducts the conformity assessment procedures for telecommunications products, within the framework of compulsory certification, and sends the corresponding certificates of conformity. Certificates of conformity of products for telecommunications sent by OCDs are prerequisite to obtaining of approval by ANATEL, for marketing purposes and legal use of these products in Brazil.

[64] Annex to Resolution 303 of July 2, 2002 - About Rules Limiting Exposure to Electric Fields, Magnetic and Electromagnetic Radio Frequencies in the range between 9 kHz and 300GHz.
http://www.anatel.gov.br/Portal/exibirPortalRedireciona.do?codigoDocumento=41593

- Radio Type Approval Certificate (RTA or TAC) which is administered by Bureau of Radio Administration (BRA) of MIIT.
- China Compulsory Certification (CCC) Certificate which is administered by the Certification and Accreditation Administration of China (CNCA) within General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ).

There is overlap between the tests required for these three certificates. For the NAL and CCC the overlap is in the safety testing with respect to SAR tests and the EMC testing where the CCC requires EMI tests. However, the EMC and Safety test reports can be transferred between the NAL and CCC certification processes to avoid duplicate testing. The procedure for the approval of data modules is similar – first the NAL approval is required then the reception centre for the TAB will distribute the test samples to the different testing laboratories for approval.

There are two national standards which specify field strength exposure limits for general public:

- Hygienic standard for environmental electromagnetic waves, GB9175 (1988) which is administered by the Ministry of Health.
- Regulation for electromagnetic radiation protection, GB8702 (1988) which is administered by the State Environment Protection Agency (SEPA).

It would appear that GB8702 (1988) is enforced for mobile network infrastructure via measurements performed by regional and municipal EPA offices.

For a representative frequency range of interest to cellular networks Table 9 gives a comparison between the limits in the two Chinese Standards and those of ICNIRP (1998)

Table 9: Comparison between the limits in the two Chinese Standards and those of ICNIRP (1998).

Frequency (MHz)	GB9175 Safe/Intermediate Area (W/m^2)	GB8702 (W/m^2)	ICNIRP (1998) (W/m^2)	Difference Factors to ICNIRP (1998)
900	0.1/0.4	0.4	4.5	45/11.25
1800	0.1/0.4	0.4	9	90/22.5
3000	0.1/0.4	0.4	10	100/25.0
6000	0.1/0.4	0.8	10	100/12.5

For convenience copies of unofficial English translations of both of these standards can also be found in Enclosure A.

The SEPA, MIIT and other relevant ministries are in the process of developing a new standard for environmental levels of RF energy but it is not known when a public discussion draft will be available.

Currently in China the situation is that all mobile handsets need certification and approval and the environmental levels from cellular network infrastructure are monitored by the various branches of the SEPA. Whilst GB 8702 has an exclusion clause for transportable infrastructure of ≤ 15W it does not appear to be applied to fixed infrastructure.

Japan

The Japanese Ministry of Internal Affairs and Communications (MIC) has produced an informative website containing the information relevant to 'Protection from Radiowave Environment'[65]. The SAR regulations applicable to mobile phones are based on those of ICNIRP, 2 W/kg/10 g but currently there are no specific regulations applicable to

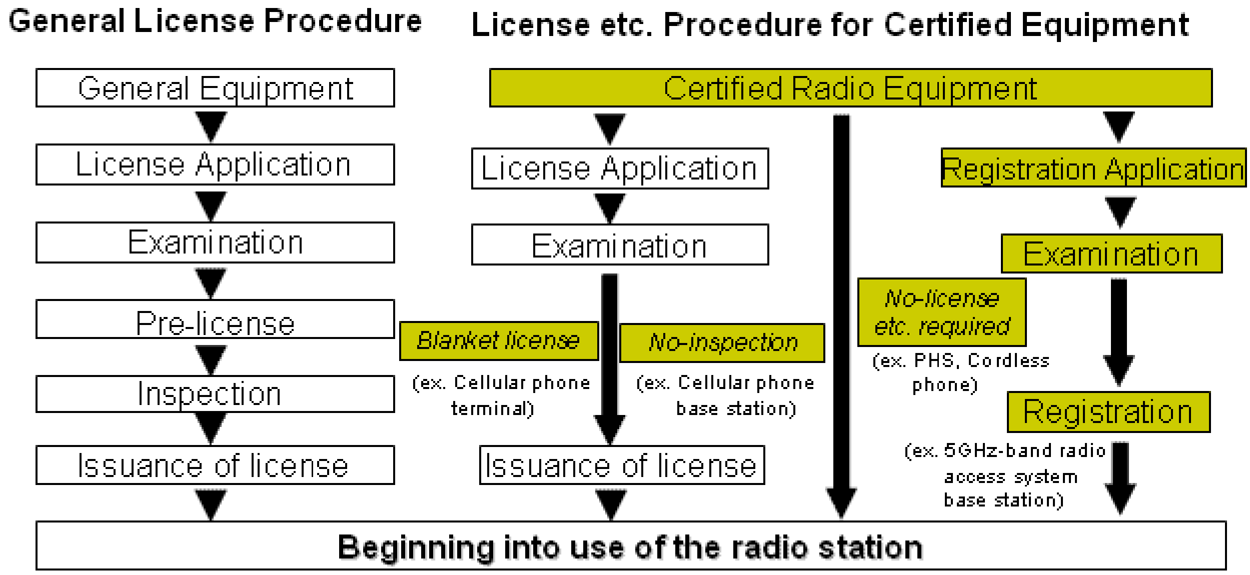
[65] http://www.tele.soumu.go.jp/e/sys/ele/index.htm

embedded modules or computer dongles, these are under development. However, the processes of the FCC outlined above have been used informally to-date.

The current field strength exposure guidelines called the ‘Radio-Radiation Protection Guidelines for Human Exposure to Electromagnetic Fields’ were published in 1997 by Telecommunications Technology Council of the previous Ministry of Posts and Telecommunications. The guidelines for members of the general public can be found in the 2000 Report of the Telecommunications Technology Council Report[66]. The limits are consistent with those of the ICNIRP (1998).

The MIC has also produced an informative website containing summary information on the Technical Regulations Conformity Certification System[67] a copy of which is included at Enclosure E.

Figure 3: Schematic of the MIC Certification Procedure which includes a Suppliers Declaration of Conformity.



The MIC regulates testing procedures for specified radio equipments which includes cellular phones and embedded modules, shown in schematic form in Figure 3. Manufacturers may use registered certification bodies, Suppliers’ Declaration of Conformity (SDoC) or mutual recognition agreements (MRAs) which currently exist between Japan and Europe, Japan and Singapore and Japan and USA. Current contacts for registered certification bodies and test laboratories registered under the MRAs are listed in Enclosure E. Also listed are the procedures to be followed for SDoC.

South Korea

The Korea Communications Commission (KCC)[68] and the Radio Research Agency (RRA)[69] are the relevant agencies in Korea responsible for the administration of the radio regulations and safety issues relevant to telecommunications. The Korean regulations for base stations and environmental levels of RF are based on ICNIRP but the SAR limits for handsets are based on the US FCC limit of 1.6W/kg/1g. Translations of both the exposure standards and the Conformity Evaluation Procedure for Radio Equipment can be found in Enclosure F.

The RRA website contains a lot of background information in English, particularly the conformity assessment system, designated test laboratories and MRA that currently exist between South Korea and Canada and South Korea and USA.

[66] http://www.tele.soumu.go.jp/resource/e/ele/body/pdf/ttc.pdf
[67] http://www.tele.soumu.go.jp/e/sys/equ/tech/index.htm
[68] http://eng.kcc.go.kr/user/ehpMain.do
[69] http://rra.go.kr/eng/index.jsp

European Union

Although developed as guides to the application of harmonized standards to multi-radio and combined radio and non-radio equipment for demonstrating compliance with the EMC Directive[70,71] and the effective use of the radio frequency spectrum[72] the general approach outlined in these references is also applicable to demonstrating compliance to the relevant RF exposure limits[73]. The RF exposure limits mirror those of ICNIRP (1998).

A washing machine, whatever communication or microprocessor modules are used in it, remains basically classified as household equipment for the application of standard and the communication or microprocessor modules will be subject to the R&TTE Directive[74]. The R&TTE Directive applies to all radio equipment and to telecommunications terminal equipment intended to be connected to public telecommunications networks.

A Notified Body, in the European Union, is an organisation that has been accredited by a Member State to assess whether a product meets certain mandatory standards. Assessment can include inspection and examination of a product, its design and manufacture and this will involve the Technical Construction File (TCF). For example, a Notified Body may designate that a telecommunications device conforms to the R&TTE Directive, which defines the standards for telecommunications devices. With this Declaration of Conformity, the manufacturer can label the product with the CE Mark, which is required for distribution and sale in the EU. A list of notified bodies for the R&TTE Directive can be found on the Enterprise and Industry website[75] of the European Commission.

CIS Countries

The Commonwealth of Independent States (CIS) is a regional organization whose participating countries are former Soviet Republics, formed during the breakup of the Soviet Union. Prior to July 2010 the Russian limit values and measurement method for EMFs from mobile devices were contained in regulation SanPiN 2.1.8/2.2.4.1190-03. An English translation is provided at Enclosure G**.**

In July 2010 a Customs Code came into force in a trilateral agreement between Belarus, Kazakhstan and Russia. As a result the so called hygienic certificates for mobile phones and devices operating in the cellular bands were no longer issued nor required in Russia[76]. Once the three countries introduce uniform technical regulations on a particular group of devices, the relevant national technical regulations are revoked. Decisions will be taken only within the confines of the Customs Union technical regulations.

The Agreement on Common Principles and Rules of Technical Regulation in Belarus Republic, Kazakhstan Republic and Russian Federation was signed by the three parties on November 18, 2010 and whilst SanPiN 2.1.8/2.2.4.1190-03 was no longer enforced the contents of the regulation were included in *The Common Sanitary-Epidemiologic and Hygienic Requirements for the Goods Subject to Sanitary Surveillance on the Territory of the Customs Union*. The limit values and measurement method of SanPiN 2.1.8/2.2.4.1190-03 were adopted by the Customs Union Commission's decision No. 299 dated May 28, 2010 as per "Part 7" on http://www.tsouz.ru/KTS/KTS17/Pages/P2_299.aspx [see p.733 and p.813 (item 5.19)].

[70] CENELEC Guide 25 Edition 3/December 2009, Guide on the use of standards for the implementation of the EMC Directive to apparatus.

[71] ETSI TR 102 070-1 V1.2.1 (2003-12), Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide to the application of harmonized standards to multi-radio and combined radio and non-radio equipment; Part 1: Electromagnetic Compatibility.

[72] ETSI TR 102 070-2 V1.1.1 (2002-11), Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide to the application of harmonized standards to multi-radio and combined radio and non-radio equipment; Part 2: Effective use of the radio frequency spectrum.

[73] 1999/519/EC, Council Recommendation on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz).

[74] 1999/5/EC, Directive of the European Parliament and of the Council on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

[75] http://ec.europa.eu/enterprise/newapproach/nando/index.cfm?fuseaction=directive.notifiedbody&dir_id=22&type_dir=NOCPD&pro_id=99999&prc_id=99999&ann_id=99999&prc_anx=99999

[76] This may only be a temporary measure ahead of a planned restructuring of the national certification system in Russia.

The draft Technical Regulation "On Safety of Communication Devices" which initially contained SAR limits has not been adopted in Russia. At the moment it is unclear whether the document will provide the basis for the common technical regulation or not, though responsibility for its development lies with Russia. The new common regulation might have different structure (content) and may not include health and safety norms. Terms of development and the adoption of the regulation are not yet determined and it is not included in the list of 47 priority technical regulations on the most important kinds of mutually supplied goods which are to be adopted in 2011.

Certification Bodies

Global Certification Forum (GCF)[77]

The GCF maintains an independent certification scheme for mobile phones and wireless devices that are based on 3GPP standards. The GCF has streamlined their processes to clarify and simplify the certification paths for all devices incorporating 3GPP connectivity. Two distinct device categories and routes to Certification are now recognized:

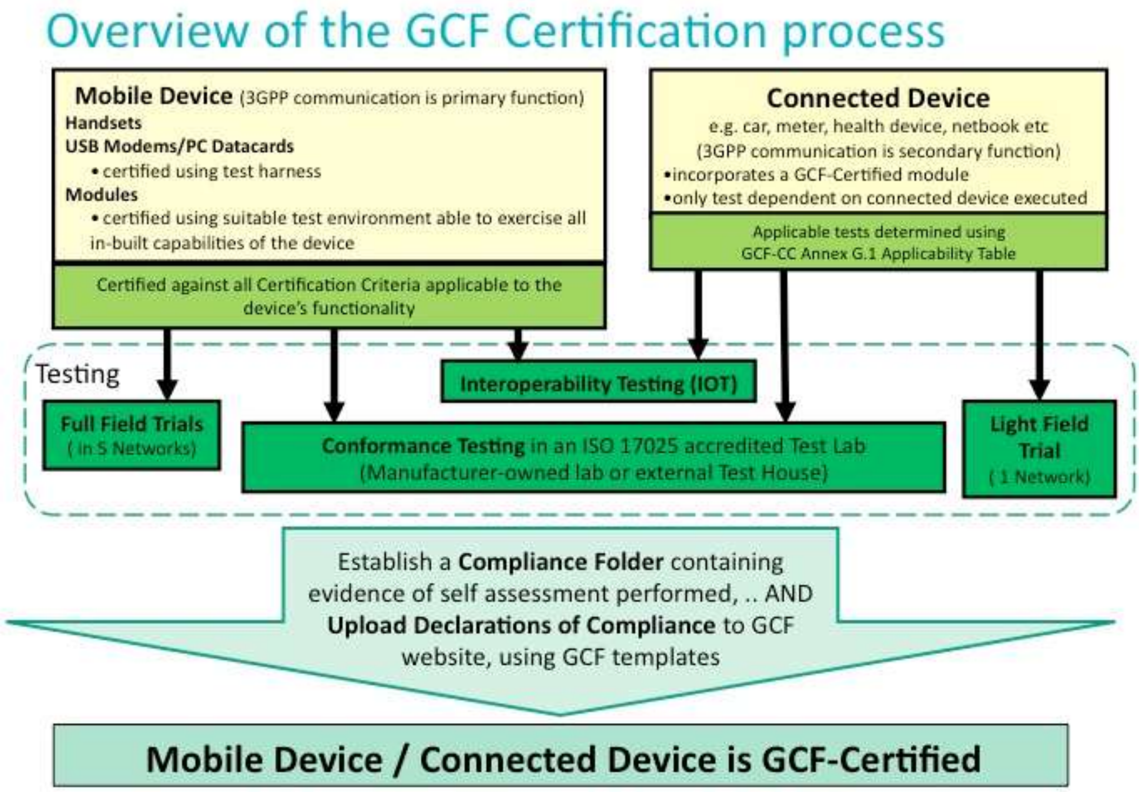
- In devices such as handsets, USB modems, data cards and 3GPP wireless modules – where 3GPP communication is the primary function of a device – GCF's well established certification process remains unchanged.
- A streamlined certification process has been launched for products where wireless communications has been incorporated by means of a GCF-certified embedded 3GPP wireless module but is not fundamental to the primary function of the device.

By explicitly linking the certification of a device to the certification of its embedded module, GCF has been able to reduce the number and scope of tests that need to be applied to the device. Testing of devices that are eligible for this new scheme is now focused on functionality such as antenna, SIM contacts and user-interface specifically provided by the device rather than its 3GPP module. The GCF has also produced an extensive document *Guidelines for the certification of devices incorporating embedded wireless modules*[78]. Figure 4 (reprinted from the GCF Guidelines) shows an overview of the GCF Certification Process.

[77] http://www.globalcertificationforum.org/WebSite/public/home_public.aspx

[78] GCF Guidelines for the certification of devices incorporating embedded wireless modules, December 2010. URL: http://www.globalcertificationforum.org/WebSite/document/public/Guidelines_for_the_certification_of_devices_incorporating_embedded_wireless_modules.pdf

Figure 4: Overview of the GCF Certification Process.



PTCRB[79]

The PTCRB was created by operators to establish a third party certification scheme to ensure the device meets a minimum set of requirements established by the operator members. Full operator members require all devices to be PTCRB certified and may block devices which have not received PTCRB certification. The purpose of the PTCRB is to provide the framework within which GERAN[80], UTRAN[81], and E-UTRAN[82] device certification can take place for members of the PTCRB. This includes, but is not limited to, determination of the test specifications and methods necessary to support the certification process for GERAN, UTRAN, and E-UTRAN devices. This group will also be responsible to generate input regarding testing of devices to standards development organizations.

The Cellular Wireless Association (CTIA)[83] has been assigned as the administrator for the PTCRB certification process. CTIA has also assumed responsibility for administration of the PTCRB issued IMEIs. This is a global scheme and the requirements for Certification are set forth by the PTCRB Operator member companies, not CTIA. Testing is performed in all bands.

The manufacturer will submit a request for certification via the certification database – located on the PTCRB website. During this process the manufacturer will select a primary lab and that lab will be responsible for all testing done on the device. The testing required will be determined by the lab based on the devices capabilities.

[79] http://www.ptcrb.com/. The PTCRB was established in 1997 as the certification forum by North American mobile operators and originally was an acronym for *PCS Type Certification Review Board,* however, it no longer has that meaning.

[80] GERAN- GSM EDGE Radio Access Network. The standards for GERAN are maintained by the 3GPP.

[81] UTRAN - Universal Terrestrial Radio Access Network. The standards for GERAN are maintained by the 3GPP.

[82] E-UTRAN the air interface of 3GPP's Long Term Evolution (LTE) upgrade path for mobile networks.

[83] http://www.ctia.org/

Upon completion of the testing, the lab will submit the required test reports and any supporting documentation to the certification database. Also the manufacturer will be required to submit any relevant documentation to the certification database. CTIA will then ensure that all requirements have been met, and then issue a certification notice to the manufacturer.

Modules and Integrations

Modules are fully tested and certified, similar to a mobile phone. Integrations that incorporate certified modules have the benefit of already having had the vast majority of test cases completed when the module was certified. The only testing required will be that associated with the interfaces associated with the integration, such as the SIM, power, and RF interfaces. Integrators will follow the same process as indicated in the general section with the exception that the integrator shall indicate which certified module they are using when entering their product into the database. Integrations may use the same PTCRB Program Management Document (PPMD) requirements document version as the module and use the test results of the module, provided they are using the same software and hardware versions as the certified module. The PTCRB has produced an extensive document[84] which goes into considerable detail on the testing requirements for certification of modules and integrations.

[84] PTCRB Program Management Document, Process Overview of PTCRB Device Type Certification and IMEI Control, Version 1.6, 20 December 2010. Note this document can be accessed via http://www.ptcrb.com/File/documents.cfm?tab=documents&ID=3 but only after registration at http://www.ptcrb.com.

Chapter 4

Design and Compliance Recommendations

Guidelines for Embedded Modules

The GSMA has published Guidelines for Embedded Modules[85] which lists a range of issues to be considered and incorporated into the design of the module. With respect to the antenna and transmitted there are a number of specifications which have significant bearing on the RF safety and interference questions.

- Every embedded module must have an antenna interface – either an antenna pad or antenna connector to enable the antenna to be directly soldered to the module or connected to the module by a RF cable.
- Since the antenna is a key component for enabling wireless technology, its critical design parameters such as mounting location and space allocation should be considered in the early phases of the Host Device development process in order to maximise its performance.
- The 3G/2G functionality must be integrated with the Host Device in such a way as to minimise any possible interference with other components.
- The embedded module and embedded Host Device shall meet minimum radiated power performance requirements in order to prevent a direct impact to overall mobile network efficiency and ensure a good end user experience in terms of performance that is, data rates and coverage.
- The transmitter power should be set to such levels that comply with the network requirements and the integrated product should be designed to comply with Regulatory safety requirements.

Guidelines for Safety and EMC/EMI Design

The above specifications must be taken into account by the designer of the module. Also, when designing the module for compliance with the relevant human exposure limits and the EMC/EMI limits for medical and automotive environments there are four variables that the designer can manipulate to achieve this aim. The four variables are:

- Power reduction which may also conflict with the minimum radiated power performance.
- Reduced duty cycle which may also conflict with the user experience in terms of performance and data rates.
- Increased separation between the antenna and human access.
- Alternative antenna selection.

Figure 5 (page 28) is a flow chart presentation of the decisions and actions that should be taken to achieve compliance with the relevant limits.

[85] GSMA Whitepaper Embedded Mobile Guideline Version 1.0, 17 March 2010.

Two key decisions are:

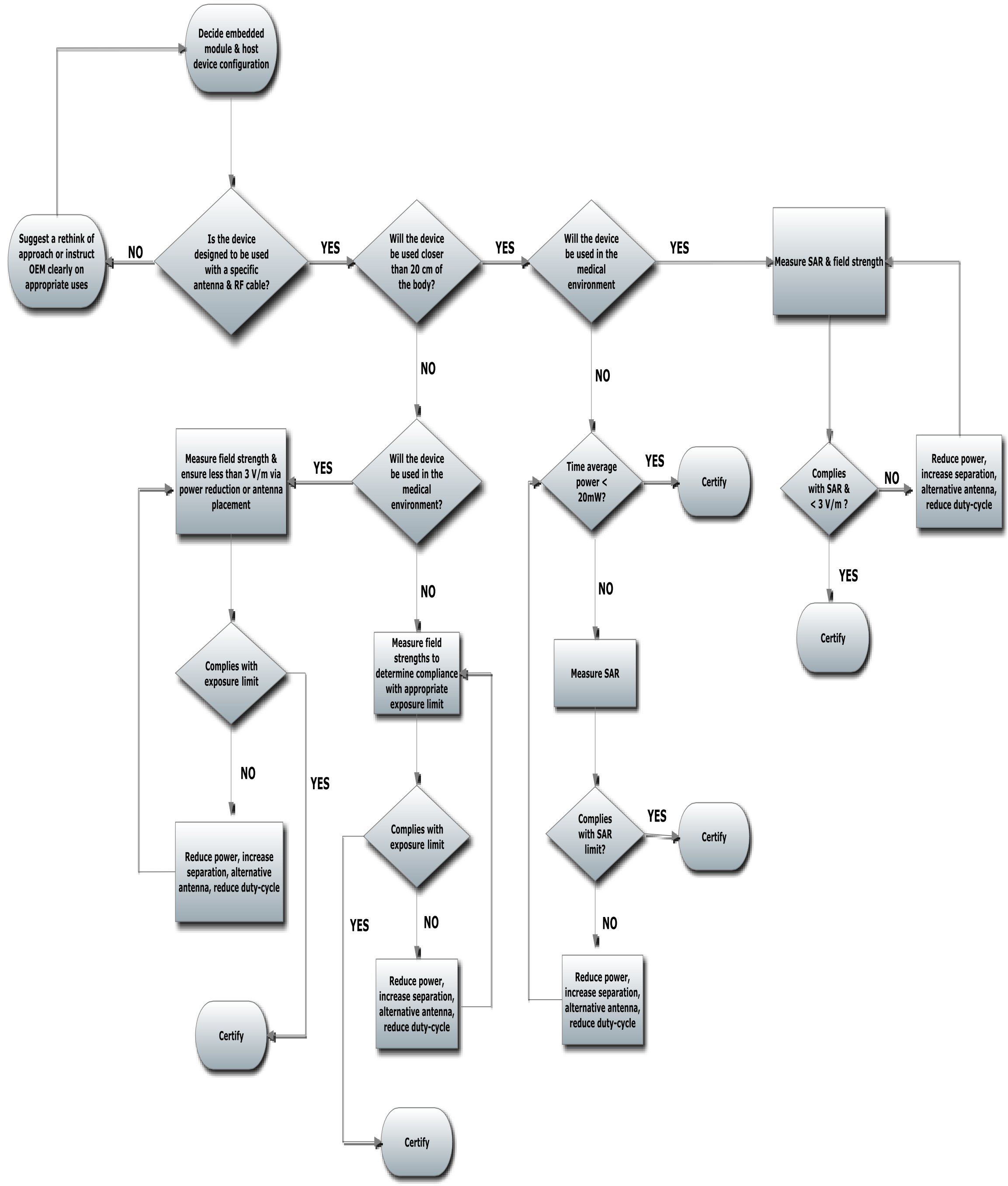
- Will the device be used closer than 20 cm of the body?
- Will the device be used in the medical environment?

These two decision points potentially trigger a measurement of SAR or the most stringent E-field requirements of 3 V/m and antenna placement and average power transmitted will be key determinants.

Given that many of the key decision points require field strength or SAR measurements it is recommended that access to suitable expertise is available during the design and prototype process. In addition, because the various national regulatory arrangements can be complex and subject to ongoing change it is further recommended that early in the design process consultation should take place with experts in the regulatory and compliance arrangements for the particular target markets.

As well as regulatory requirements that must be met at least one major operator requires that the compliance path is maintained between the module and the final consumer product and this is often best assessed by a certification body or designated laboratory and will involve the use of the TCF for the module.

Figure 5: Flowchart of decisions and options available to the designer to achieve compliance with the relevant limits.



Enclosures A

China - Relevant Standards:

1. **English Translation of Chinese National Standard GB 21288 (2007)**
2. **English Translation of Hygienic standard for environmental electromagnetic waves GB9175 (1988)**
3. **English Translation of Regulation for electromagnetic radiation protection, GB8702 (1988)**

ICS13.280
C71

National Standard of the People's Republic of China

GB 21288-2007

Limits for Human Local Exposure to Electromagnetic Fields Emitted by Mobile Phones

Issued on 14 November 2007 Entry into Force on 1 August 2008

Issued by the General Administration of Quality Supervision, Inspection and Quarantine of People's Republic of China, and Standardization Administration of the People's Republic of China

Introduction

Mobile phone handsets are held close to the head when used, and their electromagnetic radiation may affect health. This Standard has been issued in order to protect public health.

Preface

All technical contents of this standard are mandatory.

This standard was developed by and will be the responsibility of the National Standardization Technical Committees which are in charge of assessing the affects of human exposure to electronic, magnetic and electromagnetic fields, etc.

The drafting organisations of this Standard are: the Institute for Environmental Health and Related Product Safety of Chinese Centre for Disease Control and Prevention, the National Institute of Metrology, China Academy of Telecommunication Research under the Ministry of Information Industry.
The principal authors of this standard are: Cao Zhaojin, Teng Junheng, Wang Hongbo and Xu Peiji.

Limits for Human Local Exposure to Electromagnetic Fields Emitted by Mobile Phones

1. Scope

This standard specifies the limits for the exposure of the general public to electromagnetic radiation from mobile phones that are used in close proximity to human head.

This standard applies to all the mobile phones used near the heads of members of the general public, and that operate in the frequency range of 30 MHz – 6 GHz.

2. Terms and Definitions

The following terms and definitions are used in this standard.

2.1 Public exposure

This refers to the exposure of individuals of all ages and in different states of health, who are unaware of the exposure and its risks and adverse effects on their health and are therefore unable to take effective preventive measures in an uncontrolled condition.

2.2 Local Exposure

This refers to the exposure of localized parts of the surface of the human body to electromagnetic fields.

2.3 Electromagnetic Radiation

a. Phenomenon of the emission of energy in the form of electromagnetic waves from a source into space
b. Propagation of energy in the form of electromagnetic waves in space

Note: The term “electromagnetic radiation” may be extended to include the phenomenon of electromagnetic induction.

2.4 Specific Absorption Rate (SAR)

SAR is defined as the electromagnetic wave energy (dW) absorbed by unit mass (dm or ρdV) of biological tissue in unit time (dt).

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dV}\right) \qquad (1)$$

The unit for SAR is W/kg.
Note: SAR can be calculated with the following formulas:

$$SAR = \frac{\sigma E^2}{\rho} \qquad (2)$$

$$SAR = c_h \left.\frac{dT}{dt}\right|_{t=0} \qquad (3)$$

Where,
E: rms value for the strength of electrical field in tissue, V/m
σ: Conductivity of physiological tissue, S/m
ρ: Density of physiological tissue, kg/m^3
c_h: Thermal capacity of physiological tissue, J/kg K
$\left.\frac{dT}{dt}\right|_{t=0}$: Rate of temperature variation of human tissue at starting time, K/s

3. Exposure Limit

The average value of SAR must not exceed 2.0 W/kg for any 10g biological tissue for continuous 6 minutes.

4. Requirement for Labelling and Marking

All mobile phones that are used by the general public in close proximity to the human head are required to be labelled and marked as follows:

4.1 Manuals shall display in boldface: “The maximum value of the specific absorption rate (SAR) for electromagnetic radiation of this product is: X.X W/kg, which is in compliance with the requirements of National Standard GB 21288-2007. It is also encouraged to label on the external packaging the maximum SAR value for electromagnetic radiation.

Note: X represents number 0-9.

4.2 Matters that require the attention of users of cardiac pacemakers, hearing aids and cochlea implant hearing aids should be clearly stated in user manuals.

Chinese standards on the Internet
http://www.gb168.cn

Standard No. GB 21288-2007
Distributed by: Beijing Biaoke Wangluo Gongsi
No.: 0100080410002864
Security No.: 2008-0410-0135-3829-5411
Date: 10 April 2008
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GB 21288-2007

People’s Republic of China
National Standard

Limits for Human Local Exposure to Electromagnetic Fields Emitted by Mobile Phones

GB 21288-2007

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GB 9175 –88

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA
Hygienic Standard for Environmental Electromagnetic Waves

The standard is formulated with aim of enforcing the Act of Environmental Protection of the People's Republic of China (provisional), controlling the pollution of the electromagnetic waves to the environment, protecting the health of the people and promoting the development of electromagnetic technology.

1. Definition

1.1 electromagnetic waves
The electromagnetic waves in the standard refer to long wave, medium wave, short wave, ultrashort wave and microwave.

1.1.1 long wave
The electromagnetic waves with the frequency range of from 100 – 300 kHz and corresponding wavelength from 3 – 1 km.

1.1.2 medium wave
The electromagnetic waves with the frequency range of 300 kHz – 3 MHz and corresponding wavelength from 1 km – 100m.

1.1.3 short wave
The electromagnetic waves with the frequency range of 3 – 30 MHz and corresponding wavelength from 100m – 10m.

1.1.4 ultrashort wave
The electromagnetic waves with the frequency range of 30 – 300 MHz and corresponding wave length from 10m – 1m.

1.1.5 microwave
The electromagnetic waves with the frequency range of 300 MHz – 300 GHz and corresponding wavelength from 1m – 1mm.

1.1.6 mixed frequency band
The electromagnetic waves of mixed two or more than two of the long wave, medium wave, short wave, ultrashort wave and microwave.

1.2 The unit of the electromagnetic radiation intensity

1.2.1 the unit of the electric field intensity
The unit for the electromagnetic radiation of the long wave, medium wave, short wave and ultrashort wave is V/m.

1.2.2 the unit of power density
The unit for the electromagnetic radiation of microwave is $\mu W/cm^2$ or mW/cm^2.

1.2.3 Mixed field intensity
The E-field intensity of electromagnetic waves of mixed two or more than two frequencies, with the value being the square root of the sum of the square of each frequency E field intensity, as is demonstrated by the following formula:

$$E = \text{Square root of } (E_1^2 + E_2^2 + \ldots.. + E_n^2)$$

In the formula: E --- mixed E field intensity, V/m.
$E_1, E_2 \ldots E_n$ --- the E field intensity measured at each frequency, V/m.

1.3 Categories of Standard
The permitted intensity of the environmental electromagnetic waves can be defined as two categories of standard, limited by the threshold of potentially adverse effects on the human body by the electromagnetic radiation intensity and characteristics of the frequency band.

1.3.1 First category of standard
Refers to the safety area where the intensity of electromagnetic waves is not to have harmful effects on all groups of people (including infants, pregnant women, elderly, infirmities and disabled) residing, working or living for a long time. The requirement of the first category standard should be satisfied when ratio stations, TV stations or radar stations are newly established, renovated or expanded in residential areas.

1.3.2 Second category of standard
Refers to the intermediate area where the intensity of electromagnetic waves is possibly to have potentially adverse effects on all groups of people (including infants, pregnant women, elderly, infirmities and disabled) residing, working or living for a long time. Factories and institutes can be established in this area. But no residential housing, schools, hospitals and sanitarium are allowed to be built. Appropriate protection measures must be adopted for those already established.

In the areas above the second category of standard, the human body can be harmed by the electromagnetic radiation. Trees and crops can be planted in these areas; but no residential housing and public facilities the people frequently visit such as institutes, factories, stores and theaters are allowed to be build; Measures should be taken or exposure time under radiation should be limited for those already built.

2. Hygienic requirement

The categories of standard for the permitted intensity of the environmental electromagnetic waves are illustrated in the following table:

Wavelength	Unit	Permitted Intensity	
		First Category (safe area)	Second Category (intermediate area)
Long, medium and short waves 100 kHz – 30 MHz	**V/m**	**<10**	**<25**
Ultrashort waves 30-300 MHz	**V/m**	**<5**	**<12**
Microwave 300 MHz - 300 GHz	**$\mu W/cm^2$**	**<10**	**<40**
Mixed	**V/m**	**According to the major frequency band; determine by the weighing of the mixed intensity if the intensity of each band is scattered.**	

3 Testing methods for monitoring

Testing methods for monitoring of the permitted intensity of the environmental electromagnetic radiation defined in the standard can be found in Annex A.

4 Supervision and implementation

The hygiene and epidemic prevention stations or the environmental hygiene monitoring stations at all levels are responsible for the supervision of the implementation of this standard.

Annex A
Standard for the Measurement of the Environmental Electromagnetic Waves
(Supplement)

A.1 Scope

The standard is applicable to the environmental electromagnetic waves generated by the open radiators. The scope of frequency: long, medium, short waves (100 kHz-30 MHz), ultrashort waves (30 MHz-300 MHz), and microwaves (300 MHz-300 GHz).

A.2 Contents

A.2.1 Measurement methods
According to different needs and purposes, different measurement methods are taken for established and expanded stations. The measurement method taken in the investigation of the radiation intensity and distribution is called spot measurement, which takes the radiator as center and select spots of measurement in different directions. The measurement method taken in the comprehensive investigation of the background value of environmental electromagnetic waves in a certain region and the investigation of the radiation intensity on certain people's community according to the population is called plane measurement.

A2.1.1 In the spot measurement, the radiator is taken as the center, and the region to be measured is divided into sectors of 5°-10°. Spots for measurement are selected at intervals of 5-20m in the near field and at intervals of 50-100m in the far field, or at selected spots according to particular requirement.

A.2.1.1.1 Simplified measurement: measurement with the broadband field intensity meter with isotropic detectors. If the detectors are not isotropic, then each field intensity in different polarized directions should be measured and its vector is added.

A.2.1.1.2 Frequency selective measurement: measurement with the frequency selective field intensity meter. The field intensity is measured of each frequency band and put into the Equation in Section 1.2.3 to figure out the mixed field intensity. With this measurement, the field intensity respectively of long, medium, short and microwaves can be measured; so as to identify the major frequency bands in the mixed field intensity.

A.2.1.2 In the plane measurement, the region to be measured (cities) is divided into small zones, and the focus location coordinates of the residents in each zone are indicated, from which some representative zones are selected as monitoring spots. The measuring apparatus, making use of the automatic monitoring system of environmental electromagnetic waves, conducts the automatic scanning, automatic measuring and real-time processing of each frequency band. Then by weighting according to the population size of each zone, the accumulated percentage of exposure of the residential environment of the region (cities) to the electromagnetic waves.

A.2.2 Measurement position

A.2.2.1 In the open and flat environment, the measurement is conducted generally according to the height of a human being, i.e. 1.7m. In the case of the premises to be established, the measurement should be conducted at the corresponding height of the premises.

A.2.2.2 The measurement of the interiors of the building should be conducted on the basis of selection of representative spots on different levels.

A.2.3 Measuring apparatus
The field intensity meter with its sensitivity ≤ 1V/m or ≤ 1 μW/cm^2, and precision ≤ 2 dB, should be adopted for the measurement of the surrounding areas of the radiator. The automatic processing system with broadband antenna, spectrum analyzer and computer should be adopted for the measurement of the background field intensity of the region.

A.2.4 Record keeping
In addition to record all measurement data, the record should include measurement location, time, date, instruments used, antenna height, and names of personnel did the measurements.

A.2.5 Calculation of the field intensity
Calculation according to the formula, mainly to provide basis for the selection and establishment of hygienic protection zones for the newly established broadcasting stations, TV stations, radar stations and earth satellite stations.

A.2.5.1 Formula for the calculation of field intensity of long and medium waves (vertical polarization waves):

$$\mathrm{E}(mV/m = \frac{300\sqrt{P.G}}{r} xF \text{ ....} \quad (A1)$$

$$F = 1.41\frac{2+0.3X}{2+X+0.6X^2} \text{ ....} \quad (A2)$$

$$X = \frac{\pi \cdot r}{\lambda} x \frac{\sqrt{(\varepsilon-1)^2+(60\lambda\sigma)^2}}{\varepsilon^2+(60\lambda\sigma)^2} \text{ ....} \quad (A3)$$

Formula: P-transmitter power, kW;
r – distance between measured point and transmitting antenna, km;
G-antenna gain relative to a short vertical antenna over a perfectly reflecting ground, dB;
F-ground wave transmission loss coefficient;

X-numerical distance;
λ-wave length, m;
ε-dielectric constant;
σ-conductivity, S/m.

A.2.5.2 Short wave (horizontal polarization wave) field intensity calculation formula.
Short wave (horizontal polarization wave) field intensity calculation formula is similar to formulae (A1) and (A2), but X should be calculated according to formula (A4):

$$X = \frac{\pi \cdot r}{\lambda} x \frac{1}{\sqrt{(\varepsilon - 1)^2 + (60\lambda\sigma)^2}} \quad \text{(A4)}$$

A2.5.3. TV or FM ultra-short wave field intensity calculation formula:

$$\mathrm{E}(mV/m) = 2x \frac{222\sqrt{PxG}}{r} xF(\theta) \quad \text{(A5)}$$

In the formula: P-transmitter power, kW;
G-antenna gain against half-wave dipole antenna, dB;
r-distance from the measured spot to the transmission antenna, km;
F(2)- antenna vertical surface directional function.

A.2.5.4. Radar microwave power density S calculation formula:

$$S(\mu W/cm^2) = \frac{P \cdot G}{4\pi \cdot r^2} x100 \quad \text{(A6)}$$

In the formula: P-power of the transmitter, W;
G-antenna gain, dB;
r-distance from the measured spot to the transmission antenna, m.

A.2.6. Exchange of measurement unit
Exchange formula for electric field intensity and power density in the far field:

$$S = \frac{\mathrm{E}^2}{377} \quad \text{(A7)}$$

In the formula: S-power density, W/m^2;
E-electric field intensity, V/m.

Additional explanation:

The Zhejiang Medical University was in charge of the development of this standard, with the participation of Nanjing Medical Institute, Beijing Medical University, and Tongji Medical University.

The major authors of the standard were Chiang Huai, Shao Binjie and Shi Junren.

The Institute of Environmental Health and Monitoring of the Chinese Academy of Preventive Medicine, the appropriate technical department, was entrusted by the Ministry of Health with the responsibility of the explanation and interpretation of this standard.

National Standard - People's Republic of China

UDC 614.898.5 GB 8702-88

Regulations for Electromagnetic Radiation Protection

1. General provisions

1.1 These regulations are enacted in order to protect against contamination by electromagnetic radiation, to protect the environment, to safeguard public health and to promote the appropriate and practical development of incidental electro-magnetic radiation.

1.2 These Regulations apply to all units or individuals and to all equipment and apparatus within the borders of the People's Republic of China. However, the protective limits specified in these Regulations do not apply to medical or diagnostic equipment used in the treatment of illness.

1.3 The frequency range regulated by these Regulations is from 100 kHz to 300 GHz. See below for the relationships between protection levels and frequencies.

1.4 These Regulations specify upper limits for radiation that can be received, which represent the total values for all possible types of electromagnetic radiation contamination.

1.5 All units or individuals that generate electromagnetic radiation contamination must observe the principle of "reasonably achievable minimum level" and make efforts to reduce such electromagnetic radiation contamination.

1.6 All units or departments that generate electromagnetic radiation contamination may also formulate control values (standards) for each item, and such control values (standards) of each unit or department must be stricter than the levels in these Regulations.

2. Protection levels for electromagnetic radiation

2.1 Basic Limits

2.1.1 Occupation-related exposure to radiation: Whole body average specific absorption rate (SAR) must not exceed 0.1 W/kg for any continuous 6 minutes in any 8 hour working day.

2.1.2 Public exposure to radiation: whole body average specific absorption rate (SAR) must not exceed 0.02 W/kg for any continuous 6 minutes in any 24 hour day.

2.2 Derived limits

2.2.1 Occupation-related exposure: field parameters for any electromagnetic field for any continuous 6 minutes in any 8 hour working day must satisfy the requirements of Table 1.

Table 1: Derived limits for occupation-related exposure

Frequency range (MHz)	Electrical field strength (V/m)	Magnetic field strength (A/m)	Power Density (W/m^2)
0.1 – 3	87	0.25	$20^{\#}$
3 – 30	$150/\sqrt{f}$	$0.40/\sqrt{f}$	$60/f^{\#}$
30 - 3 000	28*	0.075*	2
3 000 - 15 000	$0.5\sqrt{f}$*	$0.0015\sqrt{f}$*	$f/1500$
15 000 -300 000	61*	0.16*	10

\# Plane wave derived value for reference.

* For reference, not used as limit. *f* is frequency; units are MHz; figures in table are rounded off.

2.2.2 Public exposure to radiation: field parameters for environmental electromagnetic field for any continuous 6 minutes in any 24 hour day must satisfy the requirements of Table 2.

Table 2: Derived limits for public exposure to radiation

Frequency range (MHz)	Electrical field strength (V/m)	Magnetic field strength (A/m)	Power Density (W/m^2)
0.1 – 3	40	0.1	$4^{\#}$
3 – 30	$67/\sqrt{f}$	$0.17/\sqrt{f}$	$12/f^{\#}$
30 - 3 000	12*	0.032*	0.4
3 000 - 15 000	$0.22\sqrt{f}$*	$0.001\sqrt{f}$*	$f/7500$
15 000 -300 000	27*	0.073*	2

\# Plane wave derived value for reference.

* For reference, not used as limit. *f* is frequency; units are MHz; figures in table are rounded off.

2.2.3 When one radiation source emits multiple frequencies or multiple radiation sources are present, the sum of the mean electromagnetic field for any continuous 6 minutes in any 24 hour day must satisfy the requirements of Formula 1:

$$\sum_i \sum_j \frac{A_{i,j}}{B_{i,j,L}} < 1$$

Where,
$A_{i,j}$: Radiation level of the *j*th band of the *i*th radiation source.
$B_{i,j,L}$: Electromagnetic radiation limit specified for corresponding *j*th band.

2.2.4 The instantaneous peak values for pulsed electromagnetic waves, other than meeting the above requirements, must not exceed 1000 times the values specified in Tables 1 and 2.

2.2.5 Workers in the vicinity of ISM equipment operating below 100 MHz, may work for 8 hours continuously exposed to magnetic fields of up to 1.6 A/m.

3. Management of Sources of Electromagnetic Radiation

3.1 The following sources of electromagnetic radiation may be excluded from these controls.

3.1.1 Transportable communication equipment with power output equal or less than 15W. For example, mobile communication equipment for use on land or water.
3.1.2 Radiation sources not having shielding spaces and within the equivalent radiation power limits set in Table 3.

Table 3: Equivalent radiation powers for exempted electromagnetic radiation sources.

Frequency range (MHz)	Equivalent radiation power (W)
0.1 - 3	300
>3 – 300,000	100

3.2 All owners of electromagnetic radiation sources which exceed the exempted levels under 3.1 must report, register and permit inspection of environmental protection measures implemented at the site of the source of radiation.

3.2.1 Any unit or individual prior to erecting or purchasing a source of electromagnetic radiation which exceeds the exempt levels must submit an environment impact statement or table to the Environment Protection Department.

3.2.2 The spatial distribution of the electromagnetic field must be measured *in situ* after the erection or purchase and before the operation of any source of electromagnetic radiation. If necessary, a protection zone must be delimited based on these measurements, and warning symbols must be displayed.

3.3 All units or individuals owning or producing sources of electromagnetic radiation must improve specific safety design for such sources of electromagnetic radiation.

3.3.1 All equipment producing electromagnetic radiation for use in industry, science or medicine when shipped from the factory must be provided with a certificate showing compliance to the radio interference limit. When such equipment is in operation, it must be regularly tested for leakage levels, and must not be operated at above permitted leakage levels, and must not interfere with the daily lives of residents.

3.3.2 Long wave communications, medium wave broadcasting, short wave communications and broadcasting antennae must meet the specified safety limits for distance away from densely populated areas.

3.4 Manufacturing establishments which exceed the electromagnetic radiation levels specified in 2.2.1 must provide the necessary workplace protection measures.

3.5 Training in protection against electromagnetic radiation must be provided for all staff responsible for the operation or control of all equipment emitting electromagnetic radiation. Such training must include:

a. Characteristics and risks of electromagnetic radiation
b. General protective measures and equipment and their use
c. Individual protective equipment and its use
d. Regulations on protection against electromagnetic radiation

4. Monitoring of electromagnetic radiation

4.1 Users of sources of electromagnetic radiation that exceed the exempt levels must monitor the levels of electromagnetic radiation in and around the workplace in which such source of electromagnetic radiation is situated, and must report the results of such monitoring to the local environmental protection department as follows:

a. Report results of monitoring of radiation levels after installation of new equipment or modification or expansion of existing equipment within 6 months from the date on which use of the equipment commenced.
b. Report results of monitoring of existing sources of electromagnetic radiation within 6 months after these regulations are in effective.

4.2 Work place monitoring:

4.2.1 If the operating frequency of the source of electromagnetic radiation is below 300 MHz, the electrical field strength and the magnetic field strength must be measured separately; when the operating frequency of the source of electromagnetic radiation is higher than 300 MHz, the electrical field strength only need be measured.

4.2.2. The instruments for measuring field strength or leakage should be omnidirectional, if possible. If an omnidirectional detector head is not used, one must change directions of the detector head until a maximum field strength is measured. Instrument frequency response irregularity and accuracy must not exceed ±3 dB.

4.2.3 The detector head of the measuring instrument must be used to make measurements directly at the position at which workers work, when workers are not present in such position.

4.3 Environmental monitoring:

4.3.1 Electromagnetic radiation in the environment is mostly considered plane wave, and therefore only the electrical field strength need be measured. However, if it is not plane wave field, separate measurements must be made of electrical field strength and magnetic field strength.

4.3.2 The measuring instruments may be field survey meter, spectrum analyzer and microwave receiver, etc. The measurement error must not exceed ±3 dB, and the frequency error must not exceed 1/50 of the central frequency of the frequency band being measured.

4.3.3 Measurements of radiation sources must take account of the specific environment, and, according to the type of antenna employed with the source of radiation, must be within a distance of 2000 m from the antenna and measure at selected points in the direction of maximal radiation or at selected points in all directions of radiation.

4.3.4 General electromagnetic radiation monitoring points may normally be situated mainly along principal roadways, and make measurements at specified distances in a mesh pattern.

4.3.5 Measurement points should be at open space, avoid the effects of electricity lines, high voltage lines, telephone lines, trees and buildings and so forth.

4.4 Evaluation of monitoring results:

4.4.1 If the electromagnetic radiation levels for the relevant workplace exceed the limits, the working state of the electromagnetic radiation source and protective measures must be inspected and ascertain the cause. Then effective remedial action must be taken.

4.4.2 If the environmental electromagnetic radiation levels for a particular source of electromagnetic radiation exceed the levels specified by these regulations, immediate action must be taken to reduce the level of radiation, and the environmental protection department must be notified of the cause of the excessive levels of radiation and the action being taken to remedy the situation.

4.4.3 When evaluation radiation levels, one must consider the possibility of multiple frequencies of a radiation source and the contribution of multiple sources, such as to satisfy Formula 2:

$$\sum_m \sum_n \frac{Q_{M,N}}{Q_{M,N,L}} < 1$$

Where,

$Q_{M,N,}$: Radiation level of the *N*th frequency band of the *M*th source of radiation

$Q_{M,N,L}$: Electromagnetic radiation standard radiation limit specified for the *N*th frequency band

5. Quality assurance in monitoring

5.1 A plan covering monitoring methodology and implementation must be prepared prior to monitoring of electromagnetic radiation.

5.1.1 Monitoring sites must be selected in such a way as to ensure that the results of monitoring are representative. Different methods of monitoring must be used when monitoring is performed for different purposes.

5.1.2 The frequency, capacity and response time and so forth of the monitoring instruments must be appropriate to the object to be monitored, and must ensure that the results so obtained are accurate.

5.1.3 Interference during monitoring must be avoided or minimized, and the maximum potential error due to unavoidable interference during monitoring must be estimated in the results.

5.1.4 A sufficient amount of data must be collected during monitoring in order to ensure the statistical validity of the results.

5.2 The instruments and equipment used in monitoring (including antennae and detectors) must be calibrated regularly.

5.3 The acceptance or rejection of data obtained from monitoring, and the processing of such data, must be based on statistical principles.

5.4 Full documentation must be established on the monitoring of electromagnetic radiation. All calibration certificates for instruments and antennae, information on monitoring methodology, monitoring sites, monitoring original data, and information on statistical processing procedures must be archived for later examination.

5.5 Any monitoring results that are placed on file or reported to higher authorities may be re-examined, and the person conducting such re-examination must not have any direct responsibility for the operation, but is a professional familiar with the content of this subject.

6. Definitions

6.1 Electromagnetic radiation: Phenomenon of propagating energy in space through electromagnetic waves.

6.2 Specific absorption rate (SAR): Indicates the electromagnetic radiation absorbed by the biological body per unit mass, and thus the amount of absorbed dose rate.

6.3 Power density: Indicates the effect of the amount of electromagnetic waves over a unit area at a given point in space; units are W / m^2. Alternatively, vector quantity at any given point in space.

6.4 Equivalent radiation power:

6.4.1 At below 1000 MHz, the equivalent radiated power is the product of the rated power of the equipment and the half wavelength antenna gain.
6.4.2 At above 1000 MHz, the equivalent radiated power is the product of the rated power of the equivalent and the omnidirectional antenna gain.

6.5 Thermal effect: Changes in tissue or a system after the absorption of electromagnetic radiation energy related to the direct action of heat.

6.6 Non-thermal effect: Changes in tissue or a system after the absorption of electromagnetic radiation energy, unrelated to the direct action of heat.

Enclosure B

USA – FCC RF Exposure Procedures and Equipment Authorization Policies

KDB 447489 Mobile and Portable Device - RF Exposure Procedures and Equipment Authorization Policies – D01. v04. 11/13/2009

11/13/2009

Mobile and Portable Device

RF Exposure Procedures and Equipment Authorization Policies

This document identifies certain RF exposure evaluation procedures and requirements and equipment authorization policies for mobile and portable devices.[1] It replaces preceding versions of this KDB and should be used in conjunction with other FCC policy and procedure documents.[2] Unless otherwise specified, the power thresholds in this document are applied for conducted output power with respect to source-based time-averaging defined in §§ 2.1091(d)(2) and 2.1093(d)(5) of the rules. While certain simultaneous transmission issues have been addressed in *specific FCC test procedures*, RF exposure evaluation considerations for other product configurations are still necessary.[3] As products and technologies continue to emerge, the FCC Laboratory should be contacted using the OET-Lab Knowledge Database (www.fcc.gov/labhelp) about additional procedures and specific test requirements.

1) General test requirements and specific FCC test procedures

a) When required, portable devices must be evaluated using the *specific FCC test procedures*, and the SAR measurement techniques of OET Bulletin 65 Supplement C 01-01 and IEEE Std 1528-2003.

b) When routine evaluation is required for SAR and the output power is ≤ $60/f_{(\mathrm{GHz})}$ mW, the test reduction and test exclusion procedures given herein, or in KDB 616217 and its supplement or KDB 648474, are applicable.[4]

c) Unless excluded by *specific FCC test procedures*, portable devices with output power > $60/f_{(\mathrm{GHz})}$ mW shall include SAR data for equipment approval. The FCC Laboratory may be contacted if SAR is expected to be very low, especially for devices operating below 300 MHz, to determine if SAR evaluation is necessary.[5]

d) When applicable, 802.11 a/b/g devices should be tested according to the antenna diversity procedures in KDB 248227.[6] Contact the FCC Laboratory for antenna diversity test requirements, such as MIMO and beam-forming, in other product configurations.

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[1] RF exposure evaluation includes measurement or computational modeling of field strength, power density, or SAR for devices subject to MPE or SAR limits. For mobile devices that are categorically excluded from routine evaluation, simple calculations may be used to estimate the field strength or power density to determine minimal antenna-to-user separation distances.

[2] Other equipment authorization policies and procedures include items in the TCB Exclusion List (KDB 628591), Permit But Ask Procedure (PBA) (KDB 388624), Permissive Change Policies (KDB 178919), OET Bulletin 65 and Supplement C 01-01, procedures at FCC OET Measurement Techniques (www.fcc.gov/oet/ea/eameasurements.html), and in other KDB Publications (www.fcc.gov/labhelp).

[3] The *specific FCC test procedures,* identified by KDB Publication numbers, are available using links at the website (www.fcc.gov/oet/ea/eameasurements.html). SAR measurement procedures presently available from this website are those for: 3GPP/3GPP2 devices (KDB 941225); 802.11 a/b/g devices (KDB 248227); laptop computers (KDB 616217), notebook/netbookand tablet computers (Supplement to KDB 616217), and cell phones (KDB 648474) with multiple transmitters; 3 - 6 GHz devices (KDB 865664); system accuracy verification (KDB 450824).

[4] *See* footnote 3, *supra*.

[5] This provision applies to portable devices that are designed with large antenna-to-user separation distances such that the SAR is expected to be < 0.2 W/kg at the specified operating frequency and power level.

[6] *See* footnote 3, *supra*.

e) When the SAR procedures require multiple channels to be tested and the 1-g SAR for the highest output channel is less than[7]

   i) 0.8 W/kg, where the transmission band corresponding to all channels is ≤ 100 MHz, testing for the other channels is not required; or

   ii) 0.4 W/kg, where the transmission band corresponding to all channels is ≤ 200 MHz, testing for the other channels is not required.

f) Test reports should only include data for the test configurations that are required to demonstrate compliance to the FCC rules. Test results that are not required, but included with prior FCC confirmation, must be identified and documented in test reports as inapplicable data that has not been considered for FCC equipment certification.

g) Installation and operating instructions as required by §§ 2.1033(b)(3) and 2.1033(c)(3) are necessary for installers, integrators and end users to comply with mobile and portable transmitter exposure requirements.

2) Transmitters and modules for use in portable exposure conditions that <u>do not require SAR evaluation for simultaneous transmission</u>

a) Unlicensed intentional radiators and licensed devices can be approved as either a transmitter or a module for use in <u>stand-alone</u> portable exposure conditions that do not allow simultaneous transmission.[8,9] Based on the SAR or output power level, the following three conditions may be applied; otherwise, the provisions of item 2) c) should be considered. When SAR is evaluated using the procedures in item 2) b), additional <u>stand-alone</u> SAR evaluation is not required to incorporate the transmitter into final products based on procedures contained herein, or in KDB 616217 and its supplement or KDB 648474, when simultaneous transmission SAR evaluation is not required for the transmitter.[10]

   i) A device may be used in portable exposure conditions with no restrictions on host platforms when either the source-based time-averaged output power is ≤ $60/f_{(\mathrm{GHz})}$ mW or all measured 1-g SAR are < 0.4 W/kg.[11] When SAR evaluation is required, the most conservative exposure conditions for all expected operating configurations must be tested.

   ii) A device may be approved for use in multiple host platforms, each with similar family attributes, for example, PDA, laptop/notebook/netbook computers, and tablet computers, when each host platform is tested in the most conservative exposure conditions and the 1-g SAR is < 0.8 W/kg for all configurations.

   iii) A device may be approved for use in a single platform when all hosts within the same platform have the same operating configurations and exposure conditions, with only minor configuration and construction differences. The most conservative exposure conditions among all host configurations within the platform must be fully tested using the procedures in item 2) b) according to the required platform test configurations, such as those in item 4); the

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[7] This enables the number of frequency channels required for testing in item 6 c) to be reduced without the need for a KDB inquiry or PBA.

[8] Other equipment authorization requirements, such as limited modular approval [§ 15.212(b)] and composite system [§ 15.31(k)] may also apply.

[9] Stand-alone portable exposure conditions apply to single or multiple transmitters that do not transmit simultaneously.

[10] *See* footnote 3, *supra*.

[11] A device can be a transmitter, a module or a final product by itself.

remaining less restrictive exposure conditions and host configurations may apply [see the procedures in item 1) e)]. The 1-g SAR must be < 1.2 W/kg for all configurations.

b) The conditions of item 2) a) are established using the following SAR procedures:

i) The antenna(s) and radiating structures must be tested for each host platform and device configuration according to the minimum separation distance expected for all applicable operations.

(1) Devices that can be connected to a host through a cable must be tested with the device positioned in all applicable orientations against the flat phantom.[12]

(2) Devices without built-in mechanisms, such as a permanent housing, to provide a fixed minimum separation distance from users, must be tested with the antenna(s) and radiating structures in direct contact against the flat phantom.

(3) Devices connected to built-in, non-extendable interfaces, such as CardBus or SDIO, must be tested according to the minimum separation distance required for the host and device configurations.[13] Contact the FCC Laboratory for other interface and host device test requirements.

ii) The test configuration with the highest 1-g SAR for each device configuration, evaluated in items 2) a) i) and 2) b) i) (2), must be used to determine if additional SAR evaluation is required due to enhanced energy coupling at increased separation distances.

(1) The probe tip is positioned at the peak SAR location determined in item 2) b) ii), at a distance of 2 mm from the phantom surface. With the probe fixed at this location, the device is moved away from the phantom in 5 mm increments from the <u>initial</u> touching or minimum separation position. A single-point SAR (not 1-g SAR) is measured for each of these device positions until the SAR is less than 50 % of that measured at the <u>initial</u> device position.

(2) When the device position in item 2) b) ii) (1) with the highest point SAR is 25 % greater than that measured at the <u>initial</u> device position, a complete 1-g SAR evaluation is required for that configuration.

iii) Installation and operating requirements, including restrictions, for the condition(s) of item 2) a) and host platform(s) approved in the equipment authorization must be provided to OEM integrators and end users to comply with RF exposure requirements.

c) When the maximum 1-g SAR is ≥ 1.2 W/kg for devices evaluated under item 2) a), a PBA is required for TCB approval. In addition, the transmitter or module may need to be tested and approved for the operating configurations and exposure conditions of a dedicated host device. Devices that can be connected to multiple hosts by the user may need to adjust the design to meet SAR requirements.[14] An inquiry should be submitted to the FCC Laboratory to determine if other options are applicable and acceptable.

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[12] A separation distance ≤ 0.5 cm is required for USB dongle transmitters. Contact the FCC Laboratory concerning requirements for other device form factors and interfaces; see also other guidance in the attachment to KDB 447498 for USB dongle transmitters.

[13] A separation distance ≤ 1.0 cm is required for this type of interface module used in laptop computers; a separation distance ≤ 0.5 cm is required for PDA and similar platforms. The distance is measured from the module to the surface of a flat phantom.

[14] This provision applies to devices with high SAR and users can freely operate such devices in different hosts where SAR may change due to design and operating variations.

3) **Transmitters and modules for use in portable exposure conditions that allow simultaneous transmission**

   a) Except during network hand-offs where the maximum hand-off duration is less than 30 seconds, simultaneous transmission applies when there is overlapping transmission. SAR is evaluated for simultaneous transmission using volume scan measurements.[15]

   b) SAR is not required for the following simultaneous transmission conditions[16]

      i) When excluded by the procedures in KDB 616217 or KDB 648474.[17]

      ii) When specific requirements for simultaneous transmission SAR evaluation have not been established for the host platform or device configuration:

         (1) for the antennas that are located < 5 cm from persons, where

            (a) The closest antenna separation distance is ≥ 5 cm for all simultaneous transmitting antennas within the host or device; and

            (b) The sum of the 1-g SAR is < 1.6 W/kg for all simultaneous transmitting antennas that require stand-alone SAR evaluation or the SAR to peak location separation ratios are < 0.3 for all simultaneous transmitting antenna pairs;[18] and

            (c) The output power is ≤ $60/f_{(GHz)}$ mW for any simultaneous transmitting antenna(s) for which stand-alone SAR evaluation is not required.

         (2) for the antennas that are located ≥ 5 cm from persons, contact the FCC Laboratory to determine if the simultaneous transmission SAR exclusion procedures for laptop/notebook/netbook computers in KDB 616217 and its supplement may be applied.[19]

   c) The operating and installation requirements, including restrictions, must be provided for OEM integrators and end users to comply with simultaneous transmission SAR requirements.

4) **SAR test positions and requirements for specific host platforms and exposure conditions**

   a) Antennas installed in the keyboard or base sections of laptop or convertible tablet computers are evaluated in *Laptop Mode* with the bottom of the computer in direct contact against a flat phantom and the display open to the perpendicular (90º) position.[20] The simultaneous transmission test requirements in item 3) b) ii) (1) may be applied to the keyboard section of laptop computers.

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[15] Volume scan SAR measurement requirements are described in KDB 616217 and KDB 648474.

[16] *See* Permit But Ask Procedure (KDB 388624) regarding certification requirements when simultaneous transmission SAR evaluation is required.

[17] *See* footnote 3, *supra*.

[18] SAR to peak location separation ratio is defined in KDB 648474.

[19] *See* footnote 3, *supra*.

[20] Tablet computers are constructed either with the keyboard and display in a single section (“slate” type), or in two hinged sections (“convertible” type) where the display can be folded onto the keyboard section or unfolded like a laptop computer. For testing purposes, *Laptop Mode* is defined as the operating configuration where the display is open perpendicular to and facing towards the keyboard.

b) The following procedures are applicable to tablet computers with antennas installed along the tablet edges while operating in *Tablet Mode*.[21] When the output power of an antenna is > $60/f_{(\mathrm{GHz})}$ mW, SAR is required for both bottom face and edge exposure conditions.

   i) Each antenna is evaluated for bottom face exposure with the base/bottom of the tablet in direct contact with a flat phantom. Convertible tablets must be tested in normal use conditions with the display folded on top of the keyboard section. The simultaneous transmission test requirements in item 3) b) ii) (1) may be applied to tablet computers in this operating mode.

   ii) Antennas installed along the edges of a tablet are each evaluated with the corresponding edge in direct contact with a flat phantom. The applicable edge configurations include: (A) one fixed display orientation in either portrait or landscape configuration; (B) two fixed display orientations with one in portrait and one in landscape configurations; and (C) multiple display orientations supporting both portrait and landscape configurations.

      (1) For edge configuration (A): SAR is required for each antenna located within 5 cm of the tablet edge closet to the user for the applicable display orientation. For antenna(s) located ≥ 5 cm from this edge, the test reduction and exclusion procedures for laptop computers in KDB 616217 are applied.[22]

      (2) For edge configurations (B) and (C): The procedures for edge configuration (A) are applied to each antenna, for the applicable display orientations where the corresponding edge is closest to the user. For each antenna, SAR is required only for the edge with the most conservative exposure condition.

   iii) For each edge positioned closest to the user, simultaneous transmission SAR evaluation is not required when the simultaneous transmitting antennas along that edge are:

      (1) located < 5 cm from the edge and the sum of the stand-alone 1-g SAR is < the SAR limit for these antennas or the SAR to peak location separation ratios are < 0.3 for all antenna pairs.[23]

      (2) located ≥ 5 cm from the edge and the simultaneous transmission SAR exclusion procedures for laptop computers in KDB 616217 are applicable.[24]

c) Extremity and body SAR evaluation considerations

   i) PDA, UMPC (Ultra-Mobile PC), and devices with similar form factor and configurations that allow next to the ear transmissions are tested according to the handset procedures in IEEE Std 1528-2003, OET Bulletin 65 Supplement C 01-01 and the *specific FCC test procedures*.

   ii) Devices that allow transmissions while worn next to the body using an accessory are tested with the device and associated accessories in all applicable orientations, at the minimum separation distance, using a flat phantom.

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[21] For testing purposes, *Tablet Mode* for a convertible tablet computer is defined as the operating configuration where the display is folded over onto the keyboard section and facing outwards. The display orientation may be switched between portrait or landscape configurations for both slate and convertible tablets, allowing one or more of the tablet edges to become closest to the user during normal use.

[22] *See* footnote 3, *supra*.

[23] *See* footnote 18, *supra*.

[24] *See* footnote 3, *supra*.

iii) Contact the FCC Laboratory to determine whether:

(1) Hand SAR is required for hand-held and hand-operated devices with output power > $1000 \cdot [f_{(GHz)}]^{-0.5}$ mW that are designed with the hand operating closer than 5 cm from the antenna during normal use.[25]

(2) Extremity SAR is required for wrist, feet or ankle worn devices.

(3) Body SAR is required for hand-held and hand-operated or wrist, feet and ankle worn devices that operate closer than 5 cm to the body and the output power is > $300 \cdot [f_{(GHz)}]^{-0.5}$ mW.

d) The simultaneous transmission SAR evaluation procedures for cell phones in KDB 648474 may be applied to antennas that are built-in within a PDA or UMPC.[26] Contact the FCC Laboratory for other devices having similar packaging and form factors.

5) Push-to-talk (PTT) devices[27]

a) RF exposure is evaluated with a duty factor of 50 % when the actual operating duty factor is ≤ 50 %.[28] Devices supporting higher duty factors shall be evaluated at the maximum duty factor; for example, devices supporting operator-assisted PSTN calls. Contact the FCC Laboratory when unable to test a device at the required duty factor due to hardware limitations or other reasons.

b) Portable PTT devices

i) The power thresholds and operating conditions in Table 1 are used to determine SAR test requirements for PTT radios required to comply with the general population exposure limit. When the occupational exposure limit applies, these power thresholds are increased by a factor of five (5) to determine the test requirements. SAR is required for PTT devices with maximum output power greater than these thresholds.[29] SAR evaluation is also required for separation distances smaller than those in Table 1. Contact the FCC Laboratory to determine if SAR evaluation is necessary for other frequencies or when the SAR is very low.

Table 1 - SAR Evaluation Power Thresholds for PTT devices, $f \leq 0.5$ GHz

Exposure Conditions	mW
Held to face ≥ 2.5 cm	250
Body-worn ≥ 1.5 cm	200
Body-worn ≥ 1.0 cm	150
Notes: 1. The time-averaged output power, corresponding to the required PTT duty factor, is compared with these thresholds. 2. The closest distance between the user and the device or its antenna is used to determine the power thresholds.	

[25] Hand-held and hand-operated devices are inherently designed to only transmit while operated in the user's hands.

[26] *See* footnote 3, *supra*. The cellphone procedures in KDB 648474 may apply when the same types of transmitters described in the procedures are used and next to the ear, head exposure conditions, does not apply.

[27] These provisions are limited to radios with a mechanical PTT button and no other operating modes.

[28] Transmit and receive duty factors of PTT devices are generally considered to be 50 %.

[29] PTT radios should be tested according to procedures described in the "Body-Worn and Other Configurations" section of OET Bulletin 65 Supplement C 01-01 (Appendix D).

ii) Additional SAR evaluation with a SAM phantom is required for PTT devices with held-to-ear operating mode.[30] Contact the FCC Laboratory for device operating and test configurations.

6) Test reduction considerations

a) For devices operating with passive accessories, such as optional/additional batteries, body-worn or other audio accessories, that are not primary radiating elements, but can introduce SAR changes, a manufacturer may submit an inquiry to the FCC Laboratory to request guidance for test reduction prior to commencement of testing. The KDB inquiry should include at least:

i) a detailed test plan based on the SAR impact of each accessory.

ii) a detailed explanation of the features and parameters considered; for example, material, construction, separation distance and similarity, etc.

b) Devices with multiple and optional antennas do not qualify for the same test reduction intended for passive accessories. Because antennas are primary radiating elements, each antenna must be tested independently to determine the highest exposure conditions, and the highest exposure configuration tested for each antenna should be used to determine the possible test reduction for the accessories used with that antenna.

c) When the number of test frequencies or specific frequency channels are not specified in the FCC procedures or KDB publications, the following equation should be used to determine the number of required test channels to ensure sufficient frequency channels have been tested for the frequency range and transmission bandwidth used for the transmitter. A KDB inquiry is required to determine if a reduced number of channels may be used for testing and whether a PBA is required for TCB approval.

$$N_c = Round\left\{\left[100\left(f_{\mathrm{high}} - f_{\mathrm{low}}\right)/f_c\right]^{0.5} \times \left(f_c/100\right)^{0.2}\right\};$$

where N_c is the number of test channels, f_{high} and f_{low} are the highest and lowest frequencies within the transmission band, f_c is the mid-band frequency, and frequencies are in MHz.

7) Stand-alone mobile devices[31]

a) When routine evaluation is required, MPE measurement or computational modeling is used to show compliance for § 2.1091(c).

b) For transmitters that are categorically excluded by § 2.1091(c), a separation distance smaller than that provided by conservative MPE estimates (simple calculations) may be used when justified according to MPE measurement or computational modeling results, provided the smaller distance is applicable for the operation of the transmitter and its antenna(s).

c) A minimum separation distance of 20 cm is required and must be supported by the operating and installation configurations of the transmitter and its antenna(s).

[30] See footnote 27, *supra*.

[31] A stand-alone mobile device may contain a single transmitter, or multiple transmitters that do not transmit simultaneously.

8) Transmitters and modules for use in mobile exposure conditions that allow simultaneous transmission

a) Transmitters and modules certified for mobile or portable exposure conditions and categorically excluded by § 2.1091(c) can be incorporated in mobile host devices without further testing or certification when:

i) The closest separation among all simultaneous transmitting antennas is ≥ 20 cm;[32] or

ii) The antenna separation distance and MPE compliance boundary requirements that enable all simultaneous transmitting antennas incorporated within the host to comply with MPE limits are specified in the application filing of at least one of the certified transmitters incorporated in the host device.[33] In addition, when transmitters certified for portable use are incorporated in a mobile host device the antenna(s) must be ≥ 5 cm from all other simultaneous transmitting antennas.

b) All antennas in the final product must be at least 20 cm from users and nearby persons.

9) Use of occupational and general population limits and exposure conditions

a) Occupational exposure limits generally do not apply to consumer devices and radio services supporting public networks and unlicensed frequencies.

b) RF exposure training instructions and labeling are required for users to comply with the occupational exposure requirements. Information must be included in the equipment authorization application to ensure that occupational exposure limits are only applied to "work-related" conditions, where users must be "fully aware of" and be able to "exercise control over" their exposure to qualify for the higher exposure limits.

c) Occupational training and labeling are not required for devices that comply with the general population exposure limits.

[32] The term "antennas" includes all antennas and radiating structures that may influence exposure compliance.

[33] Each transmitter must comply with the operating requirements and restrictions for all transmitters incorporated within the host. When routine evaluation is not required, MPE compliance requirements for simultaneous transmission can often be estimated for certain generic or specific configurations according to antenna output power, antenna-to-antenna and antenna-to-user separation distances to establish the required separation distances and compliance boundary for the specified exposure conditions. A compliance boundary is the perimeter that provides the required user separation distances in all directions surrounding the antennas where MPE limits are met for simultaneous transmission.

Date	Change Notices:
07/27/2008	447498 D01 Mobile Portable RF Exposure v03r01 has been changed to a new revision under the same Version: 447498 D01 Mobile Portable RF Exposure v03r02 Page 4: 3 (b) (ii) (1) (b) "SAR-to-antenna-separation ratios" changed to "SAR to peak location separation ratios" for clarification. Page 4: Footnote 17 "SAR-to-antenna-separation ratio" changed to "SAR to peak location separation ratio" for clarification. Page 5: 4 (b) (iii) (1) "SAR-to-antenna-separation ratios" changed to "SAR to peak location separation ratios" for clarification.
01/22/2009	447498 D01 Mobile Portable RF Exposure v03r02 has been changed to a new revision under the same Version: 447498 D01 Mobile Portable RF Exposure v03r03 Page 3 Note [13] : This provision applies to devices with high SAR and users can freely operate such devices in different hosts where SAR may change due to design and operating variations." **has been changed to** "*This provision applies to devices with high SAR and users can freely operate such devices in different hosts where SAR may change due to design and operating variations.* ***These devices fall under the Section 2(e) in the TCB exclusion list.*"**
11/13/2009	447498 D01 Mobile Portable RF Exposure v03r03 has been changed to a new Version: 447498 D01 Mobile Portable RF Exposure v04 1) Several places are amended to cross-reference not only KDB 616217 but also the "netbook" supplement; i.e., the following places: footnote 3; 1) b); 2) a); 2) a) ii); 3) b) ii) (2) 2) Introductory paragraph third sentence changed from "thresholds in this document are applied …" to "thresholds in this document are applied for conducted power …" 3) Footnote 2 amended to include: "Permit But Ask Procedure (PBA) (KDB 388624), Permissive Change Policies (KDB 178919)" 4) Item 1) c) changed from "devices below" to "devices operating below" 5) New footnote 7 added at item 1) e); subsequent foonotes re-numbering accordingly 6) At item 1) f) changed from "but included," to "but included with prior FCC confirmation," 7) The re-numbered footnote 12 amended to include "see also other guidance in the attachment to KDB 447498 for USB dongle transmitters" 8) At item 2) b) ii), changed from "for each host platform and device configuration, evaluated in items 2) a) and 2) b)" to "for each device configuration, evaluated in items 2) a) i) and 2) b) i) (2)" 9) Item 2) b) ii) (1) changed from "distance of one half the probe tip diameter" to "distance of 2 mm" 10) Item 2) b) ii) (1) changed from "A single point SAR is measured" to "A single-point SAR (not 1-g SAR) is measured" 11) Item 2) b) ii) (2) is changed from "highest point SAR is > 25% of that measured" to "highest point SAR is 25 % greater than that measured" 12) Item 2) c) changed from "When the maximum 1-g SAR is ≥ 1.2 W/kg, the transmitter or module …" to "When the maximum 1-g SAR is ≥ 1.2 W/kg for devices evaluated under item 2) a), a PBA is required for TCB approval. In addition, the transmitter or module …" 13) Item 2) c) amended to include "An inquiry should be submitted to the FCC Laboratory to determine if other options are applicable and acceptable." 14) Re-numbered footnote 16 changed to cross-reference PBA (KDB 388624) rather than TCB Excl. List (KDB 628591) 15) At item 4) b) ii) (2), changed from "edge configuration (a)" to "edge configuration (A)" 16) New item added, i.e., "6) Test reduction considerations"; subsequent items are re-numbered as follows: "6) Stand-alone mobile devices" changed to "7) Stand-alone mobile devices" "7) Transmitters and modules for use in mobile …" changed to "8) Transmitters and modules for use in mobile …" "8) Use of occupational and …" changed to "9) Use of occupational and …" 17) The re-numbered item "8) Transmitters and modules for use in mobile …" is changed by moving the last sentence of 8) a) ii) to be 8) b)

Enclosure C

Canada - Certification of Radio Apparatus

RSS-Gen General Requirements and Information for the Certification of Radio Apparatus Issue 3, December 2010.

Industry Canada Industrie Canada

RSS-Gen
Issue 3
December 2010

Spectrum Management and Telecommunications

Radio Standards Specification

General Requirements and Information for the Certification of Radio Apparatus

Aussi disponible en français – CNR-Gen

Preface

Radio Standards Specification-Gen, Issue 3, *General Requirements and Information for the Certification of Radio Apparatus* (formerly titled *General Requirements and Information for the Certification of Radiocommunication Equipment*), sets out general requirements for and provides information on the certification of apparatus that is used for radiocommunication other than broadcasting. This document must be used in conjunction with other Radio Standards Specifications (RSSs) specifically applicable to the type of radio apparatus for which certification is sought.

This document will be in force as of the publication date of *Canada Gazette* notice SMSE-016-10, after which the public has 120 days to make comments. Comments received will be considered, and a new issue or a revised version of this issue may be developed.

List of Changes:

(1)	**Title Page:**	The title of this RSS has been changed from *General Requirements and Information for the Certification of Radiocommunication Equipment* to *General Requirements and Information for the Certification of Radio Apparatus* to reflect the correct term as defined in the *Radiocommunication Act.* In various sections throughout the document, the term “radiocommunication equipment” was likewise replaced with “radio apparatus.”
(2)	**Section 2.2:**	Classification of receivers has been revised for clarification.
(3)	**Section 3.2 Test Report:**	This section has been abolished and its contents merged with Section 4.3.
(4)	**Section 3.2.2 (new):**	New section added for modular transmitter approval general requirements.
(5)	**Section 4.1:**	Text has been amended to allow the use of either ANSI C63.4-2003 or later editions of that standard as reference for test facilities and methods.
(6)	**Section 4.2:**	Editorial changes have been made to clarify text.
(7)	**Section 4.3:**	Editorial changes have been made to clarify text. Paragraph (i) has been revised to harmonize measurement frequency selection with international standards and ANSI C63.4.
(8)	**Section 4.4:**	The measurement bandwidth of 200 Hz of a CISPR quasi-peak meter for the frequency range 9-150 kHz has been added.

(9) **Section 4.6:** Definitions of -20 dB and -10 dB emission bandwidths have been added (new sections 4.6.3 and 4.6.4).

(10) **Section 4.7:** The procedure has changed. The user is now required to report the method used.

(11) **Section 4.8:** Editorial changes have been made to clarify text.

(12) **Section 4.9:** Upper frequency measurement requirement has been revised to 100 GHz for unwanted emissions from transmitters operating above 10 GHz.

(13) **Section 4.10:** Receiver spurious emissions requirement has been revised to harmonize with international standards developments.

(14) **Section 5.1:** New text for quality control provisions has been added.

(15) **Section 5.2:** Editorial changes have been made to clarify text.

(16) **Section 5.3 (new):** This section mentions user manual statements and includes a line on bilingual statements, moved from the beginning of Section 2. Subsequent subsections within Section 5 have been renumbered accordingly.

(17) **Section 6:** Editorial changes have been made to clarify text.

(18) **Section 7.1.3:** Paragraph containing rules for adding antenna gain to output power for comparison with limits has been removed.

(19) **Section 7.1.4:** User manual requirements have been clarified.

(20) **Section 7.1.8 (new):** General information for radio frequency identification (RFID) devices transferred from RSS-210 and text has been clarified.

(21) **Section 7.2.2:** Table (restricted bands) has been transferred from RSS-210 and RSS-310 to RSS-Gen.

(22) **Section 7.2.3:** Text pertaining to detector function for measurement of low pulse repetition rate pulse transmitters for which quasi-peak limits are specified has been added.

(23) **Section 7.2.4:** This section for receiver spurious requirements is identical to Section 6; therefore, this section has been removed and merged with Section 6.

(24)	**Section 7.2.5:**	Tables (general field limits) have been transferred from RSS-210 and RSS-310 to RSS-Gen. Provision that spurious emissions must never exceed the level of the transmitter's fundamental emission has been added.
(25)	**Section 8 (Glossary of Terms):**	In the definition of Perimeter Protection System, the term "antenna" has been replaced with "radiating source."

Enquires may be directed to the following address:

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Attention: Regulatory Standards

E-mail: res.nmr@ic.gc.ca

All Spectrum Management and Telecommunications publications are available on Industry Canada's website at http://www.ic.gc.ca/spectrum under *Official Publications*.

Issued under the authority of
The Minister of Industry

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Marc Dupuis
Director General
Engineering, Planning and Standards Branch

Contents

1. Scope

1.1 Application

This Radio Standards Specification (RSS) sets out general requirements applicable to Industry Canada certification of radio apparatus used for radiocommunication other than broadcasting.[1]

RSS-Gen must be used in conjunction with the RSS containing the technical requirements applicable to the type of radio apparatus concerned, and under which it must be certified. Except where otherwise specified in the applicable RSS, radio apparatus shall comply with the specifications and methods prescribed in RSS-Gen.

All sections of RSS-Gen except Section 7 generally apply both to radio apparatus that is subject to licensing and radio apparatus that is exempt from licensing. Section 7 generally applies only to radio apparatus that is exempt from licensing.

1.2 Exclusions

1.2.1 Broadcasting Equipment

RSSs, including RSS-Gen, do not apply to radio apparatus intended for general public broadcasting services. Such equipment is regulated by the Department's broadcasting equipment procedures and standards.

1.2.2 Interference-Causing Equipment

Interference-causing equipment, which is equipment other than radio apparatus that is capable of causing interference to radiocommunication, is covered by the Department's Interference-Causing Equipment Standards (ICES). Examples of interference-causing equipment for which ICES are published are digital apparatus and industrial, medical and scientific (ISM) radio frequency generators.

2. General Information

2.1 Categories of Radio Equipment

Radio apparatus are classified into two categories, Category I equipment and Category II equipment.

2.1.1 Category I Equipment

Category I equipment comprises radio apparatus for which a technical acceptance certificate (TAC) is required pursuant to subsections 4(2) of the *Radiocommunication Act* and 21(1) of the *Radiocommunication Regulations*. A TAC may be issued by the Certification and Engineering Bureau

[1] The term "broadcasting" means any radiocommunication in which the transmissions are intended for direct reception by the general public.

of Industry Canada (the Bureau) or a certificate may be issued by a recognized Certification Body (CB).[2]

2.1.2 Category II Equipment

Category II equipment comprises radio apparatus for which standards have been prescribed, but for which a TAC is not required. Category II equipment is certification exempt. Therefore, a TAC from Industry Canada or a certificate from a CB is not required, pursuant to subsection 4(3) of the *Radiocommunication Act*. The manufacturer and/or importer shall ensure compliance with all applicable procedures and standards for Category II equipment.

2.2 Receivers

Receivers that are used for radiocommunication other than broadcasting are defined as Category I equipment or Category II equipment, subject to compliance with applicable Industry Canada standards. Receivers shall be capable of operation only with transmitters for which RSSs are published. Receivers are classified as described in sections 2.2.1 and 2.2.2.

2.2.1 Category I Equipment Receivers

A receiver is classified as Category I equipment if it meets one of the following conditions:

(a) a stand-alone receiver (see **Note 1**, below), which operates on any frequency in the band 30-960 MHz, and is used for the reception of signals in that frequency band from a transmitter classified as Category I equipment;

(b) a Citizen's Band (CB) receiver (26.96-27.410 MHz);

(c) a scanner receiver.

Note 1: A *stand-alone receiver* is defined as any receiver that is not permanently combined together with a transmitter in a single case (transceiver), in which it functions as the receiver component of the transceiver.

Receivers classified as Category I equipment shall comply with the limits for receiver spurious emissions set out in RSS-Gen; however, equipment certification is granted under the applicable RSS standard along with the associated transmitter classified as Category I equipment. Scanner receivers are covered under their own specific RSS.

[2] The subject of a certificate issued by a foreign certification body that is designated under an international agreement, convention or treaty to which Canada is a party and that is recognized by Canada under that agreement, convention or treaty as competent to certify equipment, to the effect that the equipment complies with the applicable standards; or the subject of a certificate issued by a Canadian Certification Body that meets the requirements set out in requirements for Certification Bodies, as amended from time to time, published by Industry Canada, to the effect that the equipment complies with the applicable standards.

2.2.2 Category II Equipment Receivers

A receiver is classified as Category II equipment if it does not meet any of the conditions of Section 2.2.1.

Category II receivers shall comply with the applicable testing, labelling and user manual requirements in RSS-310.

2.3 Licence-exempt Radio Apparatus

Certain types of radio apparatus are permitted to operate without licensing from Industry Canada. These are typically low output power devices that are intended primarily for consumer or commercial applications; however, some are intended for applications in law enforcement, medical and other specialized applications.

Licence-exempt radio apparatus shares spectrum with licensed radio services and must operate on a no-interference, no-protection basis. Licence-exempt radio apparatus may not cause radio interference to, and cannot claim protection from interference caused by, licensed radio services.

General requirements for licence-exempt radio apparatus are contained in Section 7.

2.4 Licensing of Radio Apparatus

Many types of radio apparatus require a radio licence issued by Industry Canada, which sets the terms and conditions under which the radio apparatus may be operated.

Ordinarily, radio apparatus subject to licensing is classified as Category I equipment (requiring equipment certification under an RSS), and certification must be obtained before the equipment is eligible to be licensed. Whether a type of radio apparatus is subject to licensing is stated in the applicable RSS.

Inquiries concerning licensing requirements should be directed to Industry Canada District and Regional Offices located in the geographical areas of Canada where the equipment is intended to be used.

2.5 Related Documents

Industry Canada documents are available on the Spectrum Management and Telecommunications website at http://www.ic.gc.ca/spectrum, under *Official Publications*.

The following documents should be consulted:

ANSI C63.4 *Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz*

CPC-2-0-03 *Radiocommunication and Broadcasting Systems*

CS-03 *Compliance Specification for Terminal Equipment, Terminal Systems, Network Protection Devices, Connection Arrangements and Hearing Aids Compatibility*

DC-01 *Procedure for Declaration of Conformity and Registration of Terminal Equipment*

ICES-003 *Digital Apparatus*

RIC-66 *Addresses and Telephone Numbers of Regional and District Offices of Industry Canada*

RSP-100 *Radio Apparatus Certification Procedure*

CB-03 *Requirements for the Certification of Radio Apparatus to Industry Canada's Standards and Specifications*

TRC-43 *Designation of Emissions (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service*

TRC-49 *Certification Service Fees*
Information on the Application of the Telecommunications Apparatus Technical Assessment and Testing Fees Order Made under the Financial Administration Act

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ANSI – American National Standards Institute
CB – Certification Body – Procedures for Conformity Assessment Bodies
CPC – Client Procedures Circular
CS – Compliance Specification
DC – Declaration of Conformity, Terminal Attachment Program Procedure
ICES – Interference-Causing Equipment Standard
RIC – Radiocommunication Information Circular
RSP – Radio Standards Procedure
TRC – Telecommunications Regulation Circular

3. Equipment Certification of Radio Apparatus

3.1 Application for Equipment Certification

The application for equipment certification shall be prepared and submitted in accordance with Industry Canada's procedural document RSP-100, *Radio Equipment Certification Procedure*, which describes the equipment certification procedure, or the equivalent Certification Body document. A test report shall be submitted with the application for certification.

Test reports submitted by the applicants should not be dated more than one year old from the date of the application for equipment certification. Test reports dated more than one year old should be revalidated to ensure compliance with current applicable Industry Canada standards. Before equipment certification is granted, the applicant shall demonstrate compliance with the applicable Industry Canada standards.

3.2 Modular Approval for Category I Equipment or Category II Equipment

Modular approval permits the installation of the same module in a host device or multiple host devices without the need to recertify the device. Equipment certification for a modular device may be sought for either Category I equipment or Category II equipment.

Transmitters designed as modules for the installation in a host device may obtain equipment certification as a modular device provided that the applicable RSS is met and the following conditions in this section are met.

3.2.1 Labelling Requirements for the Host device

The host device shall be properly labelled to identify the modules within the host device.

The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the Industry Canada certification number of the module, preceded by the words “Contains transmitter module”, or the word “Contains”, or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: XXXXXX-YYYYYYYYYYY
where XXXXXX-YYYYYYYYYYY is the module’s certification number.

The applicant for equipment certification of the module shall provide with each unit of the module either a label such as described above, or an explanation and instructions to the user as to the host device labelling requirements.

3.2.2 Equipment Certification Requirements for Modular Transmitters

To obtain equipment certification for a modular device, the application for equipment certification shall include a cover letter in which the applicant requests modular approval for the transmitter concerned. The application for equipment certification shall also include the following completed checklist demonstrating that the modular transmitter complies with each of the following conditions:

Modular Approval Checklist:

Modular approval requirement	Yes	No *
(a) The radio elements must have the radio frequency circuitry must be shielded. Physical/discrete and tuning capacitors may be located external to the shield, but must be on the module assembly.		
(b) The module shall have buffered modulation/data input(s) (if such inputs are provided) to ensure that the module will comply with the requirements set out in the applicable RSS standard under conditions of excessive data rates or over-modulation.		
(c) The module shall have its own power supply regulation on the module. This is to ensure that the module will comply with the requirements set out in the applicable standard regardless of the design of the power supplying circuitry in the host device which houses the module.		
(d) The module shall comply with the provisions for external power amplifiers and antennas detailed in this standard. The equipment certification submission shall contain a detailed description of the configuration of all antennas that will be used with the module.		
(e) The module shall be tested for compliance with the applicable standard in a stand-alone configuration, i.e. the module must not be inside another device during testing.		
(f) The module shall comply with the Category I equipment labelling requirements.		
(g) The module shall comply with applicable RSS-102 exposure requirements, which are based on the intended use/configurations.		
(h) Is the modular device for an Industry Canada licensed exempt service?		

* Please provide a detailed explanation if the answer is "No."

3.2.3 Limited Modular Approval (LMA)

LMA may be granted when one or more of the requirements in the table above cannot be demonstrated.

LMA will also be issued in those instances where applicants can demonstrate that they will retain control over the final installation of the device, such that compliance of the end product is assured. In such cases, an operating condition on the LMA for the module must state that the module is only approved for use when installed in devices produced by a specific manufacturer.

When LMA is sought, the application for equipment certification must specifically state how control of the end product into which the module will be installed, and will be maintained, such that full compliance of the end product is always ensured.

3.3 Connection with the Public Switched Network

Radio apparatus that is designed to connect to the public switched network must comply with the applicable RSS and CS-03. It must also be registered in accordance with DC-01.

4. Measurement Methods

4.1 Methods, Instrumentation, and Facilities for the Measurement of Radio Frequency (RF) Signals and Noise Emitted from Radio Apparatus

Test facilities, test methods for field strength radiated measurement and measurements of unwanted emissions into the AC power supply network shall comply with ANSI C63.4-2003 or later edition.

4.2 Open Area Test Site (OATS) and Alternative Site Registration

Compliance radiated measurements shall be performed on an Industry Canada-registered OATS or an alternative test site. Upon successful completion of the test site registration process, Industry Canada will provide the test site registration applicant a unique registration number that identifies the site.

To obtain or renew a unique registration number, the test site registration applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later edition. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 or later edition shall be accepted.

The following information shall be submitted to Industry Canada's Certification and Engineering Bureau to successfully register or renew an accredited test facility:

(a) cover letter;
(b) physical location of the site;
(c) copy of a valid accreditation certificate from a recognized accreditation body;
(d) copy of a scope of accreditation covering ANSI C63.4-2003 or later edition; and
(e) pictures of the site for which registration/renewal is sought.

If the test facility is not accredited to ANSI C63.4-2003 or later edition, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Department will evaluate the filing to determine if recognition shall be granted.

The following information shall be submitted to Industry Canada's Certification and Engineering Bureau to successfully register or renew a non-accredited test facility:

(a) cover letter;
(b) physical location of the site;
(c) detailed description of the site (e.g. dimensions, construction materials);
(d) complete site validation test report; and
(e) pictures of the site for which registration/renewal is sought.

Revalidation shall occur on an interval not to exceed three years. In the case of a renewal, please indicate in the cover letter the previously assigned site number and a brief description of the site in question (e.g. 2156A-1, 3 metre OATS or 2156A-1, 3 metre chamber).

There is no fee or form associated with test site registration. Submissions may be filed electronically or sent by mail to the Bureau. A list of Industry Canada-registered test sites can be found at the following website:

http://www.ic.gc.ca/app/sitt/tstFclts/lnchIndx.do?TF_ACTN=TF_INDX&TF_TYP=1&lang=eng.

4.3 Compliance Testing and Reporting – General Provisions

The following sets out general provisions regarding compliance testing conditions and information required to be documented in the test report.

(a) The following characteristics of the equipment shall be stated in the test report (a list or table should be prepared):

(i) the rated transmitter power;

(ii) the type of modulation with a brief description giving any information useful for the understanding of the device, such as (but not limited to) the bit rate and symbol rate;

(iii) the frequency band(s) of operation for which the device is to be approved;

(iv) the occupied bandwidth(s), channel bandwidth(s) and the emission designator(s);

(v) if the device is pulsed, a graphical representation depicting a typical encoded pulse train showing pulse widths and amplitudes in the time domain, the method of power calculation and the type of detector used during testing shall be reported;

(vi) the frequency stability and supporting information;

(vii) a list of all antennas, including relevant information such as (but not limited to) the antenna type and the antenna gain, intended for use and to be tested with the device; and

(viii) any additional information that is needed to better understand the operation of the equipment for which certification is sought, such as the intended use of the product and the type of receiver being used (e.g. super-heterodyne or super-regenerative).

(b) The test report shall list all test instruments used, including relevant calibration information, and identify the instrument manufacturer, type and model number. The report shall also include all the measurement results and associated measurement procedures which address the requirements of the applicable RSSs.

(c) Either radiated measurements or conducted measurements made at the antenna terminals can be performed to show compliance with the applicable limits. However, radiated measurements are recommended when demonstrating compliance with transmitter unwanted emissions and receiver spurious requirements.

(d) Alternative measurement methods may be used provided that they are fully described in the test report. Industry Canada's Certification and Engineering Bureau shall be consulted to determine the acceptability of the method.

(e) Test results shall be presented in graphical form whenever possible. The graph shall also include the specification limits.

(f) Associated equipment that is normally used with the transmitter and/or receiver shall be so connected before the equipment is tested.

(g) Except where otherwise specified, tests shall be performed at the ambient temperature, at the manufacturer's rated supply voltage and power, and with the transmitter modulating signal representative (i.e. typical) of those encountered in a real system operation. The power supply voltage and the characteristics of the modulating signal shall be stated in the test report. For transmitters with constant envelope modulation, RF output power and field strength measurements performed on the fundamental can be carried out with an unmodulated carrier. Special conditions apply for frequency stability testing (see Section 4.7).

(h) If the transmitter is capable of tuning over several bands, testing at more than one carrier frequency in each frequency band is required to verify any change in RF characteristics.

(i) Except where otherwise specified, measurements shall be performed for each frequency band of operation for which the radio apparatus is to be certified, with the device operating at the frequencies in each band of operation shown in the Table 1 below:

Table 1: Frequency Range of Operation

Frequency Range over which the device operates	Number of Measurement Frequencies Required	Location of Measurement Frequency in Band of Operation
1 MHz or less	1	Centre
1 MHz to 10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near centre and 1 near low end

The frequencies selected for measurements shall be reported in the test report.

(j) The emission tests shall be performed with the device and accessories configured in a manner which tends to produce the maximum level of emissions within the range of variation that can be expected under normal operating conditions.

(k) RF power and spurious emission measurements shall be performed with each antenna type supplied or specified by the manufacturer for use with the transmitter.

4.4 CISPR Quasi-peak Detector

The CISPR quasi-peak detector (also known as CISPR detector or quasi-peak detector in this standard) shall comply with the characteristics given in Publication #16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. It has a bandwidth of 200 Hz for the band 9 kHz-150 kHz, 9 kHz for the band 150 kHz-30 MHz and 120 kHz for the band 30-1000 MHz.

4.5 Pulsed Operation

When the field strength (or envelope power) is not constant or it is in pulses, and an average detector is specified to be used, the value of field strength or power shall be determined by averaging over one complete pulse train, including blanking intervals within the pulse train, as long as the pulse train does not exceed 0.1 seconds. In cases where the pulse train exceeds 0.1 second, the average value of field strength or output power shall be determined during a 0.1 second interval during which the field strength or power is at its maximum value.

The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

4.6 Bandwidths

4.6.1 Occupied Bandwidth

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

4.6.2 -6 dB Emission Bandwidth

Where indicated, the -6 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 6 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

4.6.3 -20 dB Emission Bandwidth

Where indicated, the -20 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 20 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

4.6.4 -10 dB Emission Bandwidth

In certain applications in which a very low-level fundamental emission is contained in a very wide bandwidth, such as ultra-wideband (UWB) devices and some radar devices, the -10 dB emission bandwidth is specified in the applicable RSS requirements. The -10 dB emission bandwidth is defined as the frequency range between the two points at which the spectral density is attenuated 10 dB below the maximum in-band average spectral density.

4.7 Transmitter Frequency Stability

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.

Unless specified otherwise in the RSS that is applicable to the device, the reference temperature for transmitters is +20°C.

A hand-held device that is only capable of operating using internal batteries shall be tested using a new battery without any further requirement to vary the supply voltage. Alternatively, an external supply voltage can be used and set at the battery nominal voltage, and again at the battery operating end point voltage which must be specified by the equipment manufacturer.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environment test chamber, the unmodulated carrier frequency shall be measured under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement. The following temperatures and supply voltage ranges apply, unless specified otherwise in the applicable RSS.

(a) at temperatures of -30°C, +20°C and +50°C, and at the manufacturer's rated supply voltage; and

(b) at a temperature of +20°C and at ±15 percent of the manufacturer's rated supply voltage.

If the frequency stability limits are only met at a different temperature range than specified in (a), the frequency stability requirement will be deemed met if the transmitter is automatically inhibited from operating outside this different temperature range and the published equipment operating characteristics are revised to reflect this different temperature range.

If an unmodulated carrier is not available, the measurement method shall be described in the test report.

4.8 Transmitter Output Power

Transmitter output power measurements shall be carried out before the unwanted emissions test. The transmitter output power value, obtained from this test, serves as the reference level used to determine the unwanted emissions. For comparative purposes, the measurements of emission power and unwanted emissions can be in peak or average provided that the same parameter is used when measuring both.

If the RF output power is internally or externally adjustable or remotely controllable, set or control the power to the maximum rating of the range for which equipment certification is sought. If the spectrum analyzer selectivity or bandwidth is insufficient when measuring emission power, a resolution bandwidth, narrower than that specified, plus numerical integration, in terms of linear power to sum the transmitter output power, is permitted. The method used shall be described in the test report.

If the antenna is detachable, the transmitter output power may be measured at the antenna port using conducted measurement.

If the antenna is not detachable, field strength measurements shall be made using a calibrated open area test site or alternative test site.

The following formula may be used to convert field strength (FS) in volts/metre to transmitter output power (TP) in watts:

$$TP = (FS \text{ x } D)^2 / (30 \text{ x } G)$$

where D is the distance in metres between the two antennas and G is the antenna numerical gain referenced to isotropic gain. (**Note:** When performing radiated measurements on an open area test site or alternative test site, the influence of the metal ground plane on the maximum field strength value should be considered before calculating TP.)

Measure and record the transmitter output power using a measurement bandwidth equal to or greater than the emission bandwidth of the transmitter, or use power summation as described above. When power summation is used, the transmitter output power shall be integrated over the equipment's occupied bandwidth.

4.9 Transmitter Unwanted Emissions

The measurement method shall be described in the test report. When the applicable unwanted emissions limits are defined in relative terms, the same parameter, peak power or average power, used for the transmitter output power measurement, shall be used for unwanted emission measurements.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given in (a) and (b):

(a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency, as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value need not be reported.

When limits are expressed in absolute terms, compliance with the emission limits shall be demonstrated using a CISPR quasi-peak detector and the related measurement bandwidth for emissions below 1000 MHz. As an alternative to CISPR quasi-peak measurement, compliance with the emission limits can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.

Above 1000 MHz, compliance with the emission limits shall be demonstrated using an average detector with a minimum resolution bandwidth of 1 MHz.

4.10 Receiver Spurious Emissions

The receiver shall be operated in the normal receive mode near the mid-point of the band in which the receiver is designed to operate.

Radiated emission measurements are to be performed on a test site registered with Industry Canada. As an alternative, the conducted measurement method may be used when the antenna is detachable. In such a case, the receiver spurious signal may be measured at the antenna port.

If the receiver is super-regenerative, stabilize it by coupling to it an unmodulated carrier on the receiver frequency (antenna conducted measurement) or by transmitting an unmodulated carrier on the receiver frequency from an antenna in the proximity of the receiver (radiated measurement). Taking care not to overload the receiver, vary the amplitude and frequency of the stabilizing signal to obtain the highest level of the spurious emissions from the receiver.

For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least 3 times the highest tuneable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.

For emissions below 1000 MHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.

Above 1000 MHz, measurements shall be performed using an average detector with a minimum resolution bandwidth of 1 MHz.

4.11 Near-field Measurement Method Below 30 MHz

For measurement below 30 MHz, the field strength may be measured in its near field (i.e. the measurement distance less than wavelength/(2π)). The measured field strength shall be extrapolated to the distance specified using the formula that the field strength varies as the inverse distance square (40 dB per decade of distance). It is also permissible to take measurements at a minimum of two distances on at least one radial to determine the proper extrapolation formula instead of 40 dB.

Below 1.705 MHz, the magnetic or H-field shall be used in taking the measurement and the field intensity metre (FIM) is to be equipped with a loop antenna. The permissible limits are given in microamperes/m. The FIM can be calibrated to read in microvolts/m where E/H = 377 is used in the conversion.

5. General Requirements

5.1 Quality Control and Post-Certification Investigations/Audits

From time to time, Industry Canada will conduct market surveillance compliance audits and compliance investigations after certification of radio apparatus intended for sale in Canada. In the event of an investigation of non-compliance, the certificate holder will be asked to provide, to the Department, records of the quality control process, as well as any relevant information that would help to identify issues related to compliance. It is expected that all certificate holders will be able to demonstrate a quality control process used for production inspection and testing in accordance with good engineering practices.

5.2 Equipment Certification Numbers and Labels

Every unit of Category I radio apparatus certified for marketing and use in Canada shall bear a permanent label on which is indelibly displayed the model number and Industry Canada certification number of the equipment model (transmitter, receiver, or inseparable combination thereof). Each model shall be identified by a unique combination of a model number and a certification number, which are assigned as described below in this section.

The label shall be securely affixed to a permanently attached part of the device, in a location where it is visible or easily accessible to the user, and shall not be readily detachable. The label shall be sufficiently durable to remain fully legible and intact on the device in all normal conditions of use throughout the device's expected lifetime. These requirements may be met either by a separate label or nameplate permanently attached to the device or by permanently imprinting or impressing the label directly onto the device.

The label text shall be legible without the aid of magnification, but is not required to be larger than 8-point font size. If the device is too small to meet this condition, the label information may be included in the user manual upon agreement with Industry Canada.

The label for medical implants designed to be used within the human body shall be placed on the package and in the user manual.

The model number is assigned by the applicant and shall be unique to each model of radio apparatus under that applicant's responsibility. The model number shall be displayed on the label preceded by the text: "Model:", so it appears as follows:

Model: model number assigned by applicant

The certification number is made up of a Company Number (CN) assigned by Industry Canada's Certification and Engineering Bureau followed by the Unique Product Number (UPN), assigned by the applicant.

The certification number shall appear as follows:

IC: XXXXXX-YYYYYYYYYYY

where:

- XXXXXX-YYYYYYYYYYY is the certification number;

- XXXXXX is the Company Number (CN) assigned by Industry Canada, made of at most 6 alphanumeric characters (A-Z, 0-9), including a letter at the end of the CN to distinguish between different company addresses;

- YYYYYYYYYYY is the Unique Product Number (UPN) assigned by the applicant, made of at most 11 alphanumeric characters (A-Z, 0-9); and

the letters "IC" (Industry Canada) are to indicate the Industry Canada certification number, but are not part of the certification number.

Permitted alphanumerical characters used in the CN and UPN are limited to capital letters (A-Z) and numerals (0-9). **Example:** A company has been assigned a CN of "21A" and wishes to use a UPN of "WILAN3" for one of its products. The full Industry Canada certification number of this product would thus be: IC: 21A-WILAN3.

The use of symbols to represent characters in the certification number or the model number that are to be considered indeterminate ("wildcard" characters) is not permitted. **Example:** In the hypothetical model number 47XP-820K/A21xx, a manufacturer wishes to use the characters "xx" as wildcards to indicate that these two characters in the model number are not fixed but represent a range of characters decided by the manufacturer. This practice is not permitted. However, this same sequence of symbols can be used as a valid model number, if it identifies a single equipment model.

Category I equipment that is not labelled with the model number and the certification number as described above is not considered certified.

Category II equipment shall be labelled in accordance with the requirements of RSS-310. Note that the provisions regarding model numbers in this section also apply to the RSS-310 labelling requirements.

5.3 Required Notices to the User

Radio apparatus shall comply with the requirements to include required notices or statements to the user of equipment with each unit of equipment model offered for sale.

The required notices are specified in the RSS documents (including RSS-Gen) applicable to the equipment model. These notices are required to be shown in a conspicuous location in the user manual for the equipment, or to be displayed on the equipment model. If more than one notice is required, the equipment model(s) to which each notice pertains should be identified. Suppliers of radio apparatus shall provide notices and user information in both English and French.

5.4 External Controls

The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the requirements used to certify the equipment under the applicable RSSs. Furthermore, information on internal adjustments, reconfiguration or programmability of the device must be made available only to service depots and agents of the equipment supplier, and NOT to the public.

5.5 Multiple Band Operation

Equipment which can operate in a set of multiple frequency bands shall comply with the requirements of each of the bands in which it operates. Specifically, any active or spurious emissions shall comply with the limits prescribed for those bands in which the equipment is active. When transitioning between bands, the equipment shall not actively transmit.

5.6 Exposure of Humans to RF Fields

Category I and Category II equipment shall comply with the applicable requirements of RSS-102.

5.7 Radiocommunication Antenna Systems

Some equipment will require the use of an external antenna system and supporting structure. The Minister has established as a standard that all antennas, masts, towers or other antenna supporting structures are required to be compliant with the terms of CPC-2-0-03.

6. Receiver Spurious Emission Limits

Receivers shall comply with the limits of spurious emissions set out in this section, measured over the frequency range determined in accordance with Section 4.10.

6.1 Radiated Limits

Radiated spurious emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals.

Spurious emissions from receivers shall not exceed the radiated limits shown in the table below:

Table 2: Radiated Limits of Receiver Spurious Emissions

Frequency (MHz)	Field Strength (microvolts/m at 3 metres)*
30-88	100
88-216	150
216-960	200
Above 960	500

*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7.

6.2 Antenna Conducted Limits

If the receiver has a detachable antenna of known impedance, antenna conducted spurious emissions measurement is permitted as an alternative to radiated measurement. However, the radiated method of Section 6.1 is recommended: see **Note** below.

The antenna conducted test shall be performed with the antenna disconnected and the receiver antenna terminals connected to a measuring instrument having equal impedance to that specified for the antenna.

The receiver spurious emissions measured at the antenna terminals by the antenna conducted method shall then comply with the following limits:

Receiver spurious emissions at any discrete frequency shall not exceed 2 nanowatts in the band 30-1000 MHz, and 5 nanowatts above 1000 MHz.

Note: Audit testing by the Department to confirm compliance will use the radiated method of measuring receiver spurious emissions. If the radiated limits are exceeded or, as a result of an interference complaint, it is determined that the device's spurious emissions cause harmful interference to other authorized users of the spectrum, the Department may require that the party responsible for compliance take corrective action. Therefore, it is recommended that the radiated method be employed.

7. Licence-exempt Radio Apparatus

The requirements set out in this section apply to radio apparatus that can operate exempt from licensing. Specific requirements for licence-exempt radio devices are published in the 200 Series of RSS standards (e.g. RSS-210), which are for licence-exempt radio apparatus that is Category I equipment, or in the 300 Series of RSS standards (e.g. RSS-310), for licence-exempt radio apparatus that is Category II equipment.

While Section 7 applies generally only to licence-exempt radio apparatus, various requirements in this section may also be specified in some RSSs for radio apparatus subject to licensing.

7.1 General Information

7.1.1 External Amplifiers

Except as set out below, the marketing of RF power amplifiers for use with licence-exempt radio apparatus is prohibited.

External RF power amplifiers may be marketed separately for use with devices certified under RSS-210, Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz) or devices in the band 5725-5825 MHz certified under Annex 9 (Local Area Network Devices), under the following conditions:

(i) The RF power amplifier shall be certified with the device with which it is intended to be used, such that the amplifier-device combination does not exceed any of the limits specified for the device alone; and

(ii) The RF power amplifier shall be marketed only for use with the device with which it has been certified, so long as the following statement is included on the packaging and in the user manual:

> *Under Industry Canada regulations, this radio frequency power amplifier (insert Industry Canada certification number of radio frequency power amplifier) may only be used with the transmitter with which the amplifier has been certified by Industry Canada. The certification number for the transmitter with which this amplifier is permitted to operate is IC:XX…X-YY…Y.*

7.1.2 Transmitter Antenna

A transmitter can only be sold or operated with antennas with which it was approved. Transmitter may be approved with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest gain antenna of each combination of transmitter and antenna type for which approval is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type having equal or lesser gain as an antenna that had been successfully tested with the transmitter, will also be considered approved with the transmitter, and may be used and marketed with the transmitter. For Category I transmitters, the manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits.
User manuals for transmitters shall display the following notice in a conspicuous location:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

The above notice may be affixed to the device instead of displayed in the user manual.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi) and required impedance for each.

7.1.3 User Manual Notice for Licence-Exempt Radio Apparatus

User manuals for licence-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

7.1.4 Radio Apparatus Containing Digital Circuits (ICES-003)

Radio apparatus containing digital circuitry which can function separately from the operation of a transmitter or an associated transmitter, shall comply with ICES-003. In such cases, the labelling requirements of the applicable RSS apply, rather than the labelling requirements in ICES-003.

7.1.5 Measurement After Installation

In the case of licence-exempt equipment for which measurements can be performed only after installation, such as perimeter protection systems, and systems employing a leaky cable as an antenna, measurements for compliance shall be performed at a minimum of three installations that can be demonstrated to be representative of typical installation sites.

7.1.6 Operating Frequency Range of Devices in Master/Slave Networks

Slave devices operating in a master/slave network may be certified if they have the capability of operating outside the licence-exempt frequency bands permitted for the device by the applicable RSS, provided that they operate only in their permitted licence-exempt frequency bands under the control of a master device. Master devices marketed within Canada must only be capable of operating in licence-exempt frequency bands permitted for the device by applicable Industry Canada standards. Slave devices that can also act as master devices must meet the requirements of a master device. A master device is a device that can operate in a mode in which it is able to transmit without first receiving an enabling signal, and in which it is able to select a channel and initiate a network by sending enabling signals to other devices. A network always has at least one device operating in master mode. A slave device is a device operating in a mode in which the transmissions of the device are under control of the master. A device in slave mode is not able to initiate a network.

7.1.7 Home-Built Devices

Except scanner receivers, home built devices (not from a kit) in quantities of five or less, for personal use and not to be marketed, are not required to be certified or labelled by Industry Canada. Home-built devices must conform to all the technical requirements set out in the applicable standard(s).

7.1.8 Radio Frequency Identification (RFID) Devices

Radio apparatus designed for RFID applications includes devices called tags, which are attached to the items to be identified, and readers, which transmit a signal to interrogate a tag and receive identification data back from the tag.

RFID tags are of two types: active and passive. Active RFID tags operate from their own source of power and actively transmit identification data when interrogated by an RFID reader device. Passive RFID tags do not have their own source of power, but send identification data by passively returning energy received from an RFID reader's interrogating signal. Passive RFID tags may operate without approval from Industry Canada.

7.2 Measurement Methods and Standard Specifications

7.2.1 Measurement Bandwidths and Detector Functions

Unless otherwise specified, for all frequencies equal to or less than 1000 MHz, the emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a CISPR quasi-peak detector function. The measurement bandwidth to be used with the CISPR detector function depends on frequency and is specified in RSS-Gen, Section 4.4. As an alternative to CISPR quasi-peak measurements, compliance with the limits can be demonstrated using a peak detector function, properly adjusted for factors such as pulse desensitization as required, with an equal or greater bandwidth relative to the applicable CISPR quasi-peak bandwidth.

If an average measurement is specified for wanted emissions, an average meter having a bandwidth equal to or greater than the emission bandwidth shall be used.

Unless otherwise specified, for all frequencies greater than 1000 MHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using an average detector function having a minimum resolution bandwidth of 1 MHz.

7.2.2 Emissions Falling Within Restricted Frequency Bands

Restricted bands, identified in Table 3, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:

(a) fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of Table 3;

(b) unwanted emissions falling into restricted bands of Table 3 shall comply with the limits specified in RSS-Gen;

(c) unwanted emissions not falling within restricted frequency bands shall either comply with the limits specified in the applicable RSS, or with those specified in RSS-Gen.

Table 3: Restricted Frequency Bands [(Note)]

MHz
0.090-0.110
2.1735-2.1905
3.020-3.026
4.125-4.128
4.17725-4.17775
4.20725-4.20775
5.677-5.683
6.215-6.218
6.26775-6.26825
6.31175-6.31225
8.291-8.294
8.362-8.366
8.37625-8.38675
8.41425-8.41475
12.29-12.293
12.51975-12.52025
12.57675-12.57725
13.36-13.41
16.42-16.423
16.69475-16.69525
16.80425-16.80475
25.5-25.67
37.5-38.25
73-74.6
74.8-75.2
108-138
156.52475-156.52525
156.7-156.9

MHz
240-285
322-335.4
399.9-410
608-614
960-1427
1435-1626.5
1645.5-1646.5
1660-1710
1718.8-1722.2
2200-2300
2310-2390
2655-2900
3260-3267
3332-3339
3345.8-3358
3500-4400
4500-5150
5350-5460
7250-7750
8025-8500

GHz
9.0-9.2
9.3-9.5
10.6-12.7
13.25-13.4
14.47-14.5
15.35-16.2
17.7-21.4
22.01-23.12
23.6-24.0
31.2-31.8
36.43-36.5
Above 38.6

Note: Certain frequency bands listed in Table 1 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in the 200– and 300– series RSSs, such as RSS-210 and RSS-310, which contain the requirements that apply to licence-exempt radio apparatus.

7.2.3 Devices Employing Pulsed Operation

For licence-exempt transmitters employing pulsed operation for which an average power limit is specified, a peak power limit also applies. Unless otherwise specified, the peak power limit is 20 dB above the average power limit. The average power measurement of the fundamental shall be performed according to the method described in Section 4.5. The methodology described in Section 4.5 is also applicable to unwanted emission measurements provided that they exhibit similar pulse characteristics as the fundamental.

For devices employing pulsed operation with a pulse repetition frequency of 20 Hz or less and for which radiated emission measurements using a CISPR quasi-peak detector are specified, compliance shall be demonstrated using measuring equipment that employs a peak detector function, properly adjusted for factors such as pulse desensitization, and that has the same or larger measurement bandwidths as those specified for CISPR quasi-peak measurements.

7.2.4 AC Power Line Conducted Emissions Limits

Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The more stringent limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network (LISN).

Table 4: AC Power Line Conducted Emissions Limits

Frequency (MHz)	**Conducted limit (dBµV)**	
	Quasi-peak	**Average**
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

7.2.5 Transmitter Spurious Emission Limits

Spurious emissions from licence-exempt transmitters shall comply with the field strength limits shown below. Additionally, the level of any transmitter spurious emission shall not exceed the level of the transmitter's fundamental emission.

Table 5: General Field Strength Limits for Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

Note: Transmitting devices are not permitted in Table 1 bands or, unless stated otherwise, in TV bands (54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz).

Table 6: General Field Strength Limits for Transmitters at Frequencies Below 30 MHz (Transmit)

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1.705-30 MHz	30	N/A	30

Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

7.2.6 Transmitter Frequency Stability

Transmitter frequency stability for licence-exempt radio apparatus shall be measured in accordance with Section 4.7. Also, for licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C, +20°C and +50°C instead of at the temperatures specified in Section 4.7(a).

If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standards, measurement of the frequency stability is not required provided that the occupied bandwidth of the licence-exempt radio apparatus lies entirely outside the restricted bands of Table 1 and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz.

7.2.7 Measurement Distance

For the field strength limits specified in this document, the following conditions apply:

(a) For frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided that:

(i) measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and

(ii) it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment.

Measurements shall not be performed at a distance greater than 30 metres unless it can be further demonstrated that measurements at a distance of 30 metres or less are impractical. The results of measurements performed at a distance other than that specified shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurement; inverse linear distance-squared for power density measurements).

(b) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in this standard. However, an attempt should be made to avoid taking measurements in the near field. Pending the development of an appropriate procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either taking measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor, or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

The extrapolation method used shall be described in the test report.

8. Glossary of Commonly Used RSS Terms and Definitions

This list of terms and definitions covers the commonly used measurement terminology in all Radio Standards Specifications. These definitions are to be used only with RSSs, and do not necessarily cohere with other departmental documents.

Term	Definition
AC wire carrier current device	A device that is intended for and which transmits RF energy via the AC wire lines in residential and/or office buildings.
Auditory assistance device	A device used to provide auditory assistance to a person with a hearing impairment, or for auditory assistance in theatres, churches, etc.
Authorized bandwidth	The maximum width of the band of frequencies used to derive spectrum masks.

Term	Definition
Active average power (single phase)	The time average of the values of active power when the active power varies slowly over a specified period of time. This situation is normally encountered because electric system voltages or currents or both are regularly quasi-periodic. The average active power is readily obtained by dividing the energy flow during the specified period of time, by the time.
Class A digital apparatus	Digital apparatus that is marketed for use in commercial, industrial or business environments, and not intended for use in homes.
Class B digital apparatus	Digital apparatus that is marketed for use in any environment (e.g. in homes, commercial, business and industrial environments).
Effective radiated power (ERP or e.r.p.)	The product of the power supplied to the antenna and its gain relative to a half wave dipole in a given direction.
Emission	Radiation produced, or the production of radiation, by a radio transmitting station.
Emission designator	The designation of a set of characteristics of an emission by standard symbols (e.g. type of modulation of the main carrier, modulating signal, type of information to be transmitted and also, if appropriate, any additional signal characteristics). For example, designator 20K0FID means a bandwidth of 20.0 kHz, uses frequency modulation, is single channel and is in the data/digital format.
Equivalent isotropically radiated power (EIRP or e.i.r.p.)	The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna.
Field disturbance sensor	A device that establishes a radio frequency (RF) field in its vicinity and detects changes in that field resulting from the movement of persons or objects within its range (e.g. motion detector or burglar alarm).
Harmonic emissions	Emissions that are located at frequencies which are whole multiples of the centre frequency emissions of the transmitted signal.
Intentional radiator	A device that generates RF energy which is intended to be received off-air by a radio receiver.
Mean power (of a radio transmitter)	The average power supplied to an antenna transmission line by

Term	Definition
	a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions.
Modulation deviation limiting	The ability of a transmitter circuit to prevent the transmitter from producing deviation in excess of rated system deviation.
Necessary bandwidth	The width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions for a given class of emission.
Occupied bandwidth	The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power. This is also known as the *99% emission bandwidth*. For transmitters in which there are multiple carriers, contiguous or non-contiguous in frequency, the occupied bandwidth is to be the sum of the occupied bandwidths of the individual carriers.
Out-of-band emissions	Emissions on a frequency or frequencies immediately outside the necessary bandwidth which result from the modulation process, but exclude spurious emissions.
Parasitic emissions	Spurious emissions accidentally generated at frequencies which are independent of the carrier or characteristic frequency of an emission and of frequencies of oscillations resulting from the generation of the carrier or characteristic frequency.
Peak envelope power	The average power supplied to an antenna transmission line by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions.
Perimeter protection system	A field disturbance sensor that employs a leaky transmission line as the radiating source and allows detection of movement within the protected range.
Power line carrier system	A system employing radio frequencies used by an electric power utility company on AC transmission lines for protective relaying, telemetry, etc., for general supervision of the power system. It excludes the electric lines which connect the distribution transformer to the customer's premises.
Power spectral density	The power per unit bandwidth.

Term	Definition
Radiation	The outward flow of energy from any source in the form of radio waves.
Receiver spurious emissions	The radio frequency signals generated within the receiver which may cause interference to other equipment. This includes the period during which the equipment is scanning or switching channels.
Receiver spurious emissions – antenna conducted	Those emissions generated in a receiver and appearing at receiver antenna terminals. The manufacturer may or may not include the receiver multicoupling, filtering and preamplification equipment for the measurement, depending on whether the receiver is to be certified as a stand-alone component or as a part of an overall multicoupling-preamplification system.
Receiver spurious emissions – antenna radiated	Those emissions generated in a receiver and radiated from the receiver either via the antenna path or via the control, power, and audio cables that may be used with the receiver.
Remote control device	A radiocommunication device that transmits one-way, non-voice signals for control of an associated receiving device located at a distance from the transmitter.
Scanner receiver	Receivers which scan a frequency band or bands and demodulate and/or decode the signals. Receivers used for the purpose of detecting RF energy and avoiding occupied frequencies are not classified as scanner receivers.
Spurious emissions	Emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.
Standard input termination	Standard input termination consists of a termination equal to the load into which the receiver is designed to operate. Its value shall be specified by the manufacturer or applicant and recorded in the test report.
Standard output termination	Standard output termination consists of a termination equal to the load into which the transmitter is designed to operate. Its value shall be specified by the manufacturer or applicant and recorded in the test report.

Standard temperature	Standard temperature shall be 25 degrees Celsius ± 5 degrees Celsius.
Standard test voltage	The primary voltage applied to the input end of the power cable normally connected to the equipment. It shall be within ± 2% of the value stated by the manufacturer to be the normal working voltage.
Transient frequency behaviour	The measure of the difference, as a function of time, of the actual transmitter frequency to the assigned transmitter frequency when the transmitted RF output power is switched on or off.
Transmitter output power	The RF power dissipated in the standard output termination when operating under the rated duty cycle selected by the applicant for approval.
Unintentional radiator	A device that generates RF energy which is not intended to be radiated for reception by a radio receiver.
Unwanted emissions	Comprises of out-of-band emissions (i.e. emissions on a frequency or frequencies immediately outside the necessary bandwidth), harmonic emissions and spurious emissions.

Enclosure D

Brazil - Certification and Authorization of Telecommunications Products

Annex to Resolution No. 242, of 30 November 2000
Regulation on the Certification and Authorization of Telecommunications Products

ANNEX TO RESOLUTION NO. 242, OF 30 NOVEMBER 2000

REGULATION ON THE CERTIFICATION AND AUTHORIZATION OF TELECOMMUNICATIONS PRODUCTS

TITLE I

GENERAL PROVISIONS

Chapter I

Purpose and General Principles

Art. 1. The present Regulation establishes the general rules and procedures related to the certification and authorization of telecommunications products, including --

I – the assessment of the conformity of telecommunications products with the technical regulations issued or adopted by Anatel; and

II – the requirements concerning the authorization of telecommunications products herein prescribed.

Art. 2. The following general principles shall govern the procedures used in the certification and authorization of telecommunications products:

I – assure that the products commercialized or used in the Country are in conformity with the Regulations issued or the rules adopted by Anatel;

II – assure that the suppliers of telecommunications products fulfill the minimum quality requirements established for their products;

III – assure that the telecommunications products commercialized in the Country, particularly those offered directly to the public through commercial establishments, meet minimum quality standards and are adequately adapted to the services for which they are intended;

IV – assure fulfillment of the requirements pertaining to safety and environmental protection;

V – facilitate Brazil's inclusion in international mutual recognition agreements;

VI – promote the equitable treatment of all parties having an interest in the certification and authorization of telecommunications products; and

VII – ensure the confidential treatment of the particular technical information made available, by order of this Regulation, by the interested parties that requires such treatment.

Chapter II

Definitions and Acronyms

Art. 3. For purposes of this Regulation, the following definitions shall apply:

I – Accredited Laboratory means the body accredited by Inmetro, specifically within the scope of telecommunications, to perform tests required for the conformity assessment process and to issue reports, pursuant to the regulations, procedures, and rules governing the certifications and standards in force;

II – Authorization means the exclusive Anatel act through which the Agency, in the manner and cases herein prescribed, recognizes the certifications of conformity or approves the declarations of conformity for telecommunications products;

III – Category I Telecommunications Product mean the terminal equipment intended for use by the general public for purposes of accessing collective interest telecommunications services;

IV – Category II Telecommunications Products mean the equipment not covered by the definition of Category I products but which make use of the electromagnetic spectrum for the transmission of signals, which equipment includes antennas and those products characterized in specific regulations as restricted radiation radiocommunication equipment;

V – Category III Telecommunications Products mean any products or equipment not contained in the definitions of Category I and II products whose regulation is required to --

a) assure the interoperability of networks that support telecommunications services;
b) assure the reliability of networks that support telecommunications services; or
c) assure electromagnetic compatibility and electrical safety.

VI – Certification means the combination of regulated and standardized procedures arising from the issuance of specific Certifications or Declarations of Conformity for telecommunications products;

VII – Certification of Conformity means the document issued in accordance with the rules governing a particular certification system, which indicates the existence of an adequate level of confidence that a duly identified product is in conformity with the regulations issued or adopted by Anatel;

VIII – Conformity Assessment means the activity developed for the purpose of directly or indirectly assessing whether the applicable requirements covering a given product have been met;

IX – Declaration of Conformity means the document that certifies a particular product's conformity, pursuant to the provisions of articles 22 and 23 of this Regulation;

X – Designated Certification Body means the body designated by Anatel, whether accredited or not, that is qualified to implement and direct a conformity assessment process within the specific scope of telecommunications and to issue Certifications of Conformity;

XI – Designation means the act through which Anatel vests Certification Bodies with the duty and authority, in the manner and cases herein prescribed, to coordinate the conformity assessment process and issue certifications of conformity;

XII – International Accreditation Forum – IAF refers to the international forum that convenes the various accreditation bodies and signatories of Memorandums of Understanding and defines the principles guiding the effort for multilateral recognition of the above cited bodies. The aim of the forum is to rationalize the procedures for the multilateral recognition of the certifications executed by certification bodies accredited by signatories to the Forum;

XIII – International Laboratories Accreditation Cooperation – ILAC refers to the international forum intended to support the bodies responsible for the accreditation of testing and evaluation laboratories by providing such bodies with criteria and procedures that assure the reliability of the services performed by such laboratories;

XIV – Mutual Recognition Agreement (MLA), relative to the conformity assessment process, means the agreement signed between nations which is intended to simplify the procedures for assessing the conformity of telecommunications products and, in this way, facilitate trade between the parties. The purpose of such agreement is to formalize the recognition by the interested parties of the relevant Certification Bodies and to secure mutual acceptance of the activities developed for the purpose of assessing conformity, in accordance with the regulations of the importing parties;

XV – The National Institute for Industrial Metrology, Standardization, and Quality (*Instituto Nacional de Metrologia, Normalização e Qualidade Industrial* – Inmetro) refers to the Brazilian Certification System's official Accreditation Body;

XVI – Test means the technical operation that consists in the verification of one or more of a given product's technical characteristics, in accordance with the specific procedures prescribed in the applicable regulations.

XVII – Testing Laboratory means the body, whether accredited or not, specifically within the scope of telecommunications, that is qualified to perform the tests required for the conformity assessment process and to issue reports, as prescribed in the regulations, procedures, and rules governing the certifications and standards in force;

XVIII – Telecommunications means the transmission, emission, or reception by wire, radio waves, optical means, or any electromagnetic process of symbols, characters, signals, written matter, images, sounds, or information of any kind;

XIX – Telecommunications Product means the equipment, apparatus, device, or element comprising a medium that is necessary or sufficient for the realization of a telecommunication;

XX – Third Party means the person or body that acts independently of telecommunications manufacturers, suppliers, service providers, or potential buyers of a given product;

Chapter III

Implementation of Certification and Authorization

Art. 4. For purposes of this Regulation, all Telecommunications Products classified under Categories I, II, and III are subject to certification and authorization.

Stand-alone Paragraph. Anatel may issue acts listing the Category I, II, and III telecommunications products that shall be subject to regulation.

TITLE II

Applicable Regulations and Certification Rules

Art. 5. Anatel has the duty to issue the certification regulations and rules which are to be observed in the certification and authorization processes herein prescribed.

Paragraph 1. The regulations shall specify the requirements to which the products must conform and may set forth the procedures necessary for the performance of tests.

Paragraph 2. The certification rules shall prescribe the procedures and requirements necessary for directing the conformity assessment process, to which procedures the certification bodies are required to adhere.

Paragraph 3. The certification rules referred to in the paragraph above shall be issued by Anatel by means of official acts.

Art. 6. Anatel may, at any time, modify the certification regulations and rules and set forth provisions concerning the need to adapt the products and equipment, regardless of whether these are in use or not, as well as the procedures and terms that must be observed for purposes of fulfilling such determinations.

Stand-alone Paragraph. All modifications in the certification regulations and rules shall be announced by Anatel through the means commonly employed for such purpose and prescribed in the specific regulatory provisions.

Art. 7. In the event Anatel has issued no certification regulations or rules, it shall be the duty of the Agency to deliberate on the suitability and feasibility of the conformity assessment and authorization, for which purpose the following precepts must be observed:

I – the principles prescribed in art. 2 of this Regulation;

II – the impact of the implementation of the product or equipment in the services for which it is intended;

III – the contribution made by the use of the product or equipment in the fulfillment of universal service goals and the modernization of telecommunications services; and

IV – the international experience with the use of the product or equipment.

Art. 8. Anatel may, at is discretion, require that field tests be performed on the product or equipment for the purpose of gathering data intended to assist the Agency in rendering a decision on the suitability or feasibility of the certification.

Art. 9. In the event Anatel renders a favorable decision in regard to the implementation of the conformity assessment process, pursuant to art. 7, the Agency may --

I – require that field and laboratory tests be performed;

II – establish, on the basis of references, the requirements or technical rules to be applied in the conformity assessment process; and

III – initiate studies on the issuance of Regulations governing the product or equipment and establish the conditions to be fulfilled in the conformity assessment and authorization of the product, which conditions shall be executed in the manner set forth in Title IV of this Regulation.

Stand-alone Paragraph. The standards prescribed in indent II must include --

a) national and international technical standards;
b) regulations applicable to the product in other countries or regions;
c) regulations issued by Anatel for similar products; or
d) manufacturer specifications.

Art. 10. If the immediate application of the standards prescribed in indent II of art. 9 is not possible, Anatel shall, on a case-by-case basis, establish the specific conditions to be applied.

TITLE III

Basic Structure of the Certification and Authorization Process

Chapter I

Bodies Responsible for Product Certification and Authorization

Art. 11. The following agents are involved in the telecommunications product certification and approval processes referred to in art. 4 of this Regulation:

I – the Superintendence for Radio Frequencies and Enforcement of Anatel;

II – Designated Certification Bodies; and

III – Testing laboratories.

Chapter II

Mutual Recognition Agreements

Art. 12. As an integral component of the conformity assessment system adopted by Anatel, the Agency may sign Mutual Recognition Agreements (MLA) connected with the conformity assessment of telecommunications products for the purpose of extending recognition to certification bodies and testing laboratories.

Paragraph 1. The procedures regarding conformity assessments and the test reports issued by the Certification Bodies and the testing laboratories respectively, as set forth in this article, must be implemented and developed in accordance with the regulations prepared by Anatel or the rules by it adopted, which procedures and reports should be written in Portuguese but may, optionally, be written in English or Spanish.

Paragraph 2. The scope of the MLA signed by Anatel shall be limited to the procedures on conformity assessment.

Paragraph 3. In the event the pertinent MLA involve the recognition of testing laboratories, these must be recognized by the Designated Certification Bodies.

Paragraph 4. The MLA may contemplate the recognition of Certification Bodies that also act as testing laboratories.

Paragraph 5. In implementing the MLA, the concepts and definitions established in the ISO/IEC standards shall be considered, and a transition period shall be observed, during which the Brazilian Government shall evaluate the entities designated by foreign governments in regard to the aspects related to their conformity with the regulations in effect, as well as the procedures adopted by such entities.

Art. 13. Anatel shall recognize the certifications of telecommunications products performed by foreign Certification Bodies in those cases in which there exist Mutual Recognition Agreements signed between the Brazilian Accreditation Body and the specific foreign Accreditation Body, whose terms of recognition sill be incorporated in Memorandums of Understanding negotiated between the Certification Bodies of the interested parties.

Stand-alone Paragraph. The foreign Certification Bodies recognized by means of the agreements referred to in the heading of this article shall be considered eligible for designation by Anatel.

Chapter III

Designation of Certification Bodies by Anatel

Art. 14. Anatel shall designate Certification Bodies to direct the telecommunications product certification processes.

Art. 15. The designation of a Certification Body shall occur by means of an administrative proceeding launched at the request of such body, which shall be responsible for signing a term of responsibility and an agreement mandating that it perform the proposed activities on the basis of the standards prescribed in Annex I involving the suitability, technical requirements, and procedures of such activities. The designation shall be formalized by means of an Act issued by Anatel.

Art. 16. Anatel shall designate certification bodies that fulfill one of the following requirements:

I – the body is accredited by Inmetro to certify telecommunications products;

II – the body is a non-profit entity established in Brazil that has the technical and administrative capacity necessary to direct the conformity assessment process for telecommunications products, as defined in Annex I of the present Regulation; or

III – the body is a foreign certification body recognized through a Mutual Recognition Agreement.

Art. 17. The act formalizing the designation of the Designated Certification Body shall indicate the types and classification of the products subject to the designation, as well as the regulation that must be complied with for purposes of the certification of each product, and such act shall, further, adhere to the requirements and procedures prescribed in Annex I of the present Regulation, so as to demonstrate that the designated institution has --

I – adequate technical capacity to perform the duties assigned to it;

II – adequate qualification that permits it to perform such duties with independence; and

III – good legal standing that demonstrates that it is a legally constituted entity with legal representation.

Paragraph 1. In the act of designation, or at any time, Anatel may require the Designated Certification Body to apply for accreditation before Inmetro. Failure to comply with such condition may result in the withdrawal of such Certification Body's designation.

Paragraph 2. The requirement prescribed in the paragraph above must be fulfilled within the term and under the conditions established by Anatel.

Art. 18. The entities applying for designation must submit a Quality Manual, in fulfillment of the requirements established in Annex I, as well as their certification programs and all procedures applicable to the certification process, pursuant to the specific certification rules.

Art. 19. In the event the designation is withdrawn, Anatel shall notify the parties responsible for submitting the product authorization applications that have a signed service contract with the particular Body whose designation has been withdrawn and establish a term for such parties to sign a new contract, on the basis of the existing guidelines, with another Certification Body.

Stand-alone Paragraph. If, as a result of the cases prescribed in the heading of this article, it is found that no other Designated Certification Body capable of replacing the Body subject to the withdrawal described above exists, the conformity assessment shall be performed in the manner used for the issuance of a Declaration of Conformity and have legal effect for a term of two years from the withdrawal of the designation.

TITLE IV

Certification and Authorization Procedures

Chapter I

Conformity Assessment, Procedures, and Verification

Art. 20. The conformity assessment process of a given product in relation to the regulations issued by Anatel or by it adopted constitutes the initial phase of such process and is aimed at obtaining the authorization of such product.

Stand-alone Paragraph. The issuance of an authorization document is required for purposes of the commercialization and use, within the Country, of the products classified under Categories I, II, and III herein described.

Art. 21. For purposes of demonstrating conformity assessment before Anatel, the interested party must, while observing the objectives of the authorization request and the applicable regulations, submit one of the following documents:

I – a Declaration of Conformity;

II – a Declaration of Conformity with an accompanying test report;

III – a Certification of Conformity based on type-approval tests;

IV – a Certification of Conformity based on specific tests and periodic assessments of the product; or

V – a Certification of Conformity with an accompanying quality system assessment.

Art. 22. The Declaration of Conformity prescribed in Annex IV is the conformity assessment document applicable to home-made products intended for individual use, which does not grant the right to authorize the commercialization of the product in the Country.

Art. 23. The Declaration of Conformity with accompanying test reports prescribed in Annex V is the conformity assessment document applicable in exceptional cases in which the designated certification bodies establish terms of greater than three months for the commencement and completion of the process for issuance of the certification of conformity, not including the period required to perform tests, as a result of which cases Anatel shall undertake to direct the necessary conformity assessments.

Stand-alone Paragraph. The rule prescribed in the heading of this article shall apply when no designated and qualified certification bodies exist to direct the conformity assessments and in the case set forth in art. 65.

Art. 24. The Certification of Conformity based on type-approval tests prescribed in Annex VI is the conformity assessment certification document that applies to Category III Telecommunications Products.

Art. 25. The Certification of Conformity with accompanying tests and periodic assessments of the product prescribed in Annex VII is the conformity assessment certification document applicable to Category II Telecommunications Products.

Art. 26. The Certification of Conformity with an accompanying quality system assessment prescribed in Annex VIII is the conformity assessment certification document applicable to Category I Telecommunications Products.

Art. 27. The certification regulations and rules issued by Anatel may require that given products, as a result of their unique characteristics and the specific ends for which they are used, have the verification of their conformity formalized by means of procedures different than those prescribed in Annexes IV and VIII of the present Regulation, which procedures will, in such cases, be subject to specific treatment under the certification rules.

Chapter II

Authorization

Art. 28. The following parties are defined as interested or responsible parties and considered legitimate for purposes of requesting the authorization of particular products by Anatel:

I – the product manufacturer;

II – the supplier of the product in Brazil;

III – the natural or juridical person that applies for the authorization of the telecommunications product for individual use.

Paragraph 1. If the interested party is a natural person, such person must have full legal capacity, whereas if such party is a juridical person, it must be legally constituted under Brazilian law.

Paragraph 2. Foreign juridical persons interested in the authorization of products must have a commercial representative legally constituted in Brazil with the capacity to assume, within the territorial boundaries of the Country, all responsibilities associated with such products' commercialization and the related customer service.

Art. 29. The application for product authorization must include the following documents:

I – a certificate or declaration of conformity, in accordance with the provisions prescribed in the previous Chapter, demonstrating the product's conformity;

II – proof of payment of the chargeable fees, in accordance with Annex II of this Regulation;

III – a user manual for the product, written in Portuguese;

IV – the interested party's registration information, for which purpose it must use its own form;

V – proof that the interested party is legally established according to Brazilian law or that it has a commercial representative established in Brazil, in a manner that permits such party to assume responsibility for the product's quality and supply and any technical assistance related thereto within the national territory.

Paragraph 1. In cases in which the product is not intended for direct sale to consumers, the manual prescribed in indent III may be written in English or Spanish.

Paragraph 2. The requirement prescribed in indent III does not apply to the products specified in art. 22.

Art. 30. The provisions established in the Consumer Protection and Defense Code (*Código de Proteção e Defesa do Consumidor*) apply to the commercial relationships that fall within the scope of the present Regulation.

Art. 31. Anatel shall deny the authorization of products when --

I – the existence of a defect of form is identified in the certification or declaration of conformity;

II – the certification of conformity is issued by an undesignated certification body;

III – the certification of conformity is issued by a Designated Certification Body whose designation has been suspended or withdrawn;

IV – the certification or declaration of conformity is issued on the basis of regulations other than those applicable to the product and which are in force in the Country.

Art. 32. The product authorization subject to the certification of conformity may not be used by third parties when --

I – the product is produced in a manufacturing plant other than the one subject to evaluation, specifically in those cases involving a Certification of Conformity with an accompanying Quality System assessment; or

II – the product is distributed in Brazil by a supplier other than the one that applied for the authorization and, in which case, this circumstance would have the effect of jeopardizing the duties prescribed in art. 29, indent V, of the present Regulation.

Art. 33. In the case set forth in art. 9 of this Regulation, Anatel shall assign the Designated Certification Body, which will direct the authorization process in accordance with the conditions established by the Agency.

TITLE V

Validity and Identification of the Authorization

Chapter I

Authorization Validity and Procedure

Art. 34. The term of validity for product authorizations shall be --

I – indefinite for products approved by means of a Certification of Conformity;

II – two years for products approved by means of a Declaration of Conformity issued exceptionally in the cases set out in art. 23, as well as the authorizations performed pursuant to art. 33; and

III – five years for products approved by means of a Declaration of Conformity issued on the terms and conditions specified in indent I of art. 21.

Stand-alone Paragraph. Amendments to the product authorizations shall not result in the modification of their terms of validity.

Art. 35. The responsible party must notify the Certification Body of any modifications in the production plan or process.

Paragraph 1. The Certification Body shall evaluate the impact of such modifications and determine whether new tests will be required.
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Paragraph 2. If it is determined that new tests must be performed, the Certification Body must issue a new certification of conformity, which must be authorized by Anatel.

Art. 36. In cases of modifications in the products subject to a Declaration of Conformity, the party holding the authorization must undertake the process for issuance of a new Declaration of Conformity.

Stand-alone Paragraph. The requirement prescribed in the heading of this article does not apply if the modifications do not result in changes in the relevant technical characteristics, as verified through tests performed within the technical limits prescribed in this Regulation.

Art. 37. The obligations prescribed in articles 35 and 36 extend to the users of products, which users shall have the duty to undertake the issuance of a new product authorization whenever such users are responsible for the modification or adjustment of a particular product.

Art. 38. The withdrawal or suspension of the authorization shall not result in the prohibition of a particular product's use by users who already make legal and appropriate use of such product, as defined by Anatel, provided such use does not result in modifications in the technical regulations applicable to such product.

Paragraph 1. In cases of modifications in the applicable technical regulations which do not require the adjustment of the product in use, the provisions established in the heading of this article shall apply.

Paragraph 2. In the event the modifications in the applicable technical regulations require adjustment of the product in use, it shall be the duty of the user to perform the adjustments considered mandatory under the terms of art. 6 of this Regulation.

Chapter II

Identification of the Authorization

Art. 39. Authorized products shall have Anatel's identification seal legibly and indelibly affixed to them, pursuant to the model and instructions contained in Annex III of this Regulation, including the authorization number and the bar-code identifier, and according to the specific rules for assembling the Anatel name.

Paragraph 1. For products that are so small such that it is impractical to place the label and authorization identification code on them, the authorization label and the identification code and bar-code identifier must be placed in the operating manual provided to the user and, optionally, on the product's packaging

Paragraph 2. The interested party must seek Anatel's express authorization to apply the provision prescribed in the paragraph above.

Paragraph 3. In cases of the withdrawal or suspension of the authorization, the party responsible for the product must, immediately following publication of the acts of withdrawal or suspension, discontinue the use of the Anatel name as well as the commercialization of the product and all publicity or advertising thereof.

Art. 40. The right to use the authorization identification may not be transferred or granted to third parties, except in cases of the continued use of such identification resulting from successions recognized by Anatel.

Chapter III

Suspension and Withdrawal of the Authorization

Section I

Suspension and Withdrawal of the Certification of Conformity by the Certification Body

Art. 41. The Designated Certification Body responsible for the issuance of the Certification of Conformity may withdraw or suspend the legal validity of the certification by it issued, in accordance with the provisions set out in this Chapter.

Art. 42. The legal validity of the Certification of Conformity shall be suspended by the Designated Certification Body when --

I – the interested party fails to undertake adjustments in the certified products mandated as a result of the modification or issuance of regulations that are applicable to such products under the terms of art. 6.;

II – following certification of the product, the interested party fails to fulfill any of the clauses specified in the monitoring contract governing the periodic assessment of the product or the maintenance of the manufacturer's Quality System, as established with the Designated Certification Body;

III – the interested party uses the Certification of Conformity for purposes of giving publicity to characteristics of the product not submitted to assessment; or

IV – the interested party, through the employment of any means of promotional publicity, leads third parties to conclude that a product other than the one actually bearing the certification has been certified.

Art. 43. If within one hundred and eighty (180) days the adjustments prescribed in the stand-alone paragraph of art. 6 have not been implemented, or if a new certification process has not been performed or, additionally, a well-founded showing accepted by the Designated Certification Body presented, the Certification of Conformity shall be subject to withdrawal.

Art. 44. The Designated Certification Body must notify Anatel and the interested party within a maximum of 10 days of its decisions regarding the withdrawal or suspension of the legal validity of the Certification of Conformity for those telecommunications products subject to authorization.

Section II

Suspension of the Authorization by Anatel

Art. 45. Anatel shall suspend the legal validity of an authorization whenever it verifies irregularities related to the certification or authorization process of a particular product which are not contemplated in any of the cases prescribed in art. 49 of this Regulation.

Stand-alone Paragraph. The act of suspension of the authorization shall be given the same publicity as that given to the act granting the authorization.

Art. 46. The authorization shall be suspended in the following cases:

I – the failure to modify the product specifications in an adequate and timely manner following a determination mandating the adjustment of such product to the new regulations issued by Anatel;

II – the use or commercialization of the product with modifications that do not fulfill the obligations prescribed in articles 35 and 36 of the present Regulation;

III – the suspension by the Designated Certification Body of the legal validity of the Certification of Conformity; and

IV – any irregularity identified by Anatel in the certification or authorization process.

Stand-alone Paragraph. The recurrence of the acts prescribed in this article shall result in the withdrawal of the authorization.

Art. 47. The party having an interest in the authorization shall be notified of the suspension of such authorization's legal validity by any means of correspondence bearing proof of receipt.

Paragraph 1. The act of suspension must be based on a well-founded showing, indicating the measures that the notified party is to take and specifying the term of the suspension, which shall extend for up to one hundred and eighty (180) days.

Paragraph 2. The suspension shall remain in effect until such time as the measures prescribed in the act of suspension and the term specified in the paragraph above have been fulfilled.

Paragraph 3. The failure to implement the measures prescribed in the act of suspension referred to in paragraph 1 in an adequate and timely manner shall be cause for the withdrawal of the authorization, notwithstanding any other penalties prescribed in the applicable regulations.

Art. 48. The suspension of the legal validity of the authorization does not interrupt or suspend the continuity of the term of validity originally prescribed in the product authorization.

Section III

Withdrawal of the Authorization

Art. 49. The authorization shall be withdrawn as a result of --

I – the submission of false or fraudulent declarations or documentary evidence for the certification or authorization process;

II – the ascertainment of a significant and unjustified discrepancy between the results obtained from the tests performed on product samples and the results obtained in subsequent assessments;

III – the commercialization of the product during the time the legal validity of the authorization is suspended or the undertaking of any action that is not in conformance with the official declaration of suspension of the authorization;

IV – the reasons prescribed in the stand-alone paragraph of art. 46 and paragraph 3 of art. 47 of this Regulation; or

V – a request for the withdrawal of the authorization by the party applying for such authorization.

Art. 50. In exercising the prerogative prescribed in art. 6 of the present Regulation, Anatel may, upon a well-founded showing of an imminent risk to the safety of users or the environment, withdraw, at any time, a product authorization.

Stand-alone Paragraph. Upon verification of the case set forth in the heading of this article, Anatel shall give wide publicity thereto and advise the general public of the risks associated with continued use of the particular product.

Art. 51. Anatel shall always maintain a complete list of the suspended or withdrawn authorizations updated and available to the public.

Stand-alone Paragraph. Notwithstanding the provision established in the heading of this article, the official withdrawal of the authorization shall be given the same publicity as that given to the granting of such authorization.

Chapter IV

Renewal of the Authorization

Art. 52. The interested party may submit a request to Anatel for the renewal of the term of validity of the authorization, to which request must be attached proof of payment of the chargeable fees.

Paragraph 1. In the case prescribed in art. 23, the renewal of the authorization shall occur only after the product has been submitted to the procedures established for issuance of the Certification of Conformity.

Paragraph 2. The renewal of the authorization must be requested within, at least, six months of the expiration of its term of validity.

Paragraph 3. Upon expiration of the term prescribed in the paragraph above, the interested party must request a new authorization.

Chapter V

Appeals to the Decisions Rendered by the Certification Bodies

Art. 53. Decisions rendered by the Designated or Accredited Certification Bodies regarding the issuance, renewal, suspension, or withdrawal of Certifications of Conformity may be appealed.

Paragraph 1. In the event a Designated Certification Body already accredited by Inmetro is responsible for conducting the process for issuance of the certification, the appeals should be submitted to the competent body of the National Metrology, Standardization, and Quality System.

Paragraph 2. In the cases prescribed in the paragraph above, final decisions of the competent body of the National Metrology, Standardization, and Quality System may not be appealed to Anatel.

Paragraph 3. In the event a Designated Certification Body not accredited by Inmetro is responsible for conducting the process for issuance of the certification, the appeals should be submitted to Anatel, as set forth in the Agency's Internal Regulation.

TITLE VI

Sanctions

Art. 54. In compliance with the provision of art. 64 of the present Regulation, violators shall be subject to the following sanctions, which shall be applied separately or in combination:

I – warning;
II – fine;
III – suspension of the product authorization;
IV – withdrawal of the product authorization;
V – suspension of the designation;
VI – withdrawal of the designation.

Art. 55. For purposes of the present Regulation, the following actions, by the following entities, shall be subject to the imposition of sanctions:

I – telecommunications service providers --

a) the use, employment, or connection of products not authorized by Anatel, when such products are subject to authorization under the terms of art. 4, including the activation of terminal equipment not authorized by Anatel; or
b) the inappropriate use or modification of the technical characteristics of the product that leads to the operation of such products in a manner that does not conform with the technical characteristics on which the authorization is based.

Penalty: The penalties prescribed in the licensing contracts or terms of permission or authorization, notwithstanding the application of specific regulations governing the imposition of sanctions.

II – value added service providers --

a) the use, employment, or connection of products not authorized by Anatel, when such products are subject to authorization, under the terms of art. 4; or
b) the inappropriate use or modification of the technical characteristics of the product that leads to the operation of such products in a manner

that does not conform with the technical characteristics on which the authorization is based.

Penalty: Warning or Fine.

III – manufacturers --

a) the manufacture of products in nonconformity with the requirements on which the product certification and authorization are based, for purposes of the commercialization or use of such products in the Country; or

b) the illicit use of the product authorization or of the respective Anatel seal of identification in an unauthorized product.

Penalty: Fine and Suspension or Withdrawal of the Authorization.

IV – suppliers, distributors, and manufacturers responsible for the supply and distribution of the product --

a) the illicit use of the authorization or of the respective Anatel seal of identification in unauthorized products; or

b) the non-fulfillment of obligations that gave rise to the authorization.

Penalty: Fine and Suspension or Withdrawal of the Authorization.

c) the commercialization, in the Country, of unauthorized products, when such products are subject to authorization under the terms of art. 4.

Penalty: Fine and Confiscation.

V – any user of products --

a) the use of products not authorized by Anatel, when such products are subject to authorization under the terms of art. 4.

Penalty: Warning. In cases of Recurrence, Malicious Fraud, or Gross Negligence: Fine and Confiscation.

b) the use of equipment not authorized by Anatel which use the electromagnetic spectrum.

Penalty: Fine in addition to Sealing (Shutdown) and Confiscation.

c) the implementation of unauthorized modifications in authorized products, as determined through the application of articles 35 and 36 of the present Regulation.

Penalty: Warning. In cases of Recurrence, Malicious Fraud, or Gross Negligence: Fine and Confiscation.

VI – parties interested in or responsible for the product authorization --

a) the submission of fraudulent or false declarations or documentary evidence for the authorization process;

Penalty: Fine and Withdrawal of the Authorization.

b) any negligent or deliberate action that may have the effect of confusing or inducing an error by Anatel, the certification bodies, or the testing laboratories;

Penalty: Warning and Withdrawal of the Authorization

c) the noncompliance with the provisions of indent III of art. 31 of this Regulation.

Penalty: Warning. In cases of Recurrence, Malicious Fraud, or Gross Negligence: Fine in addition to Suspension or Withdrawal of the Authorization.

VII – the certification bodies --

a) the non-fulfillment or failure to preserve the conditions that gave rise to the designation by Anatel; or
b) conduct that is in nonconformance with the acts of designation.

Penalty: Warning. In cases of Recurrence: Fine in addition to Suspension or Withdrawal of the Designation.

Art. 56. Notwithstanding the provisions prescribed in the article above, the sanctions to be imposed by Anatel on Designated Certification Bodies, as well as the cases leading to the imposition of such sanctions, shall be specified in the acts of designation described in art. 16 of the present Regulation.

Stand-alone Paragraph. Any actions aimed at preventing or impeding Anatel's enforcement activities, including those activities intended for the collection of samples used for the purpose of performing conformity assessments of a particular product, are forbidden and subject to fine.

Art. 57. The factors that shall be considered for purposes of the application of sanctions include the nature and seriousness of the violation, the harm caused by such violation to the services, users and services operators and providers, the violator's financial condition, the advantages gained by the violator as a result of its actions, whether the violation constitutes a recurrence of an earlier violation, and any aggravating circumstances.

Art. 58. Specific regulations on the criteria and procedures for the imposition of sanctions issued by Anatel shall be applied in addition to the provisions herein set forth.

Stand-alone Paragraph. The sanctions shall be applied on the basis of a well-founding showing by Anatel.

Art. 59. In accordance with the provisions of the Internal Regulation of Anatel, no administrative sanctions shall be applied in the absence of the pertinent official procedures governing the imposition of sanctions or without the guaranteed right of a full defense.

Art. 60. The fine shall be increased by fifty percent (50%) in the event the specific violation is committed again.

Stand-alone paragraph. The specific recurrence referred to in the heading of this article shall be understood on the basis of the definition set forth in the specific regulation issued by Anatel concerning the application of administrative sanctions.

Art. 61. The fines assessed for non-fulfillment of any provisions established in the present Regulation may not be for an amount less than one hundred *reais* (R$ 100.00) or for an amount greater than three million *reais* (R$ 3,000,000.00).

Art. 62. Anatel may, on it own motion or upon a well-founded request by any interested party, undertake the measures for the confiscation of equipment.

Stand-alone paragraph. The failure by the violator to adopt the measures required to correct the defects that led to the confiscation of particular products for a period of more than ninety (90) days, shall empower the Agency to make use of the confiscated equipment as it sees fit, which use may include the destruction of such equipment.

Art. 63. Whenever the confiscation of equipment is not possible, such equipment shall be sealed (shutdown).

Paragraph 1. Products that use the electromagnetic spectrum may also be sealed (shutdown).

Paragraph 2. The purpose of the seal (shutdown) is to interrupt the use of the equipment temporarily and in a manner that allows for the eventual reinstatement of such equipment.

Paragraph 3. Only Anatel may remove the seals affixed to installations or equipment.

Art. 64. The sanctions prescribed in this chapter shall be applied notwithstanding the application of the pertinent civil and criminal legislation, as well as the penalties established in the telecommunications service licensing contracts or acts of permission or authorization.

TITLE VII

Final Provisions

Art. 65.The regulations prescribed in paragraph 1 of art. 5 may include provisions concerning special characteristics for Category I Telecommunications Products intended for use by individuals with disabilities.

Stand-alone Paragraph. In the cases prescribed in the heading of this article, the conformity assessment processes related to the particular product's special characteristics shall observe the provisions of the stand-alone paragraph of art. 23, provided such product is manufactured on a small scale, as determined by Anatel.

Art. 66. The authorization does not exempt the user of the product from the obligation to use a given product only as long as such product's performance is compatible with the regulations in force.

Art. 67. The use of portable telecommunications products within the territorial boundaries of Brazil that can be classified as component parts of personal systems, whether of global or regional use, shall be permitted during such time as the party legally authorized to bear such products remains in the Country and provided that such products are certified by a foreign Government that extends reciprocal treatment relative to the product in question or that is, further, a party to a Memorandum of Understanding to which Brazil is a signatory.

Stand-alone paragraph. The authorization prescribed in the heading of this article includes the possible commercialization of the product.

Art. 68. Products that have been restored or renovated, even if the restoration or renovation of such products involved the application of industrial processes, shall not be considered for purposes of conformity assessment or authorization.

Art. 69. Authorized products may be transferred to third parties provided such transfers are accompanied by the original fiscal and financial documentation. In such cases, the rights and obligations originally associated with the conformity assessment and authorization shall be transferred.

Art. 70. A new authorization shall not be required in cases in which the reinstallation of a particular product does not result in the modification of the tested technical characteristics of such product and the performance characteristics of such product remain compatible with the purpose for which it is used.

Art. 71. The references made in the present Regulation to telecommunications products and services include radio and TV broadcasting and related services.

Art. 72. Anatel shall give wide publicity to the databases containing non-confidential information relative to the certification and authorization procedures, and maintain, especially, public databases containing --

I – all the contents of the regulations and standards prescribed in art. 5.;

II – a list of the authorized products containing information on such products, their suppliers, and manufacturers;

III – a list of the designated certification bodies;

IV – a list of the laboratories that have been accredited or evaluated by the certification bodies;

V – the contents of the mutual recognition agreements; and

VI – the decisions on which the imposition of sanctions is based, primarily those related to public safety, health, environmental protection, and the economy.

Art. 73. All supplemental forms, instructions, and provisions shall be subject to official acts issued by Anatel.

Art. 74. The telecommunications products used by the Armed Forces, and all those that employ radio frequencies intended exclusively for military purposes, are exempt from certification or authorization by Anatel.

Art. 75. Anatel shall supervise and maintain the certification and authorization procedures in order to assure their execution on the terms and conditions established in the present Regulation.

Paragraph 1. The specific activities related to the authorization process may, as deemed appropriate and feasible by the Agency, be delegated to the Designated Certification Bodies, in which case the certifications issued by such bodies shall not require an authorization document.

Paragraph 2. In the case prescribed in the paragraph above, the issuance of the certification by the Designated Certification Body shall take into consideration the requirements established in Title V of the present Regulation.

TITLE VIII

Temporary Provisions

Art. 76. The manufacturers, distributors, and suppliers of telecommunications products whose certification is undertaken commencing on the date on which the present Regulation enters into force must comply with the provision set out in art. 39.

Paragraph 1. The products submitted for certification up to the date on which the present Regulation enters into force may, optionally, implement the provisions of art. 39.

Paragraph 2. The processes presently in effect shall, with respect to product identification, expire on the date the present Regulation enters into force.

Art. 77. Until such time as Anatel issues the regulations for products subject to certification, under the terms established in art. 5, the Telebrás Procedures (*Práticas Telebrás*) shall be adopted for the applicable items, as shall, to the extent they are pertinent, the reference rules governing the conformity assessment of telecommunications products.

Stand-alone Paragraph. The rules or regulations issued by the Ministry of Communications that specifically order the regulatory applications herein established shall remain in force until such time as Anatel issues new regulations to replace such rules and regulations.

Art. 78. The present Regulation applies only to the processes initiated from the date it enters into force.

Paragraph 1. The certification processes initiated on the basis of defective petitions prior to the date the present Regulation enters into force may not be amended after the Regulation becomes effective.

Paragraph 2. Defective petitions are considered those prepared by unauthorized parties or submitted with incomplete or nonconforming documentation

Art. 79. The present Regulation enters into force on 1 June 2001.

ANNEX I

Requirements for the Designation and Obligations of the Certification Body

(Art. 16. of this Regulation)

I – The requirements for the designation of Certification Bodies include --

a) Legal Fitness: Legal fitness shall be demonstrated as set forth in art. 16, indent II, of this Regulation, that is, the Certification Body must demonstrate its status as a legally constituted non-profit juridical person represented by its legal agents in the certification process.

b) Quality System: the quality system must be demonstrated through, at a minimum, the presentation of a Quality Manual and the certification programs to which the designation shall be linked, pursuant to art. 18. It is preferable, although not essential, that the entity have a certification of recognition indicating the existence of a quality management system issued by an Accredited Body on the basis of the guidelines established in the "International Organization for Standardization" – ISO that fulfill, at minimum, the practices described in the Quality, Auditing, and Critical Analysis sections.

c) Technical Capacity: The entity's technical capacity shall be shown by demonstrating the existence of qualified personnel specialized in the certification of telecommunications products, whether such personnel consists of full-time staff or contracted personnel, in which case the contractual link with such qualified personnel must be demonstrated. The personnel presented must be compatible with the certification as regards their --

1. number;
2. professional qualification;
3. professional experience;
4. impartiality, independence, and objectivity in decision-making;
5. technical capacity.

II – Obligations of the Designated Certification Body: The designated body must assume the obligation to abide by the principles and procedures established by Anatel, specifically --

a) The principles that must be complied with are established in art. 2 of this Regulation;
b) For procedural purposes, the certification bodies must --

1. implement procedures in which a step-by-step description of every phase that must be fulfilled in the conformity assessment

processes, as well as the associated administrative measures, is set forth;

2. direct the conformity assessment processes in accordance with the provisions established in the certification rules;
3. prepare formal reports and make them available to the interested parties immediately following their completion;
4. provide a detailed presentation in the reports of all the nonconforming items, indicating the discrepancies that were identified;
5. maintain a file of all complaints relative to the certification process, including those entered after issuance of the product certification.

ANNEX II

Table of Fees

Authorization for Certification of Conformity:	R$ 500,00
Authorization for Declaration of Conformity:	R$ 200,00
Renewal of Authorization:	R$ 200,00

ANNEX III

The Anatel Seal and Product Authorization Identification

I – The rules for assembling the Anatel seal and all signatures must strictly comply with the proportions established below, for which purpose one of the formulas described below, selected on the basis of the one that is best suited to the size and model of the authorized product, is permitted:

a) The minimum size of a signature is associated with the degree of legibility afforded by its components. The minimum estimated parameters for the height of the logo and the additional space reserved for the signature are 4 mm and 1 mm respectively, provided the printing process to be used and the materials on which the logo and signature are to be printed can accommodate these dimensions.
b) The minimum recommended height for the space around the signatures is equal to half the height (x) of the Anatel sphere. The signatures used in product identification labels should maintain the minimum limits established below for the surrounding space. Whenever possible, such signatures should use spacing greater than the minimum established.
c) For purposes of the utilization of signatures, one of the background/figure combinations provided below should be adopted.
d) Other background/figure combinations not set forth in the chart may be used provided these preserve the necessary contrast to assure the legibility of the figure.
e) Employment of the color standard in the assembling of the logo and signatures is optional, which, if adopted, however, must be submitted by the responsible party for prior approval by Anatel. In such cases, a graphic sample must be forwarded to Anatel for examination and approval.

II – The materials employed to assemble and affix the identification labels to the authorized products should be those that assure that such labels are indelibly printed for the expected lifetime of the product, such that they are readily visible and permanent and that the information contained thereon is readable.

III – The product identification label must be affixed to the particular product prior to the time such product is made available on the market, which obligation shall be the responsibility of --

Polychromatic (CMYK) Special Color (Pantone)
Anatel Yellow OC - 25M - 100Y - 0K Pantone 123C
Anatel Blue 100C - 70M - 0Y - 30K Pantone 288C
Anatel Green 100C - 0M - 60Y - 40k Pantone 3296C
Note: If the sphere is a solid color, the Anatel Blue becomes:
100C - 40M - 0Y - 15K/Pantone 2945C

a) the manufacturer, in cases where such manufacturer has a plant located in the Country;
b) the supplier in the Country or the manufacturer's legal representative, in the specific case of imported products;
c) the user, in cases in which the product is directly imported for individual use and in which the aim is the provision of services, or in cases in which the product has been developed for commercial purposes.

IV – In the event it is impractical to affix the identification label to the product, the responsible party must observe the provisions of paragraph 1 of art. 39.

V – the product authorization identification prescribed in art. 39 is composed of the following information:

HHHH-AA-FFFF

a) The Seal bearing the Anatel logo, pursuant to item I;
b) The numeric Code comprised of HHHH-AA-FFFF, where --

- HHHH identifies the product authorization by means of a numerical series of 4 characters;
- AA identifies the year of issuance of the authorization using 2 numeric characters;
- FFFF identifies the product manufacturer through 4 numeric characters.

c) A Bar Code containing, at a minimum, the following information:

1. authorization code;
2. name and address of manufacturer;
3. product type, category, and model;
4. identification and address of supplier;
5. date of issuance and term of validity of the authorization.

d) The manufacturers already having an identification system for which bar-code identification procedures are employed may make use of such system for purposes of the information described in item c, provided the process for storing and reading the data is compatible with the standard adopted by Anatel.
e) For purposes of the description and categorization of the product, the nomenclature and classifications adopted by Anatel must be observed.
f) The supplier of the product, and holder of the authorization, shall be identified through a code composed of three alphabetic characters, expressed as LLL.
g) The technical matters pertaining to the elaboration and standardization of the bar-code identification procedures shall be set forth, in detail, in the certification rules.
h) The registration information related to product manufacturers and suppliers shall be stored in databases at Anatel, as well as the registrations administered by certification bodies, in accordance

with the scope of the certifications assigned to such bodies in the acts of designation.

Annex IV

Declaration of Conformity

A. This Annex sets forth the requirements for the Declaration of Conformity, which consists of the document signed by the interested party, and refers to the demonstrations of conformity specified in indent I of art. 21.

B. The Declaration of Conformity must --
1. indicate the regulations and rules applicable to the product;
2. certify that the product is in conformity with the applicable regulations and rules.

C. In cases where the interested party is the user of the product, the Declaration of Conformity must specify explicitly that the equipment in question will be in conformity with the technical characteristics covered by the declaration.

Annex V

Declaration of Conformity with an Accompanying Test Report

A. This Annex establishes the requirements for the Declaration of Conformity issued on the basis of a Test Report and refers to the demonstration of conformity described in indent II of art. 21.

B. In addition to the requirements prescribed in Annex IV – Declaration of Conformity, the declaration covered by this Annex shall be considered in conjunction with the reports prepared by laboratories chosen by the interested party in accordance with the order of priority prescribed in item C and take into account all the tests required for purposes of the demonstration of conformity.

C. The tests to which the product sample are submitted should be performed, preferentially, by a third-party laboratory chosen by the interested party among those accredited by Inmetro or recognized through a Mutual Recognition Agreement, according the regulations issued or the rules adopted by Anatel.

D. In the event it is not possible to fulfill the provision prescribed in the item above, the interested party may make use of other laboratories chosen on the basis of the following order of priority:

1. accredited laboratories;
2. unaccredited, third-party laboratories;
3. unaccredited laboratories;
4. testing laboratories located abroad that are accredited by the particular country's official Accreditation Body, that is, the official member body of the ILAC.

Annex VI

Certification of Conformity Based on Type-Approval Tests

A. This Annex sets forth the requirements for the Certification of Conformity based on Type-Approval Tests and refers to the demonstration of conformity described in indent III of art. 21.

B. The Certification of Conformity based on Type-Approval Tests shall be issued at the request of the interested party by the Designated Certification Body chosen by such party from among those included in the list described in indent III of art. 72 and shall certify the particular product's conformity with the applicable regulations.

C. Designated Certification Bodies that participated directly or indirectly in the development of a particular product or that performed consulting services related thereto are prohibited from issuing a certification for such product. A formal statement specifically related to the product in question, in which the Designated Certification Body affirms, subject to the applicable penalties of the Law, its fulfillment of this requirement must be submitted. The failure to comply with such requirement shall, notwithstanding the application of the penal code, subject the violator to the sanctions prescribed in indent VI of art. 54.

D. The designated certification bodies must perform the certification in conformity with the certification rules issued or adopted by Anatel.

E. The certification body must base its decisions on the results of the type-approval tests performed in accordance with the applicable regulations, and

1. if, on the basis of the evaluation of the test reports, conformity has been demonstrated, issue the certification of conformity;
2. if conformity has not been demonstrated, provide the interested party with a list of the noncoformities identified in the product during the conformity assessment that must be corrected to fulfill the conformity requirements. The nonconforming items represent technical requirements that must be met, as determined in the certification body's certification program.

F. It is the duty of the Designated Certification Body to require that the interested party submit all the documentation needed to perform the certification process.

G. The tests to which the product sample is submitted should be performed, preferentially, by a third-party laboratory chosen by the interested party jointly with the contracted Designated Certification Body from among those accredited by Inmetro or recognized through Mutual Recognition Agreements, in accordance with the regulations issued or the rules adopted by Anatel.

H. The Designated Certification Body must establish a Memorandum of Understanding with the testing laboratories recognized by Mutual Recognition Agreements.

I. In the event it is not possible to fulfill the provision prescribed in item G, the interested party may make use of other laboratories chosen on the basis of the following order of priority:
1. accredited laboratories;
2. third-party laboratories that have been evaluated by the Designated Certification Body;
3. laboratories not operated by third parties that have been evaluated by the Designated Certification Body;

J. In the cases prescribed in subitems 2 and 3 of the item above, the Designated Certification Body must monitor the tests.

K. In the event there are no laboratories available that fulfill the provisions of items G and I, the Designated Certification Body may accept laboratories located abroad that are accredited by the official Accreditation Body of the particular country, that is, the official member body of the ILAC.

L. The laboratory shall submit to the Designated Certification Body the reports regarding the tests performed by it and shall supply all the information required by the regulations and rules applicable to the product.

M. The Designated Certification Bodies must coordinate the conformity assessment process by means of a certification program developed in accordance with the terms and conditions prescribed in the specific certification rules.

Annex VII

Certification of Conformity Based on Type-Approval Tests and Periodic Assessments

A. This Annex sets out the requirements for the Certification of Conformity based on type-approval tests and periodic assessments and refers to the demonstration of conformity described in indent IV of art. 21.

B. The Certification of Conformity for a product subject to periodic testing shall be issued at the request of the interested party by a Designated Certification Body chosen by such party from among those included in the list described in indent III of art. 72 and shall certify such product's conformity with the applicable regulations.

C. Issuance of the Certification of Conformity for a product subject to periodic testing shall, in addition to complying with all the requirements prescribed in Annex VI, require a contract specifying the periodic performance of tests using product samples collected from the production line or commercial establishments, so as to permit the monitoring of such product in a manner that makes it possible to certify that the technical characteristics on which its certification is based are being maintained.

Annex VIII

Certification of Conformity with a Quality System Assessment

A. This Annex defines the requirements for the Certification of Conformity, including the manufacturer's Quality System, and refers to the demonstration of conformity set out in indent V of art. 21.

B. The Certification of Conformity with the accompanying quality system assessment shall be issued at the request of the interested party by the Designated Certification Body chosen by such party from among the list described in indent III of art. 72, which Certification shall formalize the product's conformity with the applicable regulations.

C. In addition to complying with all the requirements prescribed in annexes VI and VII, the issuance of the Certification of Conformance with the Quality System assessment shall require --

1. the existence of a contract for the performance of periodic tests on the basis of product samples collected from the production line or commercial establishment for purposes of monitoring and maintaining the characteristics on which the product certification is based.
2. the manufacturer's quality system assessment for the product submitted for certification.

D. The Designated Certification Body must assure that the assessment of the manufacturer's quality system takes into consideration the procedures necessary for the continuous maintenance of the technical characteristics on which the product certification is based, pursuant to the established rules governing certification.

Enclosure E

Japan – MIC Technical Regulations Conformity Certification System

Japanese Ministry of Internal Affairs and Communications (MIC) Technical Regulations Conformity Certification System

Technical Regulations Conformity Certification System

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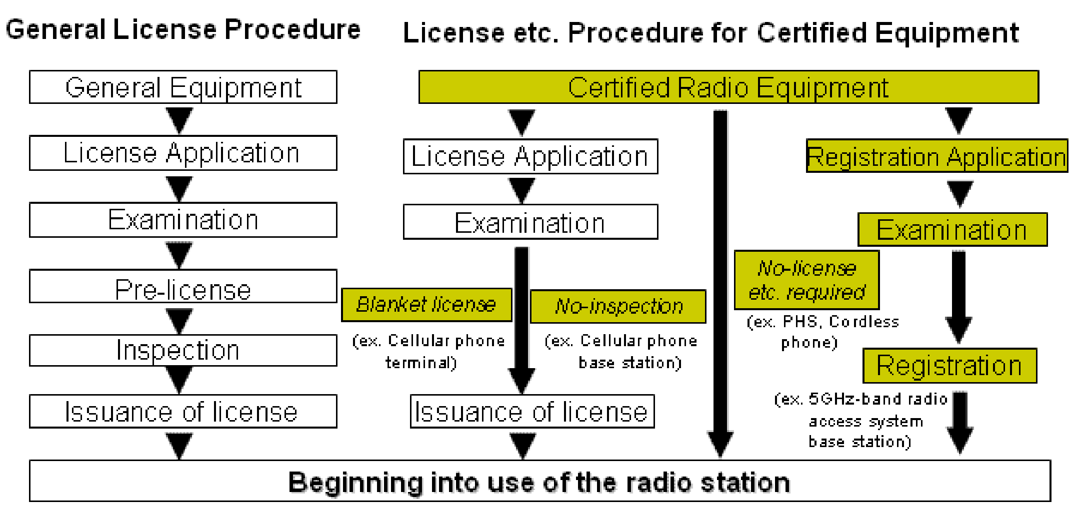
Ministry of Internal Affairs and Communications

Telecommunications Bureau of the Ministry of Internal Affairs and Communications

1.What is the Technical Regulations Conformity Certification System?

This certification system was established to achieve simplification and rationalization of administrative work for license application and to alleviate the burden borne by license applicants. In this system a person registered by the Minister for Internal Affairs and Communications (registered certification body) certifies specific radio equipment such as cellular telephones used in small-scale radio stations specified by applicable ordinances of the Ministry of Internal Affairs and Communications as conforming to technical regulations prescribed in the Radio Law (Article 38-2 (1)) prior to the installation.

Certified specified radio equipment will be granted either a simplified license application procedure, which does not require an inspection after the completion of construction work, a blanket license that covers specified radio stations, or will not require a license, depending on the type of the equipment.



(1) Outline of Certification system

i) Technical regulations conformity certification (Article 38-2)

Testing and certification will be conducted for each radio equipment.

ii) Attestation of the construction design of specified radio equipment (Article 38-24)

Testing is conducted on one sample unit for each type of radio equipment (officially called "construction design"), for attestation of the construction design. This is called the "construction design attestation system."

-> In addition to the existing certification method targeting each individual equipment, a new attestation system for the construction design (by type) of mass-manufactured equipment was implemented according to a law on organizing laws relating to telecommunications field in order to improve efficiency, issued in May 1998.

(2) Examples of target equipment

Specified radio equipment fall under one of three main categories, and a registered certification body is registered for each category.

Category		Example
Article 38-2 (1) i) of Radio Law (License not required)	->	PHS terminals, digital cordless telephone terminals, etc.
Article 38-2 (1) ii) of Radio Law (Blanket license stations)	->	Cellular telephone terminals, etc.
Article 38-2 (1) iii) of Radio Law (Others)	->	Amateur radio equipment, etc.

(3) Recognized Certification Body System (Article 38-31)

This is a system for the Minister for Internal Affairs and Communications to recognize a certification body that conducts inspection of radio equipment under foreign statute, when it makes an application certifying that a specified radio equipment that is to be used in Japan complies to technical standards of the Radio Law.

2.What is the Self-Confirmation of Technical Regulations Conformity System?

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(1) Outline of Self-Confirmation system (Article 38-33)

A manufacturer or an importer of the radio equipment, in consideration of the technical regulations, usage modes, etc. of radio equipment among specified radio equipment, as the one which rarely causes interference or other disturbance that severely jam the operation of other radio stations (special specified radio equipment), may confirm by itself that the construction type (including the methods to verify each equipment conforms to the type) of the special specified radio equipment conforms to the technical regulations.

A manufacturer or an importer shall conduct verification and shall then conduct the confirmation (self-confirmation of technical regulations conformity), only when it is deemed that the construction type of the special specified radio equipment conforms to the technical regulations specified in the preceding Chapter and that any and all specified radio equipment based on said construction type is ensured to conform to said construction type.

Upon conducting the self-confirmation of technical regulations conformity, a manufacturer or an importer may notify the Minister for Internal Affairs and Communications.

(2) Examples of target equipment

Special specified radio equipment is stipulated in Article 2 (2) of the Ordinance Concerning Technical Regulations Conformity Certification etc. of Specified Radio Equipment (Ministerial Ordinance of MPT No. 37 of 1981).

ex) digital cordless telephone terminals, Cellular telephone terminals, etc.

3.Registered Certification Bodies

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Technical regulations conformity certifications are conducted by registered certification bodies. Currently, 9 juridical persons, Telecom Engineering Center (TELEC), the Japan Amateur Radio Development Association, Inc. (JARD), DSP Research, Inc. , Chemitox, Inc. , TUV Rheinland Japan Ltd. , RF Technologies Co., Ltd. , UL Japan, Inc. , COSMOS CORPORATION Co., Ltd. and TÜV SÜD Ohtama, Ltd. are the registered certification bodies conducting these operations.

RCB Number	Registered Certification Body	Category of Business	Contact
001	TELEC	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : 5-7-2, Yashio, Shinagawa-ku, Tokyo TELEC Comprehensive Consultation Section : 3-3799-9033 http://www.telec.or.jp/ENG/Index_e.htm Links
002	JARD	Article 38-2 (1) iii) of Radio Law (Others)	Address : Kojima Bldg, 3-36-6, Sugamo, Toshima-ku, Tokyo Management Section : 3-3910-7241 http://www.jard.or.jp Links
003	DSP Research	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : 1-4-3, Minatojimaminamimachi, Chuo-ku, Kobe-shi, Hyogo PHONE : 78-940-0120 http://www.dspr.co.jp Links
004	Chemitox	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : 1-14-18, Kamiikedai, Ohta-ku, Tokyo Communication Equipment Evaluation Dept. : 3-3727-7111 http://www.chemitox.co.jp/eng/top.html Links
005	TÜV Rheinland Japan	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : 4-25-2, Kita-Yamata, Tsuzuki-ku, Yokohama EMC and Telecommunication Services : 45-914-0239 http://www.tuv.com/jp/en/index.html Links
			Address : 472, Nippa-cho, Kohoku-ku, Yokohama

006	RF Technologies	Article 38-2 (1) i) of Radio Law (License not required)	Radio Certification Section : 45-534-0645 http://www.rft.jp/rft-english/index.html Links
007	UL Japan, Inc. (name change in April 26, 2007)	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : 4383-326, Asama-cho, Ise-shi, Mie EMC Services Dept : 596-24-8116 http://uljapan.co.jp/ Links
008	COSMOS CORPORATION	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : 3571-2, Ohnoki, Watarai-cho,Watarai-gun, Mie 516-2102, Japan EMC Dept : 596-63-0707 http://www.safetyweb.co.jp/english/ Links
009	SGS Japan Inc (Discontinuation of Service in March 31, 2007)	\	\
010	TÜV SÜD Ohtama	Article 38-2 (1) i) of Radio Law (License not required)	Address : 2-8-20 Kurigi, Asao-ku, Kawasaki-shi, Kanagawa TOKYO LABORATORY: 44-980-2090 http://www.tuv-ohtama.co.jp/ Links
011	ZACTA Technology Corporation	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : 5-4149-7 Hachimanpara, Yonezawa-shi, Yamagata Technical Dept : 238-28-2880 http://www.zacta.co.jp Links
012	Intertek Japan K.K.	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : 2-3-18 Namamugi, Tsurumi-ku, Yokohama-shi, Kanagawa GMAP : 45-508-6742 http://japan.intertek-etlsemko.com/ Links

■4.Recent revisions of the system

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New scheme of conformity assessment system was introduced from January 2004.

(1) Certification system

Easing entry requirements for certification body. (abolishment of financial requirement etc.)

* encouraging competition among certification bodies for better certification services.

(2) Suppliers' declaration of Conformity (So-called SDoC)

Introduction of Self-confirmation of conformity with technical regulations.

SDoC is available for limited types of radio equipment, which are considered to rarely cause interference.

Suppliers should provid notification of self confirmation to MIC.

(3) Enhanced ex-post regulations

Ex-post regulations are tightened severer punishment.

Regulatory authority purchases radio equipment sold in the market and examines their conformity with technical regulations. (Market surveillance)

5.Mutual Recognition Agreement (MRA)

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MIC has been promoting mutual recognition of approval for radio equipment and telecommunications terminal equipment.

Japan-EC MRA (Agreement on Mutual Recognition between Japan and the European Community) came into force in January 2002.

Japan-Singapore EPA (Agreement between Japan and the Republic of Singapore for a New-Age Economic Partnership) including MRA came into force in November 2002.

Japan-U.S. MRA (Agreement on Mutual Recognition of Results of Conformity Assessment Procedures between JAPAN and THE UNITED STATES OF AMERICA) came into force in January 2008.

According to the provisions of Article 33 of the Act for Implementation of the Mutual Recognition between Japan and Foreign States in Relation to Results of Conformity Assessment Procedures of Specified Equipment (Law No.111, 2001), the specified radio equipment which has been certified as complying with the technical regulations of the Radio Law(Law No. 131, 1950) by a registered foreign conformity assessment body and to which the mark stipulated in the MIC ordinance has been affixed, shall be regarded as the specified radio equipment for which conformity with technical regulations of the Radio law.

Following bodies have been registered as a registered foreign conformity assessment body and have started conducting Conformity Assessment.

CAB ID	Registered Foreign Certification Body	Category of Business	Contact
201	TELEFICATION B.V	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others)	Address : Edisonstraat 12A, 6902 PK Zevenaar, The Netherlands URL : http://www.telefication.nl/ Links

		(All of the Specified Radio Equipment)	
202	CETECOM ICT Services GmbH	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : Untertürkheimer Str. 6-10, 66117 Saarbrücken, Germany URL : http://www.cetecom-ict.de/ Links
203	BABT	Article 38-2 (1) i) of Radio Law (License not required)	Address : Churchfield Road, Walton- on- Thames, Surrey KT12 2TD, United Kingdom URL : http://www.babt.com/ Links
204	Phoenix Testlab GmbH	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : Konigswinkel 10, 32825 Blomberg, Germany URL : http://www.phoenix-testlab.de/en/index.jsp Links
205	KTL	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : Saxon Way, Priory Park West, Hull, HU 13 9PB, United Kingdom URL : http://www.trac-ktl.com/index.html Links
206	EMCCert Dr. Rasek GmbH	Article 38-2 (1) i) of Radio Law (License not required) Article 38-2 (1) ii) of Radio Law (Blanket license stations) Article 38-2 (1) iii) of Radio Law (Others) (All of the Specified Radio Equipment)	Address : Boelwiese 5, 91320 Ebermannstadt, Germany URL : http://www.emcc.de/ Links

6.Laws and Regulations

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*Official texts of these Laws, Cabinet orders, Ordinances and Notifications are in Japanese.
These are tentative translation and may be updated without notice.

Radio Law (Law No. 131 of 1950) Links

Ordinance Regulating Radio Equipment (Radio Regulatory Commission Rules No. 18 of 1950) PDF

Tables PDF

Notification Links

Ordinance Concerning Technical Regulations Conformity Certification of Specified Radio Equipment (Ministerial Ordinance of MPT No. 37 of 1981) PDF

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7.Annex

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MIC regulates testing procedures for specified radio equipments (Notification No.88 of MIC, 2004). According to this procedures, registered certification bodies and manufactures conduct the test every type of specified radio equipments.

Example of testing procedures : Low power data communications system in the 5GHz band

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Enclosure F

South Korea - Limits and Conformity Evaluation

MINISTRY OF INFORMATION AND COMMUNICATION NOTICE No: 2000-91

This Notice is intended to notify the Guidelines for Public Health Protection from Electromagnetic Radiation according to the regulations as specified in the Electrical Radiation Act, Article 47, Clause 2, Chapter 1 as below.

December 2000
Minister, Ministry of Information and Communication

Public Health Protection Guidelines from Electromagnetic Radiation

CLAUSE 1 (Objective)

The objective of this Notice is to define the requirements for Public Health Protection Guidelines from Electromagnetic Radiation (hereinafter referred to as the 'Public Health Guidelines') according to Article 47 Clause 2 Chapter 1.

CLAUSE 2 (Definition)

The definitions of terms used in these Guidelines are as below:

1 'Electromagnetic Field' is the general term for electric fields and magnetic fields.

2 'Electric Field' refers to the condition of an area affected by an electric charge.

3 'Magnetic Field' refers to the condition of an area affected by the energy between the magnetic and electric currents.

4 'Electric Field Intensity' refers to the strength of the electric field in an electromagnetic field.

5 'Magnetic Flux Density' refers to the vector quantity generating the strength in proportion to the speed of the electric charge.

6 'Magnetic Field Intensity' refers to the strength of the magnetic field in an electromagnetic field.

7 'Power Density' refers to electricity passing through a unit surface area perpendicular to the direction of propagation of electromagnetic radiation.

8 ‘Electromagnetic Radiation Absorption Rate (SAR, W/kg)’ is the amount of energy absorbed per unit time per unit of tissue mass through exposure of the body to an electromagnetic field.

9 ‘Root Mean Square (rms)Value’ is the square root of the mean value of the squares of the even frequency type signal.

10 ‘General Public’ refers to people who are not aware of the exposure or to people who cannot take action against the exposure; however, exposure to radiation for medical purposes excluded.

11 ‘Workers’ refers to people who have occupations in those fields in which there is an awareness of the potential dangers of electromagnetic radiation exposure and who are trained to take some precautions against it.

12 ‘Whole Body Exposure’ refers to the exposure of a whole human body to an electromagnetic field.

13 ‘Localized Exposure’ refers to the exposure of a part of the human body to an electromagnetic field.

CLAUSE 3 (Electromagnetic Radiation Strength Guidelines for Whole Body Exposure)

1 Electric Intensity, Magnetic Intensity, Magnetic Flux Density and Power Density for Whole Body Exposure for the general public must not exceed the values specified in Attachment 1 to this document.

2 Electric Intensity, Magnetic intensity, Magnetic Flux Density and Power Density for Whole Body Exposure of Workers must not exceed the values specified in Attachment 2 to this document.

CLAUSE 4 (Electromagnetic Radiation Absorption Rate Guidelines for Localized Exposure)

The electromagnetic absorption rate(SAR) for localized exposure must not exceed the maximum value specified in Attachment 3 to this document.

SUPPLEMENTARY CLAUSE:

(Date) This Notice shall take effect from the 1 January 2002.

ATTACHMENT 1

Electromagnetic Radiation Strength Guidelines for General Public (see Clause 3, Para 1)

Frequency	Electric intensity (V/m)	Magnetic intensity (A/m)	Magnetic flux density (μ T)	Power density (W/m^2)
Less than 1 Hz	-	3.2×10^4	4×10^4	
1 Hz – 8 Hz	10,000	$3.2 \times 10^4/f^2$	4 x 104/f2	
8 Hz – 25 Hz	10,000	4,000/f	5,000/f	
0.025 kHz – 0.8 kHz	250/f	4/f	5/f	
0.8 kHz – 3 kHz	250/f	5	6.25	
3 kHz – 150 kHz	87	5	6.25	
0.15 MHz – 1 MHz	87	0.73/f	0.92/f	
1 MHz –10 MHz	$87/f^{1/2}$	0.73/f	0.92/f	
10 MHz – 400 MHz	28	0.073	0.092	2
400 MHz – 2000 MHz	$1.375f^{1/2}$	$0.0037f^{1/2}$	$0.0046f^{1/2}$	f/200
2 GHz - 300 GHz	61	0.16	0.20	10

Notes:

1 The unit of Frequency (f) is the same as that specified in the Frequency Range column.

2 The electric intensity, magnetic intensity, and magnetic flux density are root mean square values. Magnetic flux density is the magnetic intensity multiplied by the formula ($4\pi \times 10^{-7}$) for the space. Power density is the value of the electric intensity multiplied by the magnetic intensity of the given frequency.

3 In the under 100 kHz frequency range, the value should be the maximum value without taking account of the mean value per unit time.

4 In the frequency range over 100 kHz and under 10 GHz, mean time for measurement is 6 minutes.

5 In the frequency range over 10 GHz, $68/f^{1.05}$ minutes. The unit for f is GHz.

6 When more than one wireless station emits electromagnetic radiation in the same place and its surrounds, or one wireless station emits multiple frequency electromagnetic radiation, the electric intensity and magnetic intensity value totals must not exceed 1 after calculating the sum of the squares for the proportion of each frequency component in relation to the guideline val-

ues. Also, the power density total must not exceed 1 after calculating the sum for the proportion of each frequency component in relation to the guideline values.

ATTACHMENT 2

Electromagnetic Radiation Strength Guidelines for Workers (see Clause 3, Para 2)

Frequency	Electric intensity (V/m)	Magnetic intensity (A/m)	Magnetic flux density (μ T)	Power density (W/m^2)
Less than 1 Hz	-	1.63×10^5	2×10^5	
1 Hz – 8 Hz	20,000	$1.63 \times 10^5/f^2$	$2 \times 10^5/f^2$	
8 Hz-25 Hz	20,000	$2 \times 10^4/f$	$2.5 \times 10^4 f$	
0.025 kHz-0.82kHz	500/f	20/f	25/f	
0.82 kHz – 65 kHz	610	24.4	30.7	
0.065 MHz – 1 MHz	610	1.6/f	2.0/f	
1 MHz –10 MHz	610/f	1.6/f	2.0/f	
10 MHz – 400 MHz	61	0.16	0.2	10
400MHz – 2000MHz	$3f^{1/2}$	$0.008f^{1/2}$	$0.01f^{1/2}$	f/40
2 GHz - 300 GHz	137	0.36	0.45	50

Notes:

1 The unit of Frequency(f) is the same as that specified in the Frequency Range column.

2 Electric intensity, magnetic intensity, and magnetic flux density are root mean square value. Magnetic flux density is magnetic intensity multiplied by the formula ($4\pi \times 10^{-7}$) of the space. Power density is the value of the electric intensity multiplied by the magnetic intensity of the given frequency.

3 In the under 100 kHz frequency range, the value should be the maximum value without taking account of the mean value per unit time.

4 In the frequency range over 100 kHz and under 10 GHz, mean time for measurement is 6 minutes.

5 In the frequency range over 10 GHz, $68/f^{1.05}$ minutes. The unit for f is GHz.

6 When more than one wireless station emits electromagnetic radiation in the same place and its surrounds, or one wireless station emits multiple frequency electromagnetic radiation, the electric intensity and magnetic intensity value totals must not exceed 1 after calculating the sum of the squares for the proportion of each frequency component in relation to the guideline values. Also, the power density total must not exceed 1 after calculating the

sum for the proportion of each frequency component in relation to the guideline values.

ATTACHMENT 3

Electromagnetic Radiation Absorption Rate (SAR) Guidelines for Localized Exposure (see Clause 4)

Range of Frequency	SAR (W/kg)
100 kHz – 10 GHz	1.6

Note: The above value represents the maximum value of mean local SAR per any 1g of human body tissue.

◎ RRA Bulletin No. 2011-10

The following “Conformity Evaluation Procedure for Radio equipment” is hereby promulgated, pursuant to Article 4 Paragraph 3 of the Bulletin Concerning Conformity Evaluations for Broadcast Communications Equipment.

1 February 2011

Director of the Radio Research Agency

Conformity Evaluation Procedure for Radio Equipment

Chapter 1: General Provisions

Article 1: Objective

This bulletin has the objective of specifying the method by which it is confirmed whether an item of equipment subject to conformity evaluation for radio equipment is conformant to technical standards, pursuant to Article 4 Paragraph 3 of the Bulletin Concerning Conformity Evaluations for Broadcast Communications Equipment.

Article 2: Scope

This bulletin applies to the technical criteria review and testing of items of equipment subject to conformity evaluation for radio equipment by certification agencies and testing agencies.

Article 3: Definitions

①The definitions of the terms used in this Bulletin are as follows.

1. “Technical Criteria” refers to the “Radio Equipment Regulation” promulgated by the director of the Korea Communications Commission pursuant to Articles 45, 47 and 58 of the Radio Waves Act (hereinafter “the Act”).
2. “Rated voltage” refers to the electrical power voltage required for normal operation of the device, within (±)2% of the design voltage in the application.
3. “Specified voltage” refers to a voltage within the range specified in Article 12 of the Technical Criteria. If the rated voltage has an arbitrary rang, the specified voltage refers to a voltage between -10% of the minimum rated voltage and +10% of the maximum rated voltage; if a dry cell battery is used, this refers to a voltage between the maximum voltage of the new dry cell battery and -10% of the rated voltage.
4. “Standard temperature” refers to temperatures in the range 15 - 35°C.
5. “Standard humidity” refers to humidity in the range 45 – 75%.
6. “Receive frequency stability” or “signal displacement bandwidth” refers to the frequency range centered on a designated frequency for which stable output can be obtained.
7. “Receive sensitivity” refers to the capacity of the receiver to receive a signal of a certain weakness, and indicates receiver performance.

8. "Adjacent channel selectivity" refers to the ratio of the receive sensitivity of the device being tested to the level of the unwanted signal in an adjacent channel, in dB units, and indicates selectivity with respect to interference in an adjacent channel.
9. "Multi Input Multi Output (MIMO)" refers to technology with high capacity for distinguishing signals through signal processing by simultaneously sending and receiving signals using multiple antennas for the purpose of expanding the communication distance or improving communication speed.

②Except for the terms defined in Paragraph ①, the definitions of the terms used in this Bulletin shall be as set forth in the laws and regulations that relate to electromagnetic radiation.

Chapter 2: Confirmation of general characteristics

Article 4: Confirmation of items of equipment subject to testing

In order to perform conformity certification on radio equipment, it is confirmed that the item of equipment for which an application has been filed is in fact subject to the provisions of the Conformity Evaluation Bulletin, Article 3 Paragraph 1 Annex 1, by means of the physical product itself and the user manual (hereinafter "the manual") containing the product overview, specifications, configuration and manipulation procedures, as specified in Article 5 Paragraph 1 Subparagraph 2 of the Conformity Evaluation Bulletin.

Article 5: Confirmation of whether application documents are in conformity

It is confirmed whether the specifications including the use, environment, and voltage of the item of equipment have been conformantly entered in the manual and application documents.

Article 6: Method of confirming antenna characteristics

①The following antenna characteristics are confirmed with respect to the item of equipment for which an application for conformity evaluation has been filed. However, receiving equipment is excepted.

1. Absence of any active circuit, such as an amplifier, between the antenna and the transmitting device
2. Type and form of antenna (shape, length, exterior photo, etc.)
3. Antenna gain and orientation characteristics (excepting devices for which an electrical field strength is specified)
4. Antenna polarization characteristics (if applicable)
5. Transmitter connection type (internal or fixed, or connector specification, etc.)
6. Antenna fabricator and model name (if a product with a commercial name)

②The confirmation of antenna properties under Paragraph 1 shall be as announced by the applicant. In this case, the performance report, gain pattern diagram or antenna catalog, etc., prepared upon testing of the antenna by the fabricator or applicant, may be used.

Chapter 3:Technical Criteria Conformity Evaluation

Article 7: Matters confirmed before testing

It is confirmed that the use, frequency used, RF type, antenna power, occupied frequency bandwidth, etc., of the item of equipment(s) for which an application is made are conformant with the pertinent technical criteria, using the actual item of equipment, the manual, etc.

Article 8: Comparative confirmation

It is confirmed by comparison to the actual article that the components or parts (RF generator, modulation/demodulation, amplifier, etc.) of the item of equipment(s) for which an application is filed pertinent to RF reception and transmission are accurately described in the photographs and circuit diagrams, etc., of the manual.

Article 9: Classification of environmental conditions

The classification of environmental conditions with respect to the item of equipment(s) for which an application is filed are as given in Annex 1.

Article 10: Areas subject to conformity evaluation for each item of equipment

①The areas subject to conformity evaluation for each item of equipment for which an application is made are as given in Annex 2.

②Notwithstanding the provision of Paragraph 1, if the device is used together with another item of equipment such as a computer, or is ordinarily used indoors, and if either application of the environmental conditions of Annex 2 leads to a nonconformant operating temperature range for any item of equipment, or the device is used only indoors as a fixed or base station, then at the applicant's request, one of the temperature testing conditions ⓐ, ⓑ and ⓒ may be chosen, or the temperature range specified in the manual may be applied.

Article 11: Procedures for Technical Criteria Conformity Evaluation

The testing procedures are as follows.

1. Confirmation under Article 12 Paragraph 2 is performed after continuously applying environmental conditions such as vibration and impact, but excluding temperature, humidity and continuous operation test conditions. However, in the case of a item of equipment for installation in a fixed or base station, the manual for which bears a notice reading "This item of equipment may only be installed or used in fixed facilities," the vibration and impact tests may be omitted.

2. The continuous operation test and electrical conditions test are performed under standard temperature and humidity by applying the rated and specified voltage.
3. After applying the temperature and humidity conditions of Article 9, the rated and specified voltages are applied and the electrical conditions test is performed under the respective environmental conditions.
4. Notwithstanding Subparagraphs 1 through 3, items of equipment that have been certified as broadcast equipment and installed and operating on-site may be tested in a place and under conditions approved by the director of the RRA (hereinafter "the Director") when tested for the purpose of a declaration of changes pertinent to the technical specifications.

Article 12: Confirmation of technical criteria conformity evaluation

①Conformity to the technical specifications is confirmed by performing tests on the electrical technical specifications for transmitting, receiving and auxiliary equipment.

②It is confirmed whether the device is operating normally without any abnormality such as damage, ignition or smoking.

Article 13: Detailed procedure

①For variable-output radio equipment, testing of the antenna power deviation tolerance is tested as follows, in the manner specified in the manual.

1. Continuous output variation: Tested at upper and lower limit outputs
2. Stepwise output variation: Tested at each antenna power output step

②Testing for frequency tolerance, even when multiple forms of RF are used, is tested only once for each frequency band.

③If a certain frequency band is provided, the following steps are followed.

1. Testing is performed with respect the upper and lower limit frequencies of the band, and all frequencies in between that can be specified. In this case, the test of frequency tolerance for a device using a single generator over all relevant frequency bands may be performed on one frequency only.
2. If the device furnished multiple separate frequency bands, the test is performed by the method of Paragraph 1 for each frequency band. However, in the case of an amateur radio device furnished with multiple frequency bands, testing is performed on one designable frequency for each band, according to the category of generator used, such as medium short wave, short wave, ultra short wave, or microwave.
3. Notwithstanding Subparagraphs 1 and 2, in the case of a device installed above ground as a relay apparatus (including optical relay

apparatus) furnished with two or more electrical communications frequency bands, testing is performed on each frequency band.

④In testing relay devices that do not have an onboard radio frequency generator, the main station's output signal is used for the testing input signal, and if this does not work well, it may be replaced with a signal form a standard signal generator (hereinafter "SG") with due consideration for input level, modulation frequency, bandwidth, etc.

⑤Testing by spatial join is as follows.

1. If the device's antenna cannot be removed, or the antenna system acts as a frequency circuit, such as by means of a waveguide join, a spatial join for testing is formed using the antenna of the device.
2. When performing testing by spatial join according to Subparagraph 1, the tester must take all necessary measures to prevent impairing other communication through RF emissions from the item of equipment in question, insofar as possible, and if possible an anechoic chamber is used.

⑥The gain for a multi-input multi-output antenna system using 2 or more antennas (there must be no separately added active circuits) is as follows.

1. For items of equipment that receive and transmit in the same channel at the same time using 2 or more antennas, the total antenna gain is applied, calculated as the sum of the gain of all antennas.(The total antenna gain if N antennas are used)

2. For items of equipment other than in Subparagraph 1 (devices using spatial diversity, single amplifier, etc.), testing may be performed on the single antenna terminal having the greatest antenna gain. However, in the case of items of equipment using an amplifier for each antenna, testing must be performed on each antenna terminal.

Chapter 4: Application of other technical criteria

Article 14: Application of technical criteria for RF application equipment

In the case of RF application equipment, it is confirmed whether it is conformant to the electromagnetic interference prevention criteria specified in Radio Waves Act Article 47*ter*. However, if separately specified in laws and regulations related to electromagnetic radiation, those provisions shall be followed.

Article 15: Testing of radio equipment with specified electrical field strength, magnetic field strength, or radiative power

①The general testing conditions for radio equipment having an electrical field strength, magnetic field strength or radiative power specified in Radio Waves Act Enforcement Decree Article 25 Subparagraph 4 are as follows.

1. at testing the maximum specified voltage is applied. For radio equipment using dry-cell batteries only, new batteries are used.
2. The evaluation of conformity to technical criteria follows Article 11 Subparagraphs 1, 2 and 4.

3. To low-frequency transmitters (wireless devices of weak electrical field strength emitting radio waves of 9 kHz or below), Article 97 of the Technical Criteria applies *mutatis mutandis*, and for unwanted emissions, it applies up to 322 MHz.

②The testing methods and conditions for radio equipment of a specified electrical strength or radiative power shall insofar as possible follow the methods set forth in the "Electromagnetic interference prevention testing method" specified in Article 47*ter* of the Radio Waves Act, or the Telecommunications Community Standard (TTAS.KO-06.159).

③The method of testing magnetic-induction-type wireless devices that use frequencies of 150 kHz or below is as follows.

1. When measuring magnetic field strength, the distance between the receiving antenna and the tested device should be 10 m; if measurement cannot be performed at 0 m, then the actual measured value Hd at *d* meters is corrected thus: $H_{10}=H_d + 60\log(d/10)$. In this case the process of correction and the value measured at the actual measured distance must be stated in the test report.
2. For the receiving antenna, a shielded loop antenna must be used, and measurement is performed at a receiver bandwidth of 200 Hz and in quasi-peak-value detection mode.
3. For the output signal of the tested device, a modulating signal is used, and if modulation is not possible, a carrier may bay be used; this must be noted in the test result.

4. If apparatus for electric field strength measurement is used, a conversion to dB μA/m must be made and recorded, and the conversion factor of (-)51.5 dB is applied.

Article 16: Wireless transmitting/receiving parts

For the wireless sending/receiving part (RF module) of a broadcast communications item of equipment, the following requirements are checked.

1. The high-frequency part(s) (referring to parts including high-frequency generator, high-frequency amplifier, high-frequency mixer, high-frequency modulator, and high-frequency filter) must have their own electromagnetic shielding structure.
2. There must be a data input terminal (buffer etc.) that can satisfy technical criteria even when data comes in at excessively high speed.
3. There must be a constant-voltage circuit, and the design must be such that only constant voltage can be supplied in the finished product.
4. Either the antenna must be permanently attached, or there must be a connection terminal that enables antenna adjustment.
5. Measurement must be performed in a situation that enables the item of equipment to be measured independent, regarding either conformity to the technical criteria or conformity to the technical criteria in three or more finished products.
6. Wireless receiving/transmission parts must be conformant to the pertinent technical criteria.

Chapter 5: Miscellaneous

Article 17: Manufacturer declarations

①If requested by the applicant, confirmation may additionally be performed regarding conformity to international agreements and the resolutions or recommended standards of international organizations, insofar as this is within the testing agency's ability.

②When conformity to the pertinent resolutions or recommended standards has been confirmed under Paragraph 1, the Director may indicate the result on the test result, conformity certificate, conformity registration, or interim certificate for the broadcast communications item of equipment.

③Frequency tolerance, occupied frequency bandwidth, unwanted emissions strength, antenna power, strength of secondary RF emissions from receiving equipment, and matters that can impact receiver sensitivity and are not addressed in the technical criteria, may be handled based on the specifications set forth in the manual submitted by the applicant.

④Notwithstanding Article 9, if requested by the applicant, conditions more stringent than the environmental conditions specified in Technical Criteria Annex 2 may be applied, insofar as this is within the ability of the testing agency.

Article 18: Testing methods for each technical criteria item

①The procedures and methods for conformity evaluation testing of radio equipment shall follow the methods set forth in Annexes 3 and 4 for each technical criteria item.

②If the testing methods recommended in Paragraph 1 are absent or inapplicable, the testing agency may either select a testing procedure the validity of which is internationally accepted, or may develop and apply its own testing method the validity of which can be proven; in this case, the testing procedures must be set forth in the test report.

Chapter 6: Supplemental Provisions

Article 19: Support for items needed for testing

If, in confirming technical criteria conformity for a item of equipment for which an application has been filed, testing can only occur when the applicant has submitted items such as operating programs or supplemental testing apparatus, a request or support may be provided to the applicant, and the applicant must provide support.

Addenda

Article 1: Date of effect

This Bulletin shall take effect on the date of its publication.

Article 2: Other bulletins superseded

The “Procedures for Design Inspection and Registration (RRA Bulletin No. 2010-34)" shall cease to be effective on the date that the "Radio Equipment Conformity Evaluation Procedures" take effect.

[Annex 1] Classification of environmental conditions (pertinent to Article 9)

1. Classification of vibration testing conditions

Category symbol	Environmental conditions and method of application
ⓐ	After applying conditions of 3 mm total amplitude and from 0 to 500 vibrations per minute, 1 mm total amplitude and from 500 to 1800 vibrations per minute, vertically, laterally, and horizontally for 30 minutes each(varying the vibration rate in a 10-minute low-high-low cycle), the rated voltage is applied and the device is powered on
ⓑ	After applying conditions of from 2 mm to 3 mm total amplitude and from 0 to 500 vibrations per minute, and 1 mm total amplitude and from 500 to 1800 vibrations per minute, vertically, laterally, and horizontally for 15 minutes each(varying the vibration rate in a 5-minute low-high-low cycle), the rated voltage is applied and the device is powered on
ⓒ	With electrical power voltage applied, vibration with a total amplitude of 15 mm and vibration count of 600 to 3000 per minute, vibration is applied vertically, laterally and horizontally for 30 minutes each (varying the vibration count low-high-low on a 10-minute cycle) and the device is powered on.
ⓓ	After applying conditions of 3 mm total amplitude and from 0 to 500 vibrations per minute, 0.75 mm and 500 to 1500 vibrations per minute, and

	0.2 mm total amplitude and from 1500 to 3000 vibrations per minute, vertically, laterally, and horizontally for 30 minutes each(varying the vibration rate in a 10-minute low-high-low cycle), the rated voltage is applied and the device is powered on
ⓩ	Other (shown separately for each subject device)

2. Classification of impact testing conditions

Category symbol	Environmental conditions and method of application
ⓐ	At a height of 5 cm above and parallel to a firm wooden board of at least 1 cm thickness, the device is allowed to drop freely at least 3 times. When the device subject to measurement is powered on by applying the rated voltage after repeated testing on the various surfaces of the device, it must operate without any abnormality such as damage, ignition or smoking.
ⓑ	After either applying 5 G (here and hereinafter, 1 G represents an acceleration of 980 cm/s^2, and upon stopping 1 G is considered to have been applied upward) to the top, 2 G to the bottom and 2 G to either side for 1 minute each, or applying a shock of 15 G at least 3 times in both the horizontal and medial directions, the device must power on without any abnormality such as damage, ignition or smoke.
ⓩ	Other (shown separately for each subject device)

3. Classification of continuous operation testing conditions

Category symbol	Environmental conditions and method of

	application
ⓐ	When powered on for 8 hours under normal operating conditions
ⓑ	When powered on for 24 hours under normal operating conditions
ⓒ	When powered on for 500 hours under normal operating conditions
ⓩ	Other (shown separately for each category of subject device)

4. Classification of temperature testing conditions

Category symbol	Environmental conditions and method of application

ⓐ	When the device is placed at temperatures of (-)20°C and (+)50°C for at least 1 hour each and then powered on at that temperature by applying the specified power and voltage
ⓑ	When the device is placed at temperatures of (-)10°C and (+)50°C for at least 1 hour each and then powered on at that temperature by applying the specified power and voltage
ⓒ	When the device is placed at temperatures of 0°C and (+)40°C for at least 1 hour each and then powered on at that temperature by applying the specified power and voltage
ⓓ	When the device is placed at a temperature of (+)70°C for 2 hours and returned to room temperature and powered on by applying the specified power and voltage
ⓔ	O When the device is placed at a temperature of (+)55°C for 3 hours and then cooled to a temperature of (+)40°C and left to sit for 3 hours, and is powered on for 2 hours under those conditions at the specified power and voltage. o The device is placed at a temperature of (-)15°C for 3 hours and then heated to a temperature of 0°C and left to sit for 3 hours, and is powered on for 30 minutes under those conditions at the specified power and voltage.

ⓕ	o When the device is placed at a temperature of (+)70°C for 48 hours and then

	returned to room temperature and powered on by applying the specified power and voltage o The device is placed at a temperature of (-)65°C for 48 hours and then returned to room temperature and powered on by applying the specified power and voltage o The device is placed at a temperature of (+)55°C for 2 hours and then powered on under those conditions by applying the specified power and voltage. o The device is placed at a temperature of (-)40°C for 2 hours and then powered on under those conditions by applying the specified power and voltage.
ⓖ	o High temperature high voltage: When a voltage (+)10% greater than the rated voltage is applied at a temperature of (+)55°C o Low temperature low voltage: When a voltage (-)10% below the rated voltage is applied at a temperature of (-)40°C
ⓗ	o Portions exposed to seawater, snow and rain - The device is placed at a temperature of (-)25°C for 3 hours and then powered on under those conditions for 30 minutes by applying the specified power and voltage - The device is placed at a temperature of (+)70°C for 3 hours and then cooled to (+)55°C and powered on for 2 hours by applying the specified power and voltage o Portions not exposed to seawater, snow and rain - The device is placed at a temperature of (-)15°C for at least 3 hours and then powered on under those conditions for 30 minutes by applying the specified power and voltage

	- The device is placed at a temperature of (-)15°C for 3 hours and then powered on under those conditions for 30 minutes by applying the specified power and voltage
ⓘ	The device is placed at a temperature of (+)50°C for 3 hours and then powered on under those conditions for 2 hours by applying the specified power and voltage The device is placed at a temperature of (-)15°C for 3 hours and then powered on under those conditions for 30 minutes by applying the specified power and voltage (limited to those portions exposed to seawater, snow and rain) The device is placed at a temperature of (-)10°C for 3 hours and then powered on under those conditions for 30 minutes by applying the specified power and voltage (limited to those portions not exposed to seawater, snow and rain)
ⓙ	o Portions exposed to seawater, snow or rain - The device is placed at a temperature of (-)10°C for 3 hours and then powered on for 30 minutes by applying the specified power and voltage - The device is placed at a temperature of (+)50°C for 3 hours and then powered on for 2 hours by applying the specified power and voltage o The portions not exposed to seawater, snow and rain are placed at 0°C for 3 hours and the device is powered on for 30 minutes by applying the specified power and voltage - The device is placed at a temperature of (+)40°C for 3 hours and then powered on for 2 hours by applying the specified power and voltage
ⓚ	When the device is placed at a temperature of (-)20°C for 1 hour and is powered on for 4 hours under those conditions (with a 9-to-1 ratio of transmission time to

	receiving time)
ⓩ	Other (Specified separately and in the manual for each item of equipment)

5. Classification of humidity testing conditions

Category symbol	Environmental conditions and method of application
ⓐ	After placing the device at 95% relative humidity at (+)35°C, it is restored to room temperature and standard humidity and powered on by applying the specified power and voltage.
ⓑ	The device is placed at 93% relative humidity at (+)40°C for 4 hours, and under those conditions it is powered on by applying the specified power and voltage.
ⓒ	- The device is placed at a random relative humidity between 95% and 100% at 50°C for 48 hours, returned to standard temperature and humidity, and powered on by applying the specified power and voltage.
ⓩ	Other (enumerated separately for each item of equipment)

6. Conditions of drop test

Category symbol	Environmental conditions and method of application
ⓐ	The device is dropped three times onto the horizontal from a height of 9 m and powered on by applying the rated voltage
ⓑ	The device is dropped three times onto the horizontal from a height of 5 m and powered on by applying the rated voltage
ⓒ	The device is dropped two times onto the horizontal from a height

	of 20 m and powered on by applying the rated voltage
ⓓ	The device is dropped five times onto the horizontal from a height of 5 m and powered on by applying the rated voltage
ⓩ	Other (enumerated separately for each item of equipment)

7. Conditions of water penetration test

Category symbol	Environmental conditions and method of application
ⓐ	After submerging the device 1 m deep in water for 2 hours (or 30 minutes for devices used in lifeboats or life preservers), it is powered on by applying the rated voltage
ⓑ	After submerging the device in water 10 m deep for 5 minutes, it is powered on by applying the rated voltage
ⓒ	After submerging the device in water 4 m deep for 24 hours, it is powered on by applying the rated voltage
ⓩ	Other (enumerated separately for each item of equipment)

8. Conditions of irrigation test

Category symbol	Environmental conditions and method of application
ⓐ	After irrigating the device for 2 hours at a set pressure of between 3 kg/㎠ and 4 kg/㎠ by an irrigator having at least 30 irrigation holes (with each ole having a diameter of 1 mm) and a diameter of 5 cm, it is

	powered on by applying the rated voltage.
ⓑ	After irrigating the device for 2 hours at a set pressure of 3.6 kg/㎠ with an irrigator having at least 36 irrigation holes (with each hole having a diameter of 1 mm) and a diameter of 5 cm, it is powered on by applying the rated voltage. However, this is limited to the portions exposed to seawater, rain and snow.
ⓒ	After sprinkling water droplets from a height of 20 cm with the direction of fall at 15° from the vertical, in a quantity of from 3 mm to 5 mm per minute, forward and backward and left to right for 25 minutes each, the device is powered on by applying rated voltage.
ⓩ	Other (enumerated separately for each item of equipment)

9. Conditions of air pressure test

Category symbol	Environmental conditions and method of application
ⓐ	o For devices used at an altitude of 9000 m or above, the device is powered on at an air pressure corresponding to the maximum altitude applied for o For devices used at an altitude of 6000 to 9000 m, the device is powered on at an air pressure of 30% of 1 atmosphere o For devices used at an altitude of less than 6000 m, the device is

	powered on at an air pressure of 45% of 1 atmosphere by applying the specified power and voltage
ⓩ	Other (enumerated separately for each item of equipment)

10. Testing conditions for other tests such as the wind and vibratory motion tests, and special testing conditions not set forth in 1 through 9 above, are enumerated for each item of equipment separately.

[Table 2] Categories of Conformity Evaluation by Tested Item

Pertinent to Article 10 Paragraph 1

Equipment type	Environmental conditions	Electrical testing items
Automatic alarm receiver installed on ship	-	-
Wireless telephone alarm automatic receiver	o vibration ⓐ o impact ⓐ o continuous operation ⓒ o temperature ⓑ o humidity ⓐ	o Confirm normal operation 1 minute after powering on o Electrical operation properties of operation of the speaker when receiving RF of a wireless telephone alarm signal (Technical Criteria Article 49 Paragraph 2 Subparagraph 4 and Subparagraph 11 Items A and B) o Electrical operation properties of operation of the audio alarm when receiving RF of a wireless telephone alarm signal (Technical Criteria Article 49 Paragraph 4

			Subparagraph 3 and Subparagraph 12 Items A through C) - Testing in relation to Technical Criteria Article 49 Paragraph 2 Subparagraph 12 Items A and C is performed by applying a wireless telephone alarm signal (within the tolerances specified in Technical Criteria Article 49 Paragraph 1 Subparagraphs 3 through 6). - Operating conditions of the wireless telephone alarm signal generating device (Technical Criteria Article 49 Paragraph 2 Subparagraph 12 Item F) o The device is installed in order to receive navigational warnings, the requirements for that device (Technical

		Criteria Article 4 Paragraph 2 Subparagraph 4) - In this case, testing is performed by applying the navigation warning signal (within tolerances specified in Technical Criteria Article 57 Subparagraphs 1 and 2)
Radio compass for shipboard use		
- Radio compass for ship station us installed on a ship of at least 1600 tons gross weight used in international navigation	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Conditions of the medium-frequency radio compass (Technical Criteria Article 55 Paragraph 1) o Conditions of the medium-high-frequency radio compass (Technical Criteria Article 55 Paragraph 2) o Conditions of the dual-use radio compass (Technical Criteria Article 55 Paragraph 3)

	Other radio compasses	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓑ o Temperature ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Electrical operating properties (Technical Criteria Article 55 Paragraph 4)
Wireless equipment that is obligatory to install in aircraft under Article 28 of the Act			
-	Double-side-band wireless telephone device for use in aircraft	1. When testing with rated voltage applied: o Vibration ⓒ o Impact (acceleration) ⓑ o Temperature ⓕ o Humidity ⓒ o Air pressure ⓐ	o Confirm normal operation within 1 minute of powering on o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Antenna power ratio (Technical

		Criteria Article 63 Paragraph 1) o Modulation index (Technical Criteria Article 65) o Signal-to-noise ratio, general frequency characteristics, total noise and distortion, receiver sensitivity and pass bandwidth (Technical Criteria Article 67) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
	2. When testing by applying (±) 10% of the rated voltage o Temperature ⓖ 3. When changing the electrical voltage from (-)10% to (-)20% of the rated voltage 4. When changing the electrical voltage from (-)20% to 0 V, in increments of 2% of the rated voltage per minute	o Frequency tolerance (Technical Criteria Article 3) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Antenna power ratio (Technical Criteria Article 63 Paragraph 1) - When testing under temperature testing condition ⓖ, the value

		should be at least 70% of the value when under normal temperature and humidity and rated voltage o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o The sensitivity characteristics of the receiving device should not be impaired by any more than 6 dB from the value when under normal temperature and pressure and rated voltage
SSB wireless telephone equipment for use in aircraft	o When applying the environmental conditions of a double-side-band wireless telephone device for aircraft use	o Confirm normal operation 15 minutes after powering on o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna

		power (Technical Criteria Article 6 Paragraph 3) o Antenna power ratio (Technical Criteria Article 63 Paragraph 1) o Carrier power and other performance (Technical Criteria Article 66 Paragraph 1) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Onboard DME	o When applying the environmental conditions of a double-side-band wireless telephone device for aircraft use	o Confirm normal operation 1 minute after powering on o Frequency tolerance (Technical Criteria Article 3) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Distribution of high-frequency energy from query signal,

		interval between query signal emissions (Technical Criteria Article 71 Paragraph 1 Subparagraph 1 Items D and F) o Properties of query signal, number of query signal emissions (Technical Criteria Article 71 Paragraph 1 Subparagraph 1 Items A and F) o Receiving device sensitivity, signal attenuation, effective selectivity, decoder properties, signal intensity selection properties, distance memory performance, distance measurement precision (Technical Criteria Article 71 Paragraph 1 Subparagraph 2) o Confirmation of antenna requirements after test has ended (Technical Criteria

		Article 71 Paragraph 1 Subparagraph 1 Item H) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
ATC transponder device (limited to those transmitting a response signal with a response code of 4096)	o When applying the environmental conditions of a double-side-band wireless telephone device for aircraft use	o Frequency tolerance (Technical Criteria Article 3) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Configuration of response signal, emission of location discrimination pulse (Technical Criteria Article 70 Paragraph 2 Subparagraph 1) o Antenna power and pulse properties, response count, response delay time, response signal jitter, response properties, side lobe suppression properties (Technical Criteria Article 70 Paragraph 2 Subparagraph 2)

		o Receiving equipment sensitivity, properties of each pulse band, echo suppression, receiving pause time, desensitization to control response count, single-signal selectivity, interference signal suppression properties (Technical Criteria Article 70 Paragraph 2 Subparagraph 3) o Confirmation of antenna requirements after test has ended (Technical Criteria Article 71 Paragraph 2 Subparagraph 1 Item H) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Automatic-alarm telephone devices	o Vibration ⓐ o Continuous operation ⓐ o Temperature ⓑ o Humidity ⓐ	o Confirm normal operation within 2 minutes of powering on o Frequency tolerance (Technical Criteria Article 3)

		o Electrical operating properties (Technical Criteria Article 49 Paragraph 1)
Radio equipment used in marine mobile operations as a transmitter or receiver on a single channel using SSB	o Vibration ⓑ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ, ⓑ or ⓒ o Humidity ⓐ	o Confirm normal operation within 20 minutes of powering on o Frequency tolerance (Technical Criteria Article 3) - With regard to devices having an apparatus for remote frequency control, the frequency tolerance when adjusting the device o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Carrier power and total distortion and noise (Technical Criteria Article 44 Paragraph

		1) o Sensitivity to the frequency to be received, pass bandwidth, (referring to the width between the 2 frequencies attenuated 6 dB from the frequency to be received), attenuation, spurious response, effective selectivity, total distortion and noise (Technical Criteria Article 44 Paragraph 2) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radar equipment for use in ship station Radar installed on ships navigating domestic waters	o Vibration ⓓ o Continuous operation ⓑ o Temperature ⓗ o Humidity ⓐ o Irrigation ⓑ o Continuous compass operation Under ordinary usage conditions, at	o Confirm normal operation within 4 minutes of powering on o Designated bandwidth (Technical Criteria Article 54 Paragraph 1 Subparagraph 1) o Permitted levels of spurious

	approximately 2 rpm, the device is rotated horizontally and an equivalent signal is applied	emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Heading indicator (Technical Criteria Article 54 Paragraph 1 Subparagraph 8 Item B) o Range ring (Technical Criteria Article 54 Paragraph 1 Subparagraph 8 Item D) o Error in position displayed with respect to compass (only in case of test of continuous compass operation) (Technical Criteria Article 54 Paragraph 1 Subparagraph 11) o Azimuth resolution (Technical Criteria Article 54 Paragraph 1 Subparagraph 8 Item F) o Precision (Technical Criteria Article 54 Paragraph 1 Subparagraph 9)

Radar installed on ships navigating domestic waters	o Vibration ⓓ o Continuous operation ⓑ o Temperature ⓗ o Humidity ⓐ o Irrigation ⓑ o Continuous compass operation, when applying the environmental conditions of a radar installed on a ship engaged in domestic navigation	o Confirmation of normal operation within 4 minutes of powering on, and normal operation within 5 seconds when in a ready state o Antenna conditions (Technical Criteria Article 54 Paragraph 2 Subparagraph 3) o Designated bandwidth (Technical Criteria Article 54 Paragraph 1 Subparagraph 1) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Range ring (Technical Criteria Article 54 Paragraph 1 Subparagraph 8 Item D) o Error in position displayed with respect to compass (only in case of test of continuous compass operation)

		(Technical Criteria Article 54 Paragraph 1 Subparagraph 11) o Azimuth resolution (Technical Criteria Article 54 Paragraph 2 Subparagraph 5) o Precision (Technical Criteria Article 54 Paragraph 1 Subparagraph 9)
Radar installed on small domestic vessel (Ship Safety Act Chapter 1 Article 2 Subparagraph 11)	o Vibration ⓓ o Continuous operation ⓑ o Temperature ⓘ o Humidity ⓐ o Irrigation ⓑ	o Confirm normal operation within 4 minutes of powering on o Antenna power (Technical Criteria Article 54 Paragraph 3 Subparagraph 1) o Designated bandwidth (Technical Criteria Article 54 Paragraph 1 Subparagraph 1) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3)

		o Azimuth resolution (Technical Criteria Article 54 Paragraph 3 Subparagraph 5) o Precision (Technical Criteria Article 54 Paragraph 3 Subparagraph 6)
VHF wireless telephone device for marine use	o Vibration ⓐ o Impact ⓐ o Temperature ⓐ and ⓚ o Humidity ⓐ o Irrigation ⓒ	o Confirm normal operation 1 minute after powering on o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Frequency modulation conditions (Technical Criteria Article 45 Paragraph 1 Subparagraph 1) Power reduction device

		(Technical Criteria Article 46 Paragraph 7) o Maximum frequency deviation (Technical Criteria Article 45 Paragraph 1 Subparagraph 5) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Conditions of receiving device (Technical Criteria Article 45 Paragraph 3)
Digital selective calling device	o Vibration ⓐ o Continuous operation ⓑ o Temperature ⓔ o Irrigation ⓑ	o Confirm normal operation 1 minute after powering on o Operating conditions (Technical Criteria Article 36 Paragraph 1 Subparagraphs 2 and 5)
Narrow band direct telegraphy devices	o Vibration ⓐ o Continuous operation ⓑ o Temperature ⓔ o Irrigation ⓑ	o Confirm normal operation 1 minute after powering on o Electrical operating characteristics (Technical Criteria Article 37, Paragraph 1 Subparagraphs 2 through 6

		and Paragraph 2)
Transmitting and receiving devices for use in mobile marine applications that communicate using digital selective calling devices Digital MF, HF transmission/reception devices	o Vibration ⓐ o Continuous operation ⓑ o Temperature ⓔ o Irrigation ⓑ	o Confirm normal operation within 1 minute of powering on o Frequency tolerance (Technical Criteria Article 3) - With regard to devices having remote frequency control apparatus, the maximum and minimum values of the frequency deviation, when adjusting that apparatus, are used o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria

		Article 5) o Antenna power tolerance (Technical Criteria Article 6 Paragraph 3) Power reduction device (Technical Criteria Article 46 Paragraph 7) o Allowed nwanted emissions (Technical Criteria Article 38 Paragraph 1 Subparagraphs 1 and 2, Article 44 Paragraph 2 Subparagraph 4) o Carrier power (Technical Criteria Article 44 Paragraph 1 Subparagraph 1) - Limited to transmission devices using J3E emissions o Total noise and distortion (Technical Criteria Article 44 Paragraph 1 Subparagraph 1) - Limited to transmission devices using J3E emissions o Overall frequency characteristics (Technical

			Criteria Article 44 Paragraph 1 Subparagraph 1) - Restricted to transmission devices using J3E or H3E emissions o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Conditions of receiving device (Technical Criteria Article 38 Paragraph 1 Subparagraph 3 and Article 44 Paragraph 2 Subparagraph 1)
	Digital VHF transmission/reception devices	o Vibration ⓐ o Continuous operation ⓑ o Temperature ⓔ o Humidity ⓑ	o Confirm normal operation 1 minute after powering on o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Antenna power tolerance

			(Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Conditions of receiving device (Technical Criteria Article 38 Paragraph 3 Subparagraph 3) o Transmitting device conditions (Technical Criteria Article 38 Paragraph 3 Subparagraph 2)
Dedicated receiver for digital selective calling	MF and MF.HF dedicated receivers	o Vibration ⓐ o Continuous operation ⓑ o Temperature ⓔ o Humidity ⓑ	o Confirm normal operation 1 minute after powering on o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Conditions of receiving device (Technical Criteria Article 36 Paragraph 2 Subparagraph 2)
	VHF	o Vibration ⓐ	o Confirm normal operation 1

dedicated receiver	o Continuous operation ⓑ o Temperature ⓔ o Irrigation ⓑ	minute after powering on o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Conditions of receiving device (Technical Criteria Article 36 Paragraph 2 Subparagraph 3 Item C)
Navtex receivers	o Vibration ⓐ o Continuous operation ⓐ o Temperature ⓔ o Irrigation ⓑ	o Confirm normal operation 1 minute after powering on o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Conditions of receiving device (Technical Criteria Article 40 Subparagraphs 2 and 3)
Location information transmission devices for search and rescue use	o Vibration ⓐ o Drop ⓑ o Water infiltration ⓑ o Continuous operation ⓩ	o Confirm normal operation 1 minute after powering on o Strength of secondary RF emissions from receiving

Radar transponder devices for search and rescue use	When the device is placed at a temperature of (-)20°C for 96 hours and is powered on for 8 hours under those conditions (with a 9-to-1 ratio of transmission time to receiving time) o Temperature: one of ⓐ,ⓑ, and ⓒ, and also ⓩ After being placed in a location 45°C above the water temperature, which does not exceed (+)20°C, the device is placed in the water for 1 hour and then powered on by applying the specified voltage. o Humidity ⓐ	equipment (Technical Criteria Article 9 Paragraph 1) o Confirm that the designable frequency band is at least 9.14 GHz and at most 9.56 GHz o Device technical criteria (Technical Criteria Article 39 Paragraph 1 Subparagraphs 2, 3 and 4)
Search and rescue transmitters using automatic vessel identification	o Vibration ⓐ o Drop ⓑ o Water infiltration ⓑ o Continuous operation ⓩ When powered on for at least 96 hours at temperatures from (-)20°C to (+)55°C. o Temperature ⓩ When the device is placed at a temperature of from (-)30°C to (+)70°C for 10 – 16 hours and then returned to room temperature and powered on by applying the specified power and voltage	o Confirm normal operation 1 minute after powering on o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Transmitting device conditions (Technical Criteria Article 39 Paragraph 2 Subparagraph 2)

	When the device powered on at room temperature and the temperature is then changed to (-)20°C and (+)50°C for 10-16 hours each and then powered on at that temperature by applying the specified power and voltage o Humidity ⓐ	
Devices for wireless display for emergency satellite position indication	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Drop ⓒ o Water infiltration ⓒ o Continuous operation ⓩ When the device is placed at a temperature of (-)20°C for 1 hour and then powered on under those conditions for 48 hours o Temperature ⓐ o Humidity ⓩ When the device is placed at a relative humidity of 93% at (+)35°C for 10 hours and then restored to ordinary temperature and humidity and powered on by applying the specified voltage	o Confirm normal operation within 15 minutes of powering on o Frequency tolerance (Technical Criteria Article 3) o Occupied bandwidth (Technical Criteria Article 4) o Electrical operating characteristics (Technical Criteria Article 42 Paragraph 1 Subparagraph 2 Item A, excluding pattern type) o Antenna conditions (Technical Criteria Article 42 Paragraph 1 Subparagraph 3, excluding polarization)
Radio equipment		

for automatic identification devices Automatic vessel identification device	o Vibration ⓐ o Continuous operation ⓑ o Temperature ⓔ o Humidity ⓑ	o Confirm normal operation within 2 minutes of powering on o Frequency tolerance (Technical Criteria Article 58 Paragraph 1 Subparagraph 2 Item A) o Permitted occupied bandwidth (Technical Criteria Article 58 Paragraph 1 Subparagraph 1 Item C) o Permitted spurious emissions (Technical Criteria Article 58 Paragraph 1 Subparagraph 2 Item B) o Antenna power tolerance (Technical Criteria Article 58 Paragraph 1 Subparagraph 2 Item C) o Structural conditions (Technical Criteria Article 58 Paragraph 1 Subparagraph 1) o Transmitting device conditions (Technical Criteria Article 58 Paragraph 1 Subparagraph 2)

		o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Conditions of receiving device (Technical Criteria Article 58 Paragraph 1 Subparagraph 3)
Automatic identification device for navigational use	o Vibration ⓐ o Continuous operation ⓑ o Temperature ⓔ o Moisture ⓑ	o Confirm normal operation within 2 minutes of powering on o Frequency tolerance (Technical Criteria Article 58 Paragraph 1 Subparagraph 2 Item A) o Permitted occupied bandwidth (Technical Criteria Article 58 Paragraph 1 Subparagraph 1 Item C) o Permitted spurious emissions (Technical Criteria Article 58 Paragraph 1 Subparagraph 2 Item B) o Antenna power tolerance (Technical Criteria Article 58 Paragraph 2 Subparagraph 2 Item B)

		o Structural conditions (Technical Criteria Article 58 Paragraph 2 Subparagraph 1) o Transmitting device conditions (Technical Criteria Article 58 Paragraph 2 Subparagraph 2) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Conditions of receiving device (Technical Criteria Article 58 Paragraph 2 Subparagraph 3)
Single-channel transmitting and receiving devices using SSB (excluding devices subject to design inspection)	o Vibration ⓑ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ, ⓑ or ⓒ o Humidity ⓐ	o Confirm normal operation within 20 minutes of powering on o Frequency tolerance (Technical Criteria Article 3) - With regard to devices having an apparatus for remote frequency control, the frequency tolerance when adjusting the device o Permitted occupied bandwidth

		(Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Carrier power (Technical Criteria Article 108 Subparagraphs 1 through 4) o Total noise and distortion (Technical Criteria Article 108 Subparagraphs 1 through 4) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Devices for radio equipment for use in wireless repeater stations	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ or ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 95) o Permitted levels of spurious

		emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Transmitter conditions (Technical Criteria Article 95 Paragraph 2) (Limited to 422-423 MHz shared frequency devices)
Radio robots and radiosondes used in meteorological aid stations	o Vibration ⓑ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ+ⓩ When the radiosonde is placed at a temperature of (-)65°C for 10 minutes and then powered on at that temperature for 30 minutes by applying the specified power and voltage o Humidity ⓐ	o Confirm normal operation within 10 minutes of powering on (or if a rated warmup time is specified in the manual, after that time has passed) o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious

		emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3)
Radio buoy devices	o Vibration ⓑ o Drop ⓓ o Water infiltration ⓓ o Continuous operation ⓐ o Temperature ⓑ+ⓓ o Humidity ⓐ	o Confirm normal operation within 10 minutes of powering on (or if a rated warmup time is specified in the manual, after that time has passed) o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Modulation index of A2A.A2B emissions (Technical Criteria Article 56 Paragraph 1 Subparagraph 3) - Excluding devices with antenna power not exceeding 1 W

		o Operating conditions for the relevant functionality in the case of a radio buoy used for selective calling (Technical Criteria Article 56 Paragraph 2 Subparagraph 3)
Radio equipment using F1D,G1D,F2D,G2D, F3E and G3E emissions (excluding devices subject to design inspection)	o Vibration ⓑ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ, ⓑ or ⓒ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Maximum frequency deviation (Technical Criteria Article 107) o Low-pass filter properties (Technical Criteria Article 107; limited to F3E and G3E)

		o Adjacent channel power leakage (Technical Criteria Article 107) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Medical devices using high frequencies that must receive permits	o When powered on by applying the specified power and voltage at standard temperature and humidity	o Confirm normal operation 1 minute after powering on o Allowed electrical field strength (Technical Criteria Article 14 Paragraph 2)
Devices for radio equipment for use in wireless calling stations	o Vibration ⓑ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓑ o Humidity ⓐ	o Confirm normal operation within 1 minute of powering on o Frequency tolerance (Technical Criteria Article 110 or 85) o Permitted occupied bandwidth (Technical Criteria Article 110 or 85) o Permitted levels of spurious emissions (Technical Criteria Article 110 or 85) o Allowed deviation in antenna

		power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Mobile subscriber wireless telephone devices	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 824) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for personal mobile	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted

communication	o Temperature ⓐ o Humidity ⓐ	occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 83) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for mobile communications	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 91) o Adjacent channel power leakage (limited to devices subject to Technical Criteria Article 91 Paragraph 2) o Allowed deviation in antenna power (Technical Criteria

		Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 91)
Radio equipment for wireless data communication using RF in the 900 MHz band	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 87) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Shared-frequency wireless telephone devices	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted

		unwanted emissions, maximum frequency shift, total distortion and noise (Technical Criteria Article 88 or 111) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Low-pass filter properties (Technical Criteria Article 88 or 111) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for lifestyle radio station	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ or ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 96) o Allowed deviation in antenna power (Technical Criteria

		Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for marine mobile telephone	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions, etc. (Technical Criteria Article 90) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Low-pass filter properties (Technical Criteria Article 90) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for portable satellite	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted

communications station	o Temperature ⓐ o Humidity ⓐ	occupied frequency bandwidth, permitted unwanted emissions, etc. (Technical Criteria Article 86) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for radio detection	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions, etc. (Technical Criteria Article 105) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving

		equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for amateur radio station (excluding devices fabricated or assembled for own use)	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ or ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for subscriber loop	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions, etc.

		(Technical Criteria Article 89) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for emergency wireless telephony	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions, etc. (Technical Criteria Article 84) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for wireless	o Vibration ⓐ o Impact ⓐ	o Confirm normal operation 1 minute after powering on

CATV use	o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Wireless devices for portable internet use	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 92) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3)

		o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for location-based services	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 93) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Radio equipment for broadcast production and performance support	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ or ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Effective radiated power, permitted occupied frequency bandwidth, permitted unwanted emissions

		(Technical Criteria Article 111*bis*) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Wireless devices having the electrical field strength, magnetic field strength, or radiative power specified in Article 24 Subparagraph 4 of the Enforcement Decree of the Radio Waves Act	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Permitted electrical or magnetic field strength (limited to conditions of standard temperature and humidity) (Technical Criteria Articles 97 through 103 o Unwanted emissions from low-frequency transmitter (Article 15 Subparagraph 6)

Radio equipment for use in designated low-output radio stations	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ or ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 98) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o Allowed electrical field strength and power density (Technical Criteria Article 98) o Performance of receivers for wireless guidance devices for the visually disabled (Technical Specifications Article 98 Paragraph 3 Subparagraph 9) o Wireless devices for use in

		small base stations must conform to the technical criteria for radio equipment for the electrical communications industry
Wireless devices for RFID/USN use	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ or ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance (Technical Criteria Article 99) o Permitted occupied bandwidth, permitted unwanted emissions, electrical strength or antenna power (Technical Criteria Article 99) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Cordless telephones	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted

	o Temperature ⓒ o Humidity ⓐ	occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 100) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) o RF interference avoidance function (Technical Criteria Article 100 Paragraph 2)
Ultra wide band (UWB) wireless devices	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ or ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Permitted frequency bandwidth, permitted unwanted emissions, strength of secondary RF emissions from receiving equipment, RF interference avoidance function (Technical Criteria Article 101 Paragraph 1) o Allowed deviation in antenna

		power (Technical Criteria Article 6 Paragraph 3) ※ Frequency tolerance does not apply
Radio equipment of unspecified purpose	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ or ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Effective radiated power, permitted occupied frequency bandwidth, permitted unwanted emissions (Technical Criteria Article 101 Paragraph 2) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)
Implanted wireless medical devices	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓩ Temperature: After being placed at the	o Confirm normal operation 1 minute after powering on o Frequency tolerance, permitted frequency bandwidth, permitted spurious emissions,

	following temperatures for 1 hour each, tested at that temperature - Control unit: 0°C, 55°C - Implant unit: 25°C, 45°C o Humidity ⓐ ※ Temperature and humidity conditions apply only to frequency tolerance	RF interference avoidance function (Technical Criteria Article 102) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1) ※ Implanted radio equipment tested only at rated voltage ※ The spare-channel function of Technical Criteria Article 102 Subparagraph 7 may optionally be employed
Radio equipment for use in object detection sensors	o Vibration ⓐ o Impact ⓐ o Continuous operation ⓐ o Temperature ⓐ or ⓑ o Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance permitted occupied frequency bandwidth, strength of secondary RF emissions from receiving equipment (Technical Criteria Article

		103) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3)
Other radio equipment	o For use in mobile marine applications, the environmental conditions for digital selective calling devices apply *mutatis mutandis* o For use in mobile aviation applications, the environmental conditions for double-side band wireless telephony devices apply *mutatis mutandis* . o Other cases - Vibration ⓐ - Impact ⓐ - Continuous operation ⓐ - Temperature ⓐ - Humidity ⓐ	o Confirm normal operation 1 minute after powering on o Frequency tolerance (Technical Criteria Article 3) o Permitted occupied bandwidth (Technical Criteria Article 4) o Permitted levels of spurious emissions (Technical Criteria Article 5) o Allowed deviation in antenna power (Technical Criteria Article 6 Paragraph 3) o Strength of secondary RF emissions from receiving equipment (Technical Criteria Article 9 Paragraph 1)

[Annex 3] Testing Procedures for Each Technical Criteria Item (Pertinent to Article 18)

1. **General**

1.1 Modulating signal source

1.1.1 For the modulating signal source, any one of a waveform generator, pattern signal generator (hereinafter "pattern generator") or modulating signal source mounted within the test device can be used, depending on the emission type of the test device.

1.1.2 If the device transmits audio information and no modulated input signal is separately specified, an arbitrary audio signal (a white noise signal with bandwidth limited by a wave filter having the characteristics of recommendation ITU-T G.227).

1.1.3 Unless otherwise specified, a standard pattern signal (2^9-1 arbitrary codes (PN codes)) at the maximum transmission speed allowed in the specification (or manual) shall be used for the modulated input signal of the device transmitting data.

1.2 Dummy load

For the dummy load in all performance tests, even if unspecified, a dummy load with a nominal impedance (in most cases a pure resistance of 50 Ω) shall be used for the dummy load. In this case, it is preferred that for the safety of the measurement equipment, it be able to withstand electrical power at least 2x the maximum output of the test device.

1.3 Measurement equipment requirements

1.3.1 All measurement equipment and measurement systems must be calibrated prior to measurement by obtaining the correction factor using SG.

1.3.2 If single-sweep is used as the measurement mode of a spectrum analyzer, measurement is performed 3-10 times and the larger value is used.

1.3.3 If it is necessary to measure the modulation index of a device transmitting audio information, the settings of the measurement device shall be as follows.

◦ If a modulation analyzer is being used as a modulation meter, the low-pass filter (5 kHz, 15 kHz, 30 kHz, etc.) shall be set appropriately.

◦ If a linear detector is being used as a modulation meter, the low-pass filter shall be said to 20 kHz.

1.3.4 If a frequency counter is used, the device used shall have a frequency setting precision and frequency resolution at least one place greater than the technical standard of the device being tested. In addition, all measurement devices must have a precision exceeding the test device and must have a sufficient range to measure the output and frequency of the test device.

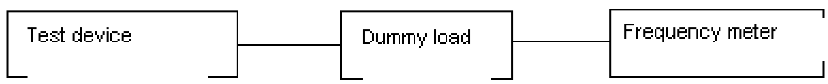
2. **Measurement of frequency tolerance**

2.1 Purpose of Testing

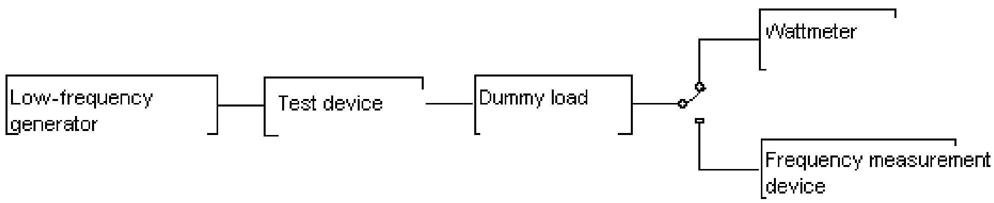
◦ The objective is to measure whether the frequency of the test device's emissions is within tolerance.

2.2 Testing flow chart

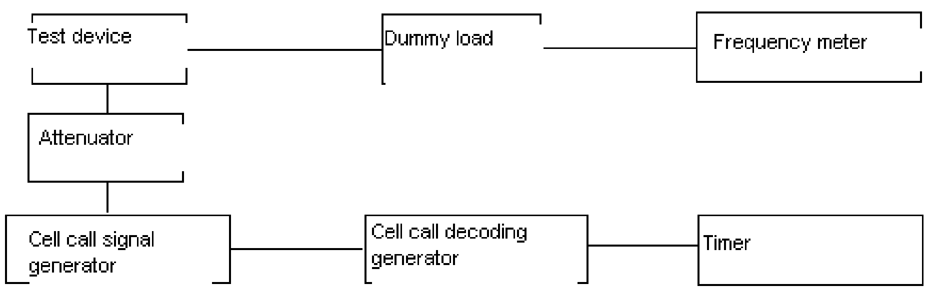
2.2.1 General case



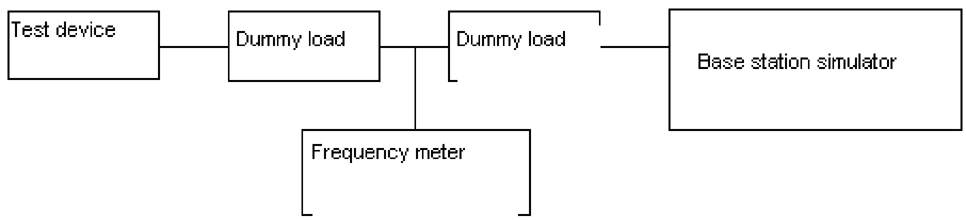
2.2.2 Case of device using single-side band



2.2.3 Case of device for a radio buoy for use in digital selective calling

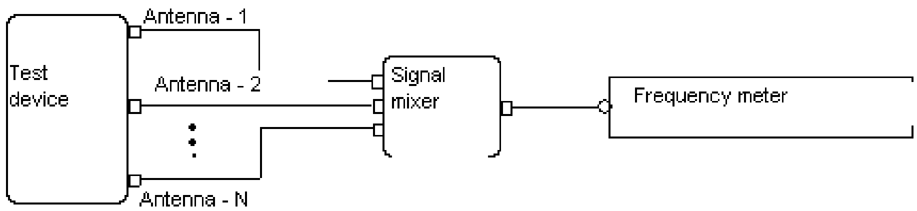


2.2.4 Case of equipment controlled by a radio station engaged in communication



◦ This corresponds to the majority of subscriber equipment for use in electrical communication service having a phase locked loop.

2.2.5 Case of equipment using multiple antennas



2.3 Testing Procedures

ⓐ The carrier frequency is measured between the time that power is supplied to the test device, set to non-modulation, and the time that the frequency stabilizes (or up to the time limit if the device has communication time limit functionality).

ⓑ If the test device is a data transmission device and cannot transmit without modulation, then unless stated otherwise in the specified technical criteria or standards, the average frequency is measured while modulating with the standard encryption testing signal.

ⓒ In the case of a device having an apparatus for external frequency control, testing is performed on the entire control range.

ⓓ (in the case of J3E emissions) The upper-side band frequency is measured between the time the test device is set to 80% of rated output by a sinusoidal signal of 1400 Hz, and power is supplied, and the time the frequency stabilizes.

ⓔ (In the case of radio buoy devices) The action of the encryption device is stopped, and under testing conditions of 1 minute transmission, 3 minutes pause, the carrier frequency is measured from the time that power is supplied and the device is activated to the time that frequency stabilizes.

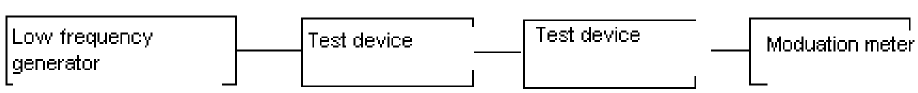
3. **Measurement of maximum frequency deviation**

3.1 Objective of Testing

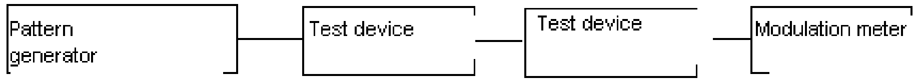
◦ The objective is to measure whether the frequency deviation value of the test device during frequency modulation is within the permitted range.

3.2 Testing Configuration

3.2.1 In the case of a device that transmits audio information



3.2.2 In the case of a device that transmits data information



3.3 Measurement equipment requirements

3.3.1 When a modulation analyzer that can perform a general properties test is used as a modulation meter, the low-pass filter is set appropriately (5 kHz, 15 kHz, 30 kHz, etc.).

3.3.2 If a linear detector that can perform a general properties test is being used as a modulation meter, the low-pass filter is set to 20 kHz.

3.4 Testing Procedures

3.4.1 In the case of a device that transmits audio information

ⓐ The test device is modulated by the specified modulation frequency (three frequencies: 500 Hz, 1000 Hz, 3000 Hz).

ⓑ The maximum frequency deviation (+ side and - side) is obtained for the time when the standard input level of the modulated input is changed (-20 dB - +30 dB).

ⓒ If the continuous tone squelch is provided, the test device is measured with tone on (hereinafter "ON").

3.4.2 In the case of a device that transmits data information

ⓐ The test device is activated by applying the specified modulation with a standard pattern.

ⓑ The maximum frequency deviation (+ side and - side) is obtained for the time when the standard input level of the modulated input is changed (-20 dB - +30 dB).

3.4.3 In the case of radio equipment for use in a radio relay station

ⓐ The test device is modulated with the specified modulation frequency. (Modulation frequency: 1000 Hz, modulation: 60%)

ⓑ The maximum frequency deviation (+ side and - side) is obtained for the time when the standard input level of the modulated input is changed (20 dB).

ⓒ If the continuous tone squelch is provided, the test device is measured with tone ON.

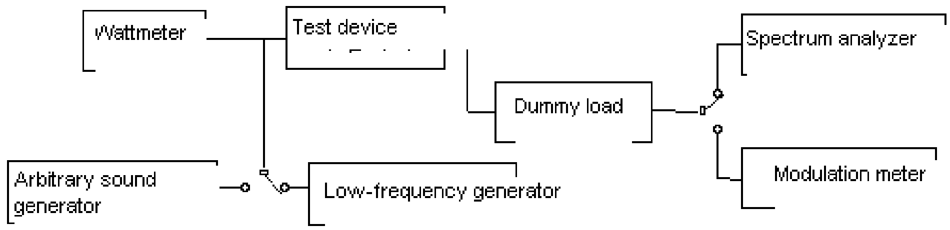
4. **Measurement of occupied frequency bandwidth**

4.1 Objective of Testing

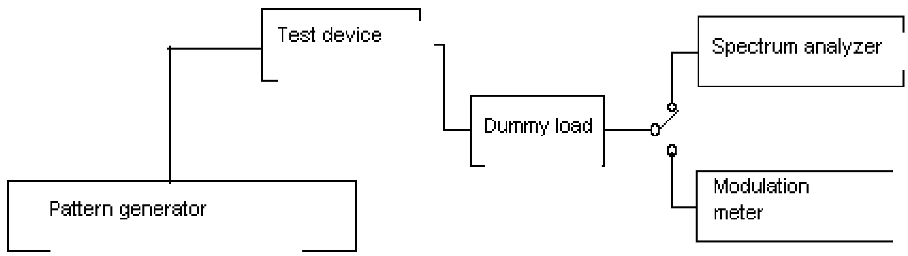
◦ The objective is to measure whether the occupied frequency bandwidth of the radiation emitted by the test device is within the permitted range.

4.2 Testing Configuration

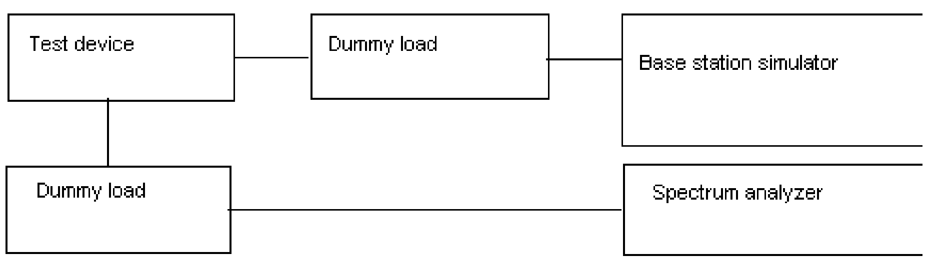
4.2.1 In the case of a device that transmits audio information



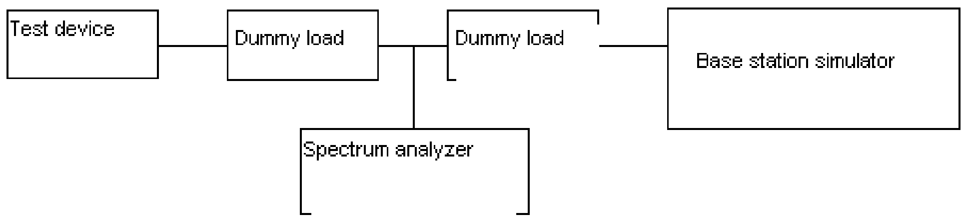
4.2.2 In the case of a device that transmits data information, or other device



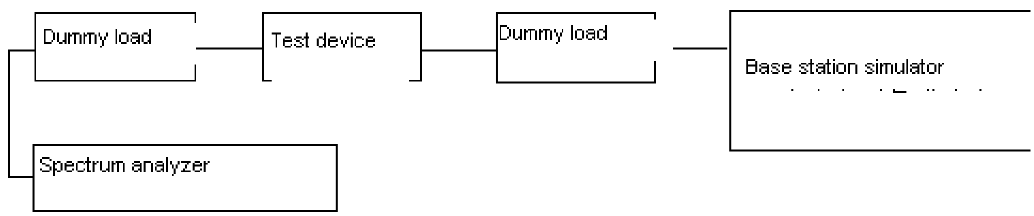
4.2.3 Case of devices with internally-mounted modulating signal source



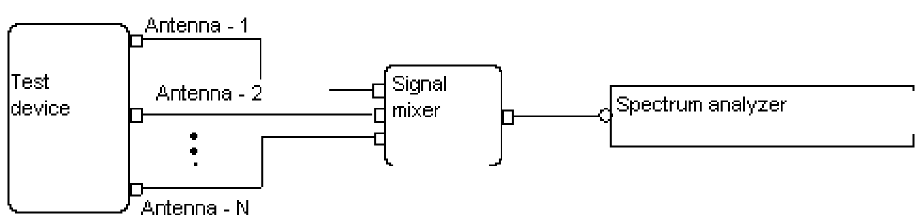
4.2.4 Case of equipment controlled by a radio station engaged in communication



4.2.5 Case of a device relaying between a base station or fixed commercial station and a mobile or fixed subscriber station



4.2.6 Case of equipment using multiple antennas



4.3 Measurement equipment requirements

ⓐ The spectrum analyzer is configured as follows.

Central frequency	Carrier frequency
Sweep frequency range	2-3x required frequency bandwidth

Resolution bandwidth	Approx. 1/50 required frequency bandwidth
Video bandwidth	Automatic
Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	10 or more

4.4 Testing Procedures

4.4.1 In the case of a device that transmits audio information

ⓐ The modulation input is measured with a wattmeter with the test device modulated 70% by a 1000 Hz sinusoidal signal.

ⓑ The modulating signal source is switched by an arbitrary sound generator and the modulation input is set to a value 10 dB greater than the value obtained in Testing Method ⓐ.

ⓒ The test device is activated under these conditions and measurement is performed using the occupied frequency bandwidth measurement functionality of the spectrum analyzer. If the spectrum analyzer has no occupied frequency bandwidth measurement functionality, the following steps must be performed. (Generally by a program through a computer interface.)

ⓓ The electrical power is measured at each sampling point and averaged over the sweep count.

ⓔ The sum of the electrical power at each sampling point (hereinafter "total electrical power") is obtained.

ⓕ Power is applied in sequence from the upper-limit sampling point, and the frequency is obtained for the sapling point at which the sum total of these is 0.5% of the total power (hereinafter “upper limit frequency”).

ⓖ Power is applied in sequence from the lower-limit sampling point, and the frequency is obtained for the sapling point at which the sum total of these is 0.5% of the total power (hereinafter “lower limit frequency”).

ⓗ The difference between the upper and lower limit frequencies is obtained.

4.4.2 Case of device using single-side band

◦ The testing configuration diagram is as in the case of a device transmitting audio information.

(J3E emissions)

ⓐ The modulated input when the test device is modulated 80% with a 1400 Hz sinusoidal signal (with the transmitter output applying modulation input at 80% of rated output) is measured with a wattmeter.

ⓑ The modulating signal source is switched with an arbitrary sound generator and the modulation input is held equal to the value obtained above.

(when using H3E or R3E transmissions)

ⓒ The modulation input of the test device is measured with a wattmeter at 80% modulation with a 1400 Hz sinusoidal signal (with side-band amplitude at 80% of carrier amplitude when comparing the two amplitudes using a spectrum analyzer).

ⓓ The procedures of 4.4.1 ⓒ-ⓗ apply *mutatis mutandis* hereafter.

4.4.3 In the case of a device that transmits data information

ⓐ The test device is set to the specified modulation level (specified modulation input level).

ⓑ The procedures of 4.4.1 ⓒ-ⓗ apply mutatis mutandis hereafter.

4.4.4 Case of devices with internally-mounted modulating signal source

ⓐ The test device is brought to the specified modulation conditions at the maximum modulation frequency by the internal or attached modulating signal source.

ⓑ The procedures of 4.4.1 ⓒ-ⓗ above apply mutatis mutandis hereafter.

4.4.5 Case of equipment controlled by a radio station engaged in communication

ⓐ Using a base station simulator, testing is performed while setting the output signal of the tested device to an arbitrary frequency channel between the maximum and minimum frequencies.

ⓑ The test device is set to the specified modulation level (specified modulation input level).

ⓒ The procedures of 4.4.1 ⓒ-ⓗ above apply mutatis mutandis hereafter.

4.4.6 Case of a device relaying between a base station or fixed commercial station and a mobile or fixed subscriber station

ⓐ In the case of a device with an onboard modulation circuit, it is set to the specified modulation level (modulation input level specified in the technical criteria or standards).

ⓑ In the case of a simple amplifying repeater, the gain of the test device is set to maximum, and the standard signal specified in the technical criteria or standards is applied at the maximum input in the specifications of the test device.

ⓒ The procedures of 4.4.1 ⓒ-ⓗ above apply *mutatis mutandis* hereafter.

4.4.7 Case of equipment using multiple antennas

ⓐ Using a computer, testing is performed while setting the output signal of the tested device to an arbitrary frequency channel between the maximum and minimum frequencies.

ⓑ The test device is set to the specified modulation level (specified modulation input level).

ⓒ The procedures of 4.4.1 ⓒ-ⓗ above apply *mutatis mutandis* hereafter.

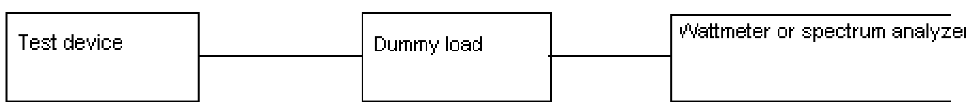
5. **Measurement of antenna power**

5.1 Purpose of Testing

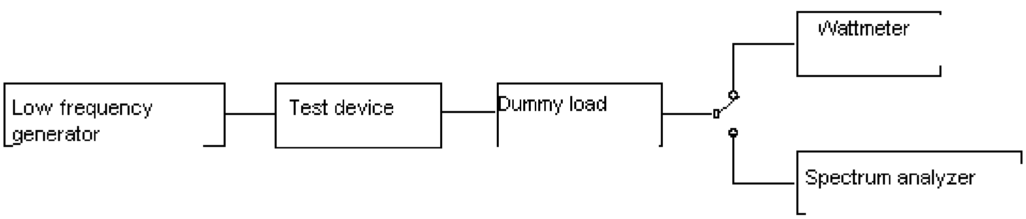
◦ The objective is to measure whether the electrical power of the test device is conformant to standards.

5.2 Testing Configuration

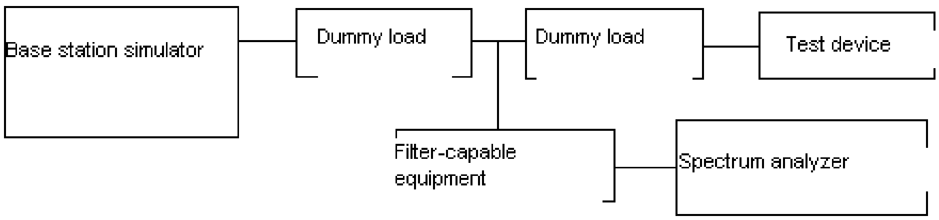
5.2.1 General case



5.2.2 Case of device using single-side band

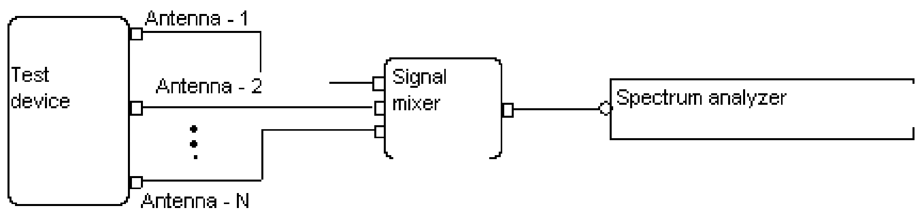


5.2.3 Case of equipment controlled by a radio station engaged in communication



5.2.4 Case of a device relaying between a base station or fixed commercial station and a mobile or fixed subscriber station

5.2.5 Case of equipment using multiple antennas



5.3 Measurement equipment requirements

◦ The units of change in modulation input signal level obtained from the low-frequency generator shall be no more than 2 dB.

◦ In the case of a device using multiple antennas, the test device is operated by the modulation technique that allows the transmission of the greatest electrical power, and is activated at the maximum electrical power control level.

5.4 Testing Procedures

5.4.1 General case

ⓐ With the test device activated without modulation, the average electrical power is measured. Measurement is performed between the time when power has been supplied and the time that the transmitter stabilizes (or in the case of devices with transmission time limit functionality, within the time limit).

ⓑ When measuring peak power, the test device is placed under modulation conditions and either substitution measurement is performed using a spectrum analyzer, or the average power is obtained by conversion according to the modulation wave type.

ⓒ In the case of a device using multiple antennas, then either the power supplied to all antennas is summed in accordance with Article 13 Paragraph 6, or measurement is performed at the maximum antenna terminal.

5.4.2 Case of device using single-side band

ⓐ A 1400 Hz sinusoidal wave is applied to the test device, and the level thereof is changed in sequence n order to measure the average power of the transmitter output.

ⓑ By continuing the above manipulation until the transmitter output is saturated, a curve is described of modulation input vs. transmitter output.

ⓒ The maximum transmitter output is obtained from this characteristic curve.

5.4.3 Case of measurement of antenna power with a spectrum analyzer

ⓐ The test device is activated at conditions of maximum output.

ⓑ The spectrum analyzer is configured as follows.

Central frequency	Carrier frequency
Sweep frequency range	2-3x required frequency bandwidth
Resolution bandwidth	Approx. 1/50 required frequency bandwidth
Video bandwidth	Automatic
Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	Single Sweep
Channel interval	If the output signal of the test device is a single-frequency channel, settings are the same as with single-sweep; in the case of multiple channels, the specified bandwidth (or channel interval) is set.

ⓒ Antenna power is measured.

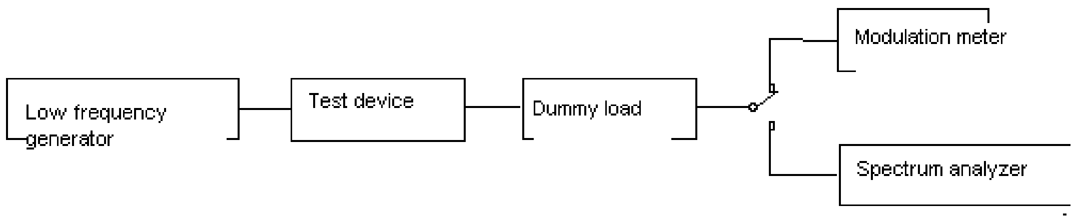
6. **Measurement of adjacent channel power leakage**

6.1 Objective of Testing

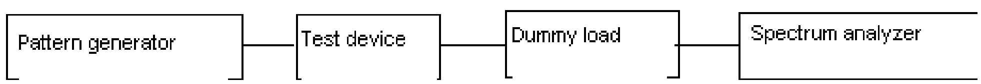
◦ The objective of testing is to measure the degree to which the power from electromagnetic radiation emitted by the test device leaks into and affects adjacent channels.

6.2 Testing configuration diagrams

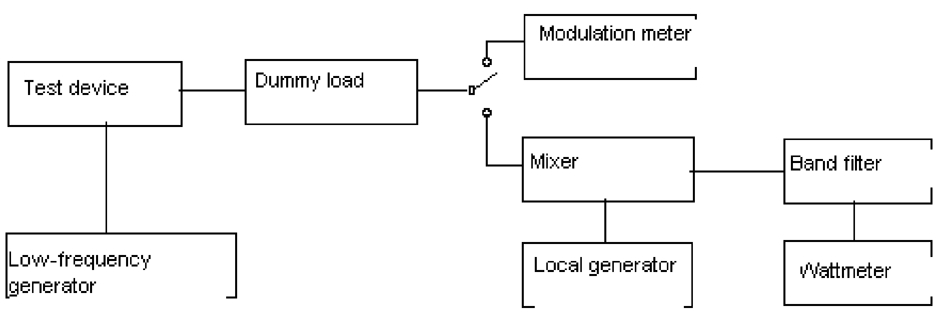
6.2.1 In the case of a device that transmits audio information



6.2.2 In the case of a device that transmits data information



6.2.3 In the case of a device using F3E or G3E emissions



6.3 Testing Procedures

ⓐ The spectrum analyzer is set as follows.

Central frequency	Carrier frequency
Sweep frequency range	4-6x required frequency

	bandwidth
Sampling count	1001 points
Resolution bandwidth	Approx. 100x required frequency bandwidth
Video bandwidth	300 Hz or less
Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	Single Sweep

ⓑ The test device is activated without modulation, and the value then measured by the spectrum analyzer (standard power) is termed P0. If it is not possible to activate the test device without modulation, the average power of the inspected channel is measured and used as the standard power (P0).

ⓒ If the test device transmits data information, it may be set to the specified modulation level (the modulation input level in the standard) by the modulating signal source.

ⓓ If the test device is a specific low-power radio device that transmits audio information, the low-frequency generator output modulated 60% at 1250 Hz is obtained, and a modulating signal 10 dB greater than this is applied to the test device.

ⓔ Measurement is performed with the spectrum analyzer in adjacent channel power ratio (hereinafter “ACPR”) measurement mode.

ⓕ If the channel interval is 100 kHz, total power is obtained within bands (±) 40 kHz of frequencies 100 kHz greater and less than the carrier frequency.

· Portable wireless telephone apparatus for sending only

ⓖ If the channel interval is 25 kHz, the total power values Pu, P1 are obtained within a band of (±) 8 kHz of frequencies 25 kHz above and below the carrier frequency.

· Specific low-output radio devices

· Devices for radio facilities for wireless calling stations

ⓗ If the channel interval is 12.5 kHz, total power is obtained within bands (±) 4 kHz of frequencies 12.5 kHz greater and less than the carrier frequency, and the ratio to standard power (P0) is also obtained.

ⓘ If the test device is an item of radio equipment for an lifestyle radio station using A3E emissions, the power at each of frequency band at the channel interval (5 kHz, 10 kHz) above and below the carrier frequency is obtained, under conditions of specified modulation input (50% modulation by 2500 Hz frequency), and the ratio of this to the standard power (P0) is obtained.

ⓙ If the test device is an item of radio equipment for an lifestyle radio station using F3E emissions, the power at each of frequency bands at the channel interval (6 kHz) above and below the carrier frequency is obtained, under conditions of applying the specified modulation input

(1.5 kHz modulation of 1250 Hz frequency), and the ratio of this to the standard power (P0) is obtained.

ⓚ If the spectrum analyzer has no ACPR measurement mode, the upper and lower channel power is measured using the configuration of 6.2.3 and the procedures below, and the ratio to the standard power is obtained.

· Transmission devices using F3E and G3E emissions

· Devices for radio equipment for use in wireless repeater stations

· Shared-frequency wireless telephone devices

(Measurement of upper-side channel frequency)

ⓛ The test device is set to non-modulated transmission, and the local generator frequency (FL) is set as the test device carrier frequency (F0) - the central frequency of the band filter (F1).

ⓜ When the output power has been brought to 6 dB below P0 by increasing the FL value, the FL value is obtained (FL1).

ⓝ FL is represented as $F_{L1}+\Delta f$.

ⓞ The low-frequency generator output that modulates the test device at 1250 Hz 60% is obtained, and a modulating signal of this value + 10 dB is applied.

ⓟ The output power (Pu) for this time is then obtained.

(Measurement of lower-side channel frequency)

ⓠ The test device is set to non-modulated transmission, and the local generator frequency (F_L) is set as the test device carrier frequency (F_0) - the central frequency of the band filter (F_1).

ⓡ When the output power has been brought to 6 dB below P_0 by reducing the FL value, the FL value is obtained (F_{L1}).

ⓢ FL is represented as F_{L1}-⊿f.

ⓣ The low-frequency generator output that modulates the test device at 1250 Hz 60% is obtained, and a modulating signal of this value + 10 dB is applied.

ⓤ The output power (P1) for this time is then obtained.

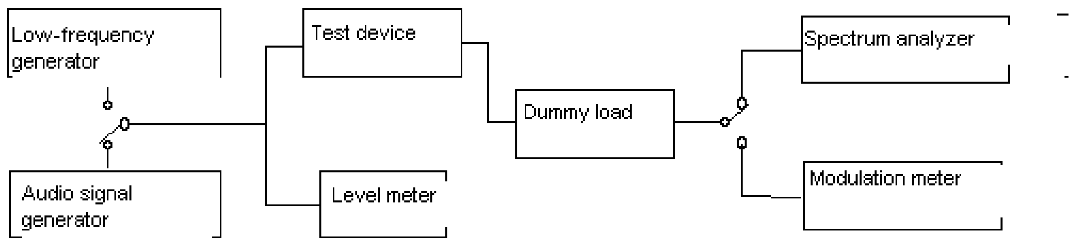
7. **Measurement of unwanted emissions outside of band**

7.1 Purpose of Testing

◦ The objective is to measure whether the unwanted emissions generated outside of the band when the test device generates electromagnetic emissions are within tolerance.

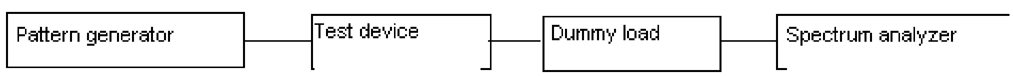
7.2 Testing Configuration

7.2.1 In the case of a device that transmits audio information

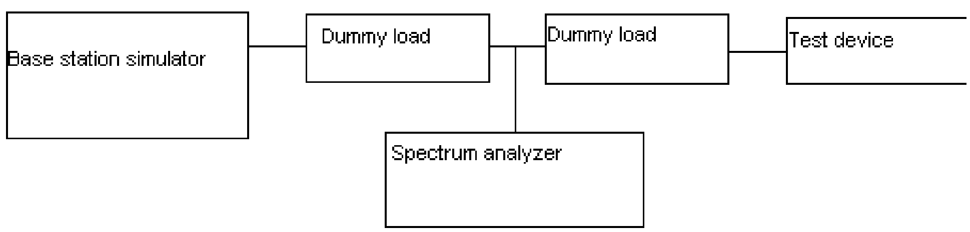


7.2.2 In the case of a device that transmits data information

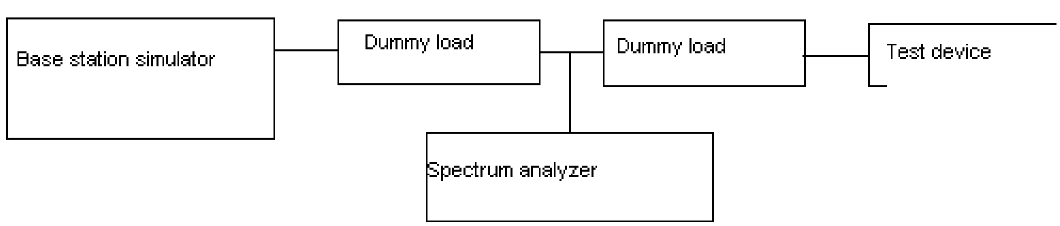
(Including dial tones, supervisory audio tones)



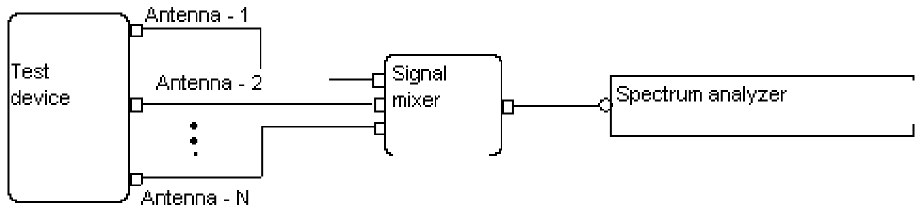
7.2.3 Case of equipment controlled by a radio station engaged in communication



ⓐ Case of a device relaying between a base station or fixed commercial station and a mobile or fixed subscriber station



7.2.4 Case of equipment using multiple antennas



7.3 Measurement equipment requirements

◦ The pattern generator must b able to generate a pattern signal at the same transmission speed as the maximum transmission speed modulated when the test device is in use.

7.4 Testing Procedures

ⓐ The spectrum analyzer is configured as follows.

Central frequency	Carrier frequency
Sweep frequency range	7x required frequency bandwidth
Resolution bandwidth	Approx. 1/50 required frequency bandwidth
Video bandwidth	300 Hz or less
Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	10 or more

ⓑ The test device is activated without modulation, and the value then measured by the spectrum analyzer (standard power) is termed P0. If it is not possible to activate the test device without modulation, the average power of the inspected channel is measured and used as the standard power (P_0).

ⓒ A modulating signal of a 1250 Hz sinusoidal wave is input, and modulated to 60% of the maximum frequency deviation of the test device, and the modulation input is then measured.

ⓓ The low-frequency generator is switched by a sound signal analyzer, and the modulation input is set to a value 10 dB greater than the value obtained in ⓐ.

ⓔ With the modulation input shut off, the test device is powered on and the power of the carrier wave (standard power: P0) is measured with the spectrum analyzer.

ⓕ In the case of an apparatus for transmission of data information, a standard pattern signal is generated at the maximum transmission speed using a pulse pattern generator, and this is applied to the test device to maintain the specified modulation level.

· The supervisory audio tone of a mobile subscriber wireless telephone apparatus is ±2 kHz of the frequency deviation; for a dial tone, ±8 kHz of frequency deviation

· If CDMA is used, the standard CDMA signal

ⓖ In the case of a device with an onboard modulating signal, the onboard modulating signal source is set to maximum transmission speed.

ⓗ It is confirmed whether the power at each frequency, from either end of the required frequency bandwidth to the specified separated frequency (generally frequencies separated by approximately 250% of the required frequency bandwidth).

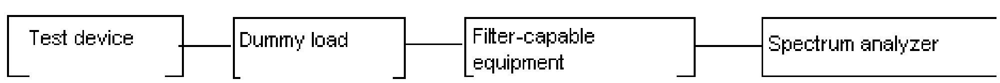
8. **Measurement of strength of unwanted emissions in the spurious domain**

8.1 Purpose of Testing

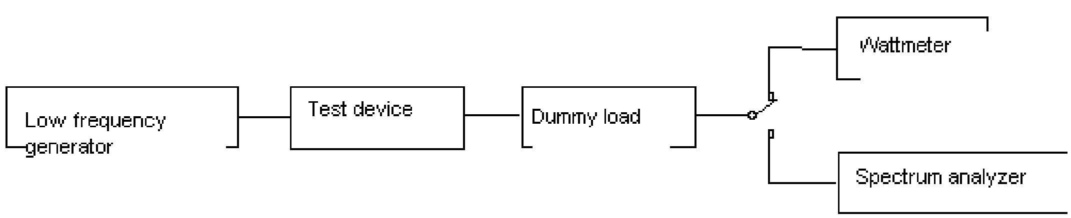
◦ The objective is to measure whether the spurious emissions generated when the test device is transmitting are within specified tolerance, so as not to interfere with other wireless devices.

8.2 Testing Configuration

8.2.1 Case of subject device ①

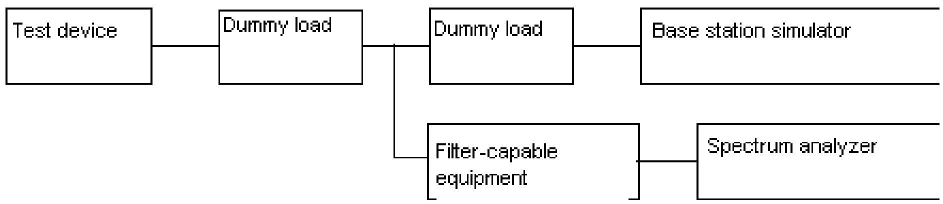


8.2.2 Case of subject device ②

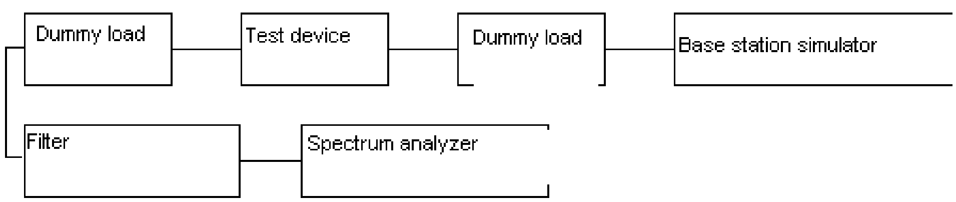


8.2.3 Case of a device that transmits data information

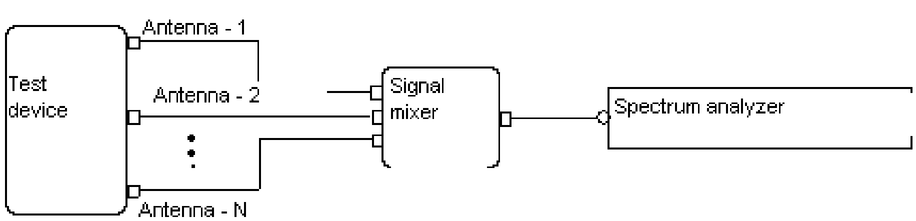
8.2.4 Case of equipment controlled by a radio station engaged in communication



8.2.5 Case of a device relaying between a base station or fixed commercial station and a mobile or fixed subscriber station



8.2.6 Case of equipment using multiple antennas



8.3 Measurement equipment requirements

ⓐ A sufficient reduction is made in the basic wave item of equipment, using a band stop filter.

ⓑ In the case of A3E, the arbitrary load is set to dynamic capacity (maximum 100 pF) and a perpendicular load of 50 Ω, and instead of a band filter device, an additional high-frequency reducer is connected.

8.4 Testing Procedures

ⓐ The test device is powered on with no modulation, and the dynamic capacity is adjusted to maximize the basic wave output, and the power is measured.

ⓑ The spectrum analyzer is configured as follows.

Central frequency	Carrier frequency
Sweep frequency range	Set so as to enable measurement from 3rd subharmonic to 3rd harmonic of the assigned frequency.
Resolution bandwidth	No less than standard bandwidth for inspected frequency 9 – 150 kHz: 1 kHz 150 kHz – 30 MHz: 10 kHz 30 MHz – 1 GHz: 100 kHz Over 1 GHz: 1 MHz For use in outer space: 4 kHz
Video bandwidth	At least 3x resolution bandwidth

	(generally in automatic mode)
Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	10 or more

ⓒ In the case of J3E emissions, the test device is placed under conditions of 80% modulation with a 1400 Hz sinusoidal signal (applying modulation input such that transmitted output is 80% of rated output).

ⓓ In the case of H3E emissions, the test device is 80% modulated with a 1400 Hz sinusoidal signal (under modulation conditions such that the sideband amplitude is 80%of the carrier amplitude when comparing the two with a spectrum analyzer).

ⓔ Regardless of the conditions above, if the technical specifications or standards provide otherwise, that provision is to be followed.

ⓕ The power of unwanted spurious-domain emissions is measured using a spectrum analyzer.

◦ The measured frequency bandwidth (SPAN) of the spectrum analyzer is set to the total range specified in SM.329 and the maximum unwanted emission in the spurious domain is measured.

◦ If needed, a precision measurement can be performed by setting the central frequency of the spectrum analyzer to the frequency of the maximum unwanted emission, and reducing the measured frequency bandwidth.

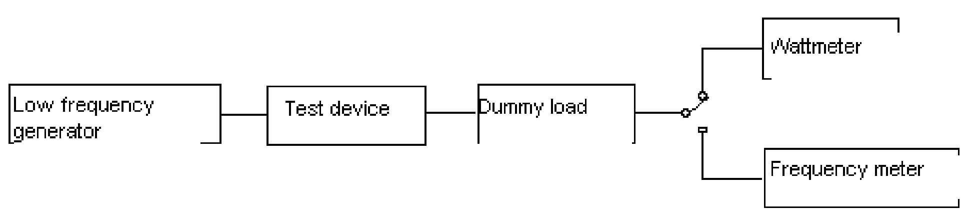
◦ If the technical criteria specify a value relative to fundamental frequency power, the fundamental frequency power and the relative value of the spurious-domain unwanted emissions measurement are obtained; if an absolute value is specified for spurious-domain unwanted emissions, the measured unwanted emission value is recorded.

9. **Measurement of carrier wave power ratio (SSB: single side band)**

9.1 Objective of Testing

◦ The objective is to measure whether the power of the emissions from the test device are within the specified tolerance.

9.2 Testing Configuration



9.3 Testing Procedures

9.3.1 The spectrum analyzer is configured as follows.

Central frequency	Carrier frequency
Sweep frequency range	3-5x required frequency bandwidth

Sampling count	1001 points
Resolution bandwidth	Minimum possible
Video bandwidth	Automatic
Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	Single Sweep

9.3.2 The test device is powered on under conditions of 80% modulation by a 1400 Hz sinusoidal signal (applying a modulation input such that the transmitter output is 80% of rated power).

9.3.3 Using the spectrum analyzer under these conditions, the ratio of upper-side-band power and carrier power is obtained.

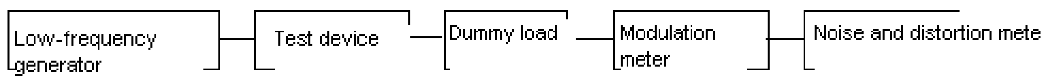
10. **Measurement of total distortion rate and noise**

10.1 Objective of Testing

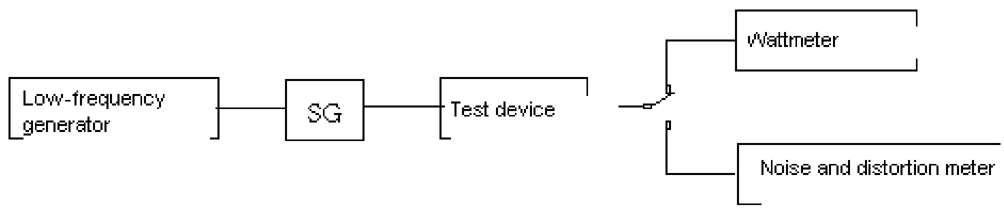
◦ The objective is to measure whether the distortion and noise generated upon transmission/reception by transmitting/receiving equipment is within tolerance.

10.2 Testing Configuration

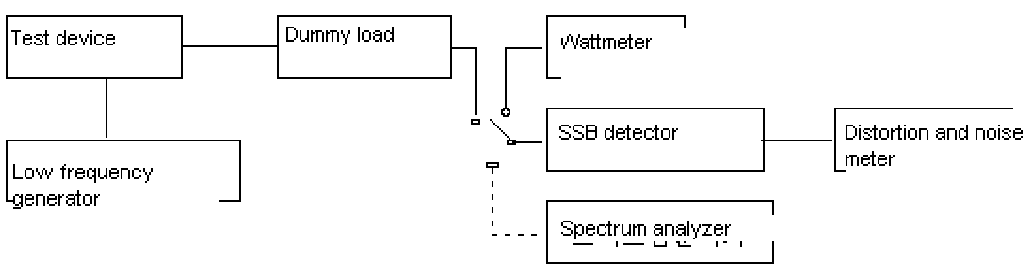
10.2.1 Case of selective calling devices, shared-frequency wireless telephone devices, and transmission devices using F3E and G3E



10.2.2 Case of receivers for selective calling devices, receiving devices using F3E and G3E, and single-channel receiving devices using single-side band at 28 MHz or below



10.2.3 Case of single-channel transmitting devices using single-side-band at 28 MHz or below



10.3 Measurement equipment requirements

◦ In the case of a test device having continuous tone squelch, after setting the modulation level, the low-pass filter of the modulation meter is set to 300 Hz.

10.4 Testing Procedures

(In the case of transmitters)

ⓐ The test device is powered on under 70% modulation conditions by a 1000 Hz sinusoidal signal.

ⓑ Under these conditions, SINAD 1) is measured from the demodulated output by the following formula:

(SINAD = (S+N+D)/(N+D), S : signal, N : Noise, D : Distortion)

(Case of a receiver)

ⓒ The frequency of SG is set to the test frequency, and 70% modulated with a 1 kHz sinusoidal wave.

ⓓ The SG output is adjusted to enable the application of an input voltage for the test device of at least 20 dB μ.

ⓔ The test device output is adjusted so that its demodulated output is 1/2 of the rated output.

ⓕ The SINAD of the test device's demodulated output is measured while the SG output is held at the level specified in ⓔ.

(Demodulation of SSB transmitter)

ⓖ The test device is powered on under conditions of 80% modulation by a 1400 Hz sinusoidal signal (applying a modulation input such that the transmitter output is 80% of rated power).

ⓗ Under these conditions, the transmitter output is applied to an SSB demodulator, and the SINAD is measured with a distortion rate meter.

(Spectrum analysis of the SSB transmitter)

ⓘ The spectrum analyzer is set as follows.

· The central frequency is set within the sideband and harmonic items of equipment.

· The sweep frequency range is set to 500 Hz.

· The resolution bandwidth is set to no more than 100 Hz.

ⓙ The test device is powered on under conditions of 80% modulation by a 1400 Hz sinusoidal signal (applying a modulation input such that the transmitter output is 80% of rated power).

ⓚ Under these conditions, using a spectrum analyzer, the sideband signal (S, 1000 Hz) and harmonics through the 7^{th} (D) are measured and (S+D)/D is obtained.

(SSB receiver)

ⓛ SG is set to non-modulated, and the output frequency is set to the test frequency (the frequency at which the demodulated output frequency of the test device becomes 1400 Hz).

ⓜ The SG output is set so that the receiver input voltage of the test device becomes 30 μV.

ⓝ The SG output is supplied and the high-frequency gain control of the test device is kept the same as when measuring sensitivity; the low-frequency gain control is adjusted so that the demodulated output of the test device is the specified output (1/2 of rated output).

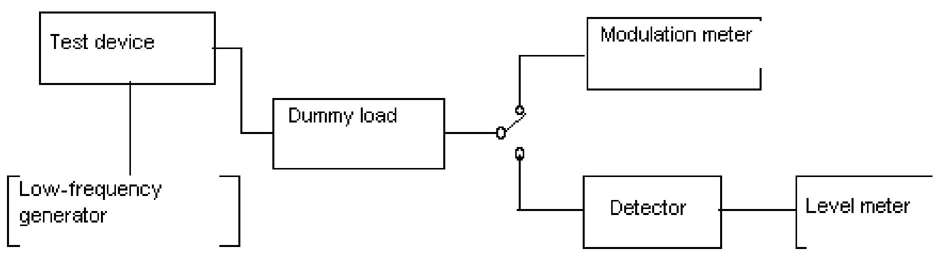
ⓞ The ratio of the receiving output (1400 Hz) in the test device, and the unwanted frequency item of equipment thereof, is obtained by SINAD.

11. **Measurement of pre-emphasis**

11.1 Purpose of Testing

◦ The objective is to measure whether the pre-emphasis used in the audio terminal for quality improvement satisfies the specified value.

11.2 Testing Configuration



11.3 Testing Procedures

ⓐ The test device is modulated by a sinusoidal wave signal of 1000 Hz, and the output of the low-frequency generator is adjusted so that the frequency deviation becomes 1 kHz.

ⓑ Under these conditions, the output of the test device is demodulated and the output level thereof is obtained.

ⓒ The demodulated output level is obtained for when the output level of the low-frequency generator is not changed, and the output frequency alone has been changed stepwise from 300 Hz to 3000 Hz.

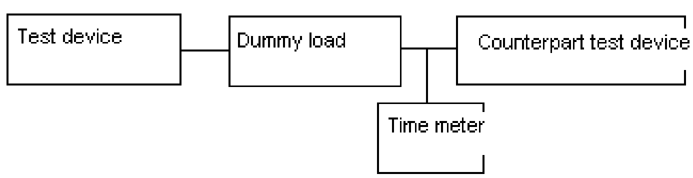
ⓓ The ratio of the values obtained in ⓑ and ⓒ is obtained.

12. **Measurement of transmission time limit**

12.1 Purpose of Testing

◦ The objective is to measure whether the test device powers on within the time limit specified when transmitting data.

12.2 Testing Configuration



12.3 Measurement equipment requirements

◦ If the test device has a gating transmission additive time-limit functionality, the meter is configured to include a second test device.

◦ If needed, an amplifier or attenuator is placed in front of the time meter.

◦ For the time meter, a spectrum analyzer, universal counter, stopwatch, oscilloscope, etc., is used.

12.4 Testing Procedures

12.4.1 Case of a device with a time limit whenever a single transmission is made

ⓐ The test device is kept at transmission conditions, and the time is measured from the start of transmission to when transmission ends automatically.

12.4.2 Case of a device having gate transmission additive time-limit functionality

ⓐ The test device is set to transmitting conditions and transmission is performed at least 2 times successively, including 1 reception, with the test device, within the specified time limit.

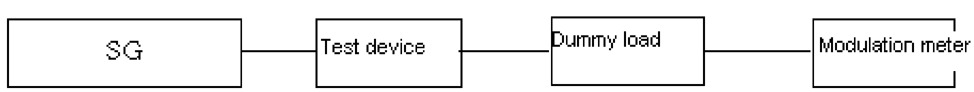
ⓑ The time from the start of transmission to the automatic end of the second transmission is measured.

13. **Measurement of modulation level**

13.1 Purpose of Testing

◦ The objective is to measure whether the modulation index of the signal of the test device is compliant with the specified value.

13.2 Testing Configuration



13.3 Testing Procedures

ⓐ The modulating signal passing through the test device, and the signal generated by the SG, are analyzed, and the degree of modulation is measured with a modulation analyzer.

14. **Measurement of electric field strength**

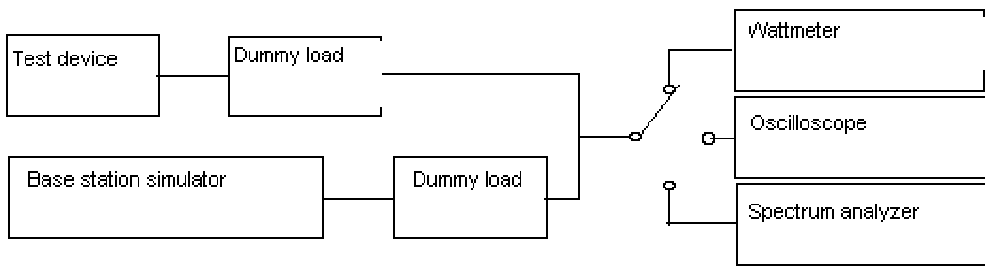
Electric field strength is measured according to Annex 4.

15. **Method of measuring output control function**

15.1 Purpose of Testing

◦ The objective is to measure whether the output emitted by a mobile station under transmission conditions is controllable, and whether the output conversion time when the output control function is operating is within the specified tolerance.

15.2 Testing Configuration



15.3 Measurement equipment requirements

◦ The time axis of the oscilloscope is set to μs units.

15.4 Testing Procedures

ⓐ The spectrum analyzer is used to measure whether the frequency has been converted by the base station simulator.

ⓑ The difference in power is measured between when output control function is active and when it is not.

ⓒ When output control function is active, the time taken for output conversion is measured with an oscilloscope.

16. **Measurement of the strength of secondary emissions**

16.1 Purpose of Testing

◦ The objective is to measure whether the secondary emissions generated by the test device under receiving conditions are within tolerance.

16.2 Testing Configuration

16.2.1 Case of test device having separate antenna terminals

16.3 Measurement equipment requirements

◦ Unless otherwise specified, the spectrum analyzer shall be set up in the same way as for the measurement of spurious-domain emissions.

16.4 Testing Procedures

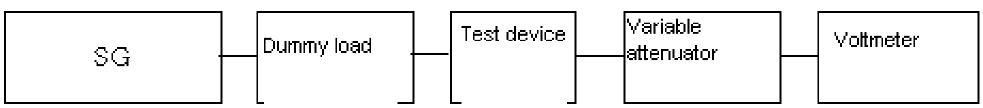
ⓐ The test device is set to receiving conditions, and the output power is then measured with a spectrum analyzer.

17. **Measurement of spurious response**

17.1 Purpose of Testing

◦ The objective is to measure whether the test device's spurious response (the capacity to suppress various interfering signals generated within the receiver) is at least of the minimum permitted value.

17.2 Testing Configuration



17.3 Testing Procedures

17.3.1 General case

ⓐ The SG is modulated 30% at 1000 Hz, and the generated frequency is adjusted to the desired tuning frequency of the test device (testing frequency).

ⓑ The test device is adjusted to optimal conditions.

ⓒ The SG output voltage is adjusted so that the receiver output is the rated output, and the SG output level in this situation is labeled V1 dB.

ⓓ The voltage at either end of the load resistance (Re) is measured with a voltmeter. The indicated level in this case is labeled A dB.

ⓔ The generated frequency of the SG is adjusted to the spurious frequency.

ⓕ The modulation conditions of the SG and the settings of the test device are always kept constant.

ⓖ This test, in principle, is performed on the frequency range from the intermediate frequency of the test device to 3x the testing frequency.

ⓗ The output level of the SG is adjusted so that the output of the receiver becomes A dB n the electronic voltmeter. The output level of the SG in this case is labeled V2 dB.

ⓘ The spurious response is V2 dB – V1 dB.

17.3.2 Case of device using single-side band

ⓐ The SG is set to non-modulated and the output frequency is set to the testing frequency. (The demodulation frequency of the test device is 1400 Hz.)

ⓑ The controller at each terminal of the test device is adjusted by the method set forth in the user manual (or if not set forth, the high-frequency gain controller is set to maximum and the low-frequency gain controller is adjusted), and the demodulation output of the test device is set to the specified output (1/2 of rated output).

ⓒ The SG output is set to a value greater than the said value by the spurious response tolerance + 10 dB, and the frequency is changed so that the frequency is obtained at which the demodulation output of the test device is equal to or greater than the specified output. This test, in principle, is performed on the frequency range from 1/3 to 3x the testing frequency.

ⓓ The SG output is adjusted with respect to each frequency obtained in ⓒ above, so that the receiver input voltage is obtained up to the time at which the test device's demodulation output becomes equal to the specified output.

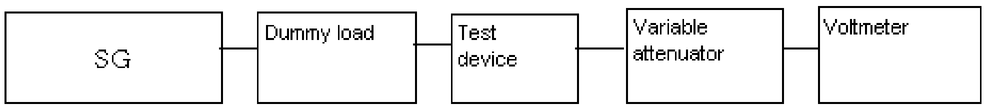
ⓔ The ratio of the value obtained in ⓓ above and 3 μV is obtained.

18. **Pass bandwidth and attenuation testing**

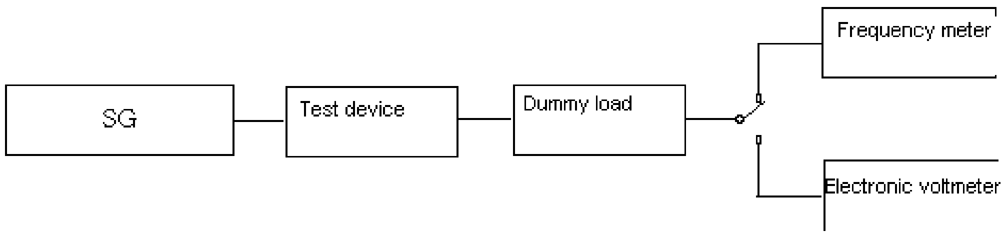
18.1 Purpose of Testing

◦ The objective is to measure whether the pass bandwidth of the test device and the degree of attenuation for each frequency are within tolerance.

18.2 Testing Configuration



◦ Case of device using single-side band



18.3 Testing Procedures

18.3.1 General case

ⓐ The SG is set to non-modulation and a testing frequency (a frequency at which the demodulation frequency in the test device becomes 1400 Hz) is generated.

ⓑ The automatic gain control (hereinafter “AGC”) of the test device is powered off (hereinafter "OFF"), and the SG output is lowered so that the respective amplifiers of the receiver are not saturated (the amplifier control maximizes the low-frequency gain while controlling the high-frequency gain).

ⓒ The voltmeter indication (A dB) and the SG output voltage (B dB) at this time are remembered.

ⓓ With the test device adjusted to maximum, the SG-generated frequency is slowly increased under the conditions set above, and the SG output is adjusted so as to maintain the voltmeter indication of A dB.

ⓔ The difference between the meter indication A dB and B dB for each SG output level (A-B dB) with respect to each mobile frequency is obtained and graphed.

ⓕ The following items are computed using this characteristic curve.

· Pass bandwidth: Frequency interval specified by 2 frequencies attenuated -6 dB from the central frequency.

· Attenuation: The curved surface on either side of the pass band is calculated by the following formula, to obtain the slope.

$$\Delta B_x = f_x - f_e \text{ [dB/kHz]}$$

ΔB_x: Difference in attenuation between f_x and f_e

f_x: Frequency of pass band

f_e: Frequency of other measurement points

18.3.2 Case of device using single-side band

ⓐ With the test device adjusted to maximum, the SG-generated frequency is decreased 2.3 kHz under the conditions set above, and the SG output is adjusted so as to maintain the voltmeter indication of A dB.

ⓑ The measurement of procedure ⓐ is performed over the range of ±2.3 kHz from the testing frequency, and the difference between the meter indication A dB and B dB for each SG output level (A-B dB) with respect to each mobile frequency is obtained and graphed.

ⓒ The pass-though bandwidth at -6 dB from this characteristic curve, and the attenuation at points -26 dB, -46 dB, and -66 dB are obtained.

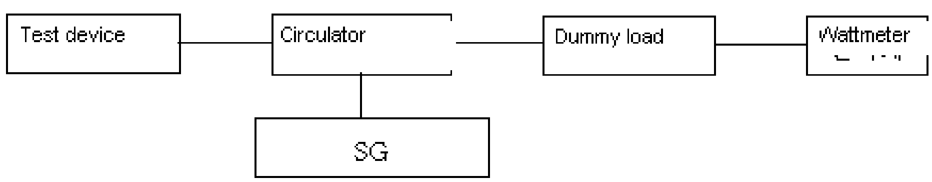
19. **Measurement of carrier wave sensing apparatus**

19.1 Purpose of Testing

◦ The objective is to measure whether, when the test device has received emissions from another wireless device, if the functionality to prevent emission on the same frequency is operating according to standards.

19.2 Testing Configuration

19.2.1 Case of an antenna terminal



19.3 Measurement equipment requirements

If the high-frequency output of the test device is small, then instead of a circulator, a device able to separate the SG signal from the test device's signal may be used.

19.4 Testing Procedures

19.4.1 Case of an antenna terminal

ⓐ With the SG output blocked and the test device set to transmitting conditions, its operation is confirmed with a voltmeter.

ⓑ The test device is set to receiving conditions.

ⓒ The output frequency of the SG is set to the receiving frequency of the test device, and the specified output (the output at which the receiver input voltage becomes as specified) is applied.

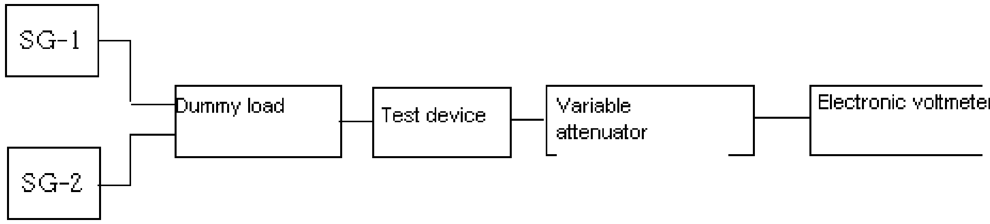
ⓓ Under these conditions, the transmission switch of the test device is switched ON, and it is confirmed with a voltmeter that no power is being transmitted.

20. **Measurement of intermodulation properties**

20.1 Purpose of Testing

◦ The objective is to measure whether the level of the intermodulating signal generated by the test device when receiving is at or below the permitted level.

20.2 Testing Configuration



20.3 Testing Procedures

ⓐ With SG-1 and SG-2 both stopped and the squelch of the test device also stopped, the noise output of the receiver is measured.

ⓑ SG-1 is activated and set to non-modulation, matched to the receiver's testing frequency fr.

ⓒ The receiver is set to maximum, and the SG-1 output is then adjusted to minimize the noise output.

ⓓ The frequency of SG-1 is adjusted to $f_r + \Delta f$.

ⓔ SG-2 is also powered on without modulation and adjusted to $f_r + 2\Delta f$.

ⓕ The noise output is minimized by fine control of one SG frequency, because the noise in the receiver output is suppressed and reduced by f_r, which is generated by intermodulation when the output of SG-1 and SG-2 is increased.

ⓖ By increasing the SG-1 output and controlling the SG-2 output, the noise output of the receiver is reduced 20 dB below the value obtained by measurement method ⓐ.

ⓗ The output level of SG-2 with respect to the SG-1 output is then recorded.

ⓘ The output of SG-1 is reduced stepwise, and at each step SG-2 is adjusted to maintain the noise suppression at 20 dB, and the SG-1 and SG-2 output levels are compared and recorded.

ⓙ A value is obtained by subtracting the 6 dB matching loss of a dummy load from the respective output levels of SG-1 and SG-2, and the characteristic curve of 20 dB noise suppression is graphed.[transverse axis is $f_r + 2\Delta f$ input level (dB) of SG-2; vertical axis is $f_r + \Delta f$ input level of SG-1]

ⓚ The line connecting the points at which SG-1 and SG-2 have the same output is entered, and the point of intersection with this is called P.

21.**Measuring sensitivity**

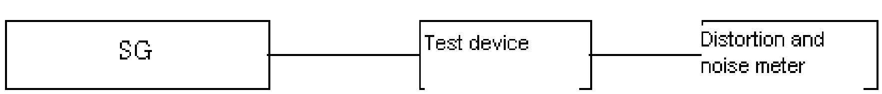
21.1 Purpose of Testing

ⓐ The objective is to measure whether the minimum receive sensitivity of the test device is at or above the permitted value.

21.2 Testing Configuration

◦ General case

◦ Case of device using single-side band



21.3 Measurement equipment requirements

21.3.1 General case

ⓐ It is preferable to perform adjustment using an attenuator with the same output impedance as the test device.

ⓑ The squelch action of the test device is switched OFF, and the audio volume is set to maximum.

ⓒ The SG desired frequency is modulated by a tone signal of 1000 Hz with maximum frequency deviation of 75%, and a voltage of 10 μV is generated.

ⓓ The test device is harmonized, and the audio volume of the test device is adjusted so as to reduce the level measured by the audio analyzer by 3 dB.

ⓔ An dummy load is selected that is appropriate based on the type of the test device.

21.3.2 Case of device using single-side band

ⓐ The SG must have the frequency setting precision and stability needed to maintain the demodulated output frequency of the test device at 1000 Hz.

21.4 Testing Procedures

21.4.1 General case

ⓐ The SG is powered OFF, and an audio analyzer is then used to check the noise output level of the test device.

ⓑ After powering ON the SG without modulation, the output level is adjusted so that the output level of the audio analyzer will be attenuated 20 dB below the noise level measured in ⓐ, and the SG output level is then recorded (test device sensitivity).

21.4.2 Case of device using single-side band

ⓐ The SG frequency is set so that the demodulated output frequency of the test device will be 1000 Hz.

ⓑ The SG is set to nonmodulation, and its output is set so that the receiver input voltage of the test device will be 3 μV.

ⓒ Under these conditions, the controller at each terminal of the test device is adjusted by the method set forth in the user manual (or if no method is set forth, the low-frequency gain controller is set to maximum and the high-frequency gain controller is adjusted) so that the demodulated output of the test device is 1/2 of the rated output.

ⓓ Under these conditions, the SINAD (S+N+D/N+D) of the demodulated output signal of the test device is measured.

21.4.3 Case of a wireless device for use by the visually impaired

ⓐ The SG is connected to the input terminal of the RF receiving part of the test device as shown in the testing configuration diagram, and the output terminal of the RF receiving part of the test device is connected to the audio analyzer.

ⓑ A signal modulated to 60% (1.5 kHz) FM of the maximum frequency deviation with a 1 kHz audio signal is applied at a strength of 60 dB μV.

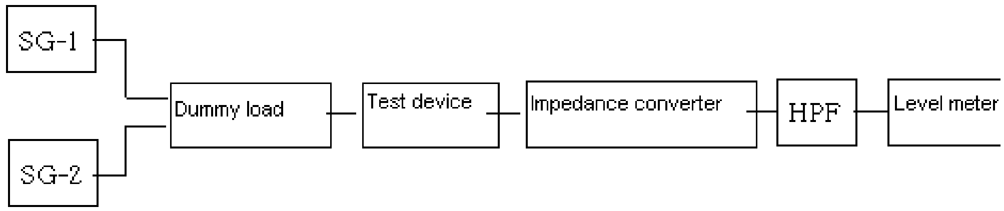
ⓒ Under the above conditions, the CCITT (C-message filter) of the audio analyzer is powered ON, the SINAD meter function is selected, and while observing the SINAD meter, the SG input level is adjusted and the receiver input level (μV) is recorded at which the SINAD meter output is shown as 12 dB.

22. **Measurement of desensitization effect**

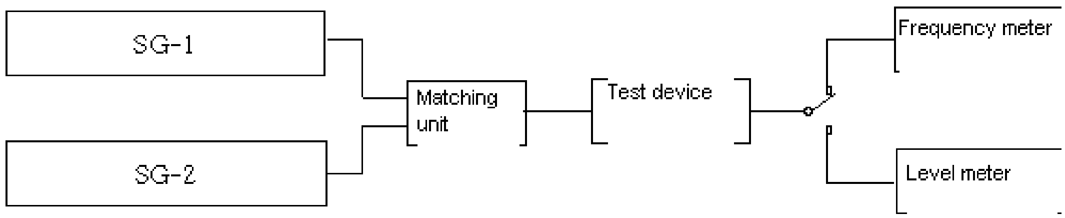
22.1 Purpose of Testing

◦ The objective is to measure whether the desensitization effect (wherein the desired output is impaired by RF interference) is at or above the permitted value.

22.2 Testing Configuration



◦ Case of device using single-side band



22.3 Measurement equipment requirements

22.3.1 General case

ⓐ With the SG-1 output set 6 dB greater than the sensitivity strength in the technical criteria, the desired frequency is generated without modulation.

ⓑ The receiver sensitivity and volume are adjusted, with AGC stopped and conditions optimal, to reach the rated output.

ⓒ The high-pass filter is for the purpose of removing noise, and must allow the fundamental frequency (1000 Hz) to pass through.

ⓓ SG-2 is used to produce interference, and a moved frequency (for example Δf) is generated without modulation.

ⓔ If the output impedance of the test device is 600 Ω, an impedance converter is not needed.

22.3.2 Case of device using single-side band

ⓐ SG-1 is for the wanted signal, and SG-2 for the interference signal.

22.4 Testing Procedures

22.4.1 General case

ⓐ While gradually increasing the output of SG-2, the receiver output of the signal wave is changed by 3 dB (6 dB by voltage) (usually downward), and the input level of the interference wave at an dummy load is remembered.

ⓑ At each frequency for which measurement is desired, the frequency deviation of the interference signal is set to the same value, and at the same time that it is changed, the input level of the unmodulated input signal is measured by the method specified in ⓐ and the measured value is recorded. (Example): In the measurement of method ⓐ, the mobile frequency is 10 kHz, 20 kHz and 30 kHz from the central frequency, and the arbitrary load matching loss is deducted from the arbitrary load input level.

22.4.2 Case of device using single-side band

ⓐ The SG-2 output is shut off and SG-1 set to nonmodulation.

ⓑ The output frequency of SG-1 is the test frequency (the demodulated output frequency of the test device is set to 1500 Hz and the output is adjusted so that the receiver input voltage is 10 μV).

ⓒ Under these conditions, the controller for each terminal of the test device is adjusted so that the demodulated output is the specified output (1/2 the rated output).

ⓓ The SG-2 output is connected and set to nonmodulation.

ⓔ The SG-2 output frequency is set to a frequency 4 kHz above the testing frequency, and the output voltage is changed, and the receiver input voltage of the interference wave is obtained when the demodulated output of the test device is 3 dB below the value of testing method ⓒ.

ⓕ The SG-2 output frequency is set to a value 4 kHz below the test frequency, and measurement is performed as in method ⓔ.

ⓖ If the measurements of ⓔ and ⓕ above cannot be performed (if the output lowering is not 3 dB) the interference input voltage is set to 10 mV and the demodulation output of the test device is then measured and the ratio of this to the value of method ⓒ (the suppression index) is obtained.

23. **Measurement of De-emphasis**

23.1 Purpose of Testing

◦ The objective is to measure whether the de-emphasis function of the test device is within the specified tolerance.

23.2 Testing Configuration

23.3 Testing Procedures

ⓐ The SG frequency is set to the testing frequency and modulated 70% with a sinusoidal wave signal at 1000 Hz.

ⓑ The output of the test device is adjusted so that the specified receiver demodulated output (1/2 of rated output) is obtained.

ⓒ The SG frequency deviation is set to 1 kHz and the receiver input voltage of the test device to 10 μV, and the demodulated output of the test device is then measured.

ⓓ The SG modulated frequency alone is changed stepwise from 300 Hz to 3000 Hz, and the demodulated output level is obtained.

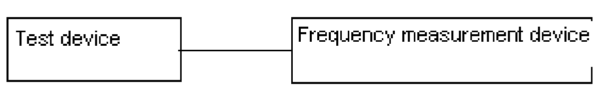
ⓔ A ratio is obtained with the values obtained in methods ⓒ and ⓓ.

24. **Measurement of local generator frequency fluctuation**

24.1 Purpose of Testing

◦ The objective is to measure whether the range within which the frequency of the local generator fluctuates during a unit time is within tolerance.

24.2 Testing Configuration



24.3 Testing Procedures

24.3.1 General case

ⓐ From the time the test device is powered on until frequency stabilizes, the local generator frequency is measured.

ⓑ When the frequency has stabilized, an arbitrary 1 hour is chosen and the values $(f_{max} - f_s)/f_s[\%]$ and $(f_s - f_{min})/f_s[\%]$ are obtained, where the maximum measured value is fmax, the minimum is fmin, and the normal local generator frequency is fs.

24.3.2 Case of device using single-side band

ⓐ From the time the test device is powered on until frequency stabilizes, the local generator frequency is measured.

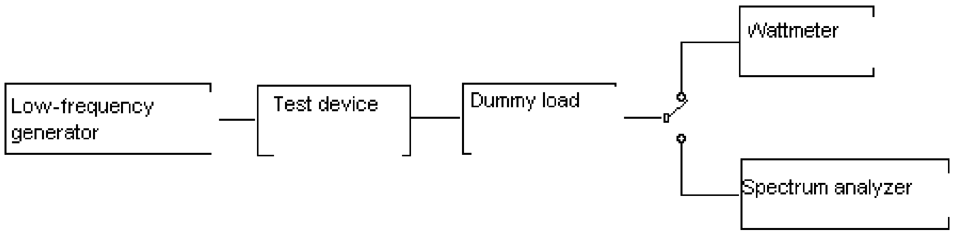
ⓑ When the frequency has stabilized, an arbitrary 1 hour is chosen and the values $(F_{max} - F_s)$ and $(F_s - F_{min})$ are obtained, where the maximum measured value is F_{max}, the minimum is F_{min}, and the normal local generator frequency is F_s.

25. **Measurement of overall frequency characteristics**

25.1 Purpose of Testing

◦ The objective is to measure whether the transmission characteristics of the test device for each frequency are within the allowed range.

25.2 Testing Configuration



25.3 Measurement equipment requirements

◦ The spectrum analyzer is set as follows.

Central frequency	Carrier frequency + modulation frequency
Sweep frequency range	10 kHz
Resolution bandwidth	No more than 300 Hz
Video bandwidth	Automatic

25.4 Testing Procedures

25.4.1 Case of J3E emissions

ⓐ The test device is powered on under conditions of 25% modulation by a 1400 Hz sinusoidal signal (applying a modulation input such that the transmitter output is 25% of rated power).

ⓑ The modulation frequency is changed at appropriate intervals from 200 Hz to 3000 Hz, the transmitter power is then measured with a wattmeter or spectrum analyzer, and the curve of modulation frequency versus transmitter output is obtained.

ⓒ The ratio of the maximum to the minimum transmitter output is obtained from 350 Hz to 2700 Hz.

◦ Example of changing the modulation frequency: Changed from 200 Hz to 3000 Hz at 150 Hz intervals. However, 2700 Hz is also measured.

25.4.1 Case of H3E emissions

ⓐ The modulation input of the test device is measured with a wattmeter at 25% modulation with a 1400 Hz sinusoidal signal (applying modulation input such that side-band amplitude is 25% of carrier amplitude when comparing the two amplitudes using a spectrum analyzer).

ⓑ The modulation frequency is changed at appropriate intervals from 200 Hz to 3000 Hz, the sideband amplitude is then measured with a wattmeter or spectrum analyzer, and the curve of modulation frequency versus sideband amplitude is obtained.

ⓒ The ratio of the maximum to the minimum transmitter output is obtained from 350 Hz to 2700 Hz.

26. **Measurement of receiving frequency stability**

26.1 Purpose of Testing

The purpose is to measure whether the frequency range at which a stable output centered on the designated frequency can be obtained is within the allowed tolerance.

26.2 Testing Configuration

26.3 Measurement equipment requirements

◦ All receiving frequencies loaded in the receiver are measured by channel.

◦ For precise measurement, if possible an RF shielded room must be used.

26.4 Testing Procedures

ⓐ As in the testing configuration diagram, the test device is connected to the spectrum analyzer and terminal before modulation of the measurement device and test device.

ⓑ After inputting to the SG the central frequency applied for, the nonmodulating signal is conveyed to the test device.

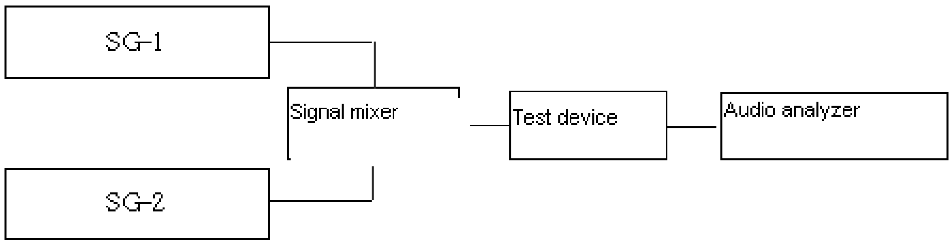
ⓒ Under max hold conditions, with the secondary (or final) intermediate frequency in the spectrum analyzer set to the central frequency, after about 5 minutes, it is confirmed and recorded whether the frequency stability with respect to the central frequency is within ±500 Hz.

27. **Adjacent channel selectivity**

27.1 Purpose of Testing

The objective is to measure the receive sensitivity of the device subject to testing, and the unwanted signal present in adjacent channels, in order to obtain the level ratio (dB).

27.2 Testing Configuration



27.3 Measurement equipment requirements

◦ All receiving frequencies loaded in the receiver are measured by channel.

◦ For precise measurement, if possible an RF shielded room must be used.

27.4 Testing Procedures

ⓐ The SG is connected to the input terminal of the receiving part of the test device as shown in the testing configuration diagram, and the output terminal of the receiving part of the test device is connected to the audio analyzer.

ⓑ With SG-2 in OFF state, the sensitivity is measured according to the sensitivity measurement procedure, and the sg-1 output level is then recorded; the SG-1 output level must be adjusted so as to be 3 dB greater than the sensitivity level (here, SINAD fluctuates).

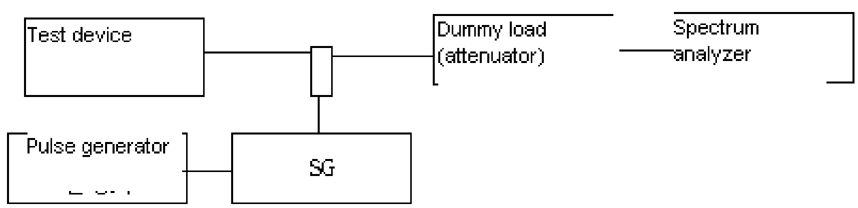
ⓒ SG-2 is set to the adjacent channel frequencies above and below, and with the modulated (tone frequency 400 Hz, maximum frequency deviation 1.5 kHz) input (interference) signal applied to the test device, the SG-2 output level (interference signal level) is adjusted until the

SINAD meter is 12 dB, and then the SG-2 output level is recorded (dBm).

ⓓ In the adjacent channels above and below, the lower difference between the test device sensitivity level at which 12 dB SINAD is obtained, and the SG-2 output level, is recorded.

28. Measurement of pre-transmission sensing (LBT)

28.1 Testing configuration diagram



28.2 Measurement equipment requirements

ⓐ The SG signal is continuously transmitted without modulation.

ⓑ The spectrum analyzer is configured as follows.

Central frequency	Carrier frequency
Sweep frequency range	Set appropriately
Resolution bandwidth	Minimum possible
Video bandwidth	Automatic

Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	Continuous sweep

28.3 Testing Procedures

ⓐ With the SG output powered OFF, the test device is set to transmission conditions and the spectrum analyzer is used to confirm RF emissions.

ⓑ The SG frequency is set to the frequency confirmed in process ⓐ, and when it is powered ON, it is confirmed using a spectrum analyzer that the test device is not emitting RF at the transmission frequency of the SG.

ⓒ The above ⓐ-ⓑ process is repeated and measurement performed at least 3 times, to confirm that the test device is not emitting RF at the SG's transmission frequency.

[Annex 4] Radiation testing

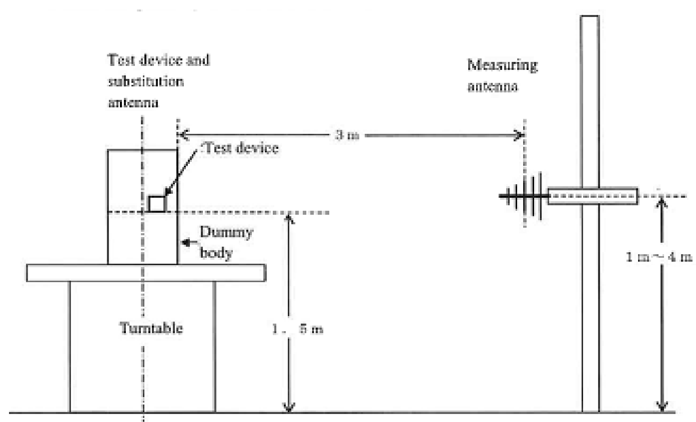
1. General

1.1 The radiation testing method enables measurement using testing procedures whose validity has been internationally verified, such as methods for measuring electrical and magnetic field strength, in addition to the antenna substitution method specified by the Telecommunications Community Standard.

1.2 Among test devices, devices that perform measurement in liquids are subject only to rated voltage testing, in order to prevent the occurrence of electrical shock which can occur during testing at specified electrical power and voltage. (For example, wireless medical devices implanted within the body)

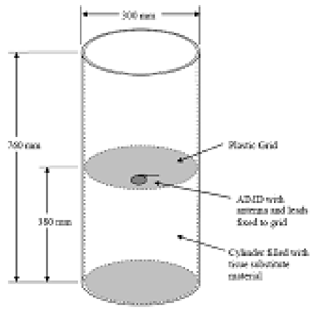
1.3 The testing configuration for measurement of unwanted emissions and output of implanted wireless medical devices are as follows, and in this case measurement is performed only with the biotissue-equivalent liquid in a temperature range of 22°C - 38°C.

1.3.1 Testing configuration diagram



1.3.2 The phantom comprises the phantom exterior and a biotissue-equivalent liquid.

1) Phantom exterior (cylindrical)



2) The phantom exterior and plastic grid must be made of materials with a low dielectric constant and low loss, such as an acrylic container or plexiglass, having a relative dielectric constant not exceeding 5 and a loss tangent not exceeding 0.05.

3) The dimensions of the phantom exterior must be: diameter (external) 300±5 mm, height 750±5 mm, thickness 6.35±1.2 mm.

4) The dielectric constant of the biotissue-equivalent liquid (based on 400 MHz) must be within the range 62.5±5%, and the conductivity must be within the range 0.9±5% (S/m).

5) Composition of biotissue-equivalent liquid (based on 400 MHz)

Item of equipment	Ratio (by weight)	Remarks
Distilled water	52.4%	
Salt (NaCl)	1.4%	
Sugar	45.0%	
Cellulose (HEC)	1.0%	
Bactericide	0.1%	

1.3.3 Procedures for installing test device

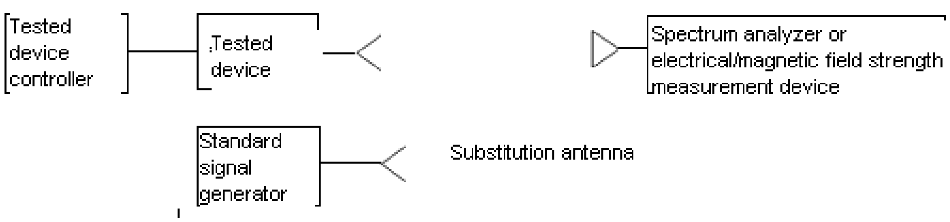
1) A plastic grid is installed at the 1/2 position within the cylindrical container, and the test device is placed above it.

2) The test device antenna is positioned at 6±0.5 cm with respect to the side of the container, and the test device antennas are positioned vertically and horizontally, after which measurement is performed on each.

3) In the case of a wireless medical implant device, with regard to any matters not specified herein, the criteria set forth in the European standard (ETSI EN 301 839-1) shall apply *mutatis mutandis*.

2. Measuring radiation power

2.1 Testing configuration diagram



2.2 Measurement equipment requirements

The spectrum analyzer is configured as follows.

Central frequency	Carrier frequency
Sweep frequency range	2-3.5x required frequency bandwidth
Resolution bandwidth	1 MHz
Video bandwidth	3x resolution bandwidth

Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	10 or more

2.3 Testing Procedures

The radiation power test shall apply the methods and procedures set forth in the Telecommunications Community Standard TTAS.KO-06.159.

3. Measuring frequency tolerance

3.1 Testing configuration diagram

3.2 Measurement equipment requirements

ⓐ For the frequency meter, either a frequency counter or a spectrum analyzer is used.

ⓑ To avoid fluctuations in the amplitude of the frequency to be measured, the attenuator is set to a suitable attenuation value in view of the input level of the frequency meter.

ⓒ If a spectrum analyzer is used, it is configured as follows.

Central frequency	Carrier frequency

Sweep frequency range	2-3.5x required frequency bandwidth
Resolution bandwidth	1-3% required frequency bandwidth
Video bandwidth	3x resolution bandwidth
Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	10 or more

3.3 Testing Procedures

ⓐ In the case of nonmodulation, measurement is performed directly using the frequency meter.

ⓑ If the test device cannot be set to nonmodulation, then 2 frequencies are measured at a level 3 dB below the highest level after at least 10 sweeps. The measured value is obtained using the following formula.

: Measured value = $(f_{max}+f_{min})/2$

4. Measurement of frequency bandwidth

4.1 Testing configuration diagram

4.2 Measurement equipment requirements

The spectrum analyzer is configured as follows.

Central frequency	Designated frequency
Sweep frequency range	2-3.5x required frequency bandwidth
Resolution bandwidth	1-3% required frequency bandwidth
Video bandwidth	3x resolution bandwidth
Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	10 or more

4.3 Testing Procedures

ⓐ The spectrum analyzer is set up as specified above.

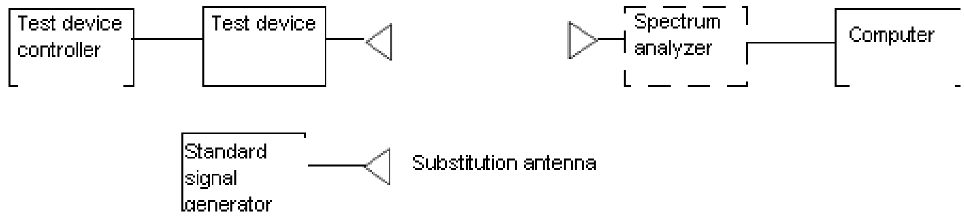
ⓑ After at least 10 repeated sweeps, the frequency with the highest output is obtained.

ⓒ An upper limit and lower limit frequency are obtained 20 dB below this value. If at this time there are multiple points 20 dB below the maximum power, the lowest value is used.

ⓓ The difference between the “upper limit frequency” and “lower limit frequency” obtained above is recorded.

5. Unwanted emissions

5.1 Testing configuration diagram



5.2 Measurement equipment requirements

ⓐ When seeking the frequency of unwanted emissions, the spectrum analyzer is set up as follows.

Sweep frequency range	30 MHz – 3 GHz
Resolution bandwidth	Frequencies below 1 GHz: 100 kHz Frequencies of at least 1 GHz: 1 MHz
Video bandwidth	Same/similar as resolution bandwidth
Detection mode	Peak detect mode
Display mode	Maximum hold mode
Sweep count	Single sweep

ⓑWhen measuring the strength of unwanted emissions, the spectrum analyzer is set up as follows.

Central frequency	Frequency to be measured
Sweep frequency range	0 Hz
Resolution bandwidth	Frequencies below 1 GHz: 100 kHz Frequencies of at least 1 GHz: 1 MHz
Video bandwidth	Same/similar as resolution bandwidth
Detection mode	sample
Sweep count	Single sweep

5.3 Testing Procedures

1) Seeking unwanted emissions frequency

ⓐ With the measurement antenna set to vertical polarization, the measurement antenna and test device are installed so as to face each other at the same height.

ⓑ The spectrum analyzer is set up as specified in 5.2 ⓐ above, and the frequency of unwanted emissions is sought. The sweep frequency range in this case is reduced to 100 MHz, 10 MHz, and 1 MHz while seeking the frequency of unwanted emissions.

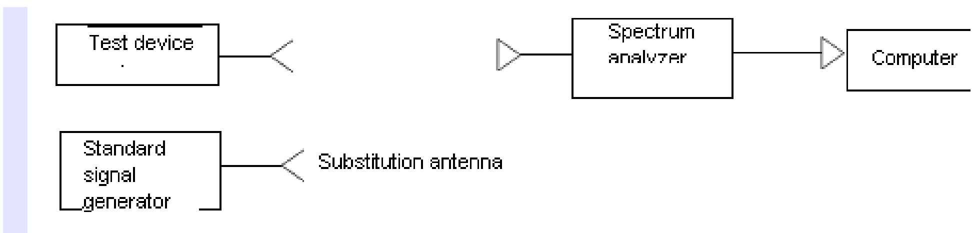
2) Measuring the strength of unwanted emissions

ⓐ The spectrum analyzer is set up as in 5.2ⓑ above.

ⓑ The unwanted emissions strength is measured according to the methods and procedures set forth in the Telecommunications Community Standard (TTAS.KO-06.159).

6. Secondary RF emissions

6.1 Testing configuration diagram



6.2 Measurement equipment requirements

ⓐ When seeking the frequency of secondary RF emissions, the spectrum analyzer is set up as follows.

Sweep frequency range	30 MHz – 3 GHz
Resolution bandwidth	Frequencies below 1 GHz: 100 kHz Frequencies of at least 1 GHz: 1 MHz
Video bandwidth	Same/similar as resolution bandwidth
Detection mode	Peak detect mode

Display mode	Maximum hold mode
Sweep count	Single sweep

ⓑ When measuring the strength of secondary RF emissions, the spectrum analyzer is set up as follows.

Central frequency	Secondary RF emission frequency
Sweep frequency range	0 Hz
Resolution bandwidth	Frequencies below 1 GHz: 100 kHz Frequencies of at least 1 GHz: 1 MHz
Video bandwidth	Same/similar as resolution bandwidth
Detection mode	sample
Sweep count	Single sweep

6.3 Testing Procedures

1) Seeking the frequency of secondary RF emissions

ⓐ The measurement antenna is installed for vertical polarization. The test device and measurement antenna are placed facing each other at the same height.

ⓑ The spectrum analyzer is set up as in 6.2ⓐ above, and the secondary RF emission frequency is measured by receiving the transmitted signal.

2) Measuring the intensity of secondary RF emissions

ⓐ The spectrum analyzer is set up as in 6.2ⓑ above.

ⓑ The secondary RF emissions strength is measured according to the methods and procedures set forth in the Telecommunications Community Standard (TTAS.KO-06.159).

Enclosure G

Russia – EMF Exposure Limits

SanPiN 2.1.8/2.2.4.1190-03

2.1.8. PHYSICAL EFFECT OF ENVIRONMENT

2.2.4. PHYSICAL EFFECT OF INDUSTRIAL ENVIRONMENT

ARRANGEMENT AND OPERATION OF LAND MOBILE RADIOCOMMUNICATION FACILITIES. HYGIENIC REQUIREMENTS

2.1.8. Физические факторы окружающей природной среды

2.2.4. Физические факторы производственной среды

Гигиенические требования к размещению и эксплуатации средств сухопутной подвижной радиосвязи

Reference No: SanPiN 2.1.8/2.2.4.1190-03

MINISTRY OF HEALTH OF THE RUSSIAN FEDERATION

Decree No. 18 of the Director of Federal service on customers' rights protection and human well-being surveillance of March 13, 2003 registered at Ministry of Justice of March 26, 2003 (Reg. No. 4329)

ON ENACTMENT OF SANITARY RULES AND REGULATIONS — SanPiN 2.1.8/2.2.4.1190-03

In respect with the Federal law No. 52-FZ "On sanitary-and-epidemiologic well-being of population" of March 30, 1999 (Code of Russian Federation Laws of 1999, No. 14, art. 1650) and Provisions of State Sanitary-and-Epidemiologic Control approved by the Decree No. 554 of the Government of the Russian Federation of July 24, 2000 (Code of Russian Federation Laws of 2000, No. 31, art. 3295) we herewith enact approved on January 30, 2003 by the Chief State Sanitary Officer of the Russian Federation the sanitary-and-epidemiologic rules and regulations "Arrangement and operation of land mobile radiocommunication facilities. Hygienic requirements. SanPiN 2.1.8/2.2.4.1190-03" since June 1, 2003.

G.G. Onischenko

I. Scope

1.1. These state sanitary-and-epidemiologic rules and regulations (Sanitary rules) are developed in respect with the Federal law No. 52-FZ "On sanitary-and-epidemiologic well-being of population" of March 30, 1999 (Code of Russian Federation Laws of 1999, No. 14, art. 1650) and Provisions of State Sanitary-and-Epidemiologic Control approved by the Decree No. 554 of the Government of the Russian Federation of July 24, 2000.

1.2. These rules shall be applied all over the Russian Federation. The rules specify sanitary-and-epidemiologic requirements to arrangement and operation of mobile radiocommunication facilities within the frequency range of 27-2400 MHz, including customer terminals of satellite communication.

1.3. The requirements of these rules are meant to prevent the effect of electromagnetic fields (EMF) produced by base and mobile land radiocommunication facilities upon human health.

1.4. The requirements of these rules do not cover marine, river, and air mobile radiocommunication facilities, ground fixed stations of satellite communication.

1.5. These rules shall be applied by all companies, businessmen, and citizens who develop, manufacture, purchase, sell and operate land mobile radiocommunication facilities and related equipment, as well as bodies and institutions of state sanitary-and-epidemiologic service of the Russian Federation.

1.6. Each individual land mobile radiocommunication facilities and related equipment shall be manufactured, purchased, sold, and operated in respect with sanitary-and-epidemiologic certificate (SES Certificate) in accordance with specified requirements.

1.7. The requirements of these rules shall be observed by all citizens, businessmen, and companies.

II. Normative parameters and units

2.1. The effect of EMF upon population and users of mobile stations of land radiocommunication facilities is evaluated:

— for the frequency range of $27 \le f < 300$ MHz, per electric field intensity, E (V/m);
— for the frequency range of $300 \le f \le 2400$ MHz, per energy flux density, EFD (mW/cm^2, μW/cm^2).

2.2. The effect of EMF upon maintenance staff is evaluated per radiant exposure (RE).

Radiant exposure within the frequency range of $27 \le f < 300$ MHz (RE_E) is calculated as follows:

$$RE_{E\ MPL} = E^2 \cdot T,\ (V^2/m) \cdot h,$$

wherein T is the action time (h).

Radiant exposure within the frequency range of $300 \le f \le 2400$ MHz (RE_{EFD}) is calculated as follows:

$$RE_{EFD\ MPL} = EFD \cdot T,\ (\mu W/cm^2) \cdot h,$$

wherein T is the action time (h).

III. Hygienic requirements to base stations

3.1. The equipment of base stations shall not produce EMP at workplace exceeding the maximum permissible levels (MPL) given in Table 3.1.

Table 3.1 — Maximum permissible level of effect of electromagnetic fields of base stations at staff workplaces

Parameter	***Frequency range, MHz***		
	27 ≤ f < 30	***30 ≤ f < 300***	***300 ≤ f ≤ 2400***
Maximum permissible RE	7000 (V/m)^2 · h	800 (V/m)^2 · h	200 (μW/cm^2) · h
Maximum MPL	296 V/m *	80 V/m *	1000 μW /cm^2 *
MPL for T ≥ 8 h per shift	30 V/m	10 V/m	25 μW /cm^2

* For T ≤ 0,08 h within the frequency range of 27 ≤ f < 300 MHz; for T ≤ 0,2 h within the frequency range of 300 ≤ f ≤ 2400 MHz.

3.2. Sanitary-and-epidemiologic requirements to the working environment of the staff exposed to EMF of different frequency ranges shall meet the requirements of the applicable sanitary rules for the manufacturing environment irrespective of EMF effect nature.

3.3. The level of EMF produced by base station antennas within apartment blocks, inside residential, public, and industrial floors shall not exceed the following maximum permissible values:

— 10,0 V/m for the frequency range of $27 \leq f < 30$ MHz;
— 3,0 V/m for the frequency range of $30 \leq f < 300$ MHz;
— 10,0 μW/cm^2 for the frequency range of $300 \leq f < 2400$ MHz.

3.4. For simultaneous exposure to several radiation sources having the same MPL, the following conditions apply:

$$\left(\sum_{i=1}^{n} E_i^2\right)^{1/2} = E_{TOT} \leq E_{MPL}; \qquad \sum_{i=1}^{n} EFD_i = EFD_{TOT} \leq EFD_{MPL};$$

wherein:

E_i electric field intensity produced by EMF source under i-th number;
EFD_i energy flux density produced by EMF source under i-th number;
E_{TOT} total electric field intensity which means energy equivalent intensity of the total field;
E_{MPL} MPL of electric field intensity of the normative range;
EFD_{MPL} MPL of energy flux density of the normative range;
EFD_{TOT} total energy flux density;
n quantity of EMF.

For simultaneous exposure to several EMF sources having the same MPL, the following conditions apply:

$$\sum_{j}^{m} \left(E_{TOTj} / E_{MPLj}\right)^2 + \sum_{k}^{q} \left(EFD_{TOTk} / EFD_{MPLk}\right) \leq 1;$$

wherein:

$E_{TOT\,j}$ total electric field intensity produced by EMF sources for j-th normative range;
$E_{MPL\,j}$ MPL of electric field intensity for j-th normative range;
$EFD_{TOT\,k}$ total energy flux density produced by EMF sources for k-th normative range;
$EFD_{MPL\,k}$ MPL of energy flux density for k-th normative range;
m quantity of ranges for which E is normalized;
q quantity of ranges for which EFD is normalized.

3.5. The levels of 50 Hz electric field intensity produced by feed and power equipment of the base stations inside the residential and public buildings shall not exceed MPL for population.

3.6. The roofs with restricted public access shall meet the requirements to the conditions of industrial effect of EMF.

3.7. Project documentation for construction, re-construction, re-equipment, expansion and commissioning of existing and re-constructed base stations as well as design and construction of residential, public, and industrial buildings thereabouts shall be approved only in respect with SES Certificates proving compliance with sanitary rules.

3.8. SES Certificates are issued in respect of the results of the sanitary-and-epidemiologic examination carried out by regional Departments of state sanitary-and-epidemiologic surveillance (SES Departments), organizations, and experts certified in a proper way.

3.9. SES Certificates for base stations within the domain of rail transport, defense and special areas are issued by regional SES Department supervising said areas.

3.10. The items to be included into SES Certificates for base stations are given in Appendix 1. The owner of radiocommunication facility is charged to submit this information, as well as to evaluate sanitary protection zones (SPZ) and building restriction zones (BRZ), and measure EMF levels.

3.11. SES Certificate is not required if radiation power is reduced, the transmitters and antennas are demounted and deactivated. In this case the operator (or his representative) shall inform regional SES Department and, in appropriate cases, special bodies.

3.12. SES Certificates are not required to arrange, commission, and operation of one fixed radio station having an effective radiation power of less than 10 Wt provided that antenna is arranged outside the building.

3.13. It is recommended to arrange antennas on isolated supports and masts.

Transmitting antennas can be arranged on roofs of residential, public and other buildings as well as in other places if conditions of 3.2 and 3.3 are met.

SES Certificate is not required when arranging only receiving antennas.

3.14. If alteration of operating conditions of radiocommunication facility results in EMF level increase within residential area, then the owner of the unit shall obtain SES Certificate as specified.

3.15. If antennas of several transmitters are arranged on the support (or roof), then sanitary-and-epidemiologic examination is carried out on transmitting radio unit (TRU) in whole. SES Certificates are also issued for TRU in whole.

3.16. To protect population from EMF effect produced by base station antennas or TRU in whole, SPZ and BRZ shall provide for development communication unit and urban area.

The scope of SPZ is defined at a height of 2 m from the ground per MPL given in 3.2 and 3.3.

BRZ is a zone around TRU wherein EMF level at a height over 2 m exceeds MPL for population as per 3.2 and 3.3.

The outer boundary of BRZ is defined per maximum height of expected buildings wherein EMF level at the last floor does not exceed MPL for population as per 3.2 and 3.3.

3.17. SPZ and BRZ shall not be used for apartment blocks, parking and stop of any type of transport, vehicle service centers, gas stations, oil and oil products storage, etc.

SPZ and BRZ or their parts shall not be considered as a reserve area and used for expansion of the industrial area.

SPZ shall not be considered as an area for joint or individual gardening.

3.18. SPZ and BRZ are defined in accordance with appropriate guidelines subject to probable combination of EMF produced by separate sources of TRU.

The boundaries of SPZ and BRZ are calculated in the direction of radiation of antennas. EMF level is measured to define the boundaries more precisely.

3.19. When defining the boundaries of SPZ and BRZ, secondary EMF effect (re-radiation of building structures, communications, interior wiring, etc.) should also be considered.

IV. Hygienic requirements to mobile stations of land radiocommunication

4.1. These Sanitary rules specify interim permissible levels (IPL) of EMF effect produced by mobile land radiocommunication facilities (including customer terminals of satellite communication) directly at a user head. IPL of EMF shall not exceed the following values:

— 45,0 V/m for the frequency range of $27 \leq f < 30$ MHz;
— 15,0 V/m for the frequency range of $30 \leq f < 300$ MHz;
— 100,0 μW/cm^2 for the frequency range of $300 \leq f < 2400$ MHz.

4.2. Mobile land radiocommunication facilities (including customer terminals of satellite communication) shall be operated only in respect with SES Certificates proving compliance with sanitary rules.

4.3. SES Certificates are issued in respect of the results of the sanitary-and-epidemiologic examination carried out by regional SES Departments, organizations, and experts certified in a proper way.

4.4. The levels per 4.1 are set for 3 years.

V. Requirements to EMF level control

5.1. General

5.1.1. Appropriate numeric and instrumental methods shall be used to control EMF level produced by land mobile radiocommunication systems.

5.1.2. Numeric methods are used to evaluate electromagnetic environment of nearby developed, existing, and re-constructed base stations of land mobile radiocommunication facilities. The following information shall be available to use numeric methods: transmitter type, operating frequency, mode, and power, antenna type, its parameters and spatial location, lay of land, available reflecting surfaces.

5.1.3. At the stage of project documentation examination only numeric methods are used to determine EMF levels produced by base stations.

5.1.4. Instrumental methods are used to control EMF levels produced by base stations, mobile stations, and customer terminals of satellite communication. If instrumental methods are used, then maximum modes and power of radiators shall be provided.

5.1.5. The measuring tools equipped with directional or unidirectional reception sensors can be used for EMF level control. Unidirectional sensors are preferred.

5.1.6. Instrumental control shall be carries out with the use of verified and certified tools. Relative error of the tools shall not exceed ± 30%.

Hygienic evaluation of measurement results is carried out subject to inaccuracy of the tool.

5.1.7. The tools meant for determination of root-mean-square value of electric field intensity shall be used to measure EMF level within the frequency range of 27-300 MHz.

5.1.8. The tools meant for determination of average energy flux density shall be used to measure EMF level within the frequency range of ≥ 300 — 2400 MHz. The tools meant for determination of root-mean-square value of electric field intensity are also permitted provided that obtained values are converted into energy flux density in accordance with appropriate guidelines.

5.2. Requirements to control of EMF level produced by base stations of land mobile radiocommunication facilities

5.2.1. The levels of electric field intensity and energy flux density of EMF produced by base stations shall be measured at a maximum radiation power of the equipment in accordance with appropriate guidelines.

5.2.2. Instrumental inspection of EMF level is carried out when:

— commissioning of base station;
— renewing (extending) SES Certificates;
— changing the conditions and operating mode of the base station affecting the level of EMF (alternative orientation, transmitter power increase, etc.);
— general location plan of next to the base station area is changed;
— certifying workplaces;
— after carried activities to reduce EMF level;
— at least once in three years (subject to dynamic control results the frequency of EMF level measurements can be reduced by SES Department resolution, but in no case shall not be more than once a year).

5.3. Requirements to control of EMF level produced by mobile stations of land radiocommunication facilities, including customer terminals of satellite communication

5.3.1. The levels of electric field intensity and energy flux density of EMF produced by mobile stations (including customer terminals of satellite communication) shall be controlled at the stage of SES Certificate issue.

5.3.2. The levels of electric field intensity and energy flux density of EMF shall be measured subject to uniform maximum level of EMF of mobile station (including customer terminals of satellite communication).

5.3.3. The measurements shall be in accordance with the requirements given in Appendix 2.

5.3.4. Evaluation of working conditions of staff using mobile stations in production activity does not require EMF level control, but relies on sanitary-and-epidemiologic examination results for the given model of mobile station.

VI. Precautions

6.1. The staff is protected from EMF effect owing to organizational, technical, and medical activities.

6.2. Organizational activities include: rational scheduling to reduce stay in EMF effect conditions, satisfactory distance from EMF sources, and safe operation of EMF sources.

6.3. Technical activities include: effective arrangement of EMF sources, use of protective means (shielding of EMF sources or workplaces).

6.4. Professionals related with EMF effect of land mobile radiocommunication facilities shall have primary and periodic medical examination in accordance with the Russian Federation legislation.

6.5. Technical documentation for mobile radiocommunication shall include information about produced EMF levels.

6.6. The owners (representatives) of communication facilities, buildings, and areas of land mobile radiocommunication facilities shall be trained to provide observance of sanitary-and-epidemiologic requirements to electromagnetic safety of maintenance staff and population.

6.7. To protect population, the owners of base stations shall consider application of different (passive and active) protection methods of public and industrial buildings from EMF at the stages of design, construction, re-construction, and operation.

6.8. To protect population, the roofs where EMF level produced by base stations exceeds MPL for population as well as the roofs with no restricted access shall be enclosed and/or have special caution signs. Radiocommunication facilities shall be deactivated when working in the areas (except for operator staff).

6.9. The following is recommended to protect population, the users of mobile stations of land radiocommunication facilities:

— maximum practicable reduction of time to use mobile radio station;
— restricted access to mobile radio stations by teenagers, pregnant women, and people having implanted pacemakers.

VII. Requirements to manufacturing inspection

7.1. Businessmen and companies, the owners of base stations, shall control compliance with these rules and routine maintenance in the course of operation of base stations.

7.2. Manufacturing inspection is carried out in accordance with the requirements of sanitary rules.

Appendix 1

The items to be stated in SES Certificates of the base station

1. Full name of the owner of the base station, his subordination, and address.
2. Name of the base station, its location (address), and year of commissioning.
3. Information about re-construction and modification of performance of base station equipment.
4. Performance of radio-transmitting equipment of base station: power of each transmitter, their quantity, operating frequency (ranges) of each transmitter, modulation type, type and factor of power gain (relative to isotropic radiator) of transmitting antennas, input power of each antenna; distance from the ground and supporting surface (roof); angle of diagram maximum and directivity diagram in horizontal and vertical planes.
5. Operating period of base station for radiation.
6. General location plan (usually of 1:500 scale) showing the location of base station antennas, adjacent buildings and areas, and estimated boundaries of SPZ and restriction areas.
7. Results of calculation of EMF level distribution on an adjacent to base station area showing the boundaries of SPZ and building restriction area.
8. Results (reports) of measurements of EMF levels in the area adjacent to base station and inside the buildings (except for design base stations).

NOTE: If base station is located in a common area as a part of TRU, then SES Certificate is issued for TRU in whole.

Listed items, performance, results of evaluation and measurement shall be submitted by the owner of the base station (TRU) to SES Department; this information is a reason to carry out sanitary-and-epidemiologic examination and reporting.

Items 6-8 are included into SES Certificate report.

Appendix 2

Requirements to measurement of EMF levels produced by mobile stations of land radiocommunication facilities during sanitary-and-epidemiologic examination

1. Controlled level of EMF intensity produced by mobile stations within the frequency range of 27-30 MHz is measured at a distance of 0,38 m from the apparatus. In this case the controlled level of EMF intensity shall not exceed 1,5 V/m. This meets the requirements of 4.1 of these rules.

2. Controlled level of EMF intensity produced by mobile stations within the frequency range of ≥ 30 — 300 MHz is measured at a distance from the apparatus as given in Table P 2.1. In this case the controlled level of EMF intensity shall not exceed 1,5 V/m. This meets the requirements of 4.1 of these rules.

The distances between the apparatus and measurement points in the frequency intervals given in the following shall be determined by linear interpolation.

Table P 2.1 — Distances to measure EMF intensity of mobile stations operated within the frequency range of ≥ 30 — 300 MHz

EMF frequency, MHz	*Distance between the apparatus and measurement point, m*	*Controlled level of EMF intensity, V/m*
≥ 30-40	0,2	1,5
150	4,9	1,5
180	4,2	1,5
300	2,5	1,5

3. Controlled EFD level of EMF of mobile stations, including customer terminals of satellite communication, within the frequency range of ≥ 300 — 2400 MHz shall be measured as follows:

— at a distance from the front panel of the apparatus as shown in Figure P 2.1 (including a frequency of 450 MHz at a distance of 620 mm) for the frequency range of ≥ 300-800 MHz;
— at a distance of 370 mm for the frequency range of ≥ 800-2400 MHz.

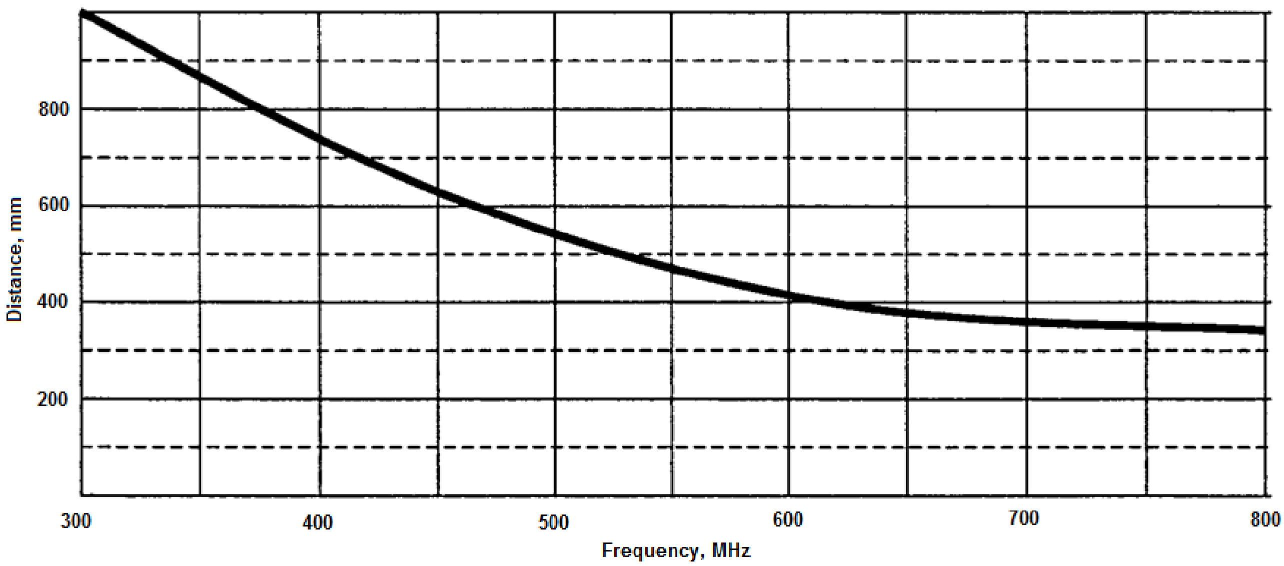


Figure P 2.1 — Distance to measure EFD level of EMF of mobile stations within the frequency range of ≥ 300 — 800 MHz

In this case EFD level of EMF within the range of ≥ 300 — 2400 MHz shall not exceed 3 μW/cm^2. This meets the requirements of 4.1 of these rules.

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