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e 5G mmWave Receiver 8-B 5GMM28B Part 2 Part 22 Part 22 Part 24 Part 27 Part 90 /27 /06 to 2024/07/22 /24
8-B GGMM28B Part 2 Part 22 Part 24 Part 27 Part 90 /27
8-B GGMM28B Part 2 Part 22 Part 24 Part 27 Part 90
8-B GGMM28B Part 2 Part 22 Part 24 Part 27
8-B 6GMM28B Part 2 Part 22 Part 24
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403000069TL

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

Authorized Signature:

Cloud Peng

Cloud Peng **Technical Manager** 



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## 1 Version

	Revision Record					
Version	Chapter	Date	Modifier	Remark		
01		2024/07/24		Original		

Prepared By	Cleriti (Levi Li) / Test Engineer
Checked By	Stone Ju (Stone Gu) / Reviewer



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#### **Test Summary** 2

## 2.1 NR Band n5/NR Band n26 (824~849 MHz)

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.18&B.23	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)(1) §22.355	±2.5ppm.		Pass



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

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Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)(2)	EIRP ≤ 2W	Test Result	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, wdhere X is the greater of 6 megahertz or the actual emission bandwidth as defined 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.	Appendix B.19&B.24&B.25	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)	25 dBm/ 1 MHz 9 kHz 25 dBm/ 1 MHz 9 kHz 25 dBm/ 1 MHz 1 M		Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(m)	P kHz % 5 MHz X MHz 10 <sup>th</sup> harmonics X=Max {6MHz, EBW}		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	Within authorized bands of operation/frequency block.		Pass



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## 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.17&B.21	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)	<ul> <li>≤ -13 dBm/1 MHz, from 9 kHz to 10<sup>th</sup> harmonics but outside authorized operating frequency ranges.</li> </ul>		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)(1) §24.235	Within authorized bands of operation/frequency block.		Pass



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## 2.4 NR Band n12

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046 §27.50(c)(9)	ERP ≤ 30 W.		Pass
Peak-Average Ratio		Limit≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix B.20 -	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)	FCC: ≤ -13 dBm/100 kHz.		Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	Within authorized bands of operation/frequency block.		Pass



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## 2.5 NR Band n26(814~824 MHz)

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Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Transmitter Conducted Power Output	§2.1046, §90.635(b)	< 100 W.		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.	Appendix B.22	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



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## 2.6 NR Band n66

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.27	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 10 <sup>th</sup> 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)(1) §27.54	Within authorized bands of operation/frequency block.		Pass



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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.28	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)(1) §27.54	within the authorized bands of operation.		Pass

## 2.7 NR Band n71



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## 2.8 NR Band n77

#### 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		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)	<ul> <li>(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 (I)(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 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.</li> </ul>	Appendix B.30	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(I)(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)(1) §27.54	Within authorized bands of operation/frequency block.		Pass



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#### 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		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.	Appendix B.29	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.	В.29	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)(1) §27.54	Within authorized bands of operation/ frequency block.		Pass



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## 2.9 NR Band n48

#### 3550-3700MHz:

3550-3700MHZ:				
Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §96.41	EIRP ≤ 23dBm		Pass
Peak-Average Ratio	§96.41	FCC: Limit≤13 dB		Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		Pass
Band Edges Compliance	§2.1051, §96.41	for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0-10 megahertz above the upper SAS- assigned channel edge and within 0- 10 megahertz below the lower SAS- assigned channel edge.		Pass
Spurious Emission at Antenna Terminals	§2.1051, §96.41	for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0-10 megahertz above the upper SAS- assigned channel edge and within 0- 10 megahertz below the lower SAS- assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any emission shall not exceed -25 dBm/MHz. (2) Additional protection levels. Notwithstanding paragraph (d)(1) of this section, the conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.	Appendix B.26	Pass



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Field Strength of Spurious Radiation	§2.1053, §96.41	for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0-10 megahertz above the upper SAS- assigned channel edge and within 0- 10 megahertz below the lower SAS- assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any emission shall not exceed -25 dBm/MHz. (2) Additional protection levels. Notwithstanding paragraph (d)(1) of this section, the conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.	Pass
Frequency Stability	§2.1055, §96.41	Within authorized bands of operation/ frequency block.	Pass
Adjacent Channel Leakage Ratio	§96.41	the Adjacent Channel Leakage Ratio for End User Devices shall be at least 30 dB.	Pass



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## **3** General Information

## 3.1 Client Information

Applicant:	Nokia Shanghai Bell Co., Ltd.
Address of Applicant:	388#, Ningqiao Road, China (Shanghai) Pilot Free Trade Zone, Shanghai 201206, China
Manufacturer:	Nokia Solutions and Networks Oy
Address of Manufacturer:	Karakaari 7 02610 Espoo Finland

## 3.2 Test Location

Company:	SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Address:	South of No. 6 Plant, No. 1, Runsheng Road, Suzhou Industrial Park, Suzhou Area, China (Jiangsu) Pilot Free Trade Zone
Post code:	215000
Test engineer:	Levi Li, Tizzy Song

## 3.3 Test Facility

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

#### A2LA (Certificate No. 6336.01)

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01.

#### Innovation, Science and Economic Development Canada

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0120.

IC#: 27594.

#### • FCC –Designation Number: CN1312

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory.

Designation Number: CN1312.

Test Firm Registration Number: 717327



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## 3.4 General Description of EUT

EUT Description:	FastMile 5G mmWave Receiver							
Model No.:	5Gmm28-B							
Trade Mark:	Nokia							
Hardware Version:	3TG02974Axxx(x:A	~Z)						
Software Version:	5GmmReceiver-36	0-1_D2	240200BieT06	01E0600				
Power Supply:	54VDC							
SN:	RF Conducted		NK24RGW24 NK24RGW24					
SIN.	RSE		KLT2422007 KLT2422007					
Feature:	UL 2*2 MIMO: NR Band n38; NR I	Band n	41; NR Band	n48; NR Band n77				
Power Class:	Class 2: NR Band r Class 1.5: UL MIMO							
	Internal Antenna	Труе		Vendor_1	Vendor_2			
	ANT0	Internal Antenna		0	SPD A-0			
	ANt1			1	SPD A-1			
	ANT2			2	SPD A-2			
	ANT3			3	SPD A-3			
Antenna Type:	ANT4			4 GPS	SPD 4-GPS			
	ANT6			6	SPD A-6			
	ANT8			8	SPD A-8			
	ANT9			9	SPD A-9			
	ANT T			Т	SPD A-T			
	Note: EUT 1 corresponding to Vendor_1,and EUT 2 corresponding to Vendor_2.							
	NR Band n2:	2.6d	Bi	NR Band n5:	2dBi			
	NR Band n7:	3dBi		NR Band n12:	0.35dBi			
Antenna Gain:	NR Band n25:	2.8d	Bi	NR Band n26:	2dBi			
	NR Band n38:	2.2d	Bi	NR Band n41:	3.4dBi			
	NR Band n48:	3.4d	Bi	NR Band n66:	2.5dBi			



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	NR Band n71:	0.2dE	Bi	NR Band n77:	3.7dBi		
	NR Band n38 MIMO:	1.4dE	Bi	NR Band n41 MIMO:	1.4dBi		
	NR Band n48 MIMO:	2.2dBi		NR Band n77 MIMO:	2.2dBi		
	Note: The antenna gain	are deri	ved from prov	ided by the manufa	cturer.		
	Provided by client						
RF Cable:	0.8dB(Below 1GH	0.8dB(Below 1GHz) 1.0dB(1.0~2.4GHz) 1.2dB(2.4~3.4GHz)					
	1.5dB(Above 3.40	1.5dB(Above 3.4GHz)					
Remark: As above information	n is provided and confirme	d by the	applicant SG	S is not liable to the	e accuracy.		

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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		44-46 % RH Ambient			
Value		Temperature(°C)	Voltage(V)		
NTNV		22~23	54		
LTLV		-30	48		
LTHV		-30	57		
HTLV		50	48		
HTHV		50	57		
Remark:					
NV: Normal Voltage LV: Low		Extreme Test Voltage	HV: High Extreme Test Voltage		
NT: Normal Temperature	T: Low	Extreme Test Temperature	HT: High Extreme Test Temperature		

## 3.7 Description of Support Units

The EUT has been tested as an independent unit.



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## 3.8 Technical Specification

SG

Characteristics	Description					
Radio System Type	🖾 SA 🖾 NSA					
	Band	ТХ	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 n12	699 to 716 MHz	729 to 746 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 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			
Supported Frequency Range	NR Band n66	1710 to 1780 MHz	2110 to 2200 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			
	ENDC FR1: DC_2A_n41a;DC_2A_n66A;DC_2A_n71A;DC_66A_n41A;DC_66A_n71A					
	FR1 CA:					
	CA_n71A-n77A;CA_n66A-n77A;CA_n2A-n77A;CA_n5A-n77A;					
	CA_n66A-n71A;CA_n48A-n66A;CA_n48A-n71A;CA_n25A-n41A;					
	CA_n41A-n66A;CA_n25A-n77A; Remark: ENDC&CA inter-band only test RSE, report only show worst mode.					
	Note*: According to ANSI C63.26:2015 section 5.2.5.3: For MIMO mode, the conducted bandedge and conducted spurious emission are tested on a single output port and then adjusted according to 10LOG(NANT) rule.					
		SCS 15kHz:				
	NR Band n2	⊠5 MHz ⊠10 MHz	⊠15 MHz   ⊠20 MHz			
Supported Channel Bandwidth		⊠25 MHz ⊠30 MHz	⊠40 MHz			
Banawian	ND Bond =5	SCS 15kHz:				
	NR Band n5	⊠5 MHz ⊠10 MHz	⊠15 MHz   ⊠20 MHz			



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		SCS 15kHz:			
	NR Band n7	⊠5 MHz	⊠10 MHz	X15 MHz	⊠20 MHz
		25 MHz	⊠ 30 MHz	A 10 MHz	
		SCS 15kHz:			
	NR Band n12	5 MHz	X10 MHz	15 MHz	
		SCS 15kHz:			
	NR Band n25	⊠5 MHz	10 MHz	15 MHz	⊠20 MHz
		25 MHz	30 MHz	A 40 MHz	
	NR Band n26	SCS 15kHz:			
	(814 to 824 MHz)	⊠5 MHz	10 MHz		
	NR Band n26	SCS 15kHz:			
	(824 to 849 MHz)	S MHz	X10 MHz	X15 MHz	20 MHz
		SCS 30kHz:			
	NR Band n38	20 MHz	⊠30 MHz;	⊠40 MHz;	
		SCS 30kHz:			
	NR Band n41	20 MHz	🖂 30 MHz	⊠40 MHz	⊠50 MHz
		⊠60 MHz	⊠70 MHz	🛛 80 MHz	⊠90 MHz
		⊠100 MHz			
	ND David v 40	SCS 30kHz:			
	NR Band n48	20 MHz	🖂 30 MHz	⊠40 MHz	
		SCS 15kHz:			
	NR Band n66	⊠5 MHz	🛛 10 MHz	🛛 15 MHz	⊠20 MHz
		25 MHz	🖾 30 MHz	⊠40 MHz	
	NR Band n71	SCS 15kHz:			
		⊠5 MHz	⊠10 MHz	🛛 15 MHz	⊠20 MHz
		SCS 30kHz			
	NR Band n77	20 MHz	⊠30 MHz	⊠40 MHz	⊠50 MHz
		⊠60 MHz	⊠70 MHz	⊠80 MHz	⊠90 MHz
		⊠100 MHz			



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## 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]	SS block SCS [kHz]	
[]		Low	1932.5	386500	[2]	
	Downlink	Mid	1960	392000	15	
_	Bounna	High	1987.5	397500		
5		Low	1852.5	370500		
	Uplink	Mid	1880	376000		
	• P	High	1907.5	381500		
		Low	1935	387000		
	Downlink	Mid	1960	392000	15	
10		High	1985	397000		
10		Low	1855	371000		
	Uplink	Mid	1880	376000		
	I	High	1905	381000		
		Low	1937.5	387500		
	Downlink	Mid	1960	392000	15	
45		High	1982.5	396500		
15		Low	1857.5	371500		
	Uplink	Mid	1880	376000	-	
		High	1902.5	380500		
	Downlink	Low	1940	388000		
		Mid	1960	392000	15	
20		High	1980	396000		
20	Uplink	Low	1860	372000		
		Mid	1880	376000	-	
		High	1900	380000		
		Low	1942.5	388500		
	Downlink	Mid	1960	392000	15	
25		High	1977.5	395500		
25		Low	1862.5	372500		
	Uplink	Mid	1880	376000	-	
		High	1897.5	379500		
		Low	1945	389000		
	Downlink	Mid	1960	392000	15	
30		High	1975	395000		
30		Low	1865	373000		
	Uplink	Mid	1880	376000	-	
		High	1895	379000		
		Low	1950	390000		
	Downlink	Mid	1960	392000	15	
40		High	1970	394000		
40		Low	1870	374000		
	Uplink	Mid	1880	376000		
		High	1890	378000		



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#### 3.9.2 Reference test frequencies for NR operating band n5

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

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]
		Low	871.5	174300	
	Downlink	Mid	881.5	176300	15
5 -		High	891.5	178300	
5		Low	826.5	165300	
	Uplink	Mid	836.5	167300	-
	-	High	846.5	169300	
		Low	874	174800	
	Downlink	Mid	881.5	176300	15
10		High	889	177800	
10 -		Low	829	165800	
	Uplink	Mid	836.5	167300	-
		High	844	168800	
		Low	876.5	175300	
	Downlink	Mid	881.5	176300	15
45		High	886.5	177300	
15 -		Low	831.5	166300	
	Uplink	Mid	836.5	167300	-
		High	841.5	168300	
		Low	879	175800	
	Downlink	Mid	881.5	176300	15
00		High	884	176800	
20		Low	834	166800	
	Uplink	Mid	836.5	167300	1 -
		High	839	167800	1



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#### Reference test frequencies for NR operating band n7 3.9.3

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.9.3.1	Test free	uencies	for NR	operating	) band n7	and SCS	15 kHz

Bandwidth	Range		g band n7 and SC	Carrier centre	SS block SCS	
[MHz]		Law	[MHz] 2622.5	[ARFCN] 524500	[kHz]	
	Desceliele	Low			15	
	Downlink	Mid	2655	531000	15	
5		High	2687.5	537500		
		Low	2502.5	500500		
	Uplink	Mid	2535	507000		
		High	2567.5	513500		
		Low	2625	525000	15	
	Downlink	Mid	2655	531000		
10		High	2685	537000		
10		Low	2505	501000		
	Uplink	Mid	2535	507000		
		High	2565	513000		
		Low	2627.5	525500		
	Downlink	Mid	2655	531000	15	
15 -		High	2682.5	536500		
15	Uplink	Low	2507.5	501500		
		Mid	2535	507000		
		High	2562.5	512500		
	Downlink Uplink	Low	2630	526000		
		Mid	2655	531000	15	
20		High	2680	536000		
20		Low	2510	502000		
		Mid	2535	507000		
		High	2560	512000		
		Low	2632.5	526500		
	Downlink	Mid	2655	531000	15	
05		High	2677.5	535500		
25 —		Low	2512.5	502500		
	Uplink	Mid	2535	507000		
	•	High	2557.5	511500		
		Low	2635	52700		
	Downlink	Mid	2655	531000	15	
		High	2675	535000		
30 -		Low	2515	503000		
	Uplink	Mid	2535	507000		
	- 1	High	2555	511000	1	
		Low	2640	528000		
	Downlink	Mid	2655	531000	15	
	Downink	High	2670	534000		
40						
		Low	2520	504000		
	Uplink	Mid	2535	507000		
		High	2550	510000		



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## 3.9.4 Reference test frequencies for NR operating band n12

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Bandwidth [MHz]	Rang	e	Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]
		Low	731.5	146300	
	Downlink	Mid	737.5	147500	15
5		High	743.5	148700	
5		Low	701.5	140300	
	Uplink	Mid	707.5	141500	
		High	713.5	142700	
		Low	734	146800	
	Downlink	Mid	737.5	147500	15
10		High	741	148200	
10		Low	704	140800	
	Uplink	Mid	707.5	141500	]
		High	711	142200	
		Low	736.5	147300	
	Downlink	Mid	737.5	147500	15
45		High	738.5	147700	1
15		Low	706.5	141300	
	Uplink	Mid	707.5	141500	]
		High	708.5	141700	]



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#### 3.9.5 Reference test frequencies for NR operating band n25

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

CBW [MHz]	frequencies for NF Range		Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]	
[10112]		Low	1932.5	386500	[KI12]	
	Downlink	Mid	1962.5	392500	15	
		High	1992.5	398500		
5 -		Low	1852.5	370500		
	Uplink	Mid	1882.5	376500		
	opinit	High	1912.5	382500		
		Low	1935	387000		
	Downlink	Mid	1962.5	392500	15	
	200000	High	1990	398000		
10		Low	1855	371000		
	Uplink	Mid	1882.5	376500		
	- [	High	1910	382000	-	
		Low	1937.5	387500		
	Downlink	Mid	1962.5	392500	15	
		High	1987.5	397500		
15 -		Low	1857.5	371500		
	Uplink	Mid	1882.5	376500		
	Opmint	High	1907.5	381500	-	
	Downlink Uplink	Low	1940	388000		
		Mid	1962.5	392500	15	
		High	1985	397000	-	
20		Low	1860	372000		
		Mid	1882.5	376500		
		High	1905	381000		
		Low	1942.5	388500		
	Downlink	Mid	1962.5	392500	15	
0.5		High	1982.5	396500		
25		Low	1862.5	372500		
	Uplink	Mid	1882.5	376500	-	
	,	High	1902.5	380500		
		Low	1945	389000		
	Downlink	Mid	1962.5	392500	15	
20		High	1980	396000		
30		Low	1865	373000		
	Uplink	Mid	1882.5	376500	-	
	·	High	1900	380000	1	
		Low	1950	390000		
	Downlink	Mid	1962.5	392500	15	
		High	1975	395000	1	
40		Low	1870	374000		
	Linlink	Mid			-	
	Uplink		1882.5	376500		
		High	1895	379000		



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#### 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:

SG

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]
		Low	861.5	172300	
	Downlink	Mid	864	172800	15
5 -		High	866.5	173300	
5	Uplink	Low	816.5	163300	
		Mid	819	163800	-
		High	821.5	164300	
		Low	/	/	
	Downlink	Mid	864	172800	15
10		High	/	/	
10		Low	/	/	
	Uplink	Mid	819	163800	- 1
		High	/	/	1

CBW [MHz]	Range	9	Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]
		Low	871.5	174300	
	Downlink	Mid	881.5	176300	15
5		High	891.5	178300	
5		Low	826.5	165300	
	Uplink	Mid	836.5	167300	-
		High	846.5	169300	
		Low	874	174800	
	Downlink	Mid	881.5	176300	15
10		High	889	177800	
10		Low	829	165800	
	Uplink	Mid	836.5	167300	-
		High	844	168800	
	Downlink	Low	876.5	175300	
		Mid	881.5	176300	15
15		High	886.5	177300	
15		Low	831.5	166300	
	Uplink	Mid	836.5	167300	-
		High	841.5	168300	
		Low	879	175800	
	Downlink	Mid	881.5	176300	15
20		High	884	176800	
20		Low	834	166800	
	Uplink	Mid	836.5	167300	-
		High	839	167800	



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#### 3.9.7 Reference test frequencies for NR operating band n38 3.9.7.1 Test frequencies for NR operating band n38 and SCS 30 kHz

SG

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



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### 3.9.8 Reference test frequencies for NR operating band n41

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

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]
	Downlink	Low	2506.02	501204	
20	&	Mid	2592.99	518598	30
	Uplink	High	2670	534000	
	Downlink	Low	2511	502200	
30	&	Mid	2592.99	518598	30
	Uplink	High	2675	535000	
	Downlink	Low	2516.01	503202	
40	&	Mid	2592.99	518598	30
	Uplink	High	2670	534000	
	Downlink	Low	2521.02	504204	
50	&	Mid	2592.99	518598	30
	Uplink	High	2664.99	532998	
	Downlink	Low	2526	505200	
60	&	Mid	2592.99	518598	30
	Uplink	High	2659.98	531996	
	Downlink	Low	2531	506200	
70	&	Mid	2592.29	518598	30
	Uplink	High	2655	531000	
	Downlink	Low	2536.02	507204	
80	&	Mid	2592.99	518598	30
	Uplink	High	2649.99	529998	
	Downlink	Low	2541	508200	
90	&	Mid	2592.99	518598	30
	Uplink	High	2644.98	528996	7
	Downlink	Low	2546.01	509202	
100	&	Mid	2592.99	518598	30
	Uplink	High	2640	528000	1



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

## 3.9.9 Reference test frequencies for NR operating band n48



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CBW [MHz]	frequencies for NR operating b Range		Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]
		Low	2112.5	422500	1 • •
5 —	Downlink	Mid	2155	431000	15
		High	2197.5	439500	
	Uplink	Low	1712.5	342500	
		Mid	1745	349000	-
		High	1777.5	355500	
		Low	2115	423000	
	Downlink	Mid	2155	431000	15
10		High	2195	439000	
10		Low	1715	343000	
	Uplink	Mid	1745	349000	-
	·	High	1775	355000	1
		Low	2117.5	423500	
	Downlink	Mid	2155	431000	15
4.5		High	2192.5	438500	1
15 -	Uplink	Low	1717.5	343500	
		Mid	1745	349000	
		High	1772.5	354500	
	Downlink	Low	2120	424000	15
		Mid	2155	431000	
		High	2190	438000	
20		Low	1720	344000	
	Uplink	Mid	1745	349000	
	- 1	High	1770	354000	
		Low	2122.5	424500	
	Downlink	Mid	2155	431000	15
		High	2187.5	437500	
25	Uplink	Low	1722.5	344500	+
		Mid	1745	349000	1 -
		High	1767.5	353500	1
	Downlink	Low	2125	425000	
		Mid	2155	431000	15
20		High	2185	437000	-
30	Uplink	Low	1725	345000	
		Mid	1745	349000	
		High	1765	353000	
		Low	2130	426000	
	Downlink	Mid	2155	431000	15
40		High	2180	436000	
		Low	1730	346000	
	Linlink	Mid			-
	Uplink		1745	349000	
		High	1760	352000	

## 3.9.10 Reference test frequencies for NR operating band n66 3.9.10.1 Test frequencies for NR operating band n66 and SCS 15 kHz

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### 3.9.11 Reference test frequencies for NR operating band n71

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

CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]
	Downlink	Low	619.5	123900	
		Mid	634.5	126900	15
5 –		High	649.5	129900	
5		Low	665.5	133100	
	Uplink	Mid	680.5	136100	-
		High	695.5	139100	
		Low	622	124400	
	Downlink	Mid	634.5	126900	15
10		High	647	129400	
10	Uplink	Low	668	133600	
		Mid	680.5	136100	-
		High	693	138600	1
	Downlink	Low	624.5	124900	15
		Mid	634.5	126900	
45		High	644.5	128900	
15 -	Uplink	Low	670.5	134100	
		Mid	680.5	136100	-
		High	690.5	138100	1
		Low	627	125400	
	Downlink	Mid	634.5	126900	15
20		High	642	128400	1
20	Uplink	Low	673	134600	
		Mid	680.5	136100	
		High	688	137600	



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#### 3.9.12 Reference test frequencies for NR operating band n77

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

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CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]
	Downlink	Low	3710.01	647334	
20	&	Mid	3840	656000	30
	Uplink	High	3969.99	664666	
	Downlink	Low	3714.99	647666	
30	&	Mid	3840	656000	30
	Uplink	High	3965.01	664334	
	Downlink	Low	3720	648000	
40	&	Mid	3840	656000	30
	Uplink	High	3960	664000	
	Downlink	Low	3725.01	648334	
50	&	Mid	3840	656000	30
	Uplink	High	3954.99	663666	1
	Downlink	Low	3730.02	648668	30
60	&	Mid	3840	656000	
	Uplink	High	3949.98	663332	
	Downlink	Low	3735	649000	
70	&	Mid	3840	656000	30
	Uplink	High	3945	663000	
	Downlink	Low	3740.01	649334	
80	&	Mid	3840	656000	30
	Uplink	High	3939.99	662666	]
	Downlink	Low	3745.02	649668	30
90	&	Mid	3840	656000	
	Uplink	High	3934.98	662332	
	Downlink	Low	3750	650000	
100	&	Mid	3840	656000	30
	Uplink	High	3930	662000	1

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CBW [MHz]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	SS block SCS [kHz]
	Downlink	Low	3460.02 630668	630668	
20	&	Mid	3500.01	633334	30
	Uplink	High	3540	636000	
	Downlink	Low	3465	631000	
30	&	Mid	3500.01	633334	30
	Uplink	High	3534.99	635666	
	Downlink	Low	3470.01	631334	
40	&	Mid	3500.01	633334	30
	Uplink	High	3530.01	635334	
	Downlink	Low	3475.02	631668	
50	&	Mid	3500.01	633334	30
	Uplink	High	3525	635000	
	Downlink	Low	3480	632000	30
60	&	Mid	3500.01	633334	
	Uplink	High	3519.99	634666	
	Downlink	Low	3485.01	632334	
70	&	Mid	3500.01	633334	30
	Uplink	High	3515.01	634334	1
	Downlink	Low	3490.02	632668	30
80	&	Mid	3500.01	633334	
	Uplink	High	3510	634000	
	Downlink	Low	3495	633000	30
90	&	Mid	3500.01	633334	
	Uplink	High	3504.99	633666	
	Downlink	Low	\	/	30
100	&	Mid	3500.01	633334	
	Uplink	High	\		



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## 4 Description of Tests

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### 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** 



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## 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



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## 4.3 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

- 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.
- RBW = 1 5% of the expected OBW
- 3. VBW  $\ge$  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



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## 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
- 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



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## 4.5 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 emissinos, 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



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## 4.6 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



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## 4.7 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 (dB $\mu$ V/m) = Measured amplitude level (dB $\mu$ V) + (Cable Loss (dB) + Antenna Factor (dB/m) – AMP(dB)) EIRP (dBm) = E (dB $\mu$ V/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,



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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.



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## 4.8 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  $\pm 0.00025\%$  ( $\pm 2.5$  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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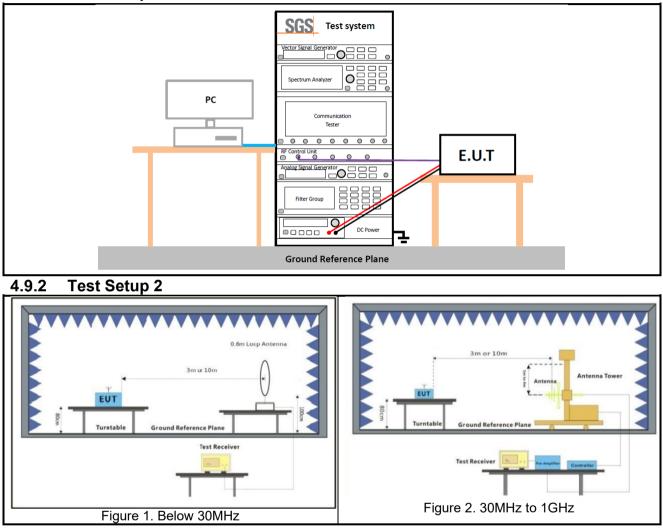
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## 4.9 Test Setups

4.9.1 Test Setup 1



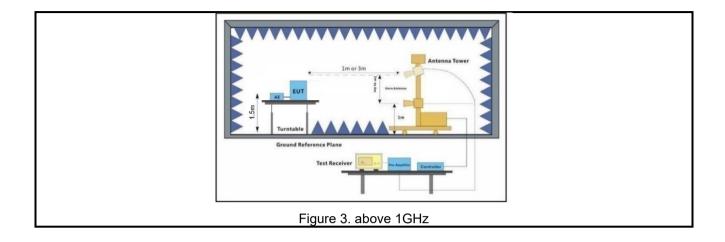


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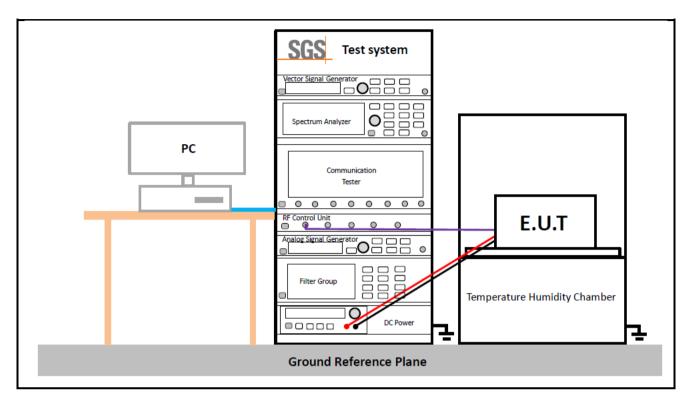
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### 4.9.3 Test Setup 3





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## 4.10 Test Conditions

Transmit Output Power Data - Average Power, Total					
Test Case	Test Conditions				
Test Environment	nt 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/TM5; 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; N					
	Band Edges Compliance				
Test Case	Test Conditions				
Test Environment	Ambient Climate & Rated Voltage				



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Test Setup 1					
RF Channels (TX)	L, H (L= low channel, H= high channel)				
Test Mode NR/TM1; NR/TM6					
	Spurious Emission at Antenna Terminals				
TestOses					
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				
	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)				
NR/TM1         NR/TM1           Test Mode         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				
rest Environment	(2) VL, VN and VH of Rated Voltage at Ambient Climate.				
Test Setup 3					
RF Channels (TX)	M (M= middle channel)				
Test Made	NR/TM1; NR/TM6				
Test Mode	The report only show the bandwidth with the worst case.				



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## 5 Main Test Instruments

SG

RF conducted test					
				Cal. date	Cal.Due date
Test Equipment	Manufacturer	Model No.	Inventory No.	(yyyy/mm/dd )	(yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	SUWI-04-01-06	2022/11/09	2025/11/08
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-07	2024/02/18	2025/02/17
Signal Analyzer	ROHDE&SCHWARZ	FSV3030	SUWI-01-02-02	2024/05/08	2025/05/07
Measurement Software	TST	TST-271-2.0	SUWI-03-55-01	NCR	NCR
Measurement Software	Tonscend	JS1120-3 Test System V 2.6.88.0336	SUWI-02-09-09	NCR	NCR
Radio Communication Analyzer	Anritsu	MT8821C	SUWI-01-26-03	2023/11/21	2024/11/20
Wideband Radio Communication Tester	ROHDE&SCHWARZ	CMW500	SUWI-01-16-05	2024/05/06	2025/05/05
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2024/05/08	2025/05/07
Temperature Chamber	ESPEC	SU-242	SUWI-01-13-01	2023/11/21	2024/11/20
Signal Analyzer	ROHDE&SCHWARZ	FSW43	SUWI-01-02-04	2024/05/09	2025/05/08



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RSE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date (yyyy/mm/dd )	Cal Due Date (yyyy/mm/dd )
Semi-Anechoic Chamber	Brilliant-emc	N/A	SUWI-04-02-01	2023/04/03	2026/03/03
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-05	2024/02/08	2025/02/07
Signal Analyzer	ROHDE&SCHWAR Z	FSW43	SUWI-01-02-04	2024/05/08	2025/05/07
Signal Analyzer	KEYSIGHT	N9020A	SUWI-01-02-06	2023/11/21	2024/11/20
Test receiver	ROHDE&SCHWAR Z	ESR7	SUWI-01-10-01	2024/02/01	2025/01/31
Receiving antenna	SCHWRZBECK MESS- ELEKTRONIK	VULB 9163	SUWI-01-11-04	2023/11/25	2024/11/24
Receiving antenna	SCHWRZBECK MESS- ELEKTRONIK	BBHA 9120D	SUWI-01-11-05	2023/11/25	2024/11/24
Receiving antenna	SCHWRZBECK MESS- ELEKTRONIK	BBHA 9170	SUWI-01-11-03	2023/05/12	2025/05/11
Amplifier	Tonscend	TAP9K3G40	SUWI-01-14-06	2023/11/21	2024/11/20
Amplifier	Tonscend	TAP0101805 0	SUWI-01-14-04	2023/11/21	2024/11/20
Amplifier	Tonscend	TAP1804004 8	SUWI-01-14-05	2023/11/21	2024/11/20
Active Loop Antenna	SCHWRZBECK MESS- ELEKTRONIK	FMZB 1519B	SUWI-01-21-01	2023/05/13	2025/05/12
Wideband Radio Communication Tester	Anritsu	MT8820C	SUWI-01-16-08	2024/02/04	2025/02/03
Wideband Radio Communication Tester	Anritsu	MT8821C	SUWI-01-26-03	2023/11/21	2024/11/20
Measurement Software	Tonscend	JS32-RSE V4.0.0.1	SUWI-02-09-06	NCR	NCR
Measurement Software	Tonscend	JS32-RE V4.0.0.0	SUWI-02-09-04	NCR	NCR
Radio	StarPoint	SP9 <i>500</i> E	SUWI-01-28-	2023/11/21	2024/11/20



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Communicatio		02	
n Analyzer			

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:

Item	Measurement Uncertainty		
Total RF power, conducted	±0.54dB		
RF power density, conducted	±1.03dB		
Spurious emissions, conducted	±0.54dB		
Radio Frequency	±1.0 %		
Duty Cycle	±0.37%		
Occupied Bandwidth	±1.0 %		
7 Radiated Emission	± 3.13dB (9k -30MHz)		
	± 4.88dB (30M -1GHz)		
	± 4.75dB (1GHz to 18GHz)		
	± 4.77dB (Above 18GHz)		
	Total RF power, conducted RF power density, conducted Spurious emissions, conducted Radio Frequency Duty Cycle		

Remark:

The U<sub>lab</sub> (lab Uncertainty) is less than U<sub>cispr/ETSI</sub> (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.



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# 7 Appendixes

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Appendix B.17	NR Band n2	
Appendix B.18	NR Band n5	
Appendix B.19	NR Band n7	
Appendix B.20	NR Band n12	
Appendix B.21	NR Band n25	
Appendix B.22	NR Band n26(814-824)	
Appendix B.23	NR Band n26(824-849)	
Appendix B.24	NR Band n38	
Appendix B.25	NR Band n41	
Appendix B.26	NR Band n48	
Appendix B.27	NR Band n66	
Appendix B.28	NR Band n71	
Appendix B.29	NR Band n77(3450-3550)	
Appendix B.30	NR Band n77(3700-3980)	

---End of Report---



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