# FCC Test Report

# (PART 90S)

**Report No.:** RF180704C01-5

**FCC ID:** ZMOL850GLD

**Test Model:** L850-GL

**Received Date:** Jul. 04, 2018

**Test Date:** Jul. 10, 2018 ~ Jul. 16, 2018

**Issued Date:** Jul. 19, 2018

**Applicant:** Fibocom Wireless Inc.

**Address:** 5/F, Tower A, Technology Building II, 1057 Nanhai Blvd, Nanshan, Shenzhen, China

**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 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 |
|---|---|---|
| RF180704C01-5 | Original Release | Jul. 19, 2018 |

## 1 Certificate of Conformity

**Product:** LTE module

**Brand:** Fibocom

**Test Model:** L850-GL

**Sample Status:** Identical Prototype

**Applicant:** Fibocom Wireless Inc.

**Test Date:** Jul. 10, 2018 ~ Jul. 16, 2018

**Standards:** FCC Part 90, Subpart S
FCC Part 2

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 :** Rona Chen , **Date:** Jul. 19, 2018

Rona Chen / Specialist

**Approved by :** , **Date:** Jul. 19, 2018

Dylan Chiou / Project Engineer

## 2 Summary of Test Results

| Applied Standard: FCC Part 90 & Part 2 (LTE 26) | | | |
|---|---|---|---|
| **FCC Clause** | **Test Item** | **Result** | **Remarks** |
| 2.1046<br>90.635 (b) | Effective Radiated Power | Pass | Meet the requirement of limit. |
| 2.1047 | Modulation Characteristics | Pass | Meet the requirement. |
| 2.1055<br>90.213 | Frequency Stability | Pass | Meet the requirement of limit. |
| 2.1049<br>90.209 | Occupied Bandwidth (*) | Pass | Meet the requirement of limit. |
| 2.1051<br>90.209 | Emission Masks | Pass | Meet the requirement of limit. |
| 2.1051<br>90.691 | Conducted Spurious Emissions | Pass | Meet the requirement of limit. |
| 2.1053<br>90.691 | Radiated Spurious Emissions | Pass | Meet the requirement of limit.<br>Minimum passing margin is -31.93 dB at 42.61 MHz. |

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement | Frequency | Expended Uncertainty (k=2) (±) |
|---|---|---|
| Radiated Emissions up to 1 GHz | 30 MHz ~ 200 MHz | 2.93 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 | 101261 | Jan. 11, 2018 | Jan. 10, 2019 |
| 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 |
| Fixed Attenuator Mini-Circuits | MDCS18N-10 | MDCS18N-10-01 | Apr. 16, 2018 | Apr. 15, 2019 |
| 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 |
| Software BV ADT | E3 6.120103 | NA | NA | NA |
| Antenna Tower MF | MFA-440H | NA | NA | NA |
| Turn Table MF | MFT-201SS | NA | NA | NA |
| Antenna Tower &Turn Table Controller MF | MF-7802 | NA | NA | NA |
| Radio Communication Analyzer | MT8820C | 6201300640 | Aug. 16, 2017 | Aug. 15, 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

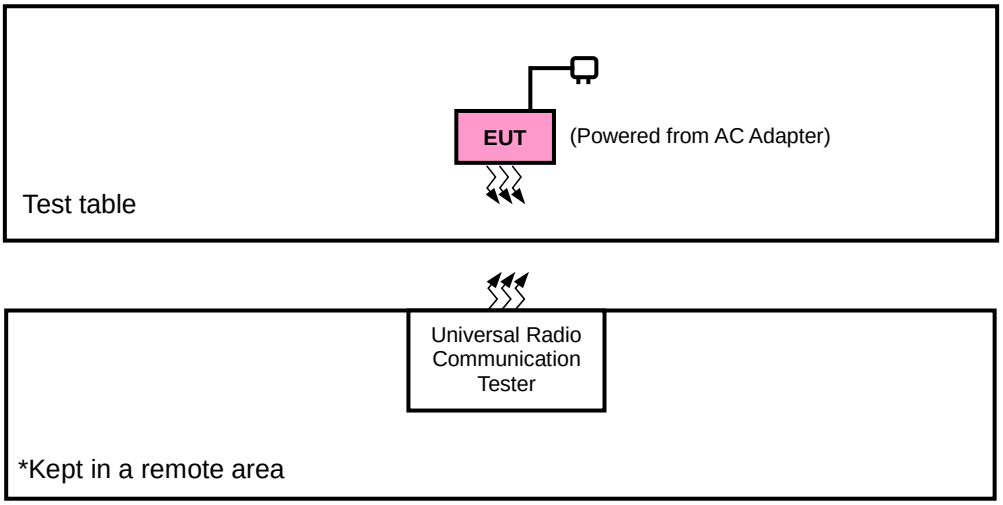
## 3.1 General Description of EUT

| | | |
|---|---|---|
| **Product** | LTE module | |
| **Brand** | Fibocom | |
| **Test Model** | L850-GL | |
| **Status of EUT** | Identical Prototype | |
| **Power Supply Rating** | 3.3 Vdc (Host equipment) | |
| **Modulation Type** | LTE | QPSK, 16QAM |
| **Frequency Range** | LTE Band 26 (Channel Bandwidth: 1.4 MHz) | 814.7 ~ 823.3 MHz |
| | LTE Band 26 (Channel Bandwidth: 3 MHz) | 815.5 ~ 822.5 MHz |
| | LTE Band 26 (Channel Bandwidth: 5 MHz) | 816.5 ~ 821.5 MHz |
| | LTE Band 26 (Channel Bandwidth: 10 MHz) | 819 MHz |
| **Emission Designator** | LTE Band 26 (Channel Bandwidth: 1.4 MHz) | 1M09G7D |
| | LTE Band 26 (Channel Bandwidth: 3 MHz) | 2M70G7D |
| | LTE Band 26 (Channel Bandwidth: 5 MHz) | 4M50W7D |
| | LTE Band 26 (Channel Bandwidth: 10 MHz) | 9M02G7D |
| **Max. ERP Power** | LTE Band 26 (Channel Bandwidth: 1.4 MHz) | 217.77 mW |
| | LTE Band 26 (Channel Bandwidth: 3 MHz) | 221.82 mW |
| | LTE Band 26 (Channel Bandwidth: 5 MHz) | 226.99 mW |
| | LTE Band 26 (Channel Bandwidth: 10 MHz) | 229.61 mW |
| **Antenna Type** | External Antenna with 3.0 dBi gain | |
| **Accessory Device** | N/A | |
| **Data Cable Supplied** | N/A | |

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 | Radiated Emission |
|---|---|
| **LTE Band 26** | Z-axis |

## LTE Band 26

| EUT Configure Mode | Test Item | Available Channel | Tested Channel | Channel Bandwidth | Modulation | Mode |
|---|---|---|---|---|---|---|
| - | ERP | 26697 to 26783 | 26697, 26740, 26783 | 1.4 MHz | QPSK, 16QAM | 1 RB / 0 RB Offset |
| | | 26705 to 26775 | 26705, 26740, 26775 | 3 MHz | QPSK, 16QAM | 1 RB / 0 RB Offset |
| | | 26715 to 26765 | 26715, 26740, 26765 | 5 MHz | QPSK, 16QAM | 1 RB / 0 RB Offset |
| | | 26740 | 26740 | 10 MHz | QPSK, 16QAM | 1 RB / 0 RB Offset |
| - | Modulation Characteristics | 26715 to 26765 | 26740 | 5 MHz | QPSK, 16QAM | 25 RB / 0 RB Offset |
| - | Frequency Stability | 26697 to 26783 | 26697, 26783 | 1.4 MHz | QPSK | 1 RB / 2 RB Offset |
| | | 26705 to 26775 | 26705, 26775 | 3 MHz | QPSK | 1 RB / 7 RB Offset |
| | | 26715 to 26765 | 26715, 26765 | 5 MHz | QPSK | 1 RB / 12 RB Offset |
| | | 26740 | 26740 | 10 MHz | QPSK | 1 RB / 49 RB Offset |
| - | Occupied Bandwidth | 26697 to 26783 | 26697, 26740, 26783 | 1.4 MHz | QPSK, 16QAM | 6 RB / 0 RB Offset |
| | | 26705 to 26775 | 26705, 26740, 26775 | 3 MHz | QPSK, 16QAM | 15 RB / 0 RB Offset |
| | | 26715 to 26765 | 26715, 26740, 26765 | 5 MHz | QPSK, 16QAM | 25 RB / 0 RB Offset |
| | | 26740 | 26740 | 10 MHz | QPSK, 16QAM | 50 RB / 0 RB Offset |
| - | Emission Mask | 26697 to 26783 | 26697, 26740, 26783 | 1.4 MHz | QPSK, 16QAM | 6 RB / 0 RB Offset |
| | | 26705 to 26775 | 26705, 26740, 26775 | 3 MHz | QPSK, 16QAM | 15 RB / 0 RB Offset |
| | | 26715 to 26765 | 26715, 26740, 26765 | 5 MHz | QPSK, 16QAM | 25 RB / 0 RB Offset |
| | | 26740 | 26740 | 10 MHz | QPSK, 16QAM | 50 RB / 0 RB Offset |
| - | Conducted Emission | 26697 to 26783 | 26697, 26740, 26783 | 1.4 MHz | QPSK | 1 RB / 0 RB Offset |
| | | 26705 to 26775 | 26705, 26740, 26775 | 3 MHz | QPSK | 1 RB / 0 RB Offset |
| | | 26715 to 26765 | 26715, 26740, 26765 | 5 MHz | QPSK | 1 RB / 0 RB Offset |
| | | 26740 | 26740 | 10 MHz | QPSK | 1 RB / 0 RB Offset |
| - | Radiated Emission | 26697 to 26783 | 26697, 26740, 26783 | 1.4 MHz | QPSK | 1 RB / 0 RB Offset |
| | | 26715 to 26765 | 26715, 26740, 26765 | 5 MHz | QPSK | 1 RB / 0 RB Offset |
| | | 26740 | 26740 | 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 | 3.3 Vdc | Getaz Yang |
| Modulation Characteristics | 25 deg. C, 65 % RH | 3.3 Vdc | Getaz Yang |
| Frequency Stability | 25 deg. C, 65 % RH | 3.3 Vdc | Getaz Yang |
| Occupied Bandwidth | 25 deg. C, 65 % RH | 3.3 Vdc | Getaz Yang |
| Peak to Average Ratio | 25 deg. C, 65 % RH | 3.3 Vdc | Getaz Yang |
| Emission Mask | 25 deg. C, 65 % RH | 3.3 Vdc | Getaz Yang |
| Conducted Emission | 25 deg. C, 65 % RH | 3.3 Vdc | Getaz Yang |
| Radiated Emission | 25 deg. C, 65 % RH | 120 Vac, 60 Hz | Thomas Wei<br>Jisyong 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 90**
**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 100 watts e.r.p.

### 4.1.2 Test Procedures

**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.

**EIRP / ERP Measurement:**

a. EIRP = Conducted Output power level + Antenna gain.

b. ERP power can be calculated form EIRP power by subtracting the gain of dipole, ERP power = EIPR power - 2.15dBi.

c. ERP = Conducted Output power level + Antenna gain (dBi) - Isotropically Factor (2.15dB)

### 4.1.3 Test Setup

4.1.4 Test Results

**Conducted Output Power (dBm)**

| Band / BW | RB Size | RB Offset | QPSK | | | 3GPP MPR (dB) | 16QAM | | | 3GPP MPR (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Low Ch 26697 | Mid Ch 26740 | High Ch 26783 | | Low Ch 26697 | Mid Ch 26740 | High Ch 26783 | |
| | | | 814.7 MHz | 819.0 MHz | 823.3 MHz | | 814.7 MHz | 819.0 MHz | 823.3 MHz | |
| 26 / 1.4M | 1 | 0 | 22.53 | 22.21 | 22.01 | 0 | 21.48 | 21.14 | 20.99 | 1 |
| | 1 | 2 | 22.46 | 22.10 | 21.88 | 0 | 21.44 | 21.04 | 20.85 | 1 |
| | 1 | 5 | 22.23 | 21.92 | 21.66 | 0 | 21.20 | 20.88 | 20.55 | 1 |
| | 3 | 0 | 21.48 | 22.17 | 21.98 | 0 | 20.36 | 21.14 | 20.94 | 1 |
| | 3 | 1 | 21.28 | 21.97 | 21.87 | 0 | 20.19 | 20.99 | 20.70 | 1 |
| | 3 | 3 | 21.29 | 21.94 | 21.62 | 0 | 20.05 | 20.80 | 20.53 | 1 |
| | 6 | 0 | 21.47 | 21.17 | 20.93 | 1 | 20.30 | 19.93 | 19.75 | 2 |

| Band / BW | RB Size | RB Offset | QPSK | | | 3GPP MPR (dB) | 16QAM | | | 3GPP MPR (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Low Ch 26705 | Mid CH 26740 | High CH 26775 | | Low Ch 26705 | Mid CH 26740 | High CH 26775 | |
| | | | 815.5 MHz | 819.0 MHz | 822.5 MHz | | 815.5 MHz | 819.0 MHz | 822.5 MHz | |
| 26 / 3M | 1 | 0 | 22.61 | 22.30 | 22.13 | 0 | 21.36 | 21.28 | 21.04 | 1 |
| | 1 | 7 | 22.52 | 22.18 | 21.98 | 0 | 21.44 | 21.06 | 20.99 | 1 |
| | 1 | 14 | 22.35 | 22.02 | 21.82 | 0 | 21.22 | 21.00 | 20.79 | 1 |
| | 8 | 0 | 21.59 | 21.24 | 21.04 | 1 | 20.31 | 20.15 | 19.96 | 2 |
| | 8 | 3 | 21.41 | 21.04 | 20.84 | 1 | 20.25 | 20.00 | 19.79 | 2 |
| | 8 | 7 | 21.27 | 21.01 | 20.79 | 1 | 20.11 | 19.91 | 19.66 | 2 |
| | 15 | 0 | 21.43 | 21.14 | 20.91 | 1 | 20.29 | 20.09 | 19.98 | 2 |

| Band / BW | RB Size | RB Offset | QPSK | | | 3GPP MPR (dB) | 16QAM | | | 3GPP MPR (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Low Ch 26715 | Mid Ch 26740 | High Ch 26765 | | Low Ch 26715 | Mid Ch 26740 | High Ch 26765 | |
| | | | 816.5 MHz | 819.0 MHz | 821.5 MHz | | 816.5 MHz | 819.0 MHz | 821.5 MHz | |
| 26 / 5M | 1 | 0 | 22.71 | 22.43 | 22.25 | 0 | 21.43 | 21.34 | 21.21 | 1 |
| | 1 | 12 | 22.53 | 22.29 | 22.15 | 0 | 21.51 | 21.30 | 21.06 | 1 |
| | 1 | 24 | 22.41 | 22.16 | 21.97 | 0 | 21.36 | 21.07 | 20.88 | 1 |
| | 12 | 0 | 21.56 | 21.42 | 21.22 | 1 | 20.48 | 20.31 | 20.05 | 2 |
| | 12 | 6 | 21.42 | 21.30 | 21.13 | 1 | 20.32 | 20.27 | 20.03 | 2 |
| | 12 | 13 | 21.31 | 21.08 | 20.85 | 1 | 20.22 | 20.09 | 19.92 | 2 |
| | 25 | 0 | 21.50 | 21.34 | 21.21 | 1 | 20.38 | 20.34 | 20.15 | 2 |

| Band / BW | RB Size | RB Offset | QPSK | 3GPP MPR (dB) | 16QAM | 3GPP MPR (dB) |
|---|---|---|---|---|---|---|
| | | | Mid Ch 26740 | | Mid Ch 26740 | |
| | | | 819.0 MHz | | 819.0 MHz | |
| 26 / 10M | 1 | 0 | 22.76 | 0 | 21.51 | 1 |
| | 1 | 24 | 22.62 | 0 | 21.59 | 1 |
| | 1 | 49 | 22.42 | 0 | 21.42 | 1 |
| | 25 | 0 | 21.65 | 1 | 20.33 | 2 |
| | 25 | 12 | 21.40 | 1 | 20.29 | 2 |
| | 25 | 25 | 21.37 | 1 | 20.26 | 2 |
| | 50 | 0 | 21.51 | 1 | 20.49 | 2 |

**ERP Power (dBm)**

Note: ERP (dBm) = Max. Conducted Power (dBm) + Gain (dBi) – 2.15

| Band 26 / 1.4M, 1RB#0 | | | | | | |
|---|---|---|---|---|---|---|
| Test Mode | QPSK | | | 16QAM | | |
| | Low Ch 26697 | Mid Ch 26740 | High Ch 26783 | Low Ch 26697 | Mid Ch 26740 | High Ch 26783 |
| | 814.7 MHz | 819.0 MHz | 823.3 MHz | 814.7 MHz | 819.0 MHz | 823.3 MHz |
| Max. Cond. Power (dBm) | 22.53 | 22.21 | 22.01 | 21.48 | 21.14 | 20.99 |
| Max. ERP Power (dBm) | 23.38 | 23.06 | 22.86 | 22.33 | 21.99 | 21.84 |
| Max. ERP Power (mW) | 217.77 | 202.30 | 193.20 | 171.00 | 158.12 | 152.76 |

| Band 26 / 3M, 1RB#0 | | | | | | |
|---|---|---|---|---|---|---|
| Test Mode | QPSK | | | 16QAM | | |
| | Low Ch 26705 | Mid CH 26740 | High CH 26775 | Low Ch 26705 | Mid CH 26740 | High CH 26775 |
| | 815.5 MHz | 819.0 MHz | 822.5 MHz | 815.5 MHz | 819.0 MHz | 822.5 MHz |
| Max. Cond. Power (dBm) | 22.61 | 22.30 | 22.13 | 21.36 | 21.28 | 21.04 |
| Max. ERP Power (dBm) | 23.46 | 23.15 | 22.98 | 22.21 | 22.13 | 21.89 |
| Max. ERP Power (mW) | 221.82 | 206.54 | 198.61 | 166.34 | 163.31 | 154.53 |

| Band 26 / 5M, 1RB#0 | | | | | | |
|---|---|---|---|---|---|---|
| Test Mode | QPSK | | | 16QAM | | |
| | Low Ch 26715 | Mid Ch 26740 | High Ch 26765 | Low Ch 26715 | Mid Ch 26740 | High Ch 26765 |
| | 816.5 MHz | 819.0 MHz | 821.5 MHz | 816.5 MHz | 819.0 MHz | 821.5 MHz |
| Max. Cond. Power (dBm) | 22.71 | 22.43 | 22.25 | 21.43 | 21.34 | 21.21 |
| Max. ERP Power (dBm) | 23.56 | 23.28 | 23.10 | 22.28 | 22.19 | 22.06 |
| Max. ERP Power (mW) | 226.99 | 212.81 | 204.17 | 169.04 | 165.58 | 160.69 |

| Band 26 / 10M, 1RB#0 | | | | | | |
|---|---|---|---|---|---|---|
| Test Mode | QPSK | | | 16QAM | | |
| | | Mid Ch 26740 | | | Mid Ch 26740 | |
| | | 819.0 MHz | | | 819.0 MHz | |
| Max. Cond. Power (dBm) | | 22.76 | | | 21.51 | |
| Max. ERP Power (dBm) | | 23.61 | | | 22.36 | |
| Max. ERP Power (mW) | | 229.61 | | | 172.19 | |

## 4.2 Modulation Characteristics Measurement

### 4.2.1 Limits of Modulation Characteristics

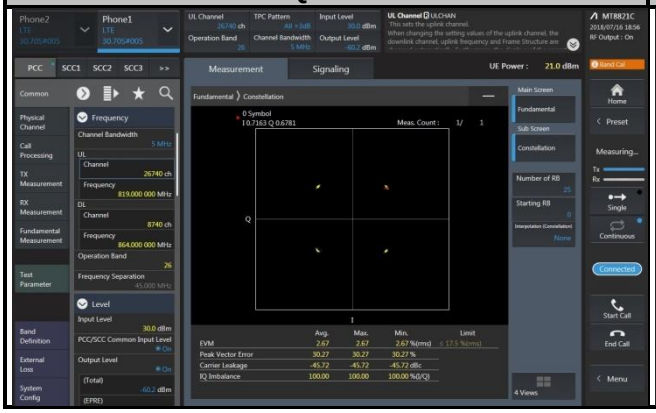
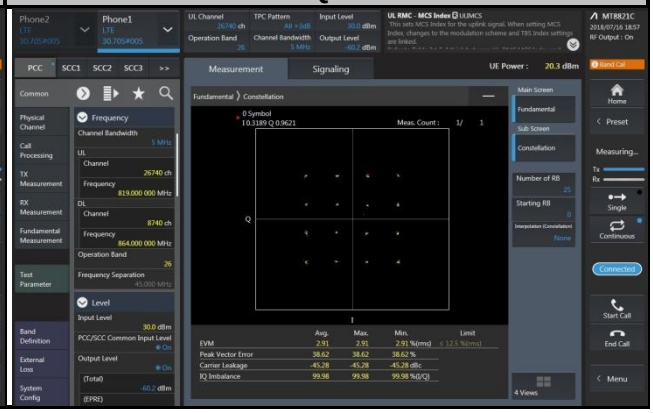
N/A

### 4.2.2 Test Setup

### 4.2.3 Test Procedure

Connect the EUT to Communication Simulator via the antenna connector. The frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

### 4.2.4 Test Results

| Spectrum Plot of Measurement | |
|---|---|
| LTE Band 26 | |
| Channel 26740 | |
| QPSK | 16QAM |
|  |  |

## 4.3 Frequency Stability Measurement

### 4.3.1 Limits of Frequency Stability Measurement

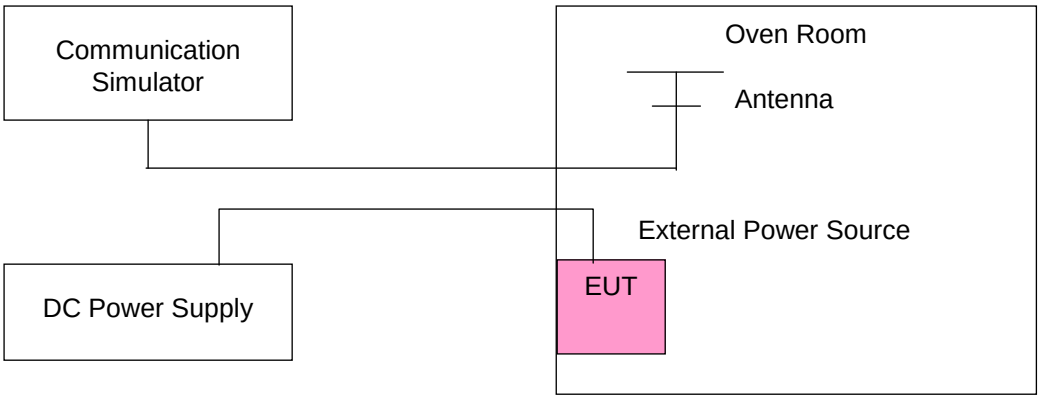
1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

### 4.3.2 Test Procedure

a. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
b. EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ±0.5 ℃ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

**NOTE:** The frequency error was recorded frequency error from the communication simulator.

### 4.3.3 Test Setup



4.3.4 Test Results

Frequency Error vs. Voltage

| Voltage (Volts) | LTE Band 26 | | | | Limit (ppm) |
|---|---|---|---|---|---|
| | Channel Bandwidth: 1.4 MHz | | | | |
| | Low Channel | | High Channel | | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) | |
| 3.3 | 814.700001 | 0.001 | 823.300001 | 0.001 | 2.5 |
| 3.135 | 814.700003 | 0.004 | 823.300004 | 0.004 | 2.5 |
| 4.4 | 814.700003 | 0.004 | 823.300002 | 0.002 | 2.5 |

**Note:** The applicant defined the normal working voltage of the battery is from 3.135 Vdc to 4.4 Vdc.

Frequency Error vs. Temperature

| Temp. (℃) | LTE Band 26 | | | | Limit (ppm) |
|---|---|---|---|---|---|
| | Channel Bandwidth: 1.4 MHz | | | | |
| | Low Channel | | High Channel | | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) | |
| -30 | 814.700003 | 0.004 | 823.300003 | 0.004 | 2.5 |
| -20 | 814.700003 | 0.004 | 823.300004 | 0.005 | 2.5 |
| -10 | 814.700003 | 0.003 | 823.300004 | 0.004 | 2.5 |
| 0 | 814.700002 | 0.002 | 823.300003 | 0.004 | 2.5 |
| 10 | 814.700003 | 0.003 | 823.300004 | 0.005 | 2.5 |
| 20 | 814.699997 | -0.004 | 823.299999 | -0.002 | 2.5 |
| 30 | 814.699997 | -0.003 | 823.299998 | -0.002 | 2.5 |
| 40 | 814.699999 | -0.001 | 823.299999 | -0.001 | 2.5 |
| 50 | 814.699999 | -0.002 | 823.299997 | -0.004 | 2.5 |
| 55 | 814.699999 | -0.001 | 823.299999 | -0.002 | 2.5 |

Frequency Error vs. Voltage

| Voltage (Volts) | LTE Band 26 | | | | Limit (ppm) |
|---|---|---|---|---|---|
| | Channel Bandwidth: 3 MHz | | | | |
| | Low Channel | | High Channel | | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) | |
| 3.3 | 815.500001 | 0.001 | 822.500002 | 0.002 | 2.5 |
| 3.135 | 815.500002 | 0.002 | 822.500002 | 0.002 | 2.5 |
| 4.4 | 815.500004 | 0.004 | 822.500003 | 0.004 | 2.5 |

**Note:** The applicant defined the normal working voltage of the battery is from 3.135 Vdc to 4.4 Vdc.

Frequency Error vs. Temperature

| Temp. (℃) | LTE Band 26 | | | | Limit (ppm) |
|---|---|---|---|---|---|
| | Channel Bandwidth: 3 MHz | | | | |
| | Low Channel | | High Channel | | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) | |
| -30 | 815.500002 | 0.002 | 822.500002 | 0.003 | 2.5 |
| -20 | 815.500002 | 0.002 | 822.500003 | 0.003 | 2.5 |
| -10 | 815.500002 | 0.003 | 822.500002 | 0.002 | 2.5 |
| 0 | 815.500003 | 0.003 | 822.500001 | 0.002 | 2.5 |
| 10 | 815.500002 | 0.002 | 822.500001 | 0.001 | 2.5 |
| 20 | 815.499997 | -0.003 | 822.499998 | -0.003 | 2.5 |
| 30 | 815.499997 | -0.003 | 822.499998 | -0.002 | 2.5 |
| 40 | 815.499998 | -0.003 | 822.499996 | -0.005 | 2.5 |
| 50 | 815.499999 | -0.002 | 822.499997 | -0.004 | 2.5 |
| 55 | 815.499997 | -0.004 | 822.499997 | -0.003 | 2.5 |

Frequency Error vs. Voltage

| Voltage (Volts) | LTE Band 26 | | | | Limit (ppm) |
|---|---|---|---|---|---|
| | Channel Bandwidth: 5 MHz | | | | |
| | Low Channel | | High Channel | | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) | |
| 3.3 | 816.500004 | 0.005 | 821.500001 | 0.001 | 2.5 |
| 3.135 | 816.500002 | 0.003 | 821.500002 | 0.002 | 2.5 |
| 4.4 | 816.500003 | 0.004 | 821.500002 | 0.002 | 2.5 |

**Note:** The applicant defined the normal working voltage of the battery is from 3.135 Vdc to 4.4 Vdc.

Frequency Error vs. Temperature

| Temp. (℃) | LTE Band 26 | | | | Limit (ppm) |
|---|---|---|---|---|---|
| | Channel Bandwidth: 5 MHz | | | | |
| | Low Channel | | High Channel | | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) | |
| -30 | 816.500002 | 0.003 | 821.500003 | 0.004 | 2.5 |
| -20 | 816.500001 | 0.001 | 821.500004 | 0.004 | 2.5 |
| -10 | 816.500001 | 0.001 | 821.500003 | 0.003 | 2.5 |
| 0 | 816.500003 | 0.004 | 821.500001 | 0.002 | 2.5 |
| 10 | 816.500004 | 0.005 | 821.500003 | 0.004 | 2.5 |
| 20 | 816.499996 | -0.005 | 821.499996 | -0.005 | 2.5 |
| 30 | 816.499999 | -0.001 | 821.499999 | -0.002 | 2.5 |
| 40 | 816.499998 | -0.002 | 821.499997 | -0.003 | 2.5 |
| 50 | 816.499999 | -0.001 | 821.499998 | -0.002 | 2.5 |
| 55 | 816.499998 | -0.002 | 821.499996 | -0.005 | 2.5 |

Frequency Error vs. Voltage

| Voltage (Volts) | LTE Band 26 | | Limit (ppm) |
|---|---|---|---|
| | Channel Bandwidth: 10 MHz | | |
| | Frequency (MHz) | Frequency Error (ppm) | |
| 3.3 | 819.000003 | 0.004 | 2.5 |
| 3.135 | 819.000002 | 0.002 | 2.5 |
| 4.4 | 819.000002 | 0.002 | 2.5 |

**Note:** The applicant defined the normal working voltage of the battery is from 3.135 Vdc to 4.4 Vdc.

Frequency Error vs. Temperature

| Temp. (℃) | LTE Band 26 | | Limit (ppm) |
|---|---|---|---|
| | Channel Bandwidth: 10 MHz | | |
| | Frequency (MHz) | Frequency Error (ppm) | |
| -30 | 819.000004 | 0.005 | 2.5 |
| -20 | 819.000004 | 0.005 | 2.5 |
| -10 | 819.000003 | 0.003 | 2.5 |
| 0 | 819.000002 | 0.003 | 2.5 |
| 10 | 819.000002 | 0.002 | 2.5 |
| 20 | 818.999997 | -0.004 | 2.5 |
| 30 | 818.999999 | -0.002 | 2.5 |
| 40 | 818.999997 | -0.004 | 2.5 |
| 50 | 818.999997 | -0.003 | 2.5 |
| 55 | 818.999998 | -0.002 | 2.5 |

## 4.4 Occupied Bandwidth Measurement

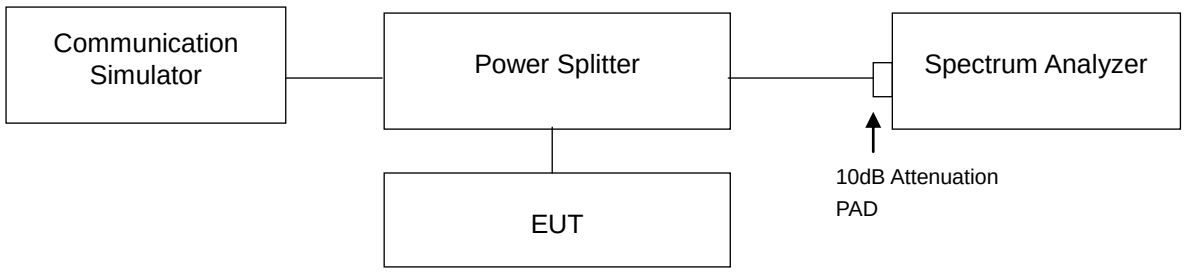
### 4.4.1 Limits of Occupied Bandwidth Measurement

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

### 4.4.2 Test Procedure

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

### 4.4.3 Test Setup



### 4.4.4 Test Results

| LTE Band 26 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel Bandwidth: 1.4 MHz | | | | Channel Bandwidth: 3 MHz | | | |
| Channel | Frequency (MHz) | 99 % Occupied Bandwidth (MHz) | | Channel | Frequency (MHz) | 99 % Occupied Bandwidth (MHz) | |
| | | QPSK | 16QAM | | | QPSK | 16QAM |
| 26697 | 814.7 | 1.09 | 1.09 | 26705 | 815.5 | 2.70 | 2.70 |
| 26740 | 819.0 | 1.09 | 1.09 | 26740 | 819.0 | 2.70 | 2.70 |
| 26783 | 823.3 | 1.09 | 1.09 | 26775 | 822.5 | 2.70 | 2.70 |

| Spectrum Plot of Worst Value | |
|---|---|
| 1.4 MHz / QPSK | 3 MHz / QPSK |
| | |

| LTE Band 26 | | | | | | | |
|---|---|---|---|---|---|---|---|
| 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 |
| 26715 | 816.5 | 4.49 | 4.50 | 26740 | 819.0 | 9.02 | 9.01 |
| 26740 | 819.0 | 4.50 | 4.50 | | | | |
| 26765 | 821.5 | 4.50 | 4.50 | | | | |

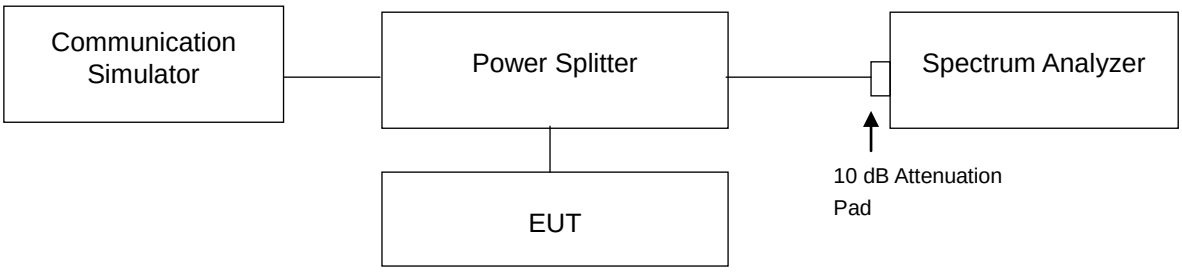
| Spectrum Plot of Worst Value | |
|---|---|
| 5 MHz / 16QAM | 10 MHz / QPSK |
| | |

## 4.5 Emission Mask Measurement

### 4.5.1 Limits of Band Edge Measurement

According to FCC part 90.691 shall be tested the emission mask. For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50+10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

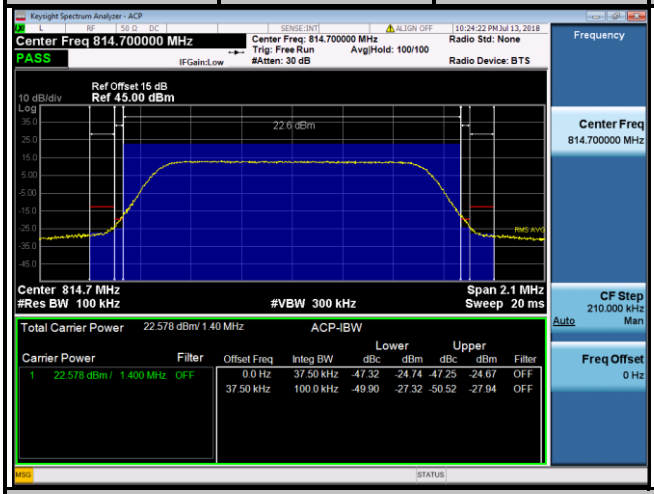
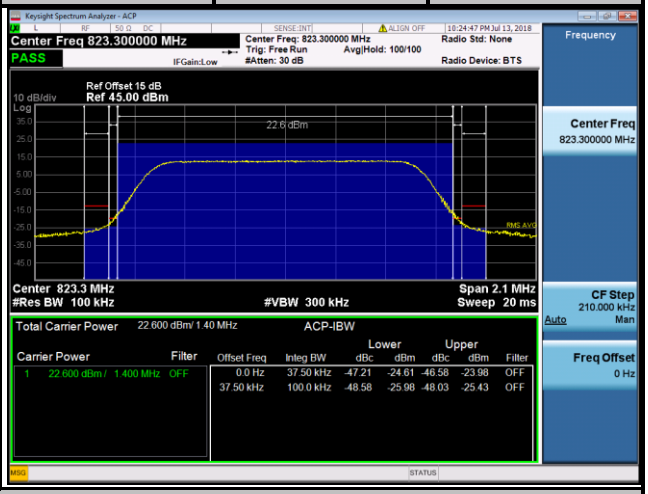
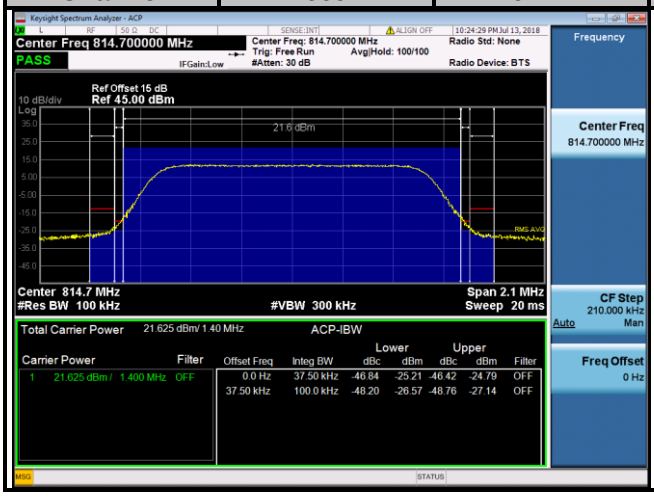
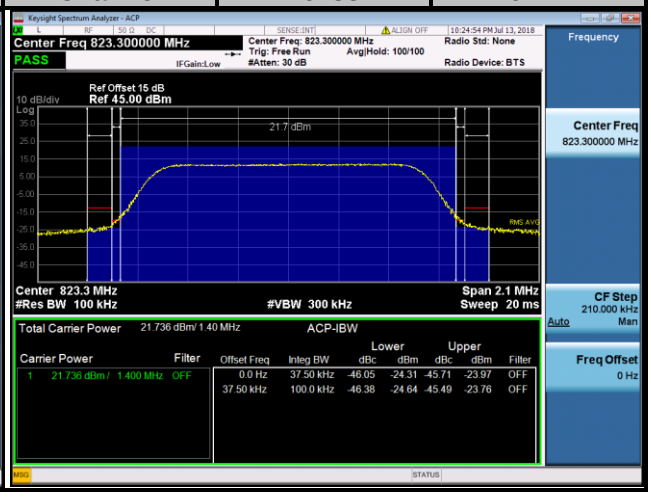
### 4.5.2 Test Setup




### 4.5.3 Test Procedures

a. The measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
b. Record the test plot.

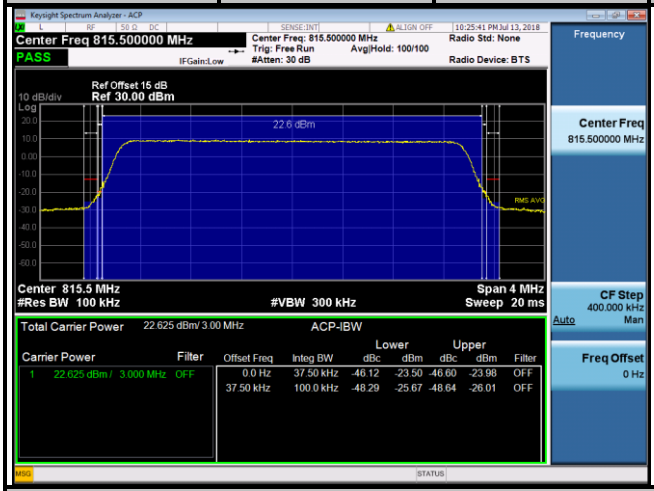
### 4.5.4 Test Results

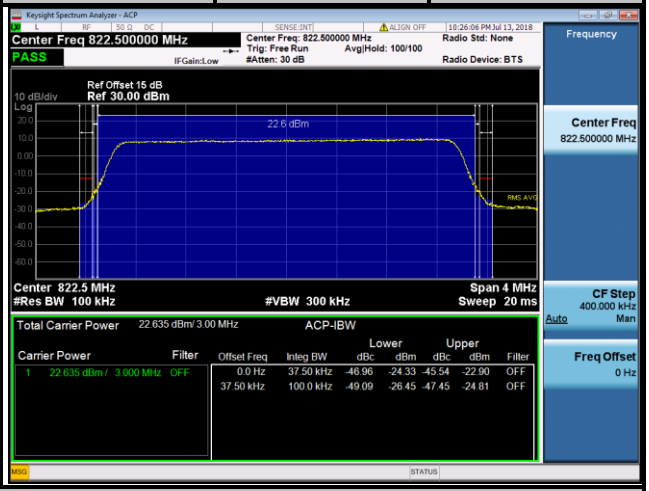
| LTE Band 26 | | | | | |
|---|---|---|---|---|---|
| Channel Bandwidth: 1.4 MHz / QPSK | | | | | |
| Channel | 26697 | 6 RB | Channel | 26783 | 6 RB |
|  | | |  | | |
| Channel Bandwidth: 1.4 MHz / 16QAM | | | | | |
| Channel | 26697 | 6 RB | Channel | 26783 | 6 RB |
|  | | |  | | |

## LTE Band 26

### Channel Bandwidth: 3 MHz / QPSK

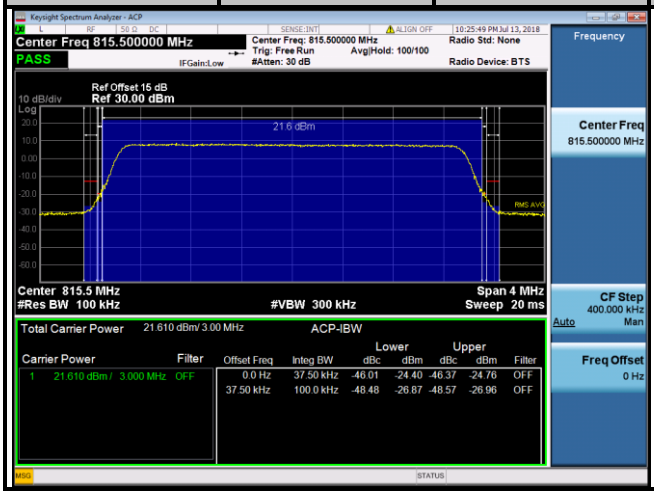
| Channel | 26705 | 15 RB | Channel | 26775 | 15 RB |
|---|---|---|---|---|---|

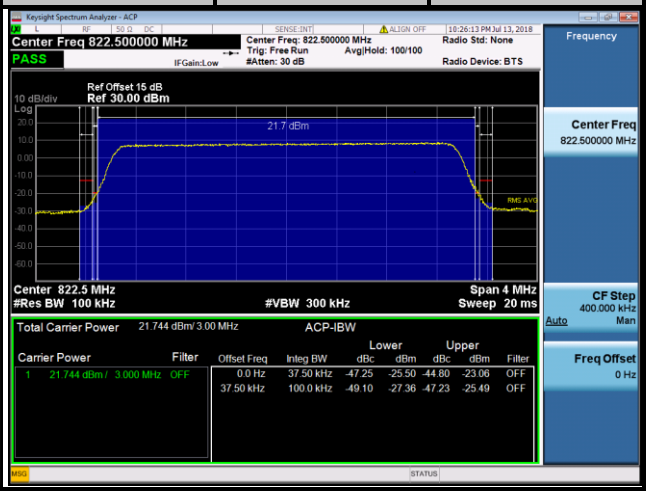



### Channel Bandwidth: 3 MHz / 16QAM

| Channel | 26705 | 15 RB | Channel | 26775 | 15 RB |
|---|---|---|---|---|---|

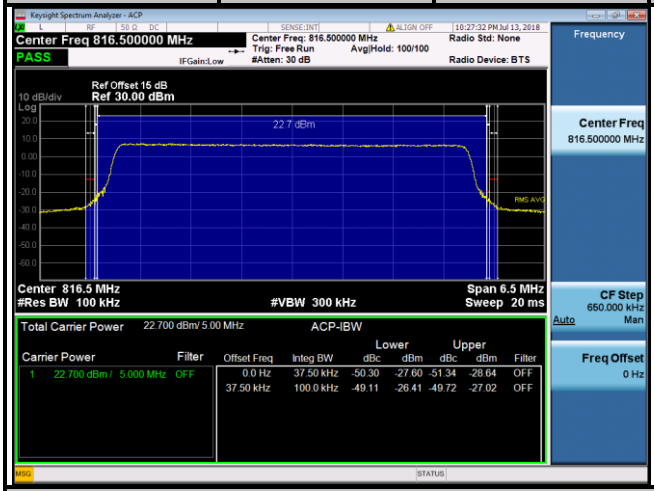


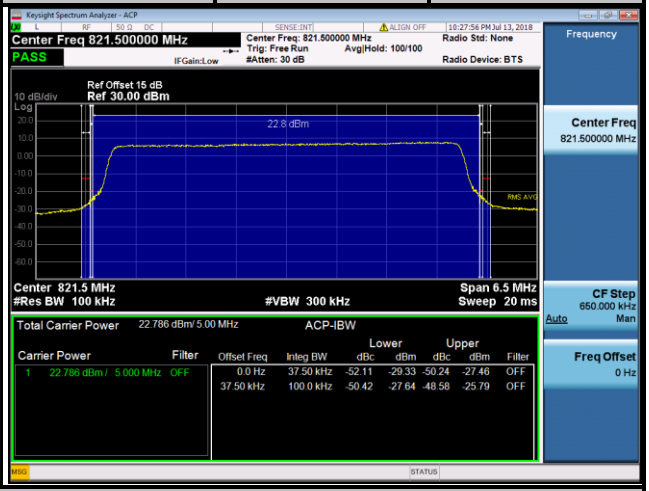



## LTE Band 26

### Channel Bandwidth: 5 MHz / QPSK

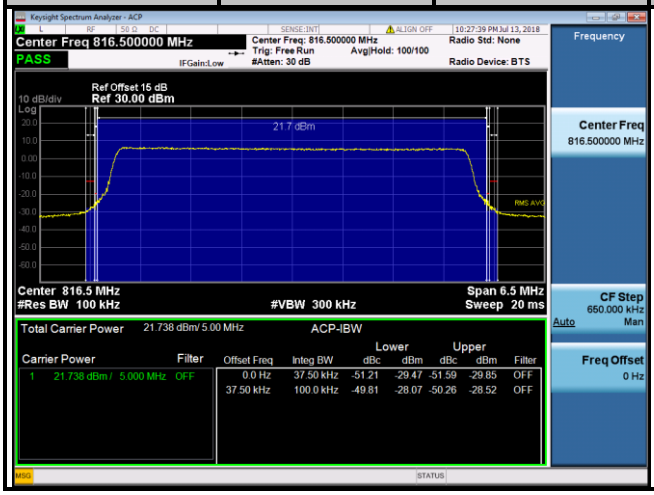
| Channel | 267151 | 25 RB | Channel | 26765 | 25 RB |
|---|---|---|---|---|---|

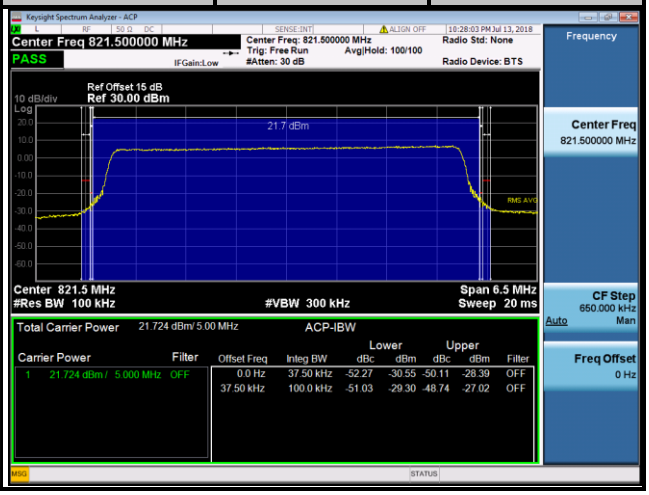


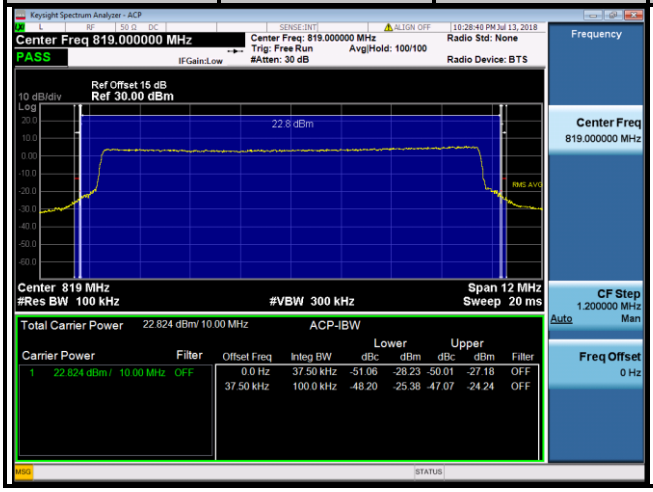
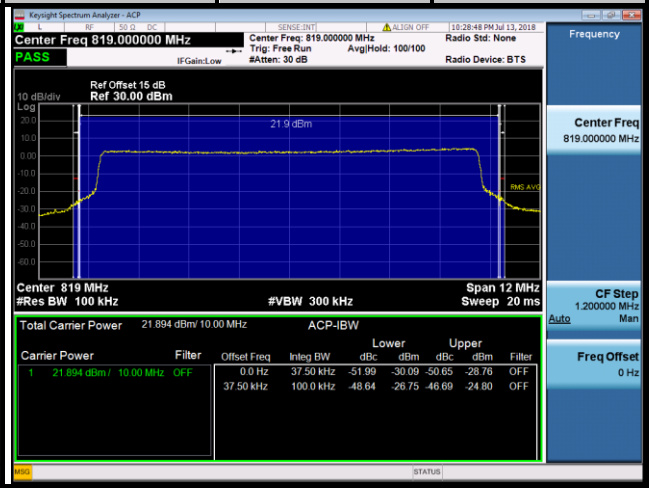




### Channel Bandwidth: 5 MHz / 16QAM

| Channel | 267151 | 25 RB | Channel | 26765 | 25 RB |
|---|---|---|---|---|---|



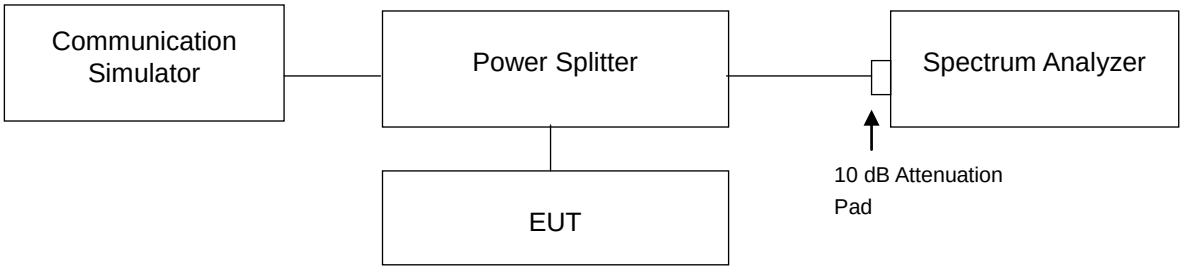
| LTE Band 26 | | | | | |
|---|---|---|---|---|---|
| Channel Bandwidth: 10 MHz / QPSK | | | Channel Bandwidth: 10 MHz / 16QAM | | |
| Channel | 26740 | 50 RB | Channel | 26740 | 50 RB |
|  | | |  | | |

## 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 log10(P) dB. The limit of emission is equal to -13 dBm.
On all frequencies between 769 – 775 MHz and 799 – 805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

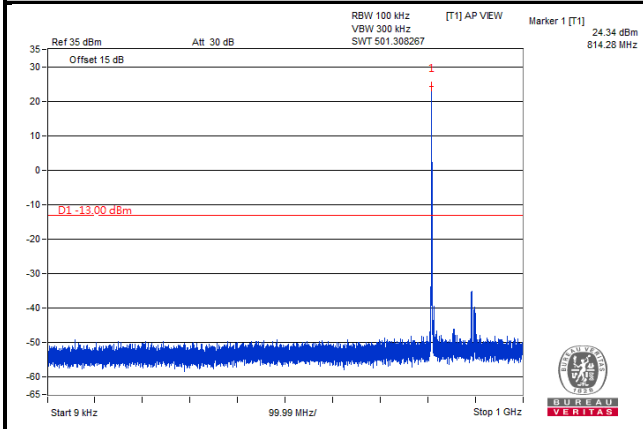
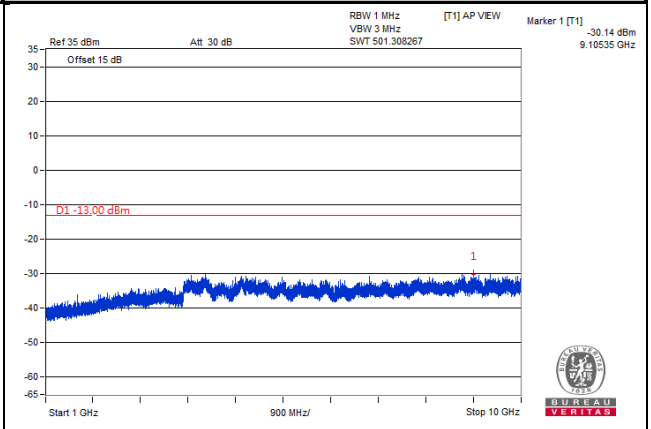
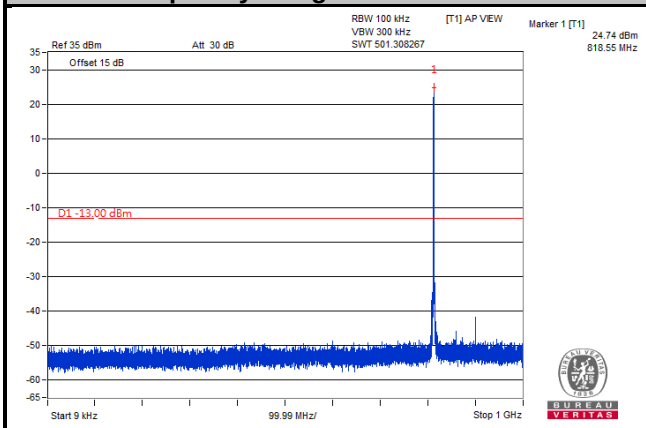
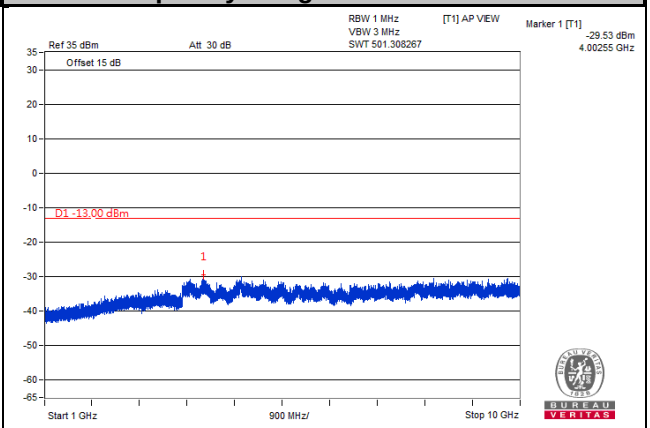
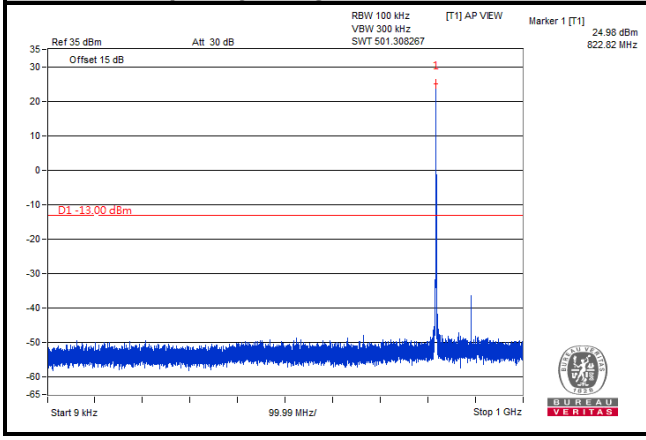
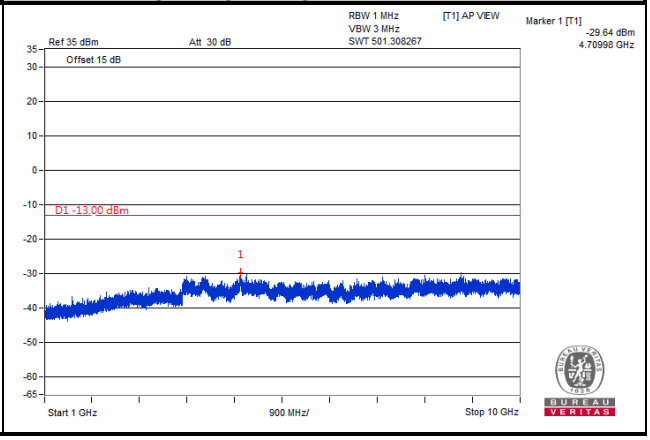
### 4.6.2 Test Setup




### 4.6.3 Test Procedure

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

## 4.6.4 Test Results

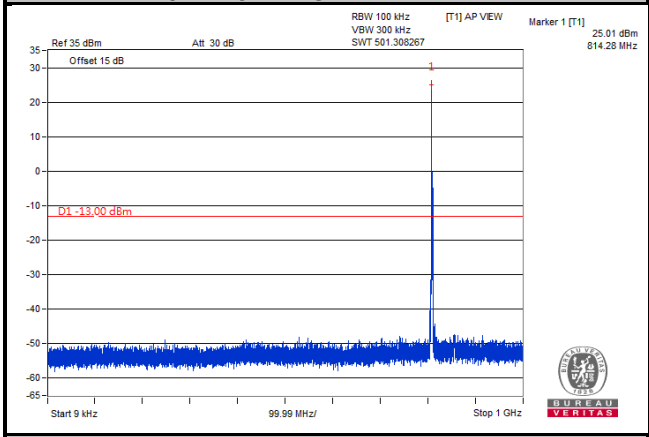
| LTE Band 26 | |
|---|---|
| Channel Bandwidth: 1.4 MHz | |
| Channel 26697 | |
| Frequency Range: 9 kHz ~ 1 GHz | Frequency Range: 1 GHz ~ 10 GHz |
|  |  |
| Channel 26740 | |
| Frequency Range: 9 kHz ~ 1 GHz | Frequency Range: 1 GHz ~ 10 GHz |
|  |  |
| Channel 26783 | |
| Frequency Range: 9 kHz ~ 1 GHz | Frequency Range: 1 GHz ~ 10 GHz |
|  |  |

## LTE Band 26

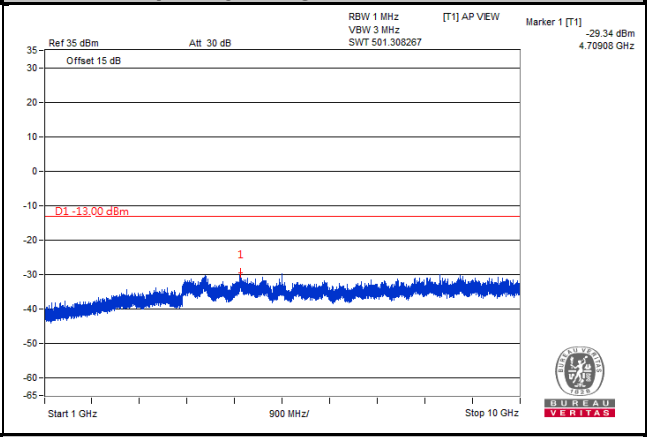
### Channel Bandwidth: 3 MHz

### Channel 26705

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

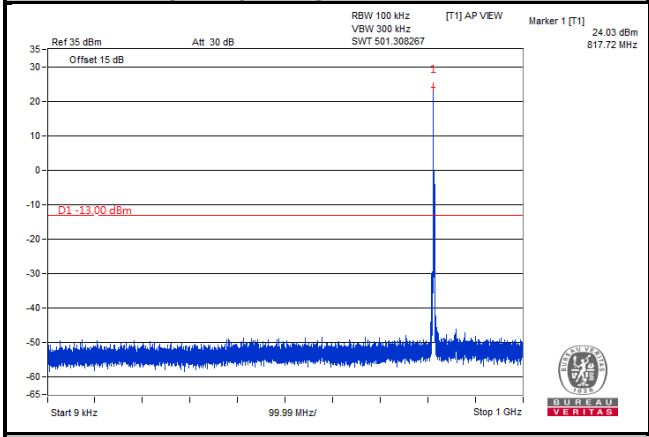



**Frequency Range: 1 GHz ~ 10 GHz**

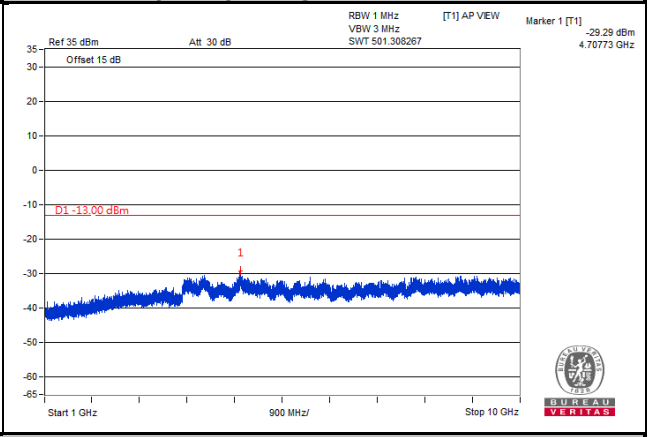



### Channel 26740

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

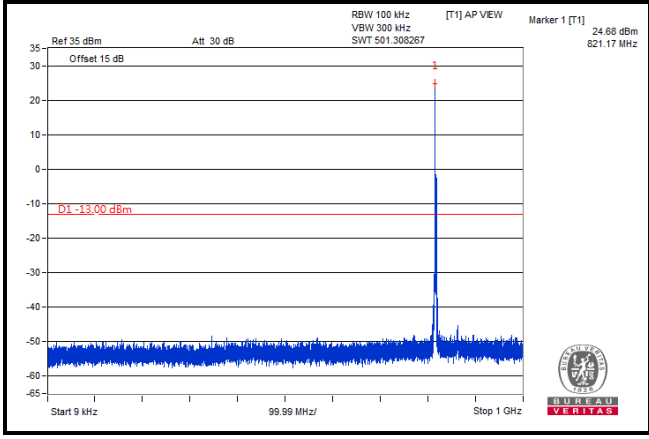



**Frequency Range: 1 GHz ~ 10 GHz**

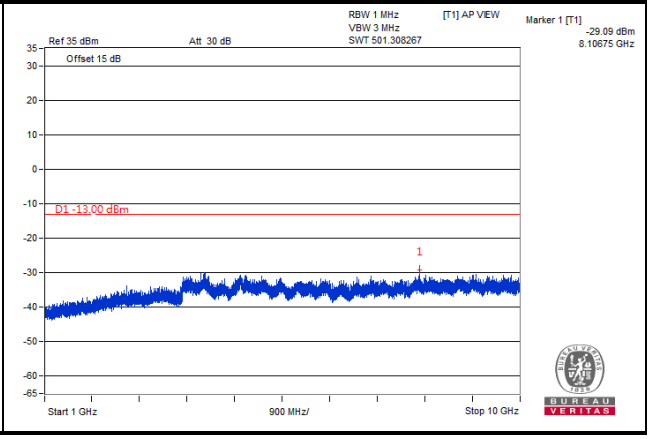



### Channel 26775

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




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

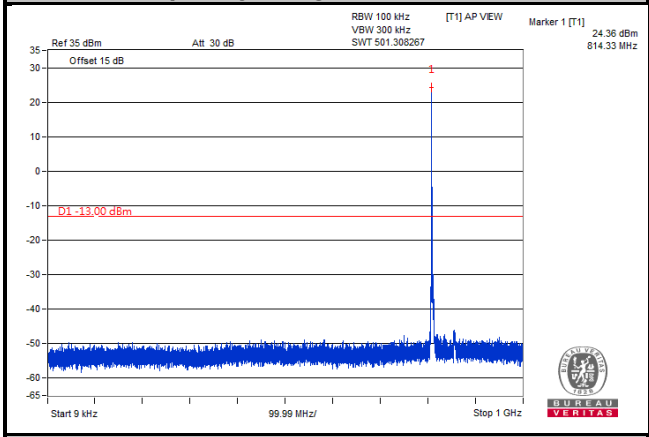


## LTE Band 26

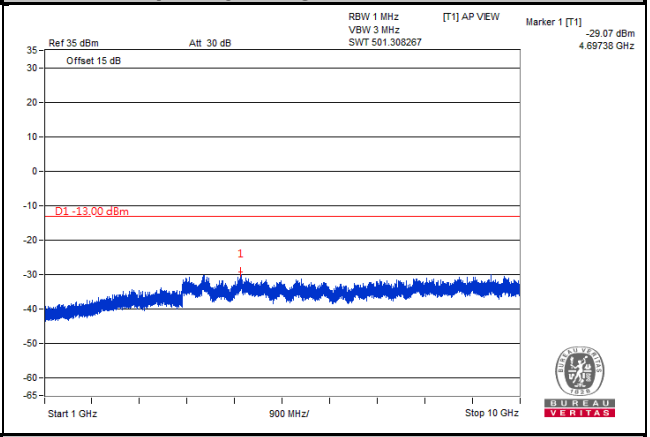
### Channel Bandwidth: 5 MHz

### Channel 26715

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

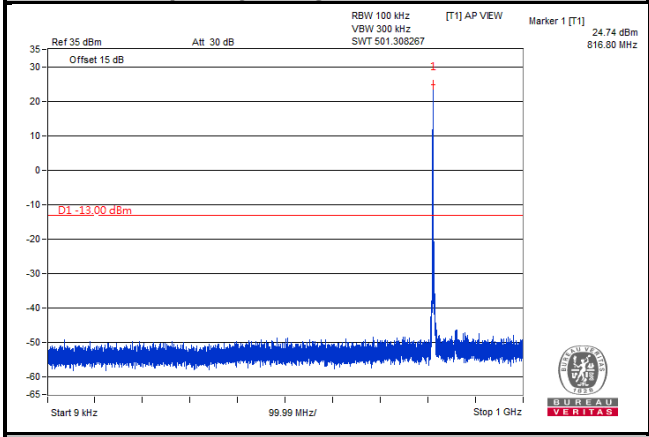



**Frequency Range: 1 GHz ~ 10 GHz**

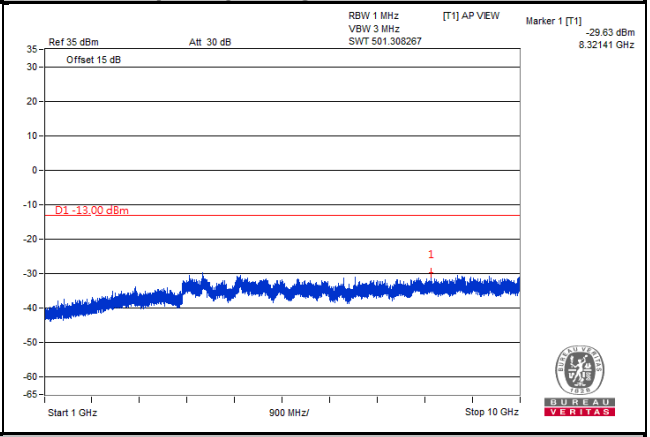



### Channel 26740

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

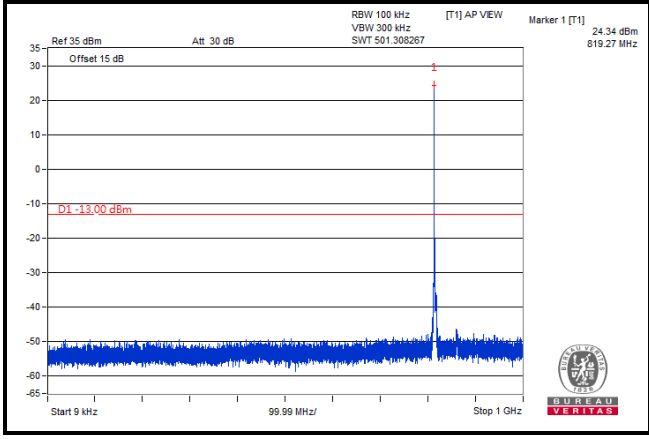



**Frequency Range: 1 GHz ~ 10 GHz**

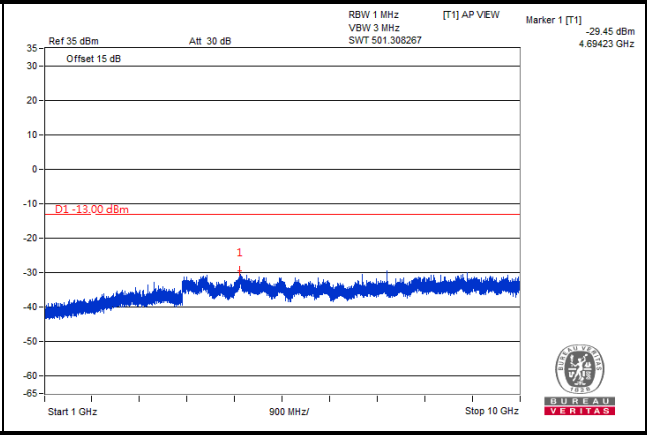


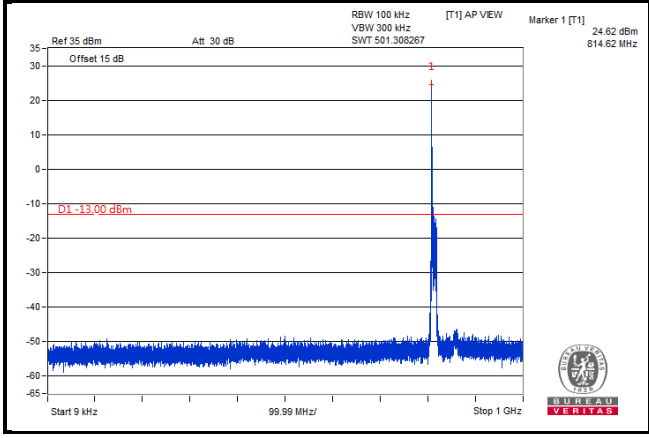
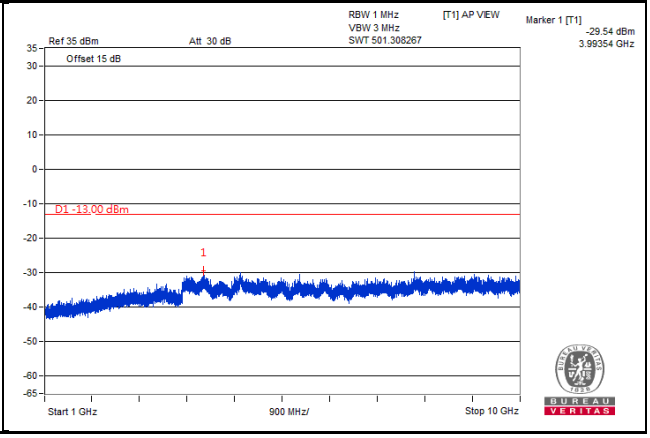

### Channel 26765

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




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



| LTE Band 26 | |
|---|---|
| Channel Bandwidth: 10 MHz | |
| Channel 26740 | |
| Frequency Range: 9 kHz ~ 1 GHz | Frequency Range: 1 GHz ~ 10 GHz |
|  |  |

## 4.7 Radiated Emission Measurement

### 4.7.1 Limits of Radiated Emission Measurement

(1) The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 +10 log10(P) dB. The limit of emission is equal to -13 dBm.

(2) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

### 4.7.2 Test Procedure

a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.

b. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Read Value” of step a. Record the power level of S.G.

c. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution horn.

d. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, E.R.P power = E.I.P.R power - 2.15 dB.

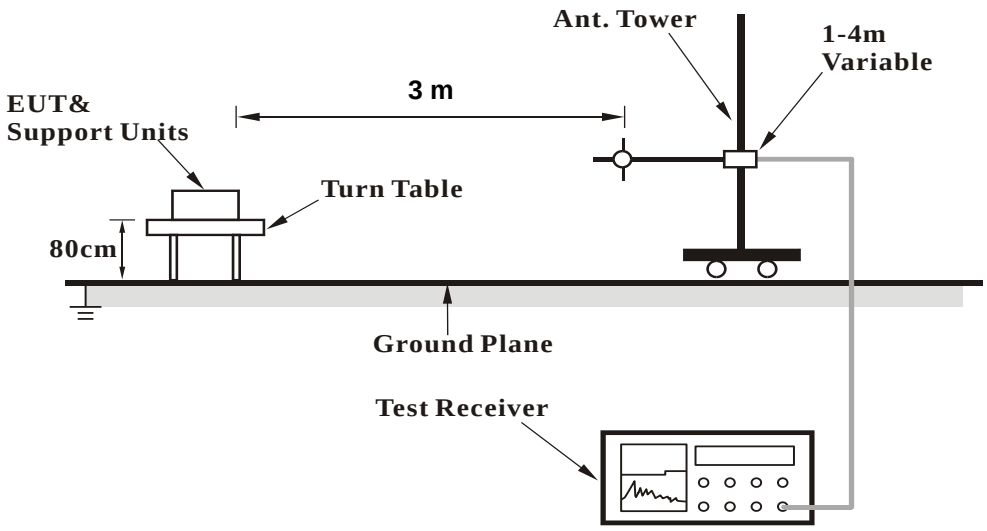
**Note:** The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

### 4.7.3 Deviation from Test Standard

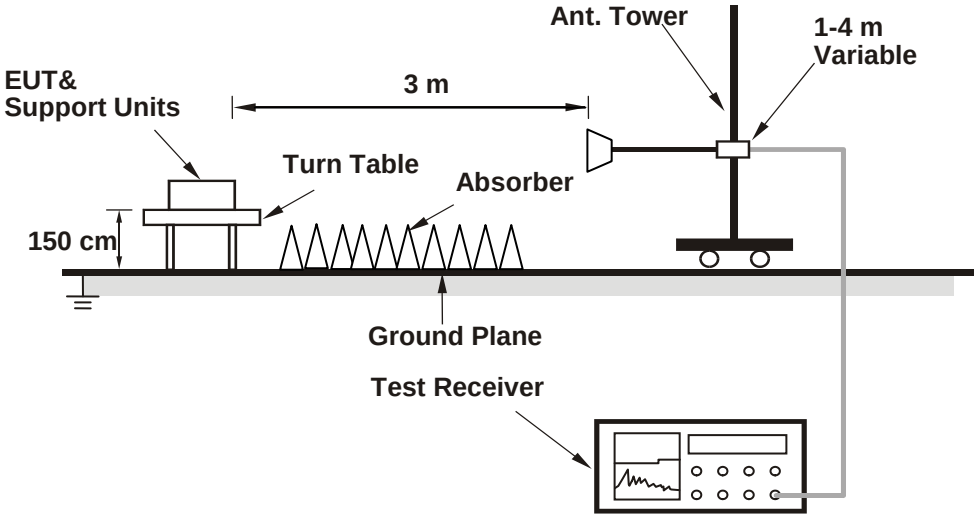
No deviation.

4.7.4 Test Setup

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




**<Radiated Emission above 1 GHz>**




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

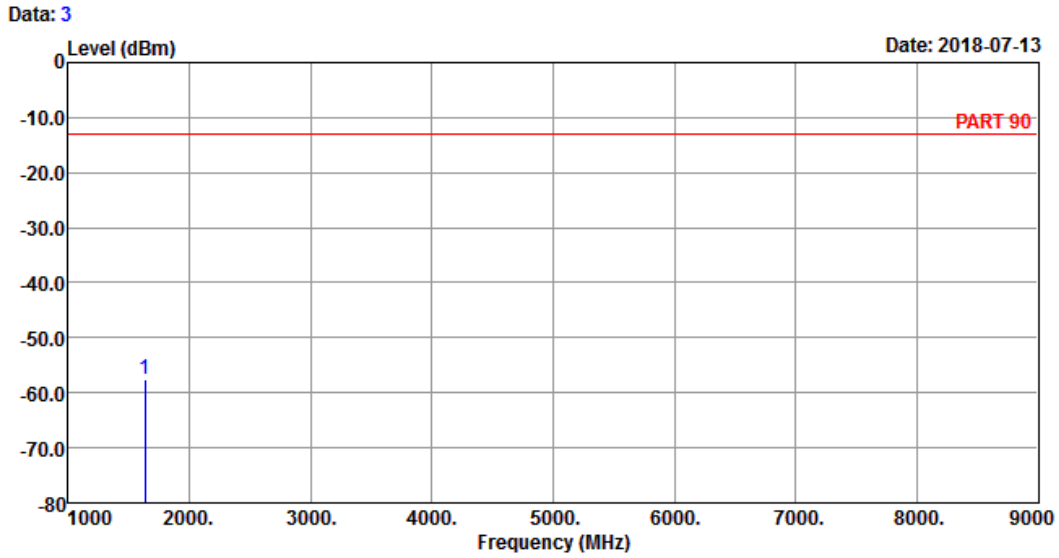
4.7.5 Test Results

**LTE Band 26**

**Channel Bandwidth: 5 MHz / QPSK**

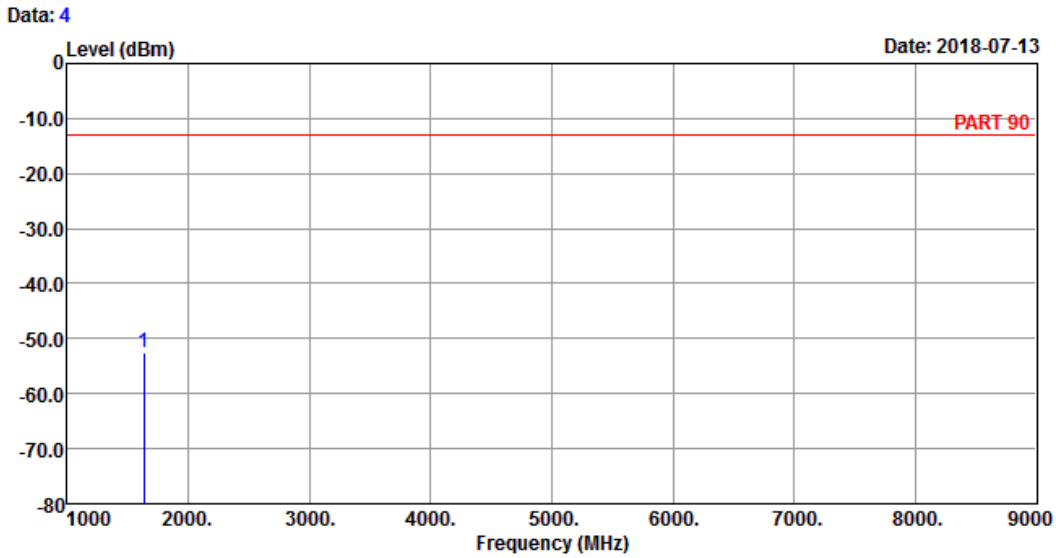
**Low Channel**

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch




Site : 966 Chamber 5
Condition: PART 90 HORIZONTAL
Remak : LTE Band 26 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 pp | 1633.00 | -57.63 | -42.84 | -13.00 | -44.63 | -14.79 | Peak |

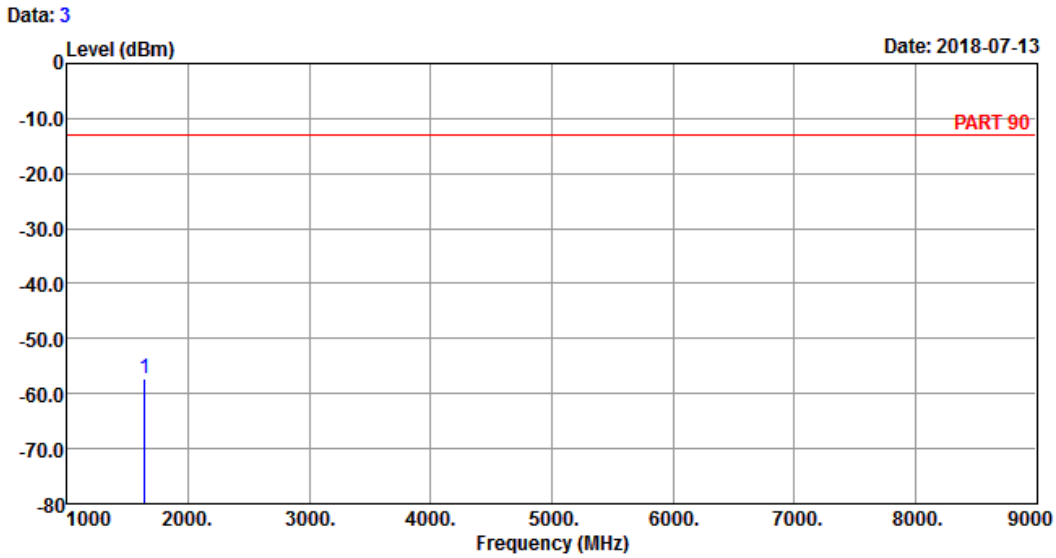



Site : 966 Chamber 5
Condition: PART 90 VERTICAL
Remak : LTE Band 26 QPSK_5M Link_L-CH
Tested by: Thomas Wei

| | Freq | Level | Read Level | Limit Line | Over Limit | Factor | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBm | dBm | dBm | dB | dB | |
| 1 pp | 1633.00 | -52.65 | -37.86 | -13.00 | -39.65 | -14.79 | Peak |

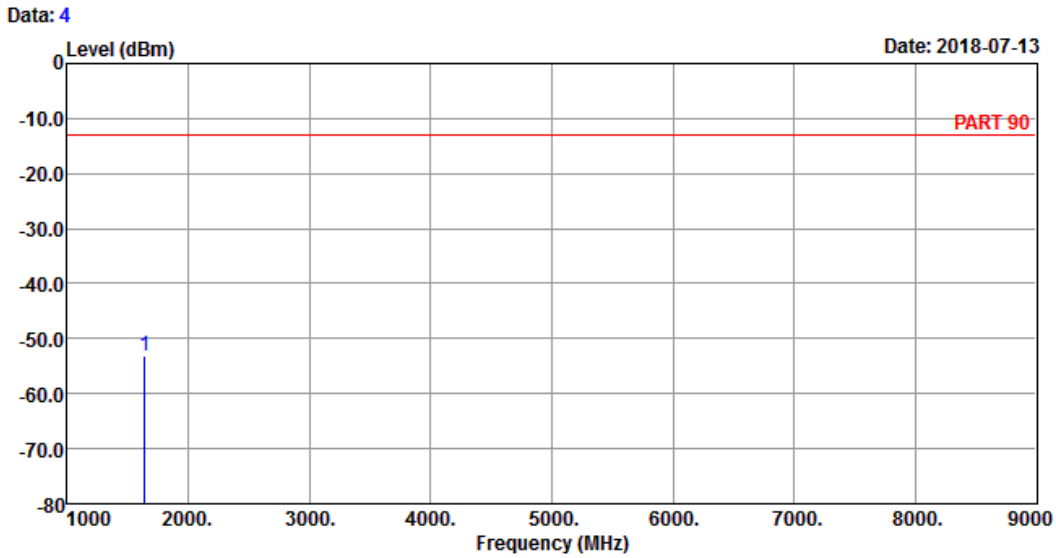
## Middle Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch




Site : 966 Chamber 5
Condition: PART 90 HORIZONTAL
Remak : LTE Band 26 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 pp | 1638.00 | -57.25 | -42.46 | -13.00 | -44.25 | -14.79 | Peak |

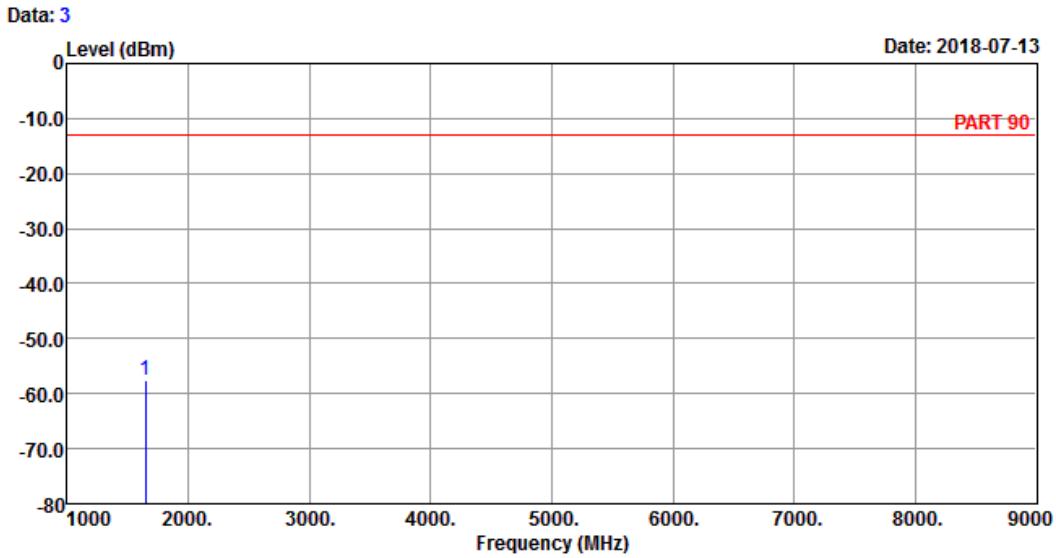



Site : 966 Chamber 5
Condition: PART 90 VERTICAL
Remak : LTE Band 26 QPSK_5M Link_M-CH
Tested by: Thomas Wei

| | Freq | Level | Read Level | Limit Line | Over Limit | Factor | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBm | dBm | dBm | dB | dB | |
| 1 pp | 1638.00 | -53.01 | -38.22 | -13.00 | -40.01 | -14.79 | Peak |

## High Channel

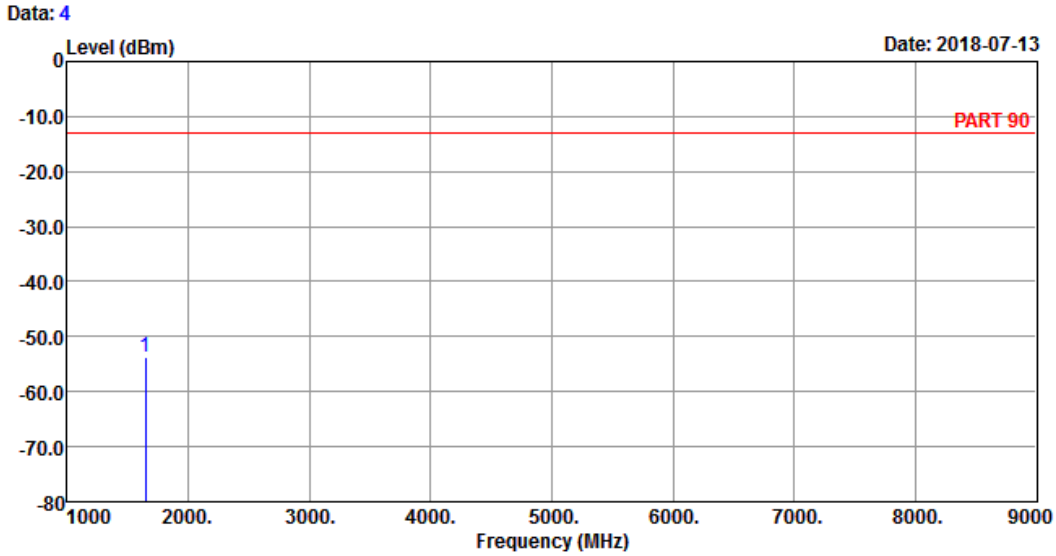
Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch




Site : 966 Chamber 5
Condition: PART 90 HORIZONTAL
Remak : LTE Band 26 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 | 1643.00 | -57.52 | -42.79 | -13.00 | -44.52 | -14.73 | Peak |

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch

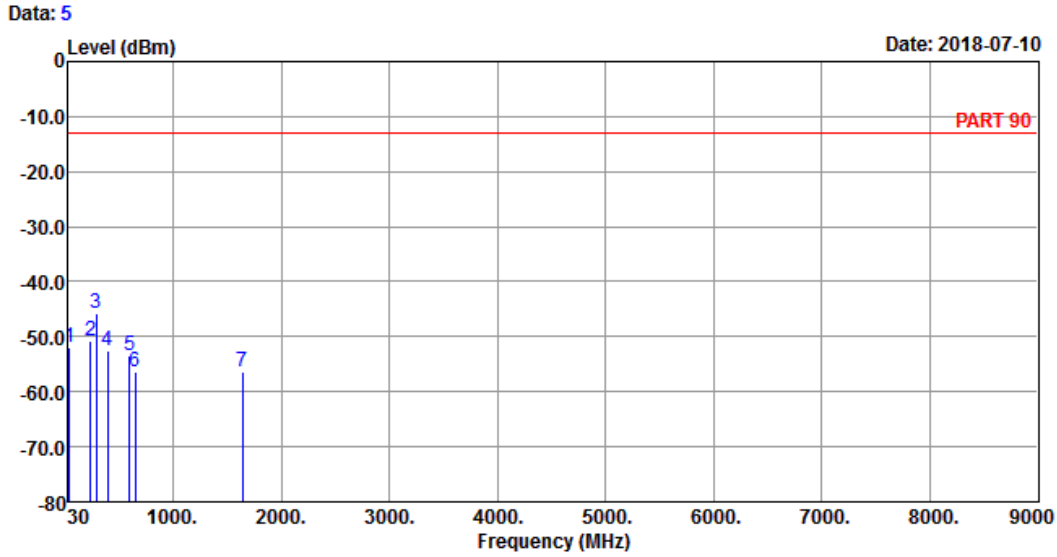



Site : 966 Chamber 5
Condition: PART 90 VERTICAL
Remak : LTE Band 26 QPSK_5M Link_H-CH
Tested by: Thomas Wei

| | Freq | Level | Read Level | Limit Line | Over Limit | Factor | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBm | dBm | dBm | dB | dB | |
| 1 pp | 1643.00 | -53.62 | -38.89 | -13.00 | -40.62 | -14.73 | Peak |

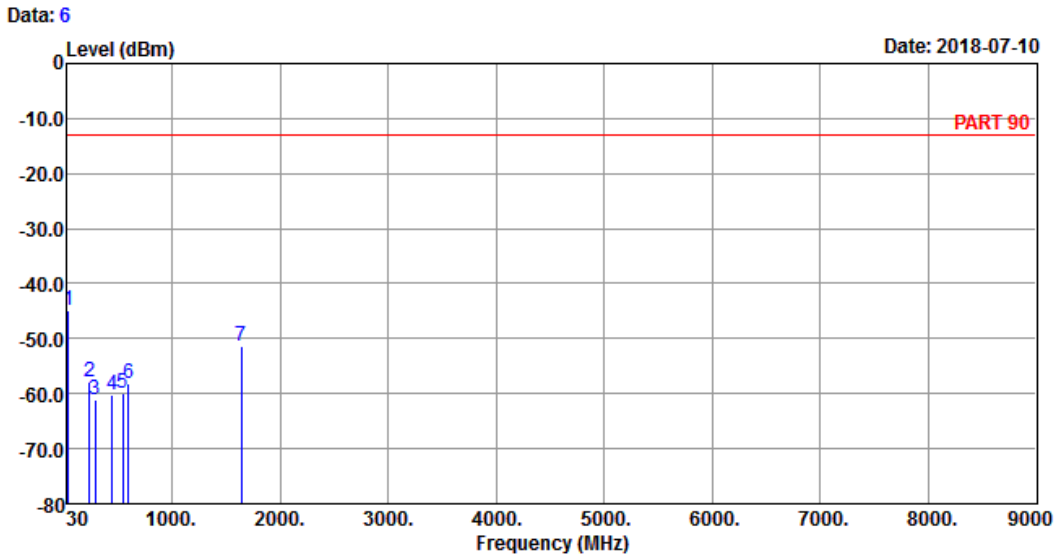
## Channel Bandwidth: 10 MHz / QPSK
## Middle Channel

Bureau Veritas Consumer Products Services Ltd.,Taoyuan Branch




Site : 966 Chamber 5
Condition: PART 90 HORIZONTAL
Remak : LTE Band 26 QPSK_10M Link_M-CH
Tested by: Thomas Wei

| | Freq | Level | Read Level | Limit Line | Over Limit | Factor | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBm | dBm | dBm | dB | dB | |
| 1 | 39.70 | -52.03 | -52.67 | -13.00 | -39.03 | 0.64 | Peak |
| 2 | 234.67 | -50.88 | -44.26 | -13.00 | -37.88 | -6.62 | Peak |
| 3 pp | 286.08 | -45.83 | -39.10 | -13.00 | -32.83 | -6.73 | Peak |
| 4 | 390.84 | -52.66 | -46.66 | -13.00 | -39.66 | -6.00 | Peak |
| 5 | 598.42 | -53.56 | -52.73 | -13.00 | -40.56 | -0.83 | Peak |
| 6 | 649.83 | -56.37 | -55.49 | -13.00 | -43.37 | -0.88 | Peak |
| 7 | 1638.00 | -56.30 | -41.51 | -13.00 | -43.30 | -14.79 | Peak |




Site : 966 Chamber 5
Condition: PART 90 VERTICAL
Remak : LTE Band 26 QPSK_10M 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 | 42.61 | -44.93 | -43.99 | -13.00 | -31.93 | -0.94 | Peak |
| 2 | 234.67 | -57.86 | -51.24 | -13.00 | -44.86 | -6.62 | Peak |
| 3 | 286.08 | -61.18 | -54.45 | -13.00 | -48.18 | -6.73 | Peak |
| 4 | 442.25 | -60.14 | -54.53 | -13.00 | -47.14 | -5.61 | Peak |
| 5 | 547.01 | -60.04 | -57.09 | -13.00 | -47.04 | -2.95 | Peak |
| 6 | 598.42 | -58.16 | -57.33 | -13.00 | -45.16 | -0.83 | Peak |
| 7 | 1638.00 | -51.24 | -36.45 | -13.00 | -38.24 | -14.79 | 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
**Web Site:** www.bureauveritas-adt.com


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

**--- END ---**