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## FCC PART 90 TEST REPORT

### FCC Part 90

Report Reference No.: TRE1205003301

FCC ID: YAMMT680F4

Compiled by

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*Wenliang Li*

Date of issue: June 06, 2012

Testing Laboratory Name: Shenzhen Huatongwei International Inspection Co., Ltd

Address: Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China

Applicant's name: Hytera Communications Corporation Ltd.

Address: HYT Tower, Hi-Tech Industrial Park North, Nanshan District, Shenzhen China. 518057

#### Test specification:

Standard: FCC Part 90 / FCC Part 2

FCC Waiver for Tetra FCC 11-63 and FCC DA 11-1604

TRF Originator: Shenzhen Huatongwei International Inspection CO., Ltd

Master TRF: Dated 2006-06

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Test item description: TETRA Mobile Terminal

Trade Mark: 

Manufacturer: Hytera Communications Corporation Ltd.

Model/Type reference: MT680 F4

Listed Models: /

Modulation:  $\pi/4$  DQPSK

Channel Separation: 25KHz

Rated Power: 10.0 Watts(40.00dBm)

Operation Frequency: 410MHz-470MHz

Ratings: DC 13.20 V

Result: Positive

**T E S T   R E P O R T**

|   |                                |
|---|--------------------------------|
| <b>Test Report No. :</b> <b>TRE1205003301</b> | June 06, 2012<br>Date of issue |
|---|--------------------------------|

Equipment under Test                      :            TETRA Mobile Terminal

Model /Type                                        :            MT680 F4

Listed Models                                        :            /

**Applicant**    :            **Hytera Communications Corporation Ltd.**

Address    :            HYT Tower,Hi-Tech Industrial Park North,Nanshan  
District,Shenzhen China.518057

**Manufacturer**    :            **Hytera Communications Corporation Ltd.**

Address    :            HYT Tower,Hi-Tech Industrial Park North,Nanshan  
District,Shenzhen China.518057

|   |                 |
|---|-----------------|
| <b>Test Result</b> according to the<br>standards on page 4: | <b>Positive</b> |
|---|-----------------|

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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## **1. TEST STANDARDS**

The tests were performed according to following standards:

**FCC Rules Part 90:** PRIVATE LAND MOBILE RADIO SERVICES.

**TIA/EIA 603:** Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

**FCC Rules Part 15 Subpart B:** RADIO FREQUENCY DEVICES-Unintentional Radiators

**FCC Part 2:** FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

**FCC Waiver for Tetra FCC 11-63 and FCC DA 11-1604**

## 2. SUMMARY

### 2.1. General Remarks

|                                |   |               |
|--------------------------------|---|---------------|
| Date of receipt of test sample | : | May 03, 2012  |
|                                |   |               |
| Testing commenced on           | : | May 03, 2012  |
|                                |   |               |
| Testing concluded on           | : | June 06, 2012 |

### 2.2. Product Description

The Hytera Communications Corporation Ltd.'s Model: MT680 F4 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

|                           |                       |                                       |
|---------------------------|-----------------------|---------------------------------------|
| Name of EUT               | TETRA Mobile Terminal |                                       |
| Model Number              | MT680 F4              |                                       |
| FCC ID                    | YAMMT680F4            |                                       |
| Rated Output Power        | 10Watt(40.00dBm)      |                                       |
| Modulation Type           | $\pi/4$ DQPSK         |                                       |
| Channel Separation        | 25KHz                 |                                       |
| Emission Designation      | 20K0DXW/20K0GXW       |                                       |
| Antenna Type              | External              |                                       |
| Frequency Range           | 410MHz-470MHz         |                                       |
| Maximum Transmitter Power | DMO                   | 11.75 W for 25 KHz Channel Separation |
|                           | TMO                   | 11.61 W for 25 KHz Channel Separation |

### 2.3. Equipment under Test

#### Power supply system utilised

|                      |   |   |                                   |
|----------------------|---|---|-----------------------------------|
| Power supply voltage | : | <input type="radio"/> 120V / 60 Hz                                | <input type="radio"/> 115V / 60Hz |
|                      |   | <input type="radio"/> 12 V DC                                     | <input type="radio"/> 24 V DC     |
|                      |   | <input checked="" type="radio"/> Other (specified in blank below) |                                   |

DC 13.20 V

#### Test frequency list

| Modulation Type | Test Mode | Test Channel   | Test Frequency |         | Remark       |
|-----------------|-----------|----------------|----------------|---------|--------------|
|                 |           |                | Tx             | Rx      |              |
| DQPSK           | TMO       | Low Channel    | 450 MHz        | 460 MHz | Only for FCC |
|                 |           | High Channel   | 460 MHz        | 470 MHz | Only for FCC |
|                 | DMO       | Low Channel    | 450 MHz        | 450 MHz | Only for FCC |
|                 |           | Middle Channel | 460 MHz        | 460 MHz | Only for FCC |
|                 |           | High Channel   | 470 MHz        | 470 MHz | Only for FCC |

### 2.4. Short description of the Equipment under Test (EUT)

410-470 MHz U frequency band TETRA Mobile Terminal with GPS function (MT680 F4).

For more details, refer to the user's manual of the EUT.

Serial number: Prototype

FCC ID: YAMMT680F4

## 2.5. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

## 2.6. EUT operation mode

The EUT was operating in normal operation mode according to ETSI EN 300 392-1 during the tests (unless otherwise stated)

## 2.7. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

|   |             |                |              |
|---|-------------|----------------|--------------|
| ○ | Power Cable | Length (m) :   | 3.00         |
|   |             | Shield :       | Unshield     |
|   |             | Detachable :   | Undetachable |
| ○ | Multimeter  | Manufacturer : | /            |
|   |             | Model No. :    | /            |

## 2.8. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **YAMMT680F4** filing to comply with FCC Part 90 Rules and FCC Waiver for Tetra FCC 11-63 and FCC DA 11-1604.

## 2.9. Modifications

No modifications were implemented to meet testing criteria.

## 2.10. Note

1. The EUT is a U frequency band (410-470 MHz) TETRA Mobile Terminal with GPS function, The functions of the EUT listed as below:

|        | Test Standards           | Reference Report |
|--------|--------------------------|------------------|
| Radio  | FCC Part 90 & FCC Waiver | TRE1205003301    |
| Health | Oet 65                   | TRE1205003302    |
| Health | Oet65                    | TRE1205003303    |

### **3. TEST ENVIRONMENT**

#### **3.1. Address of the test laboratory**

Shenzhen Huatongwei International Inspection Co., Ltd  
Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China  
Phone: 86-755-26715686 Fax: 86-755-26748089

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2009) and CISPR Publication 22.

#### **3.2. Test Facility**

The test facility is recognized, certified, or accredited by the following organizations:

##### **CNAS-Lab Code: L1225**

Shenzhen Huatongwei International Inspection Co., Ltd has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: August 02, 2007. Valid time is until Feb 28, 2015.

##### **A2LA-Lab Cert. No. 2243.01**

Shenzhen Huatongwei International Inspection Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time to Sep 30, 2013.

##### **FCC-Registration No.: 662850**

Shenzhen Huatongwei International Inspection Co., Ltd, EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 662850, Renewal date June 01, 2012.

##### **IC-Registration No.: 5377**

The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377 on February 24th, 2011.

##### **ACA**

Shenzhen Huatongwei International Inspection Co., Ltd, EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

##### **NEMKO-Aut. No.: ELA125**

Shenzhen Huatongwei International Inspection Co., Ltd has been assessed the quality assurance system, the testing facilities, qualifications and testing practices of the relevant parts of the organization. The quality assurance system of the Laboratory has been validated against ISO/IEC 17025:2005 or equivalent. The laboratory also fulfils the conditions described in Nemko Document NLA-10; the Authorization is valid through July 07, 2013.

##### **VCCI**

The 3m Semi-anechoic chamber (12.2m×7.95m×6.7m) and Shielded Room (8m×4m×3m) of Shenzhen Huatongwei International Inspection Co., Ltd has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2484. Date of Registration: December 20, 2009. Valid time is until December 19, 2012.

Main Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-2726. Date of Registration: December 20, 2009. Valid time is until December 19, 2012.

## DNV

Shenzhen Huatongwei International Inspection Co Ltd has been found to comply with the requirements of DNV towards subcontractor of EMC and safety testing services in conjunction with the EMC and Low voltage Directives and in the voluntary field. The acceptance is based on a formal quality Audit and follow-ups according to relevant parts of ISO/IEC Guide 17025(2005), in accordance with the requirements of the DNV Laboratory Quality Manual towards subcontractors. Valid time is until 24 August, 2013.

### 3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

|                       |              |
|-----------------------|--------------|
| Temperature:          | 15-35 ° C    |
| Humidity:             | 30-60 %      |
| Atmospheric pressure: | 950-1050mbar |

### 3.4. Configuration of Tested System

Fig. 2-1 Configuration of Tested System

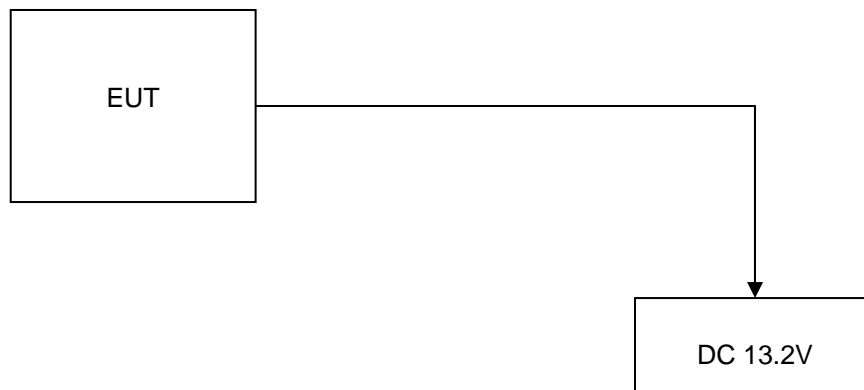


Table 2-1 Equipment Used in Tested System

### 3.5. Discription of Tested Modes

The EUT (TETRA Mobile Terminal) has been tested under normal operating condition. Six channels (the high, the middle and the low) are chosen for testing at channel separation (25 KHz).

### 3.6. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Huatongwei laboratory is reported:



| Test Items                                 | Measurement Uncertainty | Notes |
|--|-------------------------|-------|
| Frequency stability                        | 150 Hz                  | (1)   |
| Transmitter power conducted                | 0.30 dB                 | (1)   |
| Transmitter power Radiated                 | 2.20 dB                 | (1)   |
| Conducted spurious emission 9KHz-12.75 GHz | 1.60 dB                 | (1)   |
| Radiated spurious emission 9KHz-12.75 GHz  | 2.20 dB                 | (1)   |
| Conducted Emission 9KHz-30MHz              | 3.39 dB                 | (1)   |
| Radiated Emission 30~1000MHz               | 4.24 dB                 | (1)   |
| Radiated Emissio 1~18GHz                   | 5.16 dB                 | (1)   |
| Radiated Emissio 18-40GHz                  | 5.54 dB                 | (1)   |
| Occupied Bandwidth                         | -----                   | (1)   |
| Emission Mask                              | -----                   | (1)   |
| Modulation Characteristic                  | -----                   | (1)   |
| Transmitter Frequency Behavior             | -----                   | (1)   |

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

### 3.7. Test Description

| FCC Rules | Description of Test                   | Test Result |
|-----------|---------------------------------------|-------------|
| § 15.107  | Conducted Emission                    | Complies    |
| § 15.109  | Receiver Radiated Spurious Emssion    | Complies    |
| § 15.109  | Receiver Conducted Spurious Emssion   | Complies    |
| § 90.205  | Maximum Transmitter Power             | Complies    |
| § 90.207  | Modulation Characteristic             | N/A         |
| § 90.209  | Occupied Bandwidth                    | Complies    |
| § 90.210  | Emission Mask                         | N/A         |
| § 90.221  | Adjacent Channel Power                | Complies    |
| § 90.213  | Frequency Stability                   | Complies    |
| § 90.214  | Transmitter Frequency Behavior        | N/A         |
| § 90.210  | Transmitter Radiated Spurious Emssion | Complies    |
| § 90.210  | Spurious Emssion On Antenna Port      | Complies    |

### 3.8. Equipments Used during the Test

| DC Power Conducted Emission |               |             |               |                 |
|-----------------------------|---------------|-------------|---------------|-----------------|
| Name of Equipment           | Manufacturer  | Model       | Serial Number | Calibration Due |
| Artificial Mains            | Rohde&Schwarz | ESH3-Z6     | 100210        | 10/23/2012      |
| Artificial Mains            | Rohde&Schwarz | ESH3-Z6     | 100211        | 10/23/2012      |
| EMI Test Receiver           | Rohde&Schwarz | ESCS 30     | 100038        | 10/23/2012      |
| Pulse Limiter               | Rohde&Schwarz | ESHSZ2      | 100044        | 10/23/2012      |
| EMI Test Software           | Rohde&Schwarz | ES-K1 V1.71 | N/A           | 10/23/2012      |

| Transmitter Radiated Spurious Emission & Occupied Bandwidth & Emission Mask & Receiver Radiated Spurious Emission & ACP |                              |             |               |                 |
|---|------------------------------|-------------|---------------|-----------------|
| Name of Equipment   | Manufacturer                 | Model       | Serial Number | Calibration Due |
| Ultra-Broadband Antenna   | Rohde&Schwarz                | HL562       | 100015        | 10/23/2012      |
| EMI Test Receiver   | Rohde&Schwarz                | ESI 26      | 100009        | 10/23/2012      |
| RF Test Panel   | Rohde&Schwarz                | TS / RSP    | 335015/ 0017  | N/A             |
| HORN ANTENNA  | Rohde&Schwarz                | HF906       | 100039        | 10/23/2012      |
| Turntable   | ETS                          | 2088        | 2149          | N/A             |
| Antenna Mast  | ETS                          | 2075        | 2346          | N/A             |
| Filter  | Compliance Direction systems | BSU-6       | 34202         | 10/23/2012      |
| EMI Test Software   | Rohde&Schwarz                | ES-K1 V1.71 | N/A           | 10/23/2012      |
| Spectrum Analyzer   | Agilent                      | E4407B      | MY44210775    | 10/23/2012      |
| TETRA Signal Analyzer   | IFR                          | 2310        | 231001/168    | 10/23/2012      |
| Spectrum Analyze  | Rohde&Schwarz                | FSP40       | 1164.4391.40  | 10/23/2012      |

| Frequency Stability |               |         |               |                 |
|---------------------|---------------|---------|---------------|-----------------|
| Name of Equipment   | Manufacturer  | Model   | Serial Number | Calibration Due |
| Receiver            | Rohde&Schwarz | ESI 26  | 100009        | 10/23/2012      |
| Climate Chamber     | ESPEC         | EL-10KA | 05107008      | 10/23/2012      |

| Maximum Transmitter Power & Spurious Emission On Antenna Port |               |         |               |                 |
|---|---------------|---------|---------------|-----------------|
| Name of Equipment   | Manufacturer  | Model   | Serial Number | Calibration Due |
| Receiver  | Rohde&Schwarz | ESI 26  | 100009        | 10/23/2012      |
| Attenuator  | R&S           | ESH3-22 | 100449        | 10/23/2012      |
| Filter  | Anritsu       | MP526D  | 6200878392    | 10/23/2012      |

| Transient Frequency Behavior |               |          |               |                 |
|------------------------------|---------------|----------|---------------|-----------------|
| Name of Equipment            | Manufacturer  | Model    | Serial Number | Calibration Due |
| Signal Generator             | Rohde&Schwarz | SMT03    | 100059        | 23/10/2012      |
| Storage Oscilloscope         | Tektronix     | TDS3054B | B033027       | 23/10/2012      |
| TETRA Signal Analyzer        | IFR           | 2310     | 231001/168    | 10/23/2012      |

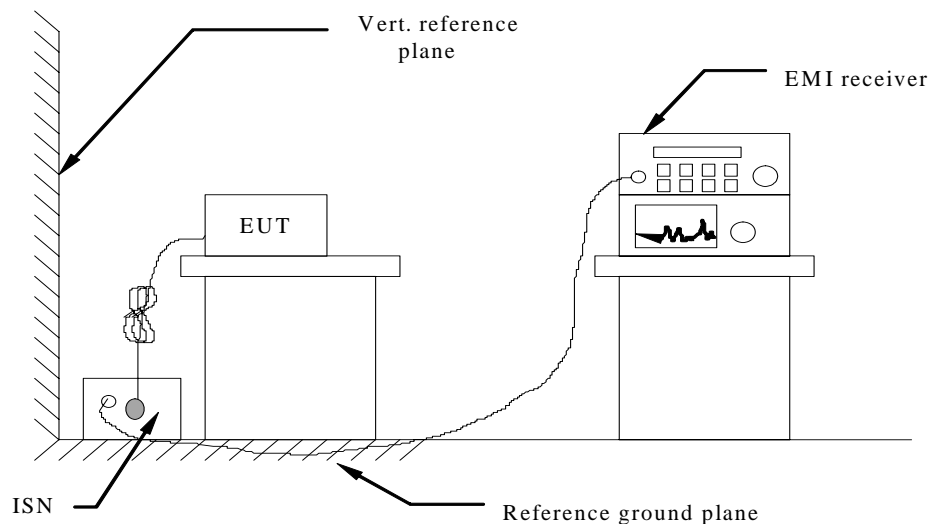
## **4. TEST CONDITIONS AND RESULTS**

### **4.1. Conducted Emissions Test**

#### **TEST APPLICABLE**

The EUT was tested according to ANSI C63.4 - 2009. The frequency spectrum from 0.15 MHz to 30 MHz was investigated. The LISN used was 50 ohm / 50 u Henry as specified by section 5.1 of ANSI C63.4 - 2009. Cables and peripherals were moved to find the maximum emission levels for each frequency.

#### **TEST CONFIGURATION**



#### **TEST PROCEDURE**

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4-2009.
- 2 Support equipment, if needed, was placed as per ANSI C63.4-2009.
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4-2009.
- 4 If a EUT received DC power from the adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

#### **Conducted Power Line Emission Limit**

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following :

| Frequency<br>(MHz) | Maximum RF Line Voltage (dB $\mu$ V) |      |         |        |
|--------------------|--------------------------------------|------|---------|--------|
|                    | CLASS A                              |      | CLASS B |        |
|                    | Q.P.                                 | Ave. | Q.P.    | Ave.   |
| 0.15 - 0.50        | 79                                   | 66   | 66-56*  | 56-46* |
| 0.50 - 5.00        | 73                                   | 60   | 56      | 46     |
| 5.00 - 30.0        | 73                                   | 60   | 60      | 50     |

\* Decreasing linearly with the logarithm of the frequency

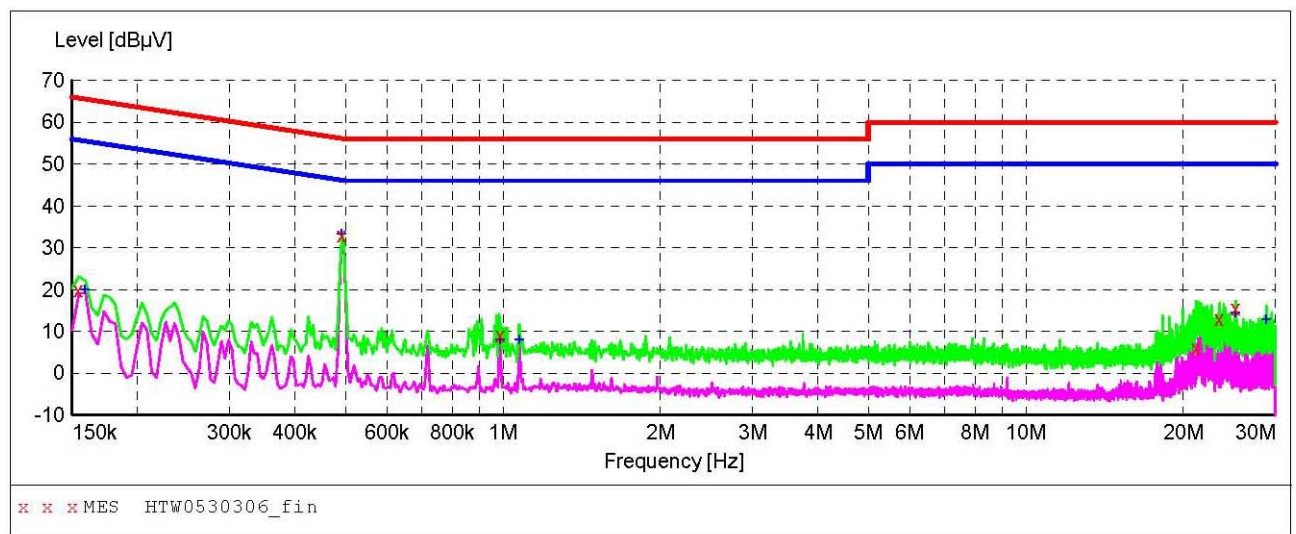
For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

### **TEST RESULTS**

#### **For DMO Mode**

**SCAN TABLE: "Voltage (9K-30M)FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "HTW0530306\_fin"**

5/30/2012 9:41AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.154500         | 20.00         | 10.1         | 66            | 45.8         | QP       | +    | GND |
| 0.492000         | 32.90         | 10.1         | 56            | 23.2         | QP       | +    | GND |
| 0.987000         | 9.10          | 10.2         | 56            | 46.9         | QP       | +    | GND |
| 21.169500        | 6.00          | 10.5         | 60            | 54.0         | QP       | +    | GND |
| 23.482500        | 13.00         | 10.6         | 60            | 47.0         | QP       | +    | GND |
| 25.201500        | 15.50         | 10.7         | 60            | 44.5         | QP       | +    | GND |

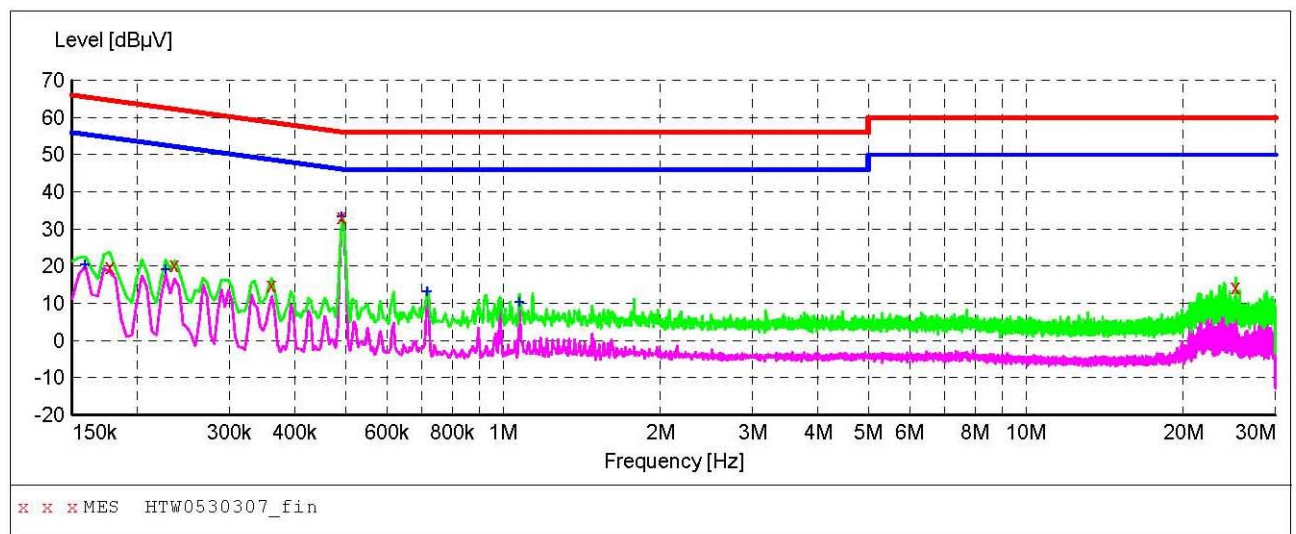
**MEASUREMENT RESULT: "HTW0530306\_fin2"**

5/30/2011 9:41AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.159000         | 19.80         | 10.1         | 56            | 35.7         | AV       | +    | GND |
| 0.492000         | 33.20         | 10.1         | 46            | 12.9         | AV       | +    | GND |
| 0.987000         | 7.90          | 10.2         | 46            | 38.1         | AV       | +    | GND |
| 1.077000         | 8.00          | 10.2         | 46            | 38.0         | AV       | +    | GND |
| 25.201500        | 14.30         | 10.7         | 50            | 35.7         | AV       | +    | GND |
| 28.797000        | 12.70         | 10.9         | 50            | 37.3         | AV       | +    | GND |

**SCAN TABLE: "Voltage (9K-30M)FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "HTW0530307\_fin"**

5/30/2012 9:45AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.177000         | 19.90         | 10.1         | 65            | 44.7         | QP       | -    | GND |
| 0.235500         | 20.40         | 10.1         | 62            | 41.9         | QP       | -    | GND |
| 0.361500         | 14.80         | 10.1         | 59            | 43.9         | QP       | -    | GND |
| 0.492000         | 33.20         | 10.1         | 56            | 22.9         | QP       | -    | GND |
| 25.201500        | 14.40         | 10.7         | 60            | 45.6         | QP       | -    | GND |

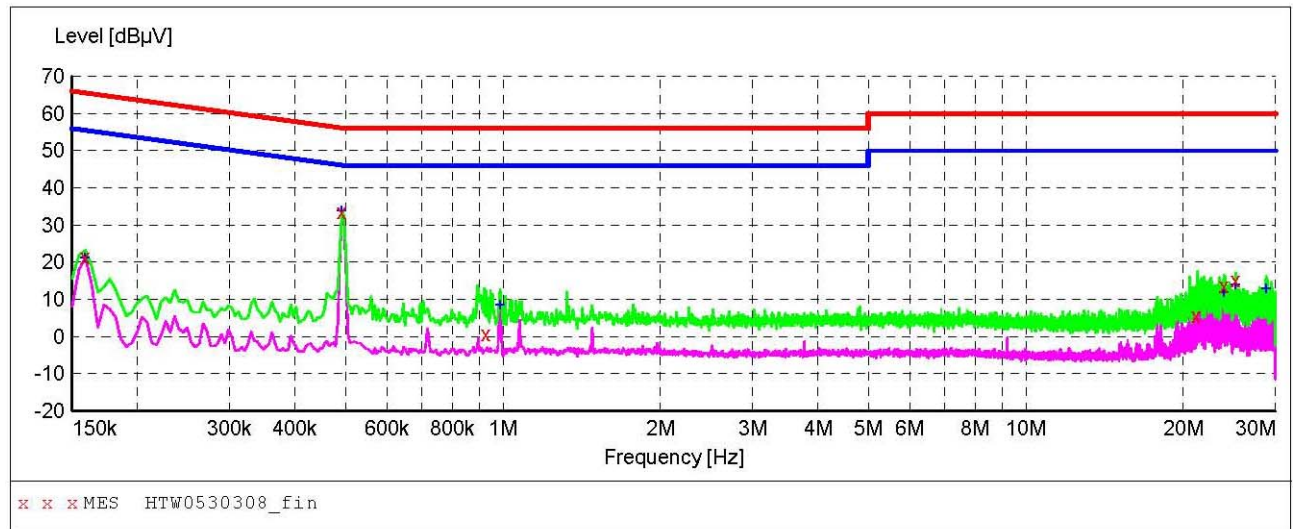
**MEASUREMENT RESULT: "HTW0530307\_fin2"**

5/30/2012 9:45AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.159000         | 20.40         | 10.1         | 56            | 35.1         | AV       | -    | GND |
| 0.226500         | 19.00         | 10.1         | 53            | 33.6         | AV       | -    | GND |
| 0.492000         | 33.40         | 10.1         | 46            | 12.7         | AV       | -    | GND |
| 0.717000         | 13.10         | 10.1         | 46            | 32.9         | AV       | -    | GND |
| 1.077000         | 10.20         | 10.2         | 46            | 35.8         | AV       | -    | GND |

**For TMO****SCAN TABLE: "Voltage (9K-30M)FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "HTW0530308\_fin"**

5/30/2012 9:48AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.159000         | 21.50         | 10.1         | 66            | 44.0         | QP       | +    | GND |
| 0.492000         | 33.60         | 10.1         | 56            | 22.5         | QP       | +    | GND |
| 0.928500         | 0.70          | 10.1         | 56            | 55.3         | QP       | +    | GND |
| 21.165000        | 5.60          | 10.5         | 60            | 54.4         | QP       | +    | GND |
| 23.905500        | 13.70         | 10.6         | 60            | 46.3         | QP       | +    | GND |
| 25.201500        | 15.10         | 10.7         | 60            | 44.9         | QP       | +    | GND |

**MEASUREMENT RESULT: "HTW0530308\_fin2"**

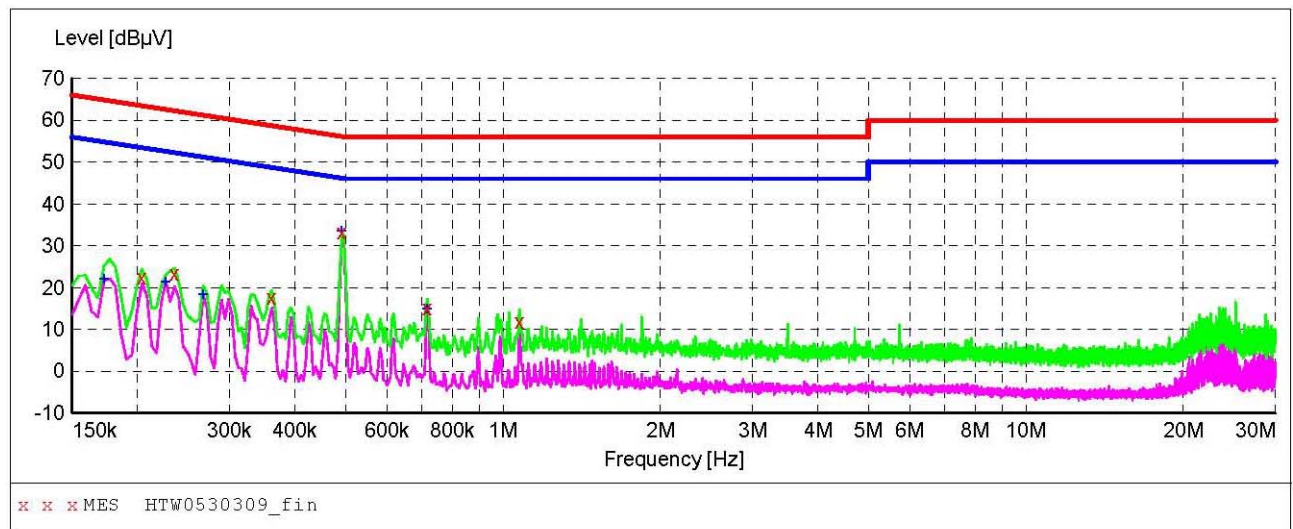
5/30/2012 9:48AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.159000         | 21.10         | 10.1         | 56            | 34.4         | AV       | +    | GND |
| 0.492000         | 33.80         | 10.1         | 46            | 12.3         | AV       | +    | GND |
| 0.987000         | 8.50          | 10.2         | 46            | 37.5         | AV       | +    | GND |
| 23.892000        | 11.70         | 10.6         | 50            | 38.3         | AV       | +    | GND |
| 25.201500        | 13.90         | 10.7         | 50            | 36.1         | AV       | +    | GND |
| 28.797000        | 12.80         | 10.9         | 50            | 37.2         | AV       | +    | GND |



**SCAN TABLE: "Voltage (9K-30M)FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "HTW0530309\_fin"**

5/30/2012 9:52AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.204000         | 22.40         | 10.1         | 63            | 41.0         | QP       | -    | GND |
| 0.235500         | 23.30         | 10.1         | 62            | 39.0         | QP       | -    | GND |
| 0.361500         | 17.50         | 10.1         | 59            | 41.2         | QP       | -    | GND |
| 0.492000         | 33.20         | 10.1         | 56            | 22.9         | QP       | -    | GND |
| 0.717000         | 15.00         | 10.1         | 56            | 41.0         | QP       | -    | GND |
| 1.077000         | 11.80         | 10.2         | 56            | 44.2         | QP       | -    | GND |

**MEASUREMENT RESULT: "HTW0530309\_fin2"**

5/30/2012 9:52AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.172500         | 22.00         | 10.1         | 55            | 32.8         | AV       | -    | GND |
| 0.226500         | 21.20         | 10.1         | 53            | 31.4         | AV       | -    | GND |
| 0.267000         | 18.30         | 10.1         | 51            | 32.9         | AV       | -    | GND |
| 0.492000         | 33.40         | 10.1         | 46            | 12.7         | AV       | -    | GND |
| 0.717000         | 14.80         | 10.1         | 46            | 31.2         | AV       | -    | GND |



## 4.2. Occupied Bandwidth, Adjacent Channel Power Test

### TEST APPLICABLE

- (a). Occupied Bandwidth: The EUT was connected to the audio signal generator and the spectrum analyzer via the main RF connector, and through an appropriate attenuator. The EUT was controlled to transmit its maximum power. Then the bandwidth of 99% power can be measured by the spectrum analyzer.
- (b). For the frequency bands indicated in 90.209, operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 25 kHz.

Maximum adjacent power levels for frequencies below 700MHz:

| Frequency Offset | Maximum ACP (dBc) for devices 1 watt and less | Maximum ACP (dBc) for devices above 1 watt |
|------------------|---|--|
| 25 kHz           | -55 dBc                                       | -60 dBc                                    |
| 50 kHz           | -70 dBc                                       | -70 dBc                                    |
| 75 kHz           | -70 dBc                                       | -70 dBc                                    |

In any case, no requirement in excess of -36 dBm shall apply.

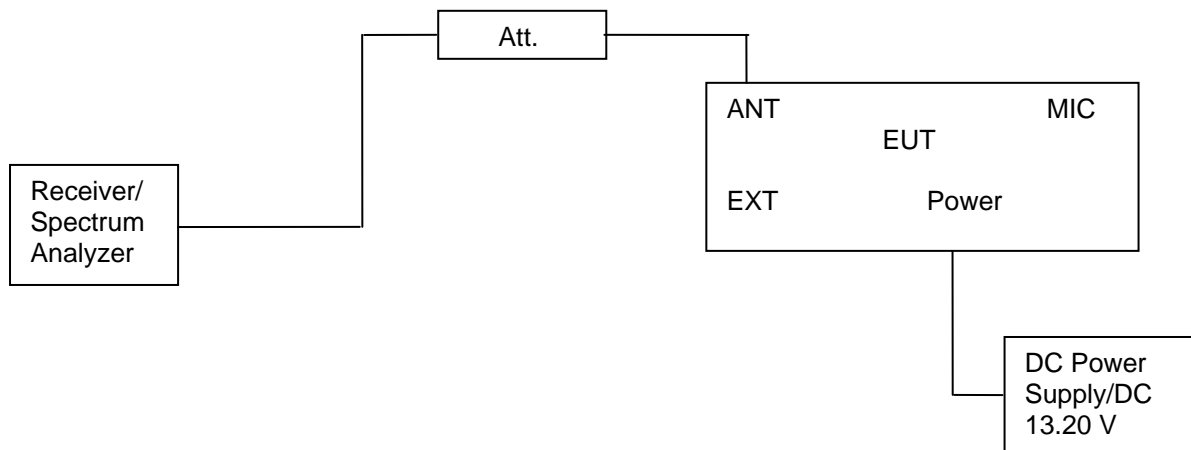
Maximum adjacent power levels for frequencies above 700MHz:

| Frequency Offset | Maximum ACP (dBc) for devices less than 15 watts | Maximum ACP (dBc) for devices 15 watts and above |
|------------------|--|--|
| 25 kHz           | -55 dBc  | -55 dBc  |
| 50 kHz           | -65 dBc  | -65 dBc  |
| 75 kHz           | -65 dBc  | -70 dBc  |

In any case, no requirement in excess of -36 dBm shall apply.

On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least  $43 + 10 \log (P)$  dB.

### TEST CONFIGURATION

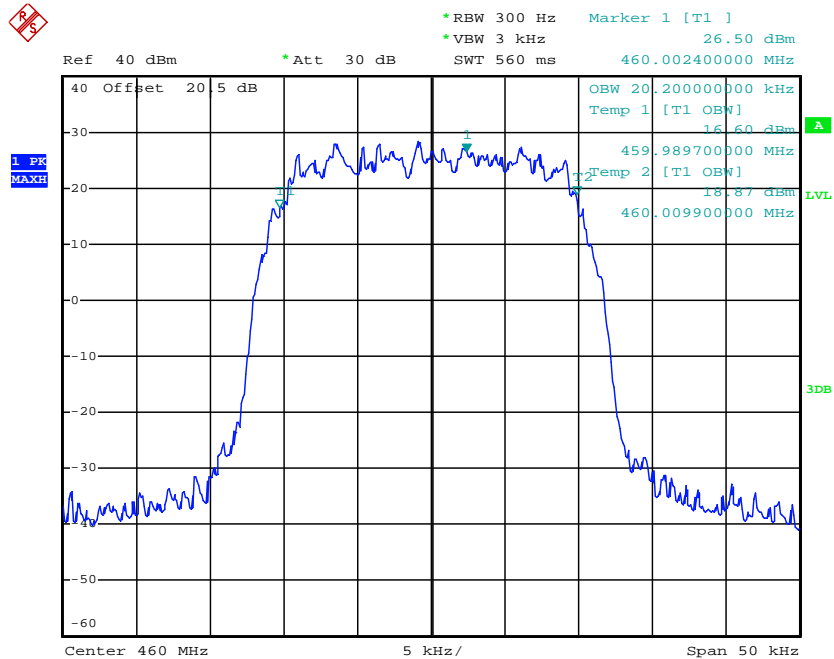


### TEST PROCEDURE

- 1 The EUT was placed on a turn table which is 0.8m above ground plane.
- 2 Set EUT as normal operation.
- 3 Set SPA Center Frequency = fundamental frequency, RBW=300Hz, VBW= 3 KHz, span =50 KHz.
- 4 Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.
- 5 Set SPA Center Frequency=fundamental frequency, RBW=300Hz, VBW=3 KHz span=50 KHz for 25 KHz channel spacing.
- 6 Set SPA Center Frequency= fundamental frequency, set ACP measurement function to test ACP.

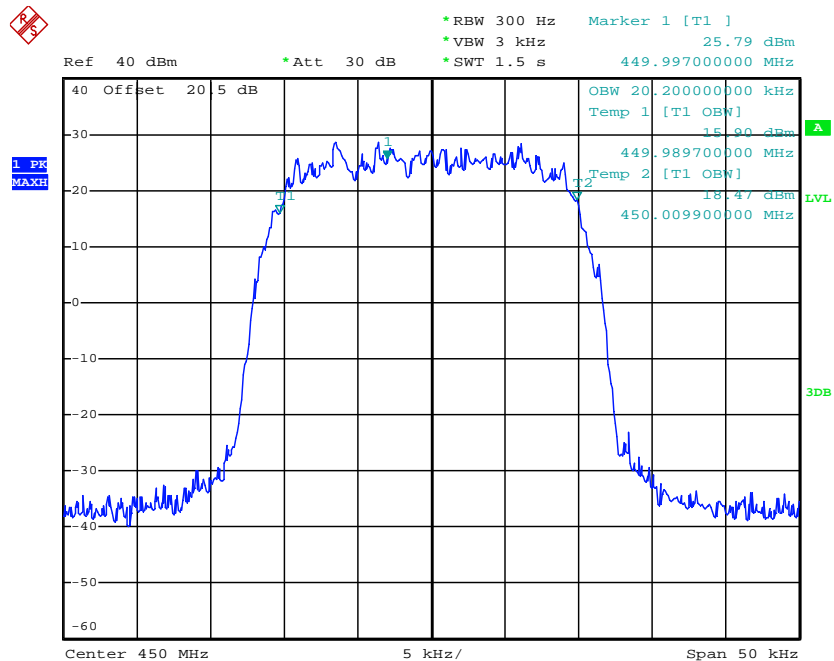


| Modulation Type | Mode | Channel Separation | Freq.(MHz) | 99% Bandwidth (KHz) | FCC Limit (KHz) | Results    |
|-----------------|------|--------------------|------------|---------------------|-----------------|------------|
| pi/4DQPSK       | TMO  | 25 KHz             | 460        | 20.20               | 22.00           | Compliance |



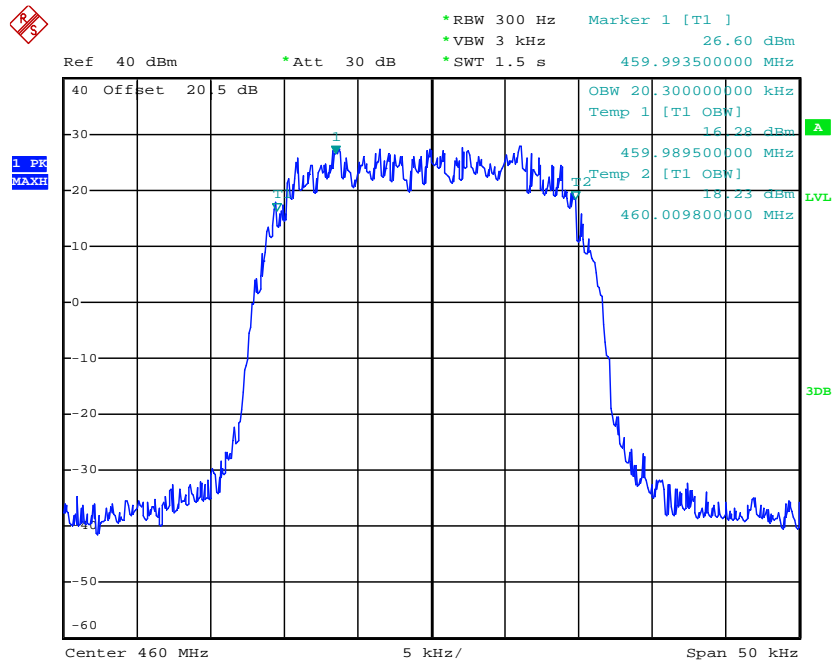
Date: 5.JUN.2012 16:12:58

| Modulation Type | Mode | Channel Separation | Freq.(MHz) | 99% Bandwidth (KHz) | FCC Limit (KHz) | Results    |
|-----------------|------|--------------------|------------|---------------------|-----------------|------------|
| pi/4DQPSK       | DMO  | 25 KHz             | 450        | 20.20               | 22.00           | Compliance |



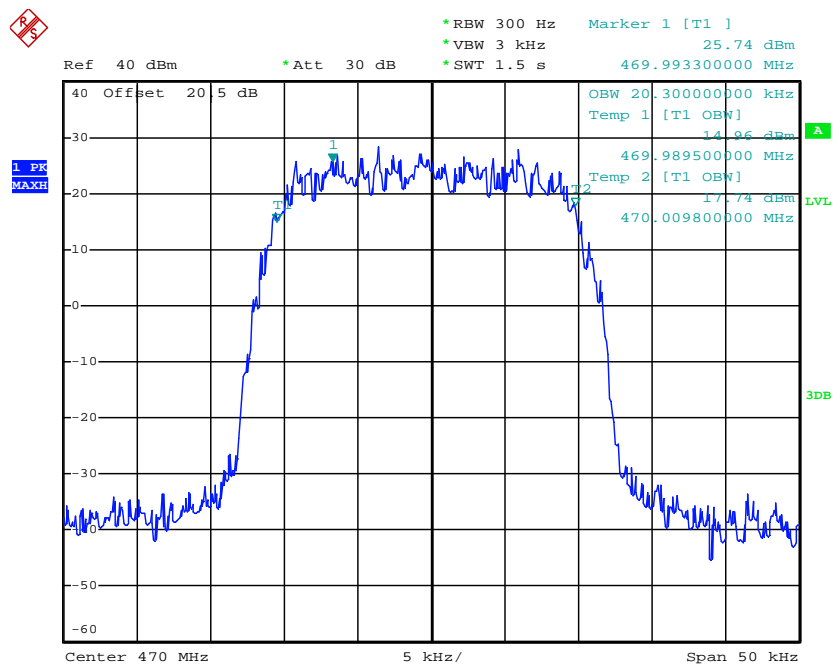
Date: 5.JUN.2012 16:34:50

| Modulation Type | Mode | Channel Separation | Freq.(MHz) | 99% Bandwidth (KHz) | FCC Limit (KHz) | Results    |
|-----------------|------|--------------------|------------|---------------------|-----------------|------------|
| pi/4DQPSK       | DMO  | 25 KHz             | 460        | 20.30               | 22.00           | Compliance |



Date: 5.JUN.2012 16:36:45

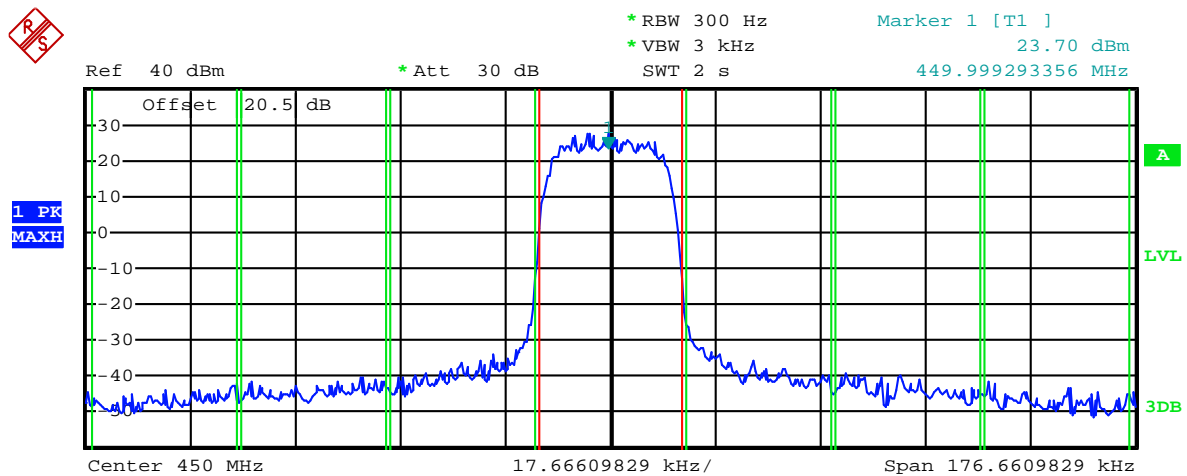
| Modulation Type | Mode | Channel Separation | Freq.(MHz) | 99% Bandwidth (KHz) | FCC Limit (KHz) | Results    |
|-----------------|------|--------------------|------------|---------------------|-----------------|------------|
| pi/4DQPSK       | DMO  | 25 KHz             | 470        | 20.30               | 22.00           | Compliance |



Date: 5.JUN.2012 16:37:43

## 4.2.2 Adjacent Channel Power (Only for FCC)

| Modulation Type | Channel Separation | Mode | Freq.(MHz) | Results    |
|-----------------|--------------------|------|------------|------------|
| pi/4DQPSK       | 25 KHz             | TMO  | 450        | Compliance |



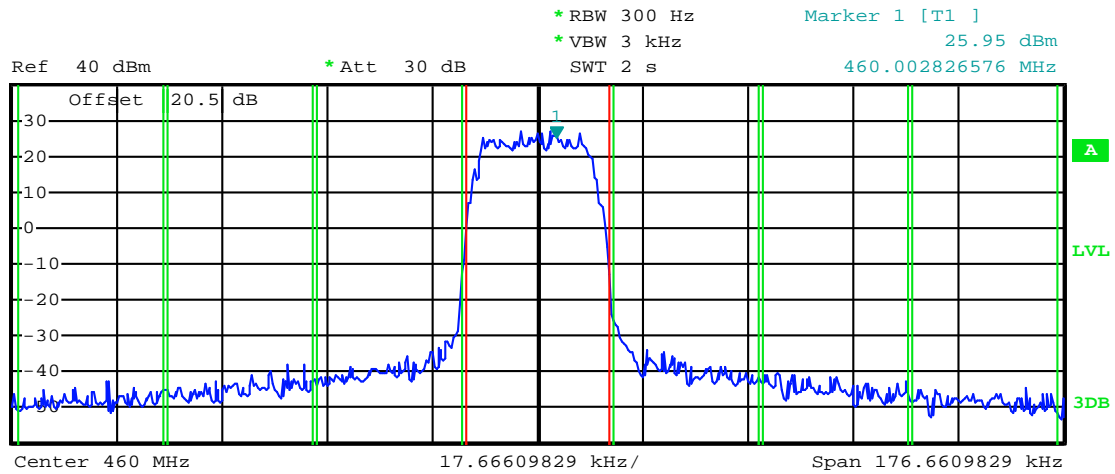
| Tx Channel            |          | TETRA |           |
|-----------------------|----------|-------|-----------|
| Bandwidth             | 24.3 kHz | Power | 41.84 dBm |
| Adjacent Channel      |          | Lower | -62.62 dB |
| Bandwidth             | 24.3 kHz | Upper | -62.31 dB |
| Spacing               | 25 kHz   |       |           |
| Alternate Channel     |          | Lower | -71.55 dB |
| Bandwidth             | 24.3 kHz | Upper | -71.57 dB |
| Spacing               | 50 kHz   |       |           |
| 2nd Alternate Channel |          | Lower | -73.10 dB |
| Bandwidth             | 24.3 kHz | Upper | -73.36 dB |
| Spacing               | 75 kHz   |       |           |

Date: 5.JUN.2012 16:30:31

25 kHz Channel Spacing, 450 MHz only for FCC

| Frequency Offset | Measurement Results |            | Limit(dBc) |
|------------------|---------------------|------------|------------|
|                  | Lower(dBc)          | Upper(dBc) |            |
| -25KHz           | -62.62              | -62.31     | -60        |
| -50KHz           | -71.55              | -71.57     | -70        |
| -75KHz           | -73.10              | -73.36     | -70        |

| Modulation Type | Channel Separation | Mode | Freq.(MHz) | Results    |
|-----------------|--------------------|------|------------|------------|
| pi/4DQPSK       | 25 KHz             | TMO  | 460        | Compliance |

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MAXH

|                              |          |              |           |
|------------------------------|----------|--------------|-----------|
| <b>Tx Channel</b>            |          | <b>TETRA</b> |           |
| Bandwidth                    | 24.3 kHz | Power        | 41.47 dBm |
| <b>Adjacent Channel</b>      |          |              |           |
| Bandwidth                    | 24.3 kHz | Lower        | -62.61 dB |
| Spacing                      | 25 kHz   | Upper        | -62.35 dB |
| <b>Alternate Channel</b>     |          |              |           |
| Bandwidth                    | 24.3 kHz | Lower        | -72.08 dB |
| Spacing                      | 50 kHz   | Upper        | -72.35 dB |
| <b>2nd Alternate Channel</b> |          |              |           |
| Bandwidth                    | 24.3 kHz | Lower        | -73.28 dB |
| Spacing                      | 75 kHz   | Upper        | -73.89 dB |

Date: 5.JUN.2012 16:28:40

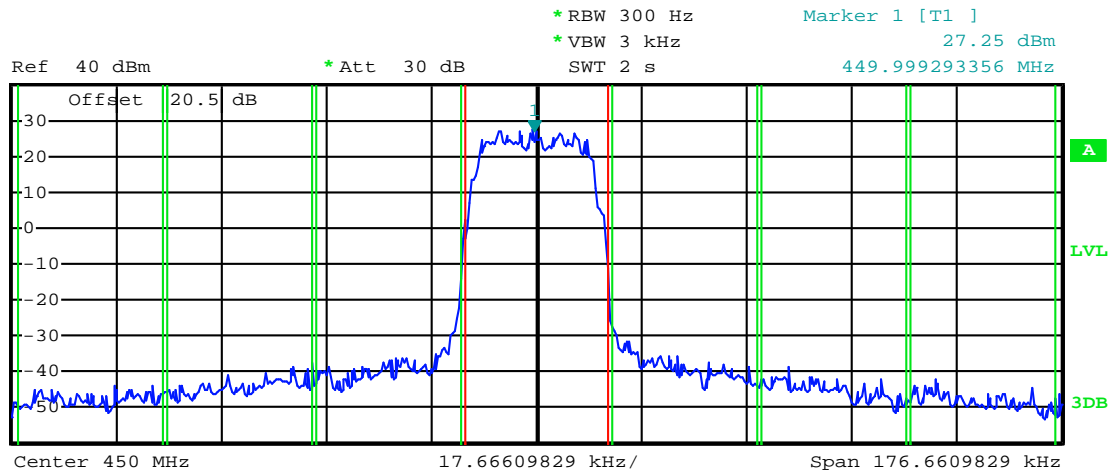
25 kHz Channel Spacing, 460 MHz only for FCC

| Frequency Offset | Measurement Results |            | Limit(dBc) |
|------------------|---------------------|------------|------------|
|                  | Lower(dBc)          | Upper(dBc) |            |
| -25KHz           | -62.61              | -62.35     | -60        |
| -50KHz           | -72.08              | -72.35     | -70        |
| -75KHz           | -73.28              | -73.89     | -70        |

| Modulation Type | Channel Separation | Mode | Freq.(MHz) | Results    |
|-----------------|--------------------|------|------------|------------|
| pi/4DQPSK       | 25 KHz             | DMO  | 450        | Compliance |



1 PK  
MAXH



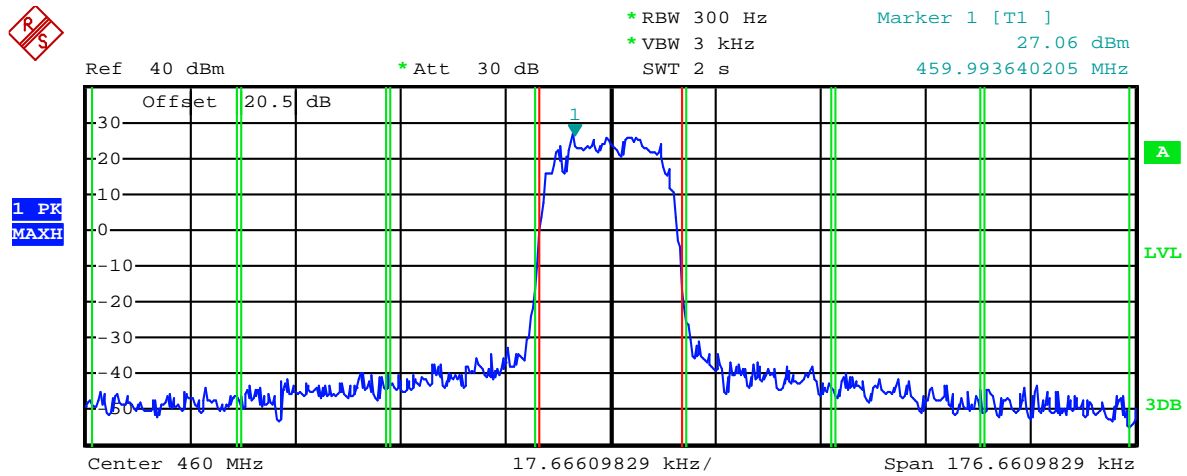
|                              |          |              |           |
|------------------------------|----------|--------------|-----------|
| <b>Tx Channel</b>            |          | <b>TETRA</b> |           |
| Bandwidth                    | 24.3 kHz | Power        | 41.87 dBm |
| <b>Adjacent Channel</b>      |          |              |           |
| Bandwidth                    | 24.3 kHz | Lower        | -63.01 dB |
| Spacing                      | 25 kHz   | Upper        | -62.54 dB |
| <b>Alternate Channel</b>     |          |              |           |
| Bandwidth                    | 24.3 kHz | Lower        | -71.21 dB |
| Spacing                      | 50 kHz   | Upper        | -71.63 dB |
| <b>2nd Alternate Channel</b> |          |              |           |
| Bandwidth                    | 24.3 kHz | Lower        | -73.56 dB |
| Spacing                      | 75 kHz   | Upper        | -73.89 dB |

Date: 5.JUN.2012 16:29:20

25 kHz Channel Spacing, 450 MHz only for FCC

| Frequency Offset | Measurement Results |            | Limit(dBc) |
|------------------|---------------------|------------|------------|
|                  | Lower(dBc)          | Upper(dBc) |            |
| -25KHz           | -63.01              | -62.54     | -60        |
| -50KHz           | -71.21              | -71.63     | -70        |
| -75KHz           | -73.56              | -73.59     | -70        |

| Modulation Type | Channel Separation | Mode | Freq.(MHz) | Results     |
|-----------------|--------------------|------|------------|-------------|
| pi/4DQPSK       | 25 KHz             | DMO  | 460        | Complicance |



| Tx Channel            |          |       |        | TETRA |  |
|-----------------------|----------|-------|--------|-------|--|
| Bandwidth             | 24.3 kHz | Power | 40.94  | dBm   |  |
| Adjacent Channel      |          |       |        |       |  |
| Bandwidth             | 24.3 kHz | Lower | -62.34 | dB    |  |
| Spacing               | 25 kHz   | Upper | -62.74 | dB    |  |
| Alternate Channel     |          |       |        |       |  |
| Bandwidth             | 24.3 kHz | Lower | -71.93 | dB    |  |
| Spacing               | 50 kHz   | Upper | -72.43 | dB    |  |
| 2nd Alternate Channel |          |       |        |       |  |
| Bandwidth             | 24.3 kHz | Lower | -73.32 | dB    |  |
| Spacing               | 75 kHz   | Upper | -73.29 | dB    |  |

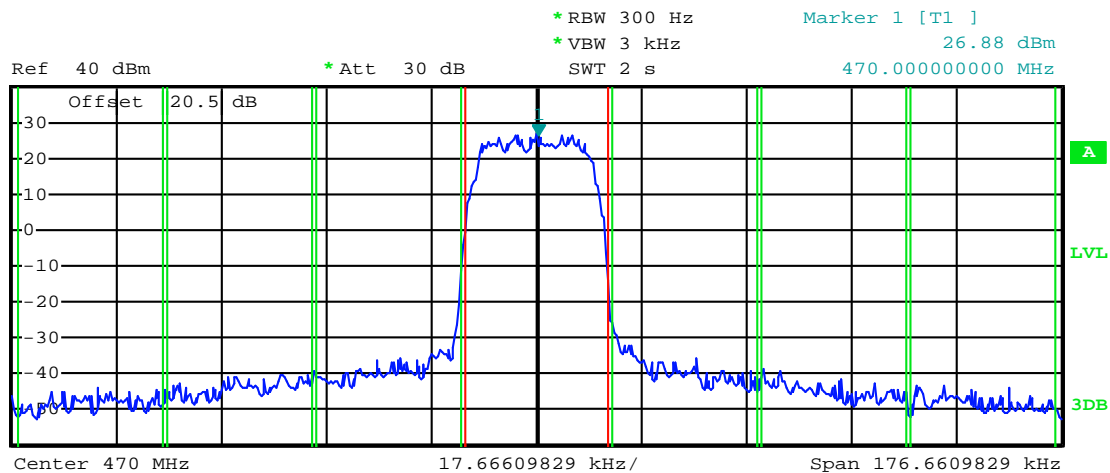
Date: 5.JUN.2012 16:31:12

25 kHz Channel Spacing, 460 MHz only for FCC

| Frequency Offset | Measurement Results |            | Limit(dBc) |
|------------------|---------------------|------------|------------|
|                  | Lower(dBc)          | Upper(dBc) |            |
| -25KHz           | -62.34              | -62.74     | -60        |
| -50KHz           | -71.93              | -72.43     | -70        |
| -75KHz           | -73.32              | -73.29     | -70        |



| Modulation Type | Channel Separation | Mode | Freq.(MHz) | Results    |
|-----------------|--------------------|------|------------|------------|
| pi/4DQPSK       | 25 KHz             | DMO  | 470        | Compliance |

1 PK  
MAXH**Tx Channel**

Bandwidth 24.3 kHz Power 41.64 dBm

**TETRA****Adjacent Channel**

Bandwidth 24.3 kHz Lower -62.52 dB

Spacing 25 kHz Upper -62.80 dB

**Alternate Channel**

Bandwidth 24.3 kHz Lower -71.72 dB

Spacing 50 kHz Upper -72.67 dB

**2nd Alternate Channel**

Bandwidth 24.3 kHz Lower -73.58 dB

Spacing 75 kHz Upper -73.62 dB

Date: 5.JUN.2012 16:32:02

25 kHz Channel Spacing, 470 MHz only for FCC

| Frequency Offset | Measurement Results |            | Limit(dBc) |
|------------------|---------------------|------------|------------|
|                  | Lower(dBc)          | Upper(dBc) |            |
| -25KHz           | -62.52              | -62.80     | -60        |
| -50KHz           | -71.72              | -72.67     | -70        |
| -75KHz           | -73.58              | -73.62     | -70        |

### 4.3. Transmitter Radiated Spurious Emission

#### TEST APPLICABLE

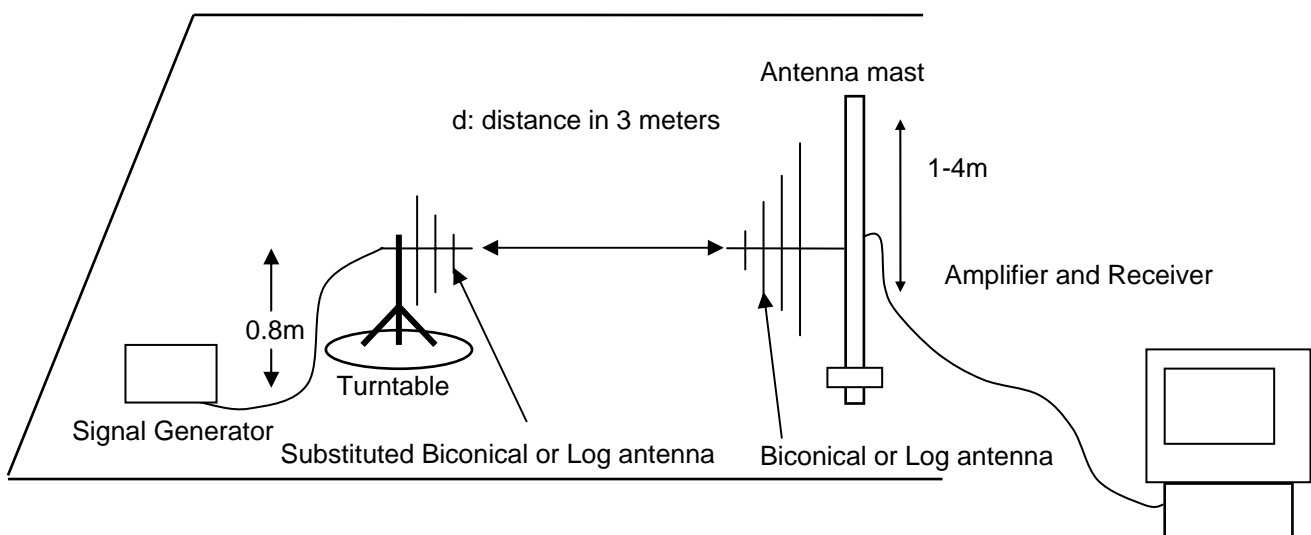
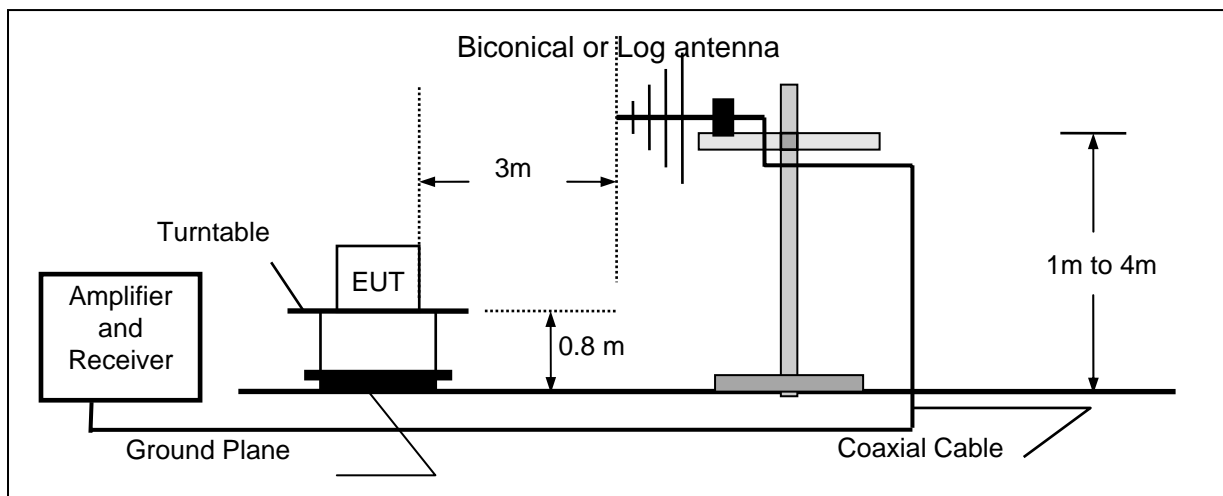
According to the TIA/EIA 603 test method, and according to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 KHz channel bandwidth:

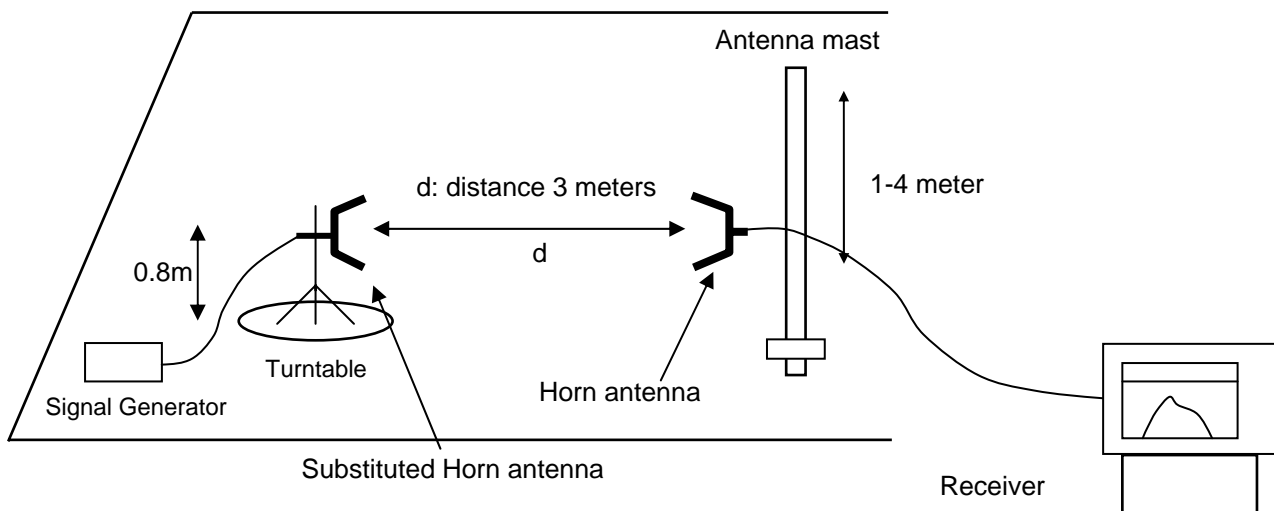
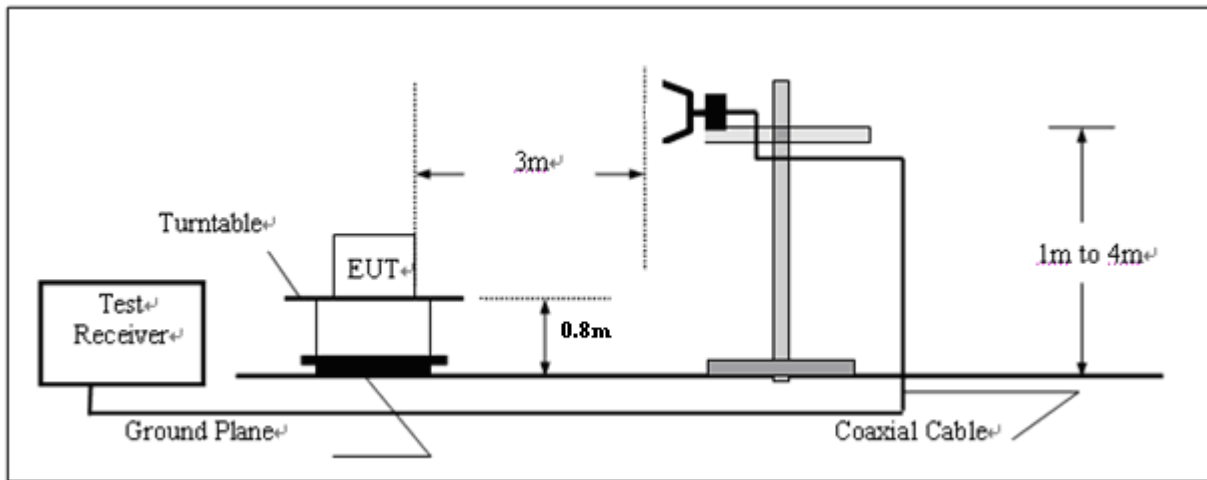
- 1 On any frequency removed from the center of the authorized bandwidth  $f_0$  to 5.625 KHz removed from  $f_0$ : Zero dB
  - 2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in KHz)  $f_0$  of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27dB
  - 3 On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in KHz)  $f_0$  of more than 12.5 KHz: At least  $50 + 10 \log(P)$  dB or 70 dB, which ever is lesser attenuation.
- For transmitters designed to transmit with 25 KHz channel separation and equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as following:

- 1 On any frequency removed from the assigned frequency by more than 50 percent, but no more than 100 percent of the authorized bandwidth: At least 25 dB.
- 2 On any frequency removed from the assigned frequency by more than 100 percent, but no more than 250 percent of the authorized bandwidth: At least 35 dB.
- 3 On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log(P)$  dB.

#### TEST CONFIGURATION

Below 1GHz



**Above 1GHz****TEST PROCEDURE**

- 1 Set the EMI Receiver (for measuring E-Field) and Receiver (for measuring EIRP) as follows:  
 Center Frequency: equal to the signal source  
 Resolution BW: 100 KHz  
 Video BW: VBW > RBW  
 Detector Mode: positive  
 Average: off  
 Span: 3 x the signal bandwidth
- 2 Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level  
 Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor + Amplifier Gain  
 $E \text{ (dBuV/m)} = \text{Reading (dBuV)} + \text{Total Correction Factor (dB)}$
- 3 The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
- 4 Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):  
 DIPOLE antenna for frequency from 30-1000 MHz or  
 HORN antenna for frequency above 1 GHz}.
- 5 Mount the transmitting antenna at 1.0 meter high from the ground plane.
- 6 Use one of the following antenna as a receiving antenna:  
 DIPOLE antenna for frequency from 30-1000 MHz or  
 HORN antenna for frequency above 1 GHz}.
- 7 If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
- 8 Adjust both transmitting and receiving antenna in a VERTICAL polarization.
- 9 Tune the EMI Receivers to the test frequency.
- 10 Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
- 11 The transmitter was rotated through 360° about a vertical axis until a higher maximum signal was received.
- 12 Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.

- 13 Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
- 14 Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:  

$$P = P_1 - L_1 = (P_2 + L_2) - L_1 = P_3 + A + L_2 - L_1$$

$$\text{EIRP} = P + G_1 = P_3 + L_2 - L_1 + A + G_1$$

$$\text{ERP} = \text{EIRP} - 2.15 \text{ dB}$$

$$\text{Total Correction factor in EMI Receiver} = L_2 - L_1 + G_1$$

Where:

  - P: Actual RF Power fed into the substitution antenna port after corrected.
  - P<sub>1</sub>: Power output from the signal generator
  - P<sub>2</sub>: Power measured at attenuator A input
  - P<sub>3</sub>: Power reading on the Average Power Meter
  - EIRP: EIRP after correction
  - ERP: ERP after correction
- 15 Adjust both transmitting and receiving antenna in a Horizontal polarization, then repeat step (11) to (14).
- 16 Repeat step (4) to (16) for different test frequency
- 17 Repeat steps (3) to (12) with the substitution antenna oriented in horizontal polarization.
- 18 Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

## **TEST RESULTS**

### **Modulation Type/Mode: pi/4DQPSK/TMO**

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (25 kHz bandwidth only): On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f d in kHz) of more than 12.5 kHz at least:

Low:  $43 + 10 \log (\text{Pwatts}) = 43 + 10 \log (11.43) = 53.58 \text{ dB}$

High:  $43 + 10 \log (\text{Pwatts}) = 43 + 10 \log (11.75) = 53.70 \text{ dB}$

Note: In general, the worse case attenuation requirement shown above was applied.

Calculation: Limit (dBm) = EL-43-10log10 (TP)

Notes: EL is the emission level of the Output Power expressed in dBm,  
 In this application, the EL is 40.00 dBm.  
 Limit (dBm) = 40.00 - 43 - 10log10 (11.75) = -13 dBm

### **Modulation Type/Mode: pi/4DQPSK/DMO**

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (25 kHz bandwidth only): On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f d in kHz) of more than 12.5 kHz at least:

Low:  $43 + 10 \log (\text{Pwatts}) = 43 + 10 \log (11.04) = 53.43 \text{ dB}$

High:  $43 + 10 \log (\text{Pwatts}) = 43 + 10 \log (11.61) = 53.56 \text{ dB}$

Note: In general, the worse case attenuation requirement shown above was applied.

Calculation: Limit (dBm) = EL-43-10log10 (TP)

Notes: EL is the emission level of the Output Power expressed in dBm,  
 In this application, the EL is 40.00 dBm.  
 Limit (dBm) = 40.00 - 43 - 10log10 (11.61) = -13 dBm

Note: 1. In general, the worse case attenuation requirement shown above was applied.

2. The measurement frequency range from 30 MHz to 5 GHz.

3. \*\*\* means that the emission level is too low to be measured or at least 20 dB down than the limit.

| Modulation/Mode |                        | pi/4DQPSK/TMO          |                      | Channel Separation  |                      | 25KHz                                     |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|---|-------------|-------------|
| Test Channel    |                        | Low Channel            |                      | Test Frequency      |                      | 450 MHz                                   |             |             |
| Frequency (MHz) | E-Field Level (dBuv/m) | EMI Detector (Peak/QP) | Antenna Polarization | Antenna Height (cm) | Table Angle (Degree) | ERP measured by Substitution Method (dBm) | Limit (dBm) | Margin (dB) |
| 900.000         | 46.89                  | Peak                   | H                    | 300                 | 36                   | -50.11                                    | -13         | 37.11       |
| 1350.000        | 44.63                  | Peak                   | H                    | 150                 | 127                  | -52.15                                    | -13         | 39.15       |
| 1800.000        | 67.55                  | Peak                   | H                    | 150                 | 36                   | -28.45                                    | -13         | 15.45       |
| ...             | ...                    |                        | H                    |                     |                      |   |             |             |
| 900.000         | 49.41                  | Peak                   | V                    | 200                 | 256                  | -47.33                                    | -13         | 34.33       |
| 1350.000        | 46.89                  | Peak                   | V                    | 100                 | 334                  | -50.00                                    | -13         | 37.00       |
| 1800.000        | 68.00                  | Peak                   | V                    | 105                 | 300                  | -29.07                                    | -13         | 16.07       |
| ...             | ...                    |                        | V                    |                     |                      |   |             |             |

| Modulation/Mode |                        | pi/4DQPSK/TMO          |                      | Channel Separation  |                      | 25KHz                                     |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|---|-------------|-------------|
| Test Channel    |                        | High Channel           |                      | Test Frequency      |                      | 460 MHz                                   |             |             |
| Frequency (MHz) | E-Field Level (dBuv/m) | EMI Detector (Peak/QP) | Antenna Polarization | Antenna Height (cm) | Table Angle (Degree) | ERP measured by Substitution Method (dBm) | Limit (dBm) | Margin (dB) |
| 920.000         | 47.15                  | Peak                   | H                    | 100                 | 9                    | -49.73                                    | -13         | 36.73       |
| 1380.000        | 47.00                  | Peak                   | H                    | 150                 | 247                  | -50.07                                    | -13         | 37.07       |
| 1840.000        | 57.93                  | Peak                   | H                    | 127                 | 200                  | -38.83                                    | -13         | 25.83       |
| ...             | ...                    |                        | H                    |                     |                      |   |             |             |
| 920.000         | 48.05                  | Peak                   | V                    | 150                 | 144                  | -47.98                                    | -13         | 34.98       |
| 1380.000        | 45.52                  | Peak                   | V                    | 100                 | 100                  | -50.58                                    | -13         | 37.58       |
| 1840.000        | 63.01                  | Peak                   | V                    | 100                 | 92                   | -33.92                                    | -13         | 20.92       |
| ...             | ...                    |                        | V                    |                     |                      |   |             |             |

| Modulation/Mode |                        | pi/4DQPSK/DMO          |                      | Channel Separation  |                      | 25KHz                                     |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|---|-------------|-------------|
| Test Channel    |                        | Low Channel            |                      | Test Frequency      |                      | 450 MHz                                   |             |             |
| Frequency (MHz) | E-Field Level (dBuv/m) | EMI Detector (Peak/QP) | Antenna Polarization | Antenna Height (cm) | Table Angle (Degree) | ERP measured by Substitution Method (dBm) | Limit (dBm) | Margin (dB) |
| 900.000         | 47.88                  | Peak                   | H                    | 350                 | 255                  | -49.11                                    | -13         | 36.11       |
| 1350.000        | 43.80                  | Peak                   | H                    | 200                 | 174                  | -52.29                                    | -13         | 39.29       |
| 1800.000        | 66.82                  | Peak                   | H                    | 200                 | 352                  | -29.93                                    | -13         | 16.93       |
| ...             | ...                    |                        | H                    |                     |                      |   |             |             |
| 900.000         | 49.44                  | Peak                   | V                    | 150                 | 69                   | -47.00                                    | -13         | 34.00       |
| 1350.000        | 45.66                  | Peak                   | V                    | 100                 | 266                  | -50.63                                    | -13         | 37.63       |
| 1800.000        | 66.92                  | Peak                   | V                    | 100                 | 189                  | -29.11                                    | -13         | 16.11       |
| ...             | ...                    |                        | V                    |                     |                      |   |             |             |

| Modulation/Mode |                        | pi/4DQPSK/DMO          |                      | Channel Separation  |                      | 25KHz                                     |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|---|-------------|-------------|
| Test Channel    |                        | High Channel           |                      | Test Frequency      |                      | 460 MHz                                   |             |             |
| Frequency (MHz) | E-Field Level (dBuv/m) | EMI Detector (Peak/QP) | Antenna Polarization | Antenna Height (cm) | Table Angle (Degree) | ERP measured by Substitution Method (dBm) | Limit (dBm) | Margin (dB) |
| 920.000         | 44.18                  | Peak                   | H                    | 144                 | 78                   | -52.21                                    | -13         | 39.21       |
| 1380.000        | 41.82                  | Peak                   | H                    | 150                 | 252                  | -55.62                                    | -13         | 42.62       |
| 1840.000        | 61.71                  | Peak                   | H                    | 300                 | 193                  | -38.03                                    | -13         | 25.03       |
| ...             | ...                    |                        | H                    |                     |                      |   |             |             |
| 920.000         | 47.88                  | Peak                   | V                    | 100                 | 111                  | -48.93                                    | -13         | 36.93       |
| 1380.000        | 45.99                  | Peak                   | V                    | 108                 | 136                  | -50.90                                    | -13         | 37.90       |
| 1840.000        | 59.07                  | Peak                   | V                    | 108                 | 299                  | -37.36                                    | -13         | 24.36       |
| ...             | ...                    |                        | V                    |                     |                      |   |             |             |

| Modulation/Mode |                        | pi/4DQPSK/DMO          |                      | Channel Separation  |                      | 25KHz                                     |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|---|-------------|-------------|
| Test Channel    |                        | High Channel           |                      | Test Frequency      |                      | 470 MHz                                   |             |             |
| Frequency (MHz) | E-Field Level (dBuv/m) | EMI Detector (Peak/QP) | Antenna Polarization | Antenna Height (cm) | Table Angle (Degree) | ERP measured by Substitution Method (dBm) | Limit (dBm) | Margin (dB) |
| 940.000         | 47.81                  | Peak                   | H                    | 250                 | 182                  | -48.83                                    | -13         | 35.83       |
| 1410.000        | 44.56                  | Peak                   | H                    | 200                 | 265                  | -52.64                                    | -13         | 39.64       |
| 1880.000        | 61.08                  | Peak                   | H                    | 200                 | 200                  | -36.12                                    | -13         | 23.12       |
| ...             | ...                    |                        | H                    |                     |                      |   |             |             |
| 940.000         | 46.88                  | Peak                   | V                    | 100                 | 330                  | -49.11                                    | -13         | 36.11       |
| 1410.000        | 46.74                  | Peak                   | V                    | 150                 | 300                  | -50.38                                    | -13         | 37.38       |
| 1880.000        | 62.22                  | Peak                   | V                    | 100                 | 255                  | -33.74                                    | -13         | 20.74       |
| ...             | ...                    |                        | V                    |                     |                      |   |             |             |

#### 4.4. Spurious Emission on Antenna Port

##### TEST APPLICABLE

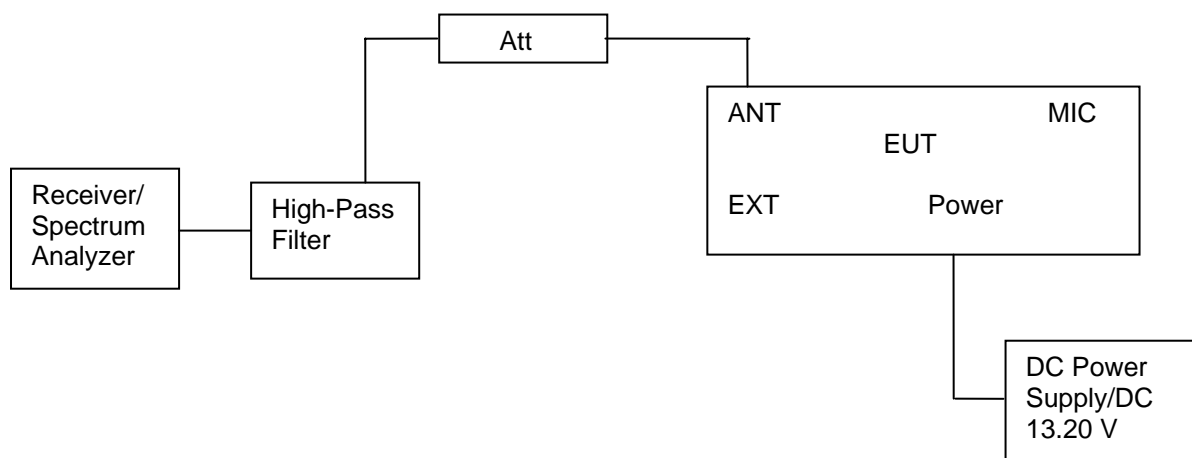
The same as Section 4.3

##### TEST PROCEDURE

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set to 100 kHz. Sufficient scans were taken to show any out of band emission up to 10th. Harmonic for the lower and the highest frequency range. Set RBW 100 kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz, while set RBW=1MHz, VBW=3MHz from the 1GHz to 10<sup>th</sup> Harmonic.

The audio input was set to 0 to get the unmodulated carrier, the resulting picture is print out for each channel separation.

##### TEST CONFIGURATION



##### TEST RESULTS

###### **Modulation Type/Mode: pi/4DQPSK/TMO**

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (25 kHz bandwidth only): On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f d in kHz) of more than 12.5 kHz at least:

Low:  $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (11.43) = 53.58 \text{ dB}$

High:  $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (11.75) = 53.70 \text{ dB}$

Note: In general, the worse case attenuation requirement shown above was applied.

Calculation: Limit (dBm) = EL-43-10log10 (TP)

Notes: EL is the emission level of the Output Power expressed in dBm,

In this application, the EL is 40.00 dBm.

Limit (dBm) = 40.00-43-10log10 (11.75) = -13 dBm

###### **Modulation Type/Mode: pi/4DQPSK/DMO**

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 11 (25 kHz bandwidth only): On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f d in kHz) of more than 12.5 kHz at least:

Low:  $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (11.04) = 53.43 \text{ dB}$

High:  $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (11.61) = 53.56 \text{ dB}$

Note: In general, the worse case attenuation requirement shown above was applied.

Calculation: Limit (dBm) = EL-43-10log10 (TP)

Notes: EL is the emission level of the Output Power expressed in dBm,

In this application, the EL is 40.00 dBm.

Limit (dBm) = 40.00 -43-10log10 (11.61) = -13 dBm

Note: 1. In general, the worse case attenuation requirement shown above was applied.

2. The measurement frequency range from 30 MHz to 5 GHz.

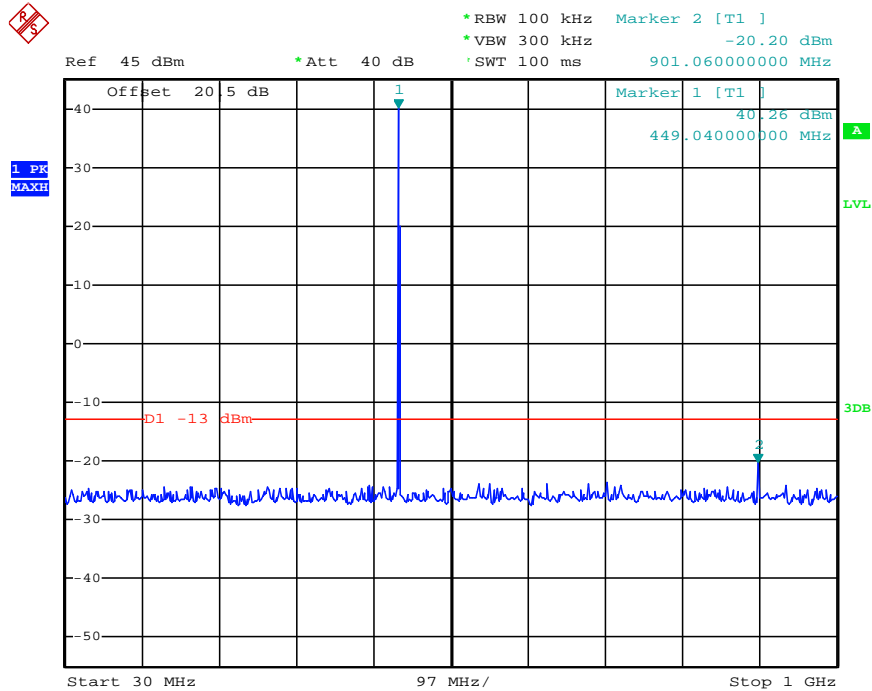
3. \*\*\* means that the emission level is too low to be measured or at least 20 dB down than the limit.

| Modulation Type/Mode | Channel Sparation | Test Channel                        | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             |
|----------------------|-------------------|-------------------------------------|----------------------|---|-------------|---|-------------|
|                      |                   |                                     |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |
| pi/4DQPSK/TMO        | 25KHz             | Low                                 | 450                  | 901.06  | -20.20      | 3152.00   | -24.66      |
|                      |                   | High                                | 460                  | 920.46  | -18.34      | 3144.00   | -24.27      |
| pi/4DQPSK/DMO        |                   | Low                                 | 450                  | 901.06  | -19.47      | 3200.00   | -24.50      |
|                      |                   | Middle                              | 460                  | 920.46  | -19.10      | 3160.00   | -24.04      |
|                      |                   | High                                | 470                  | 941.80  | -18.36      | 3648.00   | -24.65      |
| Limit                |                   | -13dBm for 25KHz Channel Separation |                      |   |             |   |             |
| Test Results         |                   | Compliance                          |                      |   |             |   |             |

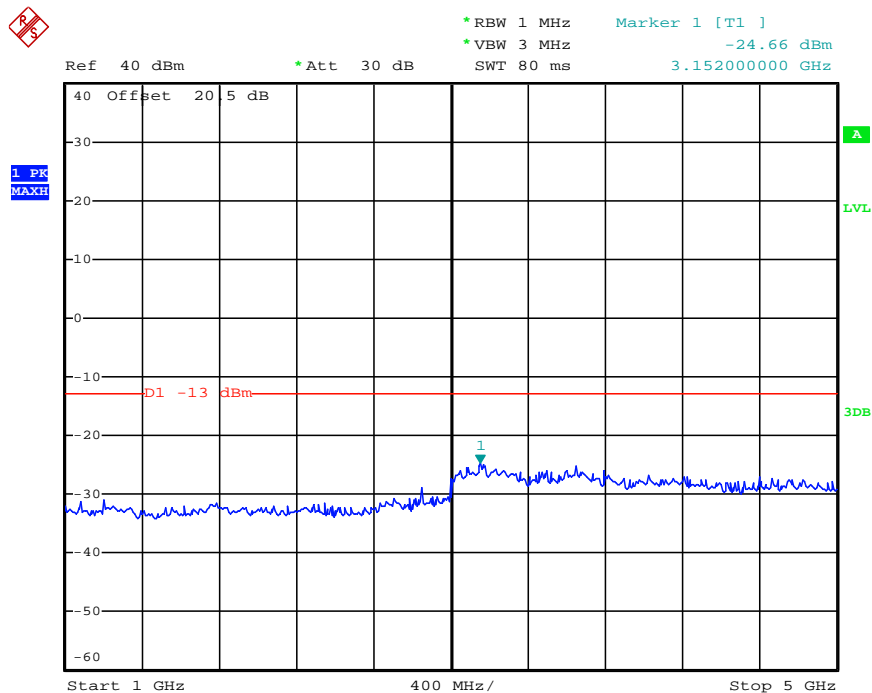
#### Plots of Spurious Emission on Antenna Port Measurement



| Modulation Type/Mode | Channel Sparation | Test Channel | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             | FCC Limit |
|----------------------|-------------------|--------------|----------------------|---|-------------|---|-------------|-----------|
|                      |                   |              |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |           |
| pi/4DQPSK/TMO        | 25KHz             | Low          | 450                  | 901.06  | -20.20      | 3152.00   | -24.66      | -13dBm    |
| Test Results         |                   |              |                      | Compliance                                      |             |   |             |           |

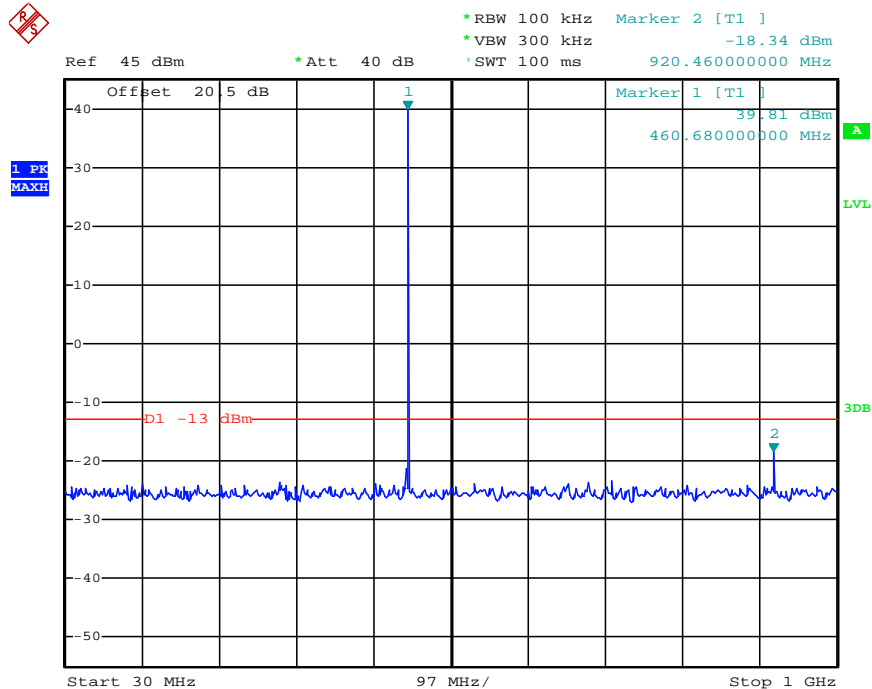


Date: 5.JUN.2012 16:10:27

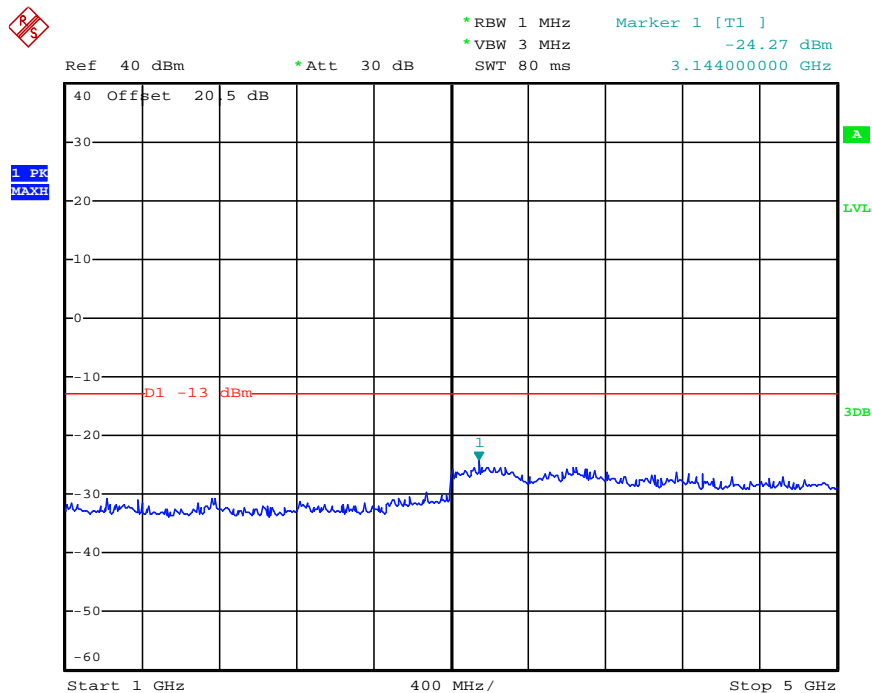


Date: 5.JUN.2012 16:10:04

| Modulation Type/Mode | Channel Sparation | Test Channel | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             | FCC Limit |
|----------------------|-------------------|--------------|----------------------|---|-------------|---|-------------|-----------|
|                      |                   |              |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |           |
| pi/4DQPSK/TMO        | 25KHz             | High         | 460                  | 920.46  | -18.34      | 3144.00   | -24.27      | -13dBm    |
| Test Results         |                   |              |                      | Compliance                                      |             |   |             |           |

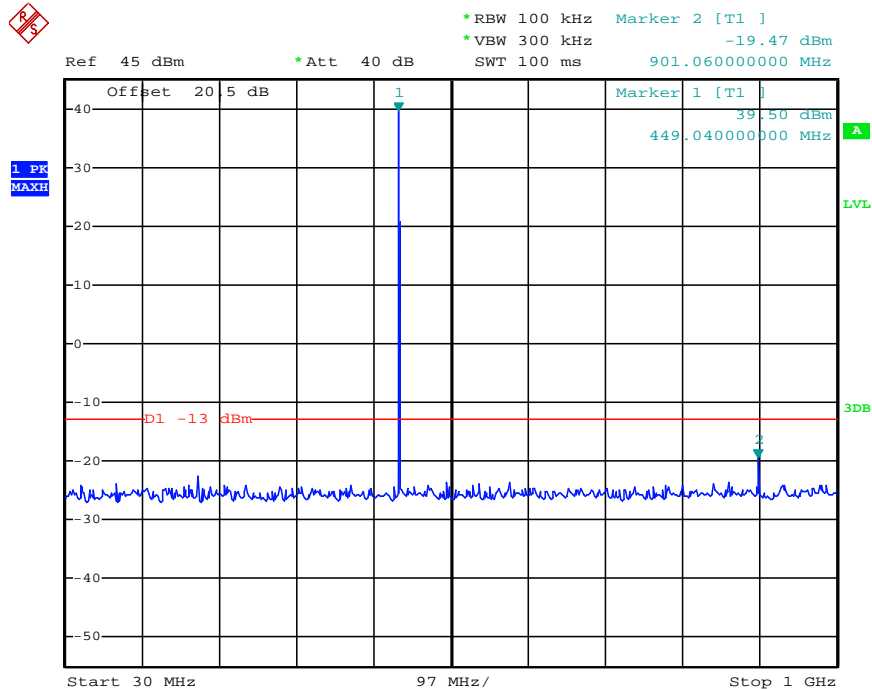


Date: 5.JUN.2012 16:11:26

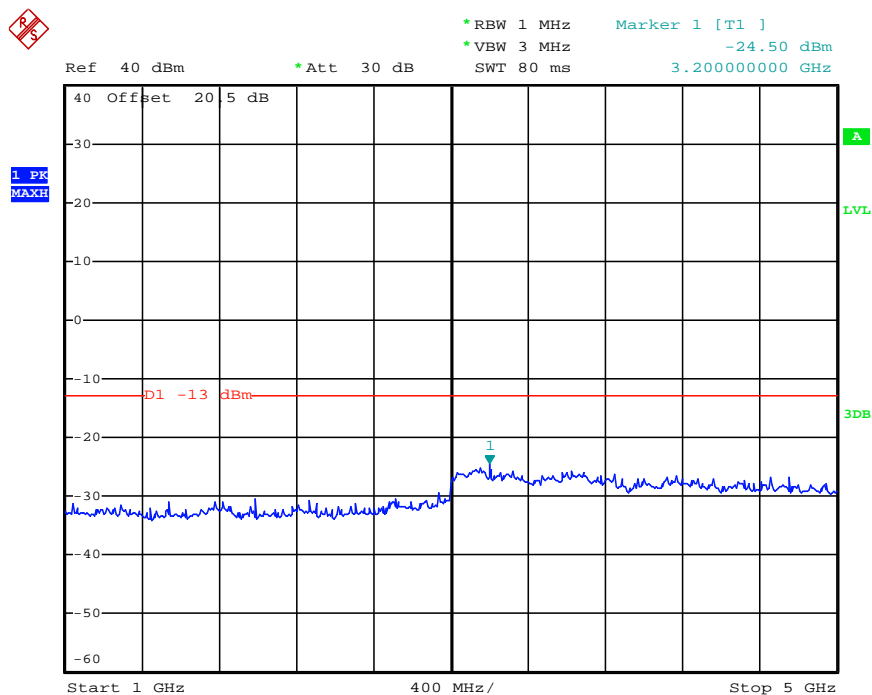


Date: 5.JUN.2012 16:12:06

| Modulation Type/Mode | Channel Sparation | Test Channel | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             | FCC Limit |
|----------------------|-------------------|--------------|----------------------|---|-------------|---|-------------|-----------|
|                      |                   |              |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |           |
| pi/4DQPSK/DMO        | 25KHz             | Low          | 450                  | 901.06  | -19.47      | 3200.00   | -24.50      | -13dBm    |
| Test Results         |                   |              |                      | Compliance                                      |             |   |             |           |

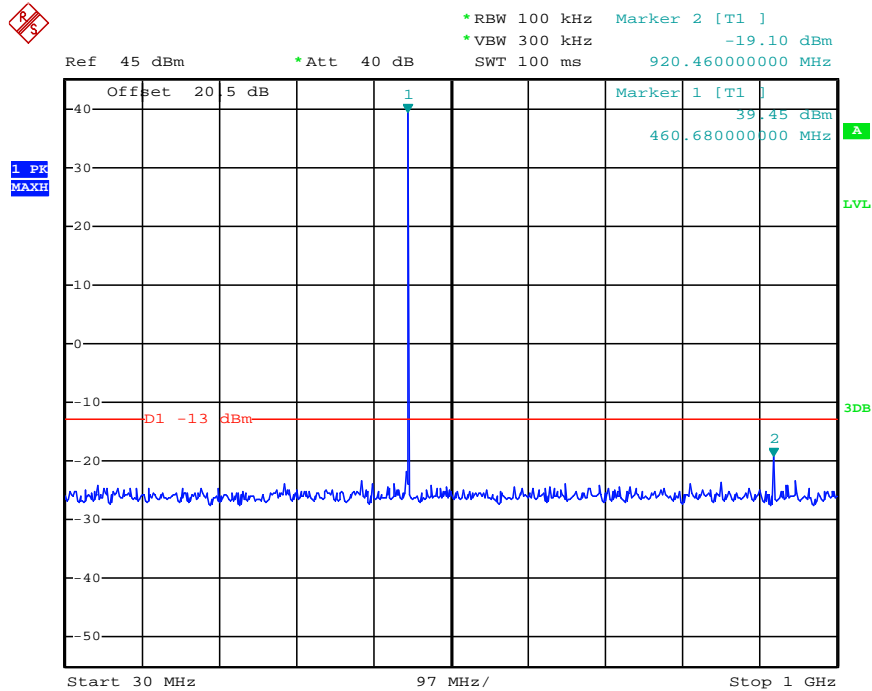


Date: 5.JUN.2012 16:08:53

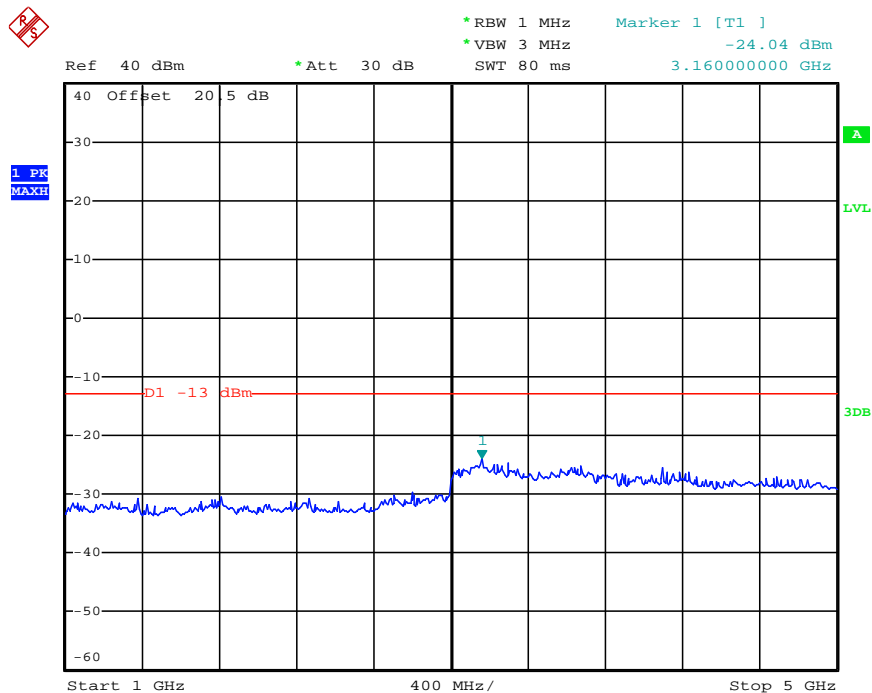


Date: 5.JUN.2012 16:09:20

| Modulation Type/Mode | Channel Sparation | Test Channel | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             | FCC Limit |
|----------------------|-------------------|--------------|----------------------|---|-------------|---|-------------|-----------|
|                      |                   |              |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |           |
| pi/4DQPSK/DMO        | 25KHz             | Middle       | 460                  | 920.46  | -19.10      | 3160.00   | -24.04      | -13dBm    |
| Test Results         |                   |              |                      | Compliance                                      |             |   |             |           |

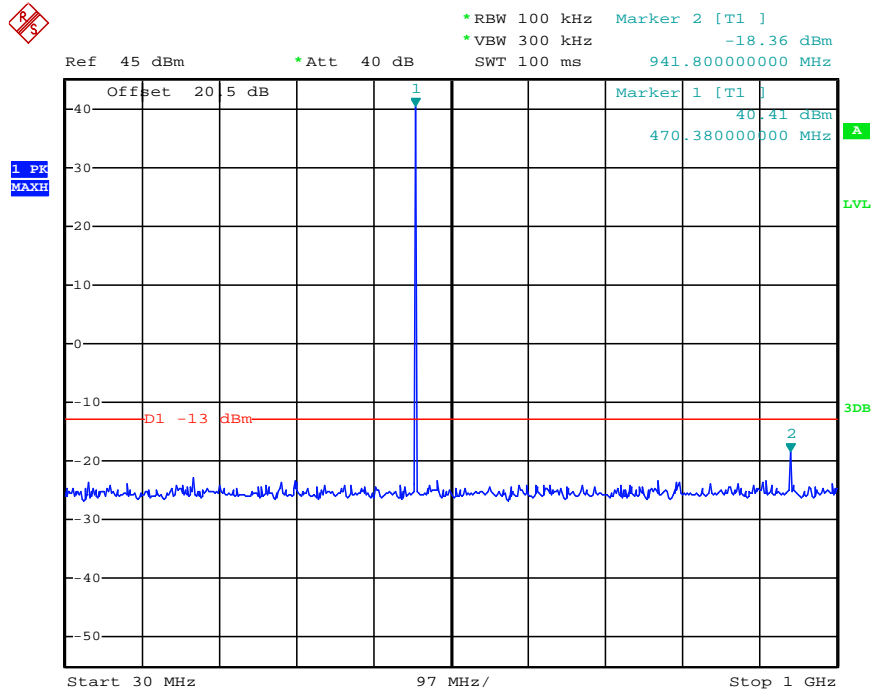


Date: 5.JUN.2012 16:07:56

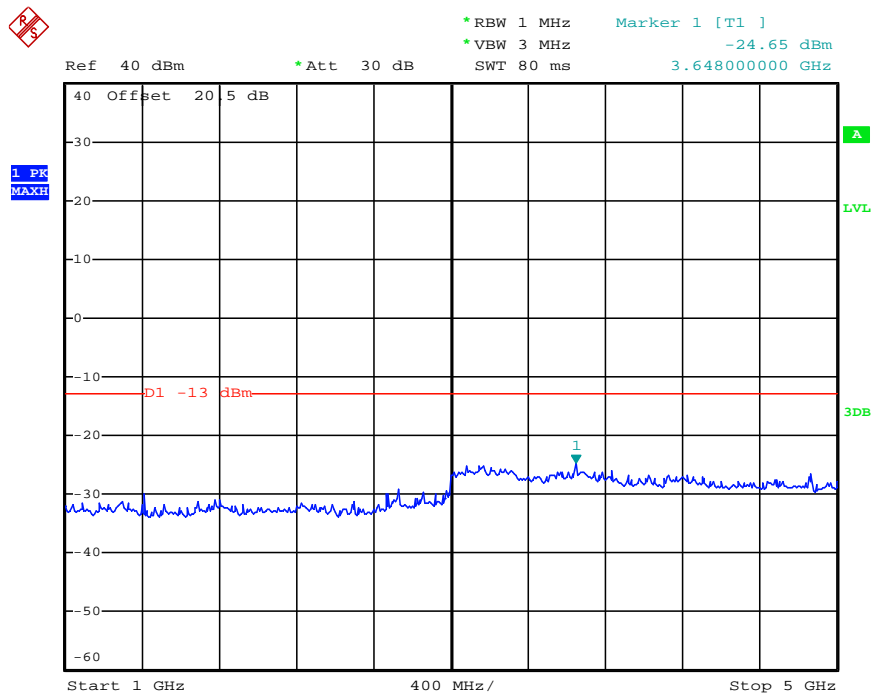


Date: 5.JUN.2012 16:07:20

| Modulation Type/Mode | Channel Sparation | Test Channel | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             | FCC Limit |
|----------------------|-------------------|--------------|----------------------|---|-------------|---|-------------|-----------|
|                      |                   |              |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |           |
| pi/4DQPSK/DMO        | 25KHz             | High         | 470                  | 941.80  | -18.36      | 3648.00   | -24.65      | -13dBm    |
| Test Results         |                   |              |                      | Compliance                                      |             |   |             |           |



Date: 5.JUN.2012 16:05:55



Date: 5.JUN.2012 16:06:36

## 4.5. Modulation Characteristics

### TEST APPLICABLE

According to CFR47 section 2.1047(a), for Voice Modulation Communication Equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000Hz shall be measured.

### TEST PROCEDURE

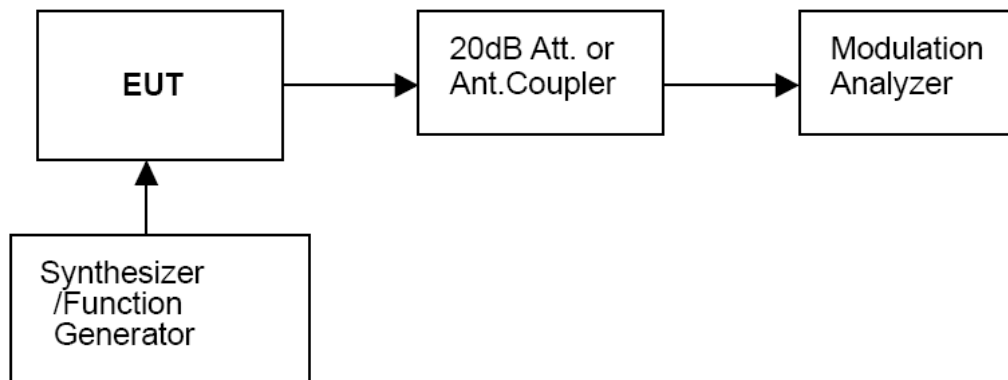
#### **Modulation Limit**

- 1 Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1 KHz using this level as a reference (0dB) and vary the input level from -20 to +20dB. Record the frequency deviation obtained as a function of the input level.
- 2 Repeat step 1 with input frequency changing to 300, 1004, 1500 and 2500Hz in sequence.

#### **Audio Frequency Response**

- 1 Configure the EUT as shown in figure 1.
- 2 Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0dB).
- 3 Vary the Audio frequency from 100 Hz to 3 KHz and record the frequency deviation.
- 4 Audio Frequency Response =  $20\log_{10} (\text{Deviation of test frequency} / \text{Deviation of 1 KHz reference})$ .

### TEST CONFIGURATION



### TEST RESULTS

#### **Modulation type: pi/4DQPSK**

Channel bandwidth: 25 kHz

It is not applicable for devices which operate with the digitized voice/data modulation type.

#### **b). Audio Frequency Response:**

**Rule Part No.: Part 2.1407(a) (b)**

#### **Method of Measurement:**

The audio frequency response was measured in accordance with TIA/EIA Specification 603 with no exception. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 300-3000Hz shall be submitted and Audio Post Limiter Low Pass Filter Response from 3.0 KHz to 50KHz. However, the audio frequency response should test from 100Hz to 5.0 KHz according to FCC Part 90.

#### **Modulation type: pi/4DQPSK**

Channel bandwidth: 25 kHz

It is not applicable for devices which operate with the digitized voice/data modulation type.

## 4.6. Frequency Stability Test

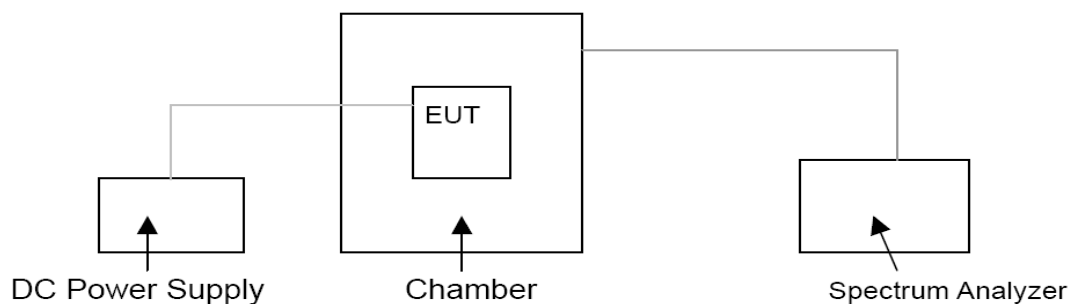
### TEST APPLICABLE

- 1 According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30°C to +60°C centigrade.
- 2 According to FCC Part 2 Section 2.1055 (a) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
- 3 Vary primary supply voltage from 85 to 115 percent of the nominal value.
- 4 According to §90.213, the frequency stability limit is 5.0 ppm for operation frequency frequency 450MHz-470MHz.

### TEST PROCEDURE

The EUT was set in the climate chamber and connected to an external DC power supply. The RF output was directly connected to Spectrum Analyzer ESI 26. The coupling loss of the additional cables was recorded and taken in account for all the measurements. After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC power supply and the voltage was adjusted in the required ranges. The result was recorded.

### TEST CONFIGURATION



### TEST LIMITS

According to 90.213, Transmitters used must have minimum frequency stability as specified in the following table.

| Frequency range (MHz)          | Fixed and base stations | Mobile stations           |                              |
|--------------------------------|-------------------------|---------------------------|------------------------------|
|                                |                         | Over 2 watts output power | 2 watts or less output power |
| Below 25 .....                 | 1,2,3 100               | 100                       | 200                          |
| 25-50 .....                    | 20                      | 20                        | 50                           |
| 72-76 .....                    | 5                       | -----                     | 50                           |
| 150-174 .....                  | 5,11 5                  | 6 5                       | 4,6 50                       |
| 216-220 .....                  | 1.0                     | -----                     | 1.0                          |
| 220-222 <sup>12</sup> .....    | 0.1                     | 1.5                       | 1.5                          |
| 421-512 .....                  | 7,11,14 2.5             | 8 5                       | 8 5                          |
| 806-809 .....                  | 14 1.0                  | 1.5                       | 1.5                          |
| 809-824 .....                  | 14 1.5                  | 2.5                       | 2.5                          |
| 851-854 .....                  | 1.0                     | 1.5                       | 1.5                          |
| 854-869 .....                  | 1.5                     | 2.5                       | 2.5                          |
| 896-901 .....                  | 14 0.1                  | 1.5                       | 1.5                          |
| 902-928 .....                  | 2.5                     | 2.5                       | 2.5                          |
| 902-928 <sup>13</sup> .....    | 2.5                     | 2.5                       | 2.5                          |
| 929-930 .....                  | 1.5                     | -----                     | -----                        |
| 935-940 .....                  | 0.1                     | 1.5                       | 1.5                          |
| 1427-1435 .....                | 9 300                   | 300                       | 300                          |
| Above 2450 <sup>10</sup> ..... | -----                   | -----                     | -----                        |

**TEST RESULTS**

| Modulation Type/Mode | Channel Separation | Test conditions    |          | Frequency error (ppm) |      |
|----------------------|--------------------|--------------------|----------|-----------------------|------|
|                      |                    | Voltage(V)         | Temp(°C) | Low                   | High |
| pi/4DQPSK/TMO        | 25 KHz             | 13.20              | -30      | 0.57                  | 0.54 |
|                      |                    |                    | -20      | 0.57                  | 0.52 |
|                      |                    |                    | -10      | 0.45                  | 0.47 |
|                      |                    |                    | 0        | 0.43                  | 0.42 |
|                      |                    |                    | 10       | 0.40                  | 0.40 |
|                      |                    |                    | 20       | 0.39                  | 0.35 |
|                      |                    |                    | 30       | 0.39                  | 0.35 |
|                      |                    |                    | 40       | 0.48                  | 0.44 |
|                      |                    |                    | 50       | 0.55                  | 0.51 |
|                      |                    | 11.22 (85% Rated)  | 20       | 0.39                  | 0.35 |
|                      |                    | 15.18 (115% Rated) | 20       | 0.39                  | 0.33 |
| Limit                |                    |                    | 5.0 ppm  |                       |      |
| Conclusion           |                    |                    | Complies |                       |      |

| Modulation Type/Mode | Channel Separation | Test conditions    |          | Frequency error (ppm) |        |      |
|----------------------|--------------------|--------------------|----------|-----------------------|--------|------|
|                      |                    | Voltage(V)         | Temp(°C) | Low                   | Middle | High |
| pi/4DQPSK/<br>DMO    | 25 KHz             | 13.20              | -30      | 0.59                  | 0.57   | 0.52 |
|                      |                    |                    | -20      | 0.57                  | 0.52   | 0.50 |
|                      |                    |                    | -10      | 0.49                  | 0.47   | 0.45 |
|                      |                    |                    | 0        | 0.45                  | 0.44   | 0.40 |
|                      |                    |                    | 10       | 0.42                  | 0.44   | 0.40 |
|                      |                    |                    | 20       | 0.39                  | 0.38   | 0.34 |
|                      |                    |                    | 30       | 0.39                  | 0.35   | 0.33 |
|                      |                    |                    | 40       | 0.48                  | 0.41   | 0.41 |
|                      |                    |                    | 50       | 0.57                  | 0.55   | 0.50 |
|                      |                    | 11.22 (85% Rated)  | 20       | 0.39                  | 0.38   | 0.34 |
|                      |                    | 15.18 (115% Rated) | 20       | 0.39                  | 0.38   | 0.33 |
| Limit                |                    |                    | 5.0 ppm  |                       |        |      |
| Conclusion           |                    |                    | Complies |                       |        |      |



## 4.7. Maximum Transmitter Power

### TEST APPLICABLE

Per FCC «2.1046 and «90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area.

### TEST PROCEDURE

Measurements shall be made to establish the radio frequency power delivered by the transmitter the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted below:

If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

The EUT connect to the Receiver through attenuator.

Measurement with Spectrum Analyzer ESI 26 conducted, external power supply with 13.20 V stabilized supply voltage.

### TEST CONFIGURATION

|     |  |            |  |                            |
|-----|--|------------|--|----------------------------|
| EUT |  | Attenuator |  | Spectrum Analyzer/Receiver |
|     |  |            |  |                            |

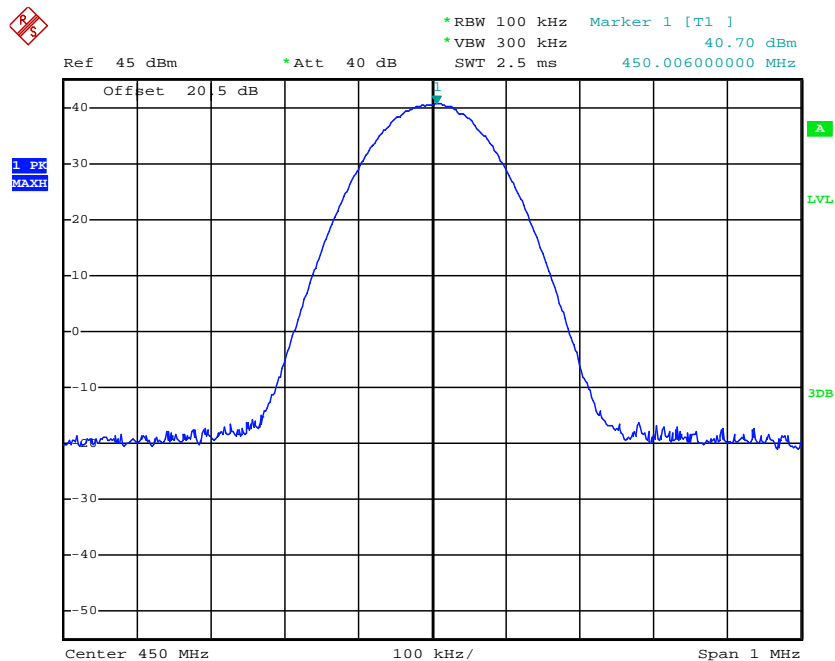
The EUT was directly connected to a RF Communication  
Test set by attenuator

### TEST RESULTS

| Modulation Type/Mode | Channel Separation | Test Channel  | Test Frequency (MHz) | Maximum Transmitter Power at Rated High Power Level (dBm) |
|----------------------|--------------------|---|----------------------|---|
| pi/4DQPSK/TMO        | 25KHz              | Low   | 450                  | 40.70   |
|                      |                    | High  | 460                  | 40.58   |
| pi/4DQPSK/DMO        |                    | Low   | 450                  | 40.65   |
|                      |                    | Middle  | 460                  | 40.53   |
|                      |                    | High  | 470                  | 40.43   |
| Limit                |                    | The limit is dependent upon the station's antenna HAAT and required service area. |                      |   |
| Test Results         |                    | Complicance   |                      |   |

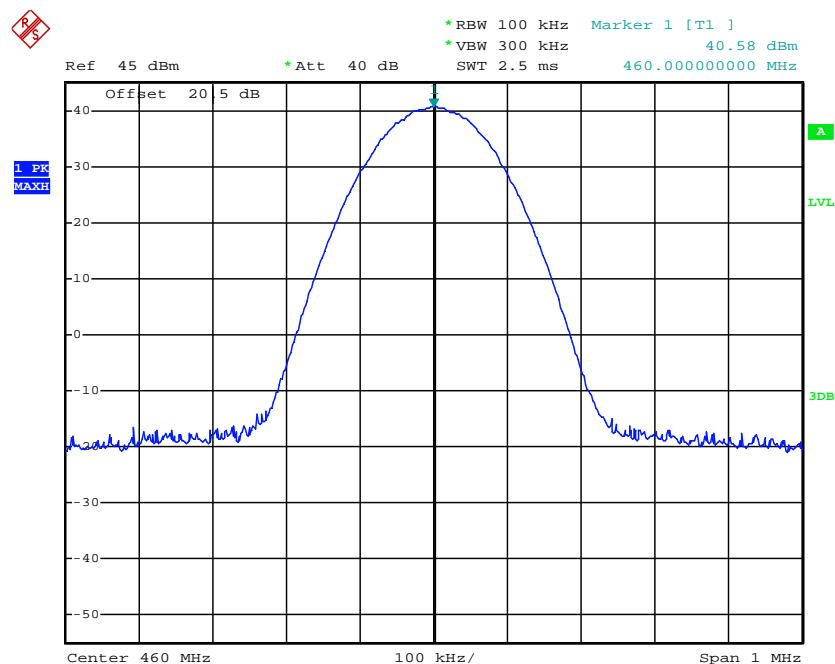
### Plots of Maximum Transmitter Power Measurement

| Modulation Type/Mode | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results     |
|----------------------|--------------------|------------|--------------------|-------------------|-----------|-------------|
| pi/4DQPSK/TMO        | 25 KHz             | 450        | 10.00              | 40.70             | Varies    | Complicance |



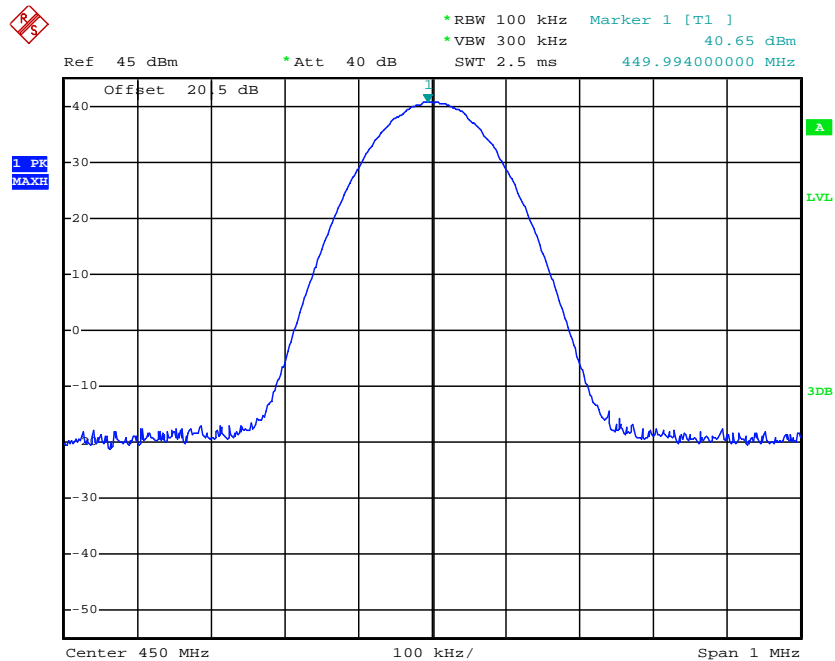
Date: 5.JUN.2012 16:01:15

| Modulation Type/Mode | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results     |
|----------------------|--------------------|------------|--------------------|-------------------|-----------|-------------|
| pi/4DQPSK/TMO        | 25 KHz             | 460        | 10.0               | 40.58             | Varies    | Complicance |



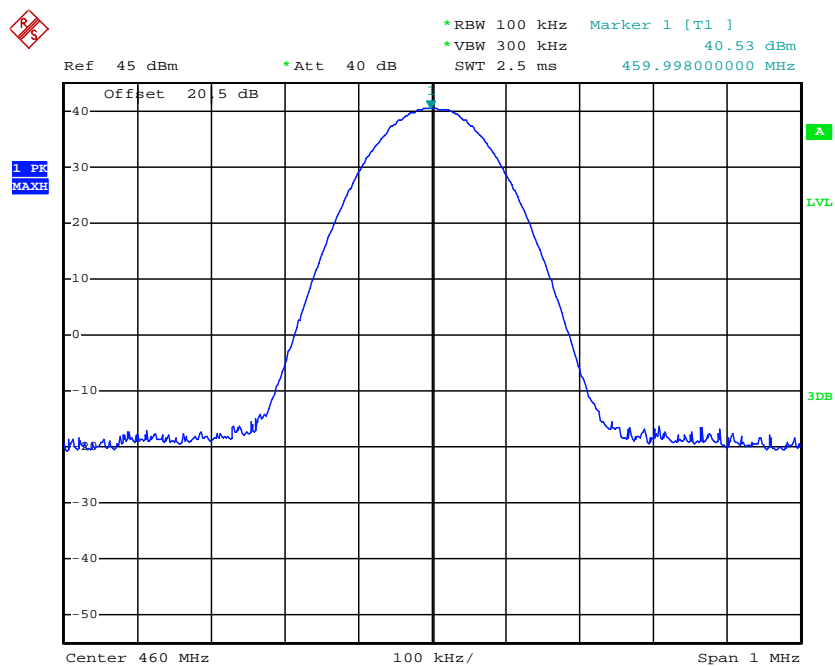
Date: 5.JUN.2012 16:02:10

| Modulation Type/Mode | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results     |
|----------------------|--------------------|------------|--------------------|-------------------|-----------|-------------|
| pi/4DQPSK/DMO        | 25 KHz             | 450        | 10.0               | 40.65             | Varies    | Complicance |



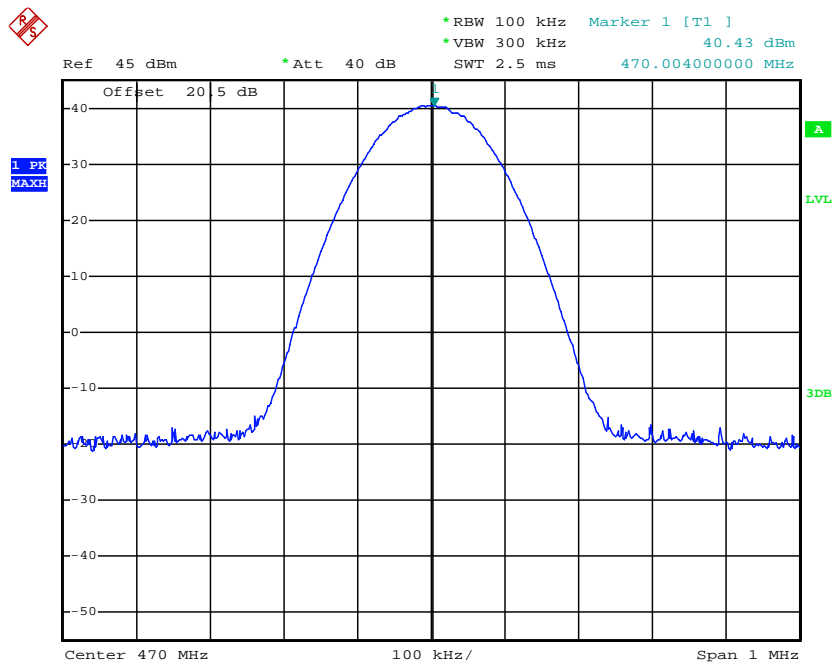
Date: 5.JUN.2012 16:03:00

| Modulation Type/Mode | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results     |
|----------------------|--------------------|------------|--------------------|-------------------|-----------|-------------|
| pi/4DQPSK/DMO        | 25 KHz             | 460        | 10.0               | 40.53             | Varies    | Complicance |



Date: 5.JUN.2012 16:03:48

| Modulation Type/Mode | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results     |
|----------------------|--------------------|------------|--------------------|-------------------|-----------|-------------|
| pi/4DQPSK/DMO        | 25 KHz             | 470        | 10.0               | 40.43             | Varies    | Complicance |



Date: 5.JUN.2012 16:04:39

## 4.8. Transmitter Frequency Behavior

### TEST APPLICABLE

Section 90.214

Transient frequencies must be within the maximum frequency difference limits during the time intervals indicated:

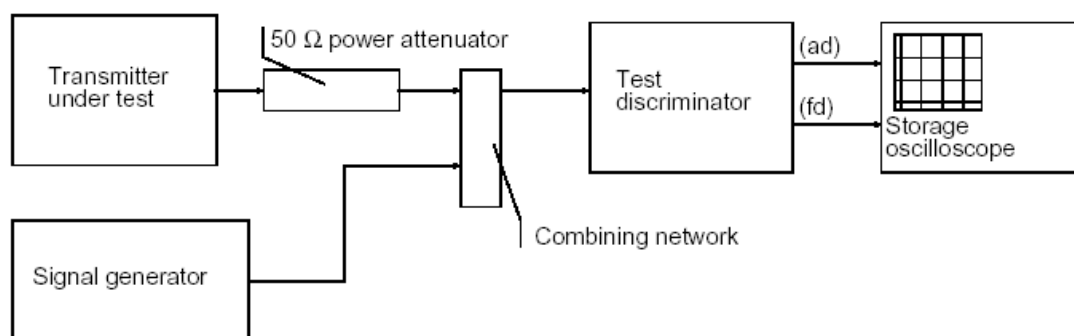
| Time intervals <sup>1, 2</sup>  | Maximum frequency difference <sup>3</sup> | All equipment  |               |
|---|---|----------------|---------------|
|   |   | 150 to 174 MHz | 421 to 512MHz |
| Transient Frequency Behavior for Equipment Designed to Operate on 25 KHz Channels   |   |                |               |
| t <sub>1</sub> <sup>4</sup> .....   | ± 25.0 KHz                                | 5.0 ms         | 10.0 ms       |
| t <sub>2</sub> .....  | ± 12.5 KHz                                | 20.0 ms        | 25.0 ms       |
| t <sub>3</sub> <sup>4</sup> .....   | ± 25.0 KHz                                | 5.0 ms         | 10.0 ms       |
| Transient Frequency Behavior for Equipment Designed to Operate on 12.5 KHz Channels |   |                |               |
| t <sub>1</sub> <sup>4</sup> .....   | ± 12.5 KHz                                | 5.0 ms         | 10.0 ms       |
| t <sub>2</sub> .....  | ± 6.25 KHz                                | 20.0 ms        | 25.0 ms       |
| t <sub>3</sub> <sup>4</sup> .....   | ± 12.5 KHz                                | 5.0 ms         | 10.0 ms       |
| Transient Frequency Behavior for Equipment Designed to Operate on 6.25 KHz Channels |   |                |               |
| t <sub>1</sub> <sup>4</sup> .....   | ±6.25 KHz                                 | 5.0 ms         | 10.0 ms       |
| t <sub>2</sub> .....  | ±3.125 KHz                                | 20.0 ms        | 25.0 ms       |
| t <sub>3</sub> <sup>4</sup> .....   | ±6.25 KHz                                 | 5.0 ms         | 10.0 ms       |

- $t_{on}$  is the instant when a 1 KHz test signal is completely suppressed, including any capture time due to phasing.  
 $t_1$  is the time period immediately following  $t_{on}$ .  
 $t_2$  is the time period immediately following  $t_1$ .  
 $t_3$  is the time period from the instant when the transmitter is turned off until  $t_{off}$ .  
 $t_{off}$  is the instant when the 1 KHz test signal starts to rise.
- During the time from the end of  $t_2$  to the beginning of  $t_3$ , the frequency difference must not exceed the limits specified in § 90.213.
- Difference between the actual transmitter frequency and the assigned transmitter frequency.
- If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

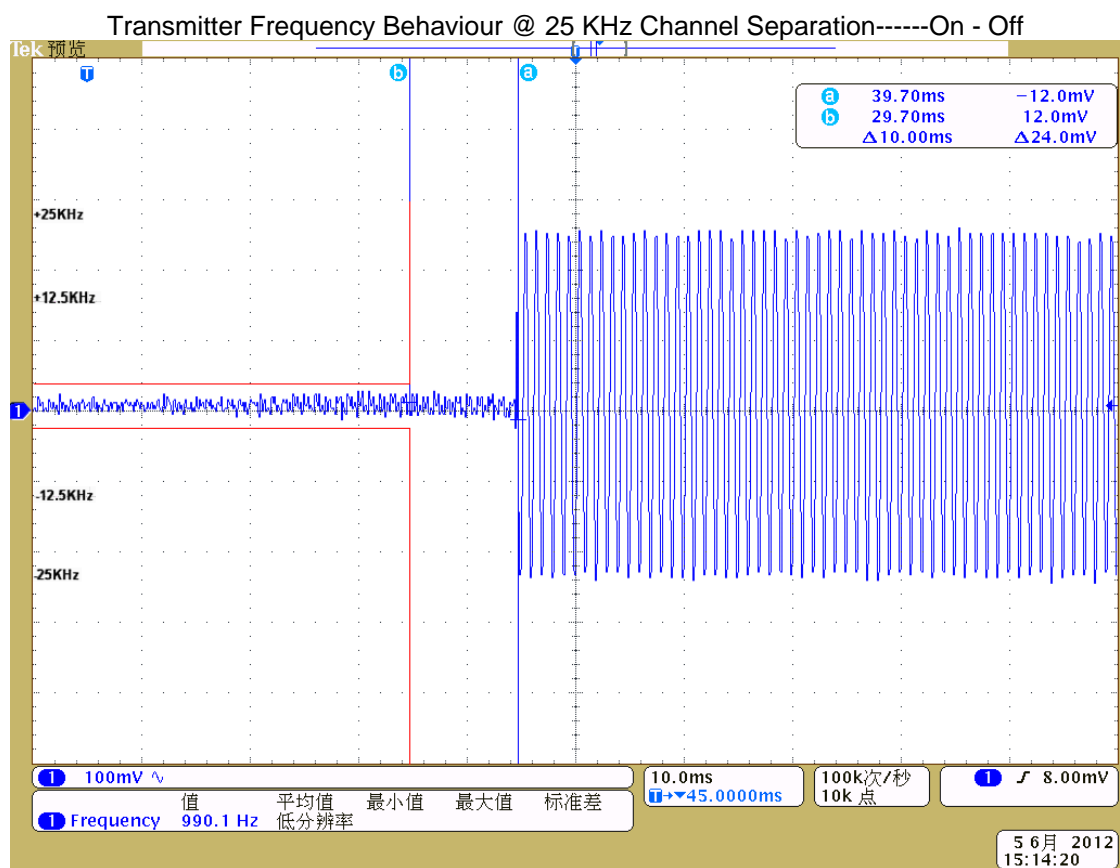
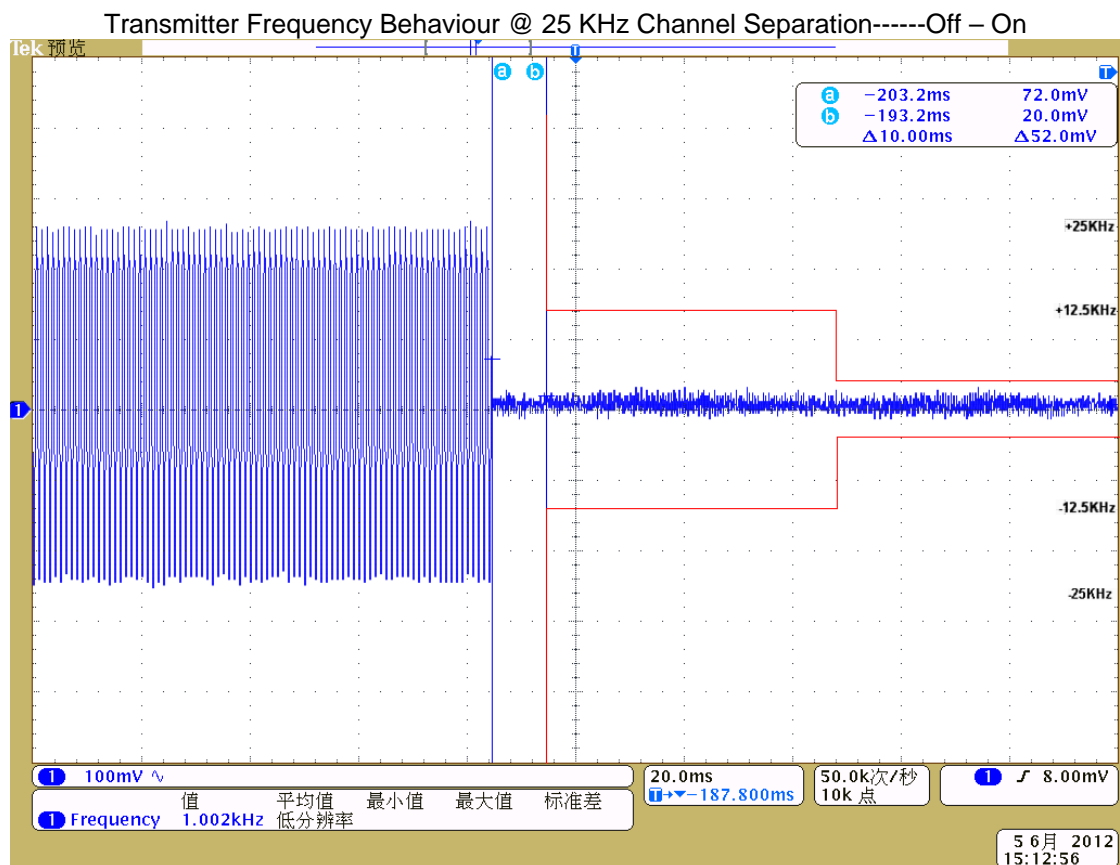
### TEST PROCEDURE

TIA/EIA-603 2.2.19

### TEST CONFIGURATION



### TEST RESULTS



## 4.9. Receiver Radiated Spurious Emission

### TEST APPLICABLE

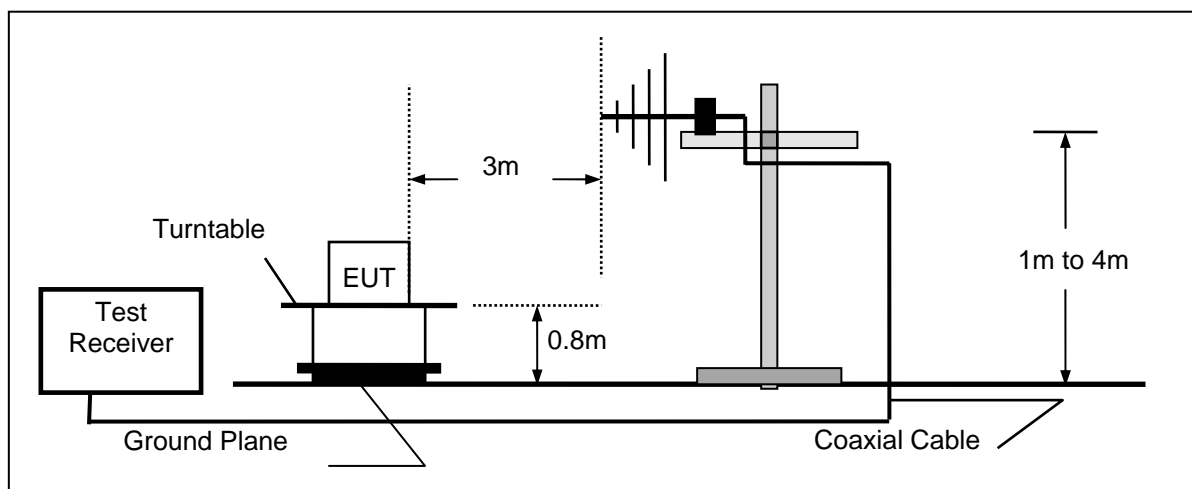
The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

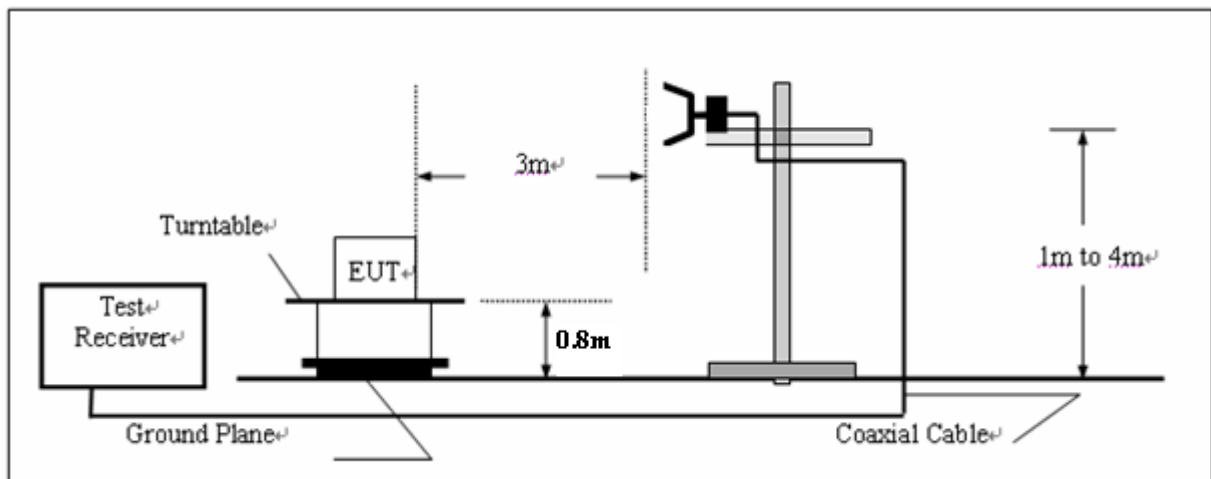
|                           |  |
|---------------------------|--|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude    | AG = Amplifier Gain                        |
| AF = Antenna Factor       |  |

### TEST CONFIGURATION

(A) Radiated Emission Test Set-Up, Frequency below 1000MHz



(B) Radiated Emission Test Set-Up, Frequency above 1000MHz



### TEST PROCEDURE

- 1 The EUT was placed on a turn table which is 0.8m above ground plane.
- 2 Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT
- 3 And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 4 Repeat above procedures until all frequency measurements have been completed.

**RECEIVER RADIATED SPOUIOUS LIMIT**

For unintentional device, according to § 15.109(a) and RSS-Gen, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency<br>(MHz) | Distance<br>(Meters) | Radiated<br>(dBµV/m) | Radiated<br>(µV/m) |
|--------------------|----------------------|----------------------|--------------------|
| 30-88              | 3                    | 40.0                 | 100                |
| 88-216             | 3                    | 43.5                 | 150                |
| 216-960            | 3                    | 46.0                 | 200                |
| Above 960          | 3                    | 54.0                 | 500                |

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

**TEST RESULTS**

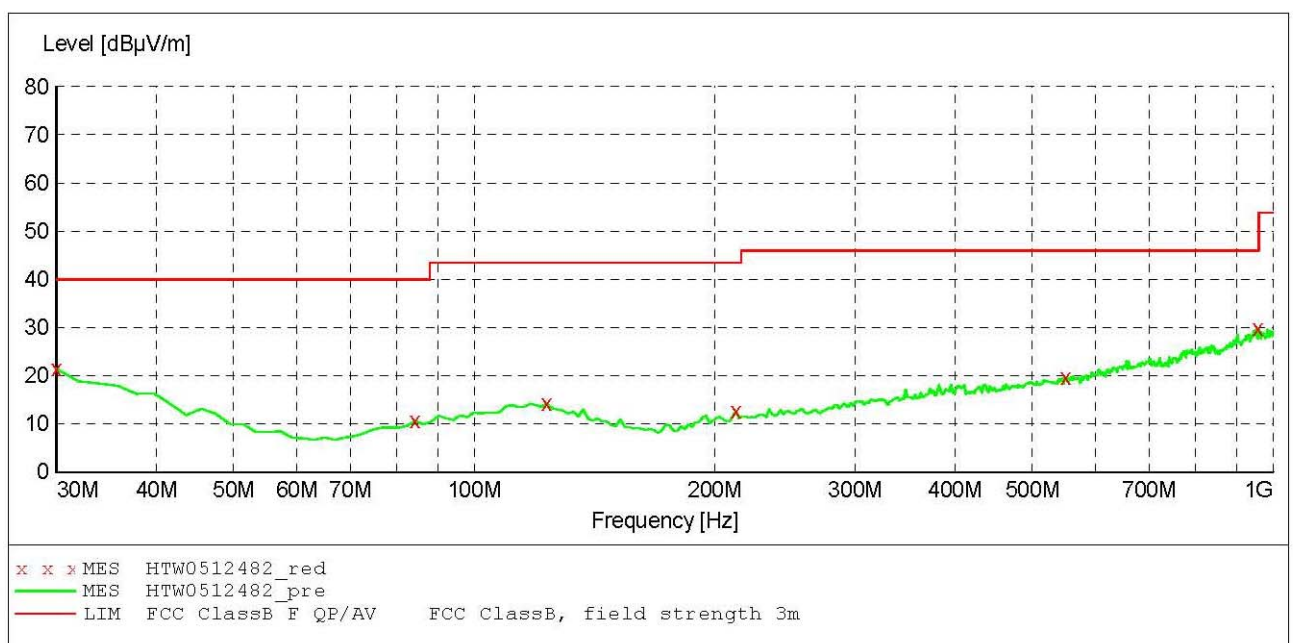
The Radiated Measurement are performed to the three channels (the high channel middle channel and the low channel), the datum recorded below is the worst case for each mode;and the EUT shall be scanned from 30 MHz to the 5th harmonic of the highest oscillator frequency in the digital devices or 1 GHz whichever is higher.



| Modulation Type/Mode | Channel Separation | Test Frequency (MHz) | Polar.     | Maximum Radiated Emissions |                | FCC Limit (dBuV/m) |
|----------------------|--------------------|----------------------|------------|----------------------------|----------------|--------------------|
|                      |                    |                      |            | Frequency (MHz)            | Datum (dBuV/m) |                    |
| pi/4DQPSK/TMO        | 25 KHz             | 460                  | H          | 959.18                     | 29.90          | 46.00              |
|                      |                    |                      | V          | 951.40                     | 29.90          | 46.00              |
| Test Results         |                    |                      | Compliance |                            |                |                    |

***SWEEP TABLE: "test (30M-1G)"***

Short Description: Field Strength  
 Start Stop Detector Meas. IF Transducer  
 Frequency Frequency Time Bandw.  
 30.0 MHz 1.0 GHz MaxPeak Coupled 120 kHz HL562 2011

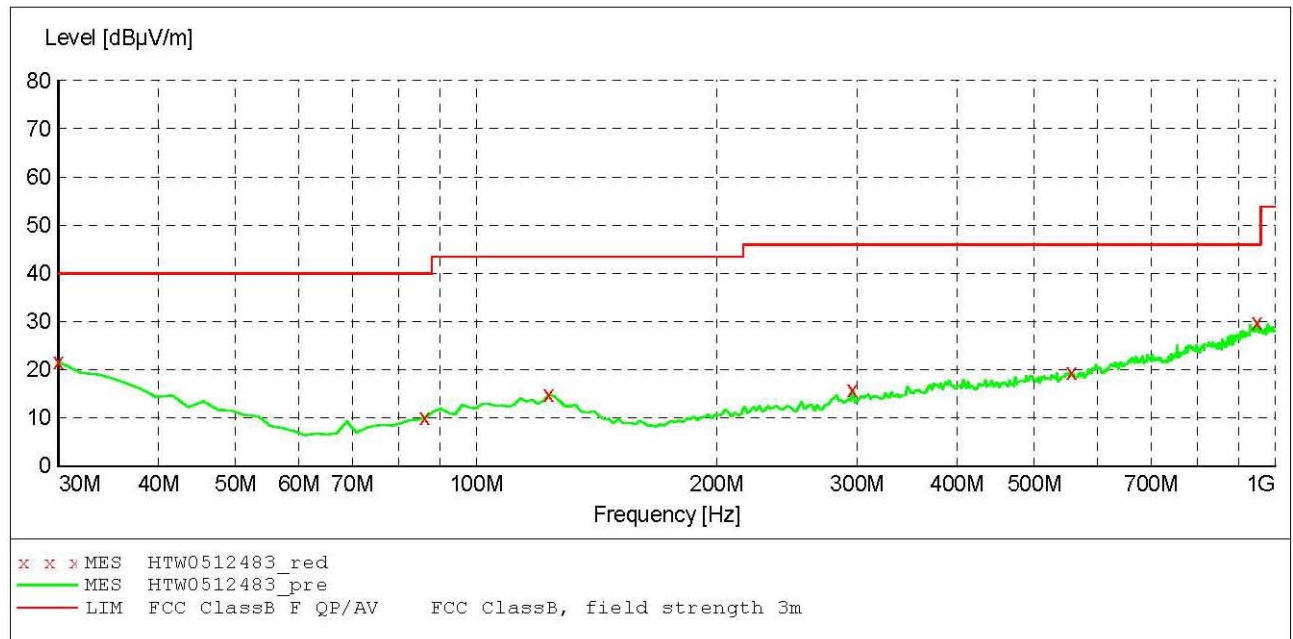
***MEASUREMENT RESULT: "HTW0512482\_red"***

5/12/2012 3:07PM

| Frequency MHz | Level dBuV/m | Transd dB | Limit dBuV/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---------------|--------------|-----------|--------------|-----------|------|-----------|-------------|--------------|
| 30.000000     | 21.40        | -10.2     | 40.0         | 18.6      | PK   | 100.0     | 13.00       | HORIZONTAL   |
| 84.428858     | 10.60        | -22.2     | 40.0         | 29.4      | PK   | 100.0     | 250.00      | HORIZONTAL   |
| 123.306613    | 14.30        | -18.4     | 43.5         | 29.2      | PK   | 100.0     | 65.00       | HORIZONTAL   |
| 212.725451    | 12.60        | -21.1     | 43.5         | 30.9      | PK   | 300.0     | 85.00       | HORIZONTAL   |
| 550.961924    | 19.70        | -13.2     | 46.0         | 26.3      | PK   | 100.0     | 140.00      | HORIZONTAL   |
| 959.178357    | 29.90        | -5.4      | 46.0         | 16.1      | PK   | 100.0     | 213.00      | HORIZONTAL   |

***SWEEP TABLE: "test (30M-1G)"***

|                    |           |                |         |         |            |
|--------------------|-----------|----------------|---------|---------|------------|
| Short Description: |           | Field Strength |         |         |            |
| Start              | Stop      | Detector       | Meas.   | IF      | Transducer |
| Frequency          | Frequency |                | Time    | Bandw.  |            |
| 30.0 MHz           | 1.0 GHz   | MaxPeak        | Coupled | 120 kHz | HL562 2011 |

***MEASUREMENT RESULT: "HTW0512483\_red"***

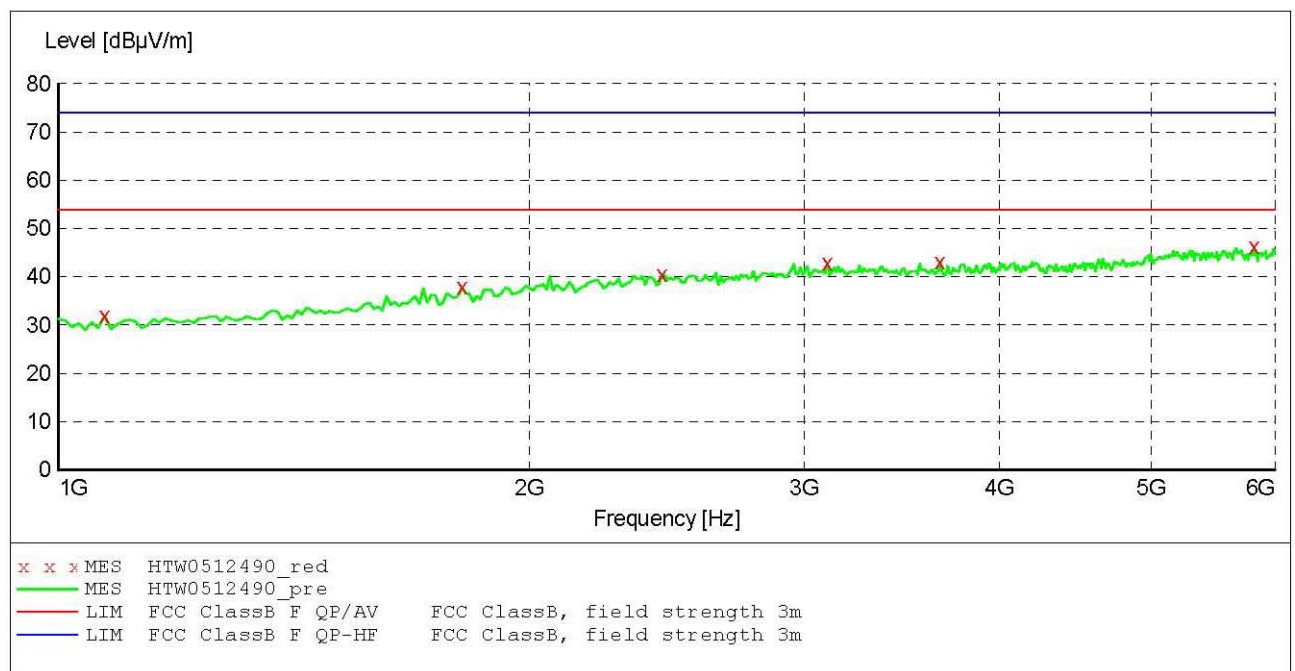
5/12/2012 3:08PM

| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 30.000000        | 21.70           | -10.2        | 40.0            | 18.3         | PK   | 100.0        | 324.00         | VERTICAL     |
| 86.372745        | 10.10           | -21.7        | 40.0            | 29.9         | PK   | 100.0        | 299.00         | VERTICAL     |
| 123.306613       | 14.80           | -18.4        | 43.5            | 28.7         | PK   | 100.0        | 19.00          | VERTICAL     |
| 296.312625       | 15.90           | -18.4        | 46.0            | 30.1         | PK   | 100.0        | 0.00           | VERTICAL     |
| 556.793587       | 19.40           | -13.3        | 46.0            | 26.6         | PK   | 100.0        | 109.00         | VERTICAL     |
| 951.402806       | 29.90           | -5.1         | 46.0            | 16.1         | PK   | 100.0        | 133.00         | VERTICAL     |

| Modulation Type/Mode | Channel Separation | Test Frequency (MHz) | Polar.     | Maximum Radiated Emissions |                | FCC Limit (dBuV/m) |
|----------------------|--------------------|----------------------|------------|----------------------------|----------------|--------------------|
|                      |                    |                      |            | Frequency (MHz)            | Datum (dBuV/m) |                    |
| pi/4DQPSK/TMO        | 25 KHz             | 460                  | H          | 5819.64                    | 46.30          | 54.00              |
|                      |                    |                      | V          | 5919.44                    | 46.50          | 54.00              |
| Test Results         |                    |                      | Compliance |                            |                |                    |

***SWEEP TABLE: "test (1G-18G) P"***

Short Description: EN 55022 Field Strength  
 Start Stop Detector Meas. IF Transducer  
 Frequency Frequency Time Bandw.  
 1.0 GHz 18.0 GHz MaxPeak Coupled 1 MHz HF906 2011

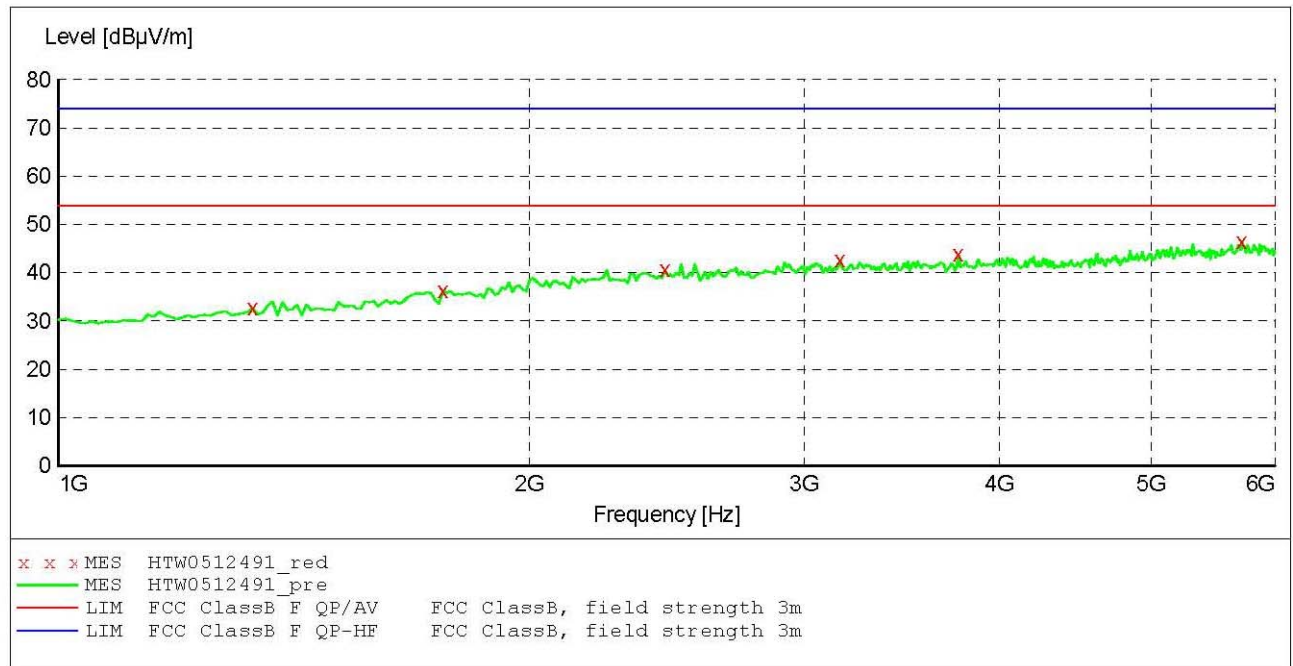
***MEASUREMENT RESULT: "HTW0512490\_red"***

5/12/2012 3:24PM

| Frequency<br>MHz | Level<br>dBuV/m | Transd<br>dB | Limit<br>dBuV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 1070.140281      | 32.00           | -9.2         | 53.9            | 21.9         | PK   | 100.0        | 242.00         | HORIZONTAL   |
| 1811.623246      | 37.80           | -3.0         | 53.9            | 16.1         | PK   | 100.0        | 180.00         | HORIZONTAL   |
| 2432.865731      | 40.40           | 0.6          | 53.9            | 13.5         | PK   | 100.0        | 217.00         | HORIZONTAL   |
| 3104.208417      | 42.90           | 2.2          | 53.9            | 11.0         | PK   | 100.0        | 251.00         | HORIZONTAL   |
| 3665.330661      | 43.10           | 3.0          | 53.9            | 10.8         | PK   | 100.0        | 360.00         | HORIZONTAL   |
| 5819.639279      | 46.30           | 7.1          | 53.9            | 7.6          | PK   | 100.0        | 36.00          | HORIZONTAL   |

***SWEEP TABLE: "test (1G-18G) P"***

Short Description: EN 55022 Field Strength  
 Start Stop Detector Meas. IF Transducer  
 Frequency Frequency Time Bandw.  
 1.0 GHz 18.0 GHz MaxPeak Coupled 1 MHz HF906 2011

***MEASUREMENT RESULT: "HTW0512491\_red"***

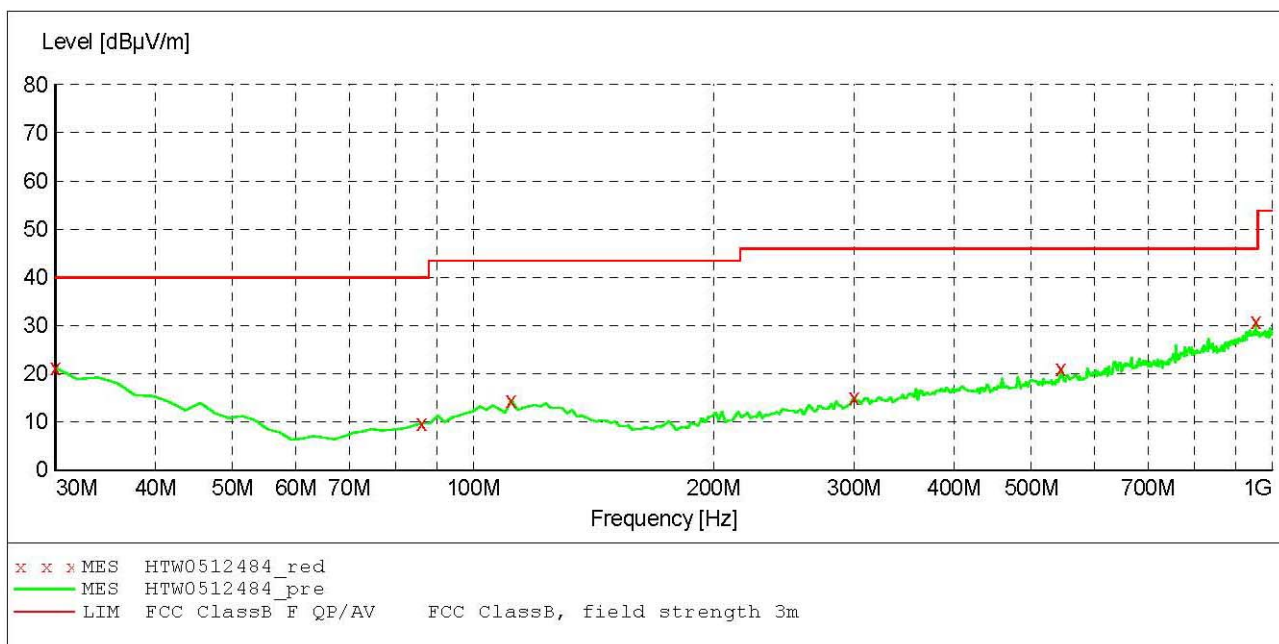
5/12/2012 3:26PM

| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 1330.661323      | 32.80           | -7.1         | 53.9            | 21.1         | PK   | 100.0        | 114.00         | VERTICAL     |
| 1761.523046      | 36.30           | -3.4         | 53.9            | 17.6         | PK   | 100.0        | 232.00         | VERTICAL     |
| 2442.885772      | 40.60           | 0.6          | 53.9            | 13.3         | PK   | 100.0        | 185.00         | VERTICAL     |
| 3164.328657      | 42.60           | 2.3          | 53.9            | 11.3         | PK   | 100.0        | 219.00         | VERTICAL     |
| 3765.531062      | 43.80           | 3.2          | 53.9            | 10.1         | PK   | 100.0        | 105.00         | VERTICAL     |
| 5719.438878      | 46.50           | 6.9          | 53.9            | 7.4          | PK   | 100.0        | 98.00          | VERTICAL     |

| Modulation Type/Mode | Channel Separation | Test Frequency (MHz) | Polar.     | Maximum Radiated Emissions |                | FCC Limit (dBuV/m) |
|----------------------|--------------------|----------------------|------------|----------------------------|----------------|--------------------|
|                      |                    |                      |            | Frequency (MHz)            | Datum (dBuV/m) |                    |
| pi/4DQPSK/DMO        | 25 KHz             | 460                  | H          | 937.80                     | 29.20          | 46.00              |
|                      |                    |                      | V          | 955.29                     | 30.90          | 46.00              |
| Test Results         |                    |                      | Compliance |                            |                |                    |

***SWEEP TABLE: "test (30M-1G)"***

|                    |           |                |         |         |            |  |
|--------------------|-----------|----------------|---------|---------|------------|--|
| Short Description: |           | Field Strength |         |         |            |  |
| Start              | Stop      | Detector       | Meas.   | IF      | Transducer |  |
| Frequency          | Frequency |                | Time    | Bandw.  |            |  |
| 30.0 MHz           | 1.0 GHz   | MaxPeak        | Coupled | 120 kHz | HL562 2011 |  |

***MEASUREMENT RESULT: "HTW0512484\_red"***

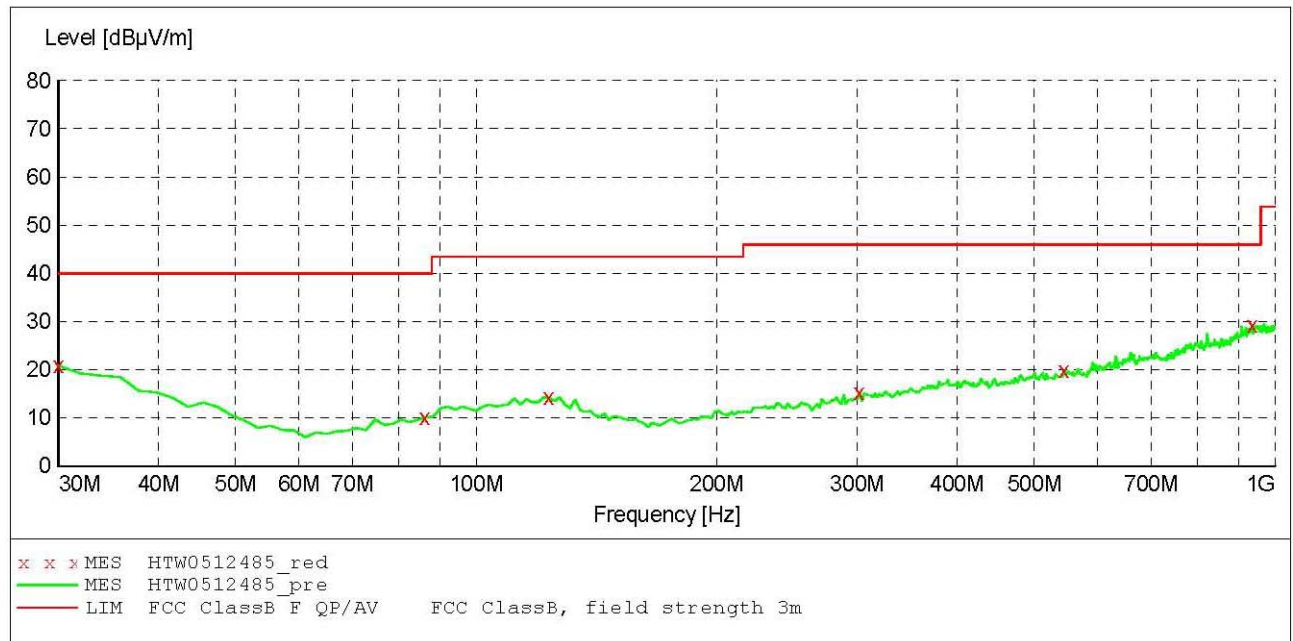
5/12/2012 3:10PM

| Frequency MHz | Level dBuV/m | Transd dB | Limit dBuV/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---------------|--------------|-----------|--------------|-----------|------|-----------|-------------|--------------|
| 30.000000     | 21.20        | -10.2     | 40.0         | 18.8      | PK   | 100.0     | 119.00      | VERTICAL     |
| 86.372745     | 9.70         | -21.7     | 40.0         | 30.3      | PK   | 100.0     | 0.00        | VERTICAL     |
| 111.643287    | 14.50        | -18.9     | 43.5         | 29.0      | PK   | 100.0     | 113.00      | VERTICAL     |
| 300.200401    | 15.00        | -18.1     | 46.0         | 31.0      | PK   | 100.0     | 119.00      | VERTICAL     |
| 545.130261    | 21.00        | -13.6     | 46.0         | 25.0      | PK   | 100.0     | 207.00      | VERTICAL     |
| 955.290581    | 30.90        | -5.2      | 46.0         | 15.1      | PK   | 100.0     | 12.00       | VERTICAL     |



***SWEEP TABLE: "test (30M-1G)"***

|                    |           |                |         |         |            |
|--------------------|-----------|----------------|---------|---------|------------|
| Short Description: |           | Field Strength |         |         |            |
| Start              | Stop      | Detector       | Meas.   | IF      | Transducer |
| Frequency          | Frequency |                | Time    | Bandw.  |            |
| 30.0 MHz           | 1.0 GHz   | MaxPeak        | Coupled | 120 kHz | HL562 2011 |

***MEASUREMENT RESULT: "HTW0512485\_red"***

5/12/2012 3:12PM

| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 30.000000        | 20.80           | -10.2        | 40.0            | 19.2         | PK   | 100.0        | 215.00         | HORIZONTAL   |
| 86.372745        | 10.10           | -21.7        | 40.0            | 29.9         | PK   | 100.0        | 282.00         | HORIZONTAL   |
| 123.306613       | 14.30           | -18.4        | 43.5            | 29.2         | PK   | 300.0        | 270.00         | HORIZONTAL   |
| 302.144289       | 15.30           | -18.0        | 46.0            | 30.7         | PK   | 300.0        | 324.00         | HORIZONTAL   |
| 545.130261       | 19.80           | -13.6        | 46.0            | 26.2         | PK   | 300.0        | 58.00          | HORIZONTAL   |
| 937.795591       | 29.20           | -5.6         | 46.0            | 16.8         | PK   | 300.0        | 82.00          | HORIZONTAL   |