Zacta

# TEST REPORT

Report number : Z101C-15070
Issue date : July 10, 2015

The device, as described herewith, was tested pursuant to applicable test procedure and complies with the requirements of;

**FCC Part 27 Subpart C**
**IC RSS-130**

The test results are traceable to the international or national standards.

| | | |
|---|---|---|
| Applicant | : | KYOCERA Corporation |
| Equipment under test (EUT) | : | Module |
| Model number | : | J79 |
| FCC ID | : | JOYJ79 |
| IC Certification Number | : | 574B-J79 |

Date of test : June 16, 17, 19, 24, 25, July 1, 2015

Test place : TÜV SÜD Zacta Ltd. Yonezawa Testing Center
4149-7 Hachimanpara 5-chome
Yonezawa-shi Yamagata 992-1128 Japan
Phone: +81-238-28-2880 Fax: +81-238-28-2888

Test results : Complied

The results in this report are applicable only to the equipment tested.
This report shall not be re-produced except in full without the written approval of TÜV SÜD Zacta Ltd.
This test report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Tested by : Taiki Watanabe

Tested by : Hikaru Shibata

Authorized by : Hiroaki Suzuki
Manager of EMC Technical Department

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# 1. Summary of Test

## 1.1 Purpose of test

It is the original test in order to verify conformance to FCC Part 27 Subpart C, IC RSS-130.

## 1.2 Standards

CFR47 FCC Part 27 Subpart C
IC RSS-130

### 1.2.1 Test Methods

ANSI/TIA/EIA-603-C-2004

### 1.2.2 Deviation from standards

None

## 1.3 List of applied test to the EUT

| FCC Section | IC Section | Test items | Condition | Result |
|---|---|---|---|---|
| 2.1046 | N/A | Conducted Output Power | Conducted | PASS |
| 27.50(b)(10) | RSS-130 4.4 | Effective Radiated Power | Radiated | PASS |
| 27.50(d)(5) | N/A | Peak to Average Ratio | Conducted | PASS |
| 2.1049 | RSS-130 4.3 | Occupied Bandwidth | Conducted | PASS |
| 27.53(g)<br>2.1051 | RSS-130 4.6 | Band Edge Spurious and Harmonic at Antenna Terminal | Conducted | PASS |
| 27.53(g)<br>2.1053 | RSS-130 4.6 | Radiated emissions and Harmonic Emissions | Radiated | PASS |
| 27.54<br>2.1055 | RSS-130 4.3 | Frequency Stability | Conducted | PASS |

### 1.3.1 Test set up

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## 1.4 Modification to the EUT by laboratory

None

# 2. Equipment Under Test

## 2.1 General Description of equipment

EUT is the Module.

## 2.2 EUT information

| | | |
|---|---|---|
| Applicant | : | KYOCERA Corporation<br>Yokohama Office 2-1-1 Kagahara, Tsuzuki-ku Yokohama-shi, Kanagawa, Japan<br>Phone: +81-45-943-6253 Fax: +81-45-943-6314 |
| Equipment under test | : | Module |
| Trade name | : | Kyocera |
| Model number | : | J79 |
| Serial number | : | N/A |
| EUT condition | : | Pre-Production |
| Power ratings | : | DC 3.9V |
| Size | : | (W) 40.0 × (D) 40.0 × (H) 4.3 mm |
| Environment | : | Indoor and Outdoor use |
| Terminal limitation | : | -20˚C to 60˚C |
| RF Specification | | |
| Frequency of Operation | : | Up Link<br>LTE Band X III: 777-787MHz<br><br>Down Link<br>LTE Band X III: 746-756MHz |
| Modulation type | : | QPSK, 16QAM |
| Emission designator | : | BW 5M QPSK: 4M51G7W, 16QAM: 4M49 D7W<br>BW 10M QPSK: 9M02G7W, 16QAM: 9M02 D7W |
| Output power | : | QPSK: 0.072W ERP (18.6dBm)<br>16QAM: 0.071W ERP (18.5dBm) |
| Antenna type | : | External antenna |
| Antenna gain | : | 3.7dBi |

## 2.3 Variation of the family model(s)

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 III | QPSK | 5MHz | 23205<br>23230<br>23255 | 779.5<br>782.0<br>784.5 |
| | | 10MHz | 23230 | 782.0 |
| | 16QAM | 5MHz | 23205<br>23230<br>23255 | 779.5<br>782.0<br>784.5 |
| | | 10MHz | 23230 | 782.0 |

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 Y axis and the worst case recorded.

# 3. Configuration of equipment

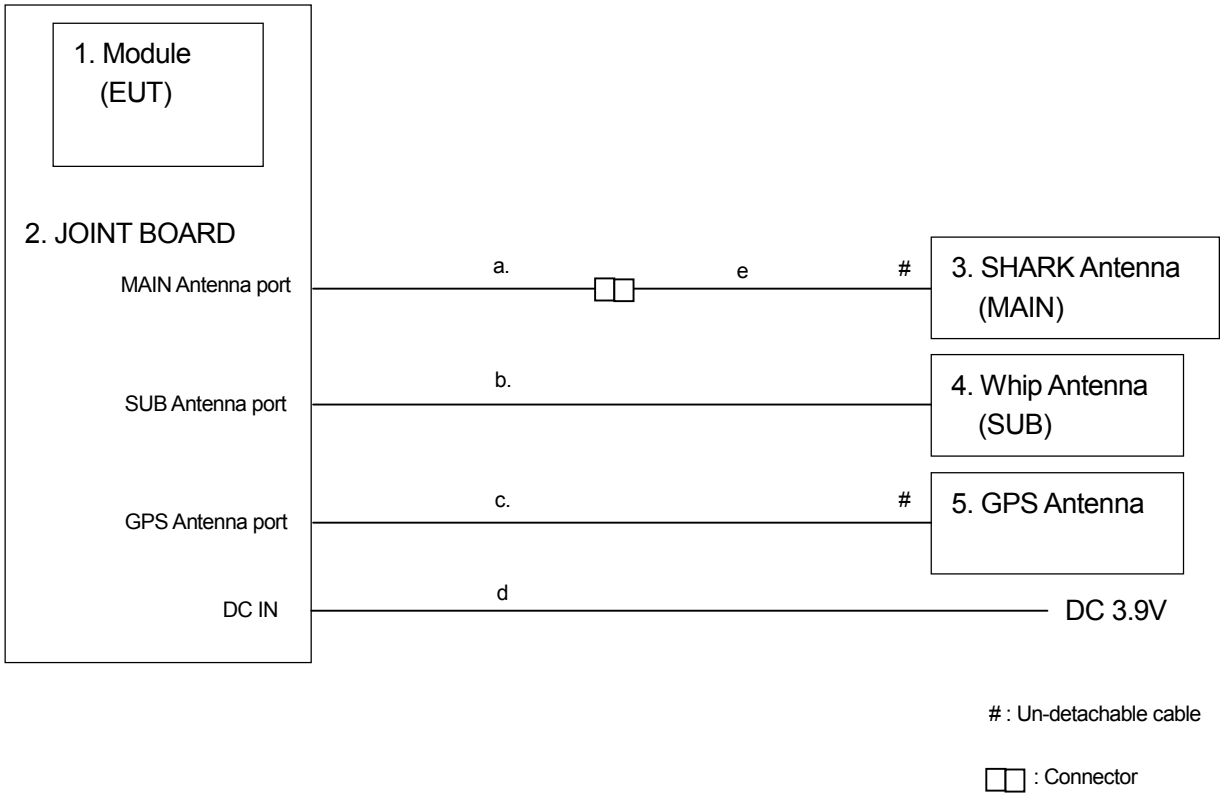
## 3.1 Equipment(s) used

| No. | Equipment | Company | Model No. | Serial No. | FCC ID / DoC | Comment |
|---|---|---|---|---|---|---|
| 1 | Module | KYOCERA | J79 | N/A | JOYJ79 | EUT |
| 2 | JOINT BOARD | KYOCERA | N/A | N/A | N/A | - |
| 3 | SHARK Antenna | YOKOWO | N/A | N/A | N/A | - |
| 4 | Whip Antenna | EAD | PTR7210 | N/A | N/A | - |
| 5 | GPS Antenna | PASTERNACK | PE51066 | N/A | N/A | - |

## 3.2 Cable(s) used

| No. | Cable | Length[m] | Shield | Connector | Comment |
|---|---|---|---|---|---|
| a | RF cable (MAIN) | 0.3 | YES | Metal | - |
| b | RF cable (SUB) | 0.3 | YES | Metal | - |
| c | GPS Antenna cable | 5.0 | YES | Metal | - |
| d | DC cable | 1.3 | NO | Plastic | - |
| e | RF cable | 0.9 | YES | Metal | - |

## 3.3 System configuration



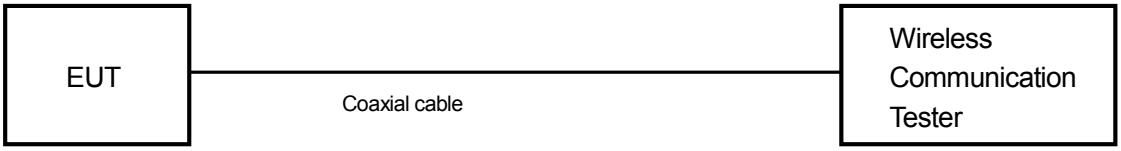

Note1: Numbers assigned to equipment or cables on this diagram correspond to the list in “3.1 Equipment(s) used” and “3.2 Cable(s) used”.

# 4. Conducted Output Power

## 4.1 Measurement procedure [FCC 2.1046]

The conducted output power was measured with a wireless communication tester connected to the antenna terminal. The wireless communication tester parameters were set to produce the maximum power from the EUT.

- Test configuration




## 4.2 Measurement result

Date : June 16, 2015
Temperature : 24.0 [˚C]
Humidity : 45.0 [%]
Test place : Shielded room No.4

Test engineer : Hikaru Shibata

| Band | BW [MHz] | Mode | RB Allocation | RB offset | Target MPR | Avg Power[dBm] | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 23205 | 23230 | 23255 |
| | | | | | | 779.5 MHz | 782.0 MHz | 784.5 MHz |
| LTE Band 13 | 5 | QPSK | 1 | 0 | 0 | 22.57 | 22.44 | 22.79 |
| | | | 1 | 12 | 0 | 22.38 | 22.61 | 22.77 |
| | | | 1 | 24 | 0 | 22.60 | 22.69 | 22.78 |
| | | | 12 | 0 | 1 | 21.62 | 21.61 | 21.71 |
| | | | 12 | 7 | 1 | 21.45 | 21.63 | 21.85 |
| | | | 12 | 13 | 1 | 21.53 | 21.63 | 21.74 |
| | | | 25 | 0 | 1 | 21.53 | 21.68 | 21.73 |
| | | 16QAM | 1 | 0 | 1 | 21.52 | 21.13 | 21.69 |
| | | | 1 | 12 | 1 | 21.42 | 21.36 | 21.72 |
| | | | 1 | 24 | 1 | 21.63 | 21.41 | 21.71 |
| | | | 12 | 0 | 2 | 20.61 | 20.62 | 20.77 |
| | | | 12 | 7 | 2 | 20.54 | 20.75 | 20.81 |
| | | | 12 | 13 | 2 | 20.61 | 20.75 | 20.76 |
| | | | 25 | 0 | 2 | 20.59 | 20.72 | 20.80 |

| Band | BW [MHz] | Mode | RB Allocation | RB offset | Target MPR | Avg Power[dBm] |
|---|---|---|---|---|---|---|
| | | | | | | 23230 |
| | | | | | | 782.0 MHz |
| LTE Band 13 | 10 | QPSK | 1 | 0 | 0 | 22.51 |
| | | | 1 | 25 | 0 | 22.65 |
| | | | 1 | 49 | 0 | 22.71 |
| | | | 25 | 0 | 1 | 21.50 |
| | | | 25 | 12 | 1 | 21.60 |
| | | | 25 | 25 | 1 | 21.72 |
| | | | 50 | 0 | 1 | 21.53 |
| | | 16QAM | 1 | 0 | 1 | 21.37 |
| | | | 1 | 25 | 1 | 20.60 |
| | | | 1 | 49 | 1 | 21.62 |
| | | | 25 | 0 | 2 | 20.53 |
| | | | 25 | 12 | 2 | 20.68 |
| | | | 25 | 25 | 2 | 20.71 |
| | | | 50 | 0 | 2 | 20.55 |

# 5. Effective Radiated Power

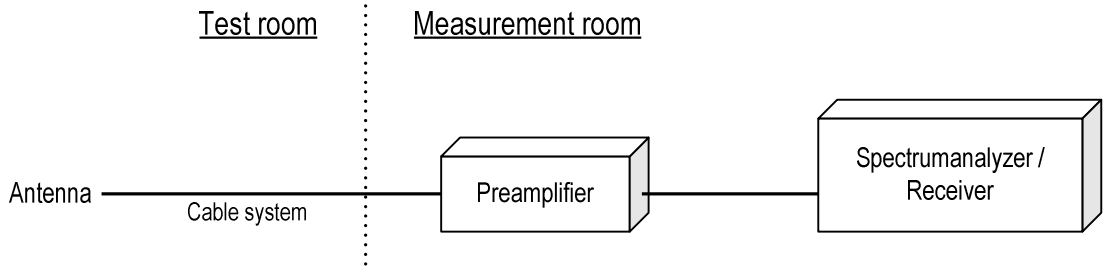
### 5.1 Measurement procedure
**[FCC 27.50(b)(10), IC RSS-130 4.4]**

<Step 1>
The EUT and support equipment are placed on a 1 meter x 1.5 meter surface, 0.8 meter height FRP table. Radiated emission measurements are performed at 3 meter distance with the broadband antenna (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 1MHz. 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.

Spectrum analyzer setting
- Detector: RMS Average (RBW: 430kHz, VBW: 1.5MHz)

- Test configuration




### 5.2 Calculation method

Result (ERP) = S.G Reading – Cable loss + Antenna Gain
Margin = Limit – Result (ERP)

Example:
Limit @ 782.0MHz : 34.7dBm
S.G Reading = 29.8dBm Cable loss = 0.7dB Ant. Gain = -10.5dBd
Result = 29.8 - 0.7 + (-10.5) = 18.6dBm
Margin = 34.7 – 18.6 = 16.1dB

### 5.3 Limit

3 W (34.7dBm)

## 5.4 Test data

Date : June 19, 2015
Temperature : 24.7 [˚C]
Humidity : 48.4 [%] Test engineer : Taiki Watanabe
Test place : 3m Semi-anechoic chamber

Date : July 1, 2015
Temperature : 23.7 [˚C]
Humidity : 58.2 [%] Test engineer : Hikaru Shibata
Test place : 3m Semi-anechoic chamber

**[LTE Band X III]**
**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 | 779.5 | -13.6 | 28.2 | 0.7 | -10.5 | 17.0 | 34.7 | 17.7 |
| H | 782.0 | -12.0 | 29.8 | 0.7 | -10.5 | 18.6 | 34.7 | 16.1 |
| H | 784.5 | -12.5 | 29.4 | 0.7 | -10.5 | 18.2 | 34.7 | 16.5 |

**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 | 779.5 | -12.3 | 29.5 | 0.7 | -10.5 | 18.3 | 34.7 | 16.4 |
| H | 782.0 | -14.8 | 27.0 | 0.7 | -10.5 | 15.8 | 34.7 | 18.9 |
| H | 784.5 | -12.2 | 29.7 | 0.7 | -10.5 | 18.5 | 34.7 | 16.2 |

**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 | 782.0 | -12.3 | 29.5 | 0.7 | -10.5 | 18.3 | 34.7 | 16.4 |

**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 | 782.0 | -13.4 | 28.4 | 0.7 | -10.5 | 17.2 | 34.7 | 17.5 |

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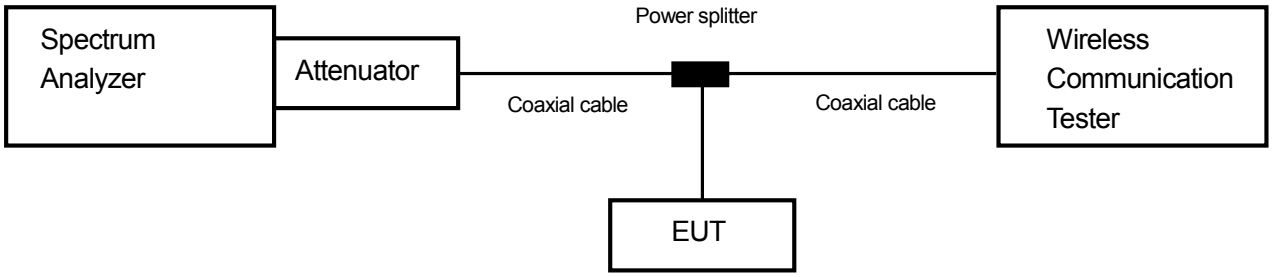
# 6. Peak to Average Ratio

## 6.1 Measurement procedure [FCC 27.50(d)(5)]

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

The spectrum analyzer is set to;
- Power Stat CCDF mode

- Test configuration




## 6.2 Limit

13.0dB or less

## 6.3 Measurement result

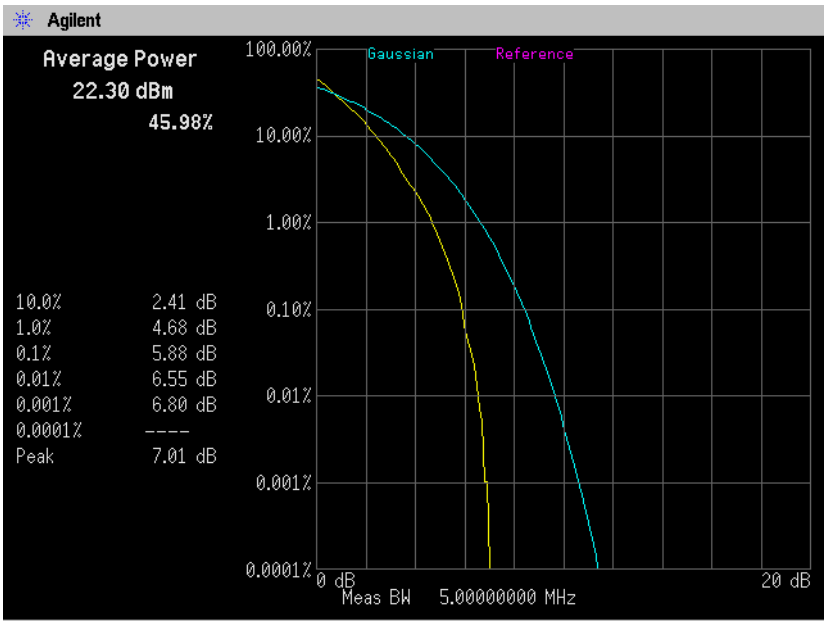
Date : June 17, 2015
Temperature : 25.7 [˚C]
Humidity : 54.5 [%]
Test place : Shielded room No.4

Test engineer : Hikaru Shibata

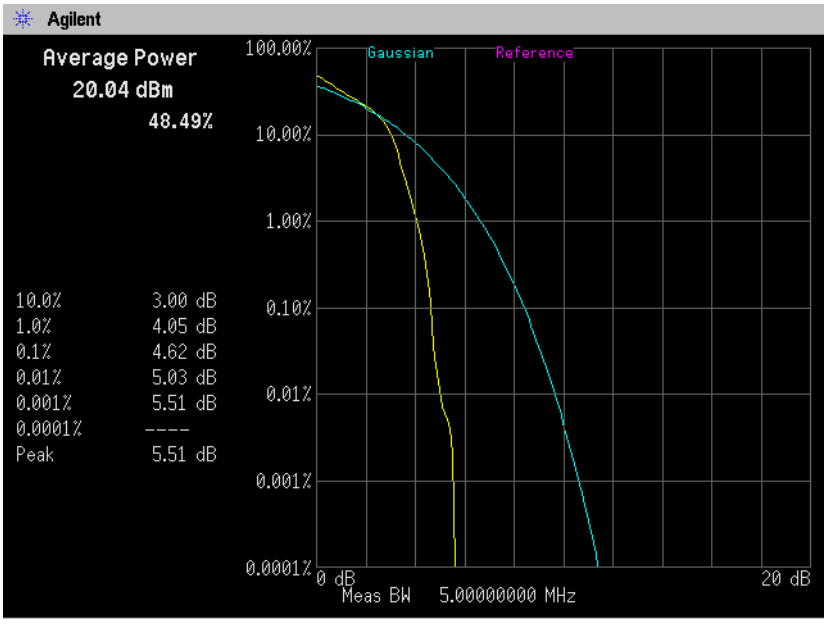
| Band | Channel | Frequency [MHz] | Modulation | BW [MHz] | RB | Peak to Average Power Ratio [dB] | Limit [dB] |
|---|---|---|---|---|---|---|---|
| LTE Band X III | 23239 | 782.0 | QPSK | 5 | 25-0 | 5.88 | 13.0 |
| | | | | 10 | 50-0 | 4.62 | 13.0 |
| | | | 16QAM | 5 | 25-0 | 6.79 | 13.0 |
| | | | | 10 | 50-0 | 6.32 | 13.0 |

## 6.4 Trace data

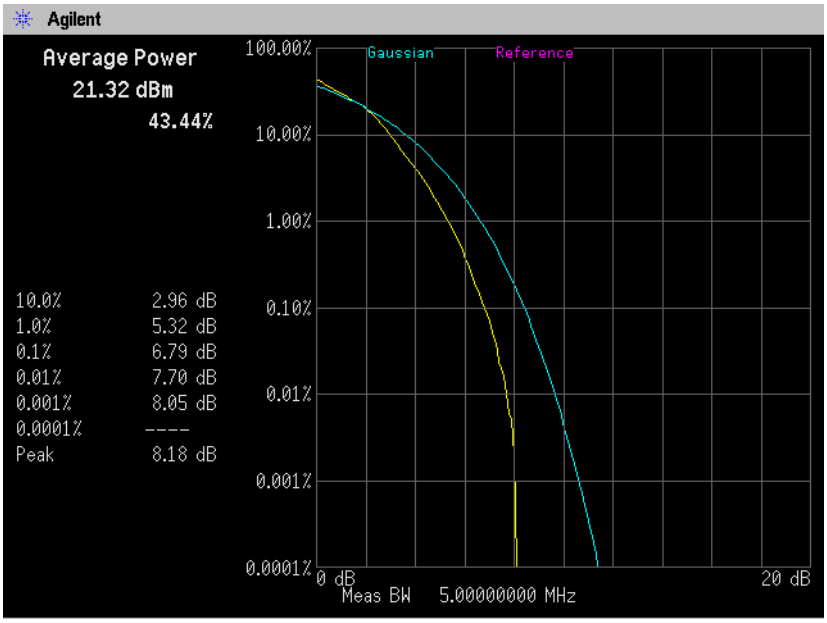
**[LTE Band X III]**
**Channel: 23230**
**QPSK, BW 5MHz, RB25-0**



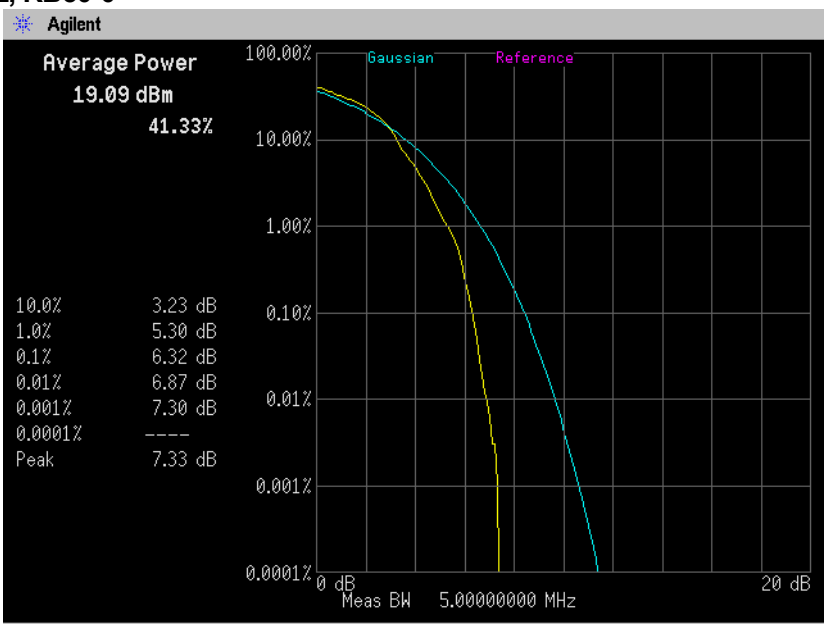

**QPSK, BW 10MHz, RB50-0**



## 16QAM, BW 5MHz, RB25-0




## 16QAM, BW 10MHz, RB50-0



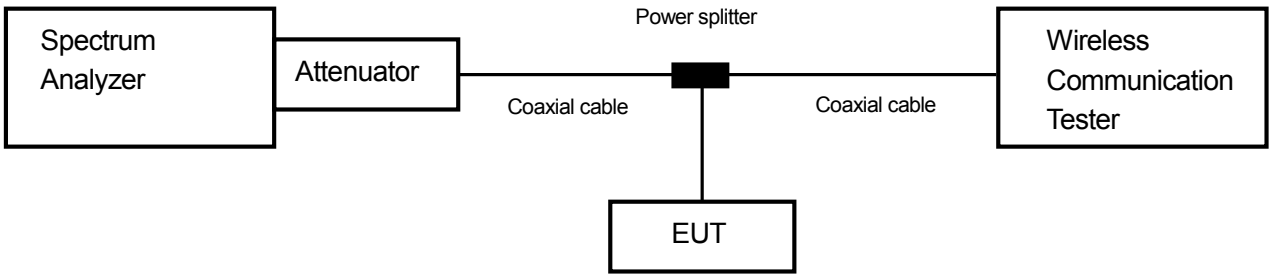
# 7. Occupied Bandwidth

## 7.1 Measurement procedure [FCC 2.1049, IC RSS-130 4.3]

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

The spectrum analyzer is set to;
- RBW=100kHz, VBW=300kHz, Span=10MHz, Sweep=auto, Detector=Peak, Trace mode=Max hold
- RBW=200kHz, VBW=620kHz, Span=20MHz, Sweep=auto, Detector=Peak, Trace mode=Max hold

- Test configuration




## 7.2 Limit

None

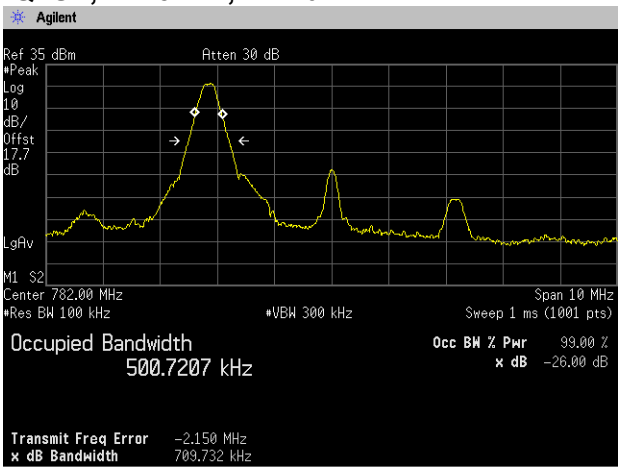
### 7.3 Measurement result

Date : June 17, 2015
Temperature : 25.7 [˚C]
Humidity : 54.5 [%] Test engineer :
Test place : Shielded room No.4 Hikaru Shibata

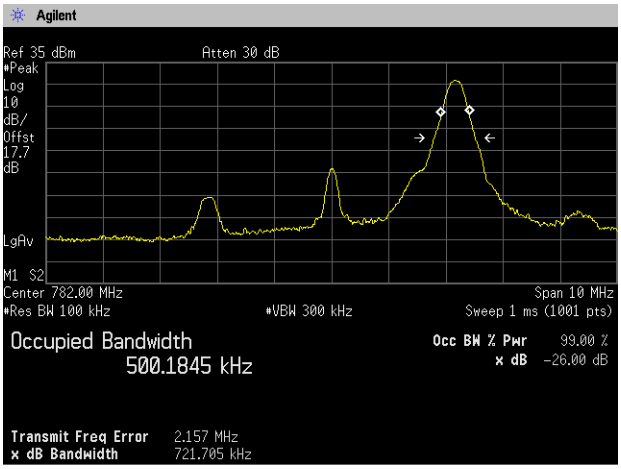
| BW | Mode | UL RB Allocation | UL RB Start | Frequency [MHz] | 26dB Bandwidth [MHz] | 99% OBW [MHz] |
|---|---|---|---|---|---|---|
| 5MHz | QPSK | 1 | 0 | 782.0 | 0.710 | 0.5007 |
| | | 1 | 24 | | 0.722 | 0.5002 |
| | | 12 | 7 | | 3.426 | 2.3472 |
| | | 25 | 0 | | 5.077 | 4.5118 |
| 5MHz | 16QAM | 1 | 0 | 782.0 | 0.688 | 0.4748 |
| | | 1 | 24 | | 0.687 | 0.4845 |
| | | 12 | 7 | | 3.377 | 2.3167 |
| | | 25 | 0 | | 5.052 | 4.4891 |
| 10MHz | QPSK | 1 | 0 | 782.0 | 1.013 | 0.7307 |
| | | 1 | 49 | | 0.986 | 0.7049 |
| | | 25 | 12 | | 6.713 | 4.7426 |
| | | 50 | 0 | | 10.067 | 9.0199 |
| 10MHz | 16QAM | 1 | 0 | 782.0 | 0.996 | 0.7245 |
| | | 1 | 49 | | 1.015 | 0.7278 |
| | | 25 | 12 | | 6.884 | 4.7914 |
| | | 50 | 0 | | 9.983 | 9.0182 |

## 7.4 Trace data

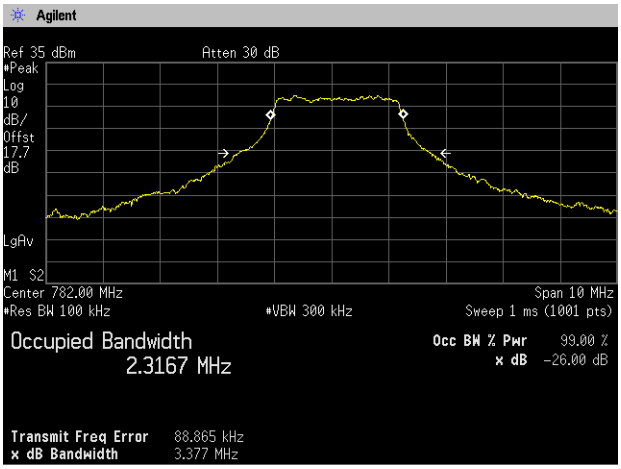
**[LTE Band X III]**
**Channel: 23095**
**QPSK, BW 5MHz, RB1-0**



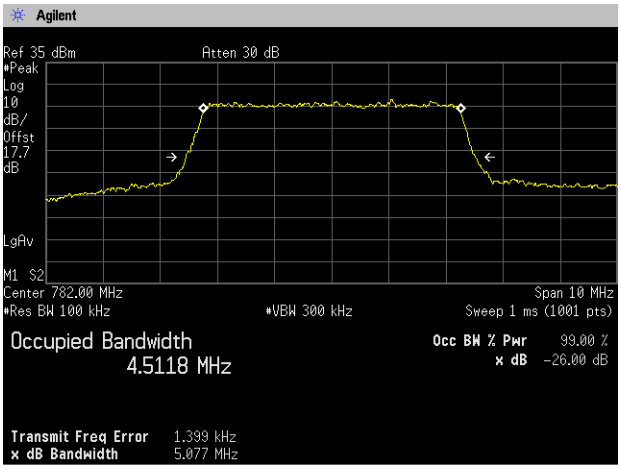

**RB1-24**



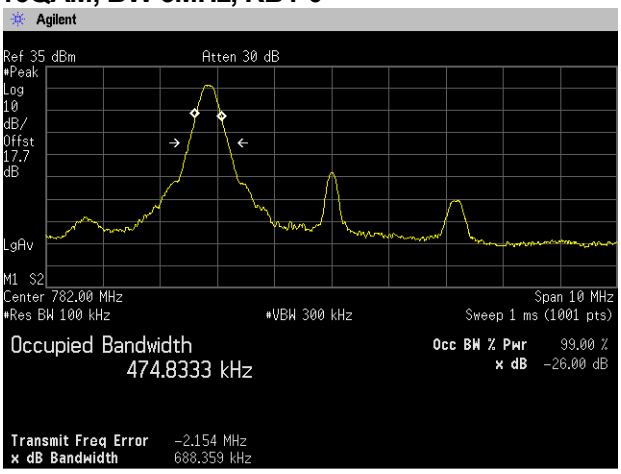

**RB12-7**



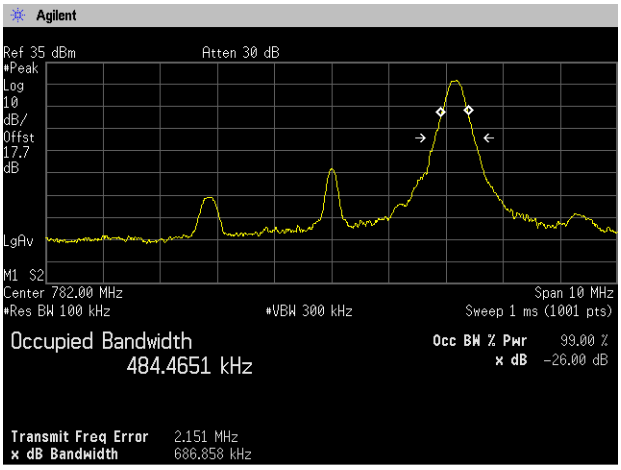

**RB25-0**



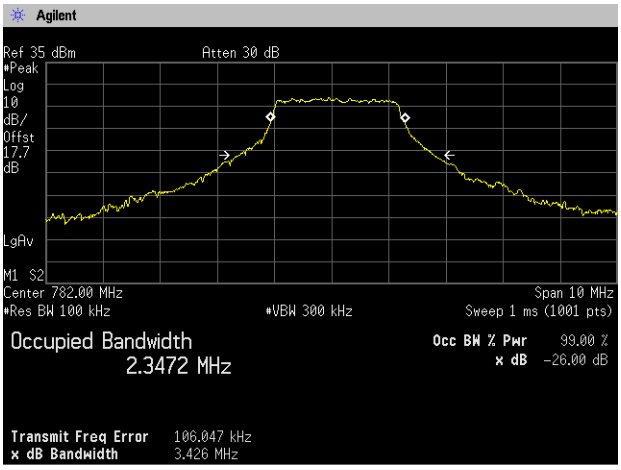
## 16QAM, BW 5MHz, RB1-0



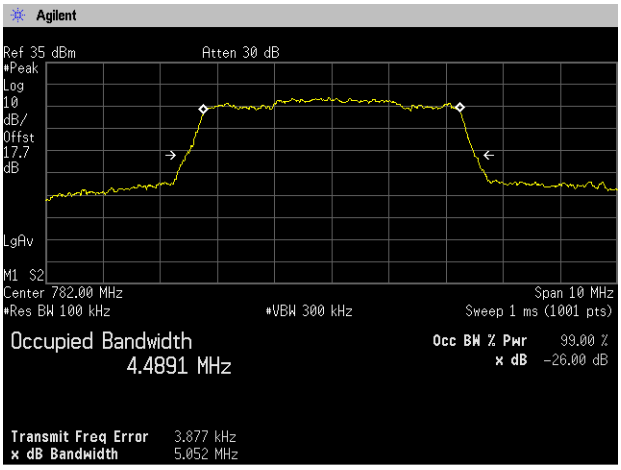

## RB1-24



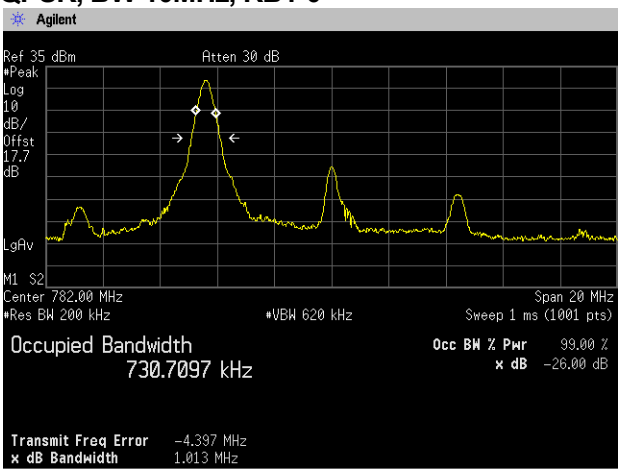

## RB12-7



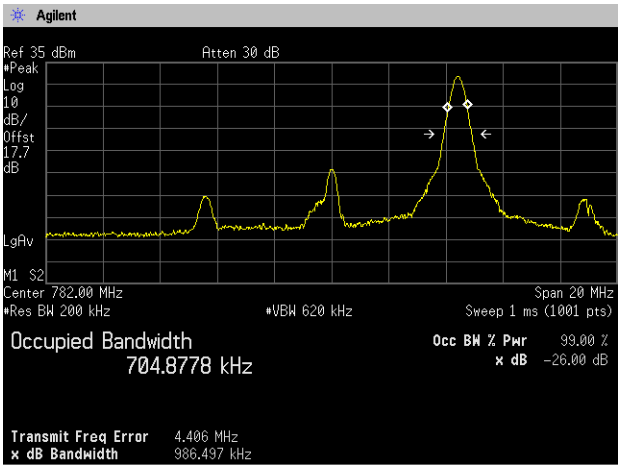

## RB25-0



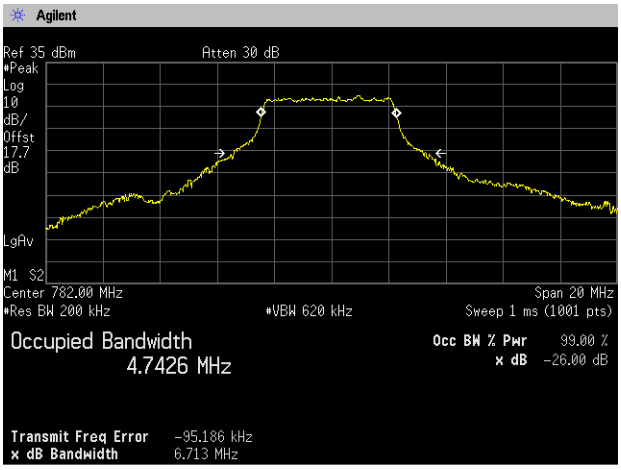
## QPSK, BW 10MHz, RB1-0



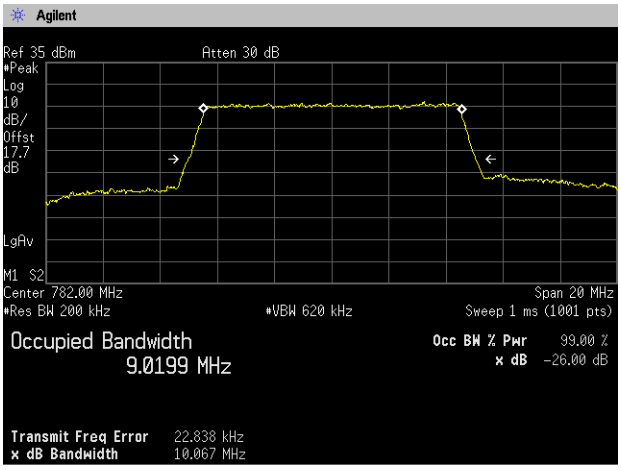

## RB1-49




## RB25-12




## RB50-0



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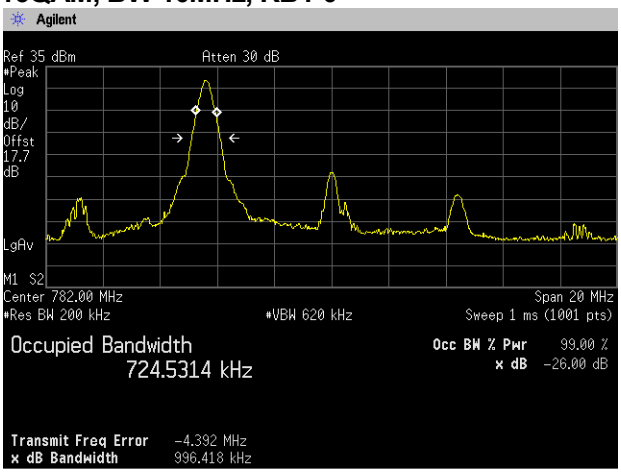
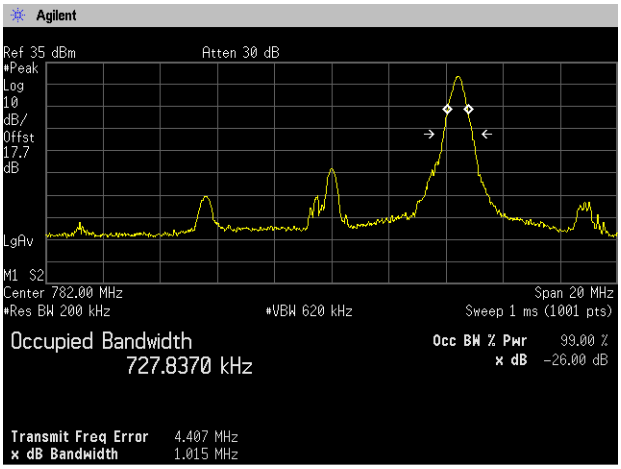
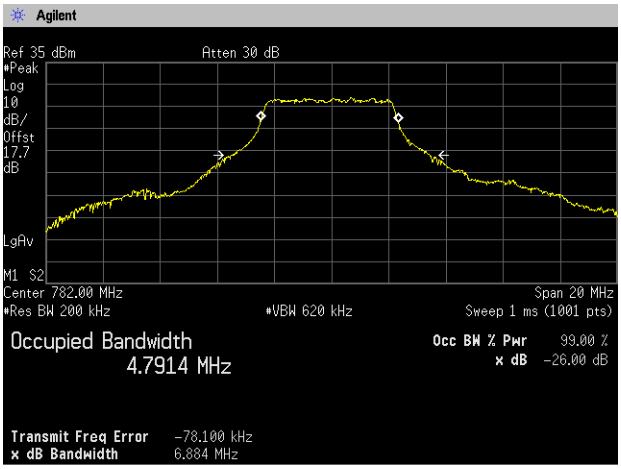
## 16QAM, BW 10MHz, RB1-0



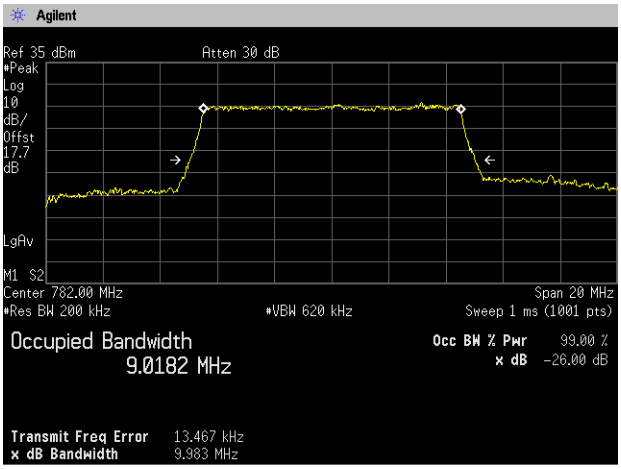

## RB1-49




## RB25-12




## RB50-0



# 8. Band Edge Spurious and Harmonic at Antenna Terminals

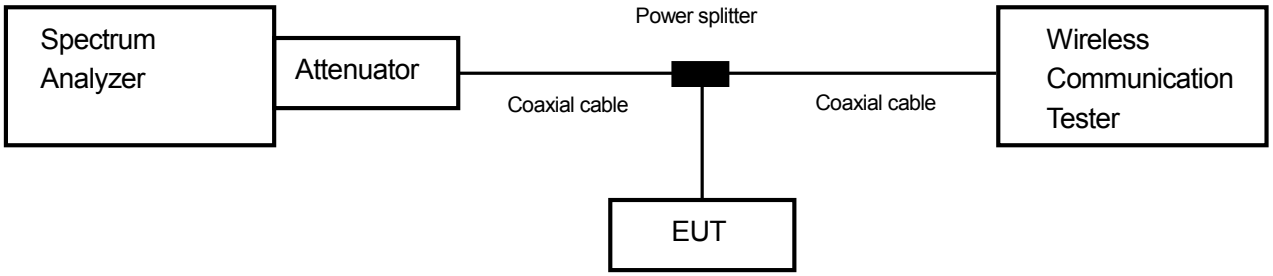
## 8.1 Measurement procedure
**[FCC 27.53(g), 2.1051, IC RSS-130 4.6]**

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>
- RBW=75kHz, VBW=220kHz, Span=10MHz, Sweep=auto, Detector=RMS, Trace mode=Max hold
- RBW=150kHz, VBW=430kHz, Span=20MHz, Sweep=auto, Detector=RMS, Trace mode=Max hold

<Spurious Emissions>
- RBW=1MHz, VBW=3MHz, Span=Arbitrary setting, Sweep=auto, Detector=Peak, Trace mode=Max hold

- Test configuration




## 8.2 Limit

-13dBm or less

## 8.3 Measurement result

Date : June 17, 2015
Temperature : 25.7 [˚C]
Humidity : 54.5 [%]
Test place : Shielded room No.4

Test engineer : Hikaru Shibata

| Band | Modulation | Bandwidth | Results | |
|---|---|---|---|---|
| LTE Band X III | QPSK | 5MHz | See the trace data | PASS |
| | | 10MHz | See the trace data | PASS |
| | 16QAM | 5MHz | See the trace data | PASS |
| | | 10MHz | See the trace data | PASS |

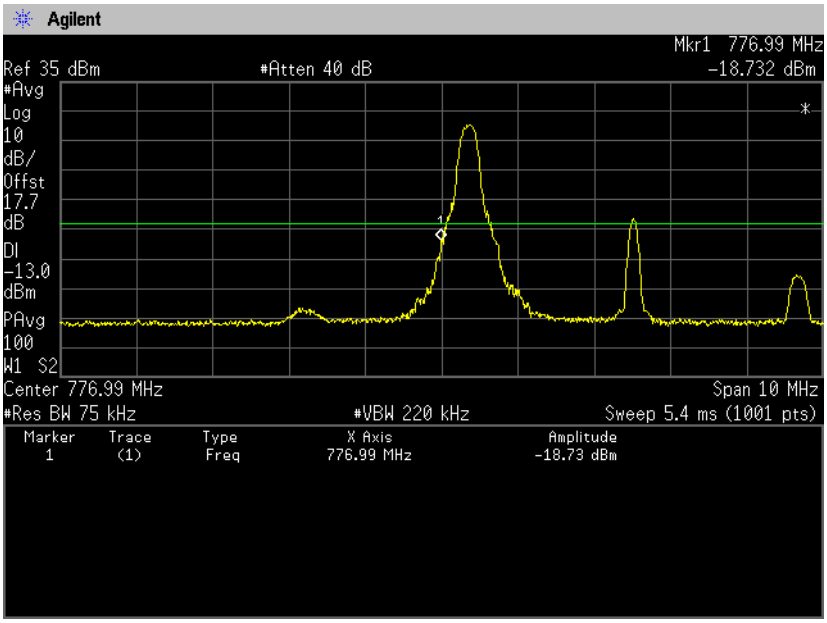
## 8.4 Trace data

**[LTE Band X III]**

**(Band Edge)**

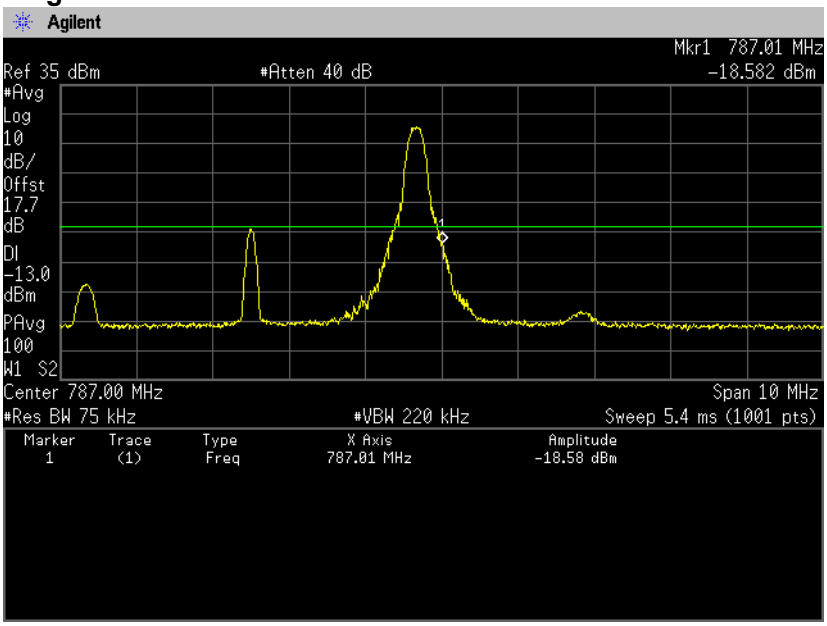
**QPSK, BW 5MHz, RB1-0**

**Channel: Low**

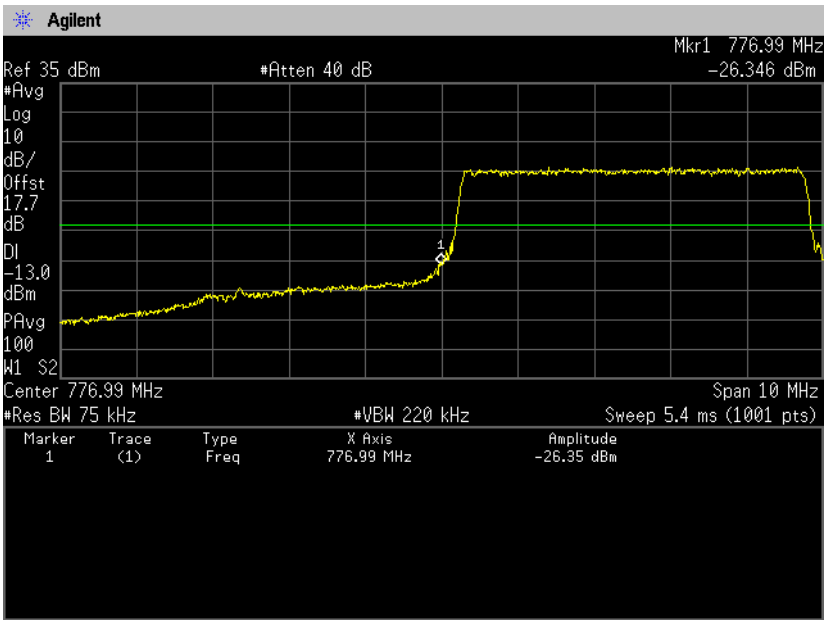



**QPSK, BW 5MHz, RB1-24**

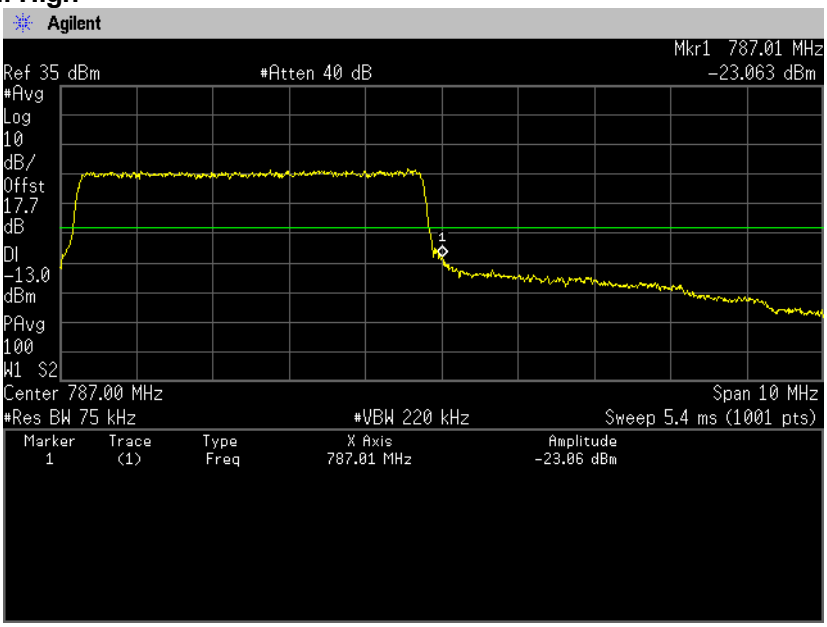
**Channel: High**



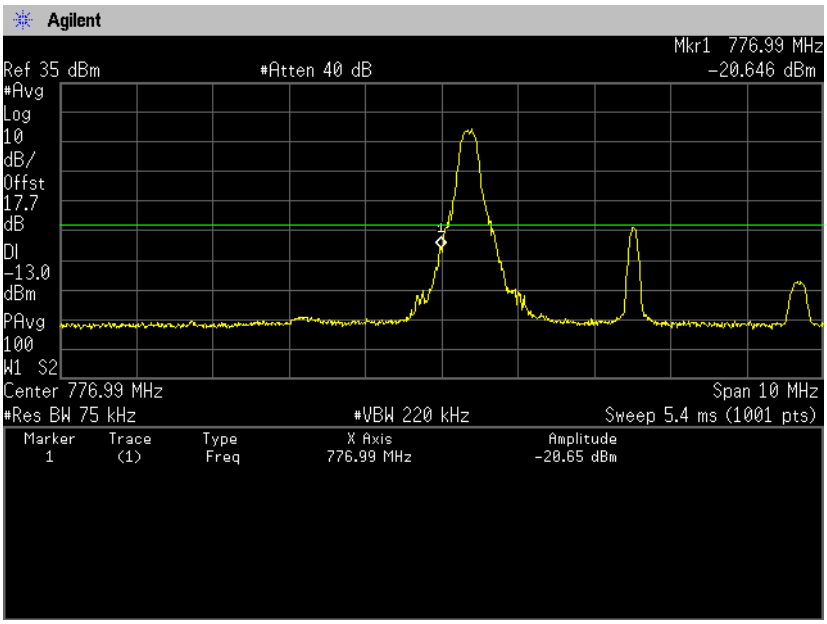
## QPSK, BW 5MHz, RB25-0
## Channel: Low



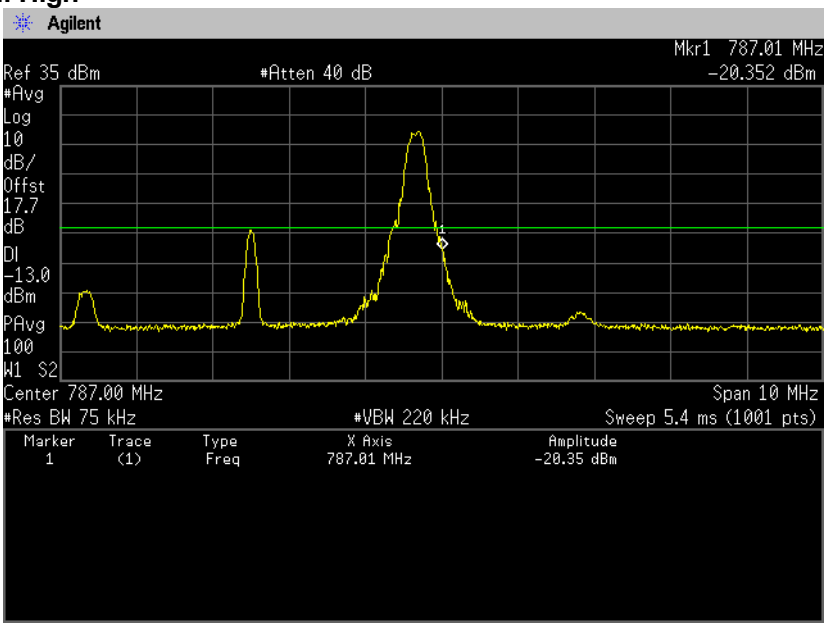

## QPSK, BW 5MHz, RB25-0
## Channel: High



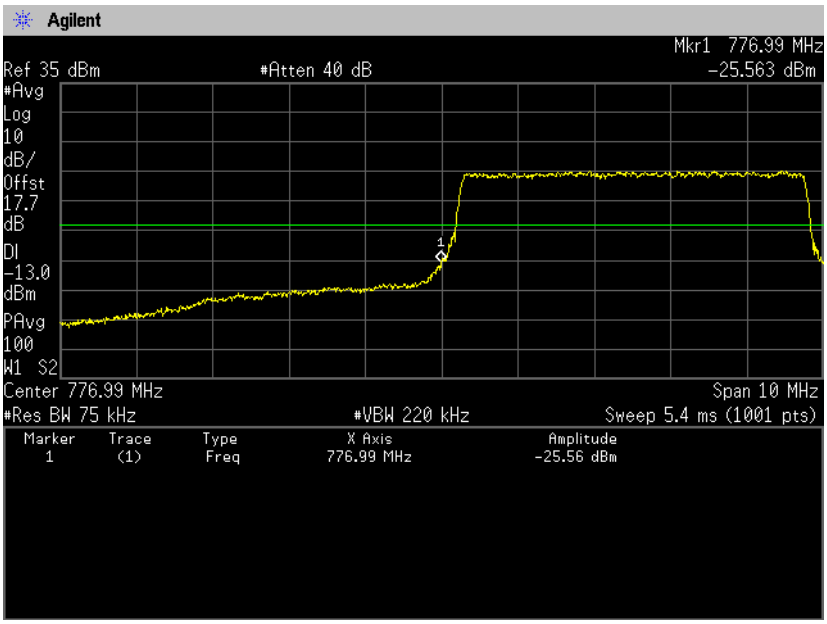
## 16QAM, BW 5MHz, RB1-0
## Channel: Low



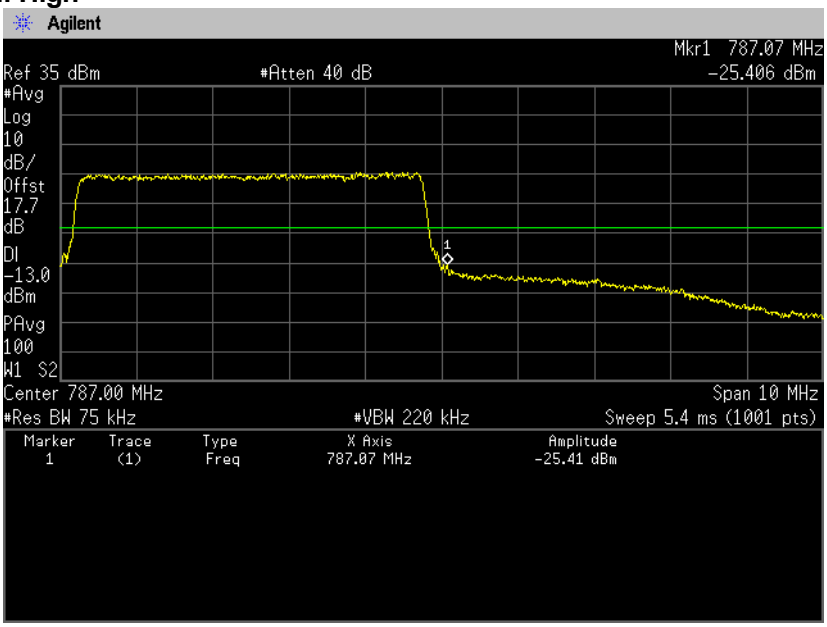

## 16QAM, BW 5MHz, RB1-24
## Channel: High



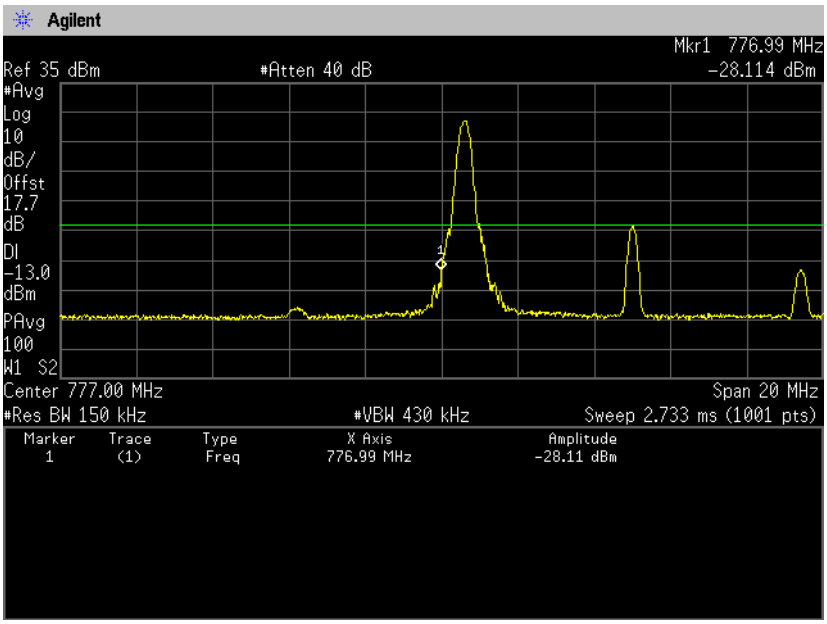
## 16QAM, BW 5MHz, RB25-0
## Channel: Low



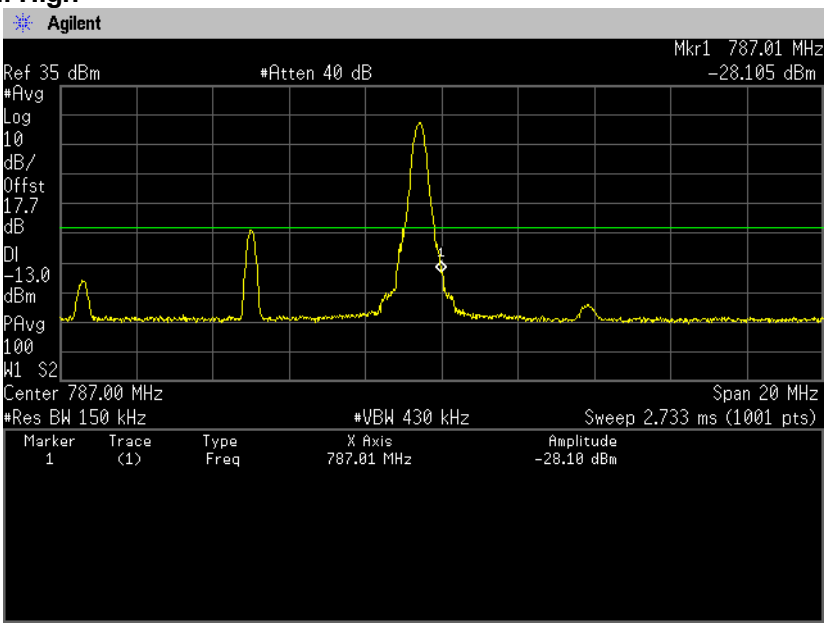

## 16QAM, BW 5MHz, RB25-0
## Channel: High



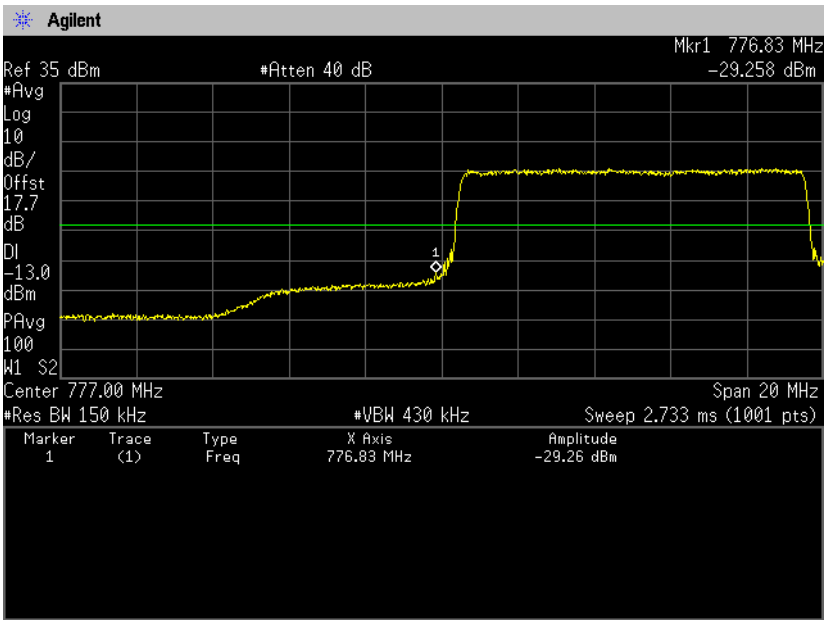
## QPSK, BW 10MHz, RB1-0
## Channel: Low



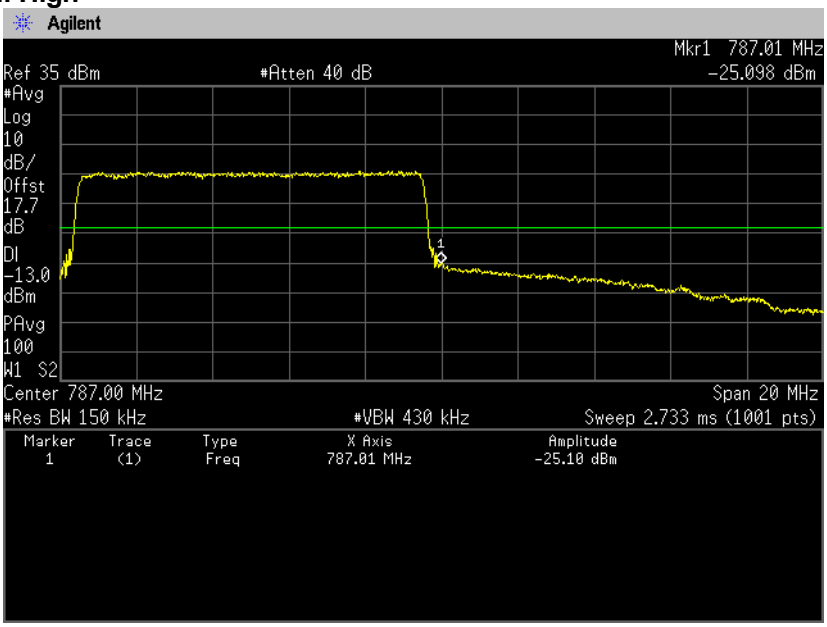

## QPSK, BW 10MHz, RB1-49
## Channel: High



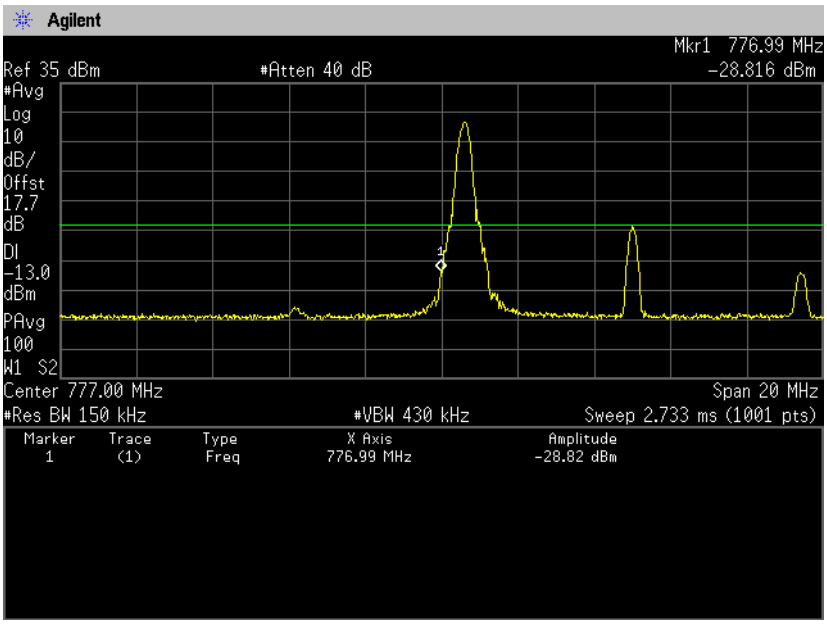
## QPSK, BW 10MHz, RB50-0
## Channel: Low



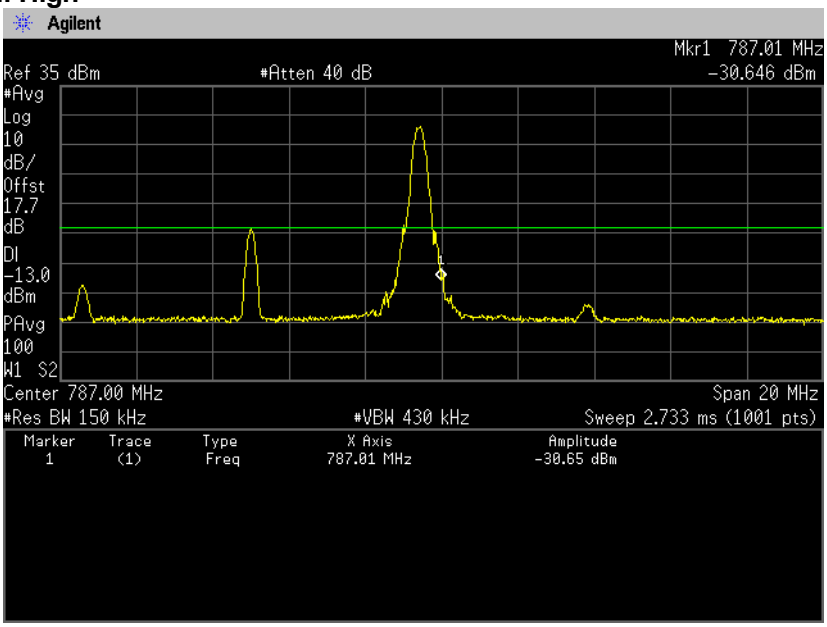

## QPSK, BW 10MHz, RB50-0
## Channel: High



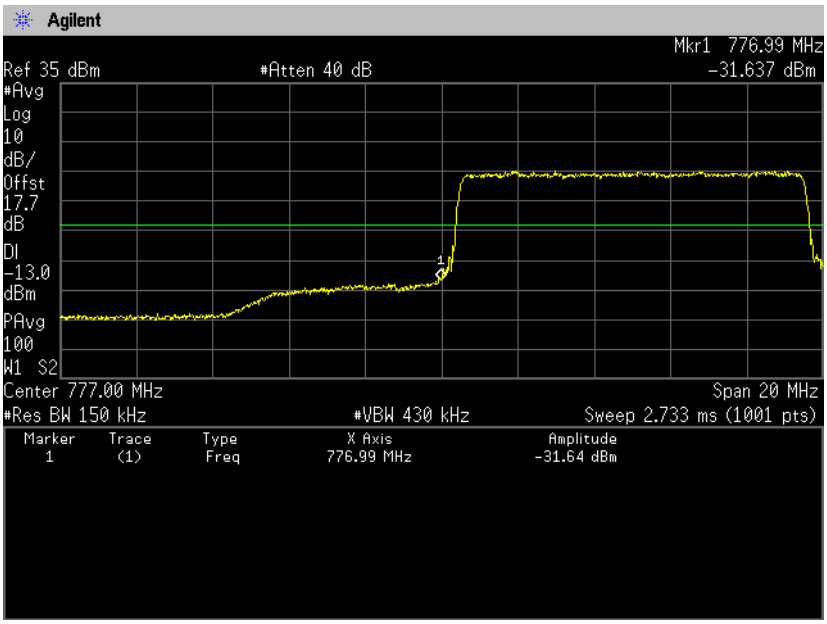
## 16QAM, BW 10MHz, RB1-0
## Channel: Low



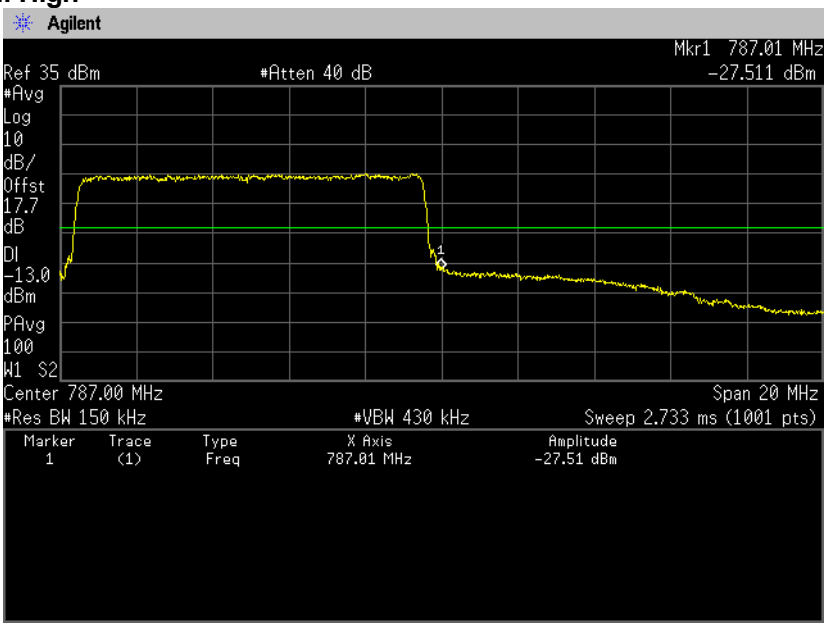

## 16QAM, BW 10MHz, RB1-49
## Channel: High



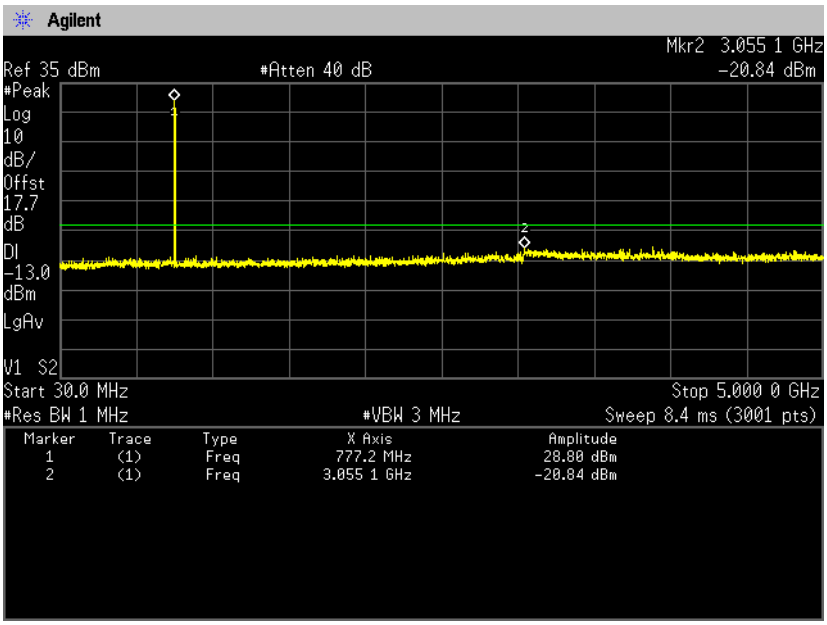
## 16QAM, BW 10MHz, RB50-0
## Channel: Low



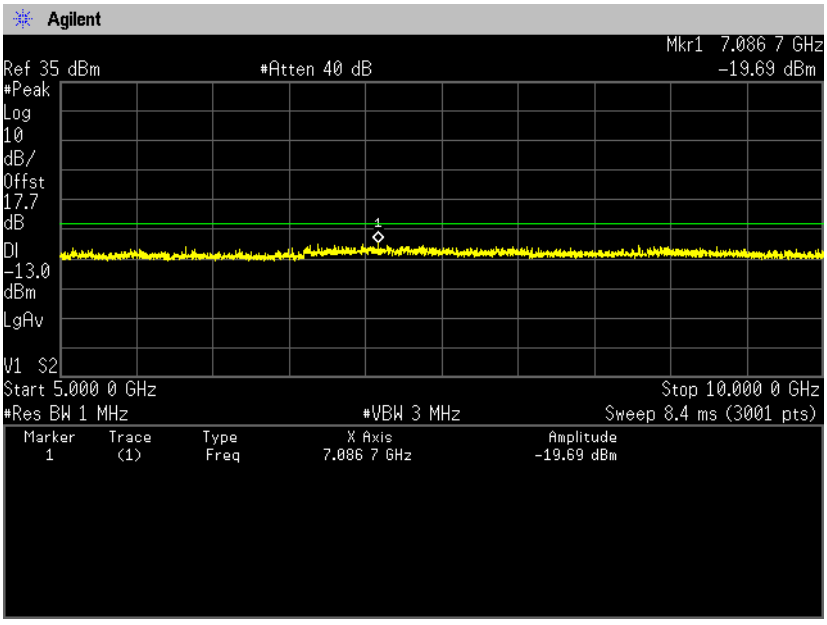

## 16QAM, BW 10MHz, RB50-0
## Channel: High



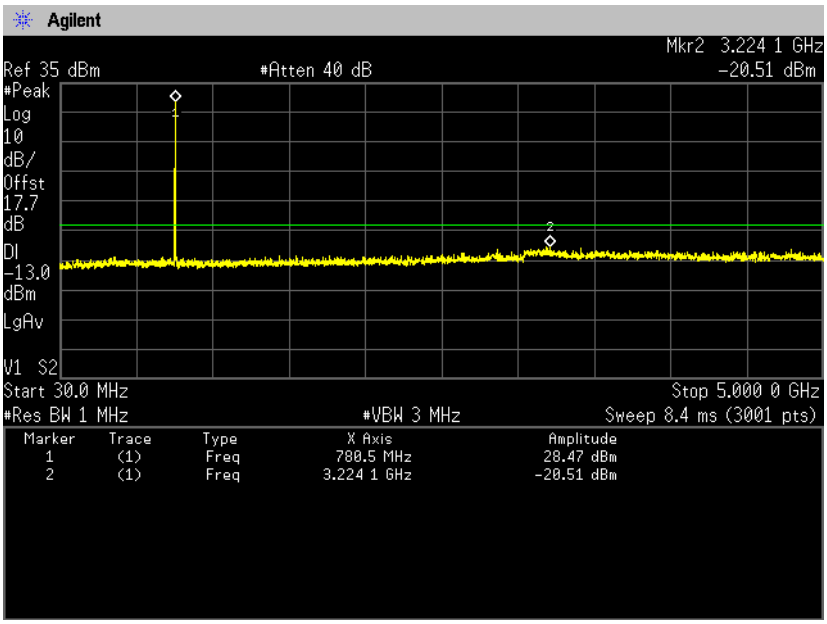
**(Spurious Emissions)**
**QPSK, BW 5MHz, RB1-0**
**Channel: 23205**
**30MHz-5GHz**



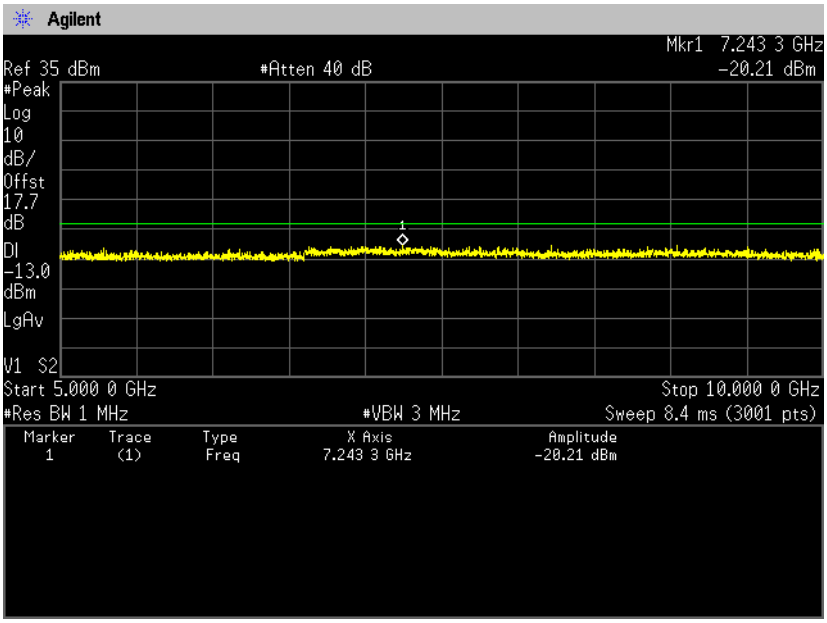

**5GHz-10GHz**



## Channel: 23230
## 30MHz-5GHz

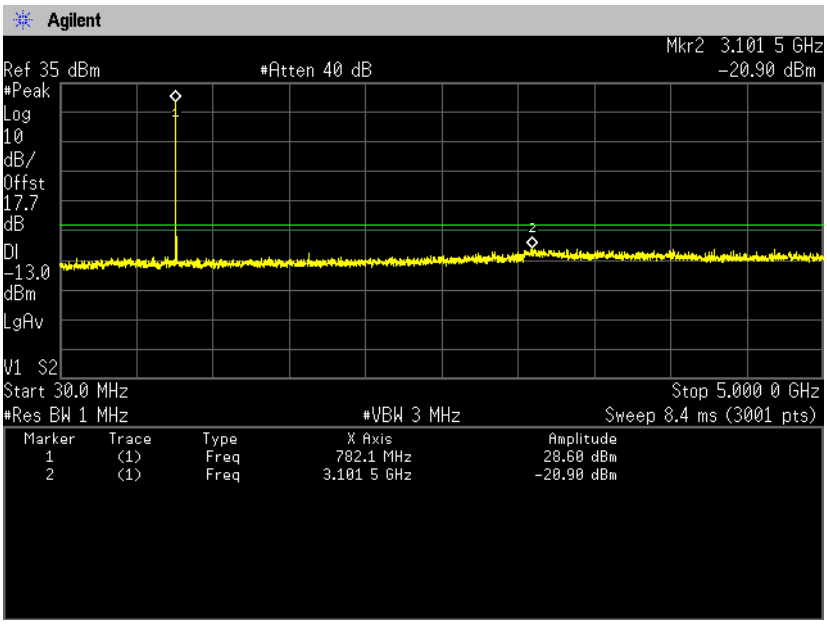



## 5GHz-10GHz

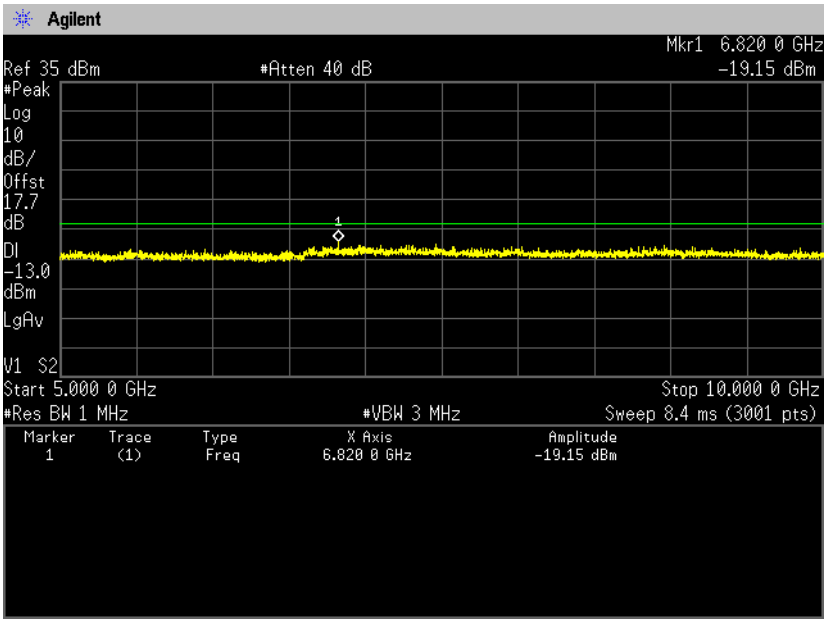


Zacta

**Channel: 23255**
**30MHz-5GHz**

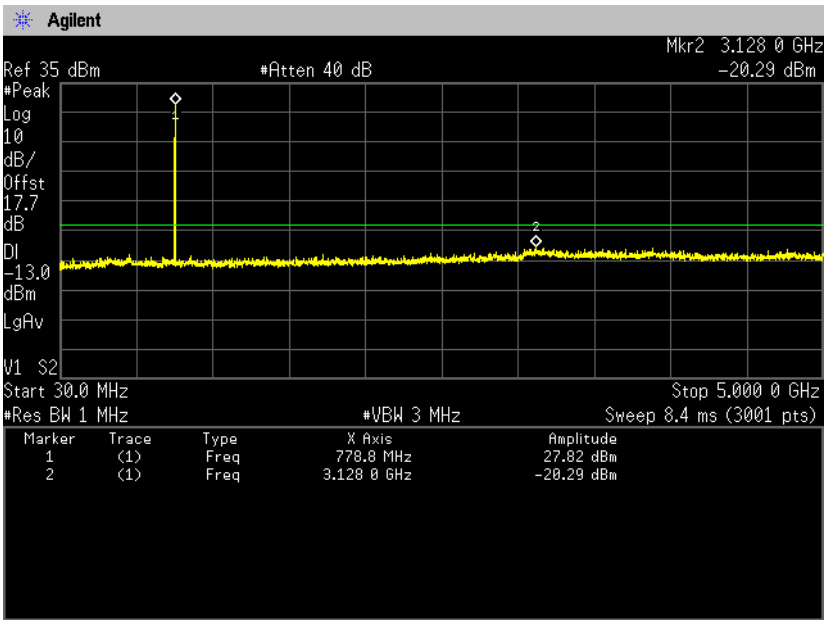



**5GHz-10GHz**

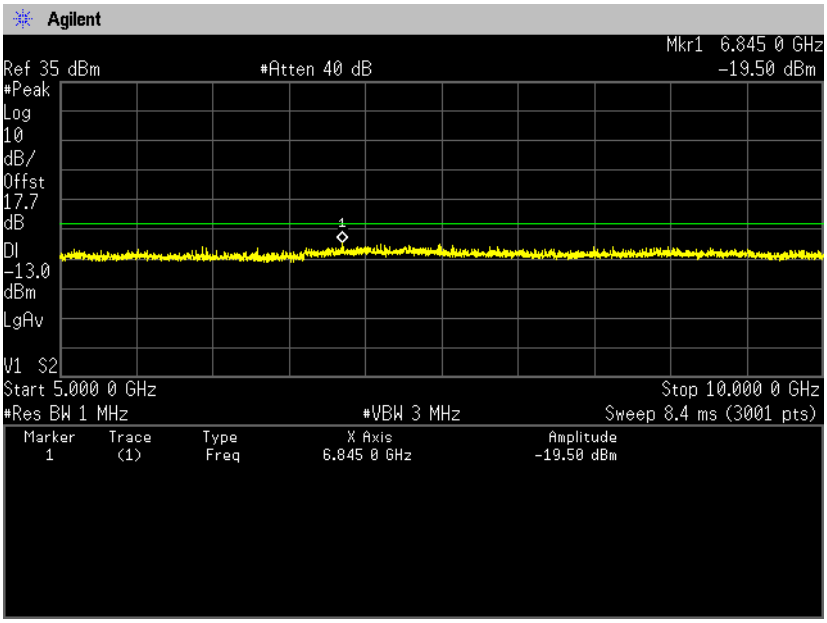


Zacta

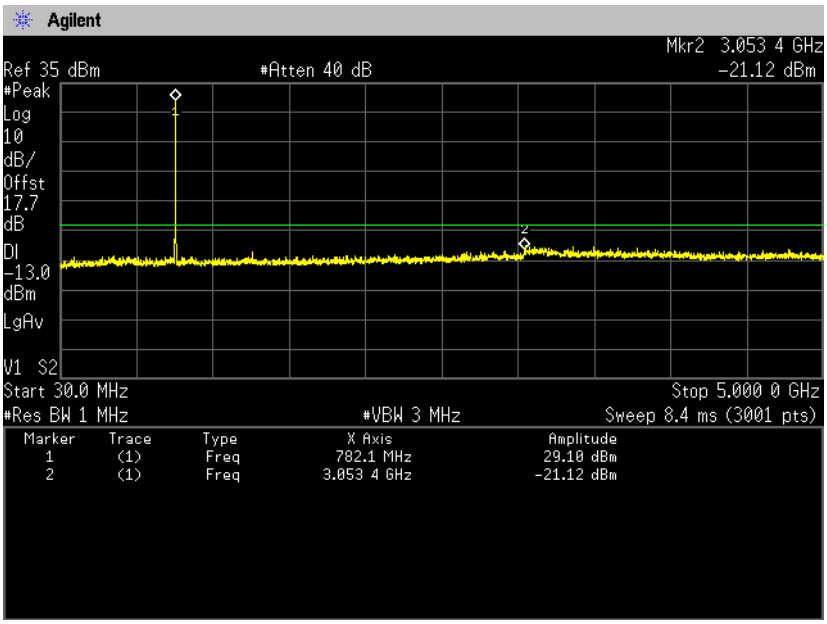
**16QAM, BW 10MHz, RB1-12**
**Channel: 23205**
**30MHz-5GHz**



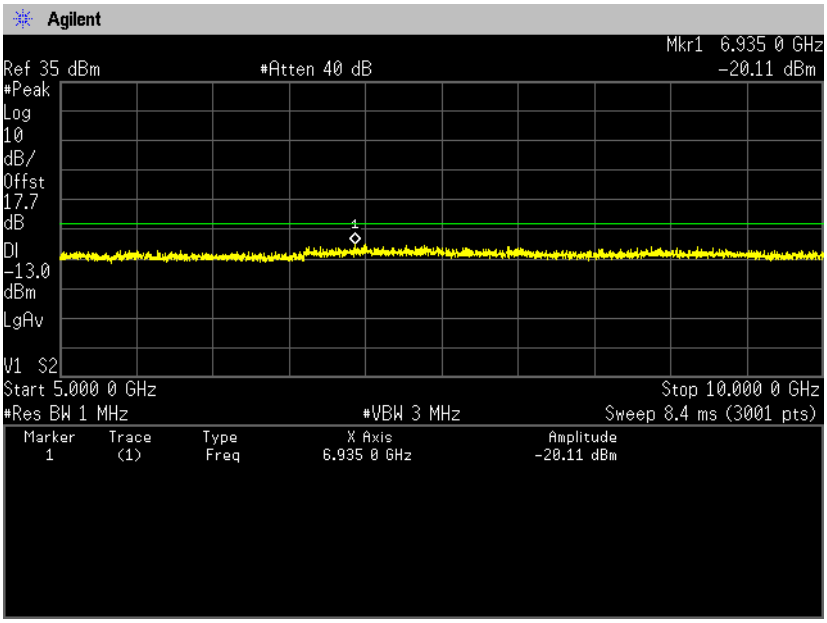

**5GHz-10GHz**



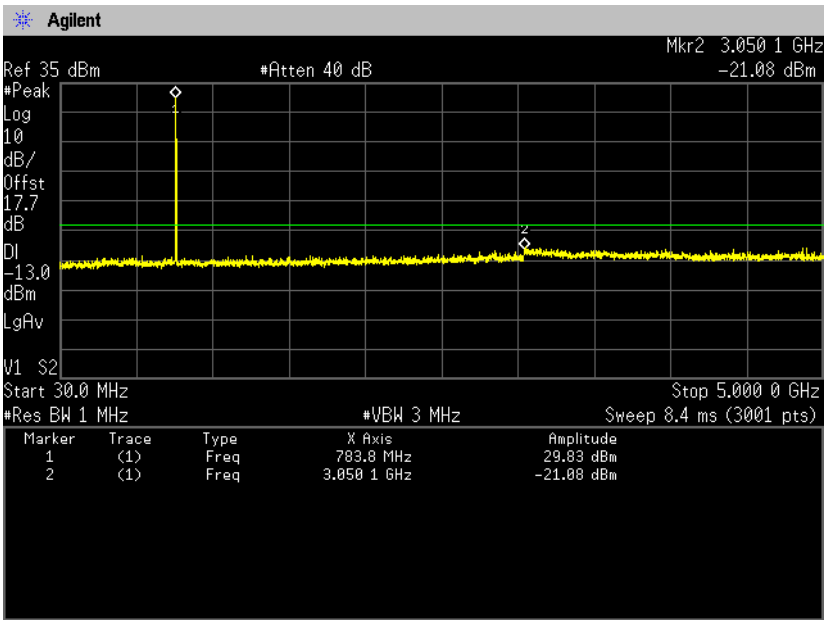
## Channel: 23230
## 30MHz-5GHz



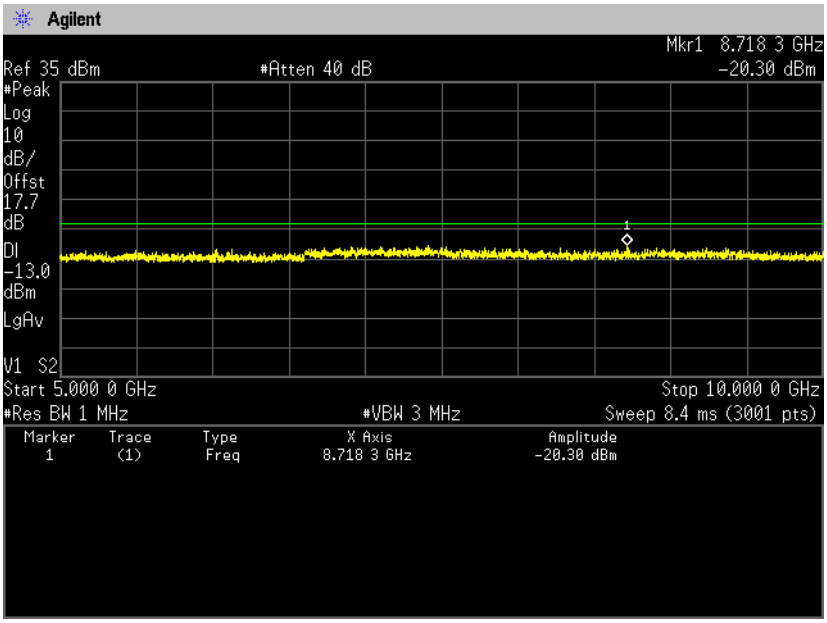

## 5GHz-10GHz



## Channel: 23255
## 30MHz-5GHz




## 5GHz-10GHz



# 9. Radiated Emissions and Harmonic Emissions

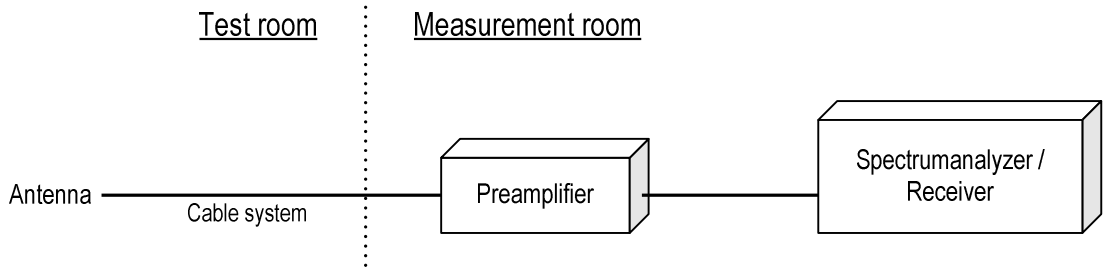
## 9.1 Measurement procedure
**[FCC 27.53(g), 2.1053, IC RSS-130 4.6]**

<Step 1>
The EUT and support equipment are placed on a 1 meter x 1.5 meter surface, 0.8 meter height FRP 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 1MHz. 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.

Spectrum analyzer setting
- Detector: Peak (RBW: 1MHz, VBW: 3MHz)

- Test configuration




## 9.2 Calculation method

Result = S.G Reading – Cable loss + Antenna Gain
Margin = Limit – Result (ERP)

Example:
Limit @ 1554.7MHz : -13.0dBm
S.G Reading = -52.8dBm Cable loss = 1.0dB Ant. Gain = 6.4dBd
Result = -52.8 – 1.0 + 6.4 = -47.4dBm
Margin = -13.0-(-47.4) = 34.4dB

## 9.3 Limit

-13dBm or less

## 9.4 Test data

Date : June 24, 2015
Temperature : 24.7 [˚C]
Humidity : 48.4 [%] Test engineer : Taiki Watanabe
Test place : 3m Semi-anechoic chamber

Date : July 1, 2015
Temperature : 23.7 [˚C]
Humidity : 58.2 [%] Test engineer : Hikaru Shibata
Test place : 3m Semi-anechoic chamber

**[LTE Band X III]**
**QPSK, BW 5MHz**
**Channel: 23205**

| 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 | 1554.7 | -50.3 | -52.8 | 1.0 | 6.4 | -47.4 | -13.0 | 34.4 |
| V | 1554.7 | -54.2 | -59.5 | 1.0 | 6.4 | -54.1 | -13.0 | 41.1 |
| H | 2332.2 | -60.5 | -64.2 | 1.3 | 7.2 | -58.3 | -13.0 | 45.3 |
| V | 2332.0 | -60.3 | -60.6 | 1.3 | 7.2 | -54.7 | -13.0 | 41.7 |
| H | 3109.5 | -57.8 | -58.0 | 1.5 | 7.3 | -52.2 | -13.0 | 39.2 |
| V | 3109.5 | -56.4 | -54.1 | 1.5 | 7.3 | -48.3 | -13.0 | 35.3 |
| H | 3886.8 | -60.2 | -58.8 | 1.6 | 7.1 | -53.3 | -13.0 | 40.3 |
| V | 3886.8 | -56.9 | -54.1 | 1.6 | 7.1 | -48.6 | -13.0 | 35.6 |

**Channel: 23230**

| 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 | 1559.7 | -46.0 | -48.2 | 1.0 | 6.4 | -42.8 | -13.0 | 29.8 |
| V | 1559.7 | -48.7 | -52.7 | 1.0 | 6.4 | -47.3 | -13.0 | 34.3 |
| H | 2339.6 | -61.5 | -64.8 | 1.3 | 7.1 | -58.9 | -13.0 | 45.9 |
| V | 2339.6 | -60.9 | -60.9 | 1.3 | 7.1 | -55.0 | -13.0 | 42.0 |
| H | 3119.4 | -61.0 | -60.8 | 1.5 | 7.2 | -55.0 | -13.0 | 42.0 |
| V | 3119.4 | -57.3 | -54.6 | 1.5 | 7.2 | -48.8 | -13.0 | 35.8 |
| H | 3899.2 | -60.8 | -59.6 | 1.6 | 7.2 | -54.1 | -13.0 | 41.1 |
| V | 3899.2 | -59.6 | -57.5 | 1.6 | 7.2 | -52.0 | -13.0 | 39.0 |

Zacta

**Channel: 23255**

| 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 | 1564.7 | -51.1 | -54.6 | 1.0 | 6.4 | -49.2 | -13.0 | 36.2 |
| V | 1564.7 | -51.3 | -55.7 | 1.0 | 6.4 | -50.3 | -13.0 | 37.3 |
| H | 2347.0 | -59.4 | -63.1 | 1.3 | 7.1 | -57.2 | -13.0 | 44.2 |
| V | 2347.0 | -58.6 | -58.8 | 1.3 | 7.1 | -52.9 | -13.0 | 39.9 |
| H | 3129.5 | -60.1 | -60.1 | 1.5 | 7.2 | -54.3 | -13.0 | 41.3 |
| V | 3129.5 | -54.6 | -51.6 | 1.5 | 7.2 | -45.8 | -13.0 | 32.8 |
| H | 3911.7 | -62.0 | -60.3 | 1.6 | 7.2 | -54.7 | -13.0 | 41.7 |
| V | 3911.7 | -60.5 | -59.0 | 1.6 | 7.2 | -53.4 | -13.0 | 40.4 |

**16QAM, BW 5MHz**
**Channel: 23205**

| 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 | 1563.3 | -50.9 | -54.6 | 1.0 | 6.4 | -49.2 | -13.0 | 36.2 |
| V | 1563.3 | -50.9 | -57.0 | 1.0 | 6.4 | -51.6 | -13.0 | 38.6 |
| H | 2345.0 | -60.5 | -62.4 | 1.3 | 7.1 | -56.5 | -13.0 | 43.5 |
| V | 2345.0 | -58.6 | -59.6 | 1.3 | 7.1 | -53.7 | -13.0 | 40.7 |
| H | 3126.6 | -59.8 | -59.2 | 1.5 | 7.2 | -53.4 | -13.0 | 40.4 |
| V | 3126.6 | -55.9 | -53.8 | 1.5 | 7.2 | -48.0 | -13.0 | 35.0 |
| H | 3908.3 | -59.9 | -58.0 | 1.6 | 7.2 | -52.4 | -13.0 | 39.4 |
| V | 3908.3 | -61.7 | -61.0 | 1.6 | 7.2 | -55.4 | -13.0 | 42.4 |

**Channel: 23230**

| 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 | 1568.4 | -49.8 | -53.4 | 1.0 | 6.4 | -48.0 | -13.0 | 35.0 |
| V | 1568.4 | -51.8 | -58.2 | 1.0 | 6.4 | -52.8 | -13.0 | 39.8 |
| H | 2352.5 | -58.7 | -61.1 | 1.3 | 7.1 | -55.2 | -13.0 | 42.2 |
| V | 2352.5 | -58.0 | -58.6 | 1.3 | 7.1 | -52.7 | -13.0 | 39.7 |
| H | 3136.7 | -58.9 | -59.2 | 1.5 | 7.2 | -53.5 | -13.0 | 40.5 |
| V | 3136.7 | -53.2 | -51.5 | 1.5 | 7.2 | -45.8 | -13.0 | 32.8 |
| H | 3920.9 | -57.4 | -54.3 | 1.6 | 7.3 | -48.7 | -13.0 | 35.7 |
| V | 3920.9 | -59.2 | -58.5 | 1.6 | 7.3 | -52.9 | -13.0 | 39.9 |

Zacta

**Channel: 23255**

| 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 | 1573.3 | -51.0 | -54.6 | 1.0 | 6.5 | -49.2 | -13.0 | 36.2 |
| V | 1573.3 | -55.8 | -61.9 | 1.0 | 6.5 | -56.5 | -13.0 | 43.5 |
| H | 2360.0 | -59.6 | -62.0 | 1.3 | 7.2 | -56.1 | -13.0 | 43.1 |
| V | 2360.0 | -61.4 | -62.3 | 1.3 | 7.2 | -56.4 | -13.0 | 43.4 |
| H | 3146.7 | -58.2 | -58.0 | 1.5 | 7.2 | -52.3 | -13.0 | 39.3 |
| V | 3146.7 | -58.1 | -56.3 | 1.5 | 7.2 | -50.6 | -13.0 | 37.6 |
| H | 3933.3 | -60.4 | -58.8 | 1.6 | 7.3 | -53.2 | -13.0 | 40.2 |
| V | 3933.3 | -57.7 | -56.7 | 1.6 | 7.3 | -51.0 | -13.0 | 38.0 |

**QPSK, BW 10MHz**
**Channel: 23230**

| 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 | 1572.9 | -52.9 | -56.5 | 1.0 | 6.5 | -51.1 | -13.0 | 38.1 |
| V | 1572.9 | -52.2 | -58.3 | 1.0 | 6.5 | -52.9 | -13.0 | 39.9 |
| H | 2359.2 | -60.7 | -63.1 | 1.3 | 7.2 | -57.2 | -13.0 | 44.2 |
| V | 2359.2 | -61.0 | -61.9 | 1.3 | 7.2 | -56.0 | -13.0 | 43.0 |
| H | 3145.7 | -58.7 | -58.5 | 1.5 | 7.2 | -52.8 | -13.0 | 39.8 |
| V | 3145.7 | -57.1 | -55.3 | 1.5 | 7.2 | -49.6 | -13.0 | 36.6 |
| H | 3932.1 | -56.1 | -54.5 | 1.6 | 7.3 | -48.8 | -13.0 | 35.8 |
| V | 3932.1 | -58.1 | -57.1 | 1.6 | 7.3 | -51.4 | -13.0 | 38.4 |

**16QAM, BW 10MHz**
**Channel: 23230**

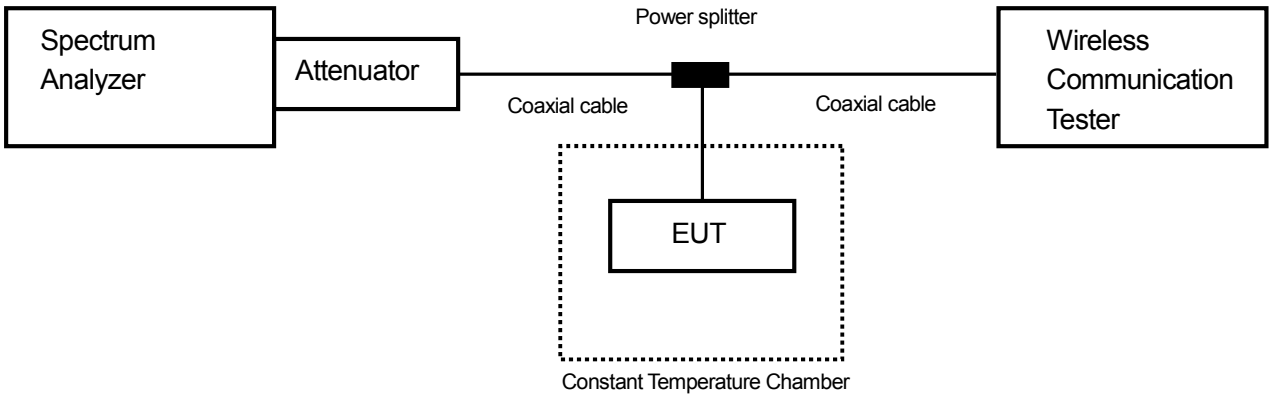
| H/V | Frequency [MHz] | S.A Reading [dBm] | S.G Reading [dBm] | Cable loss [dB] | Ant.Gain [dBd] | Result [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|
| H | 1572.9 | -51.5 | -54.6 | 1.0 | 6.5 | -49.2 | -13.0 | 36.2 |
| V | 1572.9 | -51.4 | -61.9 | 1.0 | 6.5 | -56.5 | -13.0 | 43.5 |
| H | 2359.2 | -60.4 | -62.0 | 1.3 | 7.2 | -56.1 | -13.0 | 43.1 |
| V | 2359.2 | -61.1 | -62.3 | 1.3 | 7.2 | -56.4 | -13.0 | 43.4 |
| H | 3145.7 | -59.2 | -58.0 | 1.5 | 7.2 | -52.3 | -13.0 | 39.3 |
| V | 3145.7 | -54.9 | -56.3 | 1.5 | 7.2 | -50.6 | -13.0 | 37.6 |
| H | 3932.1 | -57.0 | -58.8 | 1.6 | 7.3 | -53.1 | -13.0 | 40.1 |
| V | 3932.1 | -58.0 | -56.7 | 1.6 | 7.3 | -51.0 | -13.0 | 38.0 |

# 10. Frequency Stability

## 10.1 Measurement procedure [FCC 27.54, 2.1055, IC RSS-130 4.3]

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




## 10.2 Limit

±2.5ppm

### 10.3 Measurement result

Date : June 25, 2015
Temperature : 24.7 [˚C]
Humidity : 52.3 [%] Test engineer :
Test place : Shielded room No.4 Hikaru Shibata

**[LTE Band X III]**
**(Channel: 23230)**

| Limit: ±0.00025% = ±2.5ppm | | | | | |
|---|---|---|---|---|---|
| **Power Supply [V]** | **Temperature [ºC]** | **Measurements Frequency [Hz]** | **Frequency Tolerance [ppm]** | **Limit [ppm]** | **Result** |
| 3.90 | 25(Ref.) | 781,999,417 | 0.00000 | ±2.5 | Pass |
| | 50 | 781,998,619 | -1.02098 | ±2.5 | Pass |
| | 40 | 782,000,378 | 1.22881 | ±2.5 | Pass |
| | 30 | 781,999,283 | -0.17154 | ±2.5 | Pass |
| | 20 | 781,999,361 | -0.07231 | ±2.5 | Pass |
| | 10 | 781,998,675 | -0.94936 | ±2.5 | Pass |
| | 0 | 781,999,839 | 0.53885 | ±2.5 | Pass |
| | -10 | 781,998,406 | -1.29335 | ±2.5 | Pass |
| | -20 | 781,999,299 | -0.15118 | ±2.5 | Pass |
| | -30 | 782,000,192 | 0.99077 | ±2.5 | Pass |
| 3.315 | 25 | 781,998,549 | -1.11049 | ±2.5 | Pass |
| 4.485 | 25 | 781,998,890 | -0.67443 | ±2.5 | Pass |

Calculation;

Frequency Tolerance (ppm) = Measurements Frequency (Hz) – Reference Frequency (Hz) / Reference Frequency (Hz) x 1000000

Zacta

## 11. Uncertainty of measurement

Expanded uncertainties stated are calculated with a coverage Factor k=2.
Please note that these results are not taken into account when determining compliance or non-compliance with test result.

| Test item | Measurement uncertainty |
|---|---|
| Conducted emission at mains port | ±3.0dB |
| Radiated emission (9kHz – 30MHz) | ±4.4dB |
| Radiated emission (30MHz – 1000MHz) | ±4.5dB |
| Radiated emission (1000MHz – 26GHz) | ±3.9dB |

# 12. Laboratory description

**1. Location:**

TÜV SÜD Zacta Ltd. Yonezawa Testing Center
4149-7 Hachimanpara 5-chome Yonezawa-shi Yamagata 992-1128 Japan
Phone: +81-238-28-2880 Fax: +81-238-28-2888

**2. Facility filing information:**

1) NVLAP accreditation: NVLAP Lab. code: 200306-0

2) VLAC accreditation: Lab. code: VLAC-013

| Site name | Radiated emission | Conducted emission for mains port | Conducted emission for telecom port | Radiated emission (CMAD) | Expiry Date |
|---|---|---|---|---|---|
| 3m Semi-anechoic chamber | VLAC-013 | | | - | Jul. 3, 2017 |
| 10m Semi-anechoic chamber No.1 | | | | VLAC-013 | |
| 10m Semi-anechoic chamber No.2 | | | | | |
| Shielded room No.1 | - | VLAC-013 | | - | |

3) FCC filing:

| Site name | Registration Number | Expiry Date |
|---|---|---|
| Site 3 | 91065 | Oct. 1, 2017 |
| 3m Semi-anechoic chamber | 540072 | Feb. 20, 2017 |
| 10m Semi-anechoic chamber No.1 | | |
| 10m Semi-anechoic chamber No.2 | | |
| Shielded room No.1 | | |

4) Industry Canada Oats site filing:

| Site name | Sites on file: Oats 3m/10m | Expiry Date |
|---|---|---|
| Site 3 | 4224A-3 | Dec. 3, 2017 |
| 3m Semi-anechoic chamber | 4224A-4 | |
| 10m Semi-anechoic chamber No.1 | 4224A-5 | |
| 10m Semi-anechoic chamber No.2 | 4224A-6 | Jan. 15, 2017 |

5) VCCI site filing:

| Site name | Radiated emission | Conducted emission for mains port | Conducted emission for telecom port | Expiry Date |
|---|---|---|---|---|
| Site 3 | R-138 | C-134 | T-1222 | Nov. 16, 2017 |
| 3m Semi-anechoic chamber | A-0166 | | | Jul. 3, 2017 |
| 10m Semi-anechoic chamber No.1 | | | | |
| 10m Semi-anechoic chamber No.2 | | | | |
| Shielded room No.1 | - | A-0166 | | |

6) TÜV SÜD PS authorization:
Authorized as an EMC test laboratory

7) TÜV Rheinland authorization:
Authorized as an EMC test laboratory

# *Appendix A. Test equipment*

## Antenna port conducted test

| Equipment | Company | Model No. | Serial No. | Cal. due | Cal. date |
|---|---|---|---|---|---|
| Spectrum analyzer | Agilent Technologies | E4440A | US44302655 | Jun. 30, 2016 | Jun. 11, 2015 |
| Microwave cable | RS | YH20_S1 | N/A (S389) | Aug. 31, 2015 | Aug. 30, 2014 |
| Attenuator | Weinschel | 56-10 | J4180 | Nov. 30, 2015 | Nov. 12, 2014 |
| Microwave cable | SUHNER | SUCOFLEX104/1.5m | 199121/4 | Oct. 31, 2015 | Oct. 7, 2014 |
| Microwave cable | SUHNER | SUCOFLEX104/1.5m | 322086/4 | Jul. 31, 2015 | Jul. 30, 2014 |
| Power splitter | ANRITSU | K240B | 020205 | Jul. 31, 2015 | Jul. 12, 2014 |
| Wideband radio frequency tester | ROHDE&SCHWARZ | CMW500 | 116338 | Apr. 30, 2016 | Apr. 2, 2015 |
| Operation type temperature controlled bath | Espec | PL1KP | 14007261 | Jan. 31, 2016 | Jan. 9, 2015 |

## Radiated emission

| Equipment | Company | Model No. | Serial No. | Cal. Due | Cal. Date |
|---|---|---|---|---|---|
| EMI Receiver | ROHDE&SCHWARZ | ESCI | 100451 | Dec. 31, 2015 | Dec. 25, 2014 |
| Preamplifier | ANRITSU | MH648A | M96057 | Jun. 30, 2016 | Jun. 12, 2015 |
| Biconical antenna | Schwarzbeck | VHA9103/BBA9106 | 2125 | Jun. 30, 2016 | Jun. 4, 2015 |
| Log periodic antenna | Schwarzbeck | UHALP9108A | 0560 | Jun. 30, 2016 | Jun. 4, 2015 |
| Attenuator | TME | CFA-01NPJ-6 | N/A (S275) | Jun. 30, 2016 | Jun. 23, 2015 |
| Attenuator | TME | CFA-01NPJ-3 | N/A (S272) | Jun. 30, 2016 | Jun. 23, 2015 |
| Spectrum analyzer | Agilent Technologies | E4440A | US44302655 | Jun. 30, 2016 | Jun. 11, 2015 |
| Preamplifier | TSJ | MLA-100M18-B02-40 | 1929118 | May 31, 2016 | May 1, 2015 |
| Attenuator | AEROFLEX | 26A-10 | 081217-08 | Mar. 31, 2016 | Mar. 12, 2015 |
| Dipole antenna | Schwarzbeck | VHAP | 1020 | Sep. 30, 2015 | Sep. 5, 2014 |
| Dipole antenna | Schwarzbeck | UHAP | 994 | Sep. 30, 2015 | Sep. 5, 2014 |
| Double ridged guide antenna | EMCO | 3115 | 5205 | Feb. 29, 2016 | Feb. 16, 2015 |
| Attenuator | Agilent Technologies | 8491B | MY39268633 | Feb. 29, 2016 | Feb. 1, 2015 |
| Double ridged guide antenna | EMCO | 3115 | 000058532 | Oct. 31, 2015 | Oct. 14, 2014 |
| Signal generator | ROHDE&SCHWARZ | SMB100A | 177525 | Jun. 30, 2016 | Jun. 19, 2015 |
| Power amplifier | R&K | CGA020M602-2633R | B40240 | Mar.31, 2016 | Mar. 23, 2015 |
| Microwave cable | SUHNER | SUCOFELX102/2m | 31648/2 | Mar. 28, 2016 | Mar. 10, 2015 |
| High pass filter | Micro-Tronics | HPM50115 | 004 | Jul. 31, 2015 | Jul. 12, 2014 |
| High pass filter | Wainwright | WHKX2.8/18G-6SS | 1 | Jul. 31, 2015 | Jul. 17, 2014 |
| Wideband radio frequency tester | ROHDE&SCHWARZ | CMW500 | 126079 | Aug. 31, 2015 | Aug. 28, 2014 |
| Microwave cable | SUHNER | SUCOFLEX104/9m | 346316/4 | Oct. 31, 2015 | Oct. 31, 2014 |
| | | SUCOFLEX104/1m | 322084/4 | Oct. 31, 2015 | Oct. 31, 2014 |
| | | SUCOFLEX104/1.5m | 317226/4 | Oct. 31, 2015 | Oct. 31, 2014 |
| | | SUCOFLEX104/7m | 41625/6 | Oct. 31, 2015 | Oct. 31, 2014 |
| PC | DELL | DIMENSION E521 | 75465BX | N/A | N/A |
| Software | TOYO Corporation | EP5/RE-AJ | 0611193/V5.3.61 | N/A | N/A |
| 3m Semi-anechoic chamber | TOKIN | N/A | N/A (9002-NSA) | Apr. 30, 2016 | Apr. 27, 2015 |
| 3m Semi-anechoic chamber | TOKIN | N/A | N/A (9002-SVSWR) | Apr. 30, 2016 | Apr. 27, 2015 |

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