

## Report on the RF Testing of:

KYOCERA Corporation  
Mobile Phone, Model: EB1017  
FCC ID: JOYEB1017

In accordance with FCC Part 27 Subpart C  
and FCC Part 27 Subpart H

Prepared for: KYOCERA Corporation  
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## COMMERCIAL-IN-CONFIDENCE

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| SIGNATURE      |                            |                    |             |
|----------------|----------------------------|--------------------|-------------|
|                |                            |                    |             |
| NAME           | JOB TITLE                  | RESPONSIBLE FOR    | ISSUE DATE  |
| Hiroaki Suzuki | Deputy Manager of RF Group | Approved Signatory | 17 JUL 2020 |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Japan Ltd. document control rules.

### EXECUTIVE SUMMARY - Result: Complied

A sample(s) of this product was tested and the result above was confirmed in accordance with FCC Part 27 Subpart C and FCC Part 27 Subpart H.



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## 1 Summary of Test

### 1.1 Modification history of the test report

| Document Number | Modification History | Issue Date              |
|-----------------|----------------------|-------------------------|
| JPD-TR-20156-0  | First Issue          | Refer to the cover page |

### 1.2 Standards

CFR47 FCC Part 27 Subpart C  
CFR47 FCC Part 27 Subpart H

### 1.3 Test methods

KDB 971168 D01 Power Meas License Digital Systems v03r01  
ANSI/TIA/EIA-603-D-2010

### 1.4 Deviation from standards

None

### 1.5 List of applied test(s) of the EUT

| Test item section | Test item                                           | Condition | Result | Remark |
|-------------------|-----------------------------------------------------|-----------|--------|--------|
| 2.1046            | Conducted Output Power                              | Conducted | PASS   | *1     |
| 27.50             | Effective Radiated Power                            | Radiated  | PASS   | -      |
| 27.50             | Peak to Average Ratio                               | Conducted | PASS   | -      |
| 2.1049            | Occupied Bandwidth                                  | Conducted | PASS   | -      |
| 27.53<br>2.1051   | Band Edge Spurious and Harmonic at Antenna Terminal | Conducted | PASS   | -      |
| 27.53<br>2.1053   | Radiated emissions and Harmonic Emissions           | Radiated  | PASS   | -      |
| 27.54<br>2.1055   | Frequency Stability                                 | Conducted | PASS   | -      |

\*1: Refer to RF Exposure Report (Test Report\_SAR)

### 1.6 Test information

None

### 1.7 Test set up

Table-top

### 1.8 Test period

22-May-2020 - 1-July-2020

## 2 Equipment Under Test

### 2.1 EUT information

|                                      |                                                                                                                                                   |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicant                            | KYOCERA Corporation<br>Yokohama Office 2-1-1 Kagahara, Tsuzuki-ku Yokohama-shi,<br>Kanagawa, Japan<br>Phone: +81-45-943-6253 Fax: +81-45-943-6314 |
| Equipment Under Test (EUT)           | Mobile Phone                                                                                                                                      |
| Model number                         | EB1017                                                                                                                                            |
| Serial number                        | N/A                                                                                                                                               |
| Trade name                           | Kyocera                                                                                                                                           |
| Number of sample(s)                  | 1                                                                                                                                                 |
| EUT condition                        | Pre-Production                                                                                                                                    |
| Power rating                         | Battery: DC 3.85 V                                                                                                                                |
| Size                                 | (W) 73.0 × (D) 153.0 × (H) 8.9 mm                                                                                                                 |
| Environment                          | Indoor and Outdoor use                                                                                                                            |
| Terminal limitation                  | -20°C to 60°C                                                                                                                                     |
| Hardware version                     | DMT1.5                                                                                                                                            |
| Software version                     | 0.040RE.0022.a                                                                                                                                    |
| Firmware version                     | Not applicable                                                                                                                                    |
| RF Specification                     |                                                                                                                                                   |
| Frequency of Operation               | Up Link<br>LTE Band X VII: 704-716 MHz<br><br>Down Link<br>LTE Band X VII: 734-746 MHz                                                            |
| Modulation type                      | QPSK, 16QAM, 64QAM                                                                                                                                |
| Emission designator                  | BW 5M QPSK: 4M58G7D, 16QAM: 4M58W7D, 64QAM:<br>4M54W7D<br>BW 10M QPSK: 9M03G7D, 16QAM: 9M02W7D, 64QAM:<br>9M04W7D                                 |
| Effective Radiated Power<br>(E.R.P.) | QPSK: 0.2042 W (23.1 dBm)<br>16QAM: 0.1445 W (21.6 dBm)<br>64QAM: 0.1202 W (20.8 dBm)                                                             |
| Antenna type                         | Internal antenna                                                                                                                                  |
| Antenna gain                         | -8.1 dBi                                                                                                                                          |

## 2.2 Modification to the EUT

The table below details modifications made to the EUT during the test project.

| Modification State                | Description of Modification  | Modification fitted by | Date of Modification |
|-----------------------------------|------------------------------|------------------------|----------------------|
| Model: EB1017, Serial Number: N/A |                              |                        |                      |
| 0                                 | As supplied by the applicant | Not Applicable         | Not Applicable       |

## 2.3 Variation of family model(s)

### 2.3.1 List of family model(s)

Not applicable

### 2.3.2 Reason for selection of EUT

Not applicable

## 2.4 Description of test mode

The EUT had been tested under operating condition.  
There are three channels have been tested as following:

| Band           | Modulation               | Bandwidth | Channel | Frequency [MHz] |
|----------------|--------------------------|-----------|---------|-----------------|
| LTE Band X VII | QPSK,<br>16QAM,<br>64QAM | 5 MHz     | 23755   | 706.5           |
|                |                          |           | 23790   | 710.0           |
|                |                          |           | 23825   | 713.5           |
|                |                          | 10 MHz    | 23780   | 709.0           |
|                |                          |           | 23790   | 710.0           |
|                |                          |           | 23800   | 711.0           |

The field strength of spurious emissions was measured at each position of all three axis X, Y and Z to compare the level, and the maximum noise.

The worst emission was found in X-axis and the worst case recorded.

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports.

### 3 Configuration of Equipment

Numbers assigned to equipment on the diagram in “3.2 System configuration” correspond to the list in “3.1 Equipment used”.

Cabling and setup(s) were taken into consideration and test data was taken under worse case condition.

#### 3.1 Equipment used

| No. | Equipment    | Company | Model No. | Serial No. | FCC ID/DoC | Comment |
|-----|--------------|---------|-----------|------------|------------|---------|
| 1   | Mobile Phone | KYOCERA | EB1017    | N/A        | JOYEB1017  | EUT     |

#### 3.2 System configuration

1. Mobile Phone  
(EUT)

## 4 Test Result

### 4.1 Effective Radiated Power

#### 4.1.1 Measurement procedure

##### [FCC 27.50]

##### <Step 1>

The EUT and support equipment are placed on a 1 meter x 1 meter surface, 0.8 meter height styrene foam table. Radiated emission measurements are performed at 3 meter distance with the broadband antenna (Log periodic antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1 to 4 meters and stopped at height producing the maximum emission. The bandwidth of the spectrum analyzer is set to 1 MHz. The turntable is rotated by 360 degrees and stopped at azimuth of producing the maximum emission.

##### <Step 2>

The substitution antenna is replaced by the transmitter antenna (EUT).

The frequency of the signal generator is adjusted to the measurement frequency.

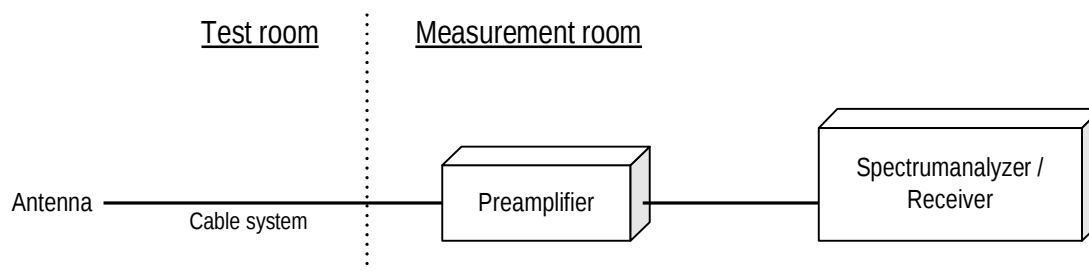
Level of the signal generator is adjusted to the level that is obtained from step 1, and record the emission level of signal generator.

The spectrum analyzer is set to;

- Span = 1.5 times the OBW
- RBW = 1-5% of the expected OBW, not to exceed 1 MHz
- VBW  $\geq 3 \times$  RBW
- Number of sweep points  $\geq 2 \times$  span / RBW
- Sweep time = auto-couple
- Detector = RMS (power averaging)
- If the EUT can be configured to transmit continuously (i.e., burst duty cycle  $\geq 98\%$ ), then set the trigger to free run.
- If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle  $< 98\%$ ), then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Ensure that the sweep time is less than or equal to the transmission burst duration.
- Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges.

If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

##### - Test configuration



#### 4.1.2 Calculation method

Result (ERP) = S.G Reading - Cable loss + Antenna Gain

Margin = Limit – Result (ERP)

Example:

Limit @ 710MHz : 34.7 dBm

S.G Reading = 25.5 dBm Cable loss = 0.7 dB Ant. Gain = -10.1 dBd

Result = 25.5 - 0.7 + (-10.1) = 14.8 dBm

Margin = 34.7 – 14.8 = 19.9 dB

#### 4.1.3 Limit

3 W (34.7 dBm)

**4.1.4 Test data**

|             |                            |               |   |                       |
|-------------|----------------------------|---------------|---|-----------------------|
| Date        | : 22~23-May-2020           | Test engineer | : |                       |
| Temperature | : 19.7 [°C]                |               |   |                       |
| Humidity    | : 53.3 [%]                 |               |   |                       |
| Test place  | : 3m Semi-anechoic chamber |               |   |                       |
|             |                            |               |   | <u>Chiaki Kanno</u>   |
| Date        | : 25~26-May-2020           | Test engineer | : |                       |
| Temperature | : 21.2 [°C]                |               |   |                       |
| Humidity    | : 66.0 [%]                 |               |   |                       |
| Test place  | : 3m Semi-anechoic chamber |               |   |                       |
|             |                            |               |   | <u>Tadahiro Seino</u> |
| Date        | : 29~30-May-2020           | Test engineer | : |                       |
| Temperature | : 21.0 [°C]                |               |   |                       |
| Humidity    | : 40.4 [%]                 |               |   |                       |
| Test place  | : 3m Semi-anechoic chamber |               |   |                       |
|             |                            |               |   | <u>Tadahiro Seino</u> |

**[LTE Band X VII]**  
**QPSK, BW 5MHz**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 706.5           | -18.1             | 27.9              | 0.7             | -5.7           | 21.5         | 34.7        | 13.2        |
| H   | 710.0           | -18.0             | 28.2              | 0.7             | -5.8           | 21.7         | 34.7        | 13.0        |
| H   | 713.5           | -18.1             | 28.8              | 0.7             | -5.8           | 22.3         | 34.7        | 12.4        |

**16QAM, BW 5MHz**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 706.5           | -19.0             | 27.0              | 0.7             | -5.7           | 20.6         | 34.7        | 14.1        |
| H   | 710.0           | -18.6             | 27.6              | 0.7             | -5.8           | 21.1         | 34.7        | 13.6        |
| H   | 713.5           | -18.9             | 27.9              | 0.7             | -5.8           | 21.4         | 34.7        | 13.3        |

**64QAM, BW 5MHz**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 706.5           | -20.0             | 26.0              | 0.7             | -5.7           | 19.6         | 34.7        | 15.1        |
| H   | 710.0           | -19.4             | 26.8              | 0.7             | -5.8           | 20.3         | 34.7        | 14.4        |
| H   | 713.5           | -19.5             | 27.3              | 0.7             | -5.8           | 20.8         | 34.7        | 13.9        |

**QPSK, BW 10MHz**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 709.0           | -17.8             | 28.4              | 0.7             | -5.8           | 21.9         | 34.7        | 12.8        |
| H   | 710.0           | -16.7             | 29.6              | 0.7             | -5.8           | 23.1         | 34.7        | 11.6        |
| H   | 711.0           | -17.5             | 29.4              | 0.7             | -5.8           | 22.9         | 34.7        | 11.8        |

**16QAM, BW 10MHz**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 709.0           | -18.4             | 27.7              | 0.7             | -5.8           | 21.2         | 34.7        | 13.5        |
| H   | 710.0           | -18.2             | 28.0              | 0.7             | -5.8           | 21.5         | 34.7        | 13.2        |
| H   | 711.0           | -18.3             | 28.1              | 0.7             | -5.8           | 21.6         | 34.7        | 13.1        |

**64QAM, BW 10MHz**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 709.0           | -19.9             | 26.2              | 0.7             | -5.8           | 19.7         | 34.7        | 15.0        |
| H   | 710.0           | -18.9             | 27.3              | 0.7             | -5.8           | 20.8         | 34.7        | 13.9        |
| H   | 711.0           | -19.4             | 26.9              | 0.7             | -5.8           | 20.4         | 34.7        | 14.3        |

## 4.2 Peak to Average Ratio

### 4.2.1 Measurement procedure

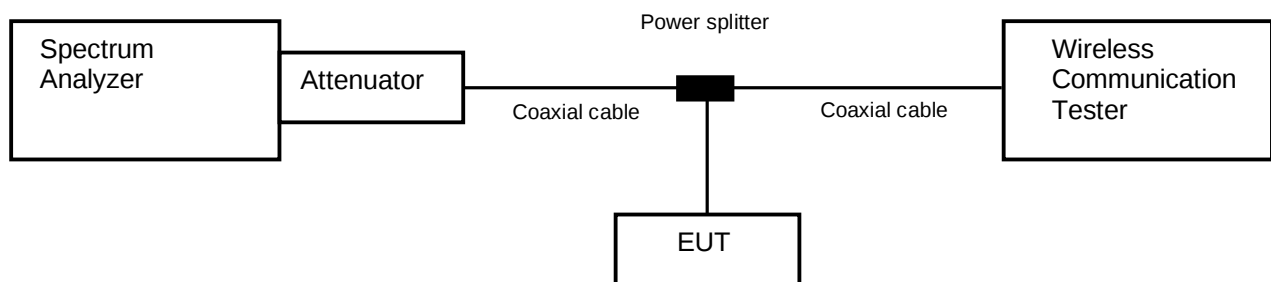
#### [FCC 27.50]

The peak to average ratio was measured with a spectrum analyzer connected to the antenna terminal.

The spectrum analyzer is set to;

- a) Power Stat CCDF mode
- b) Set resolution / measurement bandwidth  $\geq$  signal's occupied bandwidth.
- c) Set the number of counts to a value that stabilizes the measured CCDF curve.
- d) Set the measurement interval as follows:
  - 1) For continuous transmissions, set to 1ms.
  - 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 duration.
- e) Record the maximum PAPR level associated with a probability of 0.1%.

- Test configuration



### 4.2.2 Limit

13 dB or less

#### 4.2.3 Measurement result

Date : 1-July-2020

Temperature : 23.4 [°C]

Humidity : 62.3 [%]

Test place : Shielded room No.4

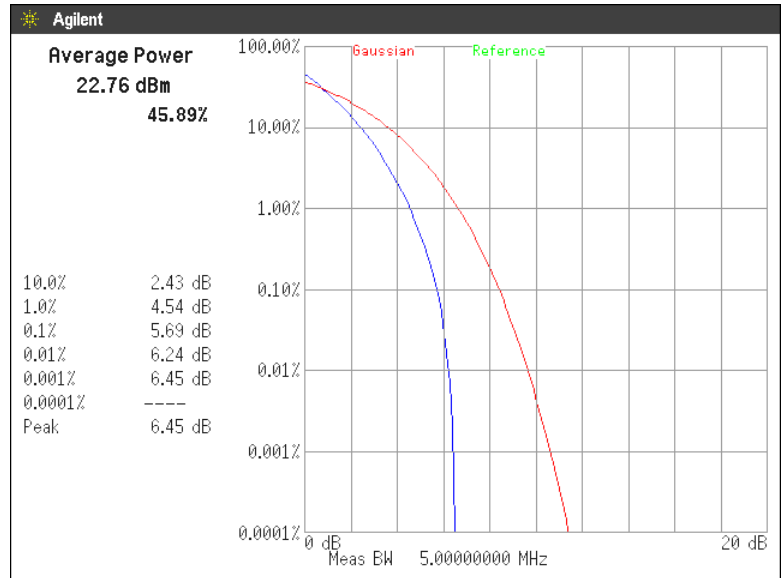
Test engineer :

Kazunori Saito

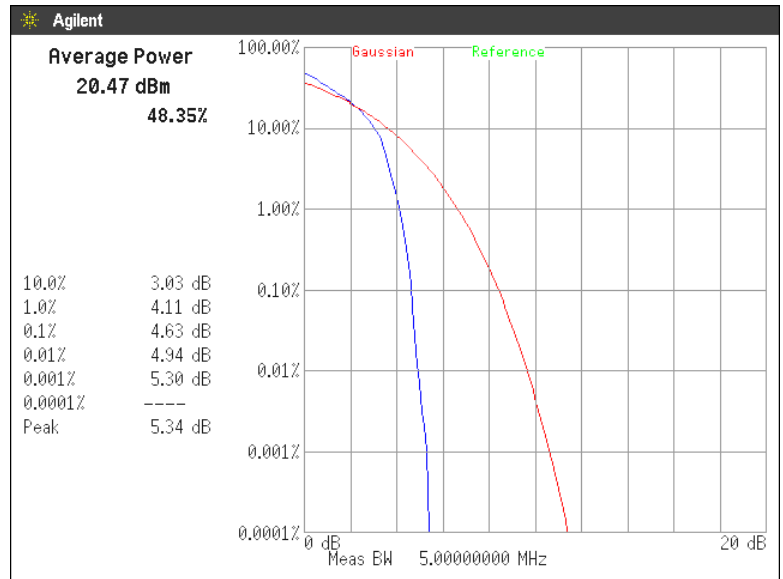
| Band              | Channel | Frequency [MHz] | Modulation | BW [MHz] | RB   | Peak to Average Power Ratio [dB] | Limit [dB] |
|-------------------|---------|-----------------|------------|----------|------|----------------------------------|------------|
| LTE<br>Band X VII | 23790   | 710.0           | QPSK       | 5        | 25-0 | 5.69                             | 13         |
|                   |         |                 |            | 10       | 50-0 | 4.63                             | 13         |
|                   |         |                 | 16QAM      | 5        | 25-0 | 6.36                             | 13         |
|                   |         |                 |            | 10       | 50-0 | 6.24                             | 13         |
|                   |         |                 | 64QAM      | 5        | 25-0 | 6.58                             | 13         |
|                   |         |                 |            | 10       | 50-0 | 6.62                             | 13         |

4.2.4 Trace data

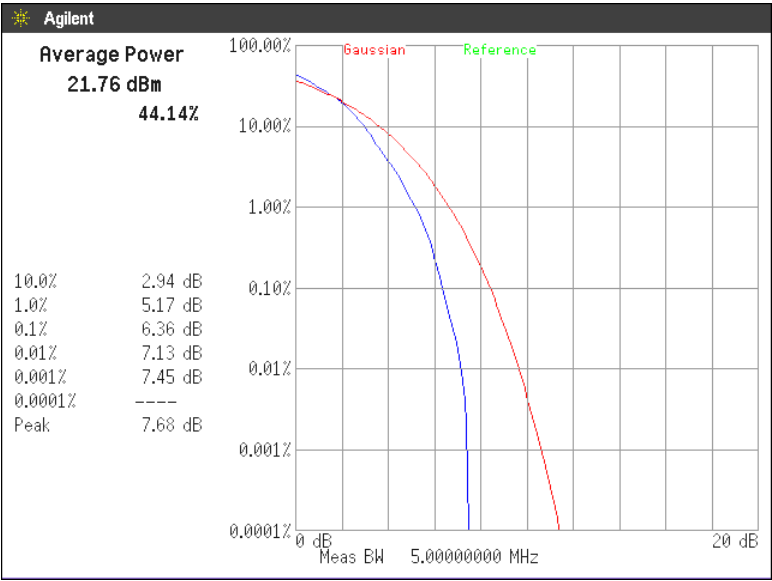
[LTE Band X VII]  
Channel: 23790  
QPSK, BW 5MHz, RB25-0



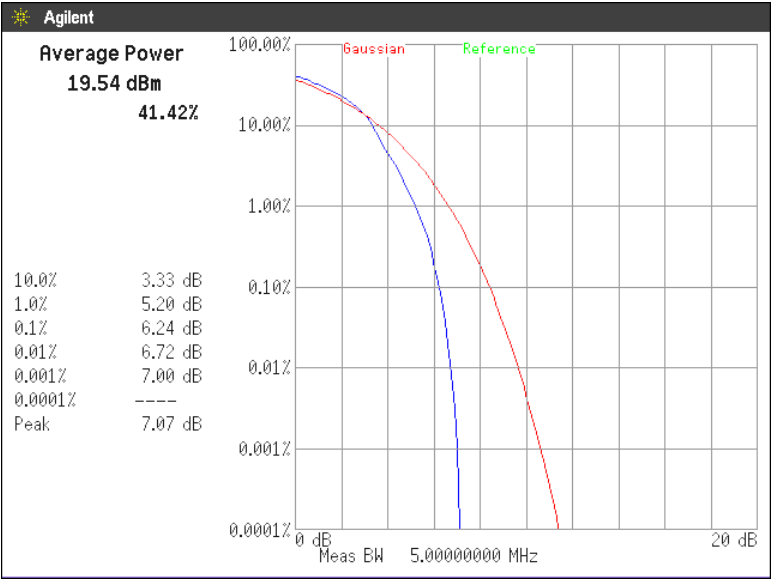
QPSK, BW 10MHz, RB50-0



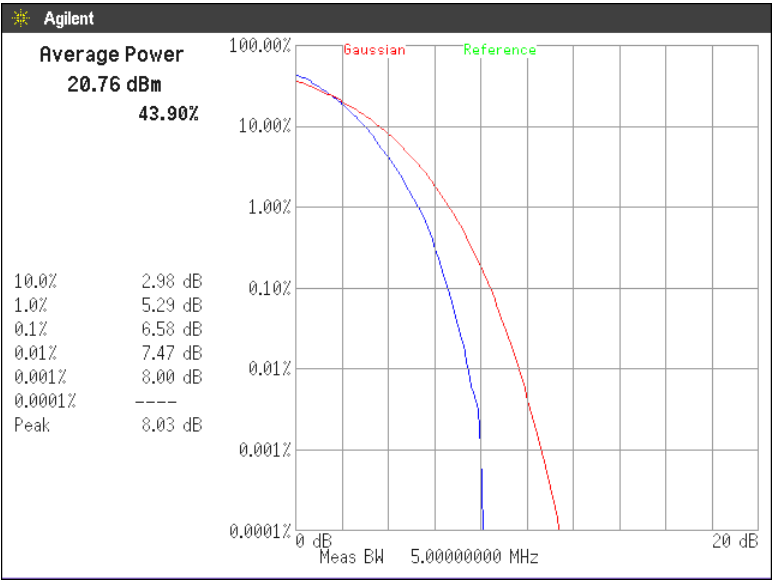
16QAM, BW 5MHz, RB25-0



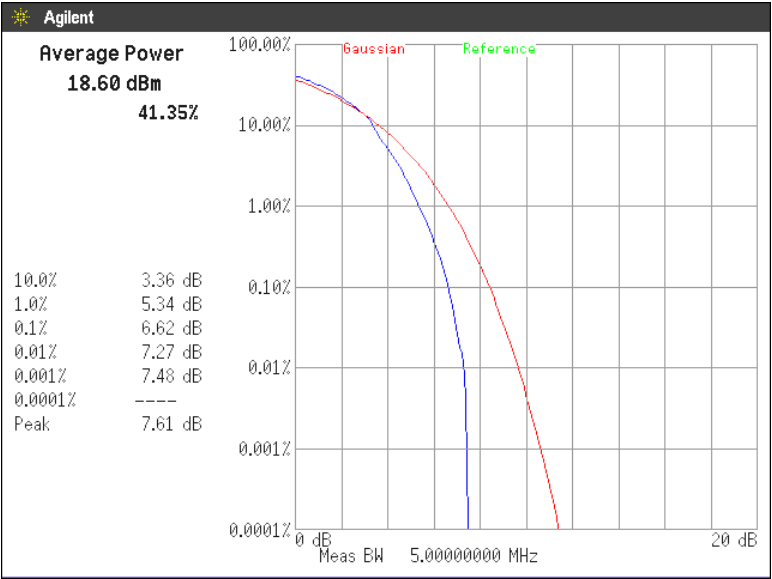
16QAM, BW 10MHz, RB50-0



64QAM, BW 5MHz, RB25-0



64QAM, BW 10MHz, RB50-0



### 4.3 Occupied Bandwidth

#### 4.3.1 Measurement procedure

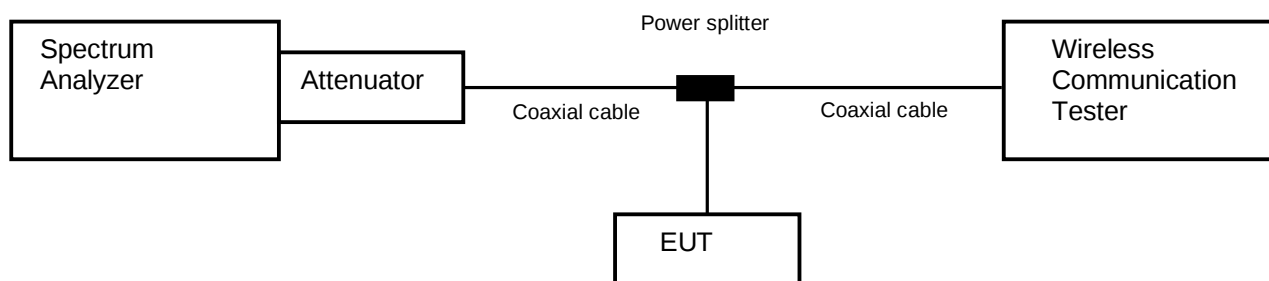
##### [FCC 2.1049]

The Occupied bandwidth was measured with a spectrum analyzer connected to the antenna terminal.

The spectrum analyzer is set to;

- a) RBW = 1-5% of the expected OBW & VBW  $\geq 3 \times$  RBW
- b) Detector = Peak
- c) Trace mode = Max hold
- d) Sweep time = auto-couple

- Test configuration



#### 4.3.2 Limit

None

#### 4.3.3 Measurement result

Date : 30-June-2019

Temperature : 23.9 [°C]

Humidity : 54.0 [%]

Test place : Shielded room No.4

Test engineer :

Kazunori Saito

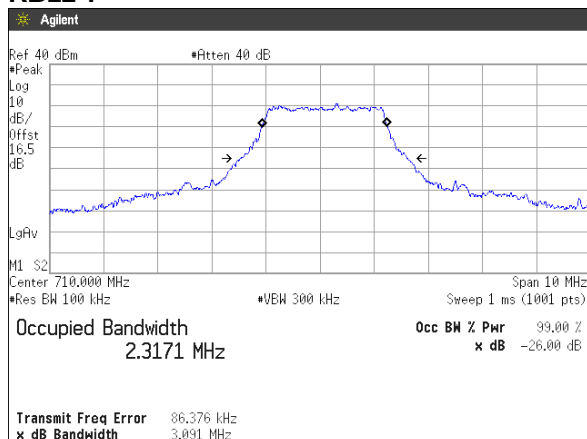
| BW    | Mode  | UL RB<br>Allocation | UL RB<br>Start | Frequency<br>[MHz] | 26dB Bandwidth<br>[MHz] | 99% OBW<br>[MHz] |
|-------|-------|---------------------|----------------|--------------------|-------------------------|------------------|
| 5MHz  | QPSK  | 12                  | 7              | 710.0              | 3.091                   | 2.3171           |
|       |       | 25                  | 0              |                    | 5.353                   | 4.5793           |
|       | 16QAM | 12                  | 7              | 710.0              | 2.995                   | 2.3058           |
|       |       | 25                  | 0              |                    | 5.353                   | 4.5776           |
|       | 64QAM | 12                  | 7              | 710.0              | 2.931                   | 2.2709           |
|       |       | 25                  | 0              |                    | 5.179                   | 4.5425           |
| 10MHz | QPSK  | 25                  | 12             | 710.0              | 5.837                   | 4.6621           |
|       |       | 50                  | 0              |                    | 10.235                  | 9.0305           |
|       | 16QAM | 25                  | 12             | 710.0              | 5.805                   | 4.6697           |
|       |       | 50                  | 0              |                    | 10.134                  | 9.0241           |
|       | 64QAM | 25                  | 12             | 710.0              | 6.328                   | 4.6934           |
|       |       | 50                  | 0              |                    | 11.963                  | 9.0413           |

## 4.3.4 Trace data

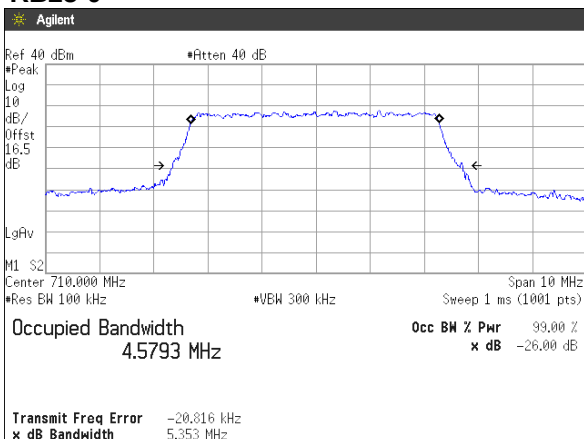
[LTE Band X VII]  
Channel: 23790

QPSK, BW 5MHz

RB12-7

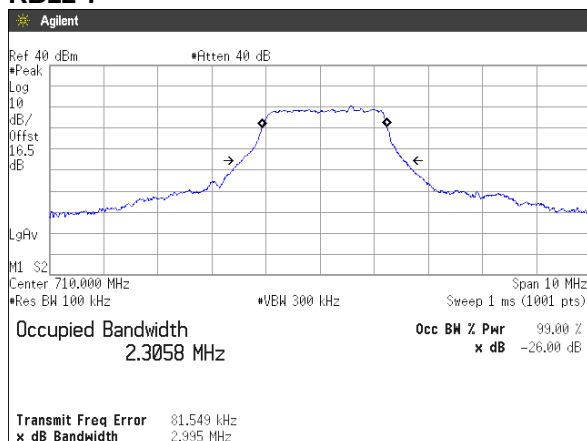


RB25-0

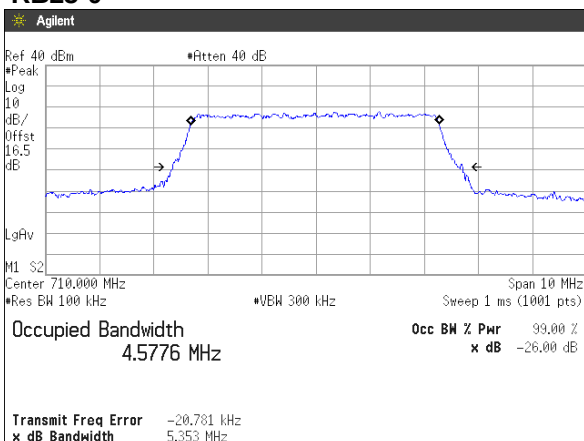


16QAM, BW 5MHz

RB12-7

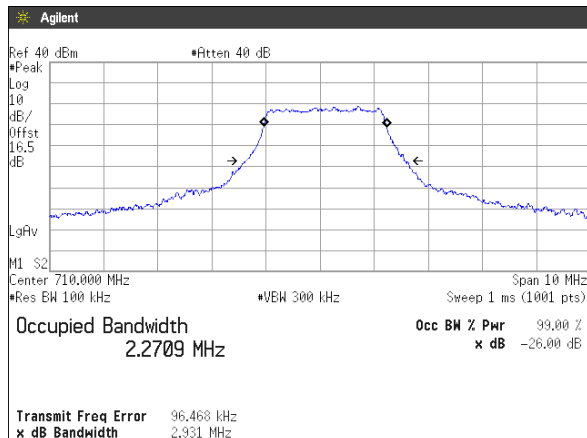


RB25-0

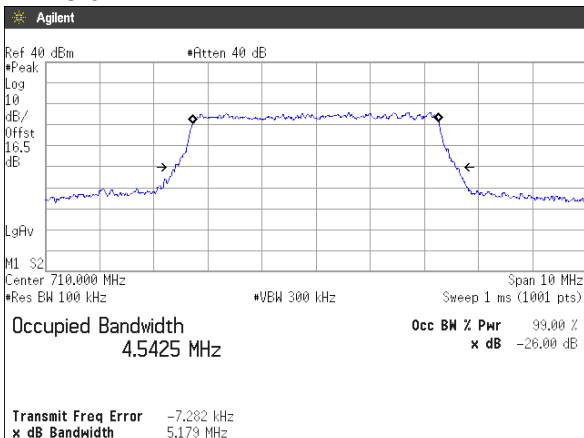


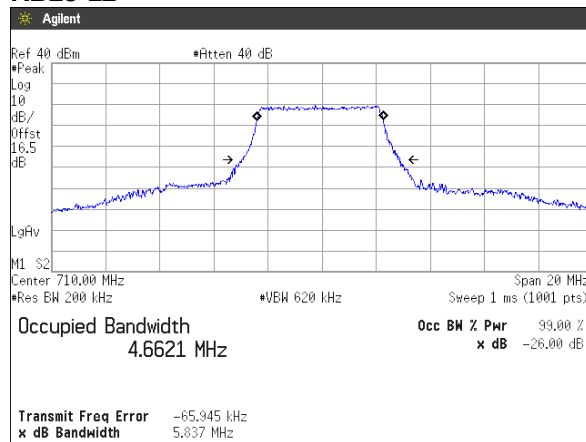
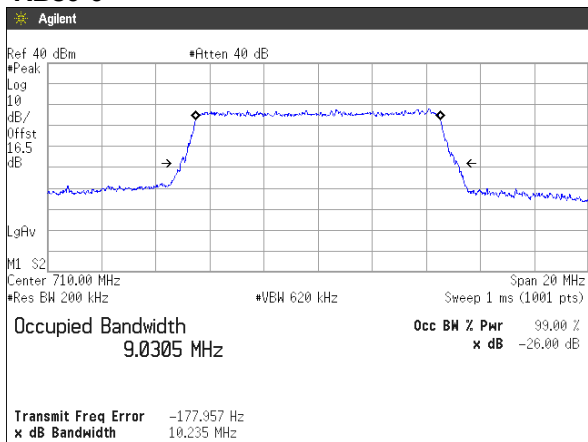
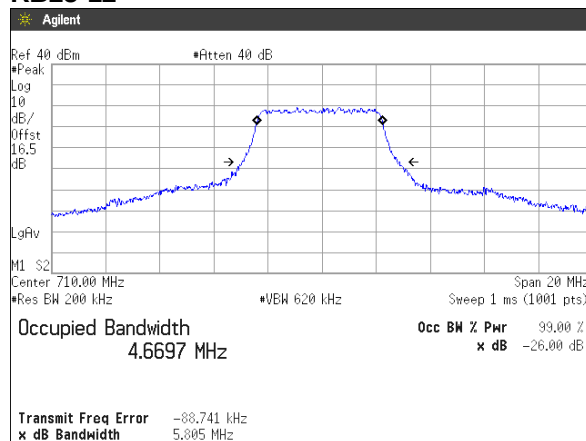
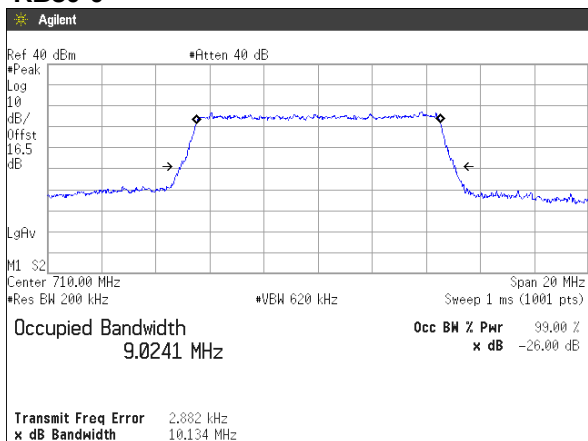
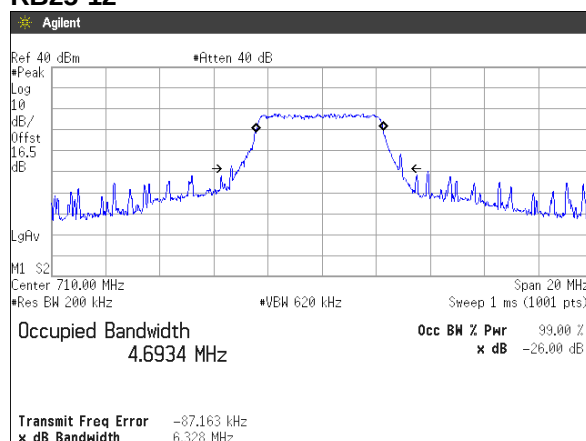
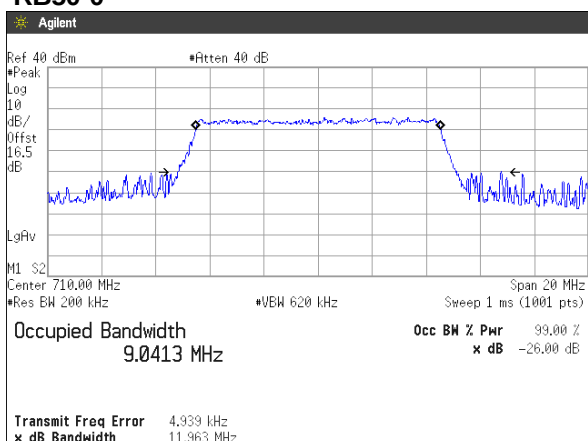
64QAM, BW 5MHz

RB12-7



RB25-0



**QPSK, BW 10MHz****RB25-12****RB50-0****16QAM, BW 10MHz****RB25-12****RB50-0****64QAM, BW 10MHz****RB25-12****RB50-0**

#### 4.4 Band Edge Spurious and Harmonic at Antenna Terminals

##### 4.4.1 Measurement procedure

###### [FCC 27.53, 2.1051]

The band edge spurious and harmonic was measured with a spectrum analyzer connected to the antenna terminal.

The spectrum analyzer is set to;

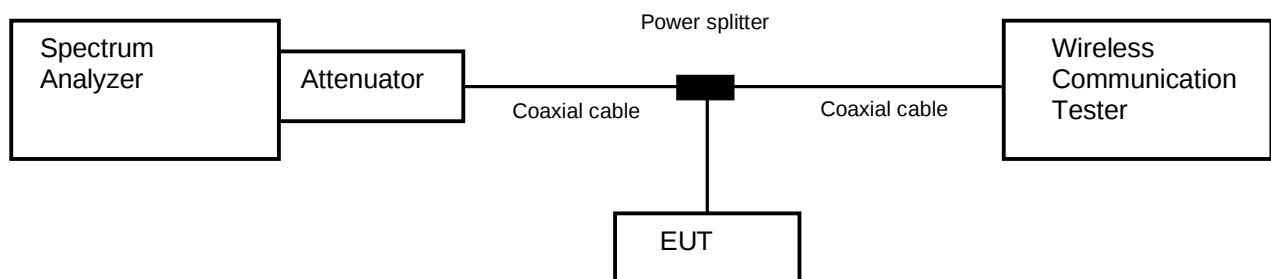
<Band Edge>

- a) Span was set large enough so as to capture all out of band emissions near the band edge
- b)  $RBW \geq 1\%$  of the emission bandwidth or  $2\%$  of the emission bandwidth
- c)  $VBW \geq 3 \times RBW$
- d) Detector = RMS
- e) Trace mode = Max hold
- f) Sweep time = auto-couple
- g) Number of sweep point  $\geq 2 \times \text{span} / RBW$

<Spurious Emissions>

- a)  $RBW = 1\text{MHz}$  &  $VBW \geq 3 \times RBW$
- b) Detector = Peak
- c) Trace mode = Max hold
- d) Sweep time = auto-couple
- e) Number of sweep point  $\geq 2 \times \text{span} / RBW$

- Test configuration



##### 4.4.2 Limit

-13 dB or less

#### 4.4.3 Measurement result

Date : 29-June-2020  
Temperature : 23.4 [°C]  
Humidity : 55.3 [%]  
Test place : Shielded room No.4

Test engineer : Kazunori Saito

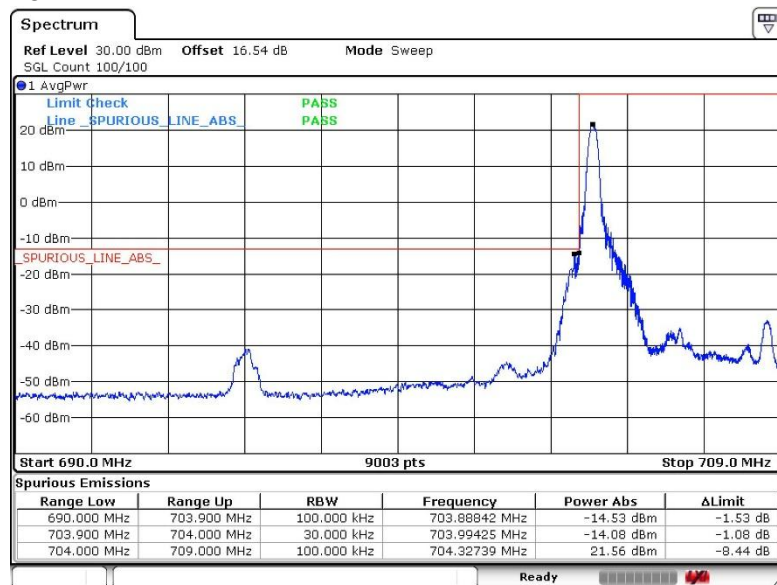
Date : 30-June-2020  
Temperature : 23.9 [°C]  
Humidity : 54.0 [%]  
Test place : Shielded room No.4

Test engineer : Kazunori Saito

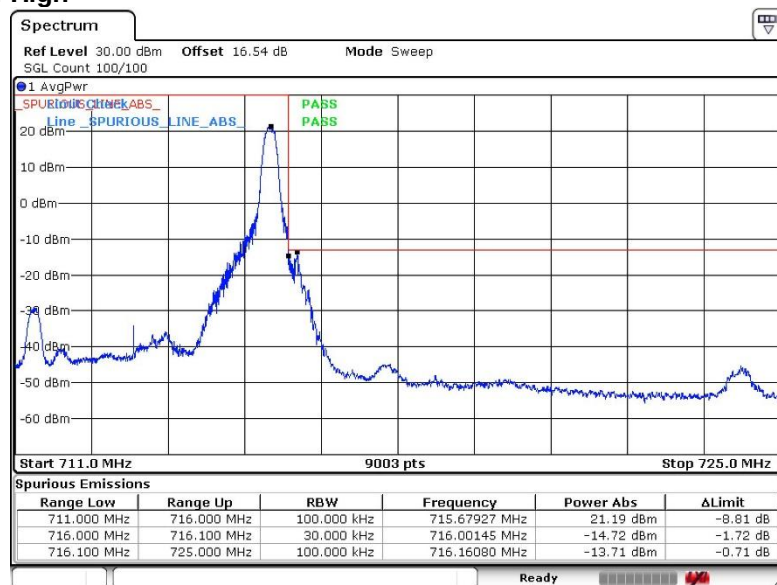
| Band              | Modulation               | Bandwidth | Results            |      |
|-------------------|--------------------------|-----------|--------------------|------|
| LTE<br>Band X VII | QPSK,<br>16QAM,<br>64QAM | 5MHz      | See the trace data | PASS |
|                   |                          | 10MHz     | See the trace data | PASS |

## 4.4.4 Trace data

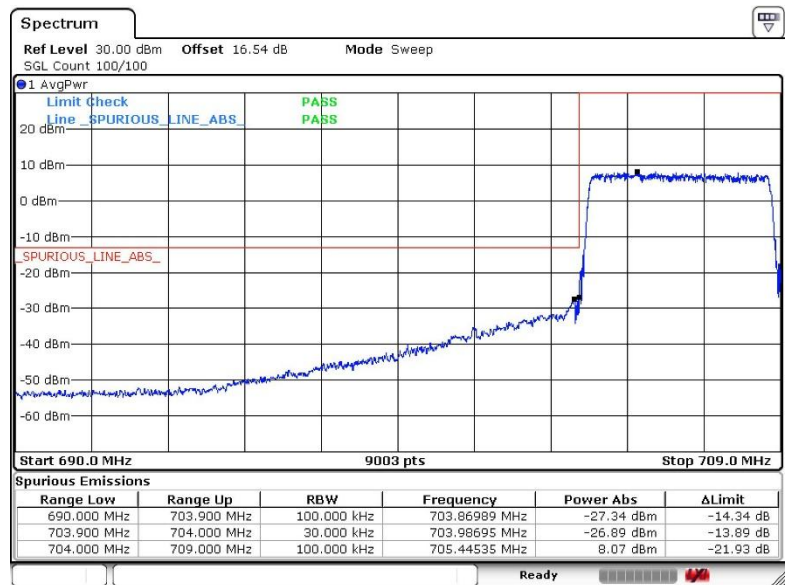
[LTE Band X VII]  
(Band Edge)  
QPSK, BW 5MHz, RB1-0  
Channel: Low



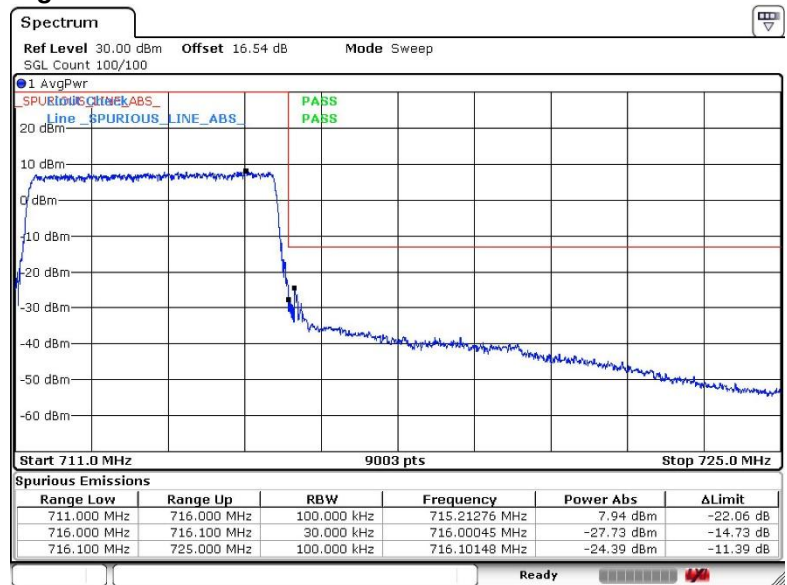
QPSK, BW 5MHz, RB1-24  
Channel: High



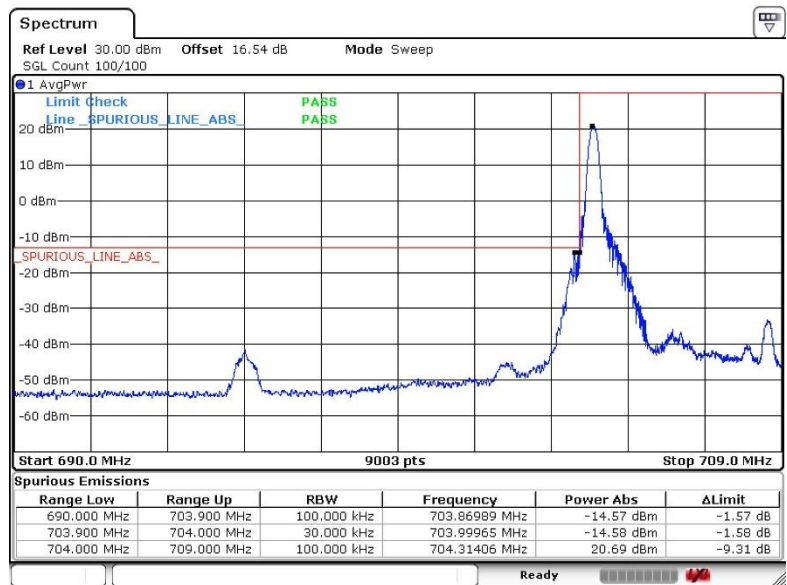
**QPSK, BW 5MHz, RB25-0**  
**Channel: Low**



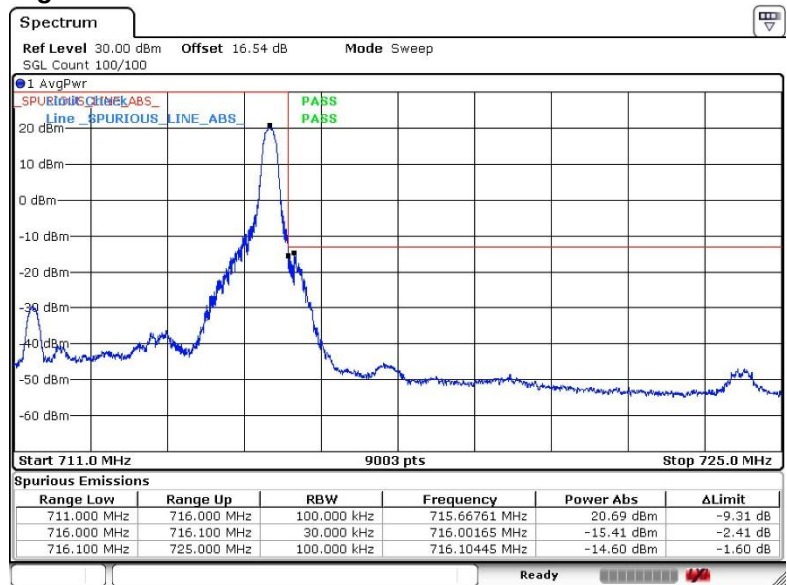
**QPSK, BW 5MHz, RB25-0**  
**Channel: High**



**16QAM, BW 5MHz, RB1-0**  
**Channel: Low**



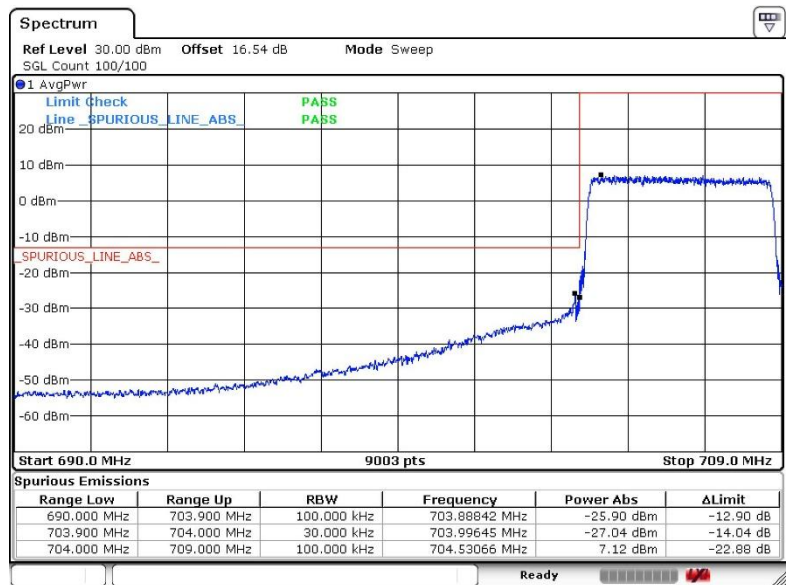
**16QAM, BW 5MHz, RB1-24**  
**Channel: High**



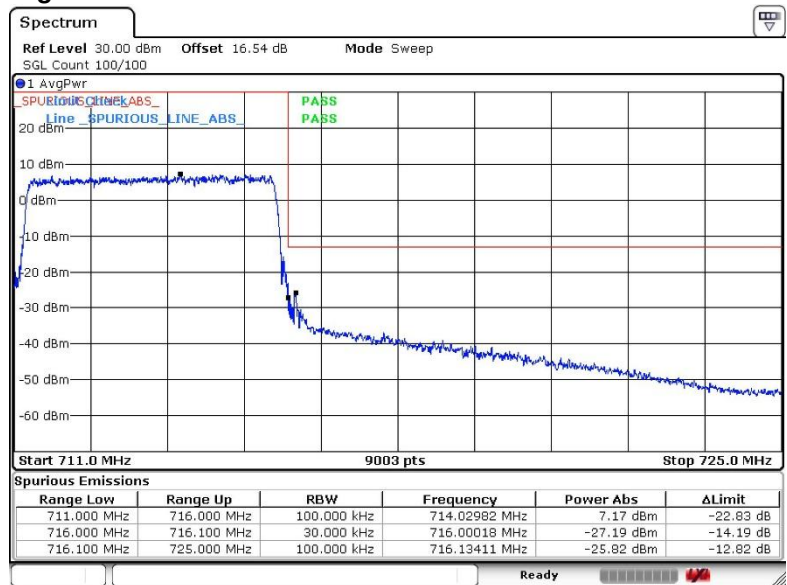


Japan

**16QAM, BW 5MHz, RB25-0**  
**Channel: Low**



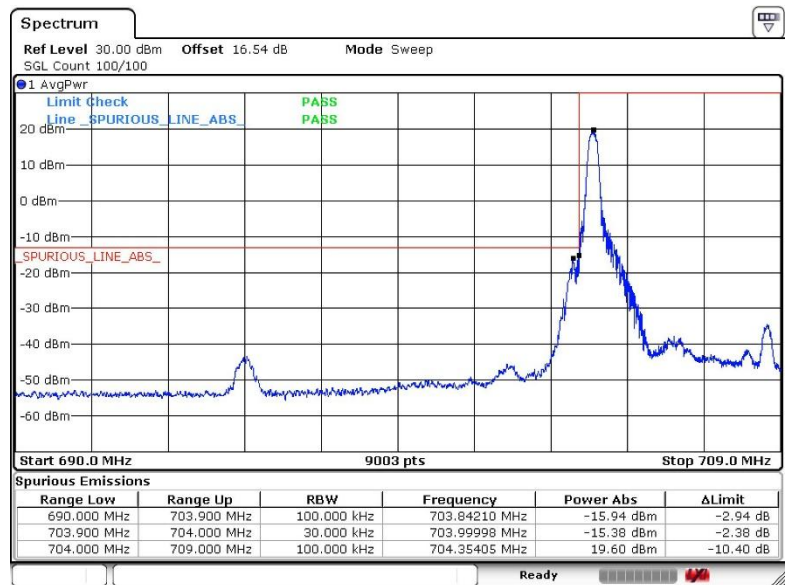
**16QAM, BW 5MHz, RB25-0**  
**Channel: High**



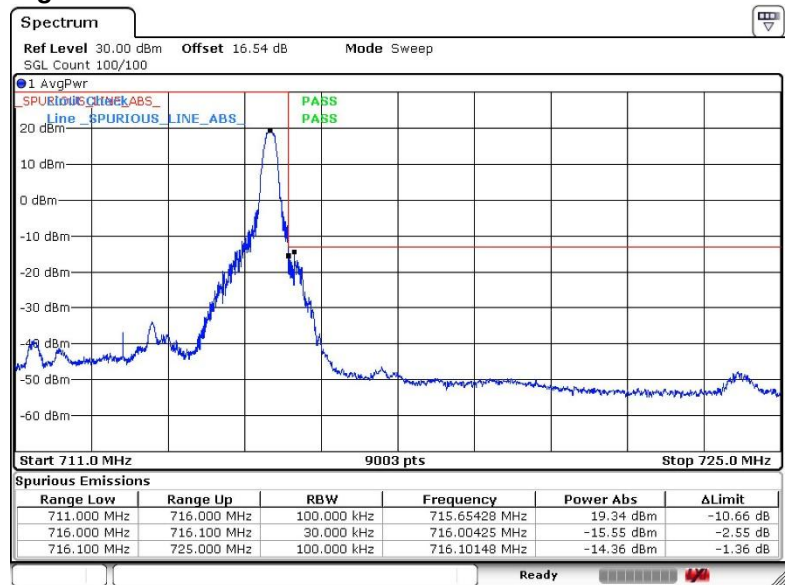


Japan

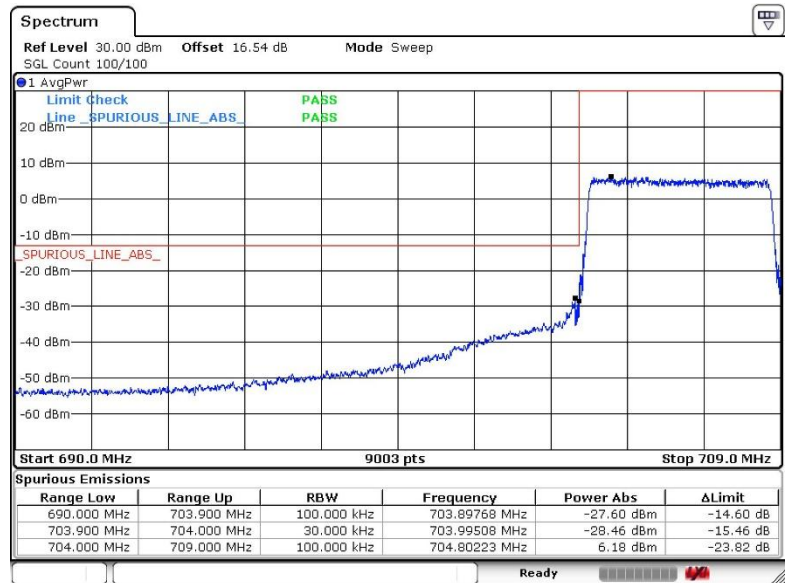
64QAM, BW 5MHz, RB1-0  
Channel: Low



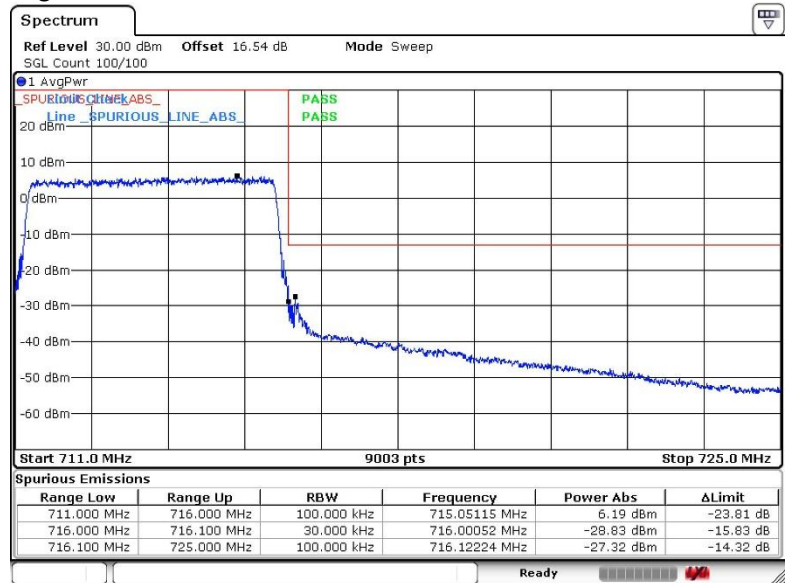
64QAM, BW 5MHz, RB1-24  
Channel: High



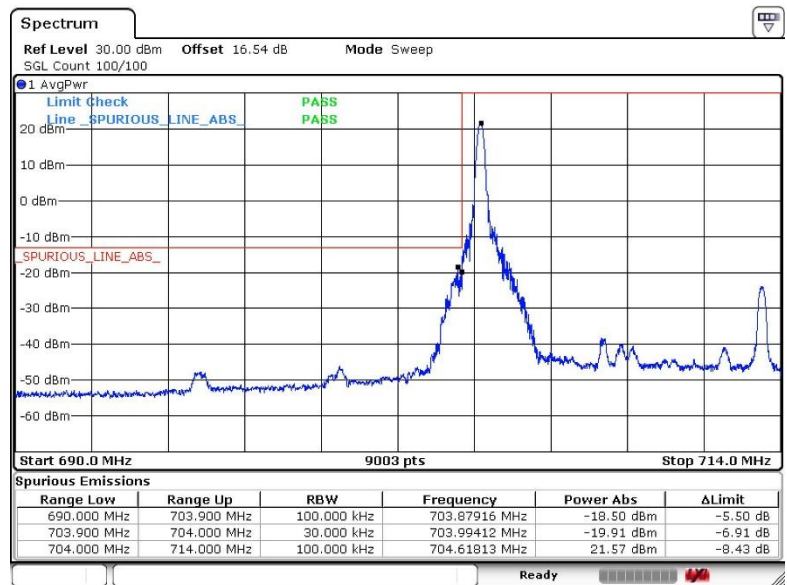
64QAM, BW 5MHz, RB25-0  
Channel: Low



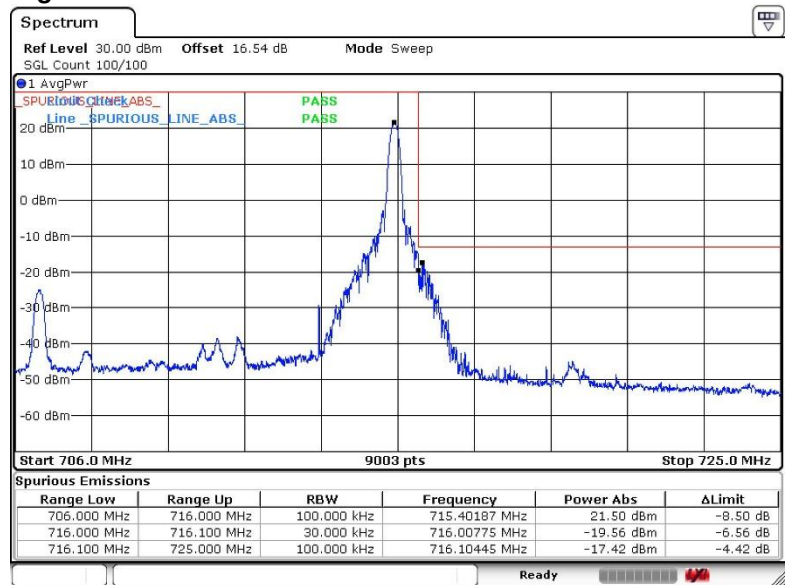
64QAM, BW 5MHz, RB25-0  
Channel: High

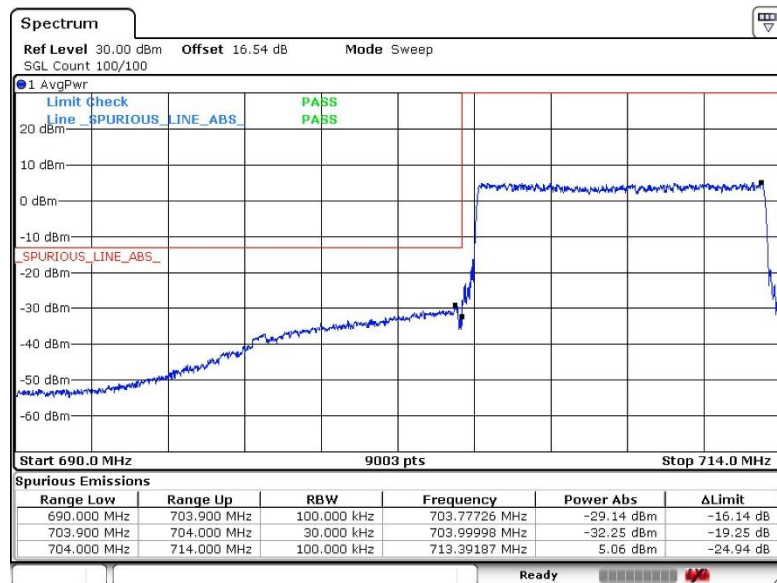
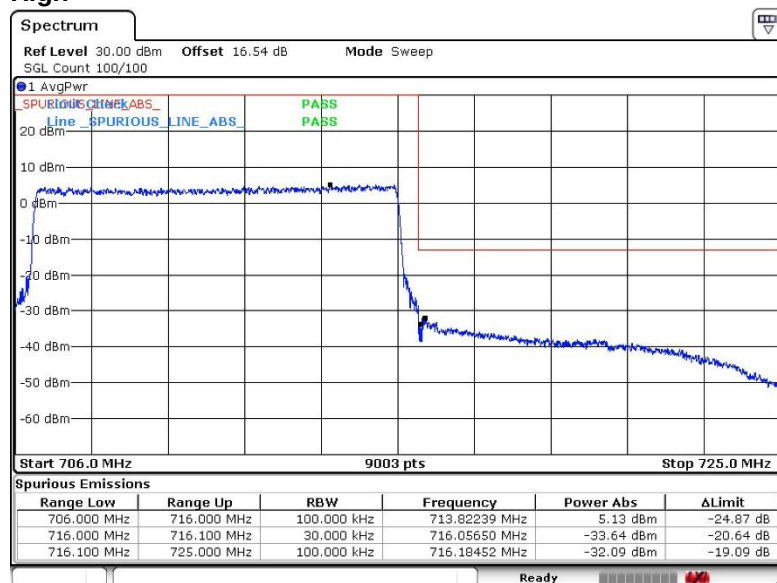


**QPSK, BW 10MHz, RB1-0**  
**Channel: Low**



**QPSK, BW 10MHz, RB1-49**  
**Channel: High**

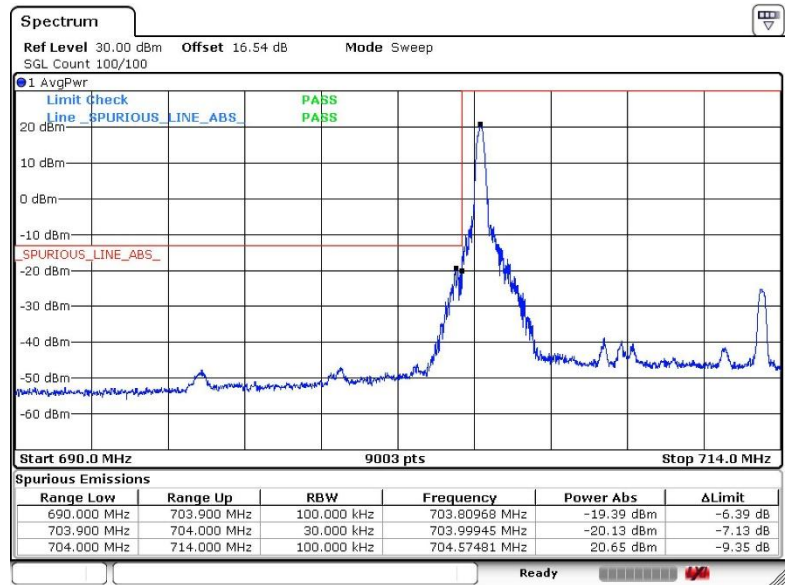


**QPSK, BW 10MHz, RB50-0**  
**Channel: Low****QPSK, BW 10MHz, RB50-0**  
**Channel: High**

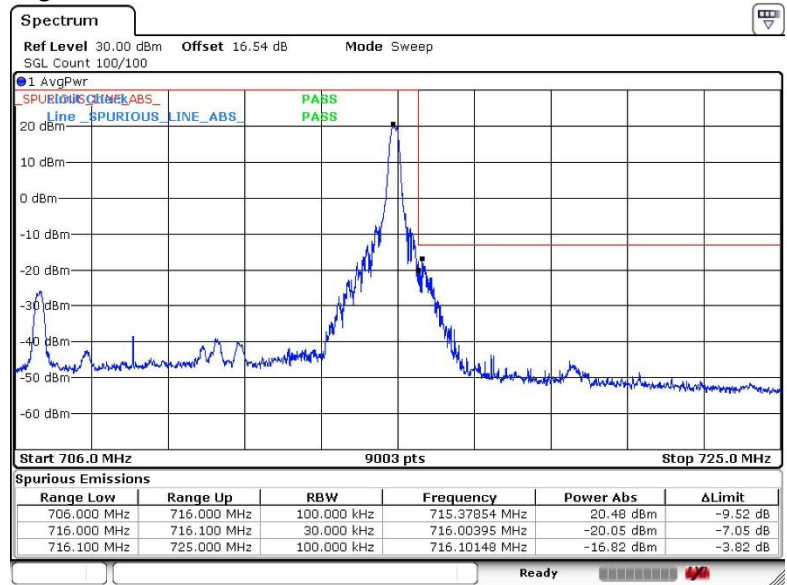


Japan

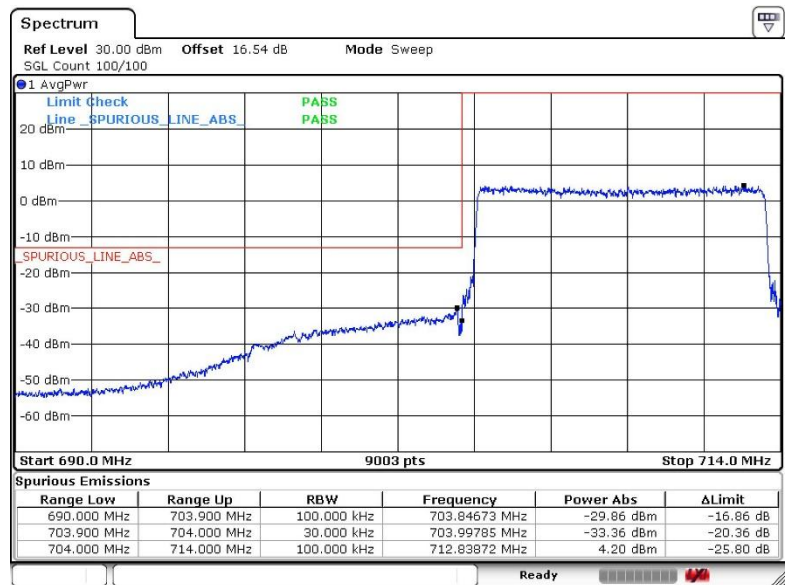
**16QAM, BW 10MHz, RB1-0**  
**Channel: Low**



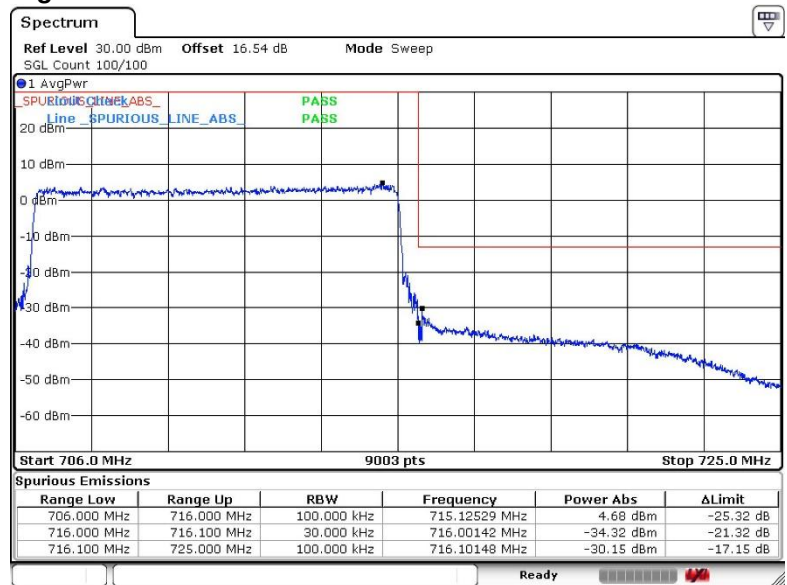
**16QAM, BW 10MHz, RB1-49**  
**Channel: High**



**16QAM, BW 10MHz, RB50-0**  
**Channel: Low**



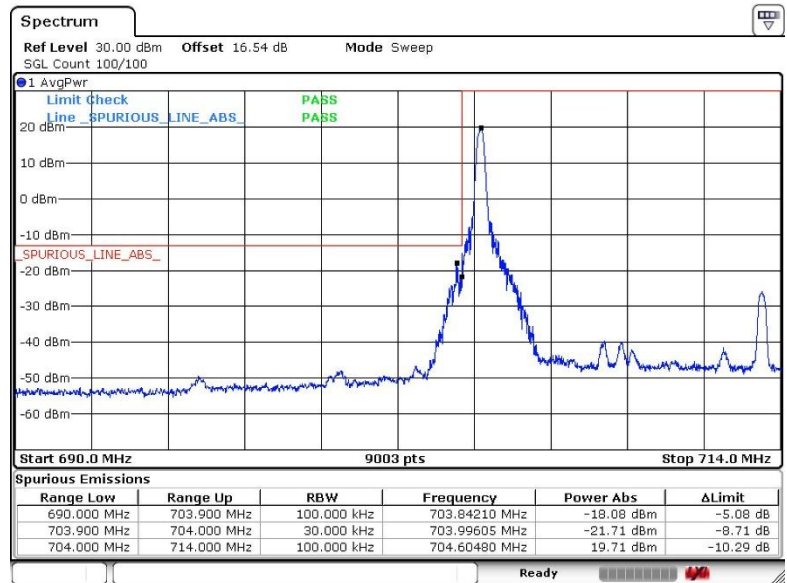
**16QAM, BW 10MHz, RB50-0**  
**Channel: High**



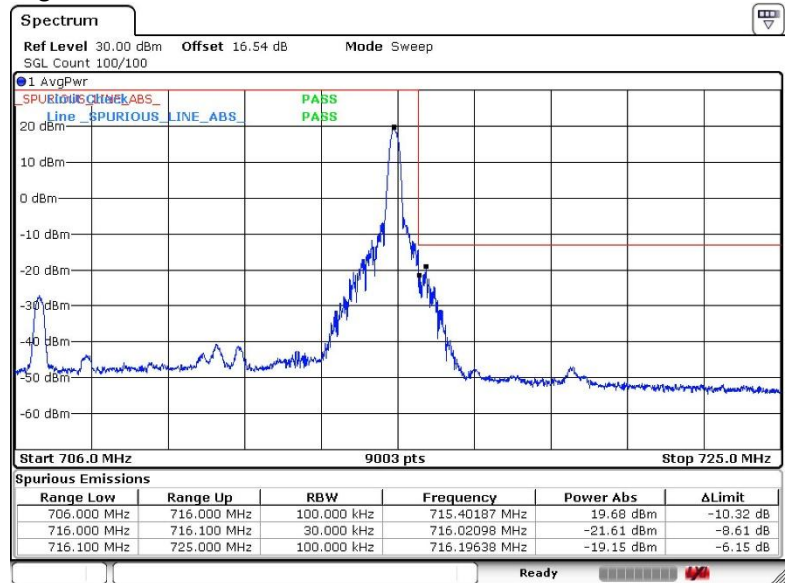


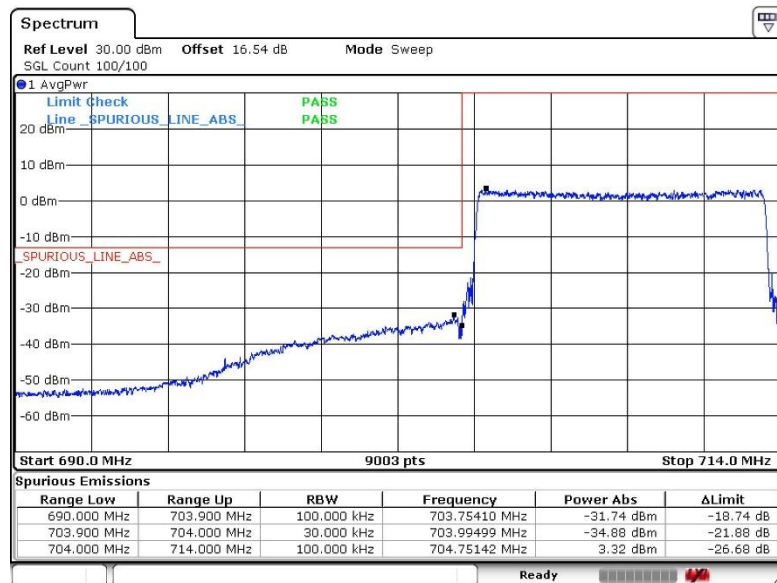
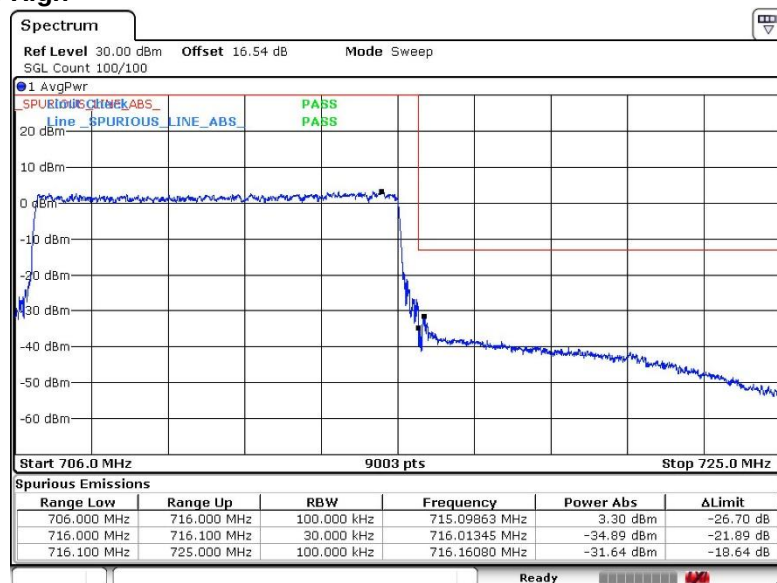
Japan

**64QAM, BW 10MHz, RB1-0**  
**Channel: Low**



**64QAM, BW 10MHz, RB1-49**  
**Channel: High**



**64QAM, BW 10MHz, RB50-0**  
**Channel: Low****64QAM, BW 10MHz, RB50-0**  
**Channel: High**

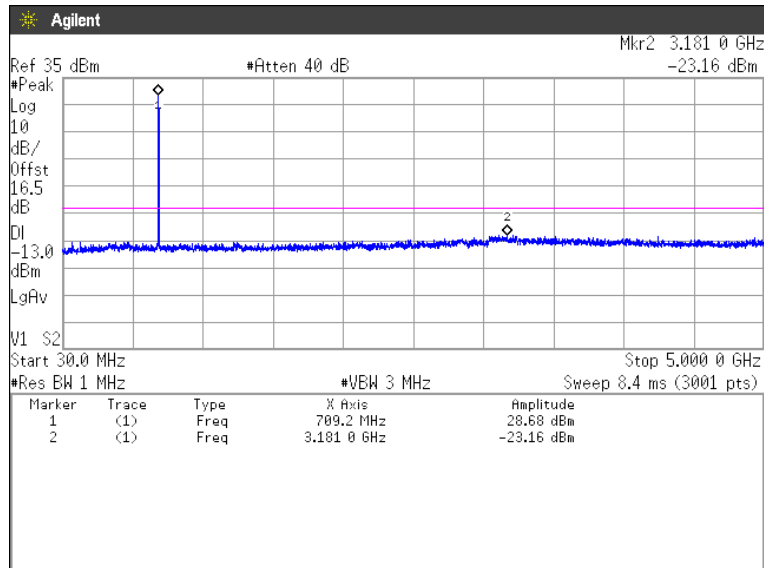
**(Spurious Emissions)**

**Note: Conducted spurious test was measured in the worst case of Effective Radiated Power.**

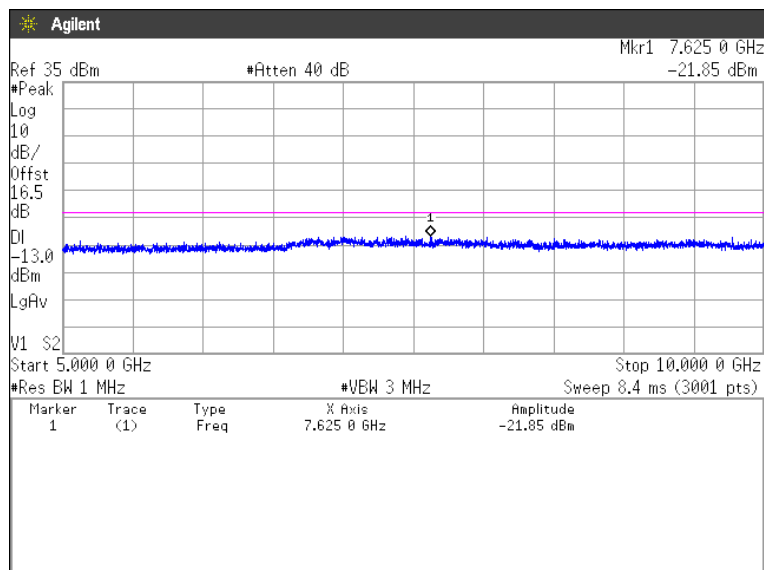
**QPSK, BW 10MHz, RB1-25**

**Channel: 23780**

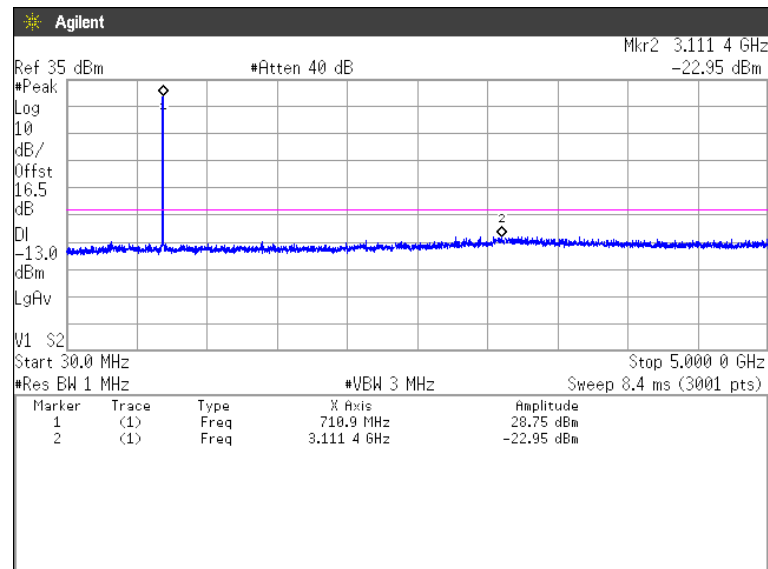
**30MHz-5GHz**



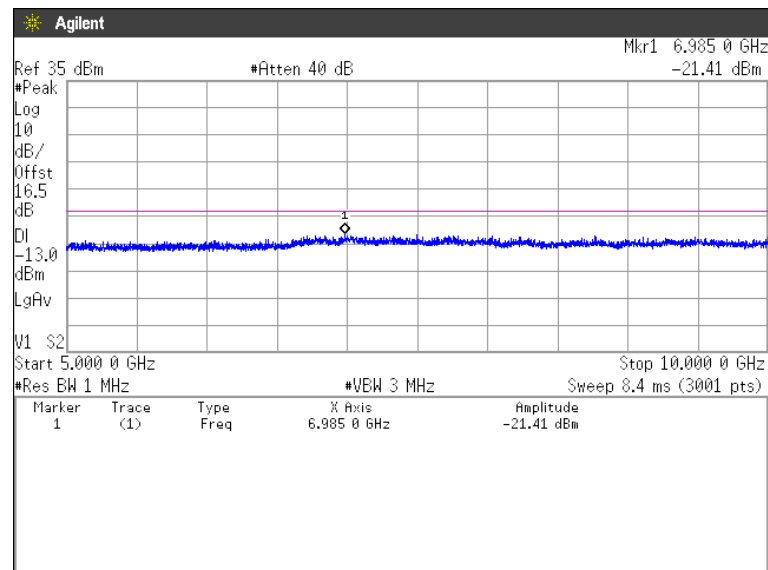
**5GHz-10GHz**



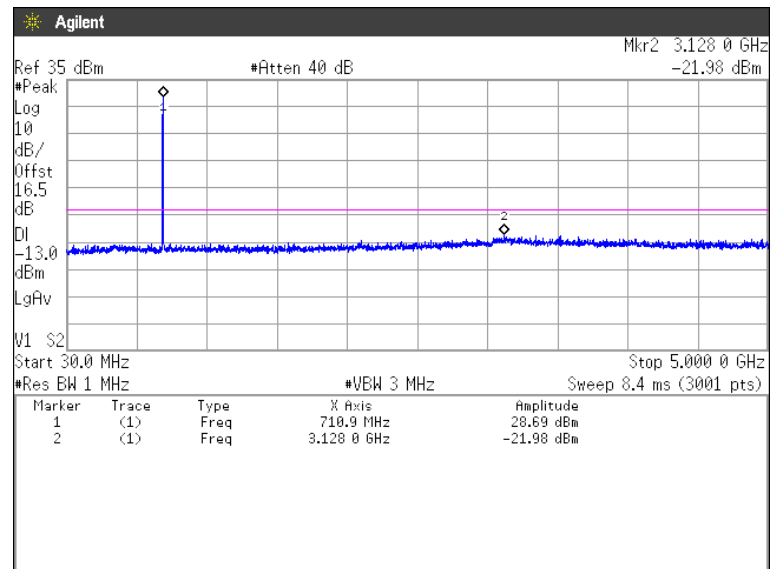
**Channel: 23790**  
**30MHz-5GHz**



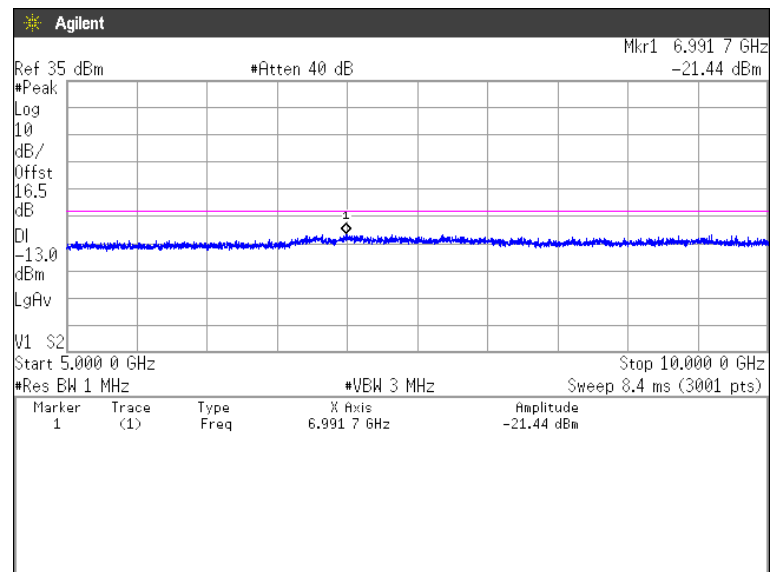
**5GHz-10GHz**



**Channel: 23800**  
**30MHz-5GHz**



**5GHz-10GHz**



## 4.5 Radiated Emissions and Harmonic Emissions

### 4.5.1 Measurement procedure

#### [FCC 27.53, 2.1053]

##### <Step 1>

The EUT and support equipment are placed on a 1 meter x 1 meter surface, 0.8 meter height styrene foam table. Radiated emission measurements are performed at 3 meter distance with the broadband antenna (Biconical antenna, Log periodic antenna and double ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1 to 4 meters and stopped at height producing the maximum emission.

The bandwidth of the spectrum analyzer is set to 1 MHz. The turntable is rotated by 360 degrees and stopped at azimuth of producing the maximum emission. The frequency is investigated up to 20GHz.

##### <Step 2>

The substitution antenna is replaced by the transmitter antenna (EUT).

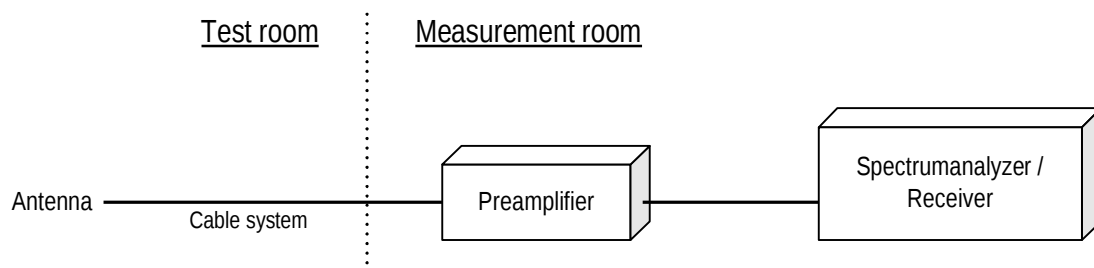
The frequency of the signal generator is adjusted to the measurement frequency.

Level of the signal generator is adjusted to the level that is obtained from step 1, and record the emission level of signal generator.

The spectrum analyzer is set to;

- a) RBW = 100 kHz for below 1GHz and 1MHz for above 1GHz / VBW  $\geq 3 \times$  RBW
- b) Detector = Peak
- c) Trace mode = Max hold
- d) Sweep time = auto-couple

- Test configuration





Japan

#### **4.5.2 Calculation method**

Result (ERP) = S.G Reading - Cable loss + Antenna Gain

Margin = Limit – Result (ERP)

Example:

Limit @ 1413 MHz : -13.0 dBm

S.G Reading = -55.6 dBm Cable loss = 1.0dB Ant. Gain = 5.9 dBd

Result = -55.6 - 1.0 + 5.9 = -50.7 dBm

Margin = -13.0 - (-50.7) = 37.7 dB

#### **4.5.3 Limit**

-13 dBm or less

**4.5.4 Test data**

Date : 22~23-May-2020  
 Temperature : 19.7 [°C]  
 Humidity : 53.3 [%]  
 Test place : 3m Semi-anechoic chamber

Test engineer : Chiaki Kanno

Date : 25~26-May-2020  
 Temperature : 21.2 [°C]  
 Humidity : 66.0 [%]  
 Test place : 3m Semi-anechoic chamber

Test engineer : Tadahiro Seino

Date : 29~30-May-2020  
 Temperature : 21.0 [°C]  
 Humidity : 40.4 [%]  
 Test place : 3m Semi-anechoic chamber

Test engineer : Tadahiro Seino

**[LTE Band X VII]**  
**QPSK, BW 5MHz**  
**Channel: 23755**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1413.0          | -55.2             | -61.5             | 1.0             | 6.9            | -55.6        | -13.0       | 42.6        |

**Channel: 23790**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1420.0          | -55.3             | -62.5             | 1.0             | 7.0            | -56.5        | -13.0       | 43.5        |

**Channel: 23825**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1427.0          | -54.8             | -61.2             | 1.0             | 7.1            | -55.1        | -13.0       | 42.1        |

**16QAM, BW 5MHz****Channel: 23755**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1413.0          | -55.3             | -61.6             | 1.0             | 6.9            | -55.7        | -13.0       | 42.7        |

**Channel: 23790**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1420.0          | -55.5             | -62.9             | 1.0             | 7.0            | -56.9        | -13.0       | 43.9        |

**Channel: 23825**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1427.0          | -55.1             | -62.0             | 1.0             | 7.1            | -55.9        | -13.0       | 42.9        |

**64QAM, BW 5MHz****Channel: 23755**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1413.0          | -55.3             | -61.8             | 1.0             | 6.9            | -55.9        | -13.0       | 42.9        |

**Channel: 23790**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1420.0          | -55.3             | -62.8             | 1.0             | 7.0            | -56.8        | -13.0       | 43.8        |

**Channel: 23825**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1427.0          | -54.2             | -60.5             | 1.0             | 7.1            | -54.4        | -13.0       | 41.4        |

**QPSK, BW 10MHz****Channel: 23780**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1418.0          | -54.3             | -59.4             | 1.0             | 7.0            | -53.4        | -13.0       | 40.4        |

**Channel: 23790**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1420.0          | -54.7             | -61.2             | 1.0             | 7.0            | -55.2        | -13.0       | 42.2        |

**Channel: 23800**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1422.0          | -54.7             | -60.5             | 1.0             | 7.0            | -54.5        | -13.0       | 41.5        |

**16QAM, BW 10MHz****Channel: 23780**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1418.0          | -55.1             | -61.7             | 1.0             | 7.0            | -55.7        | -13.0       | 42.7        |

**Channel: 23790**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1420.0          | -54.9             | -61.6             | 1.0             | 7.0            | -55.6        | -13.0       | 42.6        |

**Channel: 23800**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1422.0          | -55.0             | -61.7             | 1.0             | 7.0            | -55.7        | -13.0       | 42.7        |

**64QAM, BW 10MHz****Channel: 23780**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1418.0          | -55.3             | -62.4             | 1.0             | 7.0            | -56.4        | -13.0       | 43.4        |

**Channel: 23790**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1420.0          | -55.4             | -62.6             | 1.0             | 7.0            | -56.6        | -13.0       | 43.6        |

**Channel: 23800**

| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|-----|-----------------|-------------------|-------------------|-----------------|----------------|--------------|-------------|-------------|
| H   | 1422.0          | -55.2             | -62.4             | 1.0             | 7.0            | -56.4        | -13.0       | 43.4        |

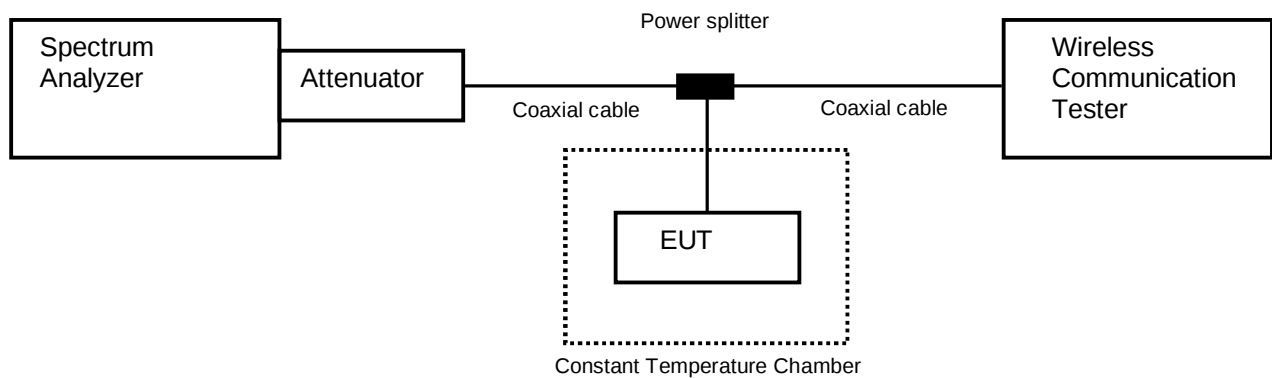
## 4.6 Frequency Stability

### 4.6.1 Measurement procedure

[FCC 27.54, 2.1055]

The EUT was placed of an inside of an constant temperature chamber as the temperature in the chamber was varied between -30°C and +50°C. The temperature was incremented by 10°C intervals and the unit was allowed to stabilize at each measurement. The frequency drift was measured with the normal Temperature and voltage tolerance and it is presented as the ppm unit.

- Test configuration



### 4.6.2 Limit

±2.5 ppm

**4.6.3 Measurement result**

Date : 1-July-2020

Temperature : 23.4 [°C]

Humidity : 62.3 [%]

Test place : Shielded room No.4

Test engineer :

Kazunori Saito

**[LTE Band X VII]**  
**(Channel: 23790)**

| Limit: $\pm 0.00025\% = \pm 2.5 \text{ ppm}$ |             |                        |                     |           |        |
|----------------------------------------------|-------------|------------------------|---------------------|-----------|--------|
| Power Supply                                 | Temperature | Measurements Frequency | Frequency Tolerance | Limit     | Result |
| [V]                                          | [°C]        | [Hz]                   | [ppm]               | [ppm]     |        |
| 3.85                                         | 25(Ref.)    | 709,999,992            | 0.00000             | $\pm 2.5$ | Pass   |
|                                              | 50          | 709,999,984            | -0.01151            | $\pm 2.5$ | Pass   |
|                                              | 40          | 709,999,983            | -0.01328            | $\pm 2.5$ | Pass   |
|                                              | 30          | 709,999,987            | -0.00783            | $\pm 2.5$ | Pass   |
|                                              | 20          | 709,999,989            | -0.00462            | $\pm 2.5$ | Pass   |
|                                              | 10          | 709,999,988            | -0.00631            | $\pm 2.5$ | Pass   |
|                                              | 0           | 709,999,987            | -0.00755            | $\pm 2.5$ | Pass   |
|                                              | -10         | 709,999,991            | -0.00221            | $\pm 2.5$ | Pass   |
|                                              | -20         | 709,999,993            | 0.00135             | $\pm 2.5$ | Pass   |
|                                              | -30         | 710,000,023            | 0.04403             | $\pm 2.5$ | Pass   |
| 3.47                                         | 25          | 709,999,995            | 0.00342             | $\pm 2.5$ | Pass   |
| 4.24                                         | 25          | 709,999,991            | -0.00231            | $\pm 2.5$ | Pass   |

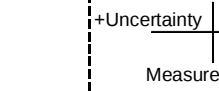
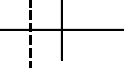
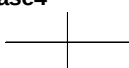
Calculation;

$$\text{Frequency Tolerance (ppm)} = \frac{\text{Measurements Frequency (Hz)} - \text{Reference Frequency (Hz)}}{\text{Reference Frequency (Hz)}} \times 1000000$$

## 5 Measurement Uncertainty

Expanded uncertainties stated are calculated with a coverage Factor  $k=2$ .  
Please note that these results are not taken into account when measurement uncertainty considerations contained in ETSI TR 100 028 Parts 1 and 2 determining compliance or non-compliance with test result.

| Test item                                  | Measurement uncertainty |
|--------------------------------------------|-------------------------|
| Conducted emission, AMN (9 kHz – 150 kHz)  | $\pm 3.8$ dB            |
| Conducted emission, AMN (150 kHz – 30 MHz) | $\pm 3.4$ dB            |
| Radiated emission ( 9kHz – 30 MHz)         | $\pm 3.9$ dB            |
| Radiated emission (30 MHz – 1000 MHz)      | $\pm 4.9$ dB            |
| Radiated emission (1 GHz – 6 GHz)          | $\pm 4.6$ dB            |
| Radiated emission (6 GHz – 18 GHz)         | $\pm 4.9$ dB            |
| Radiated emission (18 GHz – 40 GHz)        | $\pm 5.8$ dB            |
| Radio Frequency                            | $\pm 1.4 \cdot 10^{-8}$ |
| RF power, conducted                        | $\pm 0.6$ dB            |
| Temperature                                | $\pm 0.6$ °C            |
| Humidity                                   | $\pm 1.2$ %             |
| Voltage (DC)                               | $\pm 0.4$ %             |
| Voltage (AC, <10kHz)                       | $\pm 0.2$ %             |

| Judge | Measured value and standard limit value                                                                                                                                                                                                                                                                                                                                                                   |  |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| PASS  | <div> <div> <div>Standard limit value</div> <div> <div>+Uncertainty</div> <div>-Uncertainty</div> </div> <div>Measured value</div> </div> <div> <p>Case1</p>  <p>Even if it takes uncertainty into consideration, a standard limit value is fulfilled.</p> </div> </div>                                               |  |
|       | <div> <div> <div>Standard limit value</div> <div> <div>+Uncertainty</div> <div>-Uncertainty</div> </div> <div>Measured value</div> </div> <div> <p>Case2</p>  <p>Although measured value is in a standard limit value, a limit value won't be fulfilled if uncertainty is taken into consideration.</p> </div> </div>  |  |
| FAIL  | <div> <div> <div>Standard limit value</div> <div> <div>+Uncertainty</div> <div>-Uncertainty</div> </div> <div>Measured value</div> </div> <div> <p>Case3</p>  <p>Although measured value exceeds a standard limit value, a limit value will be fulfilled if uncertainty is taken into consideration.</p> </div> </div> |  |
|       | <div> <div> <div>Standard limit value</div> <div> <div>+Uncertainty</div> <div>-Uncertainty</div> </div> <div>Measured value</div> </div> <div> <p>Case4</p>  <p>Even if it takes uncertainty into consideration, a standard limit value isn't fulfilled.</p> </div> </div>                                            |  |



Japan

## 6 Laboratory Information

Testing was performed and the report was issued at:

**TÜV SÜD Japan Ltd. Yonezawa Testing Center**

Address: 5-4149-7 Hachimanpara, Yonezawa-shi, Yamagata, 992-1128 Japan  
Phone: +81-238-28-2881  
Fax: +81-238-28-2888

**Accreditation and Registration**

A2LA

Certificate #3686.03

VLAC

Accreditation No.: VLAC-013

BSMI

Laboratory Code: SL2-IN-E-6018, SL2-A1-E-6018

Innovation, Science and Economic Development Canada

ISED#: 4224A

VCCI Council

| Registration number | Expiration date |
|---------------------|-----------------|
| A-0166              | 03-July-2021    |

## Appendix A. Test Equipment

### Antenna port conducted test

| Equipment                        | Company              | Model No.       | Serial No. | Cal. Due    | Cal. Date   |
|----------------------------------|----------------------|-----------------|------------|-------------|-------------|
| Spectrum analyzer                | Agilent Technologies | E4440A          | US44302655 | 31-Aug-2020 | 05-Aug-2019 |
| Spectrum analyzer                | ROHDE&SCHWARZ        | FSV40           | 101732     | 28-Feb-2021 | 17-Feb-2020 |
| Attenuator                       | Weinschel            | 56-10           | J4180      | 31-Jul-2020 | 18-Jul-2019 |
| Microwave cable                  | HUBER+SUHNER         | SUCOFLEX 104/1m | 199120/4   | 31-Dec-2020 | 17-Dec-2019 |
| Microwave cable                  | HUBER+SUHNER         | SUCOFELX102/2m  | 802897/2   | 31-Dec-2020 | 18-Dec-2019 |
| Power divider                    | ANRITSU              | K240B           | 020205     | 31-Jul-2020 | 19-Jul-2019 |
| Wideband Radio Frequency Tester  | ROHDE&SCHWARZ        | CMW500          | 126079     | 30-Nov-2020 | 14-Nov-2019 |
| Wideband Radio Frequency Tester  | ROHDE&SCHWARZ        | CMW500          | 116338     | 31-Aug-2020 | 27-Aug-2019 |
| Temperature and humidity chamber | ESPEC                | PL1KP           | 14007261   | 30-Sep-2020 | 03-Sep-2019 |

### Radiated emission

| Equipment                       | Company              | Model No.         | Serial No.      | Cal. Due    | Cal. Date   |
|---------------------------------|----------------------|-------------------|-----------------|-------------|-------------|
| EMI Receiver                    | ROHDE&SCHWARZ        | ESCI              | 100765          | 30-Sep-2020 | 25-Sep-2019 |
| Spectrum analyzer               | Agilent Technologies | E4447A            | MY46180188      | 31-Mar-2021 | 27-Mar-2020 |
| Spectrum analyzer               | Agilent Technologies | E4440A            | US40420937      | 30-Sep-2020 | 26-Sep-2019 |
| Preamplifier                    | SONOMA               | 310               | 372170          | 30-Sep-2020 | 26-Sep-2019 |
| Biconical antenna               | Schwarzbeck          | VHBB9124/BBA9106  | 1344            | 31-Dec-2020 | 04-Dec-2019 |
| Log periodic antenna            | Schwarzbeck          | VUSLP9111B        | 345             | 31-Aug-2020 | 27-Aug-2019 |
| Attenuator                      | TOYO Connector       | NA-PJ-6           | N/A(S507)       | 31-Dec-2020 | 18-Dec-2019 |
| Attenuator                      | TAMAGAWA.ELEC        | CFA-10/3dB        | N/A(S503)       | 31-Jul-2020 | 17-Jul-2019 |
| Preamplifier                    | TSJ                  | MLA-100M18-B02-40 | 1929118         | 31-Jan-2021 | 08-Jan-2020 |
| Attenuator                      | AEROFLEX             | 26A-10            | 081217-08       | 31-Jan-2021 | 10-Jan-2020 |
| Double ridged guide antenna     | ETS LINDGREN         | 3117              | 00052315        | 30-Apr-2021 | 08-Apr-2020 |
| Attenuator                      | HUBER+SUHNER         | 6803.17.B         | N/A(2341)       | 31-Dec-2020 | 18-Dec-2019 |
| Double ridged guide antenna     | A.H.Systems Inc.     | SAS-574           | 469             | 31-Aug-2020 | 28-Aug-2019 |
| Preamplifier                    | TSJ                  | MLA-1840-B03-35   | 1240332         | 31-Aug-2020 | 28-Aug-2019 |
| Notch Filter                    | Micro-Tronics        | BRM50706          | 003             | 31-Jul-2020 | 18-Jul-2019 |
| Signal generator                | ROHDE&SCHWARZ        | SMB100A           | 177525          | 31-Jul-2020 | 18-Jul-2019 |
| RF power amplifier              | R&K                  | CGA020M602-2633R  | B40240          | 31-May-2021 | 15-May-2020 |
| Microwave cable                 | HUBER+SUHNER         | SUCOFELX102/2m    | 31648           | 31-Mar-2021 | 26-Mar-2020 |
| Dipole antenna                  | Schwarzbeck          | VHAP              | 1021            | 31-Aug-2020 | 15-Aug-2019 |
| Dipole antenna                  | Schwarzbeck          | UHAP              | 993             | 31-Aug-2020 | 15-Aug-2019 |
| Double ridged guide antenna     | ETS LINDGREN         | 3117              | 00218815        | 31-Dec-2020 | 16-Dec-2019 |
| Wideband Radio Frequency Tester | ROHDE&SCHWARZ        | CMW500            | 126079          | 30-Nov-2020 | 14-Nov-2019 |
| Wideband Radio Frequency Tester | ROHDE&SCHWARZ        | CMW500            | 116338          | 31-Aug-2020 | 27-Aug-2019 |
| Microwave cable                 | HUBER+SUHNER         | SUCOFLEX104/9m    | MY30037/4       | 31-Jan-2021 | 08-Jan-2020 |
|                                 |                      | SUCOFLEX104/1m    | my24610/4       | 31-Jan-2021 | 08-Jan-2020 |
|                                 |                      | SUCOFLEX104/8m    | SN MY30031/4    | 31-Jan-2021 | 09-Jan-2020 |
|                                 |                      | SUCOFLEX104       | MY32976/4       | 31-Jan-2021 | 08-Jan-2020 |
|                                 |                      | SUCOFLEX104/1.5m  | MY19309/4       | 31-Jan-2021 | 08-Jan-2020 |
|                                 |                      | SUCOFLEX104/7m    | 41625/6         | 31-Jan-2021 | 08-Jan-2020 |
| PC                              | DELL                 | DIMENSION E521    | 75465BX         | N/A         | N/A         |
| Software                        | TOYO Corporation     | EP5/RE-AJ         | 0611193/V5.6.0  | N/A         | N/A         |
| Absorber                        | RIKEN                | PFP30             | N/A             | N/A         | N/A         |
| 3m Semi an-echoic Chamber       | TOKIN                | N/A               | N/A(9002-NSA)   | 31-May-2021 | 29-May-2020 |
| 3m Semi an-echoic Chamber       | TOKIN                | N/A               | N/A(9002-SVSWR) | 31-May-2020 | 13-May-2019 |
| 3m Semi an-echoic Chamber       | TOKIN                | N/A               | N/A(9002-SVSWR) | 31-May-2021 | 29-May-2020 |

\*: The calibrations of the above equipment are traceable to NIST or equivalent standards of the reference organizations.