



# FCC TEST REPORT

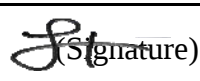
|              |                   |
|--------------|-------------------|
| Product Name | Repeater          |
| Model Name   | QUADCOMM-700N     |
| Applicant    | R-tron Inc.       |
| FCC ID       | STE-QUADCOMM-700N |

## ESTECH CO., LTD

Rm. 1015 World Venture Center, 426-5 Gasan-dong, Geumcheon-gu,  
Seoul, 153-803, Korea. Tel:82-2-867-3201, Fax:82-2-867-3204



## FCC Test Report

|                                                                                                                                                                                                                                                                |                                  |                                                                           |                                                                                                  |                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------|
| Report Number                                                                                                                                                                                                                                                  | ESTR1110-007                     |                                                                           |                                                                                                  |                         |
| Applicant                                                                                                                                                                                                                                                      | Company Name                     | R-tron Inc.                                                               |                                                                                                  |                         |
|                                                                                                                                                                                                                                                                | Address                          | Jisan IT Venture Center 7F, 1004-9 Doksan-Dong, Gumcheon-Gu, Seoul, Korea |                                                                                                  |                         |
| Product                                                                                                                                                                                                                                                        | Product Name                     | Repeater                                                                  |                                                                                                  |                         |
|                                                                                                                                                                                                                                                                | Model No.                        | QUADCOMM-700N                                                             | Manufacturer                                                                                     | R-tron Inc.             |
|                                                                                                                                                                                                                                                                | Serial No.                       | NONE                                                                      | Country of origin                                                                                | KOREA                   |
| Other                                                                                                                                                                                                                                                          | Issued Date                      | 2011-10-11                                                                | Tested Date                                                                                      | 2011-08-24 ~ 2011-10-11 |
| Test Result                                                                                                                                                                                                                                                    | Pass                             |                                                                           |                                                                                                  |                         |
| Standard                                                                                                                                                                                                                                                       | FCC PART 27                      |                                                                           |                                                                                                  |                         |
| Tested by                                                                                                                                                                                                                                                      | I.K. Hong/ Engineer              |                                                                           |  (Signature) |                         |
| Approved by                                                                                                                                                                                                                                                    | Tag-Sun Park/Engineering manager |                                                                           |  (Signature) |                         |
| <div><b>ESTECH CO., LTD</b></div> <div>Rm. 1015 World Venture Center, 426-5 Gasan-dong, Geumcheon-gu,<br/>Seoul, 153-803, Korea. Tel:82-2-867-3201, Fax:82-2-867-3204</div>                                                                                    |                                  |                                                                           |                                                                                                  |                         |
| <p>o This is certified that the above mentioned products have been tested for the sample provided by client.</p> <p>o No part of this document may not be duplicated or reproduced by any means without the express written permission of Estech Co., Ltd.</p> |                                  |                                                                           |                                                                                                  |                         |



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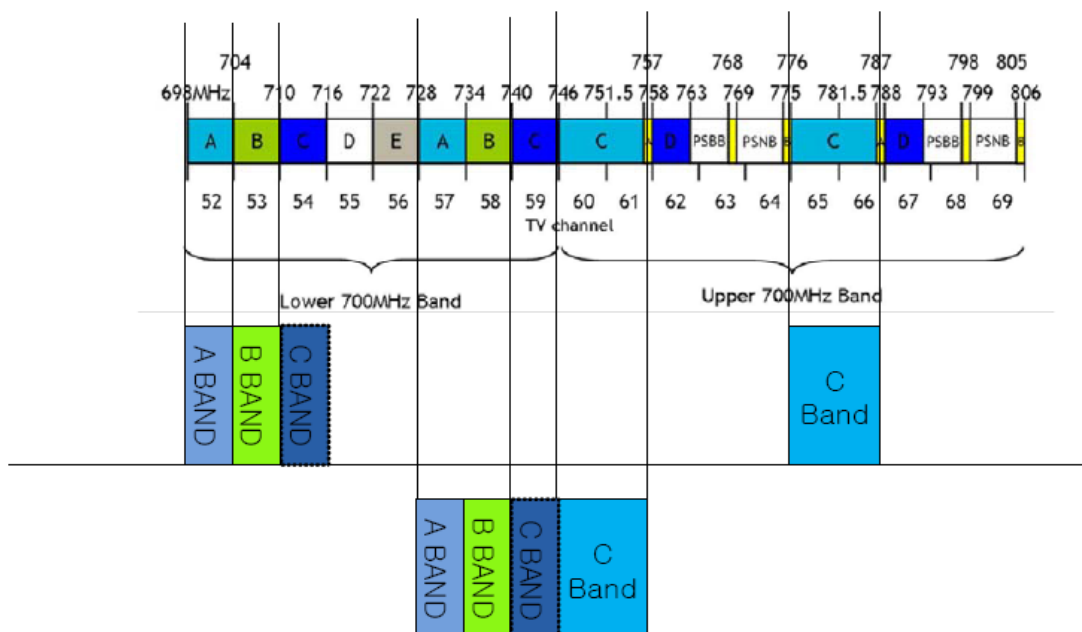
## 1. General Information

### 1.1 EUT Description

|              |                                                                        |
|--------------|------------------------------------------------------------------------|
| FCC ID       | STE-QUADCOMM-700N                                                      |
| Product Name | Repeater                                                               |
| Model Name   | QUADCOMM-700N                                                          |
| Frequency    | Uplink BW(5MHz) 698MHz ~ 710MHz<br>Downlink BW(5MHz) 728MHz ~ 740MHz   |
|              | Uplink BW(10MHz) 776MHz ~ 787MHz<br>Downlink BW(10MHz) 746MHz ~ 757MHz |
|              |                                                                        |
| Power Rating | Input: 110~240VAC 50~60Hz                                              |

LTE Frequency table

| 700M Band |       |         | Down Link |          |          |       | Up Link |          |          |       |
|-----------|-------|---------|-----------|----------|----------|-------|---------|----------|----------|-------|
| No        | Block | Channel | Center    | Start    | Stop     | BW    | Center  | Start    | Stop     | BW    |
| 1         | A     |         | 731.000   | 728.7425 | 733.2575 | 4.515 | 701.000 | 698.7425 | 703.2575 | 4.515 |
| 2         | B     |         | 737.000   | 734.7425 | 739.2575 | 4.515 | 707.000 | 704.7425 | 709.2575 | 4.515 |
| 3         | C     |         | 751.000   | 746.4925 | 755.5075 | 9.015 | 782.000 | 777.4925 | 786.5075 | 9.015 |





## 2. Laboratory Information

**2.1 Laboratory Name** Estech Co., Ltd.

### 2.2 Location

**Head Office** Rm. 1015, World Venture Center II, 426-5 Gasan-dong  
Geumcheon-gu, Seoul, 153-803. Korea.

**EMC Lab(Ichon)** 58-1, Osan-Ri, GaNam-Myon, YeoJoo-Gun, KyungKi-Do, Korea

**EMC Lab(Yanggi)** 97-1, Hoiuk-Ri Majang-Myon, Icheon-city, KyungKi-Do, Korea

**2.3 Quality System** Accredited by KOLAS(ISO/IEC 17025)

### 2.4 Major Accredited Mark



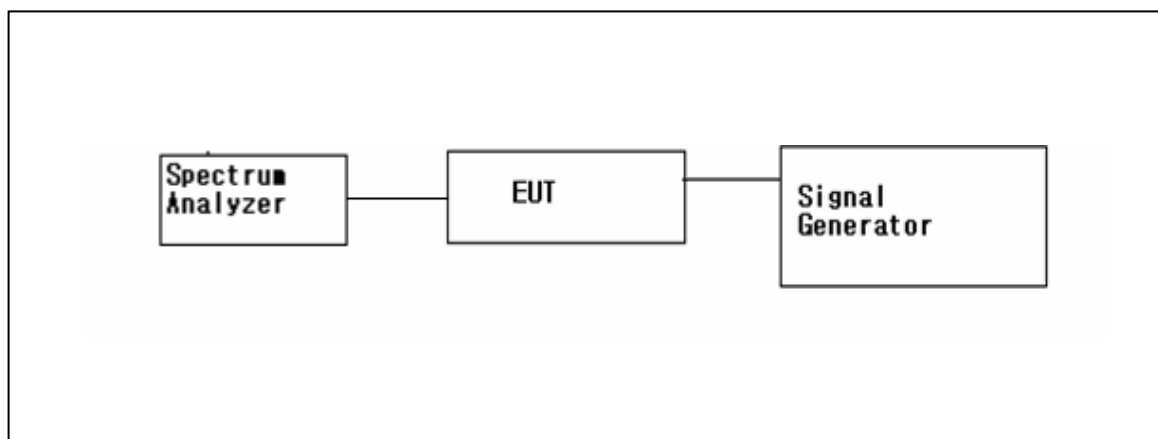
## 3. Summary of Test Results

| Test Item                                                      | Standard                       | Result |
|----------------------------------------------------------------|--------------------------------|--------|
| RF Output Power                                                | 2.1046 & 27.50                 | PASS   |
| Occupied Bandwidth                                             | 2.1049                         | PASS   |
| Band Edge / Spurious and Harmonic Emission at Antenna Terminal | 27.53(c) & 27.53(f) & 27.53(g) | PASS   |
| Field Strength of Spurious Radiation                           | 27.53(c) & 27.53(f) & 27.53(g) | PASS   |
| Frequency stability                                            | 27.54                          | PASS   |

## 4. RF Output Power

### 4.1 Test Procedure according to ANSI/TIA/EIA 603 Clause 2.2.17

1. The EUT was placed on a wooden turn table 3 meters from the receive antenna. The receive antenna height and turn table rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1MHz. A Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For reading 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.
2. The RF output port of the EUT was connected to the  
S/A This test was performed three channels (Low, High, Middle)
3. Test setup for RF Conducted measurement



### 4.2 Test Equipments

The following test equipments are used during tests

| Equipment               | Manufacturer  | Model    | Next Cal.  |
|-------------------------|---------------|----------|------------|
| Spectrum Analyzer       | Agilent       | E4440A   | 2012-09-05 |
| Spectrum Analyzer       | Agilent       | E4402B   | 2012-02-24 |
| Vector Signal Generator | ROHDE&SCHWARZ | SMBV100A | 2012-02-15 |
| Signal Generator        | HP            | E4432B   | 2012-02-24 |

#### 4.3.1 Test Results (Uplink)-BW5MHz

##### Conducted power

| Block | Freq (MHz) | Power Output (dBm) |
|-------|------------|--------------------|
| A     | 701.00     | 29.90              |
| B     | 707.00     | 29.95              |



#### 4.3.2 Test Results (Downlink)-BW5MHz

| Block | Freq (MHz) | Power Output (dBm) |
|-------|------------|--------------------|
| A     | 731.00     | 29.96              |
| B     | 737.00     | 29.90              |

#### 4.3.3 Test Results (Uplink)-BW10MHz

| Block | Freq (MHz) | Power Output (dBm) |
|-------|------------|--------------------|
| C(U)  | 782.00     | 29.97              |

\* (U)=Upper 700MHz band)

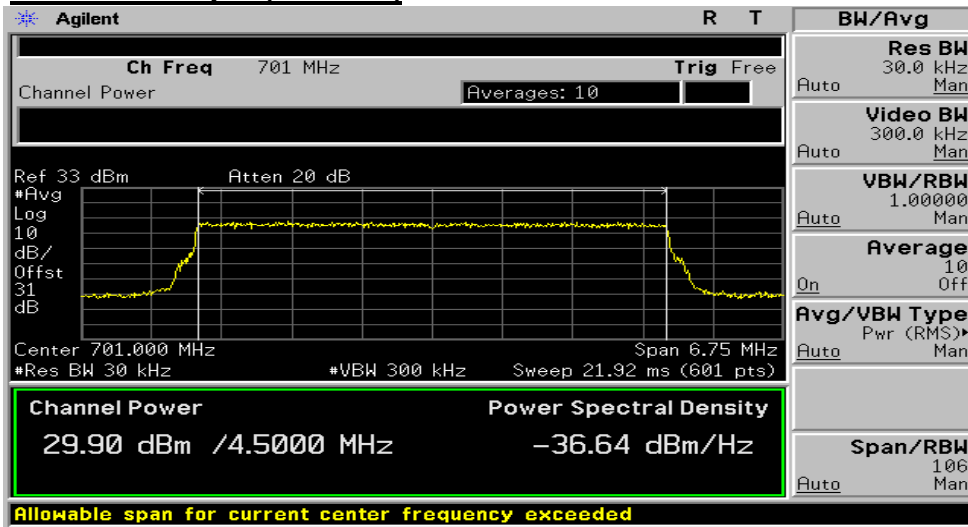
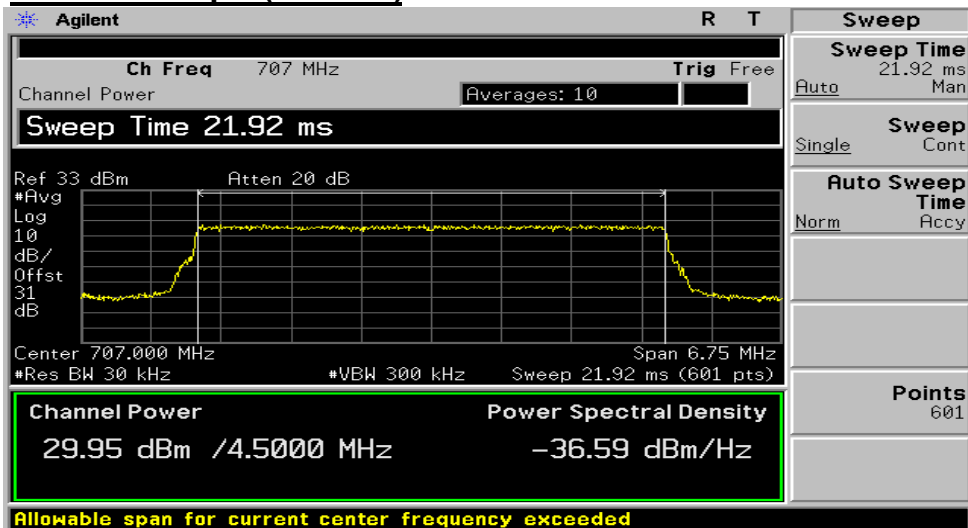
#### 4.3.4 Test Results (Downlink)-BW10MHz

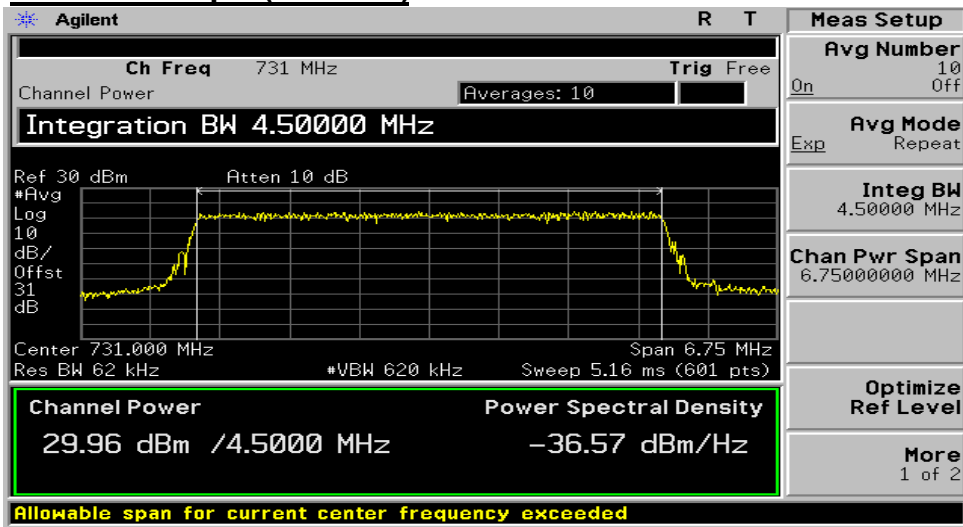
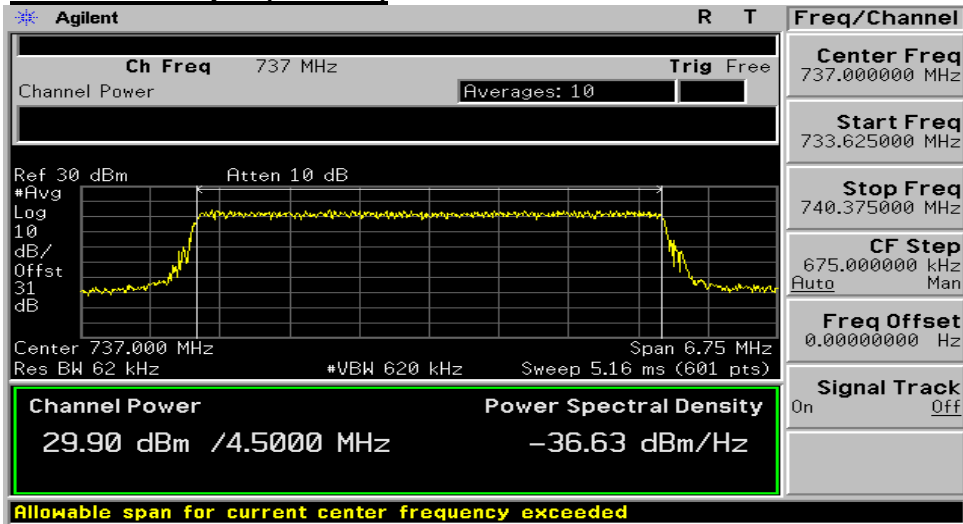
| Block | Freq (MHz) | Power Output (dBm) |
|-------|------------|--------------------|
| C(U)  | 751.00     | 29.93              |

\* (U)=Upper 700MHz band)



## 4.4 Test Plot

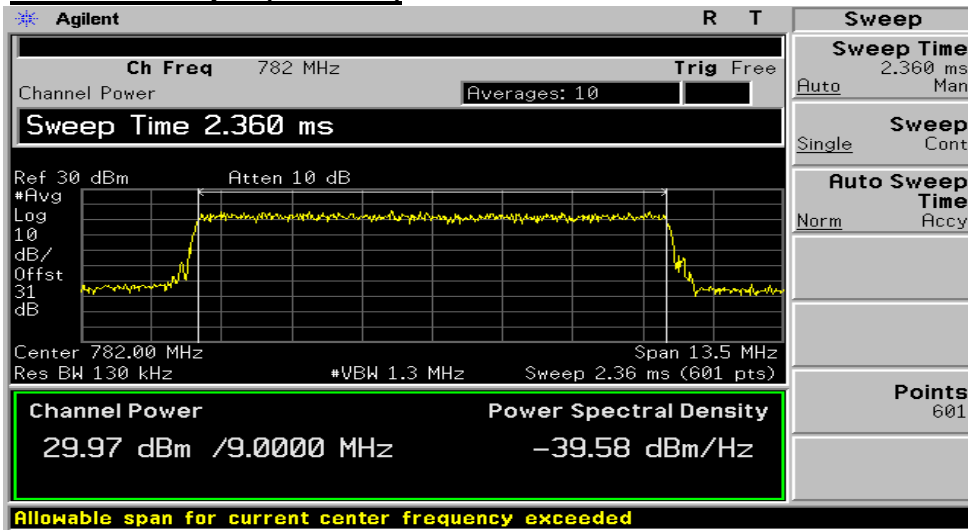
Uplink-BW5MHzRF Power Output (701MHz)RF Power Output (707MHz)

Downlink-BW5MHzRF Power Output (731MHZ)RF Power Output (737MH)



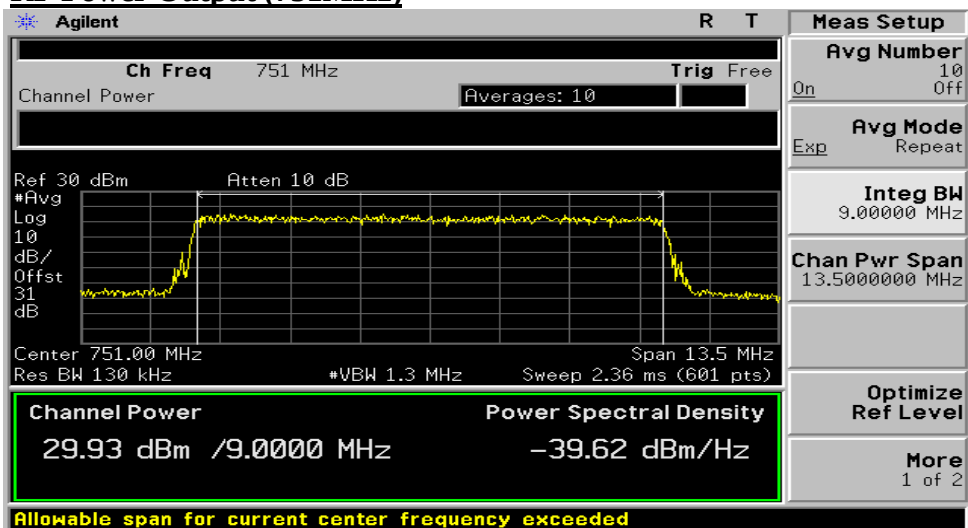
### Uplink-BW10MHz

#### RF Power Output (782MHz)



### Downlink-BW10MHz

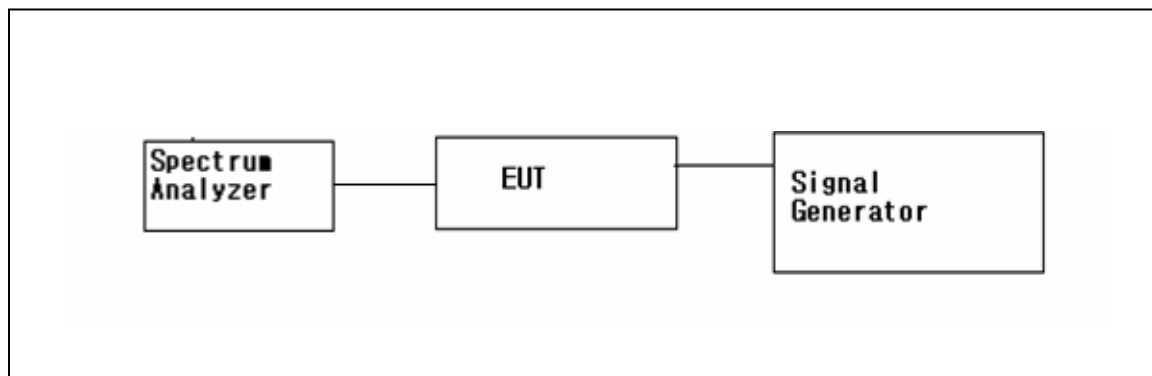
#### RF Power Output (751MHz)



## 5. Occupied Bandwidth

### 5.1 Test Procedure

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% of the Emission bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.



### 5.2 Test Equipments

The following test equipments are used during tests

| Equipment               | Manufacturer  | Model    | Next Cal.  |
|-------------------------|---------------|----------|------------|
| Spectrum Analyzer       | Agilent       | E4440A   | 2012-09-05 |
| Spectrum Analyzer       | Agilent       | E4402B   | 2012-02-24 |
| Vector Signal Generator | ROHDE&SCHWARZ | SMBV100A | 2012-02-15 |
| Signal Generator        | HP            | E4432B   | 2012-02-24 |

### 5.3 Test Results

#### (Uplink)-BW5MHz

| Block | Frequency(MHz) | 26dB Bandwidth(MHz) |
|-------|----------------|---------------------|
| A     | 701.00         | 4.855               |
| B     | 707.00         | 4.846               |

#### (Downlink)-BW5MHz

| Block | Frequency(MHz) | 26dB Bandwidth(MHz) |
|-------|----------------|---------------------|
| A     | 731.00         | 4.845               |
| B     | 737.00         | 4.846               |

\* (L)=Lower 700MHz band)



**(Uplink)-BW10MHz**

| Block | Frequency(MHz) | 26dB Bandwidth(MHz) |
|-------|----------------|---------------------|
| C(U)  | 782.00         | 9.510               |

\* (U)=Upper 700MHz band)

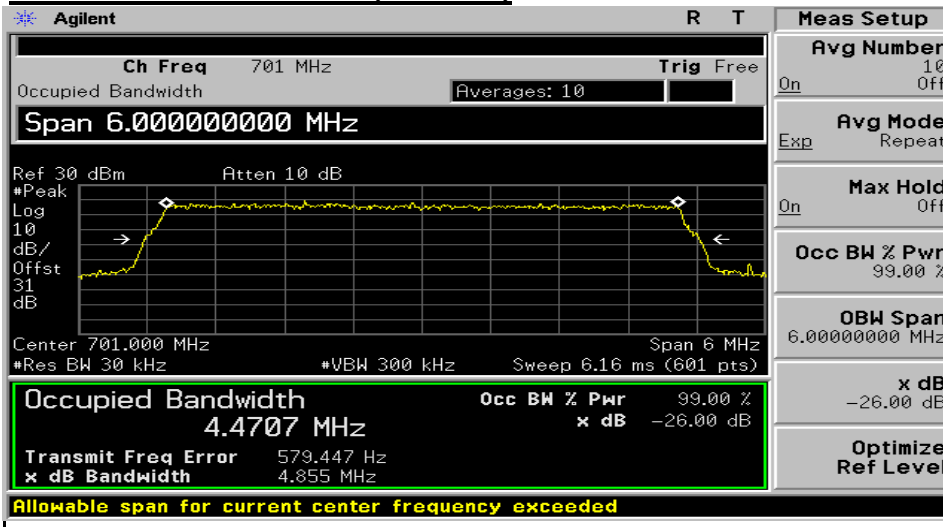
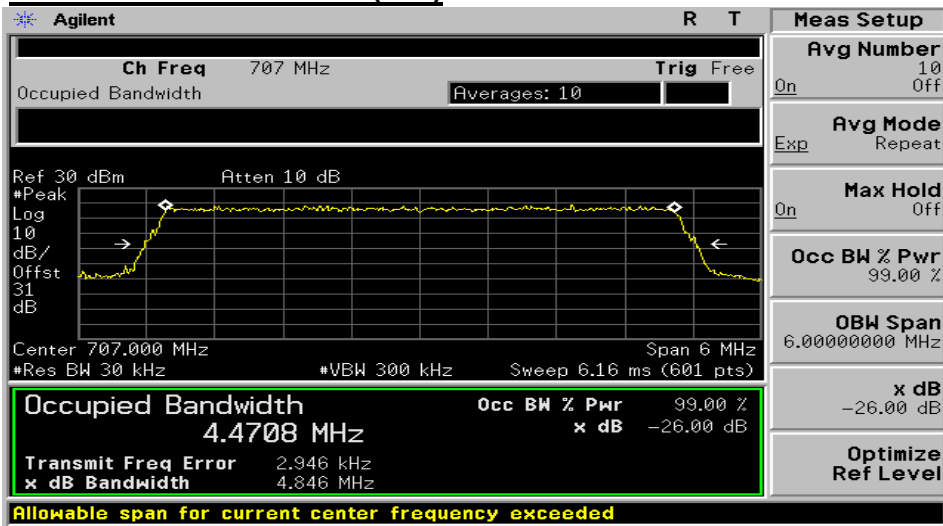
**(Downlink)-BW10MHz**

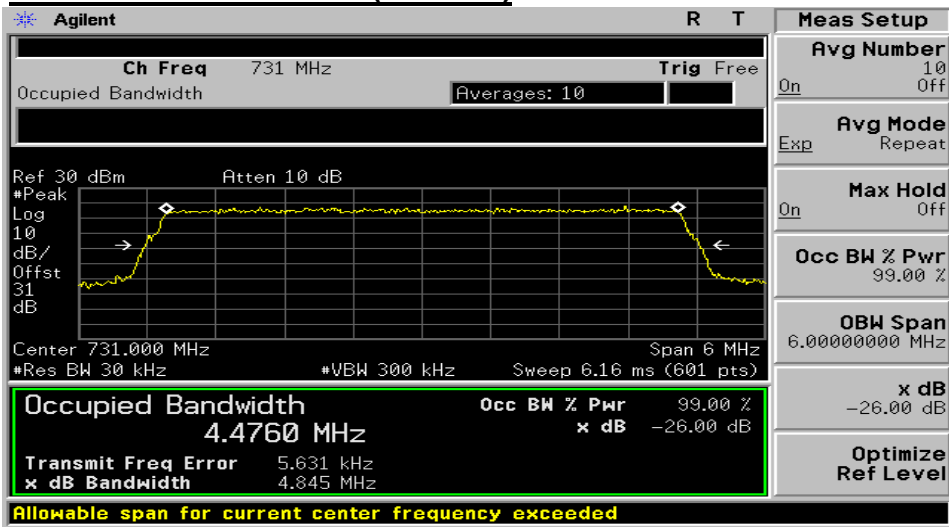
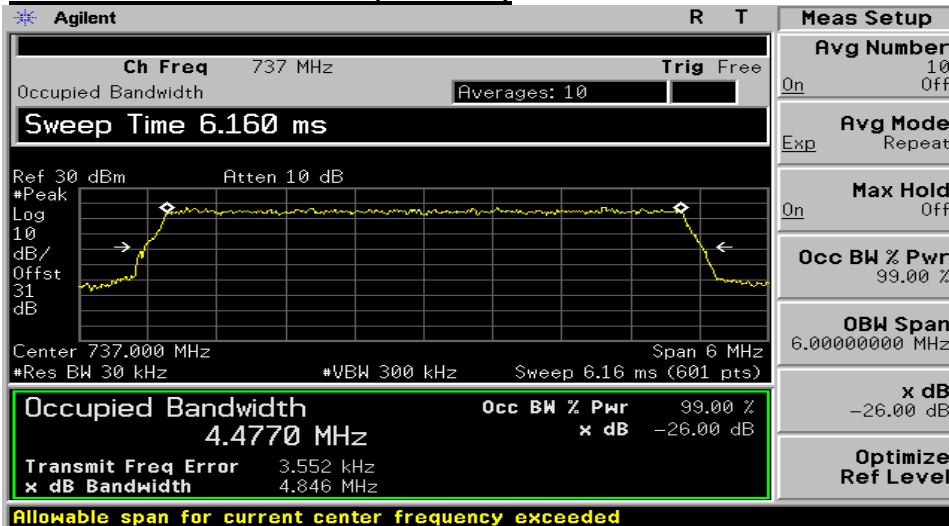
| Block | Frequency(MHz) | 26dB Bandwidth(MHz) |
|-------|----------------|---------------------|
| C(U)  | 751.00         | 9.499               |

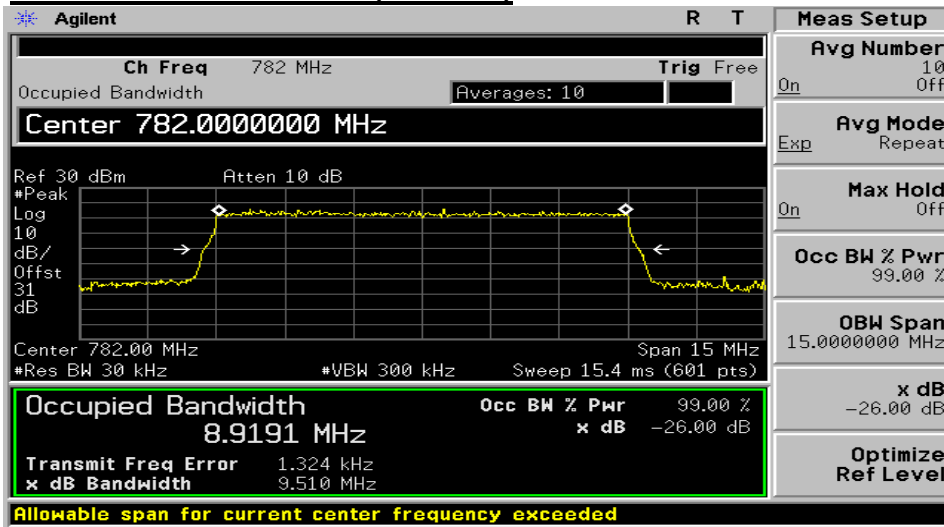
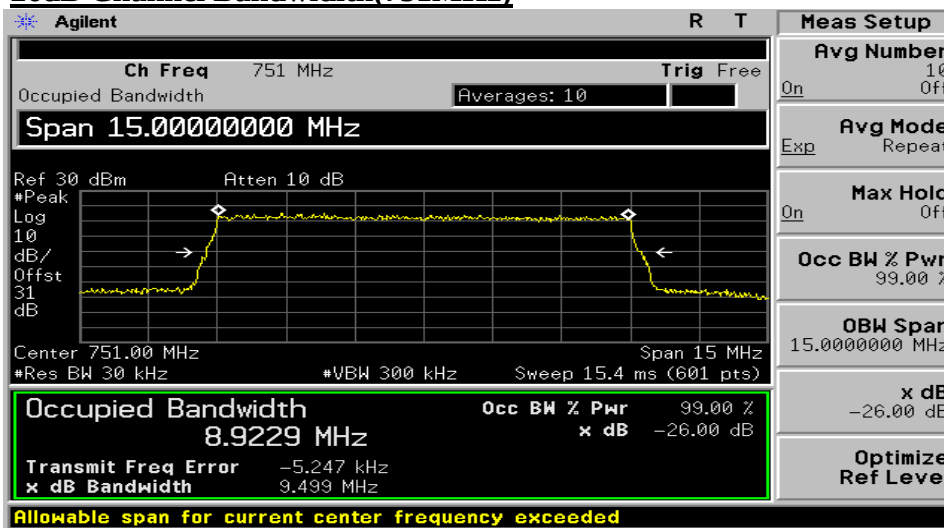
\* (U)=Upper 700MHz band)



## 5.4 Test Plot

Uplink-BW5MHz26dB Channel Bandwidth(701MHz)26dB Channel Bandwidth(707)

**Downlink-BW5MHz****26dB Channel Bandwidth(731MHz)****26dB Channel Bandwidth(737MHz)**

Uplink-BW10MHz26dB Channel Bandwidth(782MHz)Downlink-BW10MHz26dB Channel Bandwidth(751MHz)

## 6. Spurious and Harmonic Emission at Antenna Terminal

### 6.1 Test Procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to 10GHz. Set the RES BW to 1% of the emission bandwidth to show compliance with the -13dBm, limit, in the 1MHz bands immediately outside and adjacent to the top and bottom edges of the frequency block.

For the Out-of-Band measurements a 1MHz RBW was used to scan from 10MHz to 10xfo of the fundamental carrier for all frequency block. A display line was placed at -13dBm to show compliance for spurious, and harmonics.

27.53(C)(1)(3) , 27.53(F) , 27.53.(G): For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to –70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and –80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation

### 6.2 Test Equipments

The following test equipments are used during tests

| Equipment               | Manufacturer  | Model    | Next Cal.  |
|-------------------------|---------------|----------|------------|
| Spectrum Analyzer       | Agilent       | E4440A   | 2012-09-05 |
| Spectrum Analyzer       | Agilent       | E4402B   | 2012-02-24 |
| Spectrum Analyzer       | Agilent       | N9020A   | 2012-05-16 |
| Vector Signal Generator | Agilent       | N5182A   | 2012-05-16 |
| Vector Signal Generator | ROHDE&SCHWARZ | SMBV100A | 2012-02-15 |
| Signal Generator        | HP            | E4432B   | 2012-02-24 |

### 6.3 Test Results (Uplink)

(Spurious Emission: Band Edge)-BW5MHz

| Block | Frequency | Result | Limit  | Margin |
|-------|-----------|--------|--------|--------|
| A     | 697.62    | -15.46 | -13.00 | 2.46   |
| B     | 710.13    | -18.35 | -13.00 | 5.35   |

(Spurious Emission: Out of Band)-BW5MHz

| Block | Frequency | Result | Limit  | Margin |
|-------|-----------|--------|--------|--------|
| A     | 7302.00   | -26.66 | -13.00 | 13.66  |
| B     | 8306.00   | -27.75 | -13.00 | 14.75  |



### Test Results (Downlink)

(Spurious Emission: Band Edge)-BW5MHz

| Block | Frequency | Result | Limit  | Margin |
|-------|-----------|--------|--------|--------|
| A     | 727.48    | -28.18 | -13.00 | 15.18  |
| B     | 740.03    | -26.10 | -13.00 | 13.10  |

(Spurious Emission: Out of Band)-BW5MHz

| Block | Frequency | Result | Limit  | Margin |
|-------|-----------|--------|--------|--------|
| A     | 7390.00   | -28.05 | -13.00 | 15.05  |
| B     | 3474.00   | -26.85 | -13.00 | 13.85  |

### Test Results (Uplink)

(Spurious Emission: Band Edge)-BW10MHz

| Block | Frequency | Result | Limit  | Margin |
|-------|-----------|--------|--------|--------|
| C(U)  | 775.38    | -23.46 | -13.00 | 10.46  |
| C(U)  | 787.05    | -19.06 | -13.00 | 6.06   |

\* (U)=Upper 700MHz band)

(Spurious Emission: Out of Band)-BW10MHz

| Block | Frequency | Result | Limit  | Margin |
|-------|-----------|--------|--------|--------|
| C(U)  | 3098.00   | -27.34 | -13.00 | 14.34  |

\* (U)=Upper 700MHz band)

### Test Results (Downlink)

(Spurious Emission: Band Edge)-BW10MHz

| Channel | Frequency | Result | Limit  | Margin |
|---------|-----------|--------|--------|--------|
| C(U)    | 746.00    | -22.70 | -13.00 | 9.70   |
| C(U)    | 756.00    | -21.99 | -13.00 | 8.99   |

\* (U)=Upper 700MHz band)

(Spurious Emission: Out of Band)-BW10MHz

| Channel | Frequency | Result | Limit  | Margin |
|---------|-----------|--------|--------|--------|
| C(U)    | 6812.00   | -27.73 | -13.00 | 14.73  |

\* (U)=Upper 700MHz band)



## Test Results

(Spurious Emission)763-775MHz-BW10MHz

| Block | Frequency | Result | Limit  | Margin |
|-------|-----------|--------|--------|--------|
| C(U)  | 774.69    | -50.78 | -46.00 | 9.43   |

\* (U)=Upper 700MHz band)

# not : setup RBW(6.25kHz)

(Spurious Emission)793-805MHz-BW10MHz

| Channel | Frequency | Result | Limit  | Margin |
|---------|-----------|--------|--------|--------|
| C(U)    | 800.15    | -67.13 | -46.00 | 10.42  |

\* (U)=Upper 700MHz band)

# not : setup RBW(6.25kHz)

(Spurious Emission)1559-1610MHz-BW10MHz

| Block | Frequency | Result | Limit  | Margin | Ant Gain(dBi) |
|-------|-----------|--------|--------|--------|---------------|
| C(U)  | 1560.90   | -47.09 | -40.00 | 8.00   | 0.85          |

\* (U)=Upper 700MHz band)

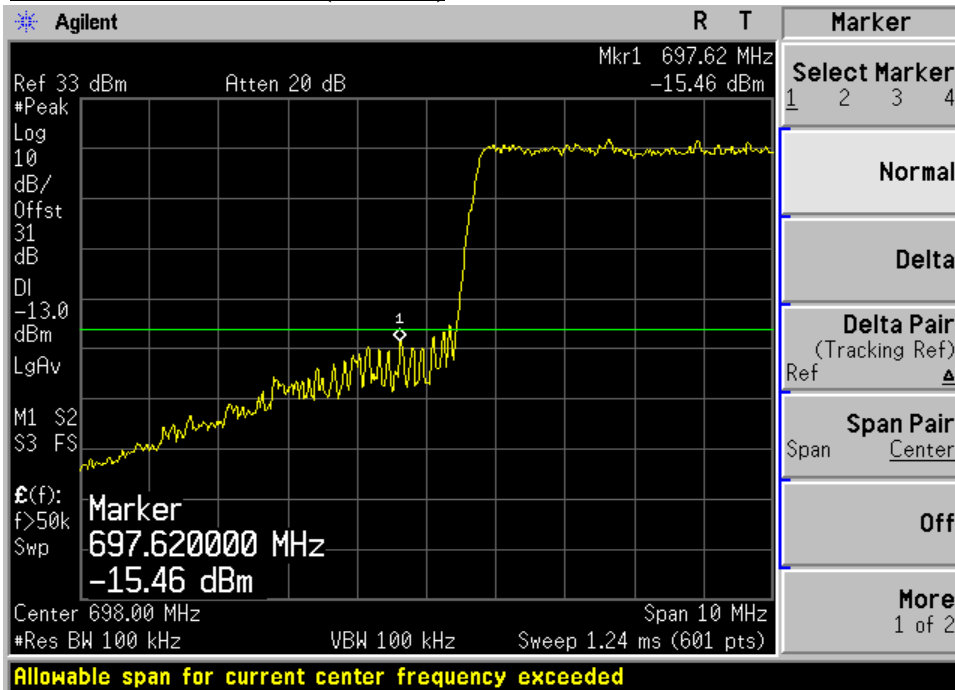
\*\* limit=-70dBW/MHz=-40dBm/MHz



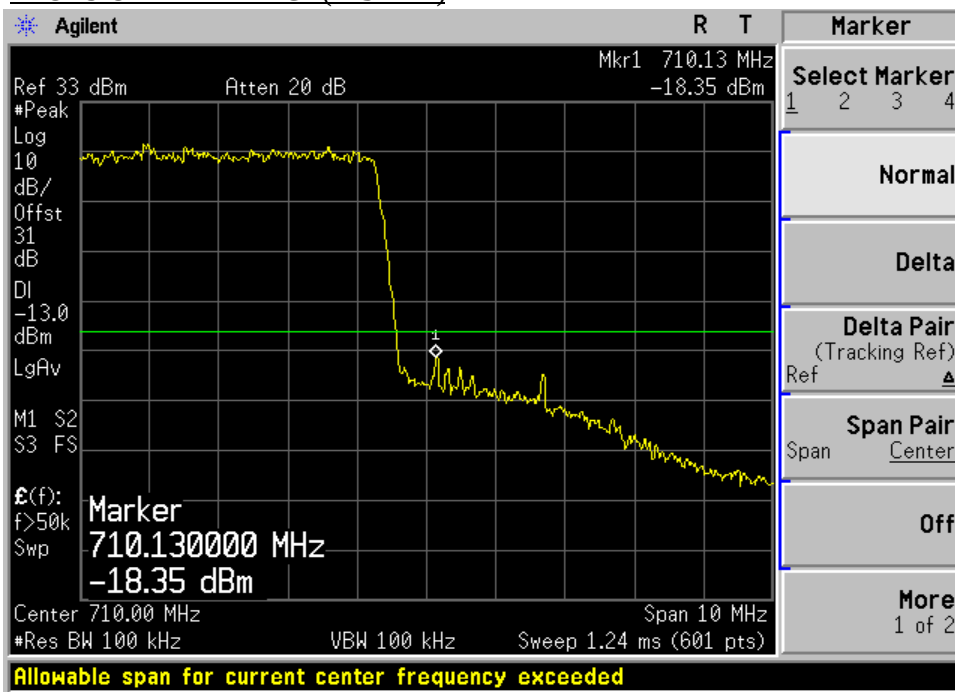
## 6.4 Test Plot

### Uplink-BW5MHz

#### PLOTS OF BAND EDGE(701MHz)



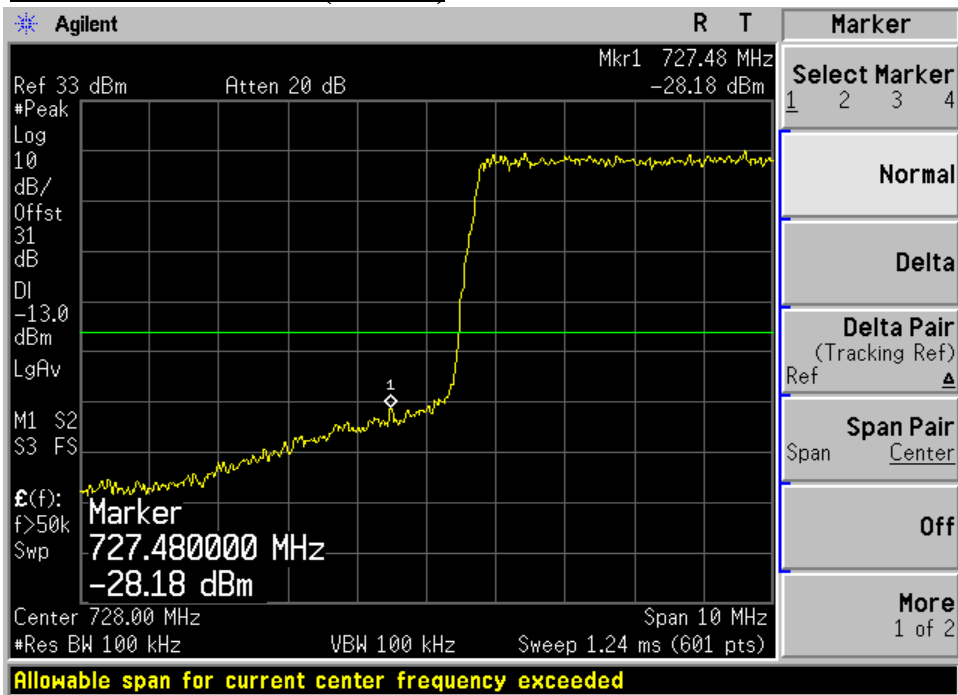
#### PLOTS OF BAND EDGE(713MHz)



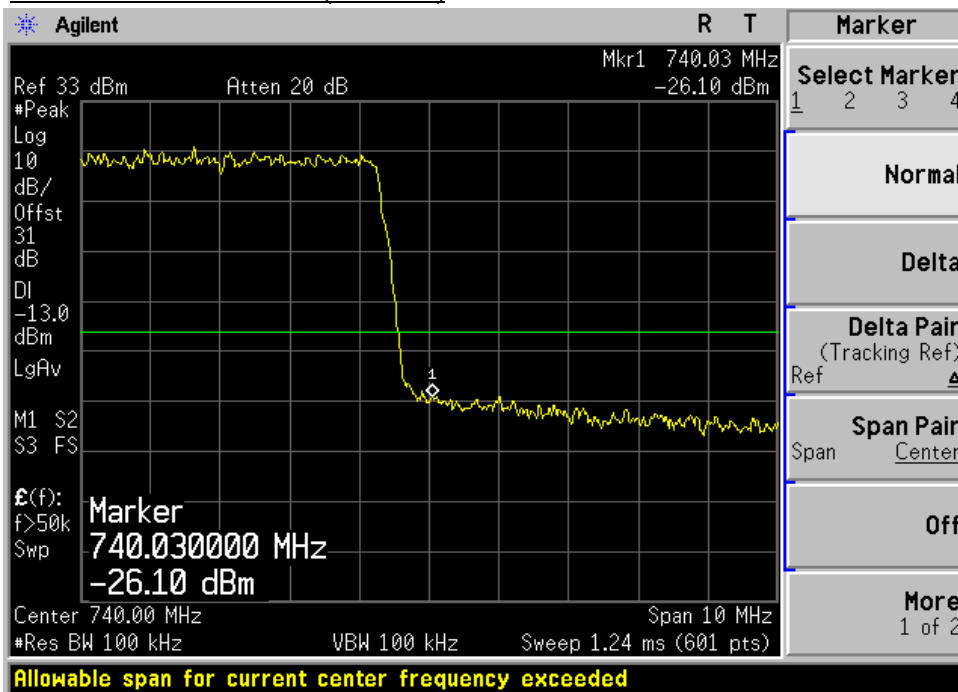


## Downlink-BW5MHz

### PLOTS OF BAND EDGE(731MHz)



### PLOTS OF BAND EDGE(743MHz)

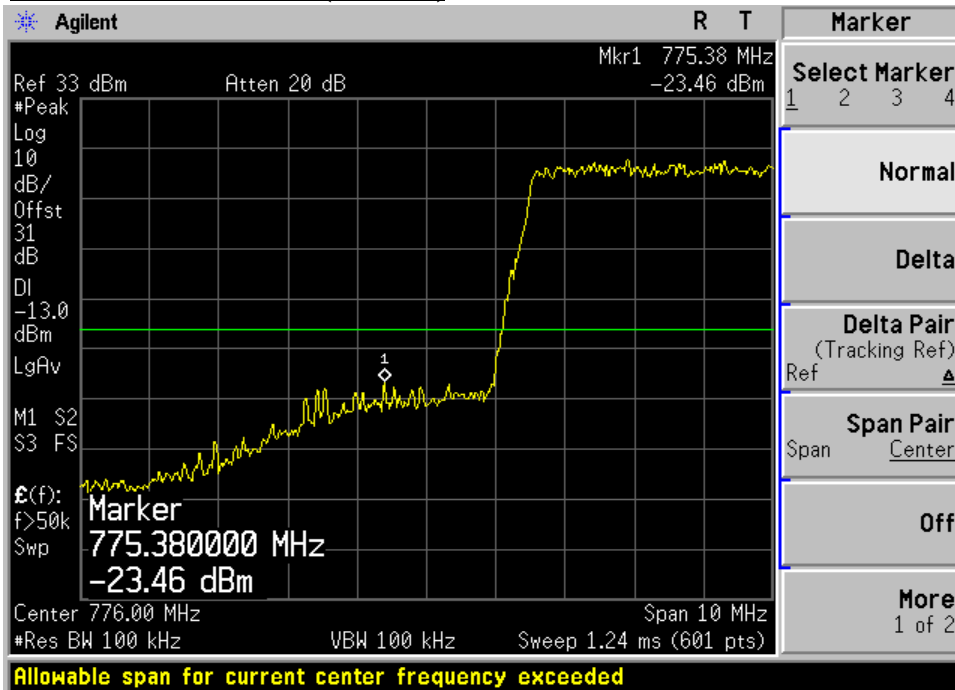




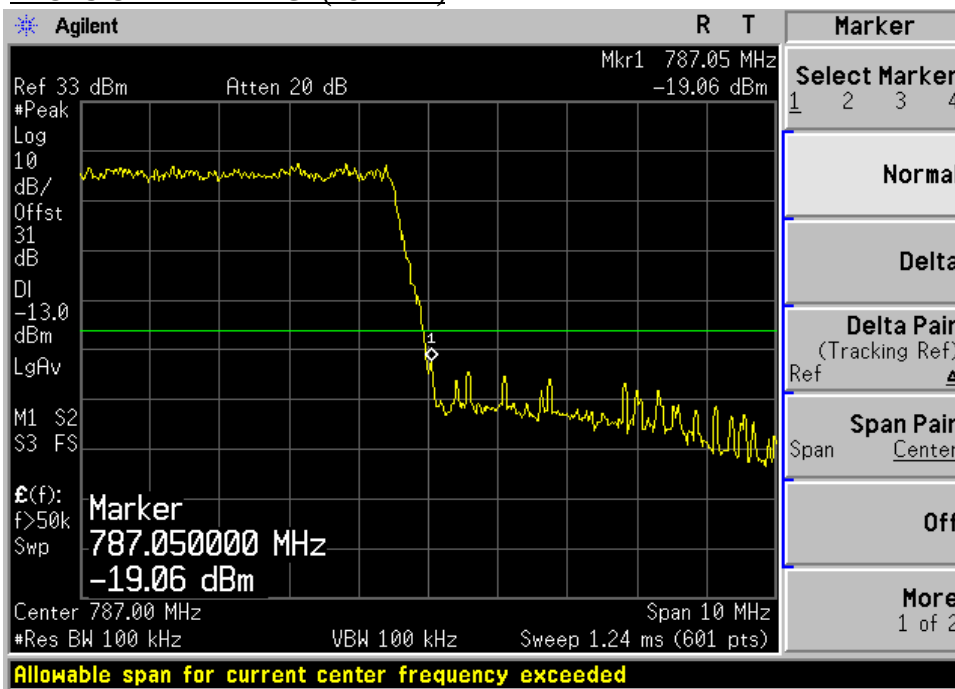
Test Plot

Uplink-BW10MHz

PLOTS OF BAND EDGE(782MHz)



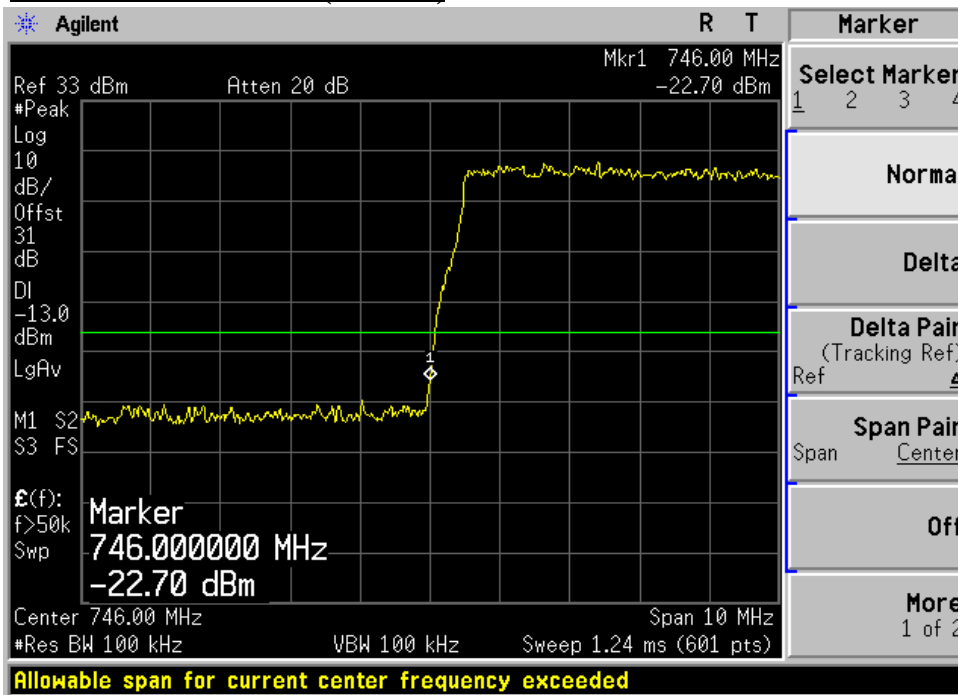
PLOTS OF BAND EDGE(782MHz)



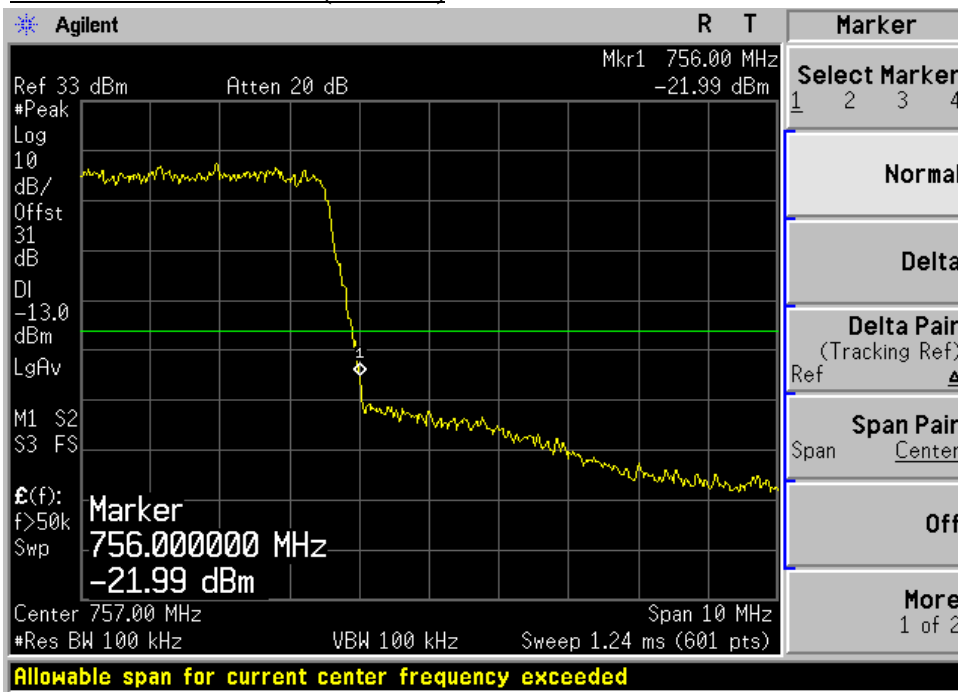


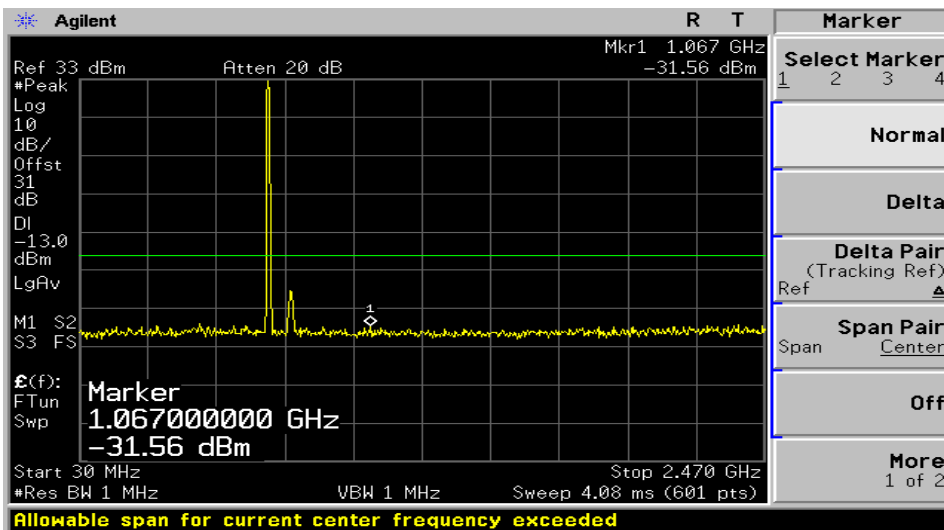
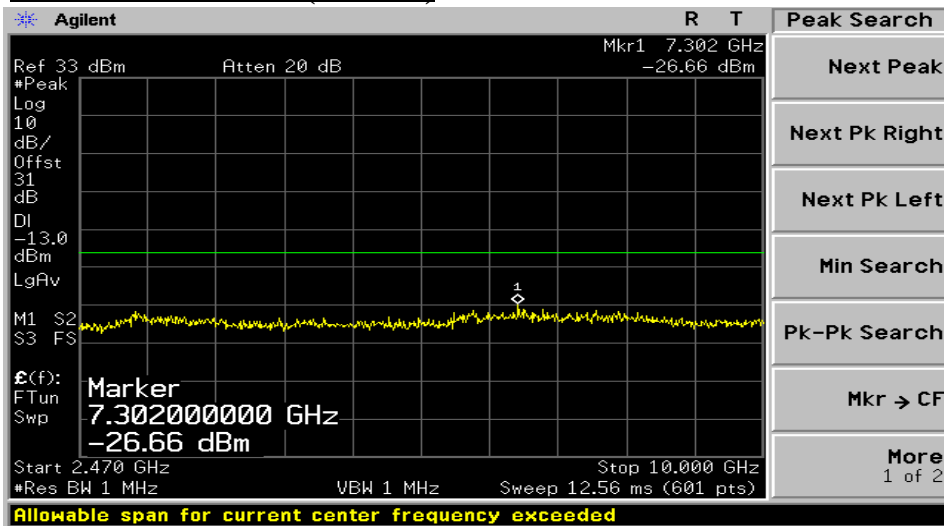
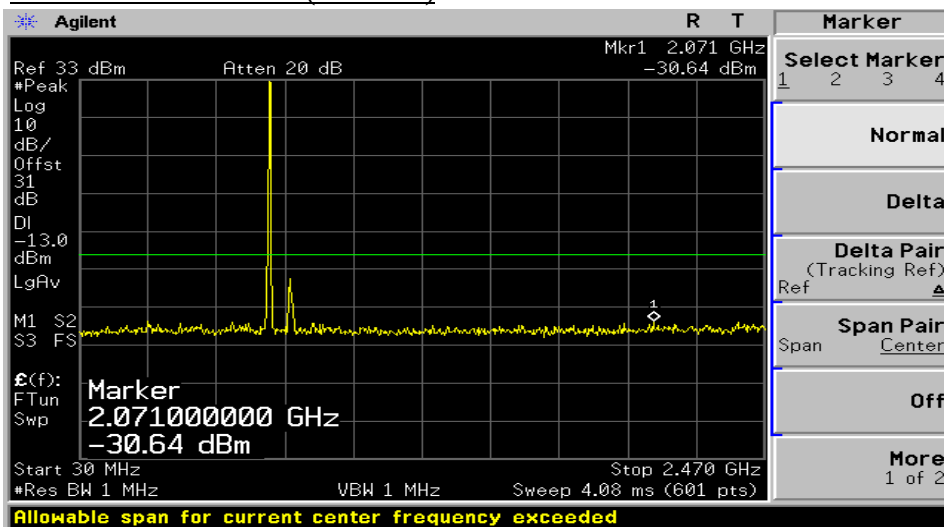
## Downlink-BW10MHz

### PLOTS OF BAND EDGE(751MHz)



### PLOTS OF BAND EDGE(751MHz)

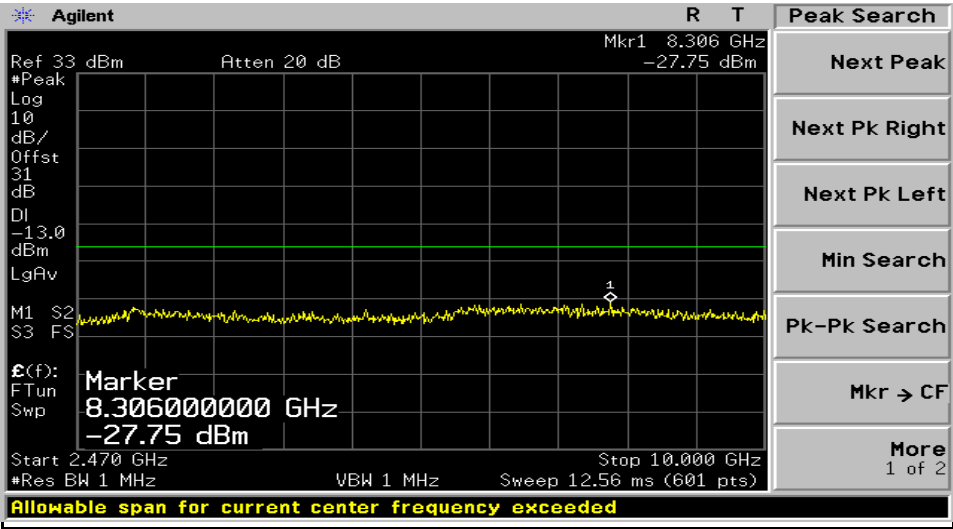


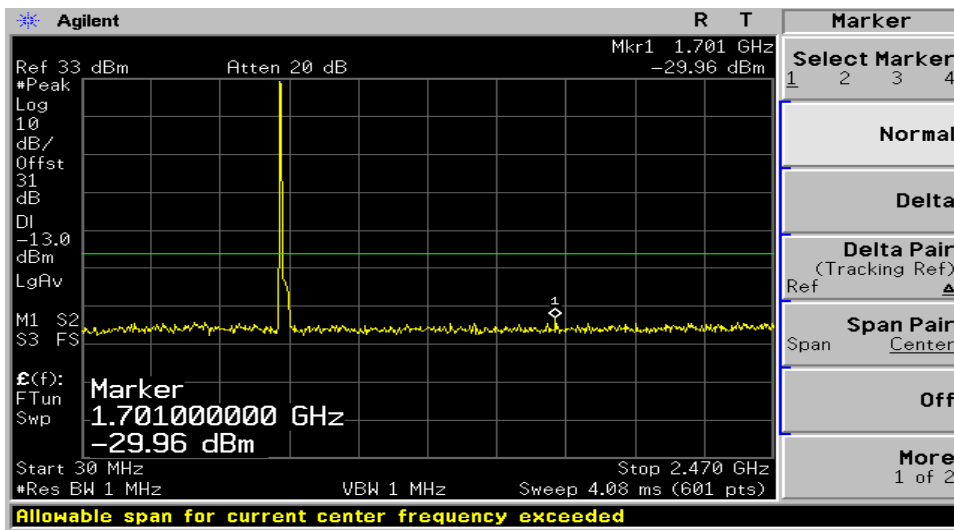
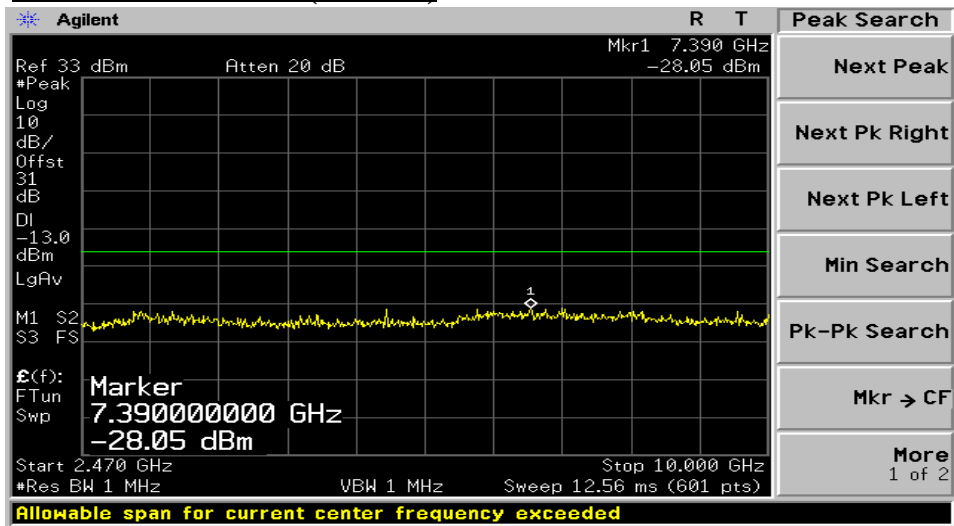
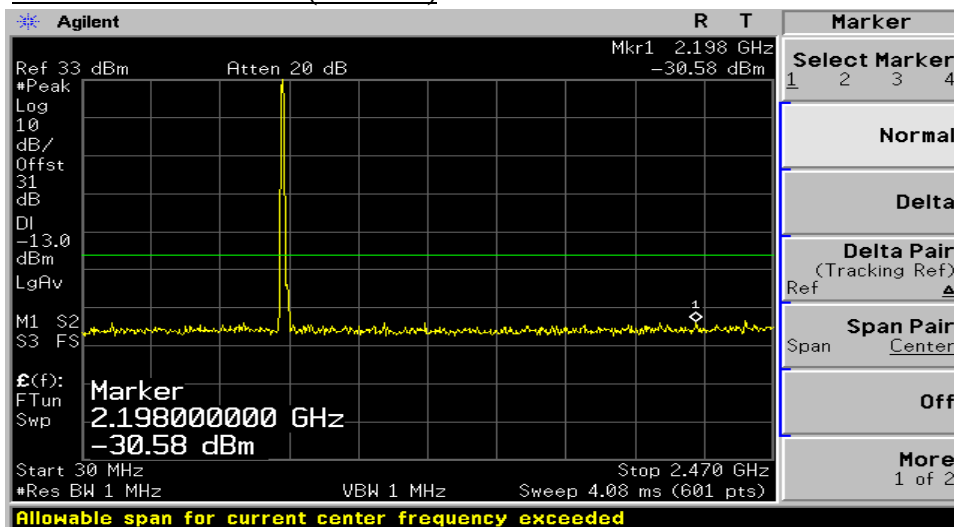
**Uplink-BW5MHz****PLOTS OF Out of Band (701MHZ)****PLOTS OF Out of Band (701MHZ)****PLOTS OF Out of Band (707MHZ)**



Uplink-BW5MHz

PLOTS OF Out of Band (707MHZ)

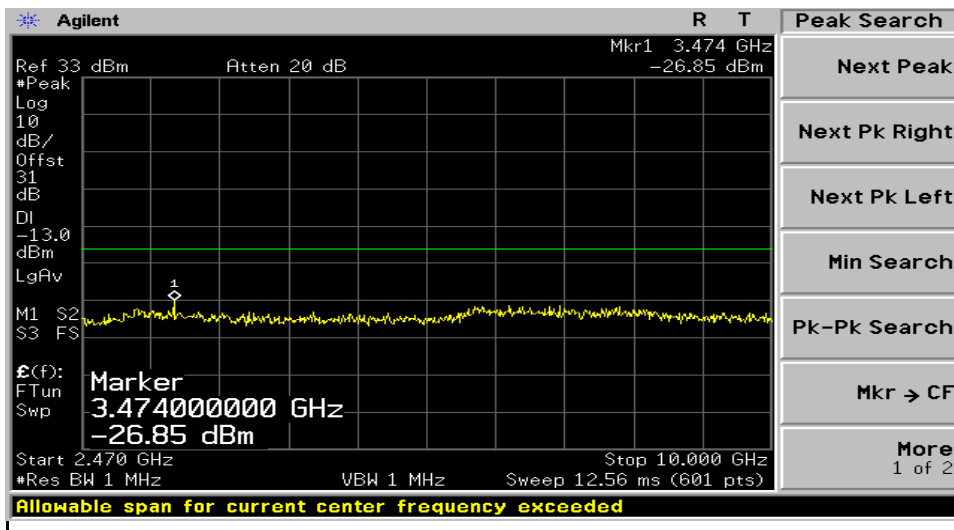


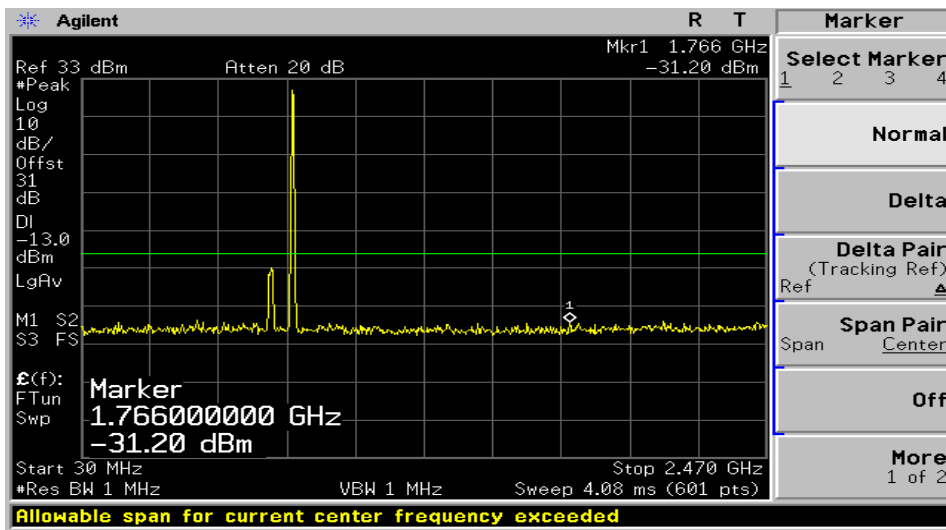
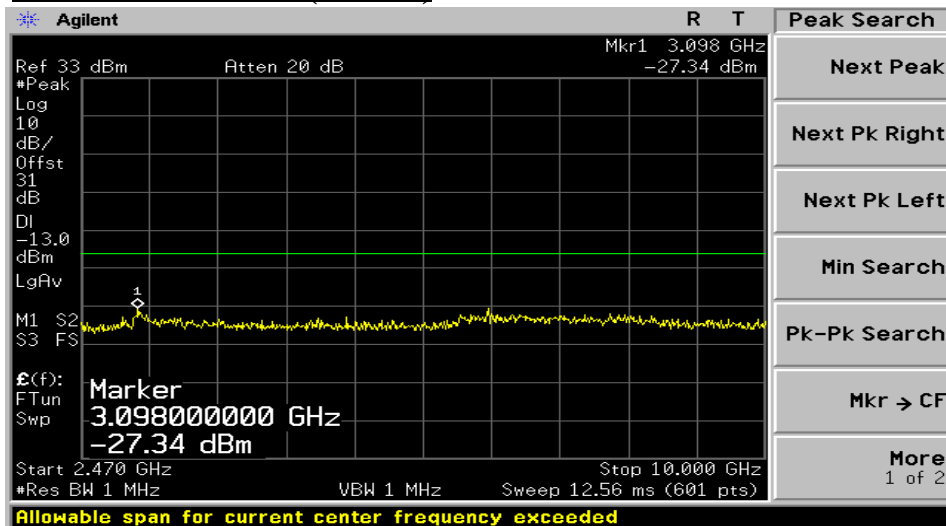
**Downlink-BW5MHz****PLOTS OF Out of Band (731MHZ)****PLOTS OF Out of Band (731MHZ)****PLOTS OF Out of Band (737MHZ)**

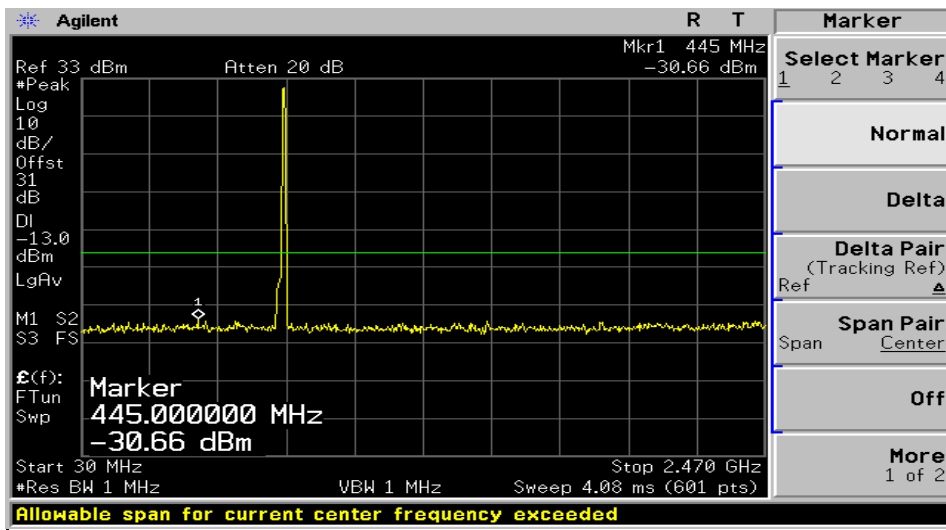
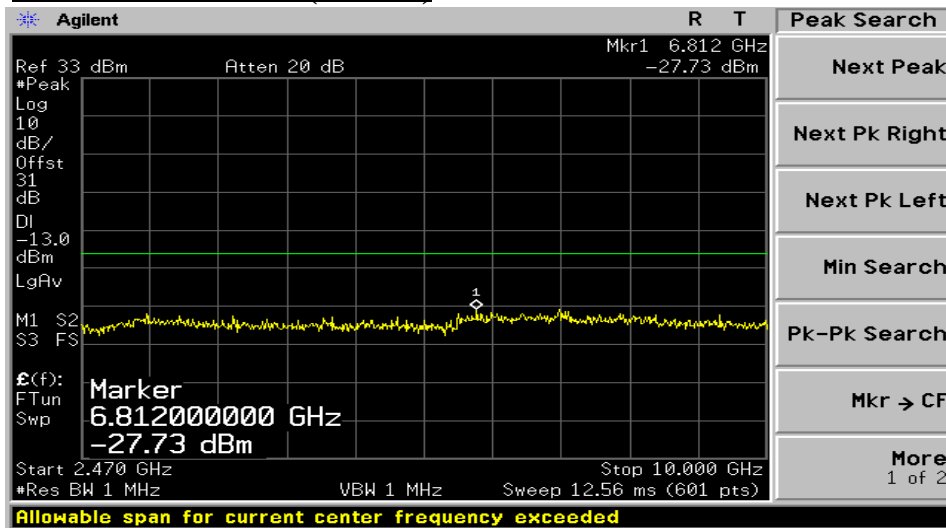


**Downlink-BW5MHz**

**PLOTS OF Out of Band (737MHZ)**



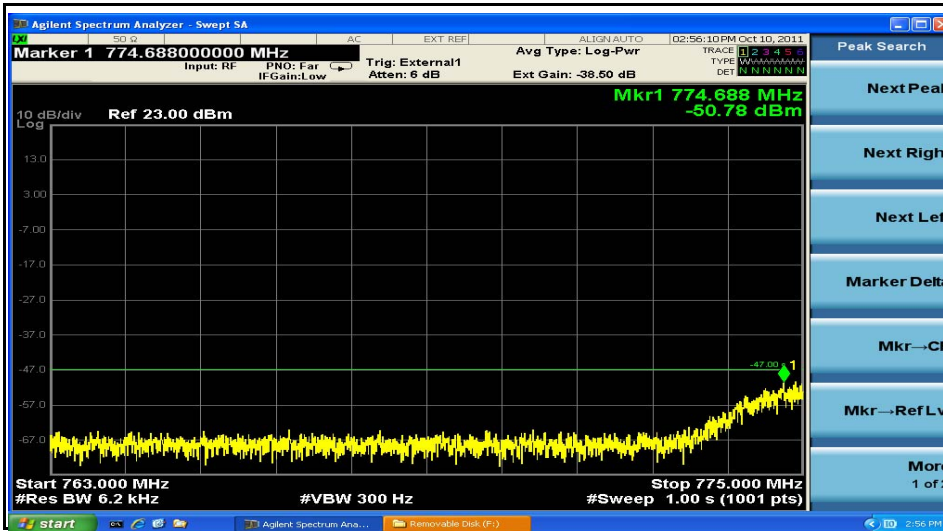
**Uplink-BW10MHz****PLOTS OF Out of Band (782MHz)****PLOTS OF Out of Band (782MHz)**

**Downlink-BW10MHz**PLOTS OF Out of Band (751MHz)PLOTS OF Out of Band (751MHz)

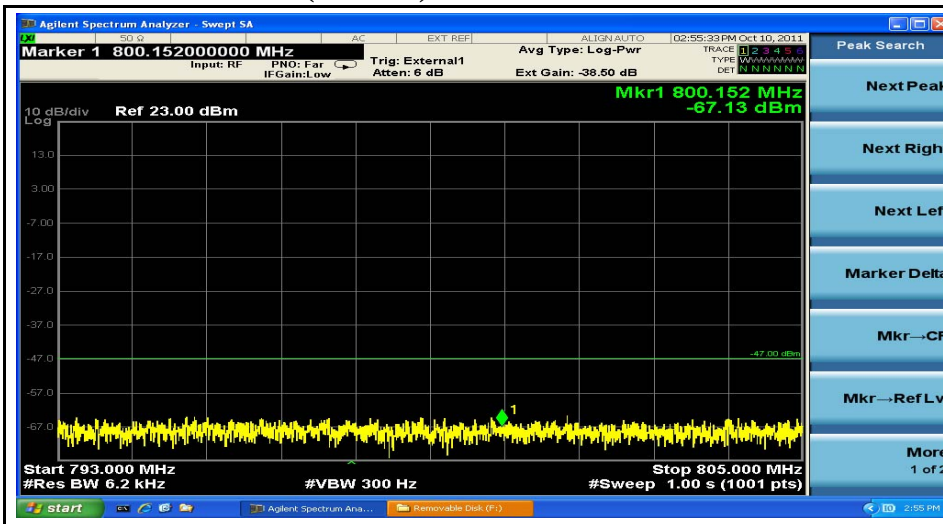


## Uplink-BW10MHz

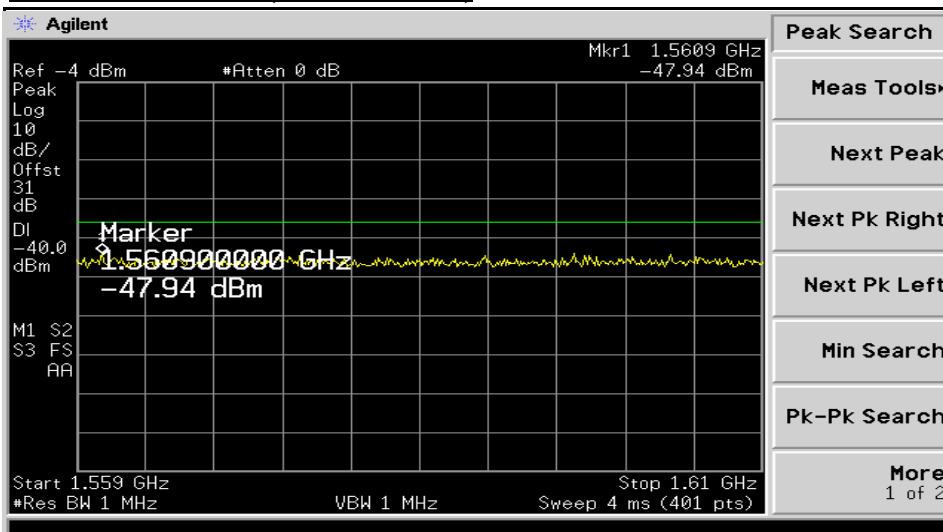
### PLOTS OF Out of Band (782MHz)



### PLOTS OF Out of Band (782MHz)



### PLOT OF Out of Ban(1559-1610MHz)



## 7. Field Strength of Spurious Radiation

### 7.1 Test Procedure according to ANSI/TIA/EIA 603 Clause 3.2.12 & FCC 27.53(c) & 27.53(f) & 27.53(g)

Radiation and harmonic emission are measured outdoors at our 3 meters test range. The equipment under test is placed on a wooden turntable 3 meters from the receive antenna. The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer (or receiver). A half wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer reading. This level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration. For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to –70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and –80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation

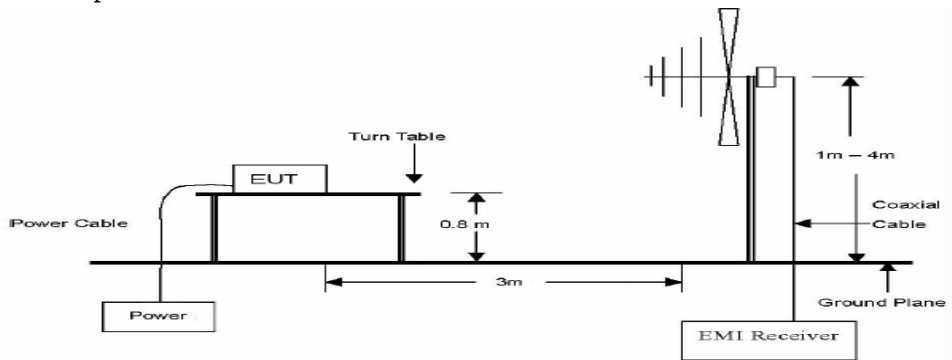
### 7.2 Test Equipments

The following test equipments are used during tests

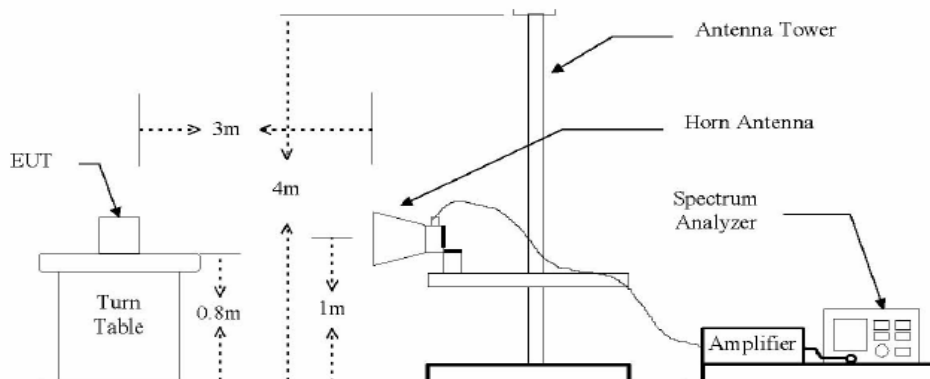
| Equipment         | Manufacturer    | Model       | Next Cal.  |
|-------------------|-----------------|-------------|------------|
| Spectrum Analyzer | Rohde & Schwarz | ESPI        | 2012-01-18 |
| Signal Generator  | HP              | 83620B      | 2012-08-30 |
| Power Meter       | HP              | EPM-442A    | 2012-01-27 |
| Power Sensor      | HP              | 8481A       | 2012-01-27 |
| Pre Amplifier     | HP              | 8449B       | 2012-01-27 |
| Attenuator        | JFW             | 50FH-010-5  | 2012-01-27 |
| Attenuator        | HP              | 8491B       | 2012-01-27 |
| Horn Antenna      | SCHWARZBECK     | BBHA 9120 D | 2012-09-06 |
| Horn Antenna      | SCHWARZBECK     | BBHA 9120 D | 2012-03-22 |

### 7.3 Test Setup

Test setup for 30 MHz to 1 GHz



Test setup for above 1 GHz





## 7.4 Test Results

### Uplink

#### 701MHz

| Frequency<br>(MHz) | Receiver<br>Reading(dBuV) | Correction Factor(dB) |        | ERP(dBm)   |        | Limit(dBm) | Polarity |
|--------------------|---------------------------|-----------------------|--------|------------|--------|------------|----------|
|                    |                           | AG(dBi)               | CL(dB) | SG Reading | Result |            |          |
| 1402.00            | 42.05                     | 5.85                  | 7.52   | -60.12     | -61.79 | -13.00     | H        |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |

#### 707MHz

| Frequency<br>(MHz) | Receiver<br>Reading(dBuV) | Correction Factor(dB) |        | ERP(dBm)   |        | Limit(dBm) | Polarity |
|--------------------|---------------------------|-----------------------|--------|------------|--------|------------|----------|
|                    |                           | AG(dBi)               | CL(dB) | SG Reading | Result |            |          |
| 1414.00            | 42.07                     | 5.95                  | 7.61   | -60.03     | -61.69 | -13.00     | H        |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |

#### Remark

- \* The TX signal isn't detected from 3rd harmonics.
- \* EIRP = SG Reading + AG(dBi)-CL(dB)
- \* ERP = SG Reading + AG(dBi)-CL(dB)+2.15(dB)



## Downlink

### 731MHz

| Frequency<br>(MHz) | Receiver<br>Reading(dBuV) | Correction Factor(dB) |        | ERP(dBm)   |        | Limit(dBm) | Polarity |
|--------------------|---------------------------|-----------------------|--------|------------|--------|------------|----------|
|                    |                           | AG(dBi)               | CL(dB) | SG Reading | Result |            |          |
| 1462.00            | 42.19                     | 6.38                  | 7.89   | -59.97     | -61.48 | -13.00     | H        |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |

### 737MHz

| Frequency<br>(MHz) | Receiver<br>Reading(dBuV) | Correction Factor(dB) |        | ERP(dBm)   |        | Limit(dBm) | Polarity |
|--------------------|---------------------------|-----------------------|--------|------------|--------|------------|----------|
|                    |                           | AG(dBi)               | CL(dB) | SG Reading | Result |            |          |
| 1474.00            | 43.01                     | 6.48                  | 7.89   | -58.51     | -59.92 | -13.00     | H        |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |

## **Remark**

- \* The TX signal isn't detected from 3rd harmonics.
- \* EIRP = SG Reading + AG(dBi)-CL(dB)
- \* ERP = SG Reading + AG(dBi)-CL(dB)+2.15(dB)



## Test Results

### Uplink

#### 782MHz

| Frequency<br>(MHz) | Receiver<br>Reading(dBuV) | Correction Factor(dB) |        | ERP(dBm)   |        | Limit(dBm) | Polarity |
|--------------------|---------------------------|-----------------------|--------|------------|--------|------------|----------|
|                    |                           | AG(dBi)               | CL(dB) | SG Reading | Result |            |          |
| 1564.00            | 42.01                     | 9.23                  | 9.89   | -59.05     | -59.71 | -40.00     | V        |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |

\* limit=-70dBW/MHz=-40dBm/MHz

### Downlink

#### 751MHz

| Frequency<br>(MHz) | Receiver<br>Reading(dBuV) | Correction Factor(dB) |        | ERP(dBm)   |        | Limit(dBm) | Polarity |
|--------------------|---------------------------|-----------------------|--------|------------|--------|------------|----------|
|                    |                           | AG(dBi)               | CL(dB) | SG Reading | Result |            |          |
| 1502.00            | 42.25                     | 6.69                  | 9.89   | -59.89     | -63.09 | -13.00     | H        |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |
|                    |                           |                       |        |            |        |            |          |

### Remark

- \* The TX signal isn't detected from 3rd harmonics.
- \* EIRP = SG Reading + AG(dBi)-CL(dB)
- \* ERP = SG Reading + AG(dBi)-CL(dB)+2.15(dB)

## 8. Frequency stability

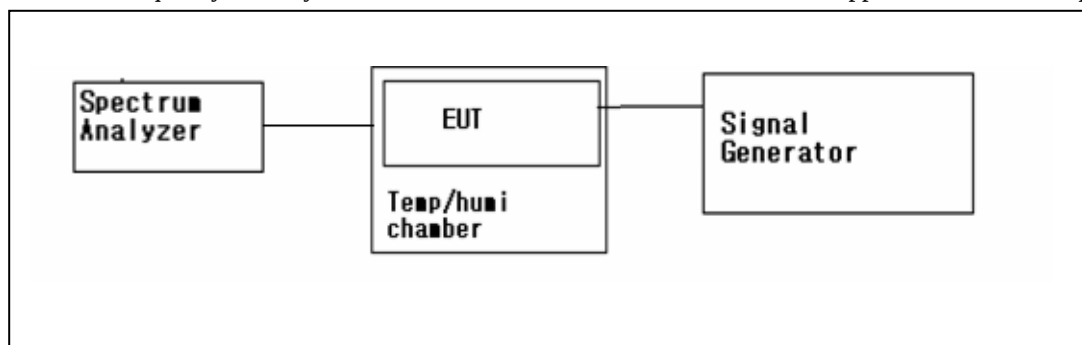
### 8.1 Test Procedure

The frequency stability of the transmitter is measured by:

**a) Temperature:** The temperature is varied from -30 °C to +60 °C using an environmental chamber.

**b) Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

※ 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  $\pm 2.5$ ppm of the center frequency.



### 8.2 Test Equipments

The following test equipments are used during tests

| Equipment               | Manufacturer     | Model    | Next Cal.  |
|-------------------------|------------------|----------|------------|
| Spectrum Analyzer       | Agilent          | E4440A   | 2012-09-05 |
| Spectrum Analyzer       | Agilent          | E4402B   | 2012-02-24 |
| Slidacs                 | Digitek power    | -        | N/A        |
| DC Power Supply         | INTERACT         | AK-3010  | 2012-02-24 |
| Tem/Hum Chamber         | TABAI ESPEC CORP | PSL-2GT  | 2012-02-07 |
| Vector Signal Generator | ROHDE&SCHWARZ    | SMBV100A | 2012-02-15 |
| Signal Generator        | HP               | E4432B   | 2012-02-24 |



### 8.3 Test Results

#### Uplink-BW5MHz

|                      |             |     |
|----------------------|-------------|-----|
| Operting Frequency : | 707,000,000 |     |
| Block :              | B           |     |
| Reference Voltage :  | 110.00      | VAC |
| Deviatin Limit :     | 0.00010     |     |

| Voltage (%) | Power (VAC) | Temperature (°C) | Frequency (Hz) | Deviation |
|-------------|-------------|------------------|----------------|-----------|
| 100         | 110.0       | +20 °C (Ref)     | 707,000,010    | 0.000010  |
| 100         |             | -30              | 707,000,005    | 0.000005  |
| 100         |             | -20              | 707,000,009    | 0.000009  |
| 100         |             | -10              | 707,000,008    | 0.000008  |
| 100         |             | 0                | 707,000,015    | 0.000015  |
| 100         |             | 10               | 707,000,012    | 0.000012  |
| 100         |             | 20               | 707,000,010    | 0.000010  |
| 100         |             | 25               | 707,000,006    | 0.000006  |
| 100         |             | 30               | 707,000,013    | 0.000013  |
| 100         |             | 40               | 707,000,019    | 0.000019  |
| 100         |             | 50               | 707,000,017    | 0.000017  |
| 100         |             | 60               | 707,000,020    | 0.000020  |
| 85          | 93.5        | 20               | 707,000,023    | 0.000023  |
| 115         | 126.5       | 20               | 707,000,017    | 0.000017  |
| EndPoint    | 85.0        | 20               | 707,000,019    | 0.000019  |



**Downlink-BW5MHz**

|                      |             |     |
|----------------------|-------------|-----|
| Operting Frequency : | 737,000,000 |     |
| Block :              | B           |     |
| Reference Voltage :  | 110.00      | VAC |
| Deviatin Limit :     | 0.00010     |     |

| Voltage (%) | Power (VAC) | Temperature (°C) | Frequency (Hz) | Deviation |
|-------------|-------------|------------------|----------------|-----------|
| 100         | 110.0       | +20 °C (Ref)     | 737,000,013    | 0.000013  |
| 100         |             | -30              | 737,000,011    | 0.000011  |
| 100         |             | -20              | 737,000,019    | 0.000019  |
| 100         |             | -10              | 737,000,020    | 0.000020  |
| 100         |             | 0                | 737,000,014    | 0.000014  |
| 100         |             | 10               | 737,000,017    | 0.000017  |
| 100         |             | 20               | 737,000,013    | 0.000013  |
| 100         |             | 25               | 737,000,022    | 0.000022  |
| 100         |             | 30               | 737,000,015    | 0.000015  |
| 100         |             | 40               | 737,000,019    | 0.000019  |
| 100         |             | 50               | 737,000,012    | 0.000012  |
| 100         |             | 60               | 737,000,016    | 0.000016  |
| 85          | 93.5        | 20               | 737,000,017    | 0.000017  |
| 115         | 126.5       | 20               | 737,000,019    | 0.000019  |
| EndPoint    | 85.0        | 20               | 737,000,012    | 0.000012  |



**Uplink-BW10MHz**

|                      |             |     |
|----------------------|-------------|-----|
| Operting Frequency : | 782,000,000 |     |
| Channel :            | C(U)        |     |
| Reference Voltage :  | 110.00      | VAC |
| Deviatin Limit :     | 0.00010     |     |

| Voltage<br>(%) | Power<br>(VAC) | Temperature<br>(°C) | Frequency<br>(Hz) | Deviation |
|----------------|----------------|---------------------|-------------------|-----------|
| 100            | 110.0          | +20 °C (Ref)        | 782,000,008       | 0.000000  |
| 100            |                | -30                 | 782,000,009       | 0.000001  |
| 100            |                | -20                 | 782,000,002       | 0.000001  |
| 100            |                | -10                 | 782,000,016       | 0.000001  |
| 100            |                | 0                   | 782,000,015       | 0.000001  |
| 100            |                | 10                  | 782,000,011       | 0.000001  |
| 100            |                | 20                  | 782,000,008       | 0.000000  |
| 100            |                | 25                  | 782,000,003       | 0.000001  |
| 100            |                | 30                  | 782,000,007       | 0.000001  |
| 100            |                | 40                  | 782,000,008       | 0.000001  |
| 100            |                | 50                  | 782,000,010       | 0.000001  |
| 100            |                | 60                  | 782,000,015       | 0.000001  |
| 85             | 93.5           | 20                  | 782,000,016       | 0.000002  |
| 115            | 126.5          | 20                  | 782,000,018       | 0.000001  |
| EndPoint       | 85.0           | 20                  | 782,000,008       | 0.000001  |



**Downlink-BW10MHz**

|                      |             |     |
|----------------------|-------------|-----|
| Operting Frequency : | 751,000,000 |     |
| Channel :            | C(U)        |     |
| Reference Voltage :  | 110.00      | VAC |
| Deviatin Limit :     | 0.00010     |     |

| Voltage<br>(%) | Power<br>(VAC) | Temperature<br>(°C) | Frequency<br>(Hz) | Deviation |
|----------------|----------------|---------------------|-------------------|-----------|
| 100            | 110.0          | +20 °C (Ref)        | 751,000,011       | 0.000000  |
| 100            |                | -30                 | 751,000,016       | 0.000001  |
| 100            |                | -20                 | 751,000,008       | 0.000001  |
| 100            |                | -10                 | 751,000,011       | 0.000001  |
| 100            |                | 0                   | 751,000,014       | 0.000001  |
| 100            |                | 10                  | 751,000,016       | 0.000001  |
| 100            |                | 20                  | 751,000,011       | 0.000000  |
| 100            |                | 25                  | 751,000,020       | 0.000001  |
| 100            |                | 30                  | 751,000,016       | 0.000001  |
| 100            |                | 40                  | 751,000,018       | 0.000001  |
| 100            |                | 50                  | 751,000,015       | 0.000001  |
| 100            |                | 60                  | 751,000,014       | 0.000001  |
| 85             | 93.5           | 20                  | 751,000,019       | 0.000002  |
| 115            | 126.5          | 20                  | 751,000,017       | 0.000001  |
| EndPoint       | 85.0           | 20                  | 751,000,020       | 0.000001  |

# Appendix 1

## RF Exposure Measurement

### 1. Introduction

**The maximum Gain measured in Fully Anechoic Chamber is 0.85dBi or 1.22 (numeric).**

Because this device is transmitting the high power signal, it is regarded specially as a dangerous band for its heating harmfulness to the human body. The manufacturer whose product is working in this frequency band is obligatory to prove the harmfulness of his product.

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Fully Anechoic Chamber (FAC), and the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is

### 2. Classification

MODE: LTE

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement for keeping 20cm separation distance and the prohibition of operating next to a person has been printed on the user's manual. So, this product is classified as the Mobile Device.

### 3. RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency(RF) radiation as specified in 1.1307(b).

#### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) - Class A

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm <sup>2</sup> ) | Average Time (minutes) |
|-----------------------|-------------------------------|------------------------------|-------------------------------------|------------------------|
| 0.3 - 3.0             | 614                           | 1.63                         | *(100)                              | 6                      |
| 3.0 - 30              | 1842/f                        | 4.89/f                       | *(900/f <sup>2</sup> )              | 6                      |
| 30 - 300              | 61.4                          | 0.163                        | 1.0                                 | 6                      |
| 300 - 1500            |                               |                              | F/300                               | 6                      |
| 1500 - 100,000        |                               |                              | 5                                   | 6                      |

#### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) - Class B

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm <sup>2</sup> ) | Average Time (minutes) |
|-----------------------|-------------------------------|------------------------------|-------------------------------------|------------------------|
| 0.3 - 1.34            | 614                           | 1.63                         | *(100)                              | 30                     |
| 1.34 - 30             | 824/f                         | 2.19/f                       | *(180/f <sup>2</sup> )              | 30                     |
| 30 - 300              | 27.5                          | 0.073                        | 0.2                                 | 30                     |
| 300 - 1500            | -                             | -                            | F/1500                              | 30                     |
| 1500 - 100,000        | -                             | -                            | 1.0                                 | 30                     |

Frequency in MHz



## 4. Friis Formula

Friis transmission formula :  $P_d = (P_{out} * G) / (4 * \pi * r^2)$

The maximum Gain measured in Fully Anechoic Chamber is 0.85dBi or 1.22 (numeric).

$P_{out}$  = output power to antenna in mW

G = gain of antenna in linear scale

$\pi = 3.1416$

MODE: LTE

$P_d$  is the limit of MPE,  $1\text{mW}/\text{cm}^2$ . If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance  $r$  where the MPE limit is reached.

The software provided by Manufacturer enabled the EUT to transmit with max power at lowest, middle and highest channel individually.



## 6. Test Results

### 6.1 Antenna Gain

The maximum Gain measured in Fully Anechoic Chamber is 0.85dBi or 1.22 (numeric).

### 6.2 Output Power into Antenna & RF Exposure value at distance 20cm:

MODE: Uplink

| Band | Channel Frequency (MHz) | Output Power to Antenna (mW) | Power Density (mW/cm <sup>2</sup> ) | Limit of Power Density (mW/cm <sup>2</sup> ) |
|------|-------------------------|------------------------------|-------------------------------------|----------------------------------------------|
| A    | 701.00                  | 977.20                       | 0.16525                             | 0.5                                          |
| B    | 707.00                  | 988.60                       | 0.16717                             | 0.5                                          |
| C(U) | 782.00                  | 993.10                       | 0.16793                             | 0.5                                          |

MODE: (Down Link)

| Channel | Channel Frequency (MHz) | Output Power to Antenna (mW) | Power Density (mW/cm <sup>2</sup> ) | Limit of Power Density (mW/cm <sup>2</sup> ) |
|---------|-------------------------|------------------------------|-------------------------------------|----------------------------------------------|
| A       | 731.00                  | 990.80                       | 0.16755                             | 0.5                                          |
| B       | 737.00                  | 977.20                       | 0.16525                             | 0.5                                          |
| C(U)    | 751.00                  | 984.00                       | 0.16640                             | 0.5                                          |

The minimum allowable distance is very close to the enclosure of the antenna and is very far away from the human being under normal use condition.