

## FCC Test Report

### (PART 27)

**Report No.:** RF190628C20-4

**FCC ID:** ZMOL850GL

**Test Model:** Lenovo Yoga C640-13IML LTE

**Series Model:** 81XL

(refer to item 3.1 for more details)

**Received Date:** Jun. 28, 2019

**Test Date:** Jul. 09 ~ Jul. 12, 2019

**Issued Date:** Aug. 01, 2019

**Applicant:** Lenovo (Shanghai) Electronics Technology Co., Ltd.

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Pilot Free Trade Zone

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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( R.O.C )

**Test Location:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Vil, Kwei Shan Dist., Taoyuan City  
33383, Taiwan (R.O.C)

**FCC Registration /  
Designation Number:** 788550 / TW0003



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### Release Control Record

Issue No.	Description	Date Issued
RF190628C20-4	Original Release	Aug. 01, 2019

## 1 Certificate of Conformity

**Product:** Notebook Computer

**Brand:** Lenovo

**Test Model:** Lenovo Yoga C640-13IML LTE

**Series Model:** 81XL

(refer to item 3.1 for more details)

**Sample Status:** Engineering Sample

**Applicant:** Lenovo (Shanghai) Electronics Technology Co., Ltd.

**Test Date:** Jul. 09 ~ Jul. 12, 2019

**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:** Aug. 01, 2019

Ivonne Wu / Supervisor

**Approved by :**



**Date:** Aug. 01, 2019

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	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 -8.97 dB at 6930.00 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	3.04 dB
	30 MHz ~ 200 MHz	2.93 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
Test Receiver Agilent	N9038A	MY51210203	Mar. 18, 2019	Mar. 17, 2020
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 13, 2018	Dec. 12, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 15, 2019	Apr. 14, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSW26	102023	Oct. 11, 2018	Oct. 10, 2019
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 25, 2018	Nov. 24, 2019
BILOG Antenna SCHWARZBECK	VULB 9168	9168-472	Nov. 23, 2018	Nov. 22, 2019
BILOG Antenna SCHWARZBECK	VULB 9168	9168-153	Nov. 23, 2018	Nov. 22, 2019
Double Ridge Guide Horn Antenna EMCO	3115	5619	Nov. 25, 2018	Nov. 24, 2019
Fixed Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
MXG Vector signal generator Agilent	N5182B	MY53050430	Nov. 19, 2018	Nov. 18, 2019
Preamplifier EMCI	EMC 012645	980115	Oct. 12, 2018	Oct. 11, 2019
Preamplifier EMCI	EMC 330H	980112	Oct. 12, 2018	Oct. 11, 2019
RF Coaxial Cable HUBER+SUHNNER	EMC104-SM-SM-800 0&3000	140811+170717	Oct. 12, 2018	Oct. 11, 2019
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM-1 000(140807)	Oct. 12, 2018	Oct. 11, 2019
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 12, 2018	Oct. 11, 2019
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	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 HwaYa Chamber 10.

### 3 General Information

#### 3.1 General Description of EUT

<b>Product</b>	Notebook Computer	
<b>Brand</b>	Lenovo	
<b>Test Model</b>	Lenovo Yoga C640-13IML LTE	
<b>Series Model</b>	81XL	
<b>Status of EUT</b>	Engineering Sample	
<b>Power Supply Rating</b>	12 Vdc (Adapter)	
<b>Modulation Type</b>	QPSK, 16QAM	
<b>Frequency Range</b>	LTE Band 30 (Channel Bandwidth: 5 MHz)	2307.5 ~ 2312.5 MHz
	LTE Band 30 (Channel Bandwidth: 10 MHz)	2310 MHz
<b>Max. EIRP Power</b>	LTE Band 30 (Channel Bandwidth: 5 MHz)	26.36 mW / 5MHz
	LTE Band 30 (Channel Bandwidth: 10 MHz)	28.25 mW / 5MHz
<b>Emission Designator</b>	LTE Band 30 (Channel Bandwidth: 5 MHz)	4M50G7D
	LTE Band 30 (Channel Bandwidth: 10 MHz)	8M99G7D
<b>Antenna Type</b>	NB Mode: PIFA Antenna with -0.04 dBi gain (Main) / -0.85 dBi gain (Aux.) Tablet Mode: PIFA Antenna with -3.56 dBi gain (Main) / -3.78 dBi gain (Aux.)	
<b>Accessory Device</b>	Refer to Note as below	
<b>Data Cable Supplied</b>	Refer to Note as below	

Note:

1. The WWAN module (Brand: Fibocom, Model: L850-GL) was installed in the EUT.
2. All models are listed as below.

Brand	Model	Difference
Lenovo	Lenovo Yoga C640-13IML LTE (Main test)	All models are electrically identical, different model names are for marketing purpose.
	81XL (Series model)	

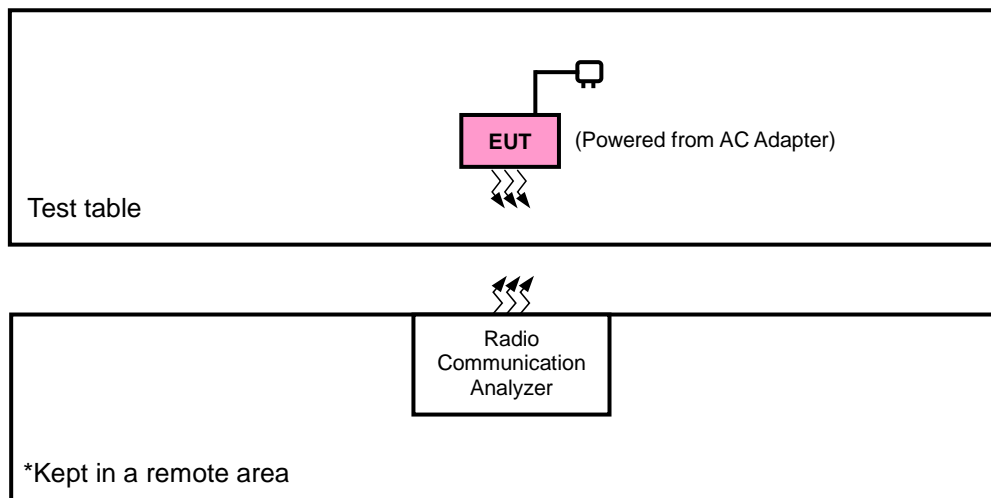
3. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter	Lenovo	PA-1450-55LL	I/P: 100-240 Vac, 50/60 Hz, 1.7 A O/P: 12 Vdc, 2 A

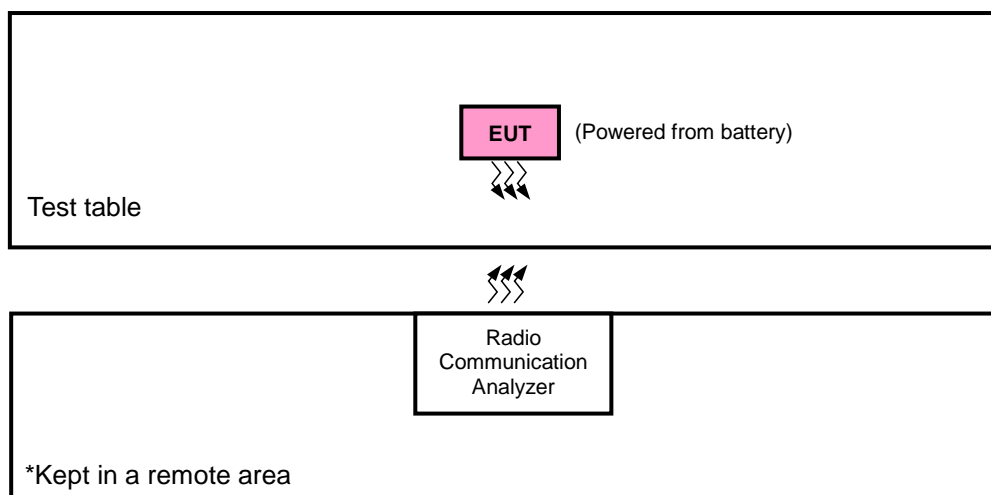
4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

### 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.



### 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 NB mode for EIRP and Z-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	1 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Modulation Characteristics	27710	27710	10 MHz	QPSK, 16QAM	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	25 RB / 0 RB Offset
		27710	27710	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
-	Band Edge	27685 to 27735	27685, 27735	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 1 RB / 24 RB Offset
		27710	27710	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset 1 RB / 49 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	120 Vac, 60 Hz	Thomas Wei
Modulation Characteristics	25 deg. C, 65 % RH	120 Vac, 60 Hz	Thomas Wei
Frequency Stability	25 deg. C, 65 % RH	120 Vac, 60 Hz	Thomas Wei
Occupied Bandwidth	25 deg. C, 65 % RH	120 Vac, 60 Hz	Thomas Wei
Band Edge	25 deg. C, 65 % RH	120 Vac, 60 Hz	Thomas Wei
Conducted Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Thomas Wei
Radiated Emission	25 deg. C, 65 % RH	120 Vac, 60 Hz	Thomas Wei

### **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:**

- All measurements were done at low, middle and high operational frequency range. RBW is 5 MHz and VBW is 15 MHz for LTE mode.
- 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.
- 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.
- $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$

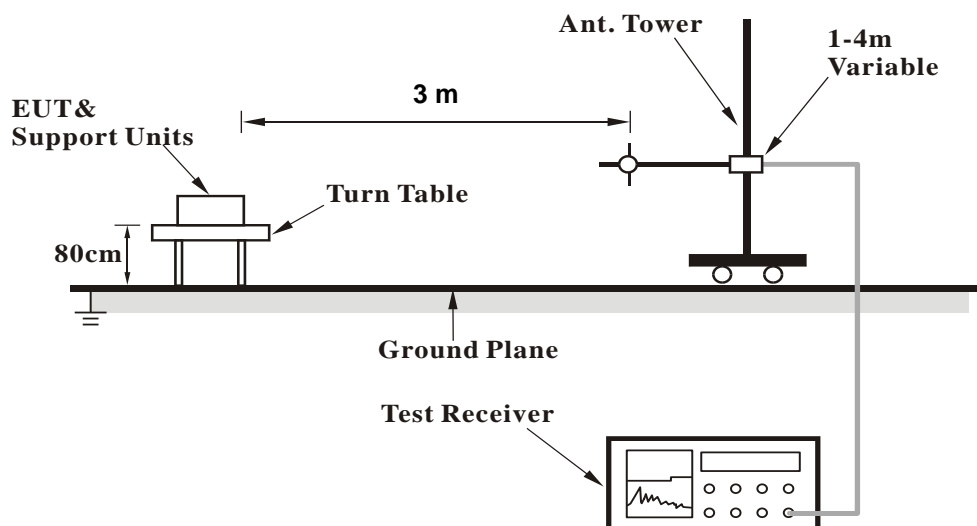
##### **Conducted Power Measurement:**

- The EUT was set up for the maximum power with LTE 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.

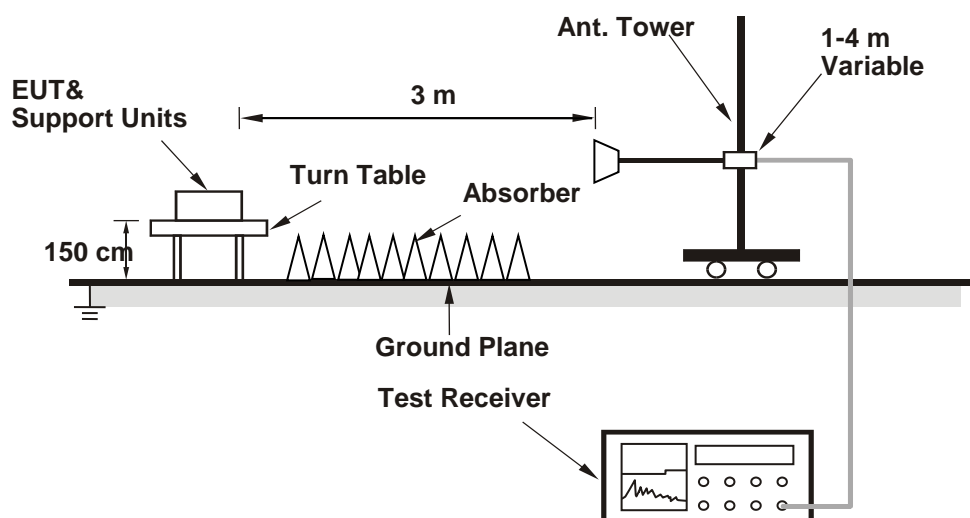
#### 4.1.3 Test Setup

##### EIRP / ERP Measurement:

<Radiated Emission below or equal 1 GHz>

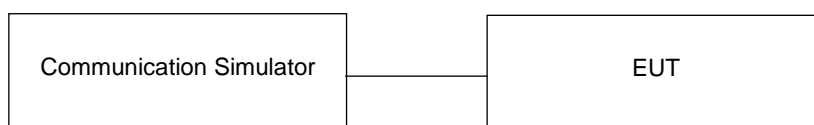


<Radiated Emission above 1 GHz>



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

##### Conducted Power Measurement:



#### 4.1.4 Test Results

##### Conducted Output Power (dBm)

LTE Band 30															
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		22.65		0	5M	QPSK	1	0	22.48	22.57	22.50	0
		1	24		22.32		0			1	12	22.10	22.24	22.20	0
		1	49		22.15		0			1	24	22.13	22.15	22.11	0
		25	0		21.45		1			12	0	21.35	21.39	21.34	1
		25	12		21.32		1			12	6	21.17	21.25	21.16	1
		25	25		21.21		1			12	13	21.15	21.21	21.14	1
		50	0		21.47		1			25	0	21.30	21.44	21.29	1
	16QAM	1	0		21.65		1		16QAM	1	0	21.46	21.56	21.45	1
		1	24		21.26		1			1	12	21.20	21.24	21.08	1
		1	49		21.08		1			1	24	21.03	21.02	20.96	1
		25	0		20.46		2			12	0	20.36	20.43	20.39	2
		25	12		20.24		2			12	6	20.21	20.23	20.17	2
		25	25		20.13		2			12	13	20.10	20.07	20.09	2
		50	0		20.44		2			25	0	20.30	20.44	20.27	2

**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)
NB	27685	2307.5	-24.82	38.99	14.17	26.12	H
	27710	2310.0	-23.96	38.17	14.21	26.36	
	27735	2312.5	-24.47	38.55	14.08	25.59	
	27685	2307.5	-31.73	39.27	7.54	5.68	V
	27710	2310.0	-31.05	38.68	7.63	5.79	
	27735	2312.5	-31.08	38.55	7.47	5.58	
Channel Bandwidth: 5 MHz / 16QAM							
NB	27685	2307.5	-25.88	38.99	13.11	20.46	H
	27710	2310.0	-25.00	38.17	13.17	20.75	
	27735	2312.5	-25.51	38.55	13.04	20.14	
	27685	2307.5	-32.99	39.27	6.28	4.25	V
	27710	2310.0	-32.31	38.68	6.37	4.34	
	27735	2312.5	-32.39	38.55	6.16	4.13	

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)
NB	27710	2310.0	-23.66	38.17	14.51	28.25	H
	27710	2310.0	-30.81	38.68	7.87	6.12	V
Channel Bandwidth: 10 MHz / 16QAM							
NB	27710	2310.0	-24.80	38.17	13.37	21.73	H
	27710	2310.0	-32.00	38.68	6.68	4.66	V

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

## 4.2 Modulation Characteristics Measurement

### 4.2.1 Limits of Modulation Characteristics

N/A

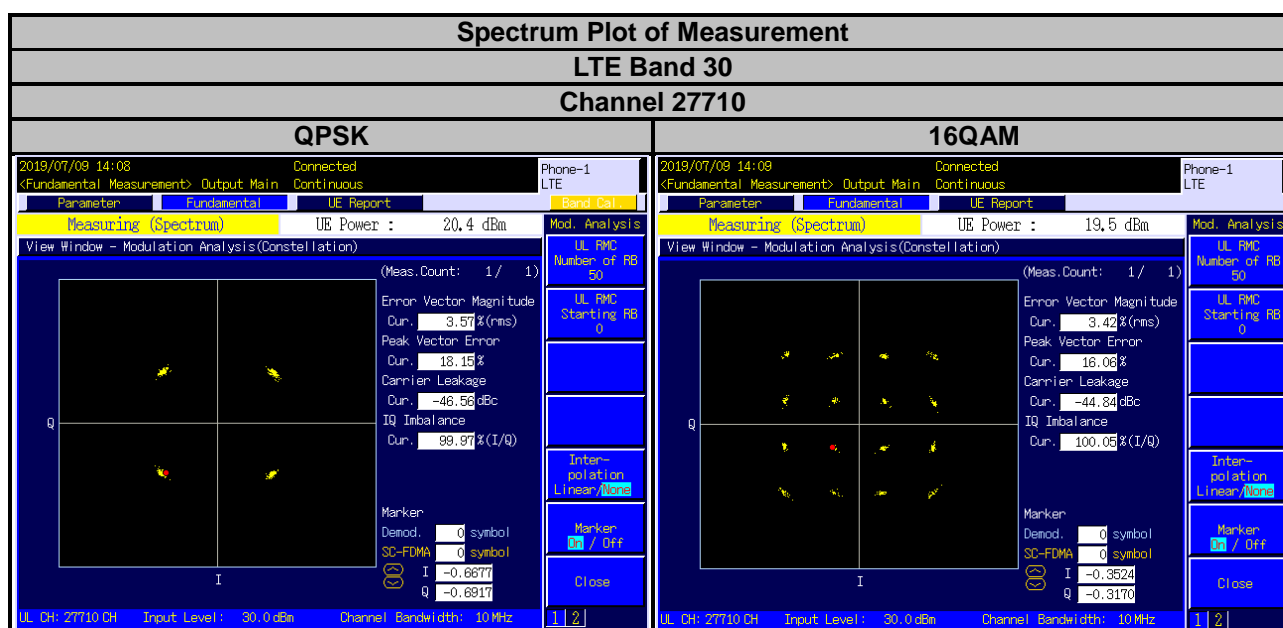
### 4.2.2 Test Setup



### 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



### 4.3 Frequency Stability Measurement

#### 4.3.1 Limits of Frequency Stability Measurement

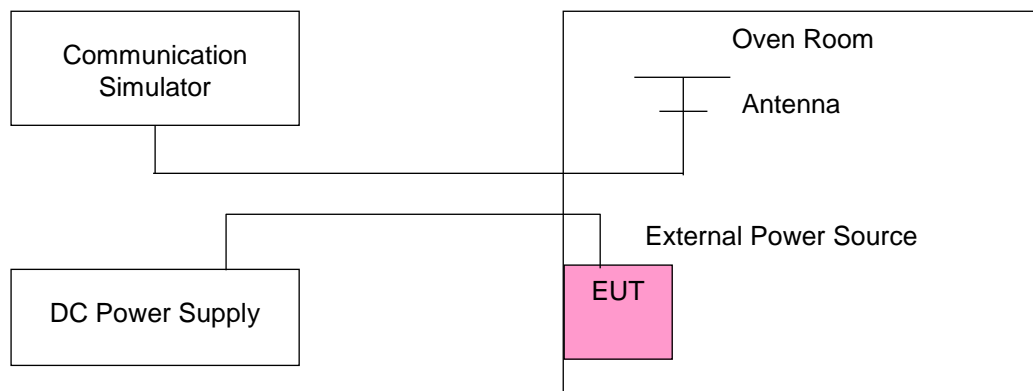
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

#### 4.3.2 Test Procedure

- 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.
- 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.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the  $\pm 0.5^{\circ}\text{C}$  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)
120	2307.500003	0.001	2312.500003	0.001
102	2307.500003	0.001	2312.500002	0.001
138	2307.500004	0.002	2312.500003	0.001

**Note:** The applicant defined the normal working voltage of the battery is from 102 Vac to 138 Vac.

##### Frequency Error vs. Temperature

Temp. (°C)	LTE Band 30			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	2307.500003	0.001	2312.500002	0.001
-20	2307.500002	0.001	2312.500002	0.001
-10	2307.500002	0.001	2312.500002	0.001
0	2307.500001	0.000	2312.500001	0.001
10	2307.500004	0.002	2312.500002	0.001
20	2307.499997	-0.001	2312.499996	-0.002
30	2307.499997	-0.001	2312.499996	-0.002
40	2307.499998	-0.001	2312.499999	0.000
50	2307.499996	-0.002	2312.499997	-0.002

### Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 30	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
120	2307.500004	0.002
102	2307.500004	0.002
138	2307.500002	0.001

**Note:** The applicant defined the normal working voltage of the battery is from 102 Vac to 138 Vac.

### Frequency Error vs. Temperature

Temp. (°C)	LTE Band 30	
	Channel Bandwidth: 10 MHz	
	Frequency (MHz)	Frequency Error (ppm)
-30	2307.500004	0.002
-20	2307.500003	0.001
-10	2307.500001	0.000
0	2307.500003	0.001
10	2307.500003	0.001
20	2307.499997	-0.002
30	2307.499997	-0.001
40	2307.499996	-0.002
50	2307.499997	-0.001

#### 4.4 Occupied Bandwidth Measurement

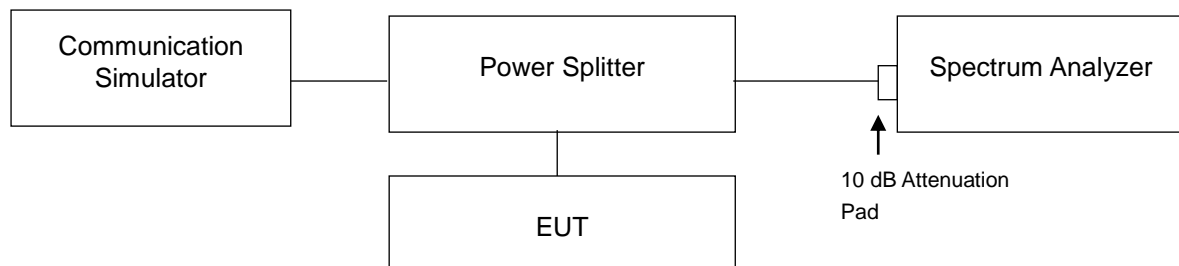
##### 4.4.1 Limits of Occupied Bandwidth Measurement

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

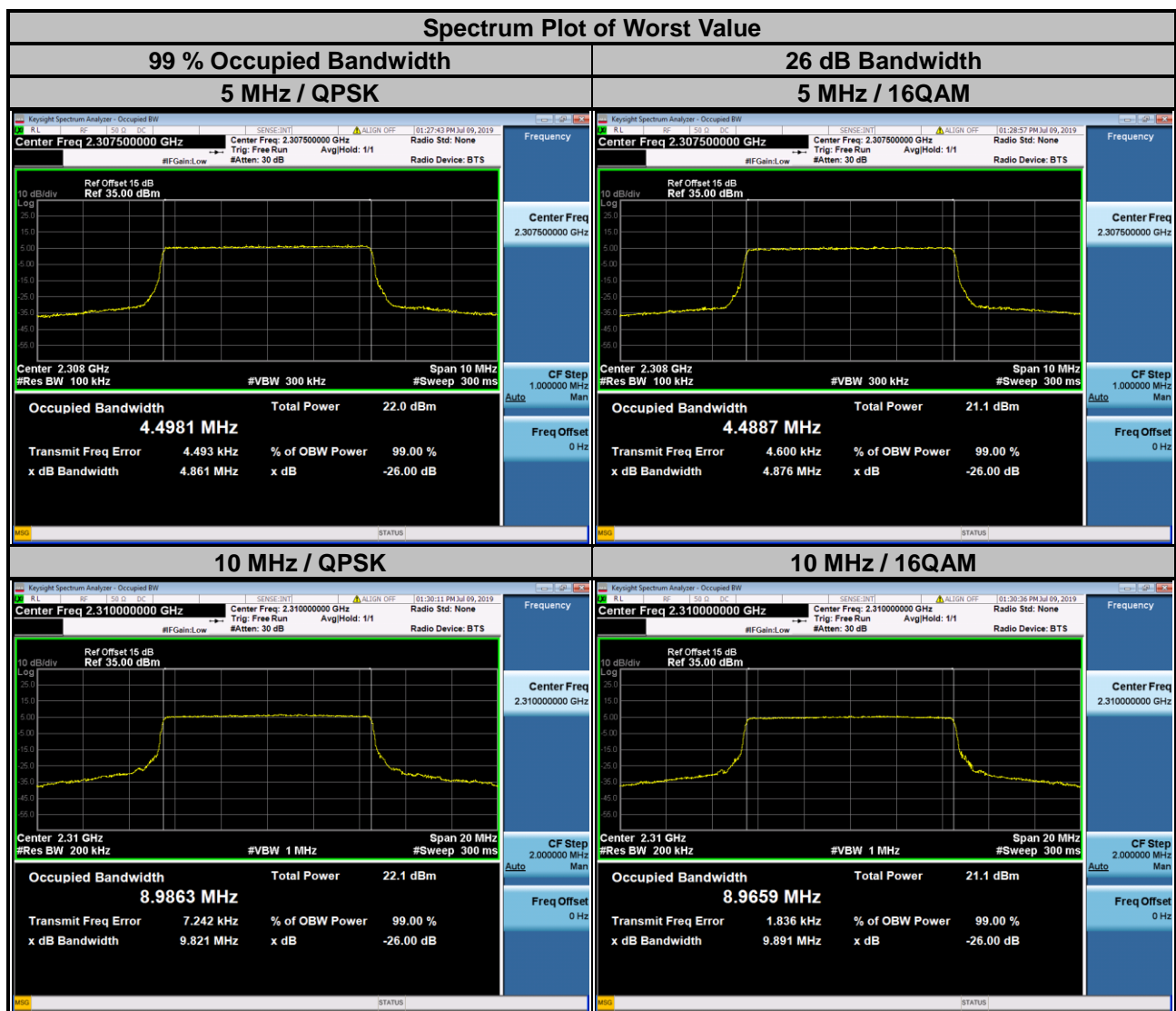
- The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

##### 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	QPSK	16QAM
27685	2307.5	4.4981	4.4887	4.861	4.876
27710	2310.0	4.4934	4.4939	4.841	4.858
27735	2312.5	4.4941	4.4935	4.839	4.885
Channel Bandwidth: 10 MHz					
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		26 dB Bandwidth (MHz)	
		QPSK	16QAM	QPSK	16QAM
27710	2310.0	8.9863	8.9659	9.821	9.891



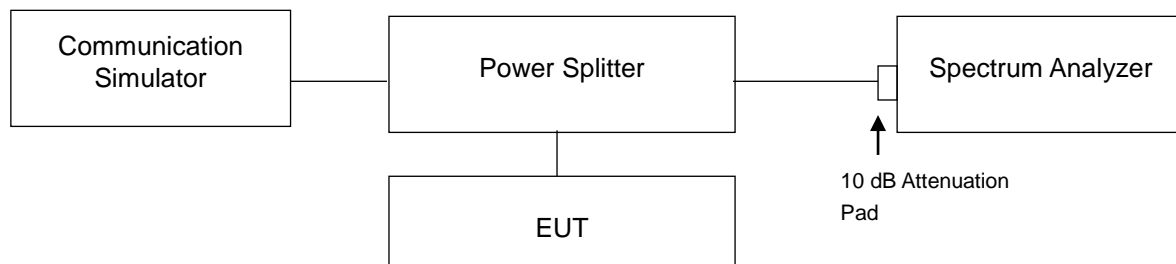
## 4.5 Band Edge Measurement

### 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.

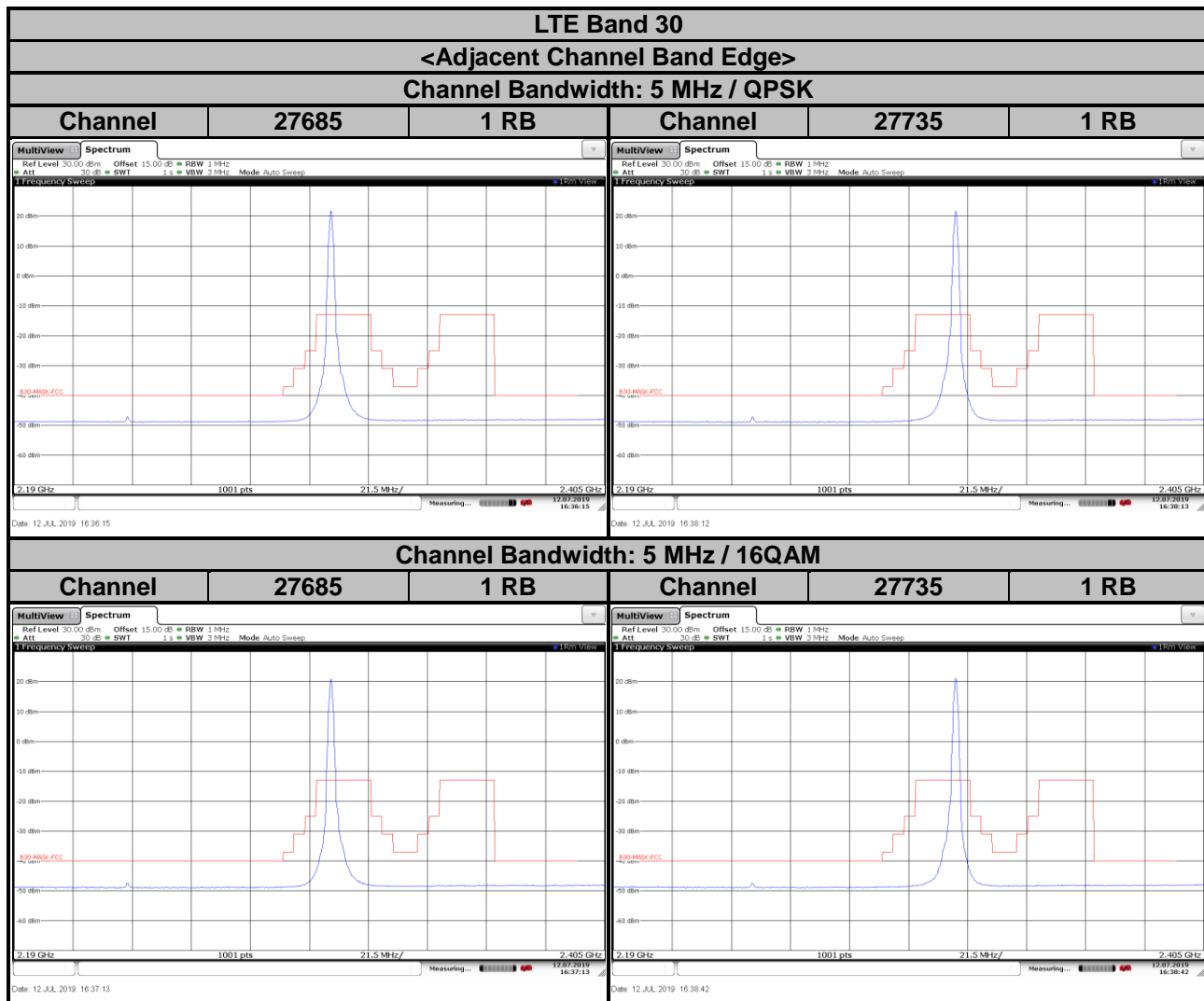
### 4.5.2 Test Setup

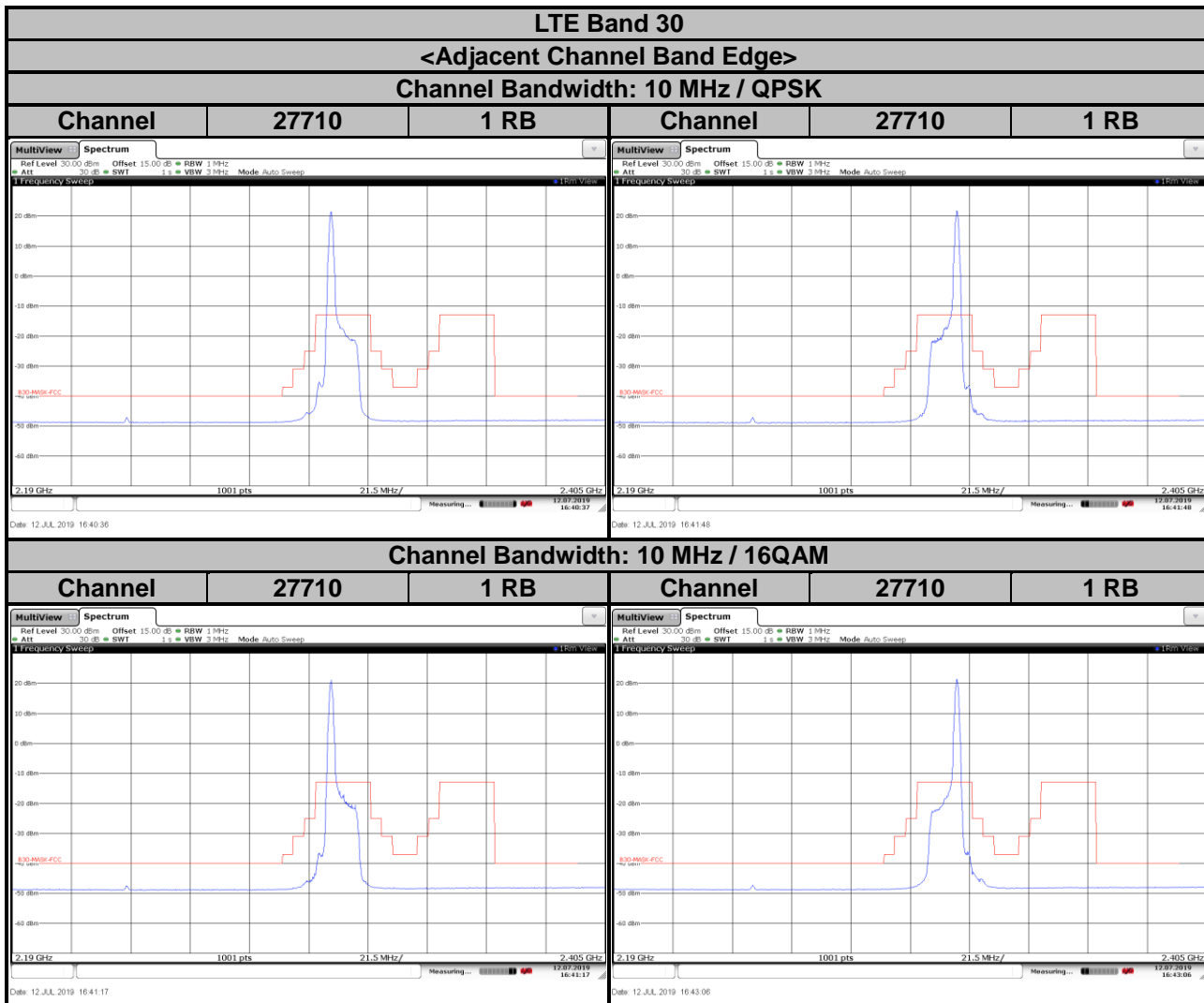


### 4.5.3 Test Procedures

- 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 2190 MHz to 2405 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



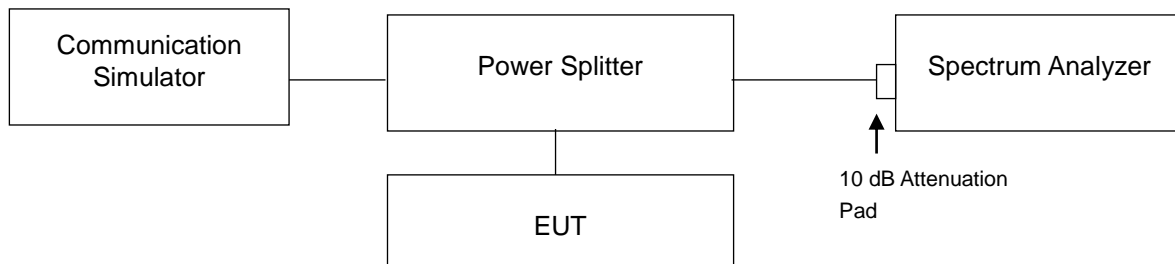


## 4.6 Conducted Spurious Emissions

### 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

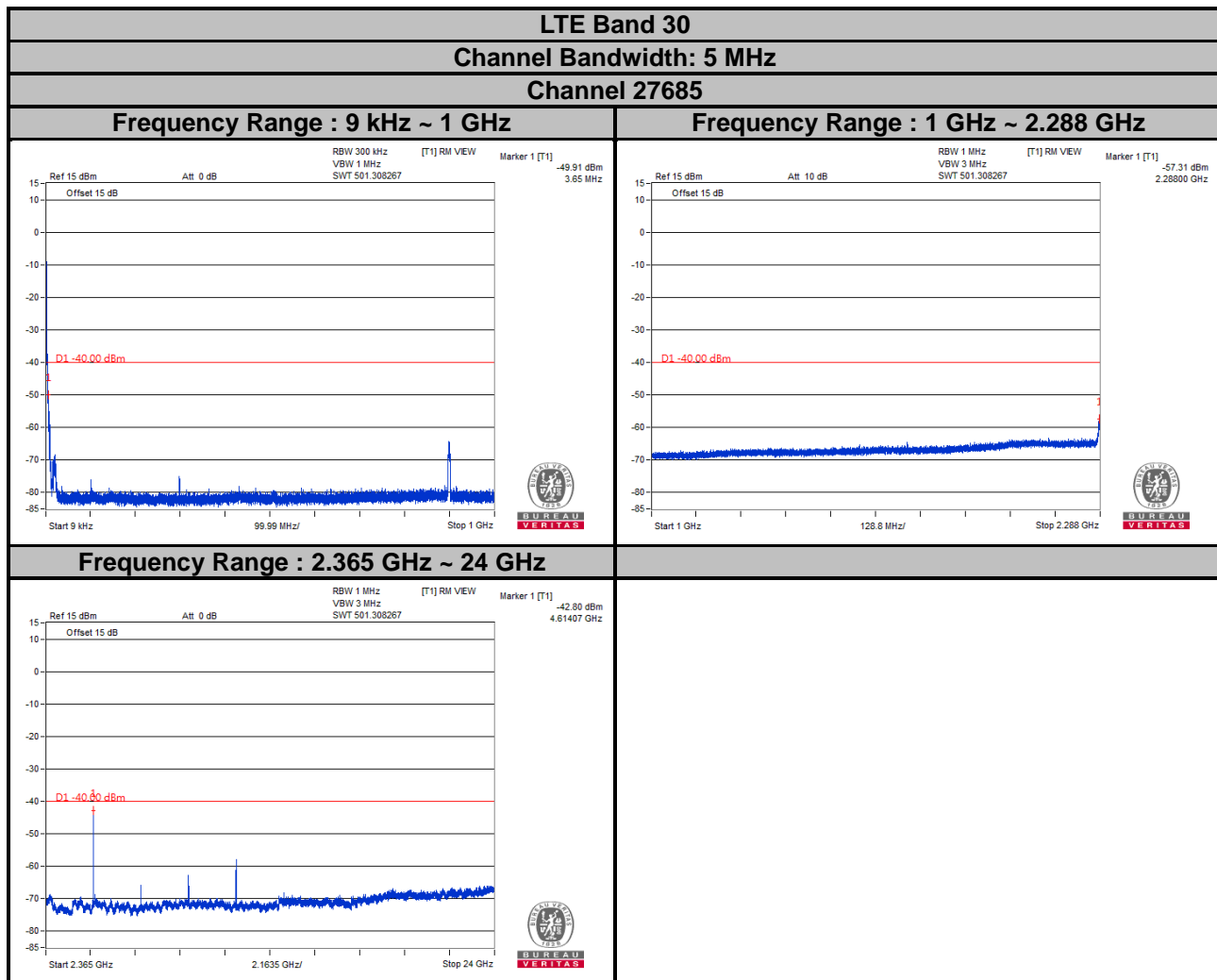


### 4.6.3 Test Procedure

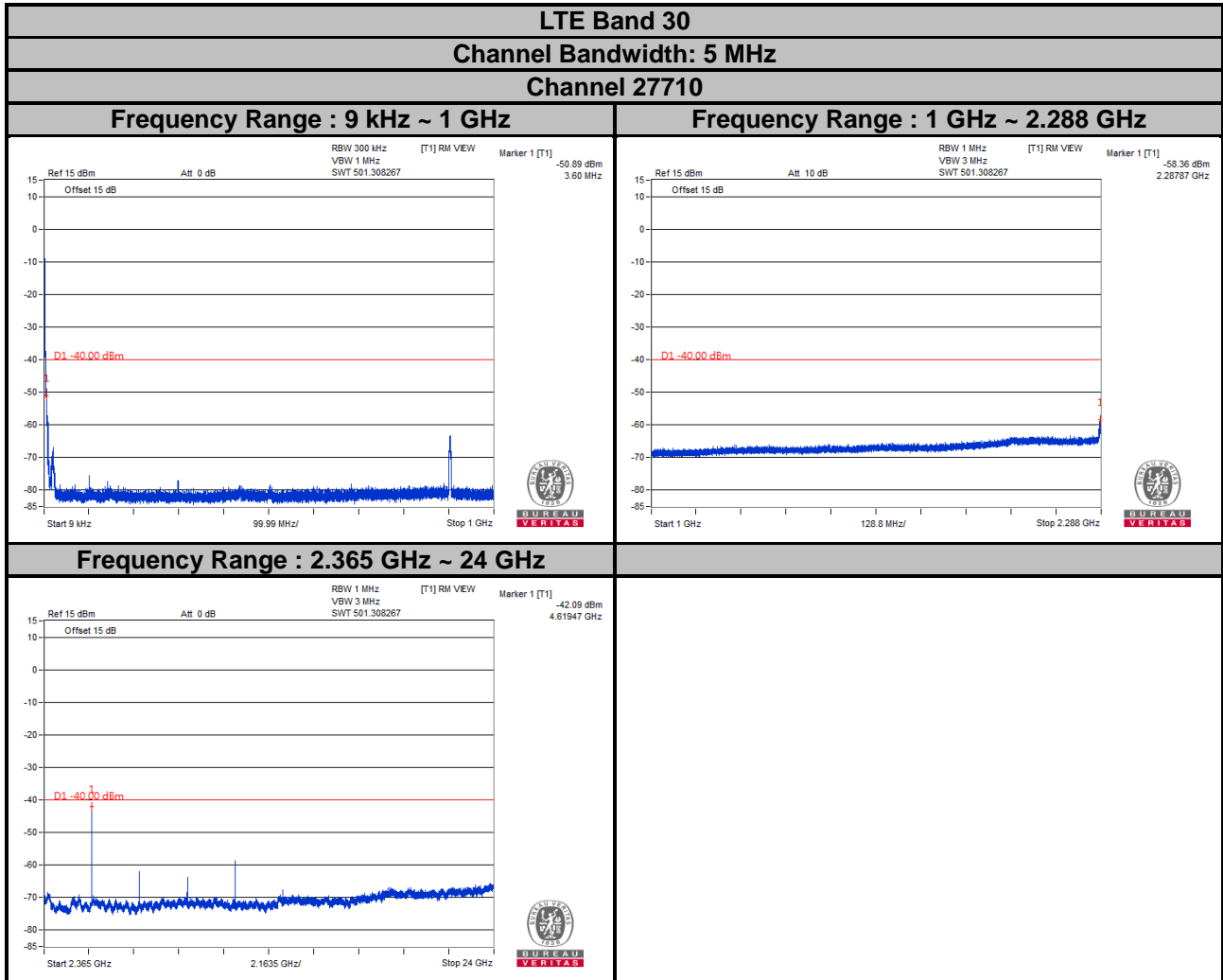
- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz to 1 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 300 kHz and VBW = 1 MHz are used for conducted emission measurement.
- 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.
- Spectrum RBW settings is referenced to ANSI 63.26 section 5.7.2 and KDB 971168 D01 Power Meas License Digital Systems v03r01 section 6.1.



#### 4.6.4 Test Results



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



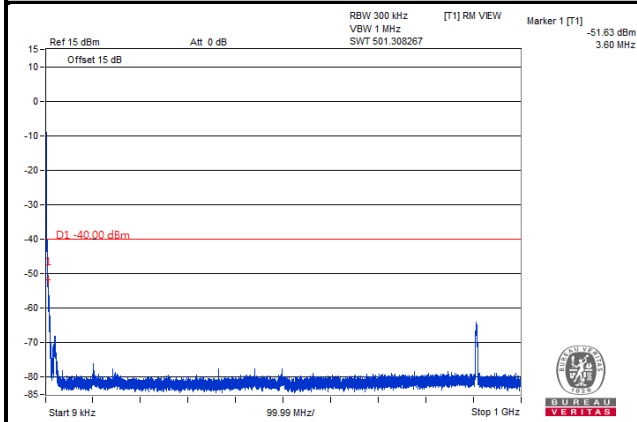
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

# LTE Band 30

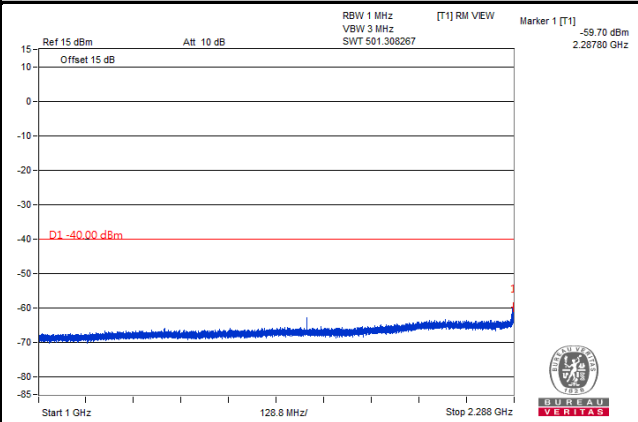
Channel Bandwidth: 5 MHz

Channel 27735

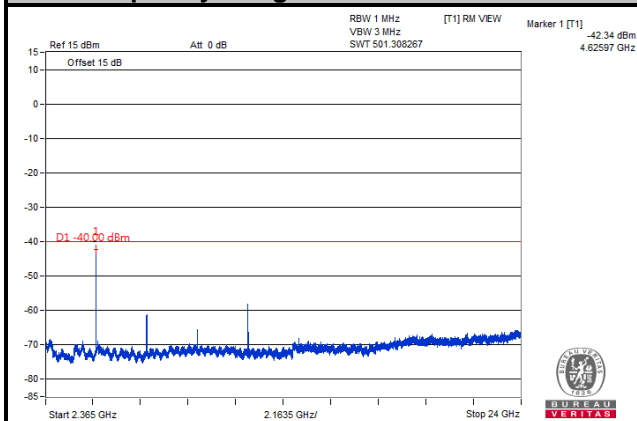
Frequency Range : 9 kHz ~ 1 GHz



Frequency Range : 1 GHz ~ 2.288 GHz



Frequency Range : 2.365 GHz ~ 24 GHz



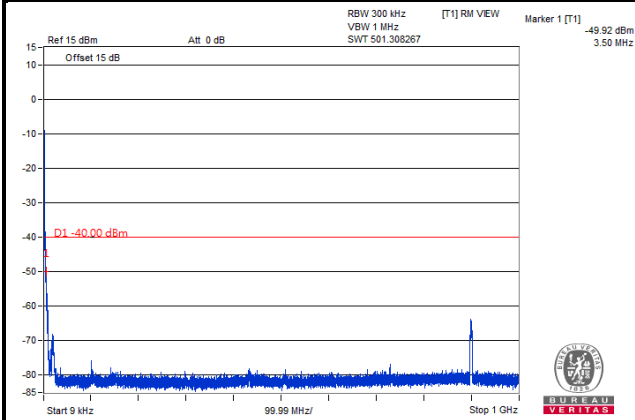
Note: The signal over the limit in 9 kHz is from spectrum analyzer.

# LTE Band 30

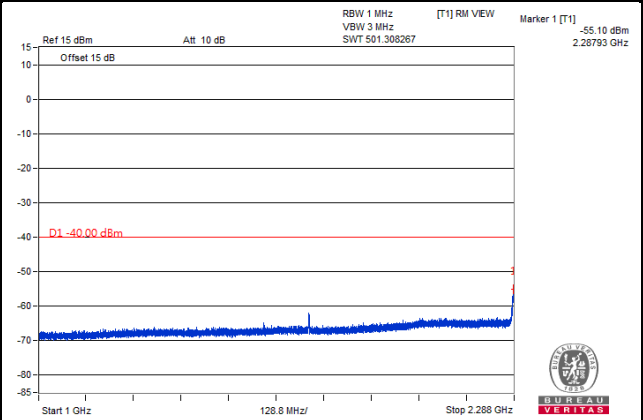
Channel Bandwidth: 10 MHz

Channel 27710

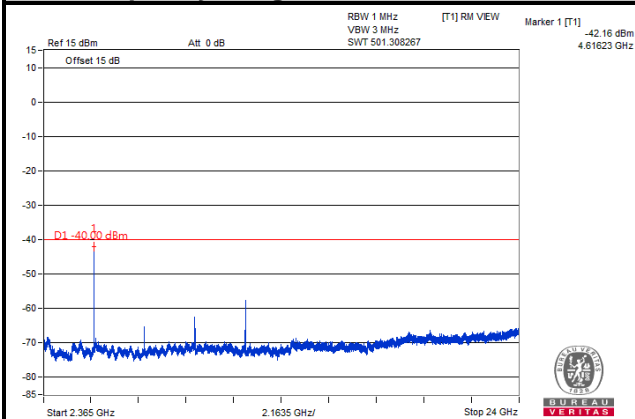
Frequency Range : 9 kHz ~ 1 GHz



Frequency Range : 1 GHz ~ 2.288 GHz



Frequency Range : 2.365 GHz ~ 24 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

- 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.
- 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
- $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$
- E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole,  $E.R.P \text{ power} = E.I.R.P \text{ power} - 2.15 \text{ dB}.$

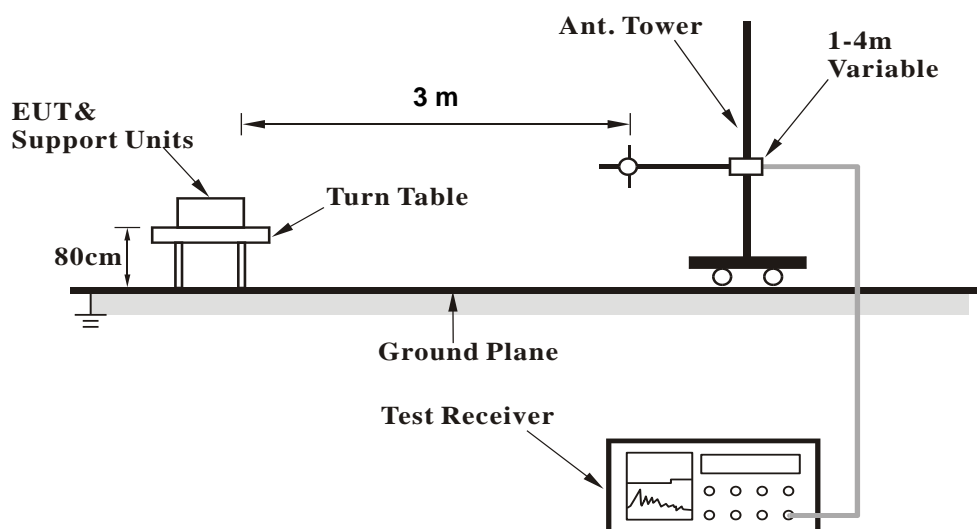
**Note:** The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

### 4.7.3 Deviation from Test Standard

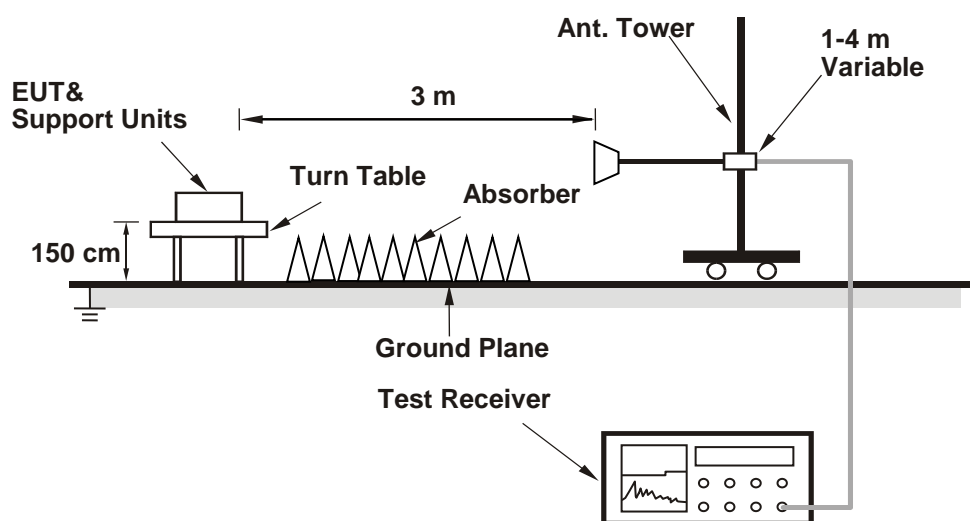
No deviation.

#### 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

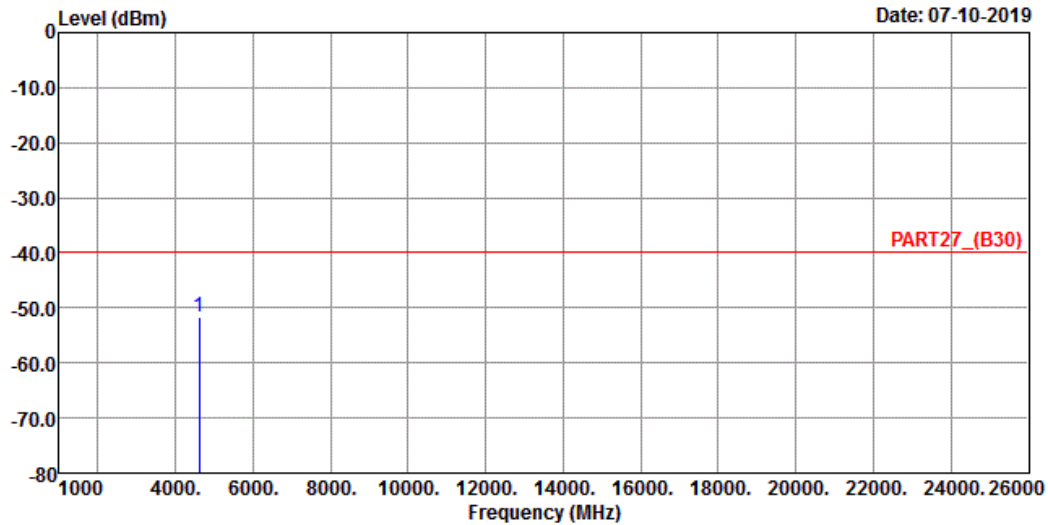


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 3

Date: 07-10-2019



Site : 966 Chamber 5

Condition: PART27\_(B30) HORIZONTAL

Remak : LTE Band 30 QPSK\_5M Link\_L-CH

Tested by: Getaz Yang

Freq	Level	Read Level	Limit	Over	
MHz	dBm	dBm	Line	Factor	Limit Remark
			dBm	dB	dB

1 pp 4615.00 -51.71 -48.06 -40.00 -3.65 -11.71 Peak

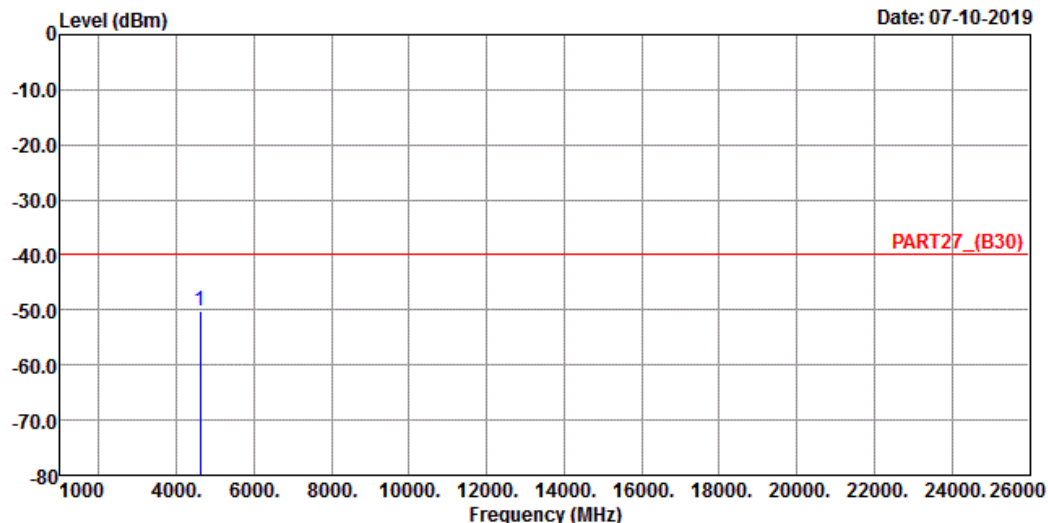


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4

Date: 07-10-2019



Site : 966 Chamber 5

Condition: PART27\_(B30) VERTICAL

Remak : LTE Band 30 QPSK\_5M Link\_L-CH

Tested by: Getaz Yang

Freq	Level	Read Level	Limit	Over	Limit	Remark
MHz	dBm	dBm	dBm	dB	dB	

1 pp 4615.00 -50.29 -46.64 -40.00 -3.65 -10.29 Peak



## Middle Channel

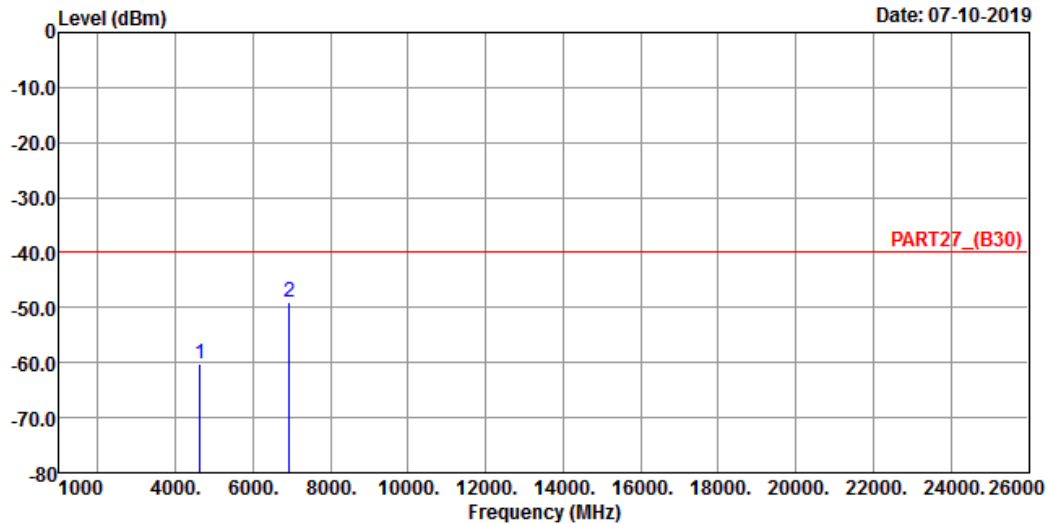


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 3

Date: 07-10-2019



Site : 966 Chamber 5

Condition: PART27\_(B30) HORIZONTAL

Remak : LTE Band 30 QPSK\_5M Link\_M-CH

Tested by: Thomas Wei

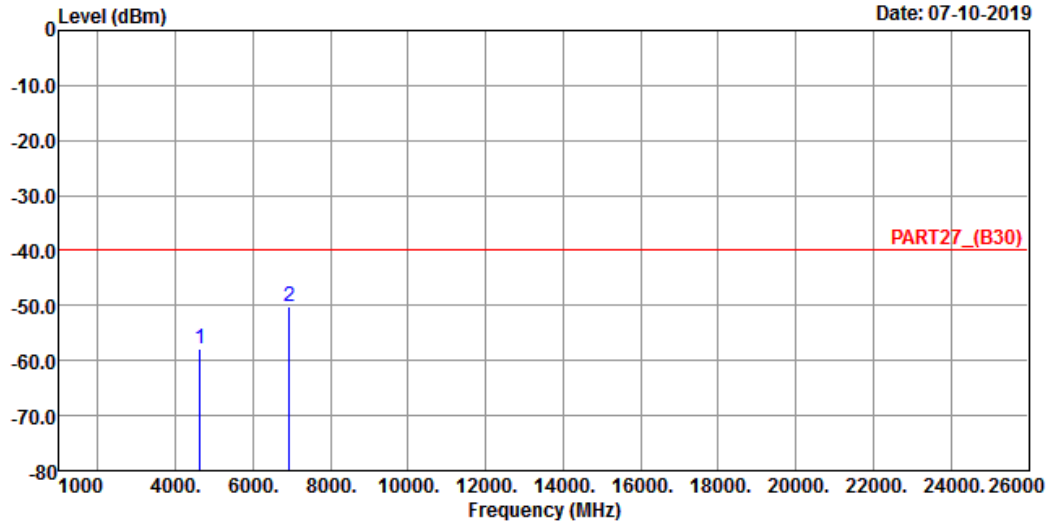
	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	4620.00	-60.10	-56.42	-40.00	-3.68	-20.10	Peak
2 pp	6930.00	-49.04	-51.73	-40.00	2.69	-9.04	Peak



# Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4



Site : 966 Chamber 5

Condition: PART27\_(B30) VERTICAL

Remak : LTE Band 30 QPSK\_5M Link\_M-CH

Tested by: Thomas Wei

	Freq	Level	Read Level	Limit	Line Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	4620.00	-57.96	-54.28	-40.00	-3.68	-17.96	Peak
2 pp	6930.00	-50.19	-52.88	-40.00	2.69	-10.19	Peak

# High Channel

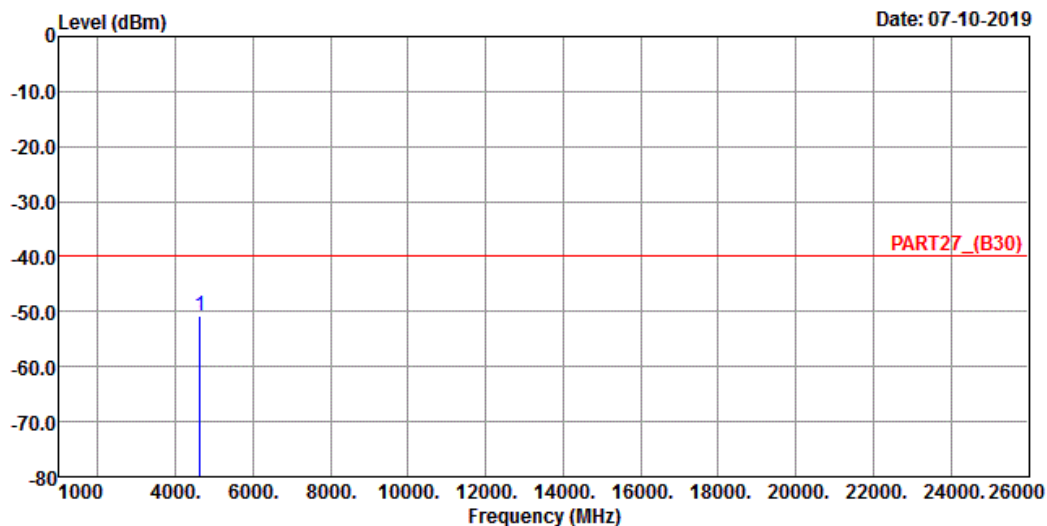


Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch

A D T

Data: 3

Date: 07-10-2019



Site : 966 Chamber 5

Condition: PART27\_(B30) HORIZONTAL

Remak : LTE Band 30 QPSK\_5M Link\_H-CH

Tested by: Getaz Yang

		Read	Limit		Over	
Freq	Level	Level	Line	Factor	Limit	Remark
MHz	dBm	dBm	dBm	dB	dB	

1 pp 4625.00 -50.90 -47.22 -40.00 -3.68 -10.90 Peak

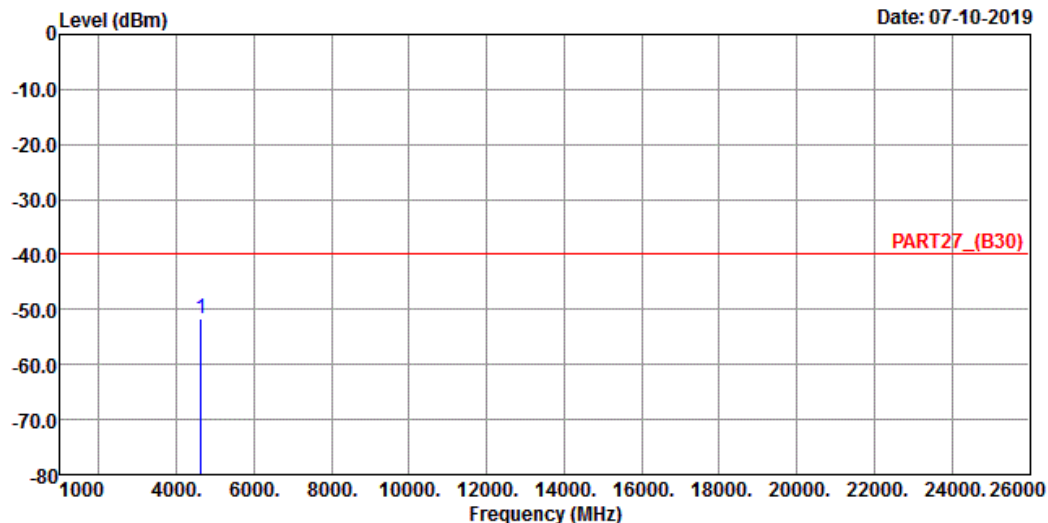


# Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4

Date: 07-10-2019



Site : 966 Chamber 5

Condition: PART27\_(B30) VERTICAL

Remak : LTE Band 30 QPSK\_5M Link\_H-CH

Tested by: Getaz Yang

Freq	Level	Read Level	Limit	Over	Limit	Remark
MHz	dBm	dBm	dBm	dB	dB	

1 pp 4625.00 -51.61 -47.93 -40.00 -3.68 -11.61 Peak

Channel Bandwidth: 10 MHz / QPSK

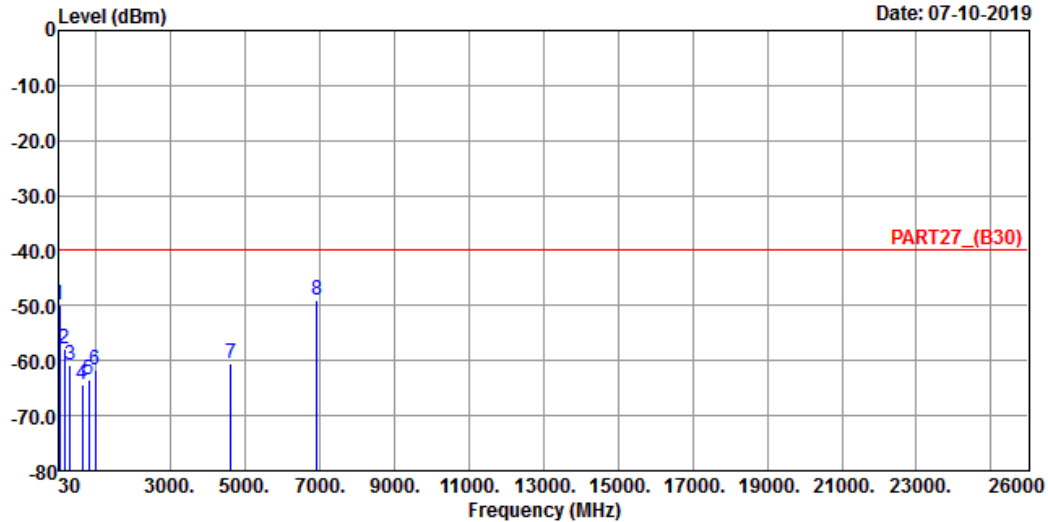


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 5

Date: 07-10-2019



Site : 966 Chamber 5

Condition: PART27\_(B30) HORIZONTAL

Remak : LTE Band 30 QPSK\_10M Link\_M-CH

Tested by: Thomas Wei

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	42.61	-49.86	-48.92	-40.00	-0.94	-9.86	Peak
2	168.71	-57.81	-52.35	-40.00	-5.46	-17.81	Peak
3	317.12	-60.92	-54.17	-40.00	-6.75	-20.92	Peak
4	637.22	-64.34	-63.49	-40.00	-0.85	-24.34	Peak
5	818.61	-63.55	-64.12	-40.00	0.57	-23.55	Peak
6	987.39	-61.69	-64.82	-40.00	3.13	-21.69	Peak
7	4620.00	-60.47	-56.79	-40.00	-3.68	-20.47	Peak
8 pp	6930.00	-48.97	-51.66	-40.00	2.69	-8.97	Peak

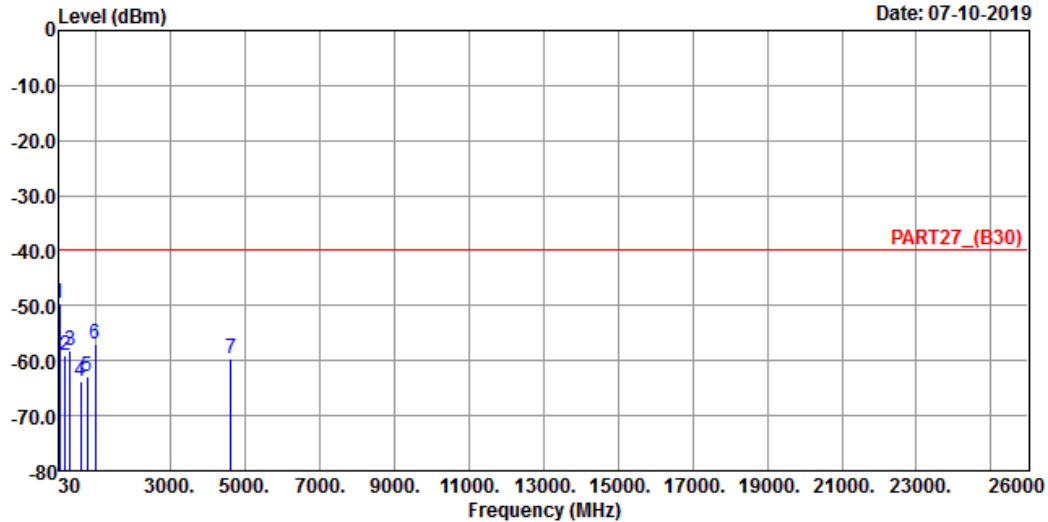


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 6

Date: 07-10-2019



Site : 966 Chamber 5

Condition: PART27\_(B30) VERTICAL

Remak : LTE Band 30 QPSK\_10M Link\_M-CH

Tested by: Thomas Wei

	Freq	Level	Read Level	Limit Line	Factor	Over Limit	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1 pp	43.58	-49.46	-47.99	-40.00	-1.47	-9.46	Peak
2	195.87	-58.96	-51.31	-40.00	-7.65	-18.96	Peak
3	327.79	-58.21	-51.63	-40.00	-6.58	-18.21	Peak
4	600.36	-63.81	-63.06	-40.00	-0.75	-23.81	Peak
5	778.84	-62.88	-63.68	-40.00	0.80	-22.88	Peak
6	1000.00	-56.85	-60.43	-40.00	3.58	-16.85	Peak
7	4620.00	-59.61	-55.93	-40.00	-3.68	-19.61	Peak

## 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](http://www.bureauveritas-adt.com)

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

--- END ---