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

TEST REPORT

Application No.:	ZEWA2304000048RG
Applicant:	Quectel Wireless Solutions Co., Ltd.
Address of Applicant:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer:	Quectel Wireless Solutions Co., Ltd.
Address of Manufacturer:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
EUT Description:	5G Sub-6 GHz LGA Module
Model No.:	RG620T-NA
Trade Mark:	Quectel
FCC ID:	XMR2023RG620TNA
Standards:	47 CFR Part 2 47 CFR Part 96
Date of Receipt:	2023/03/06
Date of Test:	2023/03/10 to 2023/04/18
Date of Issue:	2023/04/18
Test Result :	**PASS ***

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

Authorized Signature:

Ervin Li
Regulatory Manager

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1 Version

Revision Record				
Version	***Chapter***	***Date***	***Modifier***	***Remark***
01		2023/04/18		Original

Prepared By	Dee.Zheng **(Dee Zheng) / Test Engineer**
Checked By	Daniel Wang **(Daniel Wang) / Reviewer**

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2 Test Summary

2.1 LTE Band 42/ LTE Band 43/ LTE Band 48/ LTE CA_42C/ LTE CA_48C

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §96.41	EIRP ≤ 23dBm	Section 1 of Appendix B.45&B.46&B.47&B.48&B.49	Pass
Peak-Average Ratio	§96.41	FCC: Limit≤13 dB	Section 2 of Appendix B.45&B.46&B.47&B.48&B.49	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Section 4 of Appendix B.45&B.46&B.47&B.48&B.49	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.	Section 5 of Appendix B.45&B.46&B.47&B.48&B.49	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, the conducted power of any emission shall not exceed −25 dBm/MHz. (2) Additional protection levels.	Section 6 of Appendix B.45&B.46&B.47&B.48&B.49	Pass

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		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.		
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, 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.	Section 7 of Appendix B.45&B.46&B.47&B.48&B.49	Pass
Frequency Stability	§2.1055, §96.41	Within authorized bands of operation/ frequency block.	Section 8 of Appendix B.45&B.46&B.47&B.48&B.49	Pass

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No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
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3 General Information

3.1 Details of Client

Applicant:	Quectel Wireless Solutions Co., Ltd.
Address of Applicant:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer:	Quectel Wireless Solutions Co., Ltd.
Address of Manufacturer:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

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, Shenzhen, Guangdong, China
Post code:	518057
Test engineer:	Xing Guo, Jinhua Wei

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 Branch is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

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

- **Innovation, Science and Economic Development Canada**

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

CAB identifier: CN0006.

IC#: 4620C.

- **FCC –Designation Number: CN1336**

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

Designation Number: CN1336.

Test Firm Registration Number: 787754

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3.4 General Description of EUT

EUT Description:	5G Sub-6 GHz LGA Module			
Model No.:	RG620T-NA			
Trade Mark:	Quectel			
Hardware Version:	R1.0			
Software Version:	RG620TNAAAR01A04G55_OCPU			
IMEI:	RF Conducted	861075060002904		
	RSE	861085060003746		
Antenna Type:	☒ External, ☐ Integrated			
Antenna Gain:	LTE Band 42:	-4.29dBi (Ant6)	LTE Band 43:	-4.29dBi (Ant6)
	LTE Band 48:	-4.29dBi (Ant6)		
	LTE CA_42C:	-4.29dBi (Ant6)	LTE CA_48C:	-4.29dBi (Ant6)
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.			
RF Cable:	9kHz ~ 30MHz (0.3dB)	30MHz ~ 1000MHz (0.6dB)	1000MHz ~ 2000MHz (0.8dB)	
	2000MHz ~ 4000MHz (1.2dB)	4000MHz ~ 6000MHz (1.8dB)	6000MHz ~ 12750MHz (2.6dB)	
	Above 12750MHz (3.5dB)			
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3.5 Test Mode

Test Mode	Test Modes Description
LTE/TM1	LTE system, QPSK modulation
LTE/TM2	LTE system, 16QAM modulation
LTE/TM3	LTE system, 64QAM modulation
LTE/TM4	LTE system, 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	44-60 % RH Ambient	
Value	Temperature(℃)	Voltage(V)
NTNV	22~25	3.8
LTLV	-30	3.3
LTHV	-30	4.4
HTLV	50	3.3
HTHV	50	4.4
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

Description	Manufacturer	Model No.
Mother board	Quectel	N/A
Remark: all above the information of table are provided by client.		

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3.8 Technical Specification

Characteristics	Description				
Radio System Type	☒ LTE				
Supported Frequency Range	Band	TX	RX		
	LTE Band 42	3550 to 3600 MHz	3550 to 3600 MHz		
	LTE Band 43	3600 to 3700 MHz	3600 to 3700 MHz		
	LTE Band 48	3550 to 3700 MHz	3550 to 3700 MHz		
	LTE CA_42C	3550 to 3600 MHz	3550 to 3600 MHz		
	LTE CA_48C	3550 to 3700 MHz	3550 to 3700 MHz		
	LTE UL CA: CA_42C; CA_48C; CA_2A-48A; CA_4A-48A; CA_5A-48A; CA_7A-42A; CA_12A-48A; CA_13A-48A; CA_25A-48A; CA_30A-48A; CA_41A-42A; CA_41A-48A; UL CA intra-band Only test RSE, report only show worst mode.				
Supported Channel Bandwidth	LTE Band42	☒5 MHz	☒10 MHz	☒15 MHz	☒20 MHz
	LTE Band43	☒5 MHz	☒10 MHz	☒15 MHz	☒20 MHz
	LTE Band48	☒5 MHz	☒10 MHz	☒15 MHz	☒20 MHz
	LTE Band CA_42C	☒10MHz+20MHz	☒15MHz+20MHz		
		☒20MHz+10MHz	☒20MHz+15MHz		
		☒20MHz+20MHz	☒20MHz+5MHz		
		☒5MHz+20MHz			
	LTE Band CA_48C	☒10MHz+20MHz	☒15MHz+20MHz		
		☒20MHz+10MHz	☒20MHz+15MHz		
		☒20MHz+20MHz	☒20MHz+5MHz		
		☒5MHz+20MHz			
Characteristics	Description				
Designation of Emissions (Remark: the necessary bandwidth of which is the worst value from the measured occupied bandwidths for each type of channel bandwidth	E-UTRA:	QPSK	16QAM	64QAM	256QAM
	LTE Band 42	4M49G7D	4M50W7D	4M50W7D	4M49W7D
		8M98G7D	8M98W7D	9M00W7D	8M97W7D
		13M5G7D	13M5W7D	13M5W7D	13M5W7D
		18M0G7D	18M0W7D	18M0W7D	18M0W7D
	LTE Band 43	4M49G7D	4M50W7D	4M51W7D	4M50W7D
		8M98G7D	8M98W7D	8M99W7D	8M98W7D

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configuration.)		13M5G7D	13M5W7D	13M5W7D	13M4W7D
		18M0G7D	18M0W7D	18M0W7D	18M0W7D
	LTE Band 48	4M49G7D	4M49W7D	4M51W7D	4M49W7D
		8M98G7D	8M98W7D	9M01W7D	8M98W7D
		13M5G7D	13M5W7D	13M5W7D	13M5W7D
		18M1G7D	18M0W7D	18M0W7D	18M0W7D
	LTE Band CA_42C (3550-3600)	50RB+100RB:			
		27M6G7D	27M7W7D	27M7W7D	27M7W7D
		75RB+100RB:			
		32M5G7D	32M5W7D	32M5W7D	32M5W7D
		100RB+50RB:			
		27M7G7D	27M7W7D	27M7W7D	27M7W7D
		100RB+75RB:			
		32M6G7D	32M6W7D	32M6W7D	32M6W7D
		100RB+100RB:			
		37M7G7D	37M7W7D	37M7W7D	37M7W7D
		100RB+25RB:			
		22M9G7D	22M9W7D	22M9W7D	22M9W7D
		25RB+100RB:			
		22M9G7D	22M9W7D	22M9W7D	22M9W7D
	LTE Band CA_48C (3550-3700)	50RB+100RB:			
		27M7G7D	27M7W7D	27M7W7D	27M6W7D
		75RB+100RB:			
		32M5G7D	32M6W7D	32M5W7D	32M5W7D
		100RB+50RB:			
		27M7G7D	27M7W7D	27M7W7D	27M7W7D
		100RB+75RB:			
		32M6G7D	32M6W7D	32M6W7D	32M6W7D
		100RB+100RB:			
		37M7G7D	37M7W7D	37M7W7D	37M6W7D
		100RB+25RB:			
		22M9G7D	22M9W7D	22M9W7D	22M9W7D
		25RB+100RB:			
		22M9G7D	22M9W7D	22M9W7D	22M8W7D

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3.9 Test Frequencies

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 42 (3550-3600)	5MHz	TX	Channel 40115	Channel 43340	Channel 43565
			3552.5 MHz	3575 MHz	3597.5 MHz
		RX	Channel 40115	Channel 43340	Channel 43565
			3552.5 MHz	3575 MHz	3597.5 MHz
	10MHz	TX	Channel 43140	Channel 43340	Channel 43540
			3555 MHz	3575 MHz	3595 MHz
		RX	Channel 43140	Channel 43340	Channel 43540
			3555 MHz	3575 MHz	3595 MHz
	15MHz	TX	Channel 43165	Channel 43340	Channel 43515
			3557.5 MHz	3575 MHz	3592.5 MHz
		RX	Channel 43165	Channel 43340	Channel 43515
			3557.5 MHz	3575 MHz	3592.5 MHz
	20MHz	TX	Channel 43190	Channel 43340	Channel 43490
			3560 MHz	3575 MHz	3590 MHz
		RX	Channel 43190	Channel 43340	Channel 43490
			3560 MHz	3575 MHz	3590 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 43 (3600-3700)	5MHz	TX/RX	Channel 43615	Channel44090	Channel 44565
			3602.5 MHz	3650.0 MHz	3697.5 MHz
	10MHz	TX/RX	Channel 43640	Channel44090	Channel 44540
			3605.0 MHz	3650.0 MHz	3695.0 MHz
	15MHz	TX/RX	Channel 43665	Channel44090	Channel 44515
			3607.5 MHz	3650.0 MHz	3692.5 MHz
	20MHz	TX/RX	Channel 43690	Channel44090	Channel 44490
			3610 MHz	3650.0 MHz	3690.0 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 48	5MHz	TX/RX	Channel 55265	Channel55990	Channel 56715
			3552.5 MHz	3625.0 MHz	3697.5 MHz
	10MHz	TX/RX	Channel 55290	Channel55990	Channel 56690
			3555.0 MHz	3625.0 MHz	3695.0 MHz
	15MHz	TX/RX	Channel 55315	Channel55990	Channel 56665
			3557.5 MHz	3625.0 MHz	3692.5 MHz
	20MHz	TX/RX	Channel 55340	Channel55990	Channel 56640
			3560.0 MHz	3625.0 MHz	3690.0 MHz

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LTE CA_42C(3550-3600):

Range	CC-Combo / NRB_agg [RB]	CC1 Note1			CC2 Note1		
		BW [RB]	NUL/DL	fUL/DL [MHz]	BW [RB]	NUL/DL	fUL/DL [MHz]
Low	25+100	25	43123	3553.3	100	43240	3565
		100	43190	3560	25	43307	3571.7
	50+100	50	43145	3555.5	100	43289	3569.9
		100	43190	3560	50	43334	3574.4
	75+100	75	43168	3557.8	100	43339	3574.9
		100	43190	3560	75	43361	3577.1
	100+100	100	43190	3560	100	43388	3579.8
Mid	25+100	25	43248	3565.8	100	43365	3577.5
		100	43315	3572.5	25	43432	3584.2
	50+100	50	43246	3565.6	100	43390	3580
		100	43291	3570.1	50	43435	3584.5
	75+100	75	43243	3565.3	100	43414	3582.4
		100	43266	3567.6	75	43437	3584.7
	100+100	100	43241	3565.1	100	43439	3584.9
High	25+100	25	43373	3578.3	100	43490	3590
		100	43440	3585	25	43557	3596.7
	50+100	50	43346	3575.6	100	43490	3590
		100	43391	3580.1	50	43535	3594.5
	75+100	75	43319	3572.9	100	43490	3590
		100	43341	3575.1	75	43512	3592.2
	100+100	100	43292	3570.2	100	43490	3590

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LTE CA_48C(3550-3700):

Range	CC-Combo / NRB_agg [RB]	CC1 Note1			CC2 Note1		
		BW [RB]	NUL/DL	fUL/DL [MHz]	BW [RB]	NUL/DL	fUL/DL [MHz]
Low	25+100	25	55273	3553.3	100	55390	3565
		100	55340	3560	25	55457	3571.7
	50+100	50	55295	3555.5	100	55439	3569.9
		100	55340	3560	50	55484	3574.4
	75+100	75	55318	3557.8	100	55489	3574.9
		100	55340	3560	75	55511	3577.1
	100+100	100	55340	3560	100	55538	3579.8
Mid	25+100	25	55898	3615.8	100	56015	3627.5
		100	55965	3622.5	25	56082	3634.2
	50+100	50	55896	3615.6	100	56040	3630
		100	55941	3620.1	50	56085	3634.5
	75+100	75	55893	3615.3	100	56064	3632.4
		100	55916	3617.6	75	56087	3634.7
	100+100	100	55891	3615.1	100	56089	3634.9
High	25+100	25	56523	3678.3	100	56640	3690
		100	56590	3685	25	56707	3696.7
	50+100	50	56496	3675.6	100	56640	3690
		100	56541	3680.1	50	56685	3694.5
	75+100	75	56469	3672.9	100	56640	3690
		100	56491	3675.1	75	56662	3692.2
	100+100	100	56442	3670.2	100	56640	3690
Note 1: Carriers in increasing frequency order.							

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4 Description of Tests

4.1 Conducted Output Power

Measurement Procedure: FCC KDB 971168 D01 V03r01 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 (dBi)

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

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

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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 rms.

Remark: Reference test setup 1

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW $\geq$ 1% of the emission bandwidth
4. VBW $\geq$ 3 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 (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.

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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 ±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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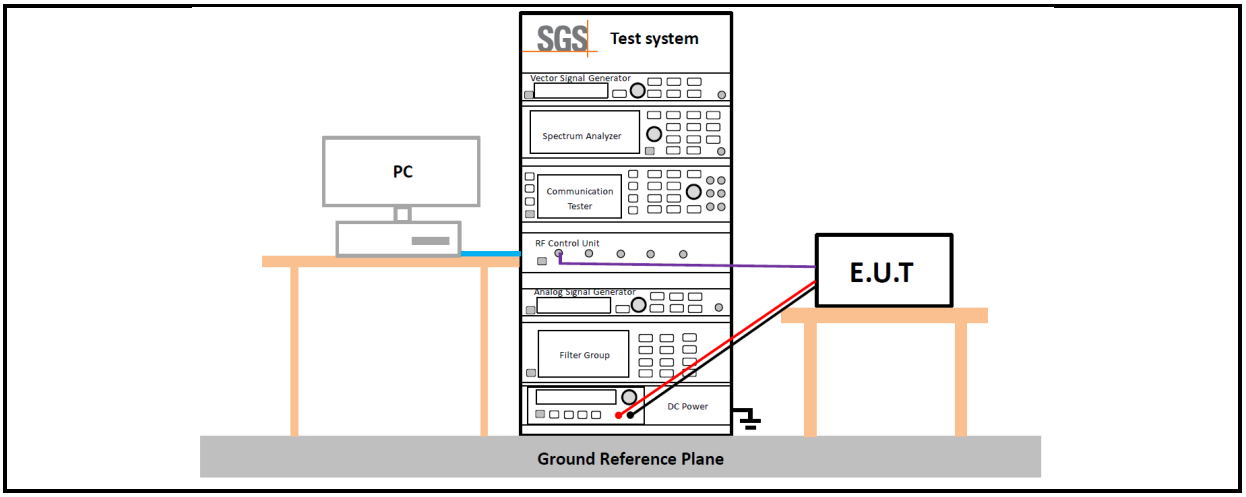
4.9 Test Setups

4.9.1 Test Setup 1



4.9.2 Test Setup 2

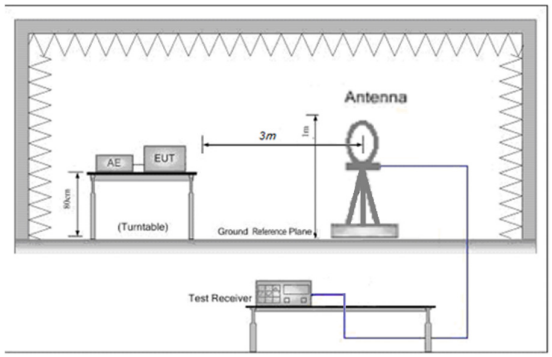


Figure 1. Below 30MHz

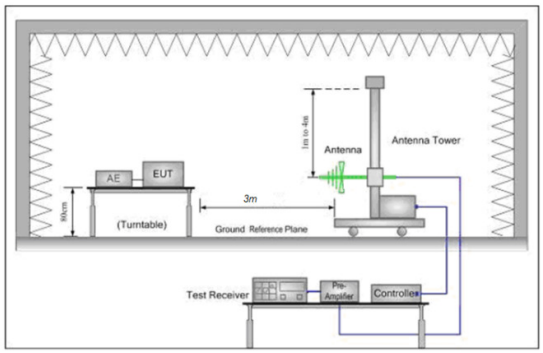


Figure 2. 30MHz to 1GHz

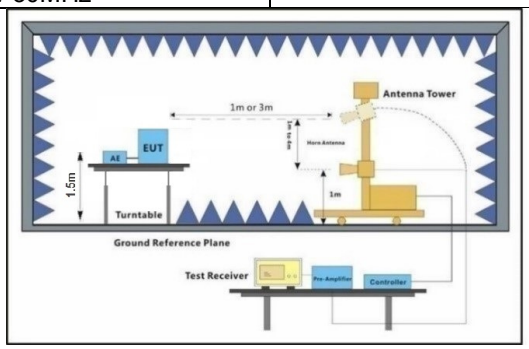


Figure 3. above 1GHz

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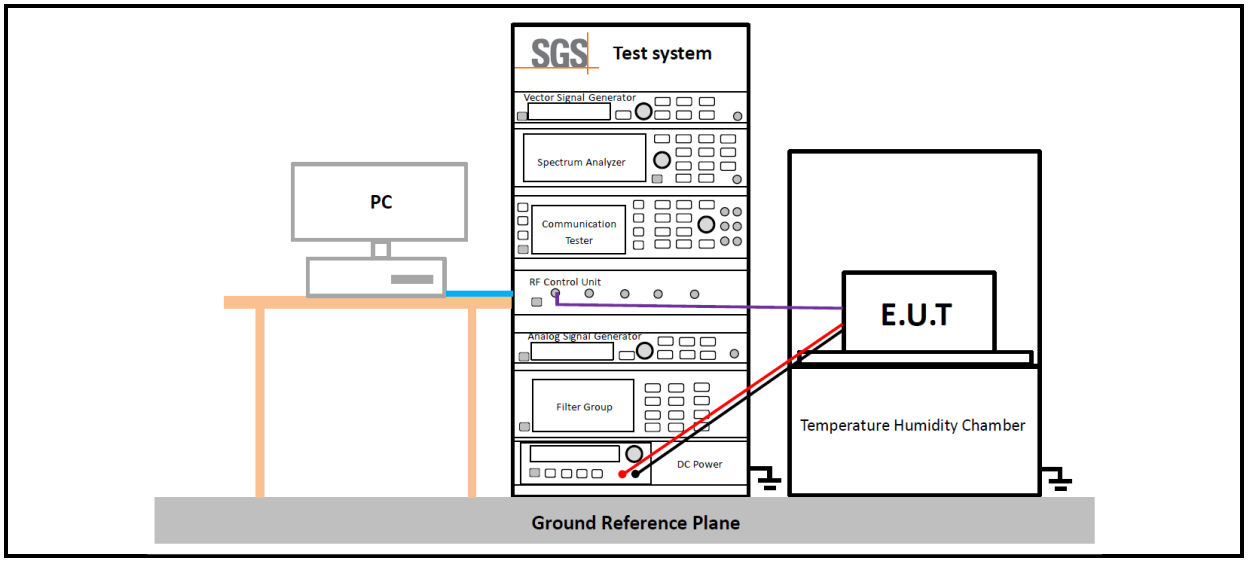
4.9.3 Test Setup 3



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4.10 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	LTE/TM1;LTE/TM2;LTE/TM3;LTE/TM4
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	LTE/TM1;LTE/TM2;LTE/TM3;LTE/TM4
Modulation Characteristics	
Test Case	**Test Conditions**
Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 1
RF Channels (TX)	M (M= middle channel)
Test Mode	LTE/TM1;LTE/TM2;LTE/TM3;LTE/TM4
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	LTE/TM1;LTE/TM2;LTE/TM3;LTE/TM4
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	LTE/TM1;LTE/TM2;LTE/TM3;LTE/TM4
Band Edges Compliance	
Test Case	**Test Conditions**

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Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 1
RF Channels (TX)	L, H (L= low channel, H= high channel)
Test Mode	LTE/TM1
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	LTE/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)
Test Mode	LTE/TM1 Remark: All bandwidth and modulation of LTE 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	LTE/TM1

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5 Main Test Instruments

RF conducted test					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy/mm/dd)**	**Cal.Due date (yyyy/mm/dd)**
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	HTC-1	SZ-WRG-M-032	2023/02/16	2024/02/15
Spectrum Analyzer	Rohde & Schwarz	FSV	SZ-WRG-M-012	2023/02/16	2024/02/15
DC power supply	HYELEC	HY3005B	SZ-WRG-M-044	2022/09/22	2023/09/21
Digital Multimeter	VICTOR	VC890C	SZ-WRG-M-071	2023/02/16	2024/02/15
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	SZ-WRG-M-033	2023/02/16	2024/02/15
Wideband Radio Communication Tester	Anritsu	MT8821C	SZ-WRG-M-042	2022/05/31	2023/05/30
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	HTC-1	SZ-WRG-M-077	2022/07/06	2023/07/05
Signal Generator	KEYSIGHT	N5182A	SZ-WRG-M-041	2023/02/16	2024/02/15
Signal &Spectrum Analyzer	Rohde & Schwarz	FSV	SZ-WRG-M-048	2023/02/16	2024/02/15

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Radiated spurious emissions					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy/mm/dd)**	**Cal.Due date (yyyy/mm/dd)**
EMI TEST RECEIVER	Rohde & Schwarz	ESR	SZ-WRG-M-047	2023/02/16	2024/02/15
Signal &Spectrum Analyzer	Rohde & Schwarz	FSV	SZ-WRG-M-048	2023/02/16	2024/02/15
Low Noise Amplifier 9K-3GHz	Tonscend	TAP9K3G32	SZ-WRG-M-049	2023/02/16	2024/02/15
Low Noise Amplifier 30M-8GHz	Tonscend	TAP30M8G30	SZ-WRG-M-050	2023/02/16	2024/02/15
Low Noise Amplifier 1G-18GHz	Tonscend	TAP01018050	SZ-WRG-M-051	2023/02/16	2024/02/15
Low Noise Amplifier 18G-40GHz	Tonscend	TAP18040048	SZ-WRG-M-052	2023/02/16	2024/02/15
Active Loop Antenna 9kHz-30MHz	SCHWARZBECK	FMZB 1519B	SZ-WRG-M-053	2022/01/16	2024/01/15
TRILOG Breitband Antenne 30MHz-1GHz	SCHWARZBECK	VULB 9168	SZ-WRG-M-054	2022/01/16	2024/01/15
Double Ridge Horn Antenna 1GHz-18GHz	SCHWARZBECK	BBHA 9120 D	SZ-WRG-M-055	2022/01/16	2024/01/15
SHF-EHF Horn 15GHz-40GHz	SCHWARZBECK	BBHA 9170	SZ-WRG-M-056	2022/01/16	2024/01/15
RSE Test Software	Tonscend	JS32-RSE V4.0.0	SZ-WRG-M-058	NCR	NCR
Radio Communication Tester	Anritsu	MT8821C	SZ-WRG-M-042	2022/05/31	2023/05/30
Chamber	CRTSGSSAC966	N/A	SZ-WRG-C-063	2022/01/05	2025/01/04
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	HTC-1	SZ-WRG-M-022	2023/02/17	2024/02/16
Spectrum Analyzer	Keysight	N9020A	SZ-WRG-M-002	2022/11/18	2023/11/17

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6 Measurement Uncertainty

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

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	± 0.42dB
2	RF power density, conducted	± 1.97dB
3	Spurious emissions, conducted	± 0.42dB
4	Radio Frequency	± 9.84Hz
5	Duty Cycle	± 0.185%
6	Occupied Bandwidth	± 4.19
7	Radiated Emission	±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.

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7 Appendixes

Appendix A.3	WWAN Setup Photos-part96
Appendix B.45	LTE Band 42(3550-3600)
Appendix B.46	LTE Band 43(3600-3700)
Appendix B.47	LTE Band 48(3550-3700)
Appendix B.48	LTE CA_42C(3550-3600)
Appendix B.49	LTE CA_48C(3550-3700)

---End of Report---

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