

# TEST REPORT

of

FCC Part 2 Subpart J, Part 27 Subpart C

FCC ID: YZP-OA1000

Equipment Under Test : Telematics Module  
Model Name : LTD-OA1000  
Applicant : LG Innotek Co., Ltd.  
Manufacturer : LG Innotek Co., Ltd.  
Date of Receipt : 2024.05.09  
Date of Test(s) : 2024.05.13 ~ 2024.07.05  
Date of Issue : 2024.07.11

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

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- 2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.
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Tested by:



Youngbin Kim

Technical  
Manager:



Jinhyoung Cho

**SGS Korea Co., Ltd. Gunpo Laboratory**



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## 1. General Information

### 1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)  
- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807  
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807  
- Designation number: KR0150

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### 1.2. Details of Applicant

Applicant : LG Innotek Co., Ltd.  
Address : 30, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796  
Contact Person : Jeong, In-chang  
Phone No. : +82 62 950 0332

### 1.3. Details of Manufacturer

Company : LG Innotek Co., Ltd.  
Address : 30, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796  
Factory 1 : LG Innotek Co., Ltd.  
Factory 1 Address : 26, Hanamsandan 5beon-ro, Gwangsan-gu, Gwangju, Republic of Korea, 62229  
Factory 2 : PT. LG INNOTEK INDONESIA  
Factory 2 Address : Bekasi International Industrial Estate, Blok C8 No.12 & 12A,  
Desa Cibat, Cikarang Selatan, Bekasi 17750, Jawa Barat - Indonesia

### 1.4. Description of EUT

|                      |                                    |
|----------------------|------------------------------------|
| Kind of Product      | Telematics Module                  |
| Model Name           | LTD-OA1000                         |
| Serial Number        | Conducted: C-01<br>Radiated: R-01  |
| Power Supply         | DC 4.0 V                           |
| Rated Power          | LTE Band 41: 23 dBm                |
| Frequency Range      | LTE Band 41: 2 496 MHz ~ 2 690 MHz |
| Modulation Technique | QPSK, 16QAM                        |
| Antenna Type         | Dipole Antenna                     |
| Antenna Gain*        | 2 496 MHz ~ 2 690 MHz : 3.97 dBi   |
| H/W Version          | 0                                  |
| S/W Version          | 01C_D20SKUS                        |
| FVIN                 | N/A                                |

### 1.5. Test Equipment List

| Equipment              | Manufacturer                | Model                                | S/N                    | Cal. Date     | Cal. Interval | Cal. Due      |
|------------------------|-----------------------------|--------------------------------------|------------------------|---------------|---------------|---------------|
| Spectrum Analyzer      | R&S                         | FSV30                                | 100955                 | Mar. 08, 2024 | Annual        | Mar. 08, 2025 |
| Signal Generator       | R&S                         | SMBV100A                             | 255834                 | Dec. 01, 2023 | Annual        | Dec. 01, 2024 |
| DC Power Supply        | R&S                         | HMP2020                              | 102133                 | Apr. 23, 2024 | Annual        | Apr. 23, 2025 |
| Communication Analyzer | Anritsu                     | MT8821C                              | 6262094325             | Mar. 05, 2024 | Annual        | Mar. 05, 2025 |
| Temperature Chamber    | ESPEC CORP.                 | PL-2J                                | 15004184               | Jun. 03, 2024 | Annual        | Jun. 03, 2025 |
| Directional Coupler    | KRYTAR                      | 152613                               | 140972                 | Jul. 04, 2023 | Annual        | Jul. 04, 2024 |
| BRIDGE Coupler         | MARK MICROWAVE INC          | CBR16-0012                           | 1542                   | May 13, 2024  | Annual        | May 13, 2025  |
| Power Sensor           | Anritsu                     | MA2411B                              | 1207272                | May 29, 2024  | Annual        | May 29, 2025  |
| Power Meter            | Anritsu                     | ML2495A                              | 1223004                | May 29, 2024  | Annual        | May 29, 2025  |
| Power Splitter         | Weinschel                   | 1534                                 | 499                    | Nov. 03, 2023 | Annual        | Nov. 03, 2024 |
| Spectrum Analyzer      | R&S                         | FSW43                                | 100637                 | Apr. 08, 2024 | Annual        | Apr. 08, 2025 |
| Low Pass Filter        | Mini-Circuits               | NLP-1200+                            | V 8979400903-1         | May 17, 2024  | Annual        | May 17, 2025  |
| High Pass Filter       | Wainwright Instrument GmbH  | WHKX10-900-1000-18000-40SS           | 7                      | Feb. 27, 2024 | Annual        | Feb. 27, 2025 |
| High Pass Filter       | Wainwright Instrument GmbH  | WHKX3.0/18G-6SS                      | 51                     | Jun. 14, 2023 | Annual        | Jun. 14, 2024 |
| High Pass Filter       | Wainwright Instrument GmbH  | WHNX7.5/26.5G-6SS                    | 11                     | Oct. 17, 2023 | Annual        | Oct. 17, 2024 |
| Preamplifier           | H.P.                        | 8447F                                | 2944A03909             | Aug. 04, 2023 | Annual        | Aug. 04, 2024 |
| Preamplifier           | R&S                         | SCU 18F                              | 101058                 | Dec. 07, 2023 | Annual        | Dec. 07, 2024 |
| Preamplifier           | MITEQ Inc.                  | JS44-18004000-35-8P                  | 1546891                | Oct. 06, 2023 | Annual        | Oct. 06, 2024 |
| Test Receiver          | R&S                         | ESU26                                | 100109                 | Jan. 16, 2024 | Annual        | Jan. 16, 2025 |
| Loop Antenna           | Schwarzbeck Mess-Elektronik | FMZB 1519                            | 1519-039               | Aug. 21, 2023 | Biennial      | Aug. 21, 2025 |
| Bilog Antenna          | Schwarzbeck Mess-Elektronik | VULB9163                             | 9163-437               | May 29, 2024  | Biennial      | May 29, 2026  |
| Horn Antenna           | R&S                         | HF906                                | 100326                 | Feb. 19, 2024 | Annual        | Feb. 19, 2025 |
| Horn Antenna           | Schwarzbeck Mess-Elektronik | BBHA 9170                            | 9170-540               | Dec. 05, 2023 | Annual        | Dec. 05, 2024 |
| Antenna Master         | Innco systems GmbH          | MA4640-XP-ET                         | MA4640/536/383 30516/L | N.C.R.        | N/A           | N.C.R.        |
| Turn Table             | Innco systems GmbH          | DS 1200S                             | N/A                    | N.C.R.        | N/A           | N.C.R.        |
| Controller             | Innco systems GmbH          | CONTROLLER CO3000-4P                 | CO3000/963/383 30516/L | N.C.R.        | N/A           | N.C.R.        |
| Anechoic Chamber       | SY Corporation              | L × W × H<br>(9.6 m × 6.4 m × 6.6 m) | N/A                    | N.C.R.        | N/A           | N.C.R.        |
| Coaxial Cable          | RADIALL                     | TESTPRO 3                            | 182287                 | Apr. 12, 2024 | Semi-Annual   | Oct. 12, 2024 |
| Coaxial Cable          | RADIALL                     | TESTPRO 3                            | 182288                 | Apr. 12, 2024 | Semi-Annual   | Oct. 12, 2024 |
| Coaxial Cable          | RADIALL                     | TESTPRO 3                            | 182291                 | Apr. 12, 2024 | Semi-Annual   | Oct. 12, 2024 |
| Coaxial Cable          | RF ONE                      | NMST-13A26-NMST-5m                   | TPC2402190004          | Apr. 03, 2024 | Semi-Annual   | Oct. 03, 2024 |
| Coaxial Cable          | RF ONE                      | NMST-13A26-NMST-10m                  | TPC2402190001          | Apr. 03, 2024 | Semi-Annual   | Oct. 03, 2024 |

**Note;**

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

## 1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC Part 2 and 27 |                                       |          |
|-------------------------------------|---------------------------------------|----------|
| Section in FCC                      | Test Item(s)                          | Result   |
| §2.1046<br>§27.50(h)(2)             | E.R.P. / E.I.R.P.                     | Complied |
| §27.53(m)(4)                        | Radiated Spurious Emissions           | Complied |
| §2.1046                             | Conducted Output Power                | Complied |
| §2.1049                             | Occupied Bandwidth                    | Complied |
| §27.50(d)(5)                        | Peak-Average Ratio                    | Complied |
| §27.53(m)(4)                        | Spurious Emission at Antenna Terminal | Complied |
| §27.53(m)(4)                        | Band Edge and Emission Mask           | Complied |
| §2.1055<br>§27.54                   | Frequency Stability                   | Complied |

## 1.7. Sample Calculation for Offset

Where relevant, the following sample calculation is provided:

### 1.7.1. Conducted Test

Offset value (dB) = Directional Coupler (dB) + Cable loss (dB)

### 1.7.2. Radiation test

- E.I.R.P. (dB m) = Measured level (dB $\mu$ V) + Antenna factor (dB/m) + Cable loss (dB) + 20 Log D - 104.8;  
where D is the measurement distance in meters.
- E.R.P. (dB m) = E.I.R.P. (dB m) - 2.15 (dB)

## 1.8. Worst Case Configuration and Mode

The worst-case is based on the conducted output power measurement investigation results.

Output power measurements were measured on QPSK and 16QAM modulations.

All testing was performed using QPSK and 16QAM modulations. However, the spurious radiated emission and spurious at antenna terminal were only performed on bandwidth and RB offset (with RB size 1) with the highest conducted power in QPSK.

The Peak-Average Ratio test was measured on 16QAM modulations.

The radiation test of the EUT was investigated in three orthogonal orientations X, Y, and Z, and the worst case data is reported.

## 1.9. Measurement Configuration

| Test Items                                                 | Band | Test Channel |     |      | Bandwidth  |    |    |    | Modulation |       | RB # |      |      |
|------------------------------------------------------------|------|--------------|-----|------|------------|----|----|----|------------|-------|------|------|------|
|                                                            |      | Low          | Mid | High | 5          | 10 | 15 | 20 | QPSK       | 16QAM | 1    | Half | Full |
| Conducted Output Power                                     | 41   | V            | V   | V    | V          | V  | V  | V  | V          | V     | V    | V    | V    |
| Frequency Stability                                        | 41   | -            | V   | -    | V          | -  | -  | -  | V          | -     | -    | -    | V    |
| Occupied Bandwidth                                         | 41   | V            | V   | V    | V          | V  | V  | V  | V          | V     | -    | -    | V    |
| Peak-to-Average Ratio                                      | 41   | V            | V   | V    | V          | V  | V  | V  | V          | -     | -    | -    | V    |
| Band edge                                                  | 41   | V            | V   | V    | V          | V  | V  | V  | V          | V     | V    | -    | V    |
| Spurious at antenna terminal & Radiated Spurious Emissions | 41   | V            | V   | V    | Worst Case |    |    |    |            |       |      |      |      |

### 1.10 . Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Parameter                          | Uncertainty |         |
|------------------------------------|-------------|---------|
| Conducted Output Power             | 0.33 dB     |         |
| Occupied Bandwidth                 | 0.05 MHz    |         |
| Conducted Spurious Emissions       | 0.99 dB     |         |
| Peak to Average Ratio              | 0.66 dB     |         |
| Frequency Stability                | 116 Hz      |         |
| Radiated Emission, 9 kHz to 30 MHz | H           | 3.60 dB |
|                                    | V           | 3.60 dB |
| Radiated Emission, below 1 GHz     | H           | 4.60 dB |
|                                    | V           | 4.90 dB |
| Radiated Emission, above 1 GHz     | H           | 3.90 dB |
|                                    | V           | 3.80 dB |

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicate a 95 % level of confidence.

### 1.11. Test Report Revision

| Revision | Report Number        | Date of Issue | Description |
|----------|----------------------|---------------|-------------|
| 0        | F690501-RF-RTL005248 | 2024.07.11    | Initial     |

## 1.12. Emission Designator and Max Power

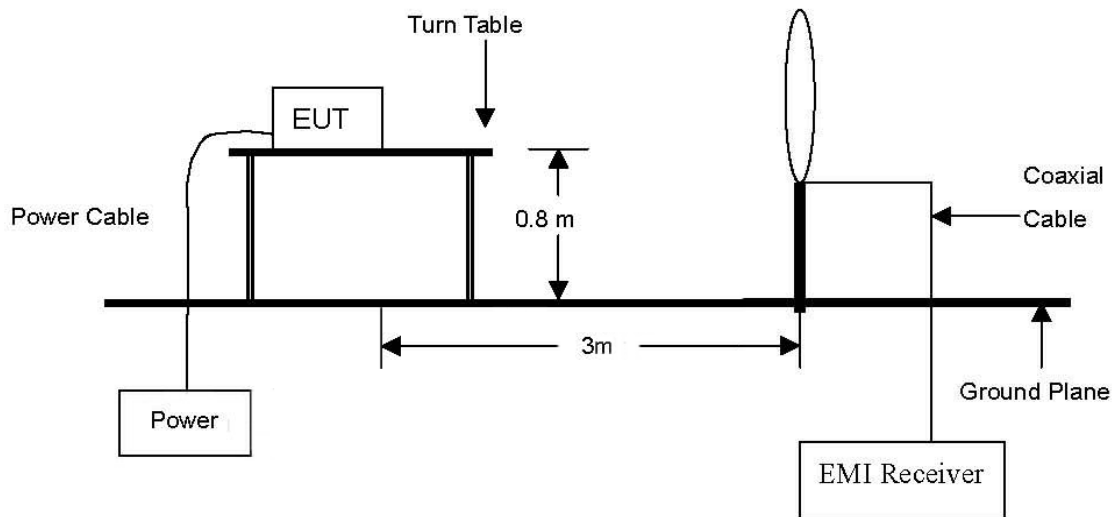
### LTE

| Band | Band width (MHz) | Modulation | Low Freq. (MHz) | Upper Freq. (MHz) | Conducted Average (dB m) | Ant. Gain (dB i) | E.R.P. / E.I.R.P. Average (dB m) | E.R.P. / E.I.R.P. Average (W) | Emission Designator |
|------|------------------|------------|-----------------|-------------------|--------------------------|------------------|----------------------------------|-------------------------------|---------------------|
| 41   | 5                | QPSK       | 2 498.5         | 2 687.5           | 23.37                    | 3.97             | 27.34                            | 0.542                         | 4M50G7D             |
|      |                  | 16QAM      |                 |                   | 22.46                    |                  | 26.43                            | 0.440                         | 4M51D7D             |
|      | 10               | QPSK       | 2 501.0         | 2 685.0           | 23.60                    |                  | 27.57                            | 0.571                         | 8M93G7D             |
|      |                  | 16QAM      |                 |                   | 22.48                    |                  | 26.45                            | 0.442                         | 8M93D7D             |
|      | 15               | QPSK       | 2 503.5         | 2 682.5           | 23.58                    |                  | 27.55                            | 0.569                         | 13M5G7D             |
|      |                  | 16QAM      |                 |                   | 22.69                    |                  | 26.66                            | 0.463                         | 13M5D7D             |
|      | 20               | QPSK       | 2 506.0         | 2 680.0           | 23.59                    |                  | 27.56                            | 0.570                         | 17M9G7D             |
|      |                  | 16QAM      |                 |                   | 22.69                    |                  | 26.66                            | 0.463                         | 17M9D7D             |

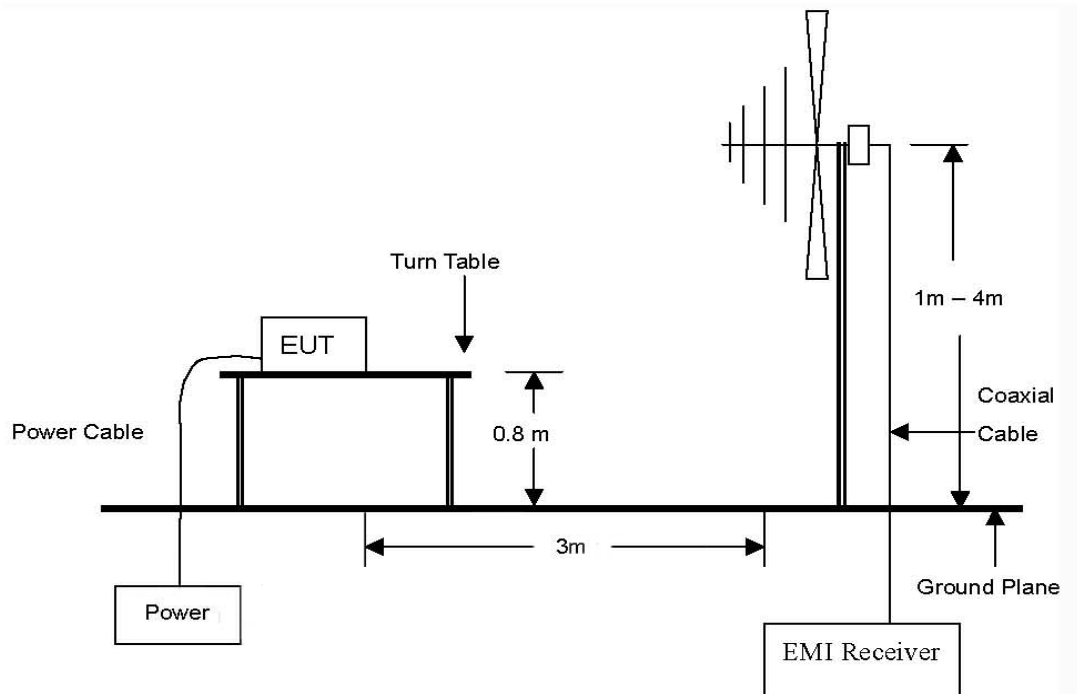
## 2. E.R.P. / E.I.R.P. & Radiated Spurious Emissions

### 2.1. Test setup

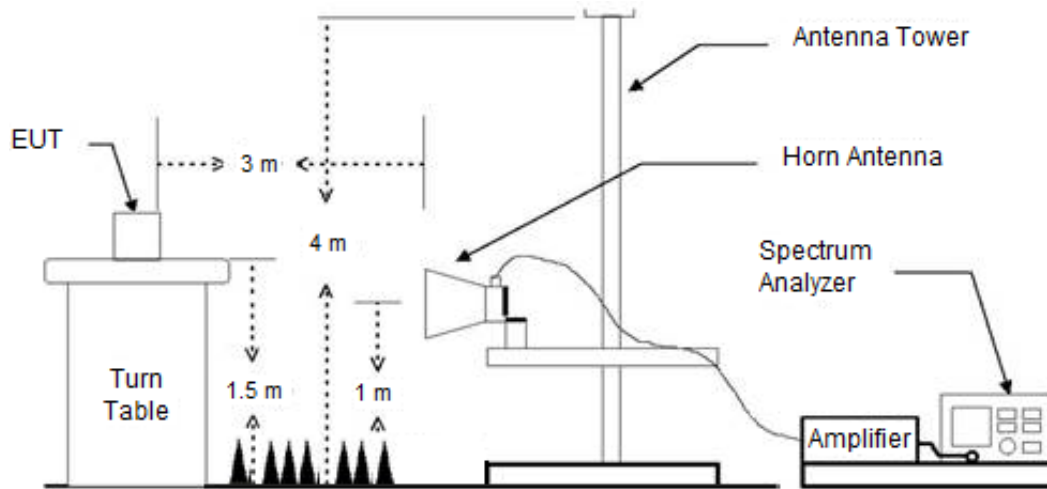
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 27 GHz Emissions.



## 2.2. Limit

### 2.2.1. Limit of E.R.P. / E.I.R.P.

- §27.50(h)(2), Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

### -2.2.2. Limit of Radiated Spurious Emissions

- §27.53(m)(4), for mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log_{10} (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log_{10} (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log_{10} (P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than  $43 + 10 \log_{10} (P)$  dB on all frequencies between 2 490.5 MHz and 2 496 MHz and  $55 + 10 \log_{10} (P)$  dB at or below 2 490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2 495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

## 2.3. Test Procedure

### 2.3.1. E.R.P. or E.I.R.P. from conducted RF output power

According to subclause 5.2.5.5 of ANSI C63.26-2015 E.R.P. and E.I.R.P. are defined as the product of the power supplied to the antenna and its gain.

The relevant equation for determining the E.R.P. or E.I.R.P. from the conducted RF output power measured using the guidance provided above is:

$$\text{E.R.P. or E.I.R.P.} = P_{\text{Meas}} + G_T$$

where:

E.R.P. or E.I.R.P. = effective radiated power or equivalent isotropically radiated power, respectively  
(expressed in the same units as  $P_{\text{Meas}}$ , typically dBW or dBm);

$P_{\text{Meas}}$  = measured transmitter output power or PSD, in dBm or dBW;

$G_T$  = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

### 2.3.2. Radiated Spurious Emissions

The test based on ANSI/TIA 603E: 2016 and ANSI C63.26-2015 and KDB 971168 D01 Power Meas License Digital Systems v03r01.

1. On a test site, the EUT shall be placed at 0.8 m or 1.5 m height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. Radiated spurious emissions measurement method was set as follows:  
RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz, VBW  $\geq 3 \times$  RBW,  
Detector = RMS, trace mode = max hold, per the guidelines of KDB 971168 D01 Power Meas License Digital Systems v03r01.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
11. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
12. The measurement shall be repeated with the test antenna orientated for horizontal polarization.

## 2.4. Test results

Ambient temperature :  $(23 \pm 1) ^\circ\text{C}$   
Relative humidity :  $47 \pm 2 \%$

### 2.4.1. E.R.P. / E.I.R.P.

#### LTE

| Band | Frequency (MHz) | Maximum Conducted Power (dB m) | Maximum Conducted Power (W) | Antenna Gain (dB i) | Maximum E.I.R.P. (dB m) | Maximum E.I.R.P. (W) | Maximum E.R.P. (dB m) | Maximum E.R.P. (W) | Limit           |
|------|-----------------|--------------------------------|-----------------------------|---------------------|-------------------------|----------------------|-----------------------|--------------------|-----------------|
| 41   | 2 496 ~ 2 690   | 23.60                          | 0.229                       | 3.97                | 27.57                   | 0.571                |                       |                    | 2 W<br>E.I.R.P. |

#### Remark;

1. E.I.R.P. (dB m) = Maximum Conducted Power (dB m) + Antenna Gain (dB i)
2. E.R.P. (dB m) = E.I.R.P. (dB m) - 2.15 (dB); where E.R.P. and E.I.R.P. are expressed in consistent units.

## 2.4.2. Radiated spurious emissions

### LTE band 41 (10 MHz - QPSK)

| Frequency (MHz)              | Measured Level (dBμV) | Ant. Pol. | AF (dB/m) | AMP+CL (dB) | E (dBμV/m) | CF (dB) | E.I.R.P. (dB m) | Limit (dB m) | Margin (dB) |
|------------------------------|-----------------------|-----------|-----------|-------------|------------|---------|-----------------|--------------|-------------|
| Low Channel (2 501.0 MHz)    |                       |           |           |             |            |         |                 |              |             |
| 5 002.04                     | 38.07                 | H         | 33.40     | -29.17      | 42.30      | -95.26  | -52.96          | -25          | 27.96       |
| 5 002.00                     | 37.71                 | V         | 33.40     | -29.17      | 41.94      | -95.26  | -53.32          | -25          | 28.32       |
| Above 5 100.00               | Not detected          | —         | —         | —           | —          | —       | —               | —            | —           |
| Middle Channel (2 593.0 MHz) |                       |           |           |             |            |         |                 |              |             |
| 5 185.96                     | 41.35                 | H         | 33.67     | -29.52      | 45.50      | -95.26  | <b>-49.76</b>   | -25          | 24.76       |
| 5 189.32                     | 36.89                 | V         | 33.68     | -29.63      | 40.94      | -95.26  | -54.32          | -25          | 29.32       |
| Above 5 200.00               | Not detected          | —         | —         | —           | —          | —       | —               | —            | —           |
| High Channel (2 685.0 MHz)   |                       |           |           |             |            |         |                 |              |             |
| 5 369.36                     | 34.56                 | H         | 34.04     | -27.62      | 40.98      | -95.26  | -54.28          | -25          | 29.28       |
| 5 370.00                     | 34.31                 | V         | 34.04     | -27.59      | 40.76      | -95.26  | -54.50          | -25          | 29.50       |
| Above 5 400.00               | Not detected          | —         | —         | —           | —          | —       | —               | —            | —           |

#### Remark;

1. AF = Antenna Factor, CL = Cable Loss, CF = Conversion Factor.
2.  $E \text{ (dB}\mu\text{V/m)} = \text{Measured Level (dB}\mu\text{V)} + \text{Antenna Factor (dB/m)} + \text{AMP (dB)} + \text{Cable Loss (dB)}$ .
3.  $E.I.R.P. \text{ (dB m)} = E \text{ (dB}\mu\text{V/m)} + CF \text{ (dB)}$ .
4.  $E.R.P. \text{ (dB m)} = E \text{ (dB}\mu\text{V/m)} + CF \text{ (dB)} - 2.15 \text{ (dB)}$ ; where E.R.P. and E.I.R.P. are expressed in consistent units.
5.  $CF \text{ (dB)} = 20 \log D - 104.8$ ; where D is the measurement distance in meters, According to KDB 971168 D01 v03r01 5.8.4.
6. The frequency spectrum is examined from 9 kHz to the 10<sup>th</sup> harmonic of the fundamental frequency of the transmitter. No other spurious and harmonic emissions were reported greater than listed emissions above table.

### 3. Conducted Output Power

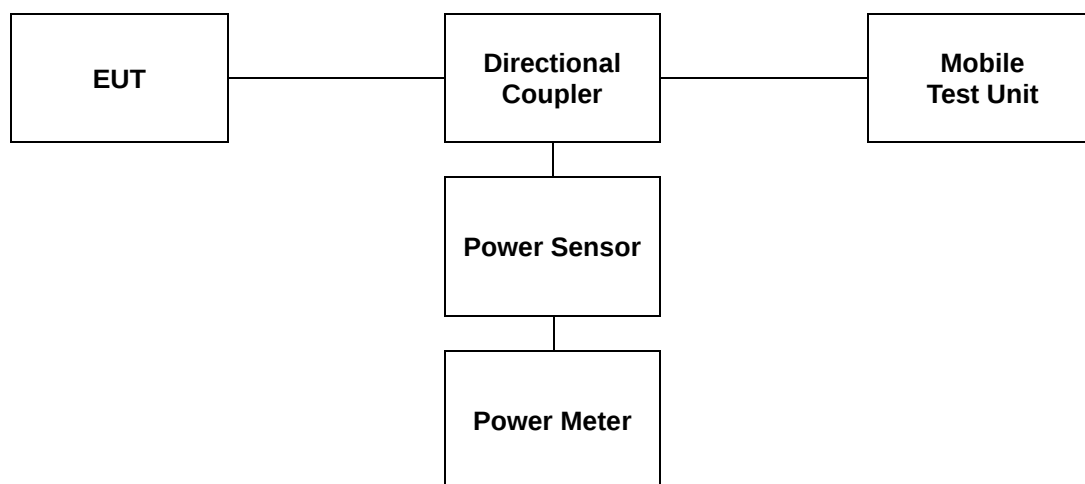
#### 3.1. Limit

CFR 47, Section FCC §2.1046

#### 3.2. Test Procedure

Output power shall be measured at the RF output terminals for all configurations.

1. The RF output of the transmitter was connected to the input of the mobile test unit in order to establish communication with the EUT.
2. The EUT was set up for the max. output power with pseudo random data modulation by using mobile test unit parameters.
3. The measurement performed using a wideband RF power meter.
4. This EUT was tested under all configurations and the highest power was investigated and reported.



### 3.3. Test Result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 ± 2 %

| LTE Band 41        |            |            |              |                        |              |                        |              |                        |       |
|--------------------|------------|------------|--------------|------------------------|--------------|------------------------|--------------|------------------------|-------|
| Bandwidth<br>(MHz) | Modulation | RB<br>Size | RB<br>Offset | Conducted Output Power |              |                        |              |                        |       |
|                    |            |            |              | 39675<br>(2 498.5 MHz) |              | 40620<br>(2 593.0 MHz) |              | 41565<br>(2 687.5 MHz) |       |
|                    |            |            |              | (dB m)                 | (W)          | (dB m)                 | (W)          | (dB m)                 | (W)   |
| 5                  | QPSK       | 1          | 0            | 23.30                  | 0.214        | 23.28                  | 0.213        | 23.26                  | 0.212 |
|                    |            | 1          | 12           | 23.35                  | 0.216        | 23.34                  | 0.216        | 23.25                  | 0.211 |
|                    |            | 1          | 24           | <b>23.37</b>           | <b>0.217</b> | 23.35                  | 0.216        | 23.27                  | 0.212 |
|                    |            | 12         | 0            | 22.41                  | 0.174        | 22.44                  | 0.175        | 22.41                  | 0.174 |
|                    |            | 12         | 6            | 22.39                  | 0.173        | 22.47                  | 0.177        | 22.43                  | 0.175 |
|                    |            | 12         | 13           | 22.39                  | 0.173        | 22.49                  | 0.177        | 22.39                  | 0.173 |
|                    |            | 25         | 0            | 22.37                  | 0.173        | 22.44                  | 0.175        | 22.35                  | 0.172 |
|                    | 16QAM      | 1          | 0            | 22.42                  | 0.175        | 22.46                  | 0.176        | 22.39                  | 0.173 |
|                    |            | 1          | 12           | 22.40                  | 0.174        | 22.45                  | 0.176        | 22.40                  | 0.174 |
|                    |            | 1          | 24           | 22.42                  | 0.175        | <b>22.46</b>           | <b>0.176</b> | 22.40                  | 0.174 |
|                    |            | 12         | 0            | 21.34                  | 0.136        | 21.44                  | 0.139        | 21.53                  | 0.142 |
|                    |            | 12         | 6            | 21.39                  | 0.138        | 21.47                  | 0.140        | 21.49                  | 0.141 |
|                    |            | 12         | 13           | 21.40                  | 0.138        | 21.50                  | 0.141        | 21.45                  | 0.140 |
|                    |            | 25         | 0            | 21.42                  | 0.139        | 21.49                  | 0.141        | 21.50                  | 0.141 |
| LTE Band 41        |            |            |              |                        |              |                        |              |                        |       |
| Bandwidth<br>(MHz) | Modulation | RB<br>Size | RB<br>Offset | Conducted Output Power |              |                        |              |                        |       |
|                    |            |            |              | 39700<br>(2 501.0 MHz) |              | 40620<br>(2 593.0 MHz) |              | 41540<br>(2 685.0 MHz) |       |
|                    |            |            |              | (dB m)                 | (W)          | (dB m)                 | (W)          | (dB m)                 | (W)   |
| 10                 | QPSK       | 1          | 0            | 23.21                  | 0.209        | <b>23.60</b>           | <b>0.229</b> | 23.25                  | 0.211 |
|                    |            | 1          | 25           | 23.22                  | 0.210        | 23.29                  | 0.214        | 23.18                  | 0.208 |
|                    |            | 1          | 49           | 23.22                  | 0.210        | 23.27                  | 0.212        | 23.17                  | 0.207 |
|                    |            | 25         | 0            | 22.35                  | 0.172        | 22.35                  | 0.172        | 22.42                  | 0.175 |
|                    |            | 25         | 12           | 22.42                  | 0.175        | 22.56                  | 0.180        | 22.41                  | 0.174 |
|                    |            | 25         | 25           | 22.41                  | 0.174        | 22.47                  | 0.177        | 22.42                  | 0.175 |
|                    |            | 50         | 0            | 22.38                  | 0.173        | 22.49                  | 0.177        | 22.41                  | 0.174 |
|                    | 16QAM      | 1          | 0            | 22.37                  | 0.173        | <b>22.48</b>           | <b>0.177</b> | 22.42                  | 0.175 |
|                    |            | 1          | 25           | 22.37                  | 0.173        | 22.48                  | 0.177        | 22.31                  | 0.170 |
|                    |            | 1          | 49           | 22.36                  | 0.172        | 22.41                  | 0.174        | 22.32                  | 0.171 |
|                    |            | 25         | 0            | 21.42                  | 0.139        | 21.45                  | 0.140        | 21.43                  | 0.139 |
|                    |            | 25         | 12           | 21.33                  | 0.136        | 21.47                  | 0.140        | 21.44                  | 0.139 |
|                    |            | 25         | 25           | 21.45                  | 0.140        | 21.45                  | 0.140        | 21.44                  | 0.139 |
|                    |            | 50         | 0            | 21.44                  | 0.139        | 21.54                  | 0.143        | 21.43                  | 0.139 |
| LTE Band 41        |            |            |              |                        |              |                        |              |                        |       |
| Bandwidth<br>(MHz) | Modulation | RB<br>Size | RB<br>Offset | Conducted Output Power |              |                        |              |                        |       |
|                    |            |            |              | 39725<br>(2 503.5 MHz) |              | 40620<br>(2 593.0 MHz) |              | 41515<br>(2 682.5 MHz) |       |
|                    |            |            |              | (dB m)                 | (W)          | (dB m)                 | (W)          | (dB m)                 | (W)   |
| 15                 | QPSK       | 1          | 0            | 23.40                  | 0.219        | 23.44                  | 0.221        | 23.34                  | 0.216 |
|                    |            | 1          | 36           | 23.32                  | 0.215        | 23.34                  | 0.216        | 23.31                  | 0.214 |
|                    |            | 1          | 74           | 23.49                  | 0.223        | <b>23.55</b>           | <b>0.226</b> | 23.45                  | 0.221 |
|                    |            | 36         | 0            | 22.51                  | 0.178        | 22.55                  | 0.180        | 22.53                  | 0.179 |
|                    |            | 36         | 18           | 22.41                  | 0.174        | 22.47                  | 0.177        | 22.60                  | 0.182 |
|                    |            | 36         | 37           | 22.45                  | 0.176        | 22.48                  | 0.177        | 22.55                  | 0.180 |
|                    |            | 75         | 0            | 22.55                  | 0.180        | 22.62                  | 0.183        | 22.57                  | 0.181 |
|                    | 16QAM      | 1          | 0            | 22.54                  | 0.179        | 22.63                  | 0.183        | 22.48                  | 0.177 |
|                    |            | 1          | 36           | 22.46                  | 0.176        | 22.55                  | 0.180        | 22.48                  | 0.177 |
|                    |            | 1          | 74           | 22.63                  | 0.183        | <b>22.69</b>           | <b>0.186</b> | 22.54                  | 0.179 |
|                    |            | 36         | 0            | 21.45                  | 0.140        | 21.59                  | 0.144        | 21.59                  | 0.144 |
|                    |            | 36         | 18           | 21.61                  | 0.145        | 21.67                  | 0.147        | 21.64                  | 0.146 |
|                    |            | 36         | 37           | 21.56                  | 0.143        | 21.65                  | 0.146        | 21.46                  | 0.140 |
|                    |            | 75         | 0            | 21.44                  | 0.139        | 21.56                  | 0.143        | 21.38                  | 0.137 |

| LTE Band 41        |            |            |              |                        |       |                        |              |                        |       |
|--------------------|------------|------------|--------------|------------------------|-------|------------------------|--------------|------------------------|-------|
| Bandwidth<br>(MHz) | Modulation | RB<br>Size | RB<br>Offset | Conducted Output Power |       |                        |              |                        |       |
|                    |            |            |              | 39750<br>(2 506.0 MHz) |       | 40620<br>(2 593.0 MHz) |              | 41490<br>(2 680.0 MHz) |       |
|                    |            |            |              | (dB m)                 | (W)   | (dB m)                 | (W)          | (dB m)                 | (W)   |
| 20                 | QPSK       | 1          | 0            | 23.38                  | 0.218 | 23.48                  | 0.223        | 23.34                  | 0.216 |
|                    |            | 1          | 50           | 23.42                  | 0.220 | <b>23.49</b>           | <b>0.223</b> | 23.35                  | 0.216 |
|                    |            | 1          | 99           | 23.35                  | 0.216 | 23.46                  | 0.222        | 23.36                  | 0.217 |
|                    |            | 50         | 0            | 22.45                  | 0.176 | 22.69                  | 0.186        | 22.55                  | 0.180 |
|                    |            | 50         | 25           | 22.51                  | 0.178 | 22.51                  | 0.178        | 22.60                  | 0.182 |
|                    |            | 50         | 13           | 22.55                  | 0.180 | 22.47                  | 0.177        | 22.60                  | 0.182 |
|                    |            | 100        | 0            | 22.49                  | 0.177 | 22.62                  | 0.183        | 22.55                  | 0.180 |
|                    | 16QAM      | 1          | 0            | 22.58                  | 0.181 | 22.62                  | 0.183        | 22.52                  | 0.179 |
|                    |            | 1          | 50           | 22.57                  | 0.181 | <b>22.69</b>           | <b>0.186</b> | 22.52                  | 0.179 |
|                    |            | 1          | 99           | 22.50                  | 0.178 | 22.60                  | 0.182        | 22.52                  | 0.179 |
|                    |            | 50         | 0            | 21.56                  | 0.143 | 21.55                  | 0.143        | 21.57                  | 0.144 |
|                    |            | 50         | 25           | 21.62                  | 0.145 | 21.68                  | 0.147        | 21.56                  | 0.143 |
|                    |            | 50         | 50           | 21.45                  | 0.140 | 21.49                  | 0.141        | 21.59                  | 0.144 |
|                    |            | 100        | 0            | 21.52                  | 0.142 | 21.67                  | 0.147        | 21.60                  | 0.145 |

## 4. Occupied Bandwidth

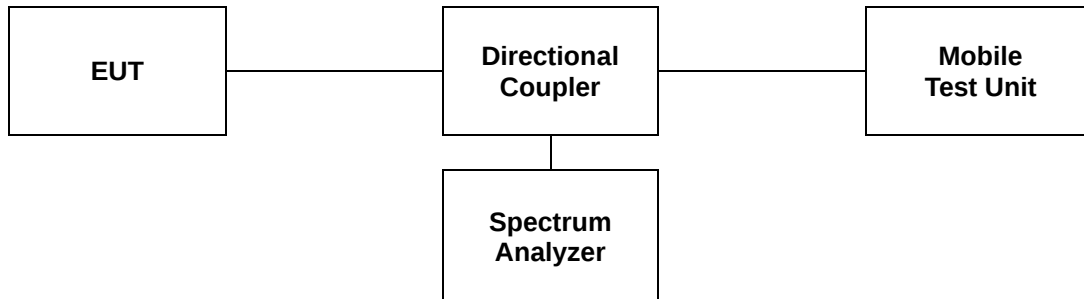
### 4.1. Limit

CFR 47, Section FCC §2.1049

### 4.2. Test Procedure

The test follows section 5.4.4 of ANSI C63.26-2015.

- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation. products including the emission skirts (typically a span of  $1.5 \times \text{OBW}$  is sufficient).
- The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be set  $\geq 3 \times \text{RBW}$ .
- Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- Set the detection mode to peak, and the trace mode to max-hold.
- If the instrument does not have a 99 % OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5 % of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5 % of the total is reached and record that frequency as the upper OBW frequency. The 99 % power OBW can be determined by computing the difference these two frequencies.
- The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).



### 4.3 Test Results

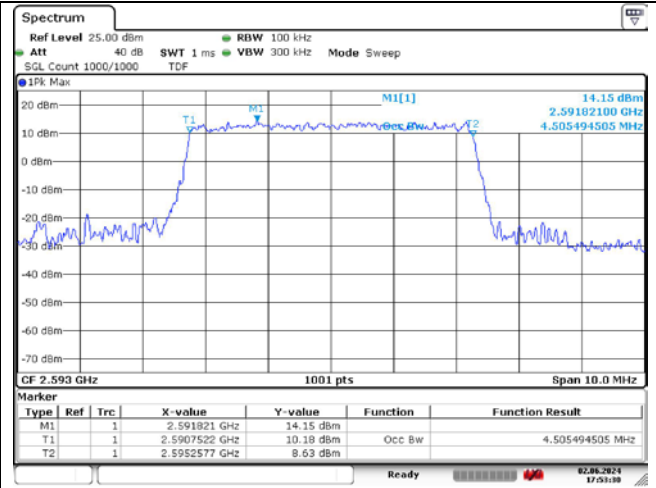
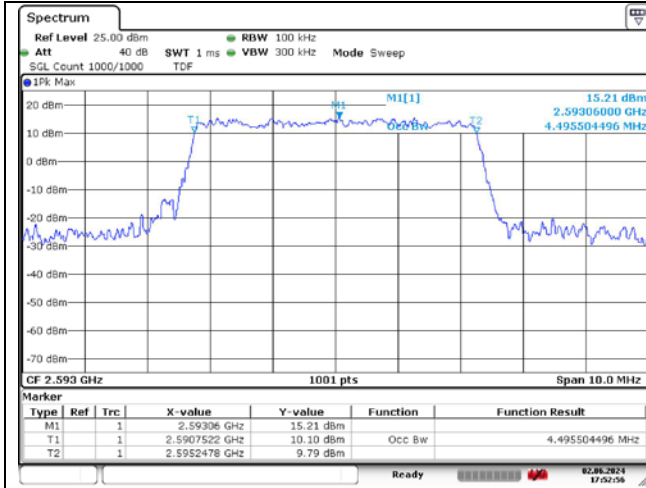
Ambient temperature :  $(23 \pm 1) ^\circ\text{C}$

Relative humidity :  $47 \pm 2 \%$

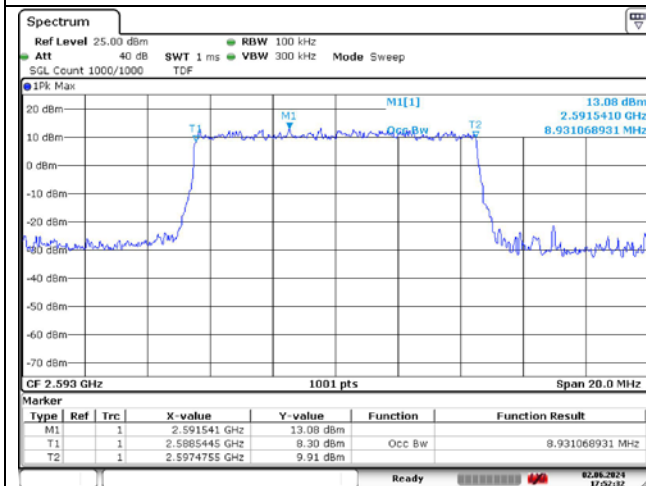
| Band | Bandwidth<br>(MHz) | Frequency<br>(MHz) | Occupied Bandwidth<br>(MHz) |        |
|------|--------------------|--------------------|-----------------------------|--------|
|      |                    |                    | QPSK                        | 16QAM  |
| 41   | 5                  | 2 593.0            | 4.496                       | 4.505  |
|      | 10                 |                    | 8.931                       | 8.931  |
|      | 15                 |                    | 13.487                      | 13.457 |
|      | 20                 |                    | 17.902                      | 17.902 |

## - Test plots

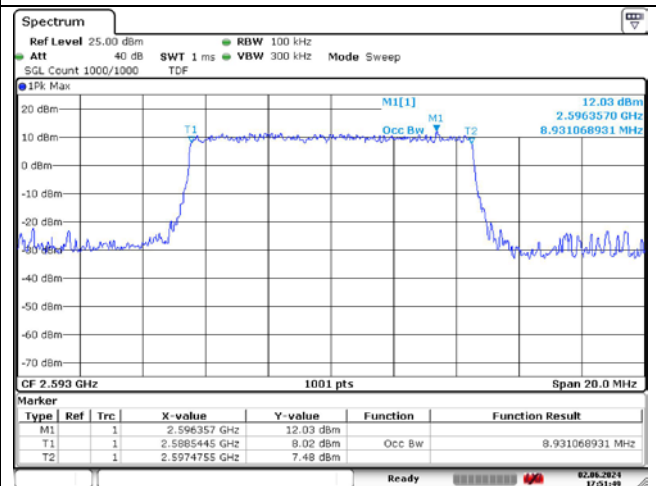
### LTE band 41



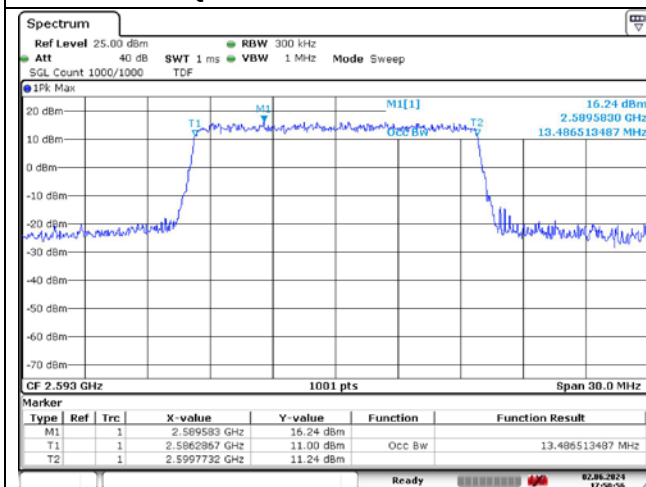
### 5 MHz QPSK Middle Channel - Full RB



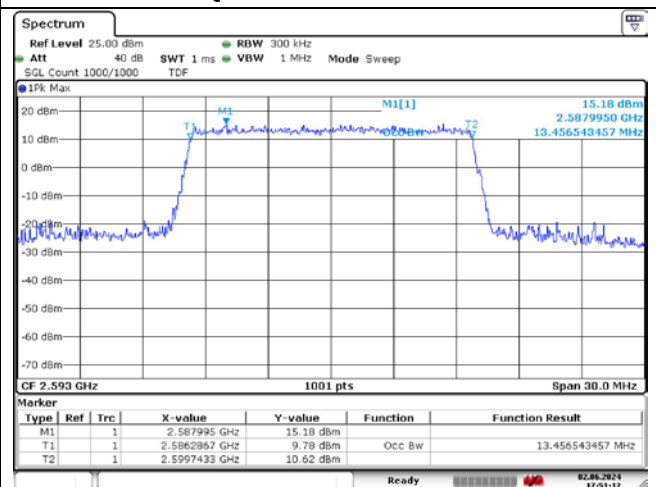
### 5 MHz 16QAM Middle Channel - Full RB



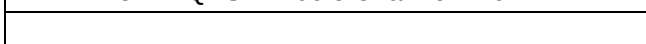
### 10 MHz QPSK Middle Channel - Full RB



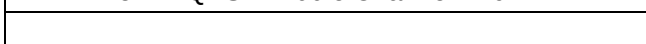
### 10 MHz 16QAM Middle Channel - Full RB

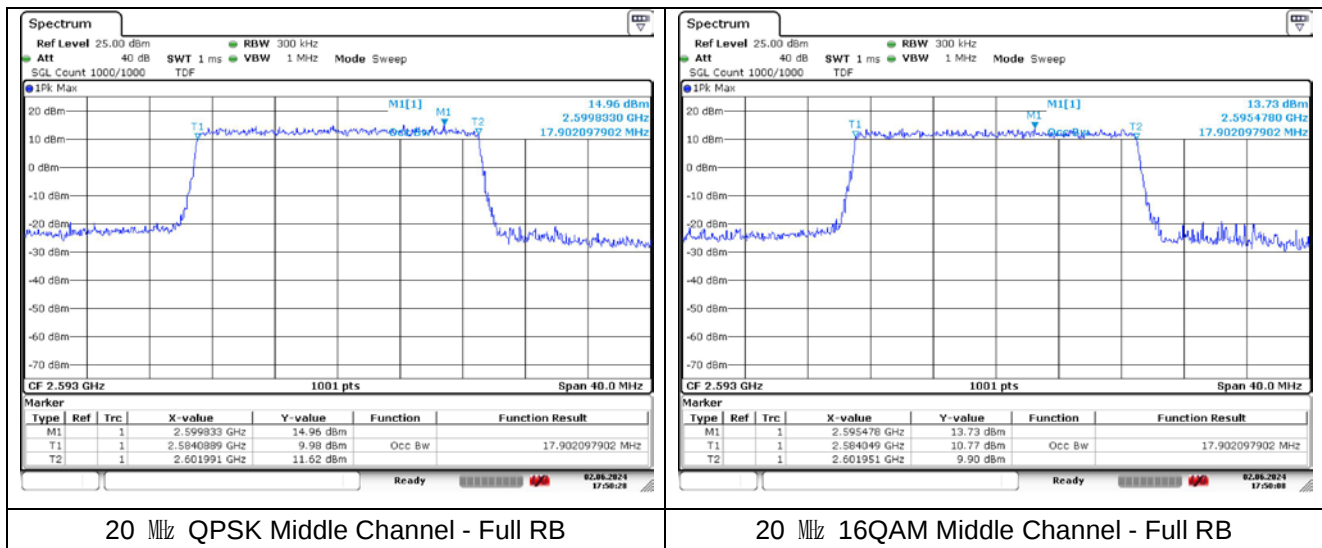


### 15 MHz QPSK Middle Channel - Full RB



### 15 MHz 16QAM Middle Channel - Full RB





## 5. Peak-Average Ratio

### 5.1. Limit

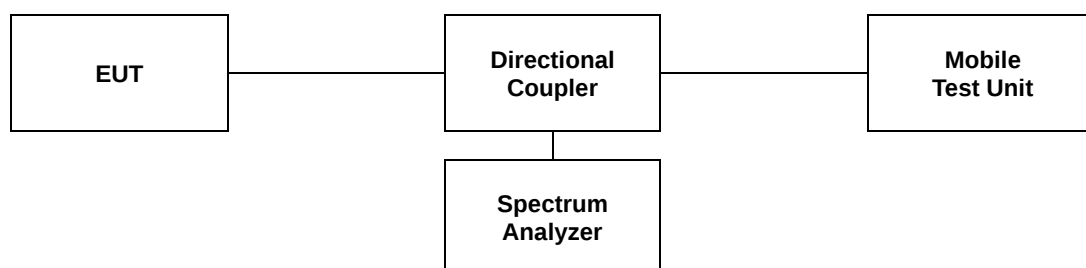
- §27.50(d)(5), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

### 5.2. Test Procedure

The test follows section 5.2.3.4 of ANSI C63.26-2015.

See instrumentation-specific application literature for further guidance regarding use of the CCDF capability. The following guidelines are offered for performing a CCDF measurement.

- 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 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.



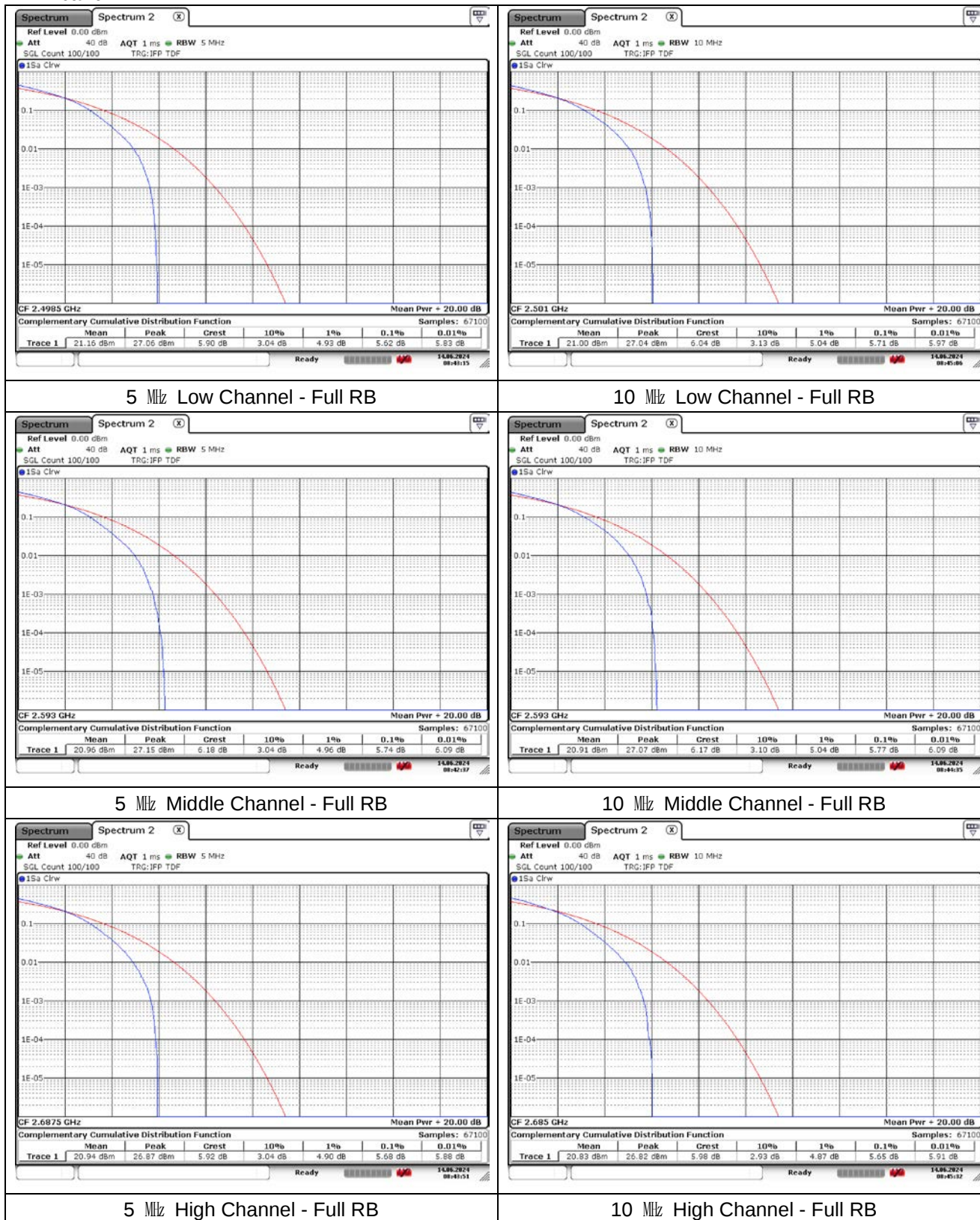
### 5.3 Test Results

Ambient temperature :  $(23 \pm 1) ^\circ\text{C}$   
 Relative humidity :  $47 \pm 2 \%$

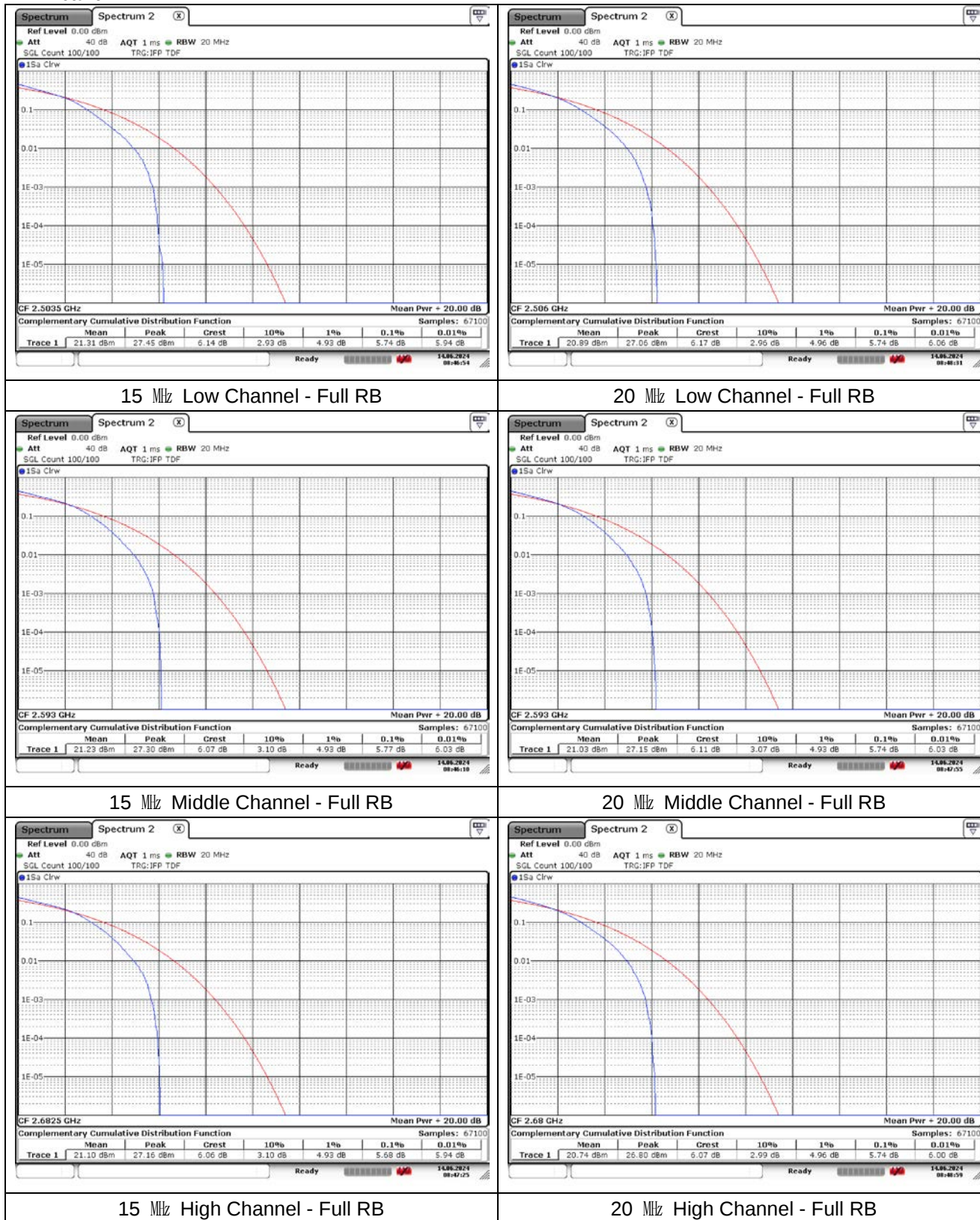
| Band | Bandwidth<br>(MHz) | Mode  | Frequency<br>(MHz) | PAR<br>(dB) |
|------|--------------------|-------|--------------------|-------------|
| 41   | 5                  | 16QAM | 2 498.5            | 5.62        |
|      |                    |       | 2 593.0            | 5.74        |
|      |                    |       | 2 687.5            | 5.68        |
|      | 10                 |       | 2 501.0            | 5.71        |
|      |                    |       | 2 593.0            | 5.77        |
|      |                    |       | 2 685.0            | 5.65        |
|      | 15                 |       | 2 503.5            | 5.74        |
|      |                    |       | 2 593.0            | 5.77        |
|      |                    |       | 2 682.5            | 5.68        |
|      | 20                 |       | 2 506.0            | 5.74        |
|      |                    |       | 2 593.0            | 5.74        |
|      |                    |       | 2 680.0            | 5.74        |

## - Test plots

### LTE band 41



### LTE band 41



## 6. Spurious Emissions at Antenna Terminal

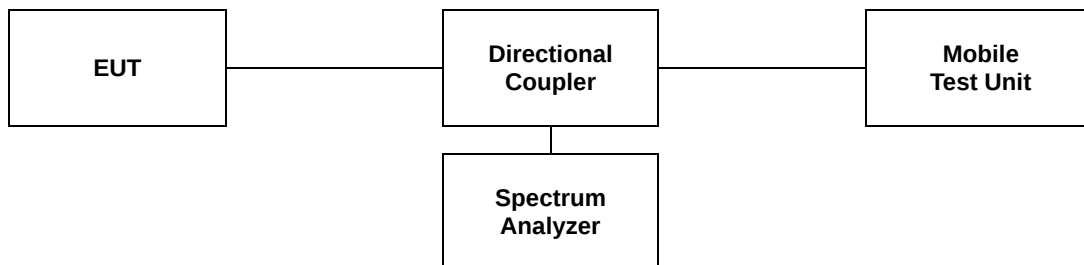
### 6.1. Limit

- §27.53(m)(4), for mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log_{10} (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log_{10} (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log_{10} (P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than  $43 + 10 \log_{10} (P)$  dB on all frequencies between 2 490.5 MHz and 2 496 MHz and  $55 + 10 \log_{10} (P)$  dB at or below 2 490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2 495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

## 6.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

1. Start frequency was set to 9 kHz and stop frequency was set to at least 10\* the fundamental frequency.
2. Detector = RMS.
3. Trace mode = Max hold.
4. Sweep time = Auto couple.
5. The trace was allowed to stabilize.
6. Please see notes below for RBW and VBW settings.
7. For plots showing conducted spurious emissions from 9 kHz to 27 GHz, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.



### Note;

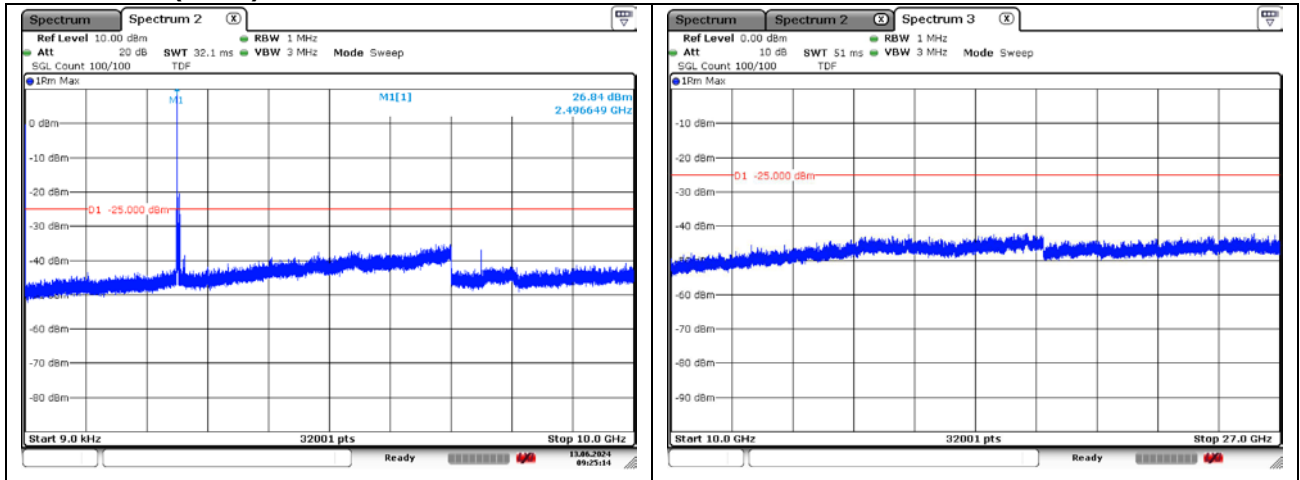
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two point, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

### 6.3. Test Results

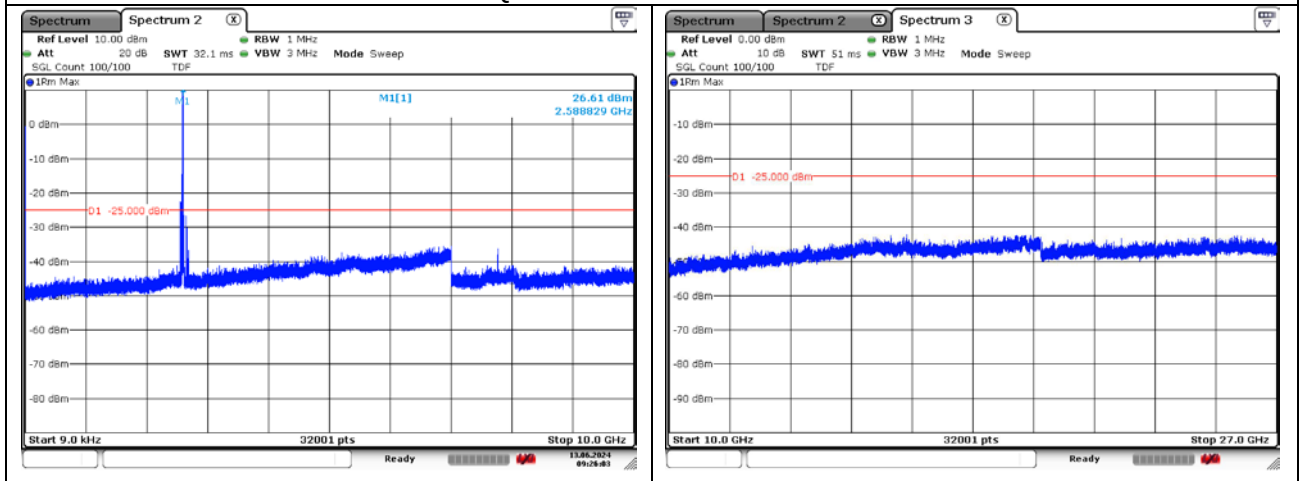
Ambient temperature :  $(23 \pm 1) ^\circ\text{C}$   
 Relative humidity :  $47 \pm 2 \%$

#### - Test plots

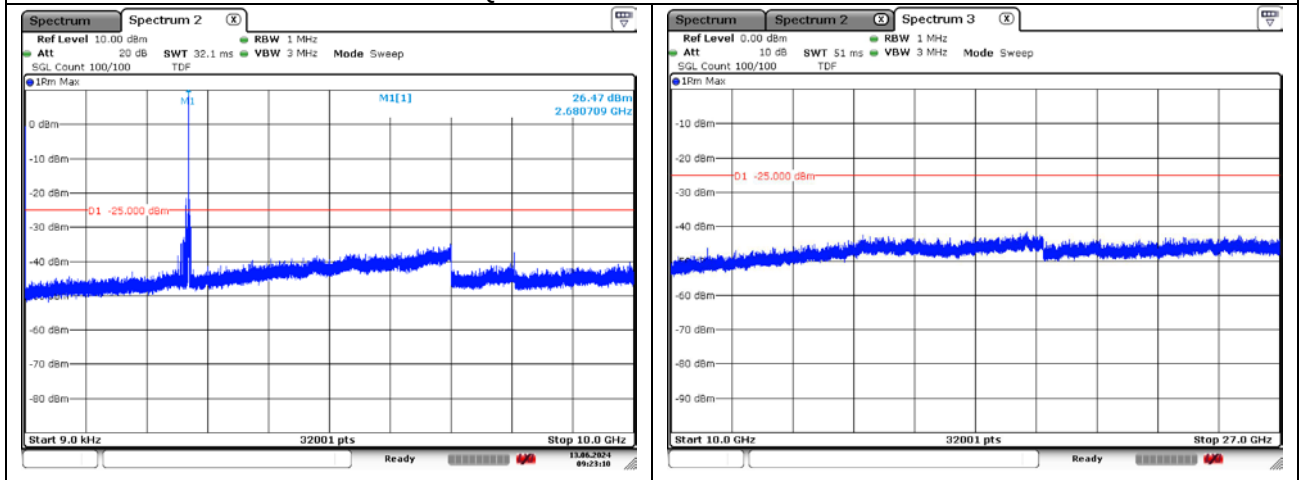
##### LTE band 41 (10 MHz)



##### QPSK Low Channel - 1 RB



##### QPSK Middle Channel - 1 RB



##### QPSK High Channel - 1 RB

## 7. Band Edge and Emission Mask

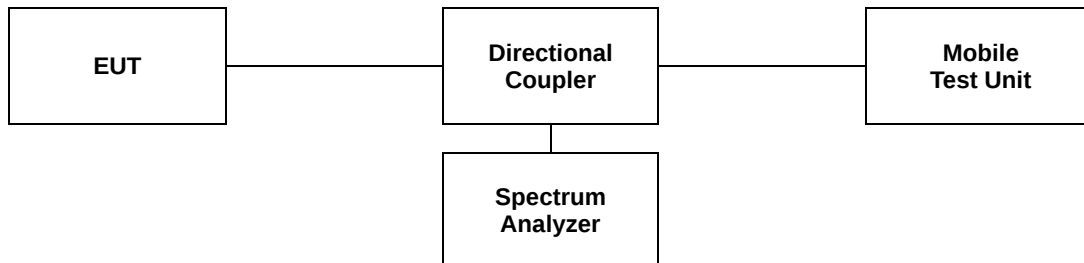
### 7.1. Limit

- §27.53(m)(4), for mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log_{10} (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log_{10} (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log_{10} (P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than  $43 + 10 \log_{10} (P)$  dB on all frequencies between 2 490.5 MHz and 2 496 MHz and  $55 + 10 \log_{10} (P)$  dB at or below 2 490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2 495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

### 7.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

- Span was set large enough so as to capture all out of band emissions near the band edge.
- $RBW \geq 1\%$  of OBW
- $VBW \geq 3 \times RBW$ .
- Detector = RMS.
- Trace mode = Average.
- Sweep time = Auto.
- The trace was allowed to stabilize.
- All path loss of frequency range was investigated and compensated to spectrum analyzer as TDF function.

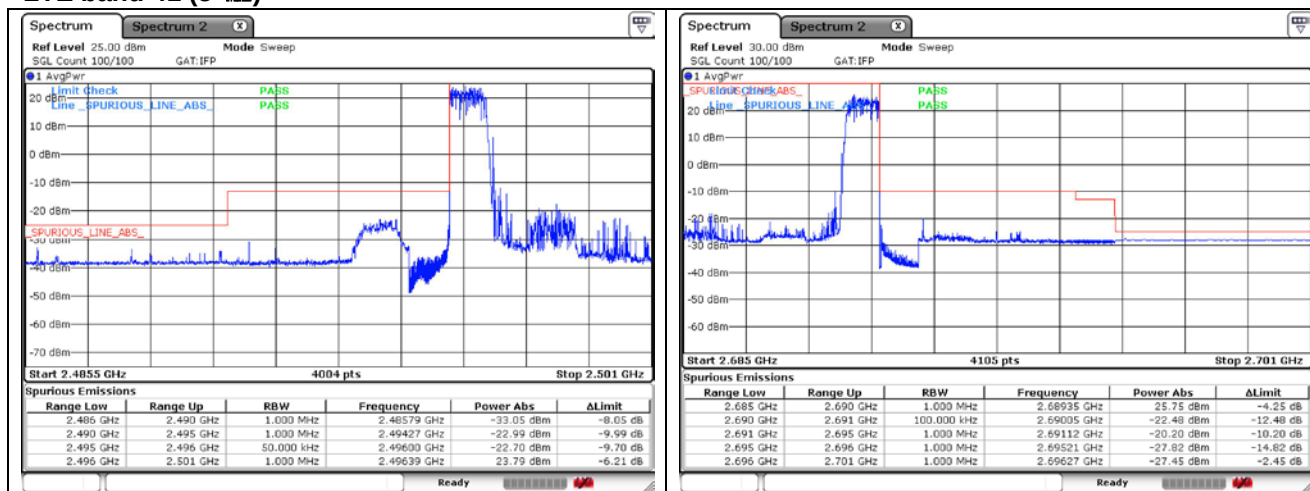


### 7.3. Test Results

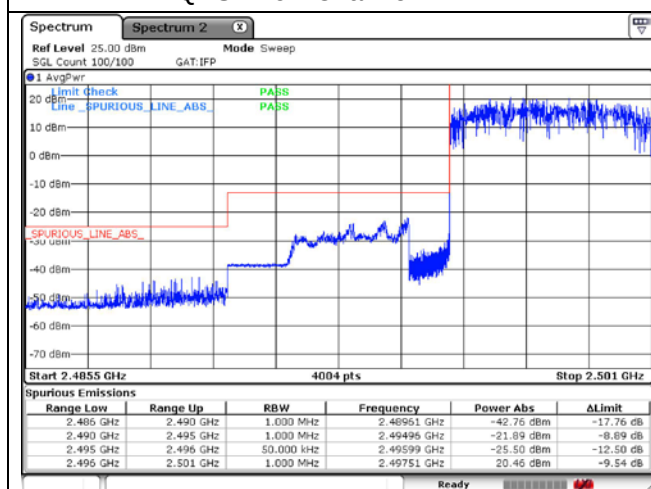
Ambient temperature :  $(23 \pm 1) ^\circ\text{C}$   
 Relative humidity :  $47 \pm 2 \%$

#### - Test plots

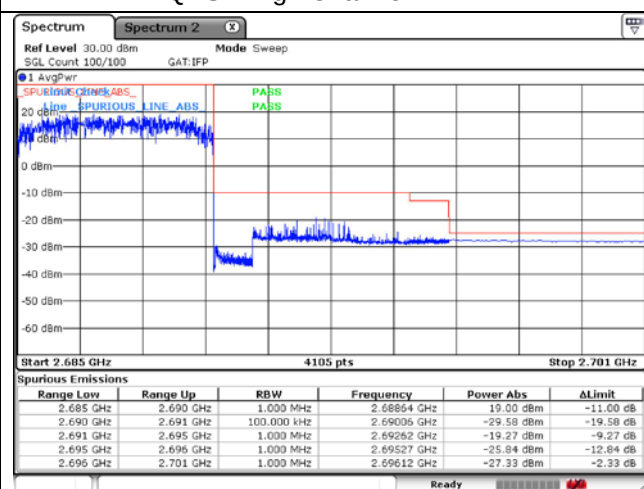
##### LTE band 41 (5 MHz)



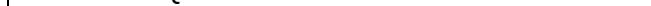
##### QPSK Low Channel - 1 RB



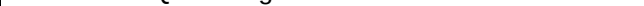
##### QPSK High Channel - 1 RB



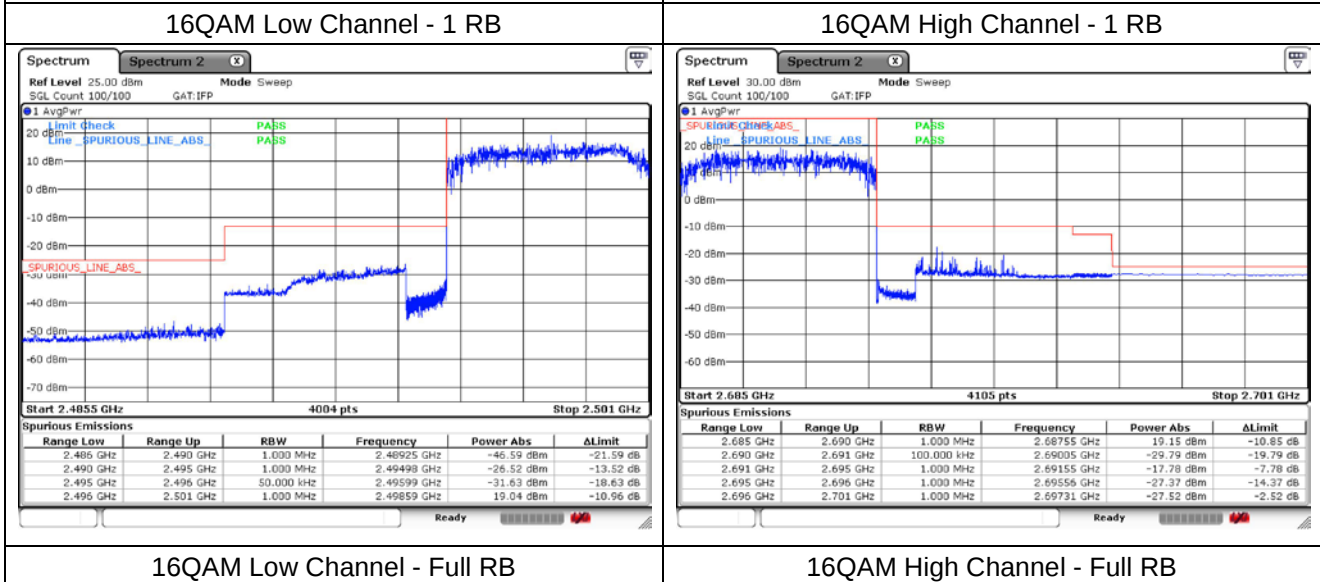
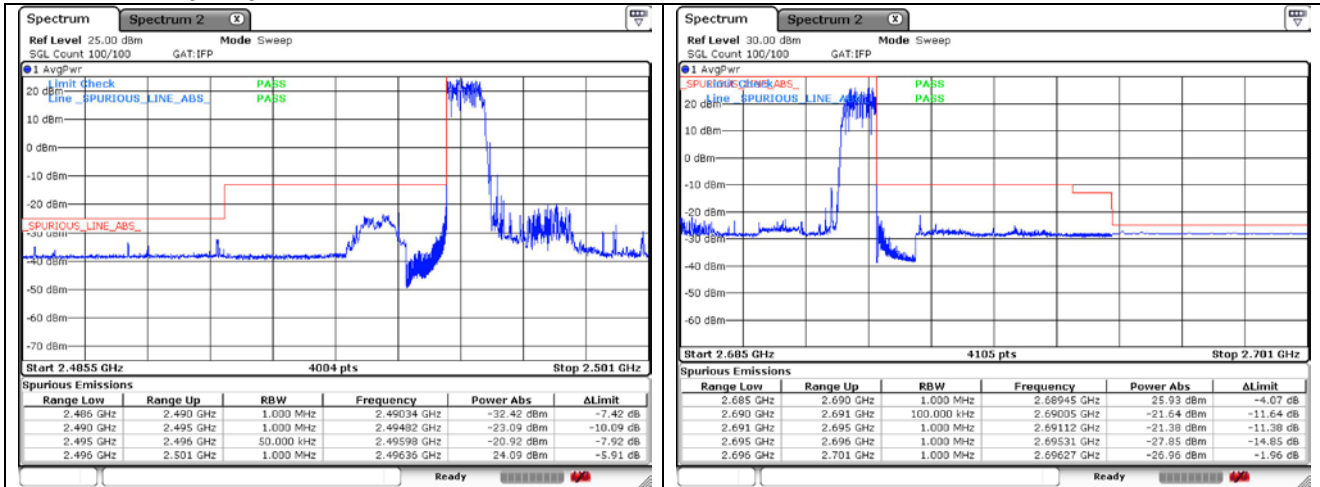
##### QPSK Low Channel - Full RB



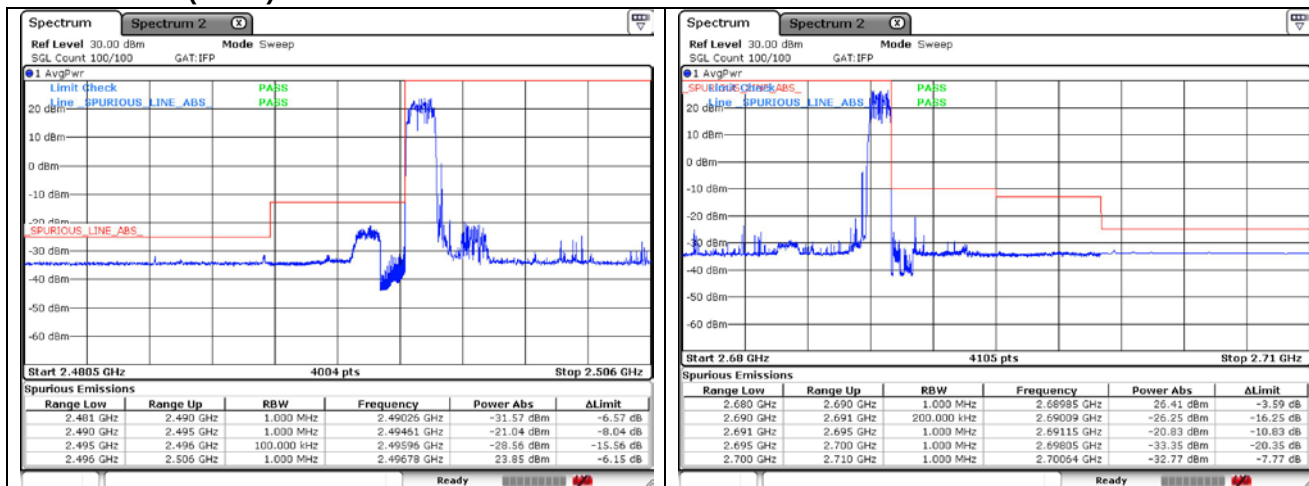
##### QPSK High Channel - Full RB



**LTE band 41 (5 MHz)**

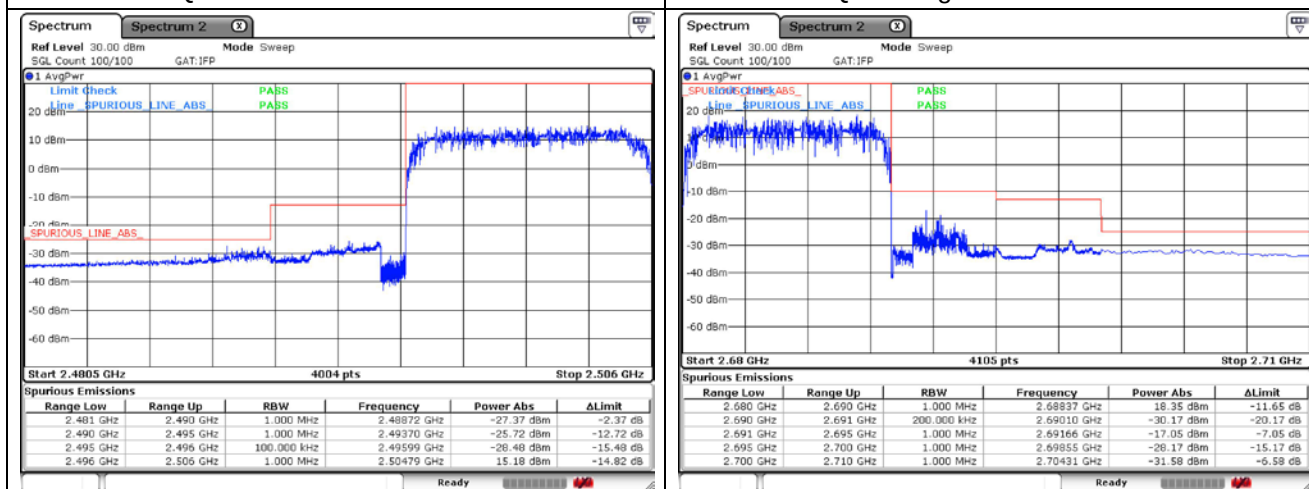


### LTE band 41 (10 MHz)



QPSK Low Channel - 1 RB

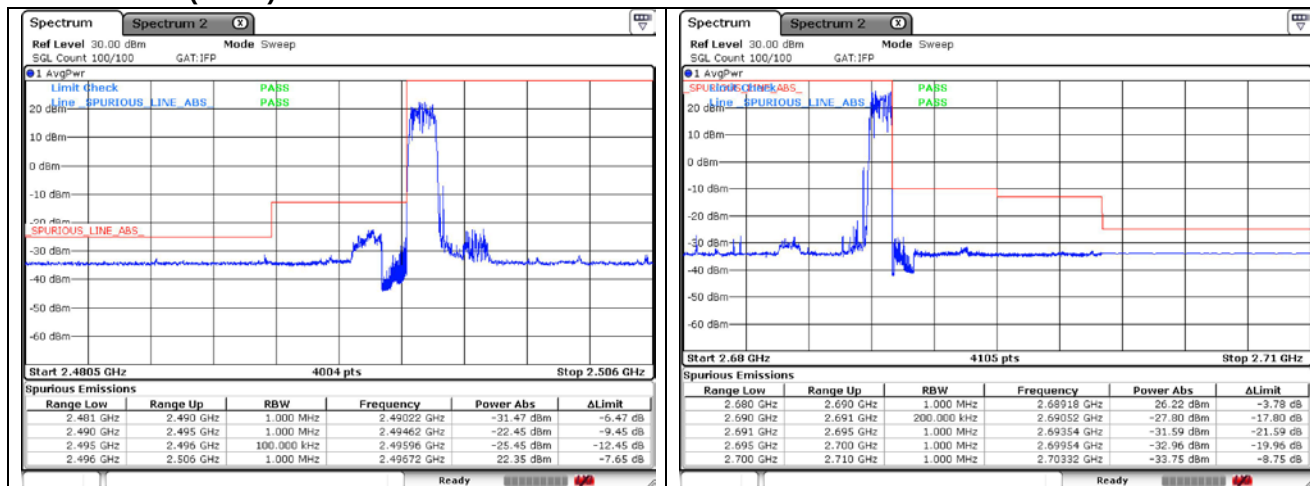
QPSK High Channel - 1 RB



QPSK Low Channel - Full RB

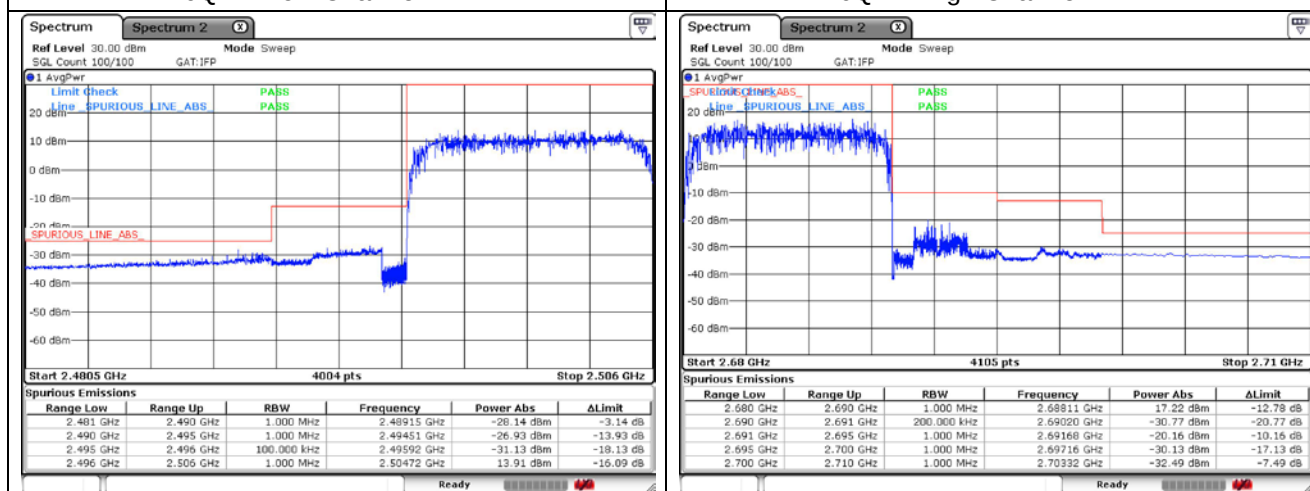
QPSK High Channel - Full RB

### LTE band 41 (10 MHz)



16QAM Low Channel - 1 RB

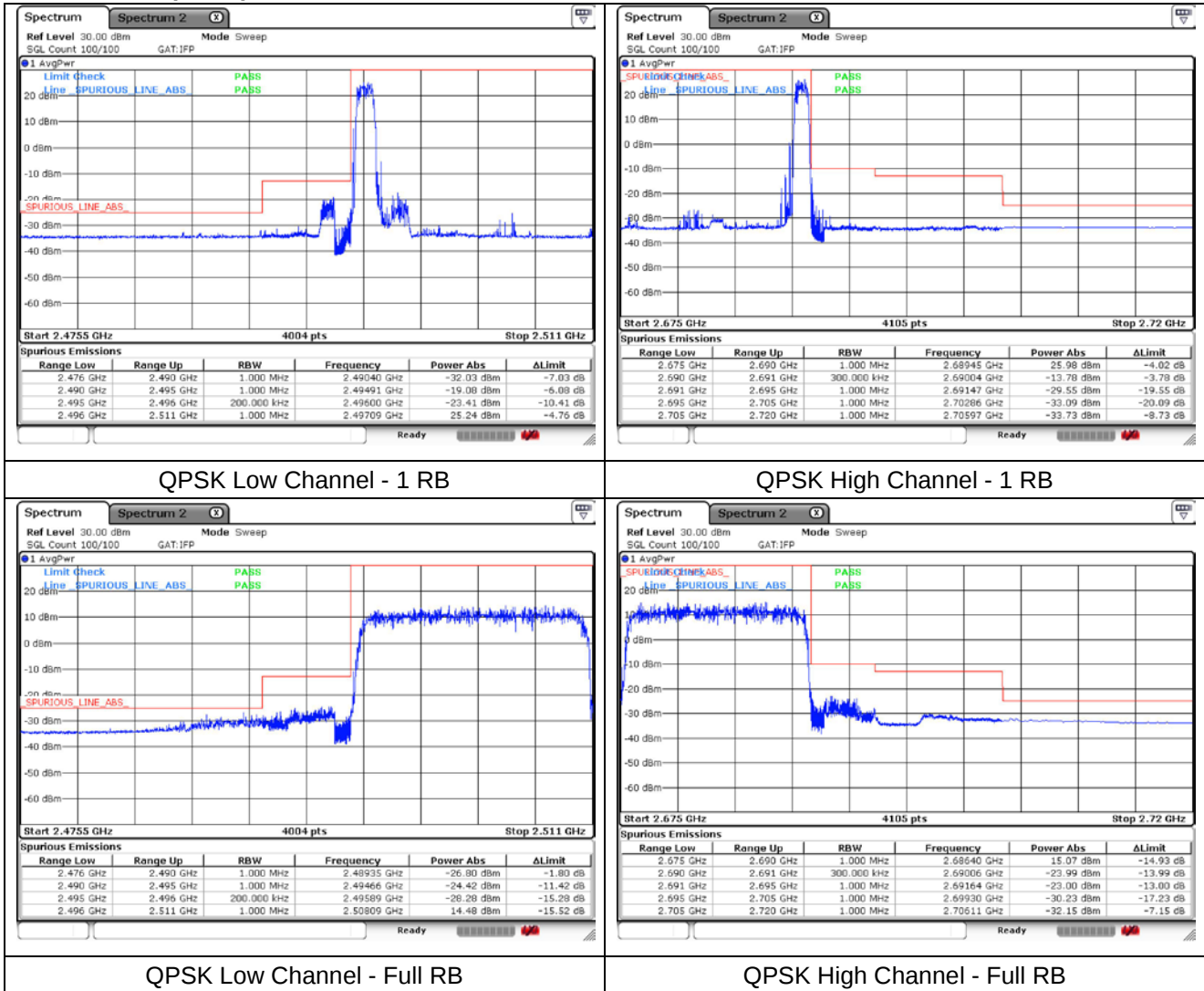
16QAM High Channel - 1 RB



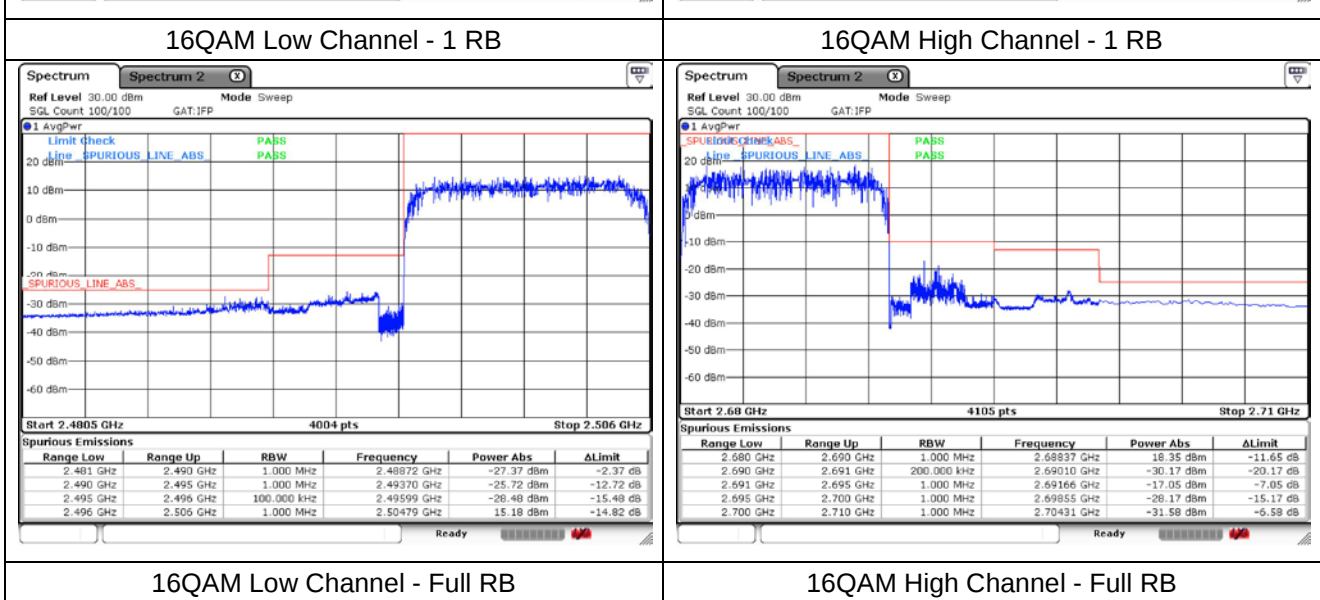
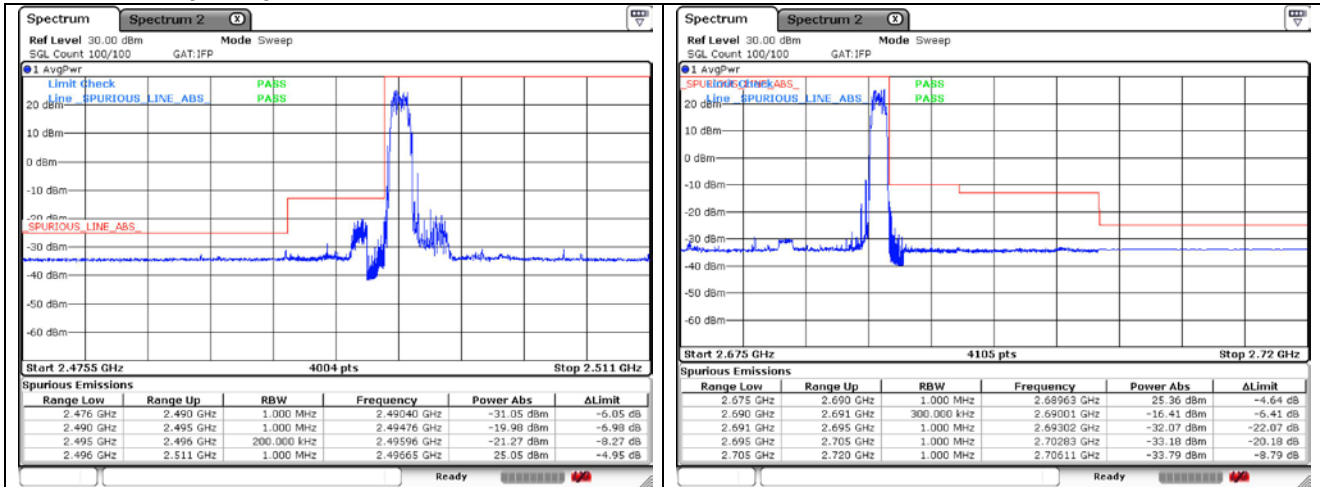
16QAM Low Channel - Full RB

16QAM High Channel - Full RB

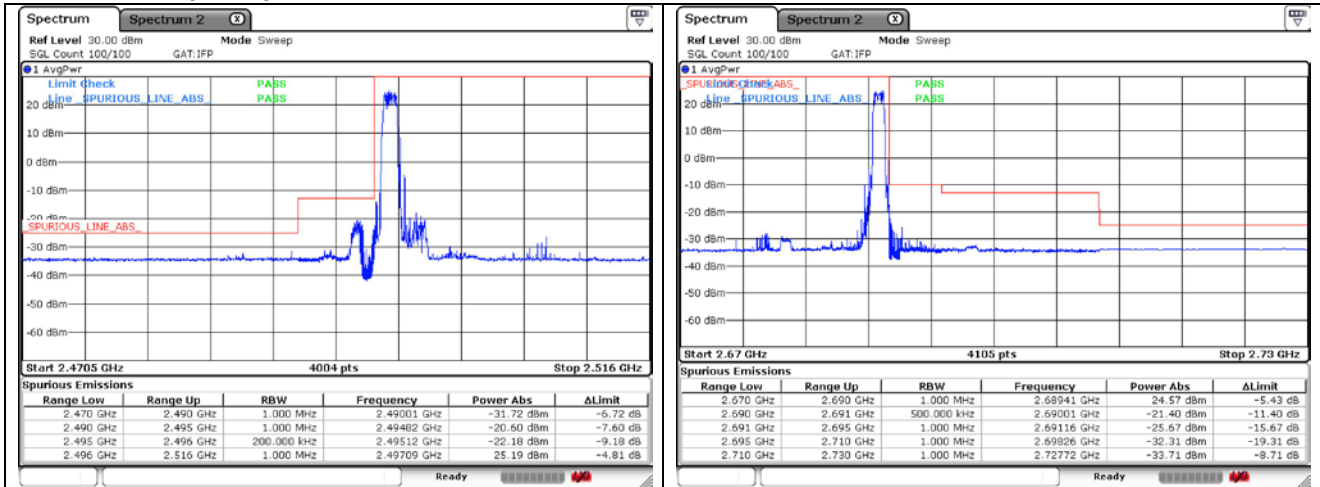
### LTE band 41 (15 MHz)



**LTE band 41 (15 MHz)**

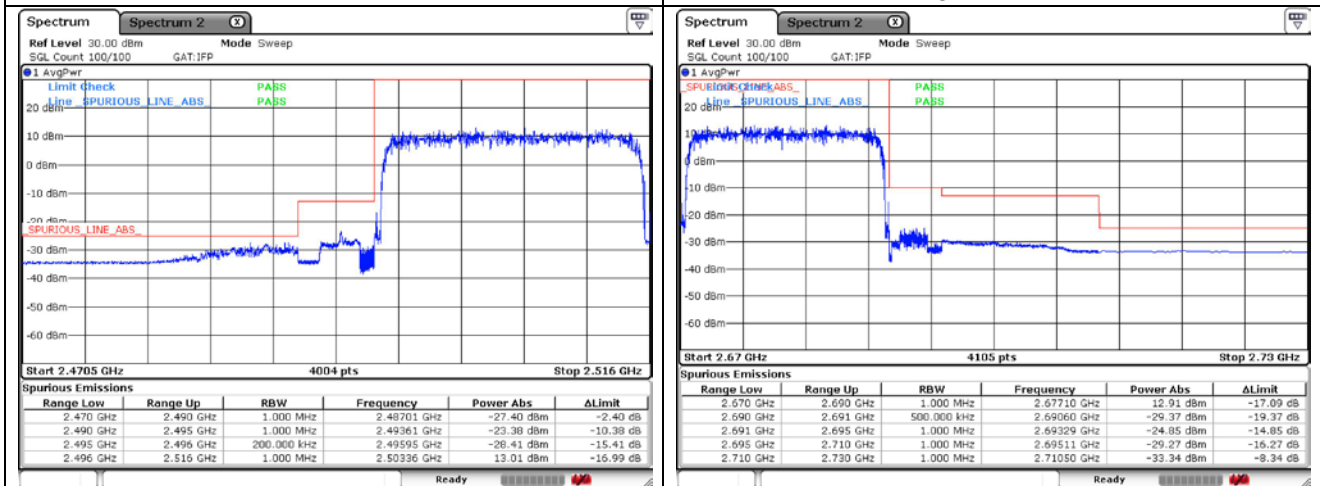


### LTE band 41 (20 MHz)



QPSK Low Channel - 1 RB

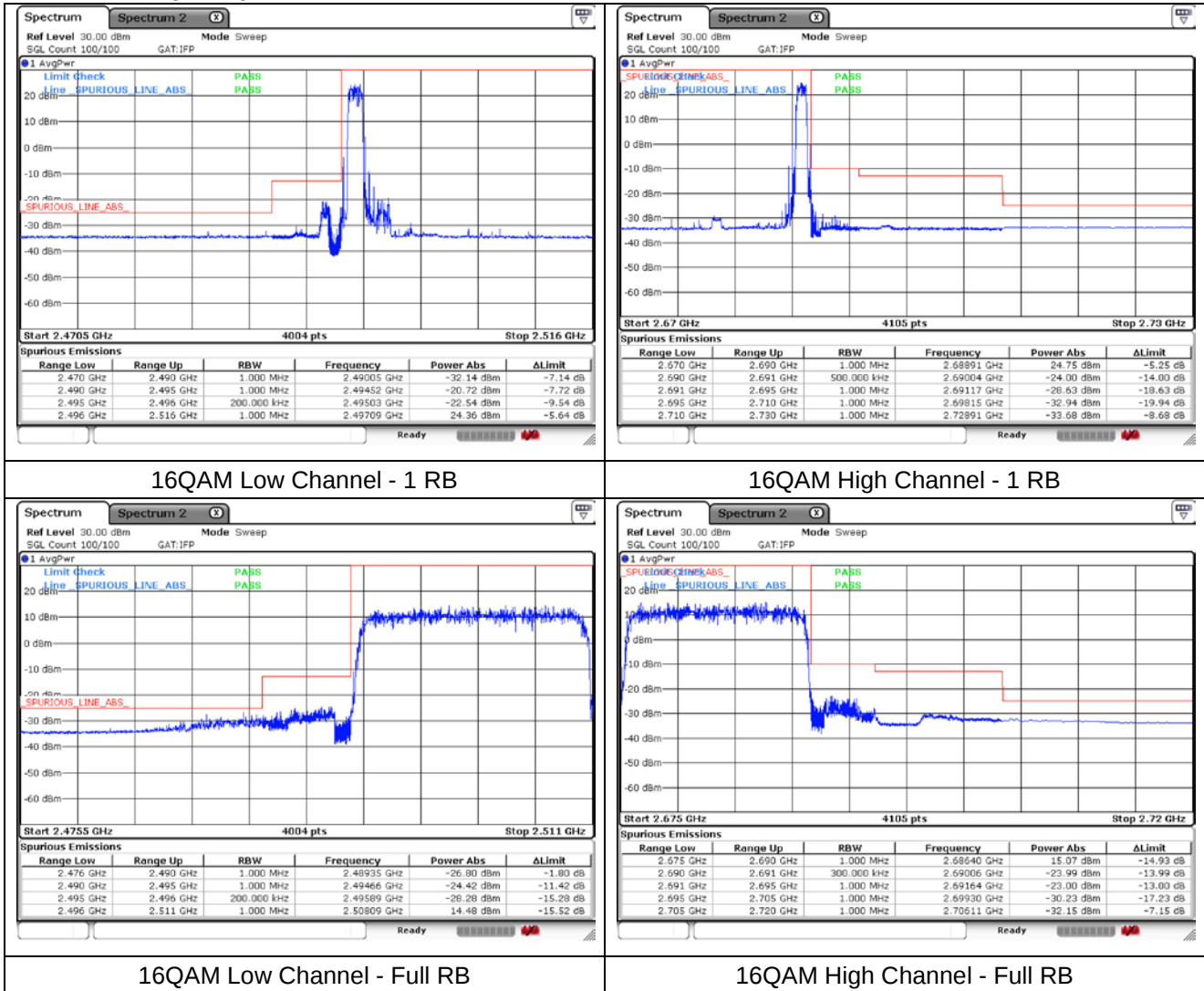
QPSK High Channel - 1 RB



QPSK Low Channel - Full RB

QPSK High Channel - Full RB

**LTE band 41 (20 MHz)**



## 8. Frequency Stability

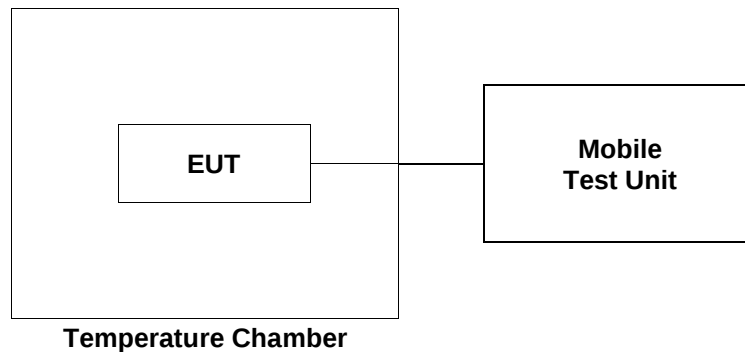
### 8.1. Limit

- § 2.1055 (a), § 2.1055 (d) & following:

- §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

### 8.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a Mobile Test Unit via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from Mobile Test Unit.



### 8.3. Test Results

Ambient temperature : (23 ± 1) °C  
 Relative humidity : 47 ± 2 %

#### LTE band 41 at middle channel

| Reference Frequency: 2 593.0 MHz        |                    |                                    |           |
|-----------------------------------------|--------------------|------------------------------------|-----------|
| Frequency Stability versus Temperature  |                    |                                    |           |
| Environment Temperature (°C)            | Power Supplied (V) | Frequency Measure with Time Elapse |           |
|                                         |                    | Frequency Error (Hz)               | ppm       |
| 50                                      | 4.00               | 11.05                              | 0.002 13  |
| 40                                      |                    | 11.31                              | 0.002 23  |
| 30                                      |                    | 12.25                              | 0.002 59  |
| 20(Ref.)                                |                    | 5.53                               | -         |
| 10                                      |                    | 3.17                               | -0.000 91 |
| 0                                       |                    | 9.88                               | 0.001 68  |
| -10                                     |                    | 12.28                              | 0.002 60  |
| -20                                     |                    | 9.57                               | 0.001 56  |
| -30                                     |                    | 11.24                              | 0.002 20  |
| Frequency Stability versus Power Supply |                    |                                    |           |
| Environment Temperature (°C)            | Power Supplied (V) | Frequency Measure with Time Elapse |           |
|                                         |                    | Frequency Error (Hz)               | ppm       |
| 20                                      | 3.40 (85%)         | 11.73                              | 0.002 39  |
|                                         | 4.60 (115%)        | 12.55                              | 0.002 71  |

- End of the Test Report -