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## FCC PART 90 Test Report

Report Reference No.: CTL1405211136-WF

FCC ID: XUI4WKT220

Compiled by

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Test Engineer Tracy Qi

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Tracy Qi

Date of issue: May 26, 2014

Testing Laboratory Name: Shenzhen CTL Testing Technology Co., Ltd.

Address: Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

Applicant's name: KONGTOP Industrial (Shenzhen) Co., Ltd.

Address: Xinwuyuan, Industrial Area, Gushu, Xixiang, Baoan, Shenzhen, China

### Test specification:

Standard: FCC Part 90: PRIVATE LAND MOBILE RADIO SERVICES

TRF Originator: Shenzhen CTL Testing Technology Co., Ltd.

Master TRF: Dated 2011-01

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Test item description: TRANSCEIVER

Trade Mark: KONGTOP

Model/Type reference: KT220

Modulation: FM

Channel Separation: 12.5KHz

Power Supply: DC 7.4V

Rated Power: 4W

Operating Frequency Range: From 400 MHz to 470 MHz

Result: Positive

**TEST REPORT**

|                                           |                               |
|-------------------------------------------|-------------------------------|
| <b>Test Report No. :</b> CTL1405211136-WF | May 26, 2014<br>Date of issue |
|-------------------------------------------|-------------------------------|

Equipment under Test : TRANSCEIVER

Model /Type : KT220

**Applicant** : **KONGTOP Industrial (Shenzhen) Co., Ltd.**

Address : Xinwuyuan, Industrial Area, Gushu, Xixiang, Baoan, Shenzhen, China

**Manufacture** : **KONGTOP Industrial (Shenzhen) Co., Ltd.**

Address : Xinwuyuan, Industrial Area, Gushu, Xixiang, Baoan, Shenzhen, China

|                                                          |                 |
|----------------------------------------------------------|-----------------|
| <b>Test Result</b> according to the 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 Part 90:** PRIVATE LAND MOBILE RADIO SERVICES

**TIA/EIA 603-C-2004:** Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

**47 CFR FCC Part 15 Subpart B** - Unintentional Radiators

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

**ANSI C63.4: 2009**



## 2. SUMMARY

### 2.1. General Remarks

|                                |   |              |
|--------------------------------|---|--------------|
| Date of receipt of test sample | : | May 21, 2014 |
|                                |   |              |
| Testing commenced on           | : | May 21, 2014 |
|                                |   |              |
| Testing concluded on           | : | May 26, 2014 |

### 2.2. Equipment Under Test

#### Power supply system utilised

|                      |   |                                                                   |                                   |
|----------------------|---|-------------------------------------------------------------------|-----------------------------------|
| Power supply voltage | : | <input checked="" 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 7.4 V from adapter by AC 120V/60Hz

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

The TRANSCEIVER, Model: KT220 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          | TRANSCEIVER            |                                        |
| Model Number         | KT220                  |                                        |
| FCC ID               | XUI4WKT220             |                                        |
| Rated Output Power   | 4 Watts(36.02dBm)      |                                        |
| Modulation Type      | FM for Analog Voice    |                                        |
|                      | Analog                 | F3E for 12.5KHz Channel Separation     |
| Channel Separation   | Analog Voice           | 12.5KHz                                |
| Antenna Type         | External               |                                        |
| Frequency Range      | From 400 MHz to 470MHz |                                        |
| Maximum Output Power | Analog                 | 3.43 W for 12.5 KHz Channel Separation |

#### Test frequency list

| Frequency Range (MHz) | Modulation Type | Channel Separation (KHz) | Test Channel | Test Frequency (MHz) |          |
|-----------------------|-----------------|--------------------------|--------------|----------------------|----------|
|                       |                 |                          |              | TX                   | RX       |
|                       | Analog/FM       | 12.5                     | A001         | 406.5000             | 406.5000 |
|                       |                 |                          | A002         | 418.0000             | 418.0000 |
|                       |                 |                          | A003         | 435.5000             | 435.5000 |
|                       |                 |                          | A004         | 453.0000             | 453.0000 |
|                       |                 |                          | A005         | 469.5000             | 469.5000 |

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

400-470MHz TRANSCEIVER (KT220).

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

Serial number: Prototype

## 2.5. EUT operation mode

The EUT has been tested under typical operating condition.

## 2.6. 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) :   | 1.2m |
|   |             | Shield :       | No   |
|   |             | Detachable :   | No   |
| ○ | Multimeter  | Manufacturer : | /    |
|   |             | Model No. :    | /    |

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

This submittal(s) (test report) is intended for FCC ID: XUI4WKT220 filing to comply with the FCC Part 90 Rules.

## 2.8. Modifications

No modifications were implemented to meet testing criteria.

## 2.9. Note

The EUT is a U frequency band (400-470MHz) TRANSCEIVER, The functions of the EUT listed as below:

|       |                |                  |
|-------|----------------|------------------|
|       | Test Standards | Reference Report |
| Radio | FCC Part 90    | CTL1405211136-WF |

### **3. TEST ENVIRONMENT**

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

Shenzhen CTL Testing Technology Co., Ltd.  
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 22/EN 55022 requirements.

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

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

##### **IC Registration No.: 9618B**

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

##### **FCC-Registration No.: 970318**

Shenzhen CTL Testing Technology 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 970318, December 19, 2013.

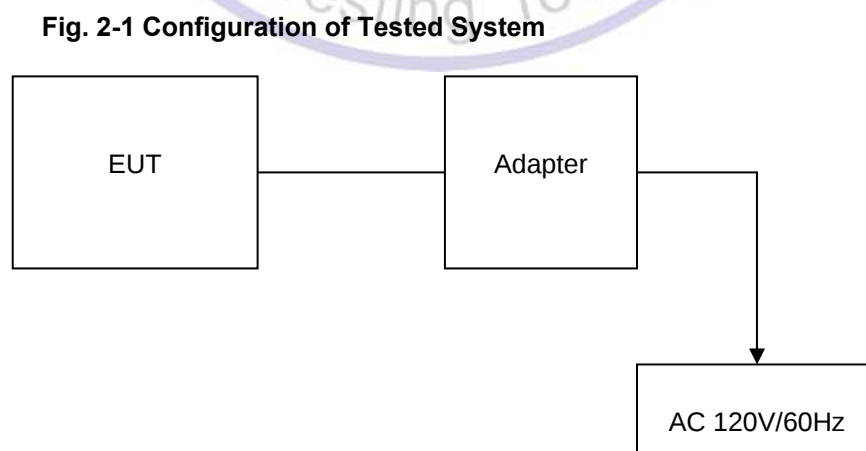
#### **3.3. Environmental conditions**

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

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

#### **3.4. Configuration of Tested System**

**Fig. 2-1 Configuration of Tested System**



### 3.5. 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 CTL Electromagnetic Technology 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 CTL laboratory is reported:

| Test                  | Range      | Measurement Uncertainty | Notes |
|-----------------------|------------|-------------------------|-------|
| Radiated Emission     | 30~1000MHz | 4.10dB                  | (1)   |
| Radiated Emission     | 1~12.75GHz | 4.32dB                  | (1)   |
| Conducted Disturbance | 0.15~30MHz | 3.20dB                  | (1)   |

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .



### 3.6. Equipments Used during the Test

| Test Equipment             | Manufacturer         | Model No.             | Serial No. | Calibration Date | Calibration Due Date |
|----------------------------|----------------------|-----------------------|------------|------------------|----------------------|
| Bilog Antenna              | Sunol Sciences Corp. | JB1                   | A061713    | 2013/07/12       | 2014/07/11           |
| Bilog Antenna              | Sunol Sciences Corp. | JB1                   | A061714    | 2013/07/12       | 2014/07/11           |
| EMI Test Receiver          | R&S                  | ESCI                  | 103710     | 2013/07/10       | 2014/07/09           |
| Spectrum Analyzer          | Agilent              | E4407B                | MY45108355 | 2013/07/06       | 2014/07/05           |
| Controller                 | EM Electronics       | Controller EM 1000    | N/A        | 2013/07/06       | 2014/07/05           |
| Horn Antenna               | Sunol Sciences Corp. | DRH-118               | A062013    | 2013/07/12       | 2014/07/11           |
| Horn Antenna               | Sunol Sciences Corp. | DRH-118               | A062014    | 2013/07/12       | 2014/07/11           |
| Horn Antenna               | SCHWARZBECK          | BBHA9170              | 1562       | 2013/07/12       | 2014/07/11           |
| Horn Antenna               | SCHWARZBECK          | BBHA9170              | 1565       | 2013/07/12       | 2014/07/11           |
| Active Loop Antenna        | SCHWARZBECK          | FMZB1519              | 1519-037   | 2013/07/12       | 2014/07/11           |
| LISN                       | R&S                  | ENV216                | 101316     | 2013/07/10       | 2014/07/09           |
| LISN                       | SCHWARZBECK          | NSLK8127              | 8127687    | 2013/07/10       | 2014/07/09           |
| Microwave Preamplifier     | HP                   | 8349B                 | 3155A00882 | 2013/07/10       | 2014/07/09           |
| Amplifier                  | HP                   | 8447D                 | 3113A07663 | 2013/07/10       | 2014/07/09           |
| Transient Limiter          | Com-Power            | LIT-153               | 532226     | 2013/07/10       | 2014/07/09           |
| Radio Communication Tester | R&S                  | CMU200                | 3655A03522 | 2013/07/06       | 2014/07/05           |
| Temperature/Humidity Meter | zhicheng             | ZC1-2                 | 22522      | 2013/07/10       | 2014/07/09           |
| SIGNAL GENERATOR           | HP                   | 8647A                 | 3200A00852 | 2013/07/10       | 2014/07/09           |
| Wideband Peak Power Meter  | Anritsu              | ML2495A               | 220.23.35  | 2013/07/06       | 2014/07/05           |
| Climate Chamber            | ESPEC                | EL-10KA               | A20120523  | 2013/07/06       | 2014/07/05           |
| High-Pass Filter           | K&L                  | 9SH10-2700/X12750-O/O | /          | 2013/07/06       | 2014/07/05           |
| High-Pass Filter           | K&L                  | 41H10-1375/U12750-O/O | /          | 2013/07/06       | 2014/07/05           |

**3.7. General Technical Requirements and Summary of Test Results**

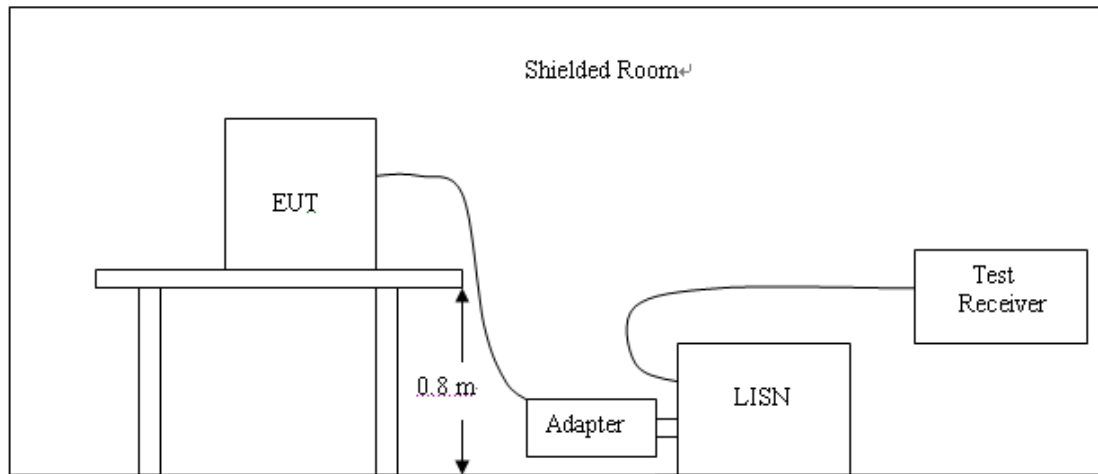
| <b>FCC Rules</b> | <b>Description of Test</b>             | <b>Test Result</b> |
|------------------|----------------------------------------|--------------------|
| § 15.107         | Conducted Emission                     | Complies           |
| § 15.109         | Receiver Radiated Spurious Emission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



## 4. TEST CONDITIONS AND RESULTS

### 4.1. Conducted Emissions Test

#### 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.
- 2 Support equipment, if needed, was placed as per ANSI C63.4.
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.
- 4 The EUT received DC13.6 V power from the battery.
- 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 (dBμV) |      |         |        |
|--------------------|--------------------------------|------|---------|--------|
|                    | 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     |

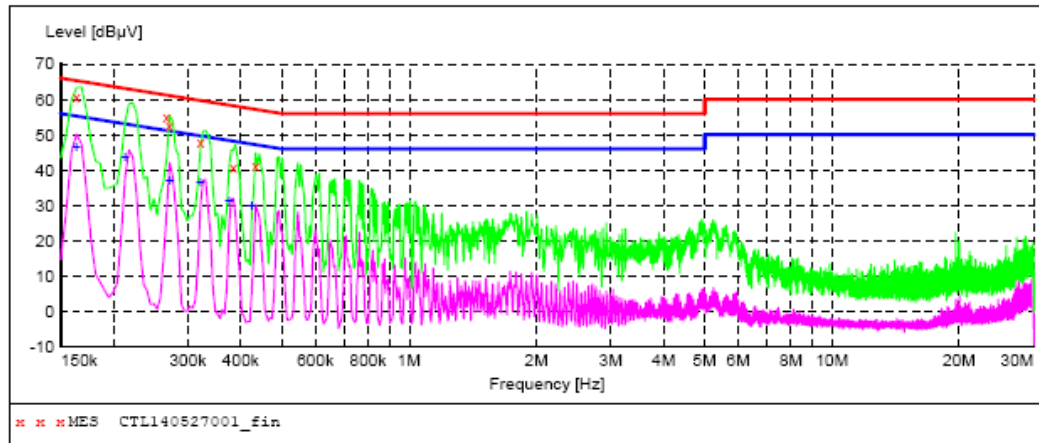
\* Decreasing linearly with the logarithm of the frequency

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

#### TEST RESULTS

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

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "CTL140527001\_fin"**

5/27/2014 9:44AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.163500         | 60.60         | 10.2         | 65            | 4.7          | QP       | N    | GND |
| 0.267000         | 55.10         | 10.2         | 61            | 6.1          | QP       | N    | GND |
| 0.271500         | 52.50         | 10.2         | 61            | 8.6          | QP       | N    | GND |
| 0.321000         | 48.10         | 10.2         | 60            | 11.6         | QP       | N    | GND |
| 0.384000         | 40.90         | 10.2         | 58            | 17.3         | QP       | N    | GND |
| 0.433500         | 41.30         | 10.2         | 57            | 15.9         | QP       | N    | GND |

**MEASUREMENT RESULT: "CTL140527001\_fin2"**

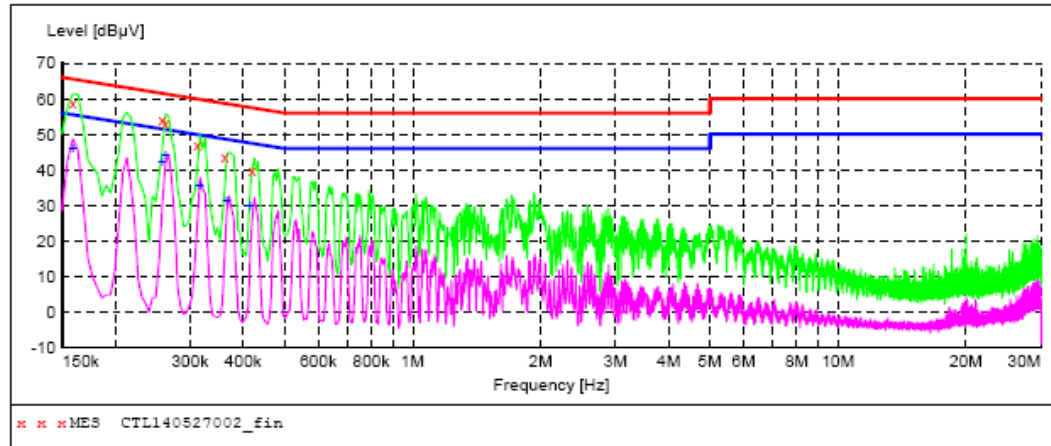
5/27/2014 9:44AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.163500         | 46.30         | 10.2         | 55            | 9.0          | AV       | N    | GND |
| 0.213000         | 43.50         | 10.2         | 53            | 9.6          | AV       | N    | GND |
| 0.271500         | 37.10         | 10.2         | 51            | 14.0         | AV       | N    | GND |
| 0.321000         | 36.40         | 10.2         | 50            | 13.3         | AV       | N    | GND |
| 0.375000         | 31.50         | 10.2         | 48            | 16.9         | AV       | N    | GND |
| 0.424500         | 29.80         | 10.2         | 47            | 17.6         | AV       | N    | GND |

Testing Tech

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

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "CTL140527002\_fin"**

5/27/2014 9:47AM

| Frequency<br>MHz | Level<br>dBuV | Transd<br>dB | Limit<br>dBuV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.159000         | 58.90         | 10.2         | 66            | 6.6          | QP       | L1   | GND |
| 0.258000         | 54.20         | 10.2         | 62            | 7.3          | QP       | L1   | GND |
| 0.262500         | 53.20         | 10.2         | 61            | 8.2          | QP       | L1   | GND |
| 0.312000         | 46.80         | 10.2         | 60            | 13.1         | QP       | L1   | GND |
| 0.361500         | 43.50         | 10.2         | 59            | 15.2         | QP       | L1   | GND |
| 0.420000         | 40.00         | 10.2         | 57            | 17.4         | QP       | L1   | GND |

**MEASUREMENT RESULT: "CTL140527002\_fin2"**

5/27/2014 9:47AM

| Frequency<br>MHz | Level<br>dBuV | Transd<br>dB | Limit<br>dBuV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.159000         | 46.10         | 10.2         | 56            | 9.4          | AV       | L1   | GND |
| 0.258000         | 42.10         | 10.2         | 52            | 9.4          | AV       | L1   | GND |
| 0.262500         | 43.90         | 10.2         | 51            | 7.5          | AV       | L1   | GND |
| 0.316500         | 35.40         | 10.2         | 50            | 14.4         | AV       | L1   | GND |
| 0.366000         | 31.30         | 10.2         | 49            | 17.3         | AV       | L1   | GND |
| 0.415500         | 30.00         | 10.2         | 48            | 17.5         | AV       | L1   | GND |

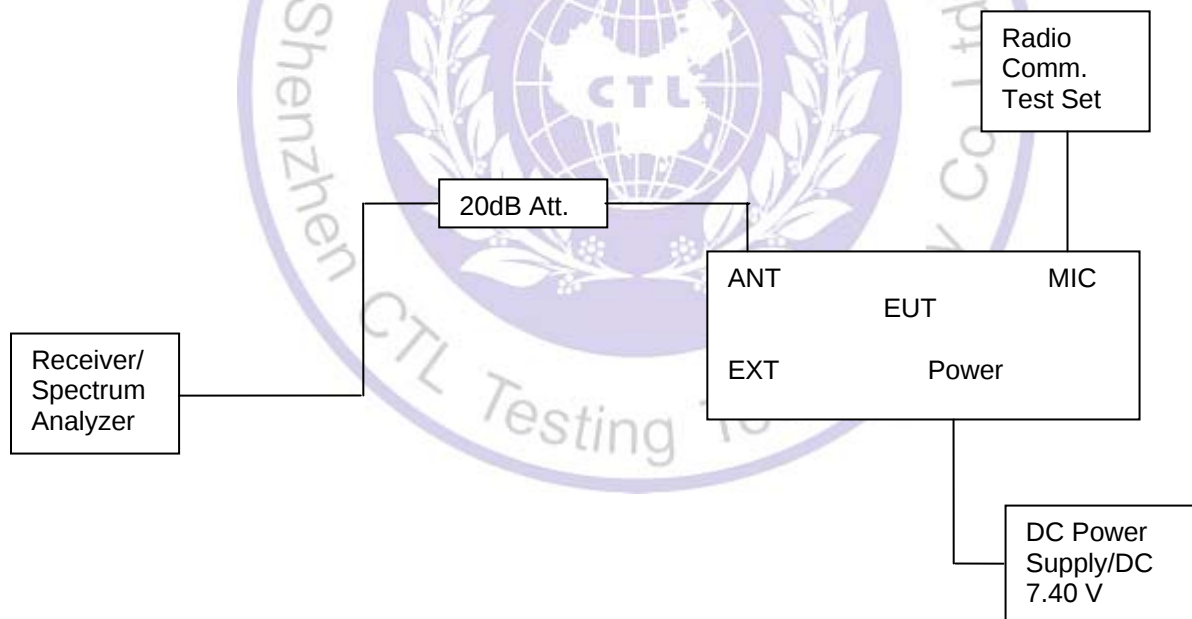


## 4.2. Occupied Bandwidth and Emission Mask

### PROVISIONS 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). Emission Mask B: For transmitters that are equipped with an audio low-pass filter pursuant to §90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:
- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not 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 not 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.
- (c). Emission Mask D, 12.5 kHz channel bandwidth equipment: For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
- (1) On any frequency 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) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(f_d - 2.88 \text{ kHz})$  dB.
  - (3) 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  $50 + 10 \log (P)$  dB or 70 dB, whichever is the lesser attenuation.

### TEST CONFIGURATION



### TEST PROCEDURE

- 1 The EUT was placed on a turn table which is 0.8m above ground plane.
- 2 The EUT was modulated by 2.5 KHz Sine wave audio signal; the level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz (12.5 kHz channel spacing) and 5 kHz (25 kHz channel spacing).
- 3 Set EUT as normal operation.
- 4 Set SPA Center Frequency = fundamental frequency, RBW=300Hz, VBW= 3 KHz, span =50 KHz.
- 5 Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.
- 6 Set SPA Center Frequency=fundamental frequency, set =100Hz, VBW=1 KHz, span=50 KHz for 12.5 channel spacing

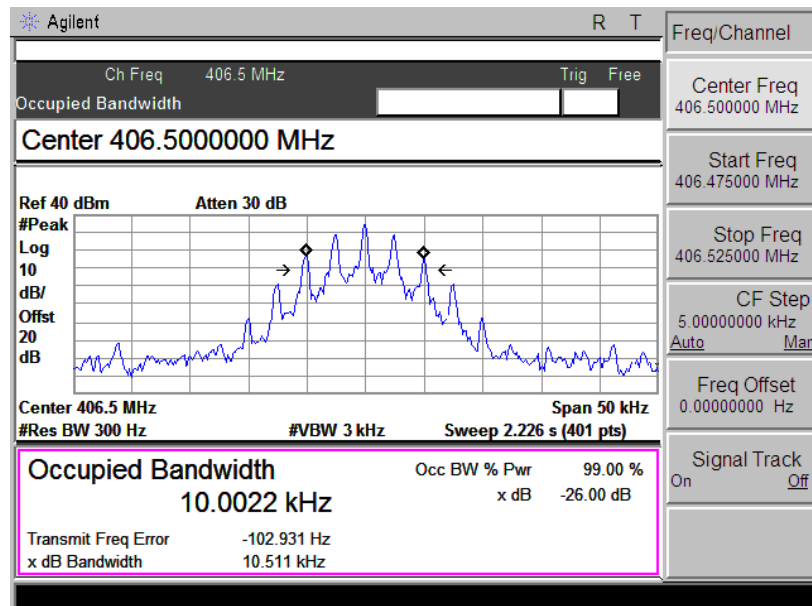
**TEST RESULTS****4.2.1 Occupied Bandwidth**

| Modulation Type | Channel Separation | Test Channel                            | Test Frequency | 99% Occupied Bandwidth | 26dB Occupied Band width |
|-----------------|--------------------|-----------------------------------------|----------------|------------------------|--------------------------|
| FM              | 12.5KHz            | A001                                    | 406.5000       | 10.0022 KHz            | 10.511 KHz               |
|                 |                    | A002                                    | 418.0000       | 9.9924 KHz             | 10.502 KHz               |
|                 |                    | A003                                    | 435.5000       | 10.0302 KHz            | 10.576 KHz               |
|                 |                    | A004                                    | 453.0000       | 10.0092 KHz            | 10.528 KHz               |
|                 |                    | A005                                    | 469.5000       | 10.0142 KHz            | 10.546 KHz               |
| Limit           |                    | 11.25KHz for 12.5KHz Channel Separation |                |                        |                          |
| Test Results    |                    | Compliance                              |                |                        |                          |

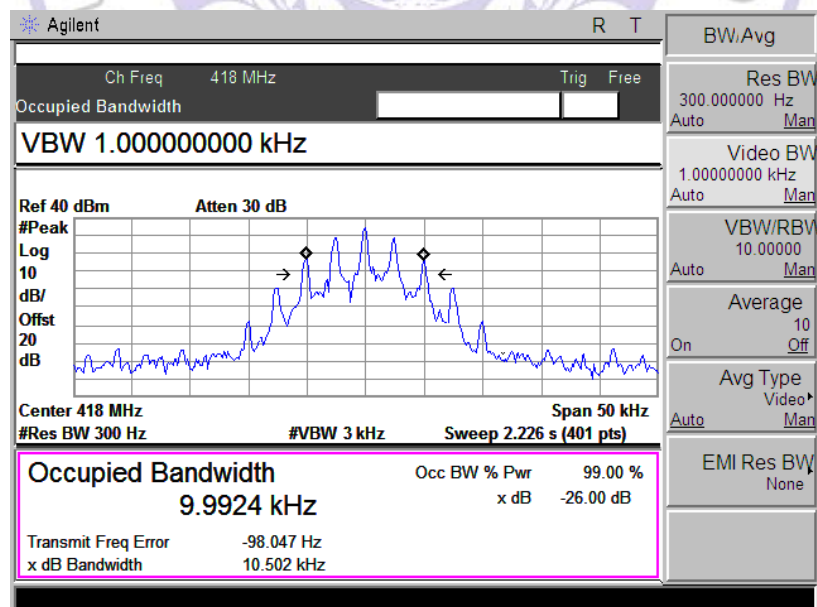


**Plots of 99% and 26dB Bandwidth Measurement**

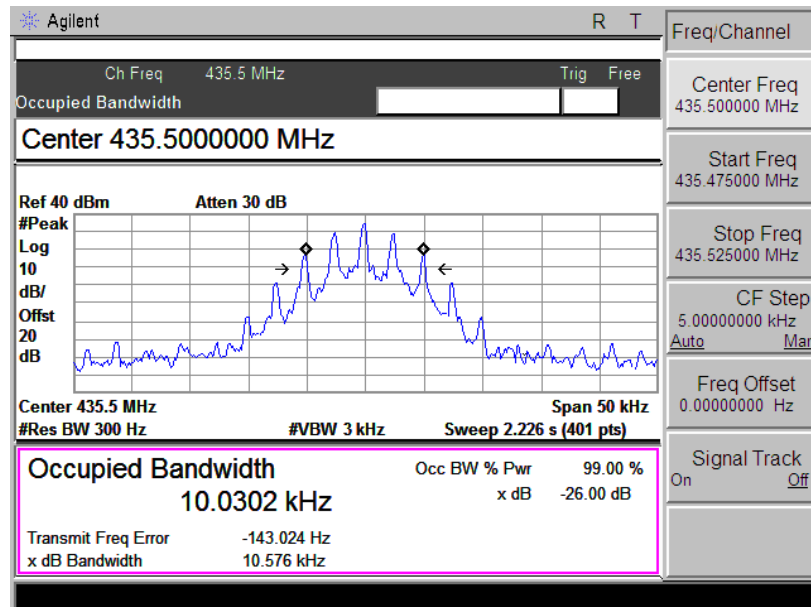
| Modulation Type | Channel Separation | Freq.(MHz) | 99% Bandwidth (KHz) | 26dB Bandwidth (KHz) | FCC Limit (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|----------------------|-----------------|------------|
| FM              | 12.5 KHz           | 406.5000   | 10.0022             | 10.511               | 11.25           | Compliance |



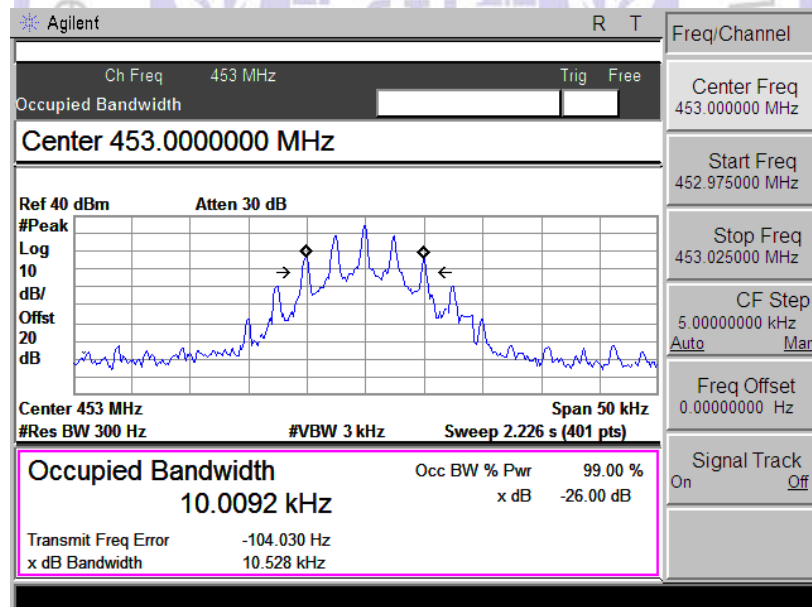
| Modulation Type | Channel Separation | Freq.(MHz) | 99% Bandwidth (KHz) | 26dB Bandwidth (KHz) | FCC Limit (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|----------------------|-----------------|------------|
| FM              | 12.5 KHz           | 418.0000   | 9.9924              | 10.502               | 11.25           | Compliance |



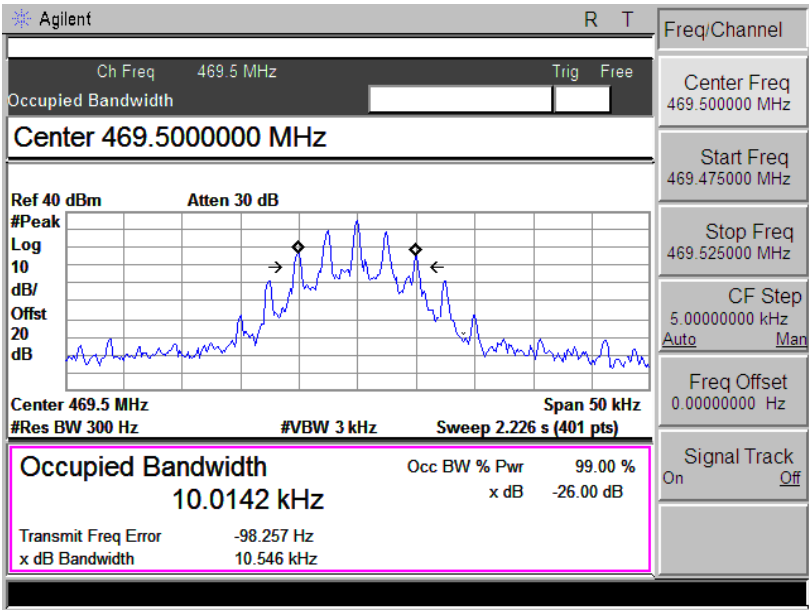
| Modulation Type | Channel Separation | Freq.(MHz) | 99% Bandwidth (KHz) | 26dB Bandwidth (KHz) | FCC Limit (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|----------------------|-----------------|------------|
| FM              | 12.5 KHz           | 435.5000   | 10.0302             | 10.576               | 11.25           | Compliance |



| Modulation Type | Channel Separation | Freq.(MHz) | 99% Bandwidth (KHz) | 26dB Bandwidth (KHz) | FCC Limit (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|----------------------|-----------------|------------|
| FM              | 12.5 KHz           | 453.0000   | 10.0092             | 10.528               | 11.25           | Compliance |



| Modulation Type | Channel Separation | Freq.(MHz) | 99% Bandwidth (KHz) | 26dB Bandwidth (KHz) | FCC Limit (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|----------------------|-----------------|------------|
| FM              | 12.5 KHz           | 469.5000   | 10.0142             | 10.546               | 11.25           | Compliance |



## 4.2.2 Emission Mask

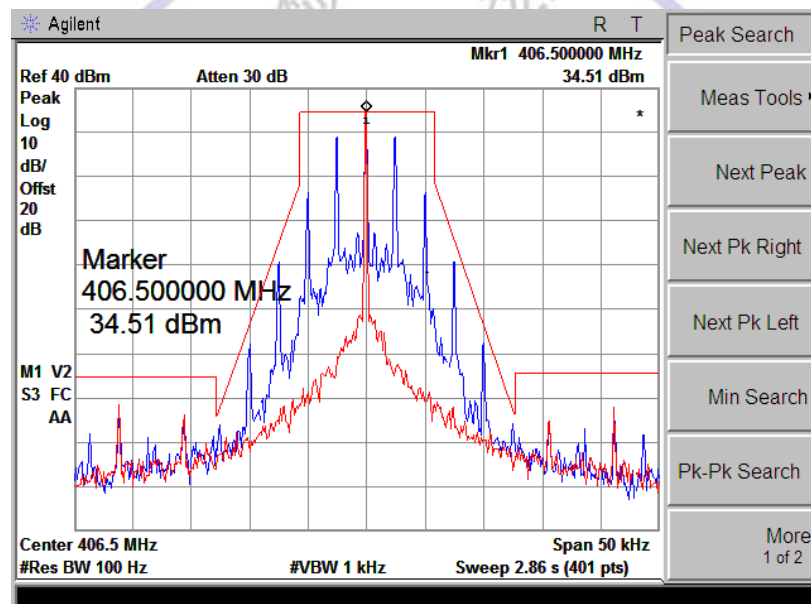
| Modulation Type | Channel Separation | Test Channel | Test Frequency | FCC Applicable Mask | RBW    |
|-----------------|--------------------|--------------|----------------|---------------------|--------|
| FM              | 12.5KHz            | A001         | 406.5000       | D                   | 100 Hz |
|                 |                    | A002         | 418.0000       | D                   | 100 Hz |
|                 |                    | A003         | 435.5000       | D                   | 100 Hz |
|                 |                    | A004         | 453.0000       | D                   | 100 Hz |
|                 |                    | A005         | 469.5000       | D                   | 100 Hz |
| Test Results    |                    | Compliance   |                |                     |        |

Referred as the attached plot hereinafter

Note: The red curve represents unmodulated signal.

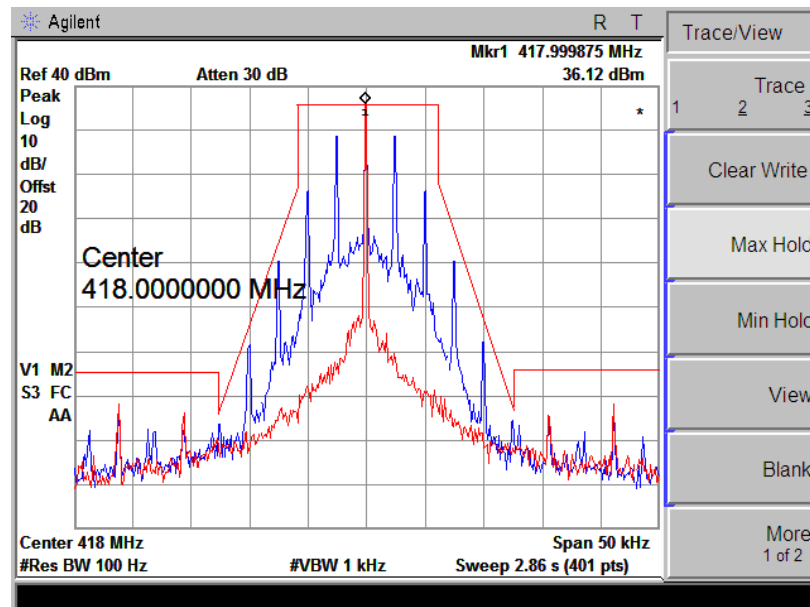
The blue curve represents modulated signal.

| Modulation Type | Channel Separation | Freq.(MHz) | FCC Applicable Mask | RBW   | Audio Freq. (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|-------|-------------------|------------|
| FM              | 12.5 KHz           | 406.5000   | D                   | 100Hz | 2.5               | Compliance |



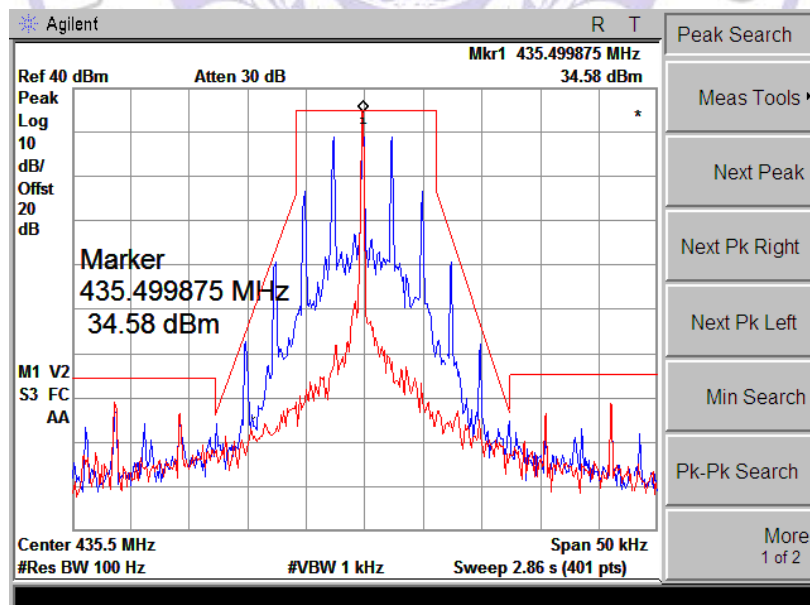
12.5 kHz Channel Spacing, 406.5000 MHz, 2500 Hz Audio Modulation Only

| Modulation Type | Channel Separation | Freq.(MHz) | FCC Applicable Mask | RBW   | Audio Freq. (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|-------|-------------------|------------|
| FM              | 12.5 KHz           | 418.0000   | D                   | 100Hz | 2.5               | Compliance |



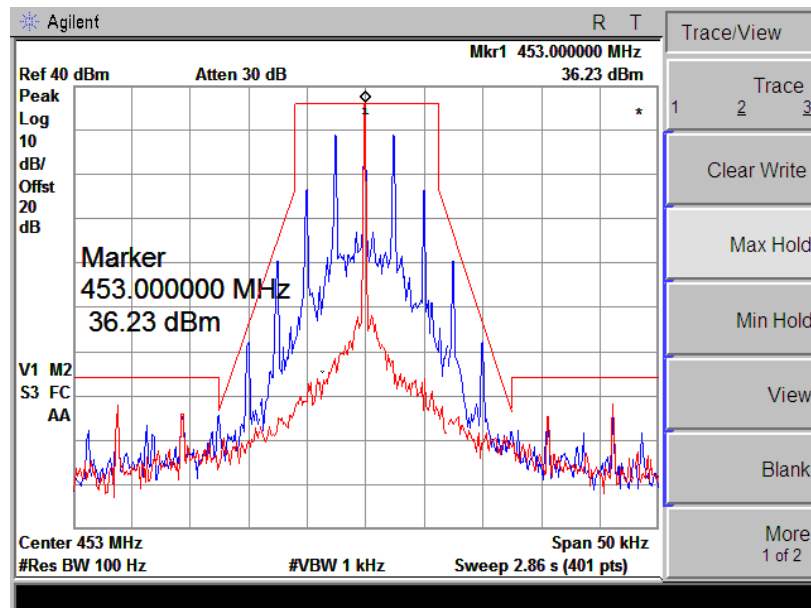
12.5 kHz Channel Spacing, 418.0000 MHz, 2500 Hz Audio Modulation Only

| Modulation Type | Channel Separation | Freq.(MHz) | FCC Applicable Mask | RBW   | Audio Freq. (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|-------|-------------------|------------|
| FM              | 12.5 KHz           | 435.5000   | D                   | 100Hz | 2.5               | Compliance |



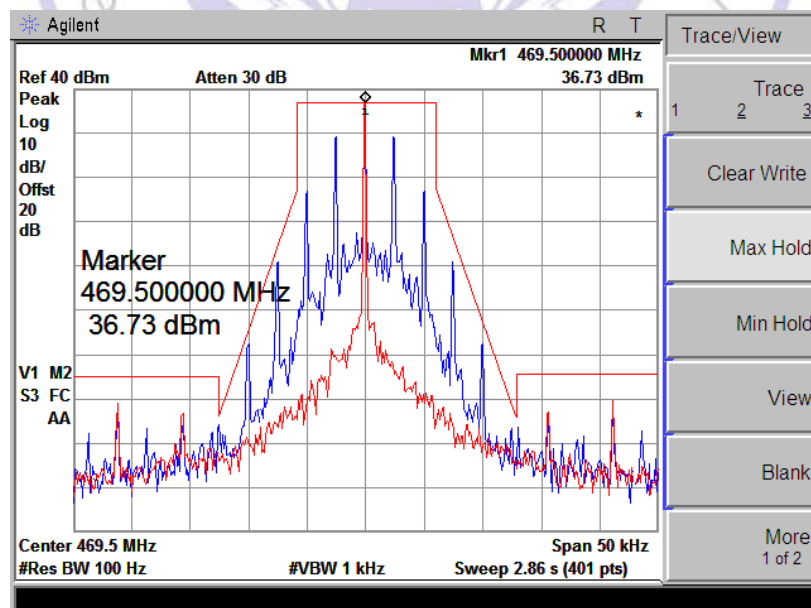
12.5 kHz Channel Spacing, 435.5000 MHz, 2500 Hz Audio Modulation Only

| Modulation Type | Channel Separation | Freq.(MHz) | FCC Applicable Mask | RBW   | Audio Freq. (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|-------|-------------------|------------|
| FM              | 12.5 KHz           | 453.0000   | D                   | 100Hz | 2.5               | Compliance |



12.5 kHz Channel Spacing, 453.5000 MHz, 2500 Hz Audio Modulation Only

| Modulation Type | Channel Separation | Freq.(MHz) | FCC Applicable Mask | RBW   | Audio Freq. (KHz) | Results    |
|-----------------|--------------------|------------|---------------------|-------|-------------------|------------|
| FM              | 12.5 KHz           | 469.5000   | D                   | 100Hz | 2.5               | Compliance |



12.5 kHz Channel Spacing, 469.5000 MHz, 2500 Hz Audio Modulation Only

### 4.3. Radiated Spurious Emission Test

#### 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:

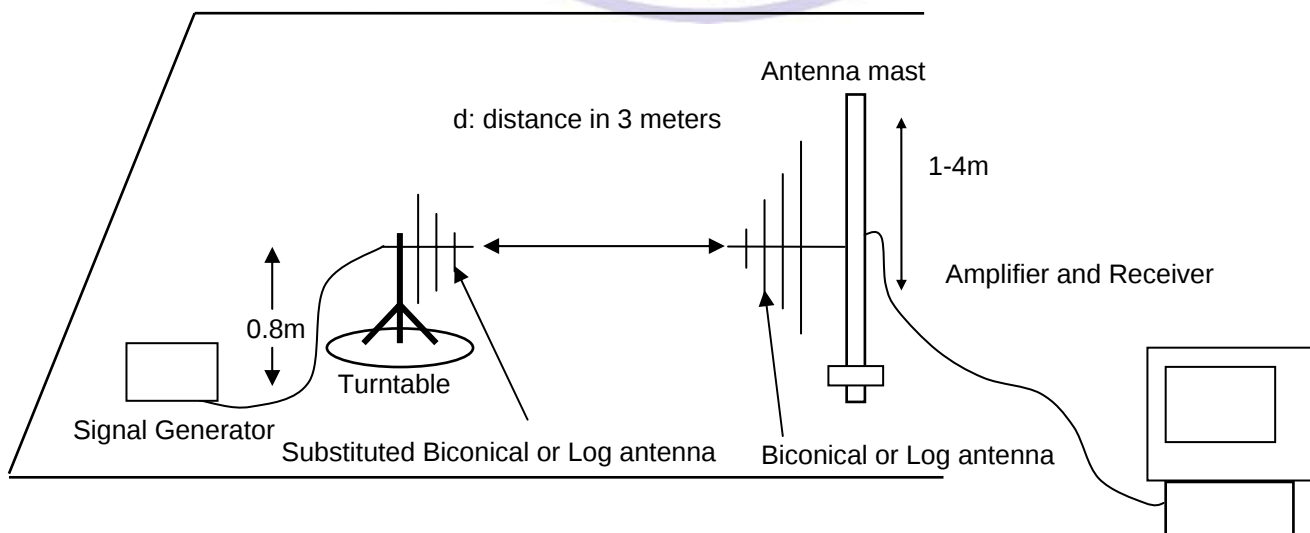
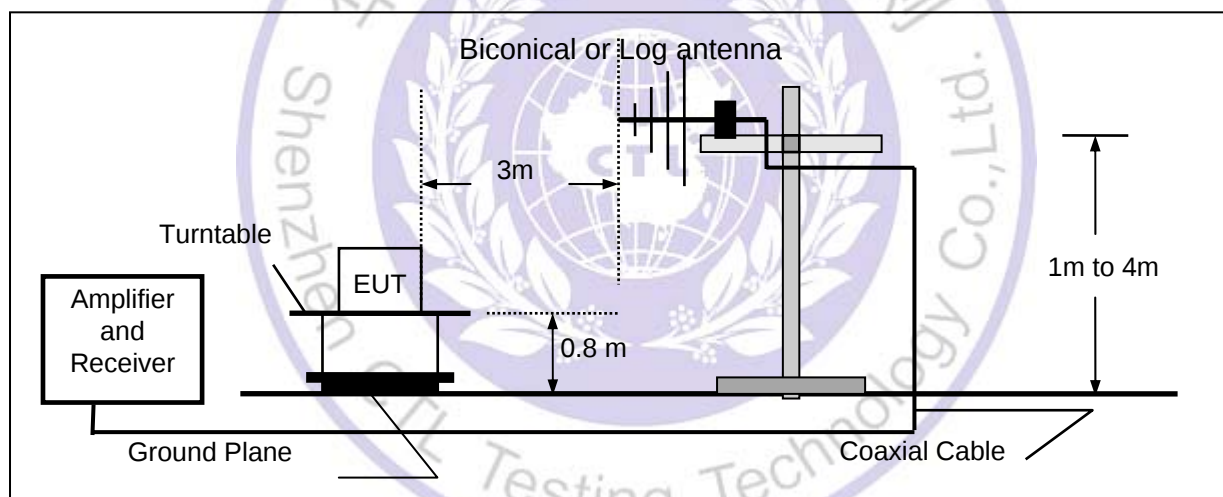
- 1 On any frequency removed from the center of the authorized bandwidth  $f_0$  to 5.625 KHz removed from  $f_0$ : Zero dB
- 2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in KHz)  $f_0$  of more than 5.625 KHz but no more than 12.5 KHz: At 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.

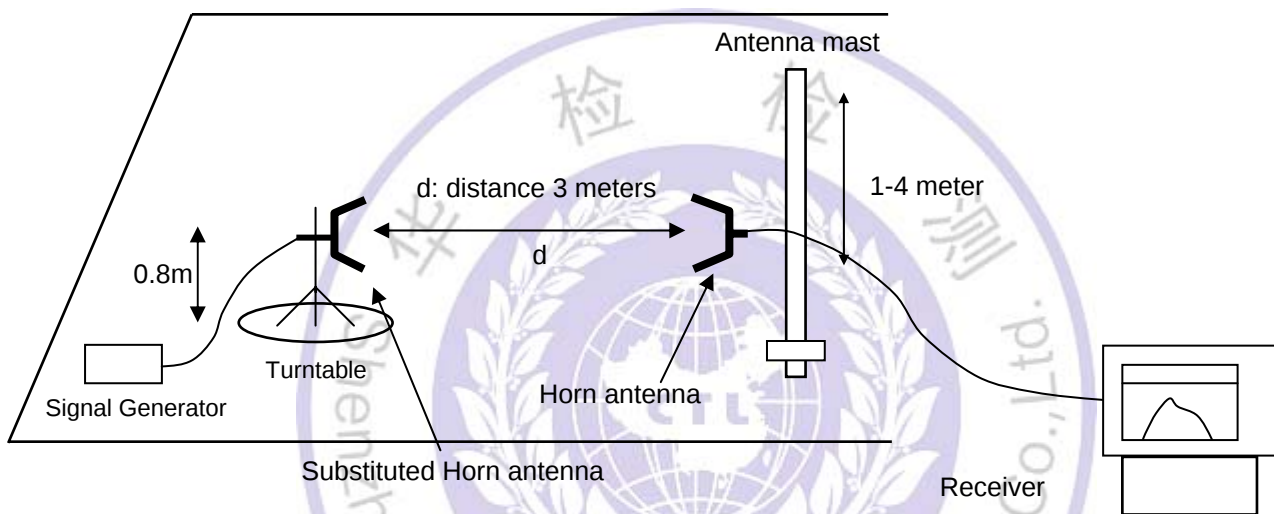
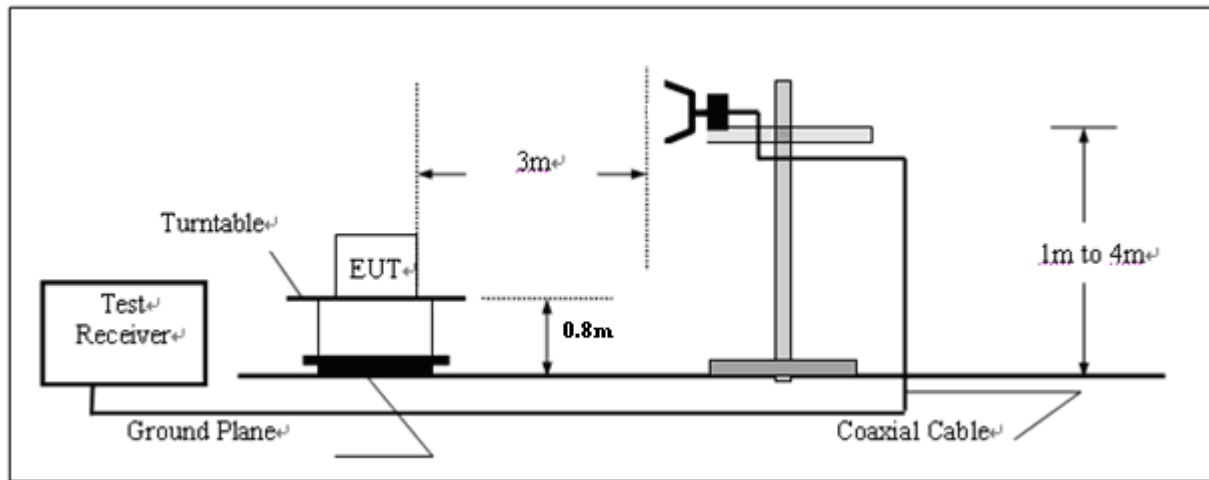
For transmitters designed to transmit with 25 KHz channel separation and equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as following:

- 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.  
 $P_1$ : Power output from the signal generator  
 $P_2$ : Power measured at attenuator A input  
 $P_3$ : 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: FM

FCC Part 22.359, 74.462, 80.211 and 90.210 (12.5 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:  $50 + 10 \log (\text{Pwatts}) = 50 + 10 \log (3.05) = 54.79 \text{ dB}$

High:  $50 + 10 \log (\text{Pwatts}) = 50 + 10 \log (3.43) = 55.35 \text{ dB}$

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

Calculation: Limit (dBm) = EL-50-10log10 (TP)

Notes: EL is the emission level of the Output Power expressed in dBm,  
 In this application, the EL is 36.02 dBm.  
 Limit (dBm) = 36.02-50-10log10 (3.43) = -20 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      |                        | FM                     |                      | Channel Separation  |                      | 12.5KHz                                   |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|-------------------------------------------|-------------|-------------|
| Test Channel    |                        | A001                   |                      | Test Frequency      |                      | 406.5000 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) |
| 813.000         | 57.59                  | Peak                   | H                    | 367                 | 231                  | -34.13                                    | -20         | 14.13       |
| 1219.500        | 44.27                  | Peak                   | H                    | 100                 | 178                  | -53.26                                    | -20         | 33.26       |
| 2032.500        | 45.21                  | Peak                   | H                    | 245                 | 304                  | -51.06                                    | -20         | 31.06       |
| ...             |                        |                        | H                    |                     |                      |                                           |             |             |
| 813.000         | 56.14                  | Peak                   | V                    | 100                 | 341                  | -34.45                                    | -20         | 14.45       |
| 1219.500        | 45.28                  | Peak                   | V                    | 100                 | 107                  | -49.27                                    | -20         | 29.27       |
| 2032.500        | 44.45                  | Peak                   | V                    | 155                 | 88                   | -54.14                                    | -20         | 34.14       |
| ...             | ...                    |                        | V                    |                     |                      |                                           |             |             |

| Modulation      |                        | FM                     |                      | Channel Separation  |                      | 12.5KHz                                   |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|-------------------------------------------|-------------|-------------|
| Test Channel    |                        | A002                   |                      | Test Frequency      |                      | 418.0000 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) |
| 836.000         | 57.27                  | Peak                   | H                    | 144                 | 300                  | -34.37                                    | -20         | 14.37       |
| 1254.000        | 45.56                  | Peak                   | H                    | 200                 | 34                   | -53.15                                    | -20         | 33.15       |
| 2090.000        | 47.52                  | Peak                   | H                    | 290                 | 221                  | -51.16                                    | -20         | 31.16       |
| ...             |                        |                        | H                    |                     |                      |                                           |             |             |
| 836.000         | 59.54                  | Peak                   | V                    | 100                 | 93                   | -32.53                                    | -20         | 12.53       |
| 1254.000        | 47.29                  | Peak                   | V                    | 108                 | 354                  | -48.28                                    | -20         | 28.28       |
| 2090.000        | 49.43                  | Peak                   | V                    | 114                 | 122                  | -53.16                                    | -20         | 33.16       |
| ...             | ...                    |                        | V                    |                     |                      |                                           |             |             |

| Modulation      |                        | FM                     |                      | Channel Separation  |                      | 12.5KHz                                   |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|-------------------------------------------|-------------|-------------|
| Test Channel    |                        | A003                   |                      | Test Frequency      |                      | 435.5000 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) |
| 871.000         | 58.53                  | Peak                   | H                    | 400                 | 189                  | -36.12                                    | -20         | 16.12       |
| 1306.500        | 47.41                  | Peak                   | H                    | 124                 | 204                  | -48.10                                    | -20         | 28.10       |
| 2613.000        | 48.25                  | Peak                   | H                    | 150                 | 77                   | -49.37                                    | -20         | 29.37       |
| ...             |                        |                        | H                    |                     |                      |                                           |             |             |
| 871.000         | 60.24                  | Peak                   | V                    | 118                 | 331                  | -34.73                                    | -20         | 14.73       |
| 1306.500        | 45.35                  | Peak                   | V                    | 100                 | 144                  | -48.30                                    | -20         | 28.30       |
| 2613.000        | 46.56                  | Peak                   | V                    | 100                 | 123                  | -52.76                                    | -20         | 32.76       |
| ...             | ...                    |                        | V                    |                     |                      |                                           |             |             |

| Modulation      |                        | FM                     |                      | Channel Separation  |                      | 12.50KHz                                  |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|-------------------------------------------|-------------|-------------|
| Test Channel    |                        | A004                   |                      | Test Frequency      |                      | 453.0000 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) |
| 906.000         | 56.74                  | Peak                   | H                    | 300                 | 288                  | -36.28                                    | -20         | 16.28       |
| 1359.000        | 45.36                  | Peak                   | H                    | 289                 | 301                  | -49.11                                    | -20         | 29.11       |
| 2265.000        | 49.05                  | Peak                   | H                    | 204                 | 178                  | -47.60                                    | -20         | 27.60       |
| ...             | ...                    |                        | H                    |                     |                      |                                           |             |             |
| 906.000         | 58.10                  | Peak                   | V                    | 105                 | 348                  | -34.40                                    | -20         | 14.40       |
| 1359.000        | 45.26                  | Peak                   | V                    | 150                 | 9                    | -52.41                                    | -20         | 32.41       |
| 2265.000        | 50.44                  | Peak                   | V                    | 100                 | 122                  | -45.21                                    | -20         | 25.21       |
| ...             | ...                    |                        | V                    |                     |                      |                                           |             |             |

| Modulation      |                        | FM                     |                      | Channel Separation  |                      | 12.50KHz                                  |             |             |
|-----------------|------------------------|------------------------|----------------------|---------------------|----------------------|-------------------------------------------|-------------|-------------|
| Test Channel    |                        | A005                   |                      | Test Frequency      |                      | 469.5000 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) |
| 939.000         | 57.50                  | Peak                   | H                    | 205                 | 305                  | -36.13                                    | -20         | 16.13       |
| 1408.500        | 45.31                  | Peak                   | H                    | 122                 | 156                  | -52.39                                    | -20         | 32.39       |
| 2347.500        | 47.58                  | Peak                   | H                    | 150                 | 99                   | -49.36                                    | -20         | 29.36       |
| ...             | ...                    |                        | H                    |                     |                      |                                           |             |             |
| 939.000         | 58.23                  | Peak                   | V                    | 100                 | 0                    | -35.42                                    | -20         | 15.42       |
| 1408.500        | 45.46                  | Peak                   | V                    | 100                 | 299                  | -52.62                                    | -20         | 32.62       |
| 2347.500        | 48.56                  | Peak                   | V                    | 150                 | 145                  | -50.39                                    | -20         | 30.39       |
| ...             | ...                    |                        | V                    |                     |                      |                                           |             |             |



#### 4.4. Spurious Emission On Antenna Port

##### TEST APPLICABLE

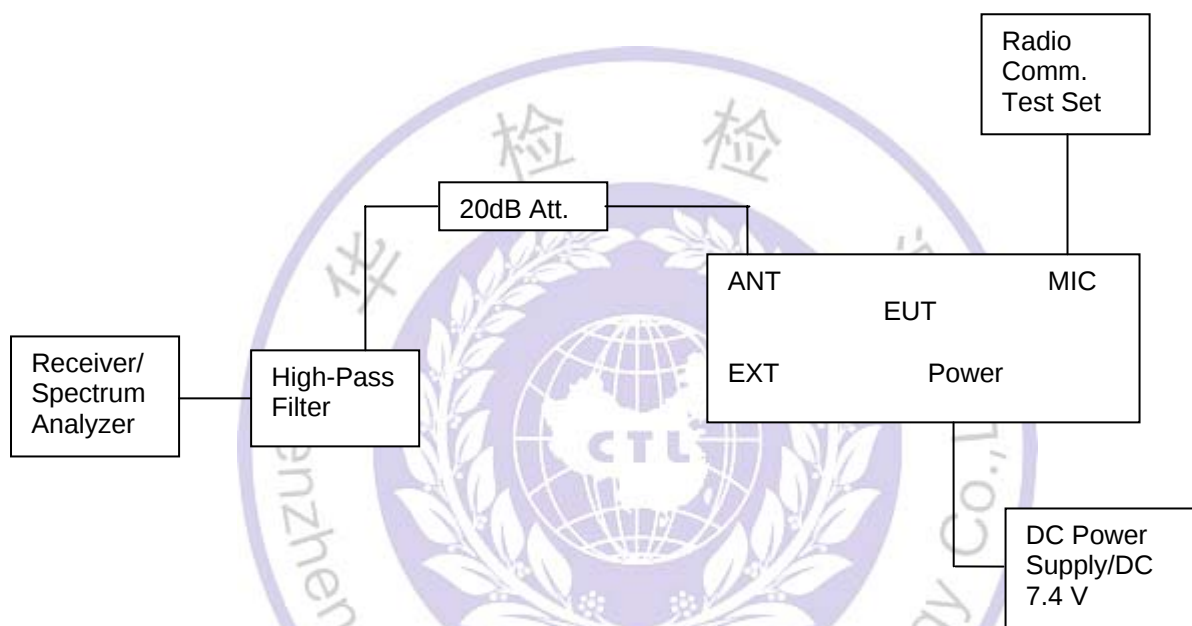
The same as Section 4.3

##### 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: FM**

FCC Part 22.359, 74.462, 80.211 and 90.210:

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:  $50 + 10 \log(P_{\text{watts}}) = 50 + 10 \log(3.05) = 54.79 \text{ dB}$

High:  $50 + 10 \log(P_{\text{watts}}) = 50 + 10 \log(3.43) = 55.35 \text{ dB}$

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

Calculation: Limit (dBm) = EL - 50 - 10log10 (TP)

Notes: EL is the emission level of the Output Power expressed in dBm,  
In this application, the EL is 36.02 dBm.

Limit (dBm) = 36.02 - 50 - 10log10 (3.43) = -20 dBm

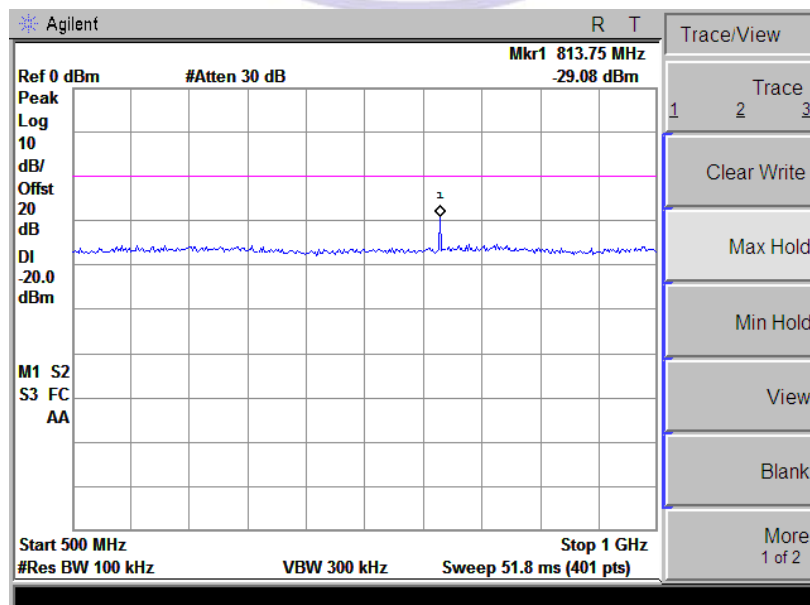
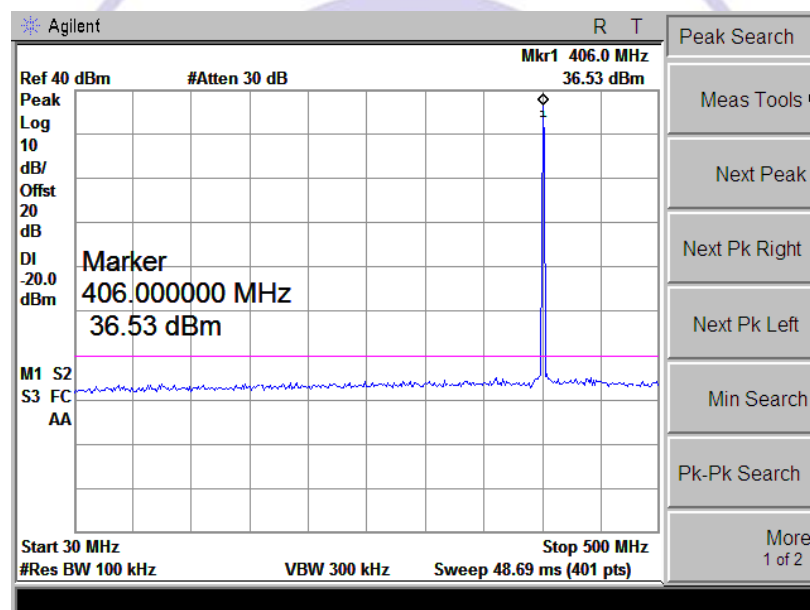
Note: 1. In general, the worse case attenuation requirement shown above was applied.

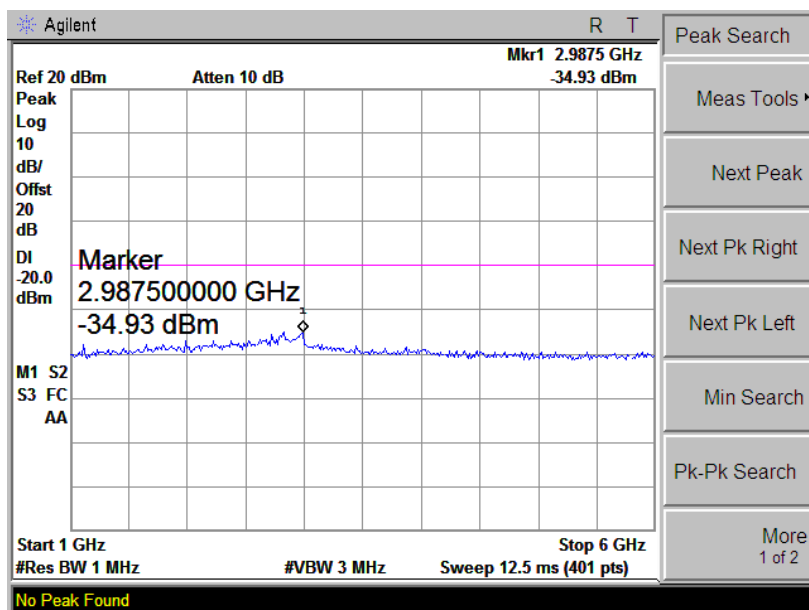
2. The measurement frequency range from 30 MHz to 6 GHz.

| Modulation Type | Channel Separation | 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) |
| Analog/FM       | 12.5KHz            | A001                                  | 406.5000             | 813.00                                          | -29.08      | ----                                            | ----        |
|                 |                    | A002                                  | 418.0000             | 836.00                                          | -30.41      | ----                                            | ----        |
|                 |                    | A003                                  | 435.5000             | 871.00                                          | -33.70      | ----                                            | ----        |
|                 |                    | A004                                  | 453.0000             | 907.00                                          | -31.72      | 4075                                            | -31.34      |
|                 |                    | A005                                  | 469.5000             | 939.00                                          | -30.01      | ----                                            | ----        |
| Limit           |                    | -20dBm for 12.5KHz Channel Separation |                      |                                                 |             |                                                 |             |
| Test Results    |                    | Compliance                            |                      |                                                 |             |                                                 |             |

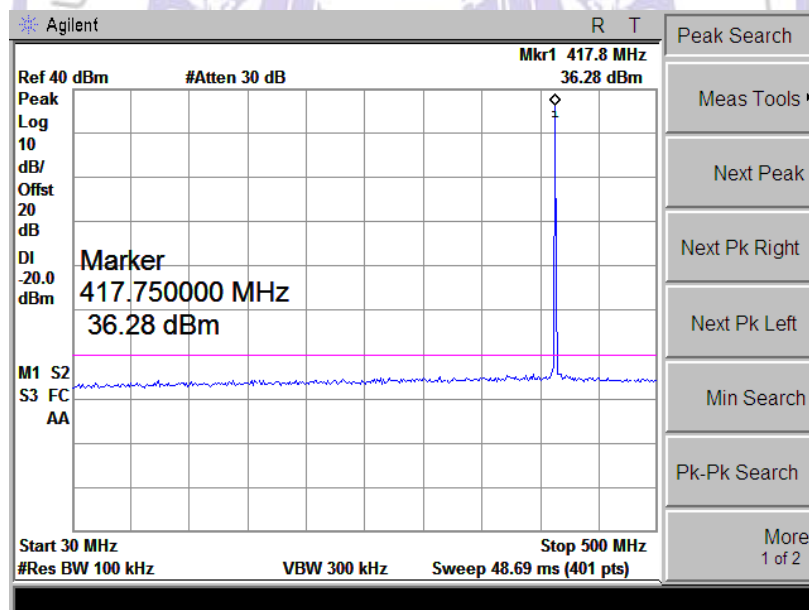
### Plots of Spurious Emission on Antenna Port Measurement

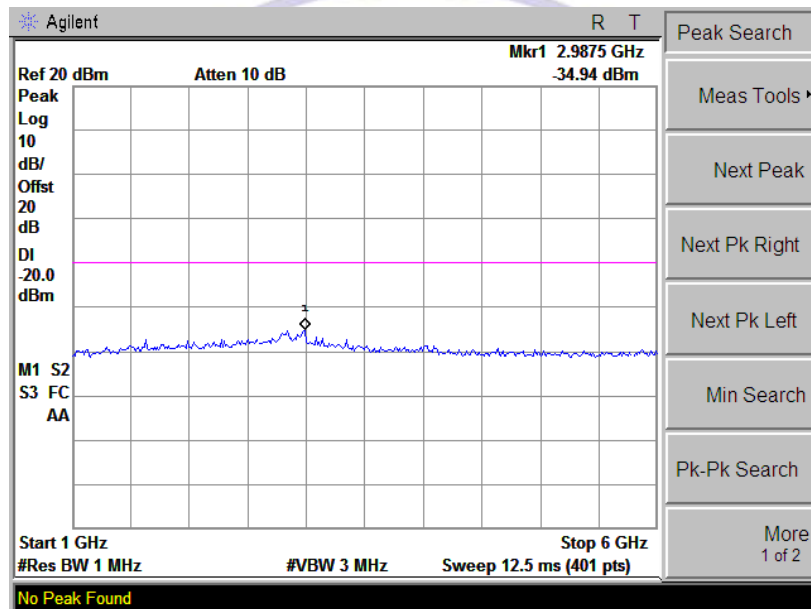
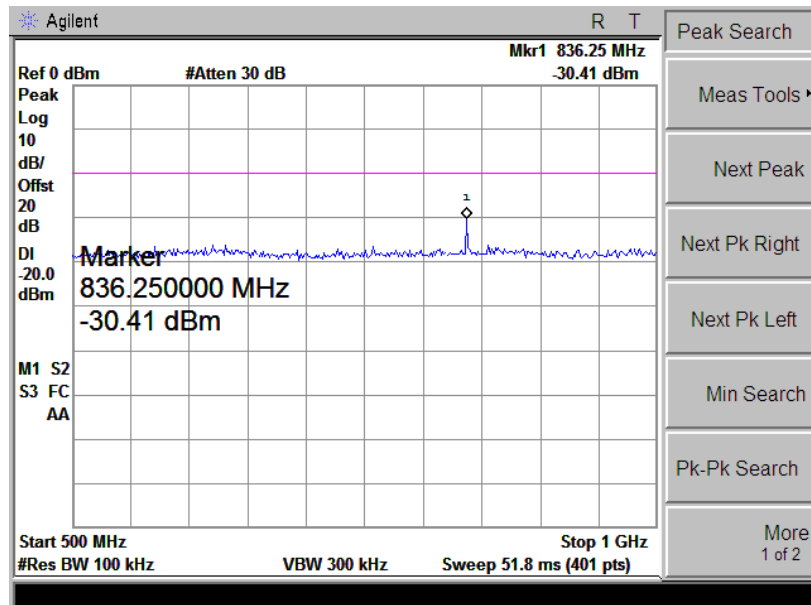
| Modulation Type | Channel Separation | Test Channel | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             | FCC Limit |
|-----------------|--------------------|--------------|----------------------|-------------------------------------------------|-------------|-------------------------------------------------|-------------|-----------|
|                 |                    |              |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |           |
| FM              | 12.5KHz            | A001         | 406.5000             | 813.00                                          | -29.08      | ----                                            | ----        | -20dBm    |
| Test Results    |                    |              |                      | Compliance                                      |             |                                                 |             |           |



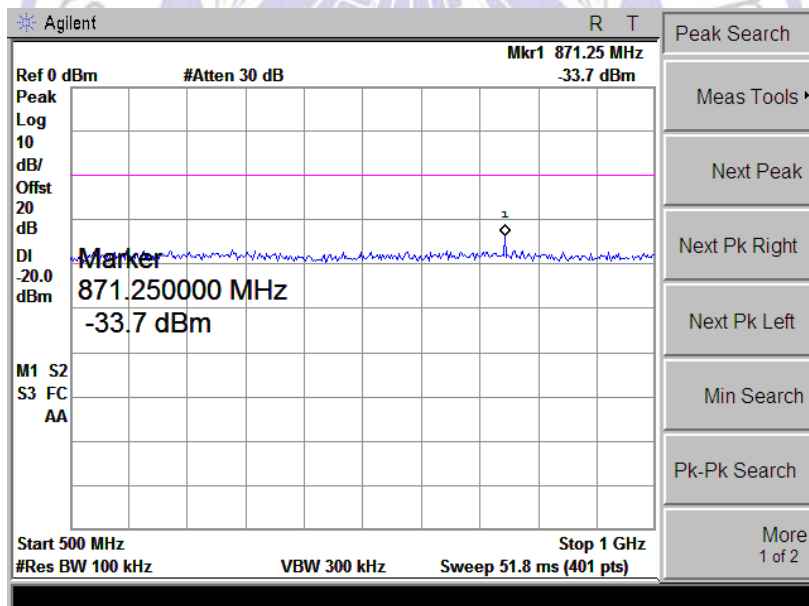
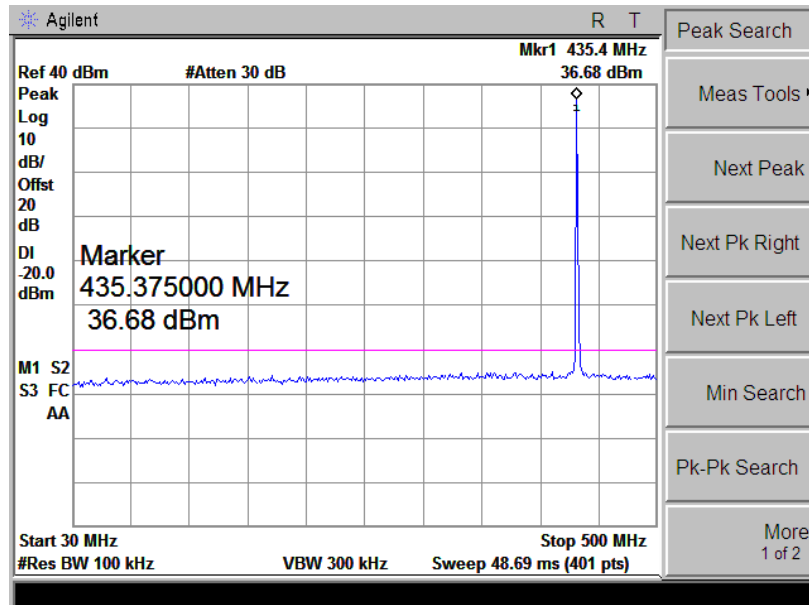


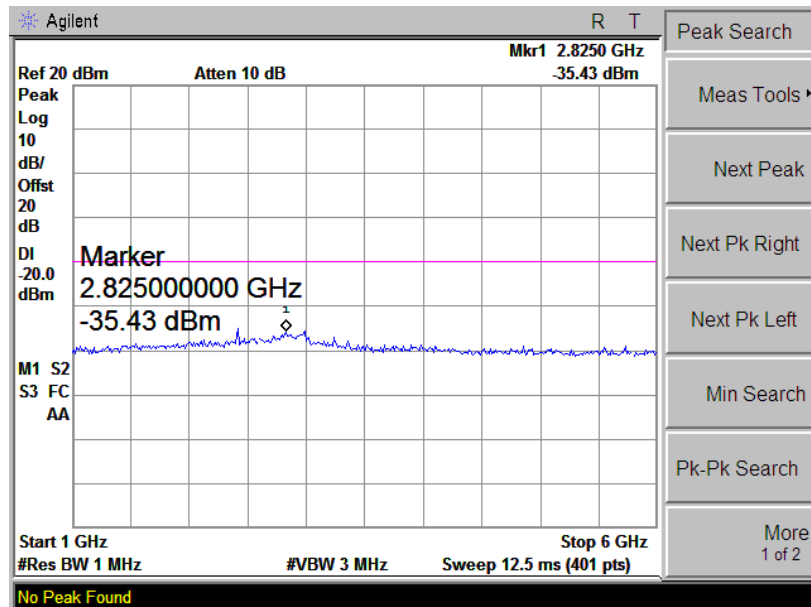
| Modulation Type | Channel Separation | Test Channel | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             | FCC Limit |
|-----------------|--------------------|--------------|----------------------|-------------------------------------------------|-------------|-------------------------------------------------|-------------|-----------|
|                 |                    |              |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |           |
| FM              | 12.5KHz            | A002         | 418.0000             | 836.00                                          | -30.41      | ----                                            | ----        | -20dBm    |
| Test Results    |                    |              |                      | Compliance                                      |             |                                                 |             |           |



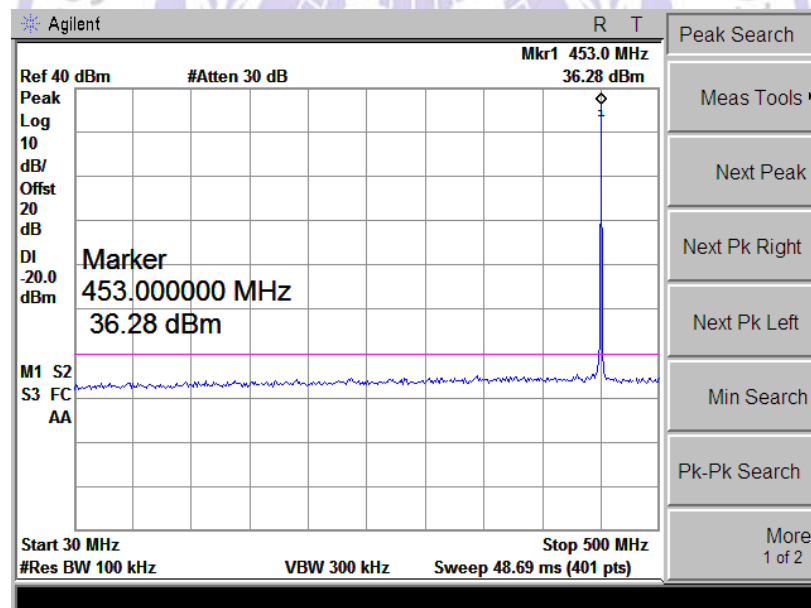


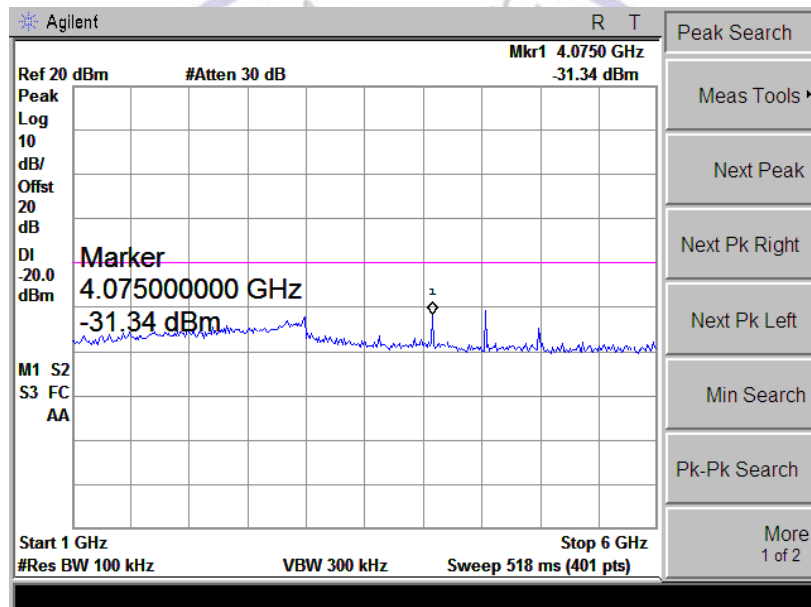
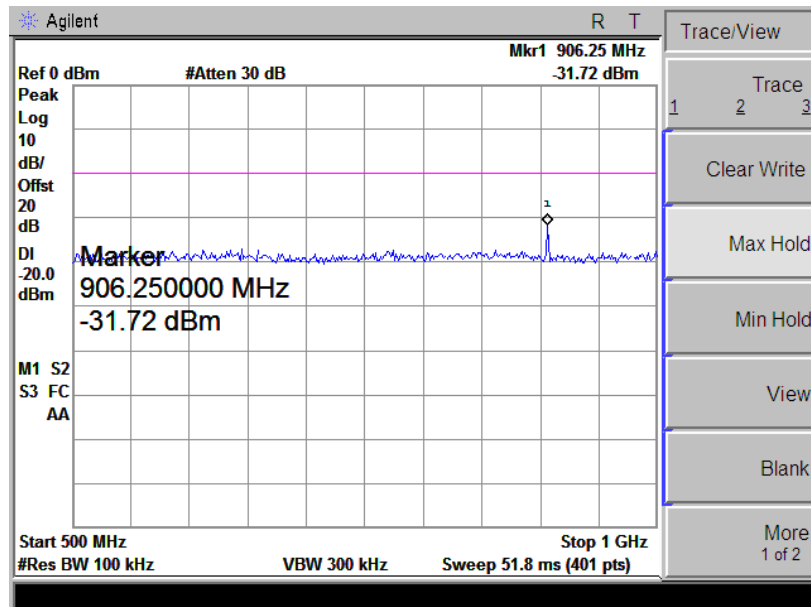
| Modulation Type | Channel Separation | Test Channel | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             | FCC Limit |
|-----------------|--------------------|--------------|----------------------|-------------------------------------------------|-------------|-------------------------------------------------|-------------|-----------|
|                 |                    |              |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |           |
| FM              | 12.5KHz            | A003         | 435.5000             | 871.00                                          | -33.70      | -----                                           | -----       | -20dBm    |
| Test Results    |                    |              |                      | Compliance                                      |             |                                                 |             |           |



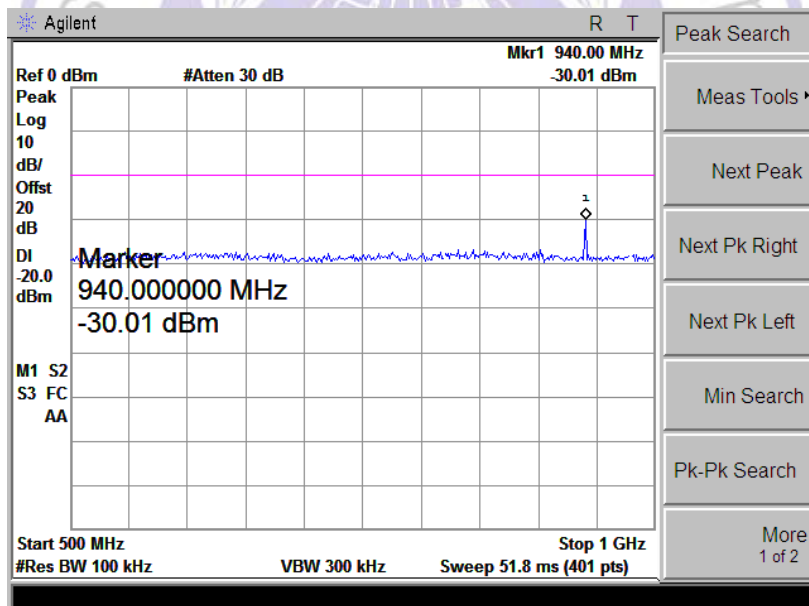
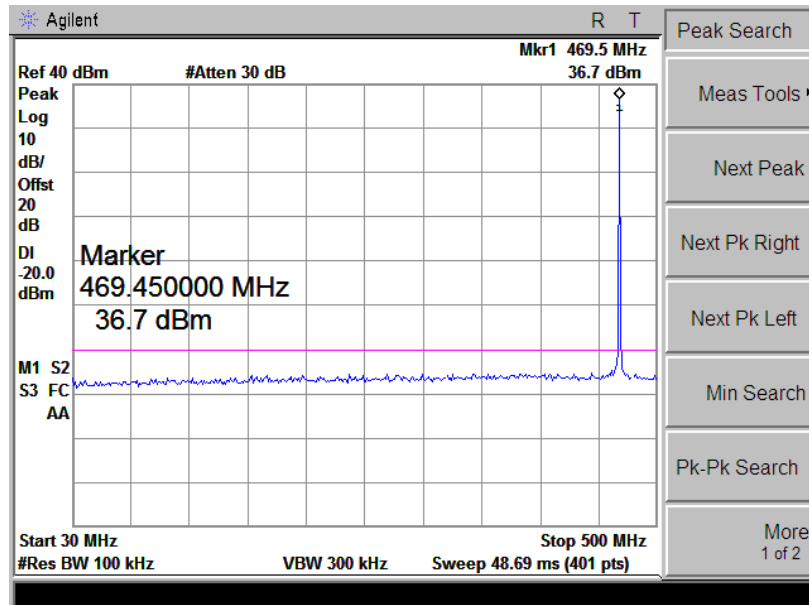


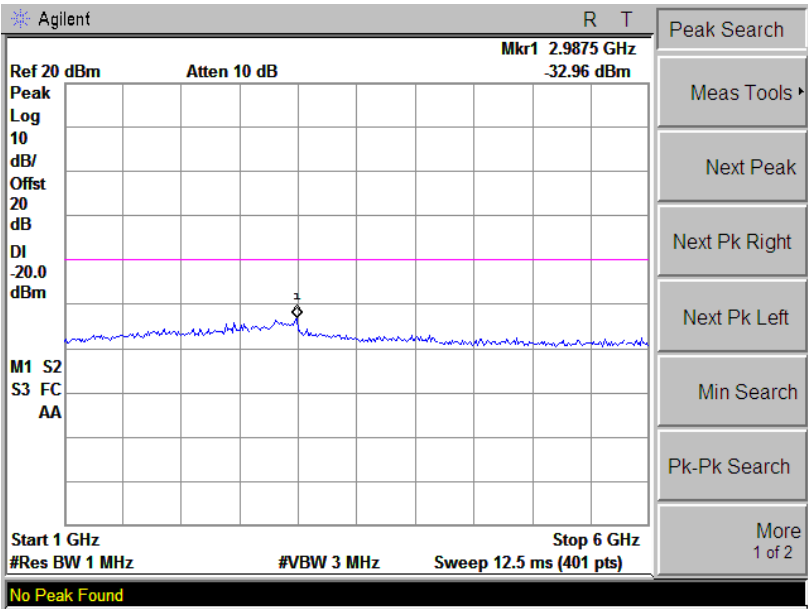
| Modulation Type | Channel Sparation | Test Channel | Test Frequency (MHz) | Maximum Conducted Spurious Emissions Below 1GHz |             | Maximum Conducted Spurious Emissions Above 1GHz |             | FCC Limit |
|-----------------|-------------------|--------------|----------------------|-------------------------------------------------|-------------|-------------------------------------------------|-------------|-----------|
|                 |                   |              |                      | Frequency (MHz)                                 | Datum (dBm) | Frequency (MHz)                                 | Datum (dBm) |           |
| FM              | 12.5KHz           | A004         | 453.0000             | 906.00                                          | -31.72      | 4075                                            | -31.34      | -20dBm    |
| Test Results    |                   |              |                      | Compliance                                      |             |                                                 |             |           |





| Modulation Type | Channel Separation | 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) |           |
| FM              | 12.5KHz            | A005         | 469.5000             | 940.00                                          | -30.01      | 3070.00                                         | -43.90      | -20dBm    |
| Test Results    |                    |              |                      | Compliance                                      |             |                                                 |             |           |





## 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

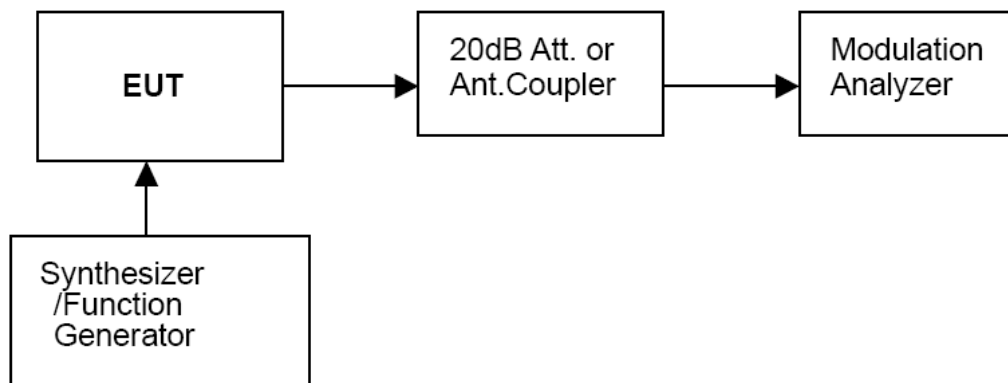
#### **Modulation Limit**

- 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

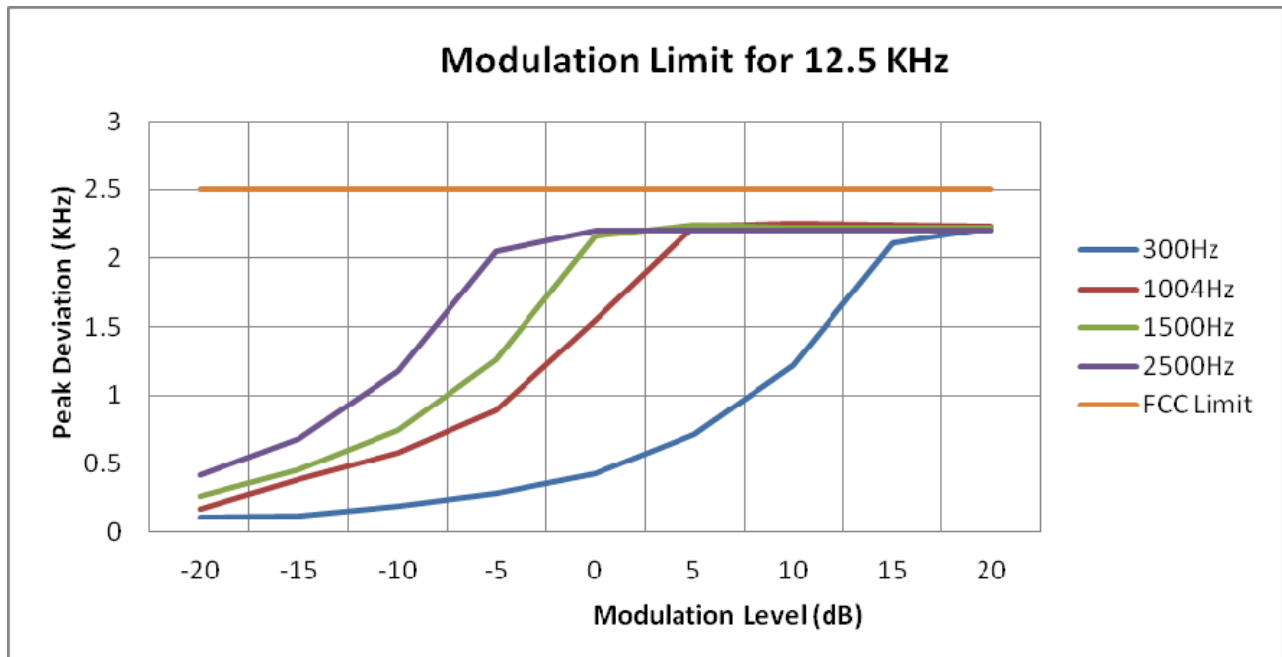


### TEST RESULTS

#### Modulation Type: FM

#### 12.5 KHz Channel Separation

| Modulation Level(dB) | Peak Freq. Deviation At 300 Hz(KHz) | Peak Freq. Deviation At 1004 H(KHz) | Peak Freq. Deviation At 1500 Hz(KHz) | Peak Freq. Deviation At 2500 Hz(KHz) |
|----------------------|-------------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|
| -20                  | 0.10                                | 0.16                                | 0.27                                 | 0.46                                 |
| -15                  | 0.14                                | 0.39                                | 0.48                                 | 0.67                                 |
| -10                  | 0.18                                | 0.56                                | 0.77                                 | 1.19                                 |
| -5                   | 0.26                                | 0.87                                | 1.26                                 | 2.08                                 |
| 0                    | 0.45                                | 1.56                                | 2.17                                 | 2.23                                 |
| +5                   | 0.73                                | 2.26                                | 2.26                                 | 2.22                                 |
| +10                  | 1.25                                | 2.25                                | 2.24                                 | 2.24                                 |
| +15                  | 2.14                                | 2.25                                | 2.24                                 | 2.24                                 |
| +20                  | 2.25                                | 2.27                                | 2.26                                 | 2.25                                 |



**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: FM**

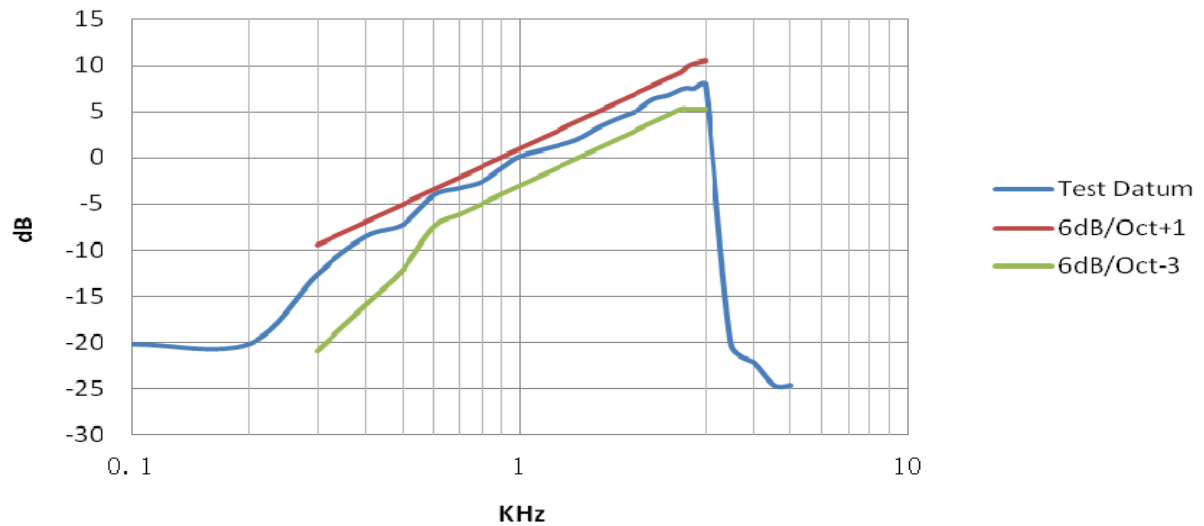
The audio frequency response curve is show below. And test Audio Level (1 KHz and 20% maximum deviation) is 2.90mv for 12.5 KHz channel separation.

**Note:**

- 1 Not applicable to new standard. However, tests are conducted under FCC's recommendation.
- 2 The Audio Frequency Response is identical for 12.5 KHz channel separation

**12.5 KHz Channel Separation**

| Frequency (KHz ) | Frequency Deviation (KHz) | 1KHz Reference Deviation (KHz) | Audio Frequency Response (dB) |
|------------------|---------------------------|--------------------------------|-------------------------------|
| 0.1              | 0.04                      | 0.51                           | -20.16                        |
| 0.2              | 0.05                      | 0.51                           | -20.16                        |
| 0.3              | 0.16                      | 0.51                           | -12.65                        |
| 0.4              | 0.24                      | 0.51                           | -8.53                         |
| 0.5              | 0.25                      | 0.51                           | -7.23                         |
| 0.6              | 0.33                      | 0.51                           | -4.06                         |
| 0.7              | 0.35                      | 0.51                           | -3.28                         |
| 0.8              | 0.39                      | 0.51                           | -2.57                         |
| 0.9              | 0.47                      | 0.51                           | -1.11                         |
| 1.0              | 0.53                      | 0.51                           | 0.18                          |
| 1.2              | 0.58                      | 0.51                           | 1.13                          |
| 1.4              | 0.66                      | 0.51                           | 1.96                          |
| 1.6              | 0.75                      | 0.51                           | 3.34                          |
| 1.8              | 0.84                      | 0.51                           | 4.32                          |
| 2.0              | 0.96                      | 0.51                           | 5.15                          |
| 2.2              | 1.05                      | 0.51                           | 6.34                          |
| 2.4              | 1.13                      | 0.51                           | 6.78                          |
| 2.6              | 1.20                      | 0.51                           | 7.46                          |
| 2.7              | 1.22                      | 0.51                           | 7.52                          |
| 2.8              | 1.24                      | 0.51                           | 7.54                          |
| 3.0              | 1.27                      | 0.51                           | 7.96                          |
| 3.5              | 0.05                      | 0.51                           | -20.18                        |
| 4.0              | 0.04                      | 0.51                           | -22.17                        |
| 4.5              | 0.03                      | 0.51                           | -24.61                        |
| 5.0              | 0.03                      | 0.51                           | -24.61                        |

**Audio Frequency Response for 12.5KHz**

## 4.6. Frequency Stability Measurement

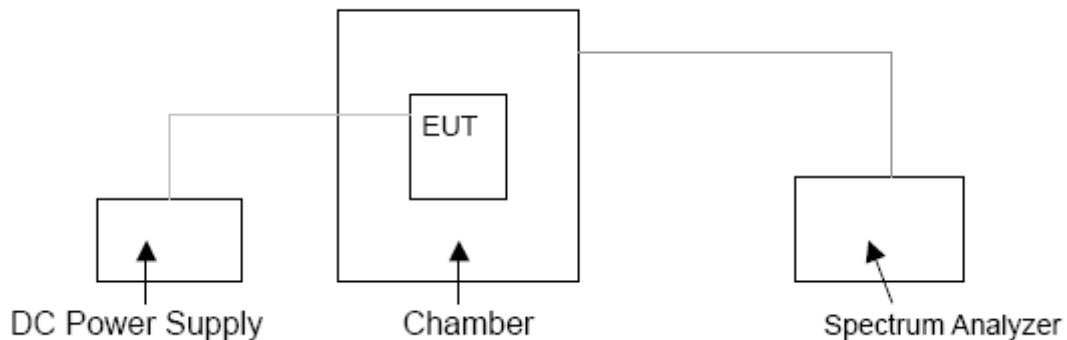
### TEST APPLICABLE

- 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 +50°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 for other than hand carried battery equipment and tested end point voltage.
- 4 According to §90.213, the frequency stability limit is 2.5 ppm for 12.5 KHz channel separation.

### 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 SETUP BLOCK DIAGRAM



### 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> ..... | -----                   | -----                     | -----                        |

| Modulation Type | Channel Separation | Test conditions   |           | Frequency error (ppm) |                |                |                |                |
|-----------------|--------------------|-------------------|-----------|-----------------------|----------------|----------------|----------------|----------------|
|                 |                    | Voltage(V)        | Temp (°C) | 406.5000 (MHz)        | 418.0000 (MHz) | 435.5000 (MHz) | 453.5000 (MHz) | 469.5000 (MHz) |
| Analog/FM       | 12.5KHz            | 7.40              | -30       | -0.76                 | -0.76          | -0.73          | 0.77           | 0.76           |
|                 |                    |                   | -20       | -0.70                 | -0.69          | -0.71          | 0.71           | 0.70           |
|                 |                    |                   | -10       | -0.63                 | -0.64          | -0.60          | 0.63           | 0.65           |
|                 |                    |                   | 0         | -0.58                 | -0.56          | -0.55          | 0.54           | 0.54           |
|                 |                    |                   | 10        | -0.40                 | -0.44          | -0.42          | 0.45           | 0.43           |
|                 |                    |                   | 20        | -0.26                 | -0.23          | -0.23          | 0.24           | 0.25           |
|                 |                    |                   | 30        | -0.30                 | -0.33          | -0.31          | 0.32           | 0.31           |
|                 |                    |                   | 40        | -0.47                 | -0.45          | -0.45          | 0.46           | 0.45           |
|                 |                    | 50                | -0.50     | -0.47                 | -0.55          | 0.50           | 0.53           |                |
|                 |                    | 6.25 (End Point)  | 25        | -0.66                 | -0.66          | -0.63          | 0.60           | 0.62           |
|                 |                    | 6.29 (85% Rated)  | 20        | -0.36                 | -0.33          | -0.30          | 0.33           | 0.34           |
|                 |                    | 8.51 (115% Rated) | 20        | -0.39                 | -0.39          | -0.37          | 0.38           | 0.35           |
| Limit           |                    |                   |           | 2.50                  | 2.50           | 2.50           | 2.50           | 2.50           |
| Conclusion      |                    |                   |           | Complies              |                |                |                |                |



## 4.7. Conducted Output Power

### TEST APPLICABLE

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

Per RSS-119 Section 5.4 and 5.4.1: The output power shall be within  $\pm 1.0$  dB of the manufacturer's rated power. Typical transmitter output powers are 110 watts for base and/or fixed stations (paging transmitters excepted), and 30 watts for mobile stations. Higher powers may be certified, but it should be noted that mobile stations are normally only licensed up to 30 watts. See the SRSP relevant to the operating frequency for equipment power limits.

### 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 40 dB attenuator.

Measurement with Spectrum Analyzer FSP40 or Aglient E4407B conducted, external power supply with 12.50 V stabilized supply voltage.

### TEST CONFIGURATION

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

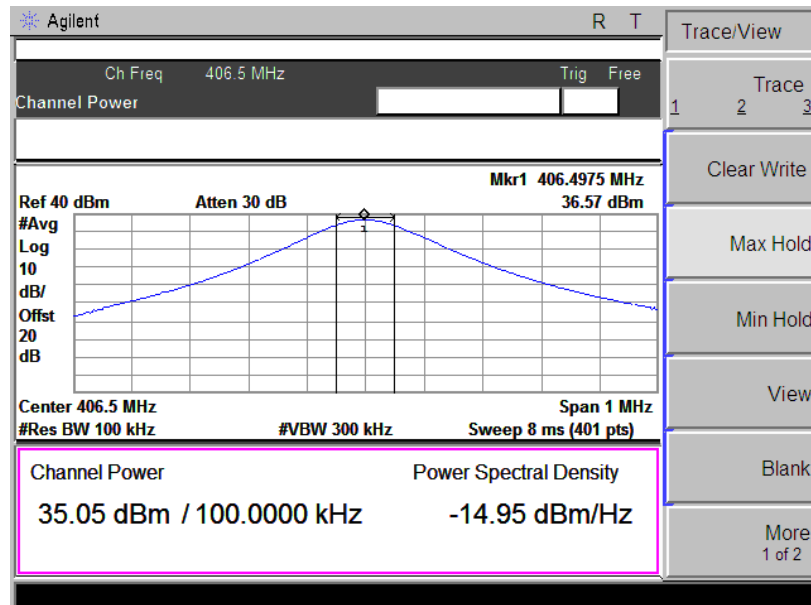
The EUT was directly connected to a RF Communication  
Test set by a 20 dB attenuator

### TEST RESULTS

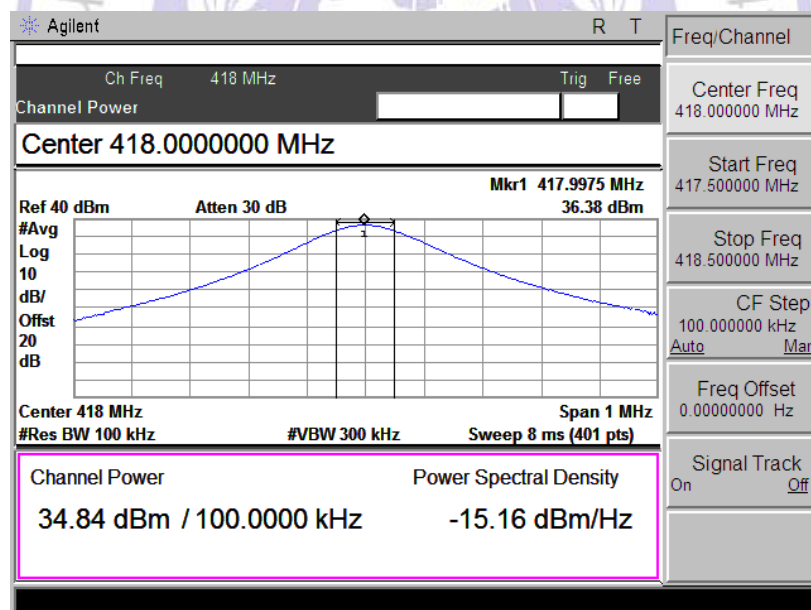
| Frequency Range (MHz) | Modulation Type                                                                       | Channel Separation (KHz) | Test Channel | Maximum Output Power Test Results (dBm) |
|-----------------------|---------------------------------------------------------------------------------------|--------------------------|--------------|-----------------------------------------|
| 400-470               | Analog/FM                                                                             | 12.5                     | A001         | 35.05                                   |
|                       |                                                                                       |                          | A002         | 34.84                                   |
|                       |                                                                                       |                          | A003         | 35.17                                   |
|                       |                                                                                       |                          | A004         | 34.94                                   |
|                       |                                                                                       |                          | A005         | 35.35                                   |
| Limit                 | FCC:The limit is dependent upon the station's antenna HAAT and required service area. |                          |              |                                         |
| Test Results          | Compliance                                                                            |                          |              |                                         |

### Plots of Maximum Transmitter Power Measurement

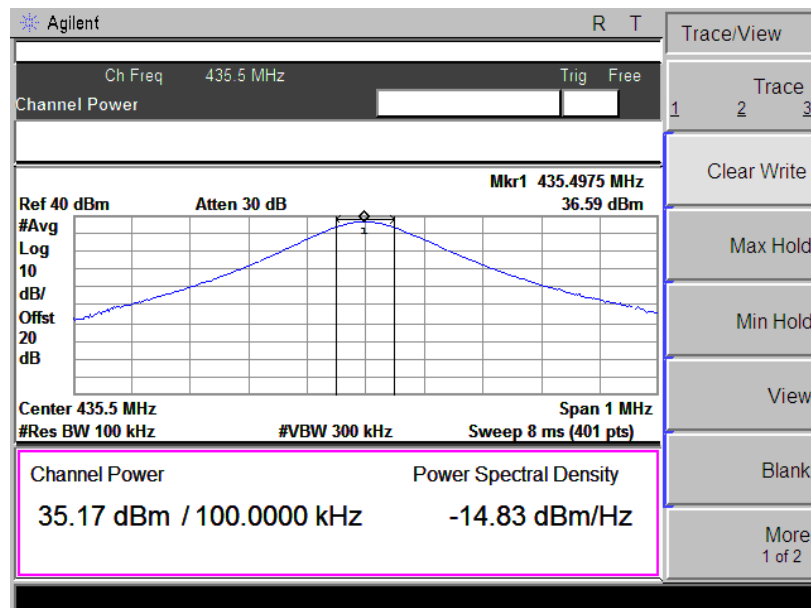
| Modulation Type | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results    |
|-----------------|--------------------|------------|--------------------|-------------------|-----------|------------|
| FM              | 12.5 KHz           | 406.5000   | 4                  | 35.05             | Varies    | Compliance |



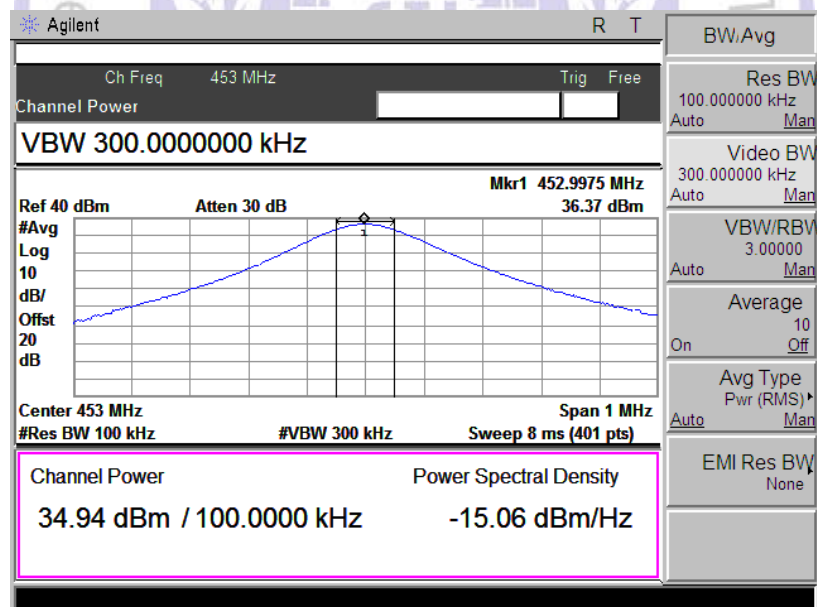
| Modulation Type | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results    |
|-----------------|--------------------|------------|--------------------|-------------------|-----------|------------|
| FM              | 12.5 KHz           | 418.0000   | 4                  | 34.84             | Varies    | Compliance |



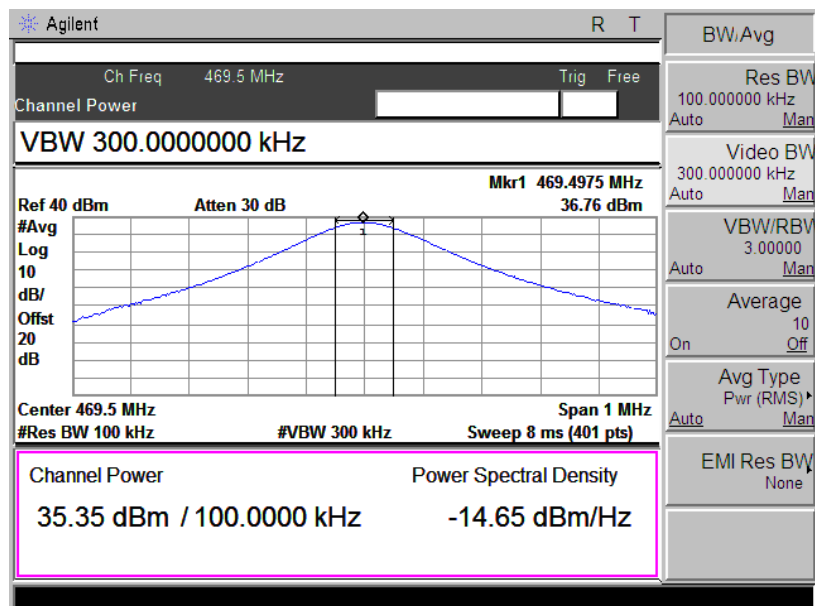
| Modulation Type | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results    |
|-----------------|--------------------|------------|--------------------|-------------------|-----------|------------|
| FM              | 12.5 KHz           | 435.5000   | 4                  | 35.17             | Varies    | Compliance |



| Modulation Type | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results    |
|-----------------|--------------------|------------|--------------------|-------------------|-----------|------------|
| FM              | 12.5 KHz           | 453.0000   | 4                  | 34.94             | Varies    | Compliance |



| Modulation Type | Channel Separation | Freq.(MHz) | Rated Power (Watt) | Measurement (dBm) | FCC Limit | Results    |
|-----------------|--------------------|------------|--------------------|-------------------|-----------|------------|
| FM              | 12.5 KHz           | 469.5000   | 4                  | 35.35             | Varies    | Compliance |



## 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:

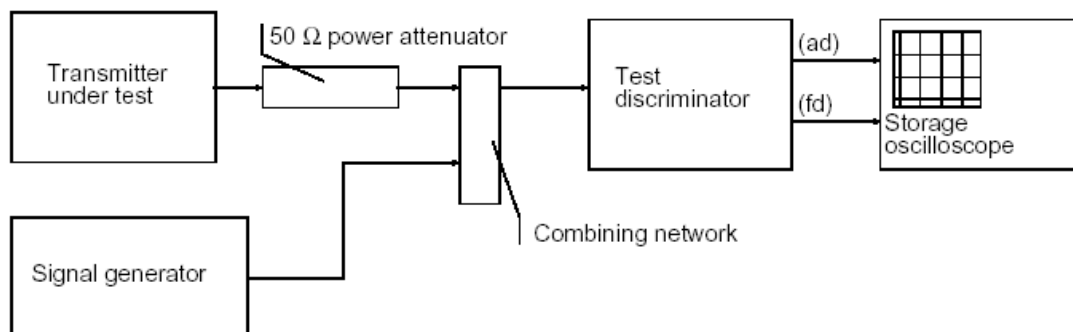
| Time intervals <sup>1, 2</sup>                                                      | Maximum frequency difference <sup>3</sup> | All equipment  |               |
|-------------------------------------------------------------------------------------|-------------------------------------------|----------------|---------------|
|                                                                                     |                                           | 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

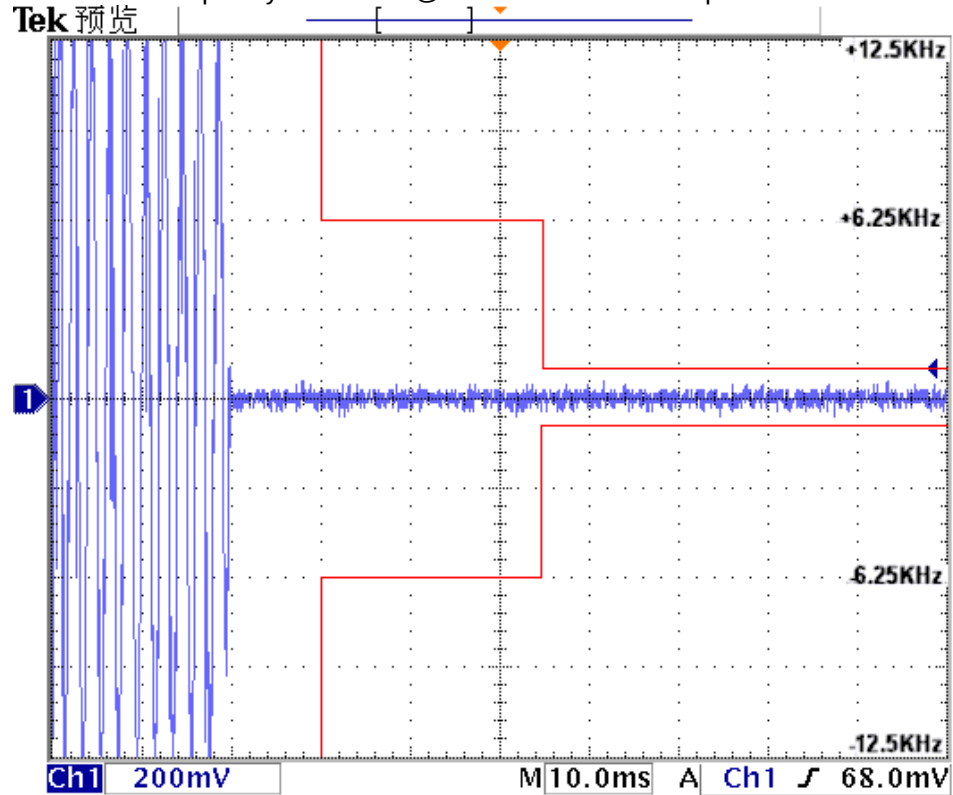


### TEST RESULTS

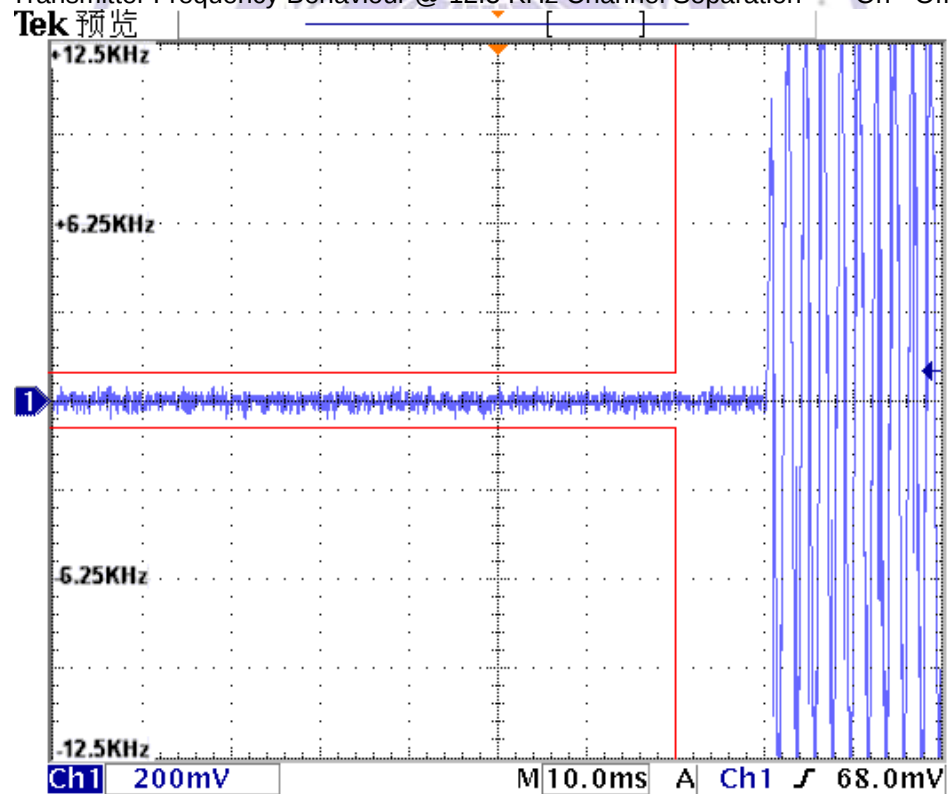
Please refer to the following plots.

Modulation Type: FM

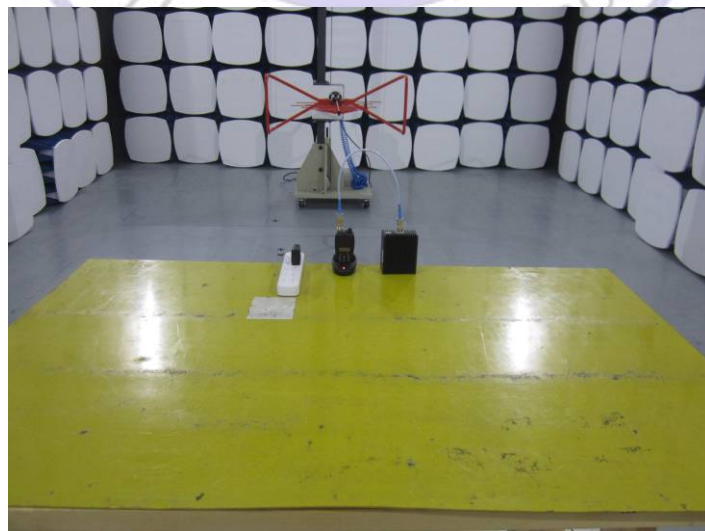
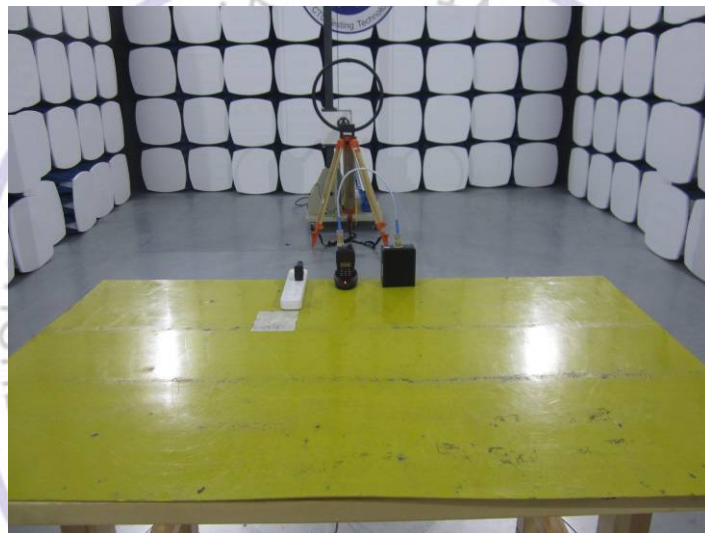
Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation-----Off – On

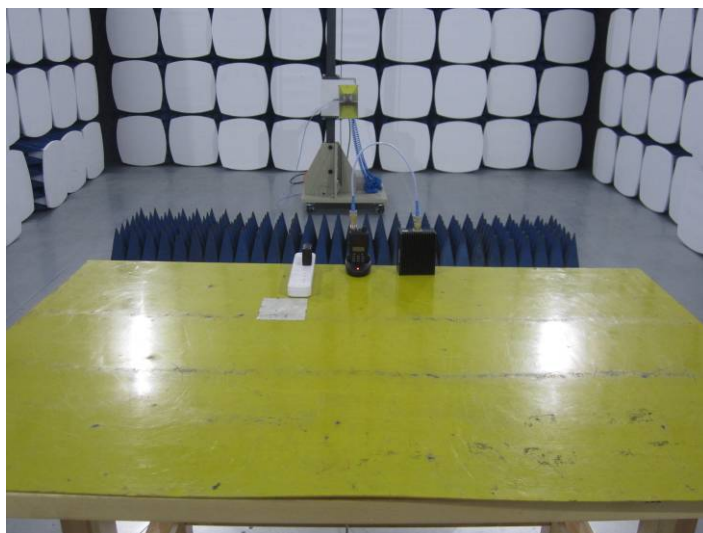


Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation-----On - Off



## 5. Test Setup Photos of the EUT





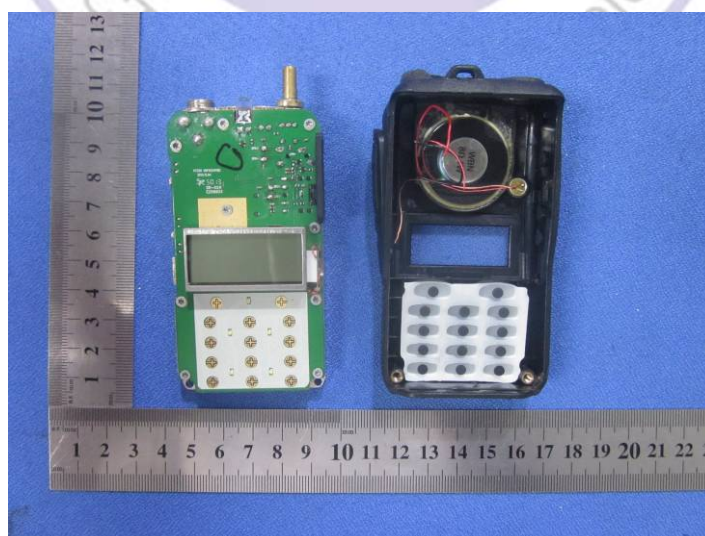
## 6. External and Internal Photos of the EUT

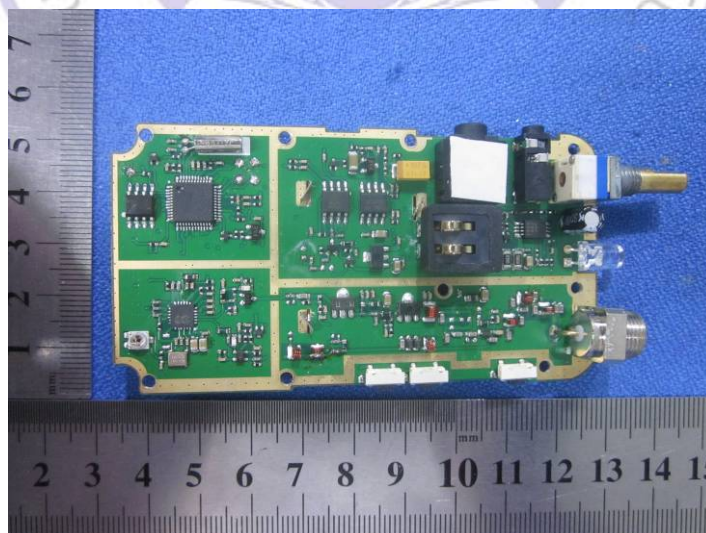
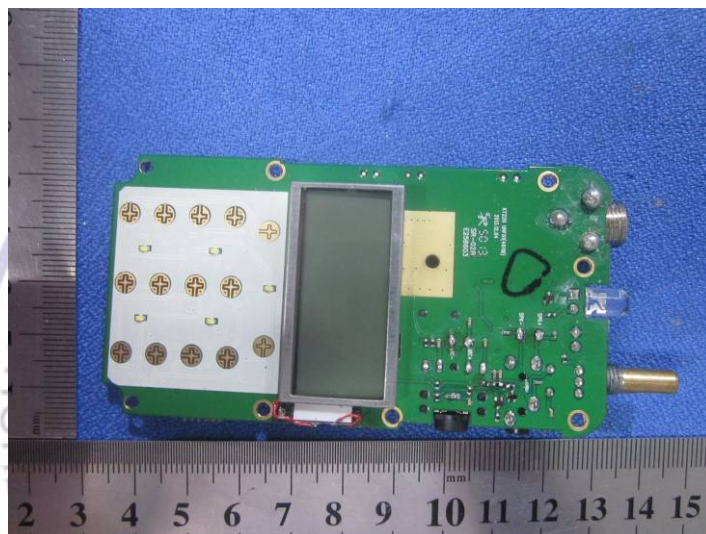
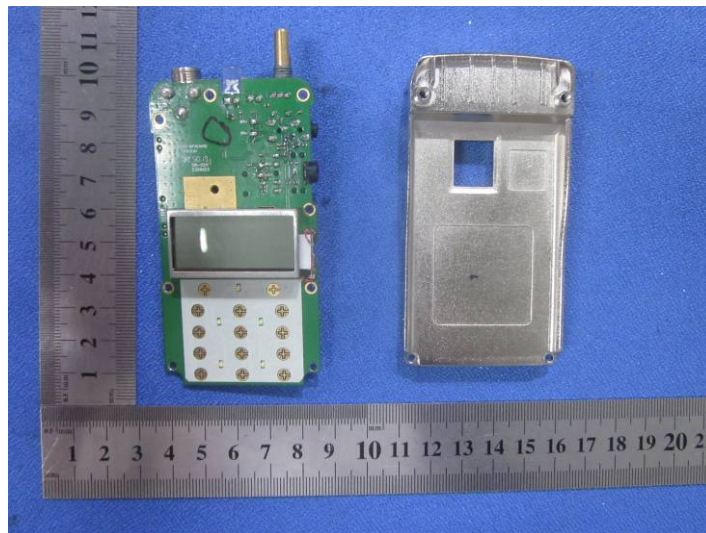
### External Photos







Internal Photos



.....End of Report.....