

# FCC Radio Test Report

## FCC ID: 2AEU7-LONDON

This report concerns (check one): ☒ Original Grant ☐ Class II Change

**Project No.** : 1504C209  
**Equipment** : Marshall London  
**Model Name** : KB-1501  
**Applicant** : Zound Industries Smartphones AB  
**Address** : Torsgatan 2, 111 23 Stockholm, Sweden

**Date of Receipt** : Apr. 22, 2015  
**Date of Test** : Apr. 22, 2015 ~ May 25, 2015  
**Issued Date** : May 26, 2015  
**Tested by** : BTL Inc.

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### **Declaration**

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### REPORT ISSUED HISTORY

| Issued No.          | Description     | Issued Date  |
|---------------------|-----------------|--------------|
| BTL-FCCP-8-1504C209 | Original Issue. | May 26, 2015 |

## 1. CERTIFICATION

Equipment : Marshall London  
Brand Name : Marshall  
Model Name : KB-1501  
Applicant : Zound Industries Smartphones AB  
Manufacturer : Zound Industries Smartphones AB  
Address : Torsgatan 2, 111 23 Stockholm, Sweden  
Factory : Huizhou BYD Electronics Co., Ltd.  
Address : Xiangshui River, Economic Development Zone, Daya Bay, Huizhou,  
Guangdong, 516083, P.R.China  
Date of Test : Apr. 22, 2015 ~ May 25, 2015  
Test Sample : ENGINEERING SAMPLE  
Standard(s) : 47 CFR FCC Part 22 Subpart H &ANSI/ C63.4 : 2009  
47 CFR FCC Part 2 &ANSI/TIA-603-C-2004

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-8-1504C209) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

**Test result included in this report is only for theWCDMA Band Vapprovalpart of the product.**

## 2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

| FCC Part 22 Subpart H& Part 2 |                                           |          |        |
|-------------------------------|-------------------------------------------|----------|--------|
| Standard(s)<br>Section        | Test Item                                 | Judgment | Remark |
| FCC                           |                                           |          |        |
| 2.1047(d)                     | Modulation Characteristics                | PASS     |        |
| 2.1046<br>22.913(a)           | Radiated RF Output                        | PASS     |        |
| 2.1049(h)<br>22.917(a)        | 99% Occupied Bandwidth                    | PASS     |        |
| 2.1051<br>22.917(a)           | Spurious Emissions at Antenna<br>Terminal | PASS     |        |
| 2.1053<br>22.917(a)           | Spurious Radiated Emissions               | PASS     |        |
| 22.917(a)                     | Band Edge Emissions                       | PASS     |        |
| 2.1055<br>22.355              | Frequency Stability                       | PASS     |        |
| 15.207                        | Conducted Emission                        | PASS     |        |

**NOTE:**

(1) "N/A" denotes test is not applicable in this test report

## 2.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3,Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.

BTL's test firm number for FCC: 319330

## 2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2  $U_{\text{CISPR}}$  requirement.

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

### A. Conducted Measurement :

| Test Site | Method | Measurement Frequency Range | U , (dB) | Note |
|-----------|--------|-----------------------------|----------|------|
| DG-C02    | CISPR  | 150 KHz~30MHz               | 3.40     |      |

### B. Radiated Measurement :

| Test Site | Parameter               | Uncertainty |
|-----------|-------------------------|-------------|
| DG-CB12   | All emissions, radiated | $\pm 6$ dB  |

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

|                     |                                                                                                                                                      |                                            |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Equipment           | Marshall London                                                                                                                                      |                                            |
| Brand Name          | Marshall                                                                                                                                             |                                            |
| Model Name          | KB-1501                                                                                                                                              |                                            |
| Model Difference    | N/A                                                                                                                                                  |                                            |
| Product Description | Operation Frequency:                                                                                                                                 | <b>WCDMA Band V :</b><br>826.4MHz~846.6MHz |
|                     | Modulation Type:                                                                                                                                     | QPSK;16QAM;BPSK                            |
|                     | ERP Output Power                                                                                                                                     | 10.76dBm                                   |
| PowerSource         | #1 DC voltage supplied from AC adapter.<br>Manufacturer/Model: BYD/BUUS050100-B01<br>#2 Supplied from Li-ion battery.<br>Manufacturer/Model: BYD/M62 |                                            |
| Power Rating        | #1 I/P: AC 100-240V 50/60Hz 200mA O/P: DC 5V 1A<br>#2 DC 3.8V 2500mAh                                                                                |                                            |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. Channel List:

| Bands           | Channel | Frequency |       |
|-----------------|---------|-----------|-------|
|                 |         | (MHz)     |       |
| WCDMA<br>Band V | 4132    | Low       | 826.4 |
|                 | 4182    | Mid       | 836.4 |
|                 | 4233    | High      | 846.6 |

3. Table for Filed Antenna @WCDMA BAand V:

| Ant. | Manufacture | Model Name | Antenna Type | Connector | Gain (dBi) |
|------|-------------|------------|--------------|-----------|------------|
| 1    | SPEED       | LF4701Q-EU | Internal     | N/A       | -1.59      |

### 3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

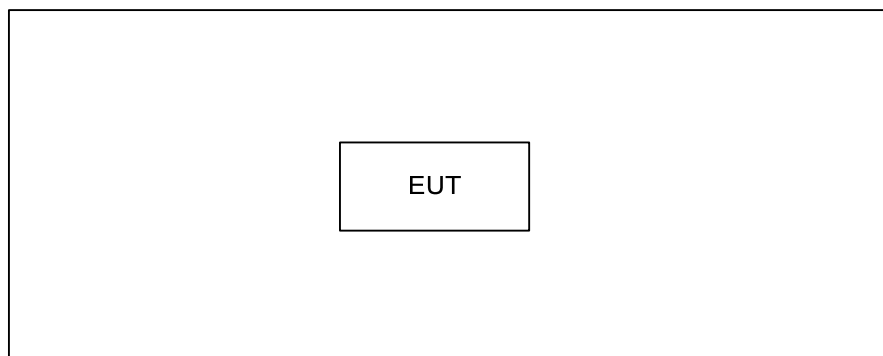
| Test Items                             | Worst TX Mode | Channel        |
|----------------------------------------|---------------|----------------|
| Radiated RF Output                     | WCDMA         | 4132/4182/4233 |
| Spurious Radiated Emissions            | WCDMA         | 4132/4182/4233 |
| Band Edge                              | WCDMA         | 4132/4233      |
| Frequency Stability                    | WCDMA         | 4132           |
| 99% Occupied Bandwidth                 | WCDMA         | 4132/4182/4233 |
| Spurious Emissions at Antenna Terminal | WCDMA         | 4132/4182/4233 |

| For Conducted Emission |             |
|------------------------|-------------|
| Final Test Mode        | Description |
| Mode 1                 | TX Mode     |

Note:

- (1) The measurements are performed at the highest, middle, lowest available channels.
- (2) The EUT is considered a portable unit; it was pre-tested on the positioned of each 3 axis. The worst case was found positioned on X-plane. Therefore only the test data of this X-plane was used for radiated emission measurement test.
- (3) Both adapter and battery are evaluated, operated the battery is the worst and recorded as below test data.

### 3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment | Mfr/Brand | Model/Type No. | FCC ID | Series No. | Note |
|------|-----------|-----------|----------------|--------|------------|------|
| -    | -         | -         | -              | -      | -          |      |

| Item | Shielded Type | Ferrite Core | Length | Note |
|------|---------------|--------------|--------|------|
| -    | -             | -            | -      |      |

## 4. TEST RESULT

### 4.1 RADIATED RF OUTPUT POWER MEASUREMENT

#### 4.1.1 LIMIT

The Radiated Peak Output Power shall be according to the specific rule Part 22.913(a) that "Mobile/Portable station are limited to 7 watts e.r.p." and 22.913(a) specified that "Peak transmit power must be measure over any interval of continuous transmission using instrumentation calibration in terms of rms-equivalent voltage.

#### 4.1.2 MEASURING INSTRUMENTS AND SETTING

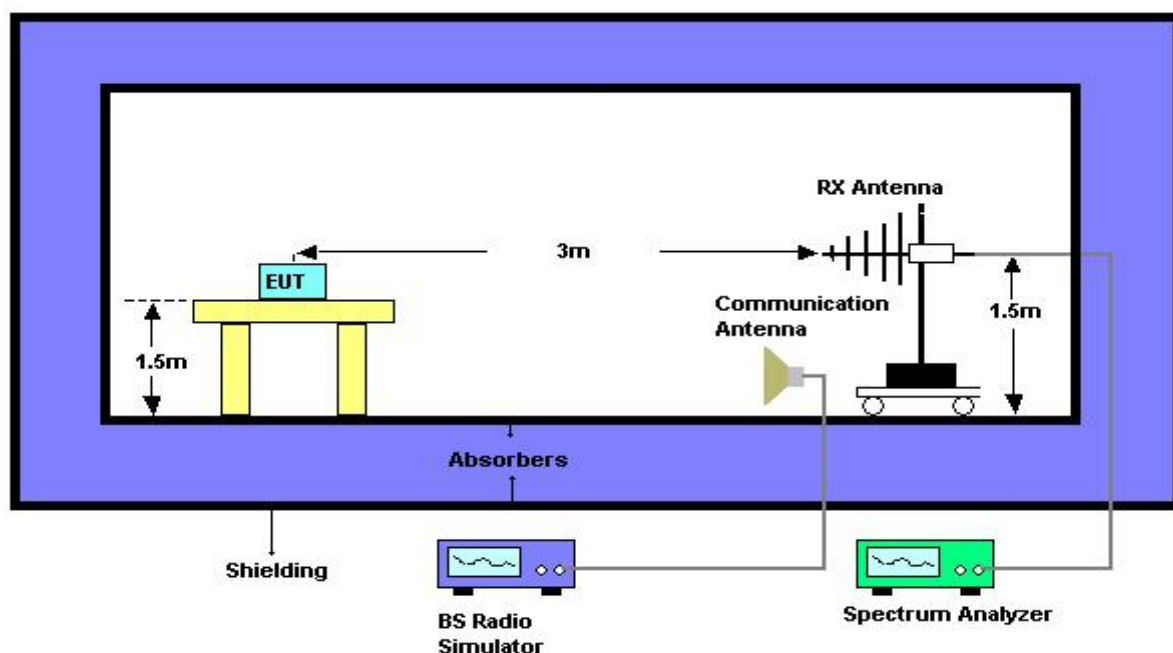
Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

| Spectrum Parameters | Setting                      |
|---------------------|------------------------------|
| Attenuation         | Auto                         |
| Center Frequency    | Low / middle / high channels |
| Span Frequency      | 10MHz                        |
| RB / VB             | 3MHz / 3MHz for Peak         |

#### 4.1.3 TEST PROCEDURE

1. The EUT was set up for the maximum peak power with WCDMA link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels, 4132, 4182 and 4233 (low, middle and high operational frequency range).
2. The conducted peak output power used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer. The path loss included the splitter loss, cable loss and 20dB pad loss. The spectrum set RB/VB 3MHz, then read peak power value and record to the test. (All transmitted path loss shall be considered in the test report data)
3. E.I.R.P peak power measurement. In the fully anechoic chamber, EUT placed on the 1.5m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
4. The substitution horn antenna is substituted for EUT at the same position, and signal generator export the CW signal to the calibration antenna. Rotated the Turn Table to find the maximum radiation power. "Raw" is the spectrum reading value, "SG" is signal generator export power, "TX Gain" is calibration antenna isotropic gain value, "TX cable" is the transmitted cable loss between the calibration antenna and signal generator. The "Factor" means that the transmission path loss is equal to "SG" - "TX cable" + "TX Gain" - "Raw".
5. Actually the real E.I.R.P peak power is equal to "Read Value" + "Factor"
6. E.R.P power can be calculated from E.I.R.P power by subtracting the gain of Integral, E.R.P power = E.I.R.P power - 2.14dBi.

#### 4.1.4 TEST SETUP LAYOUT ERP Power Measurement



#### 4.1.5 TEST DEVIATION

There is no deviation with the original standard.

#### 4.1.6 EUT OPERATION DURING TEST

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

#### 4.1.7 EUT TEST CONDITIONS

Temperature: 25°C  
Relative Humidity: 55%  
Test Voltage: DC 3.8V

#### 4.1.8 TEST RESULTS

Please refer to the Attachment A.

## 4.299% OCCUPIED BANDWIDTH MEASUREMENT

### 4.2.1 LIMIT

According to FCC 2.1049(h) specified that emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

### 4.2.2 MEASURING INSTRUMENTS AND SETTING

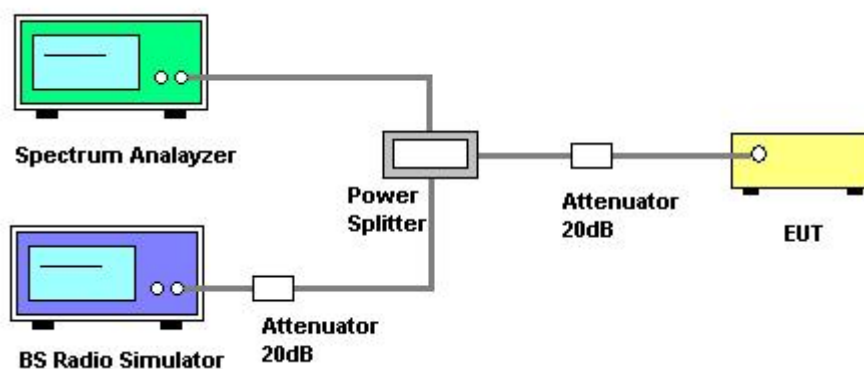
Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

| Spectrum Parameters | Setting                                                      |
|---------------------|--------------------------------------------------------------|
| Attenuation         | Auto                                                         |
| Span Frequency      | Encompass the entire emissions bandwidth (EBW) of the signal |
| RB                  | 30 kHz                                                       |
| VB                  | 100 kHz                                                      |
| Trace               | Max Hold                                                     |

### 4.2.3 TEST PROCEDURE

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Used measurement function of spectrum to measure the 99% occupied bandwidth..

### 4.2.4 TEST SETUP LAYOUT



### 4.2.5 TEST DEVIATION

There is no deviation with the original standard.

### 4.2.6 EUT OPERATION DURING TEST

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

### 4.2.7 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 55%

Test Voltage: DC 3.8V

#### **4.2.8TEST RESULTS**

Please refer to the Attachment B.

#### 4.3 SPURIOUS EMISSIONS AT ANTENNA TERMINALS MEASUREMENT

##### 4.3.1 LIMIT

In the FCC 22.917(a), on any frequency outside a licensee's frequency block within GSM spectrum, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB. The limit translates in the relevant power range (2 to 0.003W). At 2W (Power Control Level 5) the specified minimum attenuation becomes 43dB and the limit of emission equal to -13dBm

##### 4.3.2 MEASURING INSTRUMENTS AND SETTING

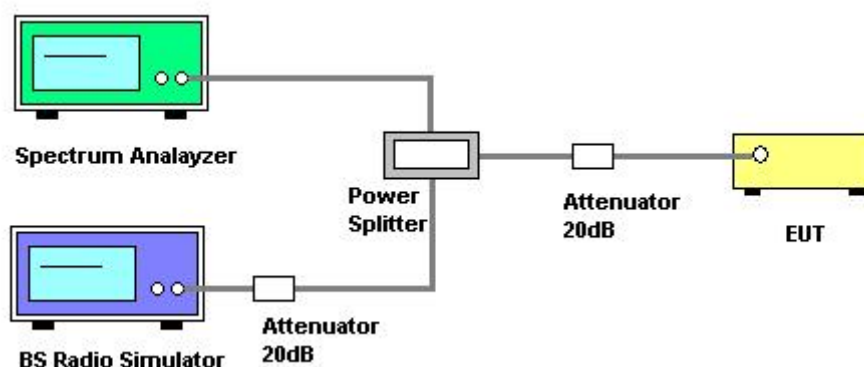
Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

| Spectrum Parameters | Setting               |
|---------------------|-----------------------|
| Attenuation         | Auto                  |
| Start Frequency     | 30MHz                 |
| Stop Frequency      | 10th carrier harmonic |
| RB / VB             | 1 MHz / 1MHz for Peak |

##### 4.3.3 TEST PROCEDURES

1. The EUT was set up for the maximum peak power with **WCDMA** link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels, 4132, 4182 and 4233 (low, middle and high operational frequency range.)
2. The conducted spurious emission used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer. This splitter loss and cable loss are the worst loss 4dB in the transmitted path track.
3. When the spectrum scanned from 30MHz to 3GHz, it shall be connected to the band reject filter attenuated the carried frequency. The spectrum set RB/VB 1MHz.
4. When the spectrum scanned from 3GHz to 10GHz, it shall be connected to the high pass filter attenuated the carried frequency. The spectrum set RB/VB 1MHz.

##### 4.3.4 TEST SETUP LAYOUT



##### 4.3.5 TEST DEVIATION

There is no deviation with the original standard.

##### 4.3.6 EUT OPERATION DURING TEST

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

**4.3.7EUT TEST CONDITIONS**

Temperature: 25°C

Relative Humidity: 55%

Test Voltage:DC 3.8V

**4.3.8TEST RESULTS**

Please refer to the Attachment C.

## 4.4 SPURIOUS RADIATED EMISSIONS MEASUREMENT

### 4.4.1 LIMIT

Out of band emissions, The power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. In the 1 MHz bands immediately outside the frequency block. The spurious emissions of limit equal to  $-13\text{dBm}$ .

### 4.4.2 MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

| Spectrum Parameters | Setting               |
|---------------------|-----------------------|
| Attenuation         | Auto                  |
| Start Frequency     | 30 MHz                |
| Stop Frequency      | 10th carrier harmonic |
| Detector            | Positive Peak         |
| Span                | 100 MHz               |
| Sweep Time          | 1s                    |
| RB / VB             | 1 MHz / 1MHz          |
| Attenuation         | Positive Peak         |

### 4.4.3 TEST PROCEDURES

1. The EUT was placed on the top of the turntable in fully anechoic chamber.
2. The test shall be made in the transmitting mode. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. This measurement shall be repeated with the transmitter in standby mode where applicable.
4. For 30~1000MHz spurious emissions measurement, the broad band bi-log receiving antenna was placed 3 meters far away from the turntable. For 1~10th carrier harmonic measurement, the receiving Horn antenna was placed 1.5 meters far away from the turntable.
5. The broadband receiving antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization. Each recorded suspected value is indicated as Read Level (Raw).
6. Replace the EUT by standard antenna and feed the RF port by signal generator.
7. Adjust the frequency of the signal generator to the suspected emission and slightly rotate the turntable to locate the position with maximum reading.
8. Adjust the power level of the signal generator to reach the same reading with Read Level (Raw).
9. The level of the spurious emission is the power level of (8) plus the gain of the standard antenna in dBi and minus the loss of the cable used between the signal generator and the standard antenna.

**4.4.4 TEST SETUP LAYOUT**

This test setup layout is the same as that shown in section 4.2.4.

**4.4.5 TEST DEVIATION**

There is no deviation with the original standard.

**4.4.6 EUT OPERATION DURING TEST**

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

**4.4.7 EUT TEST CONDITIONS**

Temperature: 25°C

Relative Humidity: 55%

Test Voltage: DC 3.8V

**4.4.8 TEST RESULTS**

Please refer to the Attachment D.

## 4.5 BAND EDGE MEASUREMENT

### 4.5.1 LIMIT

According to FCC 22.917(a) specified that power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. Then we measure that the bandwidth is about 300 kHz and the resolution bandwidth is 3 kHz.

### 4.5.2 MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

| Spectrum Parameters | Setting         |
|---------------------|-----------------|
| Attenuation         | Auto            |
| Span Frequency      | 5 MHz           |
| RB / VB             | 10 kHz / 30 kHz |
| Trace               | Sample          |
| Sweep Time          | Auto            |

### 4.5.3 TEST PROCEDURES

1. The EUT was set up for the maximum peak power with **WCDMA** link data modulation. The power was measured with R&S Spectrum Analyzer. All measurements were done at 2 channels, 4132 and 4233 (low and high operational frequency range.)
2. The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer. The splitter loss and cable loss are the worst loss 4 dB in the transmitted path track.
3. The center frequency of spectrum is the band edge frequency and span is 2 MHz. RB of the spectrum is 10 kHz and VB of the spectrum is 30 kHz.
4. Record the Sample trace plot into the test report.

### 4.5.4 TEST SETUP LAYOUT

This test setup layout is the same as that shown in section 4.2.4.

### 4.5.5 TEST DEVIATION

There is no deviation with the original standard.

### 4.5.6 EUT OPERATION DURING TEST

The BS simulator was used to set the TX channel and power level and modulate the TX signal.

### 4.5.7 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 55%

Test Voltage: DC 3.8V

#### **4.5.8TEST RESULTS**

Please refer to the Attachment E.

## 4.6 FREQUENCY STABILITY MEASUREMENT

### 4.6.1 LIMIT

According to the FCC part 22.355 shall be tested the frequency stability. The rule is defined that "The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." The frequency error rate is according to the JTC standard that the frequency error rate shall be accurate to within 2.5 ppm of the received frequency from the base station. The test extreme voltage is according to the 2.1055(d)(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and the extreme temperature rule is comply with the 2.1055(a)(1)  $-30^{\circ}\text{C} \sim 50^{\circ}\text{C}$ .

### 4.6.2 MEASURING INSTRUMENTS AND SETTING

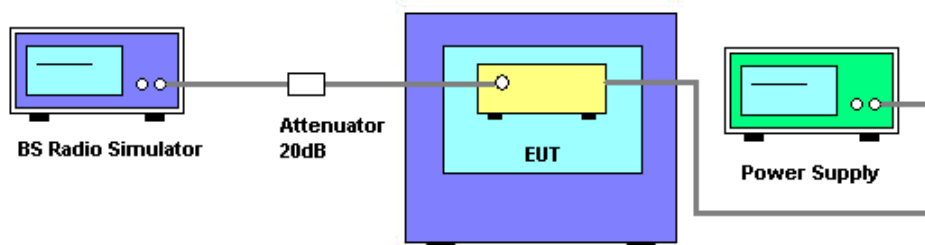
Please refer to section 5 in this report. The following table is the setting of the BS Simulator.

| Spectrum Parameters | Setting                                 |
|---------------------|-----------------------------------------|
| Frequency Error     | The maximum of transmit frequency error |

### 4.6.3 TEST PROCEDURES

1. The transmitter output (antenna port) was connected to the BS Simulator.
2. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.
3. BS simulator used the frequency error function and measured the peak frequency error.  
Power must be removed when changing from one temperature to another or one voltage to another voltage. Power warm up is at least 15 min and power applied should perform before recording frequency error.  
The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.
4. EUT is connected the external power supply to control the DC input power. The various Volts from the minimum 3.1 Volts to 4.3 Volts. Each step shall be record the frequency error rate.
5. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.
6. Extreme temperature rule is  $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$ .

### 4.6.4 TEST SETUP LAYOUT



### 4.6.5 TEST DEVIATION

There is no deviation with the original standard.

### 4.6.6 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously un-modulation transmitting mode.

#### **4.6.7EUT TEST CONDITIONS**

Temperature: 25°C

Relative Humidity: 55%

Test Voltage: DC 3.8V

#### **4.6.8TEST RESULTS**

Please refer to the Attachment F.

## 4.7 CONDUCTED EMISSION MEASUREMENT

### 4.7.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

| FREQUENCY (MHz) | Class A (dBuV) |         | Class B (dBuV) |           | Standard |
|-----------------|----------------|---------|----------------|-----------|----------|
|                 | Quasi-peak     | Average | Quasi-peak     | Average   |          |
| 0.15 -0.5       | 79.00          | 66.00   | 66 - 56 *      | 56 - 46 * | CISPR    |
| 0.50 -5.0       | 73.00          | 60.00   | 56.00          | 46.00     | CISPR    |
| 5.0 -30.0       | 73.00          | 60.00   | 60.00          | 50.00     | CISPR    |

|           |       |       |           |           |     |
|-----------|-------|-------|-----------|-----------|-----|
| 0.15 -0.5 | 79.00 | 66.00 | 66 - 56 * | 56 - 46 * | FCC |
| 0.50 -5.0 | 73.00 | 60.00 | 56.00     | 46.00     | FCC |
| 5.0 -30.0 | 73.00 | 60.00 | 60.00     | 50.00     | FCC |

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " \* " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
- (3) The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)  
 Margin Level = Measurement Value - Limit Value

The following table is the setting of the receiver

| Receiver Parameters | Setting  |
|---------------------|----------|
| Attenuation         | 10 dB    |
| Start Frequency     | 0.15 MHz |
| Stop Frequency      | 30 MHz   |
| IF Bandwidth        | 9 kHz    |

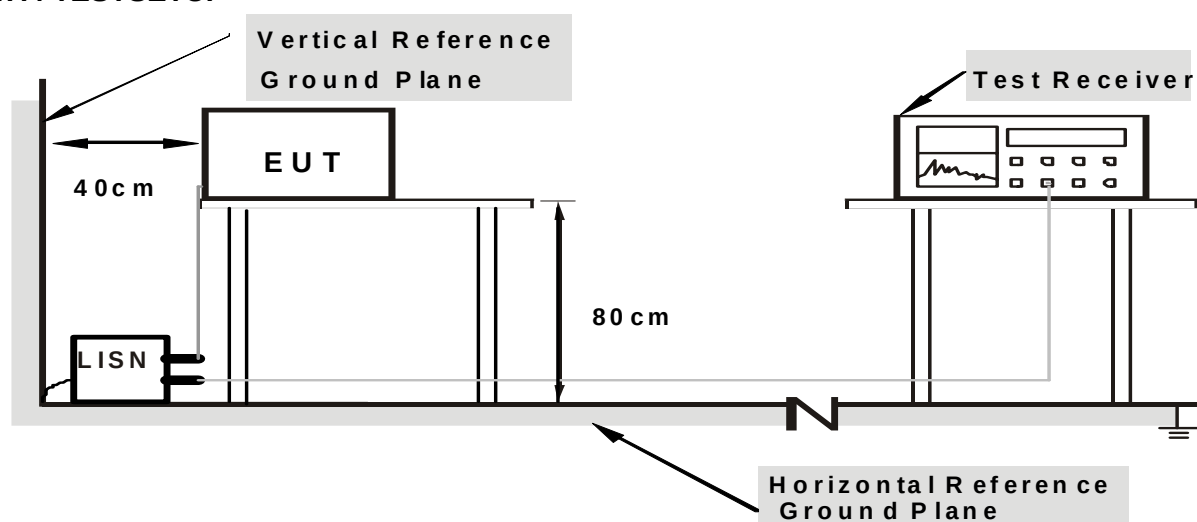
#### 4.7.2 TEST PROCEDURE

- The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the groundplane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

#### 4.7.3 DEVIATION FROM TEST STANDARD

No deviation

#### 4.7.4 TEST SETUP



Note: 1. Support units were connected to second LISN .

2. Both of LISN s (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

#### 4.7.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

#### 4.7.6 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 55%

Test Voltage: AC 120V/60Hz

#### 4.6.9 TEST RESULTS

Please refer to the Attachment G.

## 5. LIST OF MEASUREMENT EQUIPMENTS

| Conducted Emission Measurement |                                     |              |                              |            |                  |
|--------------------------------|-------------------------------------|--------------|------------------------------|------------|------------------|
| Item                           | Kind of Equipment                   | Manufacturer | Type No.                     | Serial No. | Calibrated until |
| 1                              | LISN                                | EMCO         | 3816/2                       | 00052765   | Mar. 28, 2016    |
| 2                              | LISN                                | R&S          | ENV216                       | 101447     | Mar. 28, 2016    |
| 3                              | Test Cable                          | N/A          | C_17                         | N/A        | Mar.13, 2016     |
| 4                              | EMI TEST RECEIVER                   | R&S          | ESCS30                       | 833364/017 | Mar. 28, 2016    |
| 5                              | 50Ω Terminator                      | SHX          | TF2-3G-A                     | 08122902   | Mar. 28, 2016    |
| 6                              | wideband radio communication tester | R&S          | CMW500                       | 152372     | Jan. 30, 2016    |
| 7                              | Measurement Software                | Farad        | EZ-EMC<br>Ver.NB-03A1<br>-01 | N/A        | N/A              |

| Radiated Emission Measurement |                                     |                             |                                             |            |                  |
|-------------------------------|-------------------------------------|-----------------------------|---------------------------------------------|------------|------------------|
| Item                          | Kind of Equipment                   | Manufacturer                | Type No.                                    | Serial No. | Calibrated until |
| 1                             | EXA Spectrum Analyzer               | Agilent                     | N9010A                                      | MY50520044 | Mar. 28, 2016    |
| 2                             | Microwave Preamplifier With Adaptor | EMC INSTRUMENT              | EMC012645B                                  | 980221     | Oct. 22, 2015    |
| 3                             | Amplifier                           | Agilent                     | 8449B                                       | 3008A02274 | Nov. 02, 2015    |
| 4                             | Double Ridged Guide Antenna         | ETS-LINDGREN                | 3115                                        | 00075846   | Mar. 28, 2016    |
| 5                             | Antenna                             | SCHWARZBECK                 | VULB 9160                                   | 9160-3231  | Mar. 28, 2016    |
| 6                             | Test Cable                          | N/A                         | CL-CB12-001                                 | N/A        | Oct. 22, 2015    |
| 7                             | Test Cable                          | N/A                         | CL-CB12-004                                 | N/A        | Oct. 22, 2015    |
| 8                             | Test Cable                          | N/A                         | CL-CB12-006                                 | N/A        | Oct. 22, 2015    |
| 9                             | Controller                          | CT                          | SC100                                       | N/A        | N/A              |
| 10                            | Wireless Communication Test SET     | ( 8960 Series )<br>Agilent  | E5515C                                      | MY48364183 | Mar. 15, 2016    |
| 11                            | Band Reject Filter                  | Wairwright Instruments Gmbh | WRCG<br>1710/1785-169<br>0/1805-60/12S<br>S | 38         | Mar. 04, 2016    |
| 12                            | Band Reject Filter                  | Wairwright Instruments Gmbh | WRCG<br>824/849-810/8<br>63-60/9SS          | 7          | Mar. 04, 2016    |
| 13                            | Band Reject Filter                  | Wairwright Instruments Gmbh | WRCG<br>880/915-860/9<br>35-60/9SS          | 14         | Mar.04, 2016     |
| 14                            | Band Reject Filter                  | Wairwright Instruments Gmbh | WRCG<br>1850/1910-183<br>0/1930-60/10S<br>S | 17         | Mar. 04, 2016    |
| 15                            | wideband radio communication tester | R&S                         | CMW500                                      | 152372     | Jan. 30, 2016    |

| Antenna Conducted Spurious Emission Measurement |                                     |              |          |            |                  |
|-------------------------------------------------|-------------------------------------|--------------|----------|------------|------------------|
| Item                                            | Kind of Equipment                   | Manufacturer | Type No. | Serial No. | Calibrated until |
| 1                                               | EXA Spectrum Analyzer               | Agilent      | N9010A   | MY50520044 | Mar. 28, 2016    |
| 2                                               | wideband radio communication tester | R&S          | CMW500   | 152372     | Jan. 30, 2016    |

| Band Edge Measurement |                                     |              |          |            |                  |
|-----------------------|-------------------------------------|--------------|----------|------------|------------------|
| Item                  | Kind of Equipment                   | Manufacturer | Type No. | Serial No. | Calibrated until |
| 1                     | EXA Spectrum Analyzer               | Agilent      | N9010A   | MY50520044 | Mar. 28, 2016    |
| 2                     | wideband radio communication tester | R&S          | CMW500   | 152372     | Jan. 30, 2016    |

| 99% Occupied Bandwidth Measurement |                                     |              |          |            |                  |
|------------------------------------|-------------------------------------|--------------|----------|------------|------------------|
| Item                               | Kind of Equipment                   | Manufacturer | Type No. | Serial No. | Calibrated until |
| 1                                  | EXA Spectrum Analyzer               | Agilent      | N9010A   | MY50520044 | Mar. 28, 2016    |
| 2                                  | wideband radio communication tester | R&S          | CMW500   | 152372     | Jan. 30, 2016    |

| Frequency Stability Measurement |                                     |              |          |            |                  |
|---------------------------------|-------------------------------------|--------------|----------|------------|------------------|
| Item                            | Kind of Equipment                   | Manufacturer | Type No. | Serial No. | Calibrated until |
| 1                               | EXA Spectrum Analyzer               | Agilent      | N9010A   | MY50520044 | Mar. 28, 2016    |
| 2                               | wideband radio communication tester | R&S          | CMW500   | 152372     | Jan. 30, 2016    |

Remark: "N/A" denotes no model name, serial no. or calibration specified.  
All calibration period of equipment list is one year.

## **ATTACHMENT A - RADIATED RF OUTPUT POWER**

|            |                      |
|------------|----------------------|
| Test Mode: | TX CH 4132/4182/4233 |
|------------|----------------------|

| WCDMA Band V |   | ERP Power (dBm) |              |              | Max. Limit (dBm) | Result   |
|--------------|---|-----------------|--------------|--------------|------------------|----------|
|              |   | Channel 4132    | Channel 4183 | Channel 4233 |                  |          |
| RMC          | V | 10.10           | 10.60        | 9.71         | 38.50            | Complies |
|              | H | 11.22           | 10.61        | 10.76        | 38.50            | Complies |

| WCDMA BAND II |              | Conducted Output power(dBm) |        |        |
|---------------|--------------|-----------------------------|--------|--------|
|               |              | low                         | middle | high   |
|               |              | CH9262                      | CH9400 | CH9538 |
| WCDMA         | 12.2kbps RMC | 23.32                       | 23.46  | 23.40  |
|               | 64kbps RMC   | 23.38                       | 23.38  | 23.45  |
|               | 144kbps RMC  | 23.35                       | 23.39  | 23.45  |
|               | 384kbps RMC  | 23.37                       | 23.41  | 23.51  |
| HSDPA         | Subtest 1    | 22.72                       | 22.76  | 22.85  |
|               | Subtest 2    | 22.74                       | 22.78  | 22.84  |
|               | Subtest 3    | 22.78                       | 22.90  | 22.80  |
|               | Subtest 4    | 22.68                       | 22.82  | 22.85  |
| HSUPA         | Subtest 1    | 21.65                       | 21.83  | 21.85  |
|               | Subtest 2    | 21.24                       | 21.36  | 21.39  |
|               | Subtest 3    | 21.76                       | 21.81  | 21.89  |
|               | Subtest 4    | 21.65                       | 21.83  | 21.88  |
|               | Subtest 5    | 21.71                       | 21.86  | 21.93  |
| HSPA+(DPA)    | Subtest 1    | 22.13                       | 22.26  | 22.29  |
|               | Subtest 2    | 21.69                       | 22.09  | 22.05  |
|               | Subtest 3    | 21.58                       | 21.92  | 21.78  |
|               | Subtest 4    | 21.36                       | 21.69  | 21.52  |

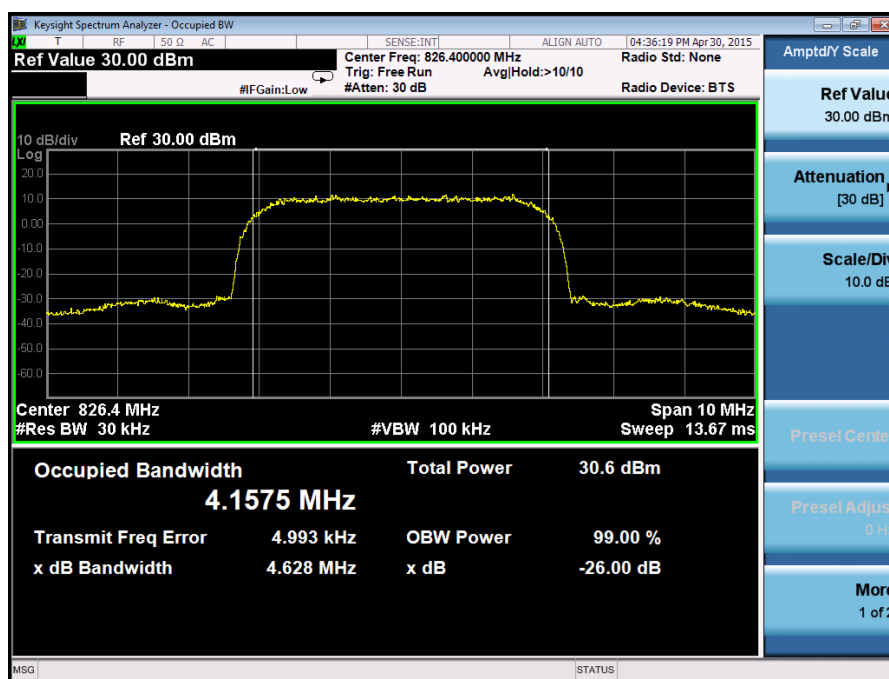
#### REMARKS:

1. Radiated Output Power(dBm)=Raw Value(dBm) + Correction Factor(dB) +Ant Gain(dBi)
2. Correction Factor(dB) = Power SplitterLoss(dB) + Cable Loss(dB)
3. The EUT does employ a power control function by which the output power is controlled from +30dBm to +19dBm (nominal) by 2dB steps. Consequently the EUT meets the requirement of Part22.913(a)
4. The antenna gain is -1.59dBi

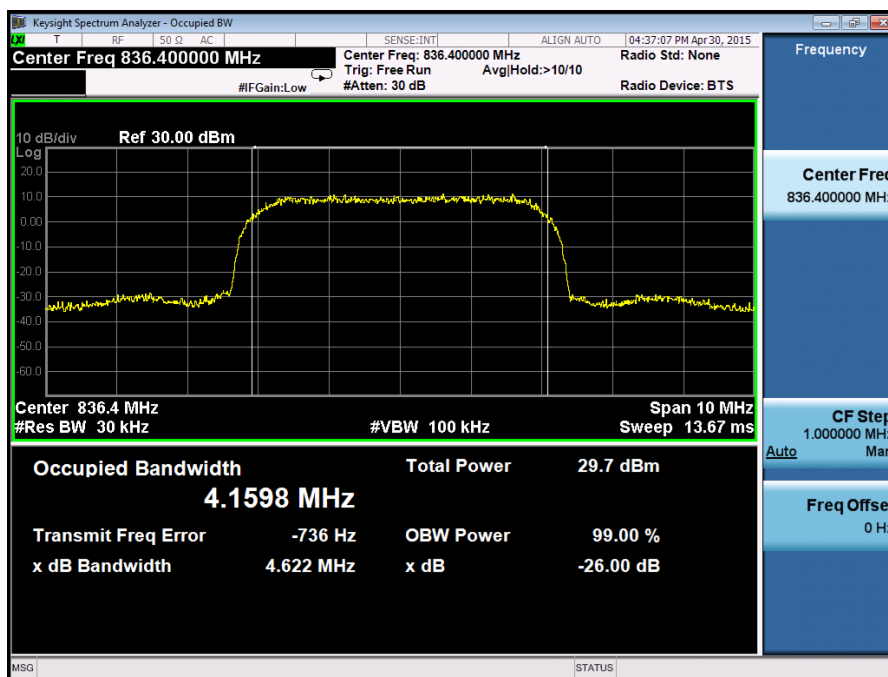
## **ATTACHMENT B - 99% OCCUPIED BANDWIDTH**

| Test Mode : TX Mode Configuration WCDMA |           |               |                        |          |
|-----------------------------------------|-----------|---------------|------------------------|----------|
| Channel                                 | Frequency | 99% OBW (MHz) | -26dBc Bandwidth (MHz) | Result   |
| 4132                                    | 826.4MHz  | 4.16          | 4.62                   | Complies |
| 4182                                    | 836.4MHz  | 4.16          | 4.62                   | Complies |
| 4233                                    | 846.6MHz  | 4.16          | 4.62                   | Complies |

### 99% Occupied Bandwidth channel 4132



## 99% Occupied Bandwidth channel 4182

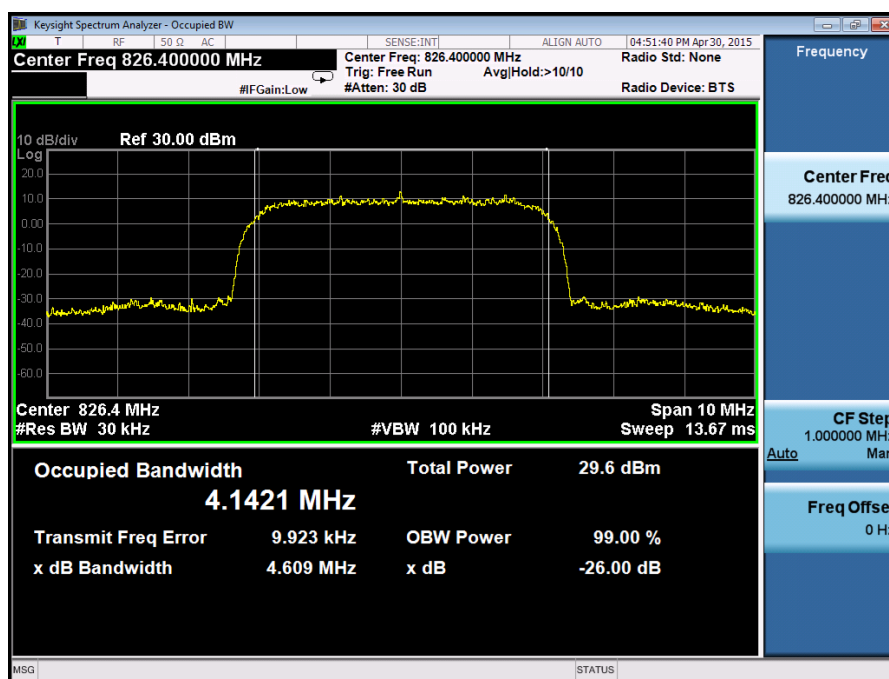


## 99% Occupied Bandwidth channel 4233

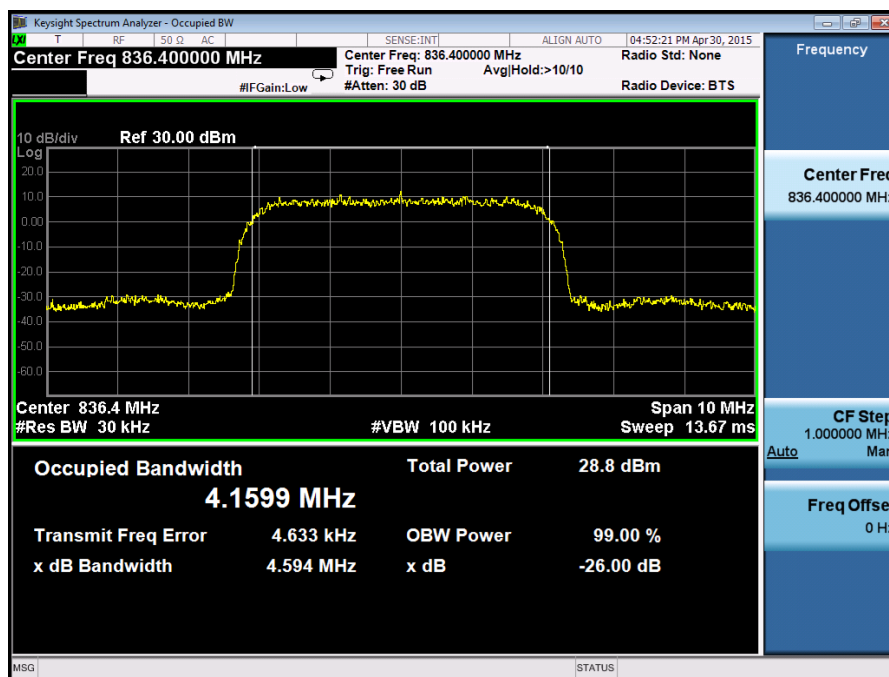


| Test Mode : TX Mode Configuration WCDMA-HSDPA |           |               |                        |          |
|-----------------------------------------------|-----------|---------------|------------------------|----------|
| Channel                                       | Frequency | 99% OBW (MHz) | -26dBc Bandwidth (MHz) | Result   |
| 4132                                          | 826.4MHz  | 4.14          | 4.61                   | Complies |
| 4182                                          | 836.4MHz  | 4.16          | 4.60                   | Complies |
| 4233                                          | 846.6MHz  | 4.15          | 4.60                   | Complies |

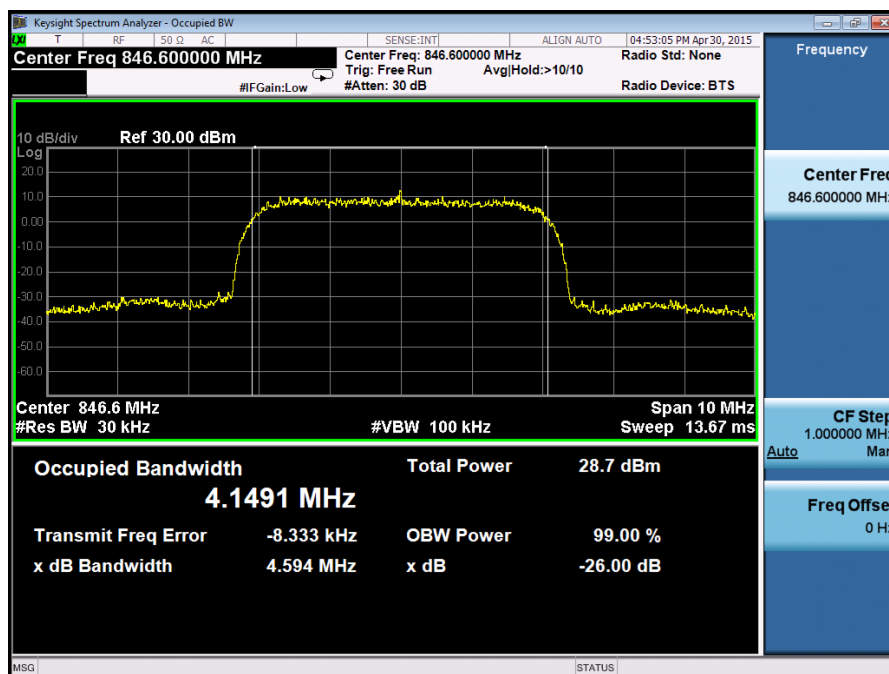
### 99% Occupied Bandwidth channel 4132



## 99% Occupied Bandwidth channel 4182

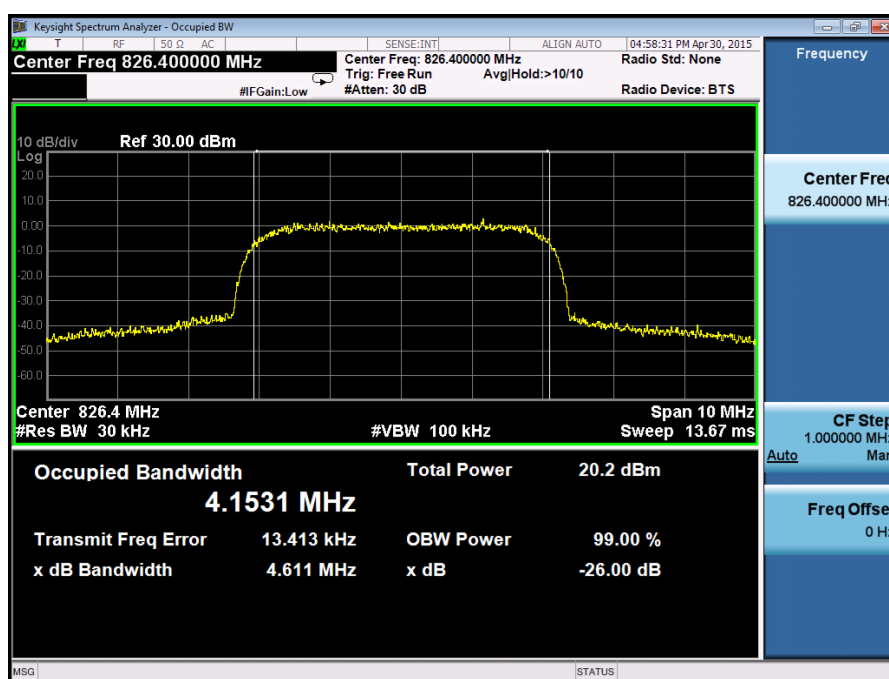


## 99% Occupied Bandwidth channel 4233

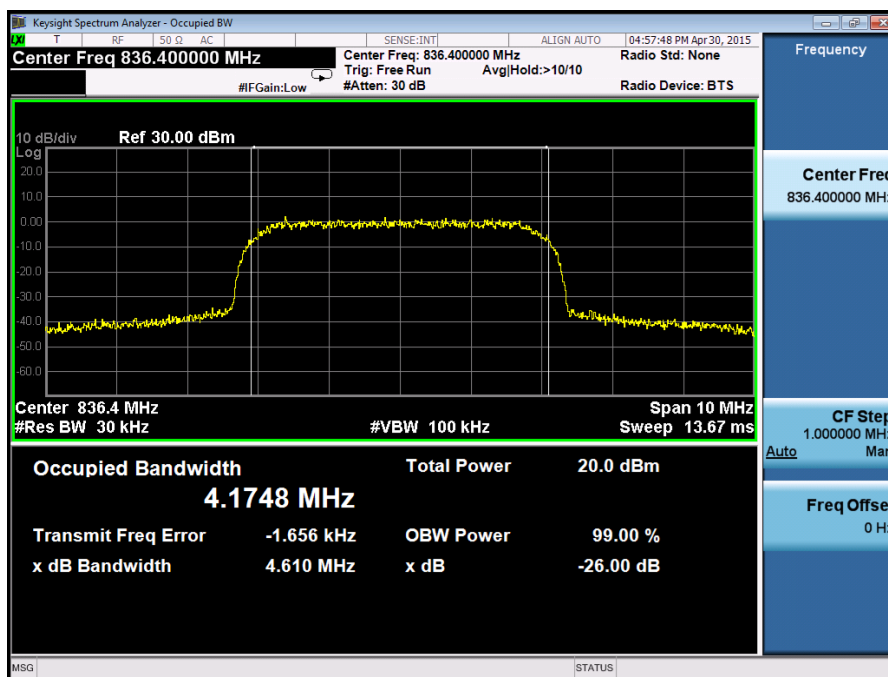


| Test Mode : TX Mode Configuration WCDMA-HSUPA |           |               |                        |          |
|-----------------------------------------------|-----------|---------------|------------------------|----------|
| Channel                                       | Frequency | 99% OBW (MHz) | -26dBc Bandwidth (MHz) | Result   |
| 4132                                          | 826.4MHz  | 4.15          | 4.61                   | Complies |
| 4182                                          | 836.4MHz  | 4.17          | 4.61                   | Complies |
| 4233                                          | 846.6MHz  | 4.18          | 4.63                   | Complies |

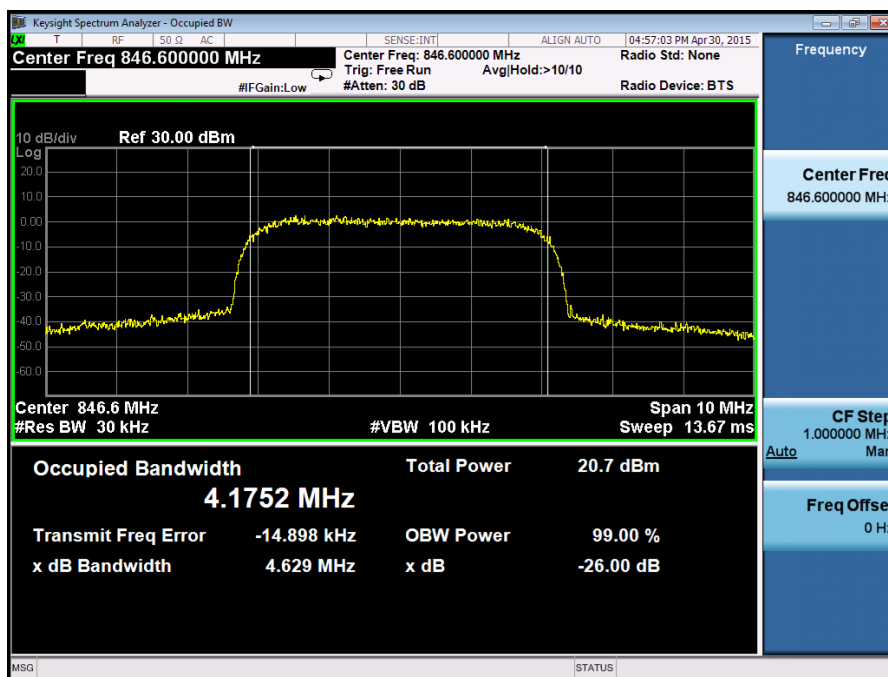
### 99% Occupied Bandwidth channel 4132



## 99% Occupied Bandwidth channel 4182



## 99% Occupied Bandwidth channel 4233



## **ATTACHMENT C - SPURIOUS EMISSIONS AT ANTENNA TERMINALS**

## Conducted Spurious of Configuration WCDMA- channel 4132



## Conducted Spurious of Configuration WCDMA- channel 4182

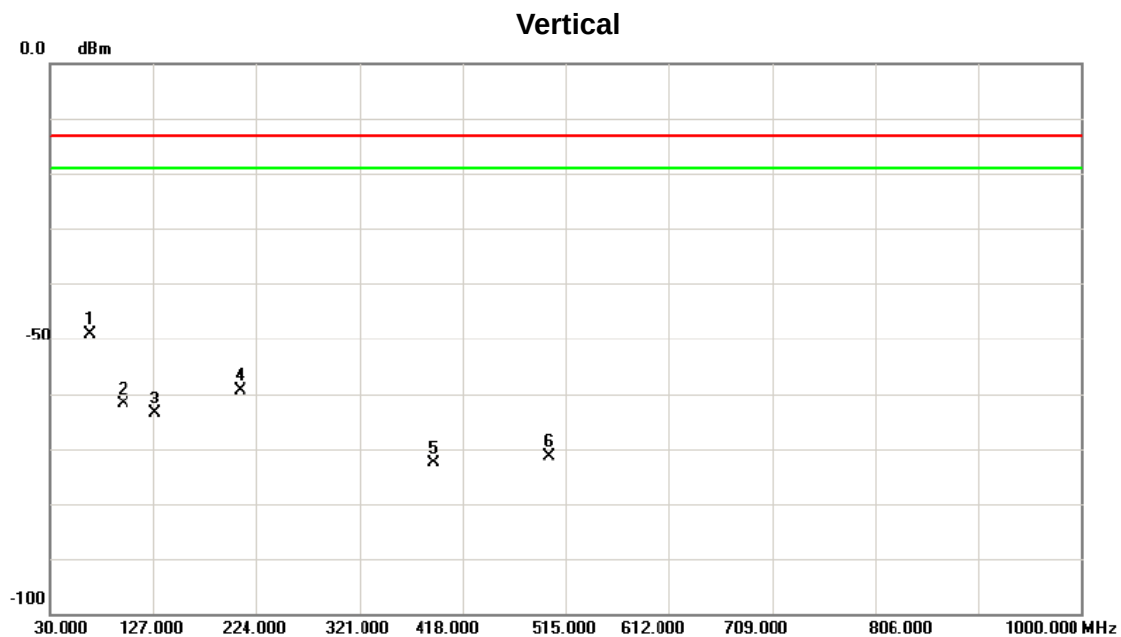


## Conducted Spurious of Configuration WCDMA- channel 4233



## **ATTACHMENTD - SPURIOUS RADIATED EMISSION**

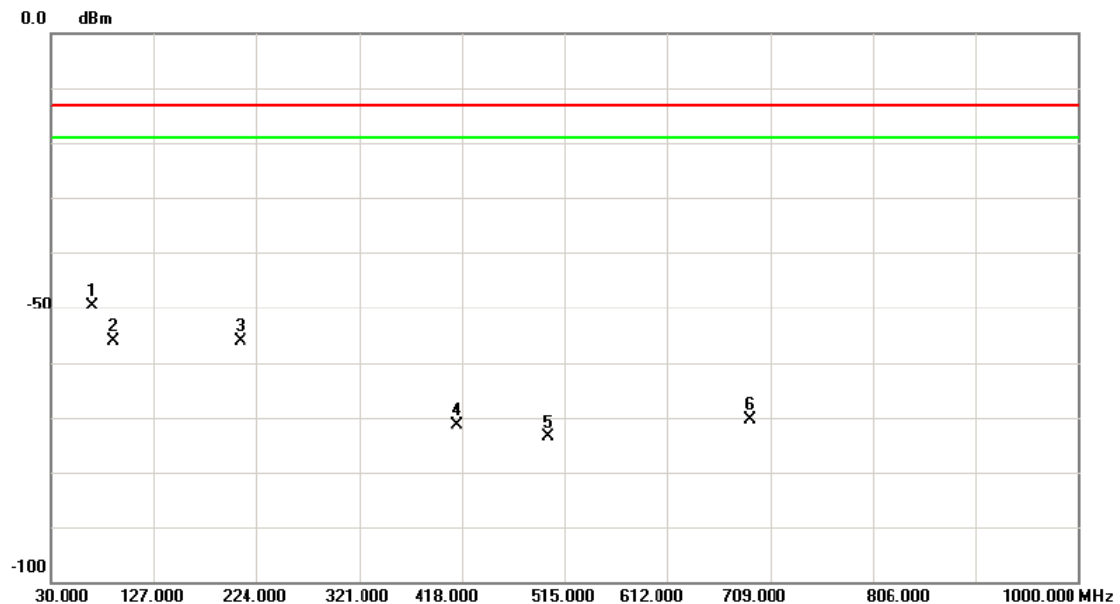
Test Mode: TX CH4182WCDMA



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Margin |          |         |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|---------|
|     |     | MHz      | dBm           | dB             | dBm         | dBm    | dB     | Detector | Comment |
| 1   | *   | 67.8300  | -49.62        | 0.40           | -49.22      | -13.00 | -36.22 | peak     |         |
| 2   |     | 98.8700  | -60.04        | -1.87          | -61.91      | -13.00 | -48.91 | peak     |         |
| 3   |     | 128.9400 | -62.71        | -0.82          | -63.53      | -13.00 | -50.53 | peak     |         |
| 4   |     | 209.4500 | -57.01        | -2.48          | -59.49      | -13.00 | -46.49 | peak     |         |
| 5   |     | 390.8400 | -76.72        | 3.98           | -72.74      | -13.00 | -59.74 | peak     |         |
| 6   |     | 499.4800 | -78.99        | 7.52           | -71.47      | -13.00 | -58.47 | peak     |         |

Test Mode: TX CH4182WCDMA

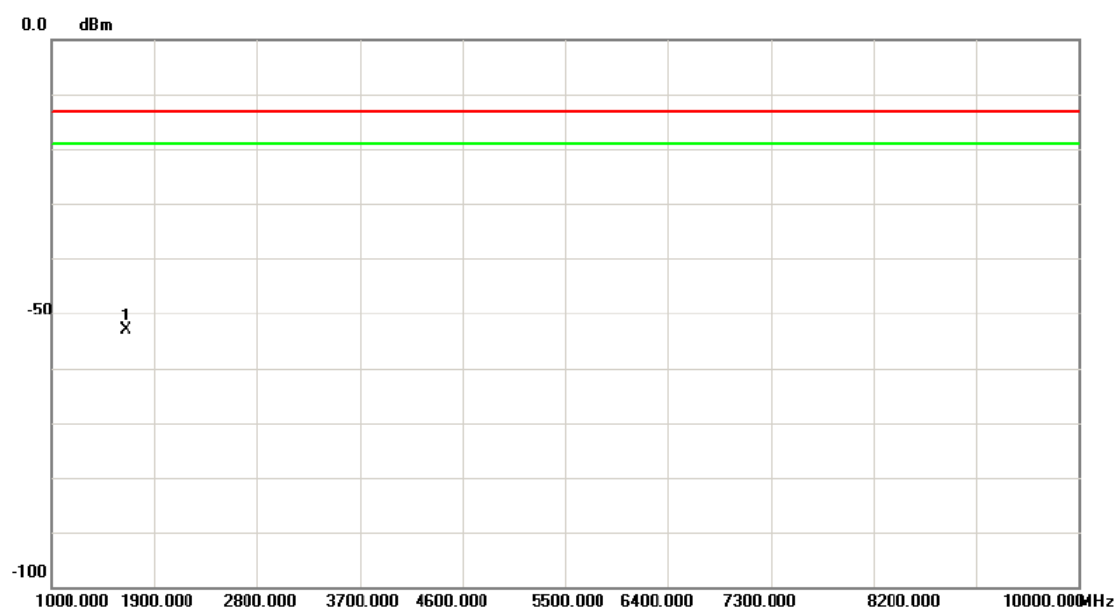
### Horizontal



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Margin |          |         |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|---------|
|     |     | MHz      | dBm           | dB             | dBm         | dBm    | dB     | Detector | Comment |
| 1   | *   | 68.8000  | -46.43        | -3.29          | -49.72      | -13.00 | -36.72 | peak     |         |
| 2   |     | 88.2000  | -49.11        | -7.13          | -56.24      | -13.00 | -43.24 | peak     |         |
| 3   |     | 209.4500 | -54.06        | -1.94          | -56.00      | -13.00 | -43.00 | peak     |         |
| 4   |     | 413.1500 | -77.96        | 6.54           | -71.42      | -13.00 | -58.42 | peak     |         |
| 5   |     | 499.4800 | -81.66        | 8.02           | -73.64      | -13.00 | -60.64 | peak     |         |
| 6   |     | 689.6000 | -83.57        | 13.27          | -70.30      | -13.00 | -57.30 | peak     |         |

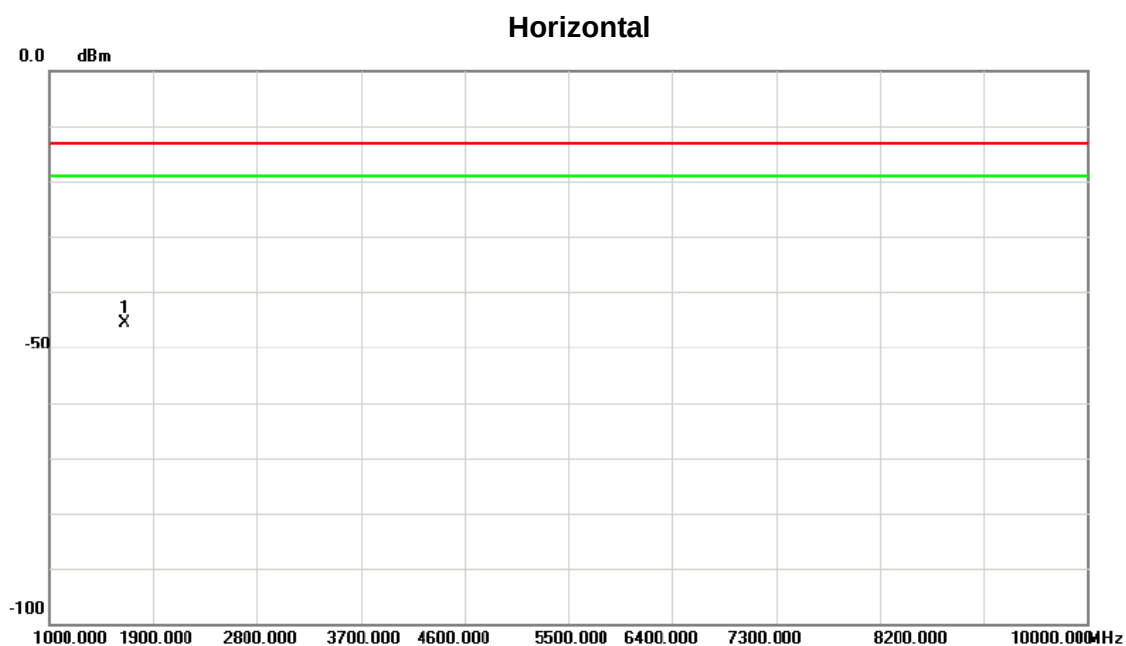
|            |                |
|------------|----------------|
| Test Mode: | TX CH4132WCDMA |
|------------|----------------|

### Vertical



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measure-ment | Limit  | Margin |          |         |
|-----|-----|----------|---------------|----------------|--------------|--------|--------|----------|---------|
|     |     | MHz      | dBm           | dB             | dBm          | dBm    | dB     | Detector | Comment |
| 1   | *   | 1654.300 | -44.16        | -8.94          | -53.10       | -13.00 | -40.10 | peak     |         |

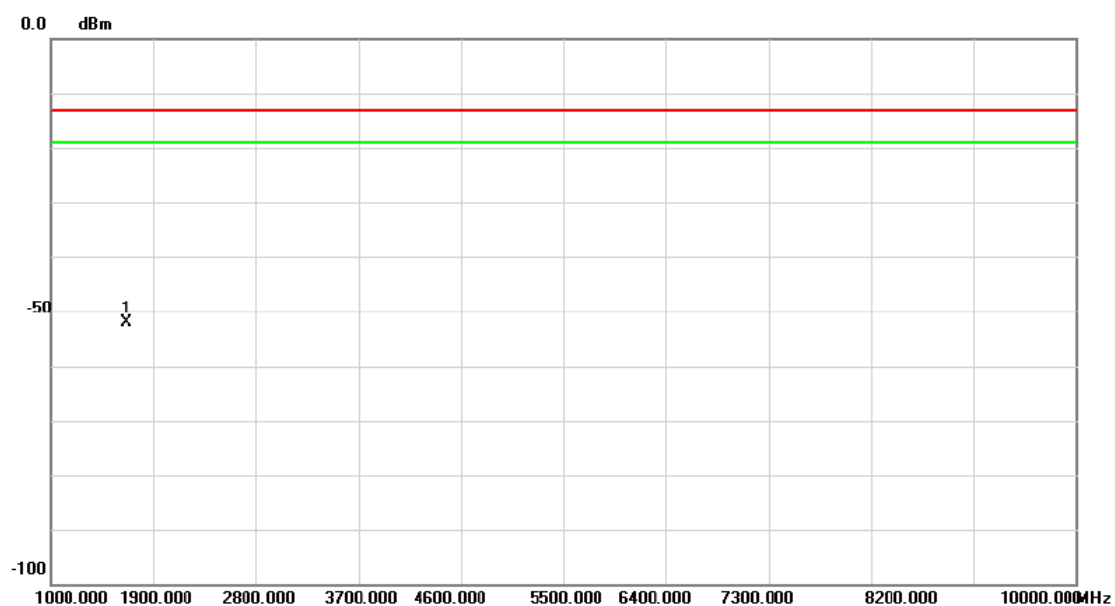
|            |                |
|------------|----------------|
| Test Mode: | TX CH4132WCDMA |
|------------|----------------|



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Margin |          |         |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|---------|
|     |     | MHz      | dBm           | dB             | dBm         | dBm    | dB     | Detector | Comment |
| 1   | *   | 1655.100 | -37.70        | -7.93          | -45.63      | -13.00 | -32.63 | peak     |         |

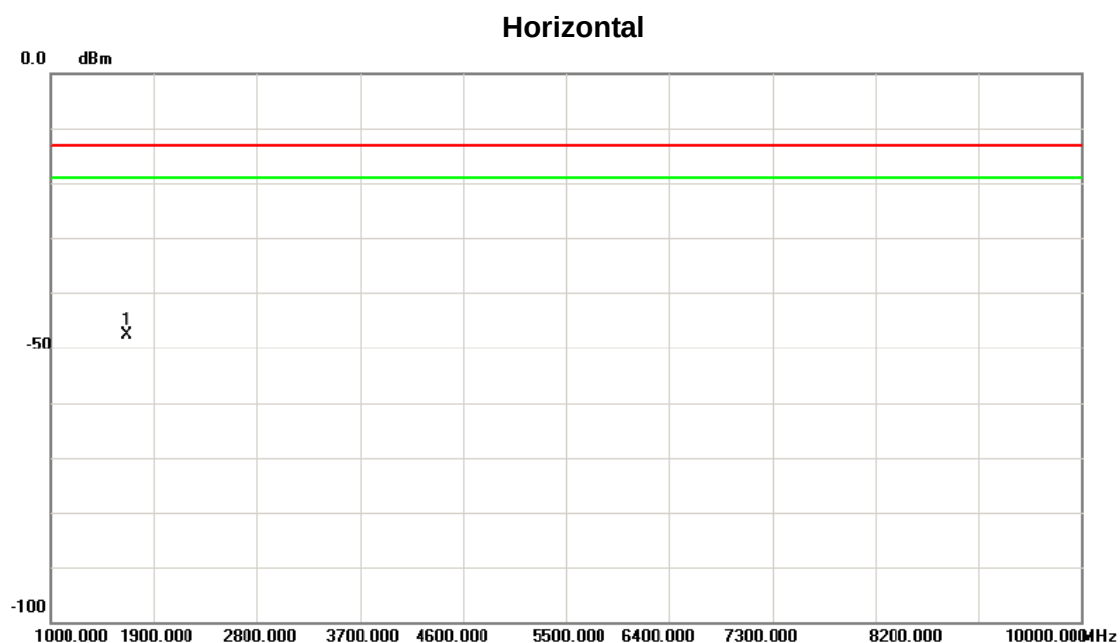
|            |                |
|------------|----------------|
| Test Mode: | TX CH4182WCDMA |
|------------|----------------|

### Vertical



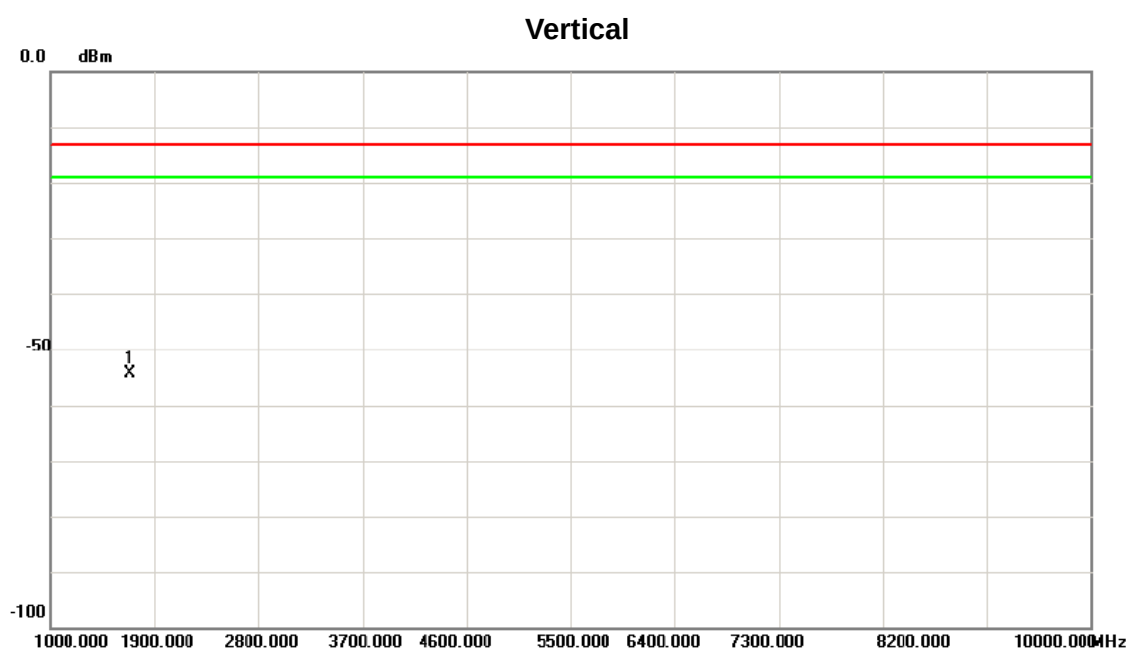
| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measure-ment | Limit  | Margin |          |         |
|-----|-----|----------|---------------|----------------|--------------|--------|--------|----------|---------|
|     |     | MHz      | dBm           | dB             | dBm          | dBm    | dB     | Detector | Comment |
| 1   | *   | 1670.650 | -43.17        | -8.86          | -52.03       | -13.00 | -39.03 | peak     |         |

|            |                |
|------------|----------------|
| Test Mode: | TX CH4182WCDMA |
|------------|----------------|



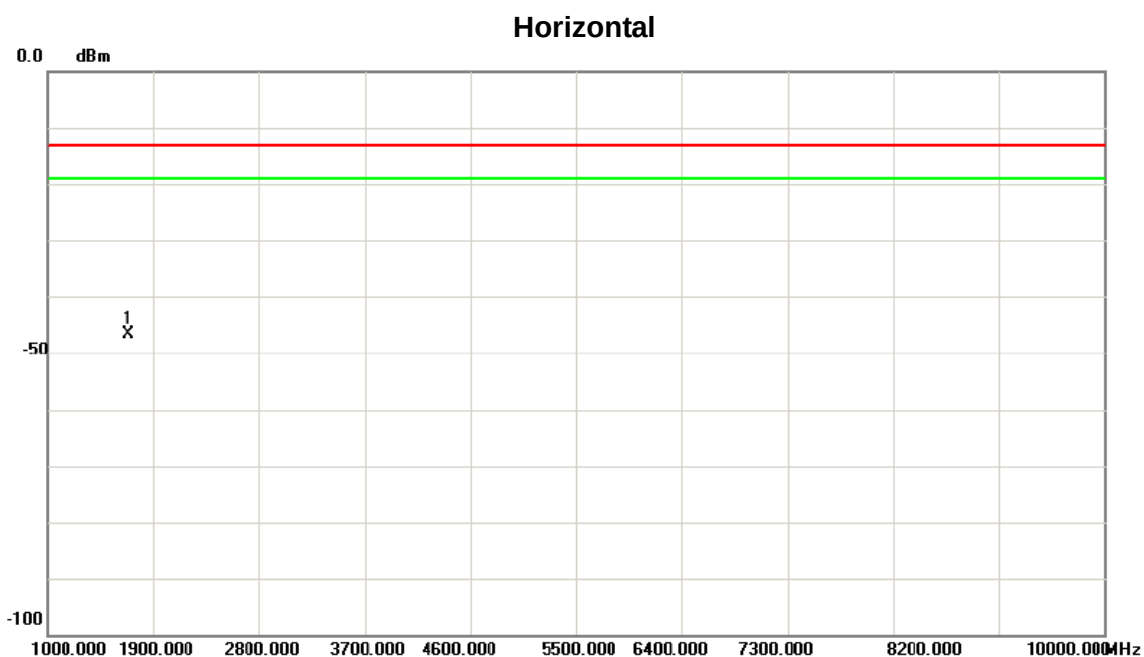
| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBm | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBm | Limit<br>dBm | Margin<br>dB | Detector | Comment |
|-----|-----|--------------|-------------------------|-------------------------|-------------------------|--------------|--------------|----------|---------|
| 1   | *   | 1670.200     | -39.76                  | -7.84                   | -47.60                  | -13.00       | -34.60       | peak     |         |

|            |                |
|------------|----------------|
| Test Mode: | TX CH4233WCDMA |
|------------|----------------|



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Margin |          |         |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|---------|
|     |     | MHz      | dBm           | dB             | dBm         | dBm    | dB     | Detector | Comment |
| 1   | *   | 1694.700 | -45.72        | -8.74          | -54.46      | -13.00 | -41.46 | peak     |         |

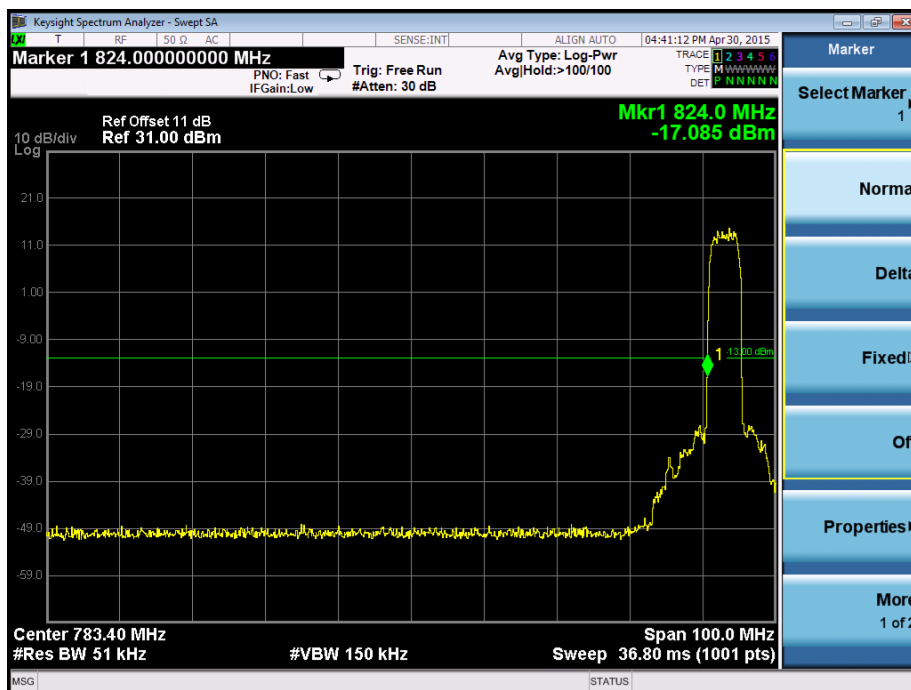
|            |                |
|------------|----------------|
| Test Mode: | TX CH4233WCDMA |
|------------|----------------|



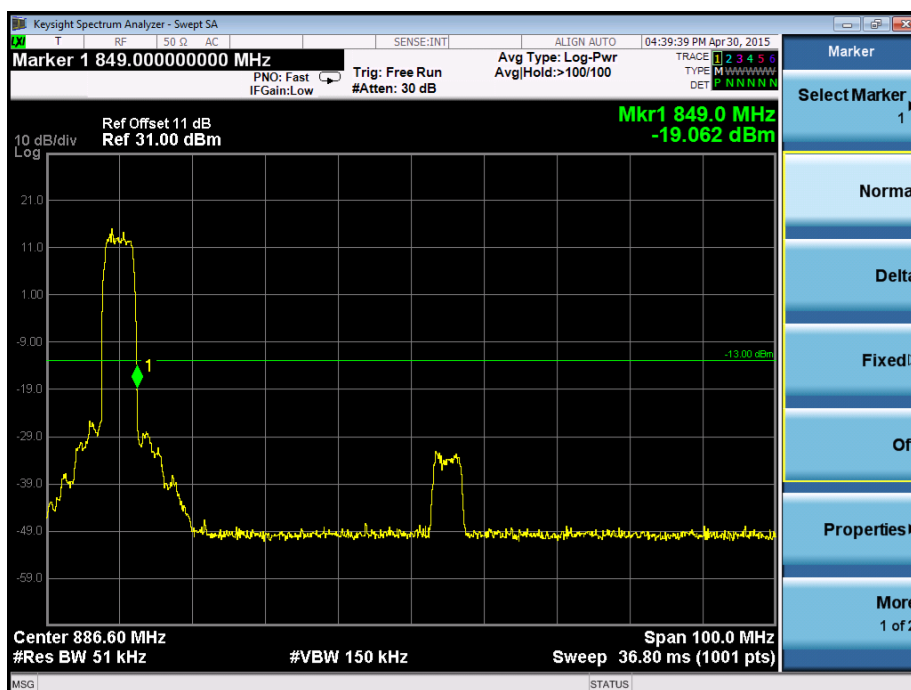
| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Margin |          |         |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|---------|
|     |     | MHz      | dBm           | dB             | dBm         | dBm    | dB     | Detector | Comment |
| 1   | *   | 1695.550 | -39.03        | -7.69          | -46.72      | -13.00 | -33.72 | peak     |         |

## **ATTACHMENTE - BAND EDGE**

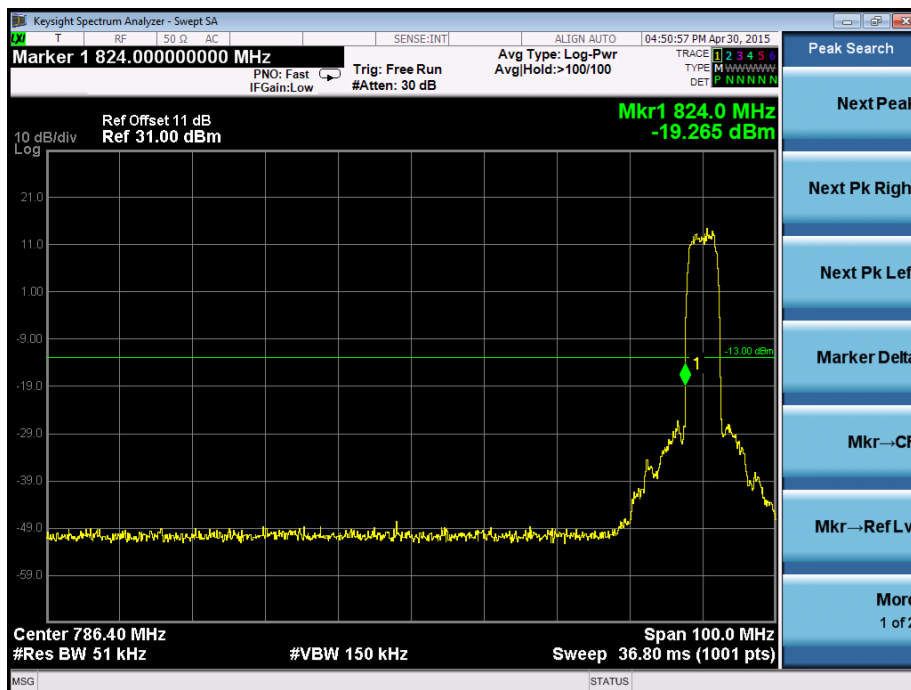
## Band Edge on Configuration WCDMA/ Channel 4132-CONDUCTED MODE



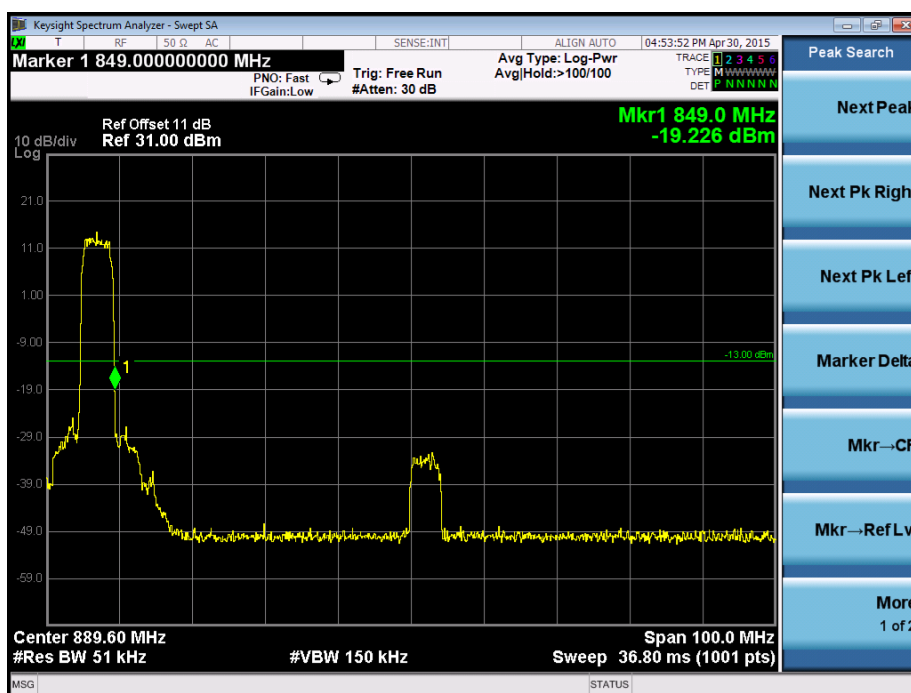
## Band Edge on Configuration WCDMA- 12.2K RMC / Channel 4233-CONDUCTED MODE



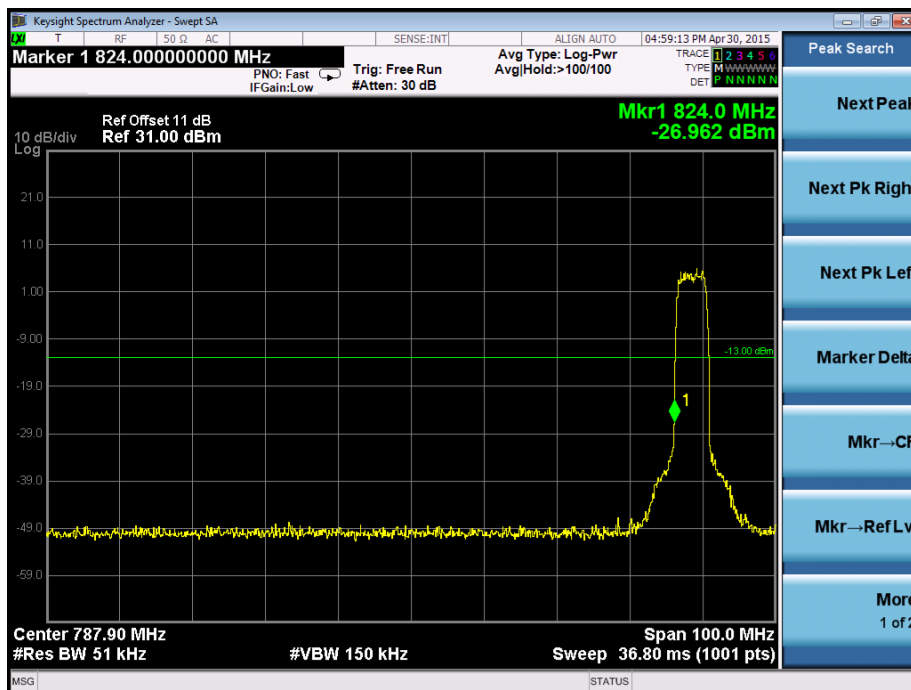
## Band Edge on Configuration WCDMA- HSDPA / Channel 4132-CONDUCTED MODE



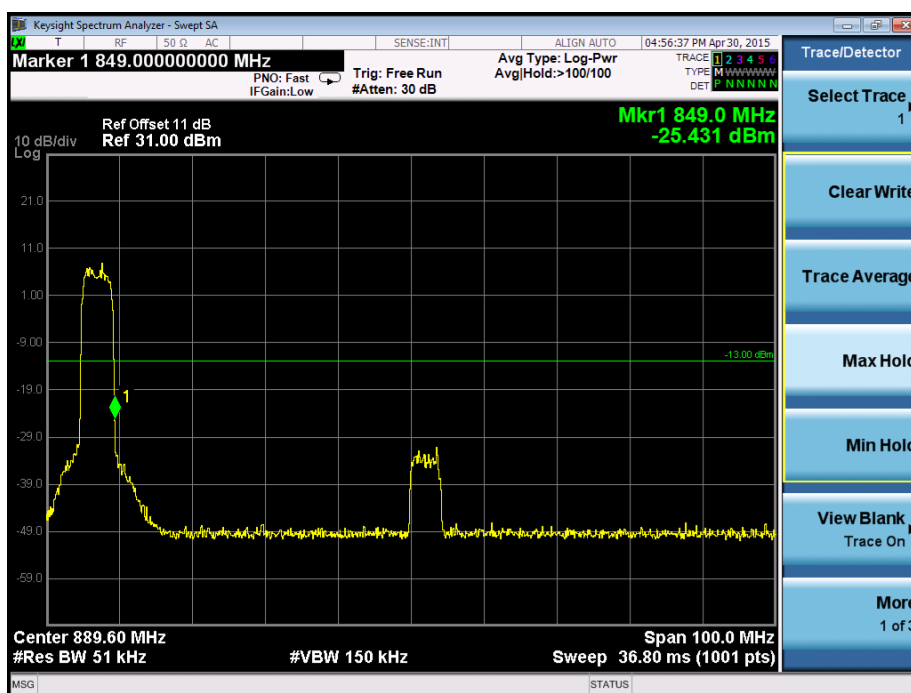
## Band Edge on Configuration WCDMA- HSDPA / Channel 4233-CONDUCTED MODE



## Band Edge on Configuration WCDMA- HSUPA / Channel 4132-CONDUCTED MODE



## Band Edge on Configuration WCDMA- HSUPA / Channel 4233-CONDUCTED MODE



## **ATTACHMENTF - FREQUENCY STABILITY**

|            |                            |
|------------|----------------------------|
| Test Mode: | TX CH 4132WCDMA- 12.2K RMC |
|------------|----------------------------|

#### Voltage vs. Frequency Stability

| Voltage(Volts)       | Frequency Error (Hz) | Frequency Error (ppm) | Limit(ppm) |
|----------------------|----------------------|-----------------------|------------|
| 3.5                  | 13                   | 0.013151602           | 0.1        |
| 3.6                  | 12                   | 0.011956002           | 0.1        |
| 3.7                  | 13                   | 0.015542802           | 0.1        |
| 3.8                  | 15                   | 0.019129603           | 0.1        |
| 3.9                  | 17                   | 0.016738403           | 0.1        |
| 4.0                  | 13                   | 0.014347202           | 0.1        |
| 4.1                  | 14                   | 0.015542802           | 0.1        |
| 4.2                  | 16                   | 0.014347202           | 0.1        |
| Max. Deviation (ppm) | <b>17</b>            | <b>0.019129603</b>    | <b>0.1</b> |

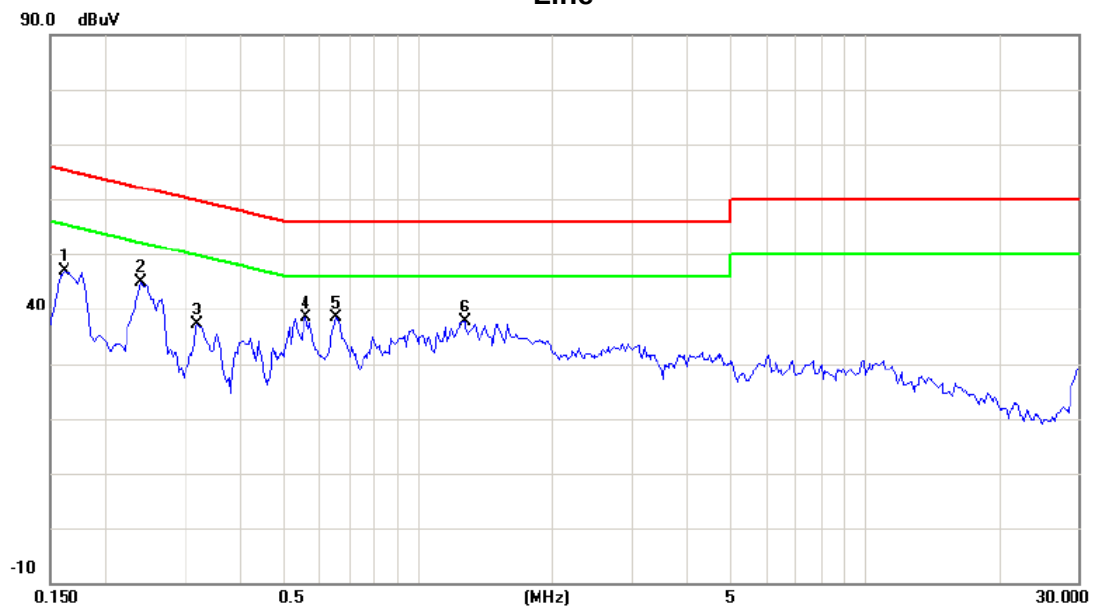
#### Temperature vs. Frequency Stability

| Temperature(°C)      | Frequency Error (Hz) | Frequency Error (ppm) | Limit(ppm) |
|----------------------|----------------------|-----------------------|------------|
| 45                   | <b>15</b>            | 0.015542802           | 0.1        |
| 30                   | 16                   | 0.017934003           | 0.1        |
| 20                   | 13                   | 0.014347202           | 0.1        |
| 10                   | 17                   | 0.019129603           | 0.1        |
| 0                    | 18                   | 0.020325203           | 0.1        |
| Max. Deviation (ppm) | <b>18</b>            | <b>0.020325203</b>    | <b>0.1</b> |

## **ATTACHMENTG -CONDUCTED EMISSION**

Test Mode: TX Mode

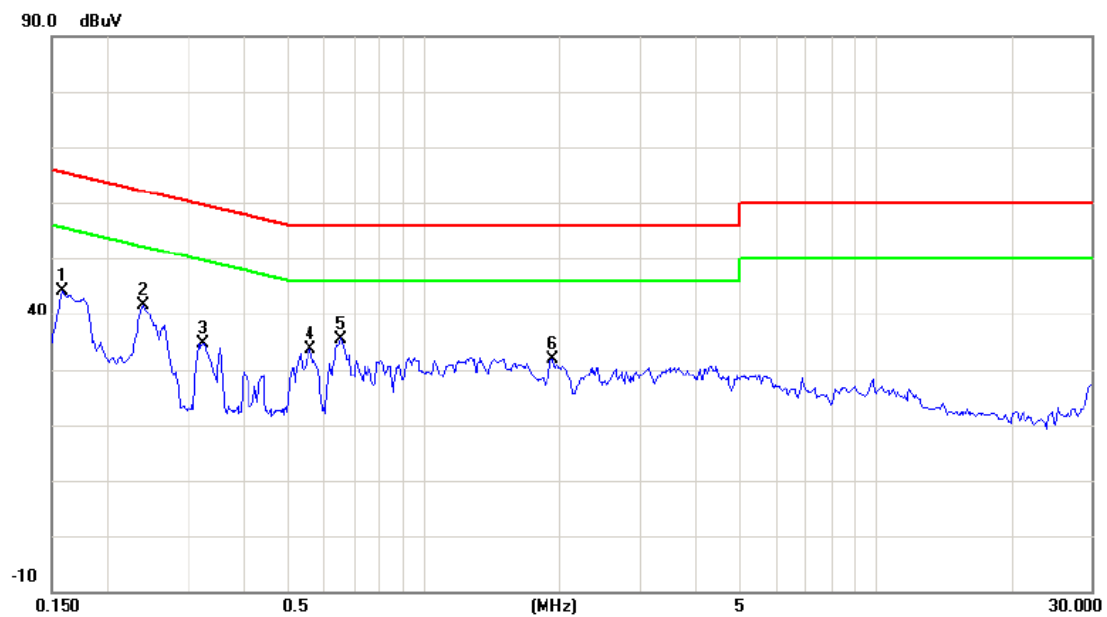
### Line



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Margin<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|--------------|----------|---------|
| 1   |     | 0.1617       | 37.12                    | 9.66                    | 46.78                    | 65.38         | -18.60       | peak     |         |
| 2   | *   | 0.2398       | 35.24                    | 9.71                    | 44.95                    | 62.10         | -17.15       | peak     |         |
| 3   |     | 0.3215       | 27.40                    | 9.75                    | 37.15                    | 59.67         | -22.52       | peak     |         |
| 4   |     | 0.5601       | 28.62                    | 9.82                    | 38.44                    | 56.00         | -17.56       | peak     |         |
| 5   |     | 0.6540       | 28.52                    | 9.85                    | 38.37                    | 56.00         | -17.63       | peak     |         |
| 6   |     | 1.2670       | 27.72                    | 9.92                    | 37.64                    | 56.00         | -18.36       | peak     |         |

Test Mode: TX Mode

### Neutral



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Margin<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|--------------|----------|---------|
| 1   |     | 0.1577       | 34.46                    | 9.57                    | 44.03                    | 65.58         | -21.55       | peak     |         |
| 2   | *   | 0.2398       | 32.10                    | 9.60                    | 41.70                    | 62.10         | -20.40       | peak     |         |
| 3   |     | 0.3256       | 25.14                    | 9.61                    | 34.75                    | 59.56         | -24.81       | peak     |         |
| 4   |     | 0.5601       | 24.02                    | 9.65                    | 33.67                    | 56.00         | -22.33       | peak     |         |
| 5   |     | 0.6542       | 25.85                    | 9.65                    | 35.50                    | 56.00         | -20.50       | peak     |         |
| 6   |     | 1.9273       | 21.96                    | 9.85                    | 31.81                    | 56.00         | -24.19       | peak     |         |