FCC RADIO TEST REPORT

FCC ID	:	**XMR2020EM120RGL2**
Equipment	:	**LTE-A Cat 12 M.2 Module**
Brand Name	:	**Quectel Wireless Solutions Company Limited**
Model Name	:	**EM120R-GL**
Applicant	:	**Quectel Wireless Solutions Co., Ltd. Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China**
Manufacturer	:	**Quectel Wireless Solutions Co., Ltd. Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China**
Standard	:	**FCC 47 CFR Part 2, and 90(S)**

Equipment: Quectel EM120R-GL tested inside of Lenovo Notebook Computer.

The product was received on Nov. 26, 2020 and testing was started from Jan. 06, 2021 and completed on Jan. 07, 2021. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this partial report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan

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History of this test report

Report No.	Version	Description	Issued Date
FG0D0427E	01	Initial issue of report	Feb. 08, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	§2.1046 §90.635	Conducted Output Power and Effective Radiated Power	-	See Note
-	-	Peak-to-Average Ratio	-	See Note
-	§2.1049 §90.209	Occupied Bandwidth and 26dB Bandwidth	-	See Note
-	§2.1051 §90.691	Emission masks – In-band emissions	-	See Note
-	§2.1051 §90.691	Emission masks – Out of band emissions	-	See Note
-	§2.1055 §90.213	Frequency Stability for Temperature & Voltage	-	See Note
3.1	§2.1053 §90.691	Field Strength of Spurious Radiation	Pass	Under limit 44.23 dB at 3259.000 MHz
Note: The module (Model: EM120R-GL) makes no difference after verifying output power, this report reuses test data from the module report.				

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Yimin Ho

1 General Description

1.1 Feature of Equipment Under Test

Product Feature	
Equipment	LTE-A Cat 12 M.2 Module
Brand Name	Quectel Wireless Solutions Company Limited
Model Name	EM120R-GL
FCC ID	XMR2020EM120RGL2
Sample 1	EUT with Host 1
Sample 2	EUT with Host 2
EUT supports Radios application	WCDMA/HSPA/LTE/GNSS
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer.
2. Equipment: Quectel EM120R-GL tested inside of Lenovo Notebook Computer.

The product was installed into Notebook Computer (Brand Name: Lenovo, Model Name: TP00129A) during test, and the host information was recorded in the following table.

Host Information	
Host 1	Host with Novocomms/JYT Antenna
Host 2	Host with Amphenol Antenna

WWAN Antenna Information				
Main Antenna	**Manufacturer**	Amphenol	**Peak gain (dBi)**	1.95
	Part number	TKC116-16-000-C	**Type**	PIFA
	Manufacturer	Novocomms/JYT	**Peak gain (dBi)**	1.83
	Part number	JYAAE0150HR	**Type**	PIFA

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

2. All test items were performed with Amphenol Antenna.

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx Frequency	LTE Band 26 : 814.7 ~ 823.3 MHz
Rx Frequency	LTE Band 26 : 859.7 ~ 868.3 MHz
Bandwidth	1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz
Type of Modulation	QPSK / 16QAM / 64QAM

1.3 Modification of EUT

No modifications are made to the EUT during all test items.

1.4 Testing Site

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.58 , Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan
Test Site No.	**Sporton Site No.**
	03CH15-HY
Test Engineer	Leo Lee, Mancy Chou, Bigshow Wang
Temperature	22.4~23.1℃
Relative Humidity	48~56%

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: TW0007

1.5 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC 47 CFR Part 2, 90
- ANSI / TIA-603-E
- ANSI C63.26-2015
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- FCC KDB 414788 D01 Radiated Test Site v01r01
- Interim Guidance for Equipment Authorization of Devices with Channel Bandwidths Combined Across Two Contiguous Service Rule Allocations OET/Lab/EACB, June 6, 2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

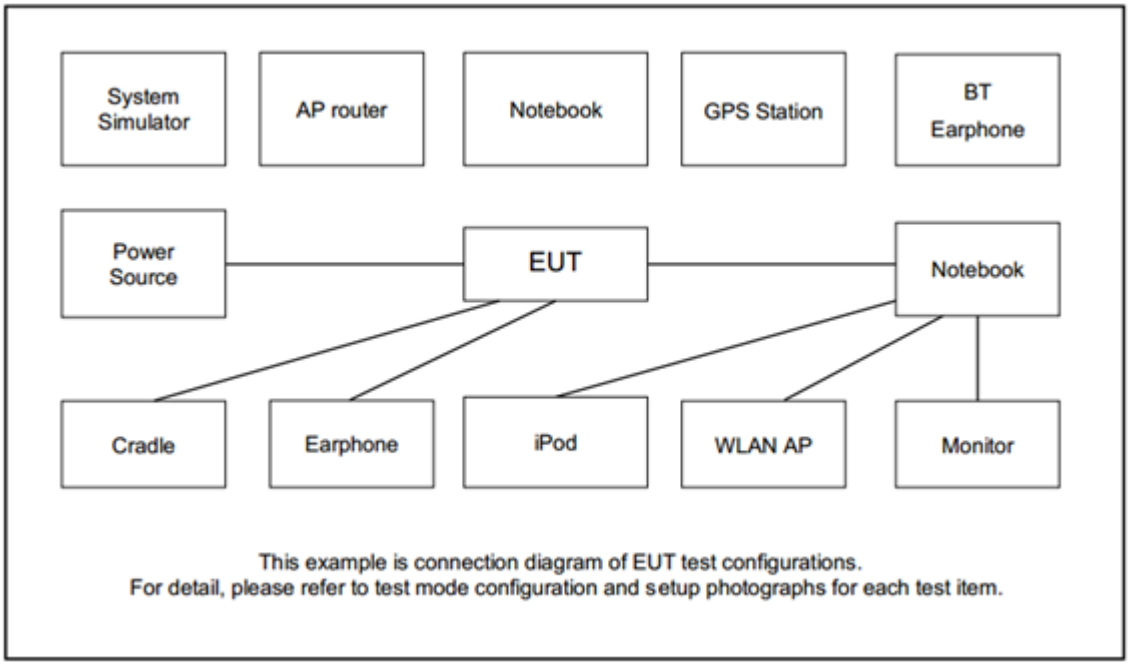
2.1 Test Mode

During all testing, EUT is in link mode with base station emulator at maximum power level.

Frequency range investigated for radiated emission is 30 MHz to 9000 MHz.

Conducted Test Cases	Band	Bandwidth (MHz)						Modulation			RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	1	Half	Full	L	M	H
Radiated Spurious Emission	26			v	v	v	-	v			v			v	v	v
Remark	1. The mark "**v** " means that this configuration is chosen for testing 2. The mark "-" means that this bandwidth is not supported. 3. LTE Band26 transmit frequency for part22 rule is 824MHz-849MHz, for part90 rule is 814MHz-824MHz. ERP over 15MHz bandwidth complies the ERP limit line of part22 rule, therefore ERP of the partial frequency spectrum which falls within part 22 also complies.															

2.2 Connection Diagram of Test System



This example is connection diagram of EUT test configurations.
For detail, please refer to test mode configuration and setup photographs for each test item.

2.3 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.4 Frequency List of Low/Middle/High Channels

LTE Band 26 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
15	Channel	26765	-	-
	Frequency	821.5	-	-
10	Channel	-	26740	-
	Frequency	-	819	-
5	Channel	26715	26740	26765
	Frequency	816.5	819	821.5

3 Radiated Test Items

3.1 Field Strength of Spurious Radiation Measurement

3.1.1 Description of Field Strength of Spurious Radiated Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E. The power of any emission FCC Part 90.691 on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least 43 + 10 log (P) dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

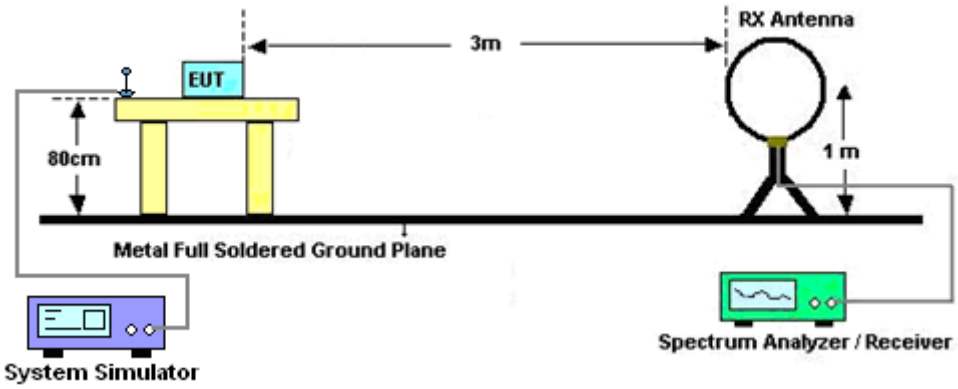
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43+10\log_{10}(P[Watts])$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

3.1.2 Test Procedures

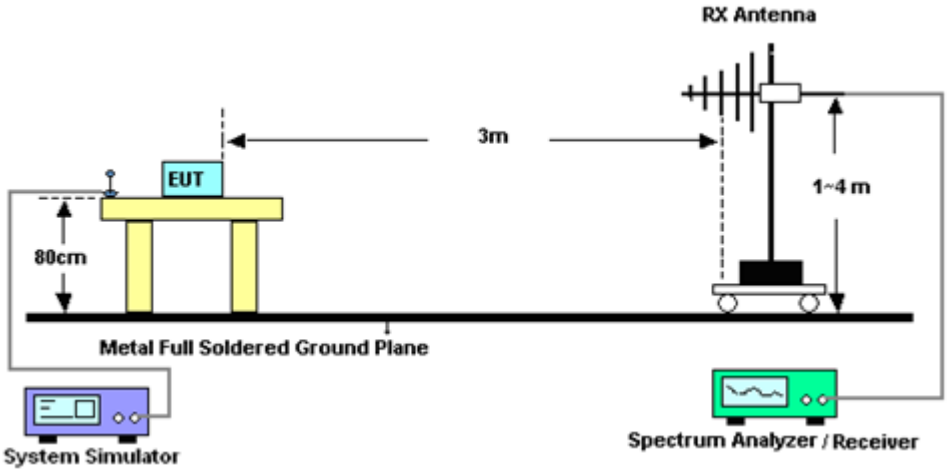
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. For testing below 1GHz, make the measurement with the spectrum analyzer's RBW = 100 kHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
6. For testing above 1GHz, make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
11. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
12. ERP (dBm) = EIRP - 2.15
13. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
14. The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)

3.1.3 Test Setup

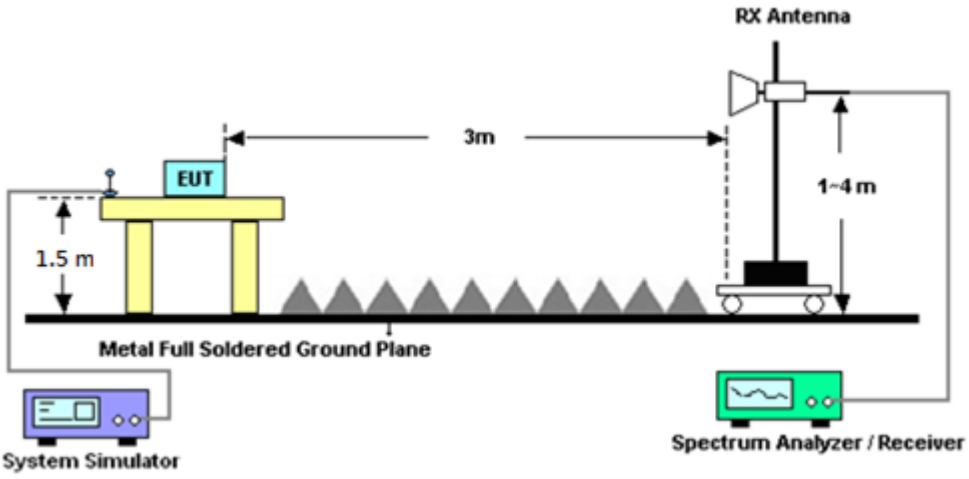
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



3.1.4 Test Result of Field Strength of Spurious Radiated

Please refer to Appendix A.

Note:

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jul. 14, 2020	Jan. 06, 2021~ Jan. 07, 2021	Jul. 13, 2021	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	37059 & 01	30MHz~1GHz	Oct. 11, 2020	Jan. 06, 2021~ Jan. 07, 2021	Oct. 10, 2021	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL6111D&00800N1D01N-06	41912&05	30MHz to 1GHz	Feb. 09, 2020	Jan. 06, 2021~ Jan. 07, 2021	Feb. 08, 2021	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 28, 2020	Jan. 06, 2021~ Jan. 07, 2021	Dec. 27, 2021	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02114	1-18GHz	Aug. 04, 2020	Jan. 06, 2021~ Jan. 07, 2021	Aug. 03, 2021	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz~18GHz	Nov. 03, 2020	Jan. 06, 2021~ Jan. 07, 2021	Nov. 02, 2021	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800055006	1GHz~18GHz	May 07, 2020	Jan. 06, 2021~ Jan. 07, 2021	May 06, 2021	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY53270195	1GHz~26.5GHz	Aug. 21, 2020	Jan. 06, 2021~ Jan. 07, 2021	Aug. 20, 2021	Radiation (03CH15-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz~44GHz	Feb. 10, 2020	Jan. 06, 2021~ Jan. 07, 2021	Feb. 09, 2021	Radiation (03CH15-HY
Spectrum Analyzer	Agilent	E4446A	MY50180136	3Hz~44GHz	May 04, 2020	Jan. 06, 2021~ Jan. 07, 2021	May 03, 2021	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jan. 06, 2021~ Jan. 07, 2021	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jan. 06, 2021~ Jan. 07, 2021	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24 (k5)	RK-000451	N/A	N/A	Jan. 06, 2021~ Jan. 07, 2021	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY36980/4, MY9838/4PE ,508405/2E	30MHz~18G	Nov. 16, 2020	Jan. 06, 2021~ Jan. 07, 2021	Nov. 15, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz-40GHz	Feb. 25, 2020	Jan. 06, 2021~ Jan. 07, 2021	Feb. 24, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz-40GHz	Feb. 25, 2020	Jan. 06, 2021~ Jan. 07, 2021	Feb. 24, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 12, 2020	Jan. 06, 2021~ Jan. 07, 2021	Mar. 11, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN4	1.53G Low Pass	Jul. 03, 2020	Jan. 06, 2021~ Jan. 07, 2021	Jul. 02, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-1080-1200-15000-60ST	SN5	1.2GHz High Pass Filter	Jul. 01, 2020	Jan. 06, 2021~ Jan. 07, 2021	Jun. 30, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN4	3GHz High Pass Filter	Sep. 16, 2020	Jan. 06, 2021~ Jan. 07, 2021	Sep. 15, 2021	Radiation (03CH15-HY)
Signal Generator	Anritsu	MG3694C	163401	0.1Hz~40GHz	Feb. 15, 2020	Jan. 06, 2021~ Jan. 07, 2021	Feb. 14, 2021	Radiation (03CH15-HY)

5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.98**

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.31**

Appendix A. Test Results of Radiated Test

LTE Band 26

LTE Band 26 / 5MHz / QPSK									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
	1628	-63.52	-13	-50.52	-75.33	-68.67	1.82	9.12	H
	2448	-57.52	-13	-44.52	-73.91	-63.63	2.24	10.49	H
	3256	-57.78	-13	-44.78	-76.57	-65.15	2.60	12.12	H
									H
									H
									H
Lowest	1628	-62.94	-13	-49.94	-75.18	-68.09	1.82	9.12	V
	2448	-59.72	-13	-46.72	-76.5	-65.83	2.24	10.49	V
	3256	-57.35	-13	-44.35	-76.56	-64.72	2.60	12.12	V
									V
									V
									V
									V
	1633	-61.39	-13	-48.39	-73.3	-66.58	1.82	9.16	H
	2454	-58.48	-13	-45.48	-74.93	-64.62	2.24	10.52	H
	3264	-57.77	-13	-44.77	-76.55	-65.17	2.61	12.16	H
									H
									H
									H
Middle	1633	-62.75	-13	-49.75	-75.06	-67.94	1.82	9.16	V
	2454	-59.65	-13	-46.65	-76.43	-65.79	2.24	10.52	V
	3264	-57.40	-13	-44.40	-76.59	-64.80	2.61	12.16	V
									V
									V
									V
									V

Highest	1640	-61.52	-13	-48.52	-73.43	-66.76	1.83	9.22	H
	2458	-59.99	-13	-46.99	-76.45	-66.15	2.24	10.55	H
	3280	-58.25	-13	-45.25	-77	-65.71	2.61	12.22	H
									H
									H
									H
									H
	1640	-59.87	-13	-46.87	-72.23	-65.11	1.83	9.22	V
	2458	-59.85	-13	-46.85	-76.64	-66.01	2.24	10.55	V
	3280	-58.05	-13	-45.05	-77.21	-65.51	2.61	12.22	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

LTE Band 26 / 10MHz / QPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	1629	-62.07	-13	-49.07	-73.89	-67.23	1.82	9.13	H
	2443	-58.74	-13	-45.74	-75.09	-64.83	2.23	10.47	H
	3256	-57.99	-13	-44.99	-76.78	-65.36	2.60	12.12	H
									H
									H
									H
									H
	1629	-62.14	-13	-49.14	-74.45	-67.30	1.82	9.13	V
	2443	-59.08	-13	-46.08	-75.86	-65.17	2.23	10.47	V
	3256	-57.55	-13	-44.55	-76.76	-64.92	2.60	12.12	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

LTE Band 26 / 15MHz / QPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	1629	-62.85	-13	-49.85	-74.67	-68.01	1.82	9.13	H
	2448	-57.61	-13	-44.61	-74	-63.72	2.24	10.49	H
	3259	-57.85	-13	-44.85	-76.63	-65.23	2.60	12.14	H
									H
									H
									H
									H
	1629	-62.50	-13	-49.50	-74.81	-67.66	1.82	9.13	V
	2448	-58.34	-13	-45.34	-75.12	-64.45	2.24	10.49	V
	3259	-57.23	-13	-44.23	-76.43	-64.61	2.60	12.14	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.