

## Nemko Korea Co., Ltd.

67-1 &amp; 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-City, Gyeonggi-Do, KOREA

TEL:+82 31 330 1700

FAX:+82 31 322 2332

### FCC/IC EVALUATION REPORT FOR CERTIFICATION

**Applicant :**

Telit Communications S.p.A.

Viale Stazione di Prosecco 5/B, 34010 Sgonico

Trieste, Italy

Dates of Issue : July 27, 2012

Test Report No. : NK-12-R-098

Test Site : Nemko Korea Co., Ltd.

FCC ID

IC ID

Brand Name

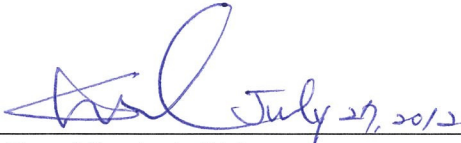
CONTACT PERSON

**RI7CE910-DUAL  
5131A-CE910DUAL****Telit****Telit Communications S.p.A.  
Viale Stazione di Prosecco 5/B, 34010  
Sgonico, Trieste, Italy  
Brian Tucker  
Telephone No. : +919-439-7977**

Applied Standard: FCC 47 CFR Part 2, 22, 24  
Classification: Licensed Transmitter(PCB)  
EUT Type: DUAL BAND CDMA Module

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

  
Tested By : Minchul. Shin  
Engineer  
Reviewed By : Deokha Ryu  
Technical Manager

Telit Communications S.p.A.

Page 1 of 52

FCC ID: RI7CE910-DUAL / IC: 5131A-CE910DUAL

# TABLE OF CONTENTS

---

|                                                                    |           |
|--------------------------------------------------------------------|-----------|
| <b>1. Scope</b>                                                    | <b>4</b>  |
| <b>2. Introduction (Site Description)</b>                          | <b>5</b>  |
| 2.1 Test facility                                                  | 5         |
| 2.2 Accreditation and listing                                      | 6         |
| <b>3. Test Conditions &amp; EUT Information</b>                    | <b>7</b>  |
| 3.1 Operating During Test                                          | 7         |
| 3.2 Environmental Conditions                                       | 7         |
| 3.3 Description of EUT                                             | 7         |
| <b>4. Measuring Instrument Calibration</b>                         | <b>8</b>  |
| <b>5. Summary of Test Results</b>                                  | <b>9</b>  |
| <b>6. Recommendation / Conclusion</b>                              | <b>9</b>  |
| <b>7. Description of Test</b>                                      | <b>10</b> |
| 7.1 Effective Radiated Power / Equivalent Isotropic Radiated Power | 10        |
| 7.2 Radiated Spurious & Harmonic Emission                          | 11        |
| 7.3 Conducted Output Power                                         | 12        |
| 7.4 Conducted Spurious Emission                                    | 13        |
| 7.5 Frequency Stability / Temperature Variation                    | 15        |
| 7.6 Conducted Output Power                                         | 16        |
| <b>8. Test Data</b>                                                | <b>17</b> |
| 8.1 Conducted Output Power                                         | 17        |
| 8.2 Effective Radiated Power (ERP)                                 | 18        |
| 8.3 Equivalent Isotropic Radiated Power (EIRP)                     | 19        |
| 8.4 Occupied Bandwidth / 26 dB Emission Bandwidth                  | 20        |
| 8.5 Radiated Spurious & Harmonic Emission (Cellular)               | 21        |
| 8.6 Radiated Spurious & Harmonic Emission (PCS)                    | 23        |
| 8.7 Frequency Stability / Temperature Variation (Cellular)         | 25        |
| 8.8 Frequency Stability / Temperature Variation (PCS)              | 26        |
| 8.9 Receiver Spurious Emissions                                    | 27        |

|                                               |           |
|-----------------------------------------------|-----------|
| <b>9. Accuracy of Measurement</b>             | <b>28</b> |
| <b>10. Test Plots (Cellular)</b>              | <b>30</b> |
| <b>11. Test Plots (PCS)</b>                   | <b>37</b> |
| <b>12. Test Equipment List</b>                | <b>44</b> |
| <b>Appendix A: Labelling Requirement</b>      | <b>45</b> |
| <b>Appendix B: Photographs of Test Set-up</b> | <b>46</b> |
| <b>Appendix C: EUT Photographs</b>            | <b>47</b> |

## 1. Scope

*Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC Part 2 & Part 22 & 24 and Industrie Canada under RSS-Gen & 132 & 133.*

|                            |                                                                                                 |
|----------------------------|-------------------------------------------------------------------------------------------------|
| <b>Responsible Party :</b> | Telit Communications S.p.A.                                                                     |
| <b>Contact Person :</b>    | Brian Tucker<br>Tel No. : +919 439 7977                                                         |
| <b>Manufacturer :</b>      | Telit Communications S.p.A.<br>Viale Stazione di Prosecco 5/B, 34010<br>Sgonico, Trieste, Italy |

- FCC ID: RI7CE910-DUAL
- IC 5131A-CE910DUAL
- Model: CE910-DUAL
- Brand Name: Telit
- EUT Type: DUAL BAND CDMA Module
- Classification: Licensed Potable Transmitter(PCB)
- Applied Standard: FCC 47 CFR Part & 2, 22, 24  
RSS-Gen, 132,133
- Test Procedure(s): ANSI C63.4 (2003)
- Dates of Test: June 18, 2012 ~ July 25, 2012
- Place of Tests: Nemko Korea Co., Ltd.

## 2. Introduction (Site Description)

### 2.1 Test facility

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions emanating from **Telit Communications S.p.A.**

**FCC ID : RI7CE910-DUAL and IC: 5131A-CE910DUAL**

These measurement tests were conducted at **Nemko Korea Co., Ltd.**

The site address is 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, KOREA

The area of Nemko Korea Corporation Ltd. Test site is located in a mountain area at 80 kilometers (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18 miles) south-southeast from central Seoul.

It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.

The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 2003.



Nemko Korea Co., Ltd.  
67-1 & 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, KOREA 449-852  
Tel) +82-31-322-1700  
Fax) +82-31-322-2332

Fig. 1. The map above shows the Seoul in Korea vicinity area.  
The map also shows Nemko Korea Corporation Ltd. and Incheon Airport.

## 2.2 Accreditation and listing

| Accreditation type                                                                  |                                                                  | Accreditation number     |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------|
|    | FCC part 15/18 Filing site                                       | Registration No. 97992   |
|                                                                                     | CAB Accreditation for DOC                                        | Designation No. KR0026   |
|    | KOLAS Accredited Lab.<br>(Korea Laboratory Accreditation Scheme) | Registration No. 155     |
|    | Canada IC Registered site                                        | Site No. 2040E           |
|    | VCCI registration site(RE/CE/Telecom CE)                         | Member No. 2118          |
|   | EMC CBTL                                                         | -                        |
|  | KCC(RRL)Designated Lab.                                          | Registration No. KR0026  |
|  | SASO registered Lab and Certification Body                       | Registration No. 2008-15 |

### 3. Test Conditions & EUT Information

---

#### 3.1 Operating During Test

The EUT was tested at the lowest channel, middle channel and the highest channel with maximum RF power and all data were recorded in the report.

#### 3.2 Environmental Conditions

|                   |             |
|-------------------|-------------|
| Temperature       | 24°C ~ 28°C |
| Relative Humidity | 30% ~ 55%   |

#### 3.3 Description of EUT

|                                   |                                                                     |                                                      |
|-----------------------------------|---------------------------------------------------------------------|------------------------------------------------------|
| Frequency Band                    | Tx                                                                  | 824.70 MHz ~ 848.31 MHz<br>1851.25 MHz ~ 1908.75 MHz |
|                                   | Rx                                                                  | 869.70 MHz ~ 893.31 MHz<br>1931.25 MHz ~ 1988.75 MHz |
| Output Power<br>(Conducted power) | Cellular CDMA : 0.292 W(24.65 dBm)<br>PCS CDMA : 0.278 W(24.44 dBm) |                                                      |
| Emission Designator               | 1M28F9W                                                             |                                                      |
| Antenna Type                      | Magnet Mount Antennas                                               |                                                      |
| Antenna Gain                      | 5.12 dBi for Cellular, 6.12 dBi for PCS                             |                                                      |
| Dimensions                        | 28.2 mm(W) x 28.2 mm(D) x 2.4 mm(H)                                 |                                                      |
| Weight                            | Approx. 4.7 g                                                       |                                                      |
| Operating Temperature             | -30°C ~ +85 °C                                                      |                                                      |

## 4. Measuring Instrument Calibration

---

All measurements were made with instruments calibrated according to the recommendation by manufacturer. Measurement of radiated emissions and conducted emissions were made with instruments conforming to American National Standards Institute, ANSI C63.4-2003.

The calibration of measuring instrument, including any accessories that may affect test results, were performed according to the recommendation by manufacturer.

- End of page -

## 5. Summary of Test Results

---

The EUT has been tested according to the following specification:

| Description of Test                             | FCC Rule                            | IC Rule                                          | Result   |
|-------------------------------------------------|-------------------------------------|--------------------------------------------------|----------|
| ERP / EIRP Measurement                          | §22.913(a)(2)<br>§24.232(c)         | RSS-132(4.4)<br>[SRSP503(5.1.3)]<br>RSS-133(6.4) | Complies |
| Conducted Output Power                          | §2.1046                             | RSS-132(4.4)<br>RSS-133(4.1)                     | Complies |
| Occupied Bandwidth /<br>26dB Emission Bandwidth | §2.1049<br>§22.917(a)<br>§24.238(a) | RSS-Gen(4.6.1)<br>RSS-133(2.3)                   | Complies |
| Conducted Spurious Emission<br>/ Band Edge      | §2.1051<br>§22.917(a)<br>§24.238(a) | RSS-132(4.5.1)<br>RSS-133(6.5.1)                 | Complies |
| Peak-Average Ratio                              | §24.232(d)                          | RSS-133(6.4)                                     | Complies |
| Radiated Spurious & Harmonic<br>Emission        | §2.1053<br>§22.917(a)<br>§24.238(a) | RSS-132(4.5.1)<br>RSS-133(6.5.1)                 | Complies |
| Frequency Stability /<br>Temperature Variation  | §2.1055<br>§22.355<br>§24.235       | RSS-132(4.3)<br>RSS-133(6.3)                     | Complies |
| Receiver Spurious Emissions                     | -                                   | RSS-Gen(6.1)<br>RSS-132(4.6)<br>RSS-133(6.6)     | Complies |

## 6. Recommendation / Conclusion

---

The data collected shows that the **Telit Communications S.p.A. DUAL BAND CDMA Module FCC ID: RI7CE910-DUAL/ IC: 5131A-CE910DUAL** is in compliance with Part 2, 22, 24 of the FCC Rules and RSS-Gen, 132, 133 of the IC Rules.

## 7. Description of Tests

### 7.1 Effective Radiated Power / Equivalent Isotropic Radiated Power

#### Test Set-up:

Effective Radiated Power Output and Equivalent Isotropic Radiated Power output Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2003.

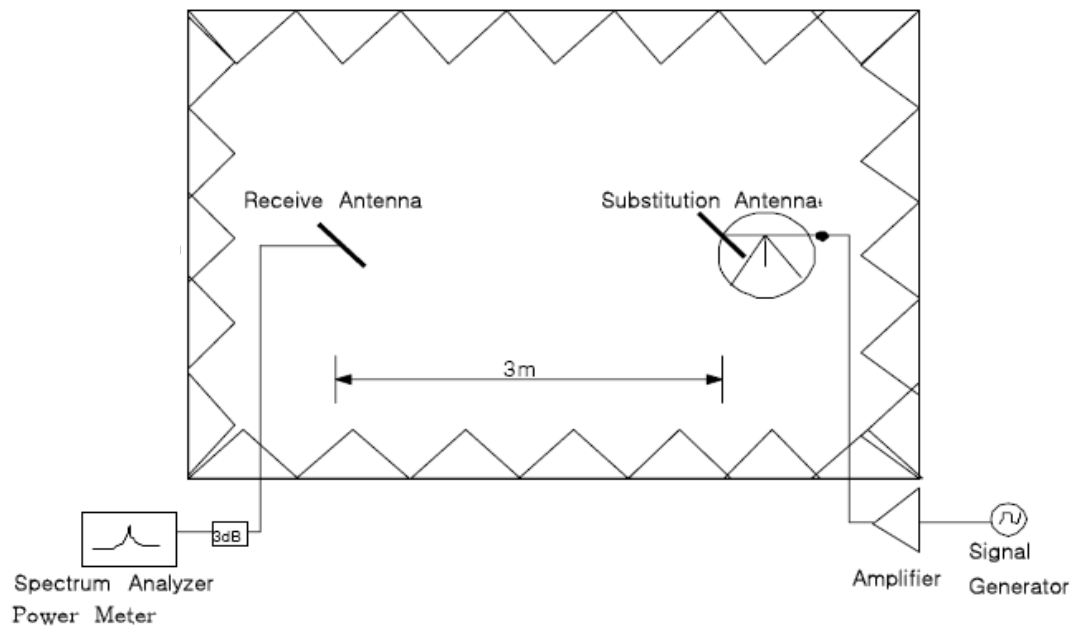


Diagram of ERP/EIRP test Set-up

The EUT was set on a non-conductive turntable in a semi anechoic chamber. In the corner of the chamber there was a communication antenna, which was connected to the BS simulator located outside the chamber. The radiated power from the EUT was measured with an antenna fixed to a antenna tower. The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.

#### Test Method:

1. The maximum power level was searched by moving the turn table and measuring antenna and manipulating the EUT. This level ( $P_{EUT}$ ) was recorded.
2. Spectrum analyzer was set to RBW 3 MHz, VBW 3 MHz, peak detection mode.
3. Replace the EUT with a substituting antenna and feed the substitution antenna at the EUT end with a signal generator connected to the antenna.
4. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained ( $P_{EUT}$ ).
5. Calculate the EIRP, in dBm, by the power loss in the cable between the generator and antenna, corrected for the gain of the substitution antenna.

## **7.2 Radiated Spurious & Harmonic Emission**

### **Test Set-up:**

Effective Radiated Power Output and Equivalent Isotropic Radiated Power output Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2003.

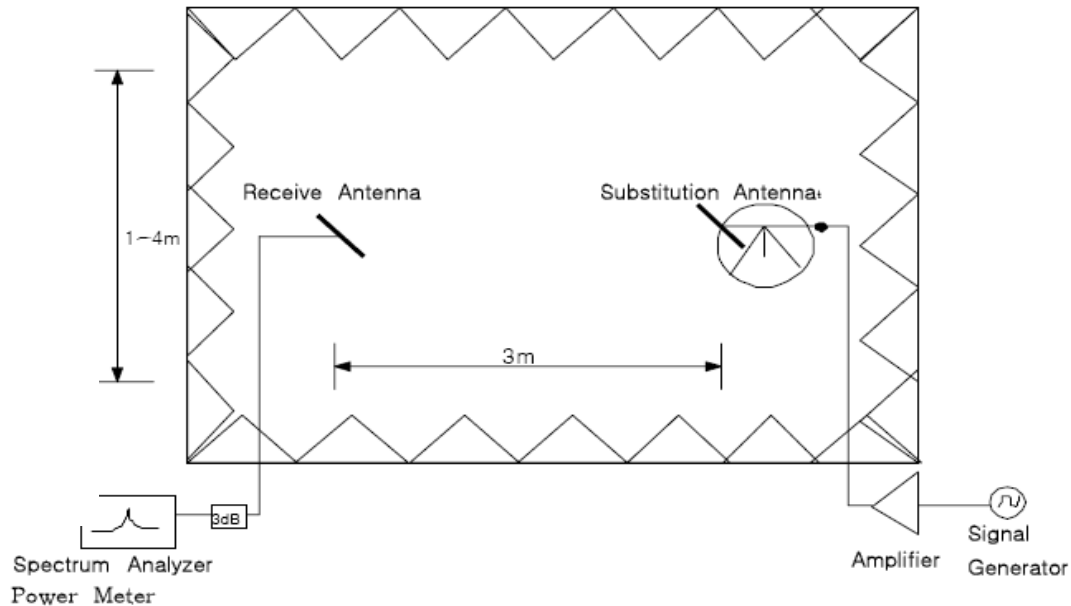


Diagram of Radiated Spurious & Harmonic test Set-up

The EUT was set on a non-conductive turntable in a semi anechoic chamber.

In the corner of the chamber there was a communication antenna, which was connected to the BS simulator located outside the chamber. The radiated power from the EUT was measured with an antenna fixed to a antenna tower.

The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.

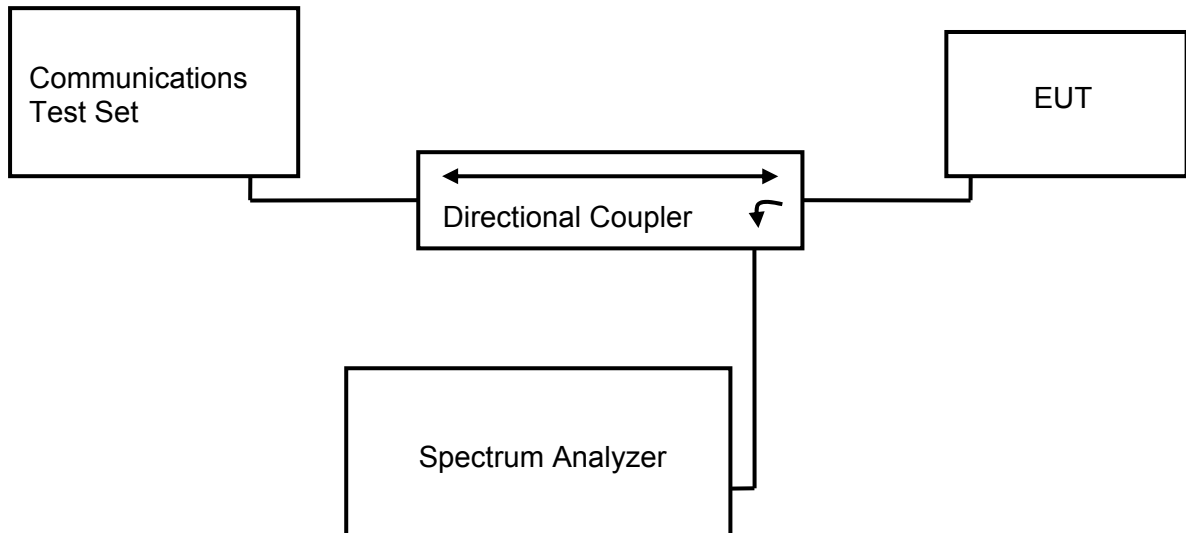
The radiated spurious and harmonic emission were measured up to 10<sup>th</sup> harmonic of the fundamental frequency of operation.

### **Test Method:**

1. The maximum power level was searched by moving the turn table and measuring antenna and manipulating the EUT. This level ( $P_{EUT}$ ) was recorded.
2. For measurements the resolution bandwidth and video bandwidth were set to 100 kHz for emissions below 1GHz and 1 MHz for emissions over 1GHz.
3. Replace the EUT with a substituting antenna and feed the substitution antenna at the EUT end with a signal generator connected to the antenna.
4. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained( $P_{EUT}$ ).
5. Calculate the ERP, in dBm, by the power loss in the cable between the generator and antenna, corrected for the gain of the substitution antenna.

### **7.3 Occupied Bandwidth / 26dB Emission Bandwidth**

#### **Test Set-up:**



#### **Test Method:**

##### **Occupied Bandwidth**

The EUT was setup to maximum output power at its lowest channel. The occupied bandwidth was measured using a spectrum analyzer. The measurements are repeated for the highest and a middle channel.

The EUT's occupied bandwidth was measured as the width of the signal between two points, one below the carrier center frequency and one above the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

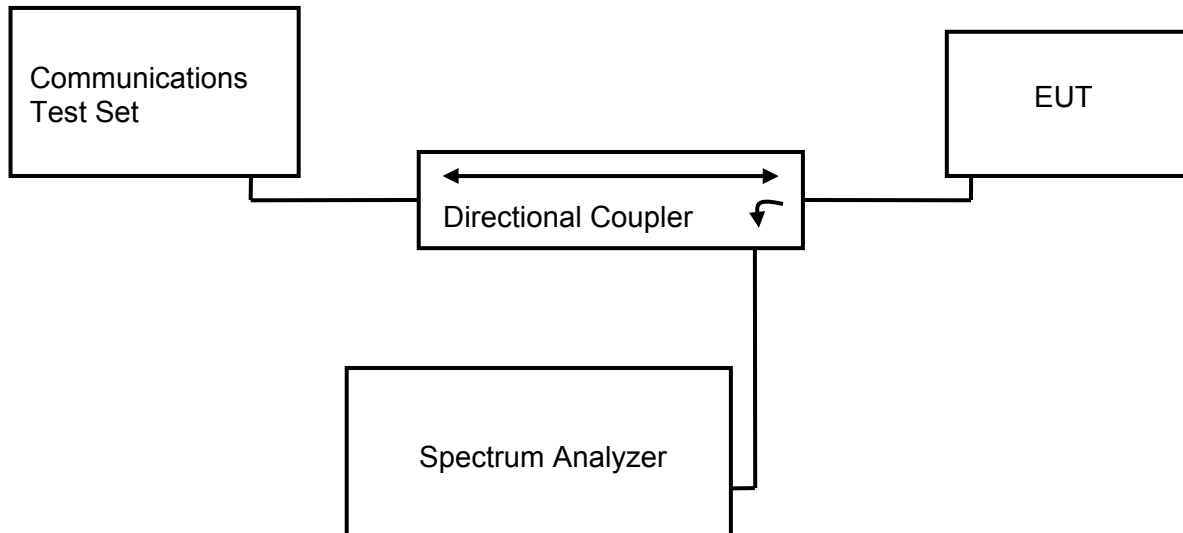
##### **26dB Emission Bandwidth**

The transmitter output was connected to the spectrum analyzer.

The RBW of spectrum analyzer was set to approximately 1% of the emission bandwidth and peak detection was used. The emission bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 26 dB.

## **7.4 Conducted Spurious Emission**

### **Test Set-up:**



### **Minimum standard:**

On any frequency outside a license frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10\log(P)$  dB. Limit equivalent to -13 dBm, calculation shown below.

$$43 + 10\log(0.912 \text{ W}) = 42.6 \text{ dB}$$

$$29.6 \text{ dBm} - 42.6 \text{ dB} = -13 \text{ dBm}$$

Compliance with the out-of-band emissions requirement is based on test being performed with an analyzer resolution bandwidth of 1 MHz. However in the 1 MHz band immediately outside and adjacent to the frequency block a resolution bandwidth of at least 1 % of the fundamental emissions bandwidth may be employed.

### **Test Procedure:**

The EUT was setup to maximum output power at its lowest channel.

The Resolution BW of the analyzer is set to 1 % of the emission bandwidth to show compliance with the -13 dBm limit, in the 1 MHz bands immediately outside and adjacent to the edge of the frequency block.

The measurements were repeated for the EUT's highest channel. For the Out-of-Band measurements a 1 MHz RBW, VBW and peak detection was used to scan from 10 MHz to 20 GHz. A display line was placed at -13 dBm to show compliance. The high, lowest and middle channels were tested for out of band measurements.

### Frequency Bands:

| BLOCK     | Frequency Range (MHz)<br>Transmitter (Tx) | Frequency Range (MHz)<br>Receiver (Rx) |
|-----------|-------------------------------------------|----------------------------------------|
| A* Low +A | 824 ~ 835                                 | 869 ~ 880                              |
| B         | 835 ~ 845                                 | 880 ~ 890                              |
| A* High   | 845 ~ 846.5                               | 890 ~ 891.5                            |
| B*        | 846.5 ~ 849                               | 891.5 ~ 894                            |

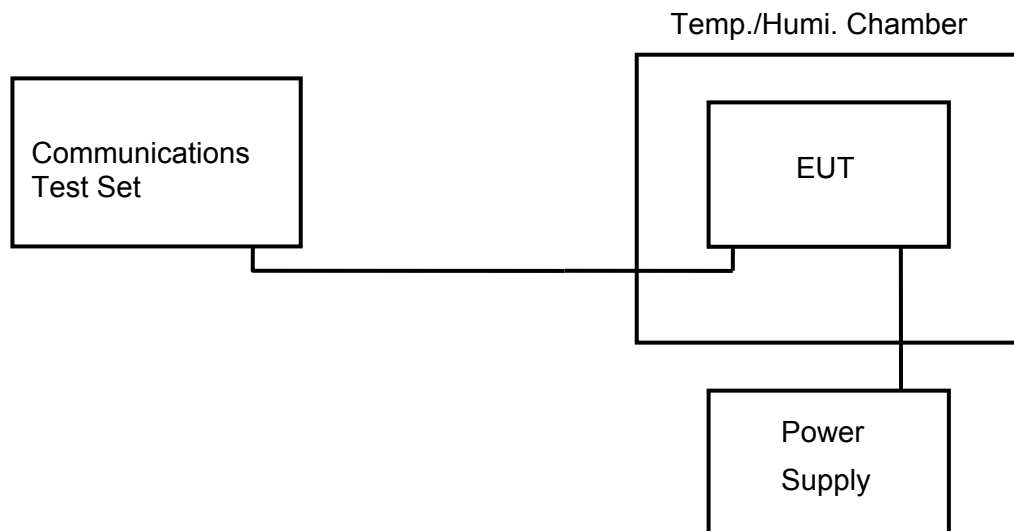
### **Cellular Service Frequency Blocks**

| BLOCK | Frequency Range (MHz)<br>Transmitter (Tx) | Frequency Range (MHz)<br>Receiver (Rx) |
|-------|-------------------------------------------|----------------------------------------|
| A     | 1850 ~ 1865                               | 1930 ~ 1975                            |
| B     | 1870 ~ 1885                               | 1950 ~ 1965                            |
| C     | 1895 ~ 1910                               | 1975 ~ 1990                            |
| D     | 1865 ~ 1870                               | 1945 ~ 1950                            |
| E     | 1885 ~ 1890                               | 1965 ~ 1970                            |
| F     | 1890 ~ 1895                               | 1970 ~ 1975                            |

### **PCS Service Frequency Blocks**

## **7.5 Frequency Stability / Temperature Variation**

### **Test Set-up:**



### **Specification :**

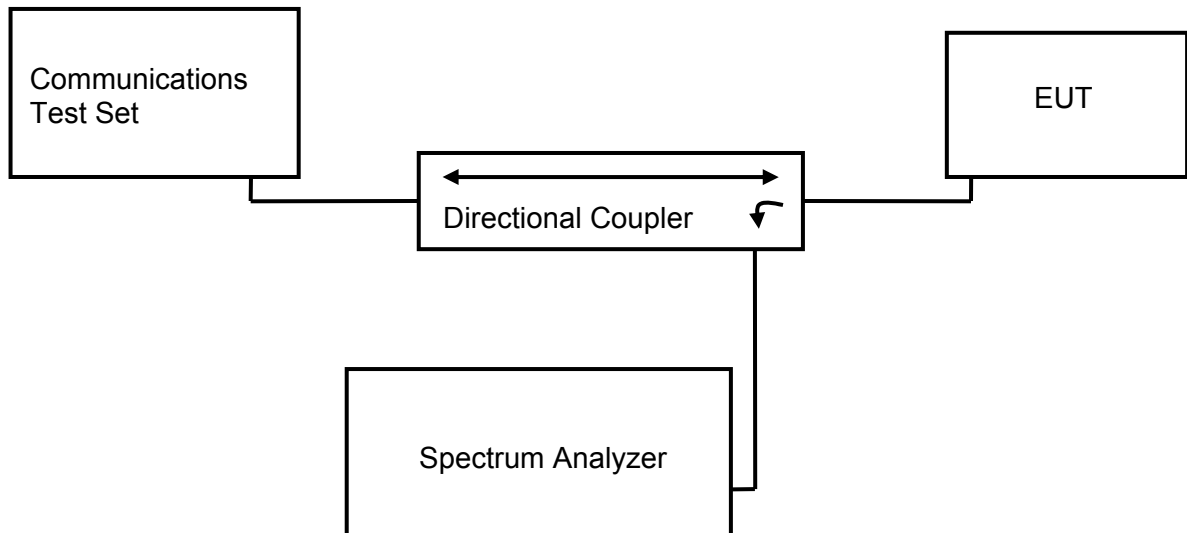
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5\text{ppm}$ ) of the center frequency.

### **Test Method :**

1. The carrier frequency of the transmitter and the individual oscillators is measured at room temperature (20 °C to 25 °C to provide a reference).
2. The equipment is subjected to an overnight “soak” at -30 °C without any power applied.
3. After the overnight “soak” at -30 °C (Usually 14 ~ 16 hours), the equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter and the individual oscillators is made within a three minute interval after applying power to the transmitter.
4. Frequency measurements are made at 10 °C interval up to room temperature. At least a period of one and one half-hour is provided to allow stabilization of the equipment at each temperature level.
5. Again the transmitter carrier frequency and the individual oscillators is measured at room temperature to begin measurement of the upper temperature levels.
6. Frequency measurements are at 10 intervals starting at - 30 °C up to + 60 °C allowing at least two hours at each temperature for stabilization. In all measurements the frequency is measured within three minutes after re-applying power to the transmitter.
7. The artificial load is mounted external to the temperature chamber.

## 7.6 Conducted Output Power

### Test Set-up:



### Test Method :

For conducted power measurement, connected the EUT to Communications Test Set (E5515C) through the Directional Coupler. Set the EUT transmit the maximum power at the wanted channel by controlled E5515C. The test was performed using the Spectrum Analyzer with 3 MHz RBW, VBW under all configurations then, the highest power was recorded.

## 8. Test Data

### 8.1 Conducted Output Power

FCC §2.1046, RSS-132(4.4), RSS-133(4.1)

Measurement Results : Cellular and PCS

Mode : 1x RTT only

| Band     | Channel | Output Power (dBm)  |       |
|----------|---------|---------------------|-------|
|          |         | Average             | Peak  |
| Cellular | 1013    | <b><u>24.65</u></b> | 29.05 |
|          | 384     | 24.49               | 29.22 |
|          | 777     | 24.10               | 28.88 |
| PCS      | 25      | 24.08               | 27.33 |
|          | 600     | 24.29               | 27.85 |
|          | 1175    | <b><u>24.44</u></b> | 28.47 |

Note: This device was tested under all R.C.s and S.O.s. The worst case is reported with RC1/SO55 with 'All Up' power control bits.

## 8.2 Effective Radiated Power (ERP)

FCC §22.913(a)(2), RSS-132(4.4)/SRSP503(5.1.3)

Measurement Results : Cellular

Mode : 1x RTT only

| Frequency (MHz) | Ant*. Pol. | Reading (dBm) | Level at Antenna Terminal (dBm) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------|---------------|---------------------------------|--------------------|-----------|-------------|-------------|
| 824.70          | V          | -9.2          | 24.1                            | 0                  | 24.1      | 38.45       | 14.35       |
| 836.52          | V          | -9.0          | 24.6                            | 0                  | 24.6      | 38.45       | 13.85       |
| 848.31          | V          | -8.9          | 25.0                            | 0                  | 25.0      | 38.45       | 13.45       |

Radiated Measurements at 3meters

Note: Effective Radiated Power Output Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2..4, Aug. 17, 2004.

This device was tested under all R.C.s and S.O.s. The worst case is reported with RC1/SO55 with 'All Up' power control bits.

$ERP(dB) = Level\ at\ Antenna\ Terminal(dBm) + Antenna\ Gain(dBd)$

### 8.3 Equivalent Isotropic Radiated Power (EIRP)

FCC §24.232(c), RSS-133(6.4)

Measurement Results : PCS

Mode : 1x RTT only

| Frequency<br>(MHz) | Ant*.<br>Pol. | Reading<br>(dBm) | Level at<br>Antenna<br>Terminal<br>(dBm) | Antenna<br>Gain<br>(dBi) | EIRP<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|---------------|------------------|------------------------------------------|--------------------------|---------------|----------------|----------------|
| 1851.25            | V             | -20.9            | 13.3                                     | 7.70                     | 21.0          | 33             | 12.0           |
| 1880.00            | V             | -19.0            | 16.1                                     | 7.70                     | 23.8          | 33             | 9.2            |
| 1908.75            | V             | -16.4            | 19.0                                     | 7.70                     | 26.7          | 33             | 6.3            |

Radiated Measurements at 3meters

Note: Effective Radiated Power Output Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2..4, Aug. 17, 2004.

This device was tested under all R.C.s and S.O.s. The worst case is reported with RC1/SO55 with 'All Up' power control bits.

$EIRP(dB) = \text{Level at Antenna Terminal}(dBm) + \text{Antenna Gain}(dBi)$

## 8.4 Occupied Bandwidth / 26 dB Emission Bandwidth

FCC §2.1049, RSS-133(2.3), RSS-Gen(4.6.1)

### Measurement Results : Cellular and PCS

#### Measurement Results : Cellular

| Channel | Frequency<br>(MHz) | Occupied BW<br>(MHz) | 26dB Emission BW<br>(MHz) |
|---------|--------------------|----------------------|---------------------------|
| 1013    | 824.70             | 1.273                | 1.430                     |
| 384     | 836.52             | 1.278                | 1.434                     |
| 777     | 848.31             | 1.274                | 1.427                     |

#### Measurement Results : PCS

| Channel | Frequency<br>(MHz) | Occupied BW<br>(MHz) | 26dB Emission BW<br>(MHz) |
|---------|--------------------|----------------------|---------------------------|
| 25      | 1851.25            | 1.283                | 1.445                     |
| 600     | 1880.00            | 1.281                | 1.449                     |
| 1175    | 1908.75            | 1.279                | 1.438                     |

## 8.5 Radiated Spurious & Harmonic Emission (Cellular)

### FCC §2.1053, §22.917(a), RSS-132(4.5.1)

#### CH 1013 (824.70 MHz)

| Frequency (MHz) | Ant*. Pol. | Reading (dBm) | Level at Antenna Terminal (dBm) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------|---------------|---------------------------------|--------------------|-----------|-------------|-------------|
| 1236.90         | V          | -57.7         | -57.0                           | 5.53               | -51.5     | -13         | 38.5        |
| 3298.50         | V          | -63.5         | -57.9                           | 7.01               | -50.9     | -13         | 37.9        |

Radiated Measurements at 3meters

#### CH 384 (836.52 MHz)

| Frequency (MHz) | Ant*. Pol. | Reading (dBm) | Level at Antenna Terminal (dBm) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------|---------------|---------------------------------|--------------------|-----------|-------------|-------------|
| 1660.35         | V          | -64.1         | -64.2                           | 5.54               | -58.7     | -13         | 45.7        |
| 2542.80         | V          | -64.7         | -60.4                           | 6.31               | -54.1     | -13         | 41.1        |
| 3355.50         | V          | -65.2         | -59.7                           | 7.02               | -52.7     | -13         | 39.7        |

Radiated Measurements at 3meters

### CH 777 (848.31 MHz)

| Frequency (MHz) | Ant*. Pol. | Reading (dBm) | Level at Antenna Terminal (dBm) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------|---------------|---------------------------------|--------------------|-----------|-------------|-------------|
| 1697.70         | V          | -65.2         | -65.3                           | 5.54               | -59.8     | -13         | 46.8        |
| 2473.50         | V          | -65.3         | -60.8                           | 6.21               | -54.6     | -13         | 41.6        |
| 2637.75         | V          | -66.0         | -61.1                           | 6.44               | -54.7     | -13         | 41.7        |
| 3417.75         | V          | -64.9         | -58.9                           | 7.03               | -51.9     | -13         | 38.9        |

### Radiated Measurements at 3meters

Note: Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2..4, Aug. 17, 2004.

This device was tested under all R.C.s and S.O.s. The worst case is reported with RC1/SO55 with 'All Up' power control bits.

ERP(dB) =Level at Antenna Terminal(dBm) + Antenna Gain(dBd)

1. \*Ant Pol. H =Horizontal V=Vertical
2. For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz with peak measurements
3. The spectrum is measured to 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.

## 8.6 Radiated Spurious & Harmonic Emission (PCS)

FCC §2.1053, §24.238(a), RSS-133(6.5.1)

### CH25 (1851.25 MHz)

| Frequency (MHz) | Ant*. Pol. | Reading (dBm) | Level at Antenna Terminal (dBm) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------|---------------|---------------------------------|--------------------|-----------|-------------|-------------|
| 3701.88         | V          | -64.3         | -57.2                           | 7.09               | -50.1     | -13         | 37.1        |
| 5553.75         | V          | -66.1         | -55.2                           | 8.33               | -46.9     | -13         | 33.9        |

### Radiated Measurements at 3meters

### CH 600 (1880.00 MHz)

| Frequency (MHz) | Ant*. Pol. | Reading (dBm) | Level at Antenna Terminal (dBm) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------|---------------|---------------------------------|--------------------|-----------|-------------|-------------|
| 3760.00         | V          | -64.4         | -56.6                           | 7.10               | -49.5     | -13         | 36.5        |
| 5640.63         | V          | -66.8         | -55.8                           | 8.42               | -47.4     | -13         | 34.4        |
| 7520.00         | V          | -65.9         | -50.0                           | 10.03              | -40.0     | -13         | 27.0        |

### Radiated Measurements at 3meters

**CH 1175 (1908.75 MHz)**

| Frequency (MHz) | Ant*. Pol. | Reading (dBm) | Level at Antenna Terminal (dBm) | Antenna Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|------------|---------------|---------------------------------|--------------------|-----------|-------------|-------------|
| 3816.25         | V          | -63.0         | -55.0                           | 7.11               | -47.9     | -13         | 34.9        |
| 5726.88         | V          | -66.1         | -55.4                           | 8.52               | -46.9     | -13         | 33.9        |
| 7635.00         | V          | -65.4         | -50.4                           | 10.62              | -39.8     | -13         | 26.8        |

**Radiated Measurements at 3meters**

Note: Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2..4, Aug. 17, 2004.

This device was tested under all R.C.s and S.O.s. The worst case is reported with RC1/SO55 with 'All Up' power control bits.

ERP(dB) =Level at Antenna Terminal(dBm) + Antenna Gain(dBd)

1. \*Ant Pol. H =Horizontal V=Vertical
2. For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz with peak measurements
3. The spectrum is measured to 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.

## 8.7 Frequency Stability / Temperature Variation (Cellular)

**Test channel : Middle channel (836.52 MHz)**

**Standard test voltage : 3.8 Vdc**

**Deviation Limit :  $\pm 2.5$  ppm**

### **Measurement Result :**

| Voltage (%) | Power (Vdc) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | ppm     |
|-------------|-------------|------------|----------------|----------------------|---------|
| 100%        | 3.8         | +23(Ref.)  | 836,519,991    | -9                   | -0.0108 |
| 100%        |             | -30        | 836,519,992    | -8                   | -0.0096 |
| 100%        |             | -20        | 836,519,993    | -7                   | -0.0084 |
| 100%        |             | -10        | 836,519,967    | -33                  | -0.0394 |
| 100%        |             | 0          | 836,519,968    | -32                  | -0.0383 |
| 100%        |             | 10         | 836,519,968    | -32                  | -0.0383 |
| 100%        |             | 20         | 836,519,983    | -17                  | -0.0203 |
| 100%        |             | 30         | 836,519,994    | -6                   | -0.0072 |
| 100%        |             | 40         | 836,519,991    | -9                   | -0.0108 |
| 100%        |             | 50         | 836,519,985    | -15                  | -0.0179 |
| 100%        |             | 60         | 836,519,985    | -15                  | -0.0179 |
| 85%         | 3.23        | 23         | 836,519,992    | -8                   | -0.0096 |
| 115%        | 4.37        | 23         | 836,519,990    | -10                  | -0.0120 |

**\*The temperature is varied from -30°C to +60°C using an environmental chamber.**

## 8.8 Frequency Stability / Temperature Variation (PCS)

**Test channel : Middle channel (1880.00 MHz)**

**Standard test voltage : 3.8 Vdc**

**Deviation Limit :  $\pm 2.5$  ppm**

### **Measurement Result :**

| Voltage (%) | Power (Vdc) | Temp. (°C) | Frequency (Hz) | Frequency Error (Hz) | ppm     |
|-------------|-------------|------------|----------------|----------------------|---------|
| 100%        | 3.8         | +23(Ref.)  | 1,880,000,021  | 21                   | 0.0112  |
| 100%        |             | -30        | 1,880,000,027  | 27                   | 0.0144  |
| 100%        |             | -20        | 1,880,000,032  | 32                   | 0.0170  |
| 100%        |             | -10        | 1,880,000,029  | 29                   | 0.0154  |
| 100%        |             | 0          | 1,879,999,975  | -25                  | -0.0133 |
| 100%        |             | 10         | 1,880,000,021  | 21                   | 0.0112  |
| 100%        |             | 20         | 1,880,000,020  | 20                   | 0.0106  |
| 100%        |             | 30         | 1,880,000,021  | 21                   | 0.0112  |
| 100%        |             | 40         | 1,880,000,017  | 17                   | 0.0090  |
| 100%        |             | 50         | 1,879,999,978  | -22                  | -0.0117 |
| 100%        |             | 60         | 1,879,999,979  | -21                  | -0.0112 |
| 85%         | 3.23        | 23         | 1,879,999,981  | -19                  | -0.0101 |
| 115%        | 4.37        | 23         | 1,880,000,021  | 21                   | 0.0112  |

**\*The temperature is varied from -30°C to +60°C using an environmental chamber.**

## 8.9 Receiver Spurious Emissions

### RSS-Gen(6.1), RSS-132(4.6), RSS-133(6.6)

| Frequency<br>(MHz) | Reading<br>(dB $\mu$ V/m) | Pol*<br>(H/V) | AF+CL+Amp<br>(dB)** | Result<br>(dB $\mu$ V/m) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|--------------------|---------------------------|---------------|---------------------|--------------------------|-------------------------|----------------|
| 156.59             | 49.1                      | H             | -21.1               | 28.0                     | 43.5                    | 15.5           |
| 159.01             | 49.1                      | V             | -21.1               | 28.0                     | 43.5                    | 15.5           |
| 474.75             | 46.7                      | V             | -16.4               | 30.3                     | 46.0                    | 15.7           |
| 688.15             | 45.4                      | H             | -11.1               | 34.3                     | 46.0                    | 11.7           |
| 697.85             | 44.8                      | H             | -11.1               | 33.7                     | 46.0                    | 12.3           |
| 959.75             | 46.3                      | V             | -7.8                | 38.5                     | 46.0                    | 7.5            |

### Radiated Measurements at 3 meters

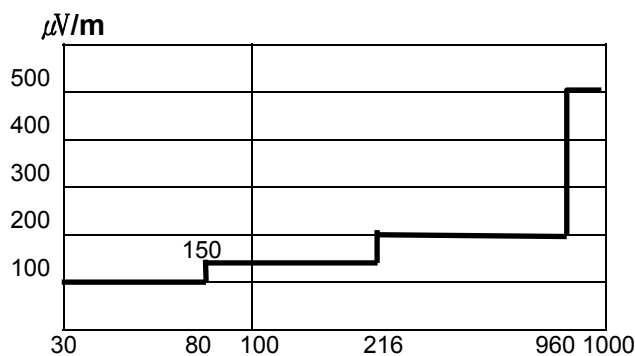


Fig. 5. Limits at 3 meters

#### Notes:

1. All modes were measured and the worst-case emission was reported.
- 2 The radiated limits are shown on Figure 5. Above 1 GHz the limit is 500  $\mu$ V/m.

MHz

#### Notes:

1. \*Pol. H = Horizontal, V = Vertical
2. \*\*AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Measurements using CISPR quasi-peak mode.
4. The limit is on the IC RSS GEN Clause 6.1.

## 9. ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

### 1. Conducted Uncertainty Calculation

| Source of Uncertainty            | $X_i$                                                        | Uncertainty of $X_i$ |                             | Coverage factor<br>$k$ | $u(X_i)$<br>(dB) | $C_i$ | $C_i u(X_i)$<br>(dB) |
|----------------------------------|--------------------------------------------------------------|----------------------|-----------------------------|------------------------|------------------|-------|----------------------|
|                                  |                                                              | Value<br>(dB)        | Probability<br>Distribution |                        |                  |       |                      |
| Receiver reading                 | <b>RI</b>                                                    | $\pm 0.1$            | normal 1                    | 1.000                  | 0.1              | 1     | 0.1                  |
| Attenuation AMN-Receiver         | <b>LC</b>                                                    | $\pm 0.08$           | normal 2                    | 2.000                  | 0.04             | 1     | 0.04                 |
| AMN Voltage division factor      | <b>LAMN</b>                                                  | $\pm 0.8$            | normal 2                    | 2.000                  | 0.4              | 1     | 0.4                  |
| Sine wave voltage                | <b>dVSW</b>                                                  | $\pm 2.00$           | normal 2                    | 2.000                  | 1.00             | 1     | 1.00                 |
| Pulse amplitude response         | <b>dVPA</b>                                                  | $\pm 1.50$           | rectangular                 | 1.732                  | 0.87             | 1     | 0.87                 |
| Pulse repetition rate response   | <b>dVPR</b>                                                  | $\pm 1.50$           | rectangular                 | 1.732                  | 0.87             | 1     | 0.87                 |
| Noise floor proximity            | <b>dVNF</b>                                                  | $\pm 0.00$           | -                           | -                      | 0.00             | 1     | 0.00                 |
| AMN Impedance                    | <b>dZ</b>                                                    | $\pm 1.80$           | triangular                  | 2.449                  | 0.73             | 1     | 0.73                 |
| Ⓐ Mismatch                       | <b>M</b>                                                     | + 0.70               | U-Shaped                    | 1.414                  | 0.49             | 1     | 0.49                 |
| Ⓑ Mismatch                       | <b>M</b>                                                     | - 0.80               | U-Shaped                    | 1.414                  | - 0.56           | 1     | - 0.56               |
| Measurement System Repeatability | <b>RS</b>                                                    | 0.05                 | normal 1                    | 1.000                  | 0.05             | 1     | 0.05                 |
| Remark                           | Ⓐ: AMN-Receiver Mismatch : +<br>Ⓑ: AMN-Receiver Mismatch : - |                      |                             |                        |                  |       |                      |
| Combined Standard Uncertainty    | Normal                                                       |                      |                             | $\pm 1.88$             |                  |       |                      |
| Expanded Uncertainty U           | Normal ( $k = 2$ )                                           |                      |                             | $\pm 3.76$             |                  |       |                      |

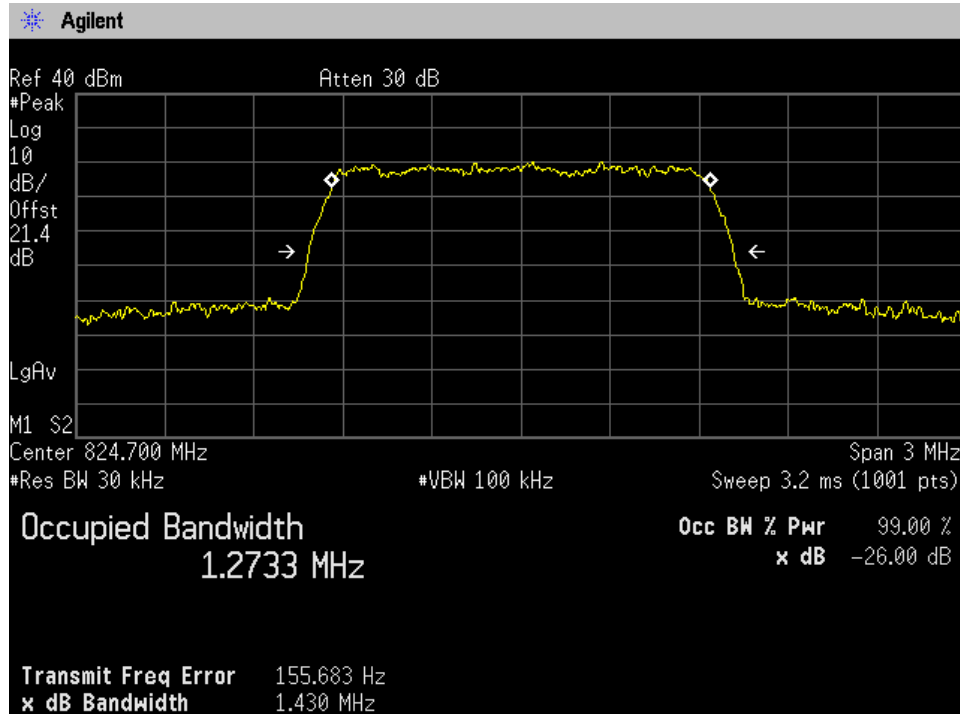
## 2. Radiation Uncertainty Calculation

| Source of Uncertainty                  | $X_i$                                                                                                                                                                                                                                                  | Uncertainty of $X_i$ |                          | Coverage factor $k$                                    | $u(X_i)$ (dB) | $C_i$ | $C_i u(X_i)$ (dB) |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------|--------------------------------------------------------|---------------|-------|-------------------|
|                                        |                                                                                                                                                                                                                                                        | Value (dB)           | Probability Distribution |                                                        |               |       |                   |
| Receiver reading                       | <b>RI</b>                                                                                                                                                                                                                                              | $\pm 0.10$           | normal 1                 | 1.000                                                  | 0.10          | 1     | 0.10              |
| Sine wave voltage                      | <b>dVsw</b>                                                                                                                                                                                                                                            | $\pm 2.00$           | normal 2                 | 2.000                                                  | 1.00          | 1     | 1.00              |
| Pulse amplitude response               | <b>dVpa</b>                                                                                                                                                                                                                                            | $\pm 1.50$           | rectangular              | 1.732                                                  | 0.87          | 1     | 0.87              |
| Pulse repetition rate response         | <b>dVpr</b>                                                                                                                                                                                                                                            | $\pm 1.50$           | rectangular              | 1.732                                                  | 0.87          | 1     | 0.87              |
| Noise floor proximity                  | <b>dVnf</b>                                                                                                                                                                                                                                            | $\pm 0.50$           | normal 2                 | 2.000                                                  | 0.25          | 1     | 0.25              |
| Antenna Factor Calibration             | <b>AF</b>                                                                                                                                                                                                                                              | $\pm 1.50$           | normal 2                 | 2.000                                                  | 0.75          | 1     | 0.75              |
| Attenuation Antenna-receiver           | <b>CL</b>                                                                                                                                                                                                                                              | $\pm 0.52$           | normal 2                 | 2.000                                                  | 0.26          | 1     | 0.26              |
| Antenna Directivity                    | <b>AD</b>                                                                                                                                                                                                                                              | $\pm 1.00$           | rectangular              | 1.732                                                  | 0.58          | 1     | 0.58              |
| Antenna Factor Height Dependence       | <b>AH</b>                                                                                                                                                                                                                                              | $\pm 0.50$           | rectangular              | 1.732                                                  | 0.29          | 1     | 0.29              |
| Antenna Phase Centre Variation         | <b>AP</b>                                                                                                                                                                                                                                              | $\pm 0.30$           | rectangular              | 1.732                                                  | 0.17          | 1     | 0.17              |
| Antenna Factor Frequency Interpolation | <b>AI</b>                                                                                                                                                                                                                                              | $\pm 0.30$           | rectangular              | 1.732                                                  | 0.17          | 1     | 0.17              |
| Site Imperfections                     | <b>SI</b>                                                                                                                                                                                                                                              | $\pm 4.00$           | triangular               | 2.449                                                  | 1.63          | 1     | 1.63              |
| Measurement Distance Variation         | <b>DV</b>                                                                                                                                                                                                                                              | $\pm 0.10$           | rectangular              | 1.732                                                  | 0.06          | 1     | 0.06              |
| Antenna Balance                        | <b>Dbal</b>                                                                                                                                                                                                                                            | $\pm 0.90$           | rectangular              | 1.732                                                  | 0.52          | 1     | 0.52              |
| Cross Polarisation                     | <b>DCross</b>                                                                                                                                                                                                                                          | $\pm 0.90$           | rectangular              | 1.732                                                  | 0.52          | 1     | 0.52              |
| Ⓐ Mismatch                             | <b>M</b>                                                                                                                                                                                                                                               | + 0.25               | U-Shaped                 | 1.414                                                  | 0.18          | 1     | 0.18              |
| Ⓑ Mismatch                             | <b>M</b>                                                                                                                                                                                                                                               | - 0.26               | U-Shaped                 | 1.414                                                  | - 0.18        | 1     | - 0.18            |
| Ⓒ Mismatch                             | <b>M</b>                                                                                                                                                                                                                                               | + 0.98               | U-Shaped                 | 1.414                                                  | 0.69          | 1     | 0.69              |
| Ⓓ Mismatch                             | <b>M</b>                                                                                                                                                                                                                                               | - 1.11               | U-Shaped                 | 1.414                                                  | - 0.79        | 1     | - 0.79            |
| Measurement System Repeatability       | <b>RS</b>                                                                                                                                                                                                                                              | 0.09                 | normal 1                 | 1.000                                                  | 0.09          | 1     | 0.09              |
| Remark                                 | Ⓐ: Biconical Antenna-receiver Mismatch : + (< 200 MHz)<br>Ⓑ: Biconical Antenna-receiver Mismatch : - (< 200 MHz)<br>Ⓒ: Log Periodic Antenna-receiver Mismatch : + ( $\geq$ 200 MHz)<br>Ⓓ: Log Periodic Antenna-receiver Mismatch : - ( $\geq$ 200 MHz) |                      |                          |                                                        |               |       |                   |
| Combined Standard Uncertainty          | Normal                                                                                                                                                                                                                                                 |                      |                          | $\pm 2.63$ (< 200 MHz)<br>$\pm 2.74$ ( $\geq$ 200 MHz) |               |       |                   |
| Expanded Uncertainty U                 | Normal ( $k = 2$ )                                                                                                                                                                                                                                     |                      |                          | $\pm 5.26$ (< 200 MHz)<br>$\pm 5.48$ ( $\geq$ 200 MHz) |               |       |                   |

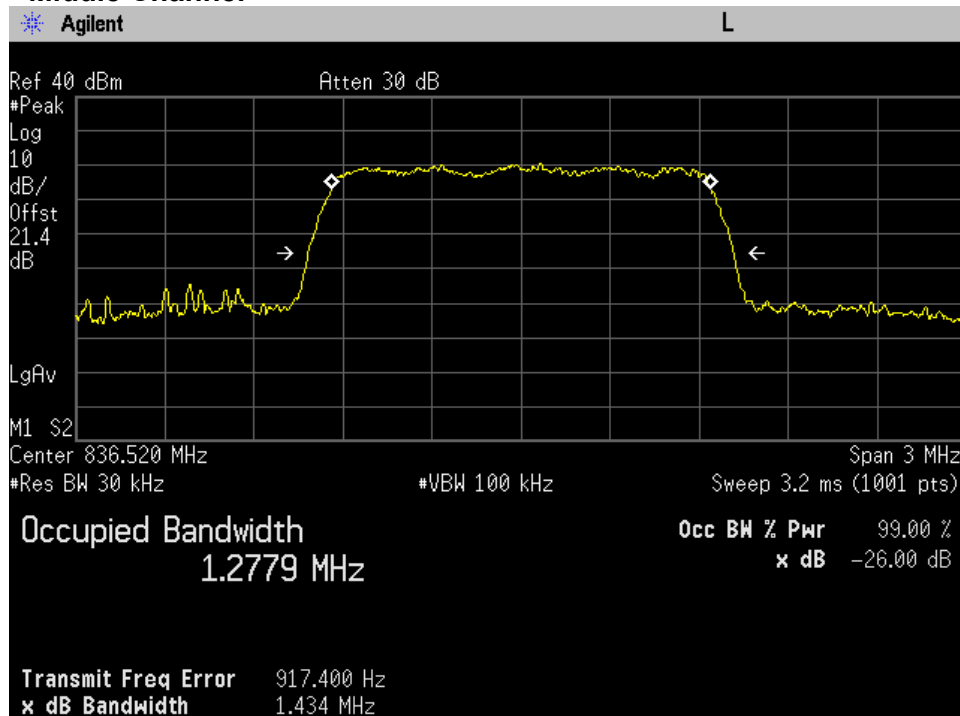
## 10. Test Plots (Cellular)

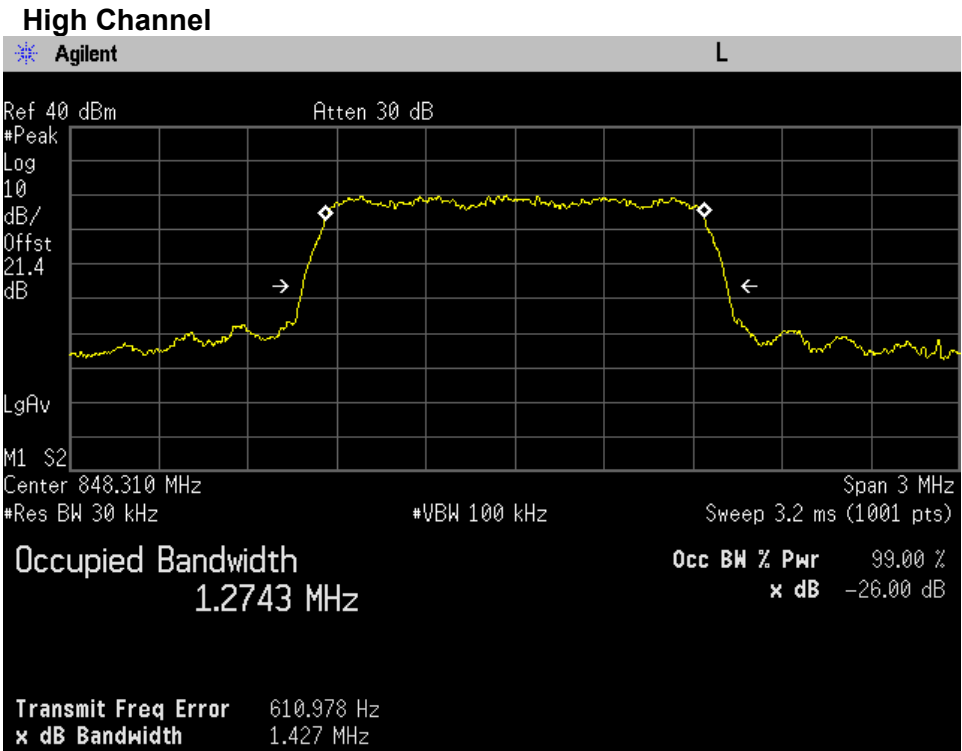
### ● Occupied Bandwidth / 26dB Bandwidth

#### Low Channel

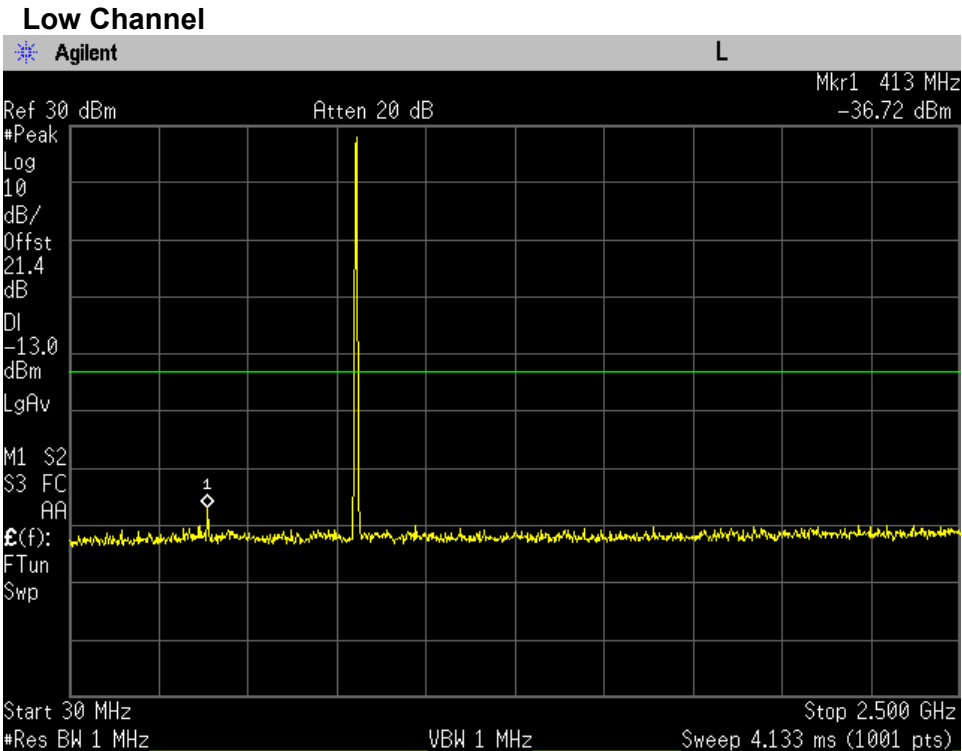


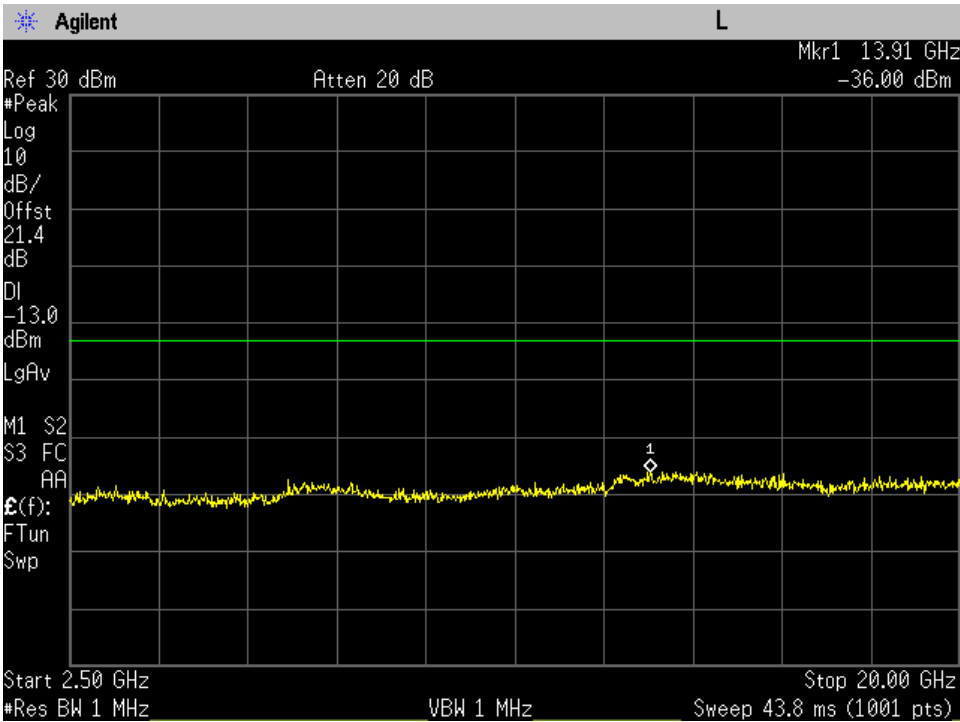
#### Middle Channel



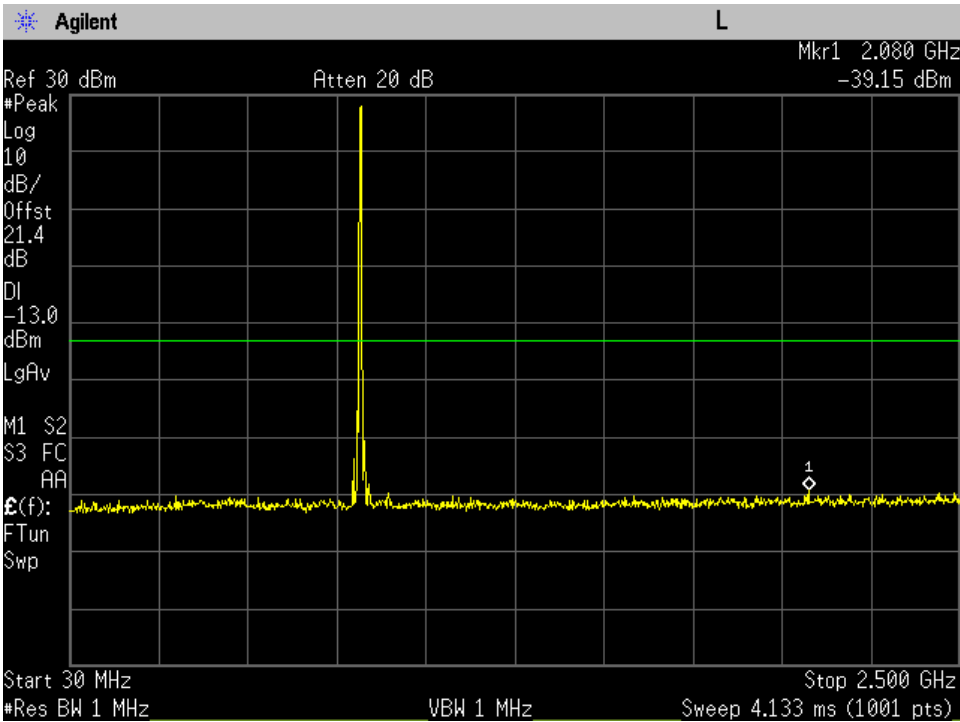


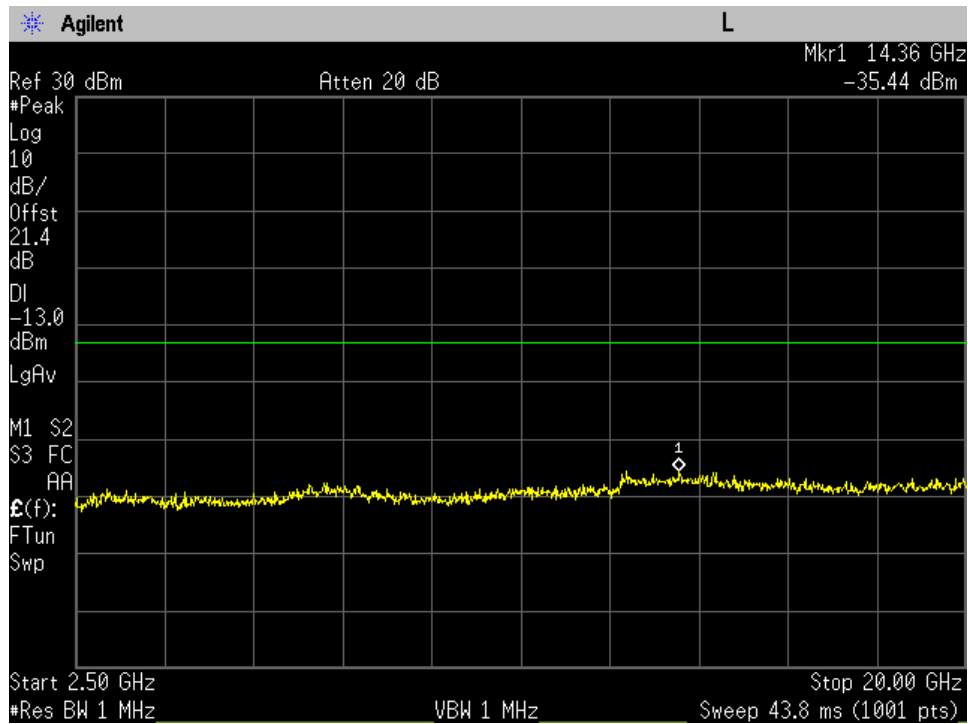
● Spurious Emission at antenna Terminals



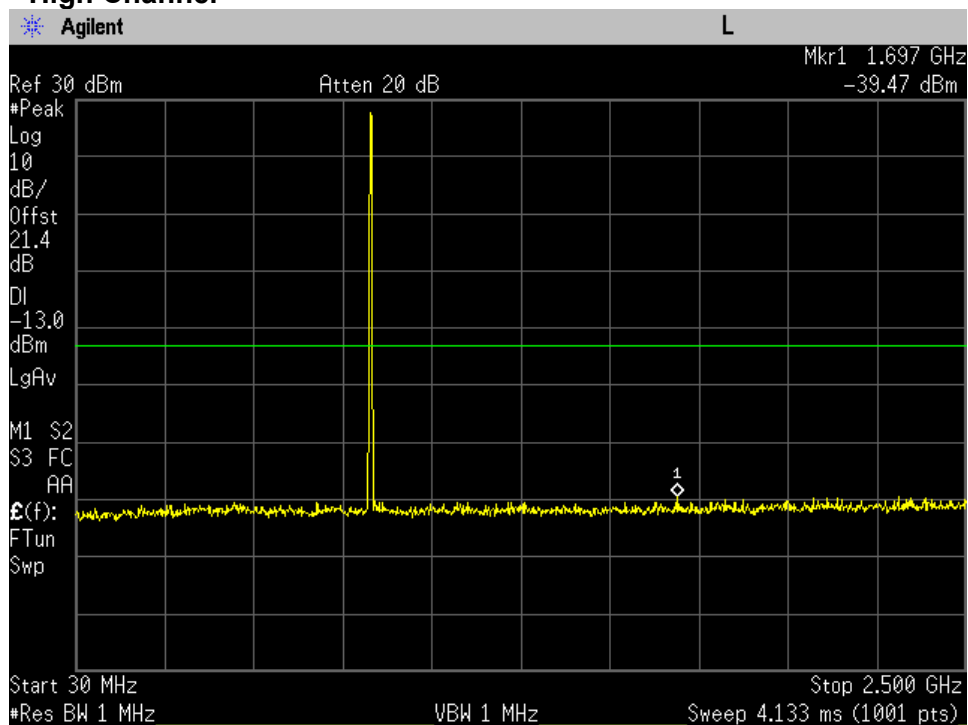


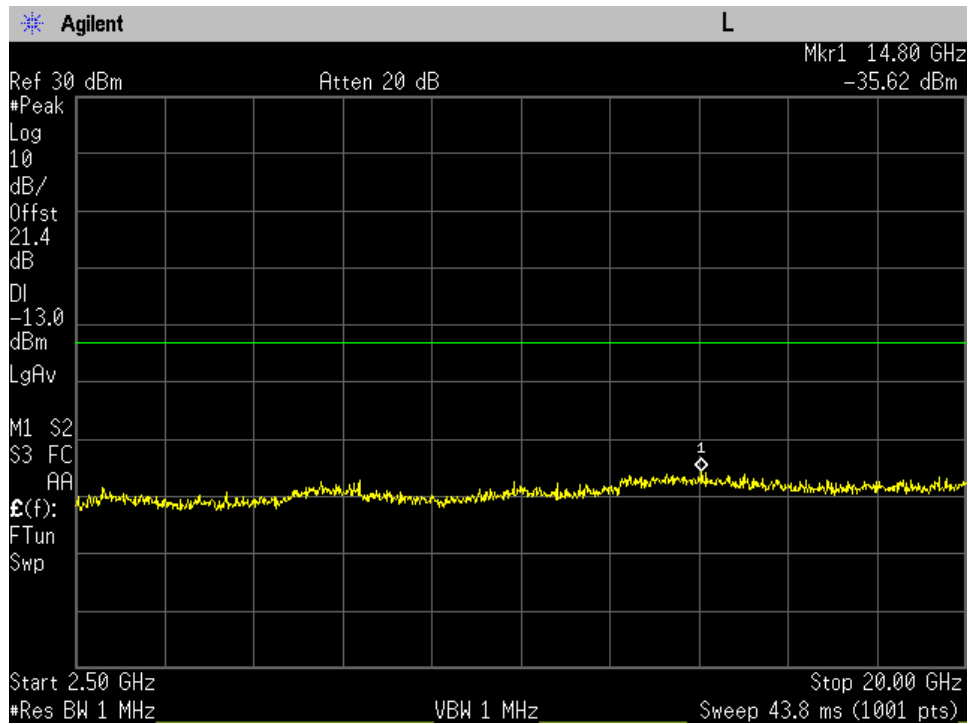
**Middle Channel**



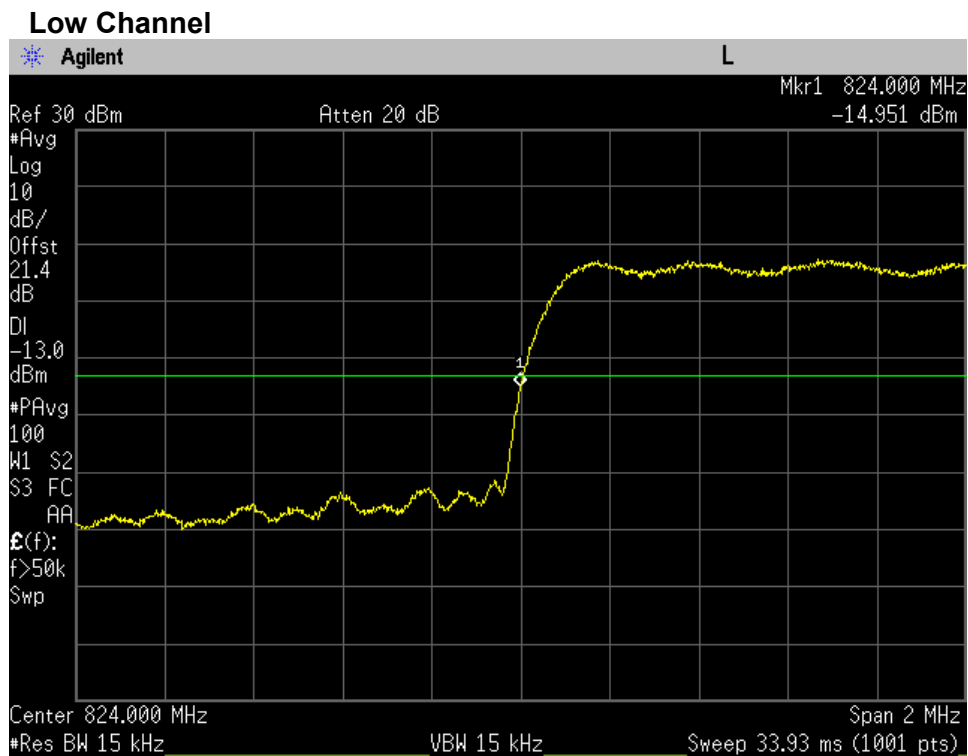


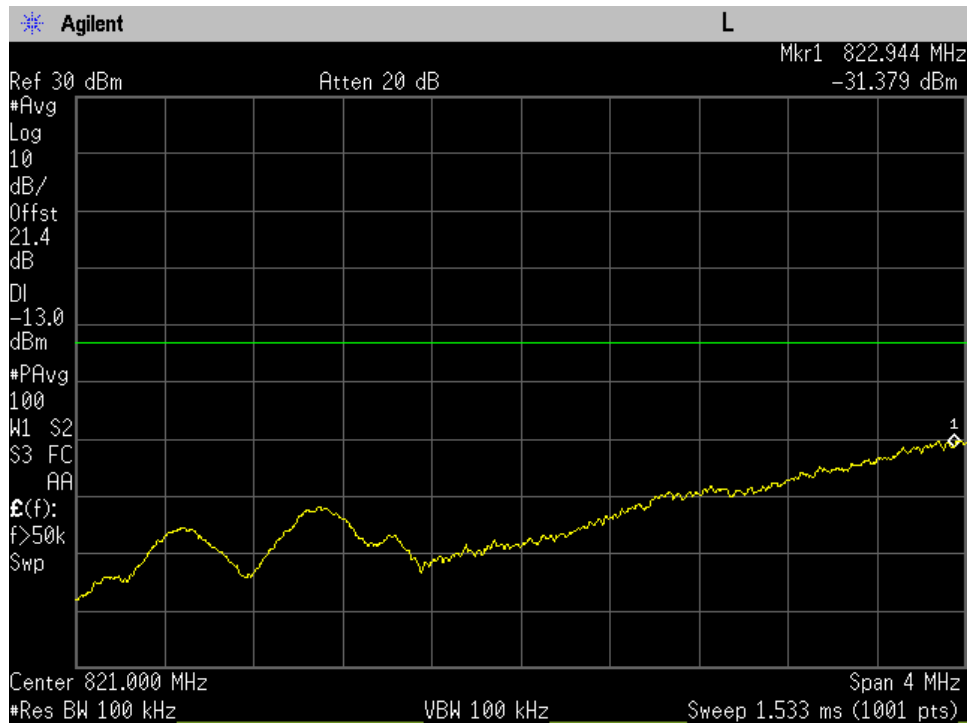
### High Channel



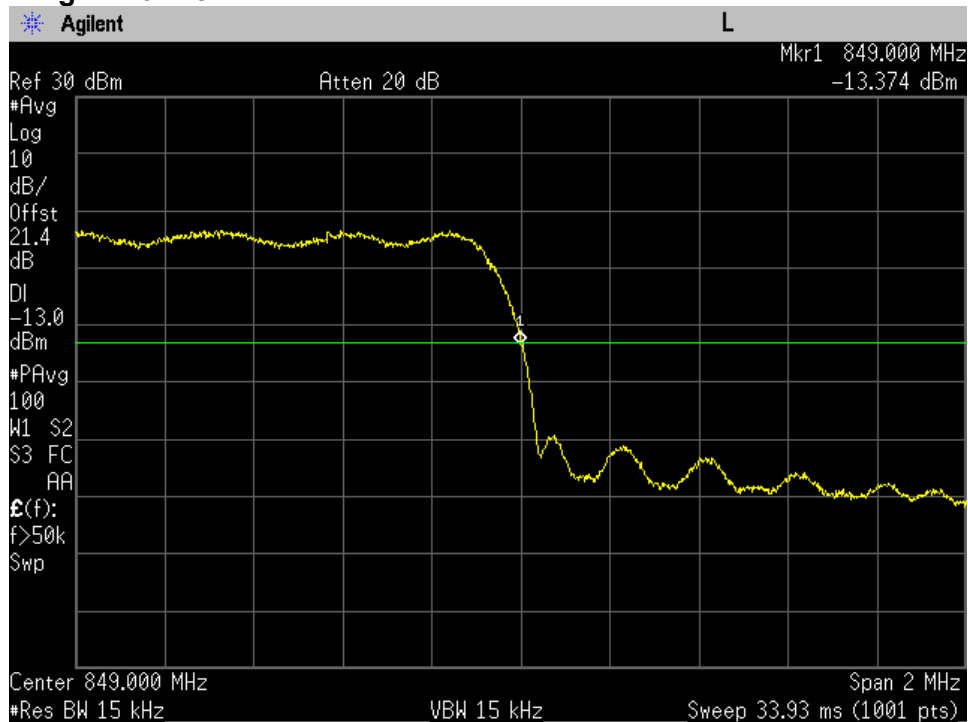


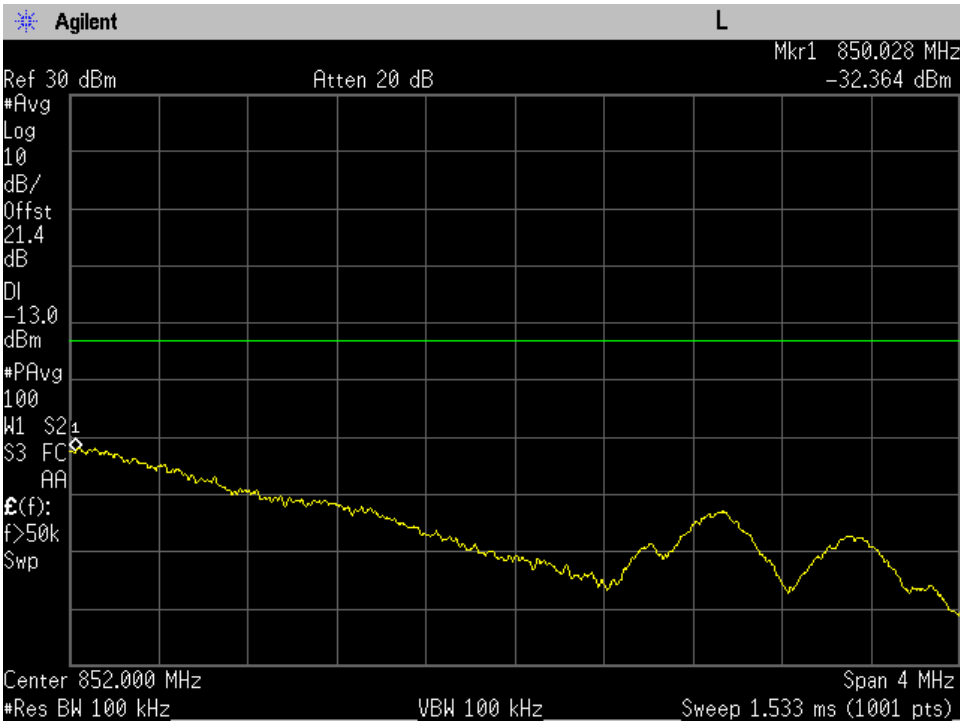
## ● Band Edge





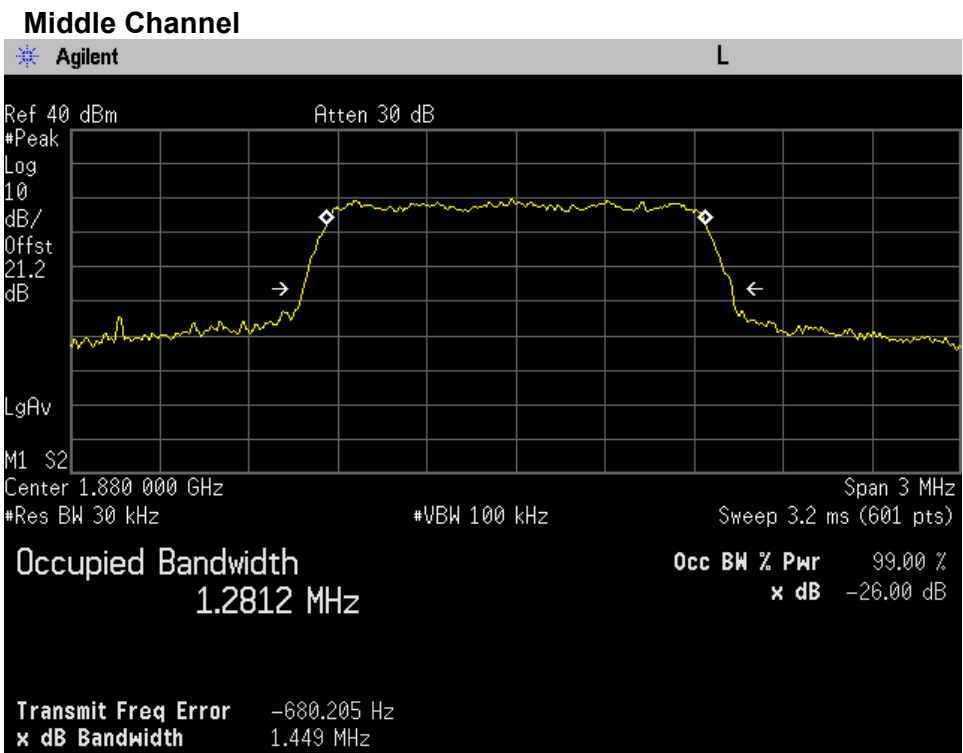
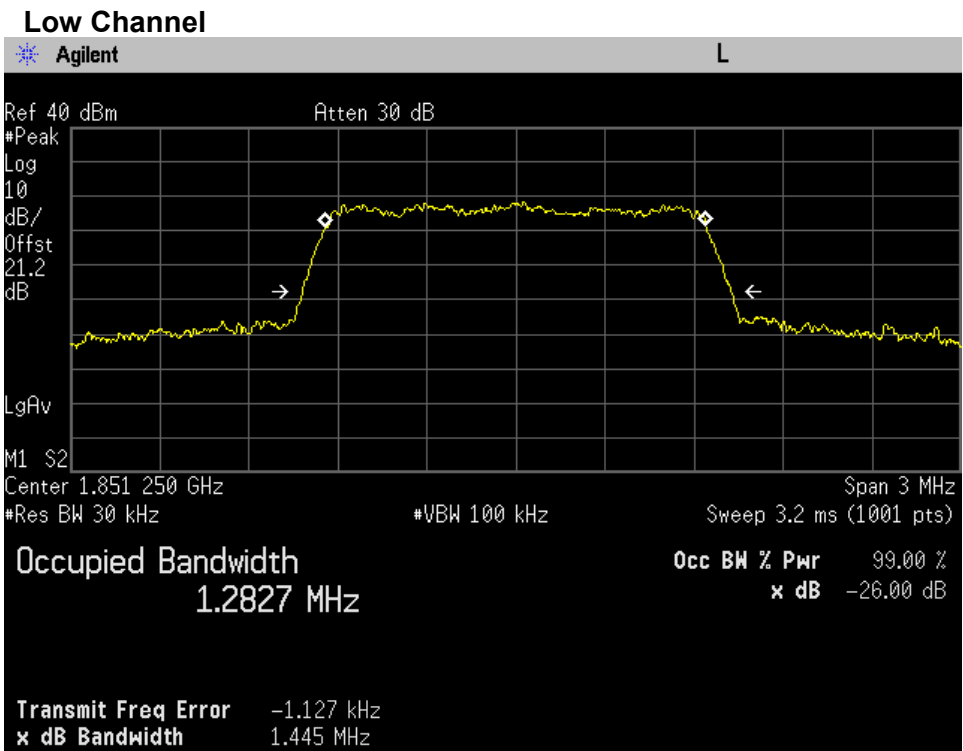
### High Channel

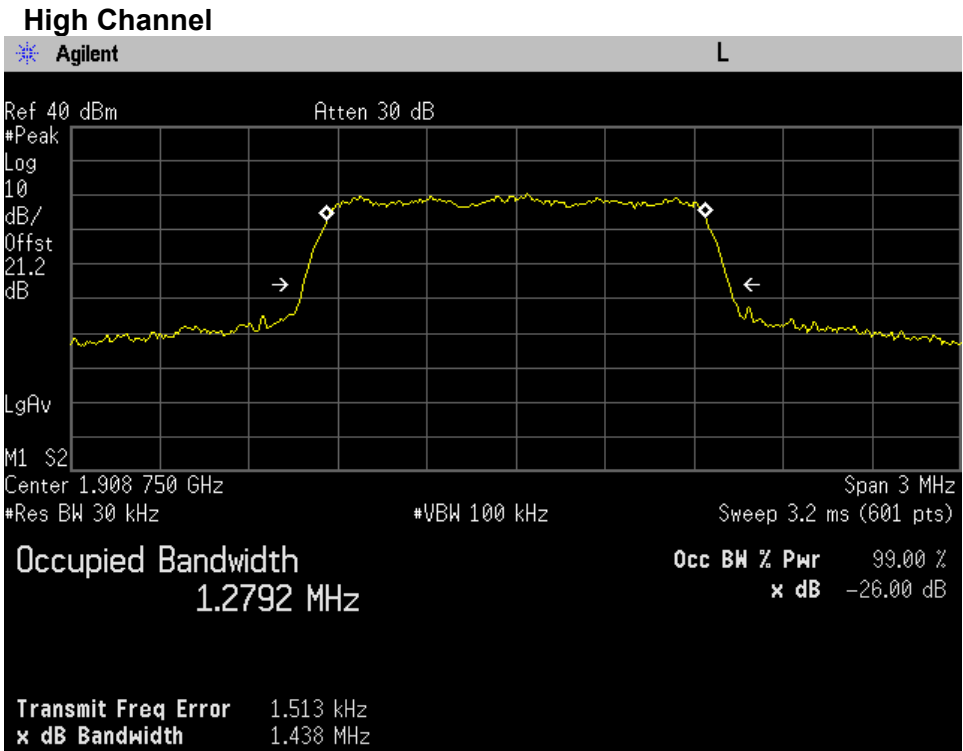




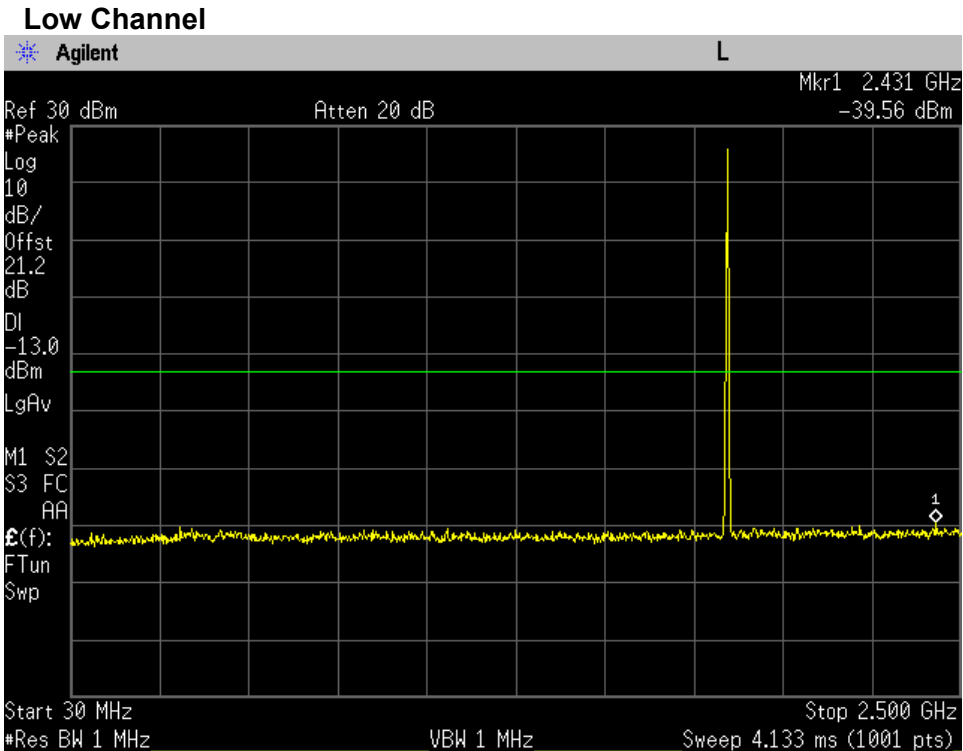
# 11. Test Plots (PCS)

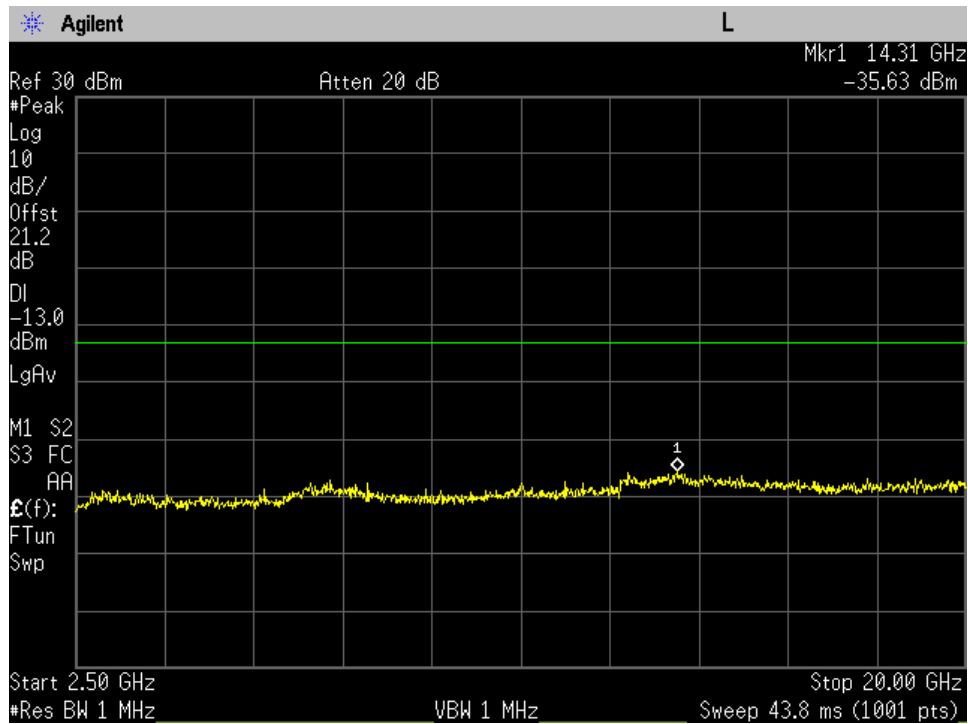
● **Occupied Bandwidth / 26dB Bandwidth**



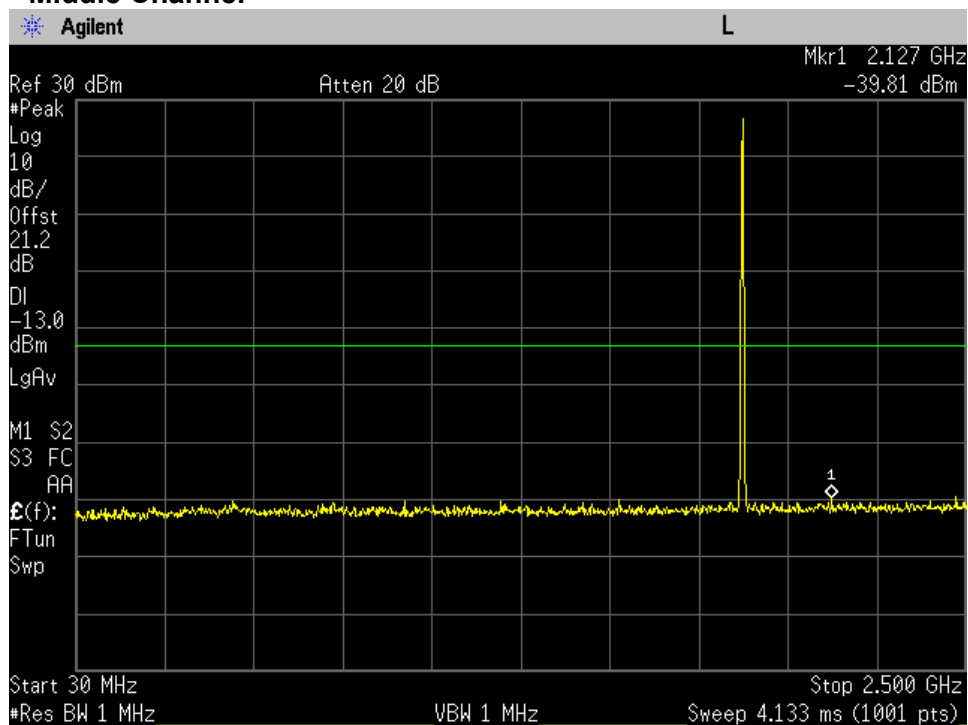


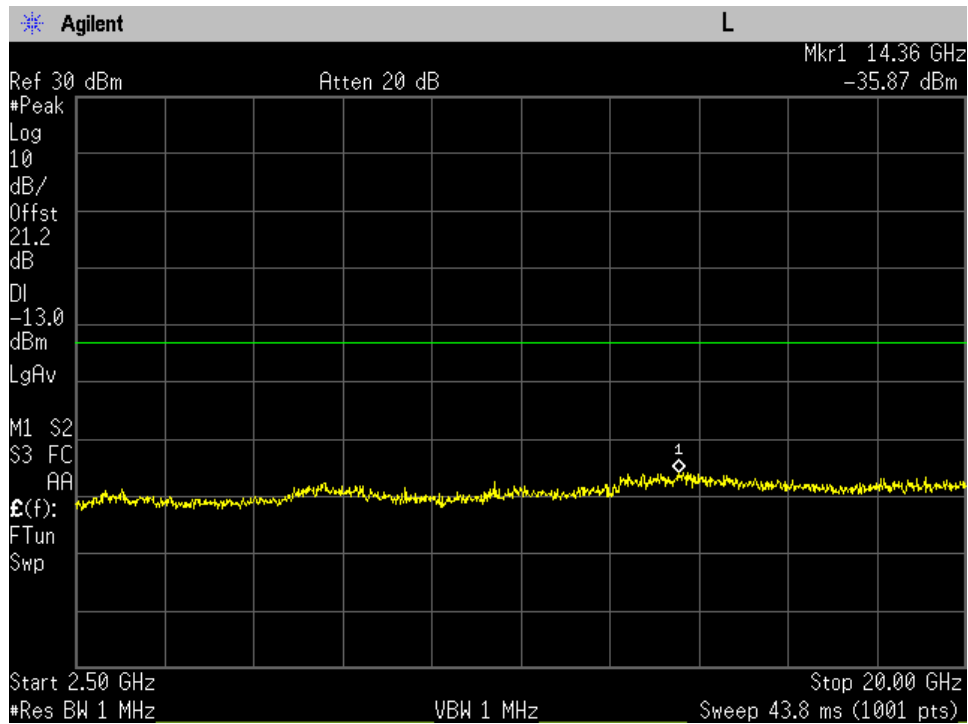
● Spurious Emission at antenna Terminals



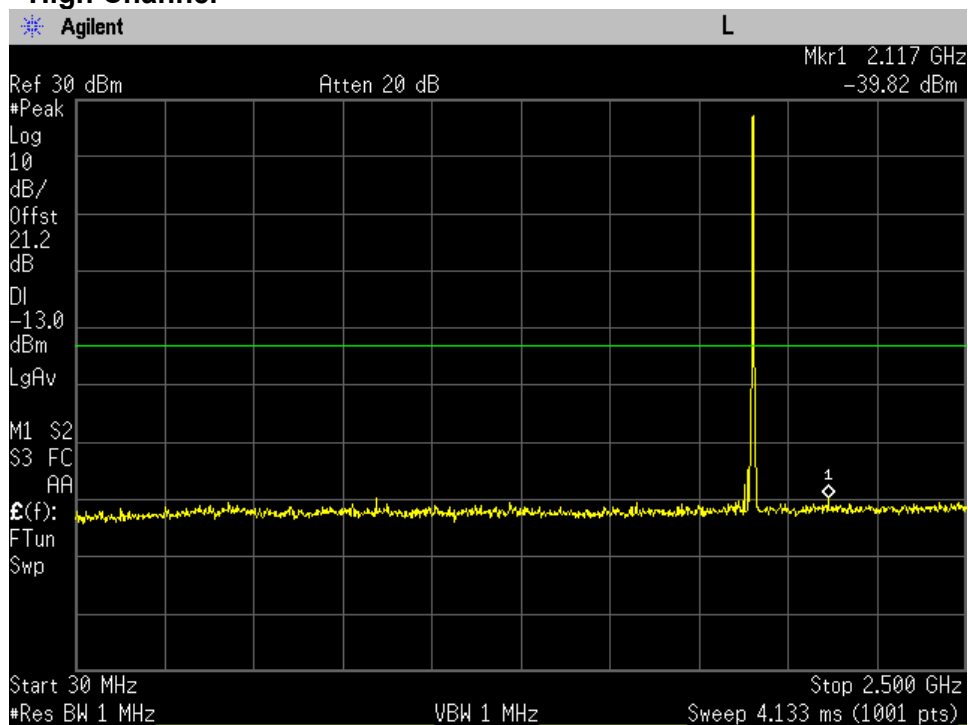


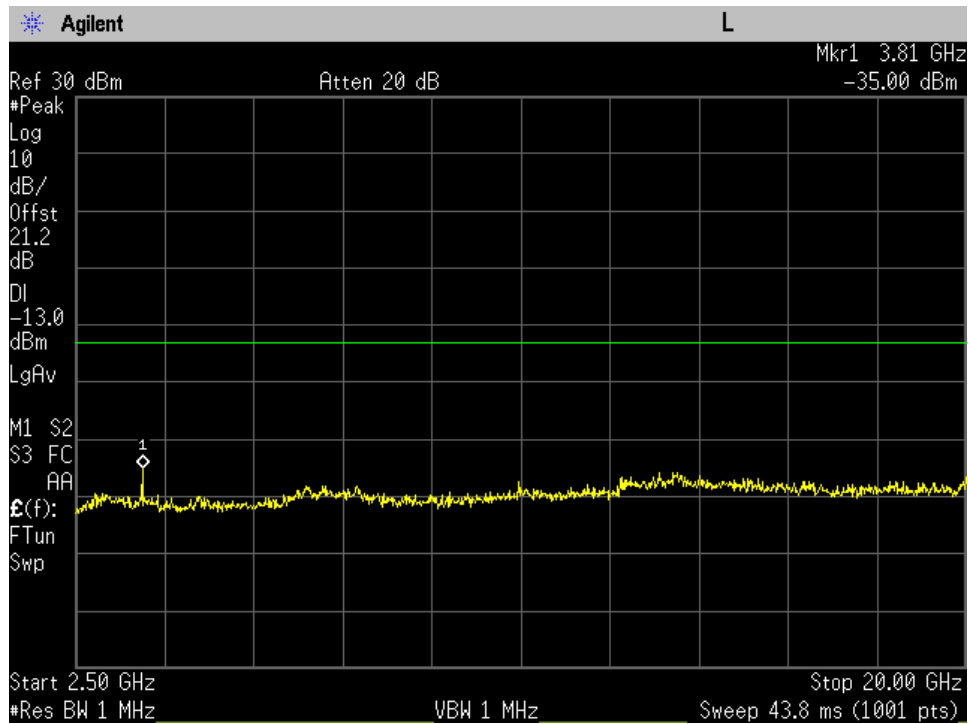
### Middle Channel



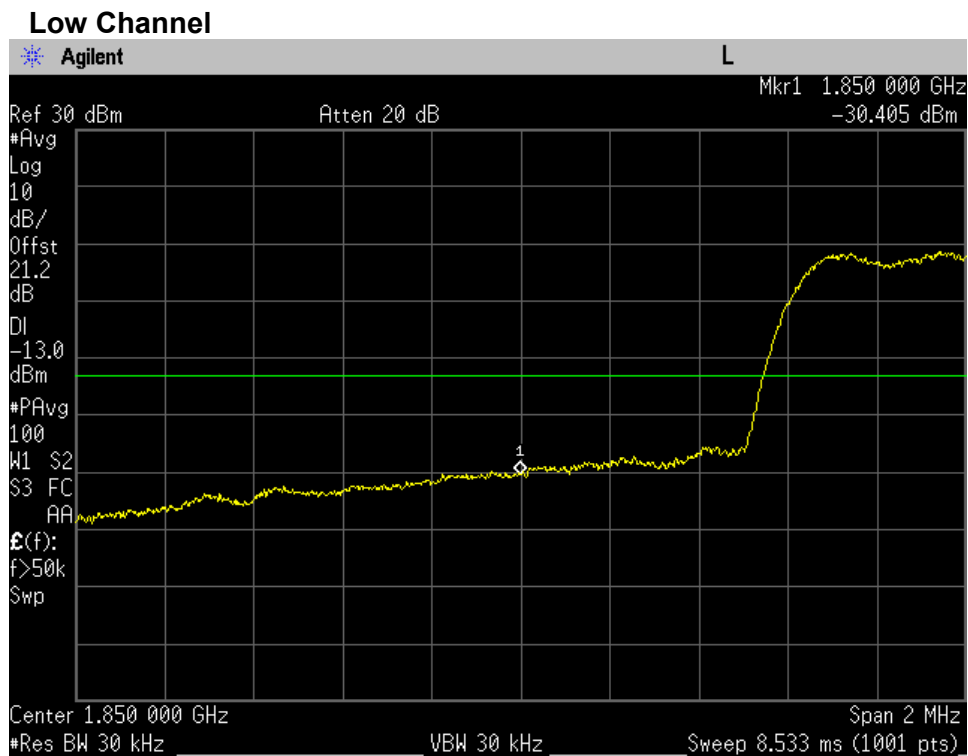


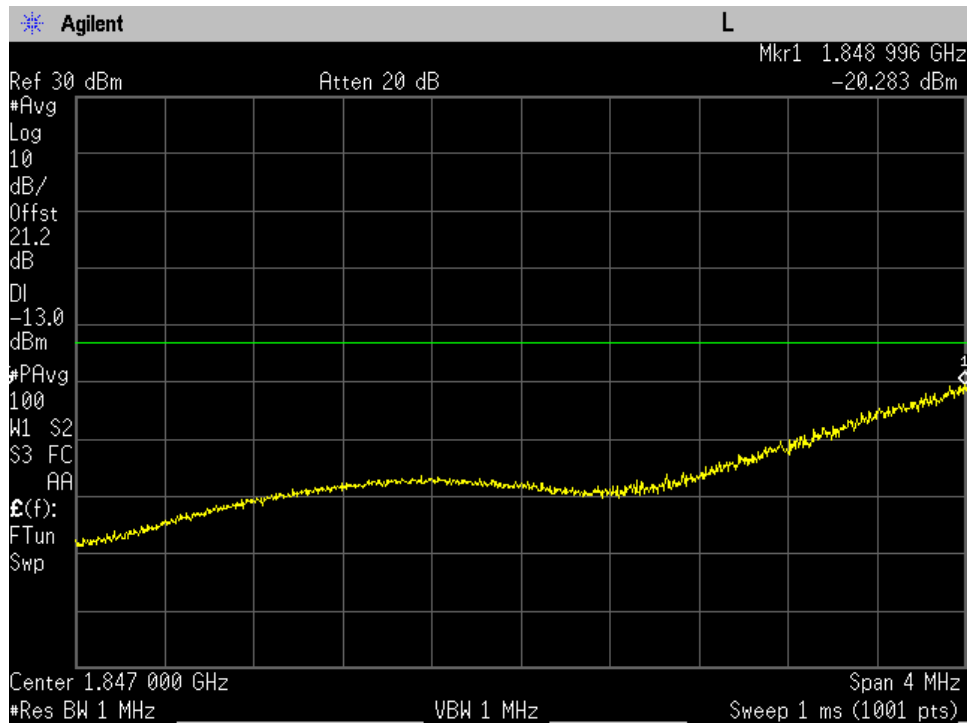
### High Channel



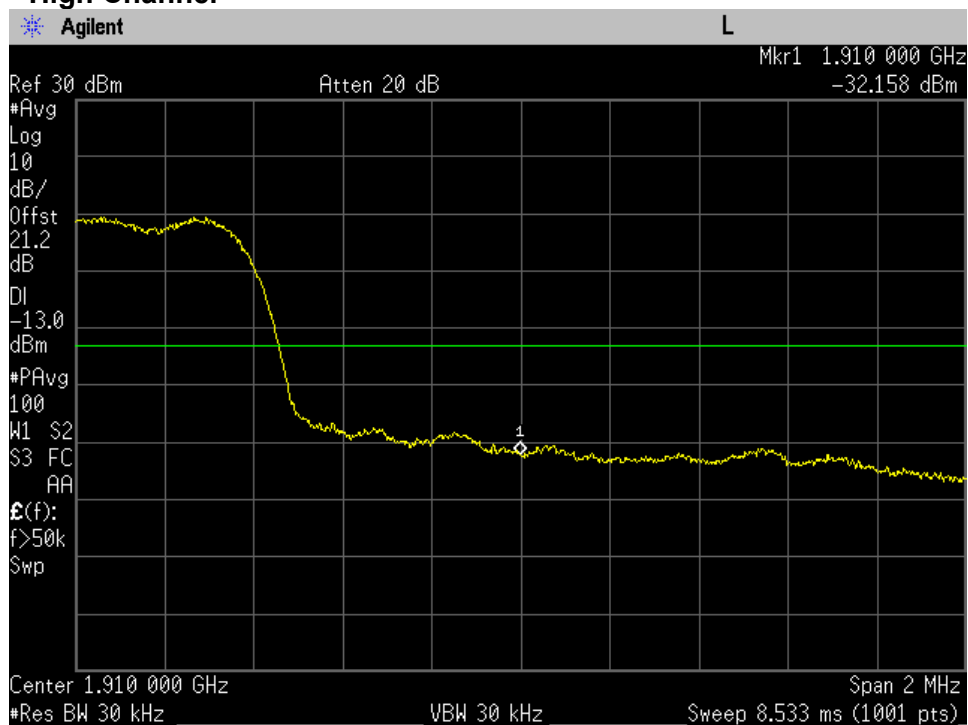


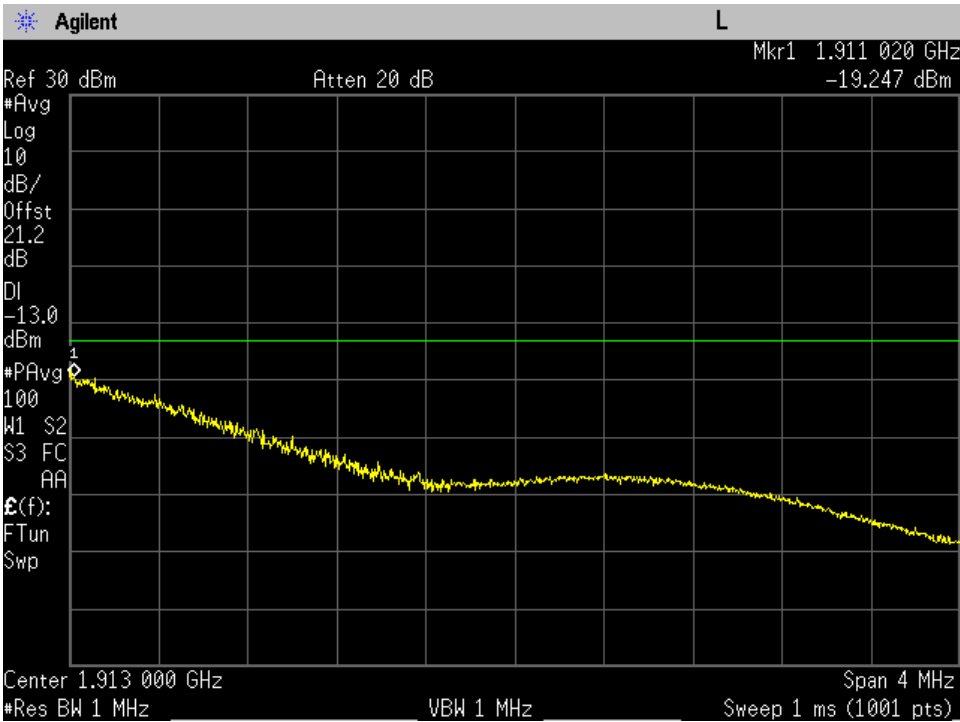
## ● Band Edge





### High Channel





## 12. Test Equipment List

| No. | Instrument                       | Manufacturer      | Model      | Serial No. | Calibration Date | Calibration Interval |
|-----|----------------------------------|-------------------|------------|------------|------------------|----------------------|
| 1   | *Test Receiver                   | R & S             | ESCS 30    | 833364/020 | Jan. 12 2012     | 1 year               |
| 2   | Test Receiver                    | R & S             | ESCS 30    | 100302     | Oct. 12 2011     | 1 year               |
| 3   | *Amplifier                       | HP                | 8447F      | 2805A03427 | Jul. 16 2012     | 1 year               |
| 4   | *Amplifier                       | Sonoma Instrument | 310N       | 291916     | Jul. 16 2012     | 1 year               |
| 5   | *Amplifier                       | R & S             | SCU-26     | 10011      | Jun. 01 2012     | 1 year               |
| 6   | *Pre Amplifier                   | HP                | 8449B      | 3008A00107 | Jan. 13 2012     | 1 year               |
| 7   | *Pre Amplifier                   | HP                | 8447F      | 2805A03351 | Oct. 06 2011     | 1 year               |
| 8   | *Wireless Communication Test Set | Agilent           | E5515C     | MY48360948 | Jan. 12 2012     | 1 year               |
| 9   | *Signal Generator                | R & S             | SMP02      | 833286/003 | Jul. 16 2012     | 1 year               |
| 10  | *Spectrum Analyzer               | R & S             | N9020A     | MY51110087 | Jul. 16 2012     | 1 year               |
| 11  | *Spectrum Analyzer               | R & S             | FSP40      | 100361     | Jul. 17 2012     | 1 year               |
| 12  | *Loop Antenna                    | R & S             | HFH2-Z2    | 100279     | Feb. 21 2012     | 2 year               |
| 13  | *Biconical Log Antenna           | ARA               | LPB-2520/A | 1209       | Dec. 21 2010     | 2 year               |
| 14  | *Horn Antenna                    | SCHWARZBECK       | BBHA9120D  | 9120D-508  | Dec. 24 2010     | 2 year               |
| 15  | *Horn Antenna                    | SCHWARZBECK       | HF907      | 100197     | Mar. 22 2011     | 2 year               |
| 16  | *Horn Antenna                    | Q-par Angus       | QSH20S20   | 8179       | Mar. 28 2011     | 2 year               |
| 17  | *Trilog-Broadband Antenna        | SCHWARZBECK       | VULB 9163  | 9163-454   | Feb. 24 2012     | 2 year               |
| 18  | *Trilog-Broadband Antenna        | SCHWARZBECK       | VULB 9168  | 9168-257   | Apr. 26 2012     | 2 year               |
| 19  | *Directional Coupler             | HP                | 778D       | 15550      | Jan. 13 2012     | 1 year               |
| 20  | LISN                             | R & S             | ESH3-Z5    | 833874/006 | Oct. 12 2011     | 1 year               |
| 21  | LISN                             | R & S             | ESH2-Z5    | 100227     | Apr. 04 2012     | 1 year               |
| 22  | *Position Controller             | DAEIL EMC         | N/A        | N/A        | N/A              | N/A                  |
| 23  | *Turn Table                      | DAEIL EMC         | N/A        | N/A        | N/A              | N/A                  |
| 24  | *Antenna Mast                    | DAEIL EMC         | N/A        | N/A        | N/A              | N/A                  |
| 25  | *Anechoic Chamber                | EM Eng.           | N/A        | N/A        | N/A              | N/A                  |
| 26  | *Shielded Room                   | EM Eng.           | N/A        | N/A        | N/A              | N/A                  |
| 27  | *Position Controller             | Seo-Young EMC     | N/A        | N/A        | N/A              | N/A                  |
| 28  | *Turn Table                      | Seo-Young EMC     | N/A        | N/A        | N/A              | N/A                  |
| 29  | *Antenna Mast                    | Seo-Young EMC     | N/A        | N/A        | N/A              | N/A                  |
| 30  | *Anechoic Chamber                | Seo-Young EMC     | N/A        | N/A        | N/A              | N/A                  |
| 31  | *Shielded Room                   | Seo-Young EMC     | N/A        | N/A        | N/A              | N/A                  |