

## FCC Test Report

### (PART 24)

**Report No.:** RF180521C04

**FCC ID:** 2AAGMGM01Q

**Test Model:** GM01Q

**Received Date:** May 21, 2018

**Test Date:** Aug. 01, 2018 ~ Aug. 11, 2018

**Issued Date:** Aug. 23, 2018

**Applicant:** SEQUANS Communications SA

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

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( 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)

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



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### Release Control Record

Issue No.	Description	Date Issued
RF180521C04	Original Release	Aug. 23, 2018

## 1 Certificate of Conformity

**Product:** GM01Q EZlinkLTE modules

**Brand:** SEQUANS

**Test Model:** GM01Q


**Sample Status:** Mass Product


**Applicant:** SEQUANS Communications SA

**Test Date:** Aug. 01, 2018 ~ Aug. 11, 2018

**Standards:** FCC Part 24, Subpart E

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. 23, 2018  
Ivonne Wu / Supervisor

**Approved by :** , **Date:** Aug. 23, 2018  
Dylan Chiou / Project Engineer

## 2 Summary of Test Results

Applied Standard: FCC Part 24 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 24.232	Effective Isotropic Radiated Power	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Meet the requirement.
2.1046 24.232(d)	Peak to Average Ratio	Pass	Meet the requirement of limit.
2.1055 24.235	Frequency Stability	Pass	Meet the requirement of limit.
2.1049 24.238(b)	Occupied Bandwidth	Pass	Meet the requirement of limit.
24.238(b)	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 24.238	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 24.238	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -13.17 dB at 5557.50 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	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	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. 16, 2018	Mar. 15, 2019
Spectrum Analyzer Agilent	N9010A	MY52220314	Nov. 24, 2017	Nov. 23, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	100115	Nov. 23, 2017	Nov. 22, 2018
BILOG Antenna SCHWARZBECK	VULB 9168	9168-153	Dec. 06, 2017	Dec. 05, 2018
Double Ridge Guide Horn Antenna EMCO	3115	5619	Nov. 30, 2017	Nov. 29, 2018
BILOG Antenna SCHWARZBECK	VULB 9168	9168-153	Dec. 06, 2017	Dec. 05, 2018
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RF C-SMS-100-SMS- 120+RFC-SMS-1 00-SMS-400)	Jun. 19, 2018	Jun. 18, 2019
MXG Vector signal generator Agilent	N5182B	MY53050430	Oct. 24, 2017	Oct. 23, 2018
Preamplifier EMCI	EMC 012645	980115	Oct. 20, 2017	Oct. 19, 2018
Preamplifier EMCI	EMC 184045	980116	Oct. 20, 2017	Oct. 19, 2018
Preamplifier EMCI	EMC 330H	980112	Oct. 13, 2017	Oct. 12, 2018
Power Meter Anritsu	ML2495A	1012010	Aug. 15, 2017	Aug. 14, 2018
Power Sensor Anritsu	MA2411B	1315050	Aug. 15, 2017	Aug. 14, 2018
RF Coaxial Cable HUBER+SUHNNER	EMC104-SM-SM-800 0&3000	140811+170717	Oct. 20, 2017	Oct. 19, 2018
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM- 1000(140807)	Oct. 20, 2017	Oct. 19, 2018
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Oct. 20, 2017	Oct. 19, 2018
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
LTE Wireless Communication Test Set Keysight	E7515A	MY56030229	Mar. 14, 2018	Mar. 13, 2019
Temperature & Humidity Chamber	GTH-120-40-CP-AR	MAA1306-019	Sep. 08, 2017	Sep. 07, 2018
DC Power Supply Topward	33010D	807748	Oct. 25, 2016	Oct. 24, 2018
Digital Multimeter Fluke	87-III	70360742	Jun. 29, 2018	Jun. 28, 2019

- 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. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1 GHz if tested.
  4. The IC Site Registration No. is IC7450F-10.



### 3 General Information

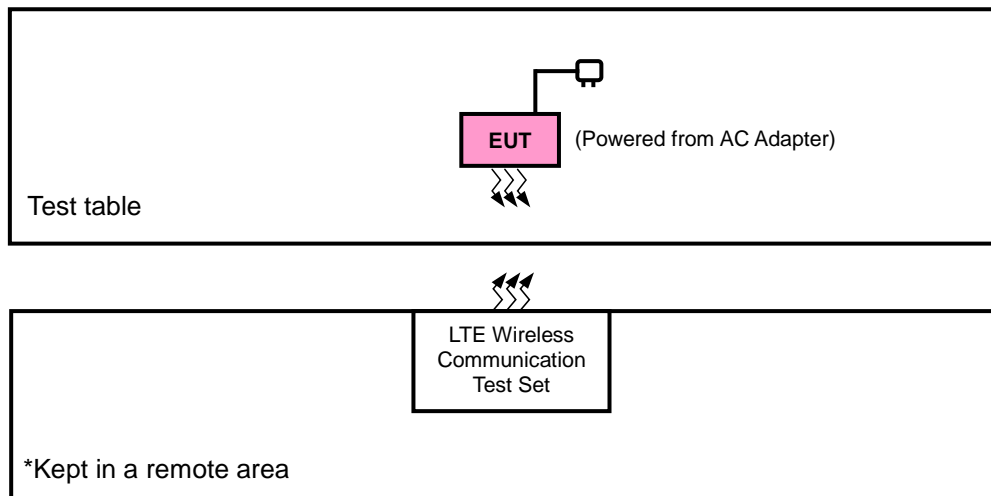
#### 3.1 General Description of EUT

<b>Product</b>	GM01Q EZlinkLTE modules	
<b>Brand</b>	SEQUANS	
<b>Test Model</b>	GM01Q	
<b>Status of EUT</b>	Mass Product	
<b>Power Supply Rating</b>	5.0 Vdc (adapter)	
<b>Modulation Type</b>	LTE	QPSK, 16QAM
<b>Frequency Range</b>	LTE Band 2 (Channel Bandwidth: 5 MHz)	1852.5 ~ 1907.5 MHz
	LTE Band 2 (Channel Bandwidth: 10 MHz)	1855.0 ~ 1905.0 MHz
	LTE Band 2 (Channel Bandwidth: 15 MHz)	1857.5 ~ 1902.5 MHz
	LTE Band 2 (Channel Bandwidth: 20 MHz)	1860.0 ~ 1900.0 MHz
<b>Max. EIRP Power</b>	LTE Band 2 (Channel Bandwidth: 5 MHz)	341.98 mW
	LTE Band 2 (Channel Bandwidth: 10 MHz)	322.85 mW
	LTE Band 2 (Channel Bandwidth: 15 MHz)	306.20 mW
	LTE Band 2 (Channel Bandwidth: 20 MHz)	285.10 mW
<b>Emission Designator</b>	LTE Band 2 (Channel Bandwidth: 5 MHz)	1M09G7D
	LTE Band 2 (Channel Bandwidth: 10 MHz)	1M10G7D
	LTE Band 2 (Channel Bandwidth: 15 MHz)	1M09G7D
	LTE Band 2 (Channel Bandwidth: 20 MHz)	1M10G7D
<b>Antenna Type</b>	Fixed External Antenna with 3 dBi gain	
<b>Accessory Device</b>	Refer to Note as below	
<b>Data Cable Supplied</b>	Refer to Note as below	

Note:

1. 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



#### 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 as the table below. Following channel(s) was (were) selected for the final test as listed below:

Band	EIRP	Radiated Emission
LTE Band 2	Z-plane	X-axis

#### LTE Band 2

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	EIRP	18625 to 19175	18625, 18900, 19175	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18650 to 19150	18650, 18900, 19150	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18675 to 19125	18675, 18900, 19125	15 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Modulation Characteristics	18700 to 19100	18900	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Frequency Stability	18625 to 19175	18625, 19175	5 MHz	QPSK	1 RB / 0 RB Offset
		18650 to 19150	18650, 19150	10 MHz	QPSK	1 RB / 0 RB Offset
		18675 to 19125	18675, 19125	15 MHz	QPSK	1 RB / 0 RB Offset
		18700 to 19100	18700, 19100	20 MHz	QPSK	1 RB / 0 RB Offset
-	Occupied Bandwidth	18625 to 19175	18625, 18900, 19175	5 MHz	QPSK, 16QAM	25 RB / 0 RB Offset
		18650 to 19150	18650, 18900, 19150	10 MHz	QPSK, 16QAM	50 RB / 0 RB Offset
		18675 to 19125	18675, 18900, 19125	15 MHz	QPSK, 16QAM	75 RB / 0 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK, 16QAM	100 RB / 0 RB Offset
-	Peak to Average Ratio	18625 to 19175	18625, 18900, 19175	5 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18650 to 19150	18650, 18900, 19150	10 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18675 to 19125	18675, 18900, 19125	15 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK, 16QAM	1 RB / 0 RB Offset
-	Band Edge	18625 to 19175	18625	5 MHz	QPSK	1 RB / 0 RB Offset 25 RB / 0 RB Offset
			19175	5 MHz	QPSK	1 RB / 24 RB Offset 25 RB / 0 RB Offset
		18650 to 19150	18650	10 MHz	QPSK	1 RB / 0 RB Offset 50 RB / 0 RB Offset
			19150	10 MHz	QPSK	1 RB / 49 RB Offset 50 RB / 0 RB Offset
		18675 to 19125	18675	15 MHz	QPSK	1 RB / 0 RB Offset 75 RB / 0 RB Offset
			19125	15 MHz	QPSK	1 RB / 74 RB Offset 75 RB / 0 RB Offset
		18700 to 19100	18700	20 MHz	QPSK	1 RB / 0 RB Offset 100 RB / 0 RB Offset
			19100	20 MHz	QPSK	1 RB / 99 RB Offset 100 RB / 0 RB Offset

EUT Configure Mode	Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
-	Conducted Emission	18625 to 19175	18625, 18900, 19175	5 MHz	QPSK	1 RB / 0 RB Offset
		18650 to 19150	18650, 18900, 19150	10 MHz	QPSK	1 RB / 0 RB Offset
		18675 to 19125	18675, 18900, 19125	15 MHz	QPSK	1 RB / 0 RB Offset
		18700 to 19100	18700, 18900, 19100	20 MHz	QPSK	1 RB / 0 RB Offset
-	Radiated Emission	18625 to 19175	18625, 18900, 19175	5 MHz	QPSK	1 RB / 0 RB Offset
		18700 to 19100	18700, 18900, 19100	20 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	26 deg. C, 58 % RH	120 Vac, 60 Hz	Thomas Wei
Modulation Characteristics	26 deg. C, 58 % RH	3.8 Vdc	Getaz Yang
Frequency Stability	26 deg. C, 58 % RH	3.8 Vdc	Getaz Yang
Occupied Bandwidth	26 deg. C, 58 % RH	3.8 Vdc	Getaz Yang
Band Edge	26 deg. C, 58 % RH	3.8 Vdc	Getaz Yang
Peak to Average Ratio	26 deg. C, 58 % RH	3.8 Vdc	Getaz Yang
Conducted Emission	26 deg. C, 58 % RH	3.8 Vdc	Getaz Yang
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 24**

**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 / Portable station are limited to 2 watts e.i.r.p.

#### 4.1.2 Test Procedures

##### **EIRP / ERP Measurement:**

- a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 10 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.  $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$ . E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole,  $E.R.P \text{ power} = E.I.R.P \text{ power} - 2.15 \text{ dB}$ .

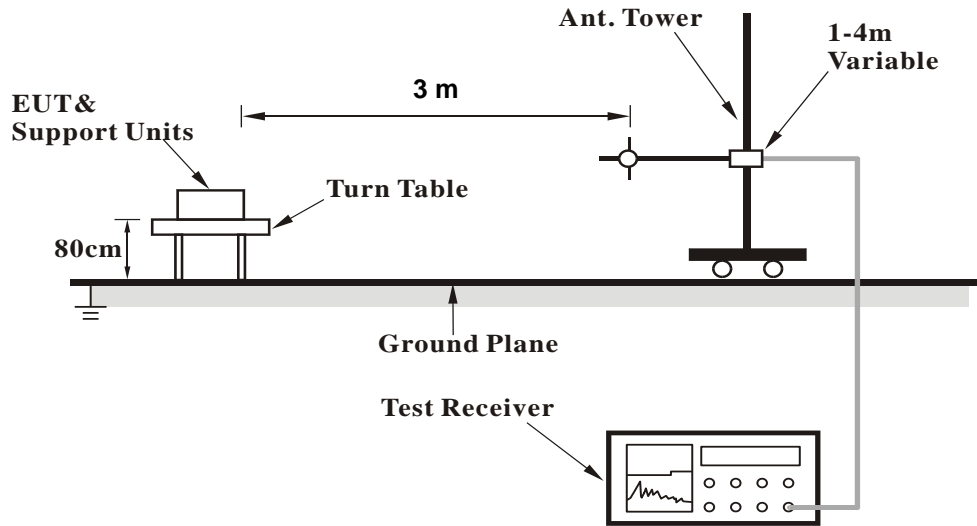
##### **Conducted Power Measurement:**

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.

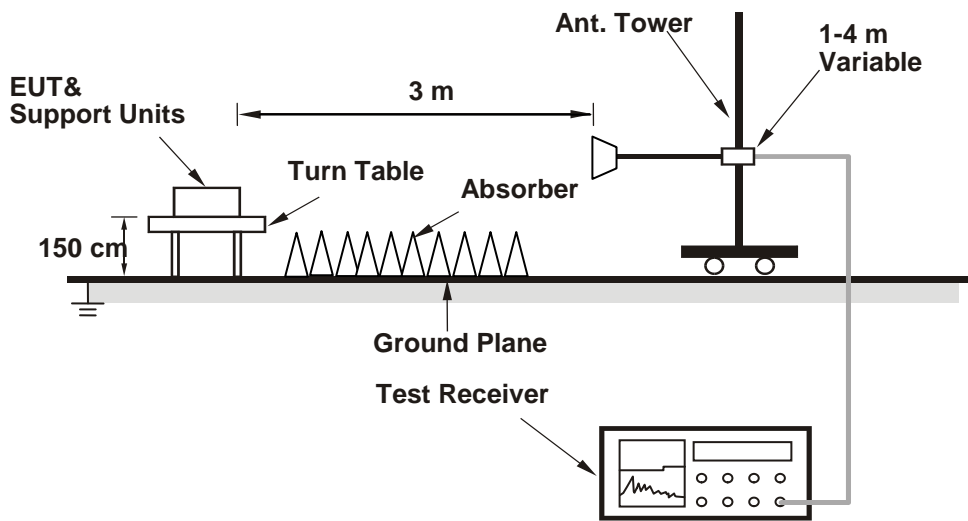
4.1.3 Test Setup

**EIRP / ERP Measurement:**

**<Radiated Emission below or equal 1 GHz>**

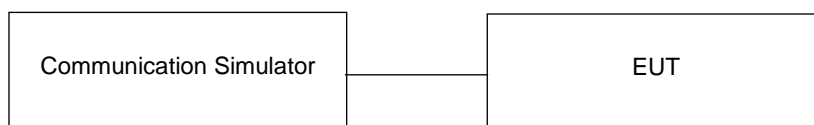


**<Radiated Emission above 1 GHz>**



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)**

BW (MHz): 5										
Test Frequency ID	N <sub>UL</sub>	Frequency of Uplink [MHz]	N <sub>DL</sub>	Frequency of Downlink [MHz]	Test Configuration Initial of Power				EUT	
					Modulation	RB Size	RB Offset	Narrowband Index	Cell power (dBm/15kHz)	power (dBm)
Low Range	18625	1852.5	625	1932.5	QPSK	1	0	0	-85	22.03
					QPSK	1	5	0	-85	22.05
					QPSK	1	0	1	-85	22.05
					QPSK	1	5	1	-85	22.05
					QPSK	1	0	3	-85	22.13
					QPSK	1	5	3	-85	22.12
					QPSK	3	0	0	-85	21.23
					QPSK	3	3	3	-85	21.43
					QPSK	6	0	0	-85	21.21
					QPSK	6	0	1	-85	21.19
					QPSK	6	0	3	-85	21.42
					16QAM	1	0	0	-85	22.3
					16QAM	1	5	0	-85	22.26
					16QAM	1	0	1	-85	22.3
					16QAM	1	5	1	-85	22.29
					16QAM	1	0	3	-85	22.07
					16QAM	1	5	3	-85	22.44
					16QAM	3	0	0	-85	21.16
					16QAM	3	3	3	-85	21.42
					16QAM	5	0	0	-85	20.31
16QAM	5	0	1	-85	20.31					
16QAM	5	0	3	-85	20.43					
Mid Range	18900	1880	900	1960	QPSK	1	0	0	-85	22.45
					QPSK	1	5	0	-85	22.42
					QPSK	1	0	1	-85	22.28
					QPSK	1	5	1	-85	22.24
					QPSK	1	0	3	-85	22.52
					QPSK	1	5	3	-85	22.55
					QPSK	3	0	0	-85	21.61
					QPSK	3	3	3	-85	21.62
					QPSK	6	0	0	-85	21.56
					QPSK	6	0	1	-85	21.59
					QPSK	6	0	3	-85	21.59
					16QAM	1	0	0	-85	22.25
					16QAM	1	5	0	-85	22.59
					16QAM	1	0	1	-85	22.56
					16QAM	1	5	1	-85	22.56
					16QAM	1	0	3	-85	22.61
					16QAM	1	5	3	-85	22.558
					16QAM	3	0	0	-85	21.75
					16QAM	3	3	3	-85	21.79
					16QAM	5	0	0	-85	20.66
16QAM	5	0	1	-85	20.62					
16QAM	5	0	3	-85	20.76					

Test Frequency ID	N <sub>UL</sub>	Frequency of Uplink [MHz]	N <sub>DL</sub>	Frequency of Downlink [MHz]	Test Configuration Initial of Power				EUT	
					Modulation	RB Size	RB Offset	Narrowband Index	Cell power (dBm/15kHz)	power (dBm)
High Range	19175	1907.5	1175	1987.5	QPSK	1	0	0	-85	22.74
					QPSK	1	5	0	-85	22.75
					QPSK	1	0	1	-85	22.79
					QPSK	1	5	1	-85	22.81
					QPSK	1	0	3	-85	22.75
					QPSK	1	5	3	-85	22.84
					QPSK	3	0	0	-85	21.78
					QPSK	3	3	3	-85	21.81
					QPSK	6	0	0	-85	21.78
					QPSK	6	0	1	-85	21.82
					QPSK	6	0	3	-85	21.85
					16QAM	1	0	0	-85	22.7
					16QAM	1	5	0	-85	23.06
					16QAM	1	0	1	-85	22.76
					16QAM	1	5	1	-85	22.82
					16QAM	1	0	3	-85	23.15
					16QAM	1	5	3	-85	23.16
					16QAM	3	0	0	-85	21.8
					16QAM	3	3	3	-85	21.87
					16QAM	5	0	0	-85	20.82
16QAM	5	0	1	-85	20.96					
16QAM	5	0	3	-85	20.91					



BW (MHz): 10

Test Frequency ID	N <sub>UL</sub>	Frequency of Uplink [MHz]	N <sub>DL</sub>	Frequency of Downlink [MHz]	Test Configuration Initial of Power				EUT	
					Modulation	RB Size	RB Offset	Narrowband Index	Cell power (dBm/15kHz)	power (dBm)
Low Range	18650	1855	650	1935	QPSK	1	0	0	-85	22.36
					QPSK	1	5	0	-85	22.32
					QPSK	1	0	3	-85	21.94
					QPSK	1	5	3	-85	21.99
					QPSK	1	0	7	-85	21.13
					QPSK	1	5	7	-85	21.78
					QPSK	4	0	0	-85	22.34
					QPSK	4	2	7	-85	21.83
					QPSK	6	0	0	-85	21.46
					QPSK	6	0	7	-85	20.94
					16QAM	1	0	0	-85	22.12
					16QAM	1	5	0	-85	21.83
					16QAM	1	0	3	-85	21.32
					16QAM	1	5	3	-85	21.18
					16QAM	1	0	7	-85	20.96
					16QAM	1	5	7	-85	21.79
					16QAM	4	2	0	-85	21.49
					16QAM	4	2	7	-85	20.44
16QAM	5	0	0	-85	21.43					
16QAM	5	0	7	-85	20.46					
Mid Range	18900	1880	900	1960	QPSK	1	0	0	-85	22.21
					QPSK	1	5	0	-85	22.39
					QPSK	1	0	3	-85	22.35
					QPSK	1	5	3	-85	22.33
					QPSK	1	0	7	-85	22.38
					QPSK	1	5	7	-85	22.37
					QPSK	4	0	0	-85	22.24
					QPSK	4	2	7	-85	22.31
					QPSK	6	0	0	-85	21.41
					QPSK	6	0	7	-85	21.42
					16QAM	1	0	0	-85	22.63
					16QAM	1	5	0	-85	22.74
					16QAM	1	0	3	-85	22.29
					16QAM	1	5	3	-85	22.65
					16QAM	1	0	7	-85	22.69
					16QAM	1	5	7	-85	22.69
					16QAM	4	2	0	-85	21.48
					16QAM	4	2	7	-85	21.47
16QAM	5	0	0	-85	21.43					
16QAM	5	0	7	-85	21.31					
High Range	19150	1905	1150	1985	QPSK	1	0	0	-85	22.44
					QPSK	1	5	0	-85	22.47
					QPSK	1	5	7	-85	22.54
					QPSK	1	0	3	-85	22.51
					QPSK	1	5	3	-85	22.53
					QPSK	1	0	7	-85	22.53
					QPSK	4	0	0	-85	22.45
					QPSK	4	2	7	-85	22.51
					QPSK	6	0	0	-85	21.58
					QPSK	6	0	7	-85	21.59
					16QAM	1	0	0	-85	22.38
					16QAM	1	5	0	-85	22.29
					16QAM	1	0	3	-85	22.17
					16QAM	1	5	3	-85	22.43
					16QAM	1	0	7	-85	22.56
					16QAM	1	5	7	-85	22.22
					16QAM	4	2	0	-85	21.58
					16QAM	4	2	7	-85	21.7
16QAM	5	0	0	-85	21.63					
16QAM	5	0	7	-85	21.77					

BW (MHz): 15										
Test Frequency ID	N <sub>UL</sub>	Frequency of Uplink [MHz]	N <sub>DL</sub>	Frequency of Downlink [MHz]	Test Configuration Initial of Power				EUT	
					Modulation	RB Size	RB Offset	Narrowband Index	Cell power (dBm/15kHz)	power (dBm)
Low Range	18675	1857.5	675	1937.5	QPSK	1	0	0	-85	22.16
					QPSK	1	5	0	-85	22.12
					QPSK	1	0	5	-85	22.14
					QPSK	1	5	5	-85	22.15
					QPSK	1	0	11	-85	22.17
					QPSK	1	5	11	-85	22.17
					QPSK	3	0	0	-85	22.18
					QPSK	3	3	11	-85	22.21
					QPSK	6	0	0	-85	22.12
					QPSK	6	0	11	-85	22.19
					16QAM	1	0	0	-85	22.11
					16QAM	1	5	0	-85	21.96
					16QAM	1	0	5	-85	21.97
					16QAM	1	5	5	-85	21.96
					16QAM	1	0	11	-85	22.23
					16QAM	1	5	11	-85	21.31
					16QAM	3	0	0	-85	22.01
					16QAM	3	3	11	-85	22
16QAM	5	0	0	-85	22.02					
16QAM	5	0	11	-85	22.02					
Mid Range	18900	1880	900	1960	QPSK	1	0	0	-85	22.27
					QPSK	1	5	0	-85	22.24
					QPSK	1	0	5	-85	22.21
					QPSK	1	5	5	-85	22.19
					QPSK	1	0	11	-85	22.08
					QPSK	1	5	11	-85	22.25
					QPSK	3	0	0	-85	22.25
					QPSK	3	3	11	-85	22.34
					QPSK	6	0	0	-85	22.21
					QPSK	6	0	11	-85	22.31
					16QAM	1	0	0	-85	22.28
					16QAM	1	5	0	-85	22.05
					16QAM	1	0	5	-85	22.05
					16QAM	1	5	5	-85	22.06
					16QAM	1	0	11	-85	22.15
					16QAM	1	5	11	-85	22.13
					16QAM	3	0	0	-85	22.01
					16QAM	3	3	11	-85	22.14
16QAM	5	0	0	-85	22.14					
16QAM	5	0	11	-85	22.3					
High Range	19125	1902.5	1125	1982.5	QPSK	1	0	0	-85	22.44
					QPSK	1	5	11	-85	22.58
					QPSK	1	0	5	-85	22.49
					QPSK	1	5	5	-85	22.51
					QPSK	1	0	11	-85	22.56
					QPSK	3	0	0	-85	22.57
					QPSK	3	3	11	-85	22.61
					QPSK	6	0	0	-85	22.54
					QPSK	6	0	11	-85	22.62
					16QAM	1	0	0	-85	22.48
					16QAM	1	5	0	-85	22.13
					16QAM	1	0	5	-85	22.2
					16QAM	1	5	5	-85	22.21
					16QAM	1	0	11	-85	22.27
					16QAM	1	5	11	-85	22.21
					16QAM	3	0	0	-85	22.51
					16QAM	3	3	11	-85	22.61
					16QAM	5	0	0	-85	22.34
16QAM	5	0	11	-85	22.49					

BW (MHz): 20

Test Frequency ID	N <sub>UL</sub>	Frequency of Uplink [MHz]	N <sub>DL</sub>	Frequency of Downlink [MHz]	Test Configuration Initial of Power				EUT	
					Modulation	RB Size	RB Offset	Narrowband Index	Cell power (dBm/15kHz)	power (dBm)
Low Range	18700	1860	700	1940	QPSK	1	0	0	-85	22.13
					QPSK	1	5	0	-85	22.13
					QPSK	1	0	7	-85	22.25
					QPSK	1	5	7	-85	22.22
					QPSK	1	0	15	-85	22.27
					QPSK	1	5	15	-85	22.28
					QPSK	3	0	0	-85	22.18
					QPSK	3	3	15	-85	22.3
					QPSK	6	0	0	-85	22.19
					QPSK	6	0	15	-85	22.28
					16QAM	1	0	0	-85	21.94
					16QAM	1	5	0	-85	21.97
					16QAM	1	0	7	-85	22.31
					16QAM	1	5	7	-85	22.67
					16QAM	1	0	15	-85	21.08
					16QAM	1	5	15	-85	22.09
					16QAM	3	0	0	-85	21.86
					16QAM	3	3	15	-85	22.07
16QAM	5	0	0	-85	22.07					
16QAM	5	0	15	-85	22.15					
Mid Range	18900	1880	900	1960	QPSK	1	0	0	-85	22.28
					QPSK	1	5	0	-85	22.29
					QPSK	1	0	7	-85	22.31
					QPSK	1	5	7	-85	22.36
					QPSK	1	0	15	-85	22.39
					QPSK	1	5	15	-85	22.38
					QPSK	3	0	0	-85	22.33
					QPSK	3	3	15	-85	22.36
					QPSK	6	0	0	-85	22.27
					QPSK	6	0	15	-85	22.41
					16QAM	1	0	0	-85	22.84
					16QAM	1	5	0	-85	22.09
					16QAM	1	0	7	-85	22.02
					16QAM	1	5	7	-85	22.16
					16QAM	1	0	15	-85	22.04
					16QAM	1	5	15	-85	22.24
					16QAM	3	0	0	-85	22.12
					16QAM	3	3	15	-85	22.43
16QAM	5	0	0	-85	22.14					
16QAM	5	0	15	-85	22.36					
High Range	19100	1900	1100	1980	QPSK	1	0	0	-85	22.39
					QPSK	1	5	0	-85	22.41
					QPSK	1	0	7	-85	22.24
					QPSK	1	5	7	-85	22.23
					QPSK	1	0	15	-85	22.58
					QPSK	1	5	15	-85	22.57
					QPSK	3	0	0	-85	22.42
					QPSK	3	3	15	-85	22.61
					QPSK	6	0	0	-85	22.44
					QPSK	6	0	15	-85	22.59
					16QAM	1	0	0	-85	22.17
					16QAM	1	5	0	-85	22.25
					16QAM	1	0	7	-85	22.51
					16QAM	1	5	7	-85	22.44
					16QAM	1	0	15	-85	22.32
					16QAM	1	5	15	-85	22.34
					16QAM	3	0	0	-85	22.18
					16QAM	3	3	15	-85	22.46
16QAM	5	0	0	-85	22.34					
16QAM	5	0	15	-85	22.61					

**EIRP Power (dBm)**

LTE Band 2							
Channel Bandwidth: 5 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Z	18625	1852.5	-17.32	36.57	19.25	84.14	H
	18900	1880.0	-17.70	37.22	19.52	89.54	
	19175	1907.5	-17.34	37.18	19.84	96.38	
	18625	1852.5	-13.02	37.65	24.63	290.40	V
	18900	1880.0	-12.53	37.58	25.05	319.89	
	19175	1907.5	-12.14	37.48	25.34	341.98	
Channel Bandwidth: 5 MHz / 16QAM							
Z	18625	1852.5	-18.30	36.57	18.27	67.14	H
	18900	1880.0	-18.68	37.22	18.54	71.45	
	19175	1907.5	-18.32	37.18	18.86	76.91	
	18625	1852.5	-14.00	37.65	23.65	231.74	V
	18900	1880.0	-13.51	37.58	24.07	255.27	
	19175	1907.5	-13.12	37.48	24.36	272.90	

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

LTE Band 2							
Channel Bandwidth: 10 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Z	18650	1855.0	-17.57	36.57	19.00	79.43	H
	18900	1880.0	-17.95	37.22	19.27	84.53	
	19150	1905.0	-17.59	37.18	19.59	90.99	
	18650	1855.0	-13.27	37.65	24.38	274.16	V
	18900	1880.0	-12.78	37.58	24.80	302.00	
	19150	1905.0	-12.39	37.48	25.09	322.85	
Channel Bandwidth: 10 MHz / 16QAM							
Z	18650	1855.0	-18.58	36.57	17.99	62.95	H
	18900	1880.0	-18.96	37.22	18.26	66.99	
	19150	1905.0	-18.60	37.18	18.58	72.11	
	18650	1855.0	-14.28	37.65	23.37	217.27	V
	18900	1880.0	-13.79	37.58	23.79	239.33	
	19150	1905.0	-13.40	37.48	24.08	255.86	

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

LTE Band 2							
Channel Bandwidth: 15 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Z	18675	1857.5	-17.80	36.57	18.77	75.34	H
	18900	1880.0	-18.18	37.22	19.04	80.17	
	19125	1902.5	-17.82	37.18	19.36	86.30	
	18675	1857.5	-13.50	37.65	24.15	260.02	V
	18900	1880.0	-13.01	37.58	24.57	286.42	
	19125	1902.5	-12.62	37.48	24.86	306.20	
Channel Bandwidth: 15 MHz / 16QAM							
Z	18675	1857.5	-18.83	36.57	17.74	59.43	H
	18900	1880.0	-19.21	37.22	18.01	63.24	
	19125	1902.5	-18.85	37.18	18.33	68.08	
	18675	1857.5	-14.53	37.65	23.12	205.12	V
	18900	1880.0	-14.04	37.58	23.54	225.94	
	19125	1902.5	-13.65	37.48	23.83	241.55	

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

LTE Band 2							
Channel Bandwidth: 20 MHz / QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Z	18700	1860.0	-18.11	36.57	18.46	70.15	H
	18900	1880.0	-18.49	37.22	18.73	74.64	
	19100	1900.0	-18.13	37.18	19.05	80.35	
	18700	1860.0	-13.81	37.65	23.84	242.10	V
	18900	1880.0	-13.32	37.58	24.26	266.69	
	19100	1900.0	-12.93	37.48	24.55	285.10	
Channel Bandwidth: 20 MHz / 16QAM							
Z	18700	1860.0	-19.22	36.57	17.35	54.33	H
	18900	1880.0	-19.60	37.22	17.62	57.81	
	19100	1900.0	-19.24	37.18	17.94	62.23	
	18700	1860.0	-14.92	37.65	22.73	187.50	V
	18900	1880.0	-14.43	37.58	23.15	206.54	
	19100	1900.0	-14.04	37.48	23.44	220.80	

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

## 4.2 Modulation Characteristics Measurement

### 4.2.1 Limits of Modulation Characteristics

N/A

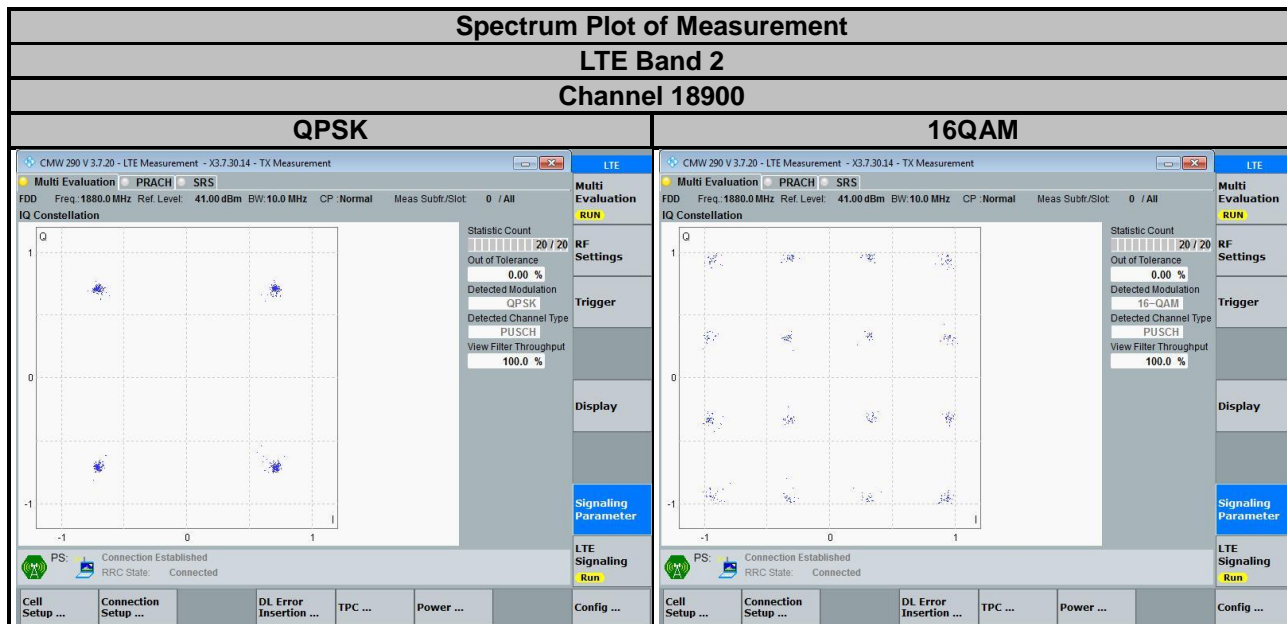
### 4.2.2 Test Setup



### 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

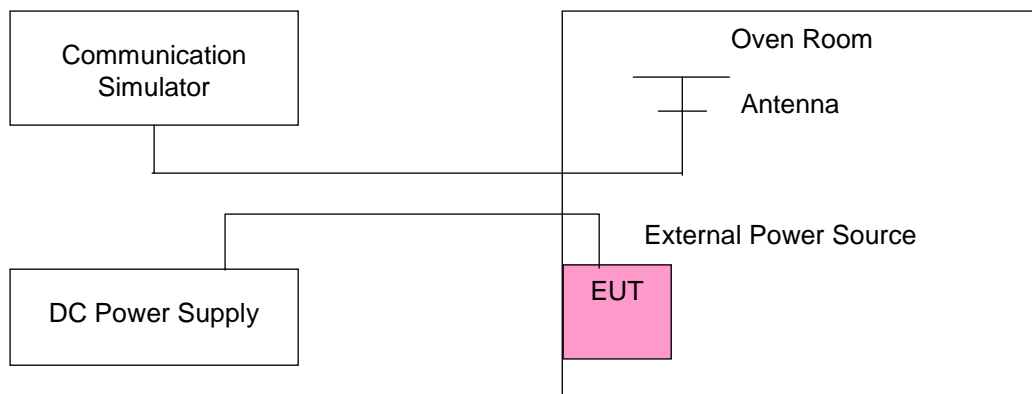
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

#### 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  $\pm 0.5$  °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 2				Limit (ppm)
	Channel Bandwidth: 5 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
3.8	1852.500002	0.001	1907.500003	0.001	2.5
3.1	1852.500003	0.001	1907.500003	0.002	2.5
4.5	1852.500004	0.002	1907.500002	0.001	2.5

**Note:** The applicant defined the normal working voltage of the battery is from 3.1 Vdc to 4.5 Vdc.

##### Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2				Limit (ppm)
	Channel Bandwidth: 5 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	1852.500003	0.002	1907.500003	0.001	2.5
-20	1852.500003	0.002	1907.500002	0.001	2.5
-10	1852.500004	0.002	1907.500002	0.001	2.5
0	1852.500004	0.002	1907.500004	0.002	2.5
10	1852.500001	0.001	1907.500003	0.002	2.5
20	1852.499999	-0.001	1907.499997	-0.001	2.5
30	1852.499998	-0.001	1907.499999	-0.001	2.5
40	1852.499998	-0.001	1907.499998	-0.001	2.5
50	1852.499997	-0.002	1907.499997	-0.002	2.5
60	1852.499997	-0.002	1907.499998	-0.001	2.5
70	1852.499997	-0.001	1907.499998	-0.001	2.5
50	1852.499998	-0.001	1907.499998	-0.001	2.5
85	1852.499998	-0.001	1907.499996	-0.002	2.5

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2				Limit (ppm)
	Channel Bandwidth: 10 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
3.8	1855.000003	0.002	1905.000001	0.001	2.5
3.1	1855.000002	0.001	1905.000002	0.001	2.5
4.5	1855.000001	0.001	1905.000001	0.001	2.5

**Note:** The applicant defined the normal working voltage of the battery is from 3.1 Vdc to 4.5 Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2				Limit (ppm)
	Channel Bandwidth: 10 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	1855.000003	0.001	1905.000003	0.002	2.5
-20	1855.000004	0.002	1905.000004	0.002	2.5
-10	1855.000001	0.001	1905.000004	0.002	2.5
0	1855.000003	0.002	1905.000003	0.002	2.5
10	1855.000002	0.001	1905.000002	0.001	2.5
20	1854.999999	-0.001	1904.999996	-0.002	2.5
30	1854.999997	-0.002	1904.999999	-0.001	2.5
40	1854.999999	-0.001	1904.999998	-0.001	2.5
50	1854.999999	-0.001	1904.999999	-0.001	2.5
60	1854.999996	-0.002	1904.999996	-0.002	2.5
70	1854.999999	-0.001	1904.999999	-0.001	2.5
50	1854.999997	-0.002	1904.999998	-0.001	2.5
85	1854.999997	-0.001	1904.999999	-0.001	2.5

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2				Limit (ppm)
	Channel Bandwidth: 15 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
3.8	1857.500002	0.001	1902.500003	0.002	2.5
3.1	1857.500004	0.002	1902.500003	0.002	2.5
4.5	1857.500004	0.002	1902.500003	0.002	2.5

**Note:** The applicant defined the normal working voltage of the battery is from 3.1 Vdc to 4.5 Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2				Limit (ppm)
	Channel Bandwidth: 15 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	1857.500001	0.001	1902.500004	0.002	2.5
-20	1857.500002	0.001	1902.500002	0.001	2.5
-10	1857.500002	0.001	1902.500002	0.001	2.5
0	1857.500003	0.001	1902.500003	0.002	2.5
10	1857.500003	0.002	1902.500004	0.002	2.5
20	1857.499998	-0.001	1902.499999	-0.001	2.5
30	1857.499999	-0.001	1902.499996	-0.002	2.5
40	1857.499997	-0.002	1902.499997	-0.002	2.5
50	1857.499999	-0.001	1902.499998	-0.001	2.5
60	1857.499996	-0.002	1902.499999	-0.001	2.5
70	1857.499997	-0.002	1902.499998	-0.001	2.5
50	1857.499997	-0.002	1902.499998	-0.001	2.5
85	1857.499999	-0.001	1902.499998	-0.001	2.5

## Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2				Limit (ppm)
	Channel Bandwidth: 20 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
3.8	1860.000003	0.001	1900.000002	0.001	2.5
3.1	1860.000002	0.001	1900.000004	0.002	2.5
4.5	1860.000002	0.001	1900.000003	0.002	2.5

**Note:** The applicant defined the normal working voltage of the battery is from 3.1 Vdc to 4.5 Vdc.

## Frequency Error vs. Temperature

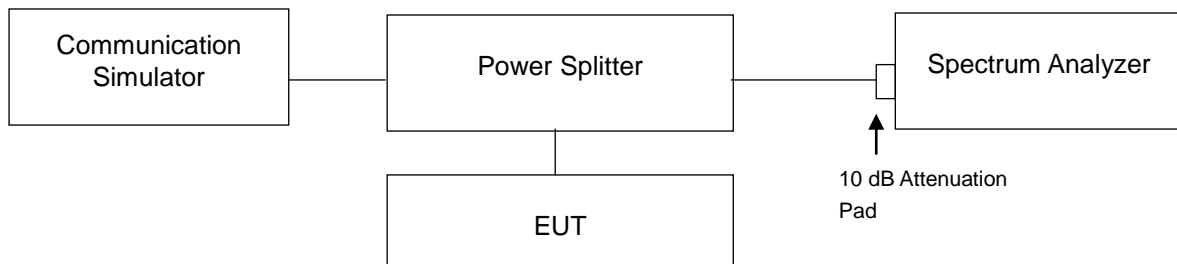
Temp. (°C)	LTE Band 2				Limit (ppm)
	Channel Bandwidth: 20 MHz				
	Low Channel		High Channel		
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)	
-30	1860.000004	0.002	1900.000003	0.002	2.5
-20	1860.000003	0.002	1900.000004	0.002	2.5
-10	1860.000002	0.001	1900.000001	0.001	2.5
0	1860.000002	0.001	1900.000003	0.001	2.5
10	1860.000003	0.001	1900.000004	0.002	2.5
20	1859.999999	-0.001	1899.999997	-0.002	2.5
30	1859.999998	-0.001	1899.999997	-0.002	2.5
40	1859.999996	-0.002	1899.999997	-0.002	2.5
50	1859.999998	-0.001	1899.999999	-0.001	2.5
60	1859.999997	-0.001	1899.999998	-0.001	2.5
70	1859.999997	-0.002	1899.999999	-0.001	2.5
50	1859.999997	-0.001	1899.999996	-0.002	2.5
85	1859.999998	-0.001	1899.999997	-0.001	2.5

## 4.4 Occupied Bandwidth Measurement

### 4.4.1 Test Procedure

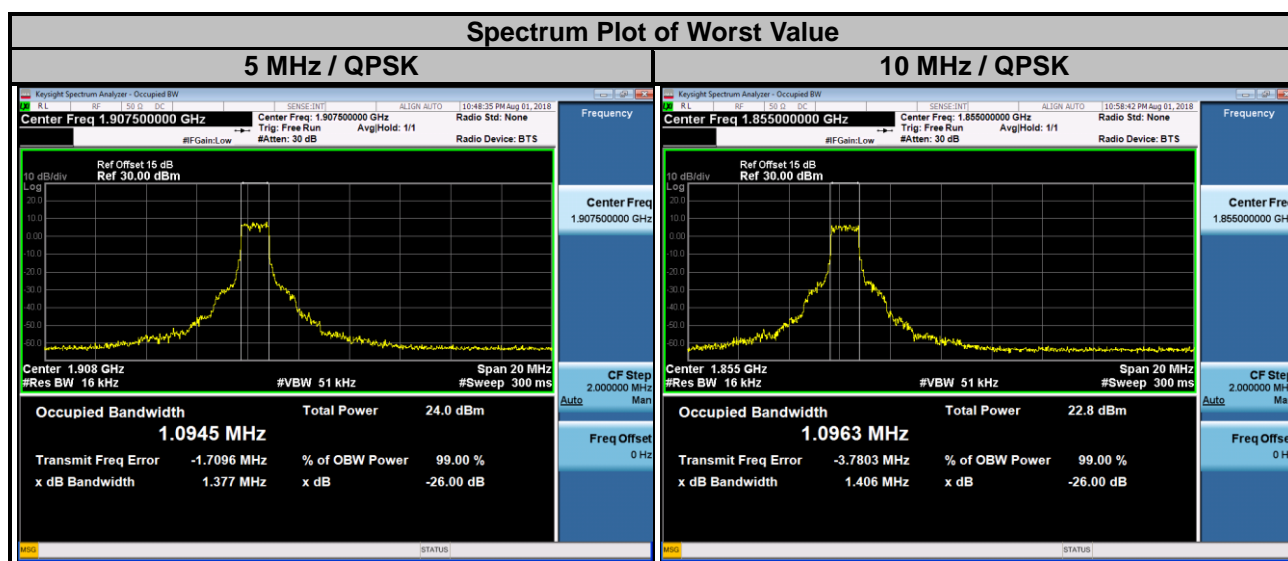
The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

### 4.4.2 Test Setup

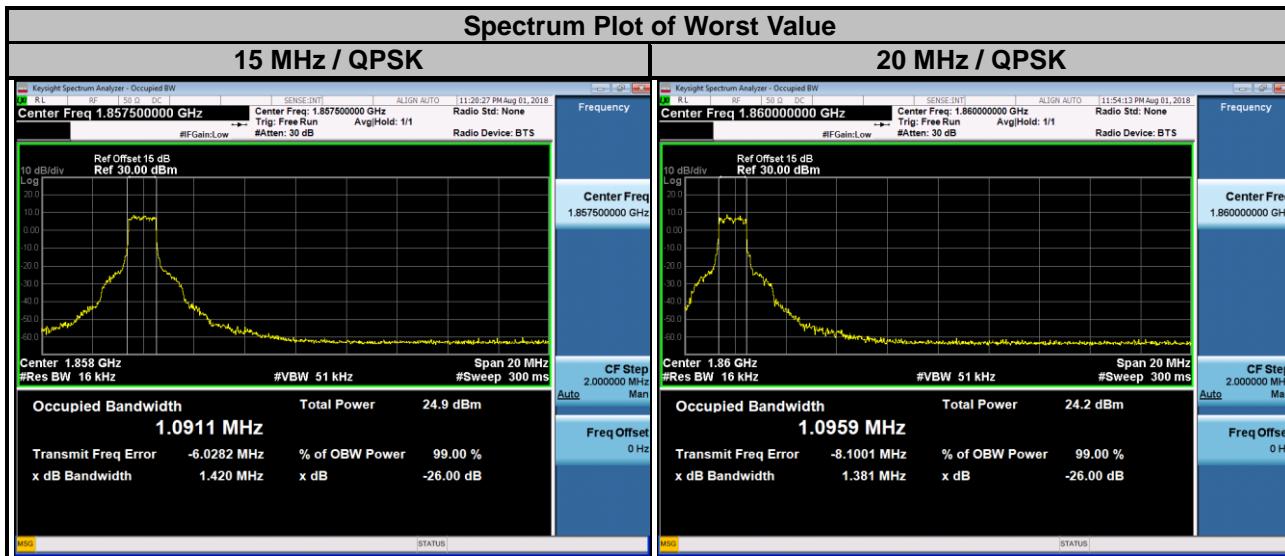


### 4.4.3 Test Result

LTE Band 2							
Channel Bandwidth: 5 MHz				Channel Bandwidth: 10 MHz			
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	
		QPSK	16QAM			QPSK	16QAM
18625	1852.5	1.0888	0.9229	18650	1855.0	1.0963	0.9161
18900	1880.0	1.0874	0.9237	18900	1880.0	1.0916	0.9173
19175	1907.5	1.0945	0.9246	19150	1905.0	1.0916	0.9182



LTE Band 2							
Channel Bandwidth: 15 MHz				Channel Bandwidth: 20 MHz			
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)		Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	
		QPSK	16QAM			QPSK	16QAM
18675	1857.5	1.0911	0.9305	18700	1860.0	1.0959	0.9172
18900	1880.0	1.0878	0.9271	18900	1880.0	1.0876	0.9176
19125	1902.5	1.0873	0.9236	19100	1900.0	1.0938	0.9166

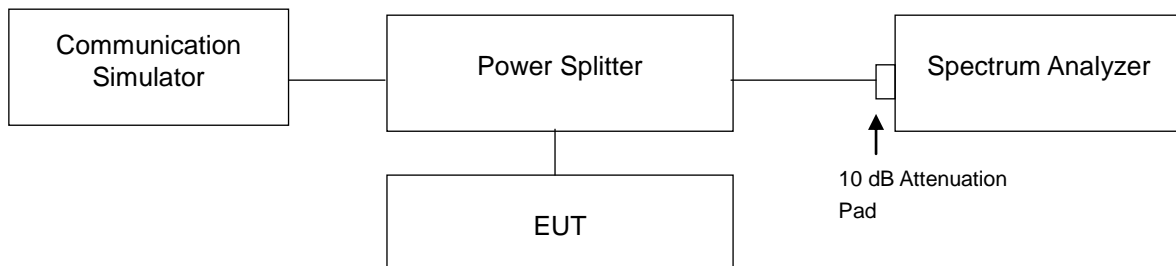


## 4.5 Band Edge Measurement

### 4.5.1 Limits of Band Edge Measurement

Power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

### 4.5.2 Test Setup

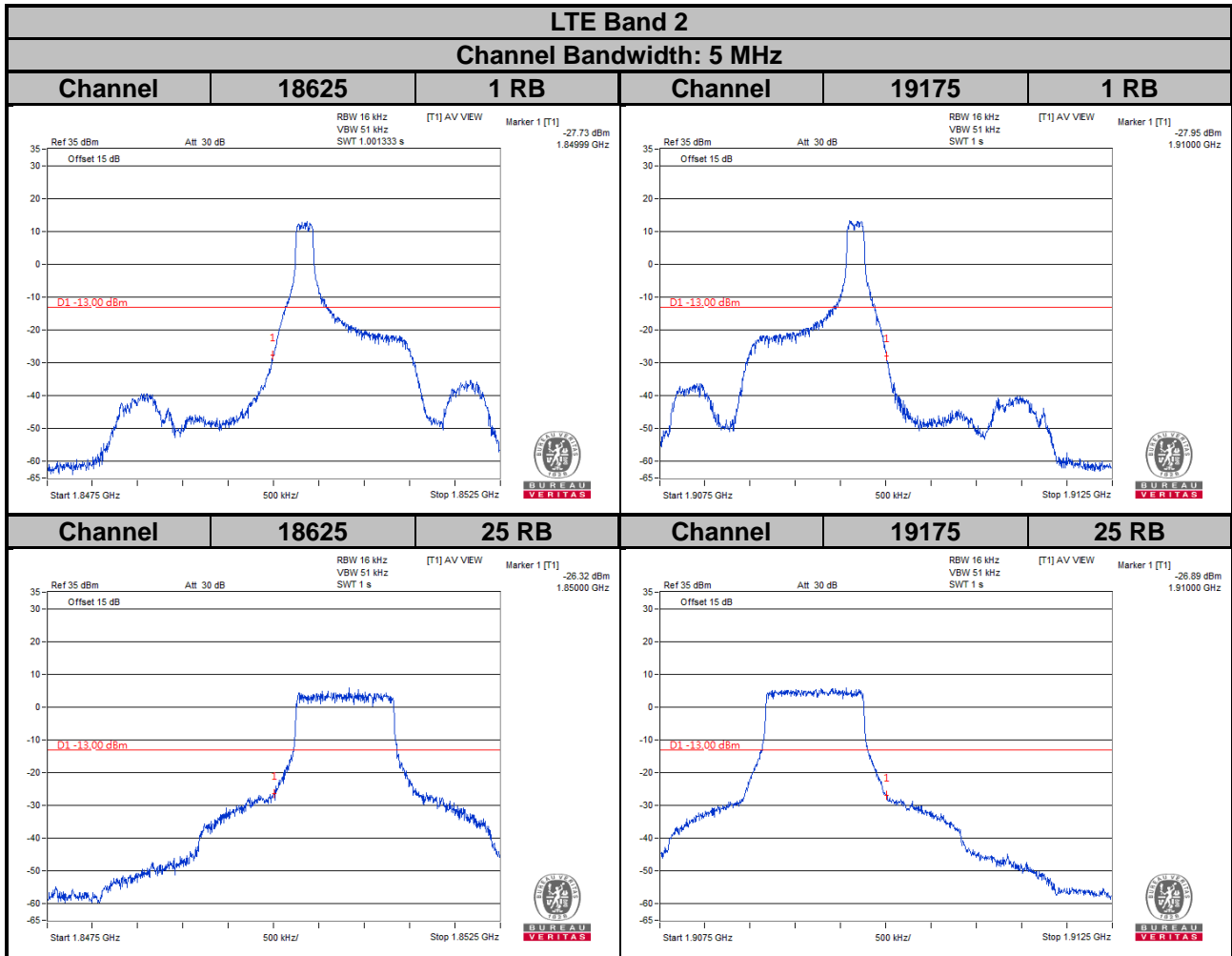


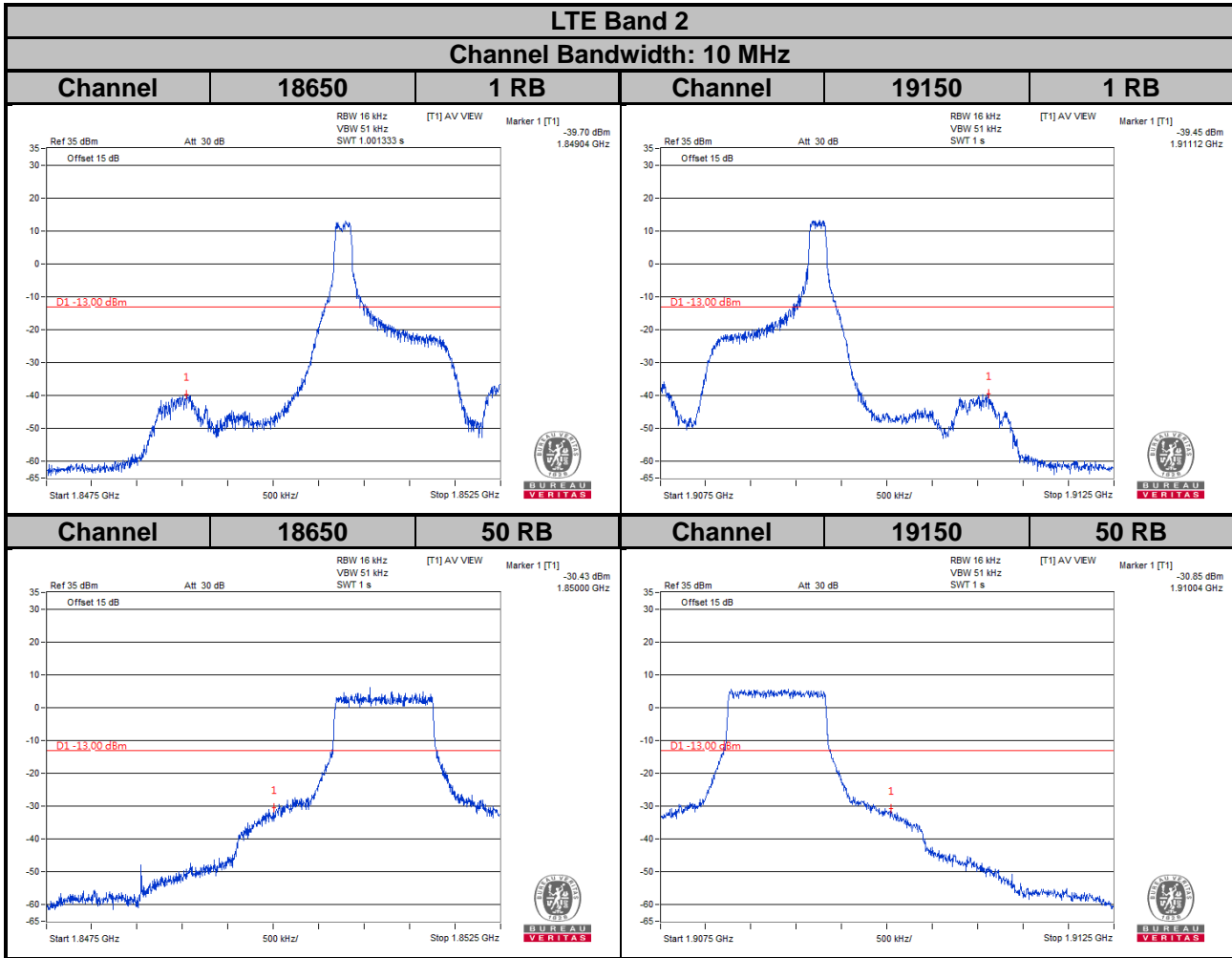
### 4.5.3 Test Procedures

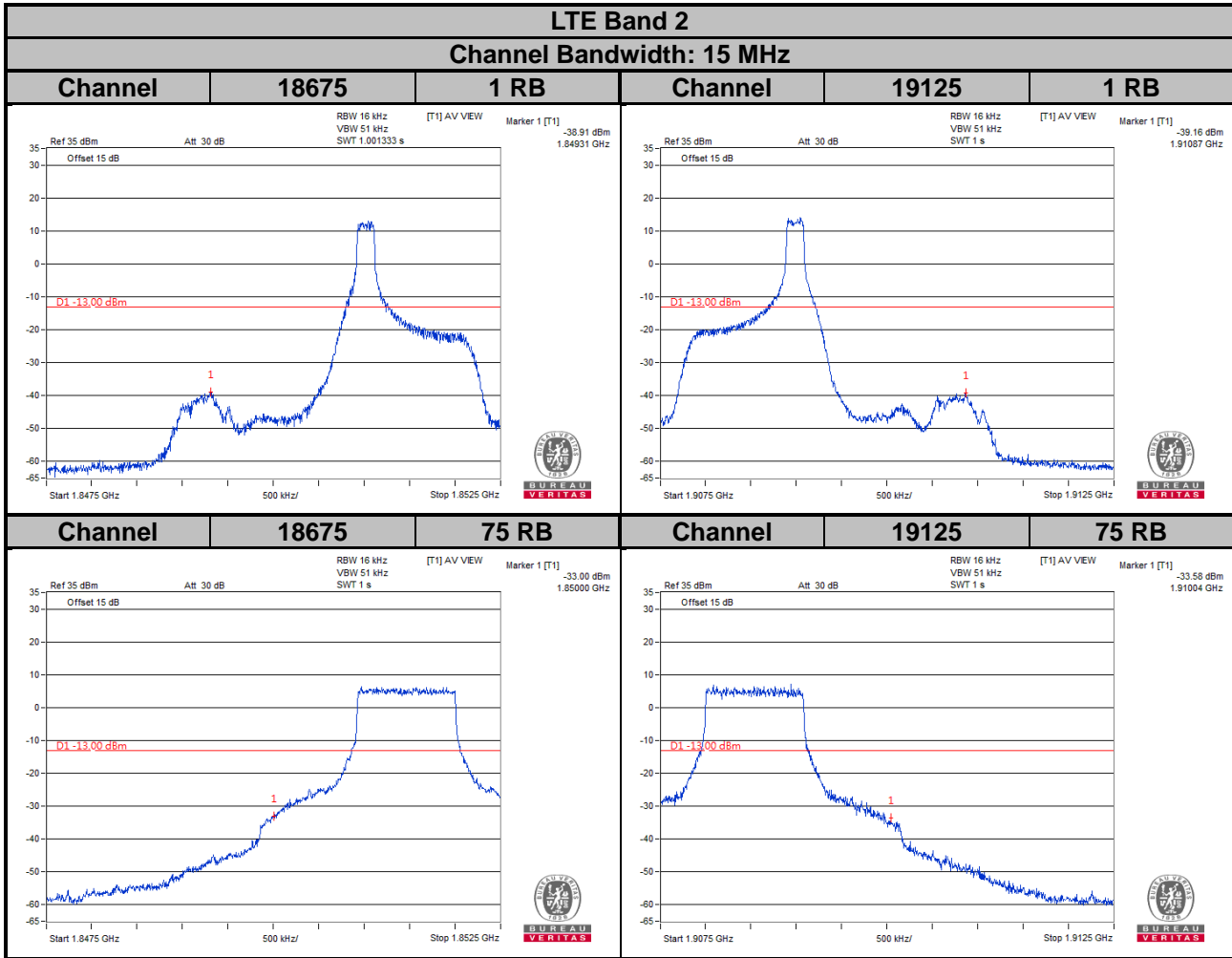
- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 16 kHz and VB of the spectrum is 51 kHz.
- Record the max trace plot into the test report.

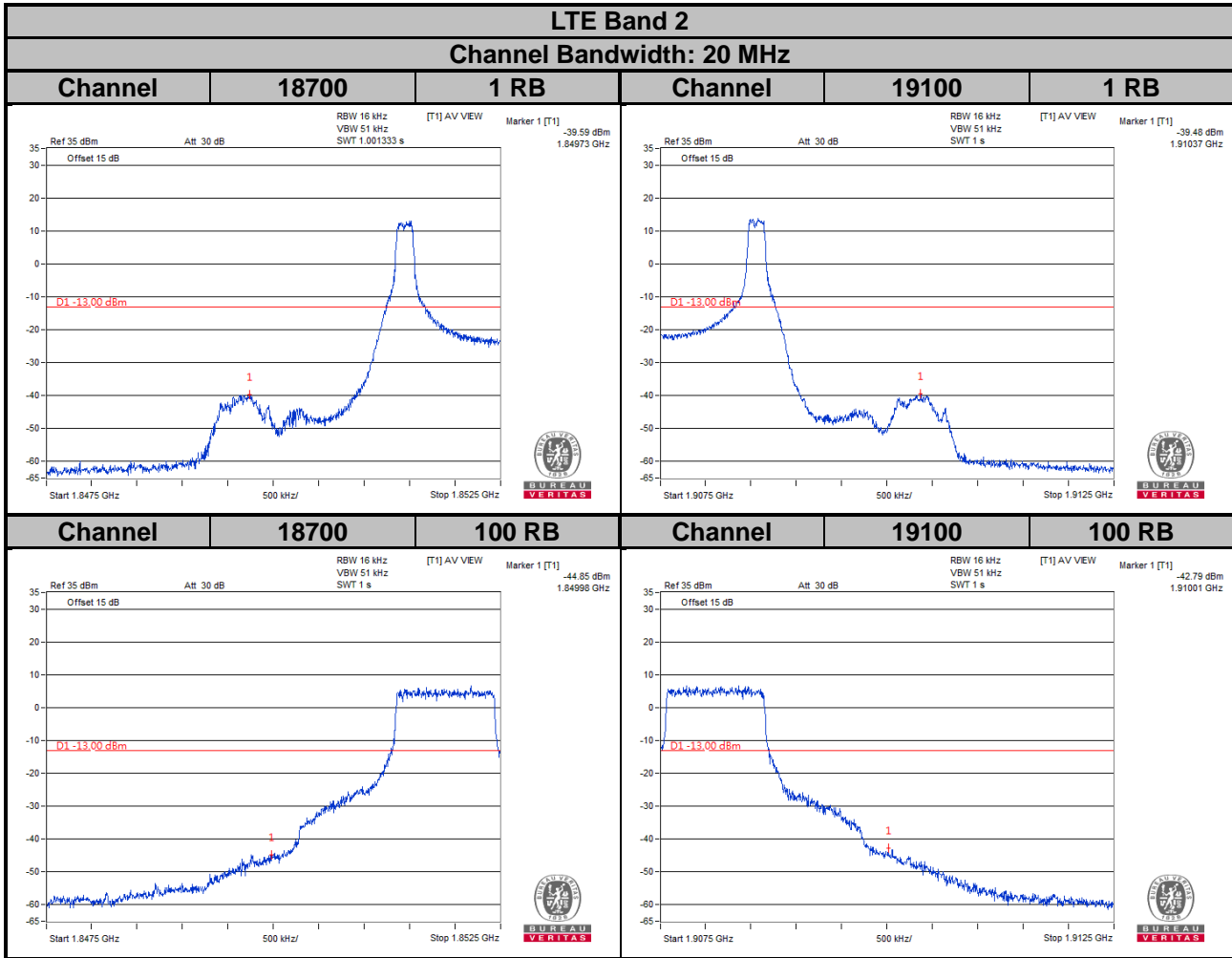


### 4.5.4 Test Results







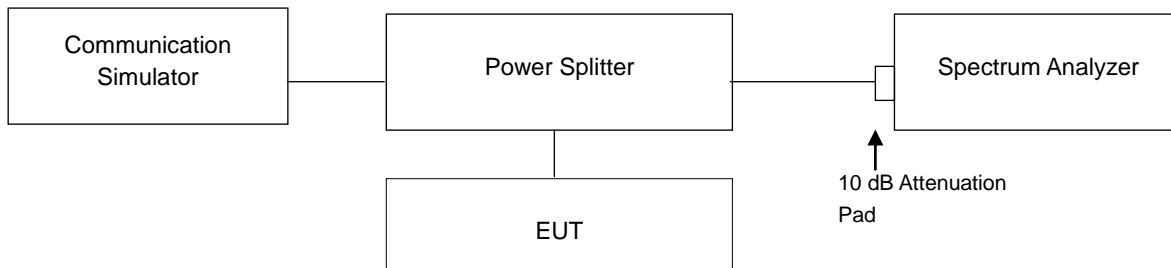


## 4.6 Peak to Average Ratio

### 4.6.1 Limits of Peak to Average Ratio Measurement

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

### 4.6.2 Test Setup

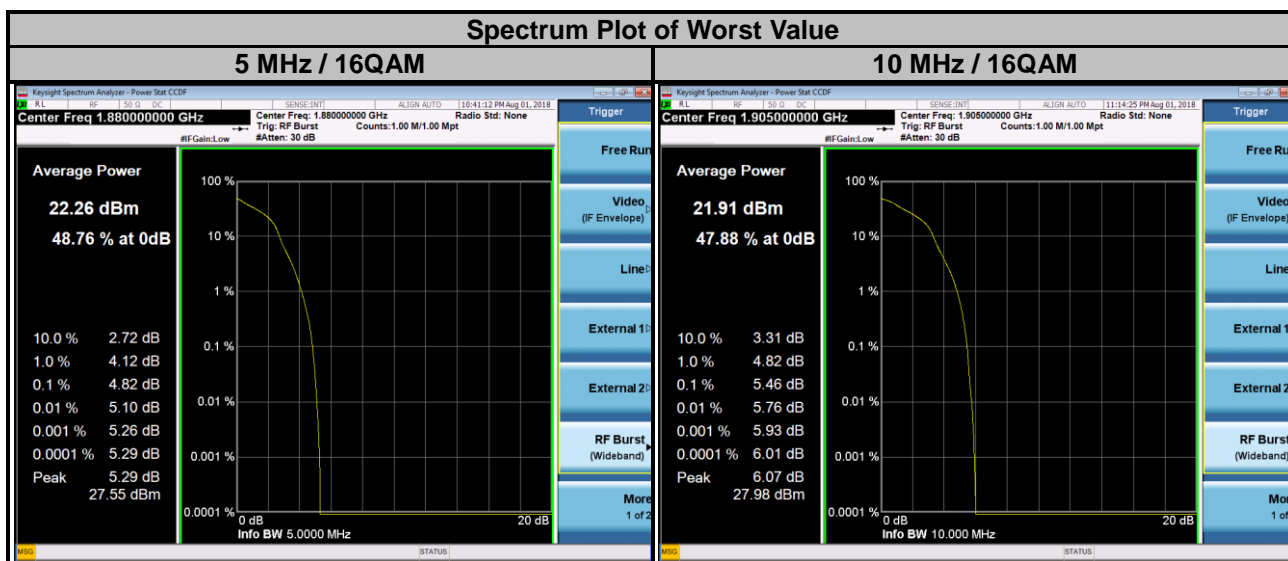


### 4.6.3 Test Procedures

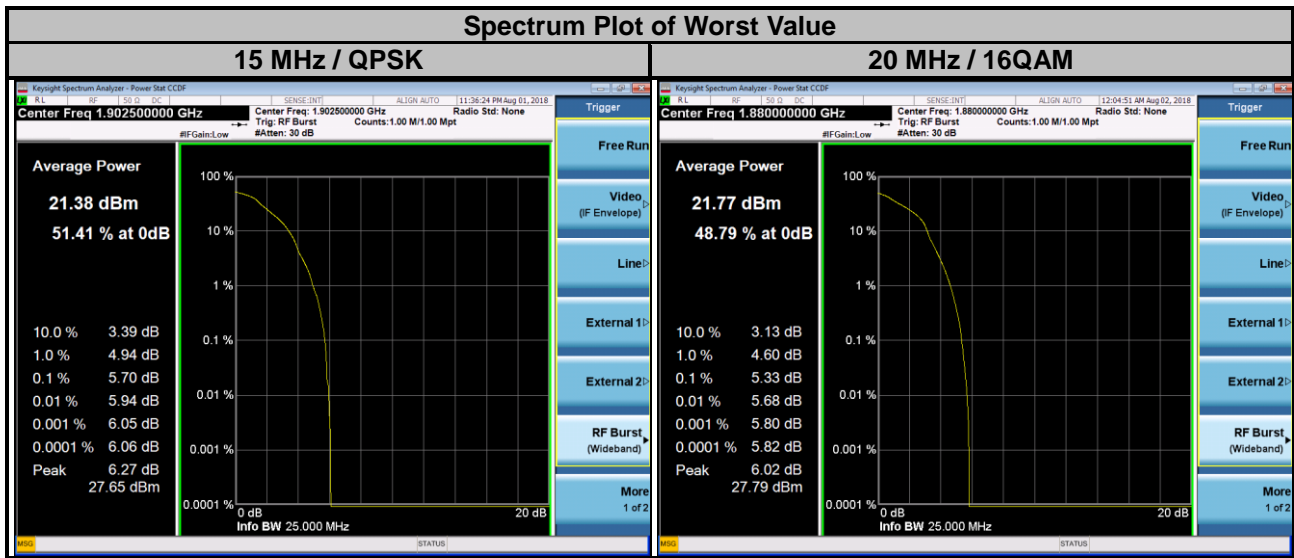
1. Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1 %.

4.6.4 Test Results

LTE Band 2							
Channel Bandwidth: 5 MHz				Channel Bandwidth: 10 MHz			
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
18625	1852.5	4.43	4.73	18650	1855.0	4.28	5.15
18900	1880.0	4.37	4.82	18900	1880.0	4.34	5.25
19175	1907.5	4.40	4.81	19150	1905.0	4.39	5.46



LTE Band 2							
Channel Bandwidth: 15 MHz				Channel Bandwidth: 20 MHz			
Channel	Frequency (MHz)	Peak to Average Ratio (dB)		Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM			QPSK	16QAM
18675	1857.5	4.26	4.88	18700	1860.0	4.31	4.76
18900	1880.0	4.45	5.14	18900	1880.0	4.45	5.33
19125	1902.5	5.70	5.26	19100	1900.0	4.42	5.02

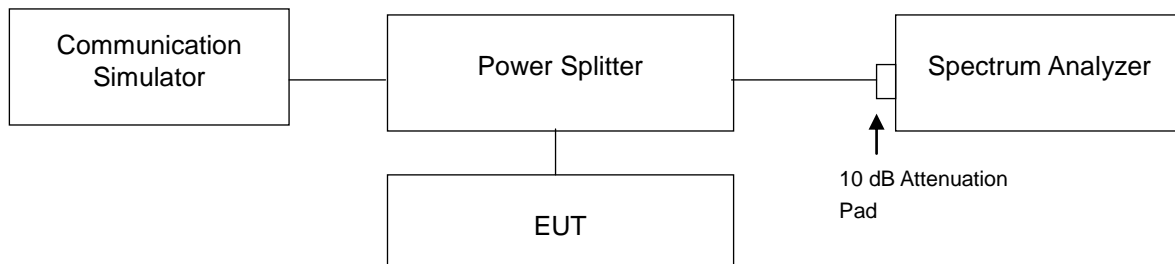


## 4.7 Conducted Spurious Emissions

### 4.7.1 Limits of Conducted Spurious Emissions Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. The emission limit equal to -13 dBm.

### 4.7.2 Test Setup

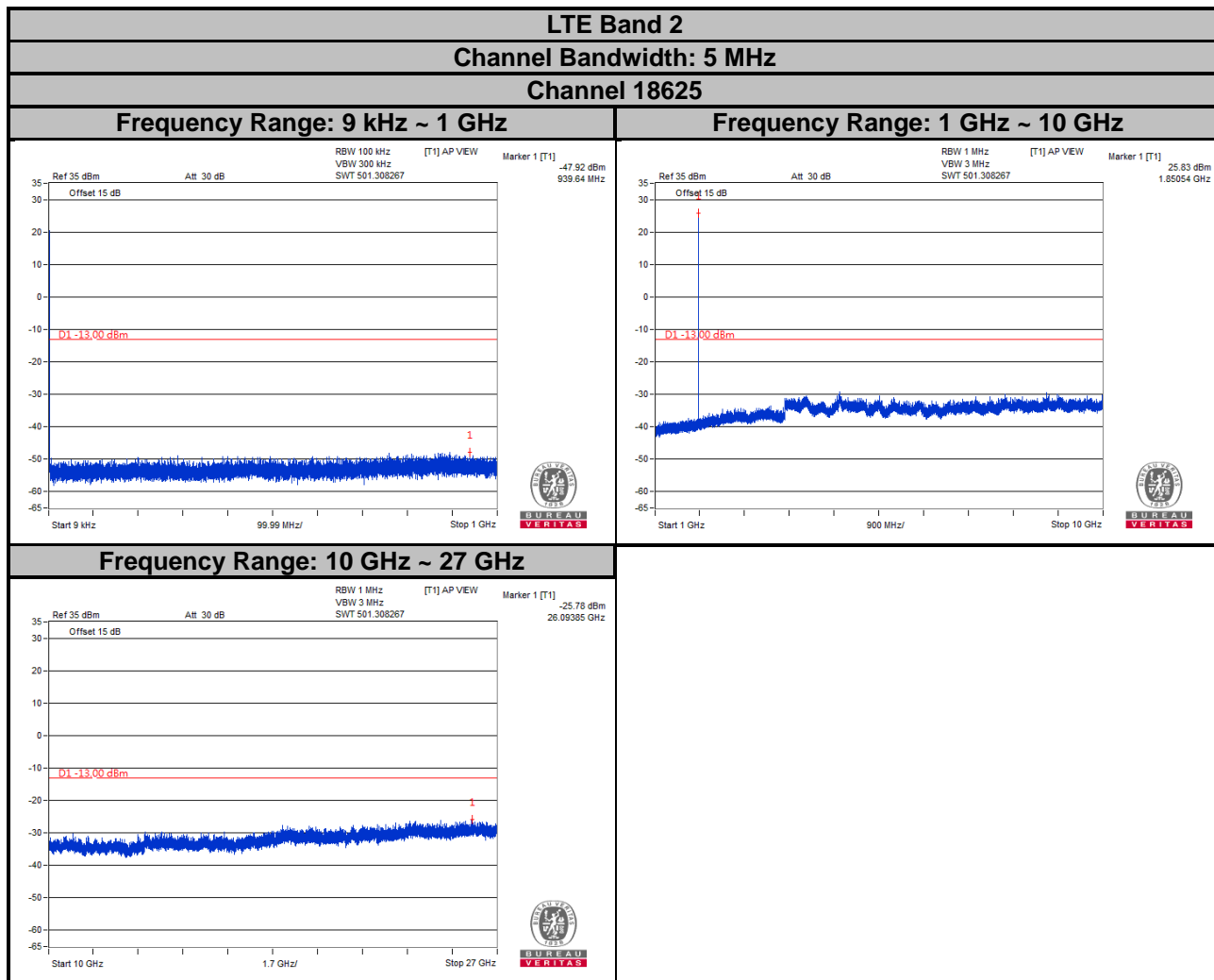


### 4.7.3 Test Procedure

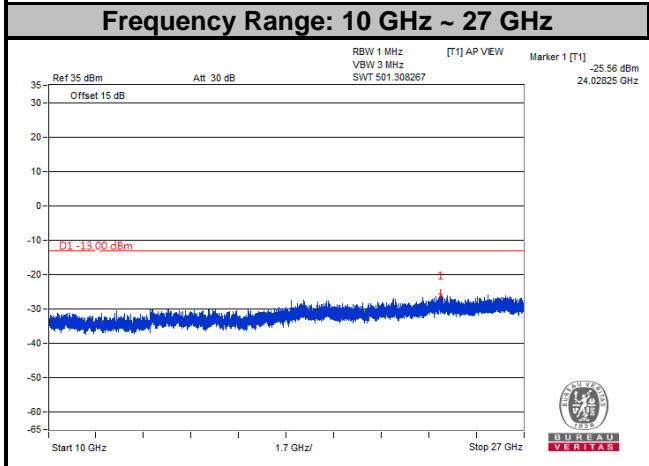
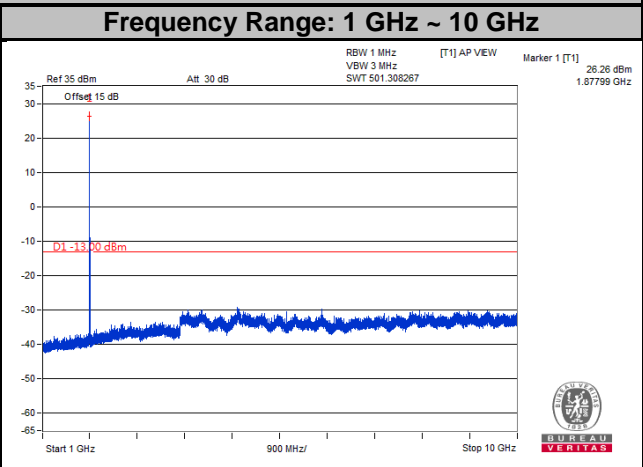
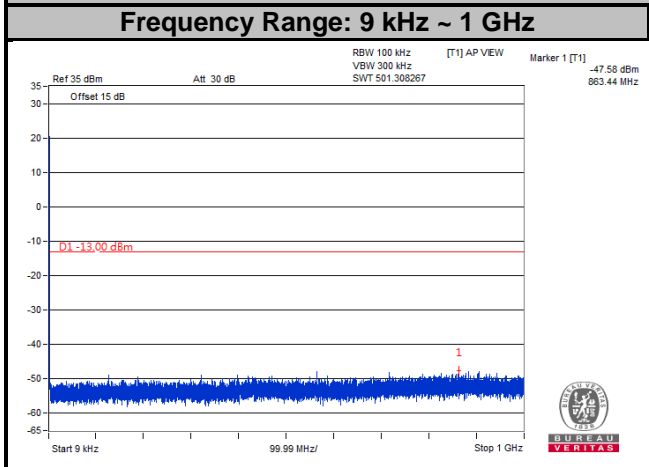
- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz to 1 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 100 kHz and VBW = 300 kHz is used for conducted emission measurement.
- Measuring frequency range is from 1 GHz to 27 GHz. 10 dB attenuation pad is connected with spectrum. RBW = 1 MHz and VBW = 3 MHz is used for conducted emission measurement.



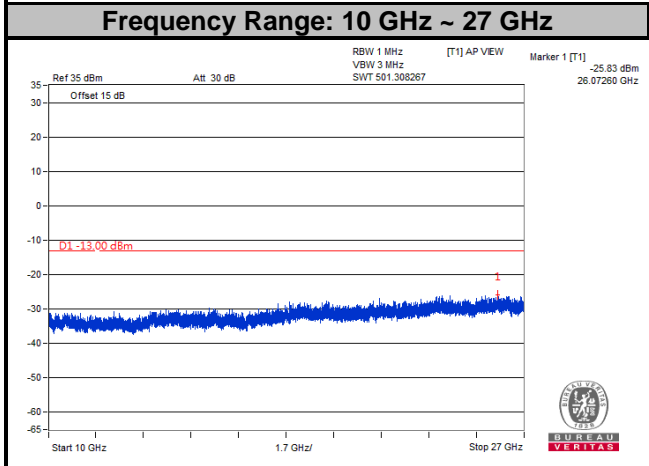
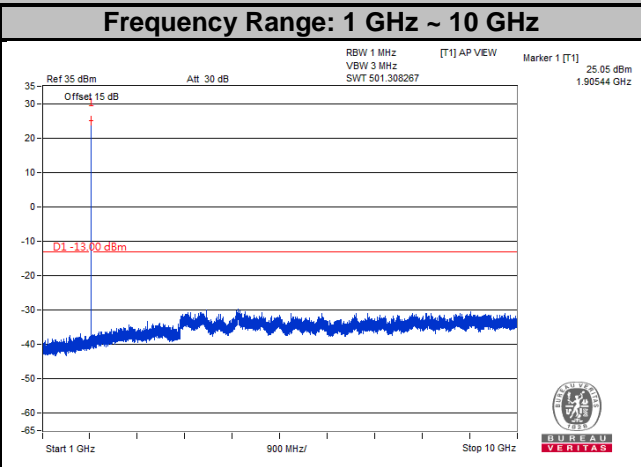
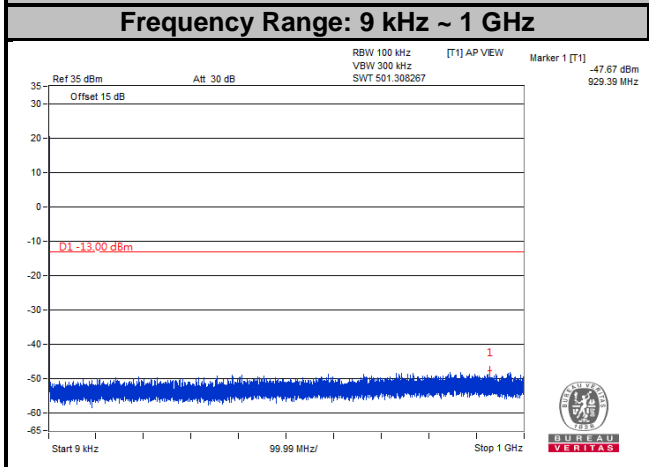
### 4.7.4 Test Results



**LTE Band 2**  
**Channel Bandwidth: 5 MHz**  
**Channel 18900**



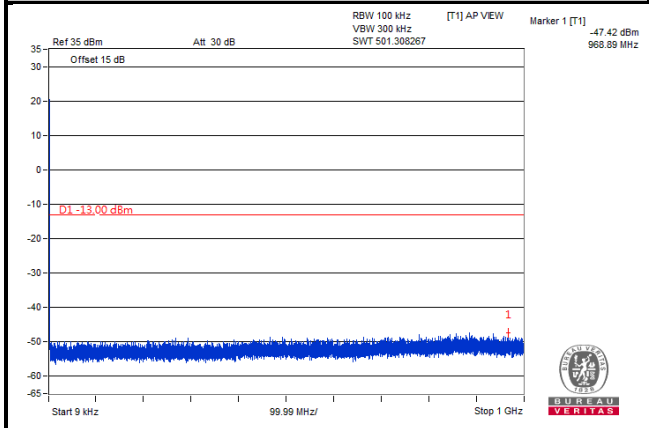
**LTE Band 2**  
**Channel Bandwidth: 5 MHz**  
**Channel 19175**



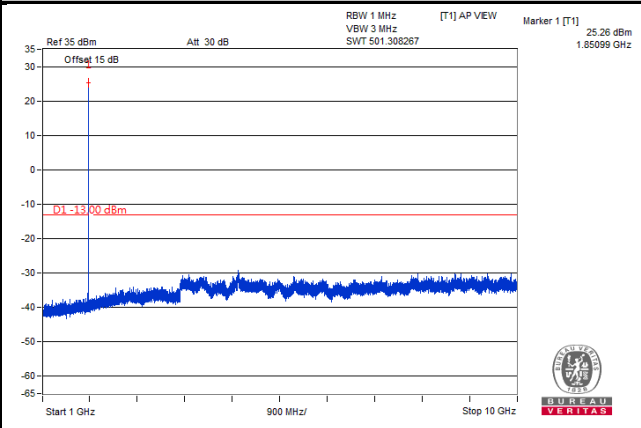
**LTE Band 2**  
**Channel Bandwidth: 10 MHz**

**Channel 18650**

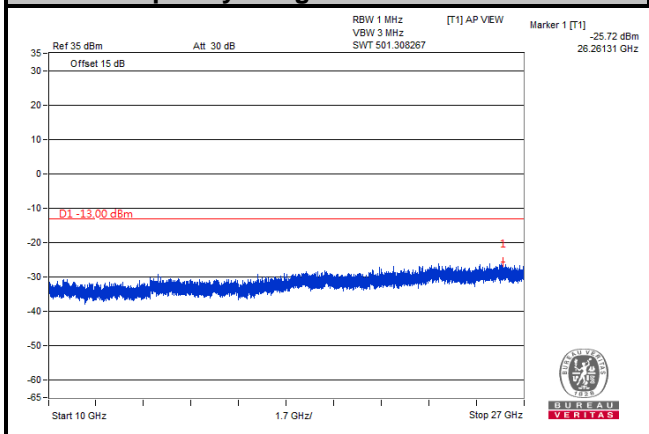
**Frequency Range: 9 kHz ~ 1 GHz**



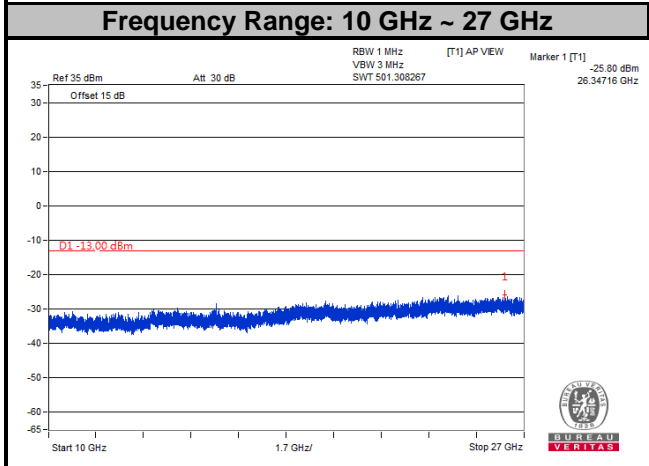
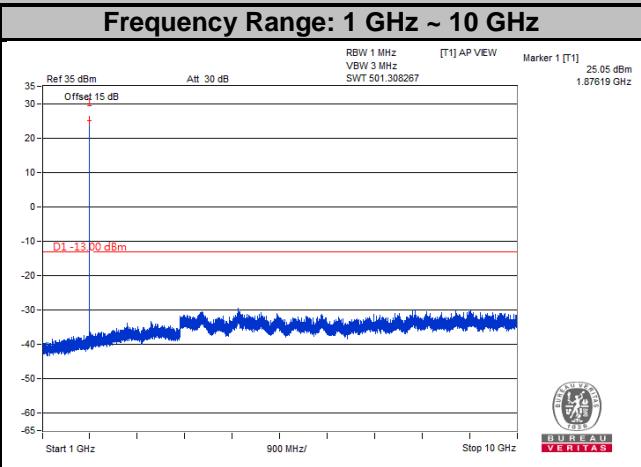
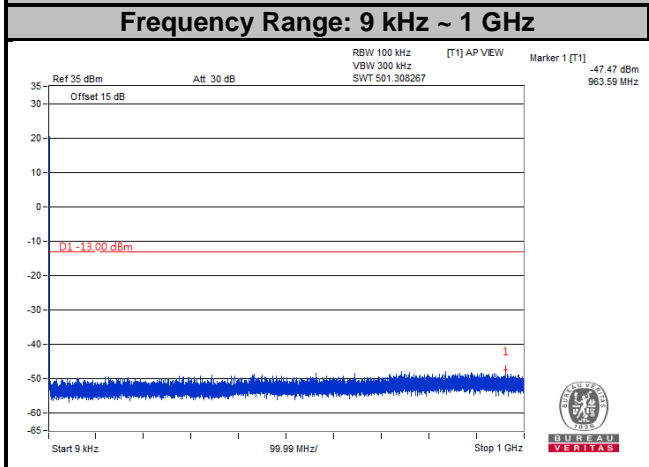
**Frequency Range: 1 GHz ~ 10 GHz**



**Frequency Range: 10 GHz ~ 27 GHz**

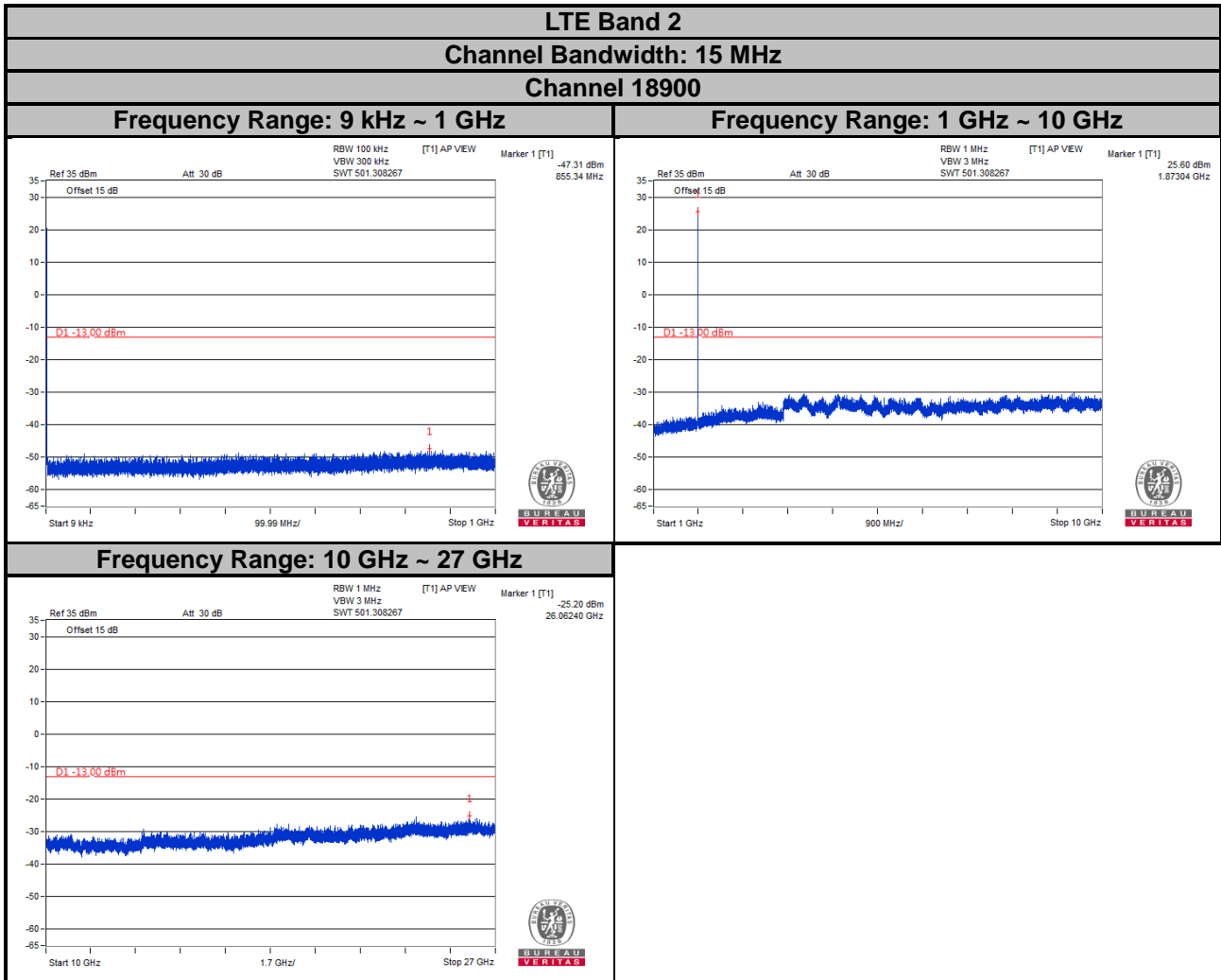


**LTE Band 2**  
**Channel Bandwidth: 10 MHz**  
**Channel 18900**

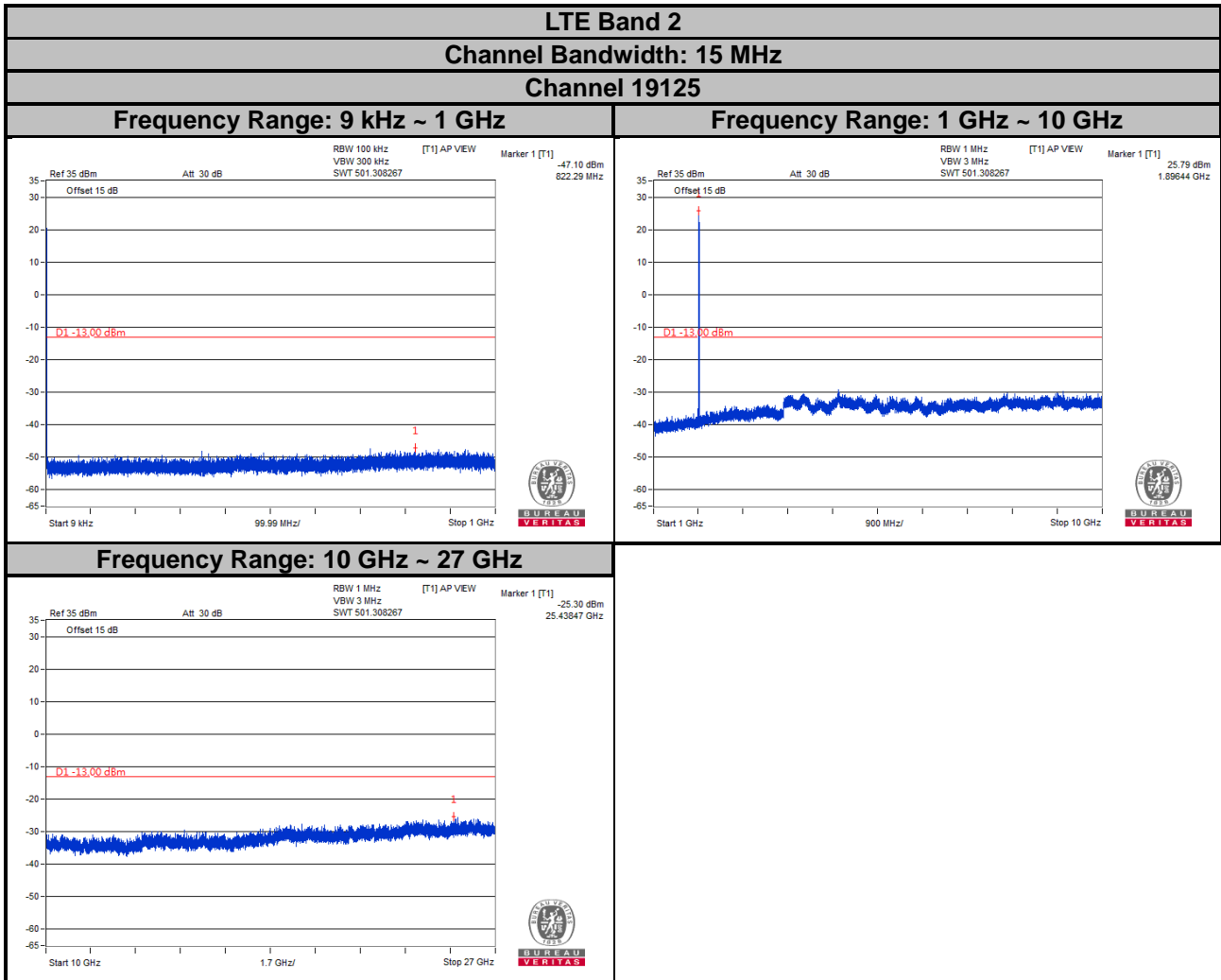








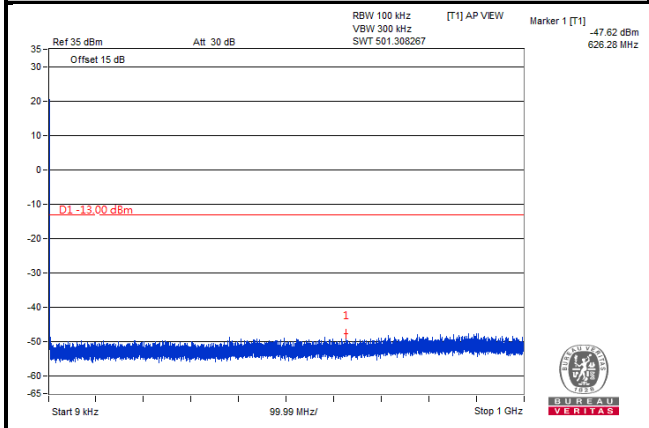




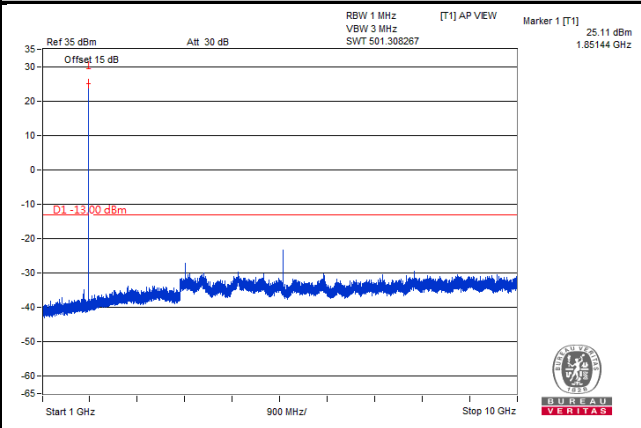
**LTE Band 2**  
**Channel Bandwidth: 20 MHz**

**Channel 18700**

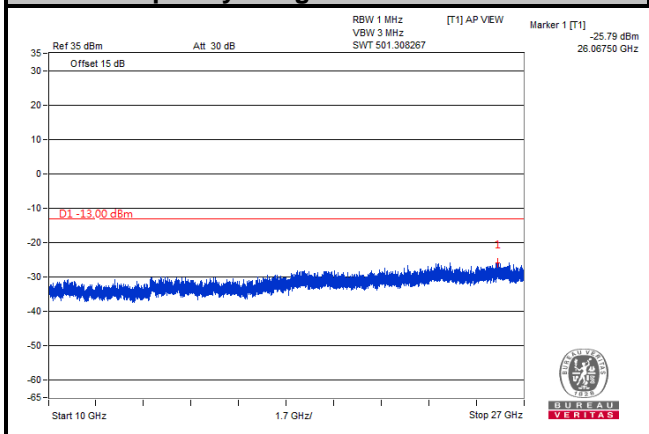
**Frequency Range: 9 kHz ~ 1 GHz**



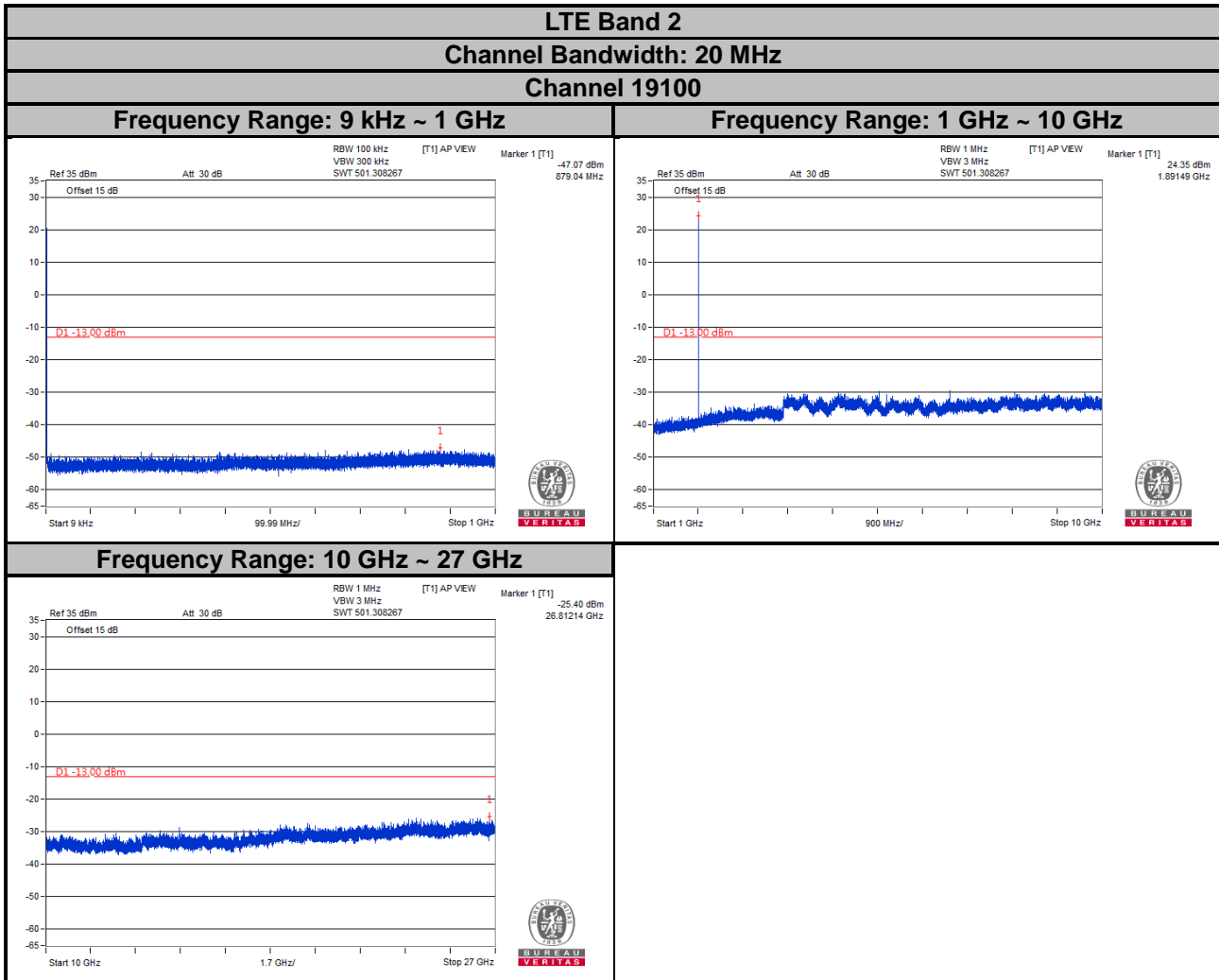
**Frequency Range: 1 GHz ~ 10 GHz**



**Frequency Range: 10 GHz ~ 27 GHz**







## 4.8 Radiated Emission Measurement

### 4.8.1 Limits of Radiated Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. The emission limit is equal to -13 dBm.

### 4.8.2 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.

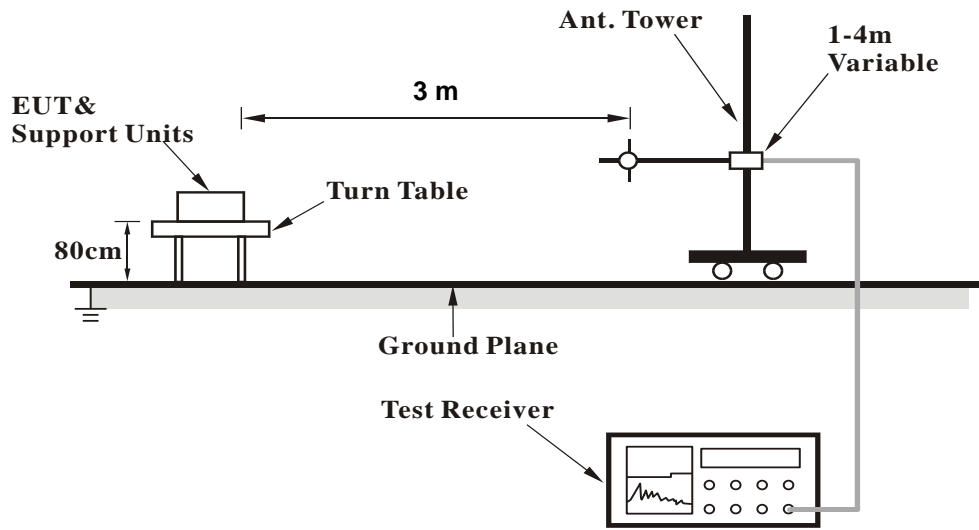
**NOTE:** The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz.

### 4.8.3 Deviation from Test Standard

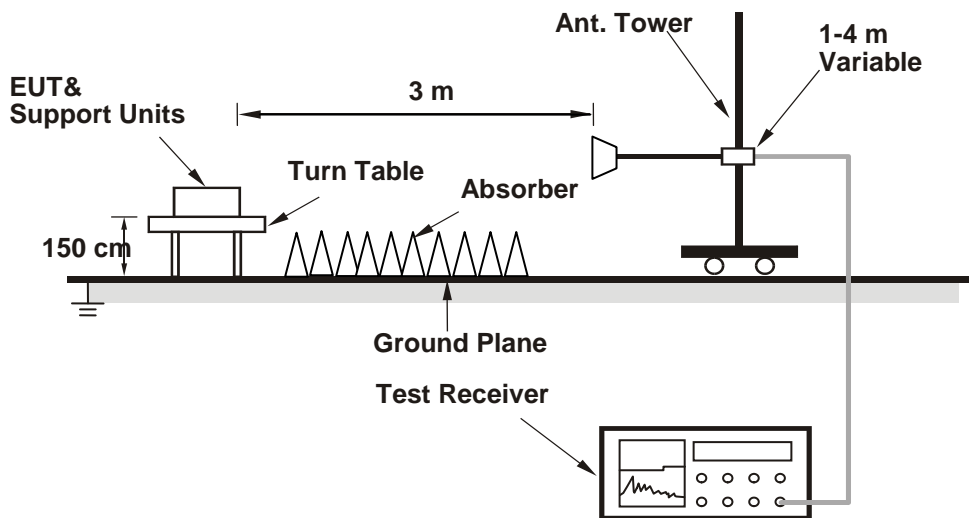
No deviation.

4.8.4 Test Setup

<Radiated Emission below or equal 1 GHz>



<Radiated Emission above 1 GHz>



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

4.8.5 Test Results

LTE Band 2

Channel Bandwidth: 5 MHz / QPSK

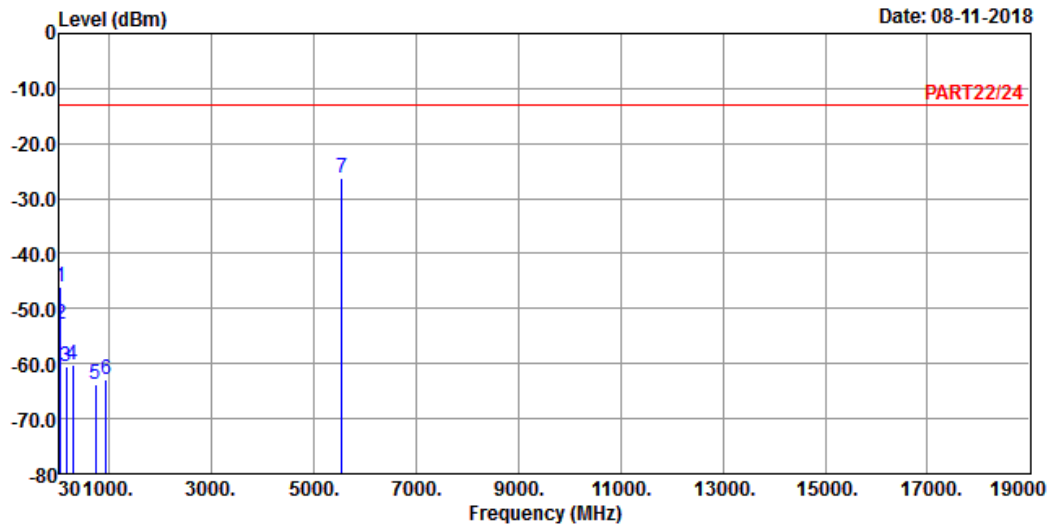
Low Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 5



Site : 966 Chamber 5  
 Condition: PART22/24 HORIZONTAL  
 Remak : Cat-M1 Band 2 QPSK\_5M Link\_L-CH  
 Tested by: Thomas Wei

	Freq	Level	Read Level	Limit	Over	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	44.55	-45.99	-44.00	-13.00	-32.99	-1.99	Peak
2	53.28	-52.93	-47.12	-13.00	-39.93	-5.81	Peak
3	163.86	-60.59	-55.47	-13.00	-47.59	-5.12	Peak
4	291.90	-60.36	-53.51	-13.00	-47.36	-6.85	Peak
5	739.07	-63.88	-64.55	-13.00	-50.88	0.67	Peak
6	938.89	-62.82	-64.35	-13.00	-49.82	1.53	Peak
7 pp	5557.50	-26.17	-24.26	-13.00	-13.17	-1.91	Peak

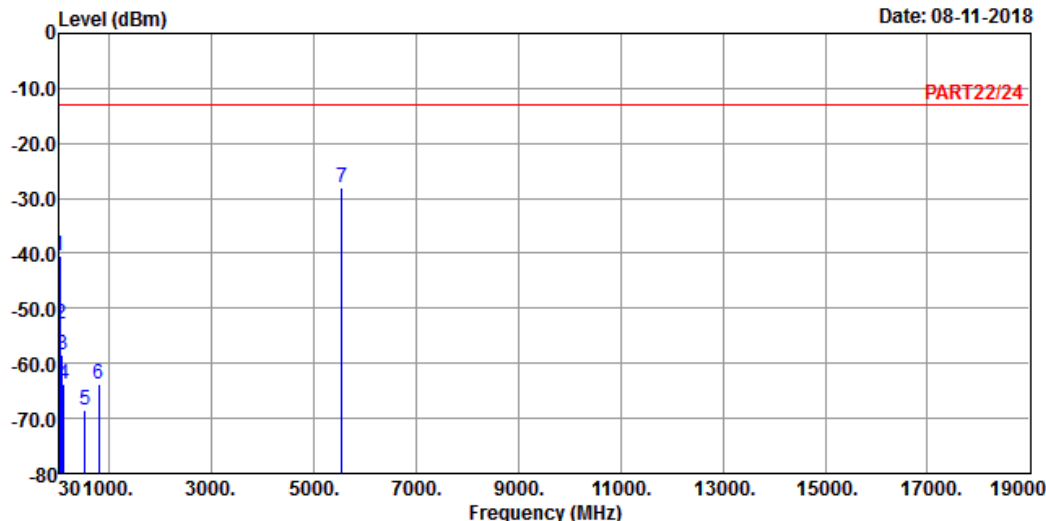


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 6

Date: 08-11-2018



Site : 966 Chamber 5  
 Condition: PART22/24 VERTICAL  
 Remak : Cat-M1 Band 2 QPSK\_5M Link\_L-CH  
 Tested by: Thomas Wei

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	41.64	-40.50	-40.09	-13.00	-27.50	-0.41	Peak
2	52.31	-52.98	-47.44	-13.00	-39.98	-5.54	Peak
3	78.50	-58.49	-48.06	-13.00	-45.49	-10.43	Peak
4	113.42	-63.63	-53.48	-13.00	-50.63	-10.15	Peak
5	532.46	-68.62	-65.15	-13.00	-55.62	-3.47	Peak
6	790.48	-63.75	-64.51	-13.00	-50.75	0.76	Peak
7 pp	5557.50	-27.94	-26.03	-13.00	-14.94	-1.91	Peak



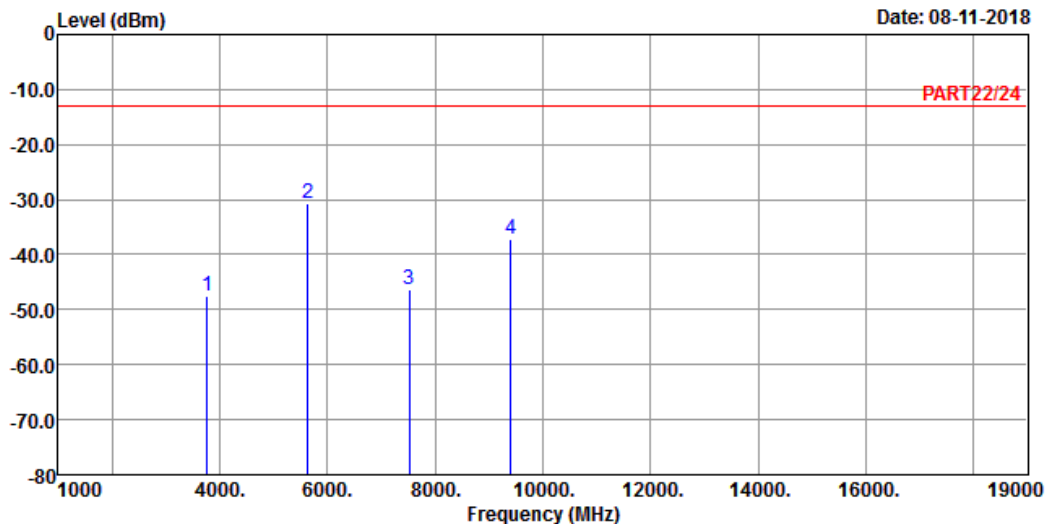
Middle Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 1



Site : 966 Chamber 5  
 Condition: PART22/24 HORIZONTAL  
 Remak : Cat-M1 Band 2 QPSK\_5M Link\_M-CH  
 Tested by: Thomas Wei

	Freq	Level	Read Level	Limit	Over	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	3760.00	-47.39	-40.74	-13.00	-34.39	-6.65	Peak
2 pp	5640.00	-30.68	-28.82	-13.00	-17.68	-1.86	Peak
3	7520.00	-46.40	-50.61	-13.00	-33.40	4.21	Peak
4	9400.00	-37.14	-42.21	-13.00	-24.14	5.07	Peak

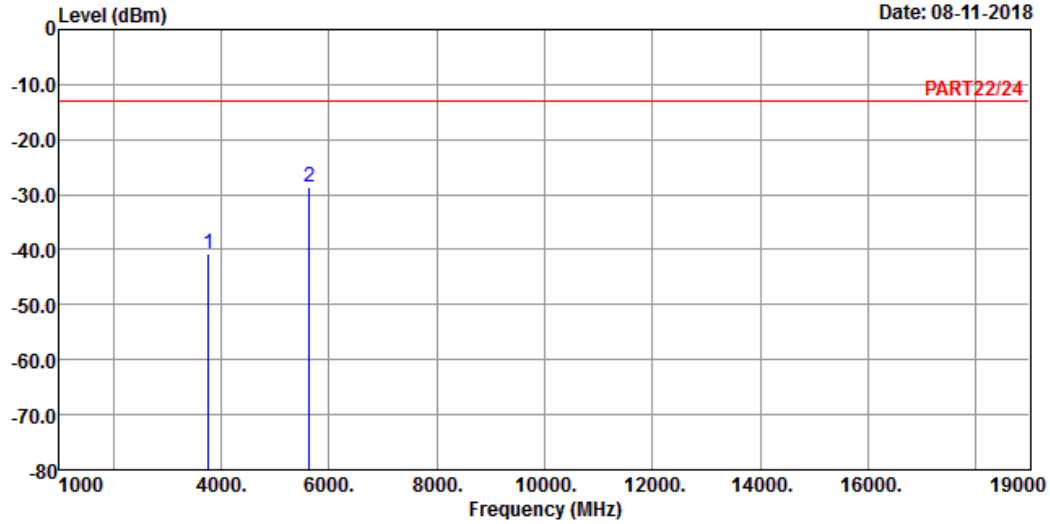


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 2

Date: 08-11-2018



Site : 966 Chamber 5  
 Condition: PART22/24 VERTICAL  
 Remak : Cat-M1 Band 2 QPSK\_5M Link\_M-CH  
 Tested by: Thomas Wei

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	3760.00	-40.74	-34.09	-13.00	-27.74	-6.65	Peak
2 pp	5640.00	-28.56	-26.70	-13.00	-15.56	-1.86	Peak

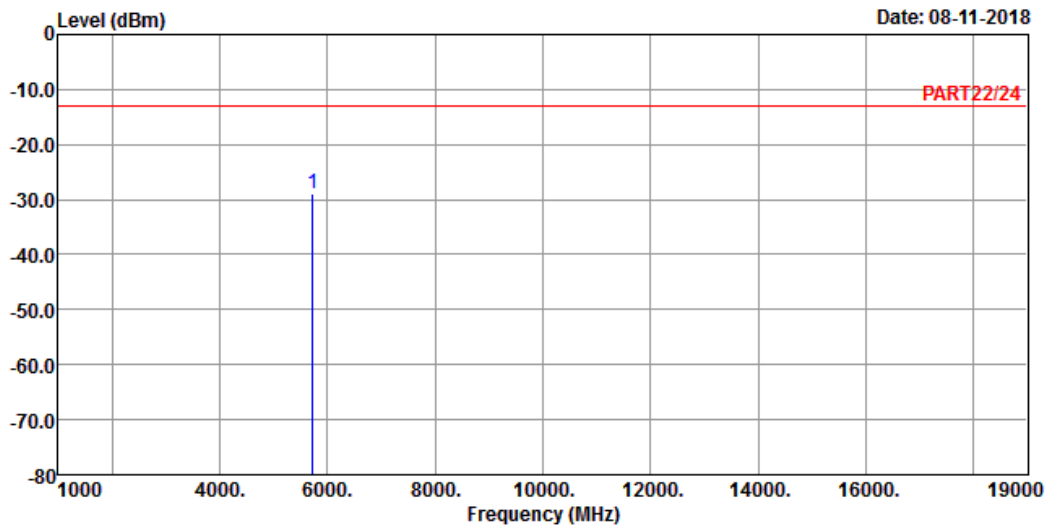
# High Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 1



Site : 966 Chamber 5  
 Condition: PART22/24 HORIZONTAL  
 Remak : Cat-M1 Band 2 QPSK\_5M Link\_H-CH  
 Tested by: Thomas Wei

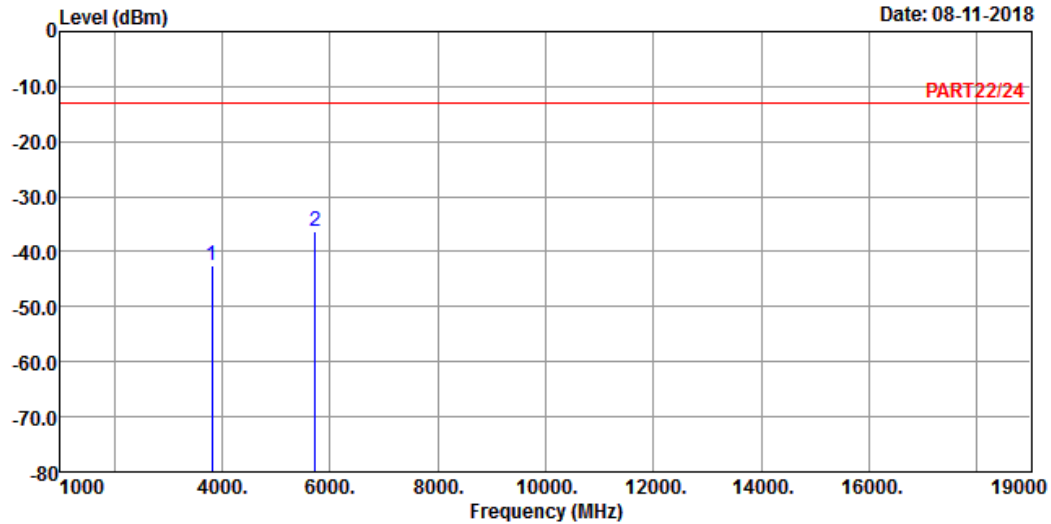
Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
MHz	dBm	dBm	dBm	dB	dB	
1 pp 5722.50	-28.86	-27.17	-13.00	-15.86	-1.69	Peak



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 2



Site : 966 Chamber 5  
 Condition: PART22/24 VERTICAL  
 Remak : Cat-M1 Band 2 QPSK\_5M Link\_H-CH  
 Tested by: Thomas Wei

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	3815.00	-42.51	-36.11	-13.00	-29.51	-6.40	Peak
2 pp	5722.50	-36.36	-34.67	-13.00	-23.36	-1.69	Peak

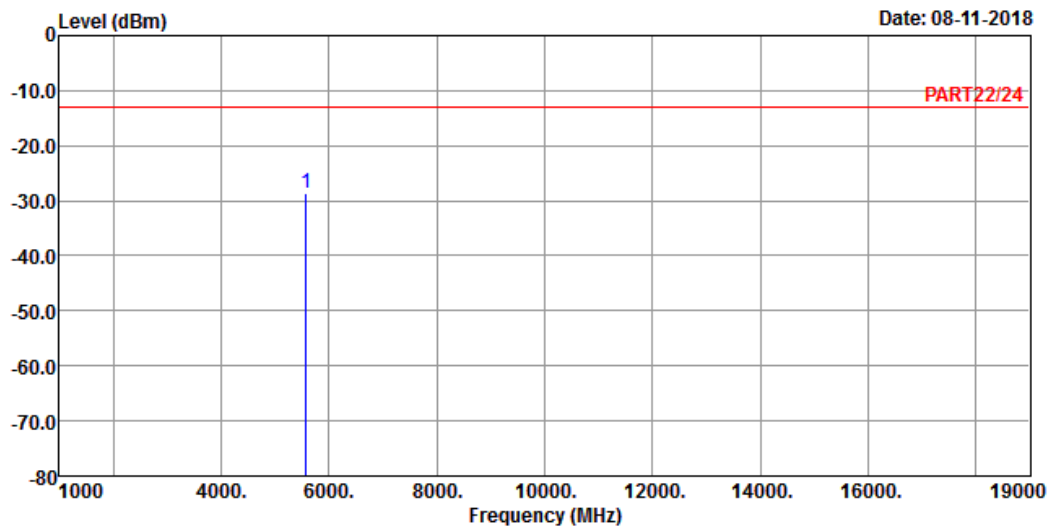
Channel Bandwidth: 20 MHz / QPSK  
Low Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 1



Site : 966 Chamber 5  
Condition: PART22/24 HORIZONTAL  
Remak : Cat-M1 Band 2 QPSK\_20M Link\_L-CH  
Tested by: Thomas Wei

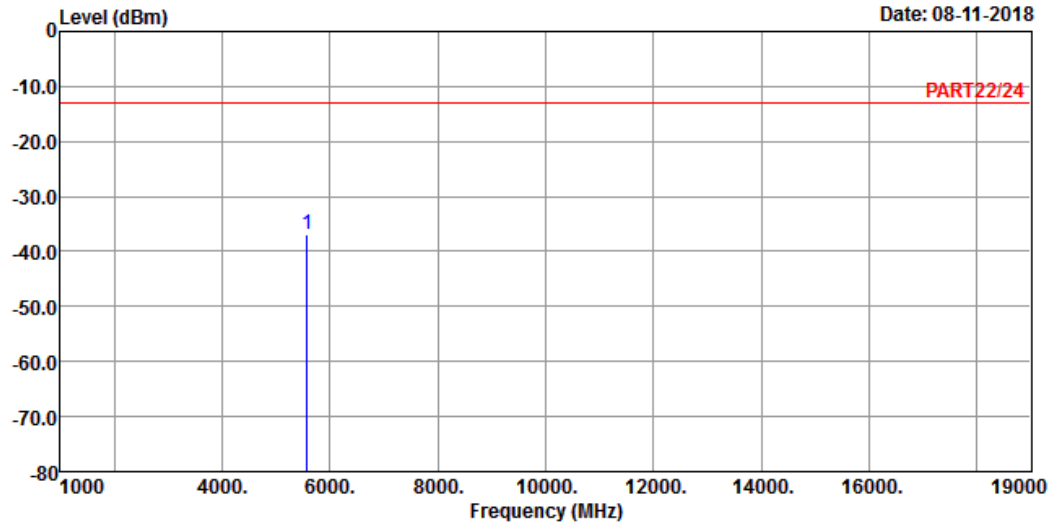
Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
MHz	dBm	dBm	dBm	dB	dB	
1 pp 5580.00	-28.52	-26.60	-13.00	-15.52	-1.92	Peak



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 2



Site : 966 Chamber 5  
 Condition: PART22/24 VERTICAL  
 Remak : Cat-M1 Band 2 QPSK\_20M Link\_L-CH  
 Tested by: Thomas Wei

Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
MHz	dBm	dBm	dBm	dB	dB	
1 pp 5580.00	-36.95	-35.03	-13.00	-23.95	-1.92	Peak

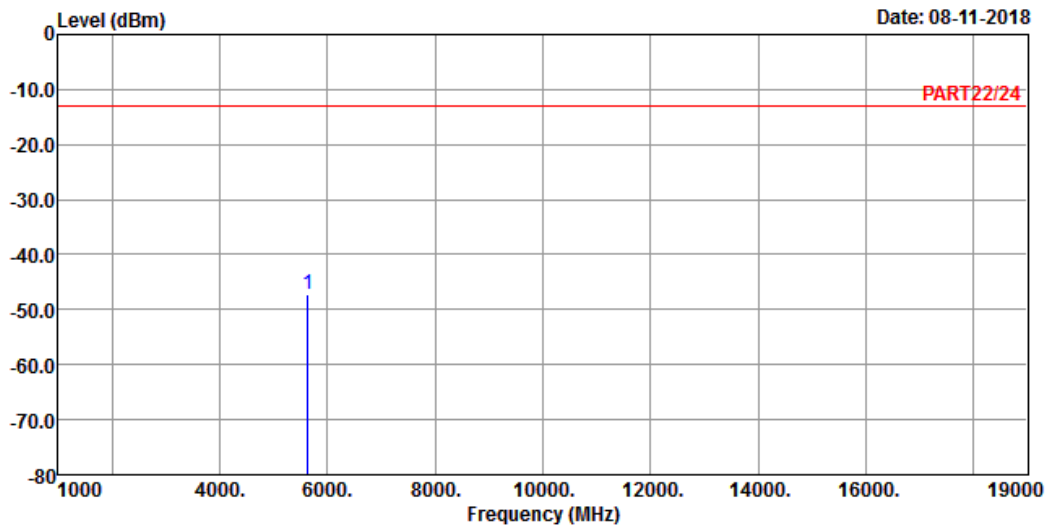
Middle Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 1



Site : 966 Chamber 5  
 Condition: PART22/24 HORIZONTAL  
 Remak : Cat-M1 Band 2 QPSK\_20M Link\_M-CH  
 Tested by: Thomas Wei

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

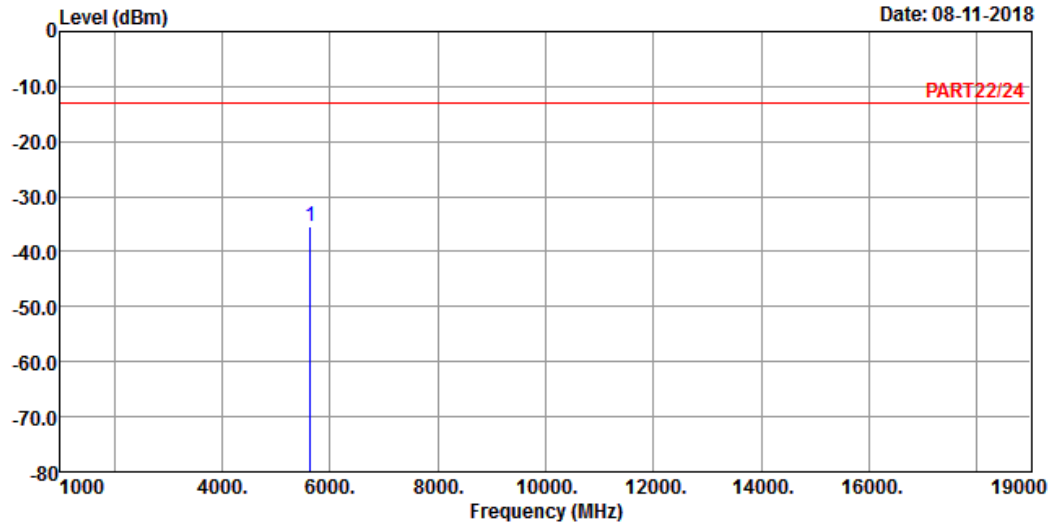
1 pp 5640.00 -47.11 -45.25 -13.00 -34.11 -1.86 Peak



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 2



Site : 966 Chamber 5  
 Condition: PART22/24 VERTICAL  
 Remak : Cat-M1 Band 2 QPSK\_20M Link\_M-CH  
 Tested by: Thomas Wei

Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
MHz	dBm	dBm	dBm	dB	dB	
1 pp 5640.00	-35.38	-33.52	-13.00	-22.38	-1.86	Peak



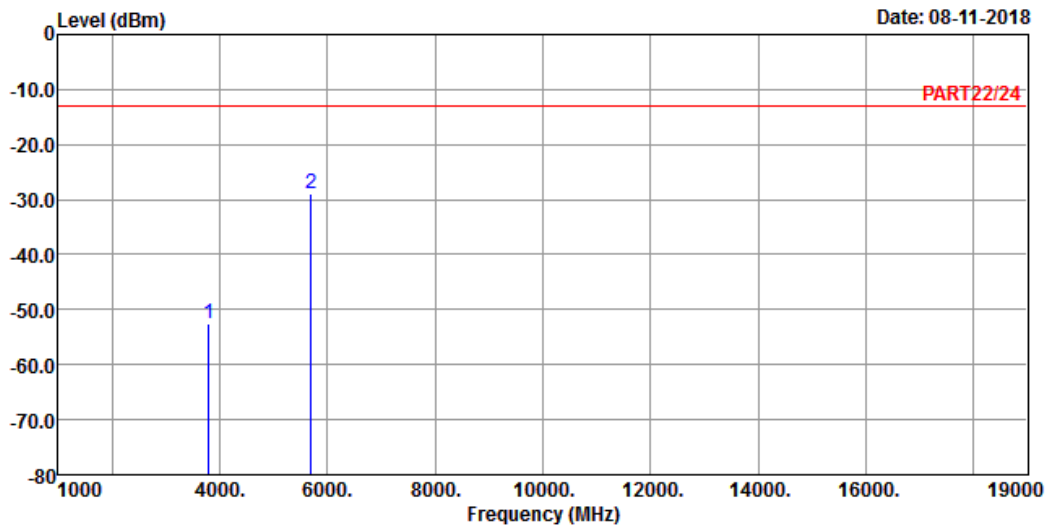
# High Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 1



Site : 966 Chamber 5  
 Condition: PART22/24 HORIZONTAL  
 Remak : Cat-M1 Band 2 QPSK\_20M Link\_H-CH  
 Tested by: Thomas Wei

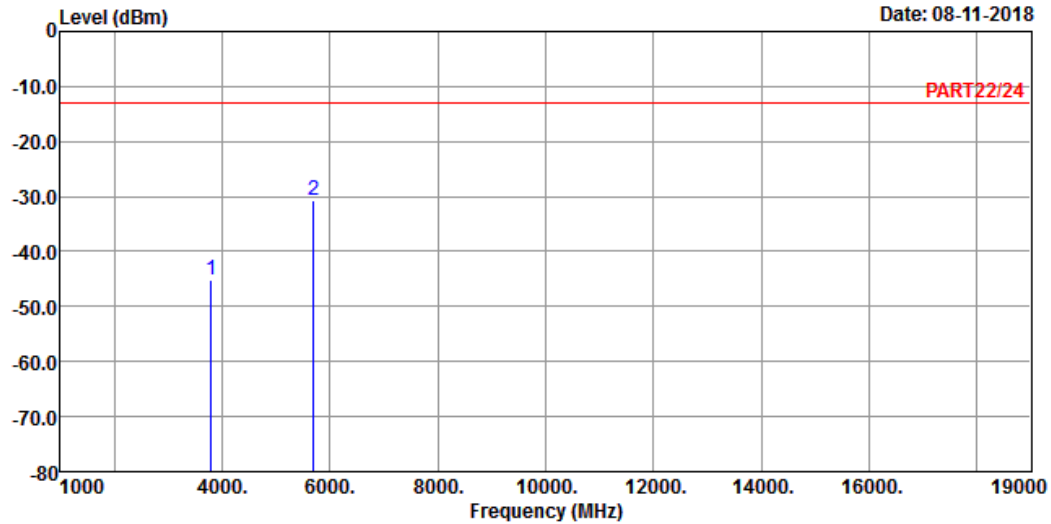
	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	3800.00	-52.58	-46.15	-13.00	-39.58	-6.43	Peak
2 pp	5700.00	-28.85	-27.12	-13.00	-15.85	-1.73	Peak



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 2



Site : 966 Chamber 5  
 Condition: PART22/24 VERTICAL  
 Remak : Cat-M1 Band 2 QPSK\_20M Link\_H-CH  
 Tested by: Thomas Wei

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark
	MHz	dBm	dBm	dBm	dB	dB	
1	3800.00	-45.28	-38.85	-13.00	-32.28	-6.43	Peak
2 pp	5700.00	-30.77	-29.04	-13.00	-17.77	-1.73	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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The address and road map of all our labs can be found in our web site also.

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