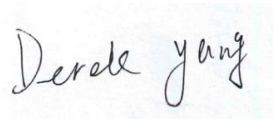
FCC TEST REPORT

Application No:	ZR/2021/30022
Applicant:	HMD Global Oy
Address of Applicant	Bertel Jungin aukio 9, 02600 Espoo, Finland
Manufacturer:	HMD Global Oy
Address of Manufacturer:	Bertel Jungin aukio 9, 02600 Espoo, Finland
EUT Description:	Smart Phone
Model No.:	TA-1371
Trade Mark:	NOKIA
FCC ID:	2AJOTTA-1371
Standards:	47 CFR Part 2 47 CFR Part 24 47 CFR Part 27
Test Method:	FCC KDB 971168 D01 Power Meas License Digital Systems V03r01 C63.26 (2015)
Date of Receipt:	2021/4/2
Date of Test:	2021/4/30 to 2021/6/30
Date of Issue:	2021/6/30
Test Result:	**PASS ***

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

Authorized Signature:

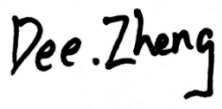


Derek Yang
Wireless Laboratory Manager

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2021/6/30		Original

Authorized for issue by:		
Prepared By		 **(Dee Zheng) / Engineer**
Checked By		 **(Jim Huang) / Reviewer**

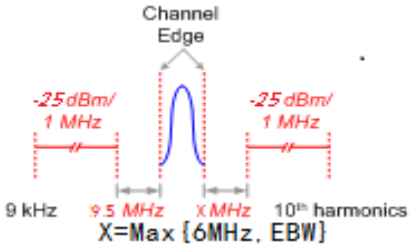
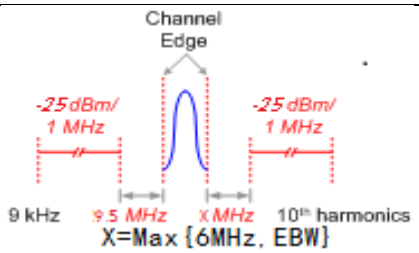
Content

2 Test Summary

2.1 NR Band N5(ENDC DC_66A-N5A/ DC_2A-N5A)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §22.913	FCC: ERP ≤ 7 W	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	---	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, §22.917	≤ -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: ≤ -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: ≤ -13 dBm/100 kHz.	Section 7 of Appendix B	Pass	B
Frequency Stability	§2.1055, §22.355	≤ ±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”.					

2.2 NR Band N38(ENDC DC_12A_N38A / DC_5A_N38A/ DC_66A_N38A) / NR Band N41(ENDC DC_12A_N41A/ DC_66A_N41A)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	EIRP ≤ 2W	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 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.	Section 5 of Appendix B	Pass	A/B
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”.					

2.4 NR Band N2(ENDC DC_12A-N2A/ DC_66A-N2A/ DC_5A-N2A/ DC_13A-N2A/ DC_14A-N2A)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232	EIRP ≤ 2 W	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	§2.1046, §24.232	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, §24.238	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Section 5 of Appendix B	Pass	B
Spurious Emission at Antenna Terminals	§2.1051, §24.238	≤ -13 dBm/1 MHz, 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, §24.238	≤ -13 dBm/1 MHz.	Section 7 of Appendix B	Pass	B
Frequency Stability	§2.1055, §24.235	≤ ±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”.					

2.5 NR Band N66(ENDC DC_2A-N66A/ DC_5A-N66A/ DC_12A-N66A/ DC_14A-N66A)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(d)	EIRP ≤ 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 10th 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	≤ ±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”.					

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

2.6 NR Band N25(ENDC DC_12A-N25A/ DC_66A-N25A)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232	EIRP ≤ 2 W	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	§2.1046, §24.232	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, §24.238	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Section 5 of Appendix B	Pass	B
Spurious Emission at Antenna Terminals	§2.1051, §24.238	≤ -13 dBm/1 MHz, 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, §24.238	≤ -13 dBm/1 MHz.	Section 7 of Appendix B	Pass	B
Frequency Stability	§2.1055, §24.235	≤ ±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”.					

2.7 NR Band N71(ENDC DC_2A-N71A/DC_66A-N71A)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(c)	EIRP ≤ 3 W	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	§2.1046,	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(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)	≤ -13 dBm/1 MHz, 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, §27.53(g)	≤ -13 dBm/1 MHz.	Section 7 of Appendix B	Pass	B
Frequency Stability	§2.1055, §27.54	within the authorized bands of operation.	Section 8 of Appendix B	Pass	A
Remark: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.					

2.8 NR Band N77 (ENDC DC_2A-N77A/ DC_12A-N77A/ DC_14A-N77A/ DC_66A-N77A)/ NR Band N78 (ENDC DC_2A-N78A/ DC_66A-N78A/ DC_12A-N78A)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(j)	EIRP ≤ 1W	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(l2)	(2) For mobile operations in the 3700-3980 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed -13 dBm/MHz. Compliance with this paragraph (l)(2) is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be either one percent of the emission bandwidth of the fundamental emission of the transmitter or 350 kHz. In the bands between 1 and 5 MHz removed from the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be 500 kHz.	Section 5 of Appendix B	Pass	A
Spurious Emission at Antenna Terminals	§2.1051, §27.53(l)	not exceed -13 dBm/MHz.	Section 6 of Appendix B	Pass	A
Field Strength of Spurious	§2.1053, §27.53(l)	not exceed -13 dBm/MHz	Section 7 of Appendix B	Pass	B

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Radiation					
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”.					

Remark1：
Because the product is a multi-TX antenna, the antenna with the max conducted power is selected for conducted testing，EIRP and RSE require all antennas to be tested.
Remark2：All test were performed by Lab A and 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:	HMD Global Oy
Address of Applicant:	Bertel Jungin aukio 9, 02600 Espoo, Finland
Manufacturer:	HMD Global Oy
Address of Manufacturer:	Bertel Jungin aukio 9, 02600 Espoo, Finland

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:	Dee Zheng,Swing Hu,Habit Zeng

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:	Leah Chen,Ken Liu,Andy Yao

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

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)

SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

FCC-Designation Number: CN1271.

3.4 General Description of EUT

EUT Description::	Smart Phone
Model No.:	TA-1371
Trade Mark:	NOKIA
Hardware Version:	V1.00
Software Version:	00WW_1_01A
Sample Type:	☒ Portable Device, ☐Module
Antenna Type:	☐ External, ☒ Integrated
Antenna Gain:	N2: -2.80dBi(ANT0); -2.06dBi(ANT1); N5: -2.22dBi(ANT0); -2.65dBi(ANT1); N25: -2.42dBi(ANT0); -2.45dBi(ANT1); N38:-2.92dBi(ANT0); -2.75dBi(ANT1); N41: -3.12dBi(ANT0); -2.15dBi(ANT1); N66: -4.22dBi(ANT0); -2.35dBi(ANT1); N71: -4.22dBi(ANT0); -4.89dBi(ANT1); N77: -1.27dBi(ANT2); -1.81dBi(ANT3); N78: -1.27dBi(ANT2); -1.81dBi(ANT3);

Remark: Conduction Power & EIRP of all antennas are tested, and only the worst data is presented

3.5 Test Mode

Test Mode	Test Modes Description
NR/TM1	NR system, DFT-s-BPSK modulation
NR/TM2	NR system, DFT-s-QPSK modulation
NR/TM3	NR system, DFT-s-16QAM modulation
NR/TM4	NR system, DFT-s-64QAM modulation
NR/TM5	NR system, DFT-s-256QAM modulation
NR/TM6	NR system, CP-QPSK modulation
NR/TM7	NR system, CP-16QAM modulation
NR/TM8	NR system, CP-64QAM modulation
NR/TM9	NR system, CP-256QAM 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	49%	
Atmospheric Pressure:	102.46 KPa	
Temperature	NT	25 °C
Voltage:	LV	3.5V
	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	☒ SA ☒ NSA		
Supported Frequency Range	Band	TX	RX
	NR Band N2	1850 to 1910 MHz	1930 to 1990 MHz
	NR Band N5	824 to 849 MHz	869 to 894 MHz
	NR Band N25	1850 to 1915MHz	1930 to 1995 MHz
	NR Band N38	2570 to 2620 MHz	2570 to 2620 MHz
	NR Band N41	2496 to 2690 MHz	2496 to 2690 MHz
	NR Band N66	1710 to 1780 MHz	2110 to 2180 MHz
	NR Band N71	663 to 698 MHz	617 to 652 MHz
	NR Band N77	3700 to 3980 MHz	3700 to 3980 MHz
	NR Band N78	3700 to 3800 MHz	3700 to 3800 MHz
Supported Channel Bandwidth	NR Band N2	SCK 15k: ☒5 MHz; ☒10 MHz; ☒15 MHz; ☒20 MHz;	
	NR Band N5	SCK 15k: ☒5 MHz; ☒10 MHz; ☒15 MHz; ☒20 MHz;	
	NR Band N25	SCK 15k: ☒5 MHz; ☒10 MHz; ☒15 MHz; ☒20 MHz;	
	NR Band N38	SCK 30k: ☒10 MHz; ☒20 MHz;	
	NR Band N41	SCK 30k: ☒10 MHz; ☒20 MHz; ☒40 MHz; ☒50 MHz; ☒60 MHz; ☒80 MHz; ☒90 MHz; ☒100 MHz	
	NR Band N66	SCK 15k: ☒5 MHz; ☒10 MHz; ☒15 MHz; ☒20 MHz;	
	NR Band N71	SCK 15k: ☒5 MHz; ☒10 MHz; ☒15 MHz; ☒20 MHz;	
	NR Band N77	SCK 30k: ☒10 MHz; ☒20 MHz; ☒30 MHz; ☒40 MHz; ☒50 MHz; ☒60 MHz; ☒80 MHz; ☒90 MHz; ☒100 MHz	
	NR Band N78	SCK 30k: ☒10 MHz; ☒20 MHz; ☒30 MHz; ☒40 MHz; ☒50 MHz; ☒60 MHz; ☒80 MHz; ☒90 MHz; ☒100 MHz	
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.)	NR Band N2	SCK 15k: 4M46G7D;4M48W7D; 8M89G7D;8M91W7D; 13M4G7D;14M1W7D 17M8G7D;17M8W7D	
	NR Band N5	SCK 15k: 4M48G7D;4M45W7D; 8M91G7D;8M92W7D; 13M4G7D;14M1W7D 17M8G7D;18M9W7D	
	NR Band N25	SCK 15k: 4M47G7D;4M47W7D;	

		8M92G7D;9M31W7D; 13M4G7D;13M4W7D 17M9G7D;17M8W7D
	NR Band N38	SCK 15k: 8M58G7D;8M61W7D; 17M8G7D;18M3W7D
	NR Band N41	SCK 30k: 8M56G7D;8M59W7D; 17M9G7D;18M2W7D 35M7G7D;37M9W7D 45M8G7D;47M5W7D 58M0G7D;57M7W7D 64M5G7D;67M5W7D 77M1G7D;77M3W7D 85M8G7D;87M5W7D 96M5G7D;97M6W7D
	NR Band N66	SCK 15k: 4M48G7D;4M48W7D; 8M90G7D;8M94W7D; 13M4G7D;13M4W7D 17M9G7D;19M0W7D
	NR Band N71	SCK 15k: 4M47G7D;4M47W7D; 8M92G7D;8M93W7D; 13M4G7D;14M1W7D 17M9G7D;17M9W7D
	NR Band N77	SCK 30k: 8M57G7D;8M58W7D; 17M7G7D;18M1W7D 26M7G7D;26M8W7D 35M7G7D;37M9W7D 45M8G7D;47M7W7D 57M9G7D;57M7W7D 77M1G7D;77M1W7D 86M8G7D;87M3W7D 96M4G7D;96M1W7D
	NR Band N78	SCK 30k: 8M57G7D;8M55W7D; 17M9G7D;18M2W7D 26M8G7D;27M9W7D 35M6G7D;37M8W7D 45M8G7D;45M7W7D 58M0G7D;57M9W7D 77M2G7D;77M5W7D 85M9G7D;87M5W7D 96M6G7D;97M9W7D

3.8 Test Frequencies

3.8.1 Reference test frequencies for NR operating band n2

3.8.1.1 Test frequencies for NR operating band n2 and SCS 15 kHz

CBW [MHz]	*carrier Bandwidth* [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	*absolute FrequencyPoint A* [ARFCN]	*offsetToCarrier* [Carrier PRBs]	SS block SCS [kHz]	GSCN	*absolute FrequencySSB* [ARFCN]
5	25	Downlink	Low	1932.5	386500	1930.25	386050	0	15	4829	386410
			Mid	1960	392000	1939.39	387878	102		4900	391970
			High	1987.5	397500	1894.53	378906	504		4968	397470
		Uplink	Low	1852.5	370500	1850.25	370050	0	-	-	-
			Mid	1880	376000	1787.03	357406	504		-	-
			High	1907.5	381500	1904.17	380834	6		-	-
10	52	Downlink	Low	1935	387000	1930.32	386064	0	15	4830	386430
			Mid	1960	392000	1936.96	387392	102		4894	391490
			High	1985	397000	1889.6	377920	504		4955	396490
		Uplink	Low	1855	371000	1850.32	370064	0	-	-	-
			Mid	1880	376000	1784.6	356920	504		-	-
			High	1905	381000	1899.24	379848	6		-	-
15	79	Downlink	Low	1937.5	387500	1930.39	386078	0	15	4831	386450
			Mid	1960	392000	1934.53	386906	102		4888	391010
			High	1982.5	396500	1884.67	376934	504		4945	395570
		Uplink	Low	1857.5	371500	1850.39	370078	0	-	-	-
			Mid	1880	376000	1782.17	356434	504		-	-
			High	1902.5	380500	1894.31	378862	6		-	-
20	106	Downlink	Low	1940	388000	1930.46	386092	0	15	4832	386650
			Mid	1960	392000	1932.1	386420	102		4882	390530
			High	1980	396000	1879.74	375948	504		4932	394590
		Uplink	Low	1860	372000	1850.46	370092	0	-	-	-
			Mid	1880	376000	1779.74	355948	504		-	-
			High	1900	380000	1889.38	377876	6		-	-

3.8.2 Reference test frequencies for NR operating band n5

3.8.2.1 Test frequencies for NR operating band n5 and SCS 15 kHz

Band width [MHz]	*carrier Bandwidth* [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	*absoluteFrequency PointA* [ARFCN]	*offsetToCarrier* [PRBs]	SS block SCS [kHz]	GSCN	*absoluteFrequencySSB* [ARFCN]
5	25	Downlink	Low	871.5	174300	869.25	173850	0	15	2178	174270
			Mid	881.5	176300	860.89	172178	102		2203	176210
			High	891.5	178300	798.53	159706	504		2228	178330
		Uplink	Low	826.5	165300	824.25	164850	0	-	-	-
			Mid	836.5	167300	743.53	148706	504		-	-
			High	846.5	169300	843.17	168634	6		-	-
10	52	Downlink	Low	874	174800	869.32	173864	0	15	2179	174290
			Mid	881.5	176300	858.46	171692	102		2197	175730
			High	889	177800	793.6	158720	504		2218	177410
		Uplink	Low	829	165800	824.32	164864	0	-	-	-
			Mid	836.5	167300	741.1	148220	504		-	-
			High	844	168800	838.24	167648	6		-	-
15	79	Downlink	Low	876.5	175300	869.39	173878	0	15	2177	174250
			Mid	881.5	176300	856.03	171206	102		2191	175250
			High	886.5	177300	788.67	157734	504		2205	176430
		Uplink	Low	831.5	166300	824.39	164878	0	-	-	-
			Mid	836.5	167300	738.67	147734	504		-	-
			High	841.5	168300	833.31	166662	6		-	-
20	106	Downlink	Low	879	175800	869.46	173892	0	15	2178	174270
			Mid	881.5	176300	853.6	170720	102		2185	174770
			High	884	176800	783.74	156748	504		2192	175450
		Uplink	Low	834	166800	824.46	164892	0	-	-	-
			Mid	836.5	167300	736.24	147248	504		-	-
			High	839	167800	828.38	165676	6		-	-

3.8.3 Reference test frequencies for NR operating band n38

3.8.3.1 Test frequencies for NR operating band n38 and SCS 30 kHz

Band width [MHz]	*carrier Bandwidth* [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	*absoluteFrequency PointA* [ARFCN]	*offsetToCarrier* [PRBs]	SS block SCS [kHz]	GSCN	*absoluteFrequencySSB* [ARFCN]
20	51	Downlink & Uplink	Low	2580	516000	2570.82	514164	0	30	6438	515070
			Mid	2595	519000	2549.1	509820	102		6474	517950
			High	2610	522000	2419.38	483876	504		6513	521070

3.8.4 Reference test frequencies for NR operating band n25

3.8.4.1 Test frequencies for NR operating band n25 and SCS 15 kHz

CBW [MHz]	*carrier Bandwidth* [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	*absolute FrequencyPoint A* [ARFCN]	*offsetToCarrier* [Carrier PRBs]	SS block SCS [kHz]	GSCN	*absoluteFrequency SSB* [ARFCN]
5	25	Downlink	Low	1932.5	386500	1930.25	386050	0	15	4829	386410
			Mid	1962.5	392500	1941.89	388378	102		4904	392410
			High	1992.5	398500	1899.53	379906	504		4979	398410
		Uplink	Low	1852.5	370500	1850.25	370050	0	-	-	-
			Mid	1882.5	376500	1789.53	357906	504		-	-
			High	1912.5	382500	1909.17	381834	6		-	-
10	52	Downlink	Low	1935	387000	1930.32	386064	0	15	4830	386430
			Mid	1962.5	392500	1939.46	387892	102		4898	391930
			High	1990	398000	1894.6	378920	504		4969	397490
		Uplink	Low	1855	371000	1850.32	370064	0	-	-	-
			Mid	1882.5	376500	1787.1	357420	504		-	-
			High	1910	382000	1904.24	380848	6		-	-
15	79	Downlink	Low	1937.5	387500	1930.39	386078	0	15	4831	386450
			Mid	1962.5	392500	1937.03	387406	102		4892	391450
			High	1987.5	397500	1889.67	377934	504		4956	396510
		Uplink	Low	1857.5	371500	1850.39	370078	0	-	-	-
			Mid	1882.5	376500	1784.67	356934	504		-	-
			High	1907.5	381500	1899.31	379862	6		-	-
20	106	Downlink	Low	1940	388000	1930.46	386092	0	15	4832	386650
			Mid	1962.5	392500	1934.6	386920	102		4886	390970
			High	1985	397000	1884.74	376948	504		4943	395530
		Uplink	Low	1860	372000	1850.46	370092	0	-	-	-
			Mid	1882.5	376500	1782.24	356448	504		-	-
			High	1905	381000	1894.38	378876	6		-	-

3.8.5 Reference test frequencies for NR operating band n41

3.8.5.1 Test frequencies for NR operating band n41 and SCS 30 kHz

Band width [MHz]	*carrier Bandwidth* [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	*absoluteFrequency PointA* [ARFCN]	*offsetToCarrier* [PRBs]	SS block SCS [kHz]	GSCN	*absoluteFrequencySSB* [ARFCN]
10	24	Downlink & Uplink	Low	2501.01	500202	2496.69	499338	0	30	6252	500190
			Mid	2592.99	518598	2551.95	510390	102		6483	518670
			High	2685	537000	2499.24	499848	504		6711	536910
15	38	Downlink & Uplink	Low	2503.5	500700	2496.66	499332	0	30	6252	500190
			Mid	2592.99	518598	2549.43	509886	102		6474	517950
			High	2682.48	536496	2494.2	498840	504		6699	535950
20	51	Downlink & Uplink	Low	2506.02	501204	2496.84	499368	0	30	6252	500190
			Mid	2592.99	518598	2547.09	509418	102		6471	517710
			High	2670	534000	2469.48	493896	504		6636	530910
40	106	Downlink & Uplink	Low	2516.01	503202	2496.93	499386	0	30	6252	500190
			Mid	2592.99	518598	2537.19	507438	102		6444	515550
			High	2670	534000	2469.48	493896	504		6636	530910
50	133	Downlink & Uplink	Low	2521.02	504204	2497.08	499416	0	30	6252	500190
			Mid	2592.99	518598	2532.33	506466	102		6432	514590
			High	2664.99	532998	2459.61	491922	504		6612	528990
60	162	Downlink & Uplink	Low	2526	505200	2496.84	499368	0	30	6252	500190
			Mid	2592.99	518598	2527.11	505422	102		6420	513630
			High	2659.98	531996	2449.38	489876	504		6588	527070
80	217	Downlink & Uplink	Low	2536.02	507204	2496.96	499392	0	30	6252	500190
			Mid	2592.99	518598	2517.21	503442	102		6396	511710
			High	2649.99	529998	2429.49	485898	504		6537	522990
90	245	Downlink & Uplink	Low	2541	508200	2496.9	499380	0	30	6252	500190
			Mid	2592.99	518598	2512.17	502434	102		6381	510510
			High	2644.98	528996	2419.44	483888	504		6513	521070
100	273	Downlink & Uplink	Low	2546.01	509202	2496.87	499374	0	30	6252	500190
			Mid	2592.99	518598	2507.13	501426	102		6369	509550
			High	2640	528000	2409.42	481884	504		6486	518910

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中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

3.8.6 Reference test frequencies for NR operating band n66

3.8.6.1 Test frequencies for NR operating band n66 and SCS 15 kHz

Band width [MHz]	*carrier Bandwidth* [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	*absoluteFrequency PointA* [ARFCN]	*offsetToCarrier* [PRBs]	SS block SCS [kHz]	GSCN	*absoluteFrequencySSB* [ARFCN]
5	25	Downlink	Low	2112.5	422500	2110.25	422050	0	15	5279	422410
			Mid	2145	429000	2124.39	424878	102		5361	428910
			High	2177.5	435500	2084.53	416906	504		5443	435410
		Uplink	Low	1712.5	342500	1710.25	342050	0	-	-	-
			Mid	1745	349000	1652.03	330406	504		-	-
			High	1777.5	355500	1774.17	354834	6		-	-
10	52	Downlink	Low	2115	423000	2110.32	422064	0	15	5280	422430
			Mid	2145	429000	2121.96	424392	102		5355	428430
			High	2175	435000	2079.6	415920	504		5430	434430
		Uplink	Low	1715	343000	1710.32	342064	0	-	-	-
			Mid	1745	349000	1649.6	329920	504		-	-
			High	1775	355000	1769.24	353848	6		-	-
15	79	Downlink	Low	2117.5	423500	2110.39	422078	0	15	5281	422450
			Mid	2145	429000	2119.53	423906	102		5349	427950
			High	2172.5	434500	2074.67	414934	504		5417	433450
		Uplink	Low	1717.5	343500	1710.39	342078	0	-	-	-
			Mid	1745	349000	1647.17	329434	504		-	-
			High	1772.5	354500	1764.31	352862	6		-	-
20	106	Downlink	Low	2120	424000	2110.46	422092	0	15	5282	422650
			Mid	2145	429000	2117.1	423420	102		5343	427470
			High	2170	434000	2069.74	413948	504		5407	432530
		Uplink	Low	1720	344000	1710.46	342092	0	-	-	-
			Mid	1745	349000	1644.74	328948	504		-	-
			High	1770	354000	1759.38	351876	6			
30	160	Downlink	Low	2125	425000	2110.6	422120	0	15	5284	422690
			Mid	2145	429000	2112.24	422448	102		5331	426510
			High	2165	433000	2059.88	411976	504		5381	430570
		Uplink	Low	1725	345000	1710.6	342120	0	-	-	-
			Mid	1745	349000	1639.88	327976	504		-	-
			High	1765	353000	1749.52	349904	6		-	-
40	216	Downlink	Low	2130	426000	2110.56	422112	0	15	5283	422670
			Mid	2145	429000	2107.2	421440	102		5319	425550
			High	2160	432000	2049.84	409968	504		5358	428670
		Uplink	Low	1730	346000	1710.56	342112	0	-	-	-
			Mid	1745	349000	1634.84	326968	504		-	-
			High	1760	352000	1739.48	347896	6		-	-

3.8.7 Reference test frequencies for NR operating band n71

3.8.7.1 Test frequencies for NR operating band n71 and SCS 30 kHz

CBW [MHz]	*carrier Bandwidth* [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	*absolute FrequencyPoint A* [ARFCN]	*offsetToCarrier* [Carrier PRBs]	SS block SCS [kHz]	GSCN	*absolute FrequencySSB* [ARFCN]
5	25	Downlink	Low	619.5	123900	617.25	123450	0	15	1548	123870
			Mid	634.5	126900	613.89	122778	102		1587	126990
			High	649.5	129900	556.53	111306	504		1623	129870
		Uplink	Low	665.5	133100	663.25	132650	0	-	-	-
			Mid	680.5	136100	587.53	117506	504		-	-
			High	695.5	139100	692.17	138434	6		-	-
10	52	Downlink	Low	622	124400	617.32	123464	0	15	1549	123890
			Mid	634.5	126900	611.46	122292	102		1581	126510
			High	647	129400	551.6	110320	504		1610	128890
		Uplink	Low	668	133600	663.32	132664	0	-	-	-
			Mid	680.5	136100	585.1	117020	504		-	-
			High	693	138600	687.24	137448	6		-	-
15	79	Downlink	Low	624.5	124900	617.39	123478	0	15	1547	123850
			Mid	634.5	126900	609.03	121806	102		1575	126030
			High	644.5	128900	546.67	109334	504		1600	127970
		Uplink	Low	670.5	134100	663.39	132678	0	-	-	-
			Mid	680.5	136100	582.67	116534	504		-	-
			High	690.5	138100	682.31	136462	6		-	-
20	106	Downlink	Low	627	125400	617.46	123492	0	15	1548	123870
			Mid	634.5	126900	606.6	121320	102		1569	125550
			High	642	128400	541.74	108348	504		1587	126990
		Uplink	Low	673	134600	663.46	132692	0	-	-	-
			Mid	680.5	136100	580.24	116048	504		-	-
			High	688	137600	677.38	135476	6		-	-

3.8.8 Reference test frequencies for NR operating band n77

3.8.8.1 Test frequencies for NR operating band n77 and SCS 30 kHz

Band width [MHz]	carrier Bandwidth [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	absoluteFrequency PointA [ARFCN]	offsetToCarrier [Carrier PRBs]	SS block SCS [kHz]	GSCN	absoluteFrequencySSB [ARFCN]
20	51	Downlink & Uplink	Low	3710.01	647334	\	\	0	30	\	\
			Mid	3840	656000	\	\	102		\	\
			High	3969.99	664666	\	\	504		\	\
30	78	Downlink & Uplink	Low	3715.02	647668	\	\	0	30	\	\
			Mid	3840	656000	\	\	102		\	\
			High	3964.98	664332	\	\	504		\	\
40	106	Downlink & Uplink	Low	3720	648000	\	\	0	30	\	\
			Mid	3840	656000	\	\	102		\	\
			High	3960	664000	\	\	504		\	\
50	133	Downlink & Uplink	Low	3725.01	648334	\	\	0	30	\	\
			Mid	3840	656000	\	\	102		\	\
			High	3954.99	663666	\	\	504		\	\
60	162	Downlink & Uplink	Low	3730.02	648668	\	\	0	30	\	\
			Mid	3840	656000	\	\	102		\	\
			High	3949.98	663332	\	\	504		\	\
70	189	Downlink & Uplink	Low	3735	649000	\	\	0	30	\	\
			Mid	3840	656000	\	\	102		\	\
			High	3945	663000	\	\	504		\	\
80	217	Downlink & Uplink	Low	3740.01	649334	\	\	0	30	\	\
			Mid	3840	656000	\	\	102		\	\
			High	3939.99	662666	\	\	504		\	\
90	245	Downlink & Uplink	Low	3745.02	649668	\	\	0	30	\	\
			Mid	3840	656000	\	\	102		\	\
			High	3934.98	662332	\	\	504		\	\
100	273	Downlink & Uplink	Low	3750	650000	\	\	0	30	\	\
			Mid	3840	656000	\	\	102		\	\
			High	3930	662000	\	\	504		\	\

3.8.1 Reference test frequencies for NR operating band n78

3.8.1.1 Test frequencies for NR operating band n78 and SCS 30 kHz

Band width [MHz]	carrier Bandwidth [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	absoluteFrequency PointA [ARFCN]	offsetToCarrier [Carrier PRBs]	SS block SCS [kHz]	GSCN	absoluteFrequencySSB [ARFCN]
10	24	Downlink & Uplink	Low	3705	647000	\	\	0	30	\	\
			Mid	3750	650000	\	\	102		\	\
			High	3795	653000	\	\	504		\	\
15	38	Downlink & Uplink	Low	3707.52	647168	\	\	0	30	\	\
			Mid	3750	650000	\	\	102		\	\
			High	3792.48	652832	\	\	504		\	\
20	51	Downlink & Uplink	Low	3710.01	647334	\	\	0	30	\	\
			Mid	3750	650000	\	\	102		\	\
			High	3789.99	652666	\	\	504		\	\
40	106	Downlink & Uplink	Low	3720	648000	\	\	0	30	\	\
			Mid	3750	650000	\	\	102		\	\
			High	3780	652000	\	\	504		\	\
50	133	Downlink & Uplink	Low	3725.01	648334	\	\	0	30	\	\
			Mid	3750	650000	\	\	102		\	\
			High	3774.99	651666	\	\	504		\	\
60	162	Downlink & Uplink	Low	3730.02	648668	\	\	0	30	\	\
			Mid	3750	650000	\	\	102		\	\
			High	3769.98	651332	\	\	504		\	\
80	217	Downlink & Uplink	Low	3740.01	649334	\	\	0	30	\	\
			Mid	3750	650000	\	\	102		\	\
			High	3759.99	650666	\	\	504		\	\
90	245	Downlink & Uplink	Low	3745.02	649668	\	\	0	30	\	\
			Mid	3750	650000	\	\	102		\	\
			High	3754.98	650332	\	\	504		\	\
100	273	Downlink & Uplink	Low	\	\	\	\	\	30	\	\
			Mid	3750	650000	\	\	102		\	\
			High	\	\	\	\	\		\	\

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

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 ≥ 3 x 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 ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x 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 * 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

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:

ERP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd)

Where:

Pd is the dipole equivalent power, Pg 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 Pg [dBm] – cable loss [dB]. The calculated Pd levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of 43 + 10log10(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

2) Calculate power in dBm by the following formula:

EIRP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBi)

EIRP=ERP+2.15dB

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

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

2) Scan from 9kHz to 40GHz,The disturbance between 9KHz to 30MHz and 18GHz to 40GHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported .

3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

4) All modes have been tested, but only the worst case data displayed in this report.

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 ±0.00025% (±2.5 ppm) of the center frequency.

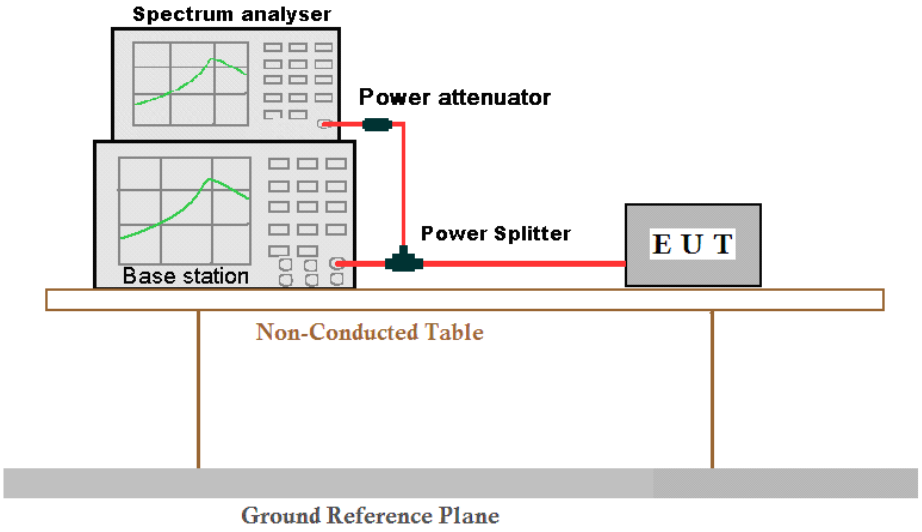
Time Period and Procedure:

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

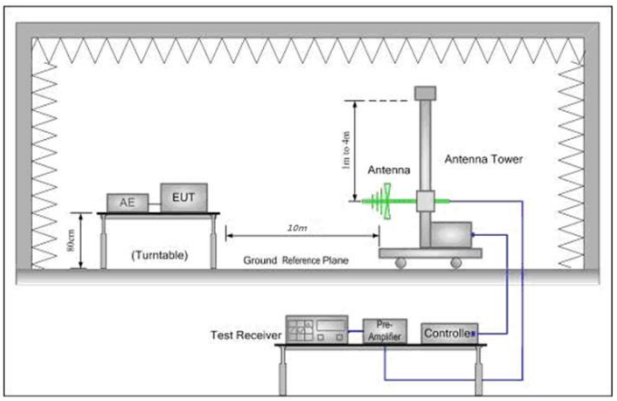


Figure 1. 30MHz to 1GHz

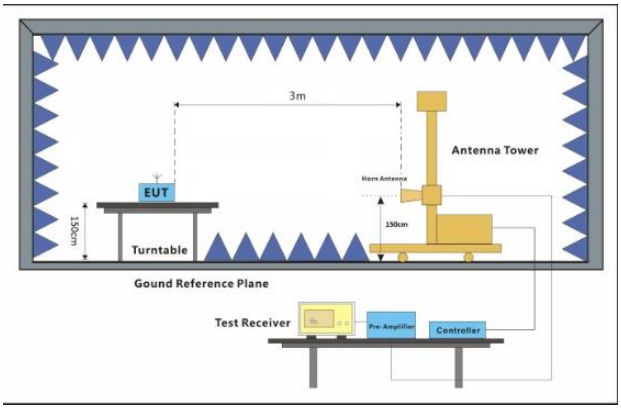


Figure 2. above 1GHz

4.9.3 Test Setup 3

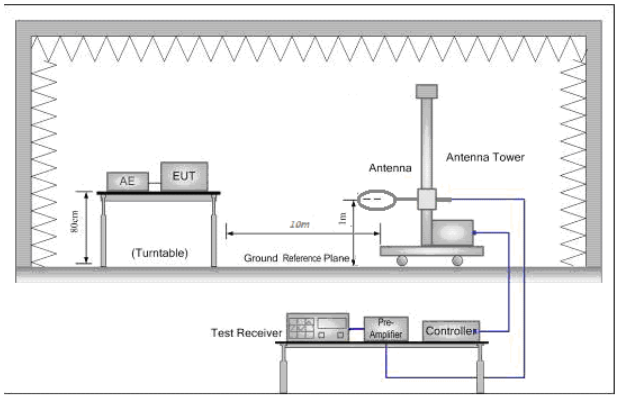


Figure 1. Below 30MHz

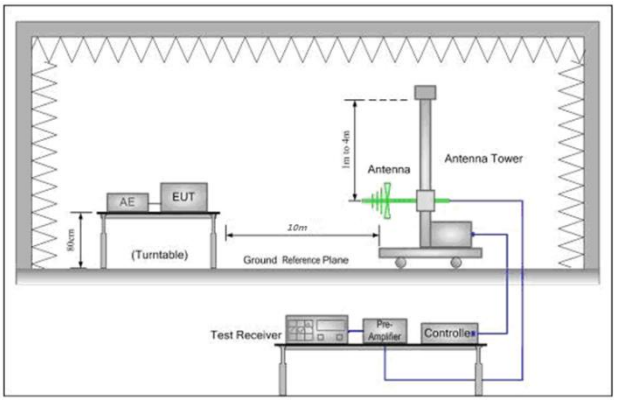


Figure 2. 30MHz to 1GHz

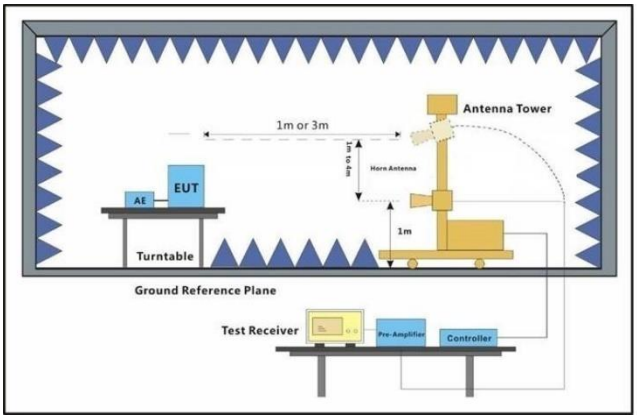
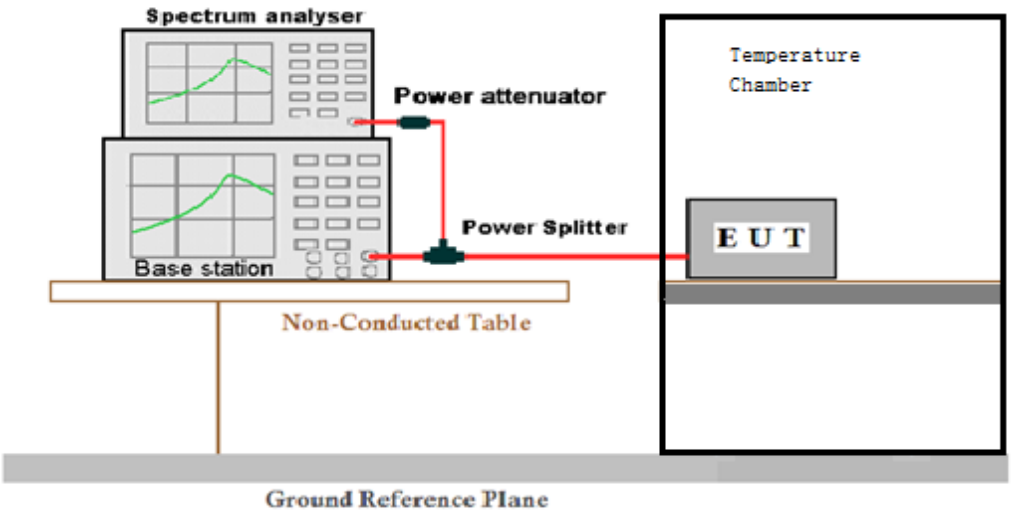


Figure 3. above 1GHz

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	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6; NR/TM7;NR/TM8; NR/TM9;
	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	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6; NR/TM7;NR/TM8; NR/TM9;
Peak-to-Average Ratio (if required)		Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	M (M= middle channel)
		Test Mode	NR/TM1;NR/TM6
Modulation Characteristics		Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	M (M= middle channel)
		Test Mode	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6; NR/TM7;NR/TM8; NR/TM9;
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	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6; NR/TM7;NR/TM8; NR/TM9;
	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	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6; NR/TM7;NR/TM8; NR/TM9;
Band Edges Compliance		Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, H (L= low channel, H= high channel)
		Test Mode	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6;

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

		NR/TM7;NR/TM8; NR/TM9;
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)
	Test Mode	NR/TM1
Field Strength of Spurious Radiation	Test Environment	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 2
	Test Mode	NR/TM1 Remark: If applicable, the EUT conf. that has maximum power density (based on the equivalent power level) is selected.
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
Frequency Stability	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
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
	Test Mode	NR/TM1;NR/TM6

5 Main Test Instruments

RF conducted test					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date**	**Cal.Due date**
				(yyyy-mm-dd)	**(yyyy-mm-dd)**
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	W074-01	2020/9/4	2021/9/3
Signal Analyzer	KEYSIGHT	N9020A	W026-08	2020/6/11	2021/6/10
				2021/5/31	2022/5/30
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2021/4/14	2022/4/13
MXG Vector Signal Generator	KEYSIGHT	N5182B	MY53051405	2021/4/14	2022/4/13
Signal Generator	Rohde & Schwarz	SMR 20	W010-19	2021/4/14	2022/4/13
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	HTC-1	W006-16	2021/4/15	2022/4/14
RF control Unit	Tonscend	JS0806-1	N/A	N/A	N/A
Band Reject Filter Group	Tonscend	JS0806-F	N/A	N/A	N/A
Test Software	Tonscend	JS1120-5 NR V2.2.03.06	NCR	NCR	NCR

RF conducted test					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date**	**Cal.Due date**
				(yyyy-mm-dd)	**(yyyy-mm-dd)**
Signal Analyzer	Rohde & Schwarz	FSU	XAW01-13-02	2020/10/26	2021/10/25
Radio communication Test Station	Anritsu	MT8000A	XAW01-03-12	2020/10/27	2021/10/26
Radio communication analyzer	Anritsu	MT8821C	XAW01-03-13	2020/10/26	2021/10/25
RF control Unit	Tonscend	JS0806-1	N/A	N/A	N/A
Band Reject Filter Group	Tonscend	JS0806-F	N/A	N/A	N/A
Humidity/ Temperature Indicator	MingGao	TH101B	XAW01-01-08	2021/4/30	2022/4/29

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	2021-04-01	2022-03-31
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2021-04-01	2022-03-31
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2020-09-11	2021-09-10
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
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	2020-10-26	2021-10-25
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2020-10-26	2021-10-25
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2020-10-27	2021-10-26
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2020-10-26	2021-10-25
5G UXM	Keysight	E7515B	XAW01-04-01	2020-09-11	2021-09-10
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2020-11-06	2021-11-05
Measurement Software	Tonscend	TS+ RSE V3.0.0.2	XAW02-05-01	NCR	NCR

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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:

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.41dB
2	RF power density, conducted	±1.96dB
3	Spurious emissions, conducted	±0.41dB
4	Radio Frequency	±7.10 x 10-8
5	Duty Cycle	±0.49%
6	Occupied Bandwidth	±0.2%

Lab B:

No.	Item	Measurement Uncertainty
1	Radiated Emission	± 4.8dB (Below 1GHz)
		± 4.8dB (1GHz to 6GHz)
		± 4.5dB (6GHz to 18GHz)
		± 5.02dB (Above 18GHz)

7 Appendixes

Appendix A	Setup Photos
Appendix B.22	N2
Appendix B.23	N5
Appendix B.24	N25
Appendix B.25	N38
Appendix B.26	N41
Appendix B.27	N66
Appendix B.28	N71
Appendix B.29	N77
Appendix B.30	N78
Appendix B.31	NSA

The End