FCC Test Report

(PART 27)

Report No.:	RF181001C19-11
FCC ID:	A4RG020G
Test Model:	G020G
Received Date:	Oct. 01, 2018
Test Date:	Oct. 04, 2018 ~ Nov. 06, 2018
Issued Date:	Dec. 27, 2018
Applicant:	Google LLC
Address:	1600 Amphitheatre Parkway, Mountain View, CA 94043, USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C)
Test Location (1):	No. 19, Hwa Ya 2nd Rd, Wen Hwa Vil, Kwei Shan Dist., Taoyuan City 33383, Taiwan (R.O.C)
Test Location (2):	B2F., No.215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan, R.O.C
FCC Registration / Designation Number:	427177 / TW0011

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RF181001C19-11	Original Release	Dec. 27, 2018

1 Certificate of Conformity

Product:	Smartphone
Test Model:	G020G
Sample Status:	Identical Prototype
Applicant:	Google LLC
Test Date:	Oct. 04, 2018 ~ Nov. 06, 2018
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 : _____ , **Date:** Dec. 27, 2018

Ivonne Wu / Supervisor

Approved by : _____ , **Date:** Dec. 27, 2018

Dylan Chiou / 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 Isotropic 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 27.53(a)(5)	Occupied Bandwidth	Pass	Meet the requirement of limit.
2.1051 27.53(a)(4)	Band Edge 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 -8.32 dB at 4620.00 MHz.

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**	**Expended Uncertainty (k=2) (±)**
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~ 1000 MHz	2.0224 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.1508 dB

2.2 Test Site And Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent Technologies	N9038A	MY52260177	Aug. 20, 2018	Aug. 19, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Jan. 11, 2018	Jan. 10, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-616	Dec. 14, 2017	Dec. 13, 2018
HORN Antenna ETS-Lindgren	3117	00143293	Dec. 13, 2017	Dec. 12, 2018
HORN Antenna SCHWARZBECK	BBHA9170	9170-480	Dec. 01, 2017	Nov. 30, 2018
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Dec. 12, 2017	Dec. 11, 2018
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 16, 2018	Apr. 15, 2019
MXG Vector signal generator Agilent	N5182B	MY53052658	May 24, 2018	May 23, 2019
Preamplifier Agilent	310N	187226	Jun. 19, 2018	Jun. 18, 2019
Preamplifier Agilent	83017A	MY39501357	Jun. 19, 2018	Jun. 18, 2019
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC-SMS-100-SMS-120+RFC-SMS-100-SMS-400)	Jun. 19, 2018	Jun. 18, 2019
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(RFC-SMS-100-SMS-24)	Jun. 19, 2018	Jun. 18, 2019
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 8.130425b	NA	NA	NA
Antenna Tower MF	NA	NA	NA	NA
Turn Table MF	NA	NA	NA	NA
Antenna Tower &Turn Table Controller MF	MF-7802	NA	NA	NA
Radio Communication Analyzer Anritsu	MT8820C	6201300640	Aug. 16, 2017	Aug. 15, 2019
Temperature & Humidity Chamber	GTH-120-40-CP-AR	MAA1306-019	Sep. 05, 2018	Sep. 04, 2019
DC Power Supply Topward	33010D	807748	NA	NA

Note:
1. The calibration interval of the above test instruments is 12 / 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HsinTien Chamber 1.
3. The horn antenna and preamplifier (model: 83017A) are used only for the measurement of emission frequency above 1 GHz if tested.
4. The IC Site Registration No. is 7450I-1.

3 General Information

3.1 General Description of EUT

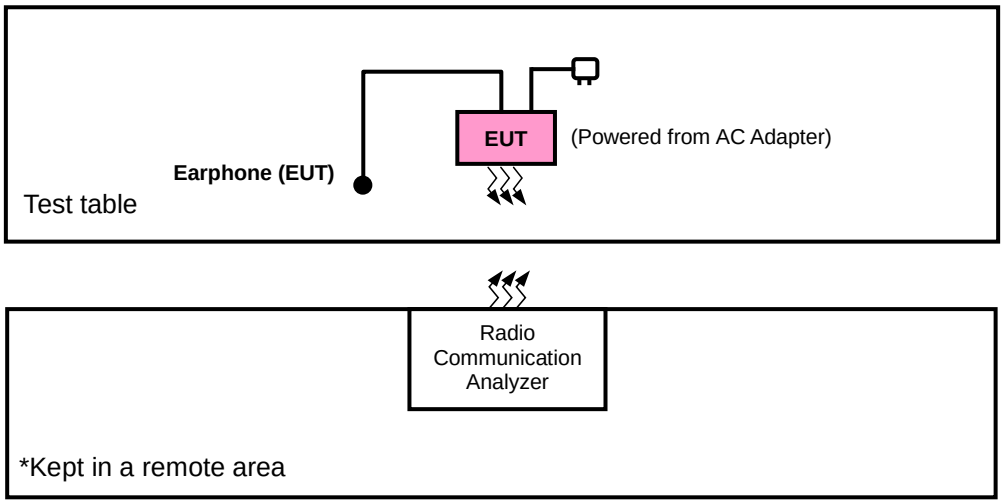
Product	Smartphone	
Test Model	G020G	
Status of EUT	Identical Prototype	
Power Supply Rating	3.85 Vdc (Li-ion battery) 5.0 Vdc or 9 Vdc (adapter) 5.0 Vdc (host equipment)	
Modulation Type	QPSK, 16QAM, 64QAM	
Frequency Range	LTE Band 30 (Channel Bandwidth: 5 MHz)	2307.5 ~ 2312.5 MHz
	LTE Band 30 (Channel Bandwidth: 10 MHz)	2310 MHz
Max. EIRP Power	LTE Band 30 (Channel Bandwidth: 5 MHz)	194.58 mW / 5MHz
	LTE Band 30 (Channel Bandwidth: 10 MHz)	196.20 mW / 5MHz
Emission Designator	LTE Band 30 (Channel Bandwidth: 5 MHz)	4M50W7D
	LTE Band 30 (Channel Bandwidth: 10 MHz)	8M97W7D
Antenna Type	PIFA Antenna with -0.2 dBi (Main) / -5 dBi (Aux.)	
Accessory Device	Refer to Note as below	
Data Cable Supplied	Refer to Note as below	

Note:

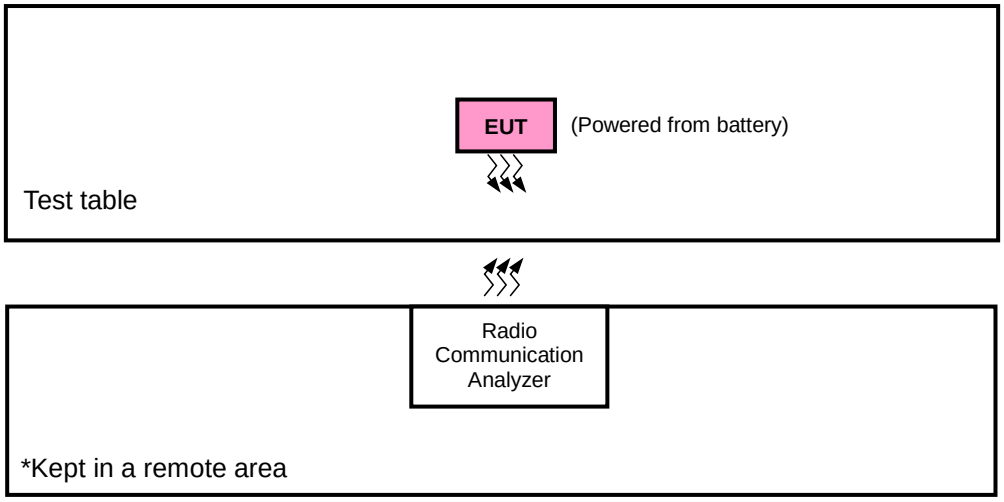
1. There're 2 configurations for the EUT listed as below.
   Main Sample: EUT + Battery 1
   2nd Sample: EUT + Battery 2
   - ✧ After pre-tested with the EUT, only the worst configuration (main sample) was chosen for the final test.
2. The EUT's accessories list refers to Ext. Pho.
3. The above EUT information 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.

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 and antenna ports

The worst case was found when positioned on X-plane for EIRP and Y-axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

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	1 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK, 16QAM, 64QAM	1 RB / 0 RB Offset
-	Modulation Characteristics	27710	27710	10 MHz	QPSK, 16QAM, 64QAM	50 RB / 0 RB Offset
-	Frequency Stability	27685 to 27735	27685, 27735	5 MHz	QPSK	1 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK	1 RB / 0 RB Offset
-	Occupied Bandwidth	27685 to 27735	27685, 27710, 27735	5 MHz	QPSK, 16QAM, 64QAM	25 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK, 16QAM, 64QAM	50 RB / 0 RB Offset
-	Band Edge	27685 to 27735	27685, 27710, 27735	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK, 16QAM	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: This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
EIRP	25 deg. C, 65 % RH	3.85 Vdc	Karl Lee
Modulation Characteristics	25 deg. C, 65 % RH	3.85 Vdc	Wayne Lin
Frequency Stability	25 deg. C, 65 % RH	3.85 Vdc	Wayne Lin
Occupied Bandwidth	25 deg. C, 65 % RH	3.85 Vdc	Wayne Lin
Band Edge	25 deg. C, 65 % RH	3.85 Vdc	Wayne Lin
Conducted Emission	25 deg. C, 65 % RH	3.85 Vdc	Wayne Lin
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Karl Lee

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

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

FCC 47 CFR Part 2
FCC 47 CFR Part 27
KDB 971168 D01 Power Meas License Digital Systems v03r01
ANSI/TIA/EIA-603-E 2016
ANSI 63.26-2015

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

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

Mobile and portable stations. (i) For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that 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. For mobile and portable stations using time division duplexing (TDD) technology, the duty cycle must not exceed 38 percent in the 2305-2315 MHz and 2350-2360 MHz bands. Mobile and portable stations using FDD technology are restricted to transmitting in the 2305-2315 MHz band. Power averaging shall not include intervals in which the transmitter is off.

4.1.2 Test Procedures

EIRP Measurement:

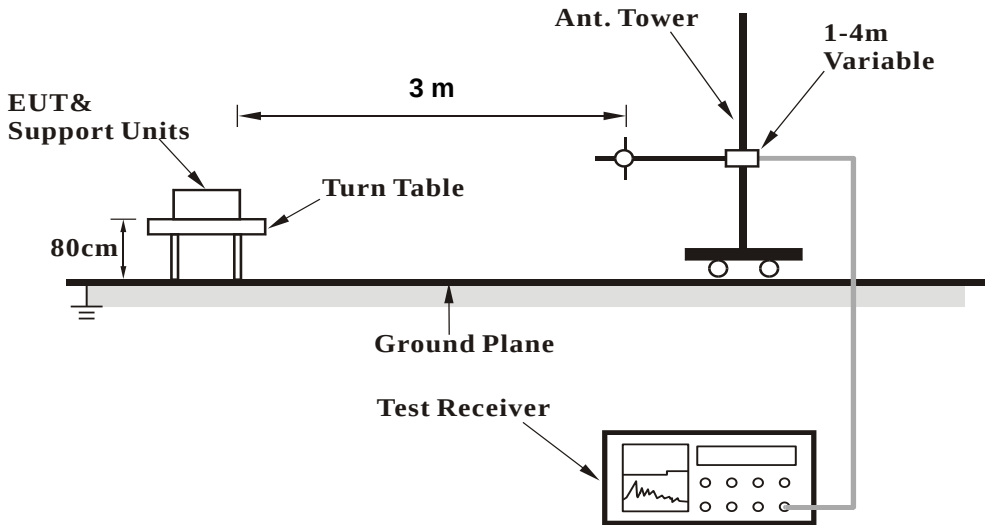
a. All measurements were done at low, middle and high operational frequency range. RBW is 5 MHz and VBW is 15 MHz for LTE mode.
b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) height of Turn 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 1 m to 4 m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
c. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a tx cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Read Value” of step b. Record the power level of S.G.
d. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution horn.

Conducted Power Measurement:

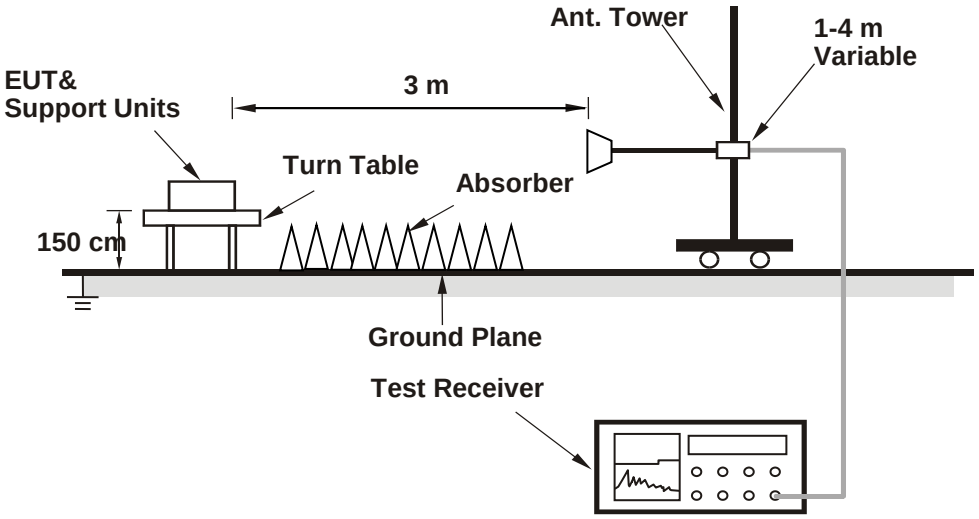
a. The EUT was set up for the maximum power with LTE link data modulation and link up with simulator.
b. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

4.1.3 Test Setup

EIRP / ERP Measurement:
<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).

Conducted Power Measurement:

4.1.4 Test Results

The worst configuration mode is presented in the report as below. Please refer to SAR test report for more detail test mode.

Band		TX Antenna	WLAN Function	Body-Worn/Hotspot
LTE	B30	Ant 2	WLAN-Off	Body-Worn/Hotspot

Conducted Output Power (dBm)

LTE Band 30																
Body-Worn / Hotspot																
Ant-2																
BW	MCS Index	RB Size	RB Offset		Mid		3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel			27710					Channel		27685	27710	27735	
		Frequency (MHz)			2310.0					Frequency (MHz)		2307.5	2310.0	2312.5	
10M	QPSK	1	0		25.06		0	5M	QPSK	1	0	24.91	24.98	24.93	0
		1	24		24.99		0			1	12	24.84	24.91	24.86	0
		1	49		24.91		0			1	24	24.76	24.83	24.78	0
		25	0		24.03		1			12	0	23.88	23.95	23.90	1
		25	12		24.01		1			12	6	23.86	23.93	23.88	1
		25	25		23.98		1			12	13	23.83	23.90	23.85	1
		50	0		24.02		1			25	0	23.87	23.94	23.89	1
	16QAM	1	0		24.03		1		16QAM	1	0	23.88	23.95	23.90	1
		1	24		23.96		1			1	12	23.81	23.88	23.83	1
		1	49		23.88		1			1	24	23.73	23.80	23.75	1
		25	0		23.00		2			12	0	22.85	22.92	22.87	2
		25	12		22.98		2			12	6	22.83	22.90	22.85	2
		25	25		22.95		2			12	13	22.80	22.87	22.82	2
		50	0		22.99		2			25	0	22.84	22.91	22.86	2
	64QAM	1	0		23.02		2		64QAM	1	0	22.87	22.94	22.89	2
		1	24		22.95		2			1	12	22.80	22.87	22.82	2
		1	49		22.87		2			1	24	22.72	22.79	22.74	2
		25	0		21.99		3			12	0	21.84	21.91	21.86	3
		25	12		21.97		3			12	6	21.82	21.89	21.84	3
		25	25		21.94		3			12	13	21.79	21.86	21.81	3
		50	0		21.98		3			25	0	21.83	21.90	21.85	3

EIRP Power

LTE Band 30							
Channel Bandwidth: 5 MHz / QPSK							
Plane	**Channel**	**Frequency (MHz)**	**Reading (dBm/5MHz)**	**Correction Factor (dB)**	**EIRP Power Density (dBm/5MHz)**	**EIRP Power Density (mW/5MHz)**	**Polarization (H/V)**
X	27685	2307.5	-21.85	44.24	22.39	173.30	H
	27710	2310.0	-21.76	44.20	22.44	175.27	
	27735	2312.5	-21.91	44.80	22.89	194.58	
	27685	2307.5	-24.85	44.19	19.34	85.92	V
	27710	2310.0	-24.95	44.09	19.14	82.00	
	27735	2312.5	-24.87	44.50	19.63	91.81	
Channel Bandwidth: 5 MHz / 16QAM							
X	27685	2307.5	-20.72	44.24	23.52	224.80	H
	27710	2310.0	-20.67	44.20	23.53	225.27	
	27735	2312.5	-21.25	44.80	23.55	226.52	
	27685	2307.5	-24.78	44.19	19.41	87.32	V
	27710	2310.0	-24.62	44.09	19.47	88.47	
	27735	2312.5	-25.00	44.50	19.50	89.10	
Channel Bandwidth: 5 MHz / 64QAM							
X	27685	2307.5	-21.73	44.24	22.51	178.16	H
	27710	2310.0	-21.67	44.20	22.53	178.94	
	27735	2312.5	-22.26	44.80	22.54	179.51	
	27685	2307.5	-25.78	44.19	18.41	69.36	V
	27710	2310.0	-25.63	44.09	18.46	70.11	
	27735	2312.5	-26.01	44.50	18.49	70.62	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

LTE Band 30							
Channel Bandwidth: 10 MHz / QPSK							
Plane	**Channel**	**Frequency (MHz)**	**Reading (dBm/5MHz)**	**Correction Factor (dB)**	**EIRP Power Density (dBm/5MHz)**	**EIRP Power Density (mW/5MHz)**	**Polarization (H/V)**
X	27710	2310.0	-21.27	44.20	22.93	196.20	H
	27710	2310.0	-24.75	44.09	19.34	85.86	V
Channel Bandwidth: 10 MHz / 16QAM							
X	27710	2310.0	-20.63	44.20	23.57	227.35	H
	27710	2310.0	-24.57	44.09	19.52	89.50	V
Channel Bandwidth: 10 MHz / 64QAM							
X	27710	2310.0	-21.63	44.20	22.57	180.59	H
	27710	2310.0	-25.58	44.09	18.51	70.93	V

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

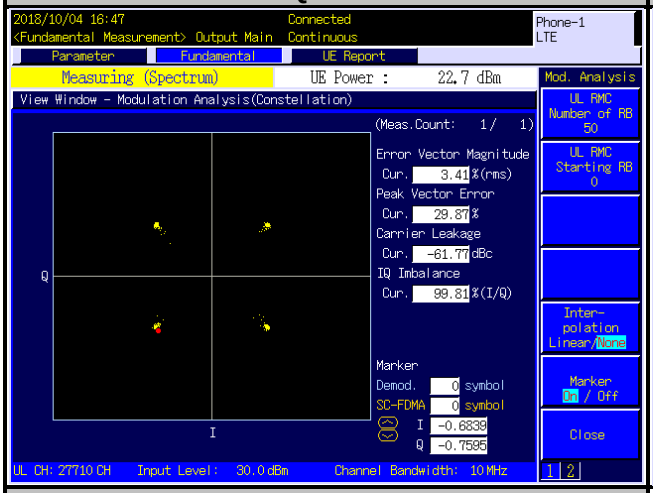
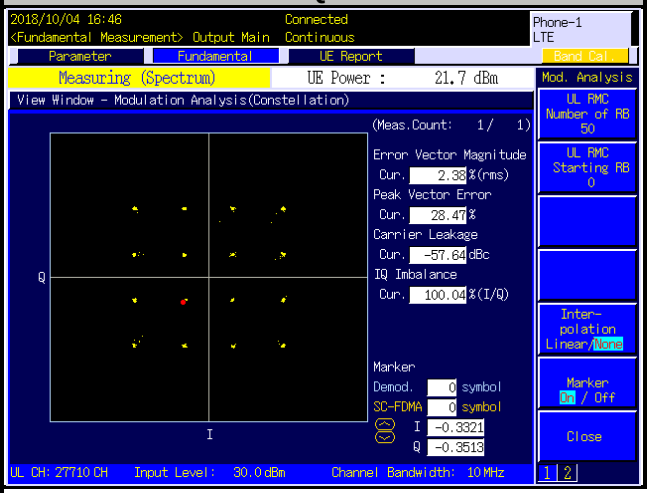
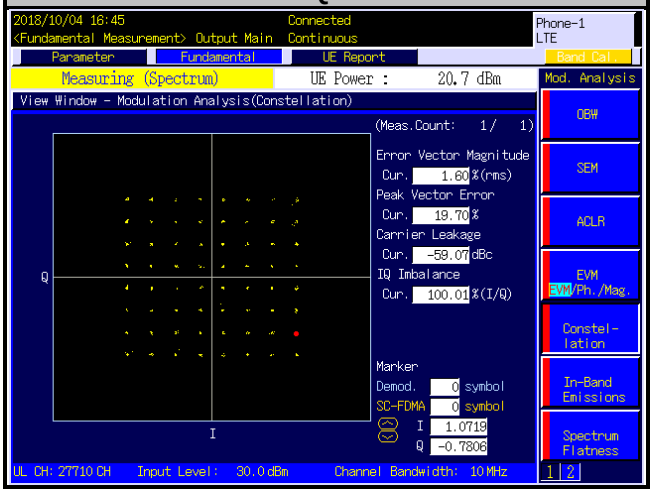
N/A

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 30	
Channel 27710	
QPSK	16QAM
	
64QAM	
	

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

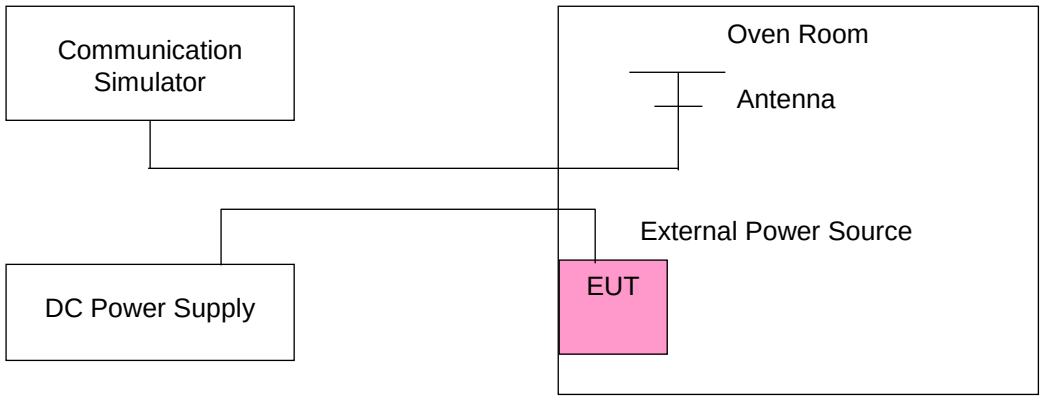
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

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)
3.85	2307.500002	0.0010	2312.500003	0.0014
3.6	2307.500001	0.0006	2312.500003	0.0015
4.4	2307.500003	0.0011	2312.500001	0.0006

Note: The applicant defined the normal working voltage of the battery is from 3.6 Vdc to 4.4 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	2307.500001	0.0004	2312.500002	0.0009
-20	2307.500002	0.0010	2312.500001	0.0006
-10	2307.500001	0.0005	2312.500003	0.0015
0	2307.500001	0.0005	2312.500004	0.0017
10	2307.500004	0.0016	2312.500004	0.0017
20	2307.499997	-0.0015	2312.499999	-0.0006
30	2307.499998	-0.0011	2312.499997	-0.0013
40	2307.499998	-0.0009	2312.499996	-0.0016
50	2307.499998	-0.0008	2312.499996	-0.0016
55	2307.499997	-0.0013	2312.499999	-0.0005

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 30	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
3.85	2310.000003	0.0013
3.6	2310.000002	0.0008
4.4	2310.000003	0.0012

Note: The applicant defined the normal working voltage of the battery is from 3.6 Vdc to 4.4 Vdc.

Frequency Error vs. Temperature

Temp. (℃)	LTE Band 30	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
-30	2310.000004	0.0017
-20	2310.000001	0.0005
-10	2310.000004	0.0016
0	2310.000001	0.0005
10	2310.000004	0.0017
20	2309.999997	-0.0014
30	2309.999999	-0.0005
40	2309.999998	-0.0009
50	2309.999998	-0.0007
55	2309.999996	-0.0017

4.4 Occupied Bandwidth Measurement

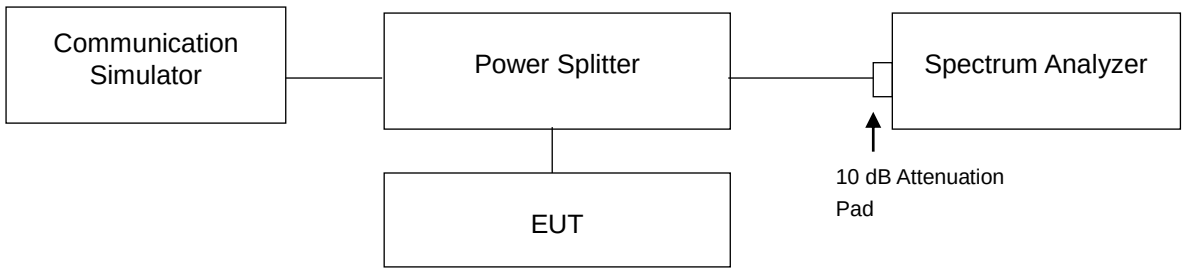
4.4.1 Limits of Occupied Bandwidth Measurement

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

a. The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
b. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

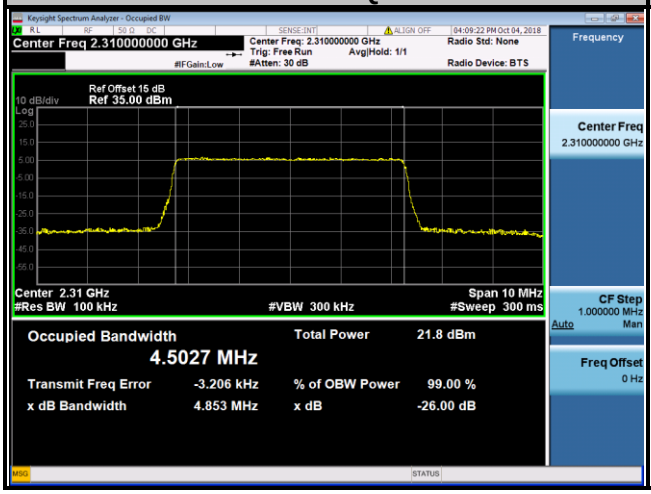
4.4.3 Test Setup



4.4.4 Test Result

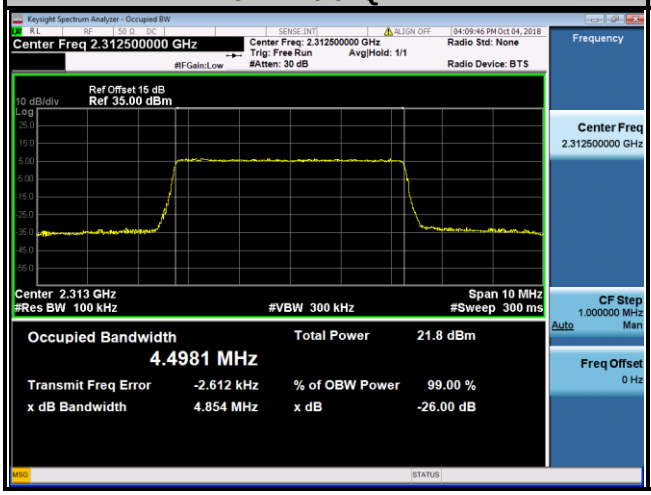
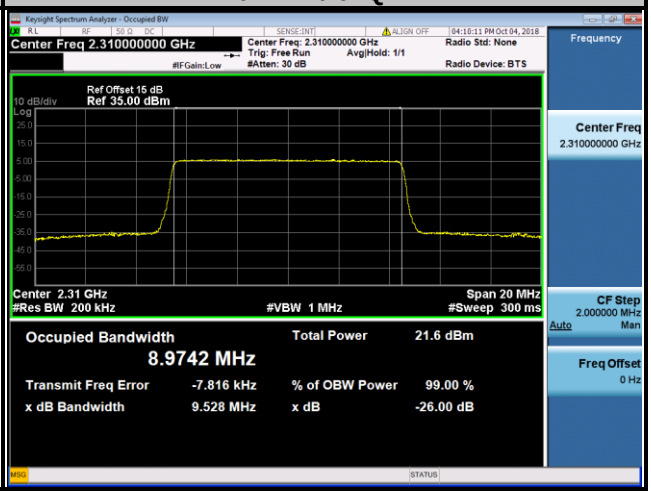
<99 % Occupied Bandwidth>

LTE Band 30									
Channel Bandwidth: 5 MHz					Channel Bandwidth: 10 MHz				
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)			Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
27685	2307.5	4.4897	4.4904	4.5022	27710	2310.0	8.9637	8.9673	8.9742
27710	2310.0	4.4887	4.4927	4.5027					
27735	2312.5	4.4917	4.4911	4.4981					

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

<26 dB Bandwidth>

LTE Band 30								
Channel Bandwidth: 5 MHz					Channel Bandwidth: 10 MHz			
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)			Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	
		QPSK	16QAM	64QAM			QPSK	16QAM	64QAM
27685	2307.5	4.825	4.809	4.840	27710	2310.0	9.523	9.514	9.528
27710	2310.0	4.811	4.800	4.853					
27735	2312.5	4.838	4.803	4.854					

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

4.5 Band Edge Measurement

4.5.1 Limits of Band Edge Measurement

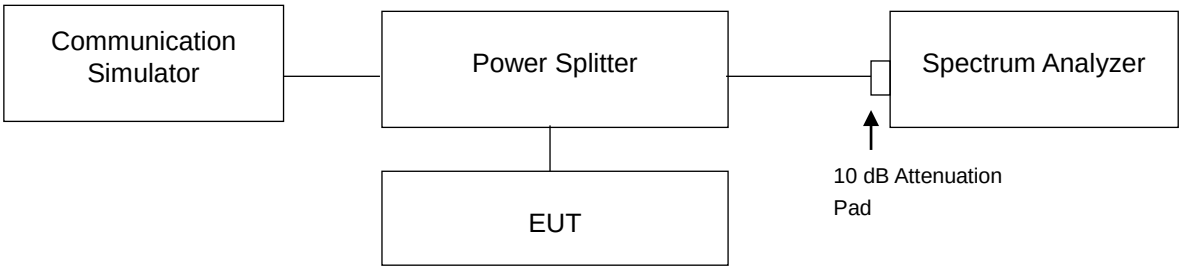
According to FCC 27.53(a) (4) For mobile and portable stations operating in the 2305-2315 MHz and 2350-2360 MHz bands:

(i) By a factor of not less than: 43 + 10 log (P) dB on all frequencies between 2305 and 2320 MHz 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 2345 MHz, 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 2305 MHz, 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 2365 MHz, and not less than 70 + 10 log (P) dB above 2365 MHz.

4.5.2 Test Setup



4.5.3 Test Procedures

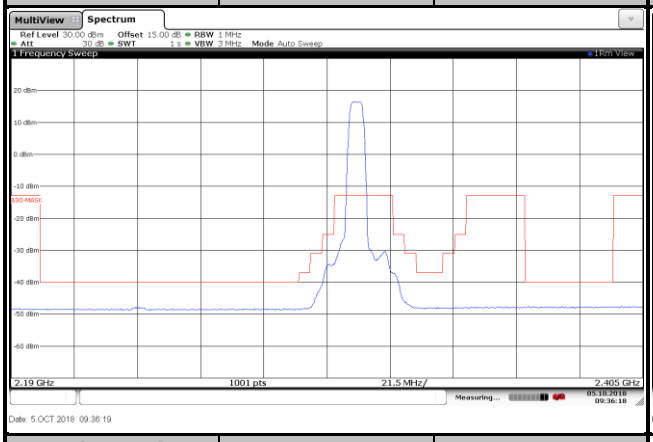
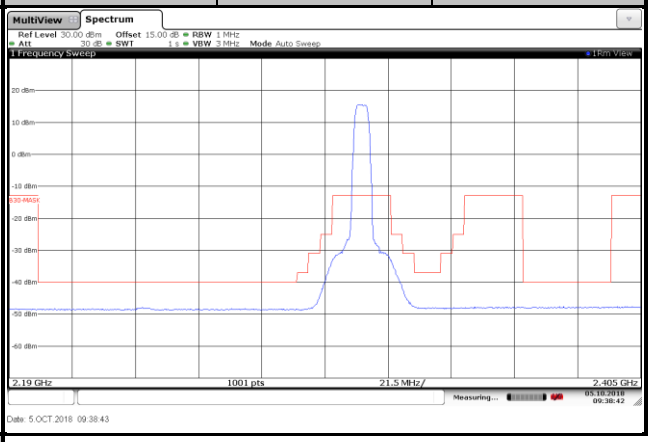
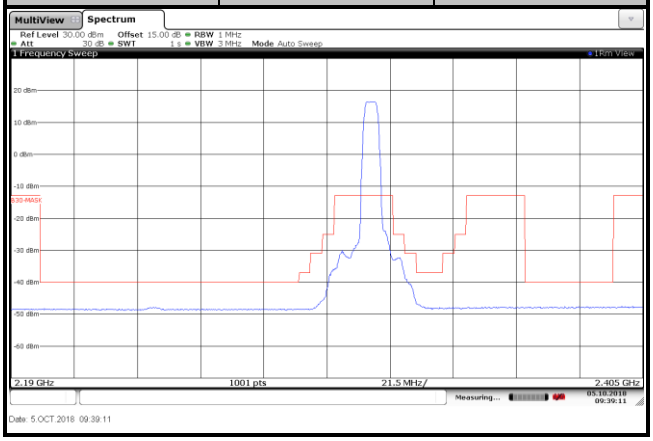
a. The EUT was set up for the maximum peak power with LTE link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 2 channels (low and high operational frequency range).

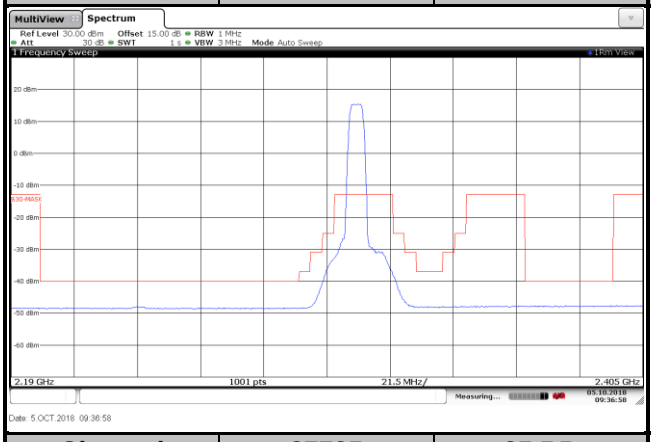
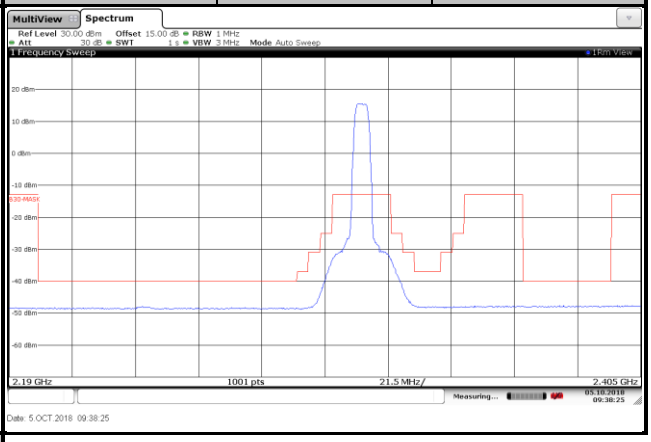
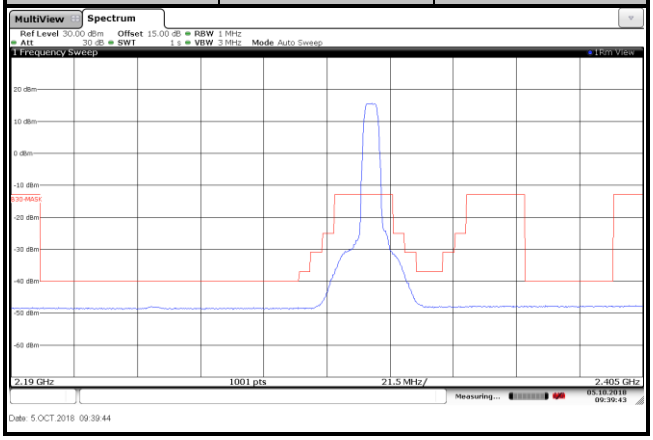
b. The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

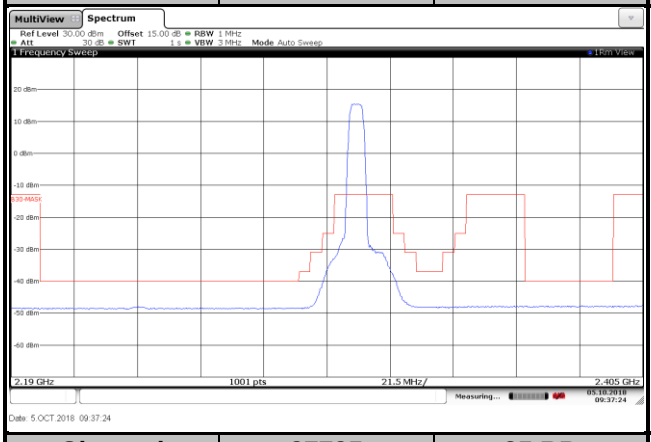
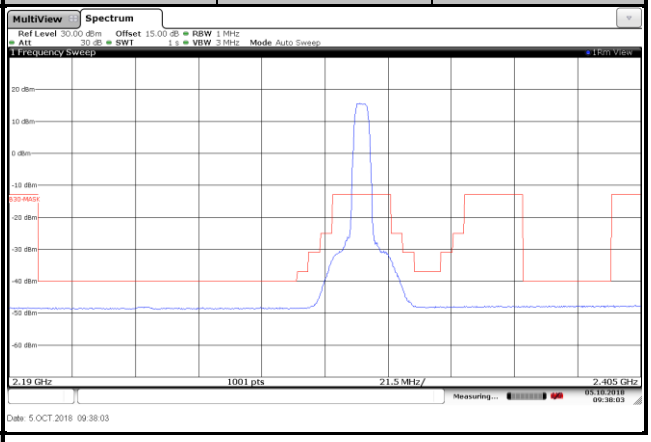
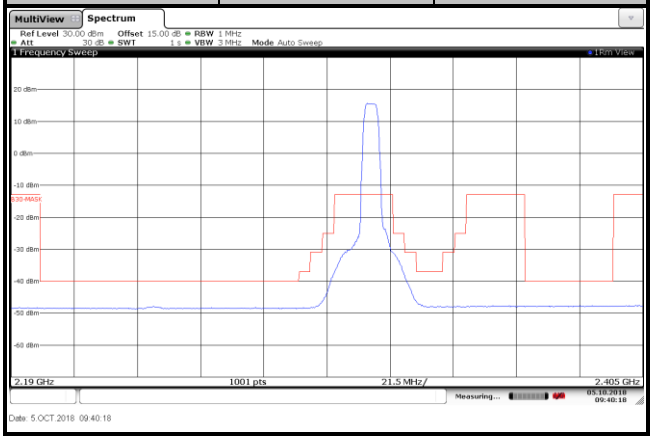
c. Measuring frequency range is from 2200 MHz to 2395 MHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz are used for conducted emission measurement.

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

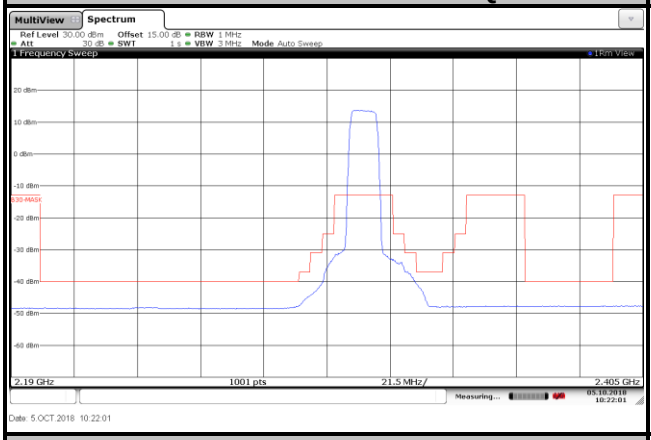
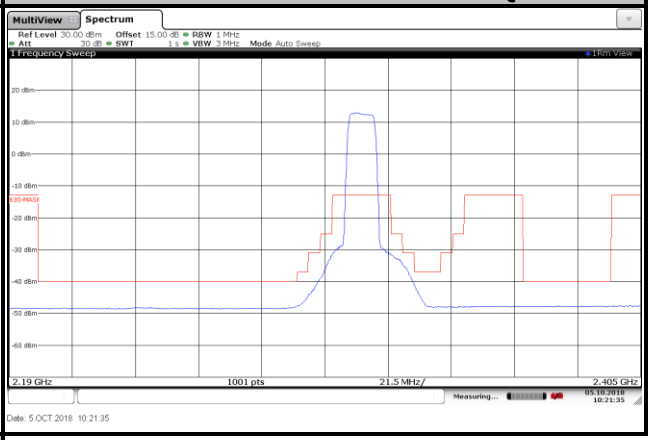
4.5.4 Test Results

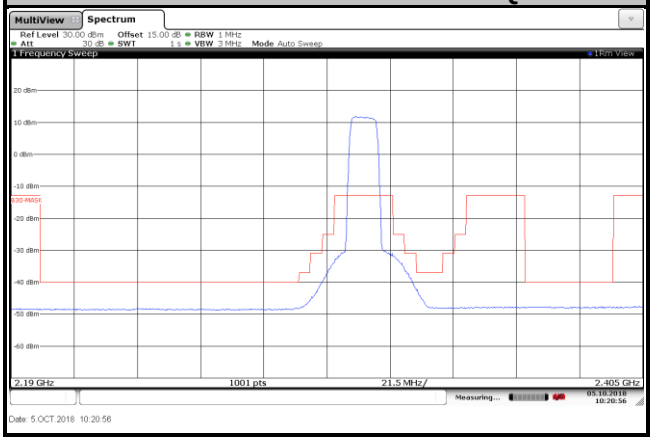
LTE Band 30					
<Adjacent Channel Band Edge>					
Channel Bandwidth: 5 MHz / QPSK					
Channel	27685	25 RB	Channel	27710	25 RB
					
Channel	27735	25 RB			
					

LTE Band 30					
<Adjacent Channel Band Edge>					
Channel Bandwidth: 5 MHz / 16QAM					
Channel	27685	25 RB	Channel	27710	25 RB
					
Channel	27735	25 RB			
					

LTE Band 30					
<Adjacent Channel Band Edge>					
Channel Bandwidth: 5 MHz / 64QAM					
Channel	27685	25 RB	Channel	27710	25 RB
					
Channel	27735	25 RB			
					

LTE Band 30		
Channel	27710	50 RB

Channel Bandwidth: 10 MHz / QPSK	Channel Bandwidth: 10 MHz / 16QAM
	

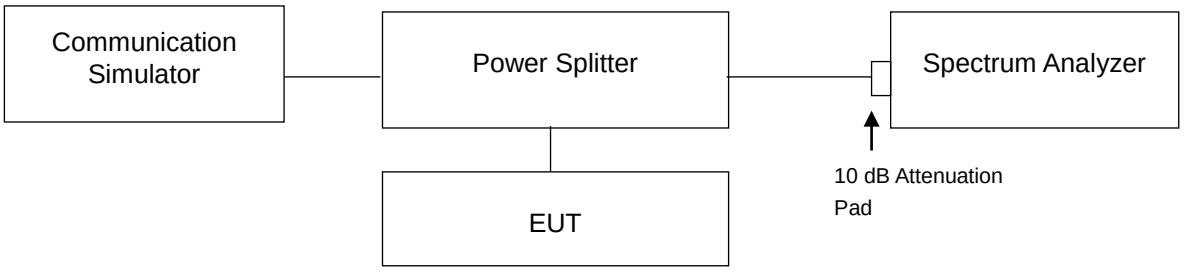
Channel Bandwidth: 10 MHz / 64QAM


4.6 Conducted Spurious Emissions

4.6.1 Limits of Conducted Spurious Emissions Measurement

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.

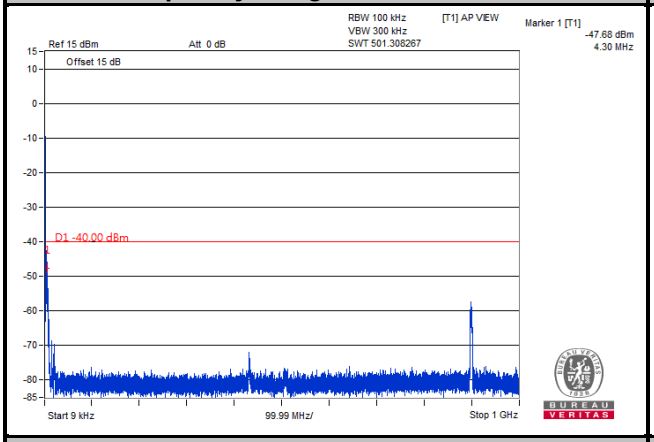
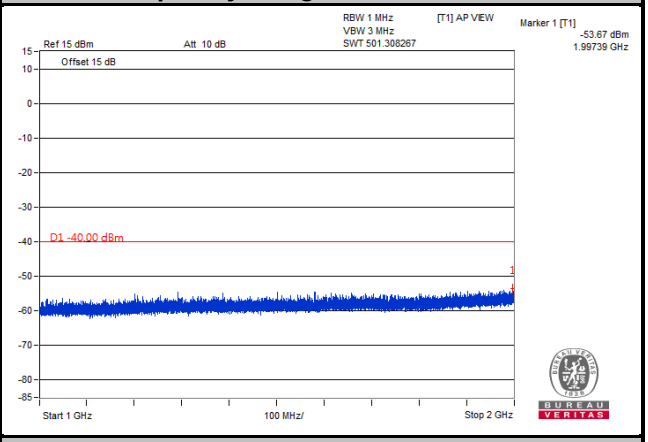
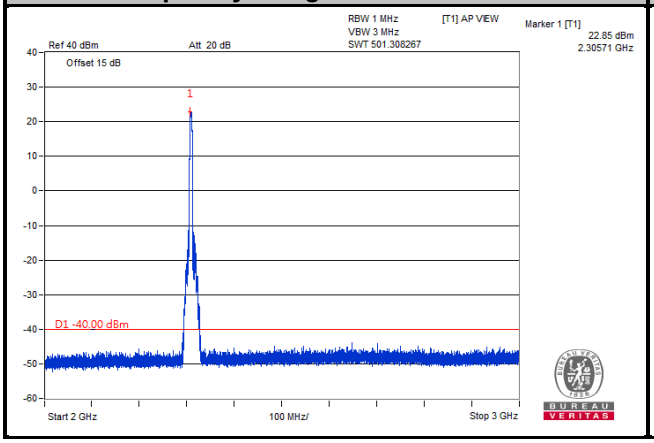
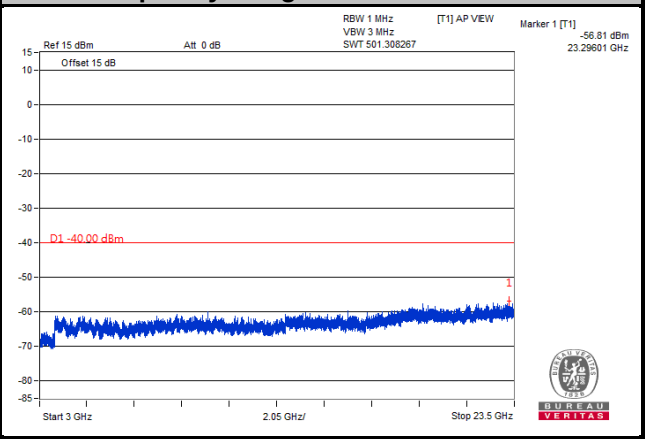
4.6.2 Test Setup



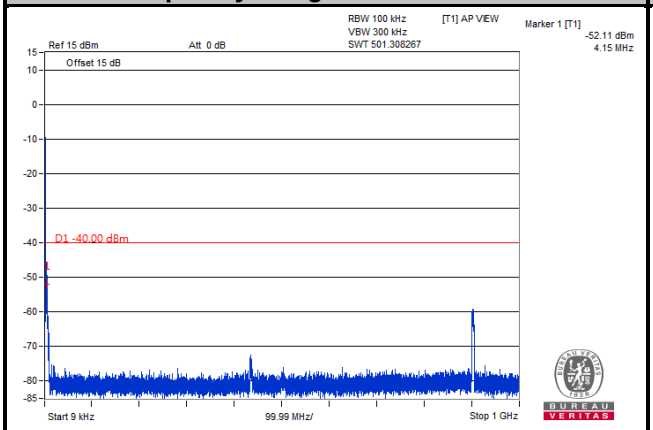
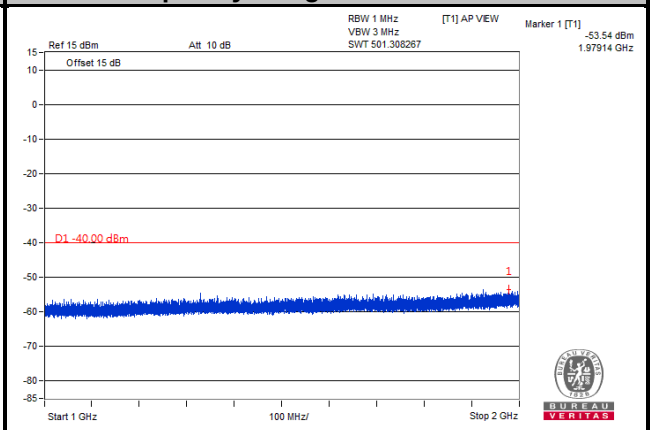
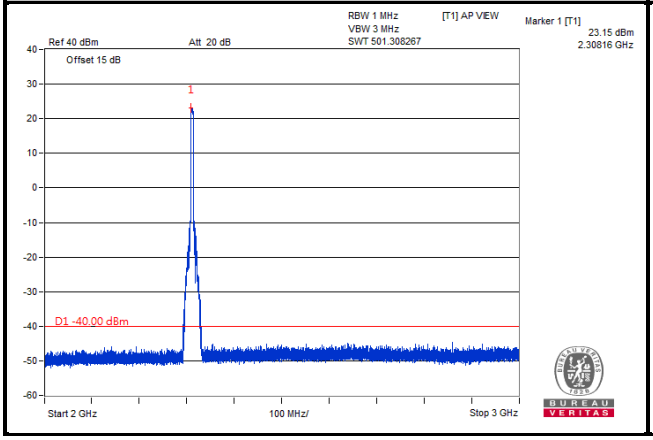
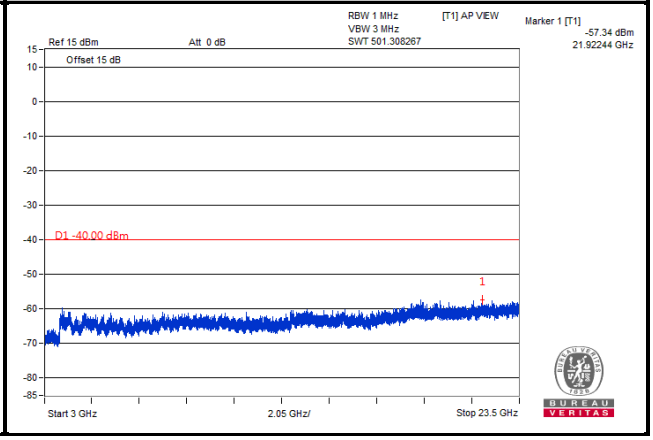
4.6.3 Test Procedure

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 = 100 kHz and VBW = 300 kHz are used for conducted emission measurement.
c. Measuring frequency range is from 1 GHz to 23.5 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz are used for conducted emission measurement.

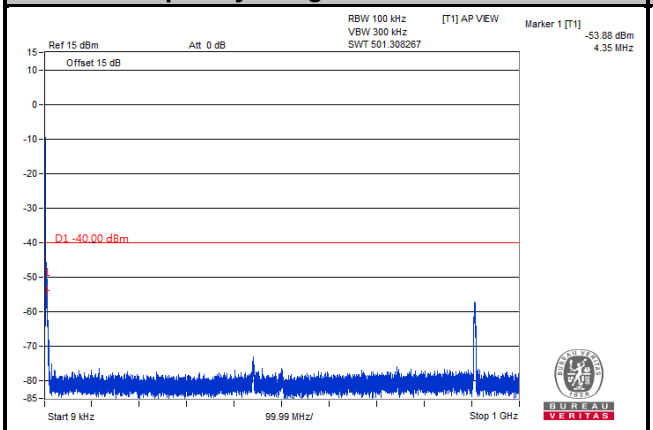
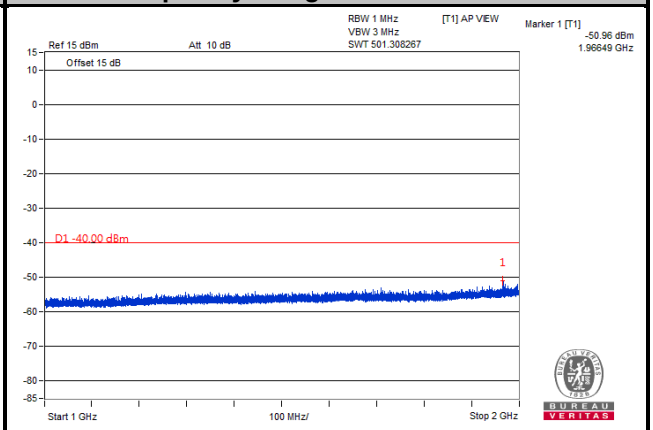
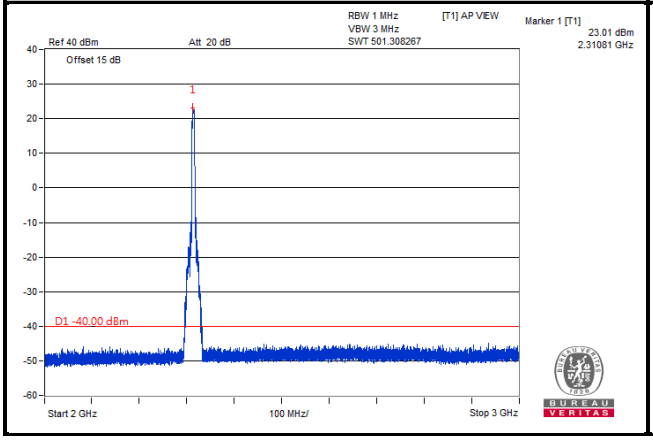
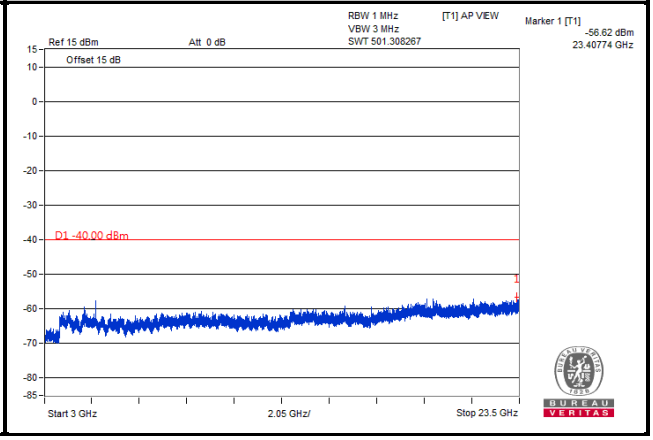
4.6.4 Test Results

LTE Band 30	
Channel Bandwidth: 5 MHz	
Channel 27685	
Frequency Range : 9 kHz ~ 1 GHz	Frequency Range : 1 GHz ~ 2 GHz
	
Frequency Range : 2 GHz ~ 3 GHz	Frequency Range : 3 GHz ~ 23.5 GHz
	

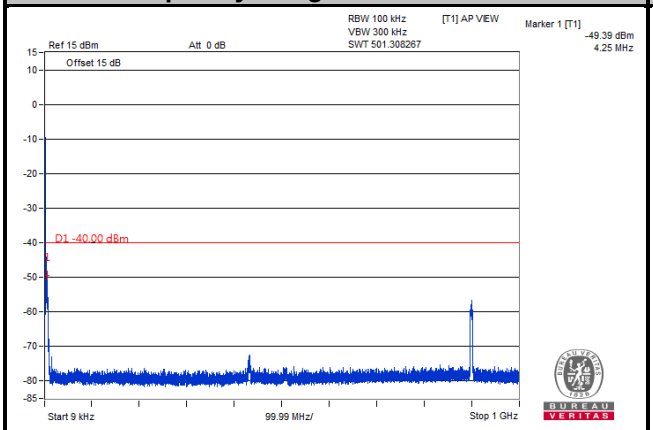
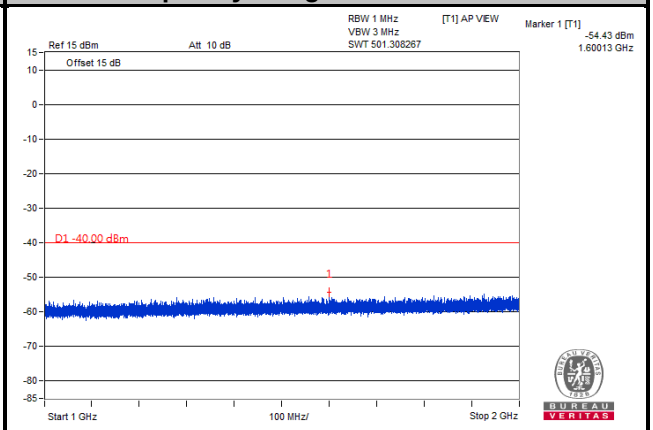
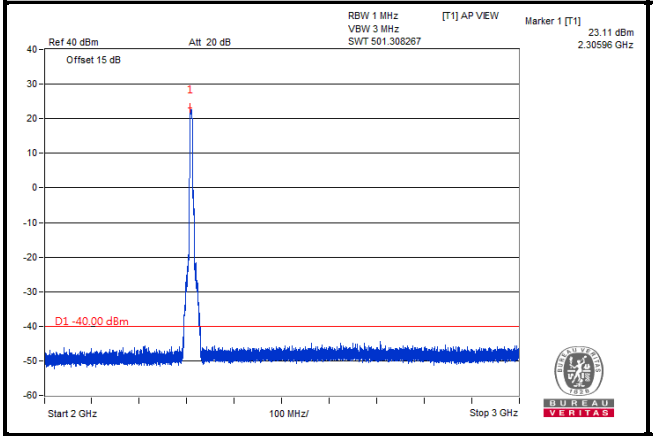
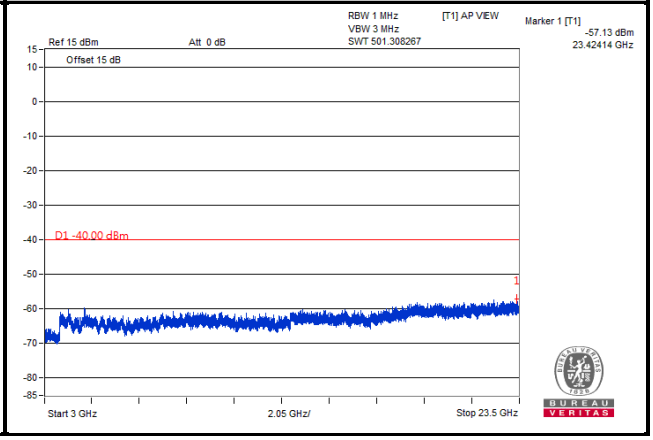
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

LTE Band 30	
Channel Bandwidth: 5 MHz	
Channel 27710	
Frequency Range : 9 kHz ~ 1 GHz	Frequency Range : 1 GHz ~ 2 GHz
	
Frequency Range : 2 GHz ~ 3 GHz	Frequency Range : 3 GHz ~ 23.5 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 GHz
	
Frequency Range : 2 GHz ~ 3 GHz	Frequency Range : 3 GHz ~ 23.5 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 GHz
	
Frequency Range : 2 GHz ~ 3 GHz	Frequency Range : 3 GHz ~ 23.5 GHz
	

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

4.7 Radiated Emission Measurement

4.7.1 Limits of Radiated Emission Measurement

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. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) 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 1 m to 4 m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
b. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Read Value “ of step a. Record the power level of S.G
c. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution horn.
d. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, E.R.P power = E.I.R.P power - 2.15 dB.

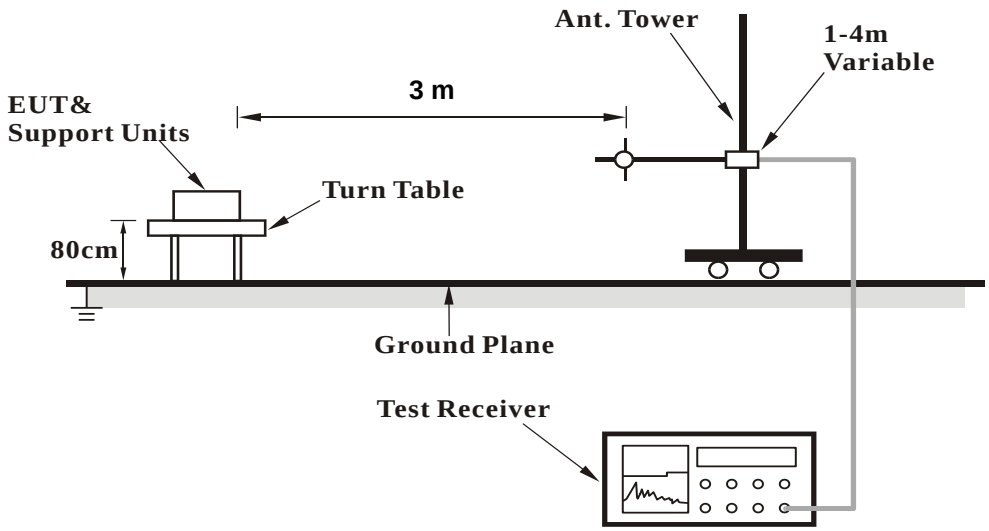
Note: The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

4.7.3 Deviation from Test Standard

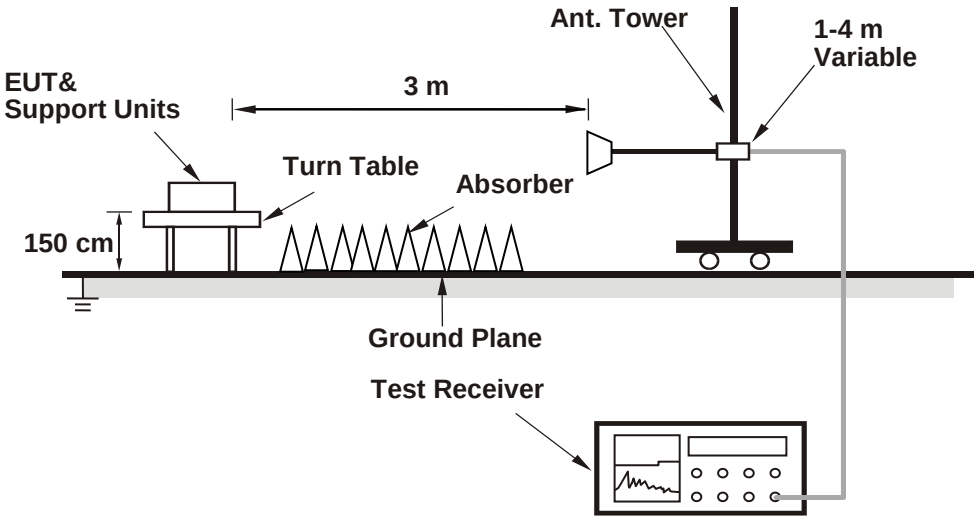
No deviation.

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).

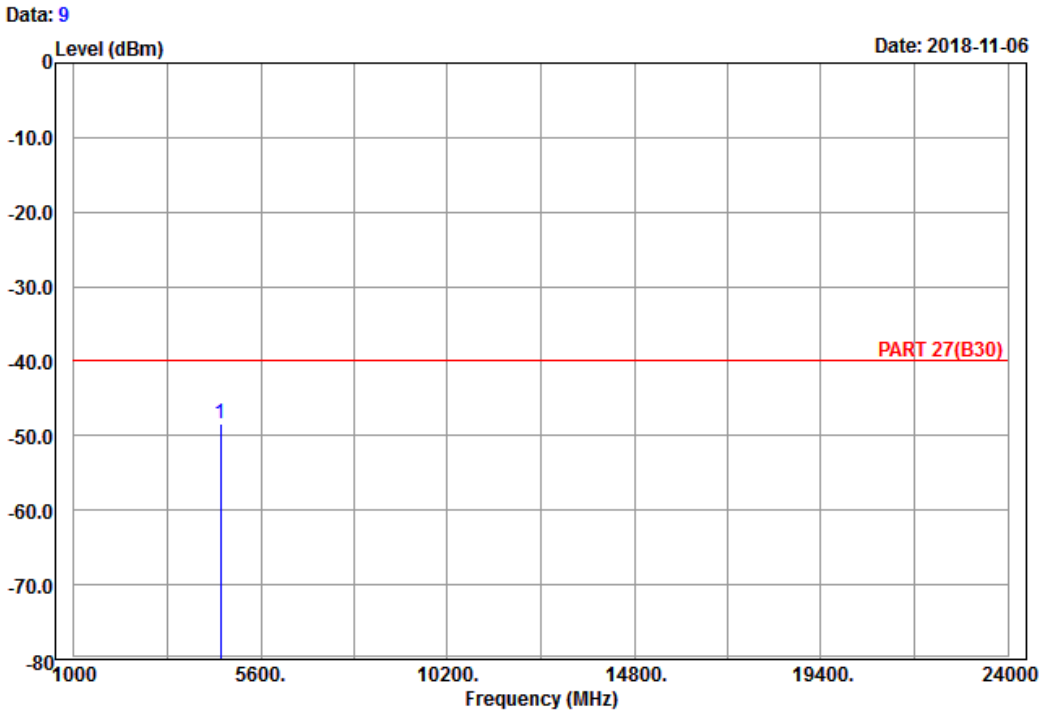
4.7.5 Test Results

LTE Band 30

Channel Bandwidth: 5 MHz / QPSK

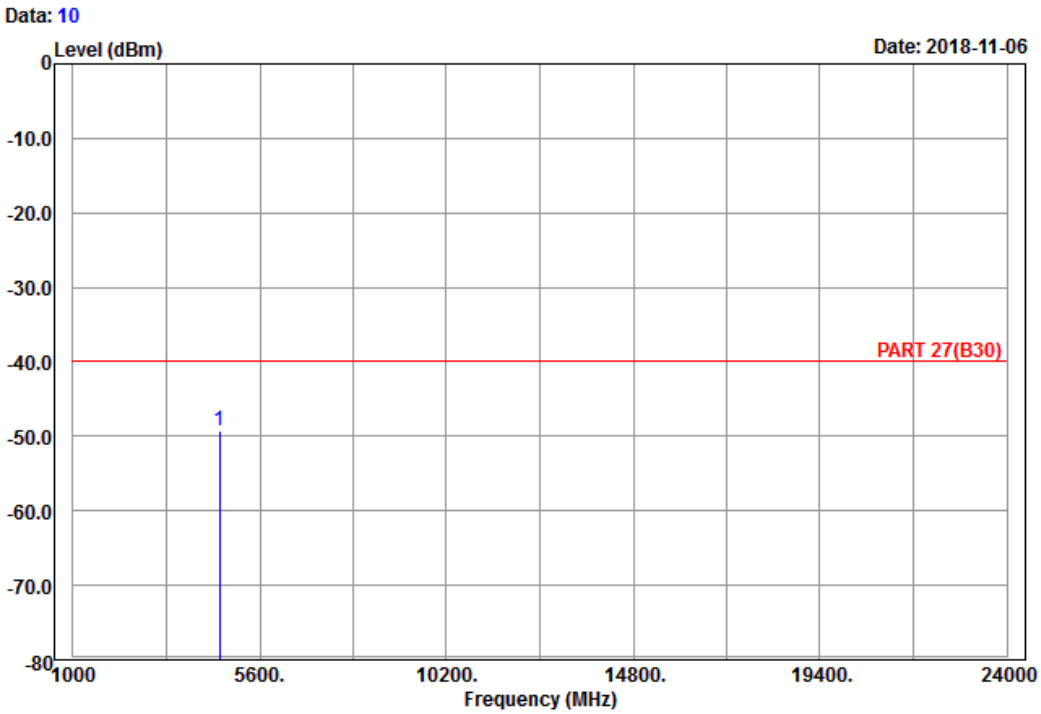
Low Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 27(B30) Horizontal
Remark : LTE_Band 30_Link_CH27685
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	4615.00	-48.45	-66.88	-40.00	-8.45	18.43	Peak

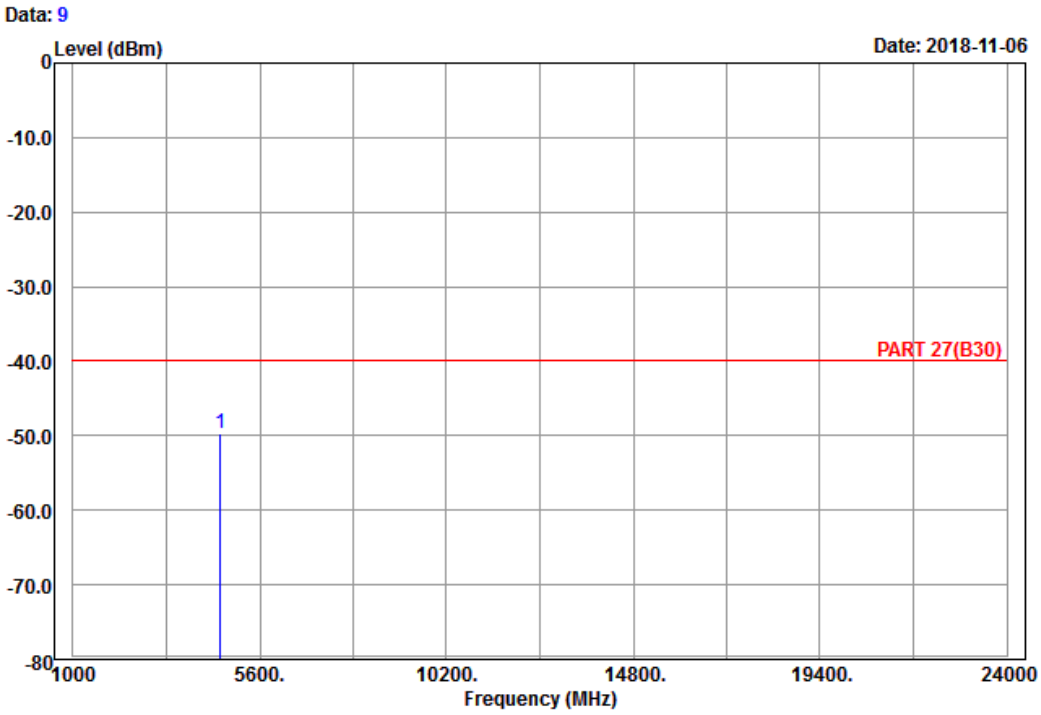


Site : 966 chamber 1
Condition: PART 27(B30) Vertical
Remark : LTE_Band 30_Link_CH27685
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	4615.00	-49.37	-67.80	-40.00	-9.37	18.43	Peak

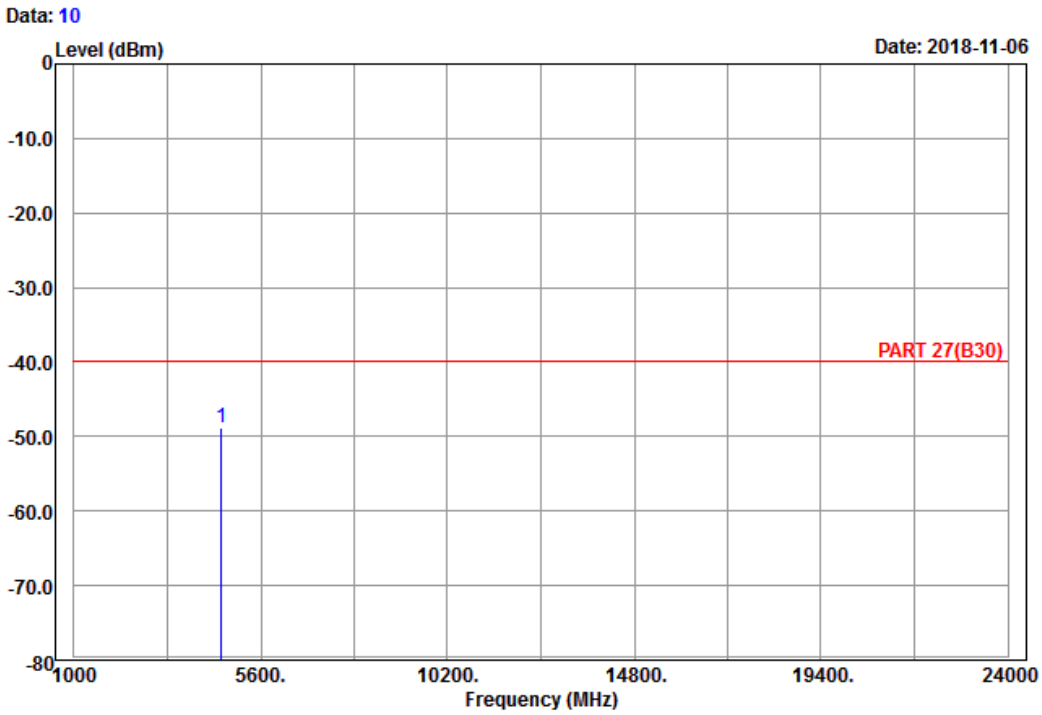
Middle Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 27(B30) Horizontal
Remark : LTE_Band 30_Link_CH27710
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	4620.00	-49.64	-68.07	-40.00	-9.64	18.43	Peak

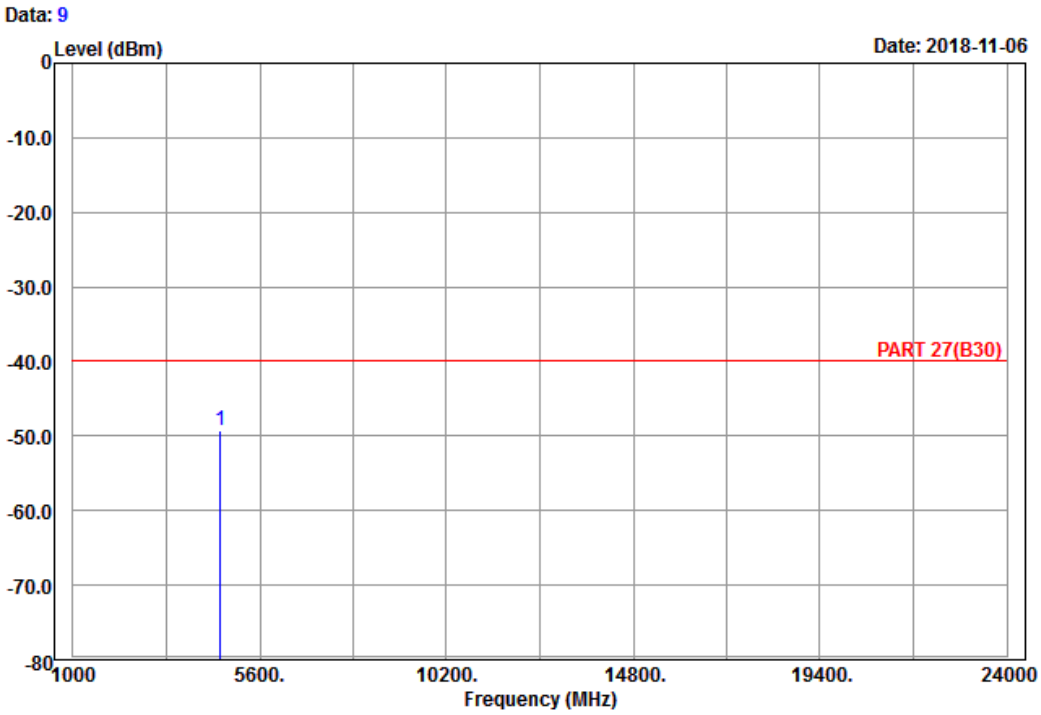


Site : 966 chamber 1
Condition: PART 27(B30) Vertical
Remark : LTE_Band 30_Link_CH27710
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	4620.00	-48.91	-67.34	-40.00	-8.91	18.43	Peak

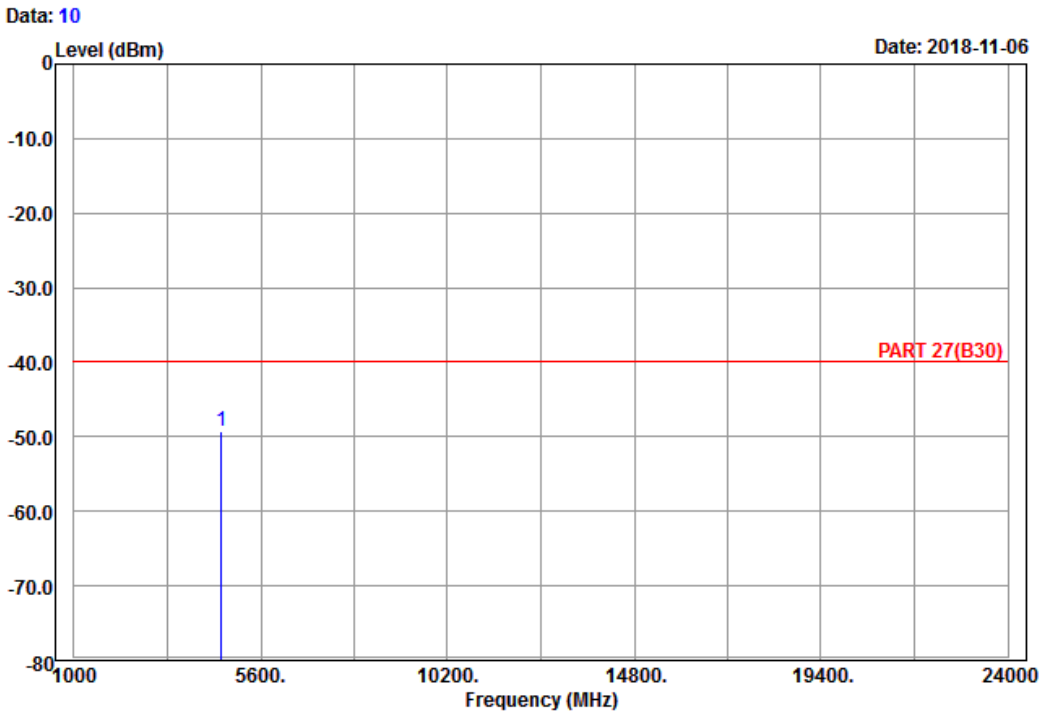
High Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 27(B30) Horizontal
Remark : LTE_Band 30_Link_CH27735
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	4625.00	-49.28	-67.71	-40.00	-9.28	18.43	Peak

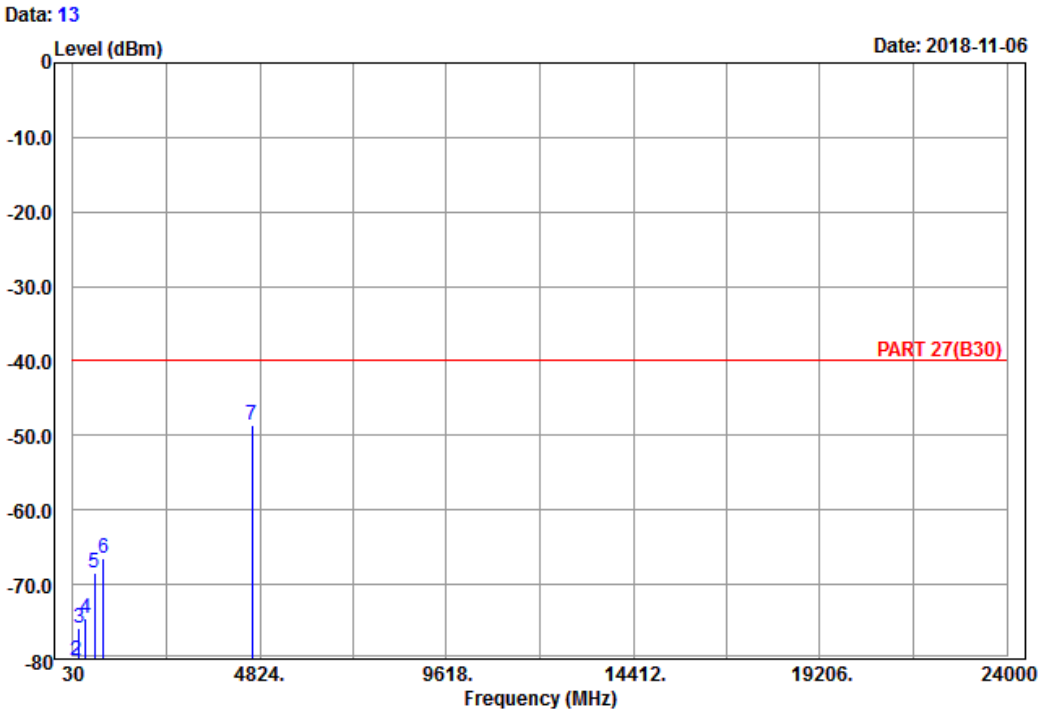


Site : 966 chamber 1
Condition: PART 27(B30) Vertical
Remark : LTE_Band 30_Link_CH27735
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	4625.00	-49.16	-67.59	-40.00	-9.16	18.43	Peak

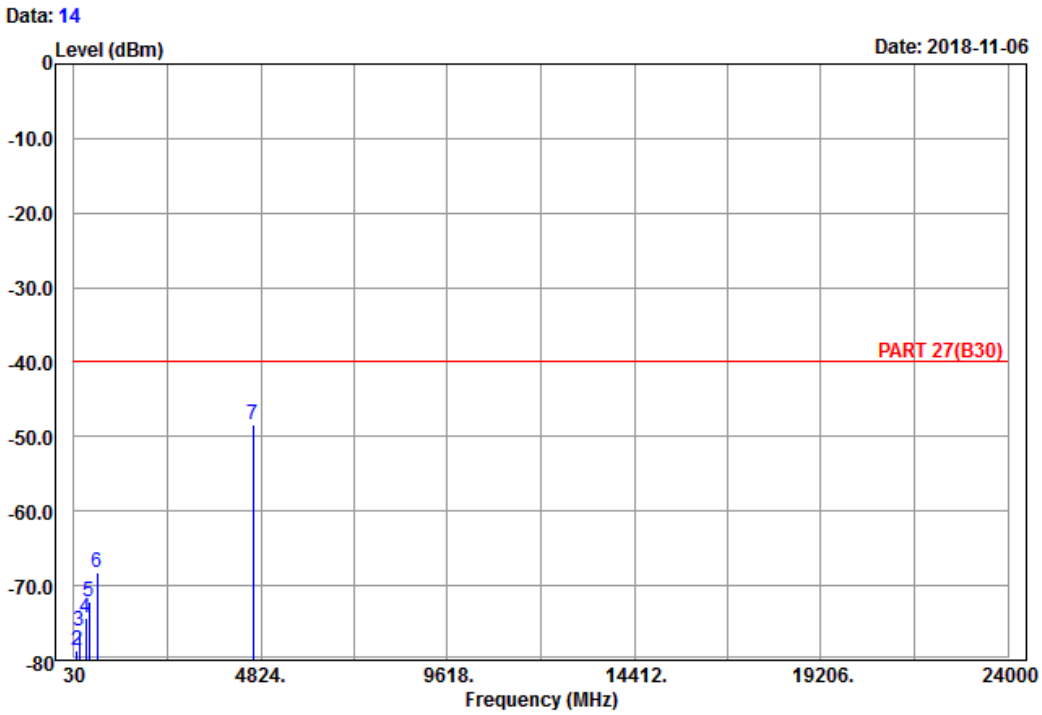
Channel Bandwidth: 10 MHz / QPSK
Middle Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch



Site : 966 chamber 1
Condition: PART 27(B30) Horizontal
Remark : LTE_Band 30_Link_CH27710
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	49.98	-83.82	-69.77	-40.00	-43.82	-14.05	Peak
2	95.07	-80.19	-69.79	-40.00	-40.19	-10.40	Peak
3	179.58	-75.95	-70.27	-40.00	-35.95	-5.68	Peak
4	360.20	-74.45	-69.59	-40.00	-34.45	-4.86	Peak
5	575.80	-68.53	-67.95	-40.00	-28.53	-0.58	Peak
6	801.90	-66.58	-68.57	-40.00	-26.58	1.99	Peak
7 pp	4620.00	-48.52	-66.95	-40.00	-8.52	18.43	Peak



Site : 966 chamber 1
Condition: PART 27(B30) Vertical
Remark : LTE_Band 30_Link_CH27710
Tested by: Karl Lee

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	48.63	-83.85	-70.42	-40.00	-43.85	-13.43	Peak
2	105.06	-78.71	-69.18	-40.00	-38.71	-9.53	Peak
3	169.59	-75.99	-69.28	-40.00	-35.99	-6.71	Peak
4	332.90	-74.37	-68.79	-40.00	-34.37	-5.58	Peak
5	413.40	-72.20	-69.16	-40.00	-32.20	-3.04	Peak
6	620.60	-68.18	-68.38	-40.00	-28.18	0.20	Peak
7 pp	4620.00	-48.32	-66.75	-40.00	-8.32	18.43	Peak

5 Pictures of Test Arrangements

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

Appendix – Information on 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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