



FCC TEST REPORT

Application No: ZR/2019/C0026
Applicant: GUANGDONG OPPO MOBILE TELECOMMUNICATIONS CORP.,LTD.
Address of Applicant: NO. 18 HaiBin Road, WuSha village, Chang An Town, DongGuan City, Guangdong,China
Manufacturer: GUANGDONG OPPO MOBILE TELECOMMUNICATIONS CORP.,LTD.
Address of Manufacturer: NO. 18 HaiBin Road, WuSha village, Chang An Town, DongGuan City, Guangdong,China
EUT Description: MOBILE PHONE
Model No.: CPH2009
Trade Mark: OPPO
FCC ID: R9C-CPH2009
Standards: 47 CFR Part 2
47 CFR Part 22 subpart H
47 CFR Part 24 subpart E
47 CFR Part 27 subpart C
47 CFR Part 90 subpart S
Test Method: FCC KDB 971168 D01 Power Meas License Digital Systems V03r01 C63.26 (2015)
Date of Receipt: 2019/12/23
Date of Test: 2019/12/23 to 2020/2/29
Date of Issue: 2021/8/11

Test Result:	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:

Derek Yang
Wireless Laboratory Manager



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SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch (FCC Laboratory)

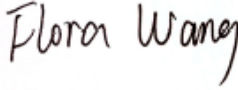
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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2020/2/29		Original
01		2021/5/26	Flora.Wang	1. Add test site Information 2. Update equipment list
02		2021/8/11	Flora.Wang	1.Add antenna height and angle for 'Field Strength of Spurious Radiation'

*This report supersedes our previous report ZR/2019/C002601, issued on 2020/2/29, which is hereby deemed null and void.

Authorized for issue by:	
Prepared By	 (Flora Wang) /Project Engineer
Checked By	 (Jim Huang) /Reviewer





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2 Test Summary

2.1 GSM850/UMTS Band 5 & LTE Band 5 / 26

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §22.913	FCC: ERP $\leq$ 7 W	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	---	Limit $\leq$ 13 dB	Section 2 of Appendix B	Pass	A
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B	Pass	A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Section 4 of Appendix B	Pass	A
Band Edges Compliance	§2.1051, §22.917	$\leq$ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Section 5 of Appendix B	Pass	A
Spurious Emission at Antenna Terminals	§2.1051, §22.917	FCC: $\leq$ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Section 6 of Appendix B	Pass	A
Field Strength of Spurious Radiation	§2.1053, §22.917	FCC: $\leq$ -13 dBm/100 kHz.	Section 7 of Appendix B	Pass	B
Frequency Stability	§2.1055, §22.355	$\leq \pm 2.5$ ppm.	Section 8 of Appendix B	Pass	A
Remark: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".					

2.2 GSM 1900/UMTS Band 2 /LTE Band 2

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232	EIRP $\leq$ 2 W	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	§2.1046, §24.232	Limit $\leq$ 13 dB	Section 2 of Appendix B	Pass	A
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B	Pass	A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Section 4 of Appendix B	Pass	A
Band Edges Compliance	§2.1051, §24.238	$\leq$ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Section 5 of Appendix B	Pass	A
Spurious Emission at Antenna Terminals	§2.1051, §24.238	$\leq$ -13 dBm/1 MHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges.	Section 6 of Appendix B	Pass	A
Field Strength of Spurious Radiation	§2.1053, §24.238	$\leq$ -13 dBm/1 MHz.	Section 7 of Appendix B	Pass	B



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Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Frequency Stability	§2.1055, §24.235	$\leq \pm 2.5$ ppm.	Section 8 of Appendix B	Pass	A
Remark: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".					

2.3 UMTS Band 4 /LTE Band 4/66

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(d)	$EIRP \leq 1$ W	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	§2.1046, §27.50(d)	Limit ≤ 13 dB	Section 2 of Appendix B	Pass	A
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B	Pass	A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Section 4 of Appendix B	Pass	A
Band Edges Compliance	§2.1051, §27.53(h)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Section 5 of Appendix B	Pass	A
Spurious Emission at Antenna Terminals	§2.1051, §27.53(h)	≤ -13 dBm/1 MHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges.	Section 6 of Appendix B	Pass	A
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	≤ -13 dBm/1 MHz.	Section 7 of Appendix B	Pass	B
Frequency Stability	§2.1055, §27.54	$\leq \pm 2.5$ ppm.	Section 8 of Appendix B	Pass	A
Remark: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".					

2.4 LTE Band 7/38/41/ CA_7C/ CA_38C/ CA_41C

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	$EIRP \leq 2$ W	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	§27.50(a)	≤ 13 dB	Section 2 of Appendix B	Pass	A
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B	Pass	A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Section 4 of Appendix B	Pass	A
Band Edges Compliance	§2.1051, §27.53(m4)	For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log(P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log(P)$ dB on	Section 5 of Appendix B	Pass	A



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Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
		all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log(P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section.			
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)		Section 6 of Appendix B	Pass	A
Field Strength of Spurious Radiation	§2.1053, §27.53(m)		Section 7 of Appendix B	Pass	B
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Section 8 of Appendix B	Pass	A
Remark: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".					

2.5 LTE Band 12/17

Test Item	FCC Rule No	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§27.50(c)	FCC: ERP $\leq$ 3 W.	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	§2.1046, §27.50(c)	Limits $\leq$ 13 dB	Section 2 of Appendix B	Pass	A
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B	Pass	A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Section 4 of Appendix B	Pass	A
Band Edges Compliance	§2.1051, §27.53(g)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Section 5 of Appendix B	Pass	A
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges.	Section 6 of Appendix B	Pass	A
Field Strength of Spurious Radiation	§2.1053, §27.53(g)	FCC: ≤ -13 dBm/100 kHz.	Section 7 of Appendix B	Pass	B



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Test Item	FCC Rule No	Requirements	Test Result	Verdict	Test Lab*
Frequency Stability	§2.1055, §27.54	$\leq \pm 2.5\text{ppm}$.	Section 8 of Appendix B	Pass	A
Remark: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".					



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Shenzhen Branch FCC Laboratory

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2.6 LTE Band 26

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Transmitter Conducted Power Output	§2.1046, §90.635	< 100 W.	Section 1 of Appendix B	PASS	A
Peak-Average Ratio	---	FCC: Limit ≤ 13 dB	Section 2 of Appendix B	N/T	A
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B	PASS	A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Section 4 of Appendix B	PASS	A
Emission Mask	§2.1051 § 90.691	For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log ₁₀ (f/6.1) decibels or 50+10Log ₁₀ (P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.	Section 5 of Appendix B	PASS	A
Spurious Emission at Antenna Terminals	§2.1051, §90.691	< 43 + 10Log ₁₀ (P[Watts]) for all out-of-band emissions	Section 6 of Appendix B	PASS	A
Field Strength of Spurious Radiation	§2.1053, §90.691	< 43 + 10Log ₁₀ (P[Watts]) for all out-of-band emissions	Section 7 of Appendix B	PASS	A
Frequency Stability	§2.1055, §90.213	< ±2.5ppm.	Section 8 of Appendix B	PASS	A
Remark: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".					

Remark:

All test were performed by Lab A and B.

Parts of test items above were subcontracted to Lab B.

Lab A SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

Lab B SGS-CSTC STANDARDS TECHNICAL SERVICES (XI'AN) CO., LTD.





3 General Information

3.1 Client Information

Applicant:	GUANGDONG OPPO MOBILE TELECOMMUNICATIONS CORP.,LTD.
Address of Applicant:	NO. 18 HaiBin Road, WuSha village, Chang An Town, DongGuan City, Guangdong,China
Manufacturer:	GUANGDONG OPPO MOBILE TELECOMMUNICATIONS CORP.,LTD.
Address of Manufacturer:	NO. 18 HaiBin Road, WuSha village, Chang An Town, DongGuan City, Guangdong,China

3.2 Test Location

Lab A:

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Test engineer:	Adam Liang, Mike Hu

Lab B:

Company:	SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.
Address:	1/F, Unit D, Building 1, Kanghong Orange Technology Park, No.137, Keyuan 3rd Road, Fengdong New City, Xi'an, Shaanxi China
Post code:	710086
Test engineer:	Ben Huang

3.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

Lab A:

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1178



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SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

Lab B:

A2LA (Certificate No. 4854.01)

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3.4 General Description of EUT

EUT Description:	MOBILE PHONE
Model No.:	CPH2009
Trade Mark:	OPPO
Hardware Version:	11
Software Version:	ColorOS V7
Sample Type:	☒ Portable Device, ☐ Module
Antenna Type:	☐ External, ☒ Integrated
Antenna Gain:	GSM850: -7.0dBi (Ant0); -3.4dBi (Ant1); GSM1900: -1.6dBi (Ant2); -2.0dBi (Ant3); WCDMA Band II: -1.6dBi (Ant2); -2.0dBi (Ant3); WCDMA Band IV: -2.4dBi (Ant2); -2.5dBi (Ant3); WCDMA Band V: -7.0dBi (Ant0); -3.4dBi (Ant1); LTE Band 2: -1.6dBi (Ant2); -2.0dBi (Ant3); LTE Band 4: -2.4dBi (Ant2); -2.5dBi (Ant3); LTE Band 5: -7.0dBi (Ant0); -3.4dBi (Ant1); LTE Band 7: -3.8dBi (Ant0); -0.3dBi (Ant2); -0.1dBi (Ant3); LTE Band 12: -5.6dBi (Ant0); -2.4dBi (Ant1); LTE Band 17: -5.6dBi (Ant0); -2.4dBi (Ant1); LTE Band 26: -7.0dBi (Ant0); -3.4dBi (Ant1); LTE Band 38: -3.8dBi (Ant0); -0.3dBi (Ant2); -0.1dBi (Ant3); LTE Band 41: -3.8dBi (Ant0); -0.3dBi (Ant2); -0.1dBi (Ant3); LTE Band 66: -2.4dBi (Ant2); -2.5dBi (Ant3); LTE CA_7C: -3.8dBi (Ant0); -0.3dBi (Ant2); -0.1dBi (Ant3); LTE CA_38C: -3.8dBi (Ant0); -0.3dBi (Ant2); -0.1dBi (Ant3); LTE CA_41C: -3.8dBi (Ant0); -0.3dBi (Ant2); -0.1dBi (Ant3);

3.5 Test Mode

Test Mode	Test Modes Description
GSM/TM1	GSM system, GSM/GPRS, GMSK modulation
GSM/TM2	GSM system, EGPRS, 8PSK modulation
UMTS/TM1	UMTS system, WCDMA, QPSK modulation
UMTS/TM2	UMTS system, WCDMA, 16QAM modulation
LTE/TM1	LTE system, QPSK modulation
LTE/TM2	LTE system, 16QAM modulation
LTE/TM3	LTE system, 64QAM modulation

Remark: The test mode(s) are selected according to relevant radio technology specifications.





3.6 Test Environment

Environment Parameter	Selected Values During Tests		
Relative Humidity	52%		
Atmospheric Pressure:	101.32 KPa		
Temperature	NT	25 °C	
Voltage:	LV	3.6V	
	NV	3.87V	
	HV	4.45V	

Remark: LV= lower extreme test voltage; NV= nominal voltage
HV= upper extreme test voltage; NT= normal temperature

3.7 Technical Specification

Characteristics	Description		
Radio System Type	☒ GSM		
	☒ UMTS		
	☒ LTE		
Supported Frequency Range	Band	TX	RX
	GSM850	824 to 849 MHz	869 to 894 MHz
	GSM1900	1850 to 1910 MHz	1930 to 1990 MHz
	UMTS Band II	1850 to 1910 MHz	1930 to 1990 MHz
	UMTS Band IV	1710 to 1755 MHz	2110 to 2155 MHz
	UMTS Band V	824 to 849 MHz	869 to 894 MHz
	LTE Band 2	1850 to 1910 MHz	1930 to 1990 MHz
	LTE Band 4	1710 to 1755 MHz	2110 to 2155 MHz
	LTE Band 5	824 to 849 MHz	869 to 894 MHz
	LTE Band 7	2500 to 2570 MHz	2620 to 2690 MHz
	LTE Band 12	699 to 716 MHz	729 to 746 MHz
	LTE Band 17	704 to 716 MHz	734 to 746 MHz
	LTE Band 26 (814 to 824 MHz)	814 to 824MHz	859 to 869 MHz
	LTE Band 26 (824 to 849 MHz)	824 to 849 MHz	869 to 894 MHz
	LTE Band 38	2570 to 2620 MHz	2570 to 2620 MHz
	LTE Band 41	2496 to 2690MHz	2496 to 2690MHz
	LTE Band 66	1710 to 1780 MHz	2110 to 2200 MHz
	LTE CA 7C	2500 to 2570 MHz	2620 to 2690 MHz
	LTE CA 38C	2570 to 2620 MHz	2570 to 2620 MHz
	LTE CA 41C	2496 to 2690MHz	2496 to 2690MHz
Target TX Output Power	GSM850:33.2 dBm (Ant0); 34.0dBm (Ant1) GSM1900: 30.5dBm (Ant2); 30.0dBm (Ant3) UMTS Band II: 24.0dBm (Ant2); 23.5dBm (Ant3) UMTS Band IV: 24.2dBm (Ant2); 23.7dBm (Ant3) UMTS Band V: 25.0dBm (Ant0); 25.0dBm (Ant1) LTE Band 2: 23.8dBm (Ant2); 23.0dBm (Ant3) LTE Band 4: 24.0dBm (Ant2); 23.2dBm (Ant3) LTE Band 5: 24.8dBm (Ant0); 25.0dBm (Ant1) LTE Band 7: 23.0dBm (Ant0); 24.0dBm (Ant2); 23.7dBm (Ant3) LTE Band 12: 24.4dBm (Ant0); 24.8dBm (Ant1) LTE Band 17: 24.4dBm (Ant0); 24.8dBm (Ant1)		



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	LTE Band 26: 24.6dBm (Ant0); 24.8dBm (Ant1) LTE Band 38: 23.0dBm (Ant0); 24.5dBm (Ant2); 23.6dBm (Ant3) LTE Band 41: 24.8dBm (Ant0); 26.0dBm (Ant2); 25.5dBm (Ant3) LTE Band 66: 24.0dBm (Ant2); 23.2dBm (Ant3) LTE CA_7C: 23.0dBm (Ant0); 24.0dBm (Ant2); 23.7dBm (Ant3) LTE CA_38C: 23.0dBm (Ant0); 24.5dBm (Ant2); 23.6dBm (Ant3) LTE CA_41C: 24.8dBm (Ant0); 26.0dBm (Ant2); 25.5dBm (Ant3)	
Supported Channel Bandwidth	GSM system:	☒ 0.2 MHz
	UMTS system:	☒ 5 MHz
	LTE Band 2	☒ 1.4 MHz; ☒ 3 MHz; ☒ 5 MHz; ☒ 10 MHz; ☒ 15 MHz, ☒ 20 MHz
	LTE Band 4	☒ 1.4 MHz; ☒ 3 MHz; ☒ 5 MHz; ☒ 10 MHz; ☒ 15 MHz, ☒ 20 MHz
	LTE Band 5	☒ 1.4 MHz; ☒ 3 MHz; ☒ 5 MHz; ☒ 10 MHz
	LTE Band 7	☒ 5 MHz; ☒ 10 MHz; ☒ 15 MHz, ☒ 20 MHz
	LTE Band 12	☒ 1.4 MHz; ☒ 3 MHz; ☒ 5 MHz; ☒ 10 MHz
	LTE Band 17	☒ 5 MHz; ☒ 10 MHz
	LTE Band 26(814-824)	☒ 1.4 MHz; ☒ 3 MHz; ☒ 5 MHz; ☒ 10 MHz;
	LTE Band 26(824-849)	☒ 1.4 MHz; ☒ 3 MHz; ☒ 5 MHz; ☒ 10 MHz; ☒ 15 MHz
	LTE Band 38	☒ 5 MHz; ☒ 10 MHz; ☒ 15 MHz, ☒ 20 MHz
	LTE Band 41	☒ 5 MHz; ☒ 10 MHz; ☒ 15 MHz, ☒ 20 MHz
	LTE Band 66	☒ 1.4 MHz; ☒ 3 MHz; ☒ 5 MHz; ☒ 10 MHz; ☒ 15 MHz, ☒ 20 MHz
	LTE CA_7C	☒ 50+100; ☒ 75+150; ☒ 75+75, ☒ 75+100 ☒ 100+100
	LTE CA_38C	☒ 75+75; ☒ 100+100
	LTE CA_41C	☒ 25+100; ☒ 50+75; ☒ 75+75; ☒ 75+100, ☒ 100+100
Characteristics	Description	
Designation of Emissions (Remark: the necessary bandwidth of which is the worst value from the measured occupied bandwidths for each type of channel bandwidth configuration.)	GSM850	249KGXW; 246KG7W
	GSM1900	241KGXW; 243KG7W
	UMTS Band II	4M14F9W;
	UMTS Band IV	4M14F9W;
	UMTS Band V	4M15F9W;
	LTE Band 2 (QPSK/64QAM/16QAM)	1M10G7D; 1M09W7D; 1M09W7D 2M70G7D; 2M70W7D; 2M70W7D 4M49G7D; 4M48W7D; 4M49W7D 8M93G7D; 8M93W7D; 8M93W7D 13M5G7D; 13M5W7D; 13M5W7D 17M9G7D; 17M9W7D; 17M9W7D
	LTE Band 4 (QPSK/64QAM/16QAM)	1M09G7D; 1M09W7D; 1M09W7D 2M70G7D; 2M69W7D; 2M69W7D 4M47G7D; 4M49W7D; 4M48W7D 8M93G7D; 8M93W7D; 8M93W7D 13M5G7D; 13M5W7D; 13M5W7D 17M9G7D; 17M9W7D; 17M9W7D
	LTE Band 5 (QPSK/64QAM/16QAM)	1M09G7D; 1M09W7D; 1M09W7D 2M70G7D; 2M69W7D; 2M69W7D 4M49G7D; 4M48W7D; 4M49W7D 8M95G7D; 8M93W7D; 8M93W7D



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LTE Band 7 (QPSK/64QAM/16QAM)	4M49G7D;4M49W7D; 4M49W7D 8M93G7D;8M93W7D; 8M93W7D 13M5G7D;13M5W7D; 13M5W7D 17M9G7D;17M9W7D; 17M9W7D
LTE Band 12 (QPSK/64QAM/16QAM)	1M10G7D;1M09W7D; 1M09W7D 2M70G7D;2M70W7D; 2M70W7D 4M49G7D;4M48W7D; 4M48W7D 8M95G7D;8M93W7D; 8M93W7D
LTE Band 17	4M48G7D;4M49W7D; 4M48W7D 8M93G7D;8M93W7D; 8M93W7D
LTE Band 26 (814-824) (QPSK/64QAM/16QAM)	1M10G7D;1M09W7D; 1M09W7D 5M94G7D;2M70W7D; 2M70W7D 4M49G7D;4M49W7D; 4M49W7D 8M95G7D;8M95W7D; 8M97W7D
LTE Band 26 (824-849) (QPSK/64QAM/16QAM)	1M09G7D;1M09W7D; 1M09W7D 2M70G7D;2M70W7D; 2M70W7D 4M49G7D;4M49W7D; 4M49W7D 8M95G7D;8M95W7D; 8M95W7D 13M5G7D;13M5W7D; 13M5W7D
LTE Band 38 (QPSK/64QAM/16QAM)	4M48G7D;4M48W7D; 4M48W7D 8M95G7D;8M95W7D; 8M93W7D 13M5G7D;13M5W7D; 13M5W7D 17M9G7D;17M9W7D; 17M9W7D
LTE Band 41 (QPSK/64QAM/16QAM)	4M49G7D;4M48W7D; 4M48W7D 8M93G7D;8M95W7D; 8M95W7D 13M5G7D;13M5W7D; 13M5W7D 17M9G7D;17M9W7D; 17M9W7D
LTE Band 66 (QPSK/64QAM/16QAM)	1M09G7D;1M09W7D; 1M09W7D 2M70G7D;2M69W7D; 2M69W7D 4M47G7D;4M47W7D; 4M49W7D 8M93G7D;8M91W7D; 8M91W7D 13M5G7D;13M4W7D; 13M5W7D 17M9G7D;17M9W7D; 17M9W7D
LTE CA_7C (QPSK/16QAM/64QAM)	28M4G7D;28M4W7D; 28M4W7D 37M4G7D;37M4W7D; 37M4W7D
LTE CA_38C (QPSK/16QAM/64QAM)	28M2G7D;28M2W7D; 28M2W7D 37M4G7D;37M4W7D; 37M5W7D
LTE CA_41C (QPSK/16QAM/64QAM)	22M9G7D;22M9W7D; 22M9W7D 37M5G7D;37M5W7D; 37M5W7D



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3.8 Test Frequencies

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
GSM850	TX	Channel 128	Channel 190	Channel 251
		824.2MHz	836.6 MHz	848.8 MHz
	RX	Channel 128	Channel 190	Channel 251
		869.2 MHz	881.6 MHz	893.8 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
GSM1900	TX	Channel 512	Channel 661	Channel 810
		1850.2MHz	1880.0 MHz	1909.8 MHz
	RX	Channel 512	Channel 661	Channel 810
		1930.2 MHz	1960.0 MHz	1989.8 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA Band II	TX	Channel 9262	Channel 9400	Channel 9538
		1852.4 MHz	1880.0 MHz	1907.6 MHz
	RX	Channel 9662	Channel 9800	Channel 9938
		1932.4 MHz	1960.0 MHz	1987.6 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA Band IV	TX	Channel 1312	Channel 1413	Channel 1513
		1712.4MHz	1732.6 MHz	1752.6 MHz
	RX	Channel 1537	Channel 1638	Channel 1738
		2112.4 MHz	2132.6 MHz	2152.6 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA Band V	TX	Channel 4132	Channel 4182	Channel 4233
		826.4MHz	836.4 MHz	846.6 MHz
	RX	Channel 4357	Channel 4407	Channel 4458
		871.4 MHz	881.4 MHz	891.6 MHz



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Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 2	1.4MHz	TX	Channel 18607	Channel 18900	Channel 19193
			1850.7 MHz	1880 MHz	1909.3 MHz
		RX	Channel 607	Channel 900	Channel 1193
			1930.7 MHz	1960 MHz	1989.3 MHz
	3MHz	TX	Channel 18615	Channel 18900	Channel 19185
			1851.5 MHz	1880 MHz	1908.5 MHz
		RX	Channel 615	Channel 900	Channel 1185
			1931.5 MHz	1960 MHz	1988.5 MHz
	5MHz	TX	Channel 18625	Channel 18900	Channel 19175
			1852.5 MHz	1880 MHz	1907.5 MHz
		RX	Channel 625	Channel 900	Channel 1175
			1932.5 MHz	1960 MHz	1987.5 MHz
	10MHz	TX	Channel 18650	Channel 18900	Channel 19150
			1855 MHz	1880 MHz	1905 MHz
		RX	Channel 650	Channel 900	Channel 1150
			1935 MHz	1960 MHz	1985 MHz
	15MHz	TX	Channel 18675	Channel 18900	Channel 19125
			1857.5 MHz	1880 MHz	1902.5 MHz
		RX	Channel 675	Channel 900	Channel 1125
			1937.5 MHz	1960 MHz	1982.5 MHz
	20MHz	TX	Channel 18700	Channel 18900	Channel 19100
			1860 MHz	1880 MHz	1900 MHz
		RX	Channel 700	Channel 900	Channel 1100
			1940 MHz	1960 MHz	1980 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 4	1.4MHz	TX	Channel 19957	Channel 20175	Channel 20393
			1710.7 MHz	1732.5 MHz	1754.3 MHz
		RX	Channel 1975	Channel 2175	Channel 2375
			2112.5 MHz	2132.5MHz	2152.5 MHz
	3MHz	TX	Channel 19965	Channel 20175	Channel 20385
			1711.5 MHz	1732.5 MHz	1753.5 MHz
		RX	Channel 2000	Channel 2175	Channel 2350
			2115 MHz	2132.5MHz	2150 MHz
	5MHz	TX	Channel 19975	Channel 20175	Channel 20375
			1712.5 MHz	1732.5 MHz	1752.5 MHz
		RX	Channel 1975	Channel 2175	Channel 2375
			2112.5 MHz	2132.5MHz	2152.5 MHz
	10MHz	TX	Channel 20000	Channel 20175	Channel 20350
			1715 MHz	1732.5 MHz	1750 MHz
		RX	Channel 2000	Channel 2175	Channel 2350
			2115 MHz	2132.5MHz	2150 MHz
	15MHz	TX	Channel 20025	Channel 20175	Channel 20325
			1717.5 MHz	1732.5 MHz	1747.5 MHz
		RX	Channel 2025	Channel 2175	Channel 2325
			2117.5 MHz	2132.5MHz	2147.5 MHz
			Channel 20050	Channel 20175	Channel 20300



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	20MHz	TX	1720 MHz	1732.5 MHz	1745 MHz
		RX	Channel 2050 2120 MHz	Channel 2175 2132.5MHz	Channel 2300 2145 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 5	1.4MHz	TX	Channel 20407	Channel 20525	Channel 20643
			824.7 MHz	836.5 MHz	848.3 MHz
		RX	Channel 2407	Channel 2525	Channel 2643
			869.7 MHz	881.5 MHz	893.3 MHz
	3MHz	TX	Channel 20415	Channel 20525	Channel 20635
			825.5 MHz	836.5 MHz	847.5 MHz
		RX	Channel 2415	Channel 2525	Channel 2635
			870.5 MHz	881.5 MHz	892.5 MHz
	5MHz	TX	Channel 20425	Channel 20525	Channel 20625
			826.5 MHz	836.5 MHz	846.5 MHz
		RX	Channel 2425	Channel 2525	Channel 2625
			871.5 MHz	881.5 MHz	891.5 MHz
	10MHz	TX	Channel 20450	Channel 20525	Channel 20600
			829 MHz	836.5 MHz	844 MHz
		RX	Channel 2450	Channel 2525	Channel 2600
			874 MHz	881.5 MHz	889 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 7	5MHz	TX	Channel 20775	Channel 21100	Channel 21425
			2502.5 MHz	2535 MHz	2567.5 MHz
		RX	Channel 2775	Channel 3100	Channel 5825
			2622.5 MHz	2655 MHz	2687.5 MHz
	10MHz	TX	Channel 20800	Channel 21100	Channel 21400
			2505 MHz	2535 MHz	2565 MHz
		RX	Channel 2800	Channel 3100	Channel 3400
			2625 MHz	2655 MHz	2685 MHz
	15MHz	TX	Channel 20825	Channel 21100	Channel 21375
			2507.5 MHz	2535 MHz	2562.5 MHz
		RX	Channel 2825	Channel 3100	Channel 3375
			2627.5 MHz	2655 MHz	2682.5 MHz
	20MHz	TX	Channel 20850	Channel 21100	Channel 21350
			2510 MHz	2535 MHz	2560 MHz
		RX	Channel 2850	Channel 3100	Channel 3350
			2630 MHz	2655 MHz	2680 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band12	1.4MHz	TX	Channel 23017	Channel 23095	Channel 23173
			699.7 MHz	707.5 MHz	715.3 MHz
		RX	Channel 5017	Channel 5095	Channel 5173
			729.7 MHz	737.5 MHz	745.3 MHz
			Channel 23025	Channel 23095	Channel 23165



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	3MHz	TX	700.5 MHz	707.5 MHz	714.5 MHz
		RX	Channel 5025	Channel 5095	Channel 5165
			730.5 MHz	737.5 MHz	744.5 MHz
	5MHz	TX	Channel 23035	Channel 23095	Channel 23155
			701.5 MHz	707.5 MHz	713.5 MHz
		RX	Channel 5035	Channel 5095	Channel 5155
			731.5 MHz	737.5 MHz	743.5 MHz
	10MHz	TX	Channel 23060	Channel 23095	Channel 23130
			704 MHz	707.5 MHz	711 MHz
		RX	Channel 5060	Channel 5095	Channel 5130
			734 MHz	737.5 MHz	741 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 17	5MHz	TX	Channel 23755	Channel 23790	Channel 23825
			706.5 MHz	710 MHz	713.5 MHz
		RX	Channel 5755	Channel 5790	Channel 5825
			736.5 MHz	740 MHz	743.5 MHz
	10MHz	TX	Channel 23780	Channel 23790	Channel 23800
			709 MHz	710 MHz	711 MHz
		RX	Channel 5780	Channel 5790	Channel 5800
			739 MHz	740 MHz	741 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band26 (814-824)	1.4MHz	TX	Channel 26697	Channel 26740	Channel 26783
			814.7 MHz	819 MHz	823.3 MHz
		RX	Channel 8697	Channel 8740	Channel 8783
			859.7 MHz	864MHz	868.3 MHz
	3MHz	TX	Channel 26705	Channel 26740	Channel 26775
			815.5 MHz	819 MHz	822.5 MHz
		RX	Channel 8705	Channel 8740	Channel 8775
			860.5 MHz	864MHz	867.5 MHz
	5MHz	TX	Channel 26715	Channel 26740	Channel 26765
			816.5 MHz	819 MHz	821.5 MHz
		RX	Channel 8715	Channel 8740	Channel 8755
			861.5 MHz	864MHz	866.5 MHz
	10MHz	TX	Channel 26740	Channel 26740	Channel 26740
			819 MHz	819 MHz	819 MHz
		RX	Channel 8740	Channel 8740	Channel 8740
			864MHz	864MHz	864MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band26 (824-849)	1.4MHz	TX	Channel 26797	Channel 26915	Channel 27033
			824.7 MHz	836.5 MHz	848.3 MHz
		RX	Channel 8697	Channel 8915	Channel 9033
			859.7 MHz	881.5 MHz	893.3 MHz
			Channel 26805	Channel 26915	Channel 27025



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	3MHz	TX	825.5 MHz	836.5 MHz	847.5 MHz
		RX	Channel 8805 860.5 MHz	Channel 8915 881.5 MHz	Channel 9025 892.5 MHz
	5MHz	TX	Channel 26815 826.5 MHz	Channel 26915 836.5 MHz	Channel 27015 846.5 MHz
		RX	Channel 8815 871.5 MHz	Channel 8915 881.5 MHz	Channel 9015 891.5 MHz
	10MHz	TX	Channel 26840 829 MHz	Channel 26915 836.5 MHz	Channel 26990 844 MHz
		RX	Channel 8840 874 MHz	Channel 8915 881.5 MHz	Channel 8990 889 MHz
	15MHz	TX	Channel 26865 831.5 MHz	Channel 26915 836.5 MHz	Channel 26965 841.5 MHz
		RX	Channel 8865 876.5 MHz	Channel 8915 881.5 MHz	Channel 8965 886.5 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 38	5MHz	TX/RX	Channel 37775 2572.5 MHz	Channel 38000 2595 MHz	Channel 38225 2617.5 MHz
			Channel 37800 2575 MHz	Channel 38000 2595 MHz	Channel 38200 2615 MHz
	10MHz	TX/RX	Channel 37825 2577.5 MHz	Channel 38000 2595 MHz	Channel 38175 2612.5 MHz
			Channel 37850 2580 MHz	Channel 38000 2595 MHz	Channel 38150 2610 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 41	5MHz	TX/RX	Channel 39675 2498.5 MHz	Channel 40620 2593 MHz	Channel 41565 2687.5 MHz
			Channel 39700 2501 MHz	Channel 40620 2593 MHz	Channel 41540 2685 MHz
	10MHz	TX/RX	Channel 39725 2503.5 MHz	Channel 40620 2593 MHz	Channel 41515 2682.5 MHz
			Channel 39750 2506 MHz	Channel 40620 2593 MHz	Channel 41490 2680 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 66	1.4MHz	TX	Channel 131979 1710.7 MHz	Channel 132322 1745 MHz	Channel 132665 1779.3 MHz
		RX	Channel 66443 2110.7 MHz	Channel 66786 2145MHz	Channel 67329 2199.3 MHz
	3MHz	TX	Channel 131987 1711.5 MHz	Channel 132322 1745 MHz	Channel 132657 1778.5MHz
		RX	Channel 66451 2111.5 MHz	Channel 66786 2145MHz	Channel 67121 2198.5MHz
			Channel 131997	Channel 132322	Channel 132647



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	5MHz	TX	1712.5 MHz	1745 MHz	1777.5 MHz
		RX	Channel 66461 2112.5 MHz	Channel 66786 2145MHz	Channel 67311 2197.5 MHz
	10MHz	TX	Channel 132022 1715 MHz	Channel 132322 1745 MHz	Channel 132622 1775 MHz
			Channel 66486 2115 MHz	Channel 66786 2145MHz	Channel 67286 2195 MHz
		RX	Channel 132047 1717.5 MHz	Channel 132322 1745 MHz	Channel 132597 1772.5 MHz
			Channel 66511 2117.5 MHz	Channel 66786 2145MHz	Channel 67261 2192.5 MHz
	15MHz	TX	Channel 132072 1720 MHz	Channel 132322 1745 MHz	Channel 132572 1770 MHz
			Channel 66536 2120 MHz	Channel 66786 2145MHz	Channel 67236 2190 MHz
		RX			
	20MHz	TX			
		RX			

Table 4.3.1.1.7A-1: Test frequencies for CA_7C

Range	CC-Combo / N _{RB,agg} [RB]	CC1 Note1					CC2 Note1				
		BW [RB]	N _{UL}	f _{UL} [MHz]	N _{DL}	f _{DL} [MHz]	BW [RB]	N _{UL}	f _{UL} [MHz]	N _{DL}	f _{DL} [MHz]
Low	50+100	50	20805	2505.5	2805	2625.5	100	20949	2519.9	2949	2639.9
		100	20850	2510	2850	2630	50	20994	2524.4	2994	2644.4
	75+50	75	20825	2507.5	2825	2627.5	50	20945	2519.5	2945	2639.5
	75+75	75	20825	2507.5	2825	2627.5	75	20975	2522.5	2975	2642.5
	75+100	75	20828	2507.8	2828	2627.8	100	20999	2524.9	2999	2644.9
		100	20850	2510	2850	2630	75	21021	2527.1	3021	2647.1
Mid	50+100	50	21006	2525.6	3006	2645.6	100	21150	2540	3150	2660
		100	21051	2530.1	3051	2650.1	50	21195	2544.5	3195	2664.5
	75+50	75	21051	2530.1	3051	2650.1	50	21171	2542.1	3171	2662.1
	75+75	75	21025	2527.5	3025	2647.5	75	21175	2542.5	3175	2662.5
	75+100	75	21003	2525.3	3003	2645.3	100	21174	2542.4	3174	2662.4
		100	21026	2527.6	3026	2647.6	75	21197	2544.7	3197	2664.7
High	50+100	50	21206	2545.6	3206	2665.6	100	21350	2560	3350	2680
		100	21251	2550.1	3251	2670.1	50	21395	2564.5	3395	2684.5
	75+50	75	21277	2552.7	3277	2672.7	50	21397	2564.7	3397	2684.7
	75+75	75	21225	2547.5	3225	2667.5	75	21375	2562.5	3375	2682.5
	75+100	75	21179	2542.9	3179	2662.9	100	21350	2560	3350	2680
		100	21201	2545.1	3201	2665.1	75	21372	2562.2	3372	2682.2
	100+100	100	21152	2540.2	3152	2660.2	100	21350	2560	3350	2680

Note 1: Carriers in increasing frequency order.



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Table 4.3.1.2.6A-1: Test frequencies for CA_38C

Range	CC-Combo / NRB_agg [RB]	CC1 Note1			CC2 Note1		
		BW [RB]	NUL/DL	fUL/DL [MHz]	BW [RB]	NUL/DL	fUL/DL [MHz]
Low	75+75	75	37825	2577.5	75	37975	2592.5
	100+100	100	37850	2580	100	38048	2599.8
Mid	75+75	75	37925	2587.5	75	38075	2602.5
	100+100	100	37901	2585.1	100	38099	2604.9
High	75+75	75	38025	2597.5	75	38175	2612.5
	100+100	100	37952	2590.2	100	38150	2610

Note 1: Carriers in increasing frequency order.

Table 4.3.1.2.9A-1: Test frequencies for CA_41C

Range	CC-Combo / NRB_agg [RB]	CC1 Note1			CC2 Note1		
		BW [RB]	NUL/DL	fUL/DL [MHz]	BW [RB]	NUL/DL	fUL/DL [MHz]
Low	25+100	25	39683	2499.3	100	39800	2511
		100	39750	2506	25	39867	2517.7
	50+75	50	39703	2501.3	75	39823	2513.3
		75	39725	2503.5	50	39845	2515.5
	50+100	50	39705	2501.5	100	39849	2515.9
		100	39750	2506	50	39894	2520.4
	75+75	75	39725	2503.5	75	39875	2518.5
		75	39728	2503.8	100	39899	2520.9
	75+100	100	39750	2506	75	39921	2523.1
		100	39750	2506	100	39948	2525.8
Mid	25+100	25	40528	2583.8	100	40645	2595.5
		100	40595	2590.5	25	40712	2602.2
	50+75	50	40549	2585.9	75	40669	2597.9
		75	40571	2588.1	50	40691	2600.1
	50+100	50	40526	2583.6	100	40670	2598.0
		100	40571	2588.1	50	40715	2602.5
	75+75	75	40545	2585.5	75	40695	2600.5
		75	40523	2583.3	100	40694	2600.4
	75+100	100	40546	2585.6	75	40717	2602.7
		100	40521	2583.1	100	40719	2602.9
High	25+100	25	41373	2668.3	100	41490	2680
		100	41440	2675	25	41557	2686.7
	50+75	50	41395	2670.5	75	41515	2682.5
		75	41417	2672.7	50	41537	2684.7
	50+100	50	41346	2665.6	100	41490	2680
		100	41391	2670.1	50	41535	2684.5
	75+75	75	41365	2667.5	75	41515	2682.5
		75	41319	2662.9	100	41490	2680
	75+100	100	41341	2665.1	75	41512	2682.2
		100	41292	2660.2	100	41490	2680

Note 1: Carriers in increasing frequency order.



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4 Description of Tests

4.1 Conducted Output Power

Measurement Procedure: FCC KDB 971168 D01 V03r01

The transmitter output was connected to a calibrated coaxial cable, attenuator and power meter, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the power reading. The tests were performed at three frequencies (low channel, middle channel and high channel) and on the highest power levels, which can be setup on the transmitters.

Remark: Reference test setup 1

4.2 Effective (Isotropic) Radiated Power of Transmitter

Measurement Procedure: FCC KDB 971168 D01 V03r01 ; C63.26 (2015)

Calculate power in dBm by the following formula:

ERP (dBm) = Conducted Power (dBm) + antenna gain (dBd)

EIRP(dBm) = Conducted Power (dBm) + antenna gain (dBi)

EIRP=ERP+2.15dB

4.3 Occupied Bandwidth

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 4.2

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel, middle channel and high channel). 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 percent of the selected span as is possible without being below 1 percent. 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 since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent 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.

Remark: Reference test setup 1



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Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

4.4 Band Edge at Antenna Terminals

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at two frequencies (low channel and high channel). in the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 100kHz or 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. The EUT emission bandwidth is measured as the width of the signal between two points, outside of which all emission are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyzer was set at thrice the resolution bandwidth. Detector Mode was set to peak or peak hold power.

Remark: Reference test setup 1

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW $\geq 1\%$ of the emission bandwidth
4. VBW $\geq 3 \times$ RBW
5. Detector = RMS
6. Number of sweep points $\geq 2 \times$ Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize





4.5 Spurious And Harmonic Emissions at Antenna Terminal

Measurement Procedure: FCC KDB 971168 D01 V03r01

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyzer, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel). The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

Remark: Reference test setup 1

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least $10 \times$ the fundamental frequency (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

4.6 Peak-Average Ratio

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.7.1

A peak to average ratio measurement is performed at the conducted port of the EUT. For WCDMA signals, the spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. For GSM signals, an average and a peak trace are used on a spectrum analyzer to determine the largest deviation between the average and the peak power of the EUT in a bandwidth greater than the emission bandwidth. The traces are generated with the spectrum analyzer set to zero span mode.

Remark: Reference test setup 1



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Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

4.7 Field Strength of Spurious Radiation

Measurement Procedure: FCC KDB 971168 D01 V03r01

Below 1GHz test procedure as below:

- 1). The EUT was powered ON and placed on a 80cm high table in the chamber. The antenna of the transmitter was extended to its maximum length.
- 2). The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 3). Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 4). The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
- 5). A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.
- 6). The output power into the substitution antenna was then measured.
- 7). Steps 5) and 6) were repeated with both antennas polarized.
- 8) Calculate power in dBm by the following formula:

$$\text{ERP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$

Where:

P_d is the dipole equivalent power, P_g is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to P_g [dBm] – cable loss [dB]. The calculated P_d levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of $43 + 10\log_{10}(\text{Power [Watts]})$.

Above 1GHz test procedure as below:

- 1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber



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2) Calculate power in dBm by the following formula:

$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

Where:

Pg is the generator output power into the substitution antenna.

3. Test the EUT in the lowest channel, the middle channel the Highest channel

4. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, Only the test worst case mode is recorded in the report.

5. Repeat above procedures until all frequencies measured was complete

Remark: Reference test setup 3

4.8 Frequency Stability / Temperature Variation

Measurement Procedure:

Frequency stability testing is performed in accordance with the guidelines of FCC KDB 971168 D01 V03r01; ANSI/C63.26 (2015)

. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency.

Time Period and Procedure:

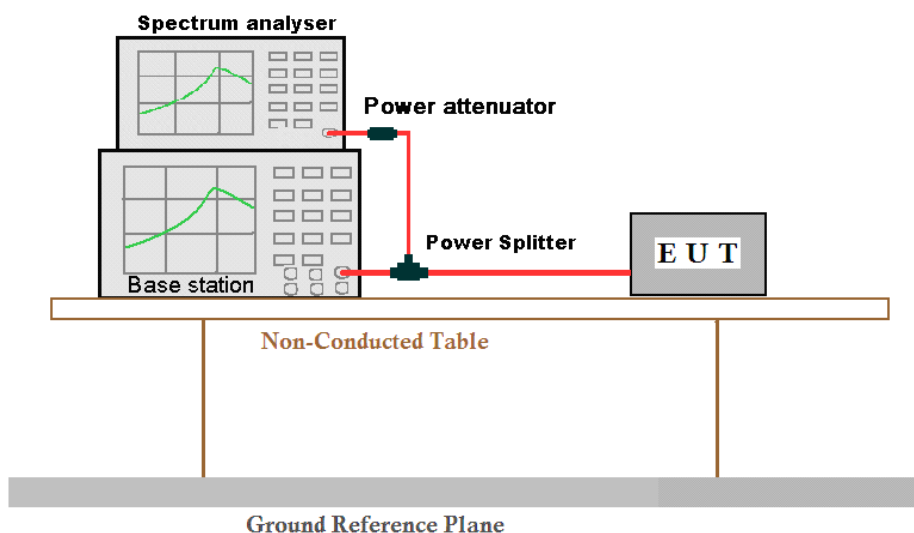
1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Remark: Reference test setup 4



4.9 Test Setups

4.9.1 Test Setup 1



4.9.2 Test Setup 2

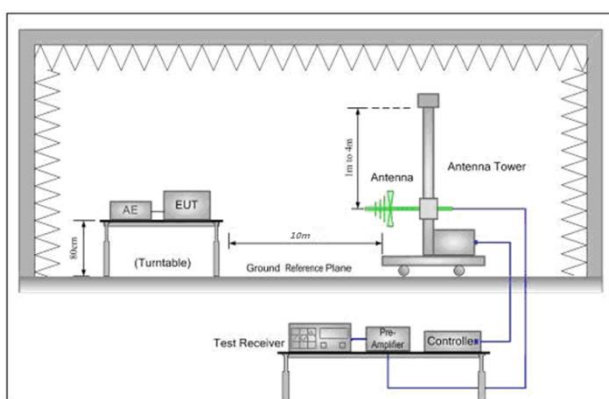


Figure 1. 30MHz to 1GHz

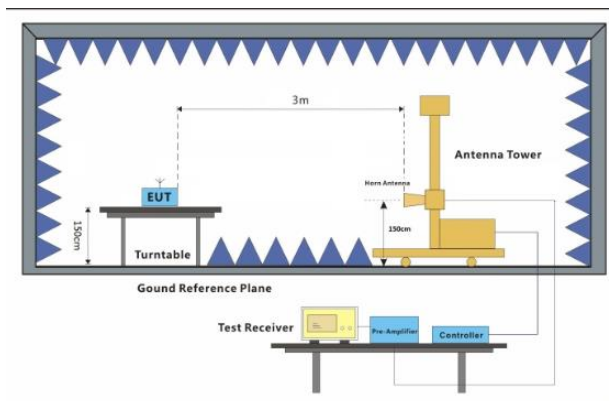


Figure 2. above 1GHz



4.9.3 Test Setup 3

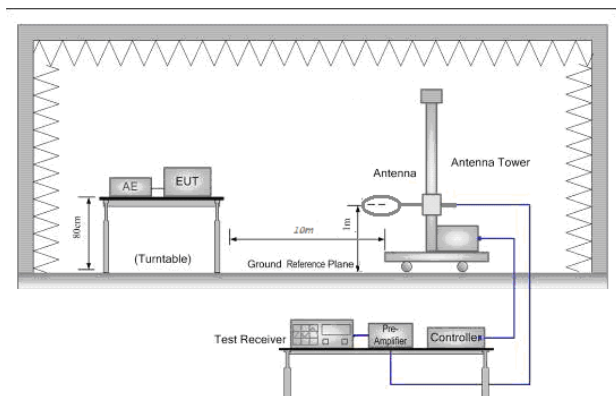


Figure 1. Below 30MHz

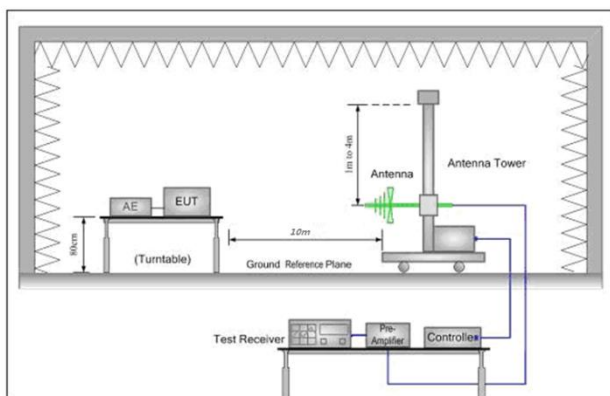


Figure 2. 30MHz to 1GHz

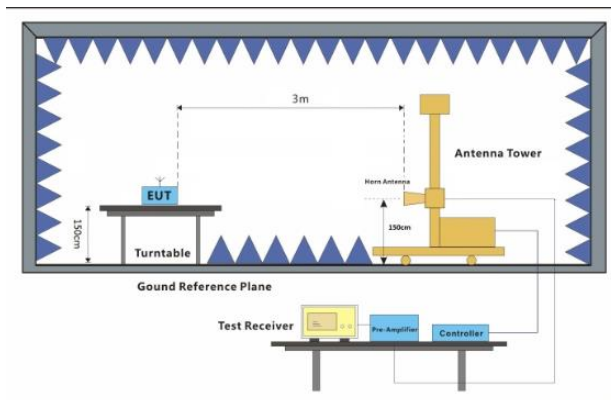
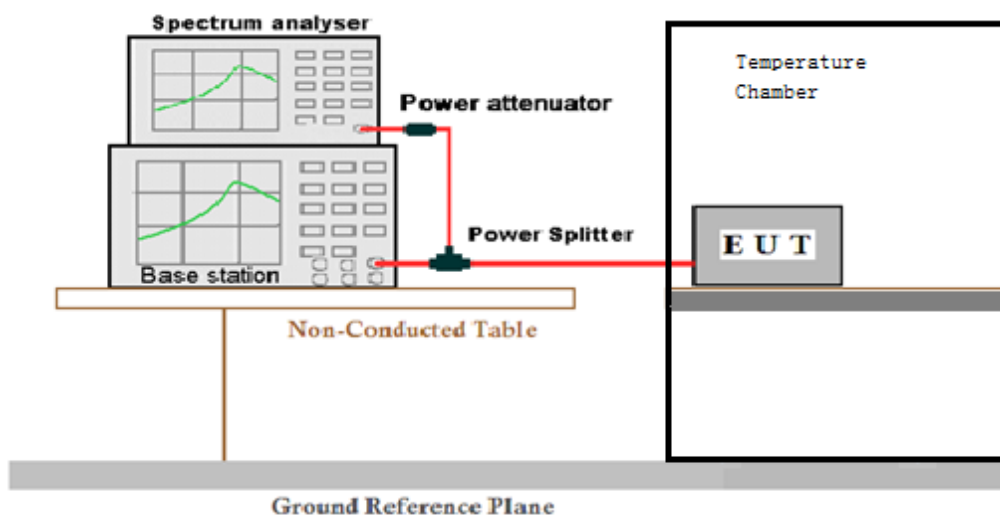


Figure 3. above 1GHz

4.9.4 Test Setup 4





4.10 Test Conditions

Test Case		Test Conditions	
Transmit Output Power Data	Average Power, Total	Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1; UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3
	Average Power, Spectral Density (if required)	Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1; UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3
Peak-to-Average Ratio (if required)		Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1; UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3
Modulation Characteristics		Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	M (M= middle channel)
		Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1; UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3
Bandwidth	Occupied Bandwidth	Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1; UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3
	Emission Bandwidth (if required)	Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1; UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3
Band Edges		Test Environment	Ambient Climate & Rated Voltage



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Compliance	Test Setup	Test Setup 1
	RF Channels (TX)	L, H (L= low channel, H= high channel)
	Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1; UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3
Spurious Emission at Antenna Terminals	Test Environment	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 1
	RF Channels (TX)	L,M, H (L= low channel, M= middle channel, H= high channel)
Field Strength of Spurious Radiation	Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1; UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3
	Test Environment	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 2
	Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1;UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3; Remark: If applicable, the EUT conf. that has maximum power density (based on the equivalent power level) is selected.
Frequency Stability	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
	Test Environment	(1) -30 °C to +50 °C with step 10 °C at Rated Voltage; (2) VL, VN and VH of Rated Voltage at Ambient Climate.
	Test Setup	Test Setup 4
	Test Mode	GSM/TM1;GSM/TM2;UMTS/TM1; UMTS/TM2; LTE/TM1;LTE/TM2;LTE/TM3



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5 Main Test Instruments

RE in Chamber					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018/3/13	2021/3/12
Spectrum Analyzer (20Hz-43GHz)	Rohde & Schwarz	FSU43	SEM004-08	2019/12/22	2020/12/21
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017/6/27	2020/6/26
Horn Antenna (800MHz-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018/4/13	2021/4/12
Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017/10/17	2020/10/16
Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2019/7/14	2020/7/14
Low Noise Amplifier (100MHz-18GHz)	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2019/7/14	2020/7/14
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	EMC2063	2019/9/20	2020/9/19
Pre-amplifier (26-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2019/12/22	2020/12/21
Band filter	N/A	N/A	N/A	N/A	N/A
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2019/6/12	2020/6/11
Wideband Radio Communication Tester	Anritsu	MT8821C	6201462742	2019/4/3	2020/4/3
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	W005-02	2019/10/22	2020/10/21
RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
Dual Output Mobile Communication DC Source	Agilent Technologies Inc	66311B	W009-09	2019/10/22	2020/10/21
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2019/4/9	2020/4/8
Coaxial Cable	SGS	N/A	SEM031-01	2019/6/12	2020/6/11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2019/10/22	2020/10/21
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	HTC-1	W006-17	2019/10/22	2020/10/21
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2019/10/22	2020/10/21
Wideband Radio Communication Tester	Anritsu	MT8821C	6201462742	2019/12/22	2020/12/21
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	W005-02	2019/10/22	2020/10/21



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Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM 001-02	2018/3/13	2021/3/12
Wideband Radio Communication Tester	Anristu	MT8821C	6201462742	2019/4/3	2020/4/3
Wideband Radio Communication Tester	Rohde & Schwarz	CM W500	W005-02	2019/10/22	2020/10/21
EXA Signal Analyzer (10Hz-26.5GHz)	Agilent Technologies Inc	N9010A	SEM 004-09	2019/3/13	2020/3/12
Spectrum Analyzer (20Hz-43GHz)	Rohde & Schwarz	FSU43	SEM 004-08	2019/12/22	2020/12/21
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM 003-01	2017/6/27	2020/6/26
Horn Antenna (800MHz-18GHz)	Rohde & Schwarz	HF907	SEM 003-07	2018/4/13	2021/4/12
Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	SEM 003-15	2017/10/17	2020/10/16
Amplifier (0.1-1300MHz)	HP	8447D	SEM 005-02	2019/7/25	2020/7/24
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM 004-11	2019/7/25	2020/7/24
Pre-amplifier (26-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM 005-08	2019/12/22	2020/12/21
Band filter	N/A	N/A	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM 026-01	2019/6/12	2020/6/11
Tunable Notch Filter WRCD1700/2000-0.2/40-10EEK	WAINRIGHT Instruments GMBH	N/A	N/A	N/A	N/A
Tunable Notch Filter WRCD800/960-0.2/40-10EEK	WAINRIGHT Instruments GMBH	N/A	N/A	N/A	N/A
HighPass Filter WHK12/15G-10SS	WAINRIGHT Instruments GMBH	N/A	N/A	N/A	N/A
HighPass Filter WHKX10-2700-3000-18000-40SS	WAINRIGHT Instruments GMBH	N/A	N/A	N/A	N/A
HighPass Filter WHKX7.0/26.5G-6SS	WAINRIGHT Instruments GMBH	N/A	N/A	N/A	N/A
Band Reject Filter WRCG 824/849-814/859-40/8SS	WAINRIGHT Instruments GMBH	N/A	N/A	N/A	N/A
Band Reject Filter WRCG 1850/1910-1835/1925-40/8SS	WAINRIGHT Instruments GMBH	N/A	N/A	N/A	N/A
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A

RSE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2019-06-27	2020-06-26
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2019-09-07	2020-09-06
Receiving antenna (30MHz-3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2019-10-13	2021-10-12
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2019-10-13	2021-10-12
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2019-10-13	2021-10-12
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR



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Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP00903040	XAW01-41-01	2019-11-18	2020-11-17
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2019-11-18	2020-11-17
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2019-12-03	2020-12-02
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2019-11-18	2020-11-17
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2019-12-06	2020-12-05
Measurement Software	Tonscend	TS+ RSE V3.0.0.2	XAW02-05-01	NCR	NCR
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2019-06-27	2020-06-26





6 Measurement Uncertainty

For a 95% confidence level ($k = 2$), the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

Lab A:

Test Item	Extended Uncertainty	Data
Transmit Output Power Data	Power [dBm]	$U = \pm 0.37 \text{ dB}$
Bandwidth	Magnitude [%]	$U = \pm 0.2\%$
Band Edge Compliance	Disturbance Power [dBm]	$U = \pm 2.0 \text{ dB}$
Spurious Emissions, Conducted	Disturbance Power [dBm]	$U = \pm 2.0 \text{ dB}$
Frequency Stability	Frequency Accuracy [ppm]	$U = \pm 0.24 \text{ ppm}$

Radiated Spurious Emissions Below 1GHz	$\pm 4.5\text{dB}$
Radiated Spurious Emissions Above 1GHz	$\pm 4.8\text{dB}$

Lab B:

No.	Item	Measurement Uncertainty
1	Radiated Emission	$\pm 4.8\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (1GHz to 6GHz)
		$\pm 4.5\text{dB}$ (6GHz to 18GHz)
		$\pm 5.02\text{dB}$ (Above 18GHz)

7 Appendixes

Appendix A	Photographs of Set-Up for ZR/2019/C0026
Appendix B.1	GSM850 & GSM1900
Appendix B.2	WCDMA Band II & IV & V
Appendix B.3	LTE Band 2
Appendix B.4	LTE Band 4
Appendix B.5	LTE Band 5
Appendix B.6	LTE Band 7
Appendix B.7	LTE Band 12
Appendix B.8	LTE Band 17
Appendix B.9	LTE Band 26 (814-824)
Appendix B.10	LTE Band 26 (824-849)
Appendix B.11	LTE Band 38
Appendix B.12	LTE Band 41
Appendix B.13	LTE Band 66
Appendix B.14	LTE CA_7C
Appendix B.15	LTE CA_38C



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Appendix B.16	LTE CA_41C
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The End

