

# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LICENSED TRANSMITTER

**Test Report No.** : OT-192-RWD-041  
**AGR No.** : A192A-045  
**Applicant** : Suntech International Ltd.  
**Address** : (Gasan-dong, Greatvally), B-1506, 32, Digital-ro9-gil, Geumchon-gu, Seoul, Korea  
**Manufacturer** : Suntech International Ltd.  
**Address** : (Gasan-dong, Greatvally), B-1506, 32, Digital-ro9-gil, Geumchon-gu, Seoul, Korea  
**Type of Equipment** : Tracking Device  
**FCC ID.** : WA2ST4500  
**Model Name** : ST4500  
**Serial number** : N/A  
**Total page of Report** : 81 pages (including this page)  
**Date of Incoming** : February 13, 2019  
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## SUMMARY

The equipment complies with the regulation; **Part 2, Part 27 Subpart C**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:

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**Revision History**

| Rev. No. | Issue Report No. | Issued Date       | Revisions       | Section Affected |
|----------|------------------|-------------------|-----------------|------------------|
| 0        | OT-192-RWD-041   | February 28, 2019 | Initial Release | All              |
|          |                  |                   |                 |                  |
|          |                  |                   |                 |                  |

## 1. VERIFICATION OF COMPLIANCE

Applicant : Suntech International Ltd.  
Address : (Gasan-dong, Greatvally), B-1506, 32, Digital-ro9-gil, Geumchon-gu, Seoul, Korea  
Contact Person : Yohan Kim / Manager  
Telephone No. : 82-2-6327-5661  
FCC ID : WA2ST4500  
Model Name : ST4500  
Serial Number : N/A  
Date : February 28, 2019

|   |  |
|---|--|
| EQUIPMENT CLASS   | PCB-PCS Licensed Transmitter                 |
| EQUIPMENT DESCRIPTION                                   | Tracking Device                              |
| THIS REPORT CONCERNS                                    | Original Grant                               |
| MEASUREMENT PROCEDURES                                  | ANSI C63.26:2015, KDB Publication 971168 D01 |
| TYPE OF EQUIPMENT TESTED                                | Pre-Production                               |
| KIND OF EQUIPMENT                                       | Certification                                |
| AUTHORIZATION REQUESTED                                 |  |
| EQUIPMENT WILL BE OPERATED<br>UNDER FCC RULES PART(S)   | FCC Part 2, Part 27 Subpart C                |
| Modifications on the Equipment to Achieve<br>Compliance | None   |
| Final Test was Conducted On                             | 3 m Semi Anechoic Chamber                    |

- The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. TEST SUMMARY

### 2.1 Test items and results

| SECTION                                    | TEST ITEMS   | RESULTS              |
|--|--|----------------------|
| 2.1049                                     | Occupied Bandwidth   | Met the Limit / PASS |
| 2.1051, 27.53(g), 27.53(f),<br>27.53(h)    | Band Edge<br>/ Spurious and Harmonic Emissions at Antenna Termianl | Met the Limit / PASS |
| 2.1046                                     | Conducted Output Power   | Met the Limit / PASS |
| 27.50(d)(5),<br>KDB Publication 971168 D01 | Peak-to-Average Ratio  | Met the Limit / PASS |
| 2.1055, 27.54                              | Frequency stability  | Met the Limit / PASS |
| 27.50(d)(4)                                | Equivalent Isotropic Radiated Power                                | Met the Limit / PASS |
| 27.50(b)(10), 27.50(c)(10)                 | EFFECTIVE RADIATED POWER   | Met the Limit / PASS |
| 2.1053, 27.53(g), 27.53(f),<br>27.53(h)    | Radiated Spurious and Harmonic Emissions                           | Met the Limit / PASS |

### 2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

### 2.3 Related Submittal(s) / Grant(s)

Original submittal only

### 2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in Part 27 Subpart C.

### 2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.26:2015. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

### 2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

- Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666 / T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

- Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

### 3. GENERAL INFORMATION

#### 3.1 Product Description

The Suntech International Ltd., Model ST4500 (referred to as the EUT in this report) is a Tracking Device. Product specification information described herein was obtained from product data sheet or user's manual.

|   |                 |           |                       |
|---|-----------------|-----------|-----------------------|
| DEVICE TYPE   | Tracking Device |           |                       |
| OPERATING FREQUENCY                                   | LTE Band 2      | TX        | 1 850 MHz ~ 1 910 MHz |
|   |                 | RX        | 1 930 MHz ~ 1 990 MHz |
|   | LTE Band 4      | TX        | 1 710 MHz ~ 1 755 MHz |
|   |                 | RX        | 2 110 MHz ~ 2 155 MHz |
|   | LTE Band 5      | TX        | 824 MHz ~ 849 MHz     |
|   |                 | RX        | 869 MHz ~ 894 MHz     |
|   | LTE Band 12     | TX        | 699 MHz ~ 716 MHz     |
|   |                 | RX        | 729 MHz ~ 746 MHz     |
|   | LTE Band 13     | TX        | 777 MHz ~ 787 MHz     |
|   |                 | RX        | 746 MHz ~ 756 MHz     |
| LTE Channel Bandwidth                                 | 10 MHz          |           |                       |
| Modulation Type                                       | QPSK, 16QAM     |           |                       |
| Maximum EIRP Power                                    | LTE Band 4      | 20.41 dBm |                       |
| Maximum ERP Power                                     | LTE Band 12     | 21.34 dBm |                       |
|   | LTE Band 13     | 21.41 dBm |                       |
| ANTENNA TYPE  | PIFA Antenna    |           |                       |
| ANTENNA GAIN  | LTE Band 2      | 1.17 dBi  |                       |
|   | LTE Band 4      | -0.72 dBi |                       |
|   | LTE Band 5      | 0.41 dBi  |                       |
|   | LTE Band 12     | -1.69 dBi |                       |
|   | LTE Band 13     | -0.31 dBi |                       |
| List of each Osc. or crystal<br>Freq.(Freq. >= 1 MHz) | 26 MHz          |           |                       |

#### 3.2 Alternative type(s)/model(s); also covered by this test report.

- None

### 4. EUT MODIFICATIONS

- None

## 5. SYSTEM TEST CONFIGURATION

### 5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

| DEVICE TYPE | MANUFACTURER | MODEL/PART NUMBER | FCC ID |
|-------------|--------------|-------------------|--------|
| Main Board  | N/A          | N/A               | N/A    |
| Battery     | N/A          | N/A               | N/A    |
| Antenna     | N/A          | N/A               | N/A    |

### 5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

| Model     | Manufacturer | Description     | Connected to |
|-----------|--------------|-----------------|--------------|
| PWS-3003D | Protek       | DC Power Supply | EUT          |

### 5.3 Mode of operation during the test

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis, and antenna ports. The worst case was found when positioned as the table below. Following channel(s) was (were) selected for the final test as listed below:

| Band        | EIRP    | Radiated Emission |
|-------------|---------|-------------------|
| LTE Band 4  | X-plane | X-axis            |
| LTE Band 12 | X-plane | X-axis            |
| LTE Band 13 | X-plane | X-axis            |

#### Test Mode : LTE Band 4

| Test Item                           | Channel Bandwidth | Modulation  | Mode                            | Test Channel                          |
|-------------------------------------|-------------------|-------------|---------------------------------|---------------------------------------|
| Conducted Output Power              | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 1 715 MHz<br>1 732.5 MHz<br>1 750 MHz |
|                                     |                   |             | 1 RB / 5 RB Offset / 0 RB Index |                                       |
|                                     |                   |             | 1 RB / 0 RB Offset / 3 RB Index |                                       |
|                                     |                   |             | 1 RB / 5 RB Offset / 3 RB Index |                                       |
|                                     |                   |             | 1 RB / 0 RB Offset / 7 RB Index |                                       |
|                                     |                   |             | 1 RB / 5 RB Offset / 7 RB Index |                                       |
|                                     |                   |             | 3 RB / 0 RB Offset / 0 RB Index |                                       |
|                                     |                   |             | 3 RB / 3 RB Offset / 7 RB Index |                                       |
|                                     |                   |             | 6 RB / 0 RB Offset / 0 RB Index |                                       |
|                                     |                   |             | 6 RB / 0 RB Offset / 7 RB Index |                                       |
| Equivalent Isotropic Radiated Power | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 1 715 MHz                             |
|                                     |                   |             |                                 | 1 732.5 MHz                           |
|                                     |                   |             |                                 | 1 750 MHz                             |
| Frequency stability                 | 10 MHz            | QPSK        | 1 RB / 0 RB Offset / 0 RB Index | 1 732.5 MHz                           |

| Test Item   | Channel Bandwidth | Modulation  | Mode                            | Test Channel |
|---|-------------------|-------------|---------------------------------|--------------|
| Occupied Bandwidth                                  | 10 MHz            | QPSK, 16QAM | 6 RB / 0 RB Offset / 0 RB Index | 1 715 MHz    |
|   |                   |             |                                 | 1 732.5 MHz  |
|   |                   |             |                                 | 1 750 MHz    |
| Peak-to-Average Ratio                               | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 1 715 MHz    |
|   |                   |             |                                 | 1 732.5 MHz  |
|   |                   |             | 6 RB / 0 RB Offset / 0 RB Index | 1 750 MHz    |
| Band Edge   | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 1 715 MHz    |
|   |                   |             | 6 RB / 0 RB Offset / 0 RB Index |              |
|   |                   |             | 1 RB / 5 RB Offset / 0 RB Index | 1 750 MHz    |
|   |                   |             | 6 RB / 5 RB Offset / 0 RB Index |              |
| Spurious and Harmonic Emissions at Antenna Terminal | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 1 715 MHz    |
|   |                   |             |                                 | 1 732.5 MHz  |
|   |                   |             |                                 | 1 750 MHz    |
| Radiated Spurious and Harmonic Emissions            | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 1 715 MHz    |
|   |                   |             |                                 | 1 732.5 MHz  |
|   |                   |             |                                 | 1 750 MHz    |

**Test Mode : LTE Band 12**

| Test Item                           | Channel Bandwidth | Modulation  | Mode                            | Test Channel                    |
|-------------------------------------|-------------------|-------------|---------------------------------|---------------------------------|
| Conducted Output Power              | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 704 MHz<br>707.5 MHz<br>711 MHz |
|                                     |                   |             | 1 RB / 5 RB Offset / 0 RB Index |                                 |
|                                     |                   |             | 1 RB / 0 RB Offset / 3 RB Index |                                 |
|                                     |                   |             | 1 RB / 5 RB Offset / 3 RB Index |                                 |
|                                     |                   |             | 1 RB / 0 RB Offset / 7 RB Index |                                 |
|                                     |                   |             | 1 RB / 5 RB Offset / 7 RB Index |                                 |
|                                     |                   |             | 3 RB / 0 RB Offset / 0 RB Index |                                 |
|                                     |                   |             | 3 RB / 3 RB Offset / 7 RB Index |                                 |
|                                     |                   |             | 6 RB / 0 RB Offset / 0 RB Index |                                 |
|                                     |                   |             | 6 RB / 0 RB Offset / 7 RB Index |                                 |
| Equivalent Isotropic Radiated Power | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 704 MHz                         |
|                                     |                   |             |                                 | 707.5 MHz                       |
|                                     |                   |             |                                 | 711 MHz                         |
| Frequency stability                 | 10 MHz            | QPSK        | 1 RB / 0 RB Offset / 0 RB Index | 707.5 MHz                       |
| Peak-to-Average Ratio               | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 704 MHz                         |
|                                     |                   |             | 6 RB / 0 RB Offset / 0 RB Index | 707.5 MHz                       |
|                                     |                   |             | 711 MHz                         |                                 |
| Band Edge                           | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 704 MHz                         |
|                                     |                   |             | 6 RB / 0 RB Offset / 0 RB Index |                                 |
|                                     |                   |             | 1 RB / 5 RB Offset / 0 RB Index | 711 MHz                         |
|                                     |                   |             | 6 RB / 5 RB Offset / 0 RB Index |                                 |

| Test Item   | Channel Bandwidth | Modulation  | Mode                            | Test Channel |
|---|-------------------|-------------|---------------------------------|--------------|
| Occupied Bandwidth                                  | 10 MHz            | QPSK, 16QAM | 6 RB / 0 RB Offset / 0 RB Index | 704 MHz      |
|   |                   |             |                                 | 707.5 MHz    |
|   |                   |             |                                 | 711 MHz      |
| Spurious and Harmonic Emissions at Antenna Terminal | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 704 MHz      |
|   |                   |             |                                 | 707.5 MHz    |
|   |                   |             |                                 | 711 MHz      |
| Radiated Spurious and Harmonic Emissions            | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 704 MHz      |
|   |                   |             |                                 | 707.5 MHz    |
|   |                   |             |                                 | 711 MHz      |

**Test Mode : LTE Band 13**

| Test Item   | Channel Bandwidth | Modulation  | Mode                            | Test Channel |
|---|-------------------|-------------|---------------------------------|--------------|
| Conducted Output Power                              | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 782 MHz      |
|   |                   |             | 1 RB / 5 RB Offset / 0 RB Index |              |
|   |                   |             | 1 RB / 0 RB Offset / 3 RB Index |              |
|   |                   |             | 1 RB / 5 RB Offset / 3 RB Index |              |
|   |                   |             | 1 RB / 0 RB Offset / 7 RB Index |              |
|   |                   |             | 1 RB / 5 RB Offset / 7 RB Index |              |
|   |                   |             | 3 RB / 0 RB Offset / 0 RB Index |              |
|   |                   |             | 3 RB / 3 RB Offset / 7 RB Index |              |
|   |                   |             | 6 RB / 0 RB Offset / 0 RB Index |              |
|   |                   |             | 6 RB / 0 RB Offset / 7 RB Index |              |
| Equivalent Isotropic Radiated Power                 | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 782 MHz      |
| Frequency stability                                 | 10 MHz            | QPSK        | 1 RB / 0 RB Offset / 0 RB Index | 782 MHz      |
| Occupied Bandwidth                                  | 10 MHz            | QPSK, 16QAM | 6 RB / 0 RB Offset / 0 RB Index | 782 MHz      |
| Peak-to-Average Ratio                               | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 782 MHz      |
|   |                   |             | 6 RB / 0 RB Offset / 0 RB Index |              |
| Band Edge   | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 782 MHz      |
|   |                   |             | 6 RB / 0 RB Offset / 0 RB Index |              |
|   |                   |             | 1 RB / 5 RB Offset / 0 RB Index | 782 MHz      |
|   |                   |             | 6 RB / 5 RB Offset / 0 RB Index |              |
| Spurious and Harmonic Emissions at Antenna Terminal | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 782 MHz      |
| Radiated Spurious and Harmonic Emissions            | 10 MHz            | QPSK, 16QAM | 1 RB / 0 RB Offset / 0 RB Index | 782 MHz      |

#### 5.4 Frequency List of Low/Middle/High Channels

| LTE Band 4 Channel and Frequency List |                     |           |             |           |
|---------------------------------------|---------------------|-----------|-------------|-----------|
| Bandwidth                             | Channel / Frequency | Low       | Middle      | High      |
| 10 MHz                                | Channel             | 20000     | 20175       | 20350     |
|                                       | Frequency           | 1 715 MHz | 1 732.5 MHz | 1 750 MHz |

| LTE Band 12 Channel and Frequency List |                     |         |           |         |
|--|---------------------|---------|-----------|---------|
| Bandwidth                              | Channel / Frequency | Low     | Middle    | High    |
| 10 MHz                                 | Channel             | 23060   | 23095     | 23130   |
|  | Frequency           | 704 MHz | 707.5 MHz | 711 MHz |

| LTE Band 13 Channel and Frequency List |                     |     |         |      |
|--|---------------------|-----|---------|------|
| Bandwidth                              | Channel / Frequency | Low | Middle  | High |
| 10 MHz                                 | Channel             | -   | 23230   | -    |
|  | Frequency           | -   | 782 MHz | -    |

#### 5.5 Configuration of Test System

**Radiated Emission Test:** Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

### 6. PRELIMINARY TEST

#### 6.1 AC Power line Conducted Emissions Tests

As this product is only using DC power, AC conducted emission test has not been performed.

#### 6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

| Operation Mode    | The Worse operating condition (Please check one only) |
|-------------------|---|
| Transmitting Mode | X   |

## 7. CONDUCTED OUTPUT POWER

### 7.1 Operating environment

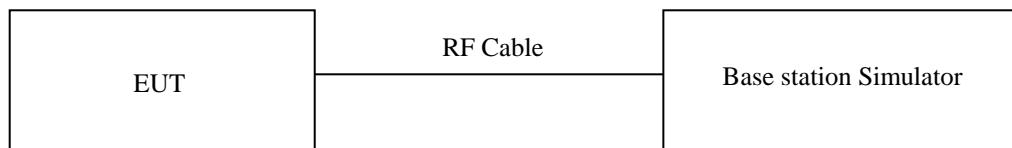
Temperature : 23 °C

Relative humidity : 47 % R.H.

### 7.2 Test set-up

Conducted Output Power is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 5.2.

A base station simulator was used to establish communication with the EUT, and Spectrum analyzer was used for test results. This device was tested under all configurations and the highest power is reported. Conducted Output Powers of EUT are reported below.



### 7.3 Test equipment used

| Model Number  | Manufacturer | Description                  | Serial Number | Last Cal.          |
|---------------|--------------|------------------------------|---------------|--------------------|
| ■ - MT8821C   | ANRITSU      | Radio Communication Analyzer | 6261849029    | Aug. 22, 2018 (1Y) |
| ■ - PWS-3003D | Protek       | DC Power Supply              | 4020409       | Aug. 24, 2018 (1Y) |

All test equipment used is calibrated on a regular basis.

## 7.4 Test data

- . Test Date : February 13, 2019 ~ February 26, 2019
- . Test Result : Pass

Conducted Average Output Power (dBm)

| Band / Bandwidth | RB Size | RB Offset | RB Index | QPSK     |            |          | 16QAM    |            |          |
|------------------|---------|-----------|----------|----------|------------|----------|----------|------------|----------|
|                  |         |           |          | LOW      | MIDDLE     | HIGH     | LOW      | MIDDLE     | HIGH     |
|                  |         |           |          | 1715 MHz | 1732.5 MHz | 1750 MHz | 1715 MHz | 1732.5 MHz | 1750 MHz |
| Band 4 / 10 MHz  | 1       | 0         | 0        | 22.83    | 22.71      | 22.76    | 22.16    | 22.35      | 22.38    |
|                  | 1       | 5         | 0        | 22.74    | 22.64      | 22.68    | 22.11    | 22.10      | 22.12    |
|                  | 1       | 0         | 3        | 22.77    | 22.68      | 22.73    | 22.12    | 22.01      | 22.13    |
|                  | 1       | 5         | 3        | 22.77    | 22.65      | 22.72    | 22.10    | 22.05      | 22.10    |
|                  | 1       | 0         | 7        | 22.76    | 22.67      | 22.50    | 22.15    | 21.99      | 22.05    |
|                  | 1       | 5         | 7        | 22.68    | 22.62      | 22.48    | 22.05    | 21.96      | 21.96    |
|                  | 3       | 0         | 0        | 22.67    | 22.60      | 22.67    | 22.11    | 22.10      | 22.16    |
|                  | 3       | 3         | 7        | 22.78    | 22.61      | 22.55    | 22.15    | 22.03      | 22.05    |
|                  | 6       | 0         | 0        | 22.70    | 22.63      | 22.66    | 22.05    | 22.09      | 22.18    |
|                  | 6       | 0         | 7        | 22.59    | 22.53      | 22.63    | 22.02    | 22.12      | 22.13    |

Conducted Average Output Power (dBm)

| Band / Bandwidth | RB Size | RB Offset | RB Index | QPSK    |           |         | 16QAM   |           |         |
|------------------|---------|-----------|----------|---------|-----------|---------|---------|-----------|---------|
|                  |         |           |          | LOW     | MIDDLE    | HIGH    | LOW     | MIDDLE    | HIGH    |
|                  |         |           |          | 704 MHz | 707.5 MHz | 711 MHz | 704 MHz | 707.5 MHz | 711 MHz |
| Band 12 / 10 MHz | 1       | 0         | 0        | 23.15   | 23.08     | 23.07   | 22.44   | 22.46     | 22.32   |
|                  | 1       | 5         | 0        | 23.06   | 22.95     | 23.04   | 22.39   | 22.42     | 22.21   |
|                  | 1       | 0         | 3        | 22.92   | 23.01     | 23.02   | 22.43   | 22.39     | 22.19   |
|                  | 1       | 5         | 3        | 23.05   | 22.99     | 23.03   | 22.44   | 22.38     | 22.25   |
|                  | 1       | 0         | 7        | 22.98   | 22.91     | 22.96   | 22.33   | 22.29     | 22.03   |
|                  | 1       | 5         | 7        | 22.95   | 22.89     | 22.94   | 22.32   | 22.24     | 22.08   |
|                  | 3       | 0         | 0        | 22.89   | 22.90     | 23.01   | 22.41   | 22.38     | 22.31   |
|                  | 3       | 3         | 7        | 22.92   | 22.77     | 22.91   | 22.38   | 22.37     | 22.29   |
|                  | 6       | 0         | 0        | 22.80   | 23.05     | 22.94   | 22.39   | 22.41     | 22.28   |
|                  | 6       | 0         | 7        | 22.82   | 22.97     | 22.92   | 22.36   | 22.40     | 22.27   |

## Conducted Average Output Power (dBm)

| Band / Bandwidth | RB Size | RB Offset | RB Index | QPSK |         |      | 16QAM |         |      |
|------------------|---------|-----------|----------|------|---------|------|-------|---------|------|
|                  |         |           |          | LOW  | MIDDLE  | HIGH | LOW   | MIDDLE  | HIGH |
|                  |         |           |          | -    | 782 MHz | -    | -     | 782 MHz | -    |
| Band 13 / 10 MHz | 1       | 0         | 0        | -    | 23.11   | -    | -     | 22.45   | -    |
|                  | 1       | 5         | 0        | -    | 23.08   | -    | -     | 22.44   | -    |
|                  | 1       | 0         | 3        | -    | 23.07   | -    | -     | 22.42   | -    |
|                  | 1       | 5         | 3        | -    | 23.05   | -    | -     | 22.42   | -    |
|                  | 1       | 0         | 7        | -    | 23.02   | -    | -     | 22.38   | -    |
|                  | 1       | 5         | 7        | -    | 22.97   | -    | -     | 22.36   | -    |
|                  | 3       | 0         | 0        | -    | 22.98   | -    | -     | 22.39   | -    |
|                  | 3       | 3         | 7        | -    | 22.85   | -    | -     | 22.38   | -    |
|                  | 6       | 0         | 0        | -    | 22.95   | -    | -     | 22.37   | -    |
|                  | 6       | 0         | 7        | -    | 22.83   | -    | -     | 22.39   | -    |

Tested by: Ju Yun Park / Assistant Manager

## 8. EQUIVALENT ISOTROPIC RADIATED POWER

### 8.1 Operating environment

Temperature : 22 °C  
Relative humidity : 48 % R.H.

### 8.2 Methods of Measurement

1. The testing follows ANSI C63.26 (2015) Section 5.5.3.
2. 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.
3. The substitution 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 2. Record the power level of S.G.
4. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution antenna power can be  
Calculated. E.R.P power = E.I.P.R power - 2.15 dBi.

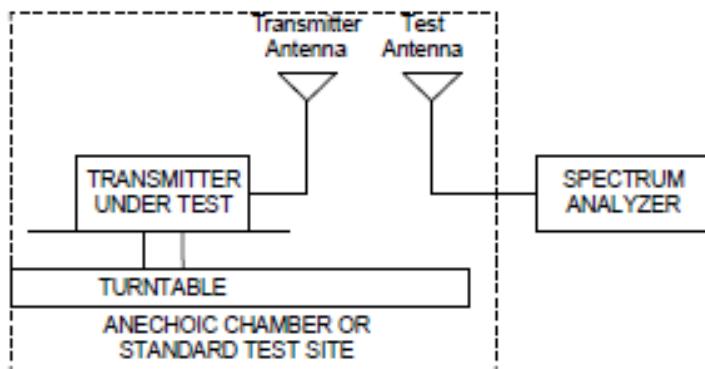
### 8.3 Limits

Rule Part 27.50(d) (4) specifies that “Fixed, mobile and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP”

|       |              |
|-------|--------------|
| Limit | 1 W (30 dBm) |
|-------|--------------|

### 8.4 Test set-up

The EUT and measurement equipment were set up as shown in the diagram below.



**8.5 Test equipment used**

| Model Number    | Manufacturer       | Description                  | Serial Number | Last Cal. (Interval) |
|-----------------|--------------------|------------------------------|---------------|----------------------|
| □ - ESCI        | Rohde & Schwarz    | EMI Test Receiver            | 101012        | Oct. 22, 2018 (1Y)   |
| ■ - ESR         | Rohde & Schwarz    | EMI Test Receiver            | 101470        | Oct. 22, 2018 (1Y)   |
| ■ - 310N        | Sonoma Instrument  | AMPLIFIER                    | 312544        | Mar. 28, 2018 (1Y)   |
| ■ - FSV30       | Rohde & Schwarz    | Signal Analyzer              | 101372        | Aug. 23, 2018 (1Y)   |
| ■ - BBV9718B    | Schwarzbeck        | Broadband Preamplifier       | 009           | Mar. 16, 2018 (1Y)   |
| ■ - SCU-03      | Rohde & Schwarz    | Signal Conditioning Unit     | 100333        | Mar. 15, 2018 (1Y)   |
| □ - SCU-18      | Rohde & Schwarz    | Pre-Amplifier                | 102266        | Aug. 24, 2018 (1Y)   |
| ■ - MA-4000XPET | Innco Systems GmbH | Antenna Master               | MA4000/509    | N/A                  |
| □ - HD100       | HD GmbH            | Position Controller          | N/A           | N/A                  |
| ■ - DT3000-3t   | Innco Systems GmbH | Turn Table                   | N/A           | N/A                  |
| □ - FMZB 1513   | Schwarzbeck        | LOOP ANTENNA                 | 1513-235      | May. 13, 2018 (2Y)   |
| ■ - VULB9163    | Schwarzbeck        | TRILOG Broadband Antenna     | 9163-255      | Jun 05, 2018 (2Y)    |
| ■ - VULB9163    | Schwarzbeck        | Hybrid Antenna               | 777           | Apr, 13, 2018 (2Y)   |
| ■ - BBHA9120D   | Schwarzbeck        | Horn Antenna                 | BBHA9120D295  | Aug. 16, 2017 (2Y)   |
| ■ - BBHA9120D   | Schwarzbeck        | Horn Antenna                 | 9120D-1349    | Dec. 04, 2017 (2Y)   |
| □ - SCU40A      | Rohde & Schwarz    | Pre-Amplifier                | 100436        | Mar. 15, 2018 (1Y)   |
| ■ - MT8821C     | ANRITSU            | Radio Communication Analyzer | 6261849029    | Aug. 22, 2018 (1Y)   |

All test equipment used is calibrated on a regular basis.

### 8.6 Test data for LTE Band 4 QPSK

- . Test Date : February 13, 2019 ~ February 26, 2019
- . Test Result : Pass

| Frequency<br>(MHz)        | Substituted Level<br>(dBm) | Ant. Pol.<br>(H/V) | Cable Loss<br>(dB) | Ant Gain<br>(dBi) | EIRP<br>(dBm) | Limits<br>(dBm) | Margin<br>(dB) |
|---------------------------|----------------------------|--------------------|--------------------|-------------------|---------------|-----------------|----------------|
| <b>Test Data for QPSK</b> |                            |                    |                    |                   |               |                 |                |
| 1715.0                    | 14.12                      | H                  | 1.21               | 7.40              | 20.31         | 30.00           | 9.69           |
| 1715.0                    | 11.63                      | V                  | 1.21               | 7.40              | 17.82         | 30.00           | 12.18          |
| 1732.5                    | 14.22                      | H                  | 1.23               | 7.30              | 20.29         | 30.00           | 9.71           |
| 1732.5                    | 11.71                      | V                  | 1.23               | 7.30              | 17.78         | 30.00           | 12.22          |
| 1750.0                    | 14.54                      | H                  | 1.23               | 7.10              | 20.41         | 30.00           | 9.59           |
| 1750.0                    | 12.02                      | V                  | 1.23               | 7.10              | 17.89         | 30.00           | 12.11          |

Remark: "H": Horizontal, "V": Vertical

### 8.7 Test data for LTE Band 4 16QAM

- . Test Date : February 13, 2019 ~ February 26, 2019
- . Test Result : Pass

| Frequency<br>(MHz)         | Substituted Level<br>(dBm) | Ant. Pol.<br>(H/V) | Cable Loss<br>(dB) | Ant Gain<br>(dBi) | EIRP<br>(dBm) | Limits<br>(dBm) | Margin<br>(dB) |
|----------------------------|----------------------------|--------------------|--------------------|-------------------|---------------|-----------------|----------------|
| <b>Test Data for 16QAM</b> |                            |                    |                    |                   |               |                 |                |
| 1715.0                     | 13.75                      | H                  | 1.21               | 7.40              | 19.94         | 30.00           | 10.06          |
| 1715.0                     | 11.07                      | V                  | 1.21               | 7.40              | 17.26         | 30.00           | 12.74          |
| 1732.5                     | 13.85                      | H                  | 1.23               | 7.30              | 19.92         | 30.00           | 10.08          |
| 1732.5                     | 11.18                      | V                  | 1.23               | 7.30              | 17.25         | 30.00           | 12.75          |
| 1750.0                     | 14.19                      | H                  | 1.23               | 7.10              | 20.06         | 30.00           | 9.94           |
| 1750.0                     | 11.44                      | V                  | 1.23               | 7.10              | 17.31         | 30.00           | 12.69          |

Remark: "H": Horizontal, "V": Vertical

Tested by: Ju Yun Park / Assistant Manager

## 9. EFFECTIVE RADIATED POWER

### 9.1 Operating environment

Temperature : 25 °C  
 Relative humidity : 46 % R.H.

### 9.2 Methods of Measurement

1. The testing follows ANSI C63.26 (2015) Section 5.5.3.
2. 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.
3. The substitution 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 2. Record the power level of S.G.
4. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution antenna power can be  
 Calculated. E.R.P power = E.I.P.R power - 2.15 dBi.

### 9.3 Limits

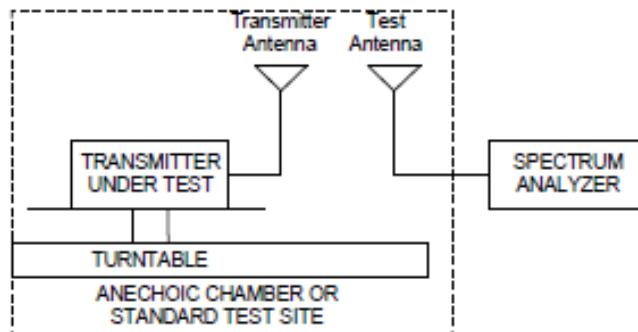
Rule Part 27.50(b) (10) specifies that “Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP”

Rule Part 27.50(c) (10) specifies that “Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP”

|       |                 |
|-------|-----------------|
| Limit | 3 W (34.77 dBm) |
|-------|-----------------|

### 9.4 Test set-up

The EUT and measurement equipment were set up as shown in the diagram below.



### 9.5 Test equipment used

| Model Number    | Manufacturer       | Description                  | Serial Number | Last Cal. (Interval) |
|-----------------|--------------------|------------------------------|---------------|----------------------|
| □ - ESCI        | Rohde & Schwarz    | EMI Test Receiver            | 101012        | Oct. 22, 2018 (1Y)   |
| ■ - ESR         | Rohde & Schwarz    | EMI Test Receiver            | 101470        | Oct. 22, 2018 (1Y)   |
| ■ - 310N        | Sonoma Instrument  | AMPLIFIER                    | 312544        | Mar. 28, 2018 (1Y)   |
| ■ - FSV30       | Rohde & Schwarz    | Signal Analyzer              | 101372        | Aug. 23, 2018 (1Y)   |
| ■ - BBV9718B    | Schwarzbeck        | Broadband Preamplifier       | 009           | Mar. 16, 2018 (1Y)   |
| ■ - SCU-03      | Rohde & Schwarz    | Signal Conditioning Unit     | 100333        | Mar. 15, 2018 (1Y)   |
| □ - SCU-18      | Rohde & Schwarz    | Pre-Amplifier                | 102266        | Aug. 24, 2018 (1Y)   |
| ■ - MA-4000XPET | Innco Systems GmbH | Antenna Master               | MA4000/509    | N/A                  |
| □ - HD100       | HD GmbH            | Position Controller          | N/A           | N/A                  |
| ■ - DT3000-3t   | Innco Systems GmbH | Turn Table                   | N/A           | N/A                  |
| □ - FMZB 1513   | Schwarzbeck        | LOOP ANTENNA                 | 1513-235      | May. 13, 2018 (2Y)   |
| ■ - VULB9163    | Schwarzbeck        | TRILOG Broadband Antenna     | 9163-255      | Jun 05, 2018 (2Y)    |
| ■ - VULB9163    | Schwarzbeck        | Hybrid Antenna               | 777           | Apr, 13, 2018 (2Y)   |
| ■ - BBHA9120D   | Schwarzbeck        | Horn Antenna                 | BBHA9120D295  | Aug. 16, 2017 (2Y)   |
| ■ - BBHA9120D   | Schwarzbeck        | Horn Antenna                 | 9120D-1349    | Dec. 04, 2017 (2Y)   |
| □ - SCU40A      | Rohde & Schwarz    | Pre-Amplifier                | 100436        | Mar. 15, 2018 (1Y)   |
| ■ - MT8821C     | ANRITSU            | Radio Communication Analyzer | 6261849029    | Aug. 22, 2018 (1Y)   |

All test equipment used is calibrated on a regular basis.

### 9.6 Test data for LTE Band 12 QPSK

- . Test Date : February 13, 2019 ~ February 26, 2019
- . Test Result : Pass

| Frequency<br>(MHz)        | Substituted Level<br>(dBm) | Ant. Pol.<br>(H/V) | Cable Loss<br>(dB) | Ant Gain<br>(dBd) | ERP<br>(dBm) | Limits<br>(dBm) | Margin<br>(dB) |
|---------------------------|----------------------------|--------------------|--------------------|-------------------|--------------|-----------------|----------------|
| <b>Test Data for QPSK</b> |                            |                    |                    |                   |              |                 |                |
| 704.0                     | 16.72                      | H                  | 0.83               | 5.45              | 21.34        | 34.77           | 13.43          |
| 704.0                     | 13.59                      | V                  | 0.83               | 5.45              | 18.21        | 34.77           | 16.56          |
| 707.5                     | 16.64                      | H                  | 0.83               | 5.45              | 21.26        | 34.77           | 13.51          |
| 707.5                     | 13.41                      | V                  | 0.83               | 5.45              | 18.03        | 34.77           | 16.74          |
| 711.0                     | 16.78                      | H                  | 0.84               | 5.25              | 21.19        | 34.77           | 13.58          |
| 711.0                     | 13.88                      | V                  | 0.84               | 5.25              | 18.29        | 34.77           | 16.48          |

Remark: "H": Horizontal, "V": Vertical

### 9.7 Test data for LTE Band 12 16QAM

- . Test Date : February 13, 2019 ~ February 26, 2019
- . Test Result : Pass

| Frequency<br>(MHz)         | Substituted Level<br>(dBm) | Ant. Pol.<br>(H/V) | Cable Loss<br>(dB) | Ant Gain<br>(dBd) | ERP<br>(dBm) | Limits<br>(dBm) | Margin<br>(dB) |
|----------------------------|----------------------------|--------------------|--------------------|-------------------|--------------|-----------------|----------------|
| <b>Test Data for 16QAM</b> |                            |                    |                    |                   |              |                 |                |
| 704.0                      | 16.35                      | H                  | 0.83               | 5.45              | 20.97        | 34.77           | 13.80          |
| 704.0                      | 12.92                      | V                  | 0.83               | 5.45              | 17.54        | 34.77           | 17.23          |
| 707.5                      | 16.19                      | H                  | 0.83               | 5.45              | 20.81        | 34.77           | 13.96          |
| 707.5                      | 12.81                      | V                  | 0.83               | 5.45              | 17.43        | 34.77           | 17.34          |
| 711.0                      | 16.45                      | H                  | 0.84               | 5.25              | 20.86        | 34.77           | 13.91          |
| 711.0                      | 13.11                      | V                  | 0.84               | 5.25              | 17.52        | 34.77           | 17.25          |

Remark: "H": Horizontal, "V": Vertical

Tested by: Ju Yun Park / Assistant Manager

### 9.8 Test data for LTE Band 13 QPSK

- . Test Date : February 13, 2019 ~ February 26, 2019
- . Test Result : Pass

| Frequency<br>(MHz)        | Substituted Level<br>(dBm) | Ant. Pol.<br>(H/V) | Cable Loss<br>(dB) | Ant Gain<br>(dBd) | ERP<br>(dBm) | Limits<br>(dBm) | Margin<br>(dB) |
|---------------------------|----------------------------|--------------------|--------------------|-------------------|--------------|-----------------|----------------|
| <b>Test Data for QPSK</b> |                            |                    |                    |                   |              |                 |                |
| 782.0                     | 17.31                      | H                  | 0.85               | 4.95              | 21.41        | 34.77           | 13.36          |
| 782.0                     | 14.98                      | V                  | 0.85               | 4.95              | 19.08        | 34.77           | 15.69          |

Remark: "H": Horizontal, "V": Vertical

### 9.9 Test data for LTE Band 13 16QAM

- . Test Date : February 13, 2019 ~ February 26, 2019
- . Test Result : Pass

| Frequency<br>(MHz)         | Substituted Level<br>(dBm) | Ant. Pol.<br>(H/V) | Cable Loss<br>(dB) | Ant Gain<br>(dBd) | ERP<br>(dBm) | Limits<br>(dBm) | Margin<br>(dB) |
|----------------------------|----------------------------|--------------------|--------------------|-------------------|--------------|-----------------|----------------|
| <b>Test Data for 16QAM</b> |                            |                    |                    |                   |              |                 |                |
| 782.0                      | 16.94                      | H                  | 0.85               | 4.95              | 21.04        | 34.77           | 13.73          |
| 782.0                      | 14.74                      | V                  | 0.85               | 4.95              | 18.84        | 34.77           | 15.93          |

Remark: "H": Horizontal, "V": Vertical

Tested by: Ju Yun Park / Assistant Manager

## 10. RADIATED SPURIOUS EMISSIONS

### 10.1 Operating environment

Temperature : 22 °C  
Relative humidity : 48 % R.H.

### 10.2 Test set-up

Radiated emission measurements are performed in the Semi-Anechoic chamber. The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI C63.26 (2015) Section 5.5.3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the level of the maximized emission. The level and position of the maximized emission is recorded with the spectrum analyzer using RMS detector.

A vertically polarized half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The power is calculated by the following formula;

$$P_d(\text{dBm}) = P_g(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

Where:  $P_d$  is the dipole equivalent power and  $P_g$  is the generator output power into the substitution antenna.

The maximum EIRP is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration

### Limits

LTE -4 Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10} (P)$  dB.”

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 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.

LTE -13 Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz equivalent isotropically radiated power (EIRP) for wideband

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EMC-003 (Rev.2)

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signals, and  $-80$  dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

LTE Band 4 / 12 Limit

|       |         |
|-------|---------|
| Limit | -13 dBm |
|-------|---------|

LTE Band 13 Limit

|                                     |         |
|-------------------------------------|---------|
| Limit out of the band 1559-1610 MHz | -13 dBm |
| Limit in the band 1559-1610 MHz     | -40 dBm |

**Radiated spurious emissions**

1. Frequency Range : 9 kHz ~ 10th Harmonics of highest channel fundamental frequency.
2. The EUT was setup to maximum output power. The 100 kHz RBW was used to scan from 30 MHz to 1 GHz. Also, the 1 MHz RBW was used to scan from 1 GHz to 20 GHz. The high, low and a middle channel were tested for out of band measurements.

**10.3 Test equipment used**

| Model Number    | Manufacturer       | Description                  | Serial Number | Last Cal. (Interval) |
|-----------------|--------------------|------------------------------|---------------|----------------------|
| □ - ESCI        | Rohde & Schwarz    | EMI Test Receiver            | 101012        | Oct. 22, 2018 (1Y)   |
| ■ - ESR         | Rohde & Schwarz    | EMI Test Receiver            | 101470        | Oct. 22, 2018 (1Y)   |
| ■ - 310N        | Sonoma Instrument  | AMPLIFIER                    | 312544        | Mar. 28, 2018 (1Y)   |
| ■ - FSV30       | Rohde & Schwarz    | Signal Analyzer              | 101372        | Aug. 23, 2018 (1Y)   |
| ■ - BBV9718B    | Schwarzbeck        | Broadband Preamplifier       | 009           | Mar. 16, 2018 (1Y)   |
| ■ - SCU-03      | Rohde & Schwarz    | Signal Conditioning Unit     | 100333        | Mar. 15, 2018 (1Y)   |
| □ - SCU-18      | Rohde & Schwarz    | Pre-Amplifier                | 102266        | Aug. 24, 2018 (1Y)   |
| ■ - MA-4000XPET | Innco Systems GmbH | Antenna Master               | MA4000/509    | N/A                  |
| □ - HD100       | HD GmbH            | Position Controller          | N/A           | N/A                  |
| ■ - DT3000-3t   | Innco Systems GmbH | Turn Table                   | N/A           | N/A                  |
| □ - FMZB 1513   | Schwarzbeck        | LOOP ANTENNA                 | 1513-235      | May. 13, 2018 (2Y)   |
| ■ - VULB9163    | Schwarzbeck        | TRILOG Broadband Antenna     | 9163-255      | Jun 05, 2018 (2Y)    |
| ■ - VULB9163    | Schwarzbeck        | Hybrid Antenna               | 777           | Apr, 13, 2018 (2Y)   |
| ■ - BBHA9120D   | Schwarzbeck        | Horn Antenna                 | BBHA9120D295  | Aug. 16, 2017 (2Y)   |
| ■ - BBHA9120D   | Schwarzbeck        | Horn Antenna                 | 9120D-1349    | Dec. 04, 2017 (2Y)   |
| □ - SCU40A      | Rohde & Schwarz    | Pre-Amplifier                | 100436        | Mar. 15, 2018 (1Y)   |
| ■ - MT8821C     | ANRITSU            | Radio Communication Analyzer | 6261849029    | Aug. 22, 2018 (1Y)   |

All test equipment used is calibrated on a regular basis.

## 10.4 Test data

### 10.4.1 Test data for LTE Band 4 QPSK

- Test Date : February 13, 2019 ~ February 26, 2019
- Detector : RMS
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(MHz)                  | Substituted Level<br>(dBm) | Ant. Pol.<br>(H/V) | Cable Loss<br>(dB) | Ant Gain<br>(dBi) | Corrected Readiang<br>(dBm) | Limits<br>(dBm) | Margin<br>(dB) |
|-------------------------------------|----------------------------|--------------------|--------------------|-------------------|-----------------------------|-----------------|----------------|
| <b>Test Data for Low Channel</b>    |                            |                    |                    |                   |                             |                 |                |
| 3430.00                             | -70.25                     | V                  | 2.11               | 12.51             | -59.85                      | -13.00          | 46.85          |
| 5145.00                             | -78.18                     | V                  | 2.46               | 12.73             | -67.91                      | -13.00          | 54.91          |
| 6860.00                             | -73.38                     | V                  | 3.25               | 12.36             | -64.27                      | -13.00          | 51.27          |
| 8575.00                             | -69.76                     | H                  | 3.93               | 11.55             | -62.14                      | -13.00          | 49.14          |
| 10290.00                            | -67.71                     | V                  | 4.06               | 11.64             | -60.13                      | -13.00          | 47.13          |
| <b>Test Data for Middle Channel</b> |                            |                    |                    |                   |                             |                 |                |
| 3465.00                             | -69.85                     | V                  | 2.11               | 12.51             | -59.45                      | -13.00          | 46.45          |
| 5197.50                             | -77.99                     | V                  | 2.46               | 12.73             | -67.72                      | -13.00          | 54.72          |
| 6930.00                             | -73.64                     | V                  | 3.25               | 12.36             | -64.53                      | -13.00          | 51.53          |
| 8662.50                             | -69.94                     | H                  | 3.93               | 11.55             | -62.32                      | -13.00          | 49.32          |
| 10395.00                            | -67.46                     | H                  | 4.06               | 11.64             | -59.88                      | -13.00          | 46.88          |
| <b>Test Data for High Channel</b>   |                            |                    |                    |                   |                             |                 |                |
| 3500.00                             | -70.34                     | H                  | 2.11               | 12.51             | -59.94                      | -13.00          | 46.94          |
| 5250.00                             | -77.95                     | V                  | 2.46               | 12.73             | -67.68                      | -13.00          | 54.68          |
| 7000.00                             | -73.45                     | V                  | 3.25               | 12.36             | -64.34                      | -13.00          | 51.34          |
| 8750.00                             | -70.20                     | V                  | 3.93               | 11.55             | -62.58                      | -13.00          | 49.58          |
| 10500.00                            | -67.51                     | H                  | 4.06               | 11.64             | -59.93                      | -13.00          | 46.93          |

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst case was found in QPSK modulation
3. Rule Part 27.53(h) specifies that “ the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  dB.”

Limit :  $30.00 - 43 + 10 \log(1.00) = -13$  dBm

“C.L” : Cable Loss, “H”: Horizontal, “V”: Vertical

Tested by: Ju Yun Park / Assistant Manager

#### 10.4.2 Test data for LTE Band 12 QPSK

- Test Date : July 16, 2018 ~ August 14, 2018
- Detector : RMS
- Measurement distance : 3 m
- Result : PASSED

| Frequency<br>(MHz)                  | Substituted Level<br>(dBm) | Ant. Pol.<br>(H/V) | Cable Loss<br>(dB) | Ant Gain<br>(dBi) | Corrected Readiang<br>(dBm) | Limits<br>(dBm) | Margin<br>(dB) |
|-------------------------------------|----------------------------|--------------------|--------------------|-------------------|-----------------------------|-----------------|----------------|
| <b>Test Data for Low Channel</b>    |                            |                    |                    |                   |                             |                 |                |
| 1408.00                             | -63.54                     | H                  | 1.14               | 7.50              | -57.18                      | -13.00          | 44.18          |
| 2112.00                             | -60.46                     | H                  | 1.36               | 6.70              | -55.12                      | -13.00          | 42.12          |
| 2816.00                             | -54.37                     | V                  | 1.82               | 5.00              | -51.19                      | -13.00          | 38.19          |
| 3520.00                             | -80.28                     | V                  | 2.11               | 12.51             | -69.88                      | -13.00          | 56.88          |
| 4224.00                             | -78.39                     | V                  | 2.32               | 12.18             | -68.53                      | -13.00          | 55.53          |
| <b>Test Data for Middle Channel</b> |                            |                    |                    |                   |                             |                 |                |
| 1415.00                             | -64.13                     | H                  | 1.14               | 7.50              | -57.77                      | -13.00          | 44.77          |
| 2122.50                             | -60.42                     | H                  | 1.36               | 6.70              | -55.08                      | -13.00          | 42.08          |
| 2830.00                             | -53.79                     | V                  | 1.82               | 5.00              | -50.61                      | -13.00          | 37.61          |
| 3537.50                             | -80.53                     | H                  | 2.11               | 12.51             | -70.13                      | -13.00          | 57.13          |
| 4245.00                             | -78.15                     | V                  | 2.32               | 12.18             | -68.29                      | -13.00          | 55.29          |
| <b>Test Data for High Channel</b>   |                            |                    |                    |                   |                             |                 |                |
| 1422.00                             | -63.69                     | H                  | 1.14               | 7.50              | -57.33                      | -13.00          | 44.33          |
| 2133.00                             | -60.59                     | H                  | 1.36               | 6.70              | -55.25                      | -13.00          | 42.25          |
| 2844.00                             | -54.05                     | V                  | 1.82               | 5.00              | -50.87                      | -13.00          | 37.87          |
| 3555.00                             | -80.31                     | V                  | 2.11               | 12.51             | -69.91                      | -13.00          | 56.91          |
| 4266.00                             | -78.99                     | H                  | 2.32               | 12.18             | -69.13                      | -13.00          | 56.13          |

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst case was found in QPSK modulation
3. Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 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.

Limit :  $34.77 - 43 + 10 \log(3.00) = -13$  dBm

“C.L” : Cable Loss, “H”: Horizontal, “V”: Vertical

Tested by: Ju Yun Park / Assistant Manager

#### 10.4.2 Test data for LTE Band 13 QPSK

- . Test Date : July 16, 2018 ~ August 14, 2018
- . Detector : RMS
- . Measurement distance : 3 m
- . Result : PASSED

| Frequency<br>(MHz)                  | Substituted Level<br>(dBm) | Ant. Pol.<br>(H/V) | Cable Loss<br>(dB) | Ant Gain<br>(dBi) | Corrected Readiang<br>(dBm) | Limits<br>(dBm) | Margin<br>(dB) |
|-------------------------------------|----------------------------|--------------------|--------------------|-------------------|-----------------------------|-----------------|----------------|
| <b>Test Data for Middle Channel</b> |                            |                    |                    |                   |                             |                 |                |
| 1564.00                             | -64.91                     | V                  | 1.14               | 6.70              | -59.35                      | -13.00          | 46.35          |
| 2346.00                             | -58.66                     | H                  | 1.46               | 5.90              | -54.22                      | -13.00          | 41.22          |
| 3128.00                             | -78.88                     | V                  | 1.83               | 10.90             | -69.81                      | -13.00          | 56.81          |
| 3910.00                             | -79.50                     | V                  | 2.32               | 12.14             | -69.68                      | -13.00          | 56.68          |
| 4692.00                             | -78.75                     | H                  | 2.41               | 12.18             | -68.98                      | -13.00          | 55.98          |

Remark: 1. The other Spurious RF Radiated emissions level is no more than noise floor.

2. The worst case was found in QPSK modulation
3. Rule Part 27.53(f)For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to  $-70 \text{ dBW/MHz}$  equivalent isotropically radiated power (EIRP) for wideband signals, and  $-80 \text{ dBW EIRP}$  for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Limit out of the band 1559-1610 MHz :  $34.77 - 43 + 10\log(3.00) = -13 \text{ dBm}$

Limit in the band 1559-1610 MHz : -40 dBm

“C.L” : Cable Loss, “H”: Horizontal, “V”: Vertical

Tested by: Ju Yun Park / Assistant Manager

## 11. PEAK-TO-AVERAGE RATIO

### 11.1 Operating environment

Temperature : 23 °C  
Relative humidity : 47 % R.H.

### 11.2 Test set-up

Peak to Average Power Ratio is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 5.7.

#### - Section 5.7.2 Measurement of peak power in a broadband noise-like signal using CCDF

- a) Set resolution/measurement bandwidth  $\geq$  OBW or specified reference bandwidth.
- b) Set the number of counts to a value that stabilizes the measured CCDF curve.
- c) Set the measurement interval as follows:
  - 1) For continuous transmissions, set to the greater of  $[10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$  or 1 ms.
  - 2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.
  - 3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
- d) Record the maximum PAPR level associated with a probability of 0.1%.
- e) The peak power level is calculated from the sum of the PAPR value from step d) to the measured average power.

#### - Section 5.7.3 Alternate Procedure for PAPR

Some regulatory requirements specify a PAPR limit when the output power limits are specified in terms of average power. If it becomes necessary to provide measurement data to demonstrate compliance to a PAPR limit, then the appropriate procedure from those provided in 5.2.3 shall be utilized to determine the peak power (or peak PSD) and the appropriate procedure from those provided in 5.2.4 shall be used to determine the average power (or average PSD). The data from these measurements is then used in Equation (2) to determine the PAPR of a narrowband CW-like signal. See 5.2.3.4 for guidance on determining the PAPR of a broadband noise-like signal.

$$\text{PAPR (dB)} = P_{\text{Pk}} (\text{dBm or dBW}) - P_{\text{Avg}} (\text{dBm or dBW})$$

where

PAPR peak-to-average power ratio, in dB

$P_{\text{Pk}}$  measured peak power or peak PSD level, in dBm or dBW

$P_{\text{Avg}}$  measured average power or average PSD level, in dBm or dBW

### 11.3 Test equipment used

| Model Number  | Manufacturer    | Description                  | Serial Number | Last Cal.          |
|---------------|-----------------|------------------------------|---------------|--------------------|
| ■ - FSV30     | Rohde & Schwarz | Signal Analyzer              | 101372        | Aug. 23, 2018 (1Y) |
| ■ - AAMCS-UDC | AA-MCS          | Directional Coupler          | 400           | Aug. 23, 2018 (1Y) |
| ■ - MT8821C   | ANRITSU         | Radio Communication Analyzer | 6261849029    | Aug. 22, 2018 (1Y) |
| ■ - PWS-3003D | Protek          | DC Power Supply              | 4020409       | Aug. 24, 2018 (1Y) |

All test equipment used is calibrated on a regular basis.

### 11.4 Test data

#### 11.4.1 Test data LTE Band 4

- Test Date : February 13, 2019 ~ February 26, 2019
- Test Result : Pass

LTE Band 4 QPSK

| Test Mode | Channel | Peak-Average Ratio(PAR)<br>CCDF 0.1 % | Limit<br>(dB) | Result |
|-----------|---------|---------------------------------------|---------------|--------|
| 1 RB      | 20000   | 4.58                                  | 13.00         | PASS   |
|           | 20175   | 4.38                                  | 13.00         | PASS   |
|           | 20350   | 4.20                                  | 13.00         | PASS   |
| 6 RB      | 20000   | 4.52                                  | 13.00         | PASS   |
|           | 20175   | 4.43                                  | 13.00         | PASS   |
|           | 20350   | 4.81                                  | 13.00         | PASS   |

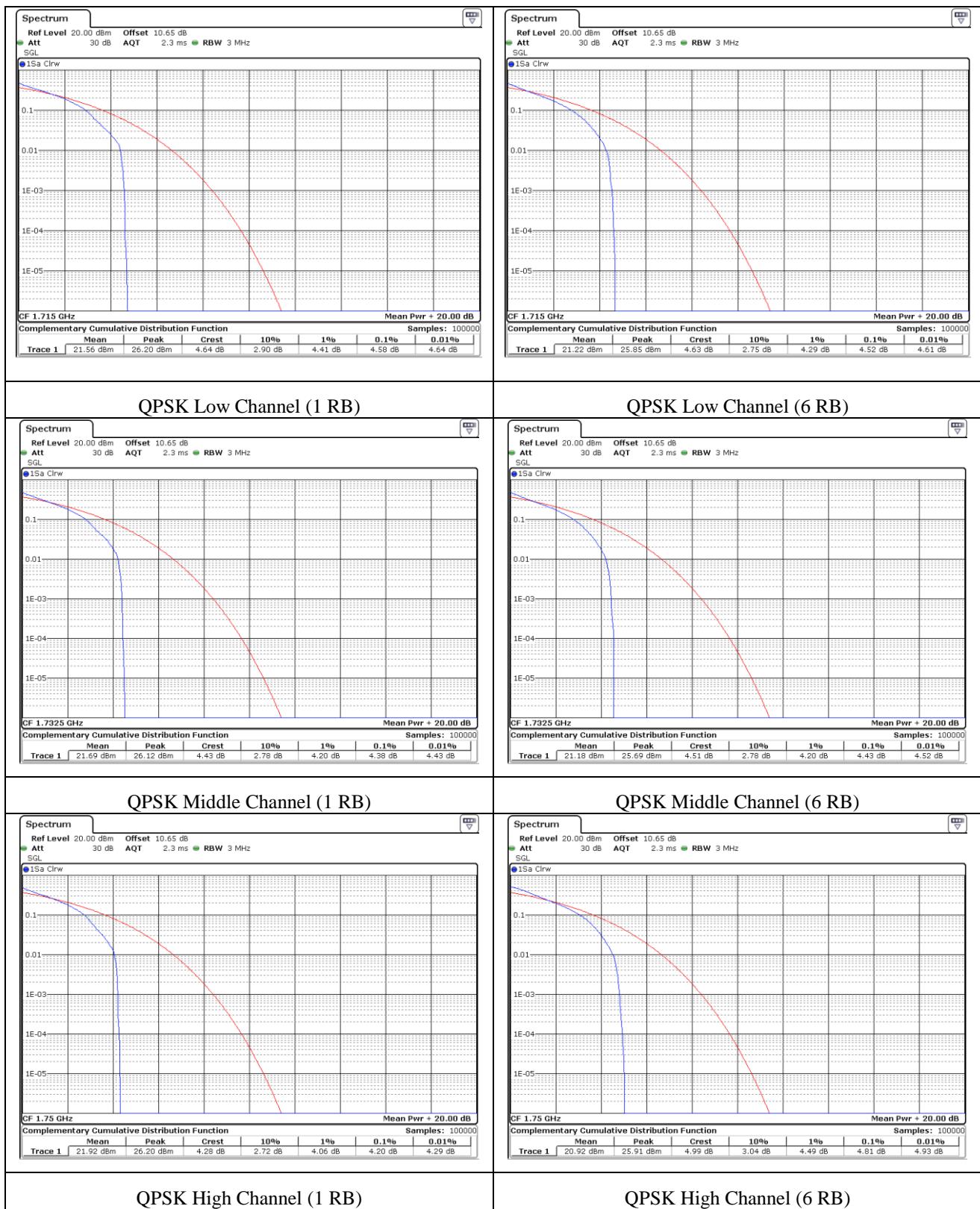
Remark: Measured the using CCDFof spectrum analyzer.

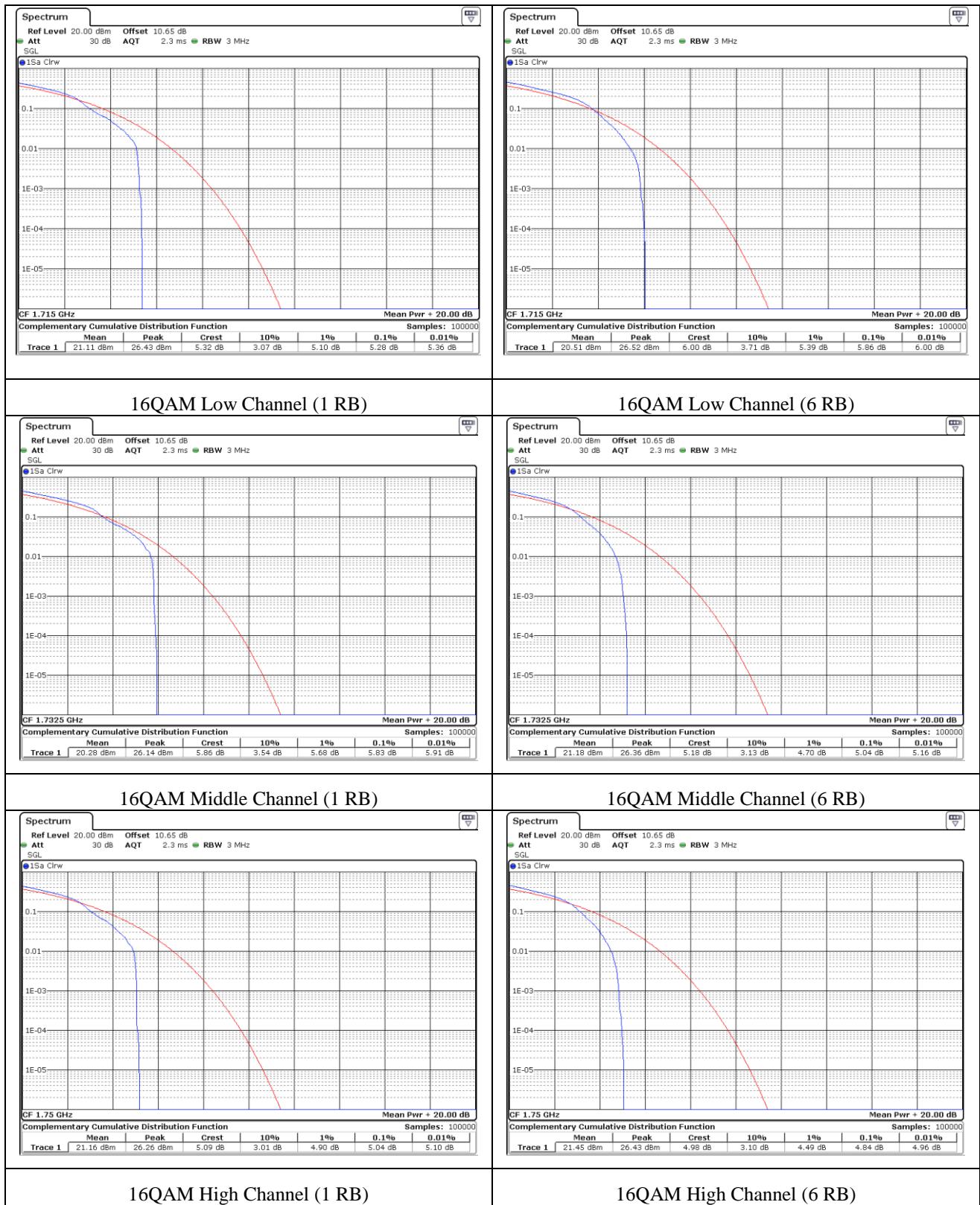
LTE Band 4 16QAM

| Test Mode | Channel | Peak-Average Ratio(PAR)<br>CCDF 0.1 % | Limit<br>(dB) | Result |
|-----------|---------|---------------------------------------|---------------|--------|
| 1 RB      | 20000   | 5.28                                  | 13.00         | PASS   |
|           | 20175   | 5.83                                  | 13.00         | PASS   |
|           | 20350   | 5.04                                  | 13.00         | PASS   |
| 6 RB      | 20000   | 5.86                                  | 13.00         | PASS   |
|           | 20175   | 5.04                                  | 13.00         | PASS   |
|           | 20350   | 4.84                                  | 13.00         | PASS   |

Remark: Measured the using CCDFof spectrum analyzer.

Tested by: Ju Yun Park / Assistant Manager





### 11.4.2 Test data LTE Band 12

- Test Date : February 13, 2019 ~ February 26, 2019
- Test Result : Pass

LTE Band 12 QPSK

| Test Mode | Channel | Peak-Average Ratio(PAR)<br>CCDF 0.1 % | Limit<br>(dB) | Result |
|-----------|---------|---------------------------------------|---------------|--------|
| 1 RB      | 23060   | 4.81                                  | 13.00         | PASS   |
|           | 23095   | 4.52                                  | 13.00         | PASS   |
|           | 23130   | 4.84                                  | 13.00         | PASS   |
| 6 RB      | 23060   | 5.59                                  | 13.00         | PASS   |
|           | 23095   | 4.78                                  | 13.00         | PASS   |
|           | 23130   | 4.70                                  | 13.00         | PASS   |

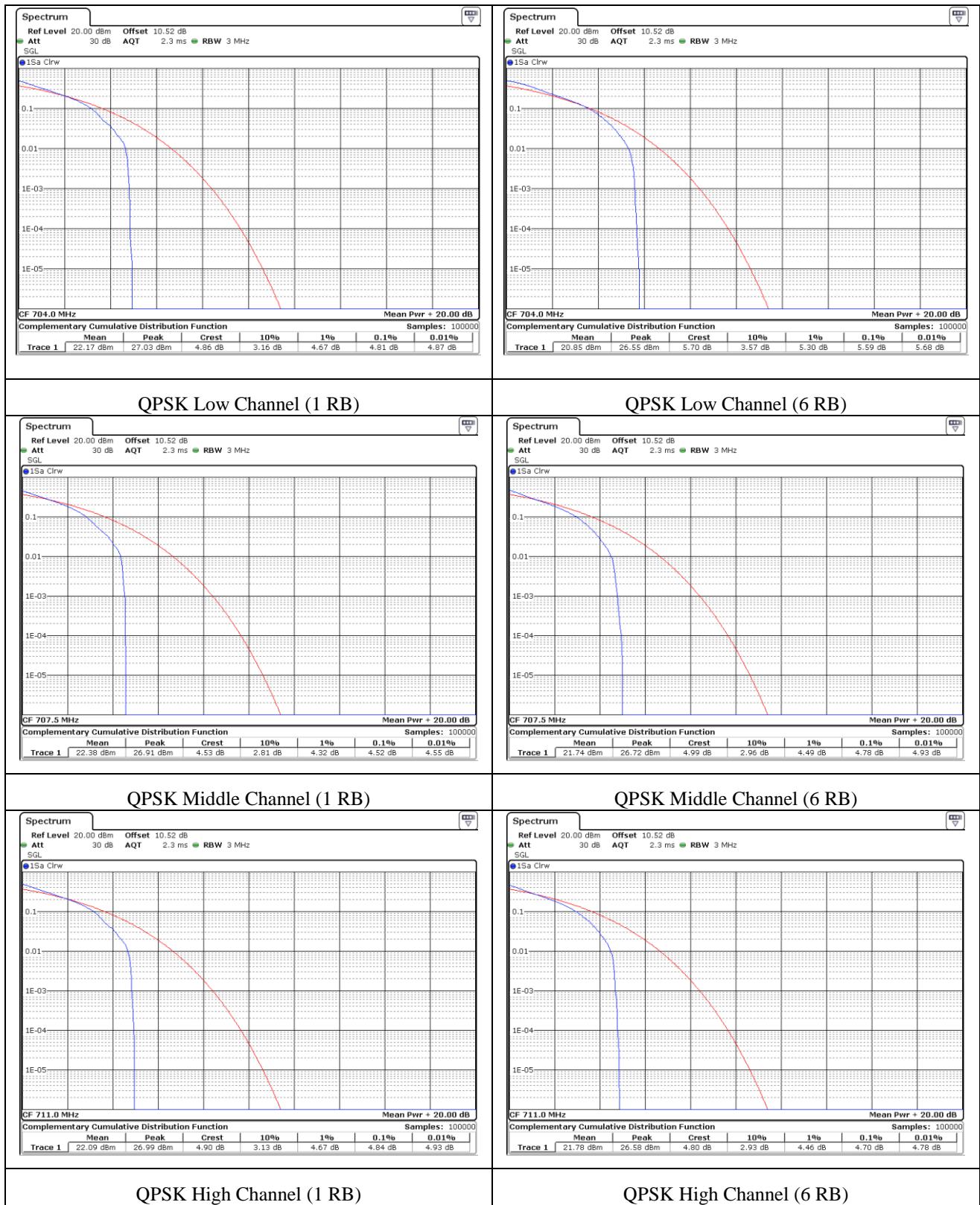
Remark: Measured the using CCDFof spectrum analyzer.

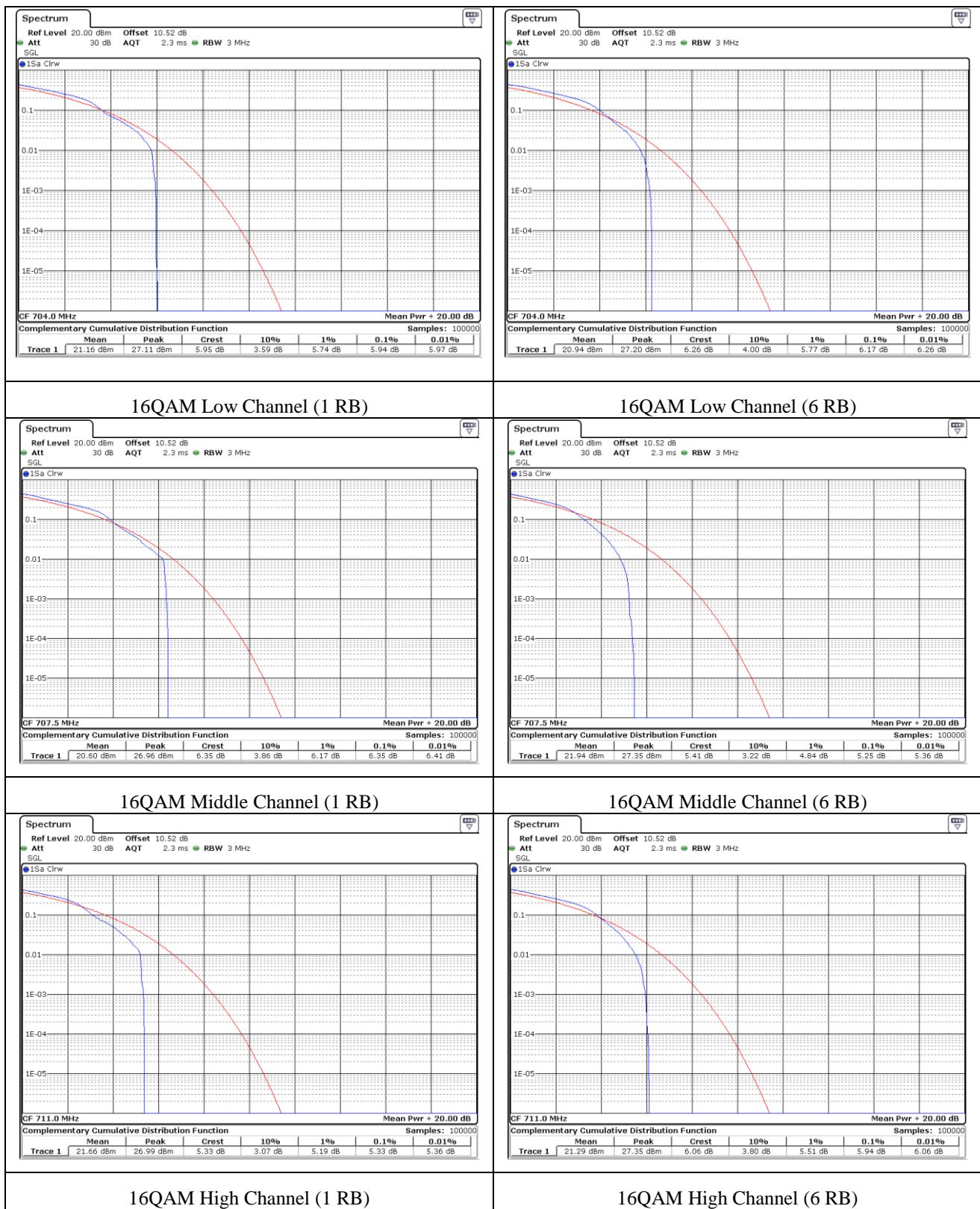
LTE Band 12 16QAM

| Test Mode | Channel | Peak-Average Ratio(PAR)<br>CCDF 0.1 % | Limit<br>(dB) | Result |
|-----------|---------|---------------------------------------|---------------|--------|
| 1 RB      | 23060   | 5.94                                  | 13.00         | PASS   |
|           | 23095   | 6.35                                  | 13.00         | PASS   |
|           | 23130   | 5.33                                  | 13.00         | PASS   |
| 6 RB      | 23060   | 6.17                                  | 13.00         | PASS   |
|           | 23095   | 5.25                                  | 13.00         | PASS   |
|           | 23130   | 5.94                                  | 13.00         | PASS   |

Remark: Measured the using CCDFof spectrum analyzer.

Tested by: Ju Yun Park / Assistant Manager





**11.4.3 Test data LTE Band 13**

- . Test Date : February 13, 2019 ~ February 26, 2019  
- . Test Result : Pass

LTE Band 13 QPSK

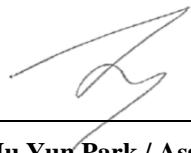
| Test Mode | Channel | Peak-Average Ratio(PAR)<br>CCDF 0.1 % | Limit<br>(dB) | Result |
|-----------|---------|---------------------------------------|---------------|--------|
| 1 RB      | 23230   | 4.55                                  | 13.00         | PASS   |
| 6 RB      | 23230   | 5.57                                  | 13.00         | PASS   |

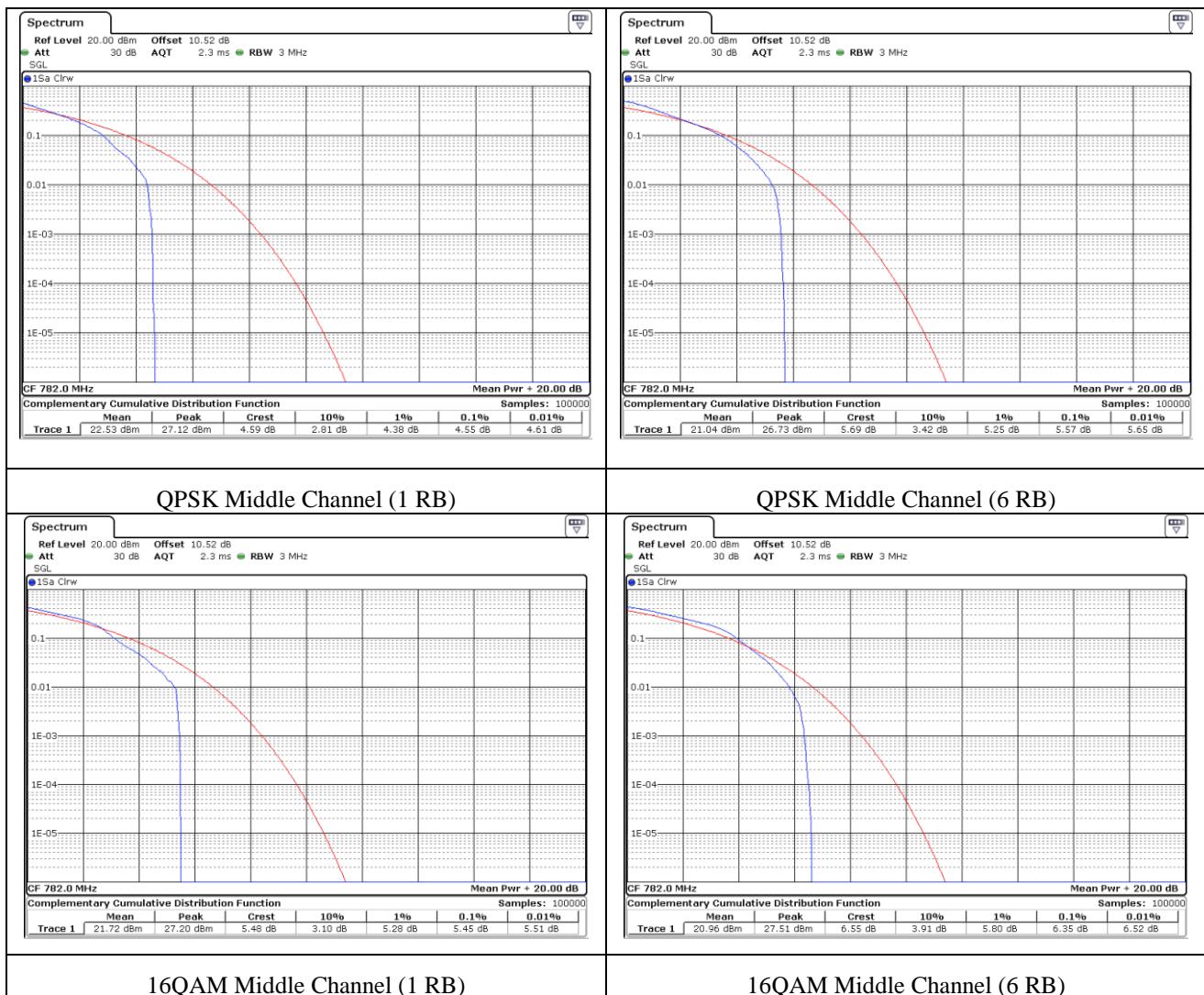
Remark: Measured the using CCDFof spectrum analyzer.

LTE Band 13 16QAM

| Test Mode | Channel | Peak-Average Ratio(PAR)<br>CCDF 0.1 % | Limit<br>(dB) | Result |
|-----------|---------|---------------------------------------|---------------|--------|
| 1 RB      | 23230   | 5.45                                  | 13.00         | PASS   |
| 6 RB      | 23230   | 6.35                                  | 13.00         | PASS   |

Remark: Measured the using CCDFof spectrum analyzer.

\_\_\_\_\_  
**Tested by: Ju Yun Park / Assistant Manager**



## 12. OCCUPIED BANDWIDTH

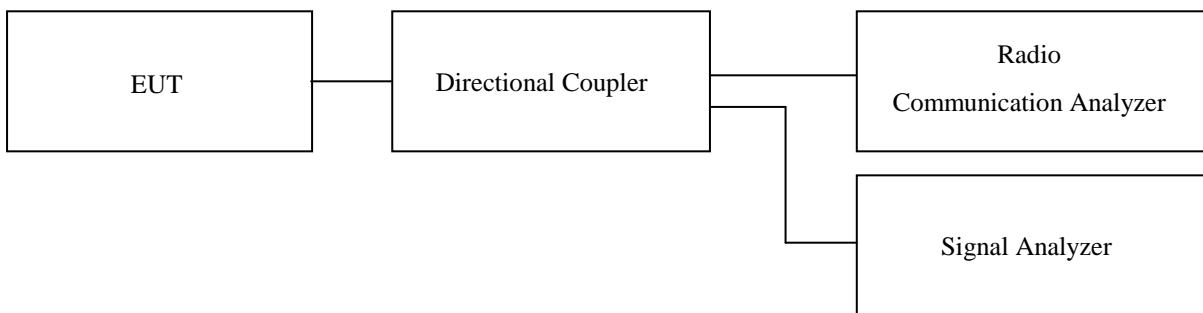
### 12.1 Operating environment

Temperature : 23 °C  
 Relative humidity : 47 % R.H.

### 12.2 Test set-up

The emission bandwidth ( $\times$ dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated  $\times$  dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least  $3\times$  the resolution bandwidth. When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately  $3\times$ RBW.



### 12.3 Test equipment used

| Model Number  | Manufacturer    | Description                  | Serial Number | Last Cal.          |
|---------------|-----------------|------------------------------|---------------|--------------------|
| ■ - FSV30     | Rohde & Schwarz | Signal Analyzer              | 101372        | Aug. 23, 2018 (1Y) |
| ■ - AAMCS-UDC | AA-MCS          | Directional Coupler          | 400           | Aug. 23, 2018 (1Y) |
| ■ - MT8821C   | ANRITSU         | Radio Communication Analyzer | 6261849029    | Aug. 22, 2018 (1Y) |
| ■ - PWS-3003D | Protek          | DC Power Supply              | 4020409       | Aug. 24, 2018 (1Y) |

All test equipment used is calibrated on a regular basis.

## 12.4 Test data

### 12.4.1 Test data for LTE Band 4

- Test Date : February 13, 2019 ~ February 26, 2019

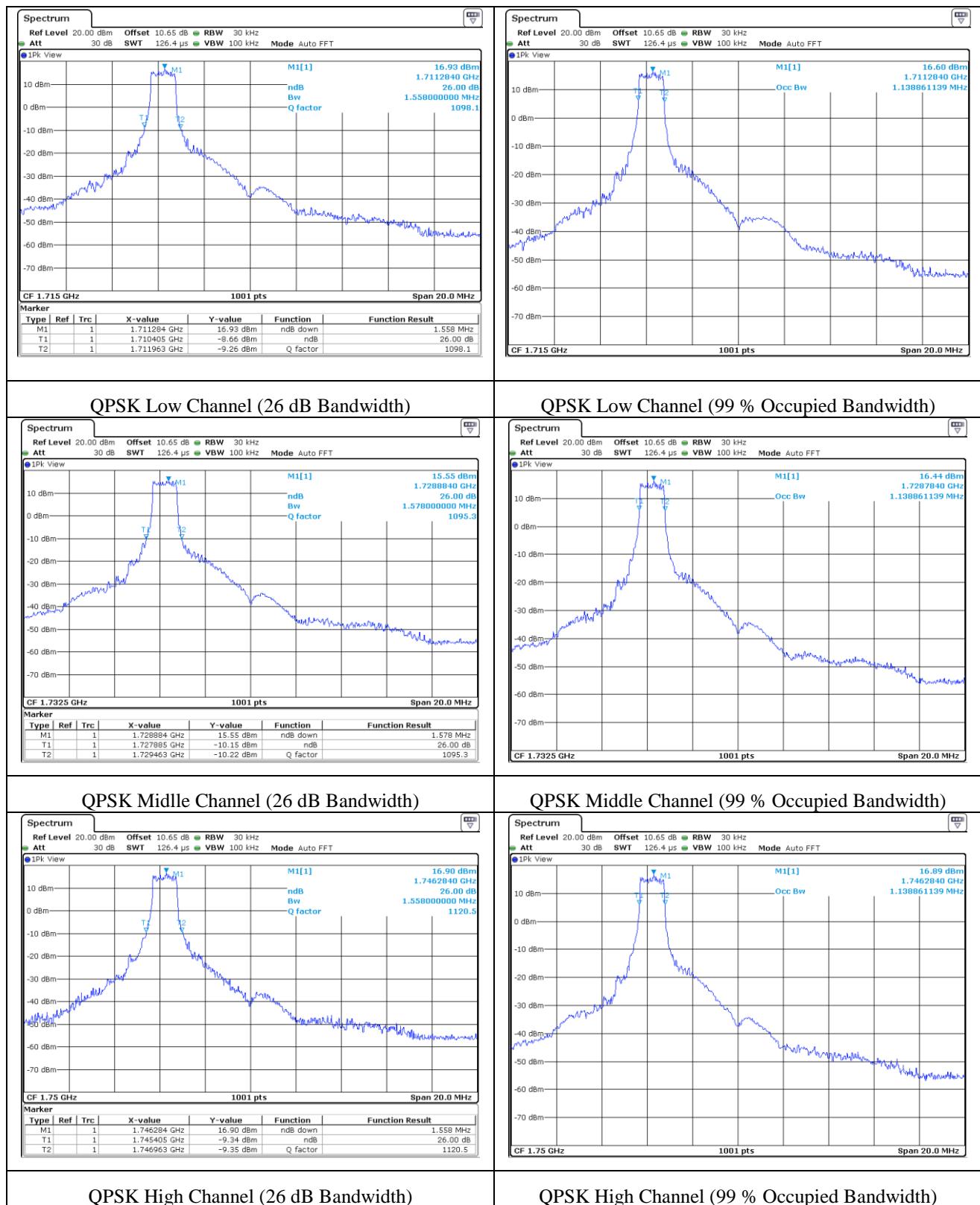
- Test Result : Pass

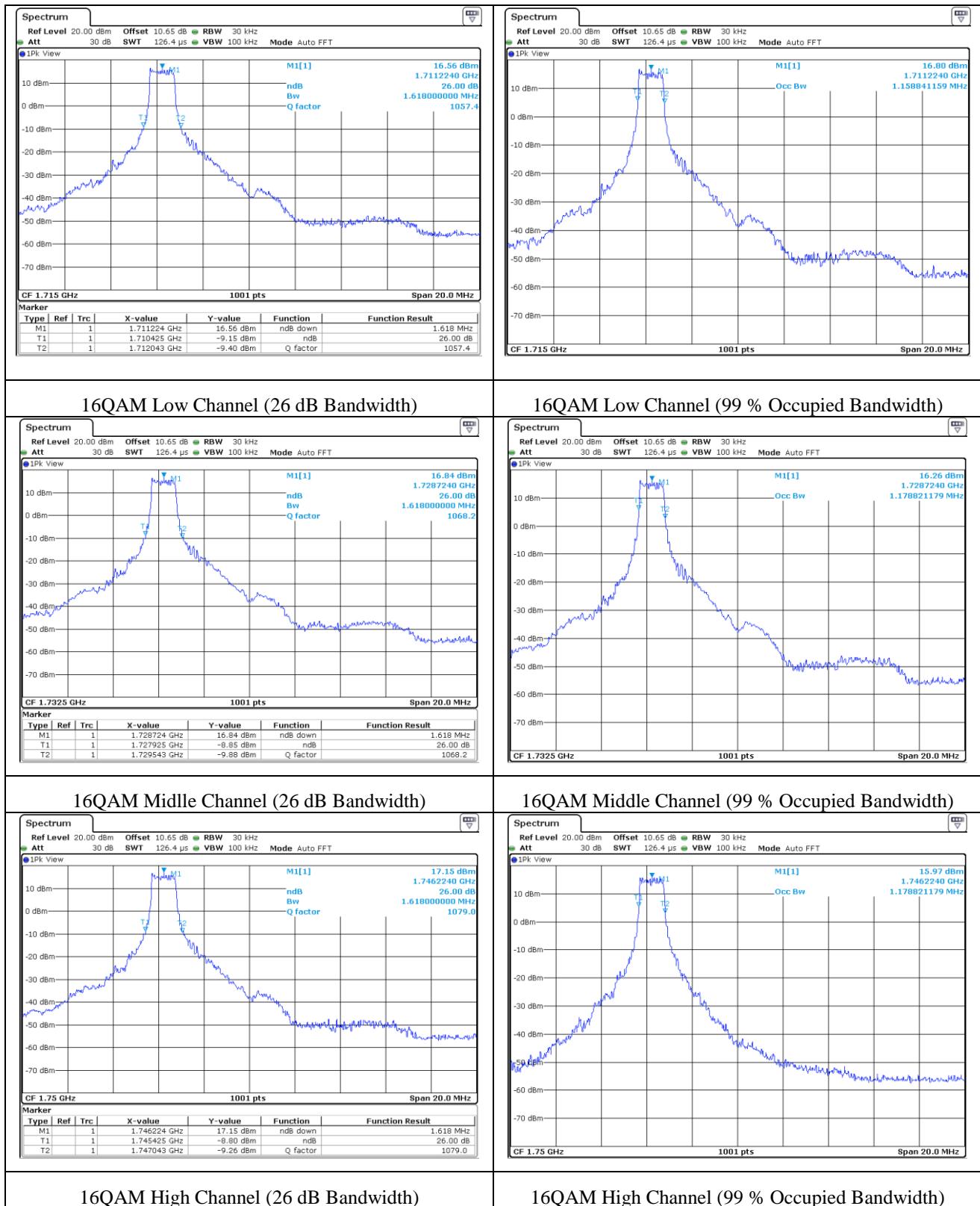
| Test Mode | Channel | 26 dB Bandwidth (MHz) | 99 % Occupied Bandwidth (MHz) | Result |
|-----------|---------|-----------------------|-------------------------------|--------|
| QPSK      | Low     | 1.558                 | 1.139                         | PASS   |
|           | Middle  | 1.578                 | 1.139                         | PASS   |
|           | High    | 1.558                 | 1.139                         | PASS   |

| Test Mode | Channel | 26 dB Bandwidth (MHz) | 99 % Occupied Bandwidth (MHz) | Result |
|-----------|---------|-----------------------|-------------------------------|--------|
| 16QAM     | Low     | 1.618                 | 1.159                         | PASS   |
|           | Middle  | 1.618                 | 1.179                         | PASS   |
|           | High    | 1.618                 | 1.179                         | PASS   |



Tested by: Ju Yun Park / Assistant Manager





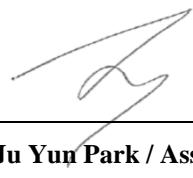
**12.4.2 Test data for LTE Band 12**

- . Test Date : February 13, 2019 ~ February 26, 2019

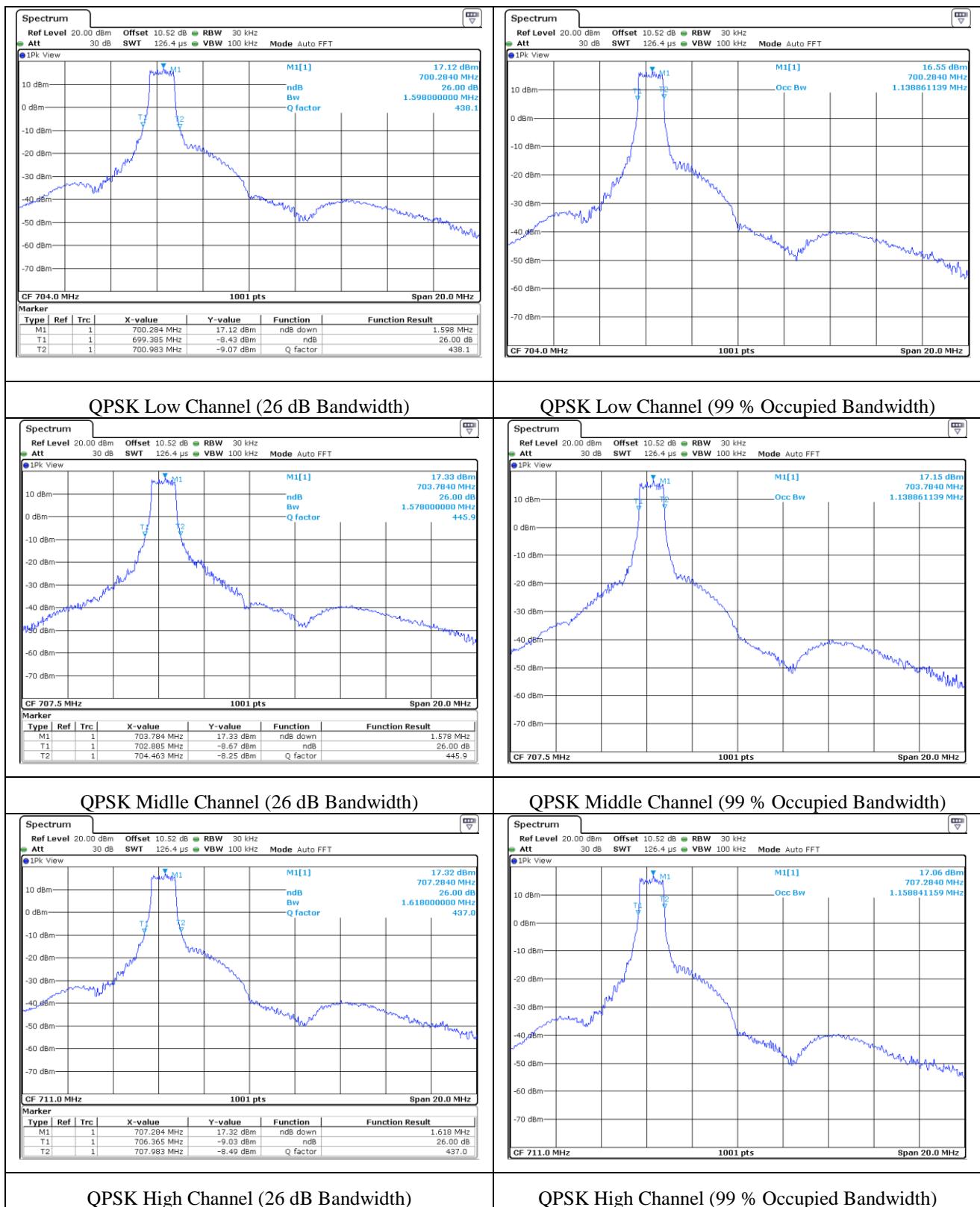
- . Test Result : Pass

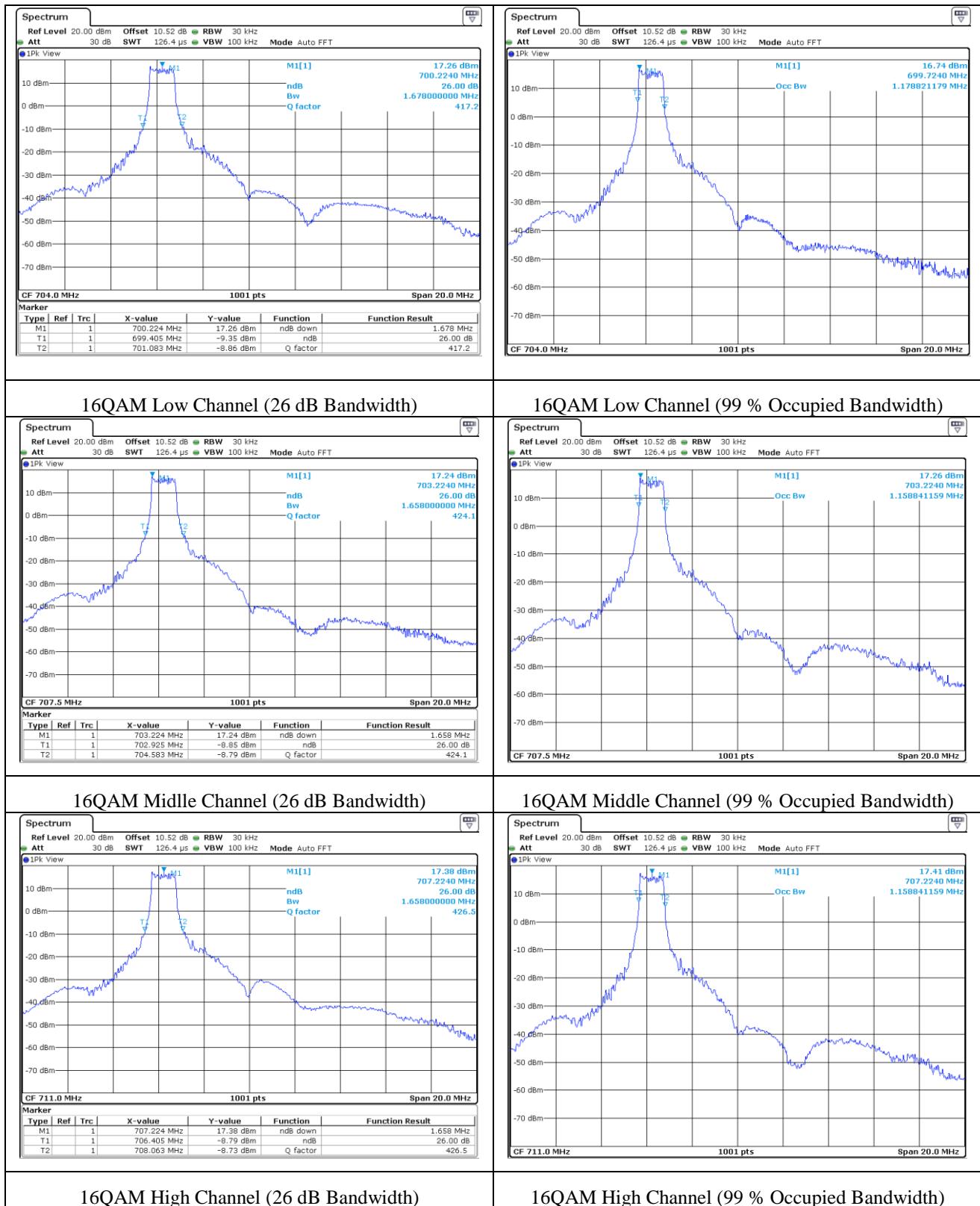
| Test Mode | Channel | 26 dB Bandwidth<br>(MHz) | 99 % Occupied Bandwidth<br>(MHz) | Result |
|-----------|---------|--------------------------|----------------------------------|--------|
| QPSK      | Low     | 1.598                    | 1.139                            | PASS   |
|           | Middle  | 1.578                    | 1.139                            | PASS   |
|           | High    | 1.618                    | 1.159                            | PASS   |

| Test Mode | Channel | 26 dB Bandwidth<br>(MHz) | 99 % Occupied Bandwidth<br>(MHz) | Result |
|-----------|---------|--------------------------|----------------------------------|--------|
| 16QAM     | Low     | 1.678                    | 1.179                            | PASS   |
|           | Middle  | 1.658                    | 1.159                            | PASS   |
|           | High    | 1.658                    | 1.159                            | PASS   |



Tested by: Ju Yun Park / Assistant Manager





**12.4.3 Test data for LTE Band 13**

- . Test Date : February 13, 2019 ~ February 26, 2019

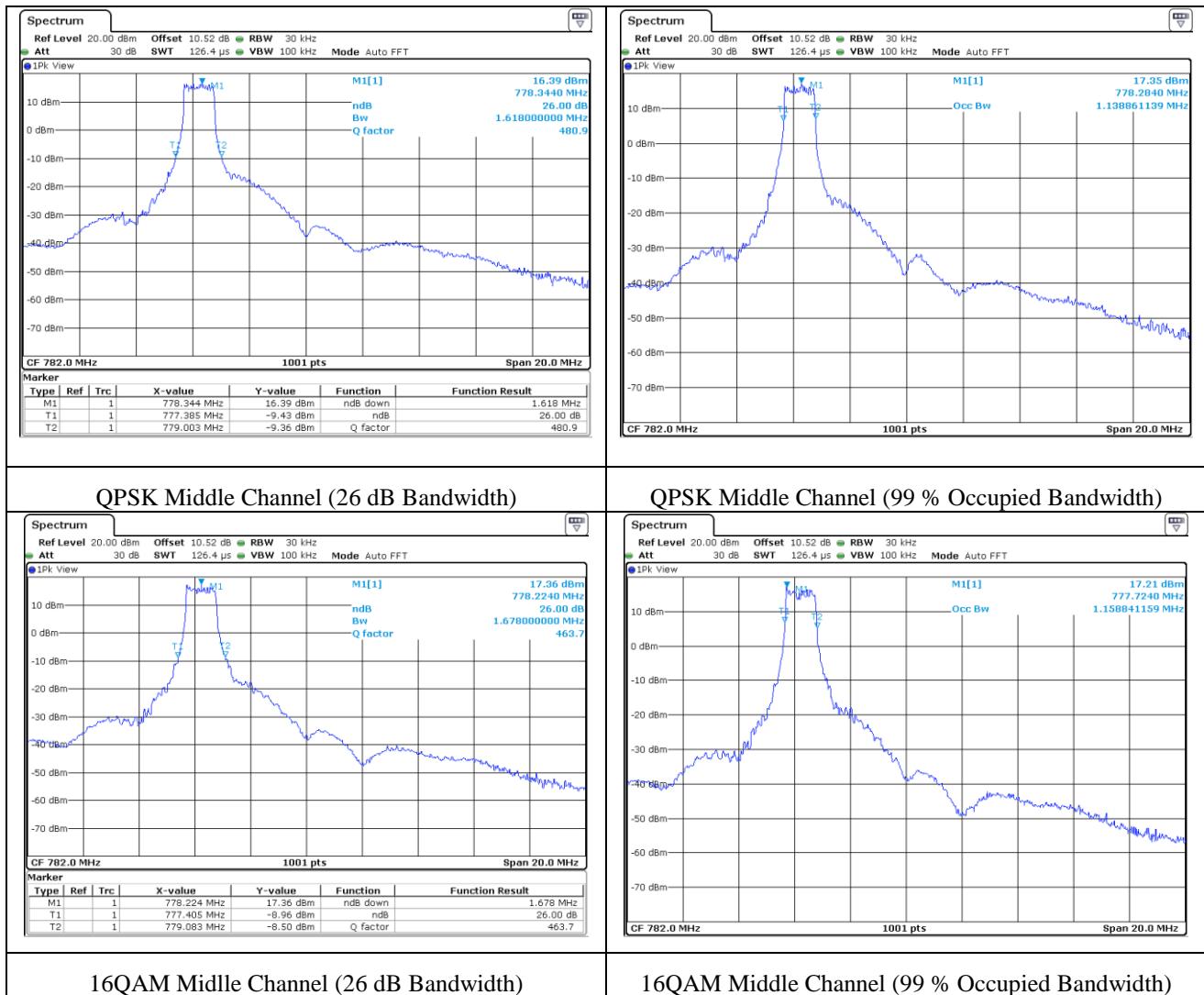
- . Test Result : Pass

| Test Mode | Channel | 26 dB Bandwidth<br>(MHz) | 99 % Occupied Bandwidth<br>(MHz) | Result |
|-----------|---------|--------------------------|----------------------------------|--------|
| QPSK      | Low     | 1.618                    | 1.139                            | PASS   |

| Test Mode | Channel | 26 dB Bandwidth<br>(MHz) | 99 % Occupied Bandwidth<br>(MHz) | Result |
|-----------|---------|--------------------------|----------------------------------|--------|
| 16QAM     | Low     | 1.678                    | 1.159                            | PASS   |



Tested by: Ju Yun Park / Assistant Manager

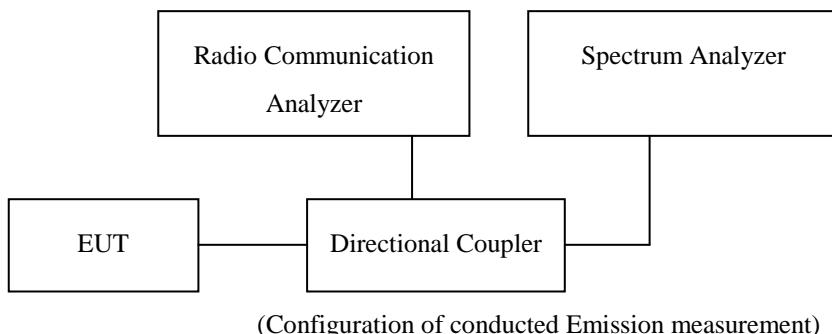


## 13. Conducted Band Edge

### 13.1 Operating environment

Temperature : 23 °C  
Relative humidity : 47 % R.H.

### 13.2 Test set-up



Conducted Spurious Emissions is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 6.

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels(low, middle and high operational range.)

The Conducted Spurious Emissions used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

### 13.3 Methods of Measurement

1. All measurements were done at low and high operational frequency range.
2. Set spectrum analyzer with RMS detector.
3. The center frequency of spectrum is the band edge frequency and set RBW of the spectrum is 20 kHz and VBW of the spectrum is 50 kHz

### 13.4 Limits

LTE -4 Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10} (P)$  dB.”

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 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

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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.

LTE -13 Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions 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. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

LTE Band 4 / 12 Limit

|       |         |
|-------|---------|
| Limit | -13 dBm |
|-------|---------|

LTE Band 13 Limit

|                                     |         |
|-------------------------------------|---------|
| Limit out of the band 1559-1610 MHz | -13 dBm |
| Limit in the band 1559-1610 MHz     | -40 dBm |

### 13.5 Test equipment used

| Model Number  | Manufacturer    | Description                  | Serial Number | Last Cal.          |
|---------------|-----------------|------------------------------|---------------|--------------------|
| ■ - FSV30     | Rohde & Schwarz | Signal Analyzer              | 101372        | Aug. 23, 2018 (1Y) |
| ■ - AAMCS-UDC | AA-MCS          | Directional Coupler          | 400           | Aug. 23, 2018 (1Y) |
| ■ - MT8821C   | ANRITSU         | Radio Communication Analyzer | 6261849029    | Aug. 22, 2018 (1Y) |
| ■ - PWS-3003D | Protek          | DC Power Supply              | 4020409       | Aug. 24, 2018 (1Y) |

All test equipment used is calibrated on a regular basis.

### 13.6 Test data

#### 13.6.1 Test data for LTE Band 4

- Test Date : February 13, 2019 ~ February 26, 2019
- Test Result : Pass

LTE Band 4 QPSK

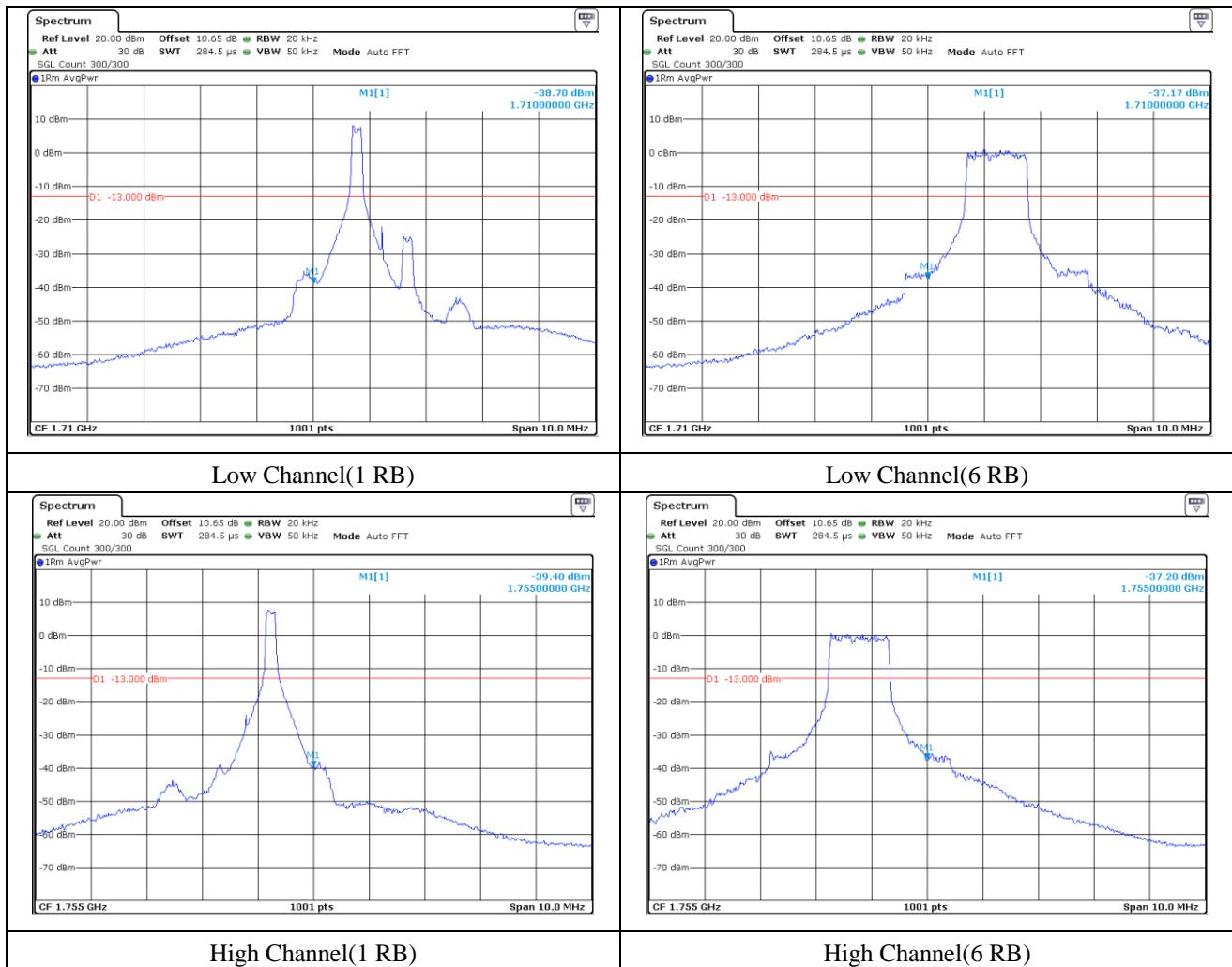
| Test Mode | Channel | Edge Frequency<br>(MHz) | MEASURED VLAUE<br>(dBm) | Limit<br>(dBm) | Result |
|-----------|---------|-------------------------|-------------------------|----------------|--------|
| 1 RB      | Low     | 1710.0000               | -38.70                  | -13.00         | PASS   |
|           | High    | 1755.0000               | -39.40                  | -13.00         | PASS   |
| 6 RB      | Low     | 1710.0000               | -37.17                  | -13.00         | PASS   |
|           | High    | 1755.0000               | -37.20                  | -13.00         | PASS   |

LTE Band 4 16QAM

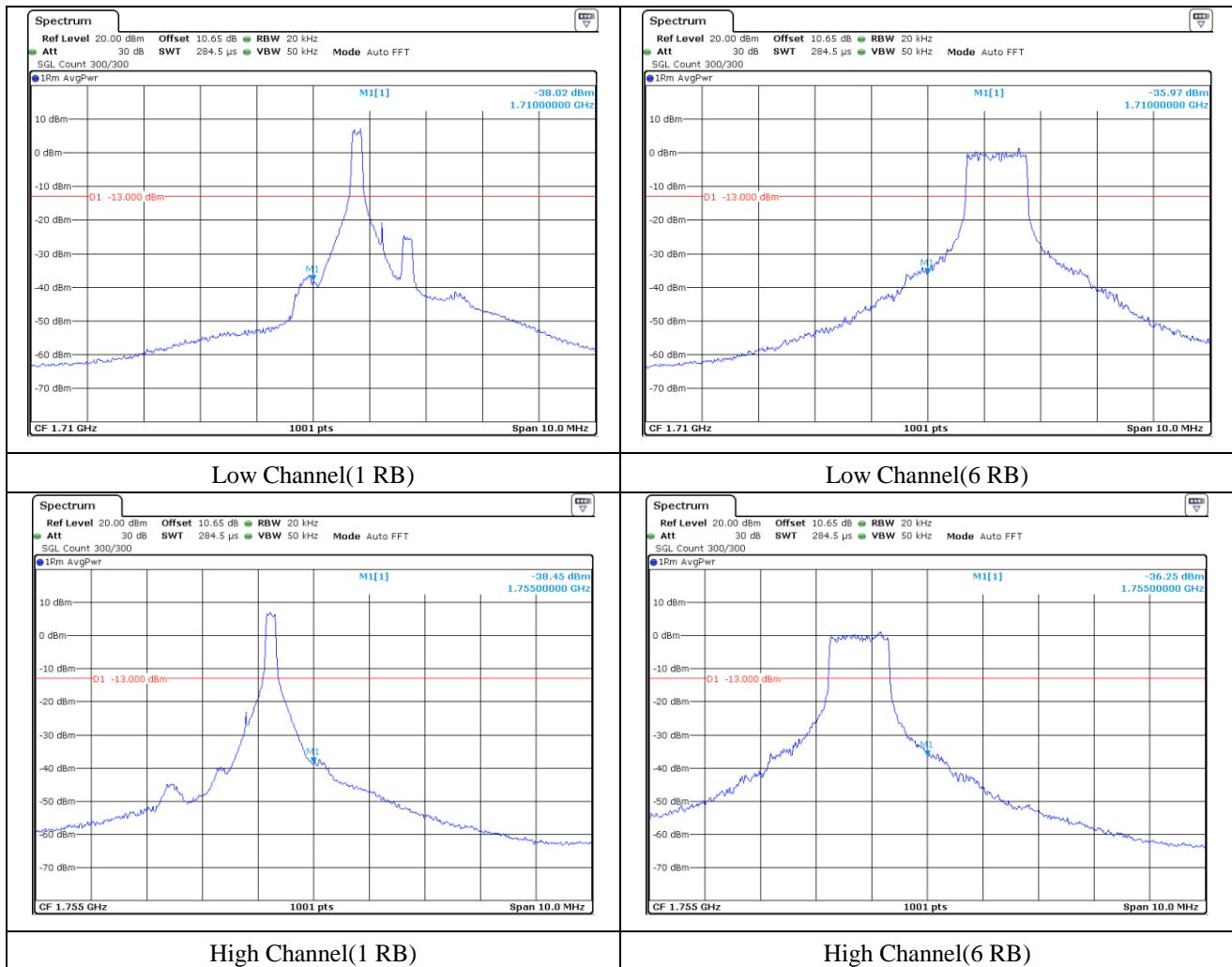
| Test Mode | Channel | Edge Frequency<br>(MHz) | MEASURED VLAUE<br>(dBm) | Limit<br>(dBm) | Result |
|-----------|---------|-------------------------|-------------------------|----------------|--------|
| 1 RB      | Low     | 1710.0000               | -38.02                  | -13.00         | PASS   |
|           | High    | 1755.0000               | -38.45                  | -13.00         | PASS   |
| 6 RB      | Low     | 1710.0000               | -35.97                  | -13.00         | PASS   |
|           | High    | 1755.0000               | -36.25                  | -13.00         | PASS   |

Tested by: Ju Yun Park / Assistant Manager

### 13.6.2 Test data for LTE Band 4 QPSK



### 13.6.3 Test data for LTE Band 4 16QAM



### 13.6.4 Test data for LTE Band 12

- Test Date : February 13, 2019 ~ February 26, 2019
- Test Result : Pass

LTE Band 12 QPSK

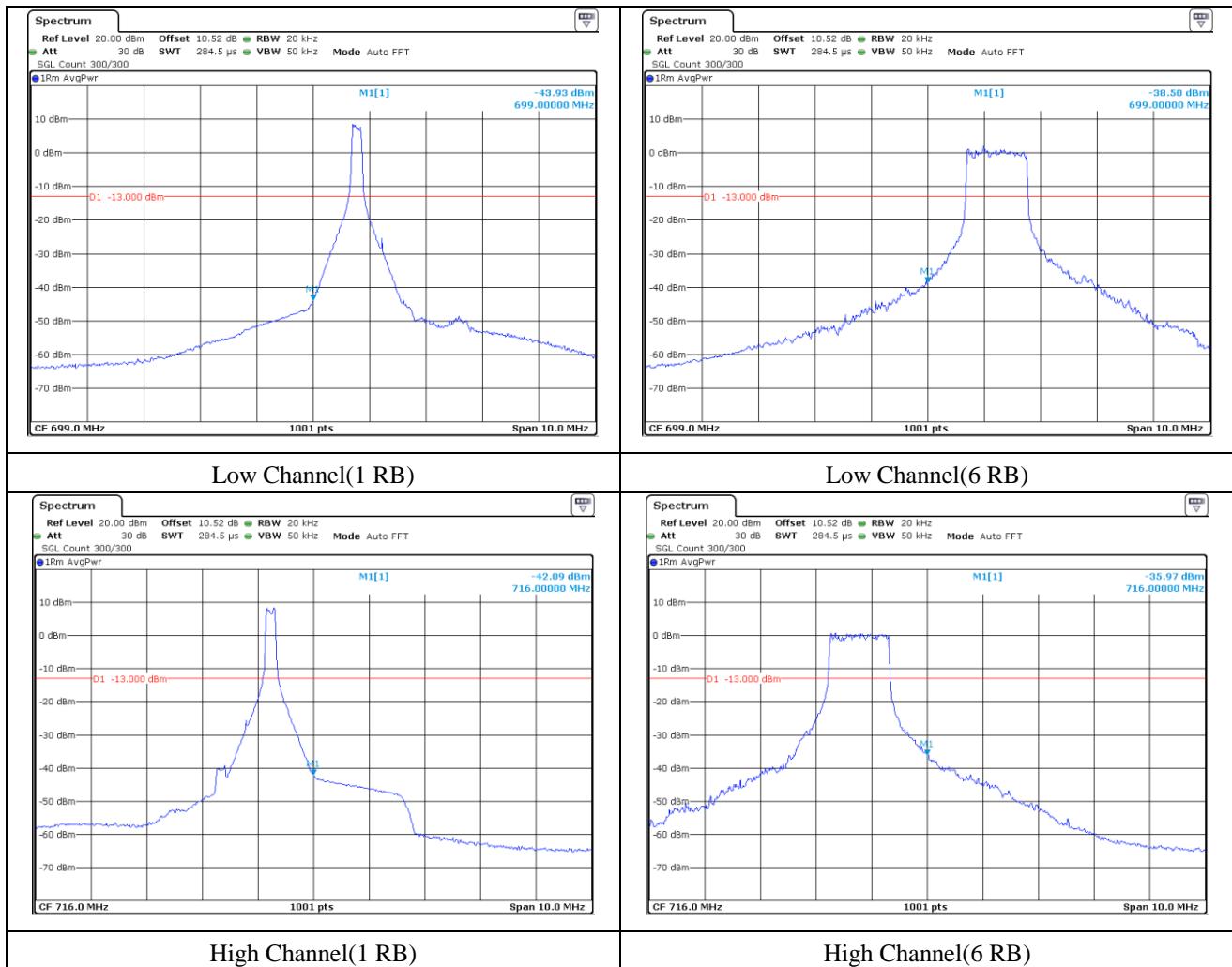
| Test Mode | Channel | Edge Frequency (MHz) | MEASURED VLAUE (dBm) | Limit (dBm) | Result |
|-----------|---------|----------------------|----------------------|-------------|--------|
| 1 RB      | Low     | 699.0000             | -43.93               | -13.00      | PASS   |
|           | High    | 716.0000             | -42.09               | -13.00      | PASS   |
| 6 RB      | Low     | 699.0000             | -38.50               | -13.00      | PASS   |
|           | High    | 716.0000             | -35.97               | -13.00      | PASS   |

LTE Band 12 16QAM

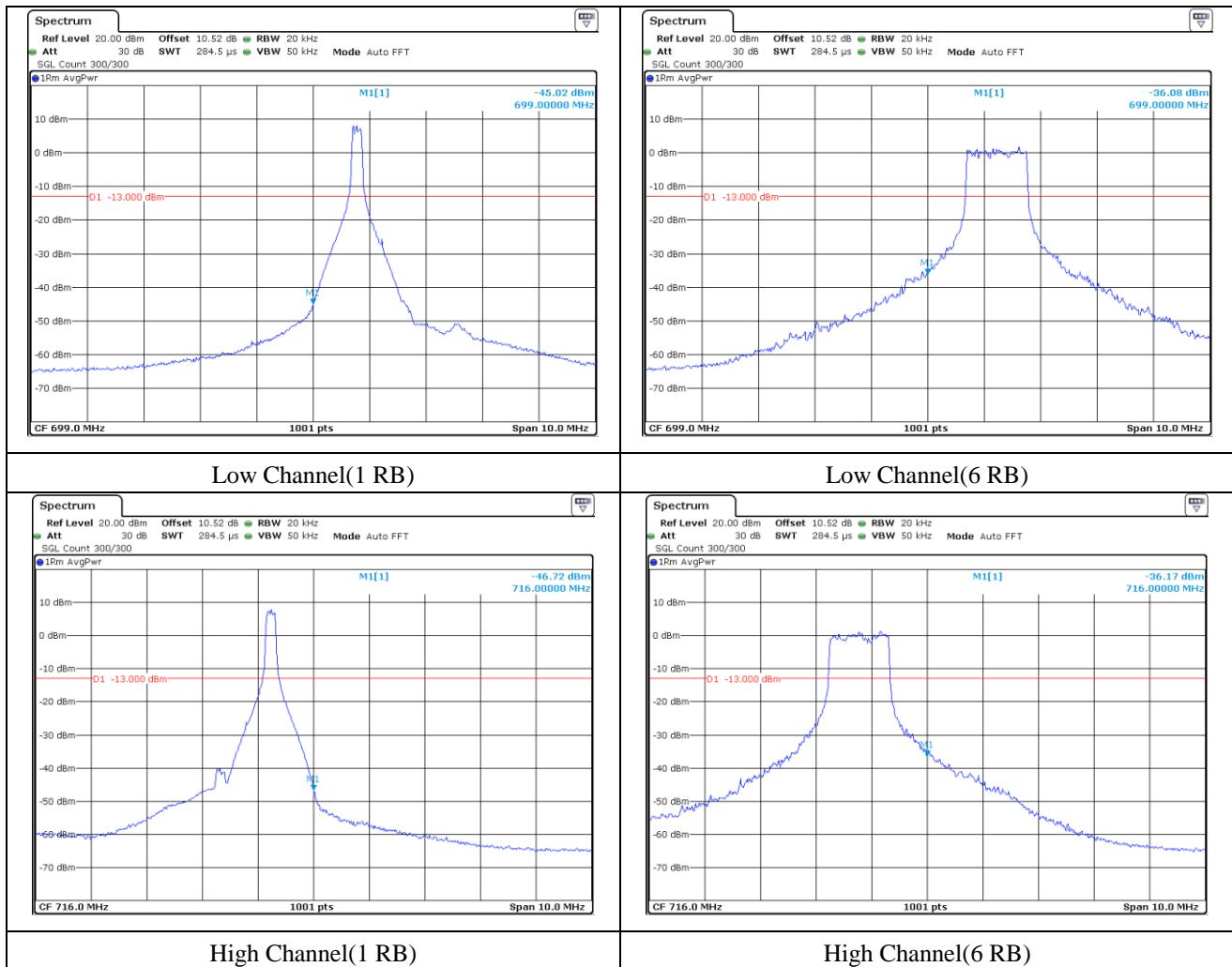
| Test Mode | Channel | Edge Frequency (MHz) | MEASURED VLAUE (dBm) | Limit (dBm) | Result |
|-----------|---------|----------------------|----------------------|-------------|--------|
| 1 RB      | Low     | 699.0000             | -45.02               | -13.00      | PASS   |
|           | High    | 716.0000             | -46.72               | -13.00      | PASS   |
| 6 RB      | Low     | 699.0000             | -36.08               | -13.00      | PASS   |
|           | High    | 716.0000             | -36.17               | -13.00      | PASS   |

Tested by: Ju Yun Park / Assistant Manager

### 13.6.5 Test data for LTE Band 12 QPSK



### 13.6.6 Test data for LTE Band 12 16QAM



### 13.6.7 Test data for LTE Band 13

- Test Date : February 13, 2019 ~ February 26, 2019
- Test Result : Pass

LTE Band 13 QPSK

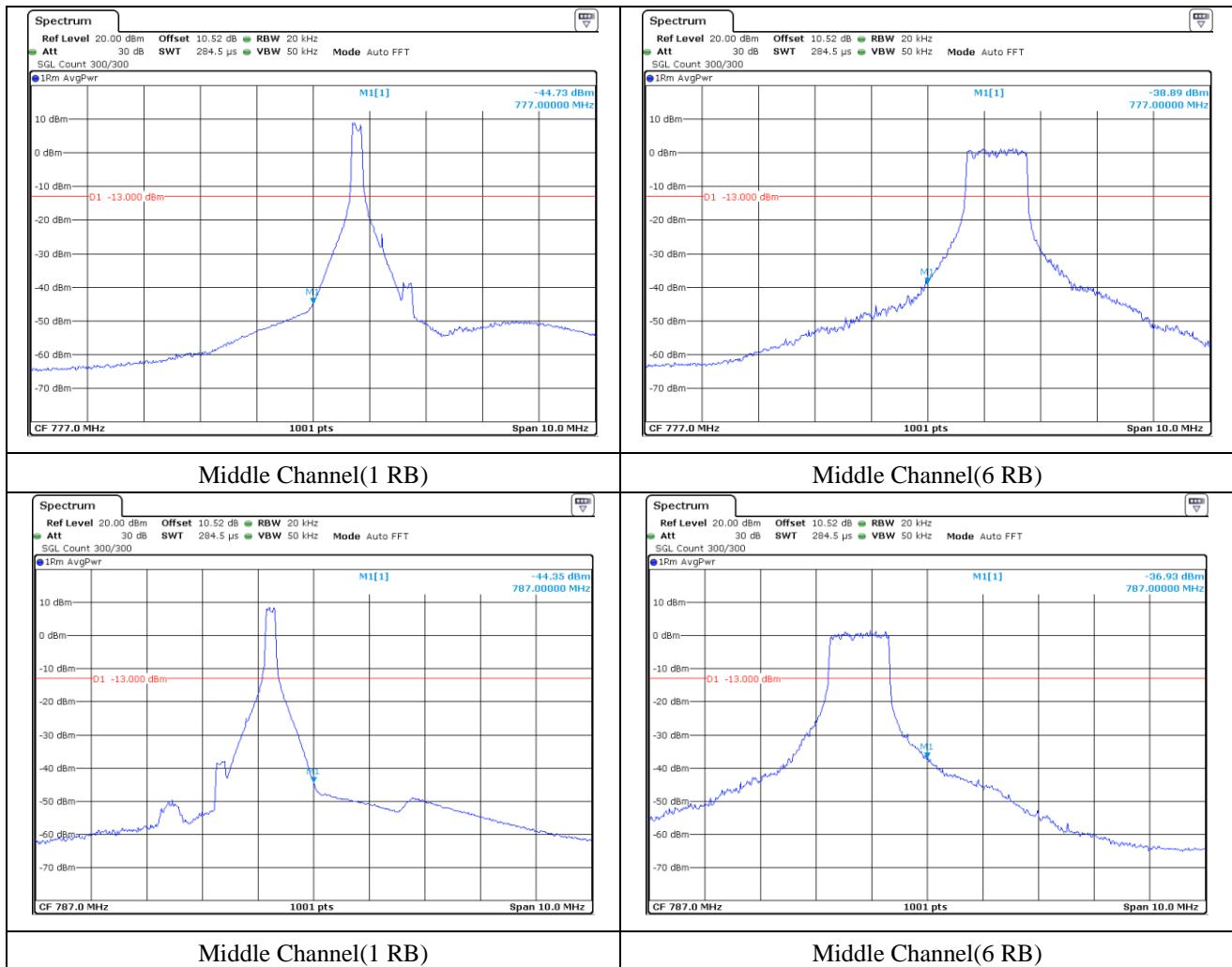
| Test Mode | Channel | Edge Frequency (MHz) | MEASURED VLAUE (dBm) | Limit (dBm) | Result |
|-----------|---------|----------------------|----------------------|-------------|--------|
| 1 RB      | Low     | 777.0000             | -44.73               | -13.00      | PASS   |
|           | High    | 787.0000             | -44.35               | -13.00      | PASS   |
| 6 RB      | Low     | 777.0000             | -38.89               | -13.00      | PASS   |
|           | High    | 787.0000             | -36.93               | -13.00      | PASS   |

LTE Band 13 16QAM

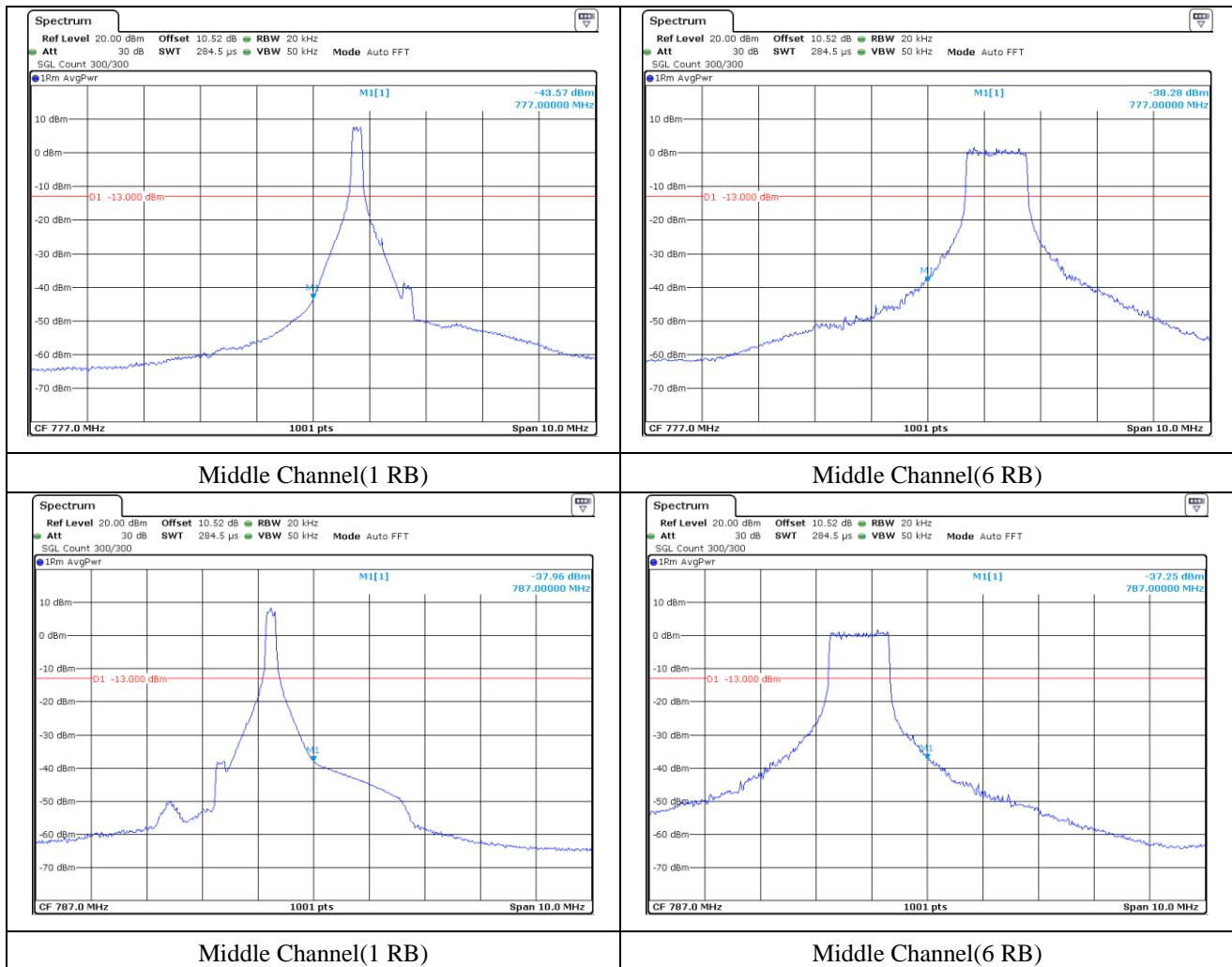
| Test Mode | Channel | Edge Frequency (MHz) | MEASURED VLAUE (dBm) | Limit (dBm) | Result |
|-----------|---------|----------------------|----------------------|-------------|--------|
| 1 RB      | Low     | 777.0000             | -43.57               | -13.00      | PASS   |
|           | High    | 787.0000             | -37.96               | -13.00      | PASS   |
| 6 RB      | Low     | 777.0000             | -38.28               | -13.00      | PASS   |
|           | High    | 787.0000             | -37.25               | -13.00      | PASS   |

Tested by: Ju Yun Park / Assistant Manager

### 13.6.8 Test data for LTE Band 13 QPSK



### 13.6.9 Test data for LTE Band 13 16QAM

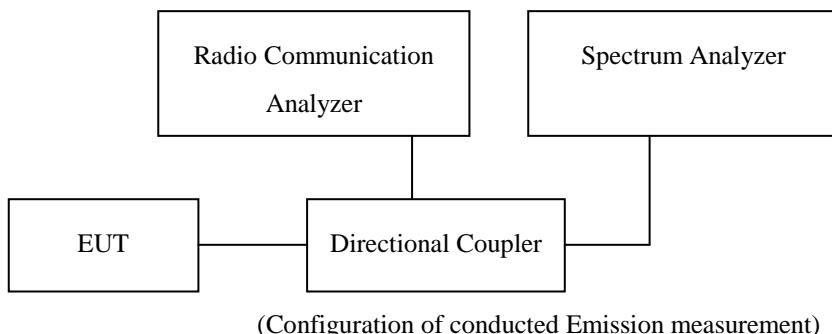


## 14. Conducted Spurious and Harmonic Emissions at Antenna Terminal

### 14.1 Operating environment

Temperature : 23 °C  
Relative humidity : 47 % R.H.

### 14.2 Test set-up



Conducted Spurious Emissions is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v04, April 9, 2018, Section 6.

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels(low, middle and high operational range.)

The Conducted Spurious Emissions used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

#### Conducted spurious emissions

The EUT was setup to maximum output power. The 100 kHz RBW and 300 kHz VBW was used to scan from 30 MHz to 1 GHz. Also, the 1 MHz RBW and 3 MHz VBW was used to scan from 1 GHz to 20 GHz. The high, low and a middle channel were tested for out of band measurements.

### 14.3 Limits

LTE -4 Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10} (P)$  dB.”

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 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.

LTE -13 Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions 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. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

LTE Band 4 / 12 Limit

|       |         |
|-------|---------|
| Limit | -13 dBm |
|-------|---------|

LTE Band 13 Limit

|                                     |         |
|-------------------------------------|---------|
| Limit out of the band 1559-1610 MHz | -13 dBm |
| Limit in the band 1559-1610 MHz     | -40 dBm |

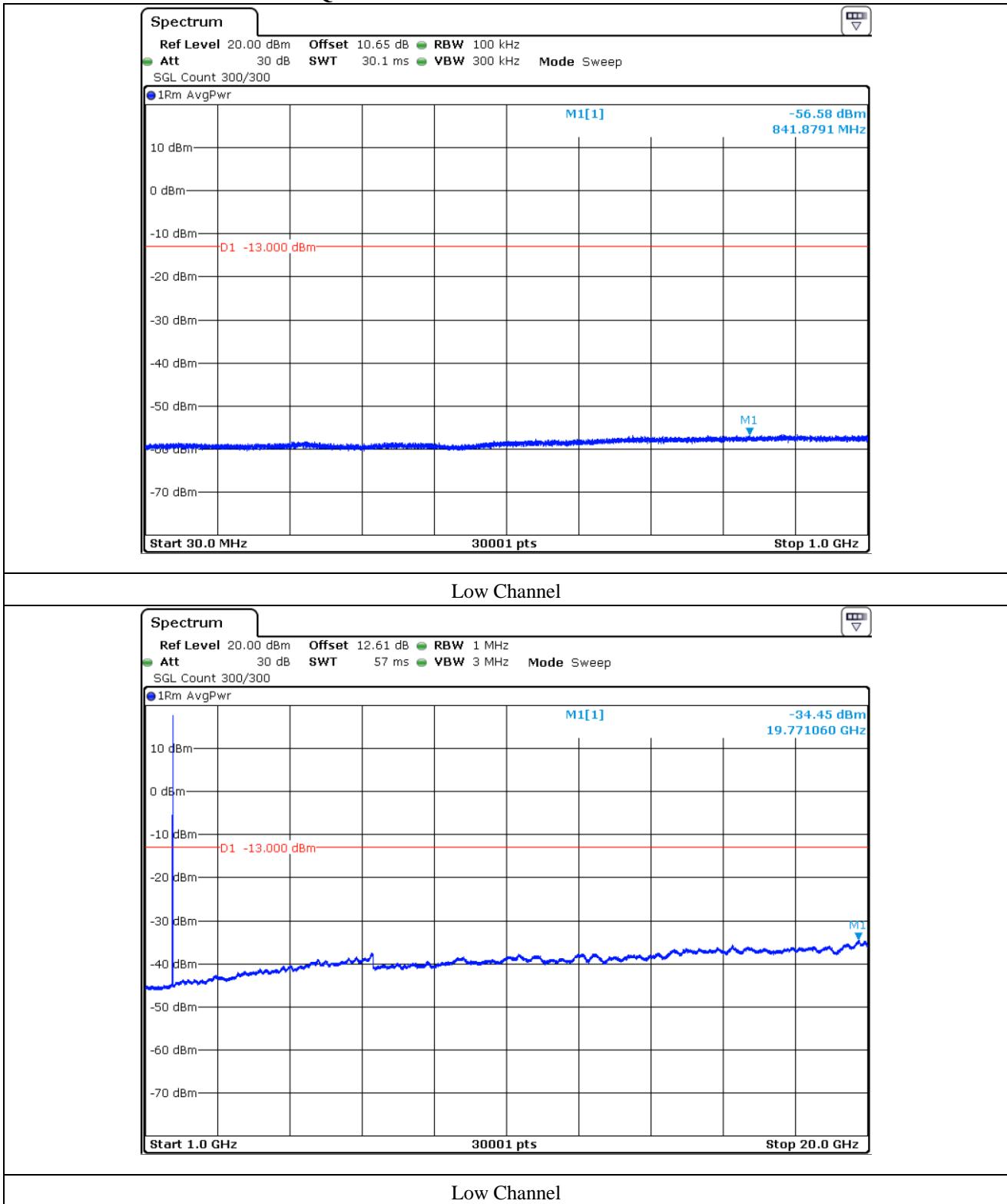
#### 14.4 Test equipment used

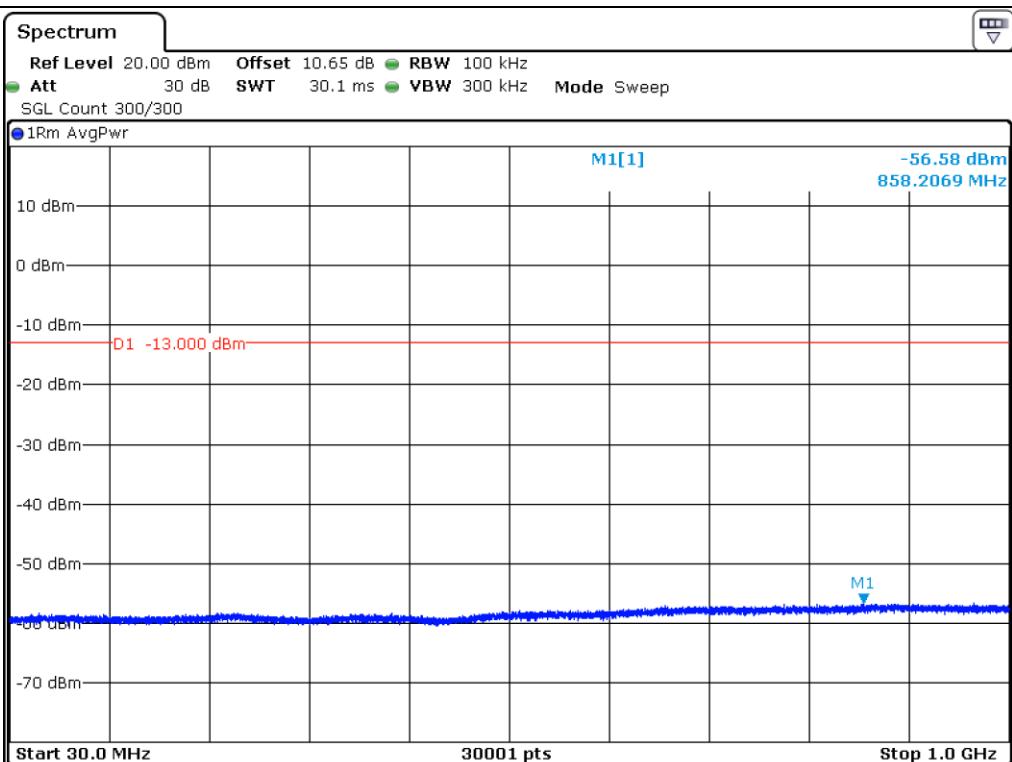
| Model Number  | Manufacturer    | Description                  | Serial Number | Last Cal.          |
|---------------|-----------------|------------------------------|---------------|--------------------|
| ■ - FSV30     | Rohde & Schwarz | Signal Analyzer              | 101372        | Aug. 23, 2018 (1Y) |
| ■ - AAMCS-UDC | AA-MCS          | Directional Coupler          | 400           | Aug. 23, 2018 (1Y) |
| ■ - MT8821C   | ANRITSU         | Radio Communication Analyzer | 6261849029    | Aug. 22, 2018 (1Y) |
| ■ - PWS-3003D | Protek          | DC Power Supply              | 4020409       | Aug. 24, 2018 (1Y) |

All test equipment used is calibrated on a regular basis.

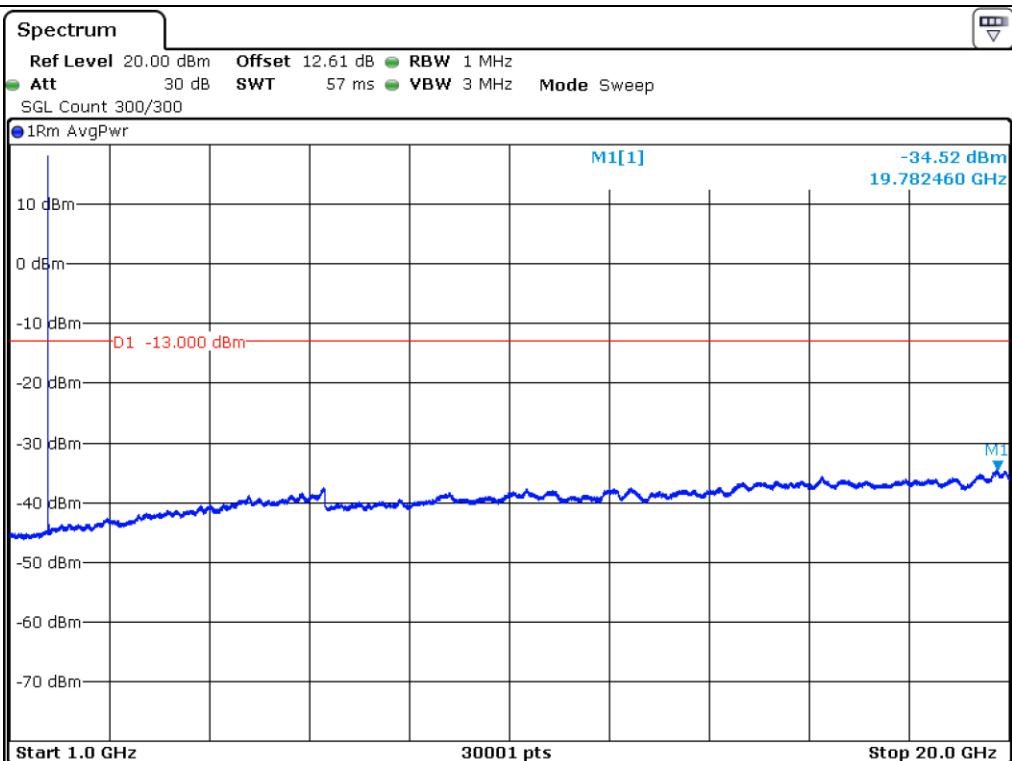
## 14.5 Test data

### 14.5.1 Test data for LTE Band 4 QPSK

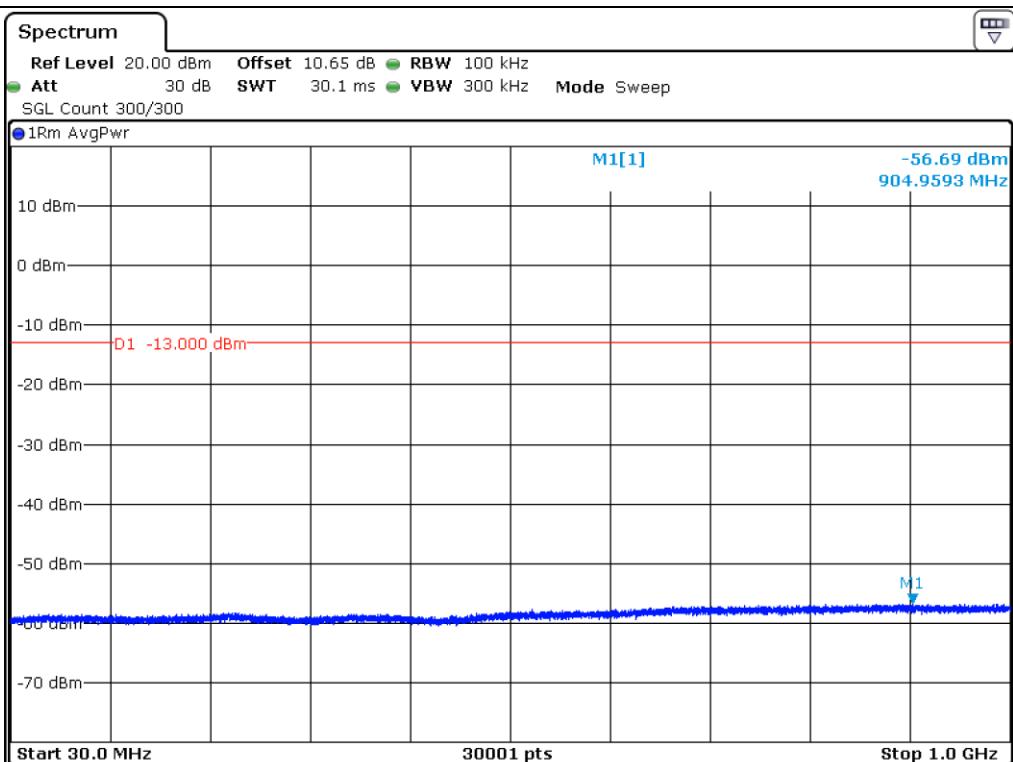




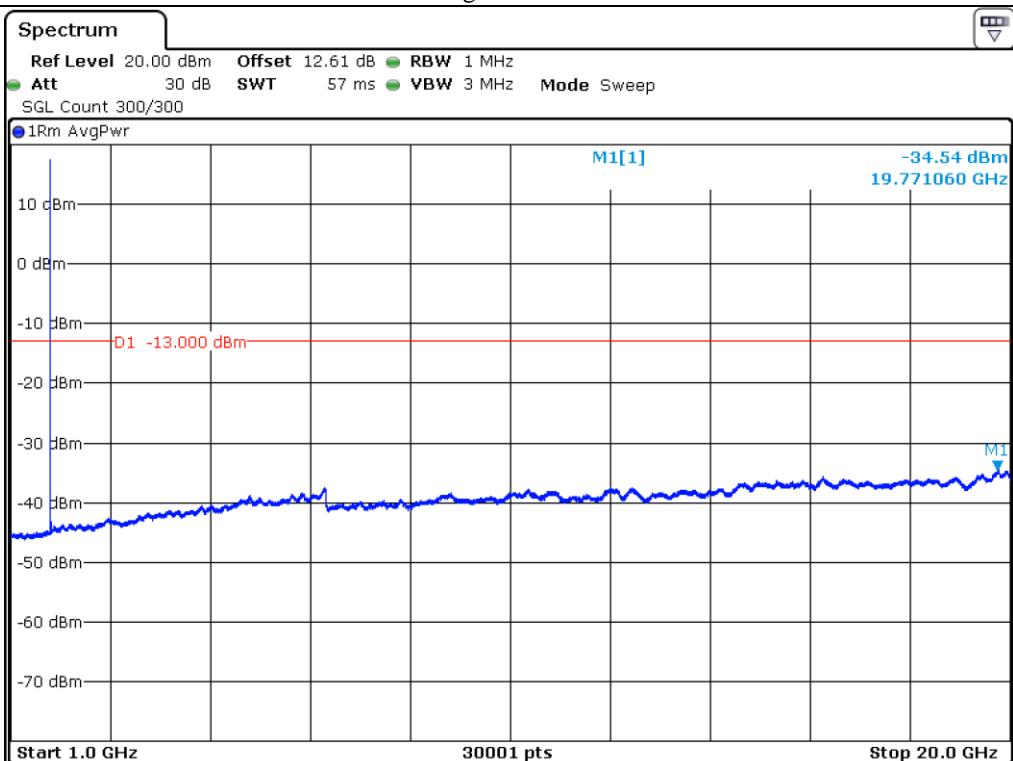
### Middle Channel



### Middle Channel

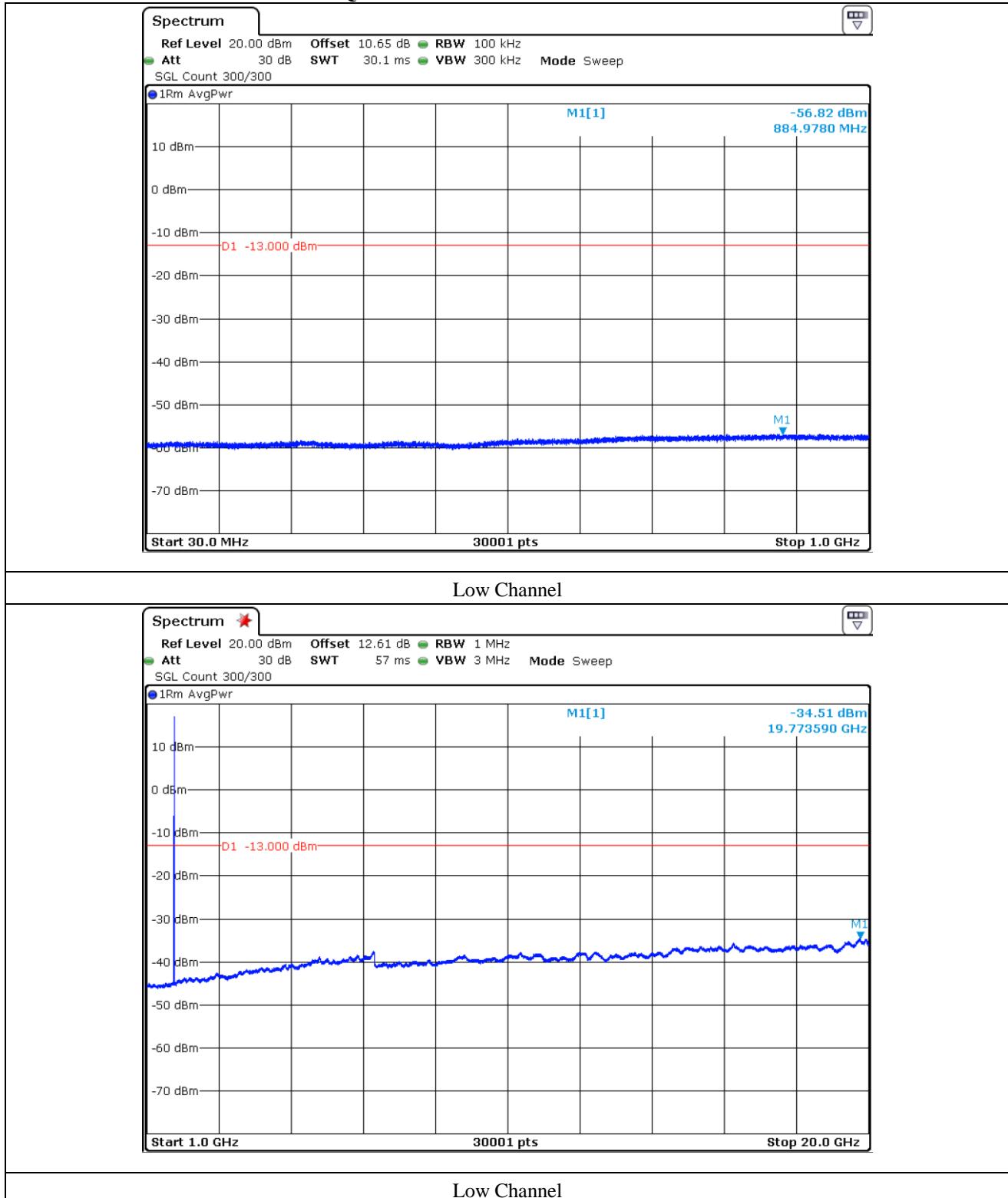


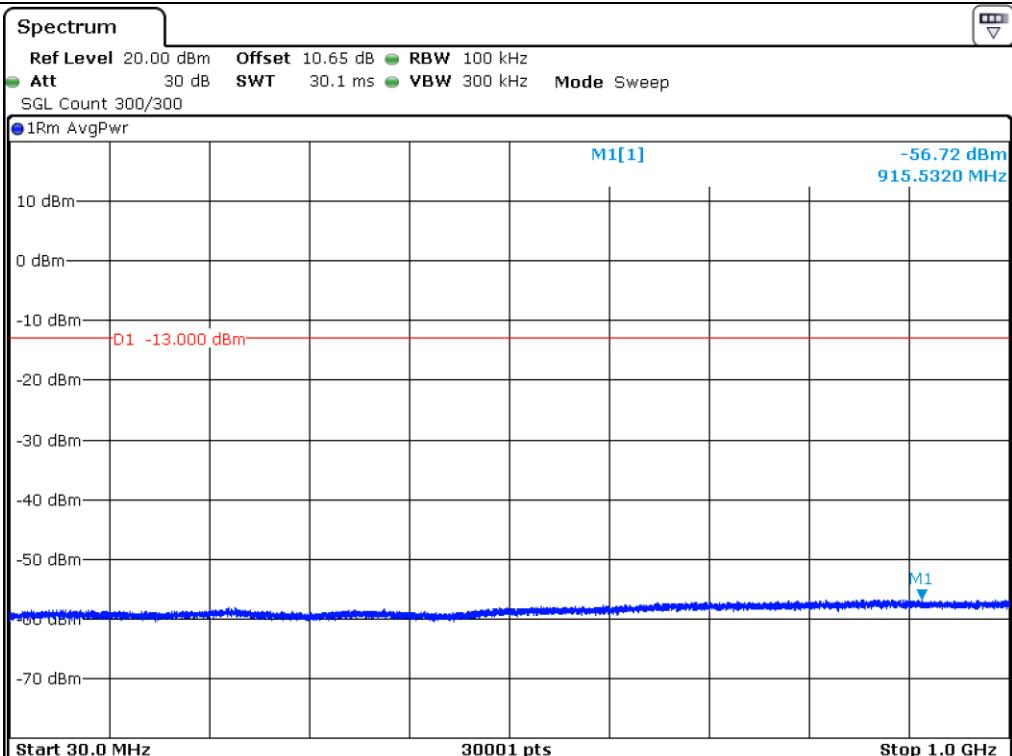
### High Channel



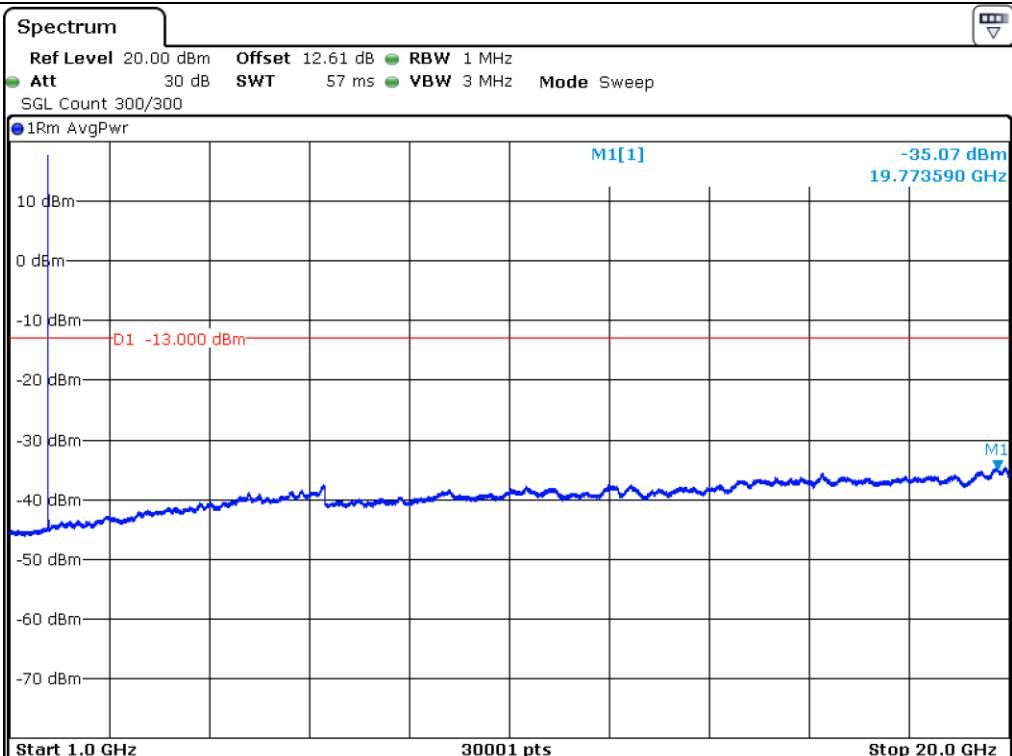
### High Channel

### 14.5.2 Test data for LTE Band 4 16QAM

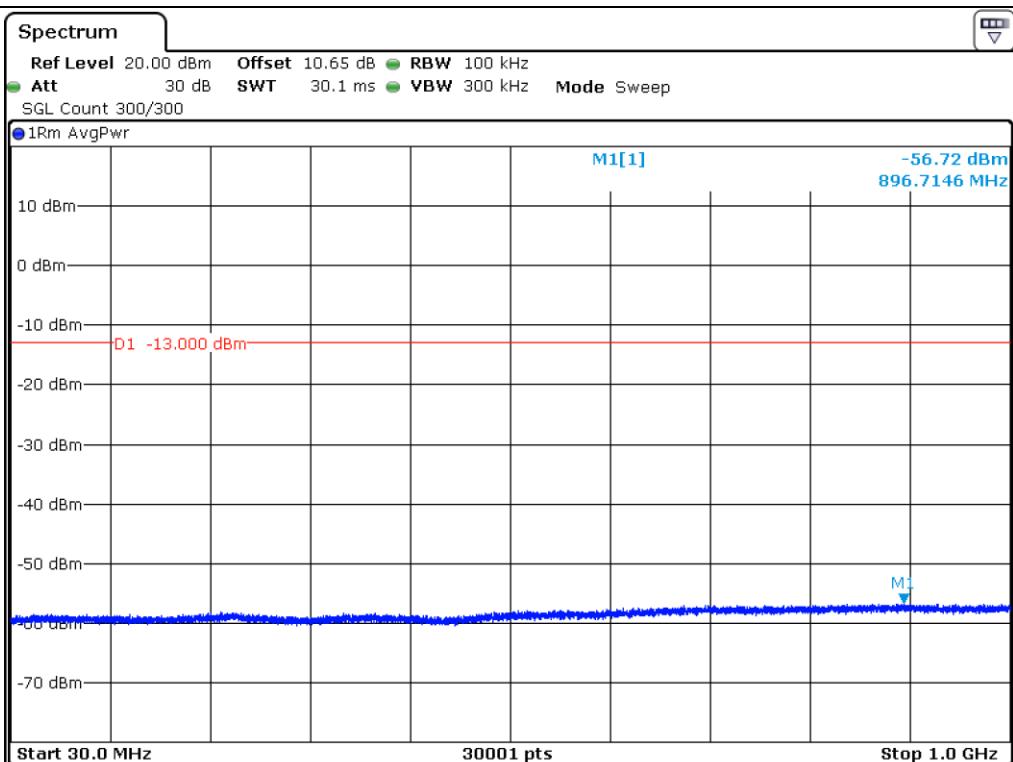




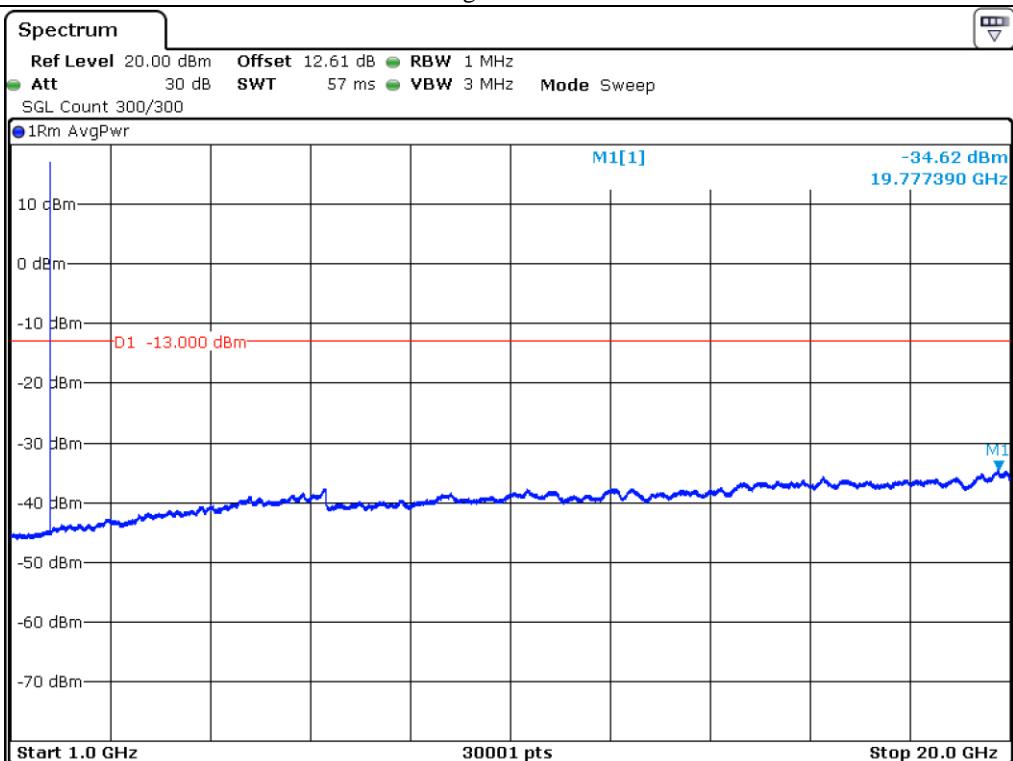
Middle Channel



Middle Channel

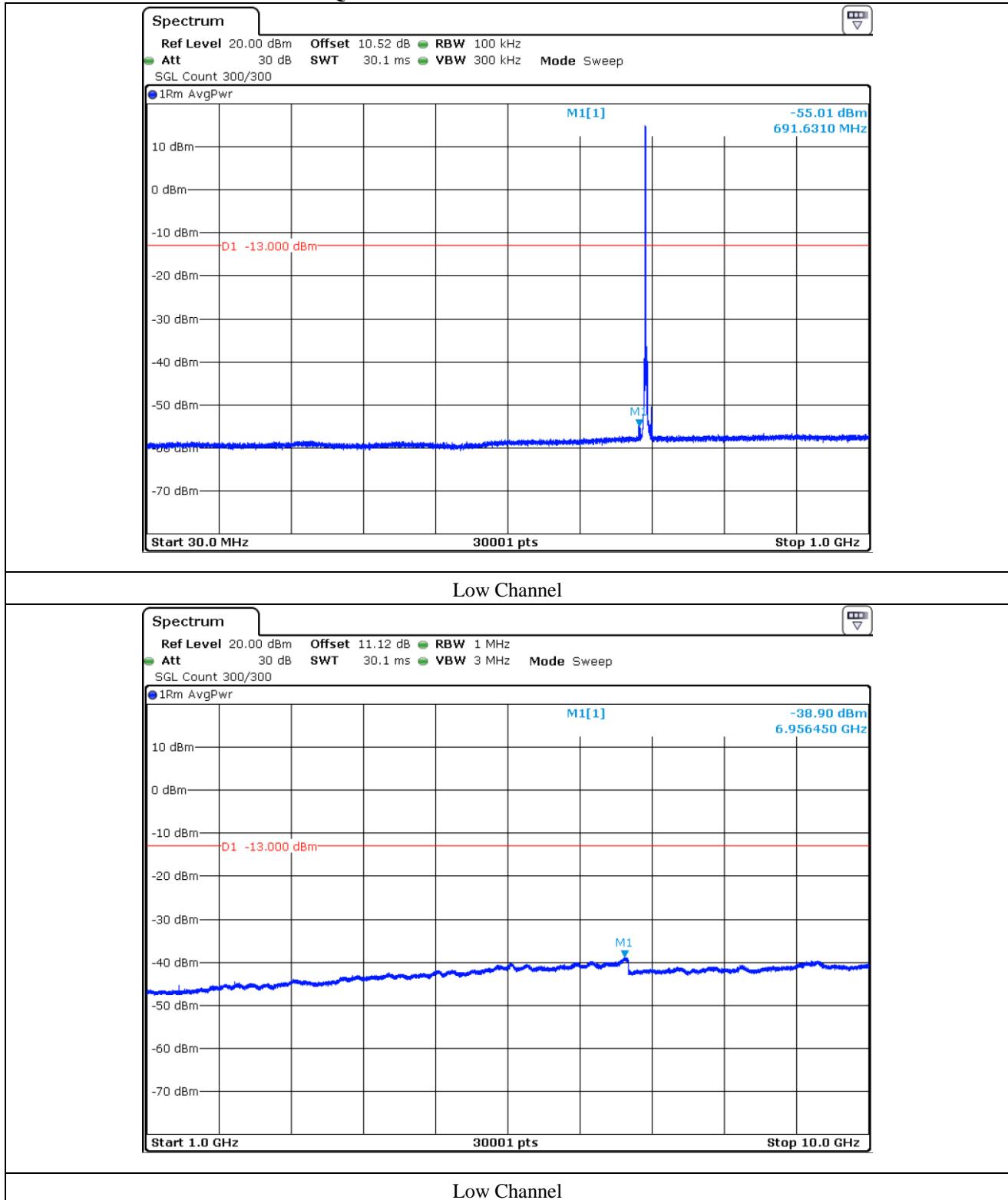


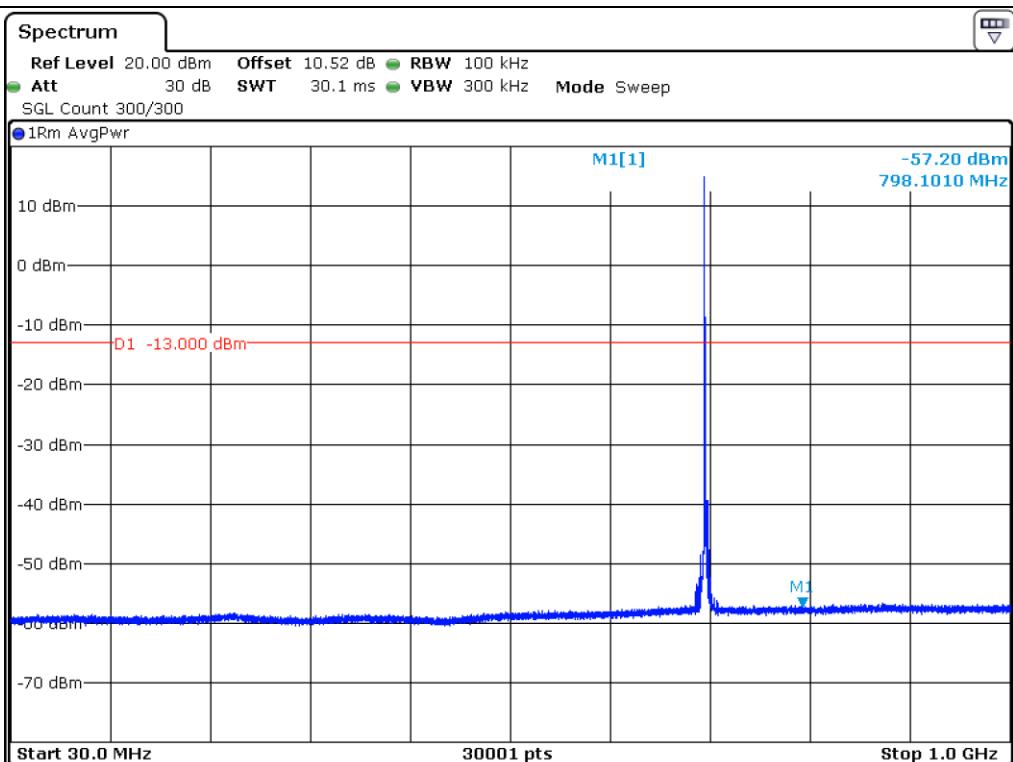
### High Channel



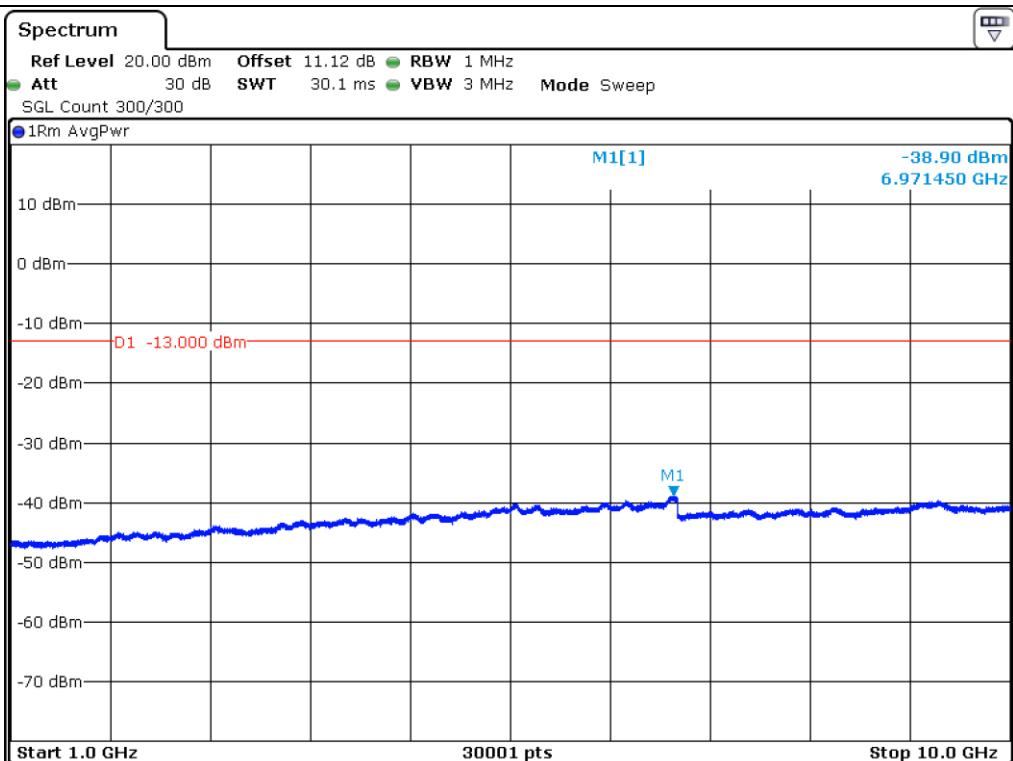
### High Channel

### 14.5.3 Test data for LTE Band 12 QPSK





### Middle Channel



### Middle Channel