FCC Test Report

(PART 27)

Report No.:	RFBFLF-WTW-P21070538F-3
FCC ID:	MSQFM350GL
Test Model:	FM350-GL
Received Date:	Dec. 28, 2022
Test Date:	Jan. 03 ~ 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-3	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:	Jan. 03 ~ Feb. 16, 2023
Standards:	FCC Part 27, Subpart C, D

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 (a)(3)	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 (a)(4)	Out of Band Emission Measurements	Pass	Meet the requirement of limit.
2.1051 27.53 (a)(4)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 27.53 (a)(4)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -10.19 dB at 4620.00 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. 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	LTE	QPSK, 16QAM, 64QAM, 256QAM
	5GNR	$\pi/2$ BPSK, QPSK, 16QAM, 64QAM, 256QAM
Frequency Range	LTE Band 30 (Channel Bandwidth: 5 MHz)	2307.5 ~ 2312.5 MHz
	LTE Band 30 (Channel Bandwidth: 10 MHz)	2310 MHz
	n30 (Channel Bandwidth 5MHz)	2307.5MHz ~ 2312.5MHz
	n30 (Channel Bandwidth 10MHz)	2310.0MHz
Max. EIRP Power	LTE Band 30 (Channel Bandwidth: 5 MHz)	230.675 mW (23.63dBm)
	LTE Band 30 (Channel Bandwidth: 10 MHz)	232.274 mW (23.66dBm)
	n30 (Channel Bandwidth 5MHz)	164.816 mW (22.17dBm)
	n30 (Channel Bandwidth 10MHz)	165.577 mW (22.19dBm)
Emission Designator	LTE Band 30 (Channel Bandwidth: 5 MHz)	4M49G7D
	LTE Band 30 (Channel Bandwidth: 10 MHz)	8M97D7W
	n30 (Channel Bandwidth 5MHz)	4M47G7D
	n30 (Channel Bandwidth 10MHz)	8M92D7W
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.

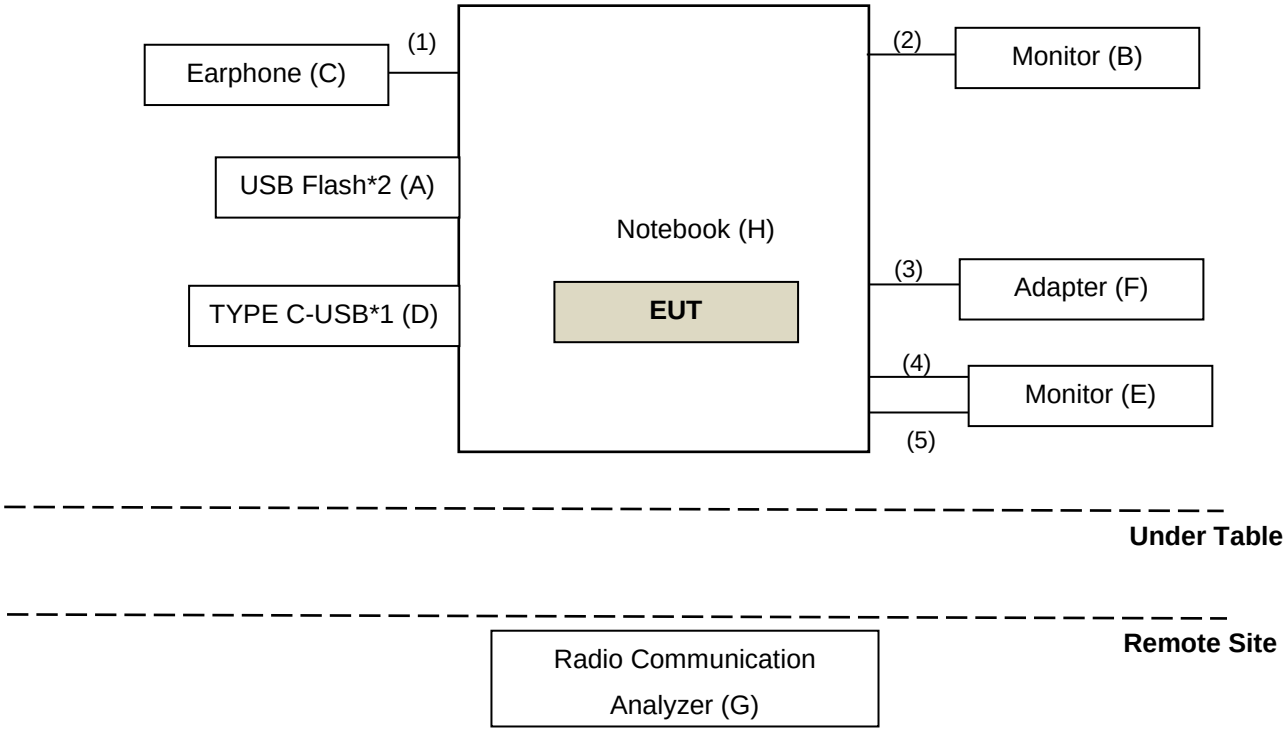
WWAN Antenna								
Ant. Type	Couple							
Band	NB				Tablet			
	Antenna Peak Gain (dBi)				Antenna Peak Gain (dBi)			
	Ant 0 (TX/RX)	Ant 1 (RX)	Ant 2 (TX/RX)	Ant 3 (RX)	Ant 0 (TX/RX)	Ant 1 (RX)	Ant 2 (TX/RX)	Ant 3 (RX)
WCDMA II / LTE 2 / 5G NR n2	**1.96**	1.51	1.82	1.96	-1.18	1.92	0.93	-1.73
WCDMA 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 NB Mode. Following channel(s) was (were) selected for the final test as listed below:

LTE Band 30

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	EIRP	27685 to 27735	27685, 27710, 27735	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
		27710	27710	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
-	Modulation Characteristics	27710	27710	5 MHz	QPSK, 16QAM, 64QAM, 256QAM	50 RB / 0 RB Offset
-	Frequency Stability	27685 to 27735	27685, 27735	5 MHz	QPSK	25 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK	50 RB / 0 RB Offset
-	Occupied Bandwidth	27685 to 27735	27685, 27710, 27735	5 MHz	QPSK, 16QAM, 64QAM, 256QAM	25 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK, 16QAM, 64QAM, 256QAM	50 RB / 0 RB Offset
-	Band Edge	27685 to 27735	27685, 27710, 27735	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 1 RB / 24 RB Offset 25 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 1 RB / 49 RB Offset 50 RB / 0 RB Offset
-	Conducted Emission	27685 to 27735	27685, 27710, 27735	5 MHz	QPSK	1 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK	1 RB / 0 RB Offset
-	Radiated Emission	27685 to 27735	27685, 27710, 27735	5 MHz	QPSK	1 RB / 0 RB Offset
		27710	27710	10 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.

n30

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
-	EIRP	461500 to 462500	461500 (2307.5MHz), 462000 (2310.0MHz), 462500 (2312.5MHz)	5MHz	$\pi/2$ BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB / 1 RB Offset 1 RB / 13 RB Offset 1 RB / 23 RB Offset 12 RB / 0 RB Offset 12 RB / 7 RB Offset 12 RB / 13 RB Offset 25 RB / 0 RB Offset
		462000	462000 (2310.0MHz)	10MHz	$\pi/2$ BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB / 1 RB Offset 1 RB / 26 RB Offset 1 RB / 50 RB Offset 25 RB / 0 RB Offset 25 RB / 14 RB Offset 25 RB / 27 RB Offset 50 RB / 0 RB Offset
-	Modulation characteristics	462000	462000 (2310.0MHz)	10MHz	$\pi/2$ BPSK / QPSK / 16QAM / 64QAM / 256QAM	52 RB / 0 RB Offset
-	Frequency Stability	461500 to 462500	461500 (2307.5MHz), 462500 (2312.5MHz)	5MHz	$\pi/2$ BPSK	25 RB / 0 RB Offset
		462000	462000 (2310.0MHz)	10MHz	$\pi/2$ BPSK	52 RB / 0 RB Offset
-	Emission Bandwidth	461500 to 462500	461500 (2307.5MHz), 462000 (2310.0MHz), 462500 (2312.5MHz)	5MHz	$\pi/2$ BPSK / QPSK / 16QAM / 64QAM / 256QAM	25 RB / 0 RB Offset
		462000	462000 (2310.0MHz)	10MHz	$\pi/2$ BPSK / QPSK / 16QAM / 64QAM / 256QAM	52 RB / 0 RB Offset
-	Emission Mask	461500 to 462500	461500 (2307.5MHz), 462500 (2312.5MHz)	5MHz	$\pi/2$ BPSK	25 RB / 0 RB Offset
		462000	462000 (2310.0MHz)	10MHz	$\pi/2$ BPSK	52 RB / 0 RB Offset
-	Conducted Emission	461500 to 462500	461500 (2307.5MHz), 462000 (2310.0MHz), 462500 (2312.5MHz)	5MHz	$\pi/2$ BPSK	1 RB / 1 RB Offset
		462000	462000 (2310.0MHz)	10MHz	$\pi/2$ BPSK	1 RB / 1 RB Offset
-	Radiated Emission Below 1GHz	461500 to 462500	461500 (2307.5MHz)	5MHz	$\pi/2$ BPSK	1 RB / 1 RB Offset
-	Radiated Emission Above 1GHz	461500 to 462500	461500 (2307.5MHz), 462000 (2310.0MHz), 462500 (2312.5MHz)	5MHz	$\pi/2$ BPSK	1 RB / 1 RB Offset
		462000	462000 (2310.0MHz)	10MHz	$\pi/2$ BPSK	1 RB / 1 RB Offset

Note:

1. For radiated emission below 1GHz, select the worst radiated emission channel (above 1GHz) for final testing.
2. For radiated emission above 1GHz, according to 3GPP 38.521-1 Section 6.5.3.1.4, choose the lowest and highest channel bandwidth for final test.
3. Only output power, modulation characteristics, occupied bandwidth items had been tested under $\pi/2$ BPSK, QPSK, 16QAM, 64QAM and 256QAM modes, the other test items were performed under worse mode according to the maximum output power.

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
Band Edge	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

3.5 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

For LTE Band 30 and 5G NR n30:
For mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth.

4.1.2 Test Procedures

Conducted Power Measurement:

For all test band except LTE band 30 and 5G NR n30:

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.

For LTE band 30 and 5G NR n30:

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 30				
BW	**MCS Index**	**Channel**		**27710**
		Frequency (MHz)		**2310**
10M	QPSK	1	0	**21.83**
		1	24	21.77
		1	49	21.69
		25	0	20.64
		25	12	20.60
		25	25	20.49
		50	0	20.60
	16QAM	1	0	20.82
		1	24	20.73
		1	49	20.71
		25	0	19.71
		25	12	19.64
		25	25	19.52
		50	0	19.68
	64QAM	1	0	19.84
		1	24	19.78
		1	49	19.76
		25	0	18.74
		25	12	18.66
		25	25	18.59
		50	0	18.66
	256QAM	1	0	16.95
		1	24	16.88
		1	49	16.94
		25	0	16.69
		25	12	16.62
		25	25	16.43
		50	0	16.54

Note: LTE Band 30 measurement results are in dBm/5MHz.

LTE Band 30						
BW	MCS Index	Channel		27685	27710	27735
		Frequency (MHz)		2307.5	2310	2312.5
5M	QPSK	1	0	21.76	**21.80**	21.71
		1	12	21.69	21.75	21.68
		1	24	21.71	21.77	21.75
		12	0	20.79	20.81	20.81
		12	6	20.63	20.73	20.72
		12	13	20.60	20.69	20.64
		25	0	20.69	20.75	20.72
	16QAM	1	0	20.91	21.01	20.97
		1	12	20.99	20.98	20.93
		1	24	20.76	20.73	20.74
		12	0	19.84	19.81	19.71
		12	6	19.78	19.81	19.73
		12	13	19.71	19.70	19.64
		25	0	19.75	19.82	19.78
	64QAM	1	0	19.85	19.87	19.78
		1	12	19.73	19.80	19.79
		1	24	19.78	19.78	19.69
		12	0	18.75	18.78	18.72
		12	6	18.78	18.80	18.77
		12	13	18.66	18.73	18.70
		25	0	18.65	18.69	18.60
	256QAM	1	0	16.84	16.89	16.86
		1	12	16.92	16.95	16.92
		1	24	16.93	16.97	16.96
		12	0	16.70	16.71	16.63
		12	6	16.48	16.58	16.49
		12	13	16.51	16.48	16.41
		25	0	16.51	16.55	16.47

Note: LTE Band 30 measurement results are in dBm/5MHz.

NR Band 30				
BW	MCS Index	RB Size	RB Offset	Mid
		Channel		462000
		Frequency (MHz)		2310
10M	DFT-S $\pi/2$ BPSK	1	1	**22.51**
		1	26	22.48
		1	50	22.41
		25	0	21.77
		25	14	22.37
		25	27	21.76
		50	0	21.86
10M	DFT-S QPSK	1	1	22.27
		1	26	22.24
		1	50	22.3
		25	0	21.16
		25	14	22.35
		25	27	21.19
		50	0	21.14
10M	DFT-S 16QAM	1	1	20.83
10M	DFT-S 64QAM	1	1	19.98
10M	DFT-S 256QAM	1	1	17.87
10M	CP QPSK	1	1	20.76
10M	CP 16QAM	1	1	20.24
10M	CP 64QAM	1	1	18.76
10M	CP 256QAM	1	1	16.07

NR Band 30						
BW	MCS Index	Channel		461500	462000	462500
		Frequency (MHz)		2307.5	2310	2312.5
5M	DFT-S $\pi/2$ BPSK	1	1	22.41	22.45	22.47
		1	13	22.38	**22.49**	22.43
		1	23	22.37	22.30	22.33
		12	0	21.73	21.71	21.64
		12	7	22.26	22.31	22.36
		12	13	21.77	21.75	21.76
		25	0	21.75	21.74	21.83
5M	DFT-S QPSK	1	1	22.17	22.20	22.28
		1	13	22.24	22.14	22.22
		1	23	22.22	22.19	22.22
		12	0	21.09	21.20	21.04
		12	7	22.27	22.27	22.28
		12	13	21.07	21.13	21.15
		25	0	21.05	21.09	21.01
5M	DFT-S 16QAM	1	1	20.80	20.79	20.84
5M	DFT-S 64QAM	1	1	19.89	19.97	19.91
5M	DFT-S 256QAM	1	1	17.90	17.74	17.90
5M	CP QPSK	1	1	20.72	20.62	20.78
5M	CP 16QAM	1	1	20.20	20.24	20.12
5M	CP 64QAM	1	1	18.74	18.79	18.78
5M	CP 256QAM	1	1	16.01	16.03	15.93

EIRP Power

LTE Band 30				
BW	MCS Index	RB Size	RB Offset	Mid
		Channel		27710
		Frequency (MHz)		2310
10M	QPSK	1	0	**23.66**
		1	24	23.60
		1	49	23.52
		25	0	22.47
		25	12	22.43
		25	25	22.32
		50	0	22.43
10M	16QAM	1	0	22.65
		1	24	22.56
		1	49	22.54
		25	0	21.54
		25	12	21.47
		25	25	21.35
		50	0	21.51
10M	64QAM	1	0	21.67
		1	24	21.61
		1	49	21.59
		25	0	20.57
		25	12	20.49
		25	25	20.42
		50	0	20.49
10M	256QAM	1	0	18.78
		1	24	18.71
		1	49	18.77
		25	0	18.52
		25	12	18.45
		25	25	18.26
		50	0	18.37

*EIRP = Conducted + antenna gain (1.83dBi)

LTE Band 30						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		27685	27710	27735
		Frequency (MHz)		2307.5	2310	2312.5
5M	QPSK	1	0	23.59	**23.63**	23.54
		1	12	23.52	23.58	23.51
		1	24	23.54	23.60	23.58
		12	0	22.62	22.64	22.64
		12	6	22.46	22.56	22.55
		12	13	22.43	22.52	22.47
		25	0	22.52	22.58	22.55
5M	16QAM	1	0	22.74	22.84	22.80
		1	12	22.82	22.81	22.76
		1	24	22.59	22.56	22.57
		12	0	21.67	21.64	21.54
		12	6	21.61	21.64	21.56
		12	13	21.54	21.53	21.47
		25	0	21.58	21.65	21.61
5M	64QAM	1	0	21.68	21.70	21.61
		1	12	21.56	21.63	21.62
		1	24	21.61	21.61	21.52
		12	0	20.58	20.61	20.55
		12	6	20.61	20.63	20.60
		12	13	20.49	20.56	20.53
		25	0	20.48	20.52	20.43
5M	256QAM	1	0	18.67	18.72	18.69
		1	12	18.75	18.78	18.75
		1	24	18.76	18.80	18.79
		12	0	18.53	18.54	18.46
		12	6	18.31	18.41	18.32
		12	13	18.34	18.31	18.24
		25	0	18.34	18.38	18.30

*EIRP = Conducted + antenna gain (1.83dBi)

NR Band 30				
BW	MCS Index	RB Size	RB Offset	Mid
		Channel		462000
		Frequency (MHz)		2310
10M	DFT-S $\pi/2$ BPSK	1	1	**22.19**
		1	26	22.16
		1	50	22.09
		25	0	21.45
		25	14	22.05
		25	27	21.44
		50	0	21.54
10M	DFT-S QPSK	1	1	21.95
		1	26	21.92
		1	50	21.98
		25	0	20.84
		25	14	22.03
		25	27	20.87
		50	0	20.82
10M	DFT-S 16QAM	1	1	20.51
10M	DFT-S 64QAM	1	1	19.66
10M	DFT-S 256QAM	1	1	17.55
10M	CP QPSK	1	1	20.44
10M	CP 16QAM	1	1	19.92
10M	CP 64QAM	1	1	18.44
10M	CP 256QAM	1	1	15.75

*EIRP = Conducted + antenna gain (1.83dBi)

NR Band 30						
BW	MCS Index	Channel		461500	462000	462500
		Frequency (MHz)		2307.5	2310	2312.5
5M	DFT-S $\pi/2$ BPSK	1	1	22.09	22.13	22.15
		1	13	22.06	**22.17**	22.11
		1	23	22.05	21.98	22.01
		12	0	21.41	21.39	21.32
		12	7	21.94	21.99	22.04
		12	13	21.45	21.43	21.44
		25	0	21.43	21.42	21.51
5M	DFT-S QPSK	1	1	21.85	21.88	21.96
		1	13	21.92	21.82	21.9
		1	23	21.9	21.87	21.9
		12	0	20.77	20.88	20.72
		12	7	21.95	21.95	21.96
		12	13	20.75	20.81	20.83
		25	0	20.73	20.77	20.69
5M	DFT-S 16QAM	1	1	20.48	20.47	20.52
5M	DFT-S 64QAM	1	1	19.57	19.65	19.59
5M	DFT-S 256QAM	1	1	17.58	17.42	17.58
5M	CP QPSK	1	1	20.4	20.3	20.46
5M	CP 16QAM	1	1	19.88	19.92	19.8
5M	CP 64QAM	1	1	18.42	18.47	18.46
5M	CP 256QAM	1	1	15.69	15.71	15.61

*EIRP = Conducted + antenna gain (1.83dBi)

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

4.2.2 Test Setup

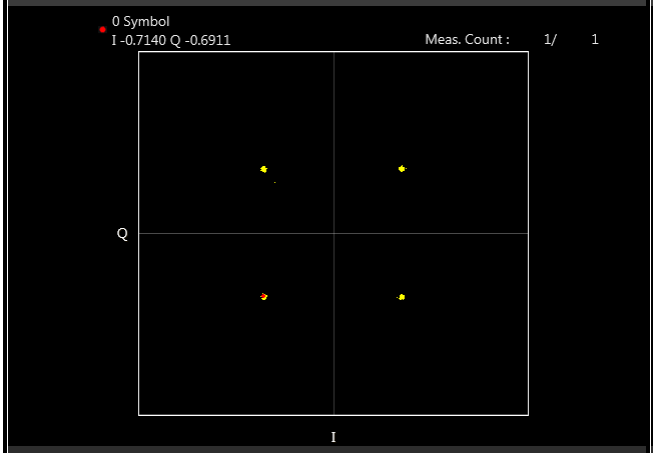
4.2.3 Test Procedure

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.

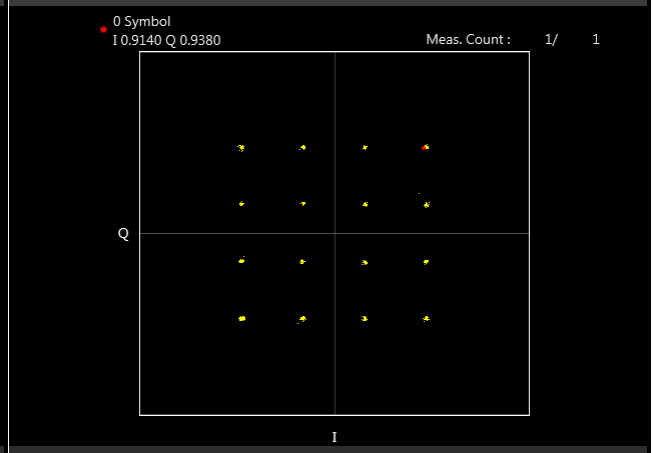
4.2.4 Test Results

LTE Band 30

Spectrum Plot of Measurement	
LTE Band 30	
Channel 27710	
QPSK	16QAM

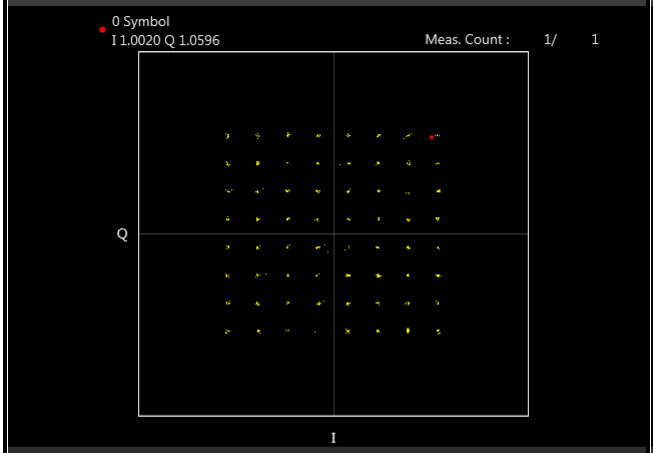


	Avg.	Max.	Min.	Limit
EVM	1.80	1.80	1.80 %(rms)	≤ 17.5 %(rms)
Peak Vector Error	18.38	18.38	18.38 %	
Carrier Leakage	-54.79	-54.79	-54.79 dBc	
IQ Imbalance	100.12	100.12	100.12 %(I/Q)	

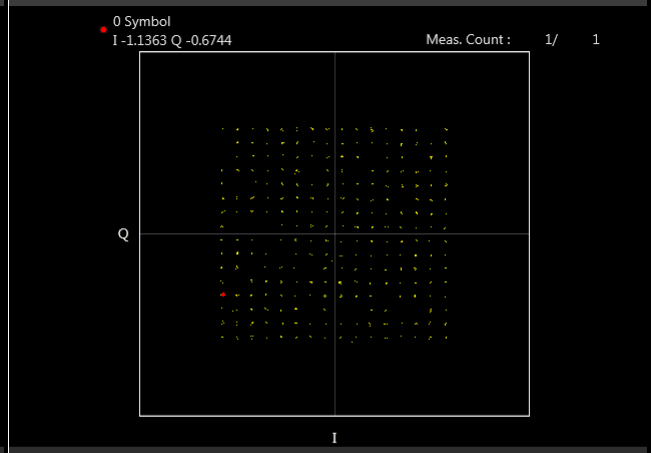


	Avg.	Max.	Min.	Limit
EVM	1.77	1.77	1.77 %(rms)	≤ 12.5 %(rms)
Peak Vector Error	16.00	16.00	16.00 %	
Carrier Leakage	-51.69	-51.69	-51.69 dBc	
IQ Imbalance	99.95	99.95	99.95 %(I/Q)	

64QAM	256QAM

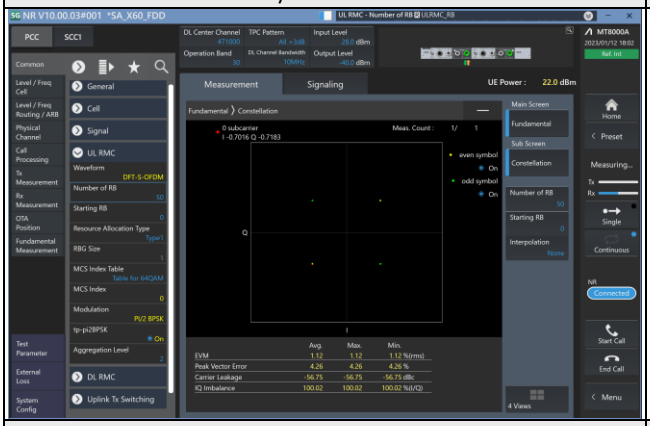
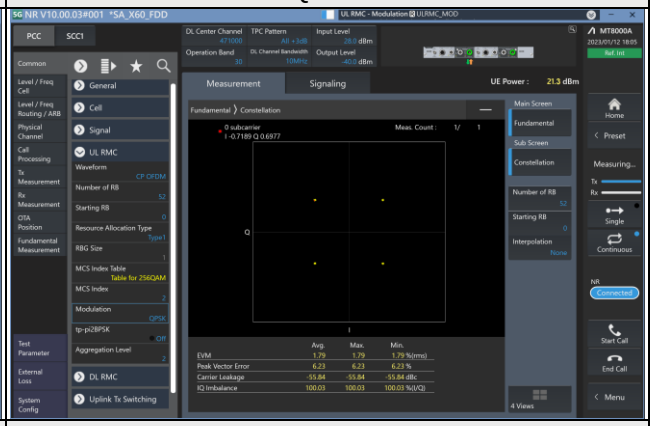
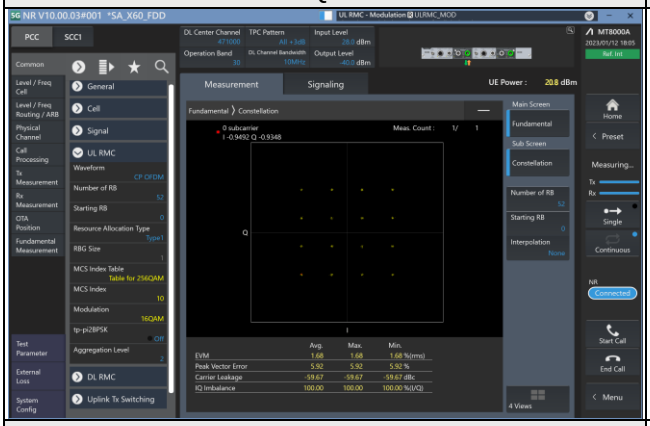
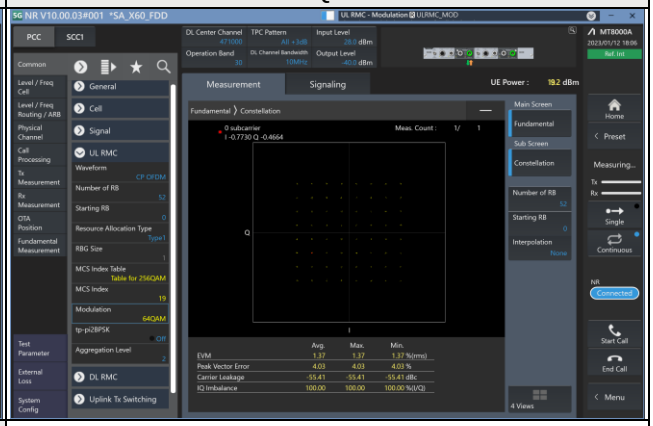
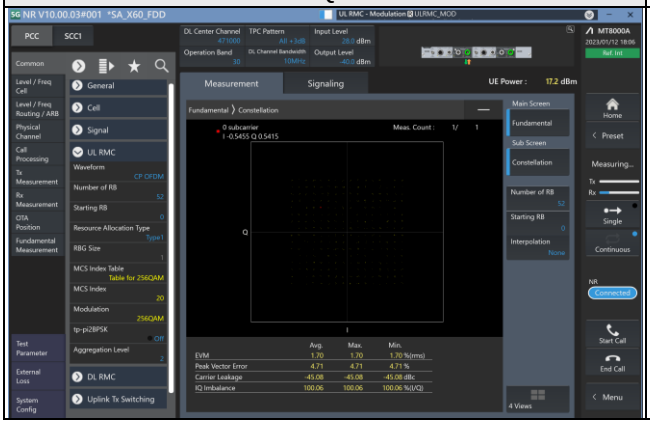


	Avg.	Max.	Min.	Limit
EVM	1.60	1.60	1.60 %(rms)	≤ 8.0 %(rms)
Peak Vector Error	15.07	15.07	15.07 %	
Carrier Leakage	-50.08	-50.08	-50.08 dBc	
IQ Imbalance	100.22	100.22	100.22 %(I/Q)	



	Avg.	Max.	Min.	Limit
EVM	1.33	1.33	1.33 %(rms)	
Peak Vector Error	9.31	9.31	9.31 %	
Carrier Leakage	-51.02	-51.02	-51.02 dBc	
IQ Imbalance	99.99	99.99	99.99 %(I/Q)	

5G NR n30

n30	
Spectrum Plot of Measurement Value	
Channel: 462000 / Frequency (MHz): 2310.0MHz	
$\pi/2$ BPSK	QPSK
	
16QAM	64QAM
	
256QAM	
	

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

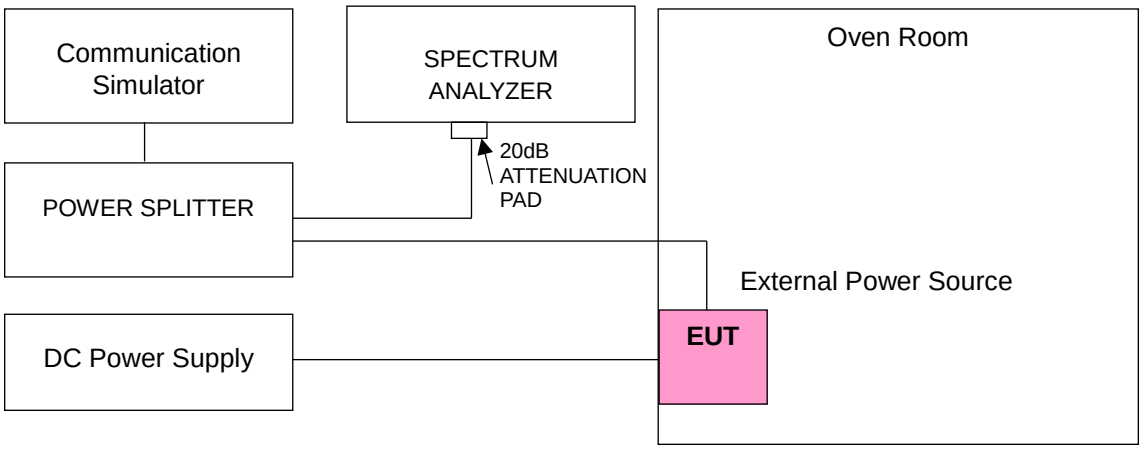
According to the FCC part 2.1055 shall be tested the frequency stability. The rule is defined that" The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." The test extreme voltage is according to the 2.1055(d)(1) Vary primary 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 30			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
9.86	2307.500001	0.000	2312.499997	-0.001
11.61	2307.499998	-0.001	2312.499999	0.000
13.35	2307.500002	0.001	2312.500001	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 30			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2307.499997	-0.001	2312.500003	0.001
-20	2307.499996	-0.002	2312.500002	0.001
-10	2307.500002	0.001	2312.500003	0.001
0	2307.500004	0.002	2312.499998	-0.001
10	2307.500002	0.001	2312.499996	-0.002
20	2307.500004	0.002	2312.499997	-0.001
30	2307.500003	0.001	2312.500004	0.002
40	2307.499997	-0.001	2312.499999	0.000
50	2307.500001	0.000	2312.500002	0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 30	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
9.86	2309.999996	-0.002
11.61	2310.000001	0.000
13.35	2309.999998	-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 30	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
-30	2309.999997	-0.001
-20	2309.999997	-0.001
-10	2310.000004	0.002
0	2310.000001	0.000
10	2309.999997	-0.001
20	2309.999999	0.000
30	2309.999998	-0.001
40	2309.999998	-0.001
50	2309.999997	-0.001

Frequency Error vs. Voltage

Voltage (Vdc)	n30			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
9.86	2307.500001	0.0004	2312.500003	0.0013
11.61	2307.499997	-0.0013	2312.499996	-0.0017
13.35	2307.500003	0.0013	2312.499999	-0.0004

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

Frequency Error vs. Temperature

Temp. (℃)	n30			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2307.499998	-0.0009	2312.500001	0.0004
-20	2307.500004	0.0017	2312.499999	-0.0004
-10	2307.500004	0.0017	2312.500001	0.0004
0	2307.500002	0.0009	2312.499998	-0.0009
10	2307.500003	0.0013	2312.500003	0.0013
20	2307.499997	-0.0013	2312.499997	-0.0013
30	2307.499999	-0.0004	2312.499999	-0.0004
40	2307.500003	0.0013	2312.499996	-0.0017
50	2307.500002	0.0009	2312.499996	-0.0017

Frequency Error vs. Voltage

Voltage (Vdc)	n30	
	Channel Bandwidth 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
9.86	2310.000003	0.0013
11.61	2310.000001	0.0004
13.35	2309.999997	-0.0013

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

Frequency Error vs. Temperature

Temp. (℃)	n30	
	Channel Bandwidth 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
-30	2309.999996	-0.0017
-20	2309.999999	-0.0004
-10	2310.000004	0.0017
0	2309.999999	-0.0004
10	2309.999999	-0.0004
20	2309.999996	-0.0017
30	2310.000004	0.0017
40	2309.999997	-0.0013
50	2310.000001	0.0004

4.4 Occupied Bandwidth Measurement

4.4.1 Limits of Occupied Bandwidth Measurement

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

4.4.2 Test Procedure

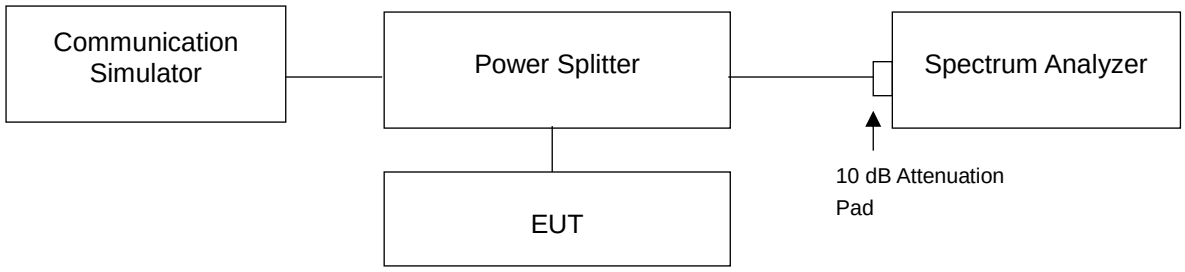
The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

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).

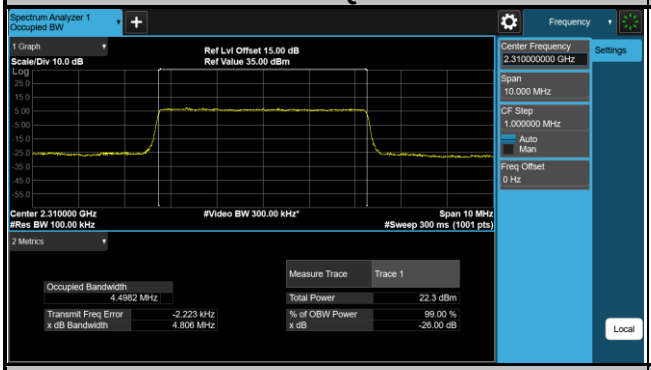
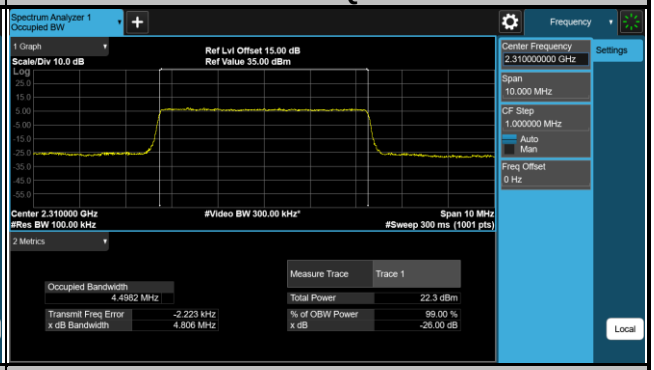
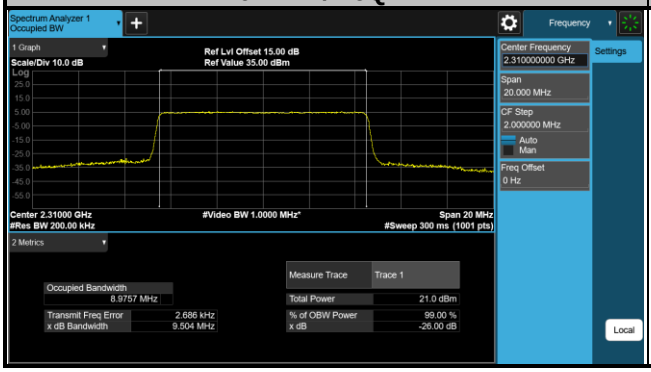
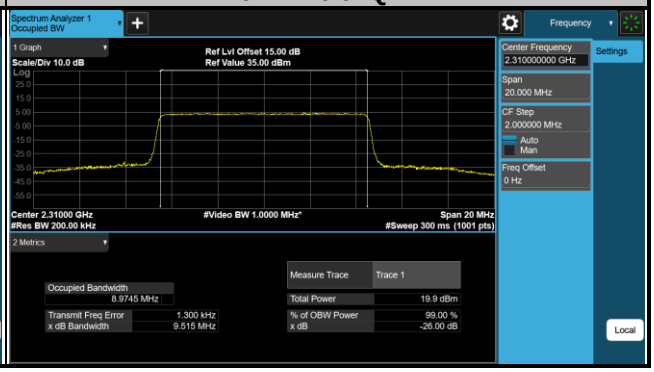
For the occupied bandwidth measurement method, please refer to section 5.4.4 of ANSI C63.26.

4.4.3 Test Setup

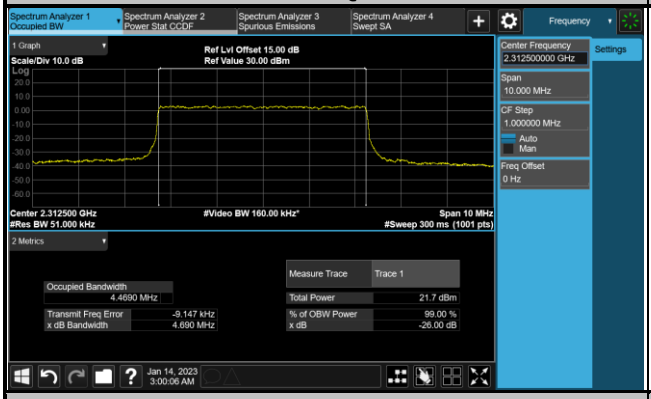
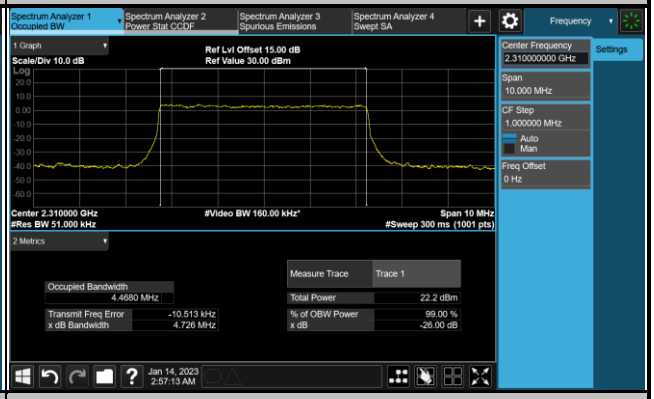
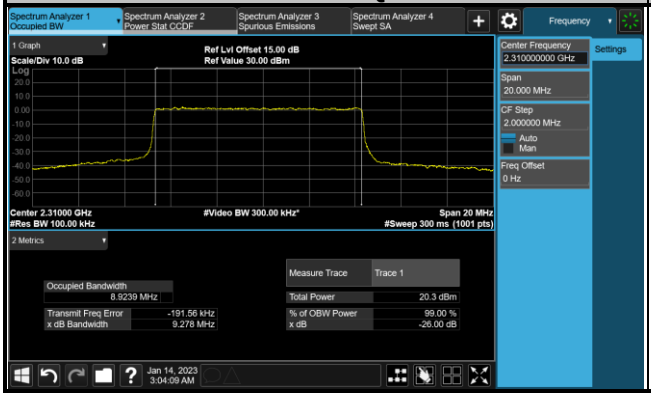


4.4.4 Test Result

LTE Band 30									
Channel Bandwidth: 5 MHz									
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)				26 dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
27685	2307.5	4.48	4.49	4.49	4.48	4.78	4.78	4.78	4.78
27710	2310.0	4.49	4.49	4.49	4.48	4.80	4.79	4.79	4.77
27735	2312.5	4.49	4.49	4.49	4.48	4.79	4.78	4.80	4.77
Channel Bandwidth: 10 MHz									
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)				26 dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
27710	2310.0	8.97	8.97	8.97	8.94	9.50	9.50	9.50	9.48

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

n30											
Channel Bandwidth: 5 MHz											
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)					26 dB Bandwidth (MHz)				
		π/2 BPSK	QPSK	16QAM	64QAM	256QAM	π/2 BPSK	QPSK	16QAM	64QAM	256QAM
461500	2307.5	4.46	4.46	4.46	4.45	4.46	4.70	4.68	4.71	4.68	4.71
462000	2310.0	4.46	4.47	4.45	4.45	4.47	4.72	4.72	4.71	4.71	4.69
462500	2312.5	4.46	4.46	4.46	4.46	4.46	4.70	4.69	4.71	4.71	4.71
Channel Bandwidth: 10 MHz											
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)					26 dB Bandwidth (MHz)				
		π/2 BPSK	QPSK	16QAM	64QAM	256QAM	π/2 BPSK	QPSK	16QAM	64QAM	256QAM
462000	2310.0	8.91	8.91	8.92	8.92	8.92	9.28	9.27	9.27	9.30	9.28

Spectrum Plot of Worst Value	
99 % Occupied Bandwidth	26 dB Bandwidth
5 MHz / QPSK	5 MHz / π/2 BPSK
	
10 MHz / 16QAM	10 MHz / 64QAM
	

4.5 Band Edge Measurement

4.5.1 Limits of Band Edge Measurement

For LTE Band 30 and 5G NR n30:
According to FCC 27.53(a) (4), for mobile and portable stations operating in the 2305-2315MHz and 2350-2360 MHz bands:

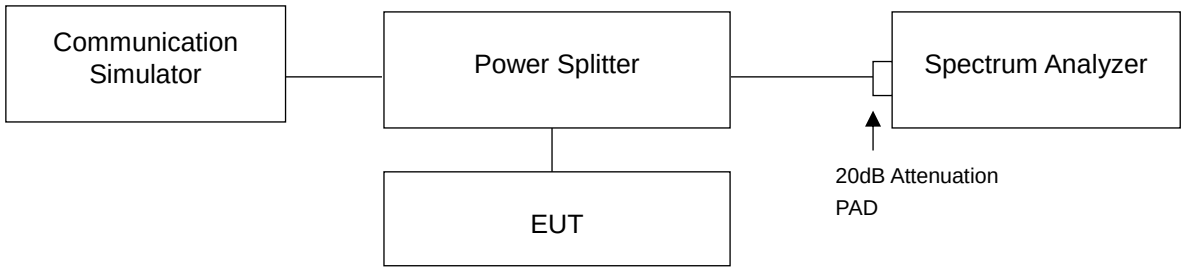
(i) By a factor of not less than: 43 + 10 log (P) dB on all frequencies between 2305 and 2320MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than 55 + 10 log (P) dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345MHz, not less than 61 + 10 log (P) dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than 67 + 10 log (P) dB on all frequencies between 2328 and 2337 MHz;

(ii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2300 and 2305MHz, 55 + 10 log (P) dB on all frequencies between 2296 and 2300 MHz, 61 + 10 log (P) dB on all frequencies between 2292 and 2296 MHz, 67 + 10 log (P) dB on all frequencies between 2288 and 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz;

(iii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2365MHz, and not less than 70 + 10 log (P) dB above 2365MHz.

(iv) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the channel blocks at 2305, 2310, 2315, 2320, 2345, 2350, 2355, and 2360 MHz, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter 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).

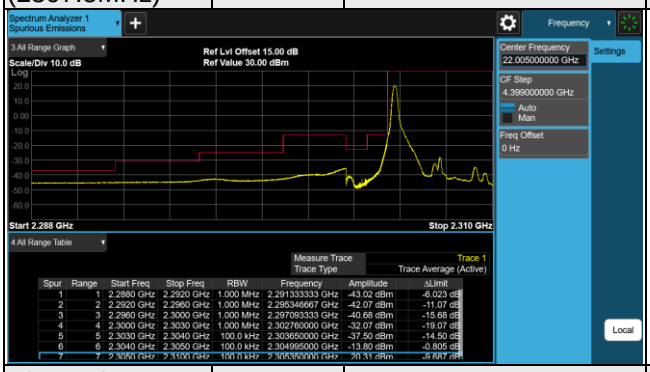
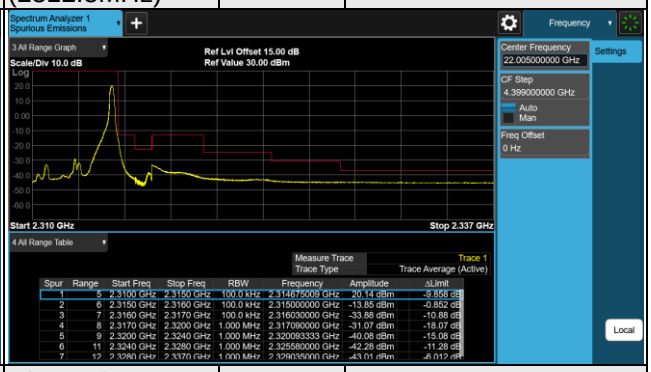
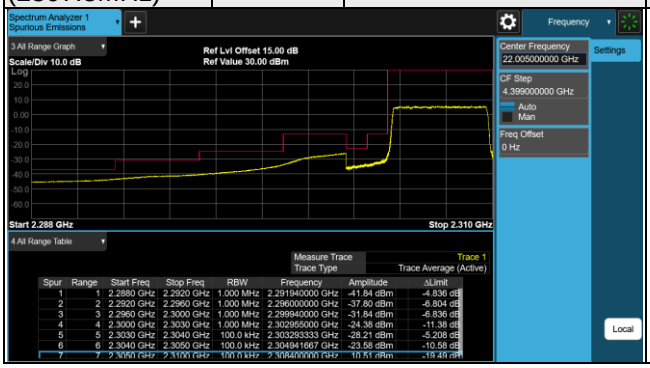
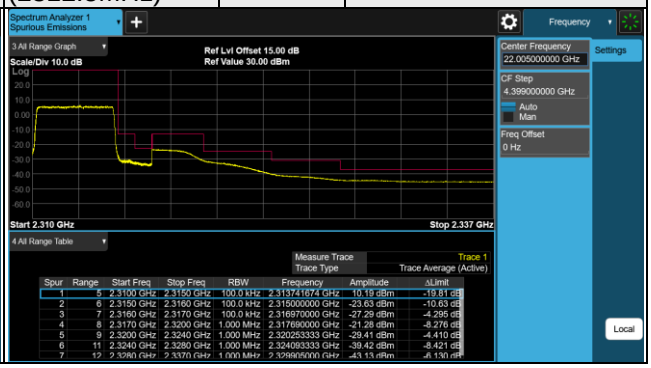
b. The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

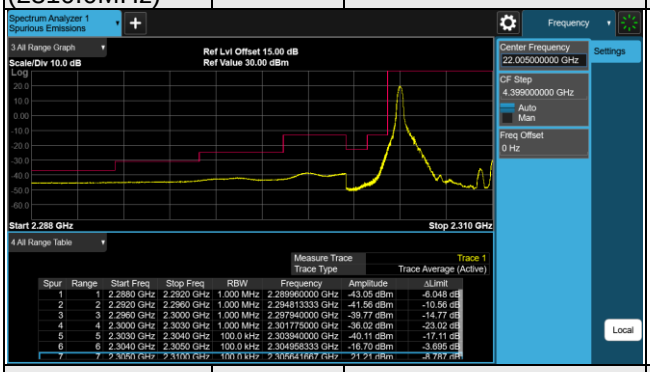
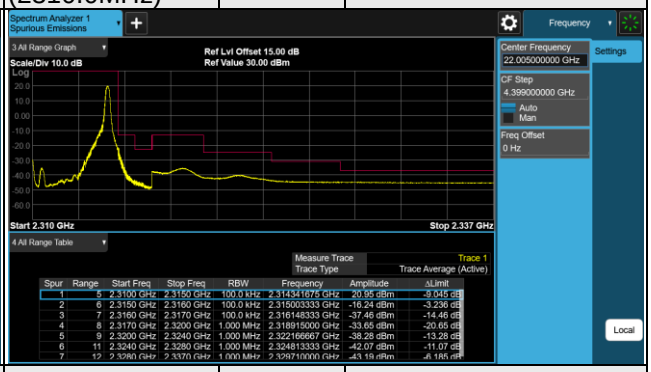
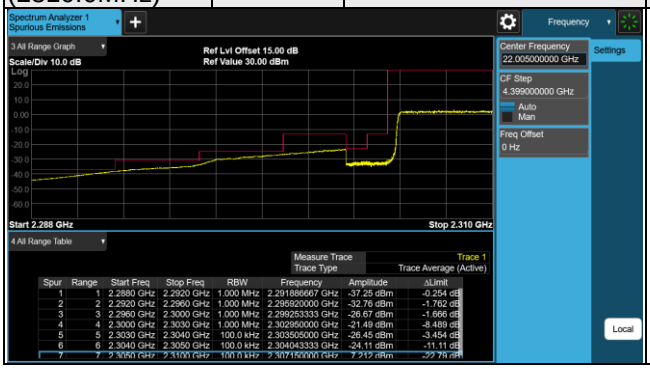
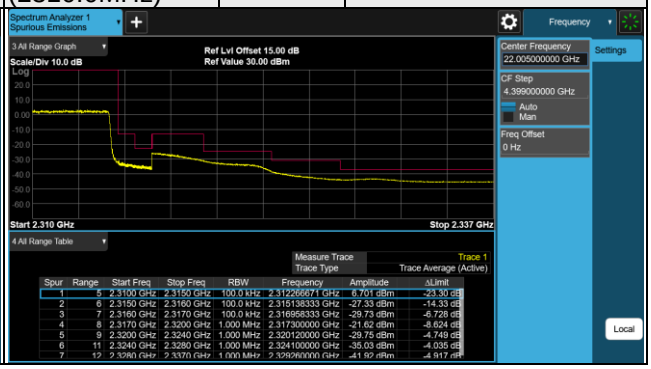
c. Measuring frequency range is from 2200 MHz to 2395 MHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz are used for conducted emission measurement.

d. Record the max trace plot into the test report.

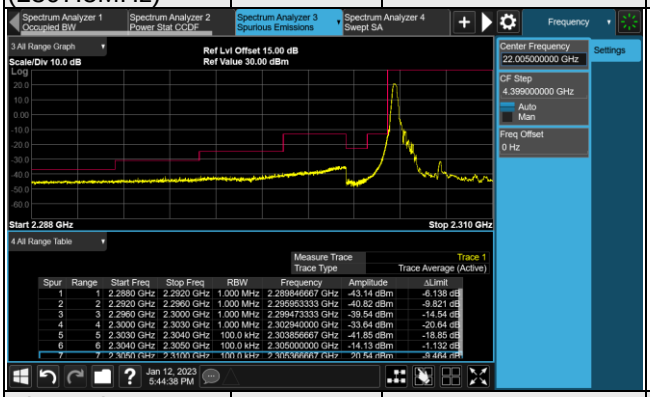
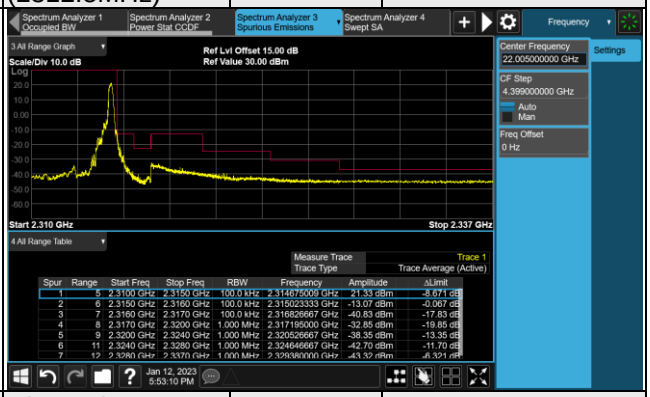
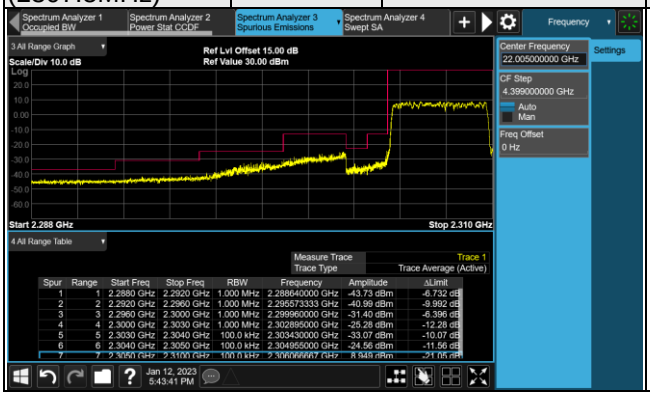
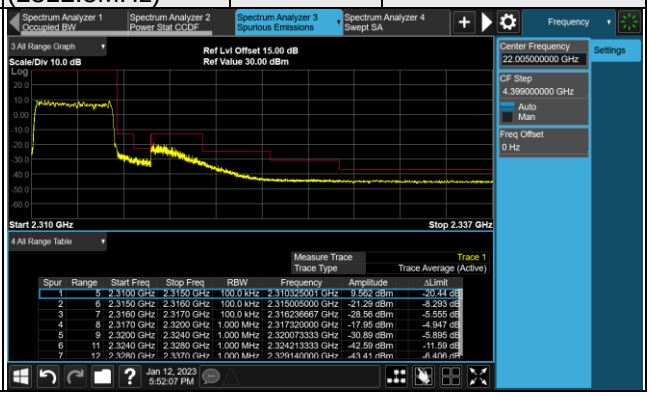
4.5.4 Test Results

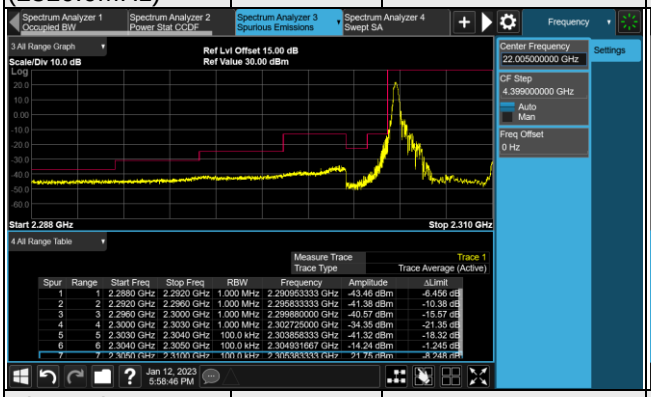
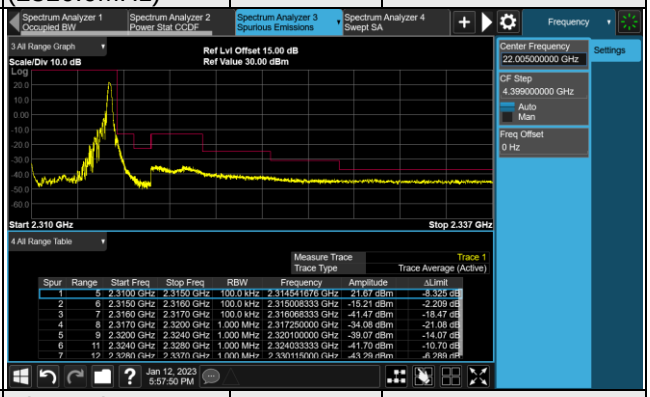
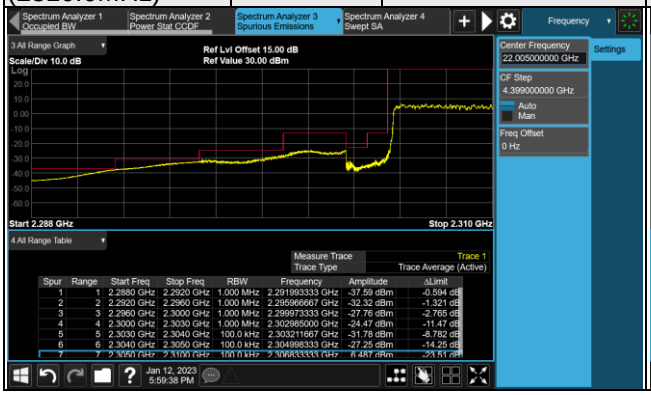
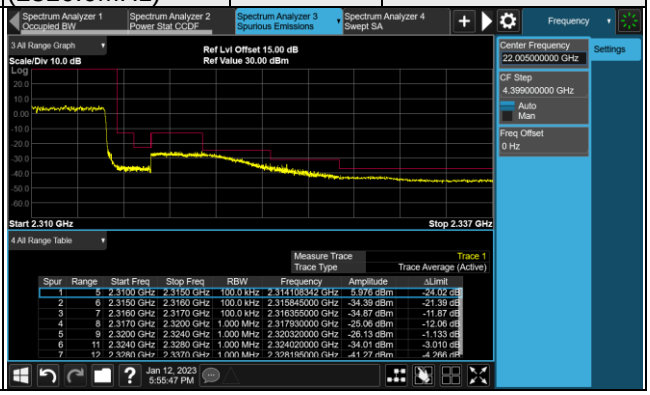
Emission Mask

LTE Band 30, Channel Bandwidth 5MHz					
Channel 27685 (2307.5MHz)	QPSK	1 RB / 0 RB Offset	Channel 27735 (2312.5MHz)	QPSK	1 RB / 24 RB Offset
					
Channel 27685 (2307.5MHz)	QPSK	25 RB / 0 RB Offset	Channel 27735 (2312.5MHz)	QPSK	25 RB / 0 RB Offset
					

LTE Band 30, Channel Bandwidth 10MHz					
Channel 27710 (2310.0MHz)	QPSK	1 RB / 0 RB Offset	Channel 27710 (2310.0MHz)	QPSK	1 RB / 49 RB Offset
					
Channel 27710 (2310.0MHz)	QPSK	50 RB / 0 RB Offset	Channel 27710 (2310.0MHz)	QPSK	50 RB / 0 RB Offset
					

Emission Mask

n30, Channel Bandwidth 5MHz					
Channel 461500 (2307.5MHz)	$\pi/2$ BPSK	1 RB / 0 RB Offset	Channel 462500 (2312.5MHz)	$\pi/2$ BPSK	1 RB / 24 RB Offset
					
Channel 461500 (2307.5MHz)	$\pi/2$ BPSK	25 RB / 0 RB Offset	Channel 462500 (2312.5MHz)	$\pi/2$ BPSK	25 RB / 0 RB Offset
					

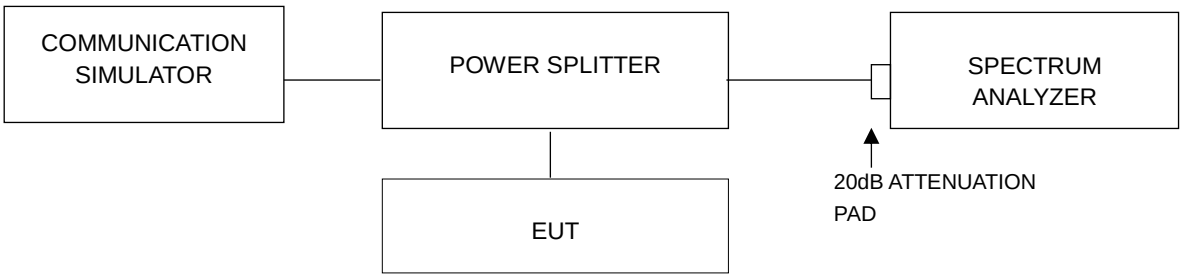
n30, Channel Bandwidth 10MHz					
Channel 462000 (2310.0MHz)	$\pi/2$ BPSK	1 RB / 0 RB Offset	Channel 462000 (2310.0MHz)	$\pi/2$ BPSK	1 RB / 50 RB Offset
					
Channel 462000 (2310.0MHz)	$\pi/2$ BPSK	51 RB / 0 RB Offset	Channel 462000 (2310.0MHz)	$\pi/2$ BPSK	51 RB / 0 RB Offset
					

4.6 Conducted Spurious Emissions

4.6.1 Limits of Conducted Spurious Emissions Measurement

According to FCC 27.53(a)(4)(ii)(iii), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 70 +10 log (P) dB. The limit of emission is equal to -40 dBm.

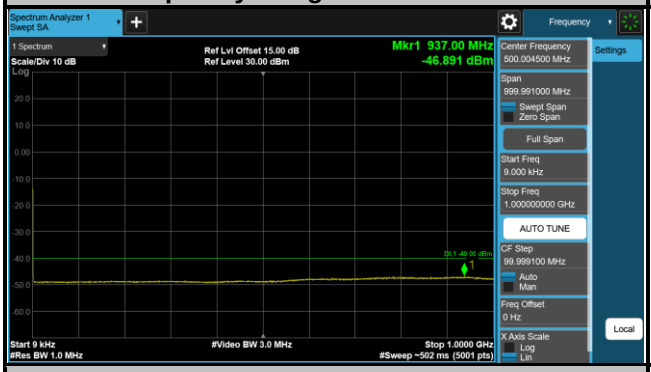
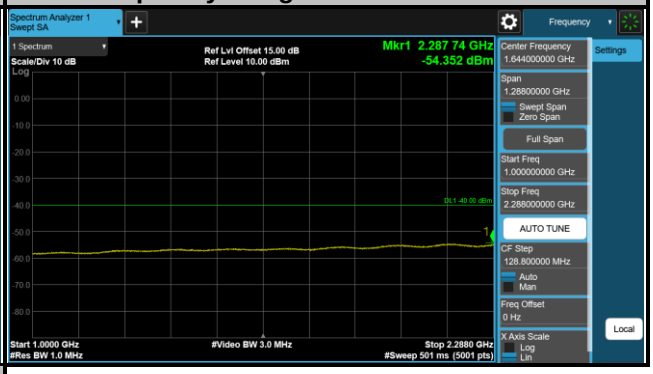
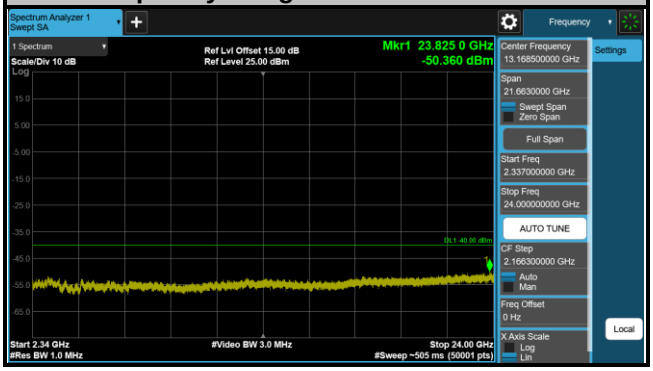
4.6.2 Test Setup



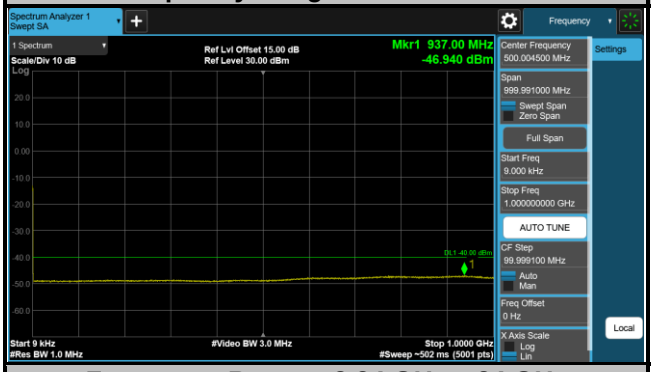
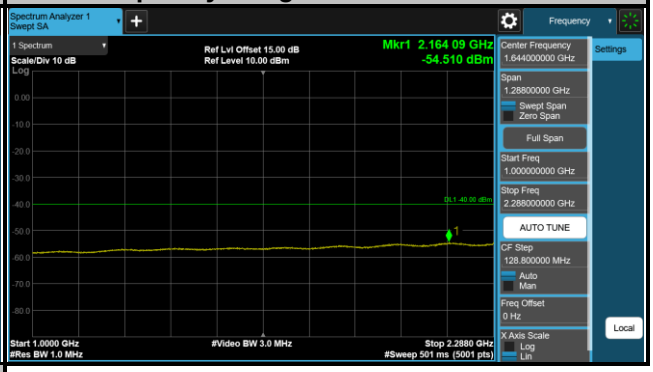
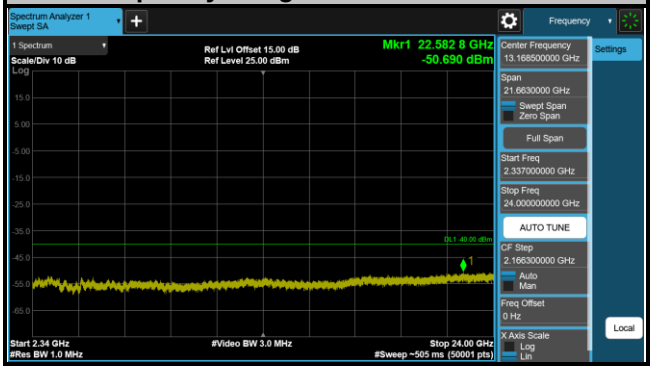
4.6.3 Test Procedure

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 24 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 is referenced to ANSI 63.26 section 5.7.2.

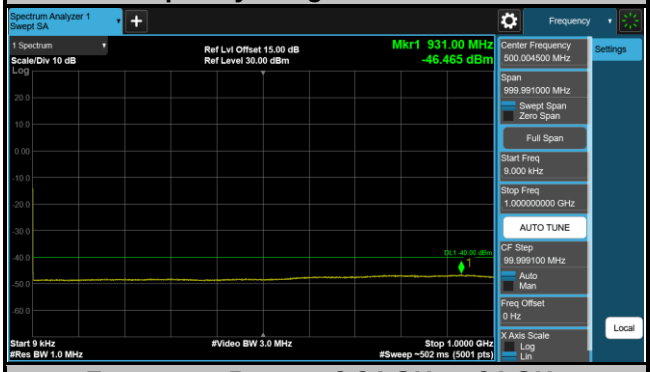
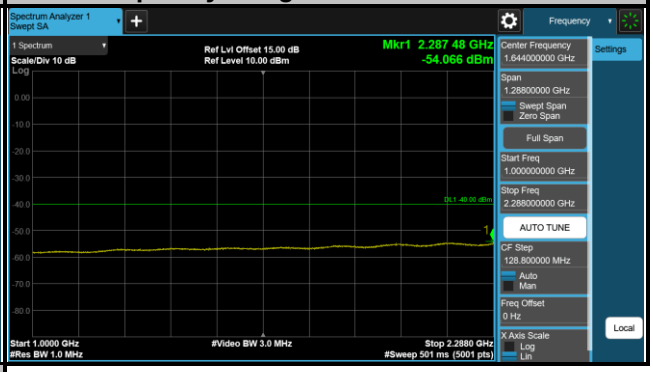
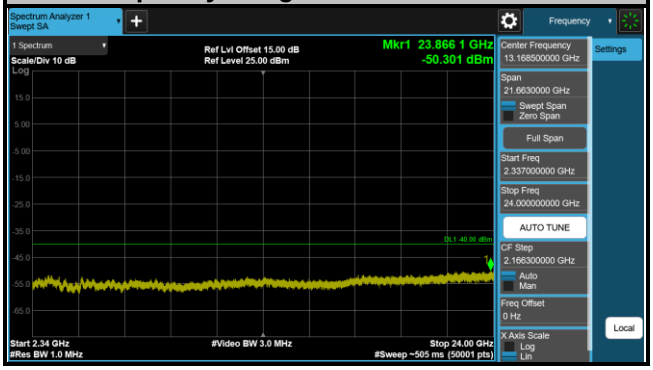
4.6.4 Test Results

LTE Band 30	
Channel Bandwidth: 5 MHz	
Channel 27685	
Frequency Range : 9 kHz ~ 1 GHz	Frequency Range : 1 GHz ~ 2.288 GHz
	
Frequency Range : 2.34 GHz ~ 24 GHz	
	

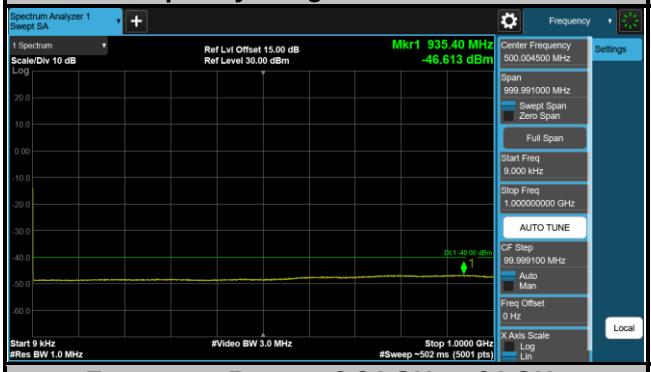
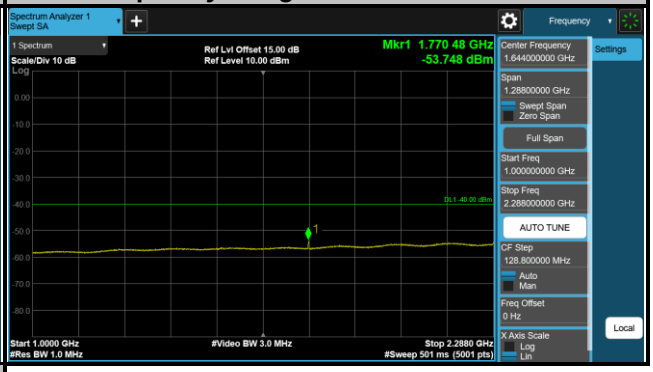
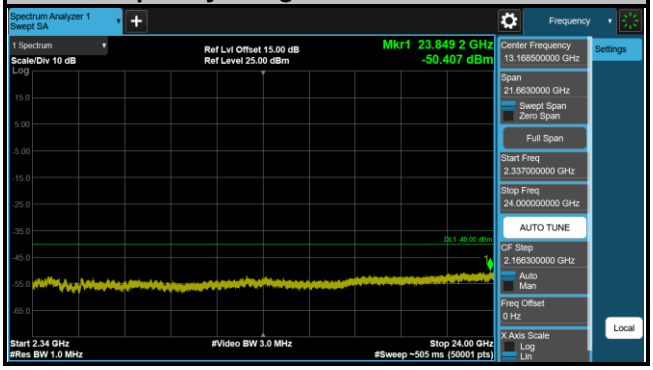
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 30	
Channel Bandwidth: 5 MHz	
Channel 27710	
Frequency Range : 9 kHz ~ 1 GHz	Frequency Range : 1 GHz ~ 2.288 GHz
	
Frequency Range : 2.34 GHz ~ 24 GHz	
	

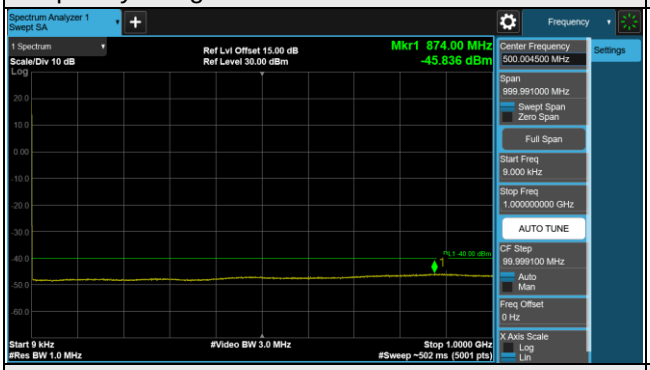
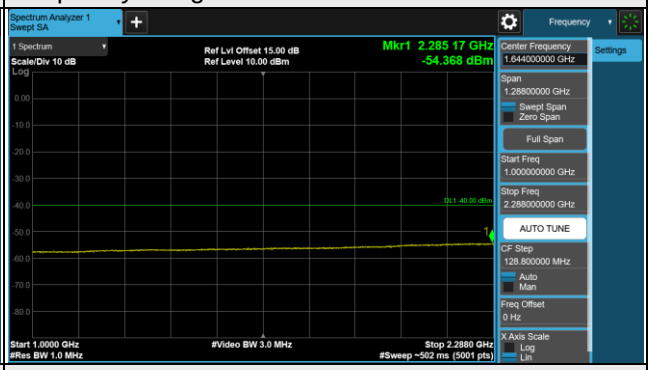
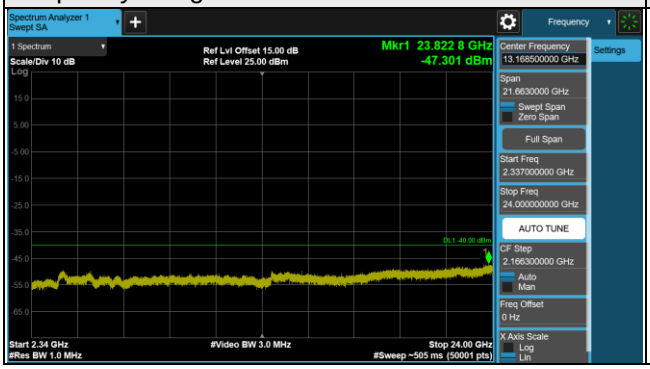
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 30	
Channel Bandwidth: 5 MHz	
Channel 27735	
Frequency Range : 9 kHz ~ 1 GHz	Frequency Range : 1 GHz ~ 2.288 GHz
	
Frequency Range : 2.34 GHz ~ 24 GHz	
	

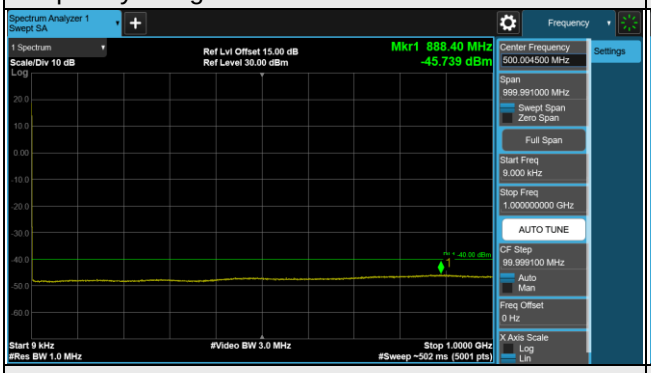
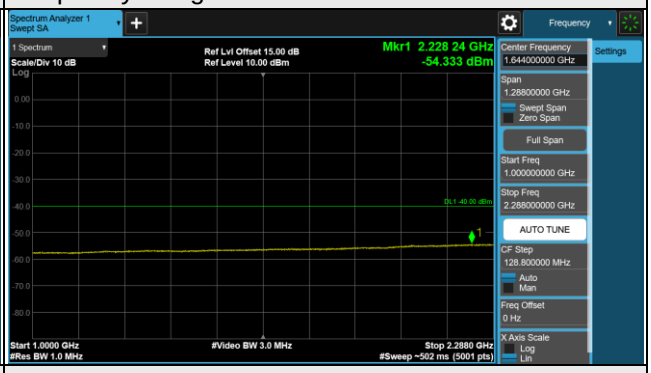
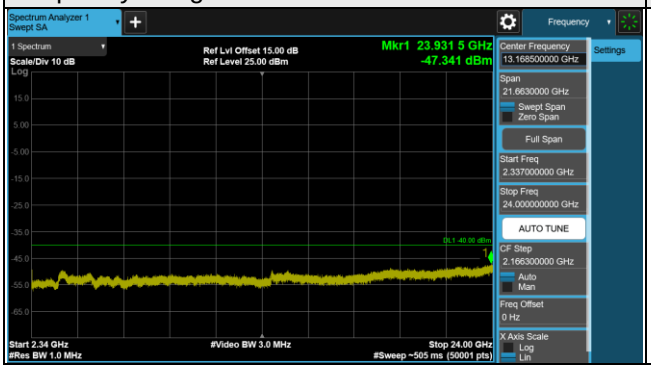
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 30	
Channel Bandwidth: 10 MHz	
Channel 27710	
Frequency Range : 9 kHz ~ 1 GHz	Frequency Range : 1 GHz ~ 2.288 GHz
	
Frequency Range : 2.34 GHz ~ 24 GHz	
	

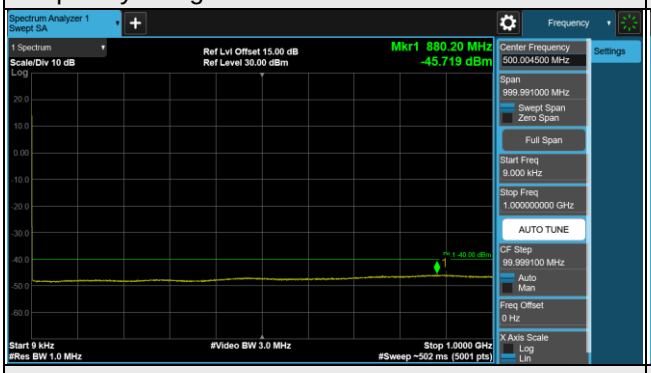
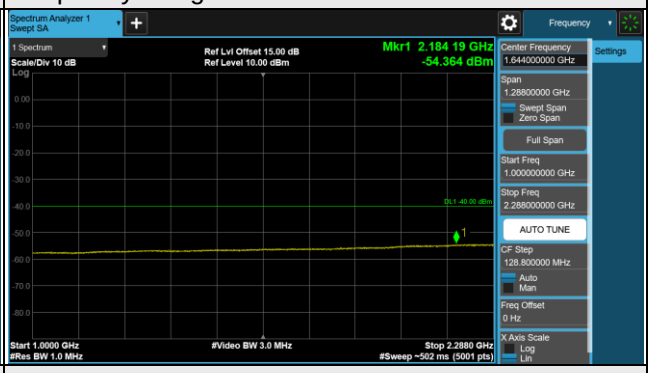
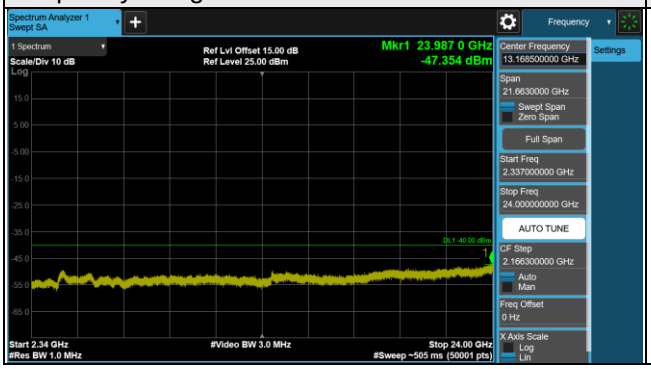
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

n30, Channel Bandwidth 5MHz	
Channel 461500 (2307.5MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 2.288GHz
	
Frequency Range : 2.34GHz ~ 24GHz	
	

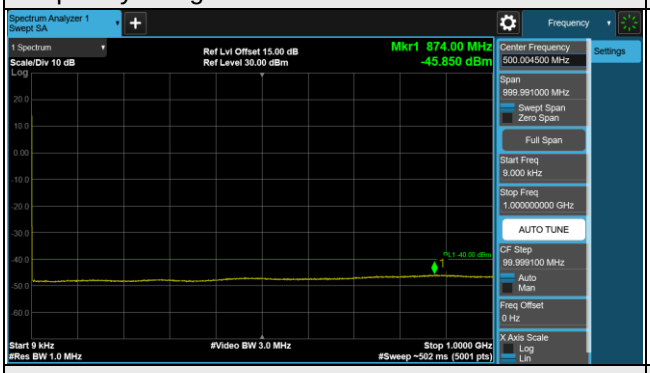
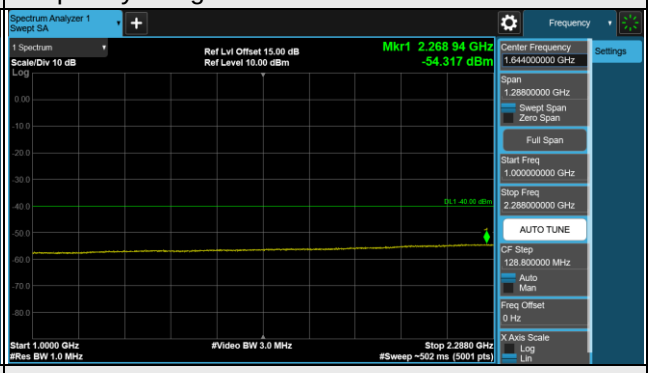
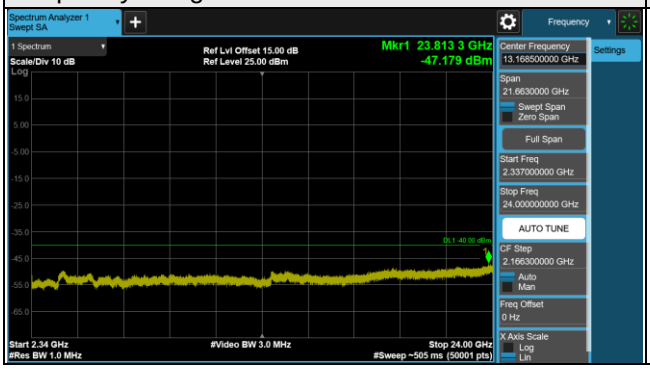
*The 9kHz signal over the limit is from Spectrum.

n30, Channel Bandwidth 5MHz	
Channel 462000 (2310.0MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 2.288GHz
	
Frequency Range : 2.34GHz ~ 24GHz	
	

*The 9kHz signal over the limit is from Spectrum.

n30, Channel Bandwidth 5MHz	
Channel 462500 (2312.5MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 2.288GHz
	
Frequency Range : 2.34GHz ~ 24GHz	
	

*The 9kHz signal over the limit is from Spectrum.

n30, Channel Bandwidth 10MHz	
Channel 462000 (2310.0MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 2.288GHz
	
Frequency Range : 2.34GHz ~ 24GHz	
	

*The 9kHz signal over the limit is from Spectrum.

4.7 Radiated Emission Measurement

4.7.1 Limits of Radiated Emission Measurement

According to FCC 27.53(a)(4)(ii)(iii), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 70 +10 log (P) dB. The limit of emission is equal to -40 dBm.

4.7.2 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.

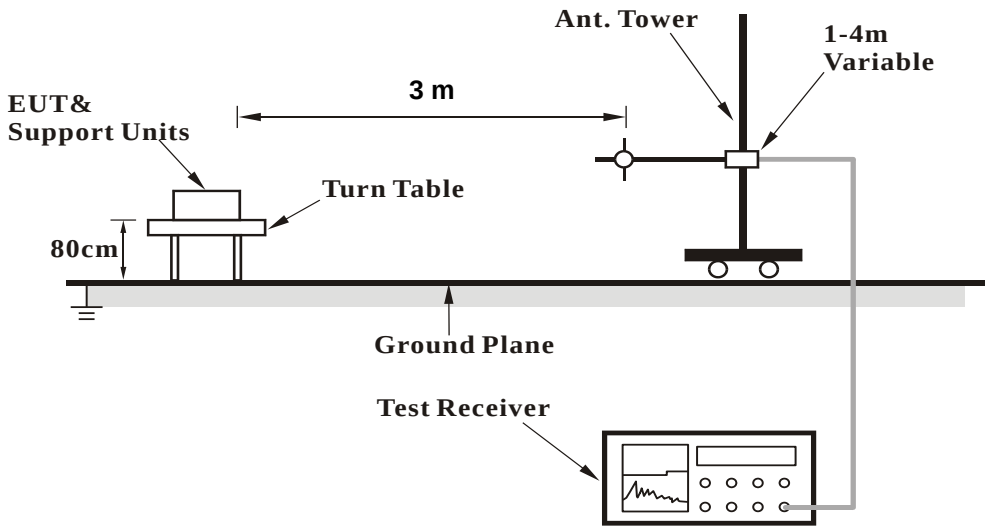
Note: The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

4.7.3 Deviation from Test Standard

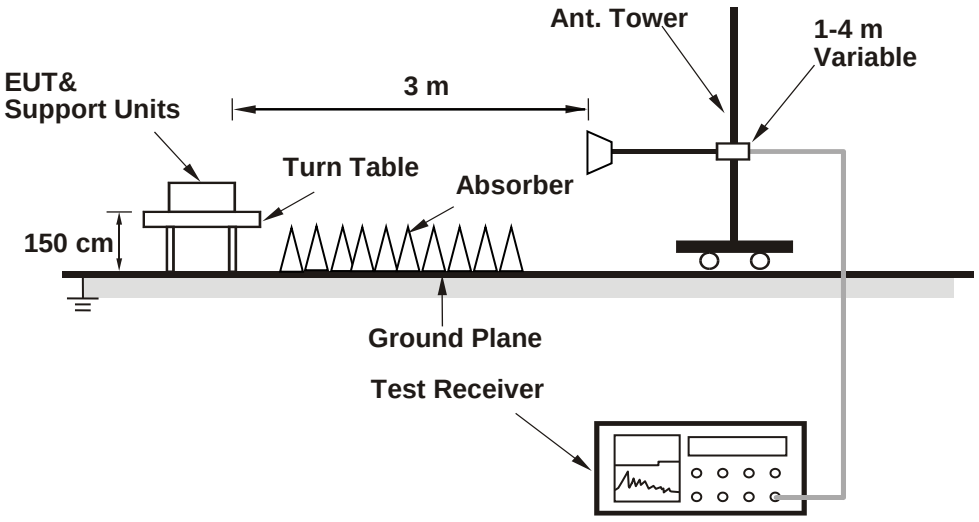
No deviation.

4.7.4 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).

4.7.5 Test Results

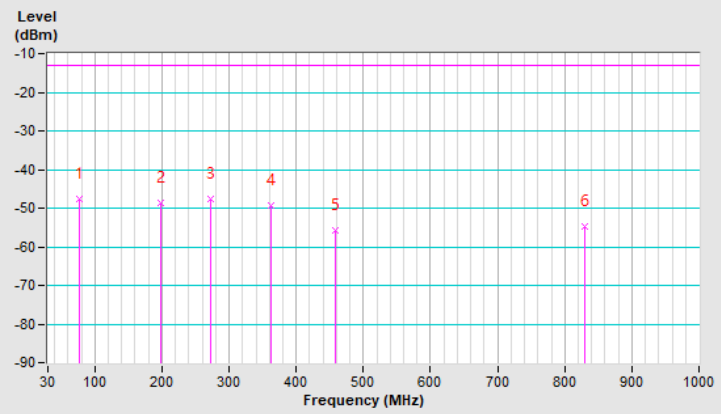
Below 1GHz
LTE Band 30

RF Mode	TX LTE Band XXX-10MHz	Channel	CH 27710：2310.0 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	77.53	-47.57	-13.00	-34.57	1.79 H	149	63.88	-111.45
2	198.78	-48.59	-13.00	-35.59	3.91 H	81	62.29	-110.88
3	273.47	-47.64	-13.00	-34.64	1.80 H	151	60.16	-107.80
4	362.71	-49.28	-13.00	-36.28	3.21 H	2	56.39	-105.67
5	458.74	-55.70	-13.00	-42.70	2.71 H	249	47.42	-103.12
6	829.28	-54.65	-13.00	-41.65	1.33 H	178	42.13	-96.78

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.

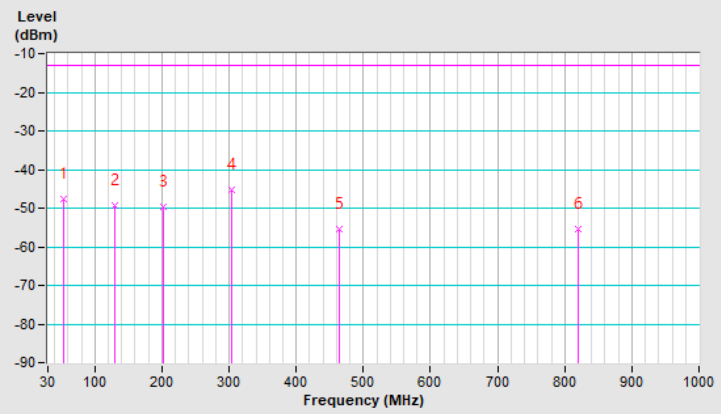


RF Mode	TX LTE Band XXX-10MHz	Channel	CH 27710：2310.0 MHz
Frequency Range	30MHz ~ 1GHz		

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	53.28	-47.61	-13.00	-34.61	1.96 V	190	60.04	-107.65
2	129.91	-49.24	-13.00	-36.24	3.73 V	11	59.43	-108.67
3	201.69	-49.73	-13.00	-36.73	1.22 V	85	61.18	-110.91
4	304.51	-45.33	-13.00	-32.33	2.03 V	174	61.58	-106.91
5	463.59	-55.57	-13.00	-42.57	2.48 V	102	47.45	-103.02
6	819.58	-55.26	-13.00	-42.26	3.06 V	238	41.43	-96.69

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.



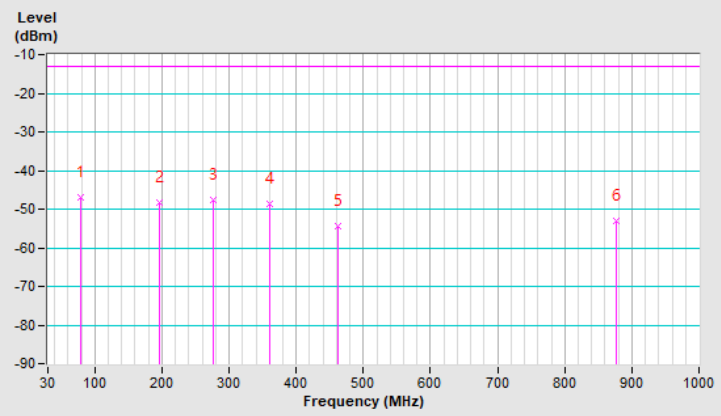
n30

RF Mode	TX 5GNR Band XXX-10MHz	Channel	CH 462500 :2312.5MHz
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	-46.95	-13.00	-33.95	1.51 H	103	64.73	-111.68
2	196.84	-48.26	-13.00	-35.26	2.04 H	6	62.55	-110.81
3	276.38	-47.73	-13.00	-34.73	1.97 H	148	59.93	-107.66
4	359.80	-48.67	-13.00	-35.67	3.85 H	232	57.09	-105.76
5	461.65	-54.44	-13.00	-41.44	2.16 H	270	48.62	-103.06
6	875.84	-52.95	-13.00	-39.95	1.15 H	63	43.65	-96.60

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.

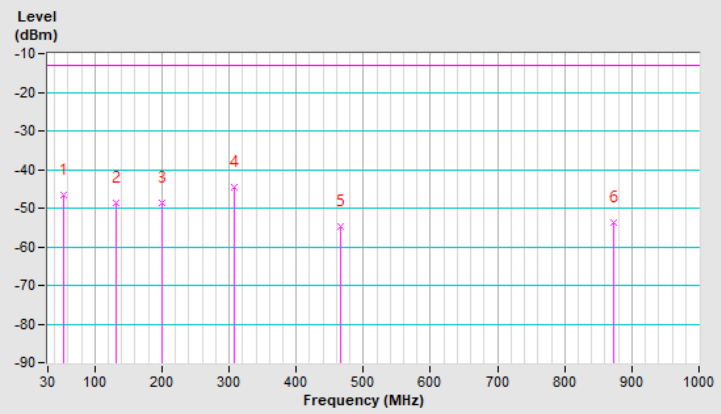


RF Mode	TX 5GNR Band XXX-10MHz	Channel	CH 462500 :2312.5MHz
Frequency Range	30MHz ~ 1GHz		

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	53.28	-46.58	-13.00	-33.58	2.55 V	15	61.07	-107.65
2	130.88	-48.80	-13.00	-35.80	1.15 V	241	59.86	-108.66
3	199.75	-48.49	-13.00	-35.49	1.77 V	67	62.40	-110.89
4	307.42	-44.60	-13.00	-31.60	1.38 V	115	62.25	-106.85
5	465.53	-54.68	-13.00	-41.68	3.21 V	96	48.29	-102.97
6	872.93	-53.56	-13.00	-40.56	2.05 V	190	43.08	-96.64

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 30, Channel Bandwidth 5MHz

RF Mode	TX LTE Band XXX-5MHz	Channel	CH 27685：2307.5 MHz
Frequency Range	1GHz ~ 25GHz		

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	4615.00	-50.77	-40.00	-10.77	2.35 H	169	56.13	-106.90
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4615.00	-51.66	-40.00	-11.66	1.10 V	322	55.24	-106.90

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 XXX-5MHz	Channel	CH 27710：2310.0 MHz
Frequency Range	1GHz ~ 25GHz		

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	4620.00	-50.55	-40.00	-10.55	1.74 H	100	56.32	-106.87
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4620.00	-51.46	-40.00	-11.46	3.24 V	111	55.41	-106.87

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 XXX-5MHz	Channel	CH 27735：2312.5 MHz
Frequency Range	1GHz ~ 25GHz		

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	4625.00	-50.55	-40.00	-10.55	2.22 H	105	56.32	-106.87
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4625.00	-51.39	-40.00	-11.39	1.32 V	155	55.48	-106.87

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.

LTE Band 30, Channel Bandwidth 10MHz

RF Mode	TX LTE Band XXX-10MHz	Channel	CH 27710：2310.0 MHz
Frequency Range	1GHz ~ 25GHz		

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	**4620.00**	**-50.19**	**-40.00**	**-10.19**	**3.38 H**	**170**	**56.68**	**-106.87**
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4620.00	-51.45	-40.00	-11.45	2.04 V	163	55.42	-106.87

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.

n30

n30, Channel Bandwidth 5MHz

RF Mode	TX 5GNR Band XXX-5MHz	Channel	CH 461500 :2307.5MHz
Frequency Range	1GHz ~ 25GHz		

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	4615.00	-50.80	-40.00	-10.80	3.04 H	165	56.10	-106.90
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4615.00	-51.16	-40.00	-11.16	1.52 V	142	55.74	-106.90

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 5GNR Band XXX-5MHz	Channel	CH 462000 :2310.0MHz
Frequency Range	1GHz ~ 25GHz		

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	4620.00	-50.75	-40.00	-10.75	3.21 H	105	56.12	-106.87
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4620.00	-51.24	-40.00	-11.24	2.32 V	154	55.63	-106.87

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 5GNR Band XXX-5MHz	Channel	CH 462500 :2312.5MHz
Frequency Range	1GHz ~ 25GHz		

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	4625.00	-50.55	-40.00	-10.55	1.11 H	287	56.32	-106.87
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4625.00	-51.45	-40.00	-11.45	1.04 V	151	55.42	-106.87

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.

n30, Channel Bandwidth 10MHz

RF Mode	TX 5GNR Band XXX-10MHz	Channel	CH 462000 :2310.0MHz
Frequency Range	1GHz ~ 25GHz		

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	4620.00	-50.63	-40.00	-10.63	2.08 H	156	56.24	-106.87
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4620.00	-51.09	-40.00	-11.09	1.26 V	232	55.78	-106.87

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.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas-adt.com

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

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