TEST REPORT

Application No:	SZCR2403000767WM
Applicant:	Sonim Technologies, Inc.
Address of Applicant:	4445 Eastgate Mall, Suite 200, San Diego, CA 92121, USA
Manufacturer:	Sonim Technologies, Inc.
Address of Manufacturer:	4445 Eastgate Mall, Suite 200, San Diego, CA 92121, USA
EUT Description:	smartphone
Model No.:	X800
Trade Mark:	Sonim
FCC ID:	WYPS6002
Standards:	47 CFR Part 2 47 CFR Part 22 47 CFR Part 24 47 CFR Part 27 47 CFR Part 90 47 CFR Part 96
Date of Receipt:	2024-03-07
Date of Test:	2024-03-27 to 2024-07-22
Date of Issue:	2024-08-09
Test Result:	**PASS ***

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

Keny Xu
EMC Laboratory Manager

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1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2024-08-09		Original

Authorized for issue by:		
		Calvin Weng **Calvin Weng/Project Engineer**
		Eric Fu **Eric Fu/Reviewer**

Content

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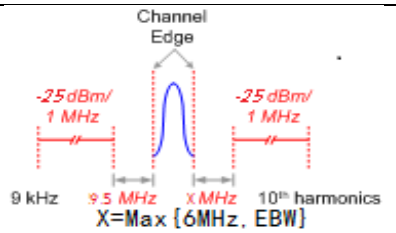
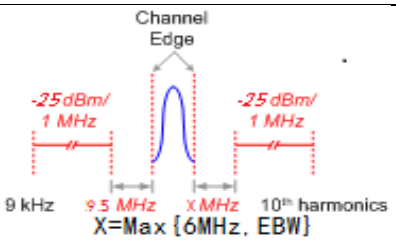
2 Test Summary

2.1 NR Band n5/NR Band n26

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §22.913(a)(5)	FCC: ERP ≤ 7 W	Appendix B.28&B.33 &B.34	Pass
Peak-Average Ratio	§22.913(d)	Limit≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Band Edges Compliance	§2.1051, §22.917(a)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		Pass
Spurious Emission at Antenna Terminals	§2.1051, §22.917(a)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.		Pass
Field Strength of Spurious Radiation	§2.1053, §22.917(a)	FCC: ≤ -13 dBm/100 kHz.		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(2) §22.355	±2.5ppm.		Pass

2.2 NR Band n7/ NR Band n38/ NR Band n41

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)(2)	EIRP ≤ 2W	Appendix B.29&B.36&B.37	Pass
Peak-Average Ratio	---	≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Band Edges Compliance	§2.1051, §27.53(m)(4)	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 de□ned in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz.		Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)			Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(m)			Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(2) §27.54	Within authorized bands of operation/frequency block.		Pass

2.3 NR Band n2/ NR Band n25

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232(c)	EIRP ≤ 2 W	Appendix B.27&B.31	Pass
Peak-Average Ratio	§24.232(d)	Limit≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Band Edges Compliance	§2.1051, §24.238(a)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		Pass
Spurious Emission at Antenna Terminals	§2.1051, §24.238(a)	≤ -13 dBm/1 MHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.		Pass
Field Strength of Spurious Radiation	§2.1053, §24.238(a)	≤ -13 dBm/1 MHz.		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(2) §24.235	Within authorized bands of operation/frequency block.		Pass

2.4 NR Band n14

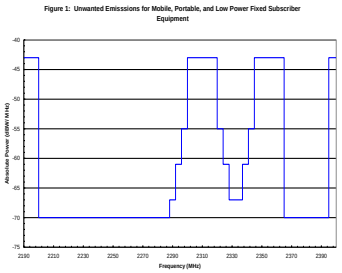
Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046 §90.542(a)	ERP ≤ 3 W.	Appendix B.30	Pass
Peak-Average Ratio	---	Limit≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Emission Mask	§2.1051 §90.210(b)	Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B. Equipment operating under this part on frequencies allocated to but shared with the Federal Government, must meet the applicable Federal Government technical standards (b) Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows: (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB..(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.		Pass
Band Edges Compliance	§2.1051 §90.543(e)(2)(3)	(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.(3) On any		Pass

		frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.		
Spurious Emission at Antenna Terminals	§2.1051, §90.543(c) §90.543(f)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges. For operations in the 758–775 MHz and 788–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/ MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.		Pass
Field Strength of Spurious Radiation	§2.1053, §90.543(c) §90.543(f)	FCC: ≤ -13 dBm/100 kHz. For operations in the 758–775 MHz and 788–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/ MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §90.213	Within authorized bands of operation/frequency block.		Pass

2.5 NR Band n26(814~824 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Transmitter Conducted Power Output	§2.1046, §90.635(b)	< 100 W.	Appendix B.32&B.34	Pass
Peak-Average Ratio	---	Limit≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Emission Mask	§2.1051 § 90.691(a)	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 Log10(f/6.1) decibels or 50+10Log10(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.		Pass
Spurious Emission at Antenna Terminals	§2.1051, §90.691	< 43 + 10Log10(P[Watts]) for all out-of-band emissions		Pass
Field Strength of Spurious Radiation	§2.1053, §90.691	< 43 + 10Log10(P[Watts]) for all out-of-band emissions		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §90.213	Within authorized bands of operation/frequency block.		Pass

2.6 NR Band n30

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(a)(3)	EIRP ≤ 50mW/1MHz EIRP ≤ 250mW/5MHz	Appendix B.35	Pass
Peak-Average Ratio	---	FCC: Limit≤13 dB		Pass
Bandwidth	§2.1049,	OBW: No limit. EBW: No limit.		Pass
Band Edges Compliance	§2.1051, §27.53(a)(4)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(a)(4)	 Figure 1: Unwanted Emisssions for Mobile, Portable, and Low Power Fixed Subscriber Equipment For mobile and portable stations operating in the 2305-2315 MHz and 2350-2360 MHz bands: (i) By a factor of not less than: 43 + 10 log (P) dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than 55 + 10 log (P) dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than 61 + 10 log (P) dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than 67 + 10 log (P) dB on all frequencies between 2328 and 2337 MHz; (ii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2300 and 2305 MHz, 55 + 10 log (P) dB on all frequencies between 2296 and 2300 MHz, 61 + 10 log (P) dB on all frequencies between 2292 and 2296 MHz, 67 +		Pass

		10 log (P) dB on all frequencies between 2288 and 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz;(iii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2365 MHz, and not less than 70 + 10 log (P) dB above 2365 MHz.		
Field Strength of Spurious Radiation	§2.1053, §27.53(a)(4)	≤ -40dBm/MHz.		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	within the range of the operating frequency blocks		Pass

2.7 NR Band n66/ NR Band n70

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(d)(4)	EIRP ≤ 1 W	Appendix B.39&B.40	Pass
Peak-Average Ratio	§27.50(d)(5)	Limit≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Band Edges Compliance	§2.1051, §27.53(h)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		Pass
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.		Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	≤ -13 dBm/1 MHz.		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(2) §27.54	Within authorized bands of operation/frequency block.		Pass

2.8 NR Band n71

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046 §27.50(c)(10)	ERP ≤ 3 W	Appendix B.41	Pass
Peak-Average Ratio	---	Limit≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Band Edges Compliance	§2.1051, §27.53(g)	≤ 43+10log10(P[Watts])		Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	≤ 43+10log10(P[Watts])		Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(g)	≤ -13 dBm/1 MHz.		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(2) §27.54	within the authorized bands of operation.		Pass

2.9 NR Band n77 / NR Band n78

3450-3550MHz:

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(k)(3)	EIRP ≤ 30dBm	Appendix B.42&B.44	Pass
Peak-Average Ratio	§27.50(k)(4)	FCC: Limit≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Band Edges Compliance	§2.1051, §27.50(n)(2)	For mobile operations in the 3450-3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz.		Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.50(n)(2)	For mobile operations in the 3450-3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz.		Pass
Field Strength of Spurious Radiation	§2.1053, §27.50(n)(2)	For mobile operations in the 3450-3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz.		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(2) §27.54	Within authorized bands of operation/ frequency block.		Pass

3700-3980MHz:

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(j)(3)	EIRP ≤ 1W	Appendix B.43&B.45	Pass
Peak-Average Ratio	---	≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Band Edges Compliance	§2.1051, §27.53(l)(2)	(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.		Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(l)(2)	not exceed -13 dBm/MHz.		Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(l)(2)	not exceed -13 dBm/MHz		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(2) §27.54	Within authorized bands of operation/frequency block.		Pass

3 General Information

3.1 Client Information

Applicant:	Sonim Technologies, Inc.
Address of Applicant:	4445 Eastgate Mall, Suite 200, San Diego, CA 92121, USA
Manufacturer:	Sonim Technologies, Inc.
Address of Manufacturer:	4445 Eastgate Mall, Suite 200, San Diego, CA 92121, USA

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China
Post code:	518057

3.3 Test Facility

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

• 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 (Member No. 1937)

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. Shenzhen EMC laboratory 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: CN1336

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

Designation Number: CN1336. Test Firm Registration Number: 787754.

• 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.

3.4 General Description of EUT

EUT Description:	smartphone		
Model No.:	X800		
Trade Mark:	Sonim		
Hardware Version:	V1.0		
Software Version:	X80.0-01-14.0-15.26.00		
Power Supply:	DC3.87V by Li-ion battery(5000mAh) Recharged by AC/DC power adapter Adapter M/N:1-CHUSQ302-097 Adapter Manufacturer: HUIZHOU PUAN ELEOTRONICS CO.,LTD Adapter output: 5V/3A,9V/2A,12V/1.5A Battery M/N:BAT-05000-21S Battery Manufacturer: Shenzhen Aerospace Electronic Co.,Ltd.		
IMEI:	RF Conducted	351348280002401 351348280002419	
	RSE	351348280016682 351348280016690	
Feature:	UL 2*2 MIMO: n77; n78		
HPUE Power Class:	Class 2: n41; n77; n78		
Antenna Type:	PIFA Antenna		
Antenna Gain:	NR Band n2:	1.2dBi(ANT2)	1dBi(ANT5)
	NR Band n5:	-3.5dBi(ANT1)	
	NR Band n7:	-0.5dBi(ANT2)	-0.2dBi(ANT5)
	NR Band n14:	-2dBi(ANT1)	
	NR Band n25:	1.2dBi(ANT2)	1dBi(ANT5)
	NR Band n26:	-3.5dBi(ANT1)	
	NR Band n30:	0.3dBi(ANT3)	
	NR Band n38:	-0.5dBi(ANT2)	-0.3dBi(ANT5)
	NR Band n41:	-0.5dBi(ANT2)	-0.2dBi(ANT5)
	NR Band n48:	-1.2dBi(ANT3)	
	NR Band n66:	1.2dBi(ANT2)	
	NR Band n70:	-1.3dBi(ANT2)	
	NR Band n71:	-5.5dBi(ANT1)	
	NR Band n77:	0.2dBi (ANT3)	0.3dBi (ANT7)

	NR Band n78:	0.4dBi(ANT3) 0.5dBi(ANT7)	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.		
RF Cable*:	☒Provided by client		
	0.5dB(0.6~1GHz)	0.8dB(1.4~2GHz)	1.0dB(2.1~2.7GHz)
	1.5dB(3~4GHz)	1.8dB(4.4~6GHz)	
Note: *Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information, SGS is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion. Remark: As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.			

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3.5 Test Mode

Test Mode	Test Modes Description
NR/TM1	NR system, DFT-s-Pi/2-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	101.0 kPa Selected Values During Tests	
Relative Humidity	45-56 % RH Ambient	
Value	**Temperature(℃)**	**Voltage(V)**
NTNV	22~25	3.87
LTLV	-30	3.65
LTHV	-30	4.45
HTLV	50	3.65
HTHV	50	4.45

Remark:

NV: Normal Voltage	LV: Low Extreme Test Voltage	HV: High Extreme Test Voltage
NT: Normal Temperature	LT: Low Extreme Test Temperature	HT: High Extreme Test Temperature

3.7 Description of Support Units

The EUT has been tested as an independent unit.

3.8 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 n7	2500 to 2570 MHz	2620 to 2690 MHz	
	NR Band n14	788 to 798 MHz	758 to 768 MHz	
	NR Band n25	1850 to 1915MHz	1930 to 1995 MHz	
	NR Band n26 (814 to 824 MHz)	814 to 824MHz	859 to 869 MHz	
	NR Band n26 (824 to 849 MHz)	824 to 849 MHz	869 to 894 MHz	
	NR Band n30	2305 to 2315 MHz	2350 to 2360 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 n48	3550 to 3700 MHz	3550 to 3700 MHz	
	NR Band n66	1710 to 1780 MHz	2110 to 2200 MHz	
	NR Band n70	1695 to 1710 MHz	1995 to 2020 MHz	
	NR Band n71	663 to 698 MHz	617 to 652 MHz	
	NR Band n77*	3700 to 3980 MHz	3700 to 3980 MHz	
		3450 to 3550 MHz	3450 to 3550 MHz	
	NR Band n78*	3700 to 3800 MHz	3700 to 3800 MHz	
		3450 to 3550 MHz	3450 to 3550 MHz	
Supported Channel Bandwidth	NR Band n2	SCS 15kHz:		
		☒5 MHz	☒10 MHz	☒15 MHz ☒20 MHz
	NR Band n5	SCS 15kHz:		
		☒5 MHz	☒10 MHz	☒15 MHz ☒20 MHz
	NR Band n7	SCS 15kHz:		
		☒5 MHz	☒10 MHz	☒15 MHz ☒20 MHz
	NR Band n14	SCS 15kHz:		
		☒5 MHz	☒10 MHz	
	NR Band n25	SCS 15kHz:		
		☒5 MHz	☒10 MHz	☒15 MHz ☒20 MHz

		☒25 MHz ☒30 MHz
	NR Band n26	SCS 15kHz:
		☒5 MHz ☒10 MHz ☒15 MHz ☒20 MHz
	NR Band n30	SCS 15kHz:
		☒10 MHz
	NR Band n38	SCS 30kHz:
		☒20 MHz ☒30 MHz; ☒40 MHz;
	NR Band n41	SCS 30kHz:
		☒20 MHz ☒30 MHz ☒40 MHz ☒50 MHz
		☒60 MHz ☒70 MHz ☒80 MHz ☒90 MHz
		☒100 MHz
	NR Band n48	SCS 30kHz:
		☒20 MHz ☒30 MHz ☒40 MHz
	NR Band n66	SCS 15kHz:
		☒5 MHz ☒10 MHz ☒15 MHz ☒20 MHz
		☒25 MHz ☒30 MHz
	NR Band n70	SCS 15kHz:
		☒15 MHz
	NR Band n71	SCS 15kHz:
		☒5 MHz ☒10 MHz ☒15 MHz ☒20 MHz
	NR Band n77	SCS 30kHz
		☒20 MHz ☒30 MHz ☒40 MHz ☒60 MHz
		☒80 MHz ☒100 MHz
	NR Band n78	SCS 30kHz
		☒20 MHz ☒30 MHz ☒40 MHz ☒50 MHz
		☒60 MHz ☒70 MHz ☒80 MHz ☒90 MHz
		☒100 MHz
EN-DC (UL) mode:	DC_13A_n2A, DC_13A_n66A, DC_13A_n77A, DC_2A_n5A, DC_2A_n66A DC_2A_n77A, DC_48A_n5A, DC_48A_n66A, DC_5A_n2A, DC_5A_n66A DC_5A_n77A, DC_66A_n2A, DC_66A_n5A, DC_66A_n77A	

3.9 Test Frequencies

3.9.1 Reference test frequencies for NR operating band n2

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

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
5	Downlink	Low	1932.5	386500
		Mid	1960	392000
		High	1987.5	397500
	Uplink	Low	1852.5	370500
		Mid	1880	376000
		High	1907.5	381500
10	Downlink	Low	1935	387000
		Mid	1960	392000
		High	1985	397000
	Uplink	Low	1855	371000
		Mid	1880	376000
		High	1905	381000
15	Downlink	Low	1937.5	387500
		Mid	1960	392000
		High	1982.5	396500
	Uplink	Low	1857.5	371500
		Mid	1880	376000
		High	1902.5	380500
20	Downlink	Low	1940	388000
		Mid	1960	392000
		High	1980	396000
	Uplink	Low	1860	372000
		Mid	1880	376000
		High	1900	380000

3.9.2 Reference test frequencies for NR operating band n5

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

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
5	Downlink	Low	871.5	174300
		Mid	881.5	176300
		High	891.5	178300
	Uplink	Low	826.5	165300
		Mid	836.5	167300
		High	846.5	169300
10	Downlink	Low	874	174800
		Mid	881.5	176300
		High	889	177800
	Uplink	Low	829	165800
		Mid	836.5	167300
		High	844	168800
15	Downlink	Low	876.5	175300
		Mid	881.5	176300
		High	886.5	177300
	Uplink	Low	831.5	166300
		Mid	836.5	167300
		High	841.5	168300
20	Downlink	Low	879	175800
		Mid	881.5	176300
		High	884	176800
	Uplink	Low	834	166800
		Mid	836.5	167300
		High	839	167800

3.9.3 Reference test frequencies for NR operating band n7

3.9.3.1 Test frequencies for NR operating band n7 and SCS 15 kHz

Bandwidth [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
5	Downlink	Low	2622.5	524500
		Mid	2655	531000
		High	2687.5	537500
	Uplink	Low	2502.5	500500
		Mid	2535	507000
		High	2567.5	513500
10	Downlink	Low	2625	525000
		Mid	2655	531000
		High	2685	537000
	Uplink	Low	2505	501000
		Mid	2535	507000
		High	2565	513000
15	Downlink	Low	2627.5	525500
		Mid	2655	531000
		High	2682.5	536500
	Uplink	Low	2507.5	501500
		Mid	2535	507000
		High	2562.5	512500
20	Downlink	Low	2630	526000
		Mid	2655	531000
		High	2680	536000
	Uplink	Low	2510	502000
		Mid	2535	507000
		High	2560	512000

3.9.4 Reference test frequencies for NR operating band n14

3.9.4.1 Test frequencies for NR operating band n14 and SCS 15 kHz

Bandwidth [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
5	Downlink	Low	760.5	151200
		Mid	763	152600
		High	765.5	153100
	Uplink	Low	790.5	158100
		Mid	793	158600
		High	795.5	159100
10	Downlink	Low	/	/
		Mid	763	152600
		High	/	/
	Uplink	Low	/	/
		Mid	793	158600
		High	/	/

3.9.5 Reference test frequencies for NR operating band n25

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

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
5	Downlink	Low	1932.5	386500
		Mid	1962.5	392500
		High	1992.5	398500
	Uplink	Low	1852.5	370500
		Mid	1882.5	376500
		High	1912.5	382500
10	Downlink	Low	1935	387000
		Mid	1962.5	392500
		High	1990	398000
	Uplink	Low	1855	371000
		Mid	1882.5	376500
		High	1910	382000
15	Downlink	Low	1937.5	387500
		Mid	1962.5	392500
		High	1987.5	397500
	Uplink	Low	1857.5	371500
		Mid	1882.5	376500
		High	1907.5	381500
20	Downlink	Low	1940	388000
		Mid	1962.5	392500
		High	1985	397000
	Uplink	Low	1860	372000
		Mid	1882.5	376500
		High	1905	381000
25	Downlink	Low	1942.5	388500
		Mid	1962.5	392500
		High	1982.5	396500
	Uplink	Low	1862.5	372500
		Mid	1882.5	376500
		High	1902.5	380500
30	Downlink	Low	1945	389000
		Mid	1962.5	392500
		High	1980	396000
	Uplink	Low	1865	373000
		Mid	1882.5	376500
		High	1900	380000

3.9.6 Reference test frequencies for NR operating band n26

3.9.6.1 Test frequencies for NR operating band n26 and SCS 15 kHz

814-824:

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
5	Downlink	Low	861.5	172300
		Mid	864	172800
		High	866.5	173300
	Uplink	Low	816.5	163300
		Mid	819	163800
		High	821.5	164300
10	Downlink	Low	/	/
		Mid	864	172800
		High	/	/
	Uplink	Low	/	/
		Mid	819	163800
		High	/	/

824-849:

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
5	Downlink	Low	871.5	174300
		Mid	881.5	176300
		High	891.5	178300
	Uplink	Low	826.5	165300
		Mid	836.5	167300
		High	846.5	169300
10	Downlink	Low	874	174800
		Mid	881.5	176300
		High	889	177800
	Uplink	Low	829	165800
		Mid	836.5	167300
		High	844	168800
15	Downlink	Low	876.5	175300
		Mid	881.5	176300
		High	886.5	177300
	Uplink	Low	831.5	166300
		Mid	836.5	167300
		High	841.5	168300
20	Downlink	Low	879	175800
		Mid	881.5	176300
		High	884	176800
	Uplink	Low	834	166800
		Mid	836.5	167300
		High	839	167800

3.9.7 Reference test frequencies for NR operating band n30

3.9.7.1 Test frequencies for NR operating band n30 and SCS 15 kHz

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
10	Downlink	Low	2355	471000
		Mid	2355	471000
		High	2355	471000
	Uplink	Low	2310	462000
		Mid	2310	462000
		High	2310	462000

3.9.8 Reference test frequencies for NR operating band n38

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

Bandwidth [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
20	Downlink & Uplink	Low	2580	516000
		Mid	2595	519000
		High	2610	522000
30	Downlink & Uplink	Low	2585	517000
		Mid	2595	519000
		High	2605	521000
40	Downlink & Uplink	Low	2590	518000
		Mid	2595	519000
		High	2600	520000

3.9.9 Reference test frequencies for NR operating band n41

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

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
20	Downlink & Uplink	Low	2506.02	501204
		Mid	2592.99	518598
		High	2670	534000
30	Downlink & Uplink	Low	2511	502200
		Mid	2592.99	518598
		High	2675	535000
40	Downlink & Uplink	Low	2516.01	503202
		Mid	2592.99	518598
		High	2670	534000
50	Downlink & Uplink	Low	2521.02	504204
		Mid	2592.99	518598
		High	2664.99	532998
60	Downlink & Uplink	Low	2526	505200
		Mid	2592.99	518598
		High	2659.98	531996
70	Downlink & Uplink	Low	2531	506200
		Mid	2592.29	518598
		High	2655	531000
80	Downlink & Uplink	Low	2536.02	507204
		Mid	2592.99	518598
		High	2649.99	529998
90	Downlink & Uplink	Low	2541	508200
		Mid	2592.99	518598
		High	2644.98	528996
100	Downlink & Uplink	Low	2546.01	509202
		Mid	2592.99	518598
		High	2640	528000

3.9.10 Reference test frequencies for NR operating band n48

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

Bandwidth [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
20	Downlink & Uplink	Low	3560.01	637334
		Mid	3624.99	641666
		High	3690	646000
30	Downlink & Uplink	Low	3565.02	637668
		Mid	3624.99	641666
		High	3684.99	645666
40	Downlink & Uplink	Low	3570	638000
		Mid	3624.99	641666
		High	3679.98	645332

3.9.11 Reference test frequencies for NR operating band n66

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

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
5	Downlink	Low	2112.5	422500
		Mid	2155	431000
		High	2197.5	439500
	Uplink	Low	1712.5	342500
		Mid	1745	349000
		High	1777.5	355500
10	Downlink	Low	2115	423000
		Mid	2155	431000
		High	2195	439000
	Uplink	Low	1715	343000
		Mid	1745	349000
		High	1775	355000
15	Downlink	Low	2117.5	423500
		Mid	2155	431000
		High	2192.5	438500
	Uplink	Low	1717.5	343500
		Mid	1745	349000
		High	1772.5	354500
20	Downlink	Low	2120	424000
		Mid	2155	431000
		High	2190	438000
	Uplink	Low	1720	344000
		Mid	1745	349000
		High	1770	354000
25	Downlink	Low	2122.5	424500
		Mid	2155	431000
		High	2187.5	437500
	Uplink	Low	1722.5	344500
		Mid	1745	349000
		High	1767.5	353500
30	Downlink	Low	2125	425000
		Mid	2155	431000
		High	2185	437000
	Uplink	Low	1725	345000
		Mid	1745	349000
		High	1765	353000

3.9.12 Reference test frequencies for NR operating band n70

3.9.12.1 Test frequencies for NR operating band n70 and SCS 15 kHz

Bandwidth [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
15	Downlink	Low	/	/
		Mid	2002.5	400500
		High	/	/
	Uplink	Low	/	/
		Mid	1702.5	340500
		High	/	/

3.9.13 Reference test frequencies for NR operating band n71

3.9.13.1 Test frequencies for NR operating band n71 and SCS 15 kHz

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
5	Downlink	Low	619.5	123900
		Mid	634.5	126900
		High	649.5	129900
	Uplink	Low	665.5	133100
		Mid	680.5	136100
		High	695.5	139100
10	Downlink	Low	622	124400
		Mid	634.5	126900
		High	647	129400
	Uplink	Low	668	133600
		Mid	680.5	136100
		High	693	138600
15	Downlink	Low	624.5	124900
		Mid	634.5	126900
		High	644.5	128900
	Uplink	Low	670.5	134100
		Mid	680.5	136100
		High	690.5	138100
20	Downlink	Low	627	125400
		Mid	634.5	126900
		High	642	128400
	Uplink	Low	673	134600
		Mid	680.5	136100
		High	688	137600

3.9.14 Reference test frequencies for NR operating band n77

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

3700-3980:

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
20	Downlink & Uplink	Low	3710.01	647334
		Mid	3840	656000
		High	3969.99	664666
30	Downlink & Uplink	Low	3714.99	647666
		Mid	3840	656000
		High	3965.01	664334
40	Downlink & Uplink	Low	3720	648000
		Mid	3840	656000
		High	3960	664000
60	Downlink & Uplink	Low	3730.02	648668
		Mid	3840	656000
		High	3949.98	663332
80	Downlink & Uplink	Low	3740.01	649334
		Mid	3840	656000
		High	3939.99	662666
100	Downlink & Uplink	Low	3750	650000
		Mid	3840	656000
		High	3930	662000

3450-3550:

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
20	Downlink & Uplink	Low	3460.02	630668
		Mid	3500.01	633334
		High	3540	636000
30	Downlink & Uplink	Low	3465	631000
		Mid	3500.01	633334
		High	3534.99	635666
40	Downlink & Uplink	Low	3470.01	631334
		Mid	3500.01	633334
		High	3530.01	635334
60	Downlink & Uplink	Low	3480	632000
		Mid	3500.01	633334
		High	3519.99	634666
80	Downlink & Uplink	Low	3490.02	632668
		Mid	3500.01	633334
		High	3510	634000
100	Downlink & Uplink	Low	\	\
		Mid	3500.01	633334
		High	\	\

3.9.15 Reference test frequencies for NR operating band n78

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

3700-3800:

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
20	Downlink & Uplink	Low	3710.01	647334
		Mid	3750	650000
		High	3789.99	652666
30	Downlink & Uplink	Low	3715.02	647668
		Mid	3750	650000
		High	3785.01	652334
40	Downlink & Uplink	Low	3720	648000
		Mid	3750	650000
		High	3780	652000
50	Downlink & Uplink	Low	3725.01	648334
		Mid	3750	650000
		High	3774.99	651666
60	Downlink & Uplink	Low	3730.02	648668
		Mid	3750	650000
		High	3769.98	651332
70	Downlink & Uplink	Low	3735	649000
		Mid	3750	650000
		High	3765	651000
80	Downlink & Uplink	Low	3740.01	649334
		Mid	3750	650000
		High	3759.99	650666
90	Downlink & Uplink	Low	3745.02	649668
		Mid	3750	650000
		High	3754.98	650332
100	Downlink & Uplink	Low	/	/
		Mid	3750	650000
		High	/	/

3450-3550:

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]
20	Downlink & Uplink	Low	3460.02	630668
		Mid	3500.01	633334
		High	3540	636000
30	Downlink & Uplink	Low	3465	631000
		Mid	3500.01	633334
		High	3534.99	635666
40	Downlink & Uplink	Low	3470.01	631334
		Mid	3500.01	633334
		High	3530.01	635334
50	Downlink & Uplink	Low	3475.02	631668
		Mid	3500.01	633334
		High	3525	635000
60	Downlink & Uplink	Low	3480	632000
		Mid	3500.01	633334
		High	3519.99	634666
70	Downlink & Uplink	Low	3485.01	632334
		Mid	3500.01	633334
		High	3515.01	634334
80	Downlink & Uplink	Low	3490.02	632668
		Mid	3500.01	633334
		High	3510	634000
90	Downlink & Uplink	Low	3495	633000
		Mid	3500.01	633334
		High	3504.99	633666
100	Downlink & Uplink	Low	\	\
		Mid	3500.01	633334
		High	\	\

4 Description of Tests

4.1 Conducted Output Power

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.2.1

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 Section 5.8.4

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 EIRP Power Density

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.3

Test Settings

1. Set instrument center frequency to OBW center frequency.
2. Set span to at least 1.5 times the OBW.
3. Set the RBW to the specified reference bandwidth (often 1 MHz).
4. Set VBW ≥ 3 × RBW.
5. Detector = RMS (power averaging).
6. Ensure that the number of measurement points in the sweep ≥ 2 × span/RBW.
7. Sweep time = auto couple.
8. Employ trace averaging (RMS) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).

4.4 Occupied Bandwidth

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 4.2 & 4.3

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

4.5 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

4.6 Spurious And Harmonic Emissions at Antenna Terminal

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

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 9kHz 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

4.7 Peak-Average Ratio

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.7.2

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

4.8 Field Strength of Spurious Radiation

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.8

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

5). 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.

6). Repeat above procedures until all frequencies measured was complete.

E (dBμV/m) = Measured amplitude level (dBμV) + (Cable Loss (dB) + Antenna Factor (dB/m) – AMP(dB))

EIRP (dBm) = E (dBμV/m) + 20 log D − 104.8; where D is the measurement distance in meters

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:

E (dBμV/m) = Measured amplitude level (dBμV) + (Cable Loss (dB) + Antenna Factor (dB/m) – AMP(dB))

EIRP (dBm) = E (dBμV/m) + 20 log D − 104.8; where D is the measurement distance in meters

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

Remark1: Reference test setup 2

Remark2: The emission below 18G were measured at a 3m test distance, while emissions above 18GHz were measured at a 1m test distance. At a measurement distance of 1 meter the limit line was increased by 20*LOG(3/1) = 9.54 dB.

Remark: Reference test setup 2

Remark:

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

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier (dB)

Level = Reading Level + AF + Factor -95.26

Margin = Limit – Level

2) Scan from 9kHz to 40GHz, The disturbance between 9KHz to 30MHz and 18GHz to 40GHz was very low, and the harmonics were the highest point could be found when testing, so only the 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) All modes have been tested, but only the worst case data displayed in this report.

4.9 Frequency Stability / Temperature Variation

Measurement Procedure:
Frequency stability testing is performed in accordance with the guidelines of FCC KDB 971168 D01 V03r01 Section 9
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 3

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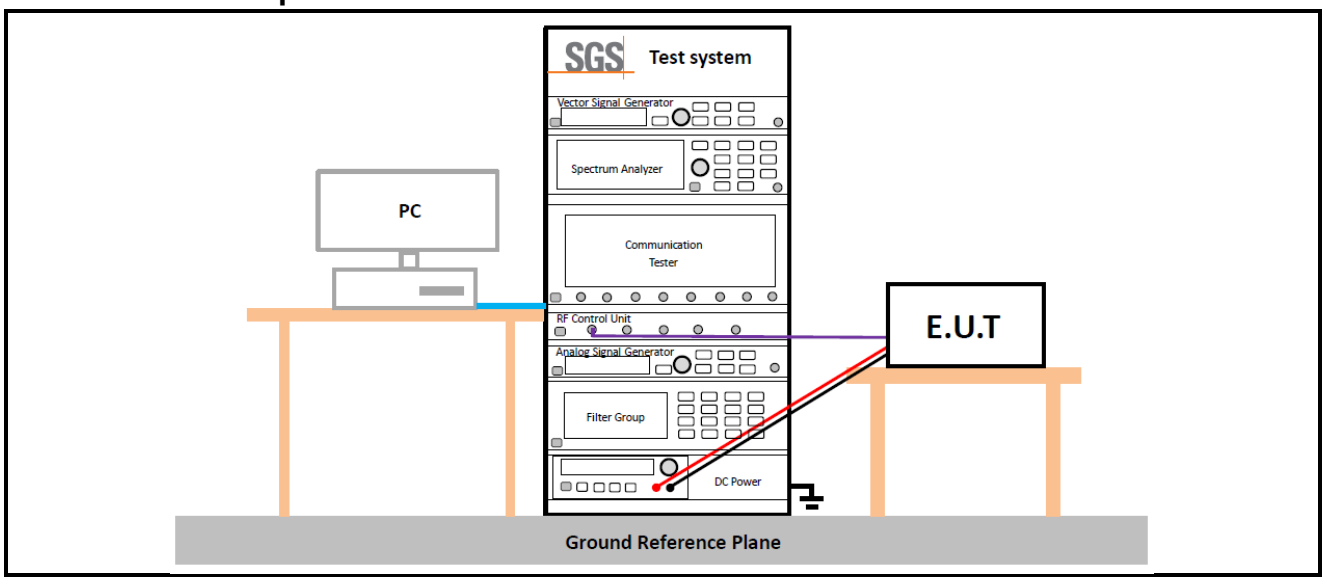
4.10 Test Setups

4.10.1 Test Setup 1



4.10.2 Test Setup 2

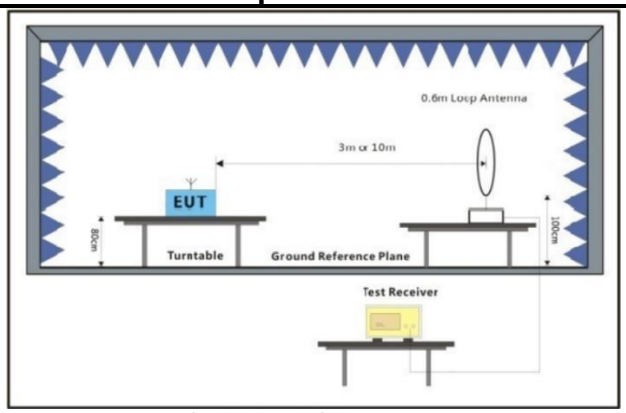


Figure 1. Below 30MHz

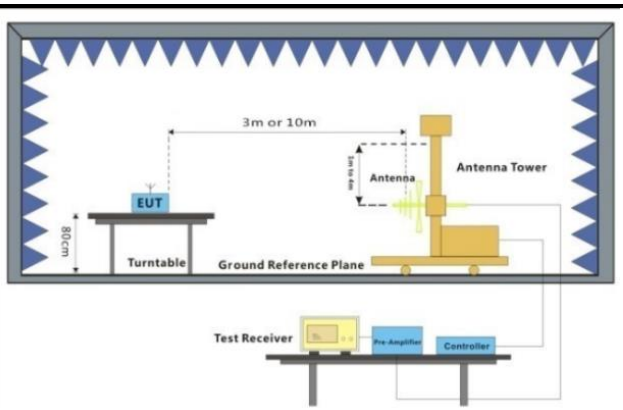


Figure 2. 30MHz to 1GHz

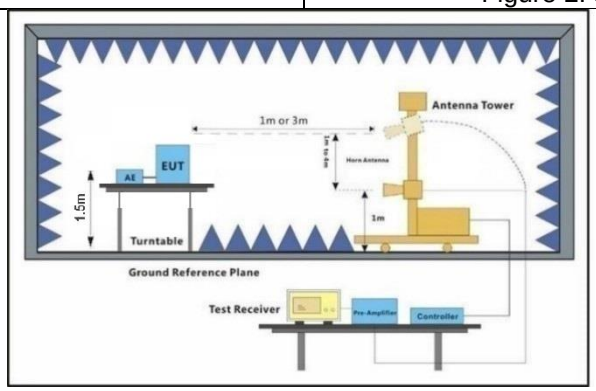
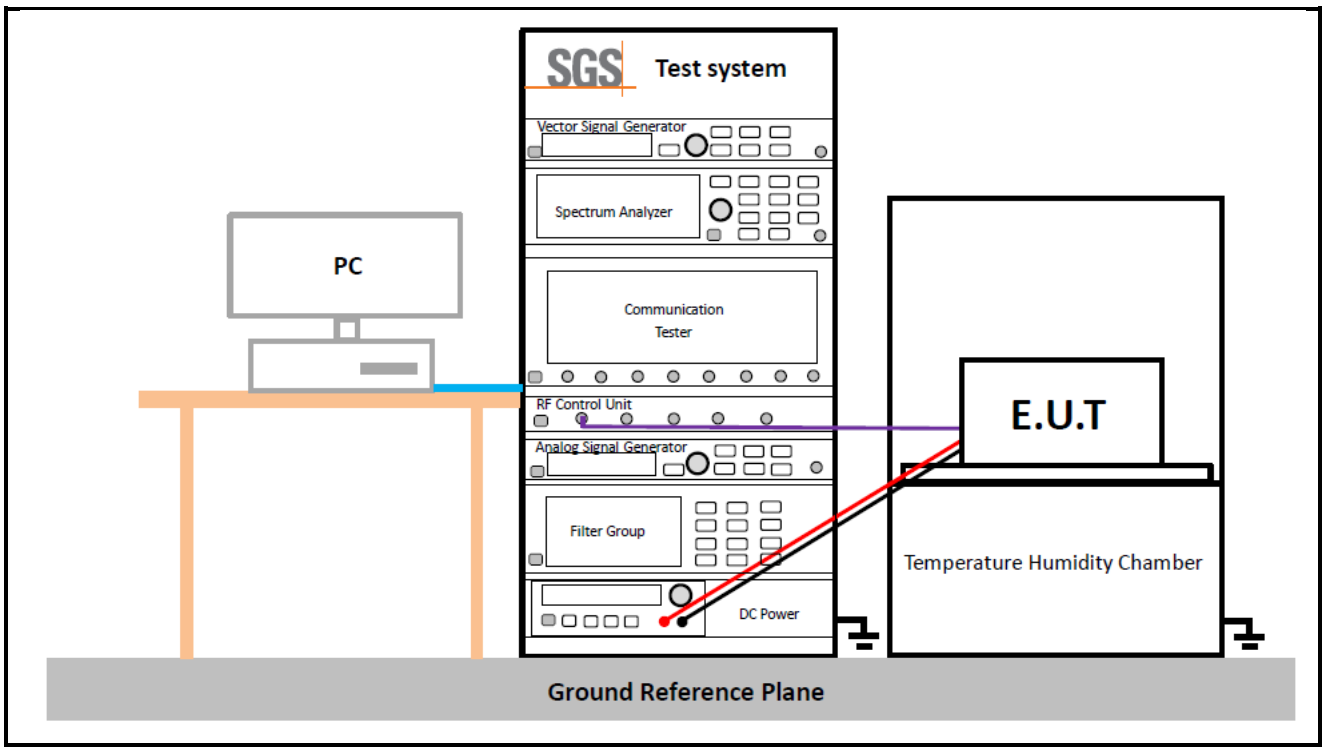


Figure 3. above 1GHz

4.10.3 Test Setup 3



4.11 Test Conditions

Transmit Output Power Data - Average Power, Spectral Density	
Test Case	**Test Conditions**
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	
Test Case	**Test Conditions**
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
Bandwidth - Occupied Bandwidth	
Test Case	**Test Conditions**
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
Bandwidth - Emission Bandwidth	
Test Case	**Test Conditions**
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 Case	**Test Conditions**
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

Spurious Emission at Antenna Terminals	
Test Case	**Test Conditions**
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

Field Strength of Spurious Radiation	
Test Case	**Test Conditions**
Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 2
RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
Test Mode	NR/TM1 Remark: All bandwidth and modulation of NR have been pre tested, and only the worst results are reflected in the report.

Frequency Stability	
Test Case	**Test Conditions**
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 3
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

5 Main Test Instruments

RF conducted test					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. Date**	**Cal. Due date**
DC power supply	HYELEC	HY3005B	SZ-WRG-M-024	2023/09/14	2024/09/13
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2024/03/20	2025/03/19
MXA Signal Analyzer	KEYSIGHT	N9020B	SEM004-24	2024/03/14	2025/03/13
Measurement Software	TST	TST PASS V2.0	N/A	N/A	N/A
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	2024/03/27	2025/03/26
Universal Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-03	2024/03/27	2025/03/26
Universal Radio Communication Tester	Anritsu	MT8000A	SEM010-10	2024/03/14	2025/03/13
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2024/03/19	2025/03/18
Power Sensor	KEYSIGHT	U2021XA	SEM009-15	2024/03/20	2025/03/19

Radiated spurious emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EMI TEST RECEIVER	Rohde & Schwarz	ESR	SZ-WRG-M-047	2024/01/30	2025/01/29
Signal &Spectrum Analyzer	Rohde & Schwarz	FSV	SZ-WRG-M-048	2024/01/30	2025/01/29
Low Noise Amplifier 9K-3GHz	Tonscend	TAP9K3G32	SEM005-23	2024/03/05	2025/03/04
Low Noise Amplifier 30M-8GHz	Tonscend	TAP30M8G30	SZ-WRG-M-050	2024/01/30	2025/01/29
Low Noise Amplifier 1G-18GHz	Tonscend	TAP01018050	SZ-WRG-M-051	2024/01/30	2025/01/29
Low Noise Amplifier 18G-40GHz	Tonscend	TAP18040048	SZ-WRG-M-052	2024/01/30	2025/01/29
Active Loop Antenna 9kHz-30MHz	SCHWARZBECK	FMZB 1519B	SZ-WRG-M-053	2023/12/25	2024/12/24
TRILOG Breitband Antenne 30MHz-1GHz	SCHWARZBECK	VULB 9168	SZ-WRG-M-054	2023/12/25	2024/12/24
Double Ridge Horn Antenna 1GHz-18GHz	SCHWARZBECK	BBHA 9120 D	SZ-WRG-M-055	2023/12/21	2024/12/20
SHF-EHF Horn 15GHz-40GHz	SCHWARZBECK	BBHA 9170	SZ-WRG-M-056	2023/12/25	2024/12/24
RSE Test Software	Tonscend	JS32-RSE V4.0.0	SZ-WRG-S-058	NCR	NCR
RE Test Software	Tonscend	JS32-RE V4.0.0	SZ-WRG-S-059	NCR	NCR
Chamber	CRTSGSSAC966	N/A	SZ-WRG-C-063	2022/01/05	2025/01/04
Humidity/ Temperature Indicator	Deli	8838	SEM002-46	2023/07/28	2024/07/27
Radio Communication Tester	Anriesu	MT8821C	SZ-WRG-M-014	2023/09/14	2024/09/13

General used equipment					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	deli	8838	SEM002-32	2023/07/28	2024//07/27
Humidity/ Temperature Indicator	deli	8838	SEM002-33	2023/07/28	2024/07/27
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2024/03/18	2025/03/17

Remark: NCR=No Calibration Requirement

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:

No.	Item	Measurement Uncertainty
1	Radio Frequency	± 5.4 x 10^{-8}
2	Duty cycle	± 0.3%
3	Occupied Bandwidth	± 3%
4	RF conducted power	± 0.8dB
5	RF power density	± 0.4dB
6	Conducted Spurious emissions	± 2.7dB
7	Radiated Spurious emission test(UE)	±4.8dB (30MHz-1GHz)
		±4.68dB (1GHz-6GHz)
		±4.52dB (6GHz-18GHz)
		±5.26dB (18GHz-40GHz)

Remark:
The U_{lab} (lab Uncertainty) is less than $U_{cispr/ETSI}$ (CISPR/ETSI Uncertainty), so the test results
– compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
– non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

7 Appendixes

Appendix A.3	WWAN Setup Photos
Appendix B.27	NR Band n2
Appendix B.28	NR Band n5
Appendix B.29	NR Band n7
Appendix B.30	NR Band n14
Appendix B.31	NR Band n25
Appendix B.32	NR Band n26(814-824)
Appendix B.33	NR Band n26(824-849)
Appendix B.34	NR Band n26c
Appendix B.35	NR Band n30
Appendix B.36	NR Band n38
Appendix B.37	NR Band n41
Appendix B.38	NR Band n48
Appendix B.39	NR Band n66
Appendix B.40	NR Band n70
Appendix B.41	NR Band n71
Appendix B.42	NR Band n77(3450-3550)
Appendix B.43	NR Band n77(3700-3980)
Appendix B.44	NR Band n78(3450-3550)
Appendix B.45	NR Band n78(3700-3800)

---End of Report---