FCC Test Report

(PART 27)

Report No.:	RFBFLF-WTW-P21070538F-4
FCC ID:	MSQFM350GL
Test Model:	FM350-GL
Received Date:	Dec. 28, 2022
Test Date:	Dec. 30, 2022 ~ Feb. 16, 2023
Issued Date:	Mar. 08, 2023
Applicant:	ASUSTeK COMPUTER INC.
Address:	1F., No. 15, Lide Rd., Beitou Dist., Taipei City 112, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

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Release Control Record

Issue No.	Description	Date Issued
RFBFLF-WTW-P21070538F-4	Original Release	Mar. 08, 2023

1 Certificate of Conformity

Product:	5G Module
Brand:	Fibocom Wireless Inc
Test Model:	FM350-GL
Sample Status:	Engineering Sample
Applicant:	ASUSTeK COMPUTER INC.
Test Date:	Dec. 30, 2022 ~ Feb. 16, 2023
Standards:	FCC Part 27, Subpart C, M

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Lena Wang , **Date:** Mar. 08, 2023

Lena Wang / Specialist

Approved by : Jeremy Lin , **Date:** Mar. 08, 2023

Jeremy Lin / Project Engineer

2 Summary of Test Results

Applied Standard: FCC Part 27 & Part 2			
FCC Clause	**Test Item**	**Result**	**Remarks**
2.1046 27.50(h)(2)	Equivalent Isotropically radiated power	Pass	Meet the requirement of limit.
2.1047	Modulation characteristics	Pass	Meet the requirement.
2.1055 27.54	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Emission Bandwidth	Pass	Meet the requirement of limit.
2.1051 27.53(m)(4)(6)	Channel Edge / Out of Band Emission Measurements	Pass	Meet the requirement of limit.
--	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1051 27.53(m)(4)(6)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 27.53(m)(4)(6)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -24.20 dB at 5160.00 MHz.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	2.44 dB
	30 MHz ~ 200 MHz	2.95 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower &Turn Max-Full	MFA-440H	AT93021705	NA	NA
Turn Table Max-Full	MFT-201SS	NA	NA	NA
Turn Table Controller Max-Full	MG-7802	NA	NA	NA
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 27, 2022	Apr. 26, 2023
Signal Analyzer Agilent	N9010A	MY52220207	Jan. 06, 2022	Jan. 05, 2023
			Jan. 03, 2023	Jan. 02, 2024
Loop Antenna TESEQ	HLA 6121	45745	Jul. 27, 2022	Jul. 26, 2023
Loop Antenna EMCI	EM-6879	269	Sep. 19, 2022	Sep. 18, 2023
Pre-amplifier EMCI	EMC001340	980201	Sep. 23, 2022	Sep. 22, 2023
RF Coaxial Cable EMCI	5D-NM-BM	140903+140902	Jan. 15, 2022	Jan. 14, 2023
			Jan. 07, 2023	Jan. 06, 2024
Pre-Ammlifier EMCI	EMC 330H	980112	Oct. 01, 2022	Sep. 30, 2023
Bi_Log Antenna Schwarzbeck	VULB9168	9168-472	Oct. 21, 2022	Oct. 20, 2023
RF Coaxial Cable WORKEN	8D-FB	Cable-Ch10-01	Oct. 01, 2022	Sep. 30, 2023
Horn Antenna Schwarzbeck	BBHA 9120D	9120D-969	Nov. 13, 2022	Nov. 12, 2023
Pre-Amplifier EMCI	EMC 012645	980115	Oct. 01, 2022	Sep. 30, 2023
RF Coaxial Cable EMCI	EMC104-SM-SM- 8000+3000	171005	Oct. 01, 2022	Sep. 30, 2023
RF Coaxial Cable HUBER SUHNER	SUCOFLEX 104	EMC104-SM-SM- 1000(140807)	Oct. 01, 2022	Sep. 30, 2023
RF FLITER MICRO-TRONICS	BRM50716	060	Jan. 10, 2022	Jan. 09, 2023
			Jan. 11, 2023	Jan. 10, 2024
RF FLITER MICRO-TRONICS	BRM17690	004	Jan. 10, 2022	Jan. 09, 2023
			Jan. 11, 2023	Jan. 10, 2024
Boresight antenna tower fixture BV	BAF-02	7	NA	NA
Radio Communication Analyzer Anritsu	MT8821C	6201462755	Mar. 03, 2022	Mar. 02, 2023
Pre-Ammlifier EMCI	EMC 184045	980116	Oct. 01, 2022	Sep. 30, 2023
Horn Antenna Schwarzbeck	BBHA 9170	148	Nov. 13, 2022	Nov. 12, 2023
RF Coaxial Cable EMCI	EMC102-KM-KM-600	150928	Jul. 09, 2022	Jul. 08, 2023
RF Coaxial Cable EMCI	EMC102-KM-KM-3000	150929	Jul. 09, 2022	Jul. 08, 2023

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HY - 966 chamber 5.

3 General Information

3.1 General Description of EUT

Product	5G Module	
Brand	Fibocom Wireless Inc	
Test Model	FM350-GL	
Status of EUT	Engineering Sample	
Power Supply Rating	11.61 Vdc (Battery) 5 Vdc / 9Vdc / 15Vdc / 20Vdc (Adapter)	
Modulation Type	QPSK, 16QAM, 64QAM, 256QAM	
Frequency Range	LTE Band 38 (Channel Bandwidth: 5 MHz)	2572.5 ~ 2617.5 MHz
	LTE Band 38 (Channel Bandwidth: 10 MHz)	2575.0 ~ 2615.0 MHz
	LTE Band 38 (Channel Bandwidth: 15 MHz)	2577.5 ~ 2612.5 MHz
	LTE Band 38 (Channel Bandwidth: 20 MHz)	2580.0 ~ 2610.0 MHz
Max. EIRP Power	LTE Band 38 (Channel Bandwidth: 5 MHz)	262.422 mW (24.19dBm)
	LTE Band 38 (Channel Bandwidth: 10 MHz)	264.850 mW (24.23dBm)
	LTE Band 38 (Channel Bandwidth: 15 MHz)	265.461 mW (24.24dBm)
	LTE Band 38 (Channel Bandwidth: 20 MHz)	266.686 mW (24.26dBm)
Emission Designator	LTE Band 38 (Channel Bandwidth: 5 MHz)	4M49G7D
	LTE Band 38 (Channel Bandwidth: 10 MHz)	8M97D7W
	LTE Band 38 (Channel Bandwidth: 15 MHz)	13M5G7D
	LTE Band 38 (Channel Bandwidth: 20 MHz)	18M0D7W
Antenna Type	Refer to Note as below	

Note:

1. The EUT is authorized for use in specific End-product. Please refer to below for more details.

Product Name	Brand	Model	Difference
Notebook PC/Expertbook	ASUS	B7402FB	For marketing purpose
		B7402F	
		B7402FV	
		B7402FVA	
		B7402FVAT	

2. The antenna information is listed as below.

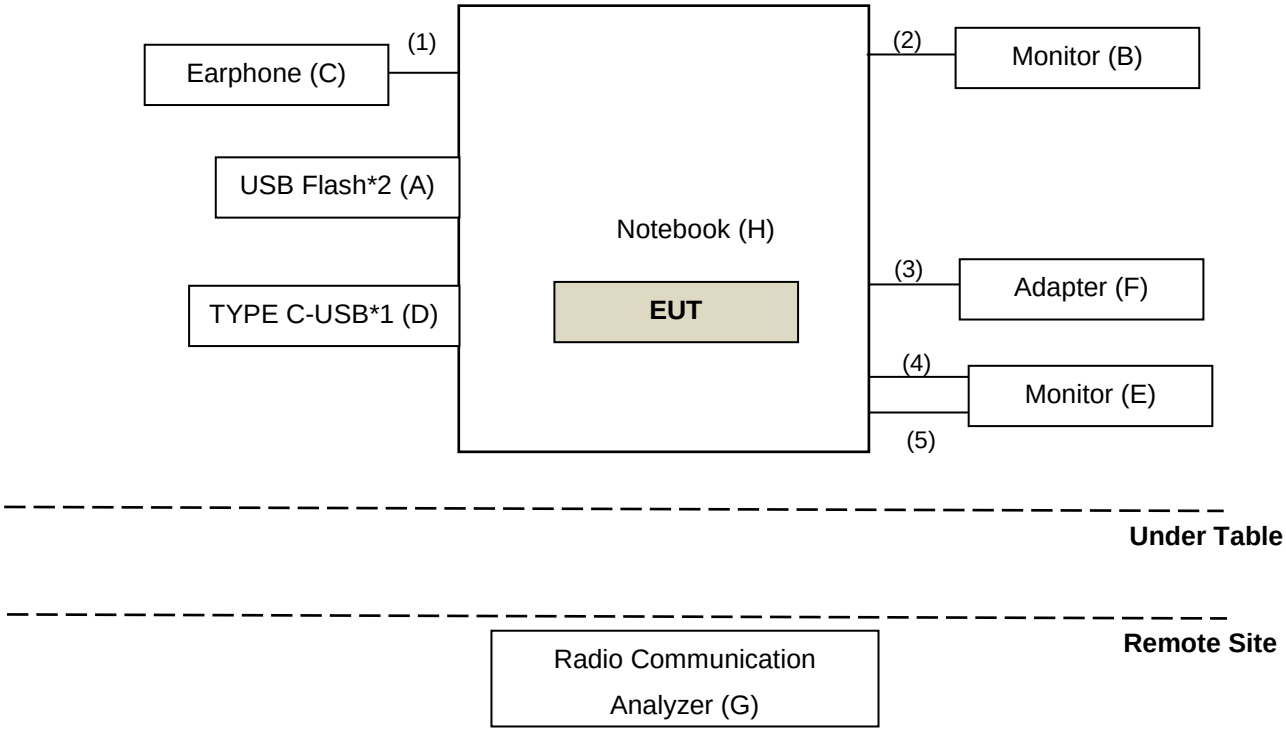
WWAN Antenna								
Ant. Type	Couple							
Band	NB				Tablet			
	Antenna Peak Gain (dBi)				Antenna Peak Gain (dBi)			
	Ant 0 (TX/RX)	Ant 1 (RX)	Ant 2 (TX/RX)	Ant 3 (RX)	Ant 0 (TX/RX)	Ant 1 (RX)	Ant 2 (TX/RX)	Ant 3 (RX)
WCDMA II / LTE 2 / 5G NR n2	**1.96**	1.51	1.82	1.96	-1.18	1.92	0.93	-1.73
WCDMA IV / LTE 4	**1.89**	1.57	1.84	1.87	1.22	1.95	0.48	-0.24
WCDMA V / LTE 5 / 5G NR n5	**-0.42**	-	-	-0.36	-3.96	-	-	-2.49
LTE 7 / 5G NR n7	1.97	1.61	1.79	1.83	0.29	1.94	**1.99**	0.79
LTE 12	**0.88**	-	-	-0.86	-1.05	-	-	-4.13
LTE 13	**1.95**	-	-	1.99	0.23	-	-	-1.81
LTE 14	**1.90**	-	-	1.81	-0.78	-	-	-1.95
LTE 17	**0.88**	-	-	-0.86	-1.05	-	-	-4.13
LTE 25 / 5G NR n25	**1.93**	1.77	1.82	1.97	-1.04	1.92	0.93	-1.69
LTE 26	**-0.03**	-	-	-0.22	-3.72	-	-	-2.49
LTE 30 / 5G NR n30	1.80	1.27	**1.83**	1.96	0.49	1.33	0.71	1.63
LTE 38 / 5G NR n38	1.31	1.55	1.88	1.81	0.8	1.96	**1.94**	-0.46
LTE 41 / 5G NR n41	**1.97**	1.98	1.50	1.84	1.82	1.84	1.86	1.96
LTE 48	**1.90**	1.89	1.73	1.91	1.84	1.77	1.82	1.83
LTE 66 / 5G NR n66	**1.94**	1.75	1.85	1.85	1.22	1.99	0.51	-0.44
5G NR n77	**1.98**	1.91	1.87	1.97	1.80	1.89	1.92	1.90
5G NR n78	**1.98**	1.75	1.87	1.91	**1.98**	1.89	1.82	1.93

*The max antenna gain was chosen for final test.

3. Detail antenna specification please refer to antenna datasheet.
4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Configuration of System under Test

<Radiated Emission Test> & <E.I.R.P. Test>



3.2.1 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	USB*2	TRANSCEND	USB3.0 32GB	N/A	N/A	Provided by Lab
B	Monitor	Dell	A14S2421HSXmTW	CN-01KWFW-WSL00-24C-711B	N/A	Provided by Lab
C	Earphone	HTC	HTC_MAX320	N/A	N/A	Provided by Lab
D	TYPE C-USB*1	SanDisk	SDDDC3-032G	N/A	N/A	Provided by Lab
E	Monitor	Dell	A14S2421HSXmTW	CN-01KWFW-WSL00-24C-714B	N/A	Provided by Lab
F	Adapter	CHICONY	A19-065N3A	N/A	N/A	Accessory of the EUT
G	Radio Communication Analyzer	Anritsu	MT8821C	6201462755	NA	Provided by Lab
H	Notebook	ASUS	B7402FV	NA	NA	Provided by client

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Audio for Earphone Cable	1	1.2	N	0	Provided by Lab
2.	HDMI Cable	1	1.8	Y	0	Provided by Lab
3.	Adapter Cable	1	1.6	Y	0	Accessory of the EUT
4.	Mini DP TO DP Cable	1	1.5	Y	0	Provided by Lab
5.	Micro HDMI TO HDMI Cable	1	1.5	Y	0	Provided by Lab

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis of Tablet Mode and NB Mode, and antenna ports.
The worst case was found when positioned on Y-axis of tablet mode. Following channel(s) was (were) selected for the final test as listed below:

LTE Band 38

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	EIRP	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset 1 RB / 12 RB Offset 1 RB / 24 RB Offset 12 RB / 0 RB Offset 12 RB / 6 RB Offset 12 RB / 13 RB Offset 25 RB / 0 RB Offset
		37800 to 38200	37800, 38000, 38200	10 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset 1 RB / 24 RB Offset 1 RB / 49 RB Offset 25 RB / 0 RB Offset 25 RB / 12 RB Offset 25 RB / 25 RB Offset 50 RB / 0 RB Offset
		37825 to 38175	37825, 38000, 38175	15 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset 1 RB / 37 RB Offset 1 RB / 74 RB Offset 36 RB / 0 RB Offset 36 RB / 19 RB Offset 36 RB / 39 RB Offset 75 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset 1 RB / 50 RB Offset 1 RB / 99 RB Offset 50 RB / 0 RB Offset 50 RB / 25 RB Offset 50 RB / 50 RB Offset 100 RB / 0 RB Offset
-	Modulation Characteristics	37850 to 38150	38000	20 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset
-	Frequency Stability	37775 to 38225	37775, 38225	5 MHz	QPSK	1 RB / 0 RB Offset
		37800 to 38200	37800, 38200	10 MHz	QPSK	1 RB / 0 RB Offset
		37825 to 38175	37825, 38175	15 MHz	QPSK	1 RB / 0 RB Offset
		37850 to 38150	37850, 38150	20 MHz	QPSK	1 RB / 0 RB Offset
-	Occupied Bandwidth	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK, 16QAM, 64QAM, 256QAM	25 RB / 0 RB Offset
		37800 to 38200	37800, 38000, 38200	10 MHz	QPSK, 16QAM, 64QAM, 256QAM	50 RB / 0 RB Offset
		37825 to 38175	37825, 38000, 38175	15 MHz	QPSK, 16QAM, 64QAM, 256QAM	75 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK, 16QAM, 64QAM, 256QAM	100 RB / 0 RB Offset

-	Peak to Average Ratio	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset
		37800 to 38200	37800, 38000, 38200	10 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset
		37825 to 38175	37825, 38000, 38175	15 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset
-	Out-of-Band Emissions	37775 to 38225	37775, 38225	5 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset 1 RB / 24 RB Offset 25 RB / 0 RB Offset
		37800 to 38200	37800, 38200	10 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset 1 RB / 49 RB Offset 50 RB / 0 RB Offset
		37825 to 38175	37825, 38175	15 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset 1 RB / 74 RB Offset 75 RB / 0 RB Offset
		37850 to 38150	37850, 38150	20 MHz	QPSK, 16QAM, 64QAM, 256QAM	1 RB / 0 RB Offset 1 RB / 99 RB Offset 100 RB / 0 RB Offset
-	Conducted Emission	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK	1 RB / 0 RB Offset
		37800 to 38200	37800, 38000, 38200	10 MHz	QPSK	1 RB / 0 RB Offset
		37825 to 38175	37825, 38000, 38175	15 MHz	QPSK	1 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK	1 RB / 0 RB Offset
-	Radiated Emission	37775 to 38225	37775, 38000, 38225	5 MHz	QPSK	1 RB / 0 RB Offset
		37850 to 38150	37850, 38000, 38150	20 MHz	QPSK	1 RB / 0 RB Offset

Note:

1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.
2. For radiated emission above 1 GHz, according to 3GPP 36.521 Section 6.6.3.1.4, choose the lowest, 5 MHz & highest channel bandwidth for final test.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
EIRP	25 deg. C, 65 % RH	11.61 Vdc	Willy Cheng
Modulation Characteristics	25 deg. C, 65 % RH	11.61 Vdc	Willy Cheng
Frequency Stability	25 deg. C, 65 % RH	11.61 Vdc	Willy Cheng
Occupied Bandwidth	25 deg. C, 65 % RH	11.61 Vdc	Willy Cheng
Out-of-Band Emissions	25 deg. C, 65 % RH	11.61 Vdc	Willy Cheng
Peak to Average Ratio	25 deg. C, 65 % RH	11.61 Vdc	Willy Cheng
Conducted Emission	25 deg. C, 65 % RH	11.61 Vdc	Willy Cheng
Radiated Emission	21 deg. C, 67 % RH	120 Vac, 60 Hz	Thomas Cheng

3.4 EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

3.1 General Description of Applied Standards and references

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test Standard:
FCC 47 CFR Part 2
FCC 47 CFR Part 27
ANSI 63.26-2015

Note: All test items have been performed and recorded as per the above standards.

References Test Guidance:
KDB 971168 D01 Power Meas License Digital Systems v03r01
ANSI/TIA/EIA-603-E 2016

Note: All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

4.1.2 Test Procedures

Conducted Power Measurement:

The EUT was set up for the maximum power with LTE and 5GNR link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

Measurement method refers to ANSI C63.26 section 5.2.4.4.

a) Set span to 2 × to 3 × the OBW.

b) Set RBW = 1% to 5% of the OBW.

c) Set VBW ≥ 3 × RBW.

d) Set number of measurement points in sweep ≥ 2 × span / RBW.
e) Set Sweep time = auto-couple.
f) Detector = power averaging (rms).
g) Set sweep trigger to “free run.”
h) Trace average at least 100 traces in power averaging (rms) mode.
i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band or channel power measurement function with band/channel limits set equal to the OBW band edges.
j) Add 10 log (1/duty cycle) to the measured power level to compute the average power during continuous transmission.

Maximum EIRP / ERP

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

$EIRP = P_{Meas} + G_T$

$ERP = P_{Meas} + G_T - 2.15$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_T gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

4.1.3 Test Setup

Conducted Power Measurement:

4.1.4 Test Results

Conducted Output Power (dBm)

LTE Band 38						
BW	**MCS Index**	**Channel**		**37775**	**38000**	**38225**
		Frequency (MHz)		**2572.5**	**2595**	**2617.5**
5M	QPSK	1	0	22.22	22.17	**22.25**
		1	12	22.19	22.13	22.04
		1	24	22.14	22.22	22.12
		12	0	21.34	21.28	21.35
		12	6	21.11	21.32	21.34
		12	13	21.24	21.22	21.24
		25	0	21.33	21.29	21.25
	16QAM	1	0	21.41	21.55	21.60
		1	12	21.54	21.52	21.54
		1	24	21.43	21.53	21.47
		12	0	20.21	20.29	20.26
		12	6	20.28	20.34	20.29
		12	13	20.19	20.17	20.11
		25	0	20.18	20.29	20.26
	64QAM	1	0	20.51	20.52	20.34
		1	12	20.37	20.45	20.33
		1	24	20.35	20.45	20.30
		12	0	19.30	19.22	19.19
		12	6	19.12	19.32	19.35
		12	13	19.15	19.17	19.04
		25	0	19.22	19.31	19.14
	256QAM	1	0	17.21	17.24	17.24
		1	12	17.42	17.32	17.41
		1	24	17.17	17.38	17.21
		12	0	17.11	17.27	17.12
		12	6	17.20	17.30	17.23
		12	13	17.07	17.05	17.09
		25	0	17.15	17.15	17.07

LTE Band 38						
BW	MCS Index	Channel		37800	38000	38200
		Frequency (MHz)		2575	2595	2615
10M	QPSK	1	0	**22.29**	22.28	22.11
		1	24	22.20	22.13	22.16
		1	49	22.18	22.17	22.16
		25	0	21.34	21.32	21.41
		25	12	21.17	21.37	21.29
		25	25	21.21	21.23	21.22
		50	0	21.16	21.24	21.29
	16QAM	1	0	21.40	21.58	21.46
		1	24	21.52	21.45	21.53
		1	49	21.43	21.39	21.44
		25	0	20.29	20.34	20.20
		25	12	20.25	20.29	20.23
		25	25	20.16	20.21	20.09
		50	0	20.23	20.25	20.25
	64QAM	1	0	20.40	20.46	20.51
		1	24	20.33	20.40	20.34
		1	49	20.31	20.38	20.25
		25	0	19.30	19.25	19.20
		25	12	19.12	19.28	19.36
		25	25	19.07	19.19	18.95
		50	0	19.20	19.22	19.16
	256QAM	1	0	17.24	17.41	17.14
		1	24	17.42	17.30	17.31
		1	49	17.15	17.28	17.26
		25	0	17.19	17.14	17.09
		25	12	17.19	17.19	17.21
		25	25	16.93	17.10	17.10
		50	0	17.17	17.16	17.02

LTE Band 38						
BW	MCS Index	Channel		37825	38000	38175
		Frequency (MHz)		2577.5	2595	2612.5
15M	QPSK	1	0	22.22	**22.30**	22.24
		1	37	22.20	22.12	22.01
		1	74	22.16	22.15	22.00
		36	0	21.42	21.29	21.41
		36	19	21.23	21.30	21.39
		36	39	21.14	21.18	21.27
		75	0	21.24	21.19	21.17
	16QAM	1	0	21.51	21.58	21.59
		1	37	21.53	21.44	21.52
		1	74	21.42	21.47	21.41
		36	0	20.34	20.30	20.28
		36	19	20.26	20.25	20.34
		36	39	20.08	20.15	20.13
		75	0	20.17	20.25	20.25
	64QAM	1	0	20.40	20.48	20.39
		1	37	20.28	20.37	20.34
		1	74	20.32	20.48	20.33
		36	0	19.25	19.32	19.17
		36	19	19.11	19.22	19.31
		36	39	19.08	19.17	18.94
		75	0	19.29	19.27	19.25
	256QAM	1	0	17.28	17.41	17.27
		1	37	17.34	17.36	17.36
		1	74	17.21	17.29	17.29
		36	0	17.11	17.23	17.17
		36	19	17.21	17.13	17.26
		36	39	16.95	17.02	17.01
		75	0	17.08	17.23	17.09

LTE Band 38						
BW	MCS Index	Channel		37850	38000	38150
		Frequency (MHz)		2580	2595	2610
20M	QPSK	1	0	22.31	**22.32**	22.25
		1	50	22.22	22.22	22.16
		1	99	22.22	22.21	22.15
		50	0	21.45	21.42	21.43
		50	25	21.24	21.36	21.37
		50	50	21.24	21.28	21.30
		100	0	21.31	21.32	21.29
	16QAM	1	0	21.54	21.60	21.60
		1	50	21.63	21.59	21.62
		1	99	21.42	21.54	21.56
		50	0	20.34	20.38	20.30
		50	25	20.27	20.35	20.36
		50	50	20.22	20.26	20.17
		100	0	20.26	20.30	20.30
	64QAM	1	0	20.51	20.56	20.49
		1	50	20.37	20.49	20.39
		1	99	20.42	20.46	20.39
		50	0	19.32	19.37	19.28
		50	25	19.22	19.33	19.37
		50	50	19.17	19.19	19.08
		100	0	19.29	19.30	19.27
	256QAM	1	0	17.35	17.39	17.29
		1	50	17.47	17.45	17.43
		1	99	17.30	17.37	17.36
		50	0	17.21	17.26	17.17
		50	25	17.26	17.28	17.32
		50	50	17.08	17.16	17.13
		100	0	17.18	17.24	17.12

EIRP Power(dBm)

LTE Band 38						
BW	**MCS Index**	**Channel**		**37775**	**38000**	**38225**
		Frequency (MHz)		**2572.5**	**2595**	**2617.5**
5M	QPSK	1	0	24.16	24.11	**24.19**
		1	12	24.13	24.07	23.98
		1	24	24.08	24.16	24.06
		12	0	23.28	23.22	23.29
		12	6	23.05	23.26	23.28
		12	13	23.18	23.16	23.18
		25	0	23.27	23.23	23.19
	16QAM	1	0	23.35	23.49	23.54
		1	12	23.48	23.46	23.48
		1	24	23.37	23.47	23.41
		12	0	22.15	22.23	22.20
		12	6	22.22	22.28	22.23
		12	13	22.13	22.11	22.05
		25	0	22.12	22.23	22.20
	64QAM	1	0	22.45	22.46	22.28
		1	12	22.31	22.39	22.27
		1	24	22.29	22.39	22.24
		12	0	21.24	21.16	21.13
		12	6	21.06	21.26	21.29
		12	13	21.09	21.11	20.98
		25	0	21.16	21.25	21.08
	256QAM	1	0	19.15	19.18	19.18
		1	12	19.36	19.26	19.35
		1	24	19.11	19.32	19.15
		12	0	19.05	19.21	19.06
		12	6	19.14	19.24	19.17
		12	13	19.01	18.99	19.03
		25	0	19.09	19.09	19.01

*EIRP = Conducted + antenna gain (1.94dBi)

LTE Band 38						
BW	MCS Index	Channel		37800	38000	38200
		Frequency (MHz)		2575	2595	2615
10M	QPSK	1	0	**24.23**	24.22	24.05
		1	24	24.14	24.07	24.10
		1	49	24.12	24.11	24.10
		25	0	23.28	23.26	23.35
		25	12	23.11	23.31	23.23
		25	25	23.15	23.17	23.16
		50	0	23.10	23.18	23.23
	16QAM	1	0	23.34	23.52	23.40
		1	24	23.46	23.39	23.47
		1	49	23.37	23.33	23.38
		25	0	22.23	22.28	22.14
		25	12	22.19	22.23	22.17
		25	25	22.10	22.15	22.03
		50	0	22.17	22.19	22.19
	64QAM	1	0	22.34	22.40	22.45
		1	24	22.27	22.34	22.28
		1	49	22.25	22.32	22.19
		25	0	21.24	21.19	21.14
		25	12	21.06	21.22	21.30
		25	25	21.01	21.13	20.89
		50	0	21.14	21.16	21.10
	256QAM	1	0	19.18	19.35	19.08
		1	24	19.36	19.24	19.25
		1	49	19.09	19.22	19.20
		25	0	19.13	19.08	19.03
		25	12	19.13	19.13	19.15
		25	25	18.87	19.04	19.04
		50	0	19.11	19.10	18.96

*EIRP = Conducted + antenna gain (1.94dBi)

LTE Band 38						
BW	MCS Index	Channel		37825	38000	38175
		Frequency (MHz)		2577.5	2595	2612.5
15M	QPSK	1	0	24.16	**24.24**	24.18
		1	37	24.14	24.06	23.95
		1	74	24.10	24.09	23.94
		36	0	23.36	23.23	23.35
		36	19	23.17	23.24	23.33
		36	39	23.08	23.12	23.21
		75	0	23.18	23.13	23.11
	16QAM	1	0	23.45	23.52	23.53
		1	37	23.47	23.38	23.46
		1	74	23.36	23.41	23.35
		36	0	22.28	22.24	22.22
		36	19	22.20	22.19	22.28
		36	39	22.02	22.09	22.07
		75	0	22.11	22.19	22.19
	64QAM	1	0	22.34	22.42	22.33
		1	37	22.22	22.31	22.28
		1	74	22.26	22.42	22.27
		36	0	21.19	21.26	21.11
		36	19	21.05	21.16	21.25
		36	39	21.02	21.11	20.88
		75	0	21.23	21.21	21.19
	256QAM	1	0	19.22	19.35	19.21
		1	37	19.28	19.30	19.30
		1	74	19.15	19.23	19.23
		36	0	19.05	19.17	19.11
		36	19	19.15	19.07	19.20
		36	39	18.89	18.96	18.95
		75	0	19.02	19.17	19.03

*EIRP = Conducted + antenna gain (1.94dBi)

LTE Band 38						
BW	MCS Index	Channel		37850	38000	38150
		Frequency (MHz)		2580	2595	2610
20M	QPSK	1	0	24.25	**24.26**	24.19
		1	50	24.16	24.16	24.10
		1	99	24.16	24.15	24.09
		50	0	23.39	23.36	23.37
		50	25	23.18	23.30	23.31
		50	50	23.18	23.22	23.24
		100	0	23.25	23.26	23.23
	16QAM	1	0	23.48	23.54	23.54
		1	50	23.57	23.53	23.56
		1	99	23.36	23.48	23.50
		50	0	22.28	22.32	22.24
		50	25	22.21	22.29	22.30
		50	50	22.16	22.20	22.11
		100	0	22.20	22.24	22.24
	64QAM	1	0	22.45	22.50	22.43
		1	50	22.31	22.43	22.33
		1	99	22.36	22.40	22.33
		50	0	21.26	21.31	21.22
		50	25	21.16	21.27	21.31
		50	50	21.11	21.13	21.02
		100	0	21.23	21.24	21.21
	256QAM	1	0	19.29	19.33	19.23
		1	50	19.41	19.39	19.37
		1	99	19.24	19.31	19.30
		50	0	19.15	19.20	19.11
		50	25	19.20	19.22	19.26
		50	50	19.02	19.10	19.07
		100	0	19.12	19.18	19.06

*EIRP = Conducted + antenna gain (1.94dBi)

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

4.2.2 Test Setup

4.2.3 Test Procedure

Connect the EUT to Communication Simulator via the antenna connector. The frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

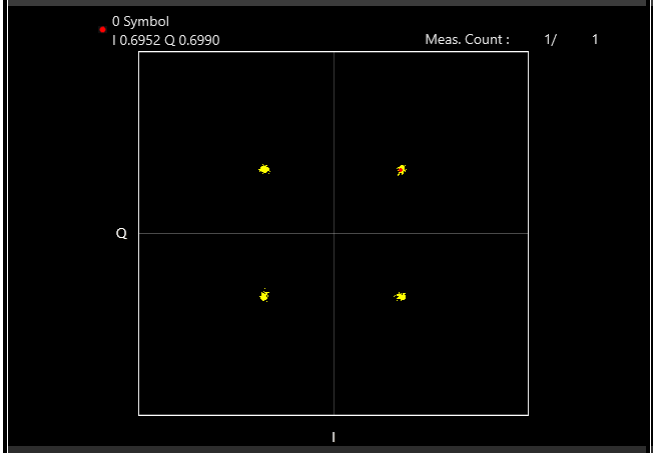
4.2.4 Test Results

Spectrum Plot of Measurement

LTE Band 38

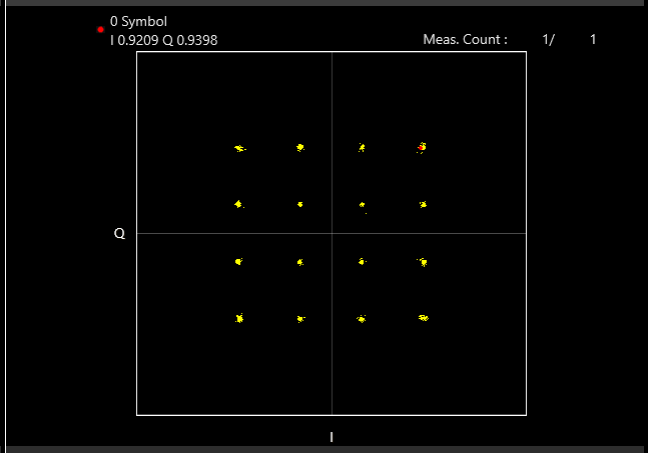
Channel 38000

QPSK



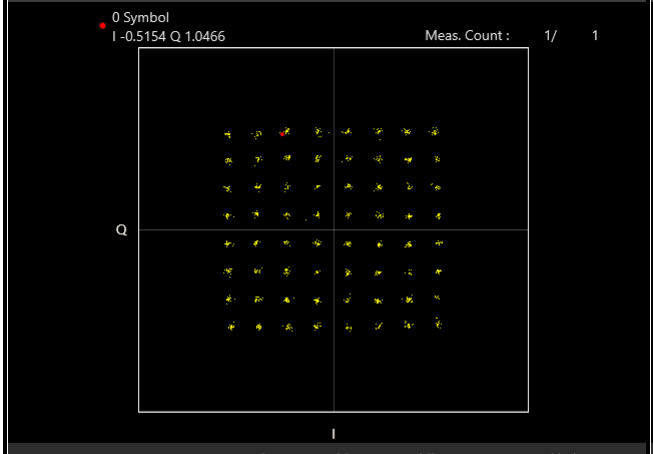
	Avg.	Max.	Min.	Limit
EVM	2.47	2.47	2.47 %(rms)	≤ 17.5 %(rms)
Peak Vector Error	21.86	21.86	21.86 %	
Carrier Leakage	-55.13	-55.13	-55.13 dBc	
IQ Imbalance	99.83	99.83	99.83 %(I/Q)	

16QAM



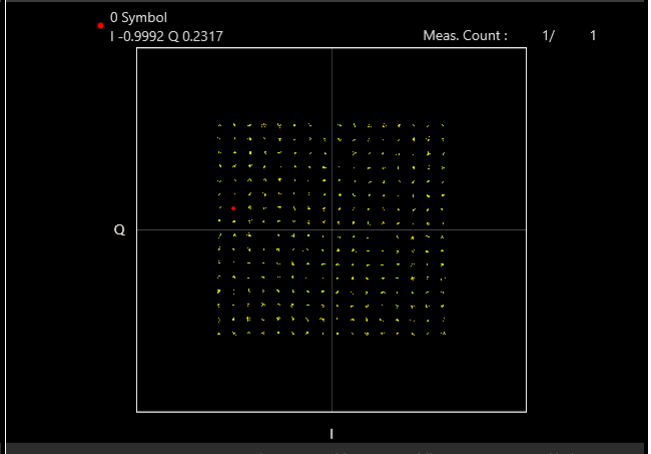
	Avg.	Max.	Min.	Limit
EVM	2.20	2.20	2.20 %(rms)	≤ 12.5 %(rms)
Peak Vector Error	18.89	18.89	18.89 %	
Carrier Leakage	-51.33	-51.33	-51.33 dBc	
IQ Imbalance	99.92	99.92	99.92 %(I/Q)	

64QAM



	Avg.	Max.	Min.	Limit
EVM	2.94	2.94	2.94 %(rms)	≤ 8.0 %(rms)
Peak Vector Error	16.75	16.75	16.75 %	
Carrier Leakage	-50.24	-50.24	-50.24 dBc	
IQ Imbalance	99.76	99.76	99.76 %(I/Q)	

256QAM



	Avg.	Max.	Min.	Limit
EVM	1.42	1.42	1.42 %(rms)	
Peak Vector Error	9.19	9.19	9.19 %	
Carrier Leakage	-49.01	-49.01	-49.01 dBc	
IQ Imbalance	99.87	99.87	99.87 %(I/Q)	

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

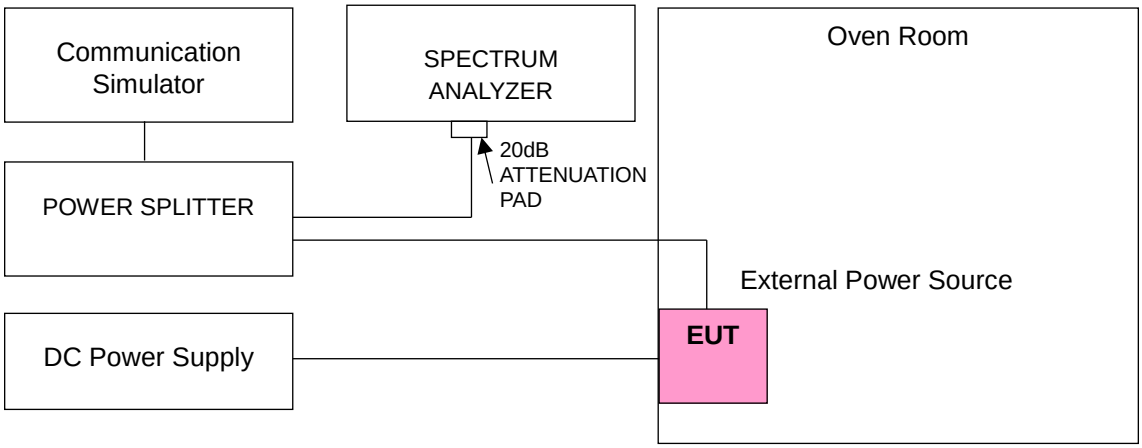
According to the FCC part 2.1055 shall be tested the frequency stability. The rule is defined that" The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." The test extreme voltage is according to the 2.1055(d)(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and the extreme temperature rule is comply with specification of EUT -30℃~ 50℃.

4.3.2 Test Procedure

a. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
b. EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ±0.5 ℃ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

NOTE: The frequency error was recorded frequency error from the communication simulator.

4.3.3 Test Setup



4.3.4 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 38			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
9.86	2572.500003	0.001	2617.500002	0.001
11.61	2572.500001	0.000	2617.499997	-0.001
13.35	2572.500001	0.000	2617.499999	0.000

Note: The applicant defined the normal working voltage of the battery is from 9.86 Vdc to 13.35 Vdc.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 38			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2572.500002	0.001	2617.499998	-0.001
-20	2572.499998	-0.001	2617.499997	-0.001
-10	2572.500001	0.000	2617.499996	-0.002
0	2572.499999	0.000	2617.500003	0.001
10	2572.500002	0.001	2617.500001	0.000
20	2572.500003	0.001	2617.499999	0.000
30	2572.499996	-0.002	2617.500002	0.001
40	2572.499996	-0.002	2617.499998	-0.001
50	2572.499999	0.000	2617.500002	0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 38			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
9.86	2575.000002	0.001	2615.000001	0.000
11.61	2574.999997	-0.001	2615.000004	0.002
13.35	2574.999999	0.000	2615.000002	0.001

Note: The applicant defined the normal working voltage of the battery is from 9.86 Vdc to 13.35 Vdc.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 38			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2575.000002	0.001	2615.000001	0.000
-20	2575.000004	0.002	2614.999998	-0.001
-10	2575.000001	0.000	2614.999999	0.000
0	2575.000003	0.001	2615.000002	0.001
10	2575.000003	0.001	2614.999997	-0.001
20	2574.999996	-0.002	2614.999998	-0.001
30	2574.999999	0.000	2615.000004	0.002
40	2575.000001	0.000	2615.000002	0.001
50	2574.999998	-0.001	2615.000004	0.002

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 38			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
9.86	2577.500001	0.000	2612.499998	-0.001
11.61	2577.499999	0.000	2612.499997	-0.001
13.35	2577.500004	0.002	2612.500002	0.001

Note: The applicant defined the normal working voltage of the battery is from 9.86 Vdc to 13.35 Vdc.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 38			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2577.499996	-0.002	2612.500002	0.001
-20	2577.499999	0.000	2612.499999	0.000
-10	2577.500004	0.002	2612.500002	0.001
0	2577.499999	0.000	2612.499999	0.000
10	2577.499999	0.000	2612.499996	-0.002
20	2577.499996	-0.002	2612.500002	0.001
30	2577.500004	0.002	2612.500002	0.001
40	2577.499997	-0.001	2612.500002	0.001
50	2577.500001	0.000	2612.499998	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 38			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
9.86	2579.999998	-0.001	2610.000001	0.000
11.61	2580.000001	0.000	2610.000002	0.001
13.35	2580.000003	0.001	2610.000000	0.000

Note: The applicant defined the normal working voltage of the battery is from 9.86 Vdc to 13.35 Vdc.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 38			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2580.000003	0.001	2609.999999	0.000
-20	2579.999998	-0.001	2609.999997	-0.001
-10	2579.999999	0.000	2609.999998	-0.001
0	2579.999999	0.000	2610.000003	0.001
10	2579.999996	-0.002	2610.000001	0.000
20	2580.000003	0.001	2609.999999	0.000
30	2580.000001	0.000	2610.000002	0.001
40	2579.999997	-0.001	2609.999999	0.000
50	2579.999997	-0.001	2610.000001	0.000

4.4 Occupied Bandwidth Measurement

4.4.1 Limits of Occupied Bandwidth Measurement

According to FCC 2.1049, 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 % of the total mean power radiated by a given emission.

4.4.2 Test Procedure

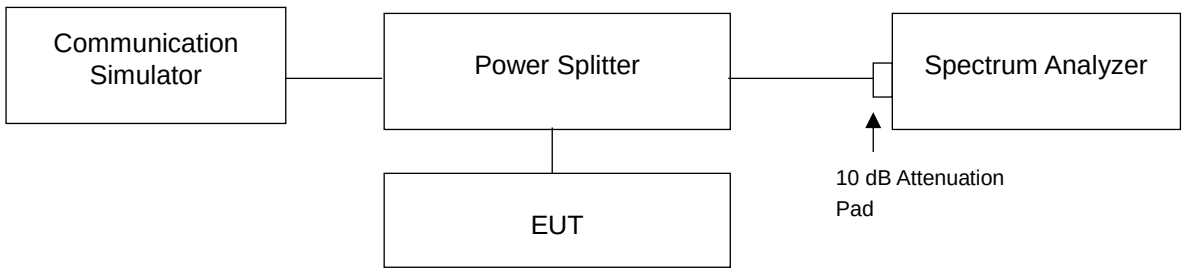
The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

For the 26dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “−X dB” requirement, i.e., if the requirement calls for measuring the −26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
f) Determine the following reference values: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
g) Determine the “−X dB amplitude” as equal to (Reference Value − X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “−X dB amplitude” determined in step f). If a marker is below this “−X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.
i) The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

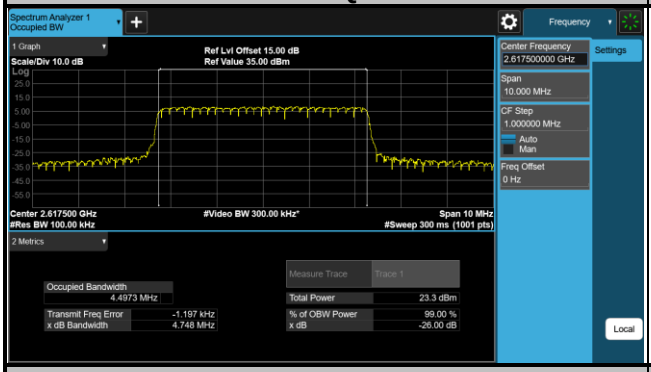
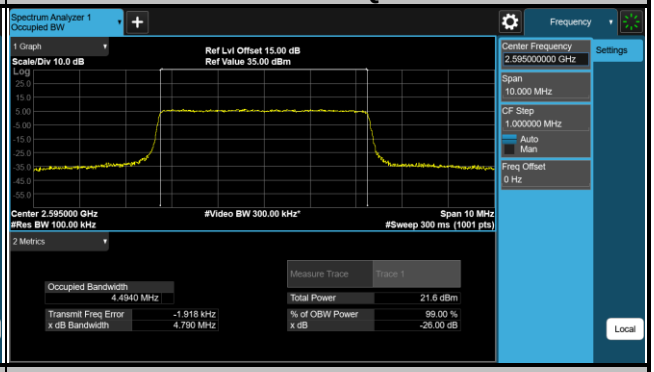
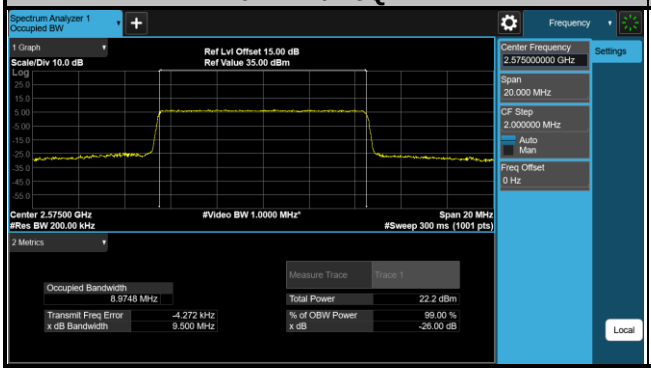
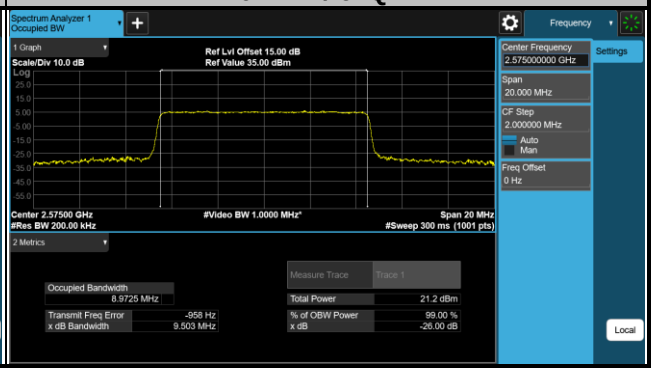
For the occupied bandwidth measurement method, please refer to section 5.4.4 of ANSI C63.26.

4.4.3 Test Setup

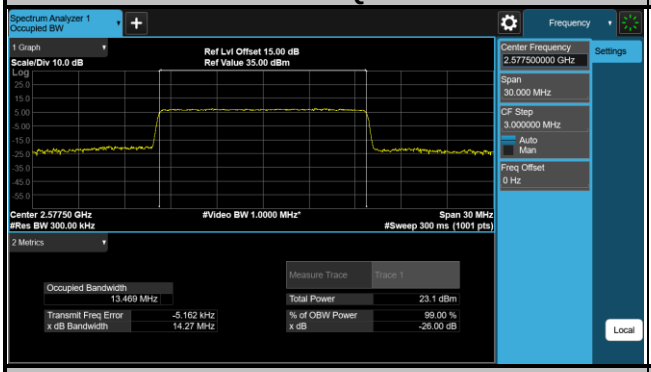
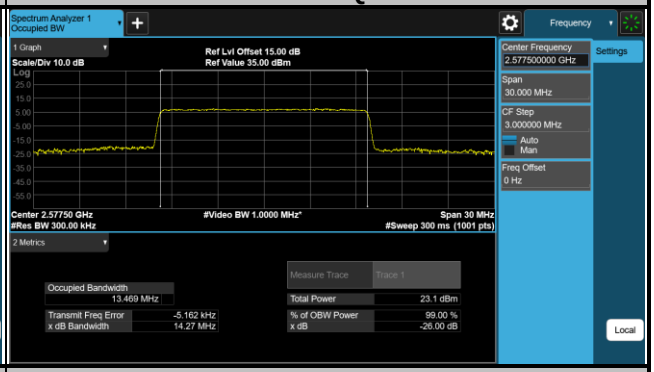
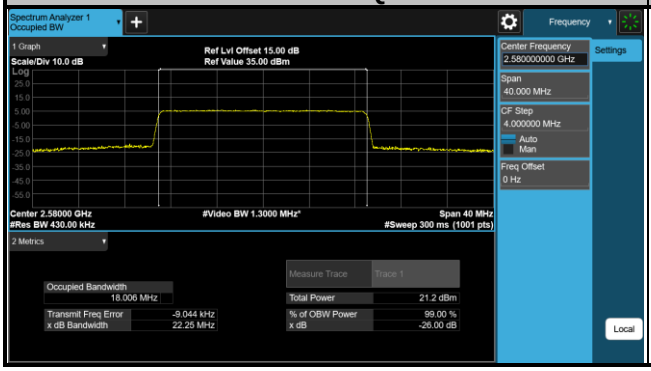
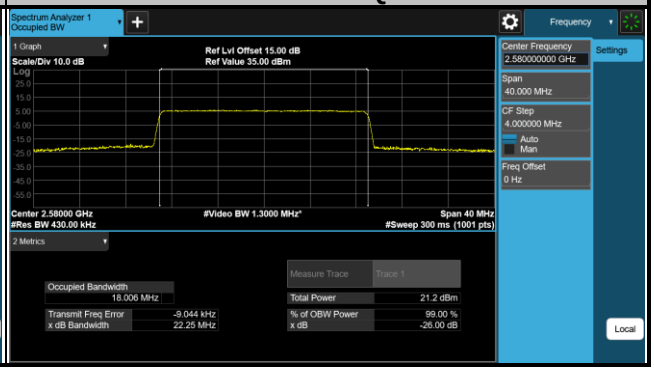


4.4.4 Test Results

LTE Band 38									
Channel Bandwidth: 5 MHz									
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)				26 dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
37775	2572.5	4.48	4.48	4.49	4.47	4.78	4.77	4.77	4.76
38000	2595.0	4.48	4.48	4.49	4.47	4.78	4.76	4.79	4.76
38225	2617.5	4.49	4.48	4.49	4.48	4.74	4.76	4.77	4.78
Channel Bandwidth: 10 MHz									
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)				26 dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
37800	2575.0	8.97	8.97	8.97	8.96	9.49	9.50	9.50	9.49
38000	2595.0	8.96	8.97	8.96	8.96	9.49	9.49	9.48	9.48
38200	2615.0	8.95	8.96	8.96	8.96	9.49	9.49	9.50	9.48

Spectrum Plot of Worst Value	
99 % Occupied Bandwidth	26 dB Bandwidth
5 MHz / QPSK	5 MHz / 64QAM
	
10 MHz / 16QAM	10 MHz / 64QAM
	

LTE Band 38									
Channel Bandwidth: 15 MHz									
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)				26 dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
37825	2577.5	13.46	13.45	13.45	13.44	14.27	14.25	14.27	14.18
38000	2595.0	13.44	13.43	13.44	13.43	14.24	14.22	14.25	14.23
38175	2612.5	13.46	13.45	13.44	13.43	14.24	14.23	14.25	14.22
Channel Bandwidth: 20 MHz									
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)				26 dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
37850	2580.0	17.96	17.95	18.00	17.92	19.08	19.05	22.25	19.01
38000	2595.0	17.93	17.92	17.97	17.92	19.03	19.02	19.08	19.02
38150	2610.0	17.92	17.91	17.93	17.92	19.00	19.01	19.02	19.01

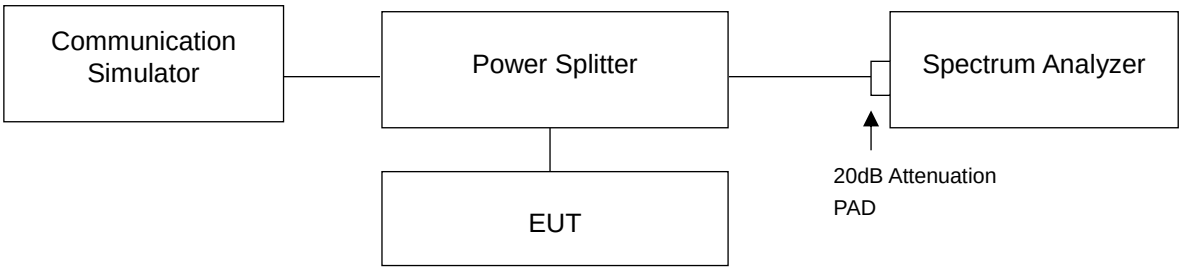
Spectrum Plot of Worst Value	
99 % Occupied Bandwidth	26 dB Bandwidth
15 MHz / QPSK	15 MHz / QPSK
	
20 MHz / 64QAM	20 MHz / 64QAM
	

4.5 Out-of-Band Emissions Measurement

4.5.1 Limits of Out-of-Band Emissions Measurement

According to FCC 27.53(m)(4) regulations, any transmit power of any emission outside of the channel edge must be attenuated below the transmitting power (P) by a factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5MHz. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 megahertz band is 2495-2496 MHz, in which case a resolution bandwidth of at least one percent may be employed.

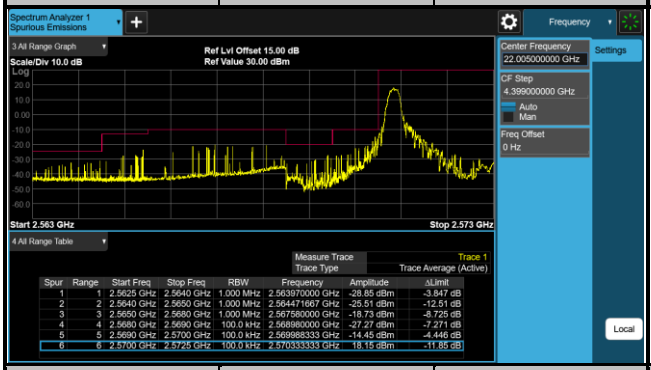
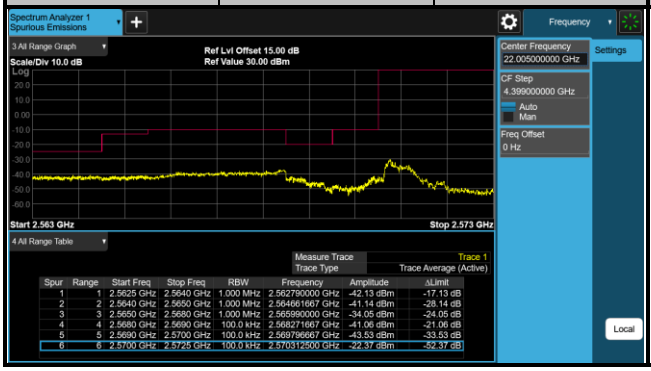
4.5.2 Test Setup

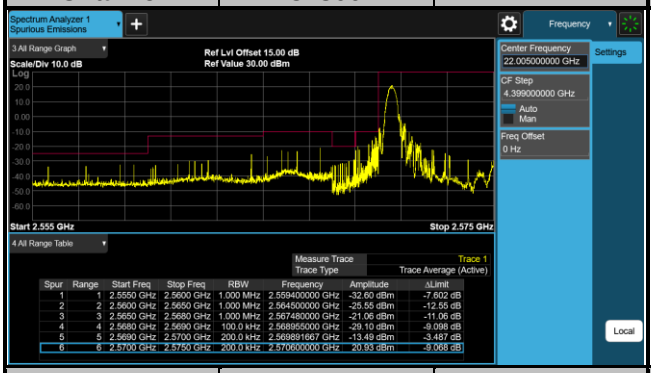
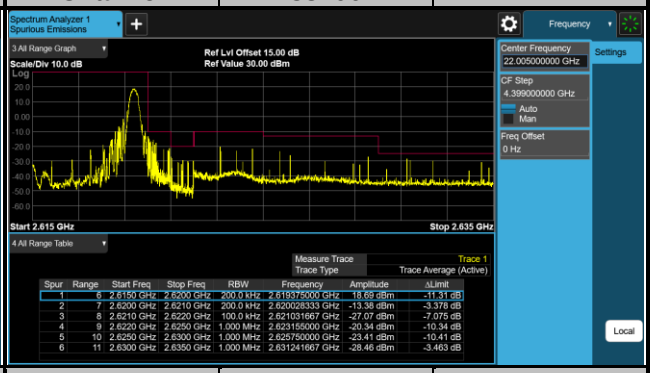
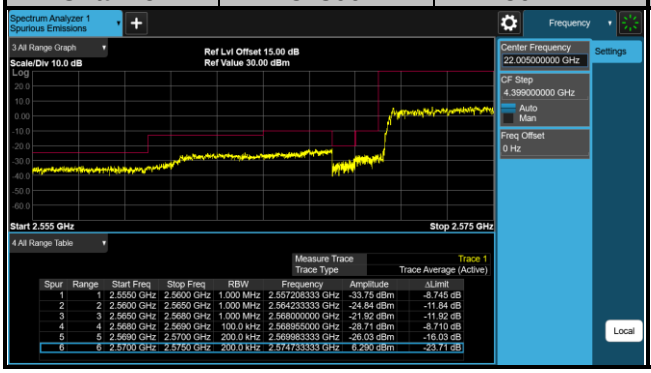
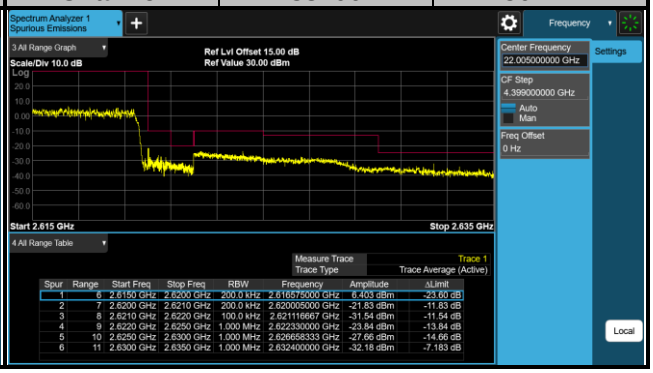


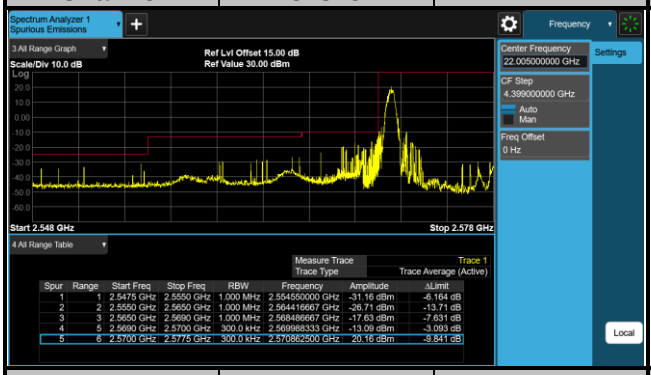
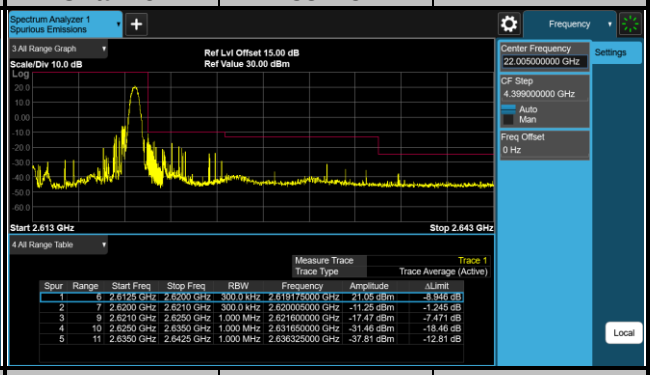
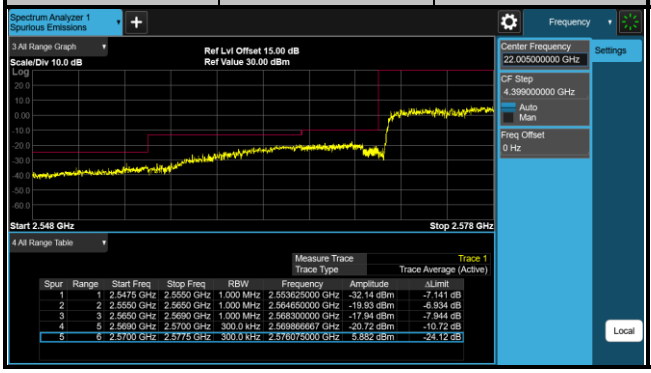
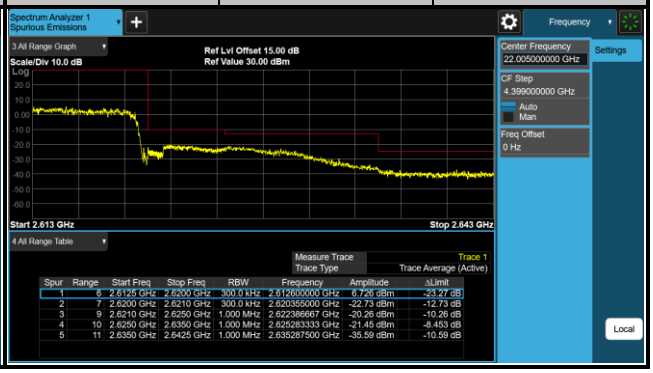
4.5.3 Test Procedures

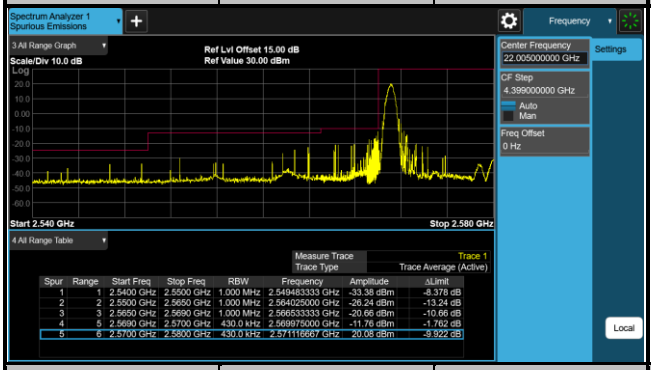
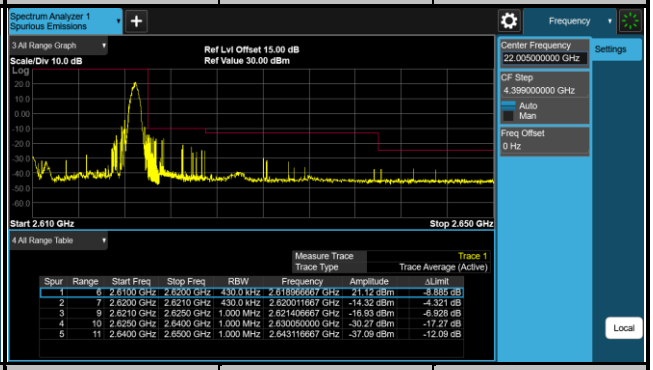
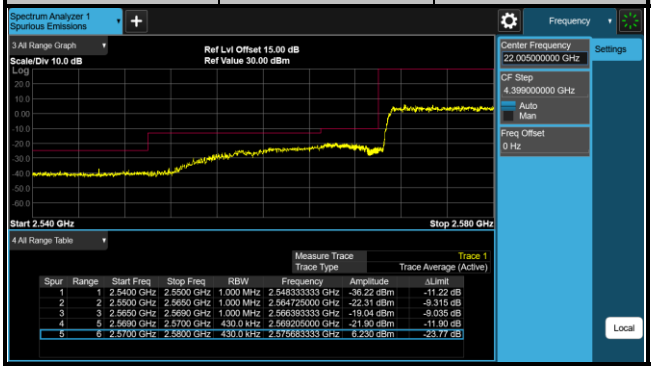
a. The EUT was set up for the maximum peak power with LTE link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 2 channels (low and high operational frequency range.).
b. The out-of-band emissions measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
c. Record the max. trace plot into the test report.

4.5.4 Test Results

LTE Band 38					
Channel Bandwidth: 5 MHz					
<Out-of-Band Emissions>					
Channel	37775	1 RB	Channel	38225	1 RB
					
Channel	37775	25 RB	Channel	38225	25 RB
					

LTE Band 38					
Channel Bandwidth: 10 MHz					
<Out-of-Band Emissions>					
Channel	37800	1 RB	Channel	38200	1 RB
					
Channel	37800	50 RB	Channel	38200	50 RB
					

LTE Band 38					
Channel Bandwidth: 15 MHz					
<Out-of-Band Emissions>					
Channel	37825	1 RB	Channel	38175	1 RB
					
Channel	37825	75 RB	Channel	38175	75 RB
					

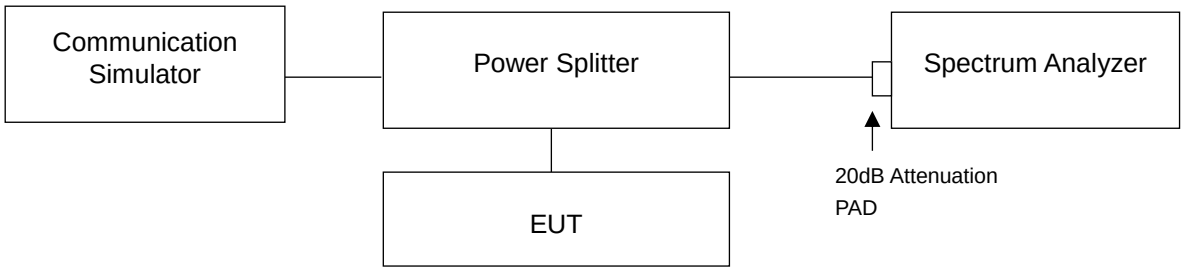
LTE Band 38					
Channel Bandwidth: 20 MHz					
<Out-of-Band Emissions>					
Channel	37850	1 RB	Channel	38150	1 RB
					
Channel	37850	100 RB	Channel	38150	100 RB
					

4.6 Peak to Average Ratio

4.6.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

4.6.2 Test Setup

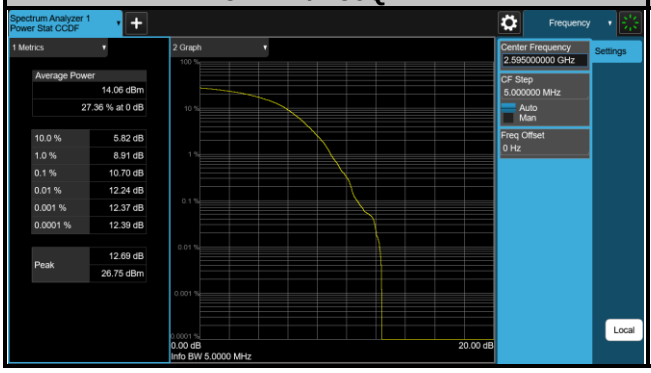
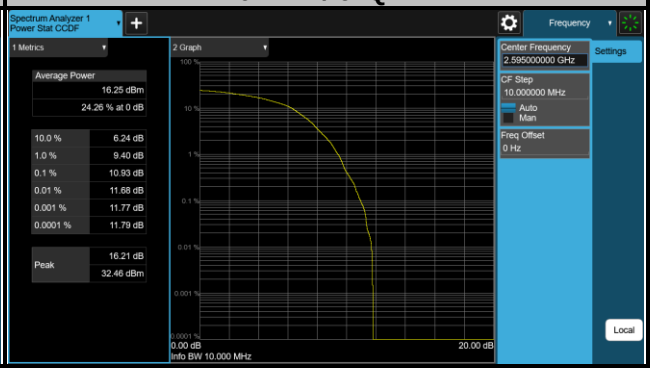


4.6.3 Test Procedures

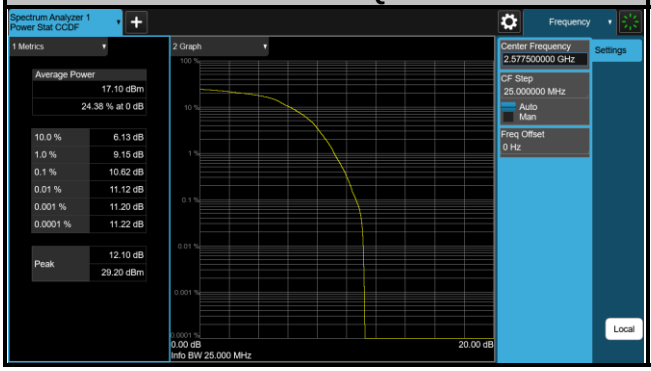
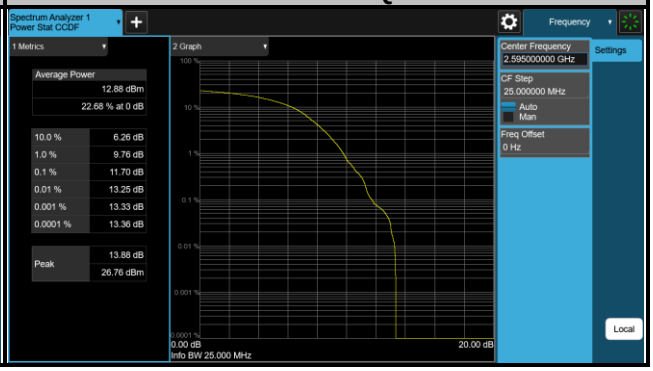
1. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1 %.

4.6.4 Test Results

LTE Band 38											
Channel Bandwidth: 5 MHz						Channel Bandwidth: 10 MHz					
Channel	Frequency (MHz)	Peak to Average Ratio (dB)				Channel	Frequency (MHz)	Peak to Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM			QPSK	16QAM	64QAM	256QAM
37775	2572.5	8.65	9.23	9.52	10.26	37800	2575.0	8.35	9.14	9.96	10.41
38000	2595.0	8.18	9.85	9.71	10.70	38000	2595.0	7.97	9.36	10.93	10.16
38225	2617.5	9.20	9.44	9.90	10.50	38200	2615.0	9.12	10.06	9.79	10.62

Spectrum Plot of Worst Value	
5 MHz / 256QAM	10 MHz / 64QAM
	

LTE Band 38											
Channel Bandwidth: 15 MHz						Channel Bandwidth: 20 MHz					
Channel	Frequency (MHz)	Peak to Average Ratio (dB)				Channel	Frequency (MHz)	Peak to Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM			QPSK	16QAM	64QAM	256QAM
37825	2577.5	8.85	10.62	10.31	9.71	37850	2580.0	8.69	8.86	10.34	10.52
38000	2595.0	8.94	10.42	9.06	9.64	38000	2595.0	8.31	8.64	10.28	11.70
38175	2612.5	6.69	10.12	9.15	10.41	38150	2610.0	8.69	9.13	9.45	9.27

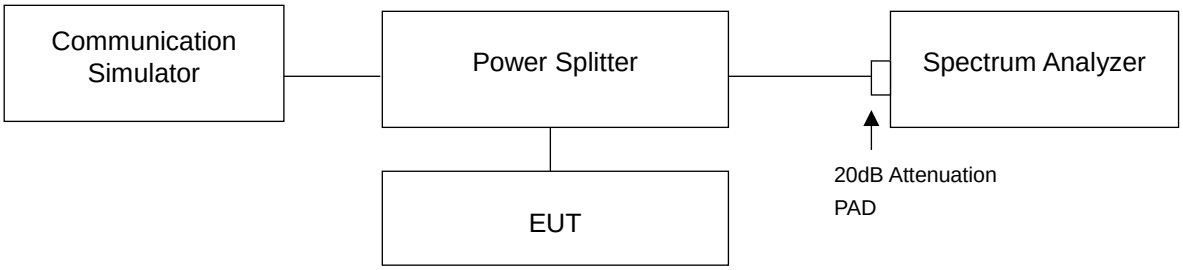
Spectrum Plot of Worst Value	
15 MHz / 16QAM	20 MHz / 256QAM
	

4.7 Conducted Spurious Emissions

4.7.1 Limits of Conducted Spurious Emissions Measurement

According to FCC 27.53(m)(4), 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 55 + 10 log (P) dB. The emission limit equal to –25dBm.

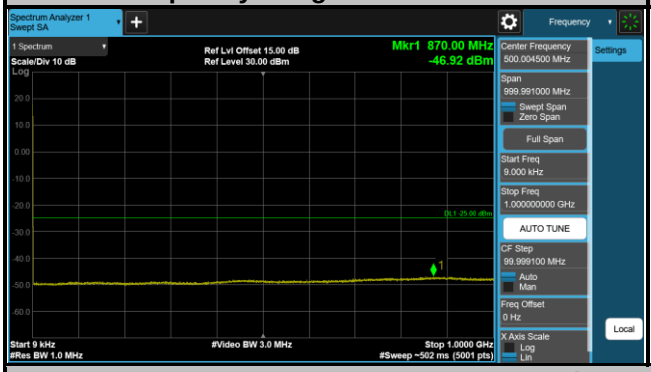
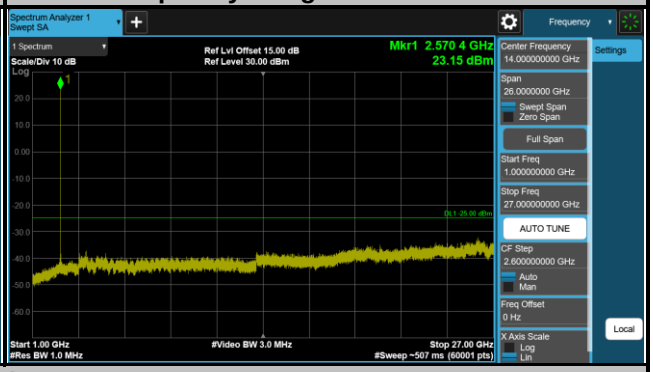
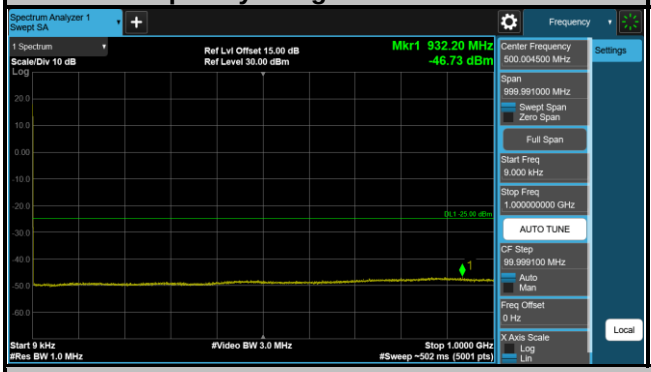
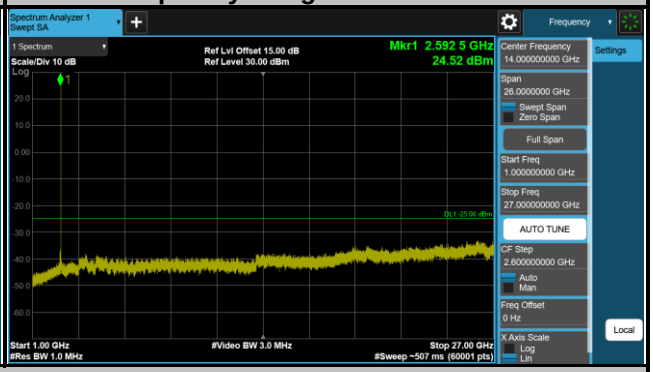
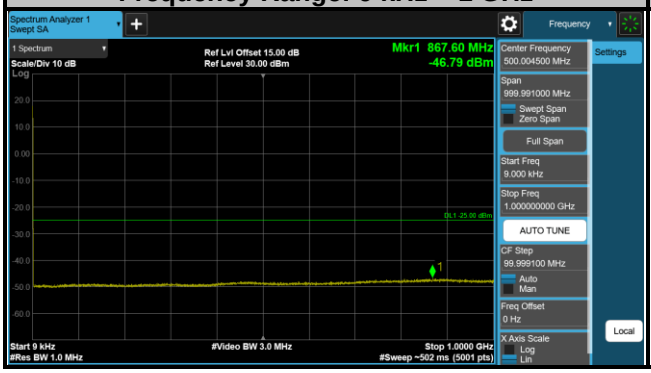
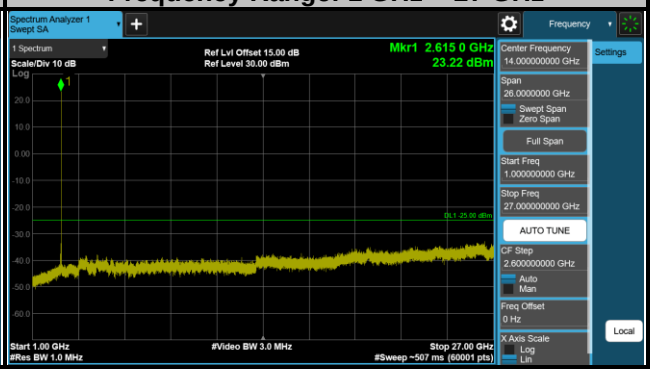
4.7.2 Test Setup



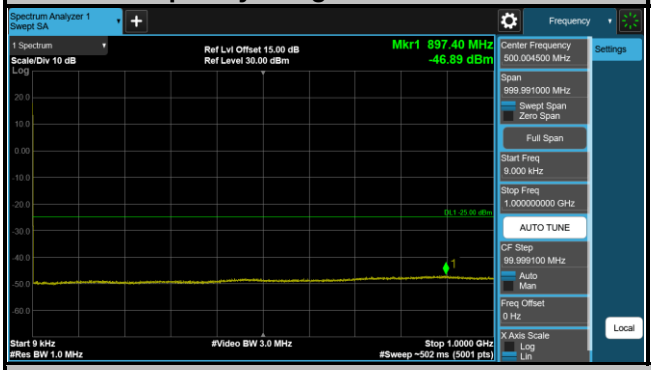
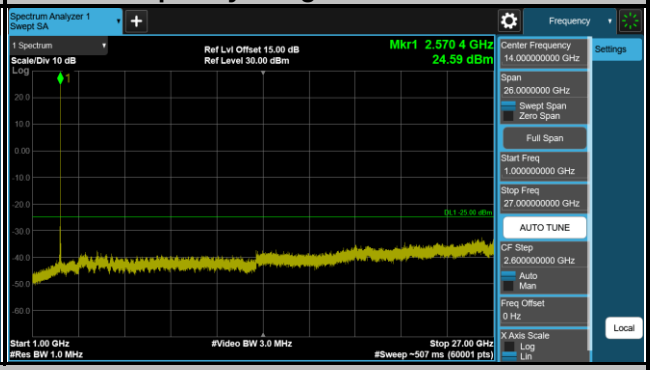
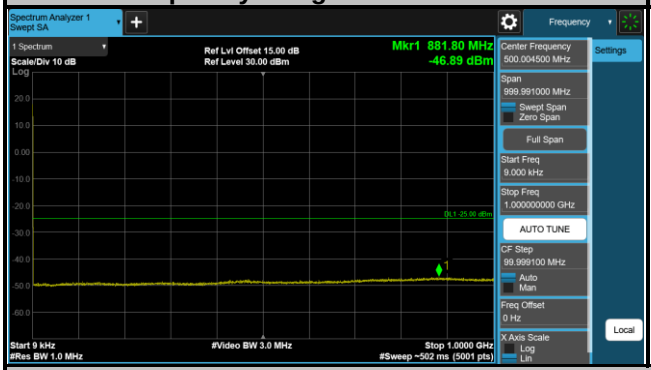
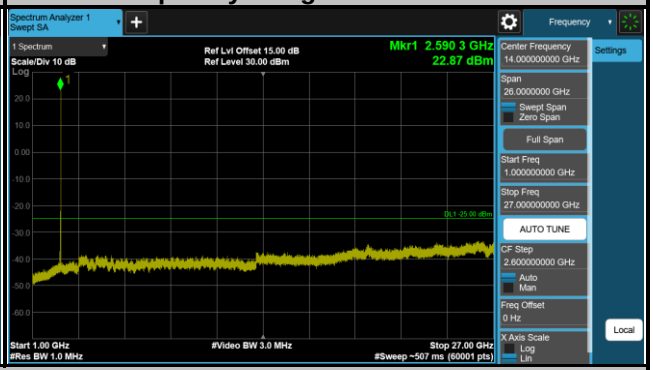
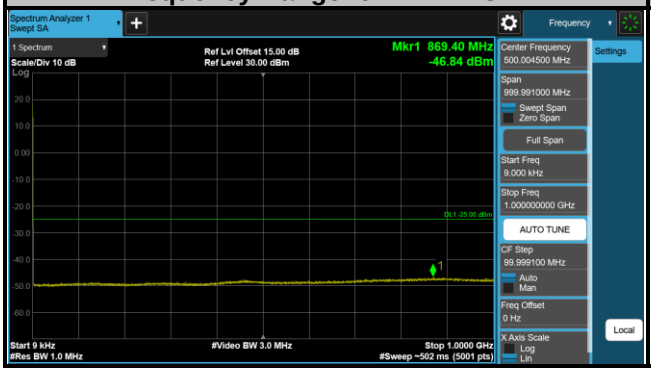
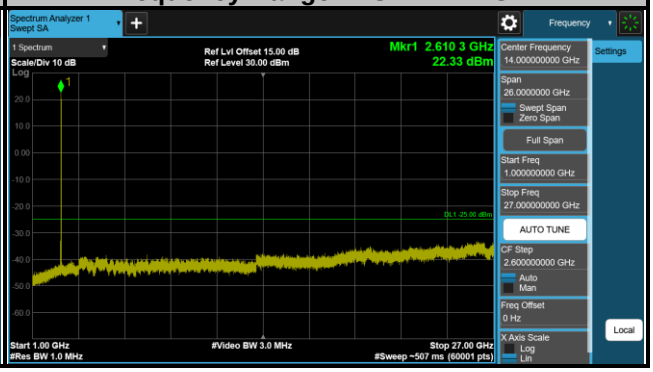
4.7.3 Test Procedure

a. The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
b. Measuring frequency range is from 9 kHz to 1 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 300 kHz and VBW = 1 MHz are used for conducted emission measurement.
c. Measuring frequency range is from 1 GHz to 27 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz are used for conducted emission measurement.
d. Spectrum RBW settings are referenced to ANSI C63.26 section 5.7.2.

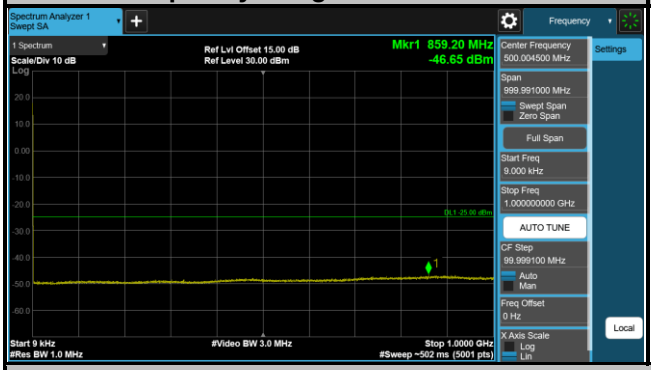
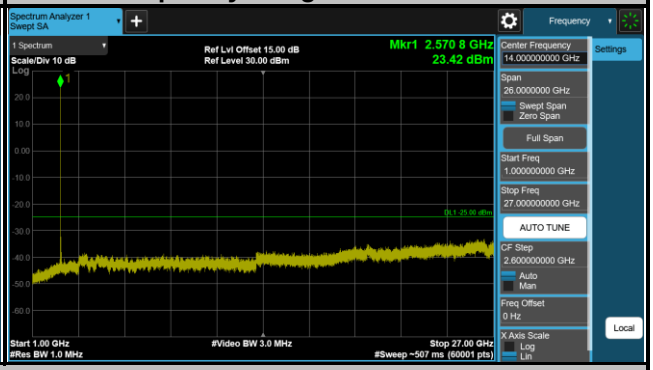
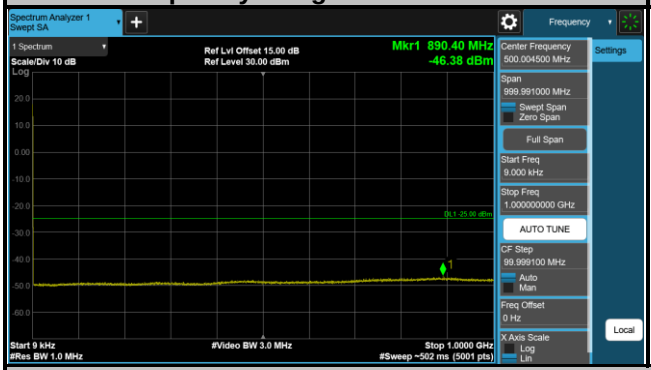
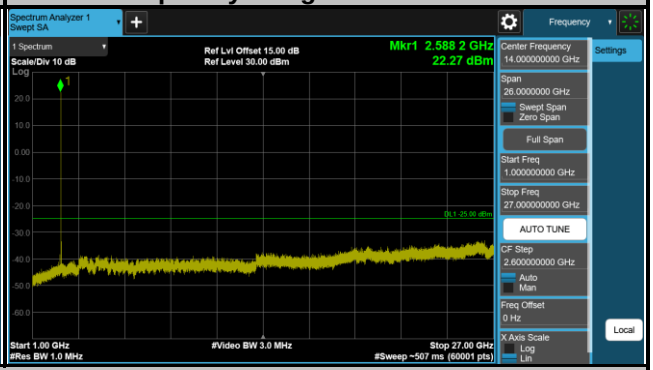
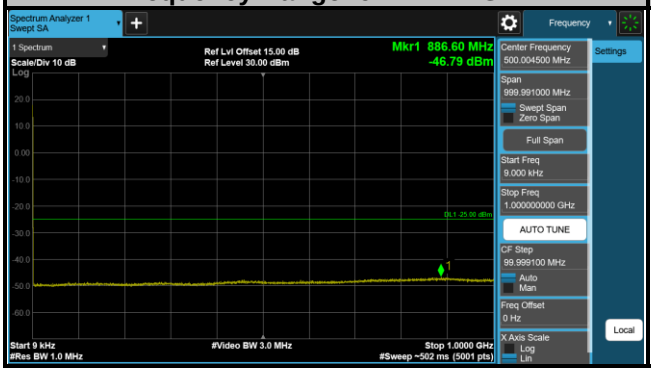
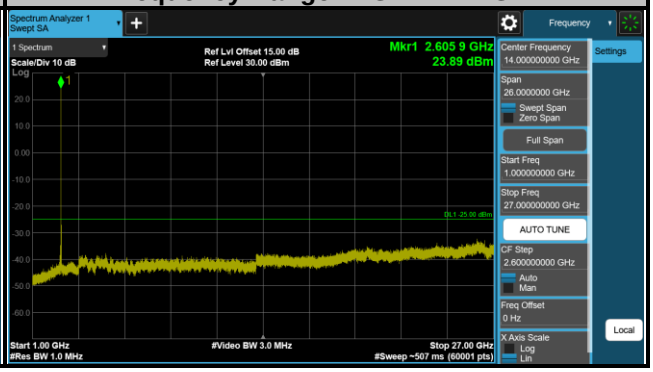
4.7.4 Test Results

LTE Band 38	
Channel Bandwidth: 5 MHz	
Channel 37775	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	
Channel 38000	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	
Channel 38225	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	

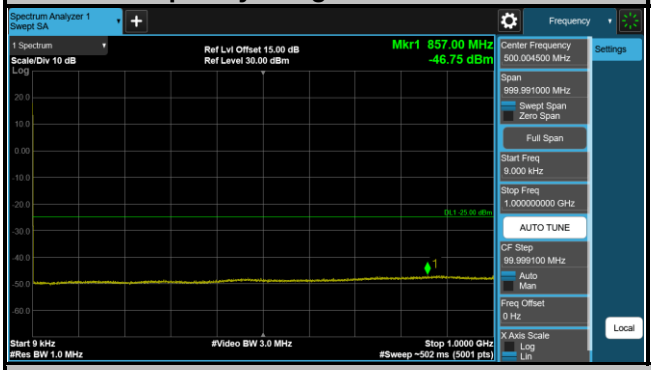
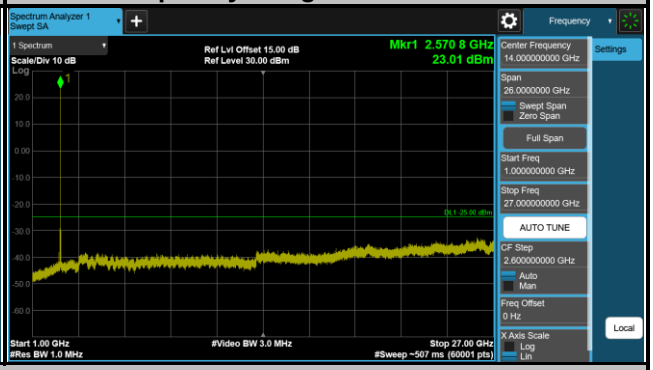
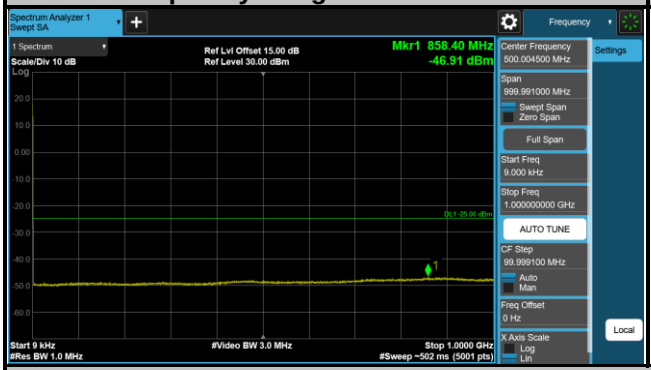
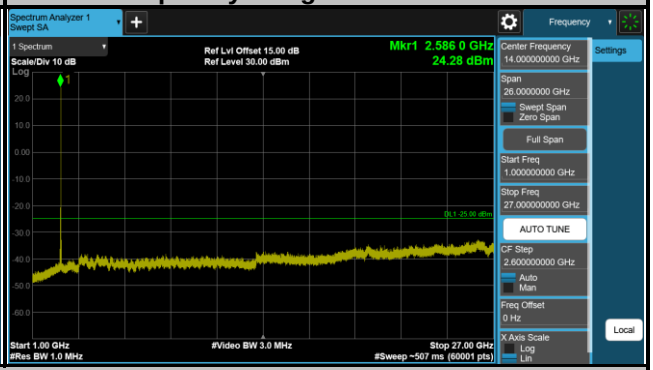
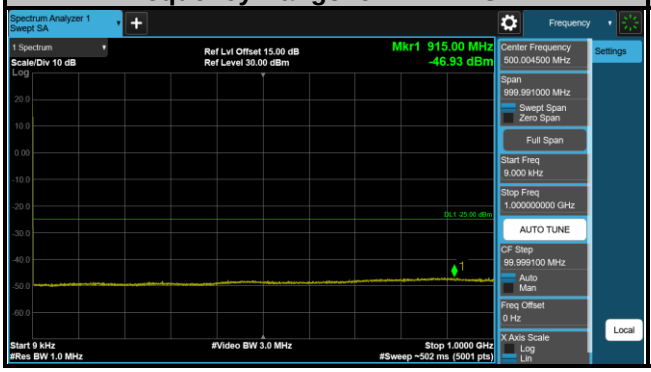
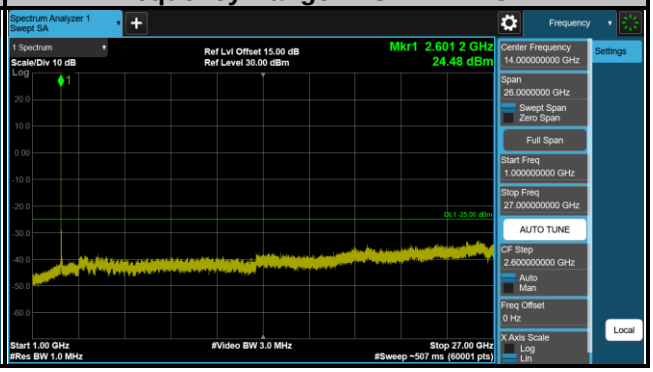
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 38	
Channel Bandwidth: 10 MHz	
Channel 37800	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	
Channel 38000	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	
Channel 38200	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	

Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 38	
Channel Bandwidth: 15 MHz	
Channel 37825	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	
Channel 38000	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	
Channel 38175	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	

Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 38	
Channel Bandwidth: 20 MHz	
Channel 37850	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	
Channel 38000	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	
Channel 38150	
Frequency Range: 9 kHz ~ 1 GHz	Frequency Range: 1 GHz ~ 27 GHz
	

Note: The signal over the limit in 9 kHz is from spectrum analyzer.

4.8 Radiated Emission Measurement

4.8.1 Limits of Radiated Emission Measurement

According to FCC 27.53(m)(4),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 55 + 10 log (P) dB. The emission limit equal to –25dBm.

4.8.2 Test Procedure

a. In the semi-anechoic chamber, EUT placed on the 0.8m(below or equal 1GHz) and/or 1.5m(above 1GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
b. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
c. Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
d. Following C63.26 section 5.5 and 5.2.7
   EIRP (dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m.
   ERP (dBm) = E (dBμV/m) + 20log(D) - 104.8 - 2.15; where D is the measurement distance (in the far field region) in m.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz.
2. The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:

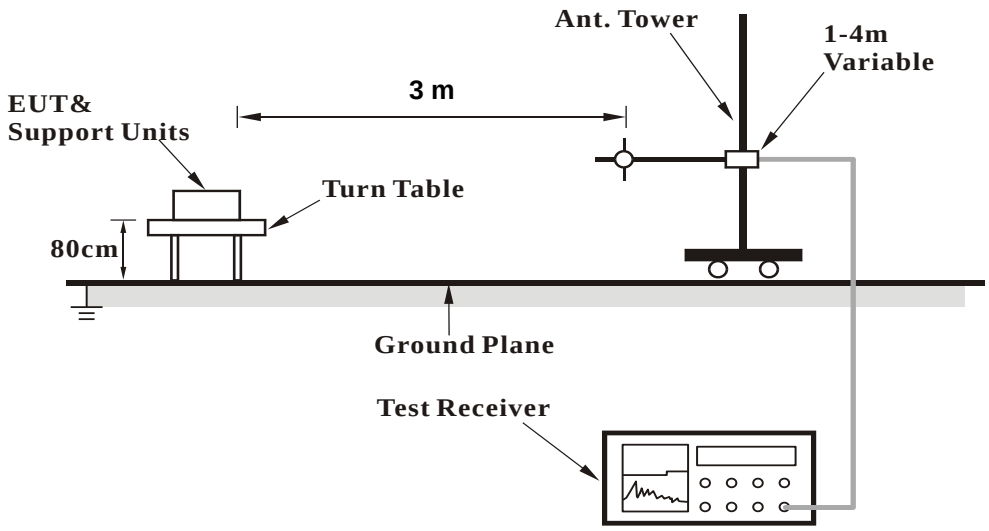
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

4.8.3 Deviation from Test Standard

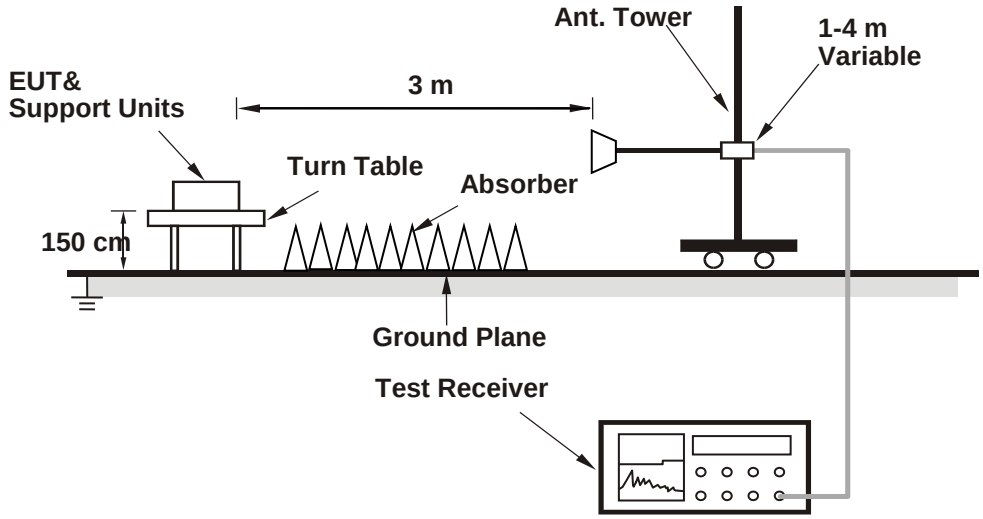
No deviation.

4.8.4 Test Setup

<Radiated Emission below or equal 1 GHz>



<Radiated Emission above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.8.5 Test Results

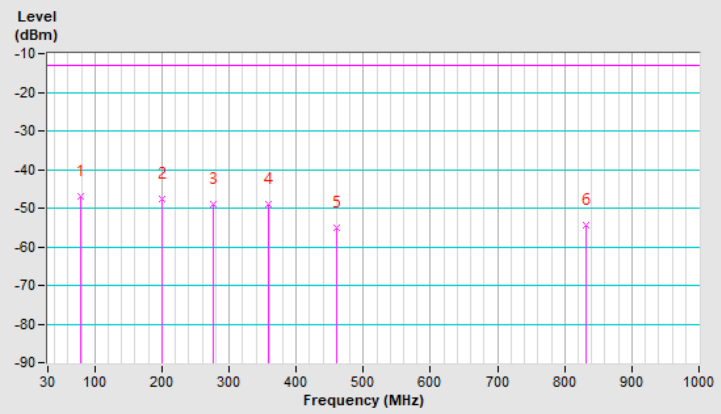
Below 1GHz
LTE Band 38

RF Mode	TX LTE Band XXXVIII-20MHz	Channel	CH 37850：2580.0 MHz
Frequency Range	30MHz ~ 1GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	78.50	-46.99	-13.00	-33.99	1.79 H	2	64.69	-111.68
2	199.75	-47.78	-13.00	-34.78	2.75 H	263	63.11	-110.89
3	276.38	-48.91	-13.00	-35.91	2.41 H	146	58.75	-107.66
4	358.83	-48.89	-13.00	-35.89	1.71 H	151	56.89	-105.78
5	460.68	-55.03	-13.00	-42.03	1.39 H	38	48.06	-103.09
6	831.22	-54.45	-13.00	-41.45	1.95 H	152	42.32	-96.77

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

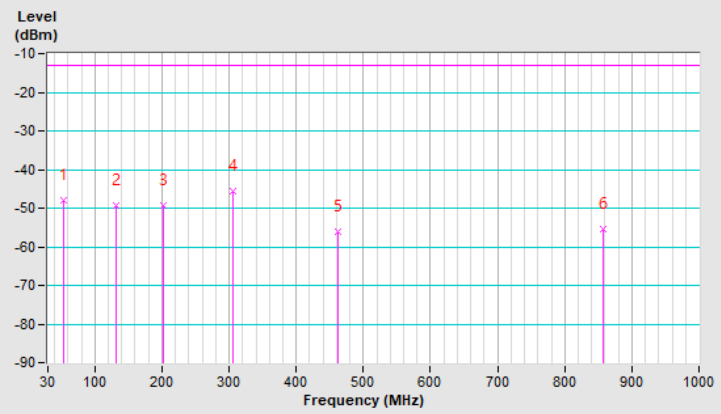


RF Mode	TX LTE Band XXXVIII-20MHz	Channel	CH 37850：2580.0 MHz
Frequency Range	30MHz ~ 1GHz		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	54.25	-47.96	-13.00	-34.96	3.64 V	158	59.86	-107.82
2	131.85	-49.30	-13.00	-36.30	2.23 V	275	59.33	-108.63
3	202.66	-49.29	-13.00	-36.29	1.73 V	59	61.63	-110.92
4	306.45	-45.54	-13.00	-32.54	1.31 V	172	61.33	-106.87
5	462.62	-56.11	-13.00	-43.11	3.96 V	106	46.93	-103.04
6	857.41	-55.50	-13.00	-42.50	2.09 V	184	41.30	-96.80

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.



Above 1GHz
LTE Band 38

RF Mode	TX LTE Band XXXVIII-5MHz	Channel	CH 37775：2572.5 MHz
Frequency Range	1 GHz ~ 27 GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5145.00	-50.05	-25.00	-25.05	2.43 H	28	55.79	-105.84
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5145.00	-49.44	-25.00	-24.44	3.33 V	261	56.40	-105.84

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

RF Mode	TX LTE Band XXXVIII-5MHz	Channel	CH 38000：2595 MHz
Frequency Range	1 GHz ~ 27 GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5190.00	-49.55	-25.00	-24.55	2.60 H	156	56.62	-106.17
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5190.00	-50.50	-25.00	-25.50	1.65 V	144	55.67	-106.17

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

RF Mode	TX LTE Band XXXVIII-5MHz	Channel	CH 38225：2617.5 MHz
Frequency Range	1 GHz ~ 27 GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5235.00	-50.52	-25.00	-25.52	3.68 H	89	55.68	-106.20
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5235.00	-49.84	-25.00	-24.84	2.45 V	277	56.36	-106.20

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

RF Mode	TX LTE Band XXXVIII-20MHz	Channel	CH 37850：2580 MHz
Frequency Range	1 GHz ~ 27 GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	**5160.00**	**-49.20**	**-25.00**	**-24.20**	**2.94 H**	**177**	**56.75**	**-105.95**
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5160.00	-50.44	-25.00	-25.44	1.11 V	317	55.51	-105.95

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

RF Mode	TX LTE Band XXXVIII-20MHz	Channel	CH 38000：2595 MHz
Frequency Range	1 GHz ~ 27 GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5190.00	-49.42	-25.00	-24.42	3.19 H	119	56.75	-106.17
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5190.00	-49.90	-25.00	-24.90	1.82 V	258	56.27	-106.17

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

RF Mode	TX LTE Band XXXVIII-20MHz	Channel	CH 38150：2610 MHz
Frequency Range	1 GHz ~ 27 GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5220.00	-49.53	-25.00	-24.53	2.15 H	311	56.69	-106.22
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5220.00	-50.48	-25.00	-25.48	2.92 V	163	55.74	-106.22

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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