

## FCC Test Report

### (PART 27)

**Report No.:** RF180308C03

**FCC ID:** NKR-CB1GSKVM2

**Test Model:** UMC-SKVM2

**Received Date:** Mar. 08, 2018

**Test Date:** Apr. 26, 2018 ~ Jun. 14, 2018

**Issued Date:** Jun. 22, 2018

**Applicant:** Wistron Neweb Corporation

**Address:** 20 Park Avenue II (or Yuanchiu 2nd Rd), Hsinchu Science Park, Hsinchu  
308, Taiwan

**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:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan  
Hsien 333, Taiwan, R.O.C.

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



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agency

## Table of Contents

|                                                                 |           |
|-----------------------------------------------------------------|-----------|
| <b>Release Control Record .....</b>                             | <b>3</b>  |
| <b>1 Certificate of Conformity .....</b>                        | <b>4</b>  |
| <b>2 Summary of Test Results.....</b>                           | <b>5</b>  |
| 2.1 Measurement Uncertainty.....                                | 5         |
| 2.2 Test Site and Instruments .....                             | 6         |
| <b>3 General Information .....</b>                              | <b>8</b>  |
| 3.1 General Description of EUT .....                            | 8         |
| 3.2 Configuration of System under Test.....                     | 9         |
| 3.2.1 Description of Support Units.....                         | 9         |
| 3.3 Test Mode Applicability and Tested Channel Detail .....     | 10        |
| 3.4 EUT Operating Conditions .....                              | 11        |
| 3.5 General Description of Applied Standards.....               | 11        |
| <b>4 Test Types and Results .....</b>                           | <b>12</b> |
| 4.1 Output Power Measurement.....                               | 12        |
| 4.1.1 Limits of Output Power Measurement .....                  | 12        |
| 4.1.2 Test Procedures.....                                      | 12        |
| 4.1.3 Test Setup.....                                           | 13        |
| 4.1.4 Test Results .....                                        | 14        |
| 4.2 Frequency Stability Measurement .....                       | 18        |
| 4.2.1 Limits of Frequency Stability Measurement.....            | 18        |
| 4.2.2 Test Procedure .....                                      | 18        |
| 4.2.3 Test Setup.....                                           | 18        |
| 4.2.4 Test Results .....                                        | 19        |
| 4.3 Occupied Bandwidth Measurement.....                         | 21        |
| 4.3.1 Limits of Occupied Bandwidth Measurement .....            | 21        |
| 4.3.2 Test Procedure .....                                      | 21        |
| 4.3.3 Test Setup.....                                           | 21        |
| 4.3.4 Test Result .....                                         | 22        |
| 4.4 Band Edge Measurement .....                                 | 23        |
| 4.4.1 Limits of Band Edge Measurement .....                     | 23        |
| 4.4.2 Test Setup.....                                           | 23        |
| 4.4.3 Test Procedures.....                                      | 23        |
| 4.4.4 Test Results .....                                        | 24        |
| 4.5 Peak to Average Ratio .....                                 | 28        |
| 4.5.1 Limits of Peak to Average Ratio Measurement .....         | 28        |
| 4.5.2 Test Setup.....                                           | 28        |
| 4.5.3 Test Procedures.....                                      | 28        |
| 4.5.4 Test Results .....                                        | 29        |
| 4.6 Conducted Spurious Emissions .....                          | 30        |
| 4.6.1 Limits of Conducted Spurious Emissions Measurement.....   | 30        |
| 4.6.2 Test Setup.....                                           | 30        |
| 4.6.3 Test Procedure .....                                      | 30        |
| 4.6.4 Test Results .....                                        | 31        |
| 4.7 Radiated Emission Measurement.....                          | 33        |
| 4.7.1 Limits of Radiated Emission Measurement .....             | 33        |
| 4.7.2 Test Procedure .....                                      | 33        |
| 4.7.3 Deviation from Test Standard .....                        | 33        |
| 4.7.4 Test Setup.....                                           | 34        |
| 4.7.5 Test Results .....                                        | 35        |
| <b>5 Pictures of Test Arrangements.....</b>                     | <b>51</b> |
| <b>Appendix – Information on the Testing Laboratories .....</b> | <b>52</b> |

### Release Control Record

| Issue No.   | Description      | Date Issued   |
|-------------|------------------|---------------|
| RF180308C03 | Original Release | Jun. 22, 2018 |

## 1 Certificate of Conformity

**Product:** LTE CAT M1 communication board

**Brand:** WNC

**Test Model:** UMC-SKVM2

**Sample Status:** Identical Prototype

**Applicant:** Wistron Neweb Corporation

**Test Date:** Apr. 26, 2018 ~ Jun. 14, 2018

**Standards:** FCC Part 27, Subpart F

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 :** Evonne Liu, **Date:** Jun. 22, 2018  
Evonne Liu / Specialist

**Approved by :** Dylan Chiou, **Date:** Jun. 22, 2018  
Dylan Chiou / Project Engineer

## 2 Summary of Test Results

| Applied Standard: FCC Part 27 & Part 2 (LTE 13) |                              |        |                                                                                      |
|-------------------------------------------------|------------------------------|--------|--------------------------------------------------------------------------------------|
| FCC Clause                                      | Test Item                    | Result | Remarks                                                                              |
| 2.1046<br>27.50(b)(10)                          | Maximum Peak Output Power    | Pass   | Meet the requirement of limit.                                                       |
| 2.1055<br>27.54                                 | Frequency Stability          | Pass   | Meet the requirement of limit.                                                       |
| 2.1049<br>27.53(g)                              | Occupied Bandwidth           | Pass   | Meet the requirement of limit.                                                       |
| 27.50(d)(5)                                     | Peak to Average Ratio        | Pass   | Meet the requirement of limit.                                                       |
| 27.53(g)                                        | Band Edge Measurements       | Pass   | Meet the requirement of limit.                                                       |
| 2.1051<br>27.53(g)                              | Conducted Spurious Emissions | Pass   | Meet the requirement of limit.                                                       |
| 2.1053<br>27.53(g)(f)                           | Radiated Spurious Emissions  | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -2.62 dB at 1569.00 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          | Expanded Uncertainty (k=2) ( $\pm$ ) |
|------------------------------------|--------------------|--------------------------------------|
| Conducted Emissions at mains ports | 150 kHz ~ 30 MHz   | 2.44 dB                              |
| 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<br>Agilent                       | N9038A                     | MY51210129                                                        | Feb. 06, 2018       | Feb. 05, 2019           |
| Spectrum Analyzer<br>Agilent                   | N9010A                     | MY52220314                                                        | Nov. 24, 2017       | Nov. 23, 2018           |
| Spectrum Analyzer<br>ROHDE & SCHWARZ           | FSU43                      | 100115                                                            | Nov. 23, 2017       | Nov. 22, 2018           |
| Double Ridge Guide Horn<br>Antenna EMCO        | 3115                       | 5619                                                              | Nov. 30, 2017       | Nov. 29, 2018           |
| BILOG Antenna<br>SCHWARZBECK                   | VULB 9168                  | 9168-153                                                          | Dec. 06, 2017       | Dec. 05, 2018           |
| RF signal cable<br>ETS-LINDGREN                | 5D-FB                      | Cable-CH1-01(R<br>FC-SMS-100-SM<br>S-120+RFC-SMS<br>-100-SMS-400) | Jun. 23, 2017       | Jun. 22, 2018           |
| Spectrum Analyzer<br>ROHDE & SCHWARZ           | FSU43                      | 100115                                                            | Nov. 23, 2017       | Nov. 22, 2018           |
| MXG Vector signal<br>generator<br>Agilent      | N5182B                     | MY53050430                                                        | Oct. 24, 2017       | Oct. 23, 2018           |
| Preamplifier<br>EMCI                           | EMC 012645                 | 980115                                                            | Oct. 20, 2017       | Oct. 19, 2018           |
| Preamplifier<br>EMCI                           | EMC 184045                 | 980116                                                            | Oct. 20, 2017       | Oct. 19, 2018           |
| Preamplifier<br>EMCI                           | EMC 330H                   | 980112                                                            | Oct. 13, 2017       | Oct. 12, 2018           |
| Power Meter<br>Anritsu                         | ML2495A                    | 1012010                                                           | Aug. 15, 2017       | Aug. 14, 2018           |
| Power Sensor<br>Anritsu                        | MA2411B                    | 1315050                                                           | Aug. 15, 2017       | Aug. 14, 2018           |
| RF Coaxial Cable<br>HUBER+SUHNNER              | EMC104-SM-SM-8<br>000&3000 | 140811+170717                                                     | Oct. 20, 2017       | Oct. 19, 2018           |
| RF Coaxial Cable<br>HUBER+SUHNNER              | SUCOFLEX 104               | EMC104-SM-SM-<br>1000(140807)                                     | Oct. 20, 2017       | Oct. 19, 2018           |
| RF Coaxial Cable<br>Worken                     | 8D-FB                      | Cable-Ch10-01                                                     | Oct. 20, 2017       | Oct. 19, 2018           |
| Boresight Antenna Fixture                      | FBA-01                     | FBA-SIP01                                                         | NA                  | NA                      |
| Software<br>BV ADT                             | E3<br>6.120103             | NA                                                                | NA                  | NA                      |
| Antenna Tower<br>MF                            | MFA-440H                   | NA                                                                | NA                  | NA                      |
| Turn Table<br>MF                               | MFT-201SS                  | NA                                                                | NA                  | NA                      |
| Antenna Tower & Turn<br>Table Controller<br>MF | MF-7802                    | NA                                                                | NA                  | NA                      |

| Description & Manufacturer     | Model No.            | Serial No.  | Date of Calibration | Due Date of Calibration |
|--------------------------------|----------------------|-------------|---------------------|-------------------------|
| Radio Communication Analyzer   | MT8820C              | 6201300640  | Aug. 16, 2017       | Aug. 15, 2019           |
| Temperature & Humidity Chamber | GTH-120-40-CP-A<br>R | MAA1306-019 | Sep. 08, 2017       | Sep. 07, 2018           |
| DC Power Supply<br>Topward     | 33010D               | 807748      | Oct. 25, 2016       | Oct. 24, 2018           |
| Digital Multimeter<br>Fluke    | 87-III               | 70360742    | Jun. 30, 2017       | Jun. 29, 2018           |

- 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>             | LTE CAT M1 communication board                                                                         |                   |
| <b>Brand</b>               | WNC                                                                                                    |                   |
| <b>Test Model</b>          | UMC-SKVM2                                                                                              |                   |
| <b>Status of EUT</b>       | Identical Prototype                                                                                    |                   |
| <b>Power Supply Rating</b> | 5.0 Vdc (adapter)                                                                                      |                   |
| <b>Modulation Type</b>     | LTE                                                                                                    | QPSK, 16QAM       |
| <b>Frequency Range</b>     | LTE Band 13 (Channel Bandwidth: 5 MHz)                                                                 | 779.5 ~ 784.5 MHz |
|                            | LTE Band 13 (Channel Bandwidth: 10 MHz)                                                                | 782.0 MHz         |
| <b>Emission Designator</b> | LTE Band 13 (Channel Bandwidth: 5 MHz)                                                                 | 1M08G7D           |
|                            | LTE Band 13 (Channel Bandwidth: 10 MHz)                                                                | 1M09G7D           |
| <b>Max. ERP Power</b>      | LTE Band 13 (Channel Bandwidth: 5 MHz)                                                                 | 165.58 mW         |
|                            | LTE Band 13 (Channel Bandwidth: 10 MHz)                                                                | 177.42 mW         |
| <b>Antenna Type</b>        | Mode A: Fixed Internal Antenna with 2.74 dBi gain<br>Mode B: Fixed External Antenna with 1.66 dBi gain |                   |
| <b>Accessory Device</b>    | Refer to Note as below                                                                                 |                   |
| <b>Data Cable Supplied</b> | N/A                                                                                                    |                   |

Note:

1. The EUT contains following accessory devices.

| Product     | Brand | Model          | Description |
|-------------|-------|----------------|-------------|
| WWAN Module | WNC   | UMC-A12Q7-R    | --          |
| Antenna 1   | WNC   | 81.UMCKVM2.G01 | --          |
| Antenna 2   | WNC   | 81.UMCKVM2.G21 | --          |

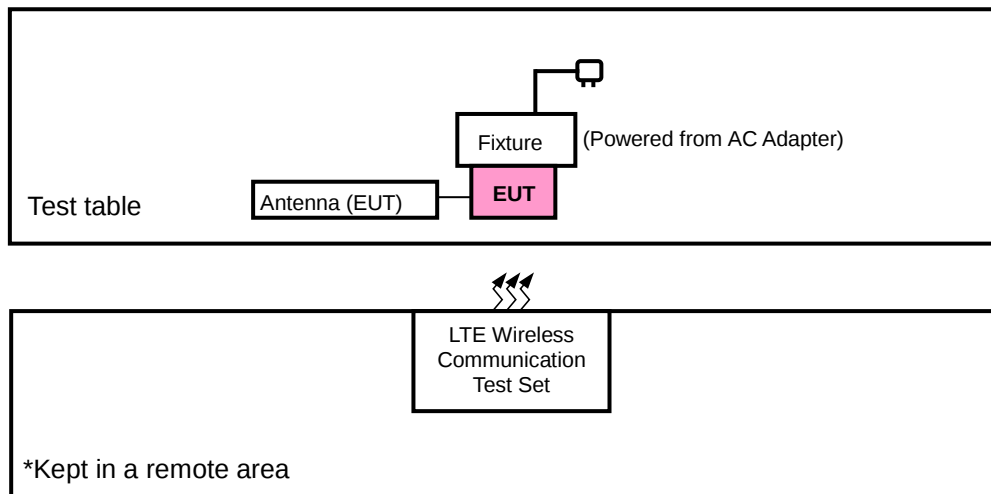
2. This device has 2 configurations as below.

Mode A: EUT test for Antenna 1

Mode B: EUT test for Antenna 2

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer 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. The following support units or accessories were used to form a representative test configuration during the tests.

| No. | Product                             | Brand    | Model No.                             | Serial No. | FCC ID |
|-----|-------------------------------------|----------|---------------------------------------|------------|--------|
| 1.  | Adapter                             | N/A      | N/A                                   | N/A        | N/A    |
| 2.  | Fixture                             | N/A      | GE Digital Energy kV2c electric meter | N/A        | N/A    |
| 3.  | LTE Wireless Communication Test Set | Keysight | E7515A                                | MY56030229 | N/A    |

| No. | Signal Cable Description Of The Above Support Units |
|-----|-----------------------------------------------------|
| 1.  | N/A                                                 |
| 2.  | N/A                                                 |
| 3.  | N/A                                                 |

Note:

1. All power cords of the above support units are non-shielded (1.8m).

### 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        | ERP                                | Radiated Emission                  |
|-------------|------------------------------------|------------------------------------|
| LTE Band 13 | Mode A: X-plane<br>Mode B: Y-plane | Mode A: X-plane<br>Mode B: Z-plane |

#### LTE Band 13

| EUT Configure Mode | Test Item             | Available Channel | Tested Channel      | Channel Bandwidth | Modulation  | Mode                |
|--------------------|-----------------------|-------------------|---------------------|-------------------|-------------|---------------------|
| A, B               | ERP                   | 23205 to 23255    | 23205, 23230, 23255 | 5 MHz             | QPSK, 16QAM | 1 RB / 0 RB Offset  |
|                    |                       | 23230             | 23230               | 10 MHz            | QPSK, 16QAM | 1 RB / 24 RB Offset |
| A                  | Frequency Stability   | 23205 to 23255    | 23205, 23255        | 5 MHz             | QPSK        | 1 RB / 0 RB Offset  |
|                    |                       | 23230             | 23230               | 10 MHz            | QPSK        | 1 RB / 24 RB Offset |
| A                  | Occupied Bandwidth    | 23205 to 23255    | 23205, 23230, 23255 | 5 MHz             | QPSK, 16QAM | 25 RB / 0 RB Offset |
|                    |                       | 23230             | 23230               | 10 MHz            | QPSK, 16QAM | 50 RB / 0 RB Offset |
| A                  | Peak to Average Ratio | 23205 to 23255    | 23205, 23230, 23255 | 5 MHz             | QPSK, 16QAM | 1 RB / 0 RB Offset  |
|                    |                       | 23230             | 23230               | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset  |
| A                  | Band Edge             | 23205 to 23255    | 23205               | 5 MHz             | QPSK        | 1 RB / 0 RB Offset  |
|                    |                       |                   | 23255               | 5 MHz             | QPSK        | 25 RB / 0 RB Offset |
|                    |                       | 23230             | 23230               | 10 MHz            | QPSK        | 1 RB / 24 RB Offset |
|                    |                       |                   |                     |                   |             | 25 RB / 0 RB Offset |
|                    |                       |                   | 23230               | 10 MHz            | QPSK        | 1 RB / 0 RB Offset  |
|                    |                       |                   |                     |                   |             | 50 RB / 0 RB Offset |
| A                  | Conducted Emission    | 23205 to 23255    | 23205, 23230, 23255 | 5 MHz             | QPSK        | 1 RB / 0 RB Offset  |
|                    |                       | 23230             | 23230               | 10 MHz            | QPSK        | 1 RB / 0 RB Offset  |
| A, B               | Radiated Emission     | 23205 to 23255    | 23205, 23230, 23255 | 5 MHz             | QPSK        | 1 RB / 0 RB Offset  |
|                    |                       | 23230             | 23230               | 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    |
|-----------------------|--------------------------|----------------|--------------|
| ERP                   | 25 deg. C, 65 % RH       | 120 Vac, 60 Hz | Jistong Wang |
| Frequency Stability   | 25 deg. C, 65 % RH       | 120 Vac, 60 Hz | Carlos Chen  |
| Occupied Bandwidth    | 25 deg. C, 65 % RH       | 120 Vac, 60 Hz | Carlos Chen  |
| Band Edge             | 25 deg. C, 65 % RH       | 120 Vac, 60 Hz | Carlos Chen  |
| Peak to Average Ratio | 25 deg. C, 65 % RH       | 120 Vac, 60 Hz | Carlos Chen  |
| Conducted Emission    | 25 deg. C, 65 % RH       | 120 Vac, 60 Hz | Carlos Chen  |
| Radiated Emission     | 25 deg. C, 65 % RH       | 120 Vac, 60 Hz | Jistong Wang |

### **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

Portable stations (hand-held devices) operating in the 776-787 MHz band are limited to 3 watts ERP

#### 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 5 MHz for WCDMA and 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 from E.I.R.P power by subtracting the gain of dipole,  $E.R.P \text{ power} = E.I.P.R \text{ power} - 2.15 \text{ dBi}$ .

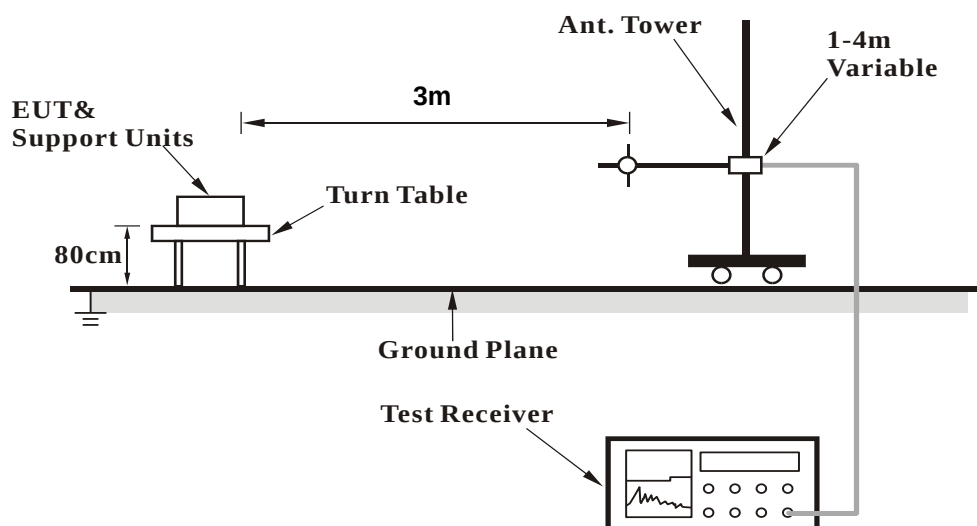
##### **Conducted Power Measurement:**

- 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.

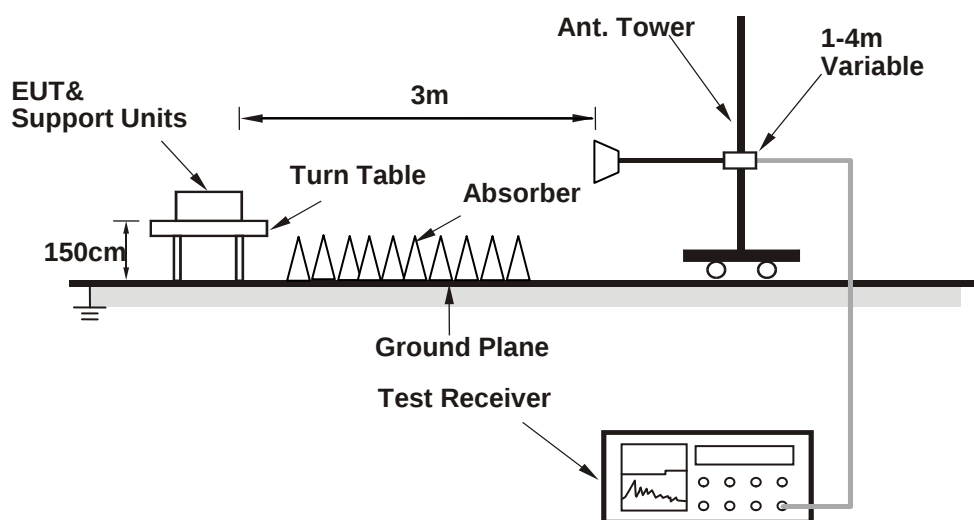
#### 4.1.3 Test Setup

##### EIRP / ERP Measurement:

<Radiated Emission below or equal 1 GHz>

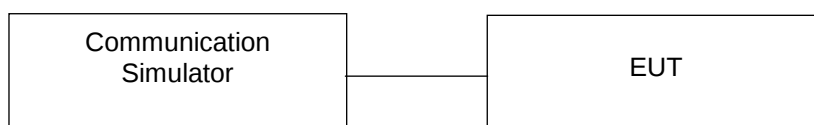


<Radiated Emission above 1 GHz>



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

##### Conducted Power Measurement:



#### 4.1.4 Test Results

##### Conducted Output Power (dBm)

|      |         |           |     |       |         |    |           |     |         |       |
|------|---------|-----------|-----|-------|---------|----|-----------|-----|---------|-------|
| eMTC | Band 13 | Region(s) | FOC | Power | Class 3 | 23 | Tolerance | 2.7 | maximum | 22.61 |
|------|---------|-----------|-----|-------|---------|----|-----------|-----|---------|-------|

| BW(MHz):          |                 | 5                         |                 |                             |                    |         |           |                  |                        |             |
|-------------------|-----------------|---------------------------|-----------------|-----------------------------|--------------------|---------|-----------|------------------|------------------------|-------------|
| Test Frequency ID | N <sub>UL</sub> | Frequency of Uplink [MHz] | N <sub>DL</sub> | Frequency of Downlink [MHz] | Test Configuration |         |           |                  | EUT                    |             |
|                   |                 |                           |                 |                             | Modulation         | RB Size | RB Offset | Narrowband Index | Cell power (dBm/15kHz) | power (dBm) |
| Low Range         | 23205           | 779.5                     | 5205            | 748.5                       | QPSK               | 1       | 0         | 0                | -85                    | 22.35       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 5         | 0                | -85                    | 22.25       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 0         | 1                | -85                    | 22.28       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 5         | 1                | -85                    | 22.21       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 0         | 3                | -85                    | 22.58       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 5         | 3                | -85                    | 22.52       |
|                   |                 |                           |                 |                             | QPSK               | 3       | 0         | 0                | -85                    | 21.45       |
|                   |                 |                           |                 |                             | QPSK               | 3       | 3         | 3                | -85                    | 21.54       |
|                   |                 |                           |                 |                             | QPSK               | 6       | 0         | 0                | -85                    | 21.45       |
|                   |                 |                           |                 |                             | QPSK               | 6       | 0         | 1                | -85                    | 21.29       |
|                   |                 |                           |                 |                             | QPSK               | 6       | 0         | 3                | -85                    | 21.57       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 0         | 0                | -85                    | 22.33       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 5         | 0                | -85                    | 22.16       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 0         | 1                | -85                    | 22.31       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 5         | 1                | -85                    | 22.05       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 0         | 3                | -85                    | 22.22       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 5         | 3                | -85                    | 22.28       |
|                   |                 |                           |                 |                             | 16QAM              | 3       | 0         | 0                | -85                    | 21.38       |
|                   |                 |                           |                 |                             | 16QAM              | 3       | 3         | 3                | -85                    | 21.61       |
|                   |                 |                           |                 |                             | 16QAM              | 5       | 0         | 0                | -85                    | 21.48       |
|                   |                 |                           |                 |                             | 16QAM              | 5       | 0         | 1                | -85                    | 21.43       |
|                   |                 |                           |                 |                             | 16QAM              | 5       | 0         | 3                | -85                    | 21.6        |
| Mid Range         | 23230           | 782                       | 5230            | 751                         | QPSK               | 1       | 0         | 0                | -85                    | 22.43       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 5         | 0                | -85                    | 22.61       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 0         | 1                | -85                    | 22.31       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 5         | 1                | -85                    | 22.52       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 0         | 3                | -85                    | 22.39       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 5         | 3                | -85                    | 22.47       |
|                   |                 |                           |                 |                             | QPSK               | 3       | 0         | 0                | -85                    | 21.59       |
|                   |                 |                           |                 |                             | QPSK               | 3       | 3         | 3                | -85                    | 21.53       |
|                   |                 |                           |                 |                             | QPSK               | 6       | 0         | 0                | -85                    | 21.55       |
|                   |                 |                           |                 |                             | QPSK               | 6       | 0         | 1                | -85                    | 21.46       |
|                   |                 |                           |                 |                             | QPSK               | 6       | 0         | 3                | -85                    | 21.52       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 0         | 0                | -85                    | 22.52       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 5         | 0                | -85                    | 22.49       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 0         | 1                | -85                    | 22.46       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 5         | 1                | -85                    | 22.36       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 0         | 3                | -85                    | 22.49       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 5         | 3                | -85                    | 22.43       |
|                   |                 |                           |                 |                             | 16QAM              | 3       | 0         | 0                | -85                    | 21.43       |
|                   |                 |                           |                 |                             | 16QAM              | 3       | 3         | 3                | -85                    | 21.41       |
|                   |                 |                           |                 |                             | 16QAM              | 5       | 0         | 0                | -85                    | 21.52       |
|                   |                 |                           |                 |                             | 16QAM              | 5       | 0         | 1                | -85                    | 21.45       |
|                   |                 |                           |                 |                             | 16QAM              | 5       | 0         | 3                | -85                    | 21.4        |
| High Range        | 23255           | 784.5                     | 5255            | 753.5                       | QPSK               | 1       | 0         | 0                | -85                    | 22.52       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 5         | 0                | -85                    | 22.42       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 0         | 1                | -85                    | 22.38       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 5         | 1                | -85                    | 22.39       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 0         | 3                | -85                    | 22.38       |
|                   |                 |                           |                 |                             | QPSK               | 1       | 5         | 3                | -85                    | 22.4        |
|                   |                 |                           |                 |                             | QPSK               | 3       | 0         | 0                | -85                    | 21.55       |
|                   |                 |                           |                 |                             | QPSK               | 3       | 3         | 3                | -85                    | 21.43       |
|                   |                 |                           |                 |                             | QPSK               | 6       | 0         | 0                | -85                    | 21.55       |
|                   |                 |                           |                 |                             | QPSK               | 6       | 0         | 1                | -85                    | 21.5        |
|                   |                 |                           |                 |                             | QPSK               | 6       | 0         | 3                | -85                    | 21.45       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 0         | 0                | -85                    | 22.53       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 5         | 0                | -85                    | 22.48       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 0         | 1                | -85                    | 22.45       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 5         | 1                | -85                    | 22.41       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 0         | 3                | -85                    | 22.44       |
|                   |                 |                           |                 |                             | 16QAM              | 1       | 5         | 3                | -85                    | 22.45       |
|                   |                 |                           |                 |                             | 16QAM              | 3       | 0         | 0                | -85                    | 21.47       |
|                   |                 |                           |                 |                             | 16QAM              | 3       | 3         | 3                | -85                    | 21.36       |
|                   |                 |                           |                 |                             | 16QAM              | 5       | 0         | 0                | -85                    | 21.52       |
|                   |                 |                           |                 |                             | 16QAM              | 5       | 0         | 1                | -85                    | 21.39       |
|                   |                 |                           |                 |                             | 16QAM              | 5       | 0         | 3                | -85                    | 21.38       |

| BW(MHz):          |                 | 10                        |                 |                             |                                    |         |           |                  |                        |             |
|-------------------|-----------------|---------------------------|-----------------|-----------------------------|------------------------------------|---------|-----------|------------------|------------------------|-------------|
| Test Frequency ID | N <sub>UL</sub> | Frequency of Uplink [MHz] | N <sub>DL</sub> | Frequency of Downlink [MHz] | Test ConfigurationInitial of Power |         |           |                  | EUT                    |             |
|                   |                 |                           |                 |                             | Modulation                         | RB Size | RB Offset | Narrowband Index | Cell power (dBm/15kHz) | power (dBm) |
| Mid Range         | 23230           | 782                       | 5230            | 751                         | QPSK                               | 1       | 0         | 0                | -85                    | 22.48       |
|                   |                 |                           |                 |                             | QPSK                               | 1       | 5         | 0                | -85                    | 22.36       |
|                   |                 |                           |                 |                             | QPSK                               | 1       | 0         | 3                | -85                    | 22.44       |
|                   |                 |                           |                 |                             | QPSK                               | 1       | 5         | 3                | -85                    | 22.34       |
|                   |                 |                           |                 |                             | QPSK                               | 1       | 0         | 7                | -85                    | 22.35       |
|                   |                 |                           |                 |                             | QPSK                               | 1       | 5         | 7                | -85                    | 22.29       |
|                   |                 |                           |                 |                             | QPSK                               | 4       | 0         | 0                | -85                    | 22.37       |
|                   |                 |                           |                 |                             | QPSK                               | 4       | 2         | 7                | -85                    | 22.34       |
|                   |                 |                           |                 |                             | QPSK                               | 6       | 0         | 0                | -85                    | 21.42       |
|                   |                 |                           |                 |                             | QPSK                               | 6       | 0         | 7                | -85                    | 21.3        |
|                   |                 |                           |                 |                             | 16QAM                              | 1       | 0         | 0                | -85                    | 22.37       |
|                   |                 |                           |                 |                             | 16QAM                              | 1       | 5         | 0                | -85                    | 22.32       |
|                   |                 |                           |                 |                             | 16QAM                              | 1       | 0         | 3                | -85                    | 22.31       |
|                   |                 |                           |                 |                             | 16QAM                              | 1       | 5         | 3                | -85                    | 22.26       |
|                   |                 |                           |                 |                             | 16QAM                              | 1       | 0         | 7                | -85                    | 22.28       |
|                   |                 |                           |                 |                             | 16QAM                              | 1       | 5         | 7                | -85                    | 22.24       |
|                   |                 |                           |                 |                             | 16QAM                              | 4       | 2         | 0                | -85                    | 22.46       |
|                   |                 |                           |                 |                             | 16QAM                              | 4       | 2         | 7                | -85                    | 22.43       |
|                   |                 |                           |                 |                             | 16QAM                              | 5       | 0         | 0                | -85                    | 21.45       |
|                   |                 |                           |                 |                             | 16QAM                              | 5       | 0         | 7                | -85                    | 21.31       |

# ERP Power (dBm)

## Mode A

| LTE Band 13                      |         |                 |           |                        |           |          |                    |
|----------------------------------|---------|-----------------|-----------|------------------------|-----------|----------|--------------------|
| Channel Bandwidth: 5 MHz / QPSK  |         |                 |           |                        |           |          |                    |
| Plane                            | Channel | Frequency (MHz) | LVL (dBm) | Correction Factor (dB) | ERP (dBm) | ERP (mW) | Polarization (H/V) |
| X                                | 23205   | 779.5           | -8.57     | 32.24                  | 21.52     | 141.91   | H                  |
|                                  | 23230   | 782.0           | -7.83     | 32.17                  | 22.19     | 165.58   |                    |
|                                  | 23255   | 784.5           | -9.32     | 32.11                  | 20.64     | 115.88   |                    |
|                                  | 23205   | 779.5           | -13.03    | 32.43                  | 17.25     | 53.09    | V                  |
|                                  | 23230   | 782.0           | -12.99    | 32.42                  | 17.28     | 53.46    |                    |
|                                  | 23255   | 784.5           | -13.73    | 32.46                  | 16.58     | 45.50    |                    |
| Channel Bandwidth: 5 MHz / 16QAM |         |                 |           |                        |           |          |                    |
| X                                | 23205   | 779.5           | -9.65     | 32.24                  | 20.44     | 110.66   | H                  |
|                                  | 23230   | 782.0           | -8.89     | 32.17                  | 21.13     | 129.72   |                    |
|                                  | 23255   | 784.5           | -10.32    | 32.11                  | 19.64     | 92.04    |                    |
|                                  | 23205   | 779.5           | -14.25    | 32.43                  | 16.03     | 40.09    | V                  |
|                                  | 23230   | 782.0           | -14.49    | 32.42                  | 15.78     | 37.84    |                    |
|                                  | 23255   | 784.5           | -14.93    | 32.46                  | 15.38     | 34.51    |                    |

| LTE Band 13                       |         |                 |           |                        |           |          |                    |
|-----------------------------------|---------|-----------------|-----------|------------------------|-----------|----------|--------------------|
| Channel Bandwidth: 10 MHz / QPSK  |         |                 |           |                        |           |          |                    |
| Plane                             | Channel | Frequency (MHz) | LVL (dBm) | Correction Factor (dB) | ERP (dBm) | ERP (mW) | Polarization (H/V) |
| X                                 | 23230   | 782.0           | -7.53     | 32.17                  | 22.49     | 177.42   | H                  |
|                                   | 23230   | 782.0           | -12.80    | 32.42                  | 17.47     | 55.85    | V                  |
| Channel Bandwidth: 10 MHz / 16QAM |         |                 |           |                        |           |          |                    |
| X                                 | 23230   | 782.0           | -8.76     | 32.17                  | 21.26     | 133.66   | H                  |
|                                   | 23230   | 782.0           | -14.00    | 32.42                  | 16.27     | 42.36    | V                  |

# Mode B

| LTE Band 13                      |         |                 |           |                        |           |          |                    |
|----------------------------------|---------|-----------------|-----------|------------------------|-----------|----------|--------------------|
| Channel Bandwidth: 5 MHz / QPSK  |         |                 |           |                        |           |          |                    |
| Plane                            | Channel | Frequency (MHz) | LVL (dBm) | Correction Factor (dB) | ERP (dBm) | ERP (mW) | Polarization (H/V) |
| Y                                | 23205   | 779.5           | -8.57     | 32.24                  | 21.52     | 141.91   | H                  |
|                                  | 23230   | 782.0           | -8.64     | 32.17                  | 21.38     | 137.40   |                    |
|                                  | 23255   | 784.5           | -8.81     | 32.11                  | 21.15     | 130.32   |                    |
|                                  | 23205   | 779.5           | -11.57    | 32.43                  | 18.71     | 74.30    | V                  |
|                                  | 23230   | 782.0           | -11.72    | 32.42                  | 18.55     | 71.61    |                    |
|                                  | 23255   | 784.5           | -12.06    | 32.46                  | 18.25     | 66.83    |                    |
| Channel Bandwidth: 5 MHz / 16QAM |         |                 |           |                        |           |          |                    |
| Y                                | 23205   | 779.5           | -9.58     | 32.24                  | 20.51     | 112.46   | H                  |
|                                  | 23230   | 782.0           | -9.65     | 32.17                  | 20.37     | 108.89   |                    |
|                                  | 23255   | 784.5           | -9.82     | 32.11                  | 20.14     | 103.28   |                    |
|                                  | 23205   | 779.5           | -12.58    | 32.43                  | 17.70     | 58.88    | V                  |
|                                  | 23230   | 782.0           | -12.73    | 32.42                  | 17.54     | 56.75    |                    |
|                                  | 23255   | 784.5           | -13.07    | 32.46                  | 17.24     | 52.97    |                    |

| LTE Band 13                       |         |                 |           |                        |           |          |                    |
|-----------------------------------|---------|-----------------|-----------|------------------------|-----------|----------|--------------------|
| Channel Bandwidth: 10 MHz / QPSK  |         |                 |           |                        |           |          |                    |
| Plane                             | Channel | Frequency (MHz) | LVL (dBm) | Correction Factor (dB) | ERP (dBm) | ERP (mW) | Polarization (H/V) |
| Y                                 | 23230   | 782.0           | -8.34     | 32.17                  | 21.68     | 147.23   | H                  |
|                                   | 23230   | 782.0           | -11.42    | 32.42                  | 18.85     | 76.74    | V                  |
| Channel Bandwidth: 10 MHz / 16QAM |         |                 |           |                        |           |          |                    |
| Y                                 | 23230   | 782.0           | -9.35     | 32.17                  | 20.67     | 116.68   | H                  |
|                                   | 23230   | 782.0           | -12.43    | 32.42                  | 17.84     | 60.81    | V                  |

## 4.2 Frequency Stability Measurement

### 4.2.1 Limits of Frequency Stability Measurement

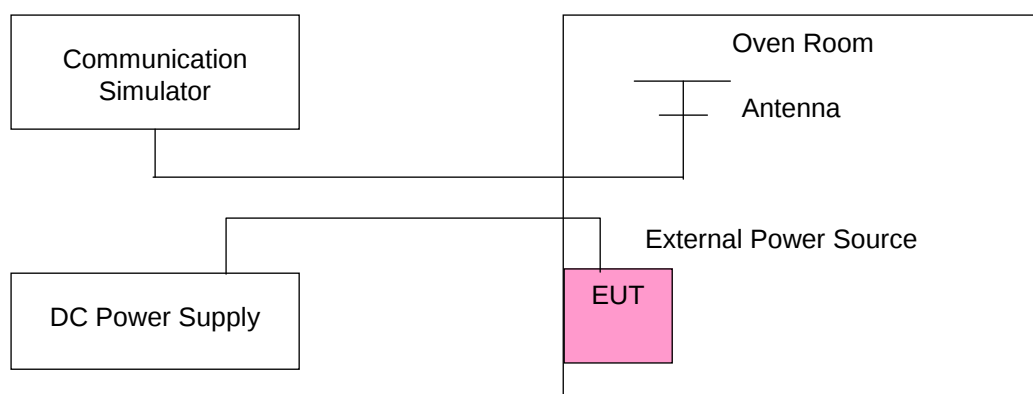
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

### 4.2.2 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.

### 4.2.3 Test Setup



#### 4.2.4 Test Results

##### Frequency Error vs. Voltage

| Voltage<br>(Volts) | LTE Band 13              |                       |                 |                       | Limit (ppm) |
|--------------------|--------------------------|-----------------------|-----------------|-----------------------|-------------|
|                    | Channel Bandwidth: 5 MHz |                       |                 |                       |             |
|                    | Low Channel              |                       | High Channel    |                       |             |
|                    | Frequency (MHz)          | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |             |
| 3.8                | 779.500002               | 0.003                 | 784.500004      | 0.004                 | 2.5         |
| 3.4                | 779.500003               | 0.004                 | 784.500002      | 0.003                 | 2.5         |
| 4.2                | 779.500002               | 0.002                 | 784.500002      | 0.002                 | 2.5         |

**Note:** The applicant defined the normal working voltage of the battery is from 3.4 Vdc to 4.2 Vdc.

##### Frequency Error vs. Temperature

| Temp. (°C) | LTE Band 13              |                       |                 |                       | Limit (ppm) |
|------------|--------------------------|-----------------------|-----------------|-----------------------|-------------|
|            | Channel Bandwidth: 5 MHz |                       |                 |                       |             |
|            | Low Channel              |                       | High Channel    |                       |             |
|            | Frequency (MHz)          | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |             |
| -20        | 779.500002               | 0.002                 | 784.500002      | 0.002                 | 2.5         |
| -10        | 779.500003               | 0.004                 | 784.500004      | 0.005                 | 2.5         |
| 0          | 779.500003               | 0.004                 | 784.500004      | 0.005                 | 2.5         |
| 10         | 779.500003               | 0.003                 | 784.500003      | 0.004                 | 2.5         |
| 20         | 779.500002               | 0.003                 | 784.500003      | 0.004                 | 2.5         |
| 30         | 779.499997               | -0.004                | 784.499998      | -0.003                | 2.5         |
| 40         | 779.499997               | -0.004                | 784.499996      | -0.005                | 2.5         |
| 50         | 779.499999               | -0.002                | 784.499996      | -0.005                | 2.5         |
| 60         | 779.499997               | -0.003                | 784.499997      | -0.004                | 2.5         |
| 70         | 779.499997               | -0.004                | 784.499999      | -0.001                | 2.5         |

**Note:**

1. The applicant declared that the normal operating temperature of the EUT is from -20°C to 70°C.
2. The EUT would shut down automatically as below -20°C.

### Frequency Error vs. Voltage

| Voltage<br>(Volts) | LTE Band 13               |                       | Limit (ppm) |
|--------------------|---------------------------|-----------------------|-------------|
|                    | Channel Bandwidth: 10 MHz |                       |             |
|                    | Frequency (MHz)           | Frequency Error (ppm) |             |
| 3.8                | 782.000002                | 0.003                 | 2.5         |
| 3.4                | 782.000001                | 0.001                 | 2.5         |
| 4.2                | 782.000002                | 0.002                 | 2.5         |

**Note:** The applicant defined the normal working voltage of the battery is from 3.4 Vdc to 4.2 Vdc.

### Frequency Error vs. Temperature

| Temp. (°C) | LTE Band 13               |                       | Limit (ppm) |
|------------|---------------------------|-----------------------|-------------|
|            | Channel Bandwidth: 10 MHz |                       |             |
|            | Frequency (MHz)           | Frequency Error (ppm) |             |
| -20        | 782.000004                | 0.005                 | 2.5         |
| -10        | 782.000003                | 0.004                 | 2.5         |
| 0          | 782.000003                | 0.004                 | 2.5         |
| 10         | 782.000003                | 0.003                 | 2.5         |
| 20         | 782.000002                | 0.002                 | 2.5         |
| 30         | 781.999998                | -0.003                | 2.5         |
| 40         | 781.999998                | -0.003                | 2.5         |
| 50         | 781.999997                | -0.003                | 2.5         |
| 60         | 781.999999                | -0.001                | 2.5         |
| 70         | 781.999998                | -0.003                | 2.5         |

**Note:**

1. The applicant declared that the normal operating temperature of the EUT is from -20°C to 70°C.
2. The EUT would shut down automatically as below -20°C.

### 4.3 Occupied Bandwidth Measurement

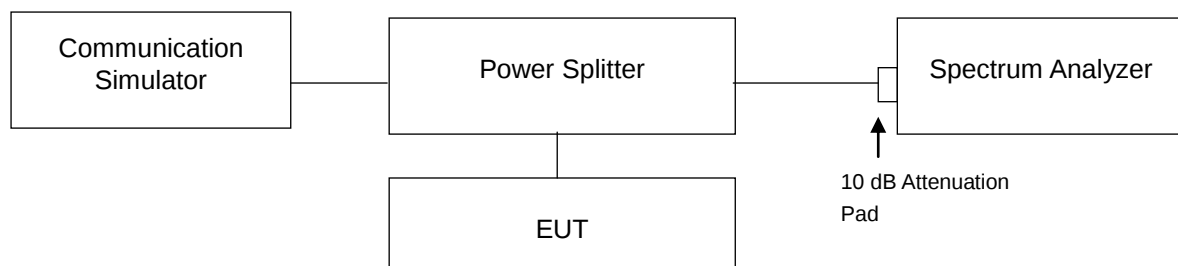
#### 4.3.1 Limits of Occupied Bandwidth Measurement

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.

#### 4.3.2 Test Procedure

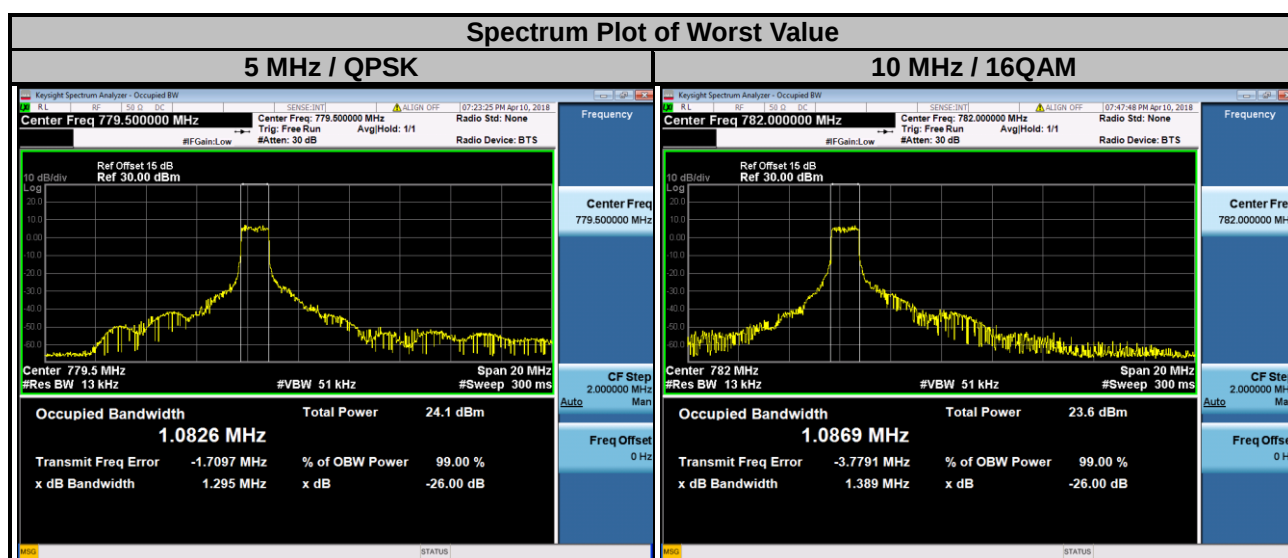
- The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

#### 4.3.3 Test Setup



#### 4.3.4 Test Result

| LTE Band 13              |                 |                               |        |                           |                 |                               |        |
|--------------------------|-----------------|-------------------------------|--------|---------------------------|-----------------|-------------------------------|--------|
| 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  |
| 23205                    | 779.5           | 1.0826                        | 0.9062 | 23230                     | 782.0           | 1.0869                        | 0.9990 |
| 23230                    | 782.0           | 1.0817                        | 0.9005 |                           |                 |                               |        |
| 23255                    | 784.5           | 1.0786                        | 0.9085 |                           |                 |                               |        |



## 4.4 Band Edge Measurement

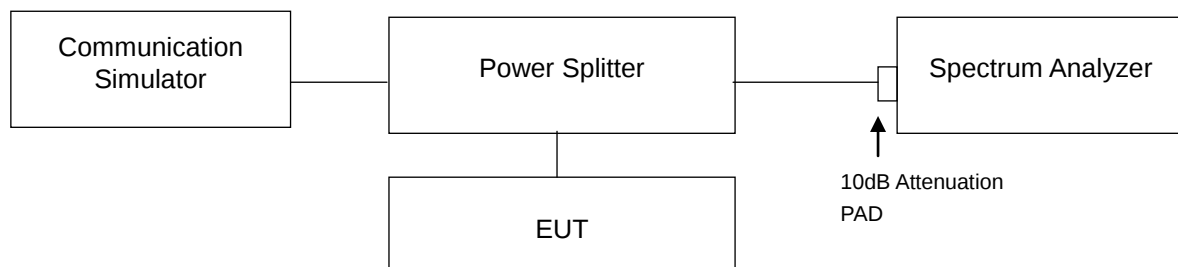
### 4.4.1 Limits of Band Edge Measurement

For operations in the 776-787 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least  $43 + 10 \log (P)$  dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater.

However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

For operations in the 1710–1755 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log_{10}(P)$  dB.

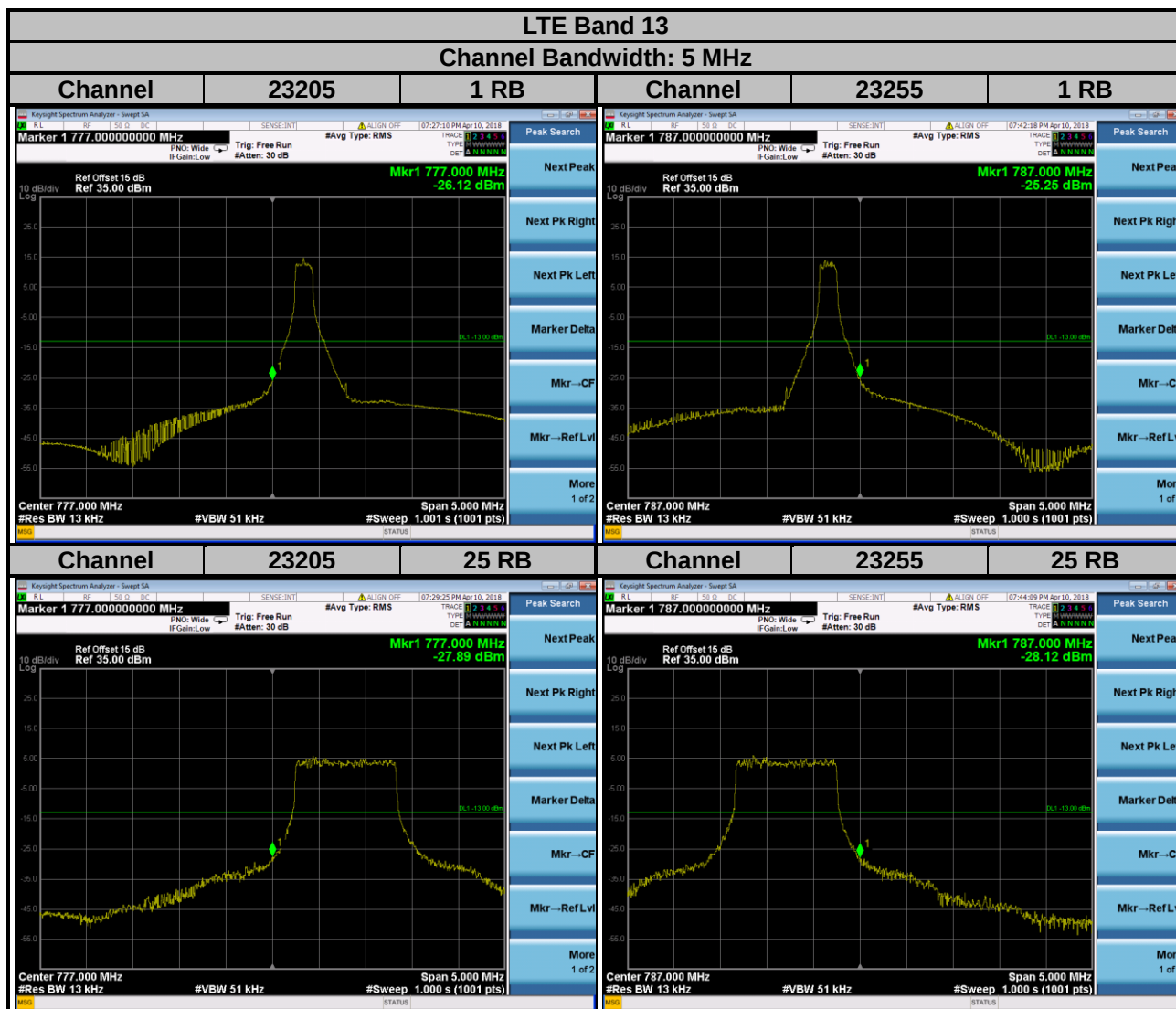
### 4.4.2 Test Setup

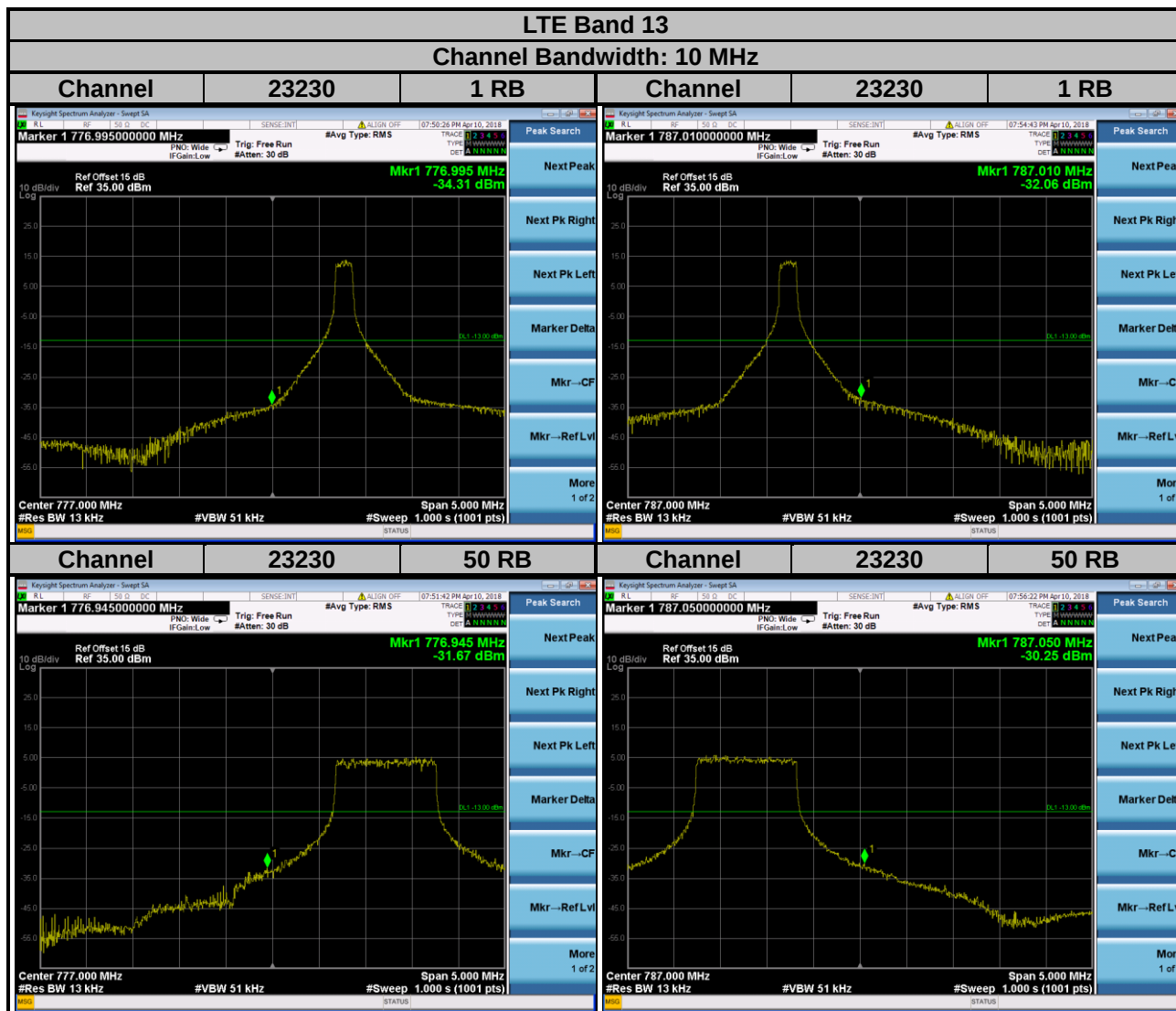


### 4.4.3 Test Procedures

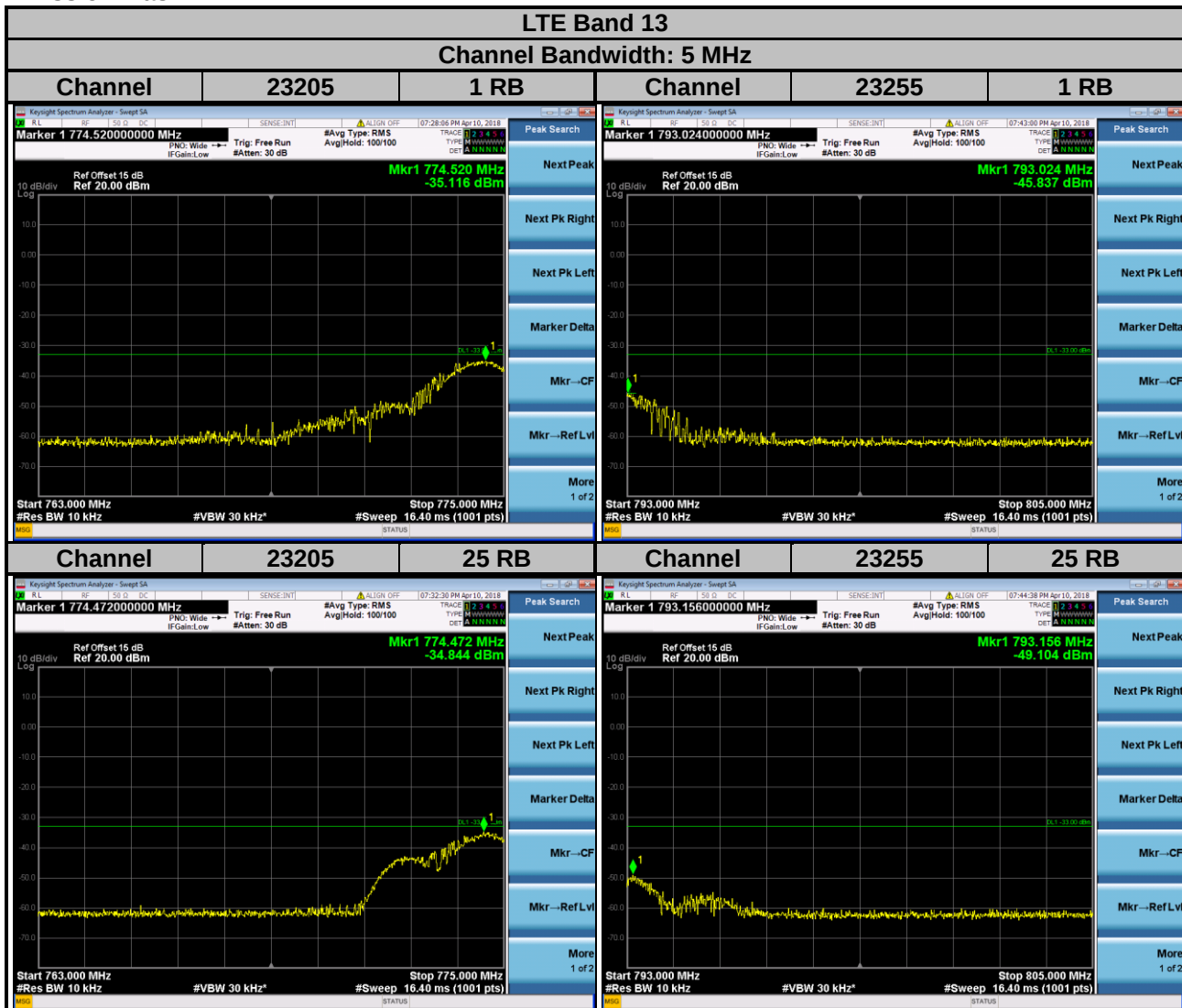
- All measurements were done at low and high operational frequency range.
- The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (LTE Bandwidth 5 MHz/10 MHz).
- Record the max. trace plot into the test report.

#### 4.4.4 Test Results





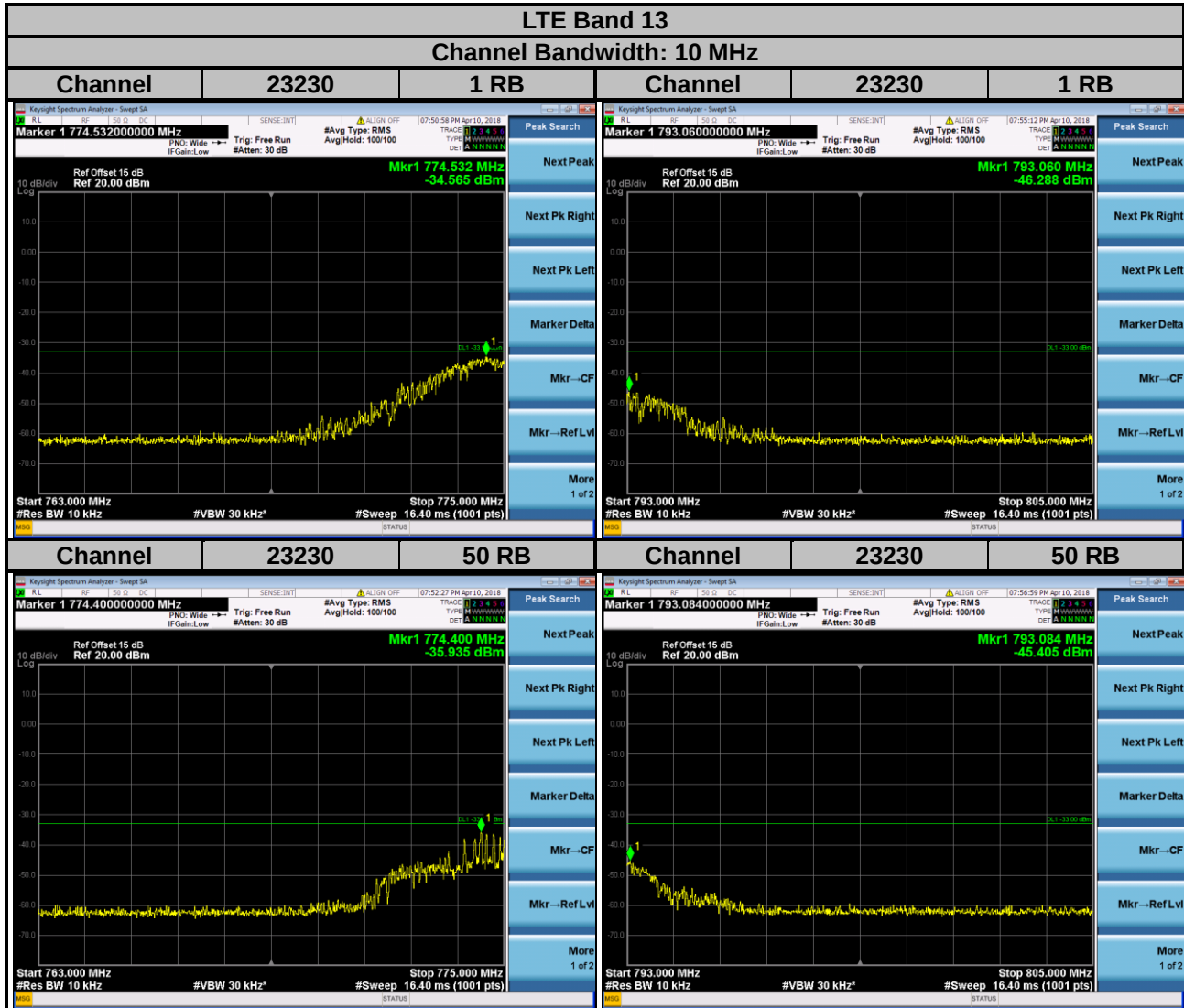
## Emission Mask



For the 763 - 775 MHz and 793 - 805 MHz band, the FCC limit is  $65 + 10\log(P[\text{watt}])$  in a 6.25 kHz bandwidth. Since it was not possible to set the resolution bandwidth to 6.25 kHz with the available equipment, a bandwidth of 10 kHz was used instead to show compliance. By using a 10 kHz bandwidth on the spectrum analyzer.

$$10\log(10\text{kHz}/6.25\text{kHz}) = 2.04 \text{ dB}$$

$$\text{Limit line} = -35 \text{ dBm} + 2.04 \text{ dB} = -32.96 \text{ dBm}$$



For the 763 - 775 MHz and 793 - 805 MHz band, the FCC limit is  $65 + 10\log(P[\text{watt}])$  in a 6.25 kHz bandwidth. Since it was not possible to set the resolution bandwidth to 6.25 kHz with the available equipment, a bandwidth of 10 kHz was used instead to show compliance. By using a 10 kHz bandwidth on the spectrum analyzer.

$$10\log(10\text{kHz}/6.25\text{kHz}) = 2.04 \text{ dB}$$

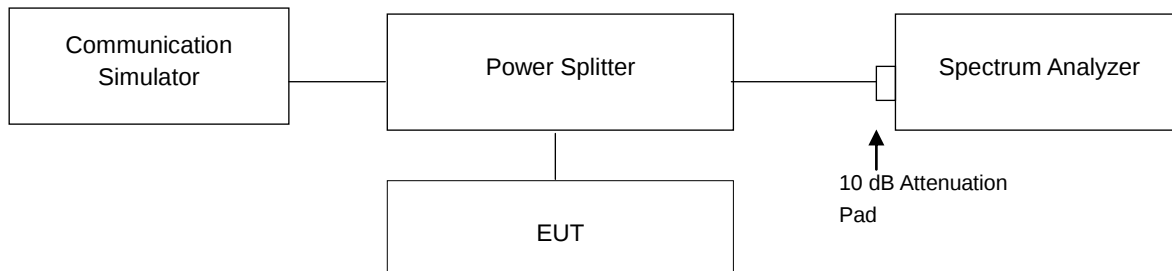
$$\text{Limit line} = -35 \text{ dBm} + 2.04 \text{ dB} = -32.96 \text{ dBm}$$

## 4.5 Peak to Average Ratio

### 4.5.1 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.

### 4.5.2 Test Setup

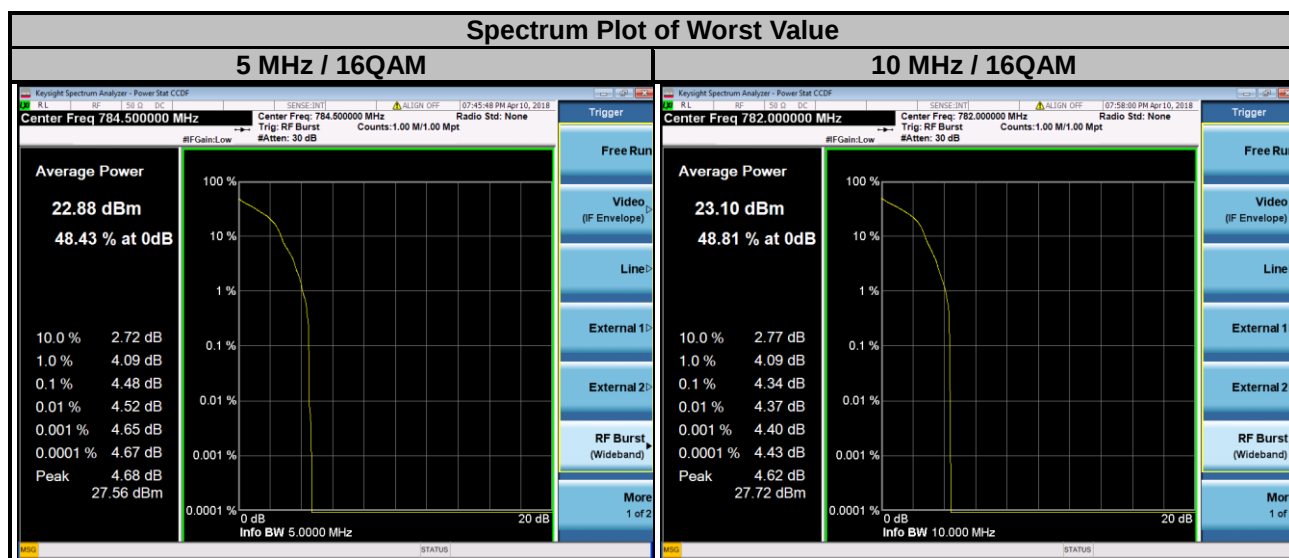


### 4.5.3 Test Procedures

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 %.

#### 4.5.4 Test Results

| LTE Band 13              |                 |                            |       |                           |                 |                            |       |
|--------------------------|-----------------|----------------------------|-------|---------------------------|-----------------|----------------------------|-------|
| 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 |
| 23205                    | 779.5           | 4.00                       | 4.44  | 23230                     | 782.0           | 3.98                       | 4.34  |
| 23230                    | 782.0           | 3.99                       | 4.44  |                           |                 |                            |       |
| 23255                    | 784.5           | 4.03                       | 4.48  |                           |                 |                            |       |

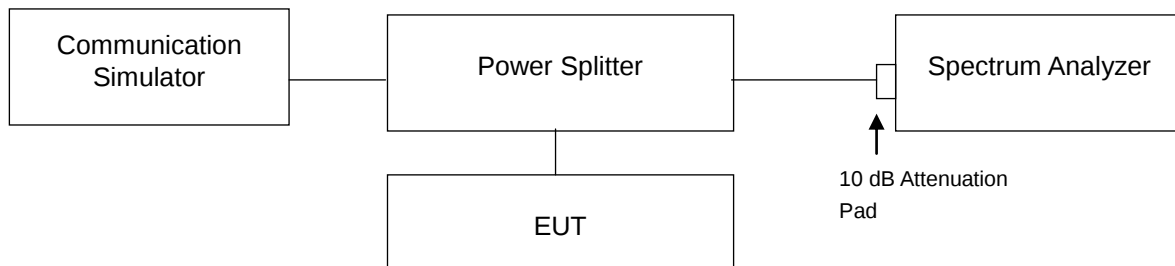


## 4.6 Conducted Spurious Emissions

### 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  $43 + 10 \log_{10}(P)$  dB. The limit of emission is equal to -13 dBm.

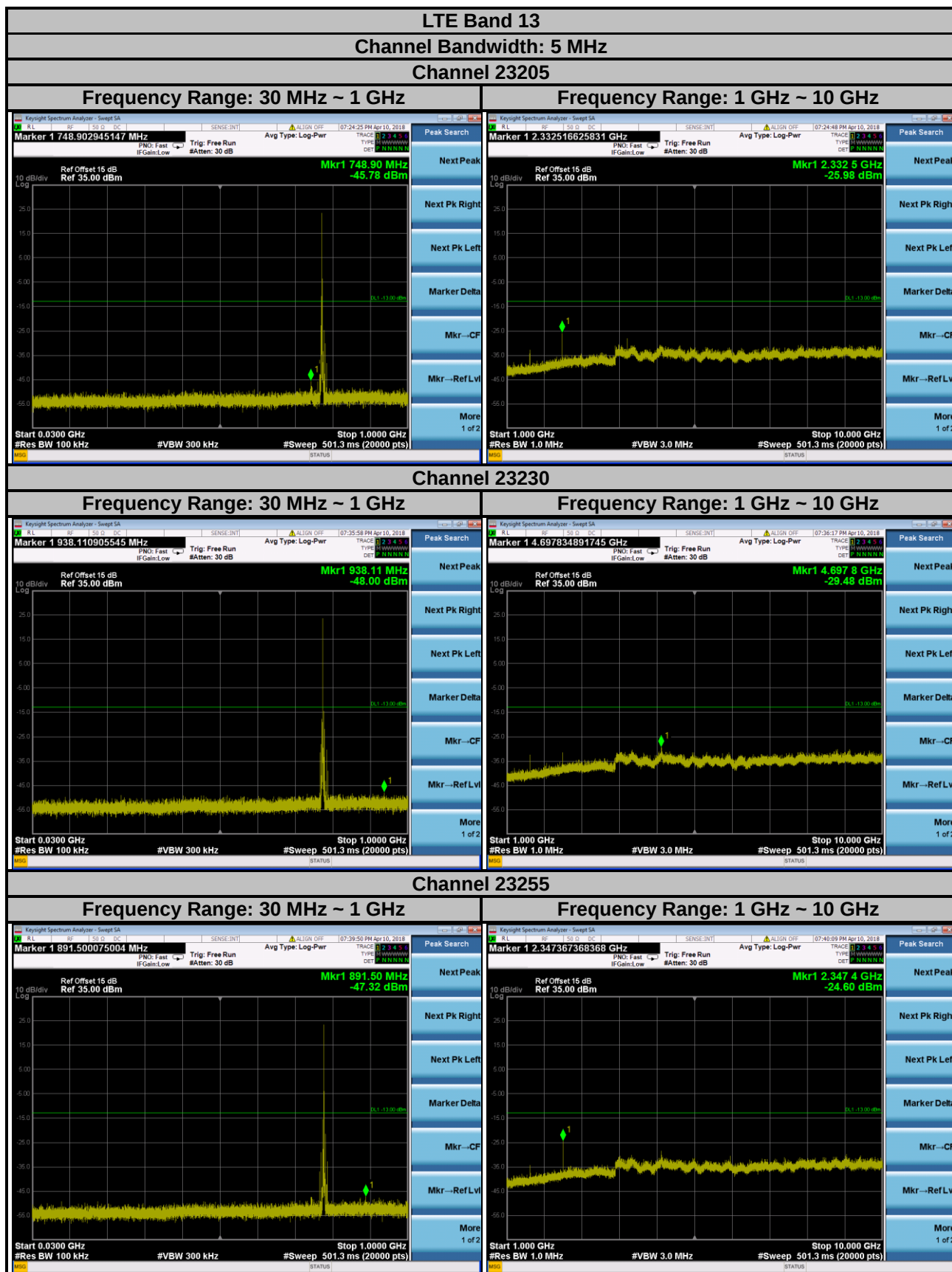
### 4.6.2 Test Setup

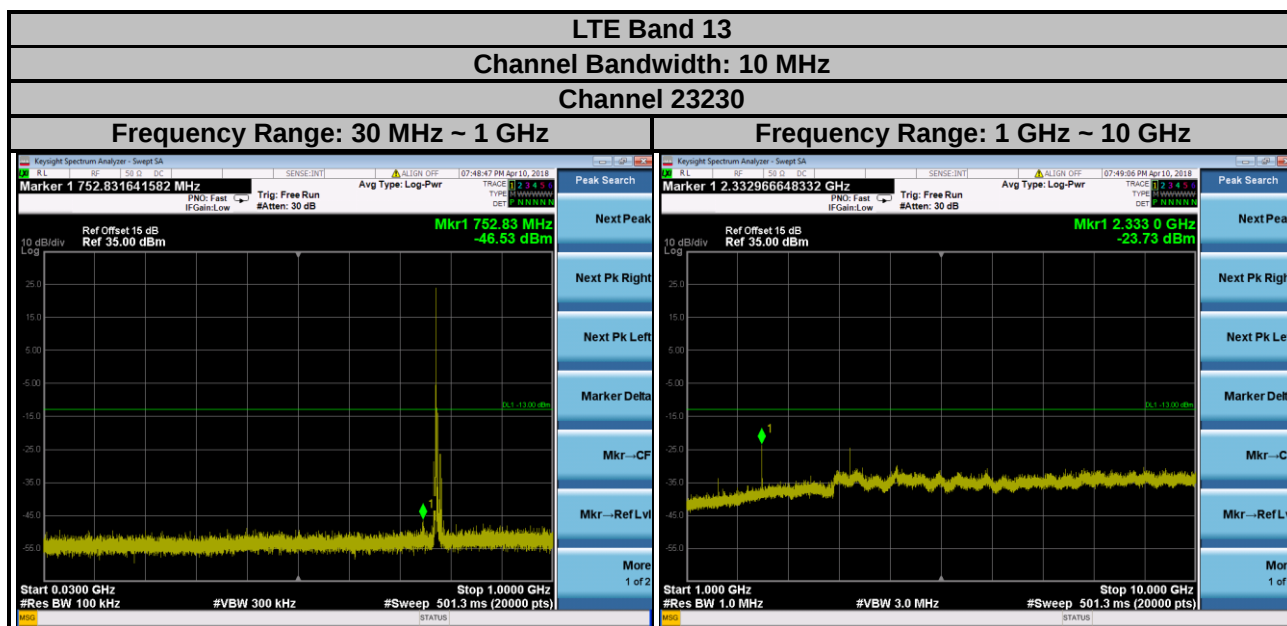


### 4.6.3 Test Procedure

- 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 30 MHz to 10 GHz for LTE Band 13. 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





## 4.7 Radiated Emission Measurement

### 4.7.1 Limits of Radiated Emission Measurement

- a. The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log_{10}(P)$  dB. The limit of emission is equal to -13 dBm.
- b. For operations in the 775-788 MHz, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz. The limit of emissions 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.  $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$ .
- d. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole,  $E.R.P \text{ power} = E.I.P.R \text{ power} - 2.15 \text{ dBi}$ .

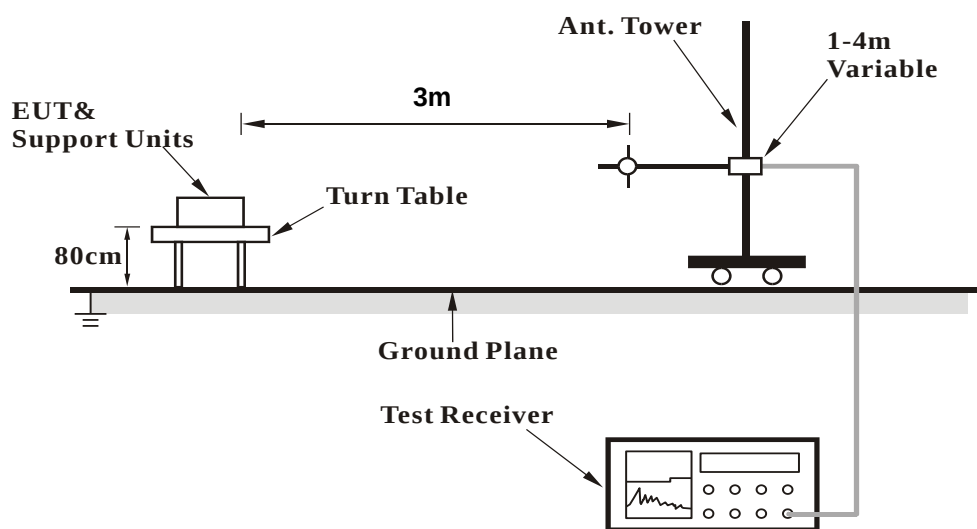
**Note:** The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

### 4.7.3 Deviation from Test Standard

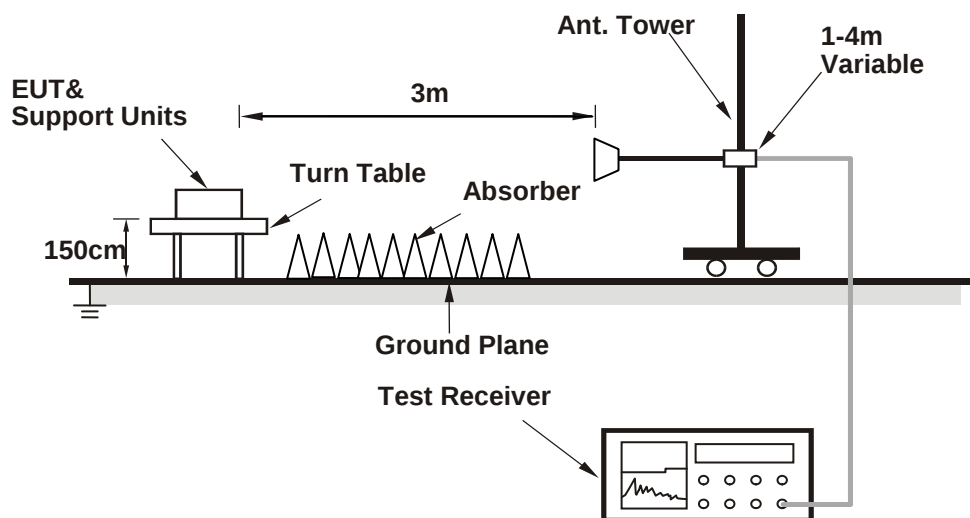
No deviation.

#### 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 13

Mode A

Channel Bandwidth: 5 MHz / QPSK

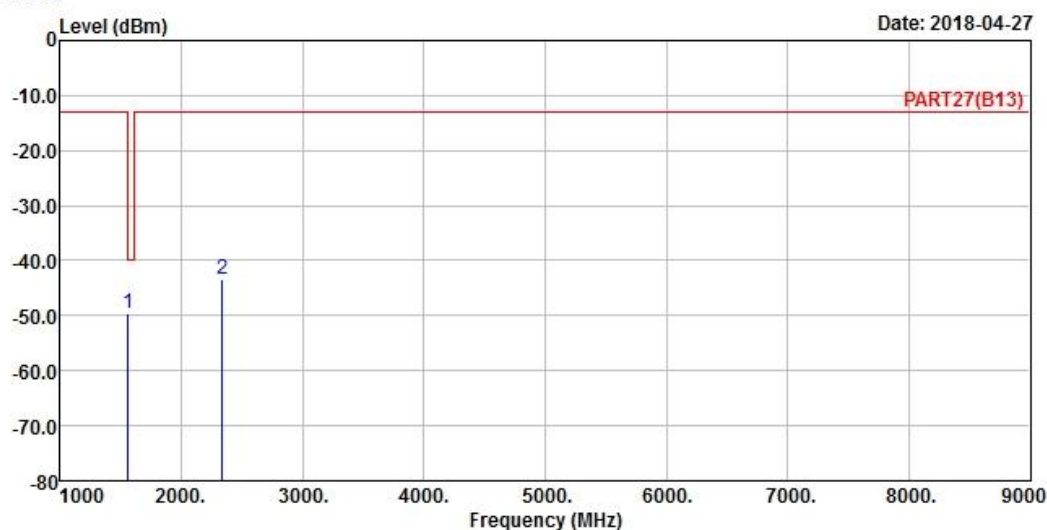
Low Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 3



Site : 966 Chamber 5

Condition: PART27(B13) HORIZONTAL

Remak : CAT\_M1 Band 13 QPSK\_5M Link\_L-CH

Tested by: Jisyong Wang

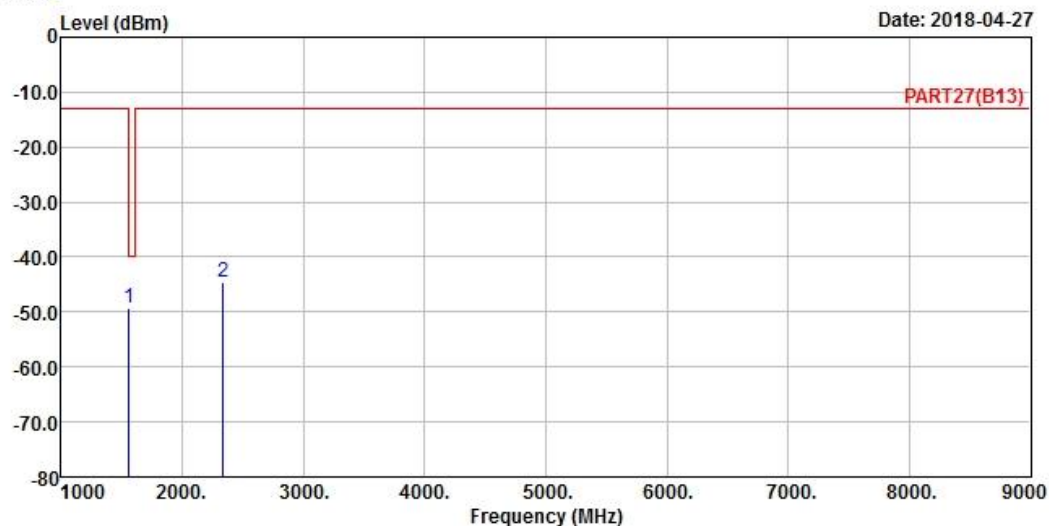
|      | Freq    | Level  | Read Level | Limit Line | Over Limit | Factor | Remark |
|------|---------|--------|------------|------------|------------|--------|--------|
|      | MHz     | dBm    | dBm        | dBm        | dB         | dB     |        |
| 1 pp | 1559.00 | -49.57 | -34.55     | -40.00     | -9.57      | -15.02 | Peak   |
| 2    | 2338.50 | -43.50 | -32.92     | -13.00     | -30.50     | -10.58 | Peak   |



# Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4



Site : 966 Chamber 5

Condition: PART27(B13) VERTICAL

Remak : CAT\_M1 Band 13 QPSK\_5M Link\_L-CH

Tested by: Jisyong Wang

|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1559.00 | -49.29 | -34.27 | -40.00 | -9.29  | -15.02 | Peak   |
| 2    | 2338.50 | -44.55 | -33.97 | -13.00 | -31.55 | -10.58 | Peak   |

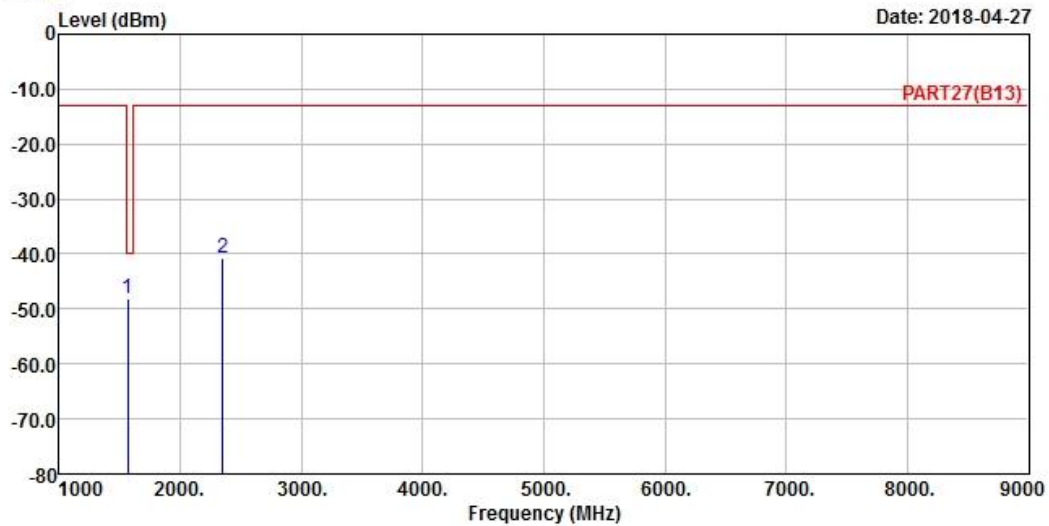
# Middle Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 3



Site : 966 Chamber 5  
Condition: PART27(B13) HORIZONTAL  
Remak : CAT\_M1 Band 13 QPSK\_5M Link\_M-CH  
Tested by: Jisyong Wang

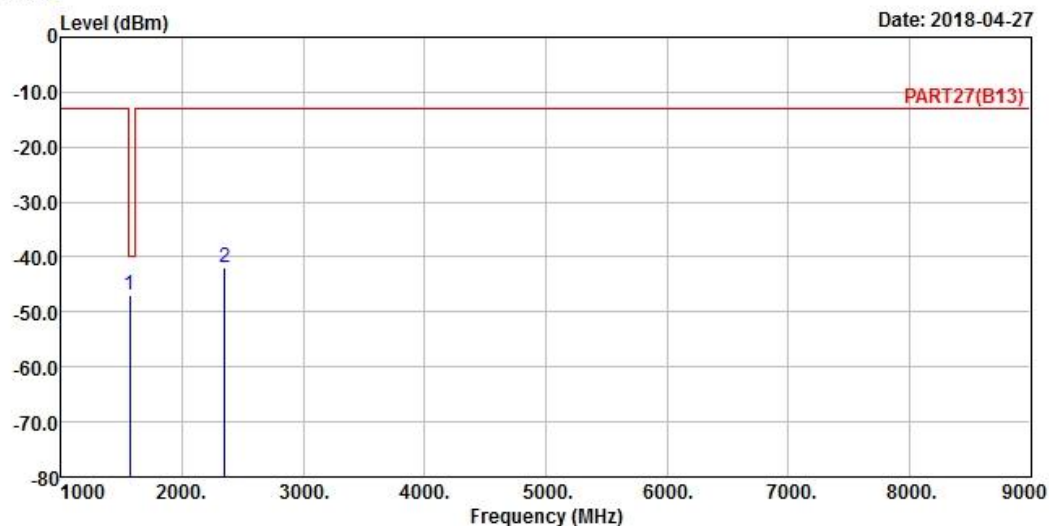
|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1564.00 | -48.19 | -33.17 | -40.00 | -8.19  | -15.02 | Peak   |
| 2    | 2346.00 | -40.70 | -30.26 | -13.00 | -27.70 | -10.44 | Peak   |



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4



Site : 966 Chamber 5

Condition: PART27(B13) VERTICAL

Remak : CAT\_M1 Band 13 QPSK\_5M Link\_M-CH

Tested by: Jisyong Wang

|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1564.00 | -47.07 | -32.05 | -40.00 | -7.07  | -15.02 | Peak   |
| 2    | 2346.00 | -41.93 | -31.49 | -13.00 | -28.93 | -10.44 | Peak   |

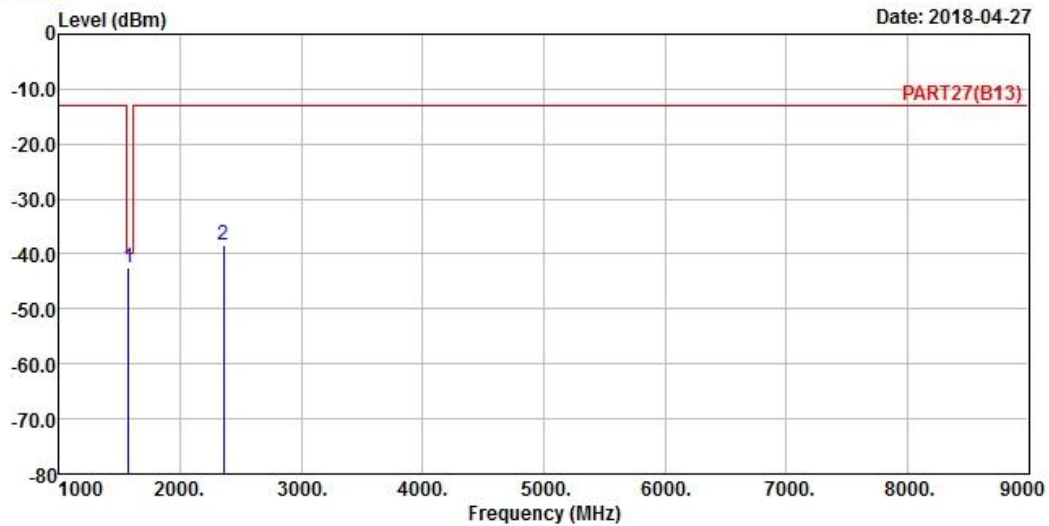
# High Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 3



Site : 966 Chamber 5  
Condition: PART27(B13) HORIZONTAL  
Remak : CAT\_M1 Band 13 QPSK\_5M Link\_H-CH  
Tested by: Jisyong Wang

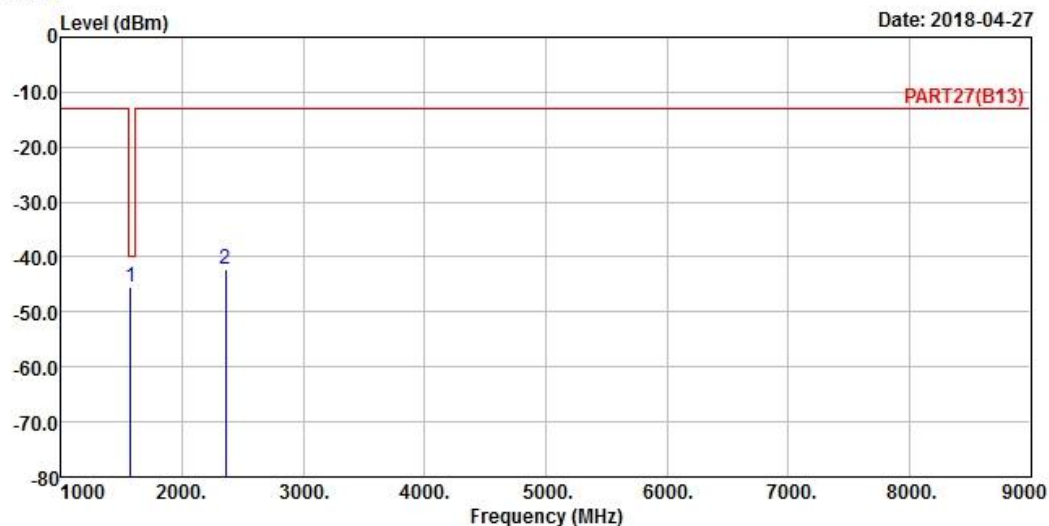
|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1569.00 | -42.62 | -27.66 | -40.00 | -2.62  | -14.96 | Peak   |
| 2    | 2353.50 | -38.33 | -27.89 | -13.00 | -25.33 | -10.44 | Peak   |



# Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4



Site : 966 Chamber 5

Condition: PART27(B13) VERTICAL

Remak : CAT\_M1 Band 13 QPSK\_5M Link\_H-CH

Tested by: Jisyong Wang

|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1569.00 | -45.44 | -30.48 | -40.00 | -5.44  | -14.96 | Peak   |
| 2    | 2353.50 | -42.30 | -31.86 | -13.00 | -29.30 | -10.44 | Peak   |

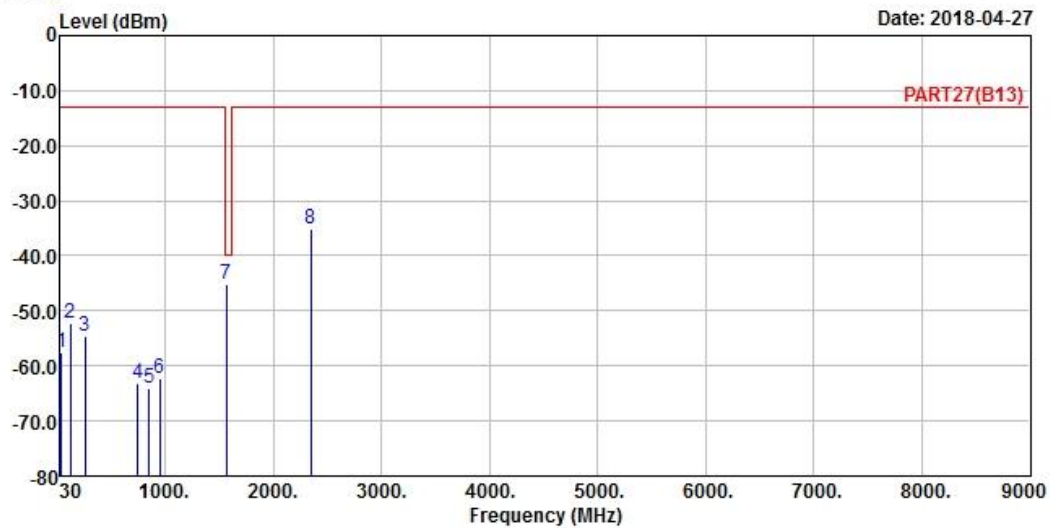
Channel Bandwidth: 10 MHz / QPSK



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 5



Site : 966 Chamber 5  
Condition: PART27(B13) HORIZONTAL  
Remak : CAT\_M1 Band 13 QPSK\_10M Link\_M-CH  
Tested by: Jisyong Wang

|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1    | 40.67   | -57.55 | -57.67 | -13.00 | -44.55 | 0.12   | Peak   |
| 2    | 126.03  | -52.32 | -43.17 | -13.00 | -39.32 | -9.15  | Peak   |
| 3    | 259.89  | -54.49 | -48.30 | -13.00 | -41.49 | -6.19  | Peak   |
| 4    | 744.89  | -63.10 | -63.88 | -13.00 | -50.10 | 0.78   | Peak   |
| 5    | 847.71  | -64.09 | -64.40 | -13.00 | -51.09 | 0.31   | Peak   |
| 6    | 948.59  | -62.33 | -64.10 | -13.00 | -49.33 | 1.77   | Peak   |
| 7 pp | 1564.00 | -45.17 | -30.15 | -40.00 | -5.17  | -15.02 | Peak   |
| 8    | 2346.00 | -35.25 | -24.81 | -13.00 | -22.25 | -10.44 | Peak   |

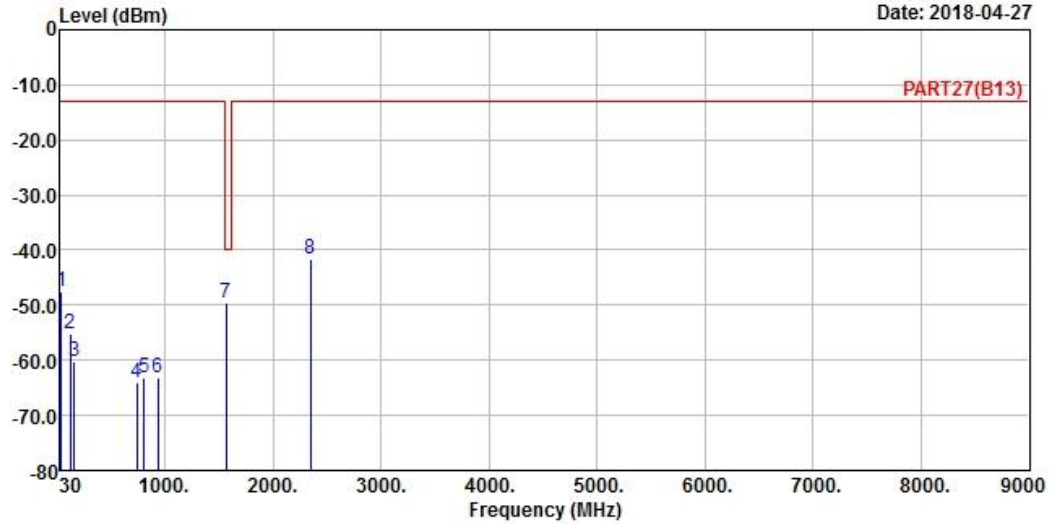


# Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 6

Date: 2018-04-27



Site : 966 Chamber 5  
Condition: PART27(B13) VERTICAL  
Remak : CAT\_M1 Band 13 QPSK\_10M Link\_M-CH  
Tested by: Jisyong Wang

|      | Freq    | Level  | Read Level | Limit Line | Over Limit | Factor | Remark |
|------|---------|--------|------------|------------|------------|--------|--------|
|      | MHz     | dBm    | dBm        | dBm        | dB         | dB     |        |
| 1    | 39.70   | -47.63 | -48.27     | -13.00     | -34.63     | 0.64   | Peak   |
| 2    | 122.15  | -55.11 | -45.49     | -13.00     | -42.11     | -9.62  | Peak   |
| 3    | 161.92  | -60.35 | -55.37     | -13.00     | -47.35     | -4.98  | Peak   |
| 4    | 736.16  | -63.96 | -64.57     | -13.00     | -50.96     | 0.61   | Peak   |
| 5    | 803.09  | -63.03 | -63.74     | -13.00     | -50.03     | 0.71   | Peak   |
| 6    | 936.95  | -63.17 | -64.66     | -13.00     | -50.17     | 1.49   | Peak   |
| 7 pp | 1564.00 | -49.58 | -34.56     | -40.00     | -9.58      | -15.02 | Peak   |
| 8    | 2346.00 | -41.63 | -31.19     | -13.00     | -28.63     | -10.44 | Peak   |

# Mode B

Channel Bandwidth: 5 MHz / QPSK

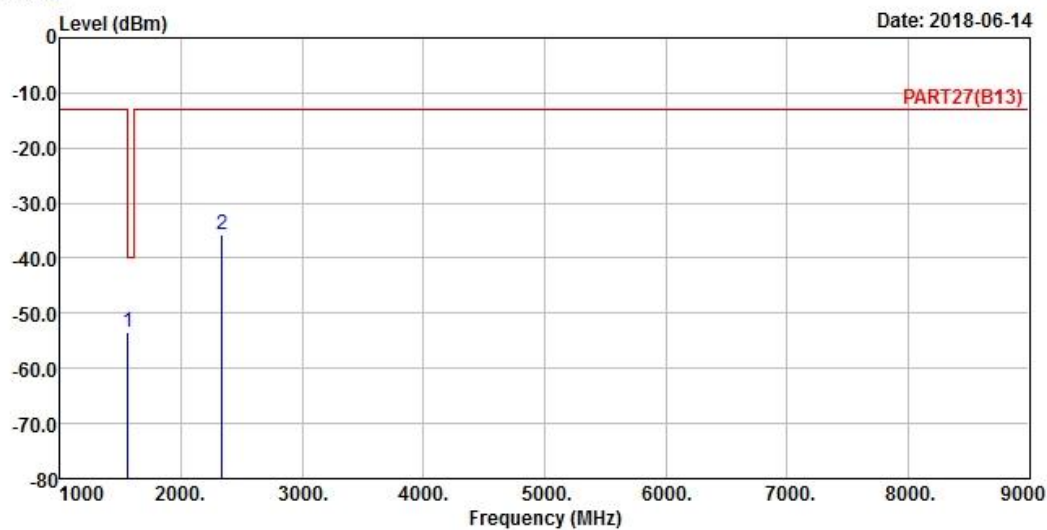
Low Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 3



Site : 966 Chamber 5  
Condition: PART27(B13) HORIZONTAL  
Remak : CAT\_M1 Band 13 QPSK\_5M Link\_L-CH  
Tested by: Jisyong Wang

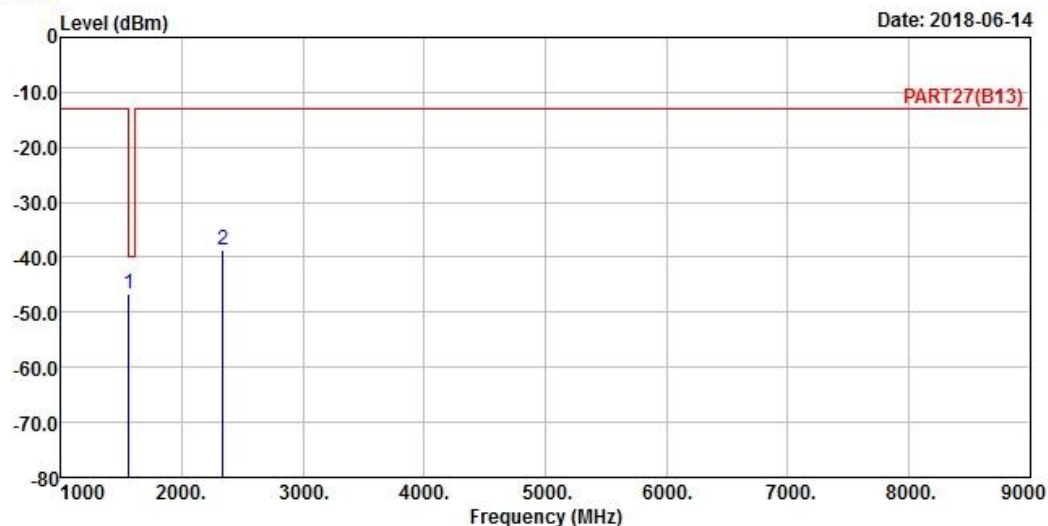
|   |            |        | Read   | Limit  | Over   |        |        |
|---|------------|--------|--------|--------|--------|--------|--------|
|   | Freq       | Level  | Level  | Line   | Limit  | Factor | Remark |
|   | MHz        | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 | pp 1559.00 | -53.52 | -40.20 | -40.00 | -13.52 | -13.32 | Peak   |
| 2 | 2338.50    | -35.65 | -26.27 | -13.00 | -22.65 | -9.38  | Peak   |



# Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4



Site : 966 Chamber 5

Condition: PART27(B13) VERTICAL

Remak : CAT\_M1 Band 13 QPSK\_5M Link\_L-CH

Tested by: Jisyong Wang

|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1559.00 | -46.52 | -33.20 | -40.00 | -6.52  | -13.32 | Peak   |
| 2    | 2338.50 | -38.61 | -29.23 | -13.00 | -25.61 | -9.38  | Peak   |

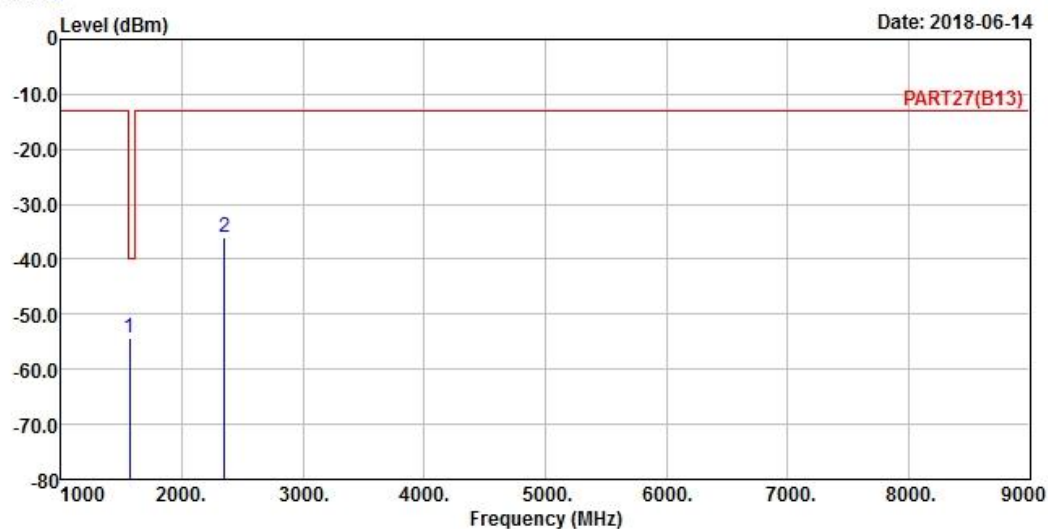
# Middle Channel



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 3



Site : 966 Chamber 5  
Condition: PART27(B13) HORIZONTAL  
Remak : CAT\_M1 Band 13 QPSK\_5M Link\_M-CH  
Tested by: Jisyong Wang

|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1564.00 | -54.25 | -40.91 | -40.00 | -14.25 | -13.34 | Peak   |
| 2    | 2346.00 | -36.15 | -26.71 | -13.00 | -23.15 | -9.44  | Peak   |

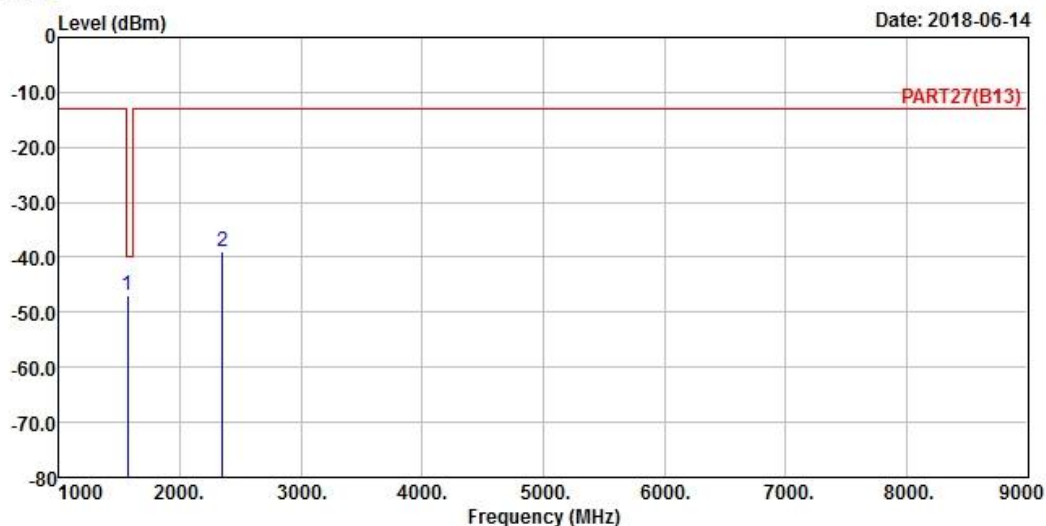


Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4

Date: 2018-06-14



Site : 966 Chamber 5

Condition: PART27(B13) VERTICAL

Remak : CAT\_M1 Band 13 QPSK\_5M Link\_M-CH

Tested by: Jisyong Wang

|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1564.00 | -47.02 | -33.68 | -40.00 | -7.02  | -13.34 | Peak   |
| 2    | 2346.00 | -39.02 | -29.58 | -13.00 | -26.02 | -9.44  | Peak   |

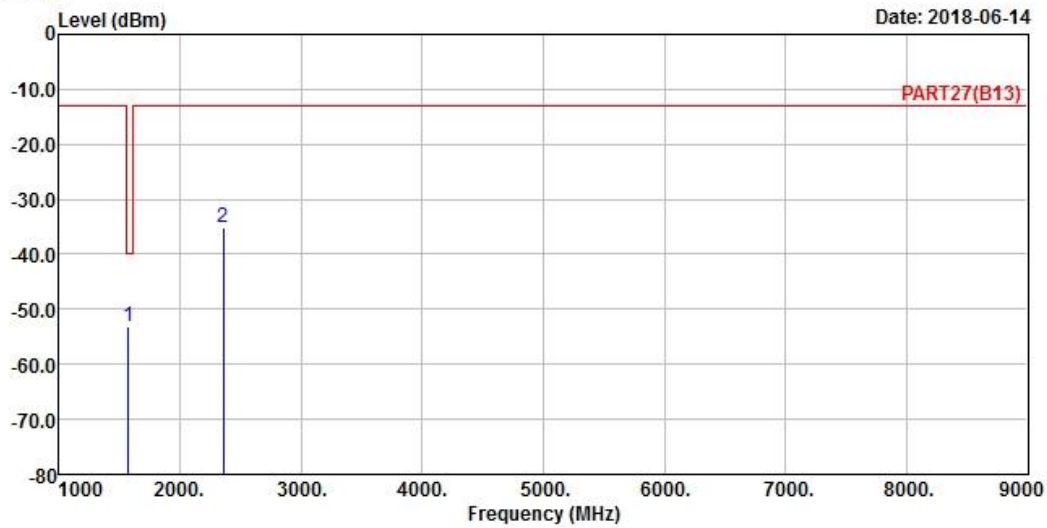
# High Channel



Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch

A D T

Data: 3



Site : 966 Chamber 5  
Condition: PART27(B13) HORIZONTAL  
Remak : CAT\_M1 Band 13 QPSK\_5M Link\_H-CH  
Tested by: Jisyong Wang

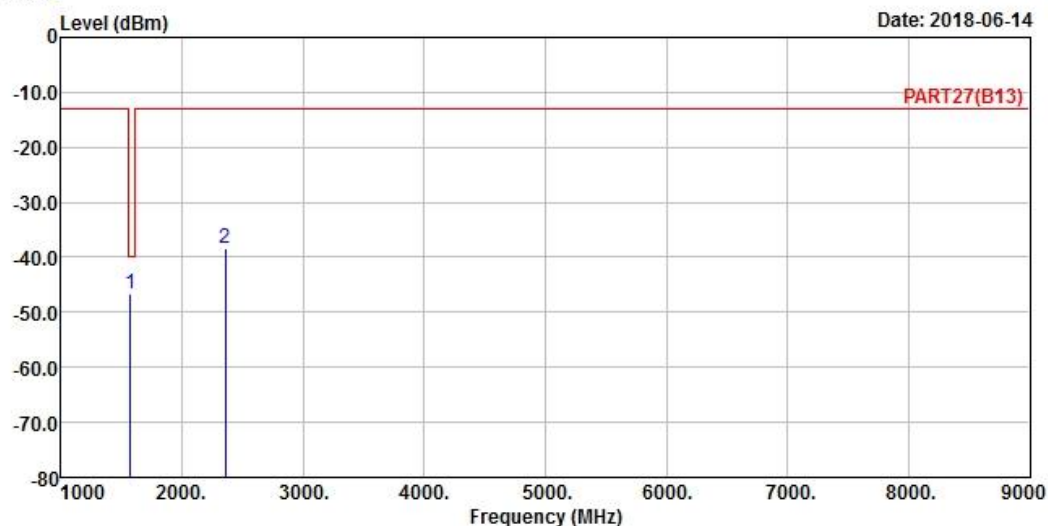
|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1569.00 | -53.02 | -39.67 | -40.00 | -13.02 | -13.35 | Peak   |
| 2    | 2353.50 | -35.02 | -25.51 | -13.00 | -22.02 | -9.51  | Peak   |



# Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 4



Site : 966 Chamber 5

Condition: PART27(B13) VERTICAL

Remak : CAT\_M1 Band 13 QPSK\_5M Link\_H-CH

Tested by: Jisyong Wang

|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1 pp | 1569.00 | -46.52 | -33.17 | -40.00 | -6.52  | -13.35 | Peak   |
| 2    | 2353.50 | -38.52 | -29.01 | -13.00 | -25.52 | -9.51  | Peak   |

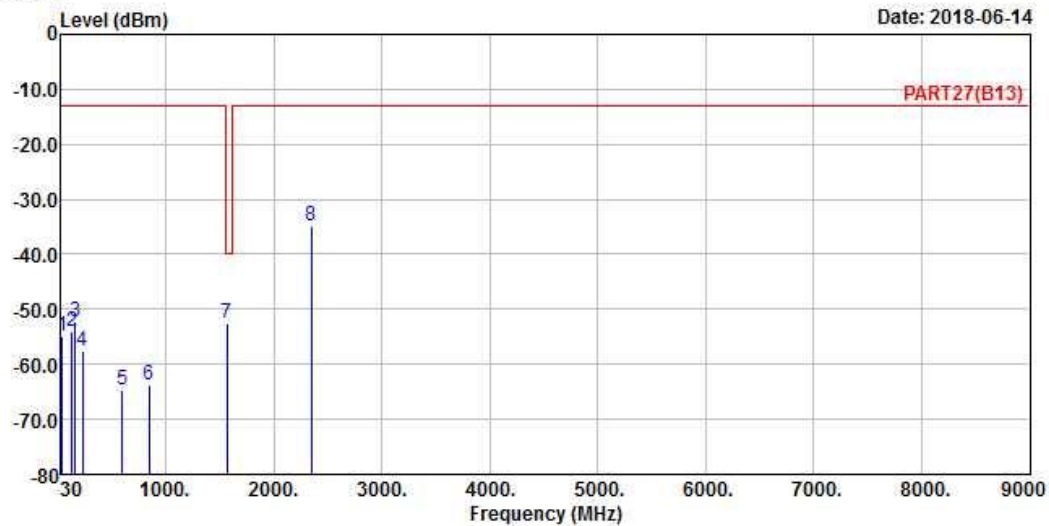
Channel Bandwidth: 10 MHz / QPSK



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 5



Site : 966 Chamber 5  
Condition: PART27(B13) HORIZONTAL  
Remak : CAT\_M1 Band 13 QPSK\_10M Link\_M-CH  
Tested by: Jisyoung Wang

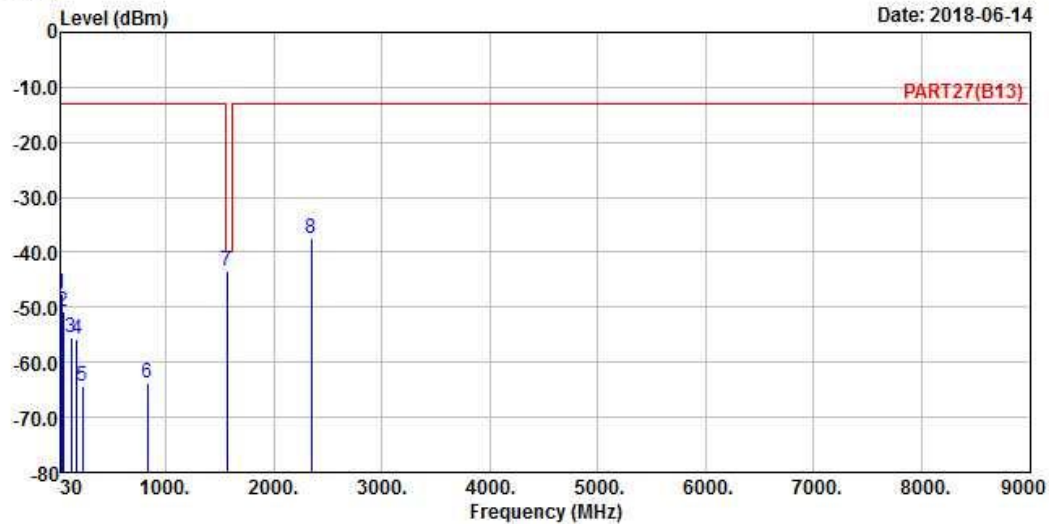
|      |         |        | Read   | Limit  | Over   |        |        |
|------|---------|--------|--------|--------|--------|--------|--------|
|      | Freq    | Level  | Level  | Line   | Limit  | Factor | Remark |
|      | MHz     | dBm    | dBm    | dBm    | dB     | dB     |        |
| 1    | 38.73   | -55.03 | -55.13 | -13.00 | -42.03 | 0.10   | Peak   |
| 2    | 128.94  | -54.06 | -45.25 | -13.00 | -41.06 | -8.81  | Peak   |
| 3    | 160.95  | -52.28 | -47.37 | -13.00 | -39.28 | -4.91  | Peak   |
| 4    | 228.85  | -57.59 | -50.74 | -13.00 | -44.59 | -6.85  | Peak   |
| 5    | 592.60  | -64.59 | -63.51 | -13.00 | -51.59 | -1.08  | Peak   |
| 6    | 842.86  | -63.74 | -64.09 | -13.00 | -50.74 | 0.35   | Peak   |
| 7 pp | 1564.00 | -52.62 | -39.28 | -40.00 | -12.62 | -13.34 | Peak   |
| 8    | 2346.00 | -34.89 | -25.45 | -13.00 | -21.89 | -9.44  | Peak   |



Bureau Veritas Consumer Products Services Ltd., Taoyuan Branch

A D T

Data: 6



Site : 966 Chamber 5

Condition: PART27(B13) VERTICAL

Remak : CAT\_M1 Band 13 QPSK\_10M Link\_M-CH

Tested by: Jisyoung Wang

|      | Freq    | Level  | Read Level | Limit Line | Over Limit | Factor | Remark |
|------|---------|--------|------------|------------|------------|--------|--------|
|      | MHz     | dBm    | dBm        | dBm        | dB         | dB     |        |
| 1    | 30.00   | -47.54 | -47.92     | -13.00     | -34.54     | 0.38   | Peak   |
| 2    | 48.43   | -50.84 | -46.83     | -13.00     | -37.84     | -4.01  | Peak   |
| 3    | 123.12  | -55.48 | -45.98     | -13.00     | -42.48     | -9.50  | Peak   |
| 4    | 177.44  | -55.76 | -48.87     | -13.00     | -42.76     | -6.89  | Peak   |
| 5    | 226.91  | -64.21 | -57.28     | -13.00     | -51.21     | -6.93  | Peak   |
| 6    | 826.37  | -63.67 | -64.17     | -13.00     | -50.67     | 0.50   | Peak   |
| 7 pp | 1564.00 | -43.52 | -30.18     | -40.00     | -3.52      | -13.34 | Peak   |
| 8    | 2346.00 | -37.38 | -27.94     | -13.00     | -24.38     | -9.44  | 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:

**Linko EMC/RF Lab**

Tel: 886-2-26052180

Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab**

Tel: 886-3-6668565

Fax: 886-3-6668323

**Hwa Ya EMC/RF/Safety**

Tel: 886-3-3183232

Fax: 886-3-3270892

**Email:** [service.adt@tw.bureauveritas.com](mailto:service.adt@tw.bureauveritas.com)

**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 ---