GSMA Thrive

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毫米波与智能手机

如何把毫米波放进5G终端

mmWave in smart phones

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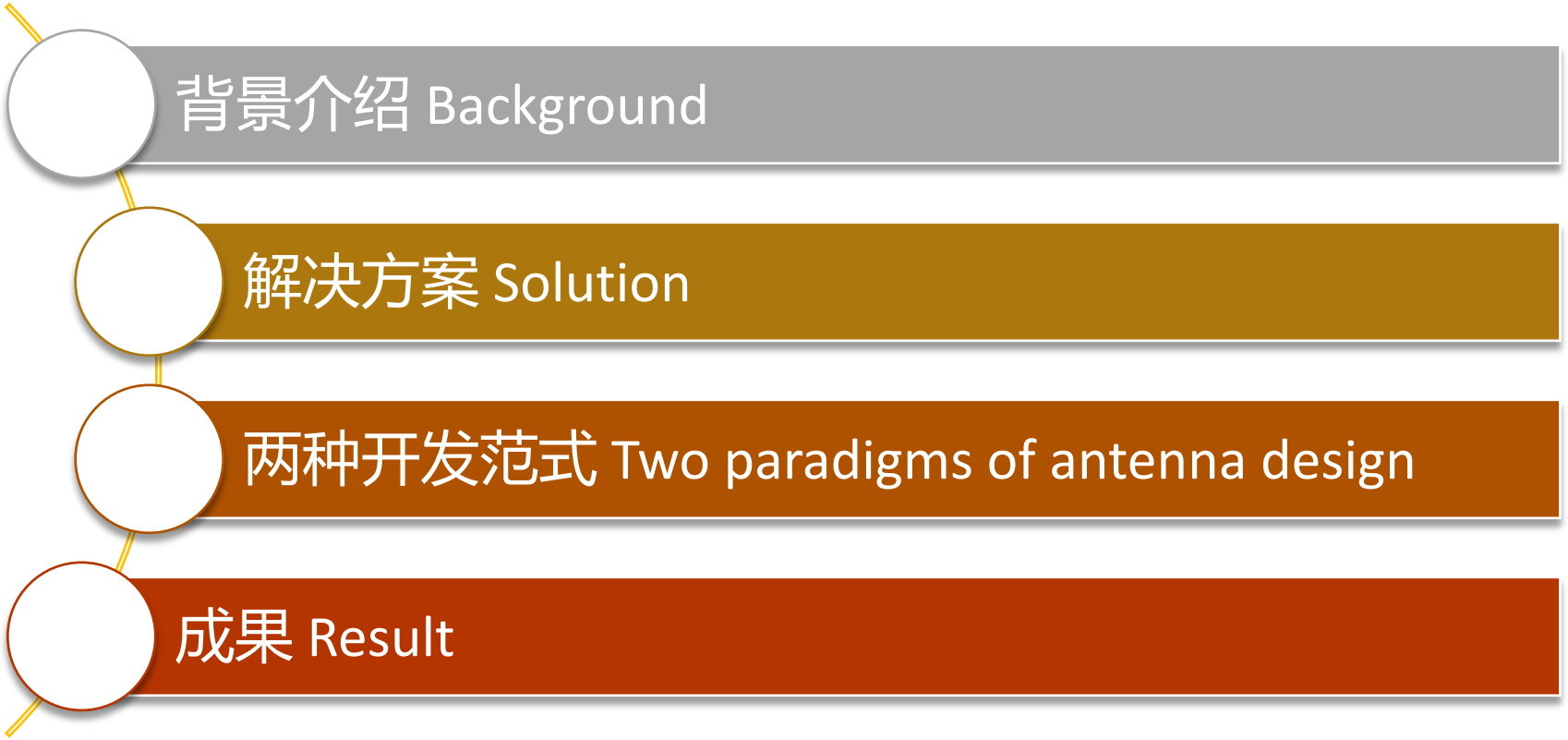
目录 Outline



背景介绍 Background

5G增加了毫米波频段：24.25GhZ-52.6GHz
5G includes mmWave band： 24.25GhZ-52.6GHz

Table 5.2-1: NR operating bands in FR2

Operating Band	Uplink (UL) operating band BS receive UE transmit			Downlink (DL) operating band BS transmit UE receive			Duplex Mode
	F_{UL_low}	–	F_{UL_high}	F_{DL_low}	–	F_{DL_high}	
n257	26500 MHz	–	29500 MHz	26500 MHz	–	29500 MHz	TDD
n258	24250 MHz	–	27500 MHz	24250 MHz	–	27500 MHz	TDD
n260	37000 MHz	–	40000 MHz	37000 MHz	–	40000 MHz	TDD
n261	27500 MHz	–	28350 MHz	27500 MHz	–	28350 MHz	TDD

大带宽！
Wide bandwidth！

背景介绍 Background

毫米波带来的挑战：
Challenge from mmWave

1.高路损导致覆盖范围受限。
Significant path loss leads to limited coverage.

a. $\frac{\mathrm{P_r}}{\mathrm{Pt}} = \mathrm{G_t G_r}(\frac{\lambda}{4\pi R})^2$ ⇒ $(Path\ loss_{30G} - Path\ loss_{3G})_{same\ distance} = 20dB$

如何补偿路损？
Solution ?

2. 高传输损耗导致低效率和发热。
High TL loss leads to low system efficiency and thermal issue.

如何减少插损？
Solution ?

3.易受物体遮挡。
Blockage from hand，body，glass，etc.

解决方案 Solution

针对高路损和插损的解决方案：“AIP”+中频线

Solution for significant path loss and IL：“AIP”+ IF line

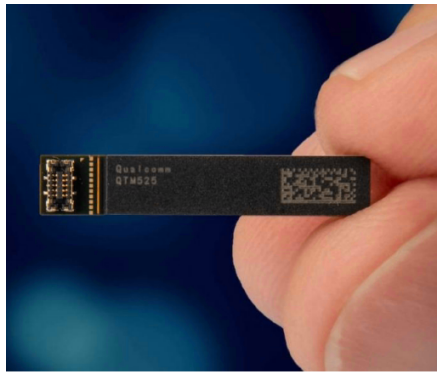
$$\eta = \frac{P_r}{Pt} = G_t G_r \left(\frac{\lambda}{4\pi R}\right)^2$$

1×4 directional array

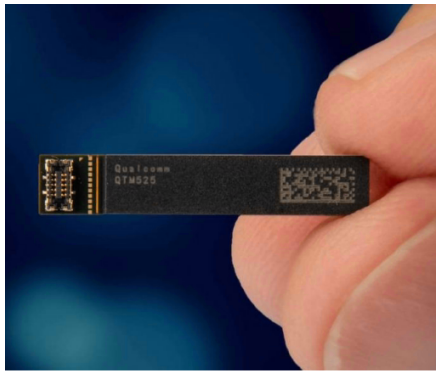
η +9

缩短馈线

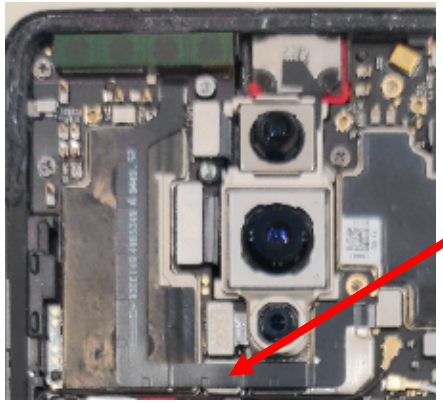
Short TL



“AIP”， such as Qualcomm QTM525



二次变频

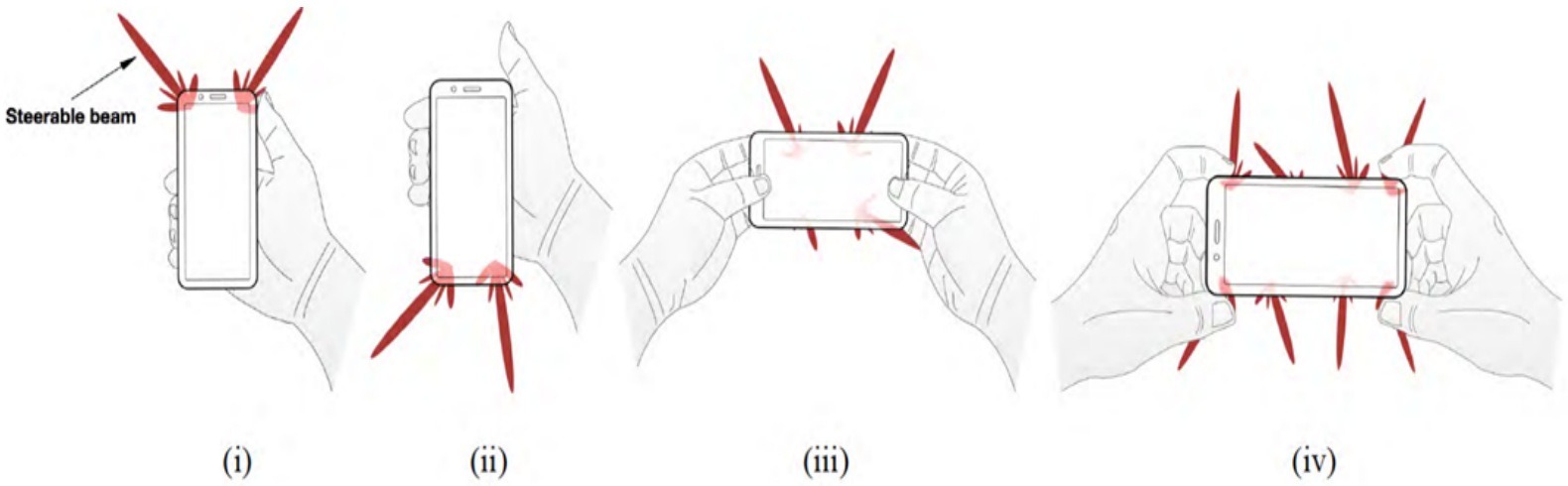


低损耗传输线

Low IL IF TL

解决方案 Solution

针对定向和易受物体遮挡的解决方案:多模组布局+波束扫描/跟踪
Solution for improving coverage and blockage: Multiple modules + Beam sweeping/tracking



Multiple modules + Beam sweeping/tracking

OnePlus 8 mmW：3×QTM525

两种开发范式 Two paradigms of antenna design

怎么把“**毫米波**“放进手机？
How to put mmWave into UE

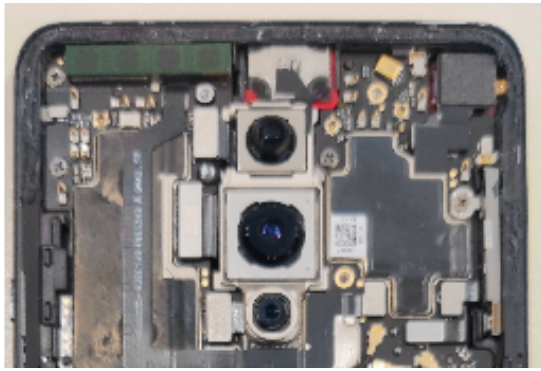
怎么把毫米波“**放**”进手机？
How to put mmWave into UE with good performance

手机毫米波“天线”的开发范式和Sub6天线不同！
The paradigm of the mmWave design is different from sub6!

外置天线
External antenna

PCB天线
PCB antenna

金属边框天线
Metal frame antenna

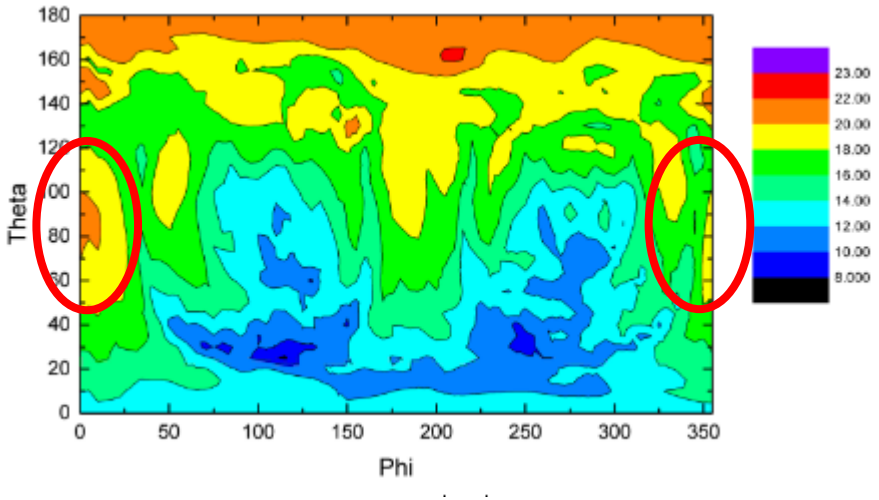


AIP

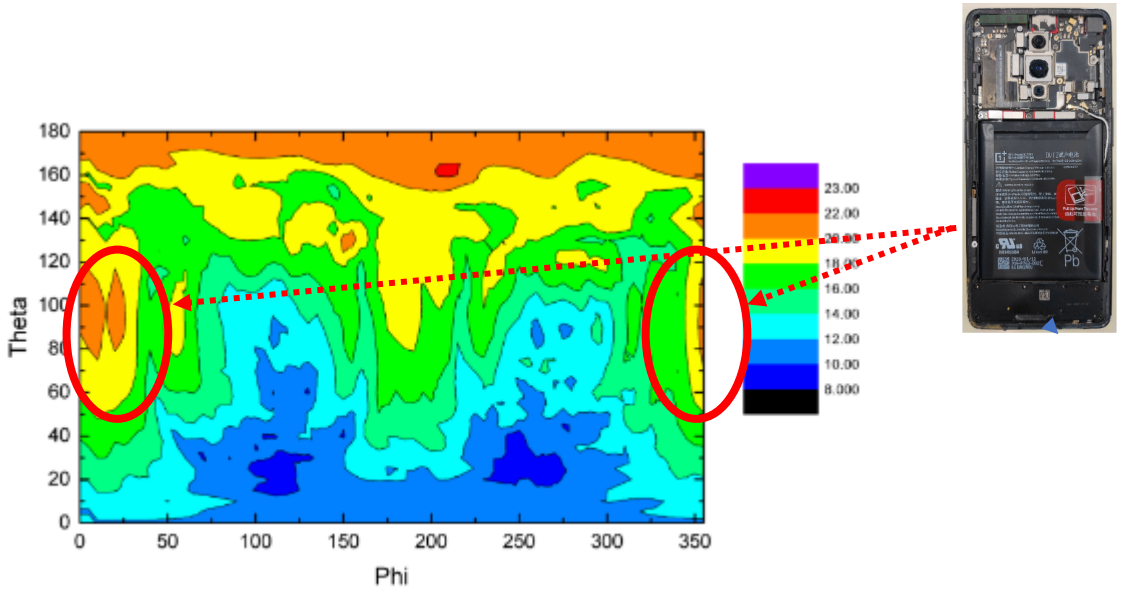
两种开发范式 Two paradigms of antenna design

手机毫米波“天线”的开发范式和Sub6天线不同！
The paradigm of the mmWave design is different from sub6!

1.不同的性能指标：EIRP/EIS（Peak/CDF）VS TRP/TIS
Different preference requirement：EIRP/EIS（Peak/CDF）VS TRP/TIS



Signal distribution, No. 1



Signal distribution, No. 2

Different user experience with the same peak EIRP & 50%CDF

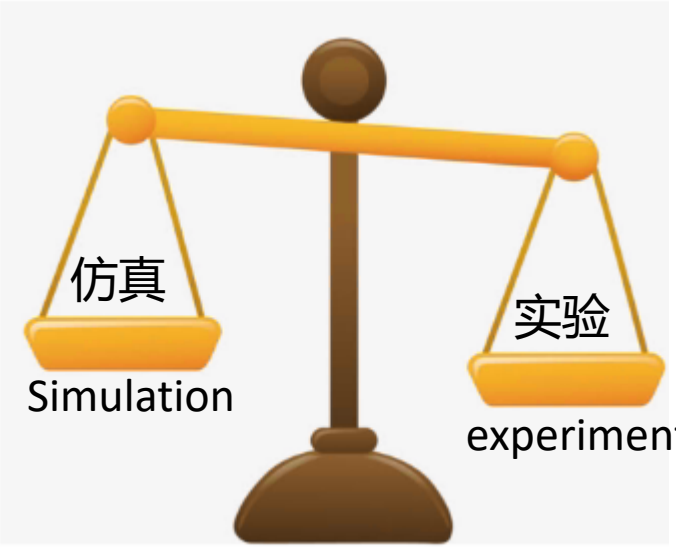
两种开发范式 Two paradigms of antenna design

2.不同的评估手段：仿真为主 VS 实验为主

Different investigate method：based on simulation VS experiment

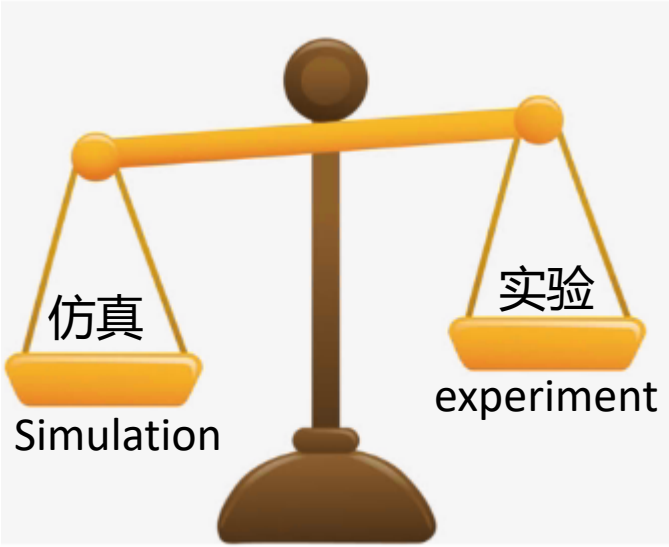
太多的影响因素：结构，材料等，并且不能改变天线。

Structure，material，etc., will change mmWave performance, while antenna couldn't be changed.



Sub6天线开发

Su6 antenna design



毫米波天线开发

mmWave antenna design

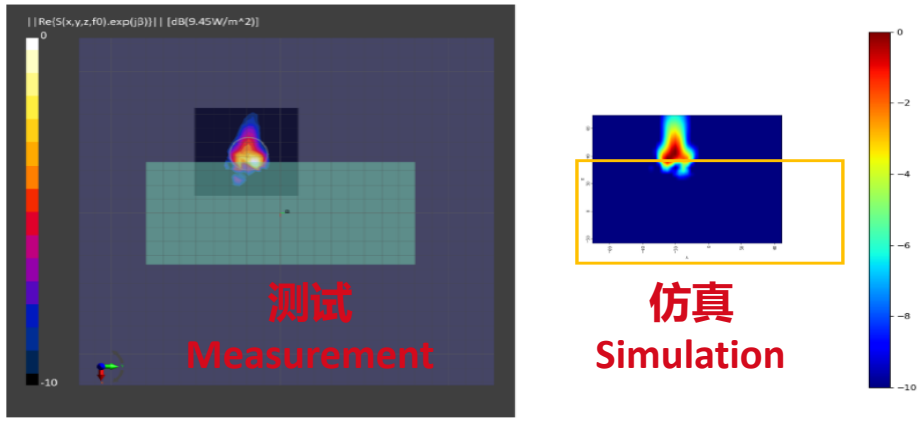
两种开发范式 Two paradigms of antenna design

2.不同的评估手段：仿真为主 VS 实验为主

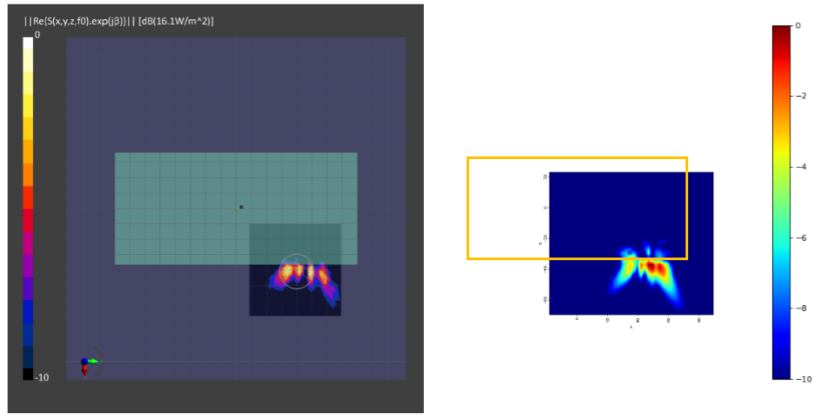
Different investigate method：based on simulation VS experiment

FCC认证：Power density（PD）

FCC certification：Power density（PD）



Module 2: n261, Mid Channel, Beam ID: 30, Back

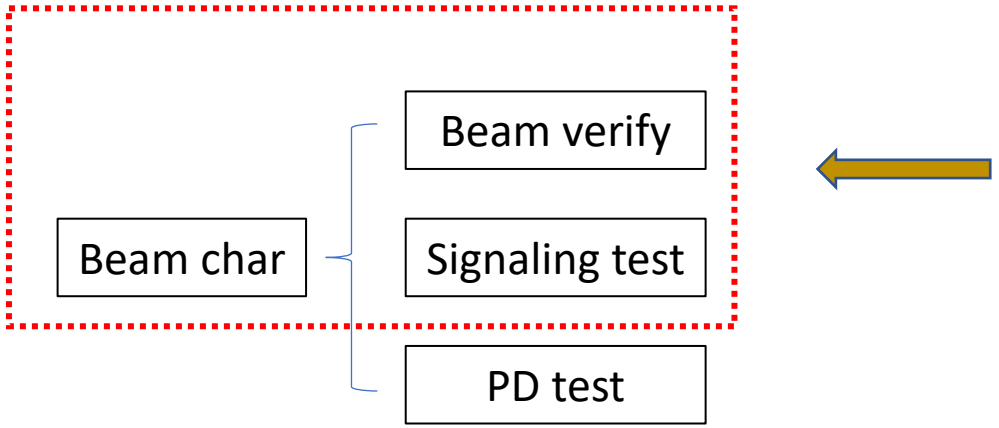


Module 1: n260, Mid Channel, Beam ID: 168, Back

两种开发范式 Two paradigms of antenna design

3.不同的测试手段和对象：完全基于空口测试和波束

Different measurement method：OTA test & based on beam



成果 Result

一加8毫米波版于2020年4月29号北美上市，轻薄旗舰（160.2mmx72.9mmx8.0mm）。支持n257，n260，n261频段，最高支持8CC 2 ×2 MIMO。

OnePlus 8 5G UW has launched on Apr. 29th, size is 160.2mmx72.9mmx8.0mm. support n257, n260, n261 band, and up to 8CC 2 ×2 MIMO.

OnePlus 8 5G UW

成果 Result

8月25号在北京与爱立信商用基站配合，率先完成2020年IMT-2020毫米波终端测试 ，上行距离达到1.2km，4cc 下行吞吐率达到2.1Gbps。

Complete IMT-2020 field test with Ericsson base station in Beijing on Aug. 25th, connection distance up to 1.2km，4cc throughput up to 2.1Gbps.

Thanks !

Q&A