FCC CO-LOCATION RADIO TEST REPORT

FCC ID	:	**ZMOL860GL16L**
Equipment	:	**LTE Module**
Brand Name	:	**Fibocom Wireless Inc.**
Model Name	:	**L860-GL-16**
Applicant	:	**Fibocom Wireless Inc.** **1101,Tower A, Building 6, Shenzhen International, Innovation Valley, Dashi 1st Rd, Nanshan, ShenZhen, China**
Manufacturer	:	**LCFC (HeFei) Electronics Technology Co., Ltd.** **No. 3188-1, Yungu Road (Hefei Export Processing Zone), Hefei Economics & Technology Development Area, Anhui, CHINA**
Standard	:	**FCC 47 CFR Part 2, 27**

Equipment: Fibocom L860-GL-16 tested inside of Lenovo Notebook Computer.

The product was received on Sep. 03, 2021 and testing was started from Oct. 04, 2021 and completed on Oct. 05, 2021. We, Sporton International Inc. Wensan 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. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory

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History of this test report

Report No.	Version	Description	Issued Date
FG190337G	01	Initial issue of report	Oct. 18, 2021
FG190337G	02	Revise Host Information	Dec. 29, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1053 §27.53 (a)(4)	Radiated Spurious Emission (Band 30)	Pass	Under limit 11.38 dB at 4620.000 MHz
	§2.1051 §27.53 (m)(4)	Radiated Spurious Emission (Band 41)		

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: Sheng Kuo

Report Producer: Amy Chen

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	LTE Module
Brand Name	Fibocom Wireless Inc.
Model Name	L860-GL-16
FCC ID	ZMOL860GL16L
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: Fibocom L860-GL-16 tested inside of Lenovo Notebook Computer.

The product was installed into Notebook Computer (Brand Name: Lenovo, Model Name: TP00128B) during test, and the host information was recorded in the following table.

Host Information	
Host 1	Host with Amphenol Antenna
Host 2	Host with JYT/NVC Antenna
Integrated WLAN Module	Brand Name: Intel Model Name: AX211D2W

WWAN Antenna Information				
Main Antenna	**Manufacturer**	Amphenol	**Peak gain(dBi)**	LTE Band 30 : 0.84 LTE Band 41 : 1.62
	Part number	TKC114-16-000-C	**Type**	PIFA
Main Antenna	**Manufacturer**	JYT/NVC	**Peak gain(dBi)**	LTE Band 30 : -3.03 LTE Band 41 : -4.12
	Part number	JYAAE0154HR	**Type**	PIFA

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

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx Frequency	LTE Band 30: 2307.5 MHz ~ 2312.5 MHz LTE Band 41: 2498.5 MHz ~ 2687.5 MHz
Rx Frequency	LTE Band 30: 2352.5 MHz ~ 2357.5 MHz LTE Band 41: 2498.5 MHz ~ 2687.5 MHz
Bandwidth	LTE Band 30: 5MHz / 10MHz LTE Band 41: 5MHz / 10MHz / 15MHz / 20MHz
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 Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan
Test Site No.	**Sporton Site No.**
	03CH12-HY
Test Engineer	Jack Cheng, Lance Chiang and Chuan Chu
Temperature	21.6~26.2℃
Relative Humidity	56~68%

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

FCC Designation No.: TW3786

1.5 Applicable Standards

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

- ANSI C63.26-2015
- ANSI / TIA-603-E
- FCC 47 CFR Part 2, 27
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 414788 D01 Radiated Test Site v01r01
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

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

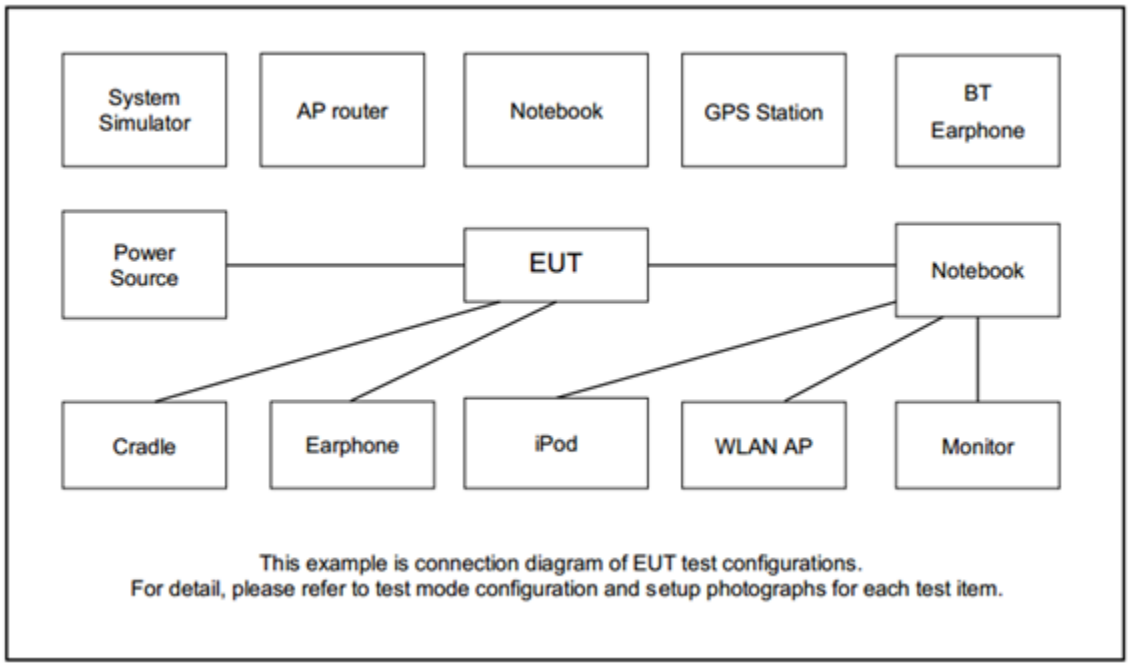
2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

The measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape) and Notebook Type, adjusting the measurement antenna orientation, following C63.26 exploratory test procedures and find X Plane for LTE Band 30 ; Notebook Type for LTE Band 41 (HPUE) as worst plane.

Test Items	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	30	-	-	v	v	-	-	v			v			v	v	v
	41	-	-				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. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. 4. During the Radiated Spurious Emission test, the EUT turn on the WLAN functions simultaneously. 5. For Radiated Test Cases, the tests were performed with Battery (L20C4P71) and Sample 1.															

2.2 Connection Diagram of Test System



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	MT8821C	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 30 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
10	Channel	-	27710	-
	Frequency	-	2310	-
5	Channel	27685	27710	27735
	Frequency	2307.5	2310	2312.5

LTE Band 41 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
20	Channel	39750	40620	41490
	Frequency	2506.0	2593.0	2680.0

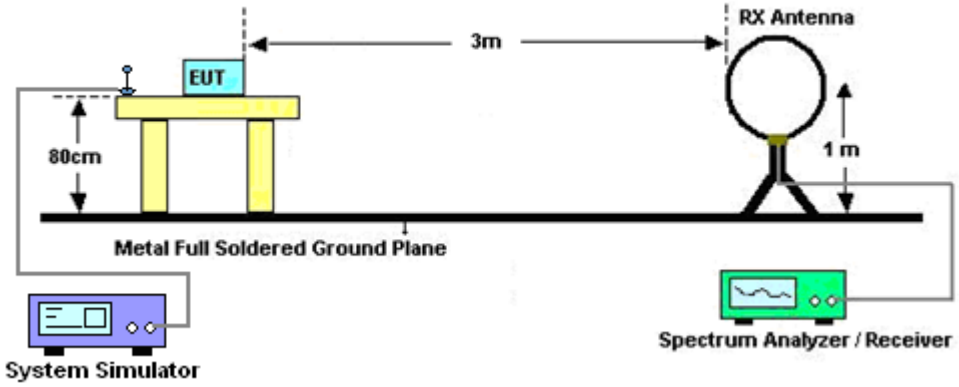
3 Radiated Test Items

3.1 Measuring Instruments

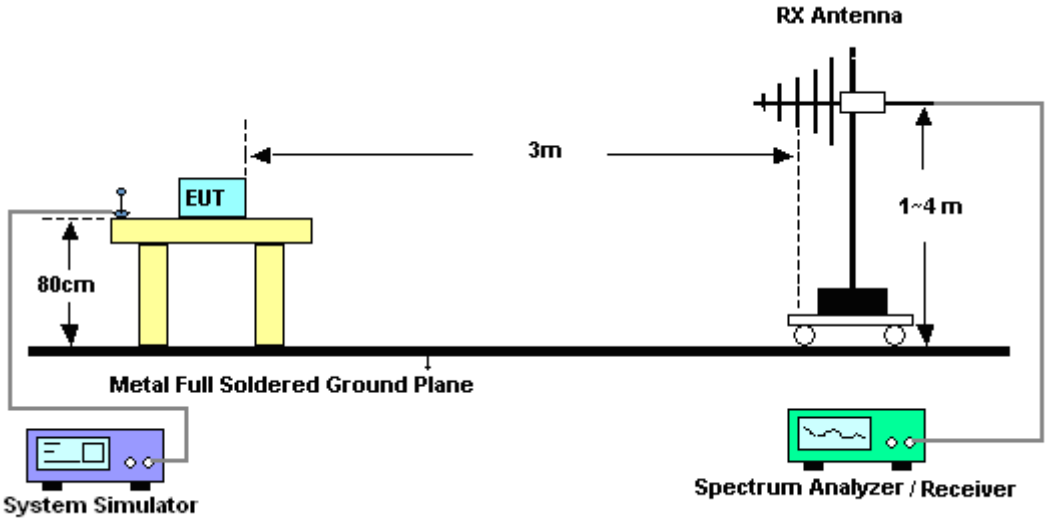
See list of measuring instruments of this test report.

3.1.1 Test Setup

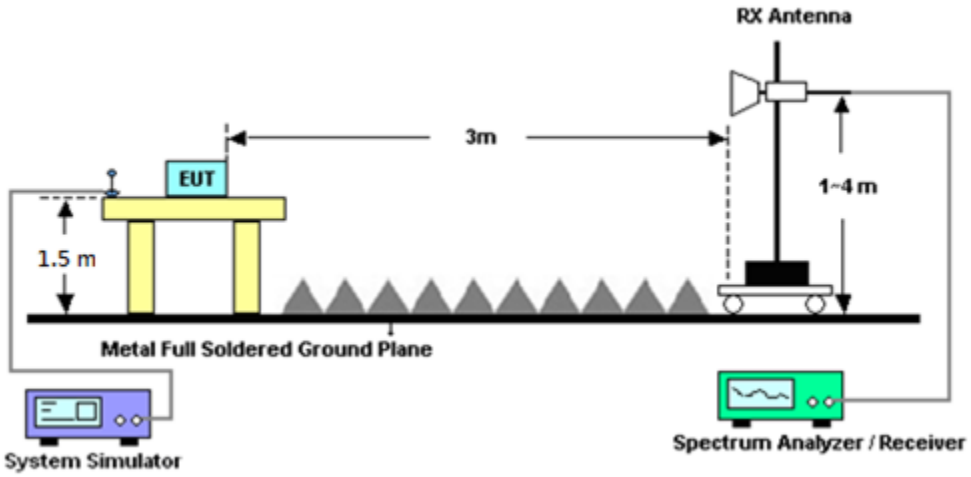
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated emissions above 1GHz



3.1.2 Test Result of Radiated Test

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 adequate comparison measurement 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.

3.2 Radiated Spurious Emission Measurement

3.2.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E.

For LTE Band 30

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 70 + 10 log (P) dB.

For LTE Band 41

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 55 + 10 log (P) dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

3.2.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

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. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
    For LTE Band 30
    The limit line is derived from 70 + 10log(P)dB below the transmitter power P(Watts)
    = P(W)- [70 + 10log(P)] (dB)
    = [30 + 10log(P)] (dBm) - [70 + 10log(P)] (dB)
    = -40dBm.
    For LTE Band 41
    The limit line is derived from 55 + 10log(P)dB below the transmitter power P(Watts)
    EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
    ERP (dBm) = EIRP - 2.15

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	100315	9 kHz~30 MHz	Jan. 04, 2021	Oct. 04, 2021~ Oct. 05, 2021	Jan. 03, 2022	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	37059 & 01	30MHz~1GHz	Oct. 11, 2020	Oct. 04, 2021~ Oct. 05, 2021	Oct. 10, 2021	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 11, 2020	Oct. 04, 2021~ Oct. 05, 2021	Oct. 10, 2021	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1328	1GHz~18GHz	Nov. 23, 2020	Oct. 04, 2021~ Oct. 05, 2021	Nov. 22, 2021	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1212	1GHz~18GHz	May 18, 2021	Oct. 04, 2021~ Oct. 05, 2021	May 17, 2022	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	00993	18GHz~40GHz	Nov. 19, 2020	Oct. 04, 2021~ Oct. 05, 2021	Nov. 18, 2021	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz~40GHz	May 21, 2021	Oct. 04, 2021~ Oct. 05, 2021	May 20, 2022	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 24, 2021	Oct. 04, 2021~ Oct. 05, 2021	Mar. 23, 2022	Radiation (03CH12-HY)
Preamplifier	Aglient	8449B	3008A02375	1GHz~26.5GHz	May 25, 2021	Oct. 04, 2021~ Oct. 05, 2021	May 24, 2022	Radiation (03CH12-HY)
Preamplifier	E-INSTRUMENT TECH LTD.	ERA-100M-18G-56-01-A70	EC1900249	1GHz~18GHz	Dec. 05, 2020	Oct. 04, 2021~ Oct. 05, 2021	Dec. 04, 2021	Radiation (03CH12-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 11, 2020	Oct. 04, 2021~ Oct. 05, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Jan. 15, 2021	Oct. 04, 2021~ Oct. 05, 2021	Jan. 14, 2022	Radiation (03CH12-HY)
Signal Generator	Rohde & Schwarz	SMB100A	101107	100kHz~40GHz	Dec. 04, 2020	Oct. 04, 2021~ Oct. 05, 2021	Dec. 03, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 11, 2020	Oct. 04, 2021~ Oct. 05, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 22, 2021	Oct. 04, 2021~ Oct. 05, 2021	Feb. 21, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz~40GHz	Feb. 22, 2021	Oct. 04, 2021~ Oct. 05, 2021	Feb. 21, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WLKS1200-12SS	SN2	1.2GHz Low Pass Filter	Mar. 17, 2021	Oct. 04, 2021~ Oct. 05, 2021	Mar. 16, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-1080-1200-15000-60SS	SN1	1.2GHz High Pass Filter	Mar. 17, 2021	Oct. 04, 2021~ Oct. 05, 2021	Mar. 16, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN2	3GHz High Pass Filter	Jul. 12, 2021	Oct. 04, 2021~ Oct. 05, 2021	Jul. 11, 2022	Radiation (03CH12-HY)
Hygrometer	TECPEL	DTM-303B	TP210102	N/A	Sep. 09, 2021	Oct. 04, 2021~ Oct. 05, 2021	Sep. 08, 2022	Radiation (03CH12-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Oct. 04, 2021~ Oct. 05, 2021	N/A	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Oct. 04, 2021~ Oct. 05, 2021	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Oct. 04, 2021~ Oct. 05, 2021	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Oct. 04, 2021~ Oct. 05, 2021	N/A	Radiation (03CH12-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))	**3.10 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.39 dB**

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.34 dB**

Appendix A. Test Results of Radiated Test

LTE Band 30 + WLAN 802.11ax HE20 CH07 MIMO <Chain A+B>

LTE Band 30 / 5MHz / 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	4611	-54.66	-40	-14.66	-49.08	-65.88	1.45	12.68	H
	6916	-59.25	-40	-19.25	-58.56	-69.54	1.73	12.02	H
	9221	-60.04	-40	-20.04	-62.95	-69.66	2.16	11.78	H
									H
									H
									H
									H
	4611	-51.99	-40	-11.99	-45.63	-63.21	1.45	12.68	V
	6916	-57.14	-40	-17.14	-56.01	-67.43	1.73	12.02	V
	9221	-59.01	-40	-19.01	-62.91	-68.63	2.16	11.78	V
									V
									V
									V
									V
Middle	4616	-54.42	-40	-14.42	-48.86	-65.64	1.46	12.68	H
	6924	-60.30	-40	-20.30	-59.66	-70.58	1.73	12.01	H
	9231	-60.01	-40	-20.01	-62.92	-69.62	2.16	11.77	H
									H
									H
									H
									H
	4614	-51.62	-40	-11.62	-45.28	-62.84	1.46	12.68	V
	6924	-58.47	-40	-18.47	-57.38	-68.75	1.73	12.01	V
	9231	-59.17	-40	-19.17	-63.09	-68.78	2.16	11.77	V
									V
									V
									V
									V

LTE Band 30 / 5MHz / 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)
Highest	4620	-52.73	-40	-12.73	-47.18	-63.95	1.46	12.68	H
	6930	-59.95	-40	-19.95	-59.32	-70.22	1.73	12.00	H
	9243	-60.84	-40	-20.84	-63.73	-70.43	2.16	11.76	H
									H
									H
									H
									H
	4620	-51.38	-40	-11.38	-45.06	-62.60	1.46	12.68	V
	6930	-57.31	-40	-17.31	-56.23	-67.58	1.73	12.00	V
	9243	-59.63	-40	-19.63	-63.55	-69.22	2.16	11.76	V
									V
									V
									V
									V

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

LTE Band 30 / 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	4611	-55.42	-40	-15.42	-49.84	-66.64	1.45	12.68	H
	6917	-59.49	-40	-19.49	-58.81	-69.77	1.73	12.02	H
	9222	-60.17	-40	-20.17	-63.08	-69.79	2.16	11.78	H
									H
									H
									H
									H
	4611	-51.95	-40	-11.95	-45.59	-63.17	1.45	12.68	V
	6917	-58.19	-40	-18.19	-57.06	-68.47	1.73	12.02	V
	9222	-59.12	-40	-19.12	-63.02	-68.74	2.16	11.78	V
									V
									V
									V
									V
									V

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

LTE Band 41(HPUE) + WLAN 802.11ax HE20 CH100 MIMO <Chain A+B>

LTE Band 41 / 20MHz / 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	4992	-49.76	-25	-24.76	-71.25	-60.75	1.61	12.60	H
	7488	-45.58	-25	-20.58	-72.2	-54.72	1.98	11.12	H
	9990	-41.98	-25	-16.98	-70.96	-50.89	2.40	11.30	H
									H
									H
									H
									H
	4992	-50.06	-25	-25.06	-71.09	-61.05	1.61	12.60	V
	7488	-45.36	-25	-20.36	-71.93	-54.50	1.98	11.12	V
	9990	-41.07	-25	-16.07	-70.82	-49.98	2.40	11.30	V
									V
									V
									V
									V
Middle	5166	-50.06	-25	-25.06	-71.65	-61.24	1.65	12.83	H
	7752	-45.50	-25	-20.50	-71.6	-54.63	2.03	11.15	H
	10332	-41.36	-25	-16.36	-71.33	-50.00	2.39	11.03	H
									H
									H
									H
									H
	5166	-50.36	-25	-25.36	-71.74	-61.54	1.65	12.83	V
	7752	-46.27	-25	-21.27	-72.13	-55.40	2.03	11.15	V
	10332	-41.45	-25	-16.45	-71.5	-50.09	2.39	11.03	V
									V
									V
									V
									V

LTE Band 41 / 20MHz / 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)
Highest	5340	-49.97	-25	-24.97	-72.12	-61.35	1.70	13.08	H
	8016	-44.04	-25	-19.04	-71.5	-53.21	2.06	11.23	H
	10683	-40.67	-25	-15.67	-71.51	-49.08	2.49	10.90	H
									H
									H
									H
									H
	5340	-50.28	-25	-25.28	-72.09	-61.66	1.70	13.08	V
	8016	-44.21	-25	-19.21	-71.56	-53.38	2.06	11.23	V
	10683	-40.67	-25	-15.67	-71.27	-49.08	2.49	10.90	V
									V
									V
									V
									V

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