

# **FCC Part 90 & RSS-119**

## **TEST REPORT**

*For*

**Two Way Radio**

**Model Name: TC-300U (2)**

**Trade Name: HYT**

**FCC ID: R74TC-300U2, IC: 5465A-TC300U2**

**Report No.: SZAGC003080701E6**

**Date of Issue: Jul.08 2008**

*Prepared For*

**Shenzhen HYT Science & Technology Co., Ltd.**

**HYT Tower, Shenzhen Hi-Tech Industrial Park North, Beihuan Rd.,**

**Nanshan District, Shenzhen, P.R.C.**

TEX: 86-755-2697 2999

FAX: 86-755-8613 7130

*Prepared By*

**Shenzhen Attestation of Global Compliance Science & Technology Co., Ltd**

**1F, No.2 Building, Chaxi Sanwei Industrial Zone, Gushu Community,**

**Xixiang Street, Bao'an District, Shenzhen, China**

TEL: 86-755-2974 2358

FAX: 86-755-2600 8484

## VERIFICATION OF COMPLIANCE

|                      |                                                                                                                                                   |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicant:           | SHENZHEN HYT SCIENCE & TECHNOLOGY CO., LTD.<br>HYT Tower, Shenzhen Hi-Tech Industrial Park North, Beihuan Rd., Nanshan District, Shenzhen, P.R.C. |
| Manufacturer:        | SHENZHEN HYT SCIENCE & TECHNOLOGY CO., LTD.<br>HYT Tower, Shenzhen Hi-Tech Industrial Park North, Beihuan Rd., Nanshan District, Shenzhen, P.R.C. |
| Product Description: | Two-way Radio                                                                                                                                     |
| Brand Name:          | HYT                                                                                                                                               |
| Model Number:        | TC-300 U(2)                                                                                                                                       |
| Serial Number:       | N/A                                                                                                                                               |
| File Number:         | SZAGC003080701E6                                                                                                                                  |
| Date of Test:        | Jul.01, 2007 ~ Jul.08, 2007                                                                                                                       |

### We hereby certify that:

The above equipment was tested by Shenzhen Attestation of Global Compliance Science & Technology Co., Ltd. The data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C 63.4:2003 and TIA/EIA 603. The sample tested as described in this report is in compliance with the FCC Rules Part 90.

The test results of this report relate only to the tested sample identified in this report.

Prepared By: Tony Tian  
Tony Tian Jul.08, 2008

Checked By: Randy He  
Randy He Jul.08, 2008

Authorized By: King Zhang  
King Zhang Jul.08, 2008

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# 1. GENERAL INFORMATION

## 1.1 PRODUCT DESCRIPTION

The EUT is a single channel Two-way Radio designed for voice communication. It is designed by way of utilizing the FM modulation achieves the system operating.

A major technical description of EUT is described as following:

|                                       |                                                                                                                                      |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Communication Type                    | Voice / Tone only                                                                                                                    |
| Modulation                            | F3E                                                                                                                                  |
| Emission Type                         | 16K0F3E (2M+2D, M=3, D=5.0, NB=16KHz for 25.0 KHz separation)<br>11K0F3E (2M+2D, M=3, D=2.5, NB=11KHz for 12.5 KHz separation)       |
| Emission Bandwidth                    | 5.75 KHz (Limit:11.25 KHz for 12.5 KHz channel separation)<br>15.01 KHz (Limit: 20 KHz for 25 KHz channel Separation)                |
| Peak Frequency Deviation              | 1.88 KHz for 12.5 KHz Channel Separation (Limit $\leq\pm 2.5$ KHz)<br>3.76 KHz for 25 KHz Channel Separation (Limit $\leq\pm 5$ KHz) |
| Maximum Transmitter Power             | Power: 1.78W(12.5KHz Channel Space)<br>Power: 1.79W(25.0KHz Channel Space)                                                           |
| Output power Modification             | Fixed can't be changed                                                                                                               |
| Antenna Designation                   | Detachable                                                                                                                           |
| Power Supply                          | DC 7.4V by battery                                                                                                                   |
| Battery Endpoint                      | DC 6.1V                                                                                                                              |
| Operation Frequency Range and Channel | Frequency Range: 450 MHz to 470 MHz<br>Top Channel: 450.575 MHz<br>Centre Channel: 460.575 MHz<br>Bottom Channel: 469.575 MHz        |
| Frequency Tolerance                   | 1.49 ppm for 12.5 KHz Channel Separation<br>1.47 ppm for 25.0 KHz Channel Separation                                                 |

## **1.2 RELATED SUBMITTAL(S) / GRANT (S)**

This submittal(s) (test report) is intended for **FCC ID: R74TC-300U2** and **IC: 5465A-TC300U2** filing to comply with the FCC Part 90 requirements and RS-119 requirements.

## **1.3 TEST METHODOLOGY**

The radiated emission testing was performed according to the procedures of ANSI C63.4 : 2003;TIA/EIA 603 and FCC CFR 47 Rules of 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057.

## **1.4 TEST FACILITY**

The test site used to collect the radiated data is located on the address of F1, Bldg A, Changyuan New Material Port, Keyuan Rd., Science & Industry Park, Nanshan District, 518057, Shenzhen, P.R.China. (Accurate Technology Co., Ltd.)

The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003 and IC requirements in documents RS212  
FCC register No.: 253065

## **1.5 SPECIAL ACCESSORIES**

Not available for this EUT intended for grant.

## **1.6 EQUIPMENT MODIFICATIONS**

Not available for this EUT intended for grant.

## 2. SYSTEM TEST CONFIGURATION

### 2.1 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.

### 2.2 EUT EXERCISE

The Transmitter was operated in the normal operating mode. the TX frequency was fixed which was for the purpose of the measurements.

### 2.3 GENERAL TECHNICAL REQUIREMENTS

- (1). Section 15.207: Conducted Limits (Not applicable)
- (2). Section 90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area
- (3). Section 90.207: Modulation Characteristic
- (4). Section 90.209: Occupied Bandwidth
- (5). Section 90.210: Emission Mask
- (6). Section 90.213: Frequency Tolerance
- (7). Section 90.214: Transient Frequency Behavior

### 2.4 CONFIGURATION OF TESTED SYSTEM

Fig. 2-1 Configuration of Tested System



Table 2-1 Equipment Used in Tested System

| Item | Equipment     | Model No.  | Identifier                              | Series No. | Note |
|------|---------------|------------|-----------------------------------------|------------|------|
| 1    | Two way Radio | TC-300U(2) | FCC ID: R74TC-300U2<br>IC:5465A-TC300U2 | --         | EUT  |
| --   | --            | --         | --                                      | --         | --   |
| --   | --            | --         | --                                      | --         | --   |

### 3. SUMMARY OF TEST RESULTS

| FCC Rules | RS-119 | Description Of Test          | Result    |
|-----------|--------|------------------------------|-----------|
| §15.207   | RS-Gen | Conducted Emission           | N/A       |
| §90.205   | §5.4   | Maximum Transmitter Power    | Compliant |
| §90.207   | §5.13  | Modulation Characteristic    | Compliant |
| §90.209   | §5.5   | Occupied Bandwidth           | Compliant |
| §90.210   | §5.8   | Emission Mask                | Compliant |
| §90.213   | §5.3   | Frequency Tolerance          | Compliant |
| §90.214   | §5.9   | Transient Frequency Behavior | Compliant |



## **4. DESCRIPTION OF TEST MODES**

The EUT (Two way Radio) has been tested under normal operating condition. Three channels (The top channel, the middle channel and the bottom channel) are chosen for testing at each channel separation (12.5 KHz/ 25 KHz).

## 5. CONDUCTED LIMITS (NOT APPLICABLE)

### 5.1 PROVISIONS APPLICABLE

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the, the radio frequency voltage that is conducted back onto the AC power line on any frequencies within the band 150 KHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50uH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

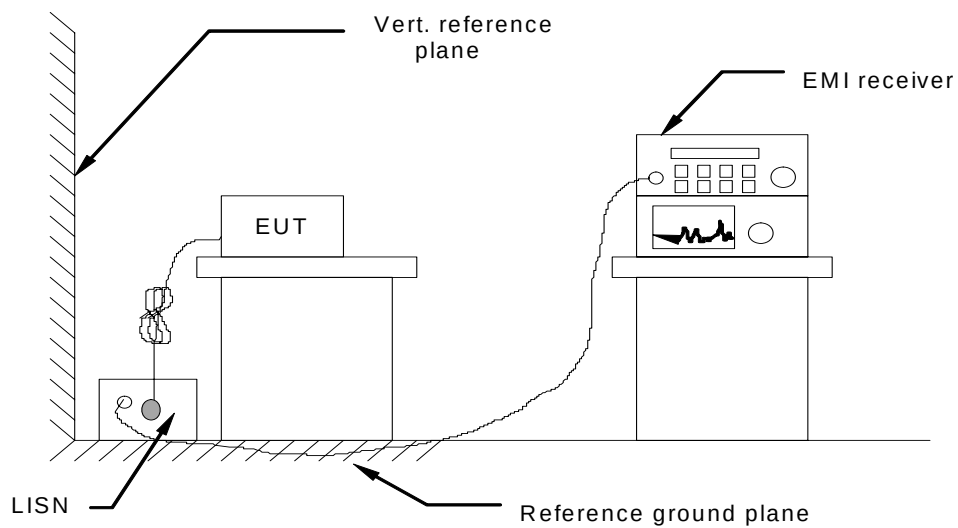
| Frequency of Emission (MHz) | Conducted Limit(dBuV) |            |
|-----------------------------|-----------------------|------------|
|                             | Quasi-Peak            | Average    |
| 0.15 – 0.5                  | 66 to 56 *            | 56 to 46 * |
| 0.5 – 5                     | 56                    | 46         |
| 5 – 30                      | 60                    | 50         |

\* Decreases with the logarithm of the frequency.

### 5.2 MEASUREMENT PROCEDURE

- (1) The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When 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 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- (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 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 150kHz to 30MHz for emissions in each of the test modes.  
During the above scans, the emissions were maximized by cable manipulation.

### 5.3 TEST SETUP BLOCK DIAGRAM



### 5.4 TEST EQUIPMENT USED

| Conducted Emission Test Site |              |       |               |                 |
|------------------------------|--------------|-------|---------------|-----------------|
| Name of Equipment            | Manufacturer | Model | Serial Number | Calibration Due |
| --                           | --           | --    | --            | --              |
| --                           | --           | --    | --            | --              |
| --                           | --           | --    | --            | --              |
| --                           | --           | --    | --            | --              |

## 5.5 TEST RESULT

### LINE CONDUCTED EMISSION TEST

| FREQ<br>MHz | PEAK<br>RAW<br>dBuV | Q.P.<br>RAW<br>dBuV | AVG<br>RAW<br>dBuV | Q.P.<br>Limit<br>dBuV | AVG<br>Limit<br>dBuV | Q.P.<br>Margin<br>dB | AVG<br>Margin<br>dB | NOTE |
|-------------|---------------------|---------------------|--------------------|-----------------------|----------------------|----------------------|---------------------|------|
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |
| ---         | ---                 | ---                 | ---                | ---                   | ---                  | ---                  | ---                 | ---  |

\*\*NOTE:

“---” denotes the peak emission level was or more than 2dB below the Average limit, so no re-check anymore.

L1 = Line One (Hot side) / L2 = Line Two (Neutral side)

## **6. FREQUENCY TOLERANCE**

### **6.1 Provisions Applicable**

- a). According to FCC Part 2 Section 2.1055(a)(1), the frequency stability shall be measured with variation of ambient temperature from  $-30^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$  centigrade.
- b). According to FCC Part 2 Section 2.1055(d)(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.
- c). According to FCC Part 90 Section 90.213, the frequency tolerance must be maintained within 0.00025% for 12.5KHz channel separation and 0.0005% for 25KHz channel separation.

### **6.2 Measurement Procedure**

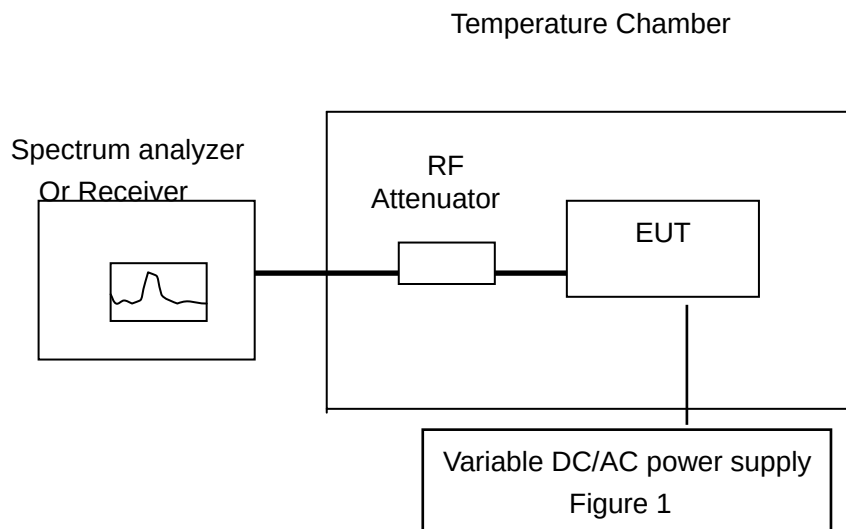
#### **6.2.1 Frequency stability versus environmental temperature**

1. Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.
2. Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1KHz and Video Resolution Bandwidth to 1KHz and Frequency Span to 50KHz. Record this frequency as reference frequency.
3. Set the temperature of chamber to  $60^{\circ}\text{C}$ . Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a  $10^{\circ}\text{C}$  decreased per stage until the lowest temperature  $-30^{\circ}\text{C}$  is measured, record all measured frequencies on each temperature step.

#### **6.2.2 Frequency stability versus input voltage**

1. Setup the configuration per figure 1 for frequencies measured at temperature if it is within  $15^{\circ}\text{C}$  to  $25^{\circ}\text{C}$ . Otherwise, an environment chamber set for a temperature of  $20^{\circ}\text{C}$  shall be used. The EUT shall be powered by DC 6.4V
2. Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1KHz and Video Resolution Bandwidth to 1KHz. Record this frequency as reference frequency.
3. Supply the EUT primary voltage at the operating end point which is specified by manufacturer and record the frequency.

### 6.3 Test Setup Block Diagram



### 6.4 Test equipment used:

| NAME OF EQUIPMENT | MANUFACTURER | MODEL  | SERIAL NUMBER | CAL. DATE  |
|-------------------|--------------|--------|---------------|------------|
| EMI Test Receiver | R&S          | ESCS30 | 100307        | 07/13/2007 |
| H & T CHAMBER     | H&T Chamber  | TN-400 | TN2007SR038   | 07/13/2007 |

## 6.5 Test result

(1) Frequency stability versus input voltage (battery operation end point voltage is 6.1V)

### Measurement Result for Channel Separation of 12.5 KHz

| Channel | Reference Frequency (MHz) | Frequency Measured at end point voltage | Frequency Deviation (PPM) | Limit (PPM) |
|---------|---------------------------|-----------------------------------------|---------------------------|-------------|
| Top     | 450.575                   | 450.574536                              | 1.03                      | 2.5         |
| Middle  | 460.575                   | 460.574532                              | 1.02                      | 2.5         |
| Bottom  | 469.575                   | 469.574515                              | 1.03                      | 2.5         |

### Measurement Result for Channel Separation of 25KHz

| Channel | Reference Frequency (MHz) | Frequency Measured at end point voltage | Frequency Deviation (PPM) | Limit (PPM) |
|---------|---------------------------|-----------------------------------------|---------------------------|-------------|
| Top     | 450.575                   | 450.574575                              | 0.94                      | 5.0         |
| Middle  | 460.575                   | 460.574552                              | 0.97                      | 5.0         |
| Bottom  | 469.575                   | 469.574552                              | 0.95                      | 5.0         |

(2)Frequency stability versus ambient temperature

**Bottom Channel @ 12.5 KHz Channel Separations**

| Reference Frequency: 450.575 MHz |                  | Limit: 2.5PPM                                              |       |
|----------------------------------|------------------|------------------------------------------------------------|-------|
| Environment Temperature (°C)     | Power Supply (V) | Frequency deviation measured with time Elapse (10 minutes) |       |
|                                  |                  | (MHz)                                                      | (PPM) |
| 60                               | 7.4              | 450.574329                                                 | 1.49  |
| 50                               | 7.4              | 450.574377                                                 | 1.38  |
| 40                               | 7.4              | 450.574428                                                 | 1.27  |
| 30                               | 7.4              | 450.574472                                                 | 1.17  |
| 20                               | 7.4              | 450.574520                                                 | 1.07  |
| 10                               | 7.4              | 450.574561                                                 | 0.97  |
| 0                                | 7.4              | 450.574608                                                 | 0.87  |
| -10                              | 7.4              | 450.574652                                                 | 0.77  |
| -20                              | 7.4              | 450.574691                                                 | 0.69  |
| -30                              | 7.4              | 450.574742                                                 | 0.57  |

**Middle Channel @ 12.5 KHz Channel Separations**

| Reference Frequency: 460.575 MHz |                  | Limit: 2.5PPM                                              |       |
|----------------------------------|------------------|------------------------------------------------------------|-------|
| Environment Temperature (°C)     | Power Supply (V) | Frequency deviation measured with time Elapse (10 minutes) |       |
|                                  |                  | (MHz)                                                      | (PPM) |
| 60                               | 7.4              | 460.574331                                                 | 1.45  |
| 50                               | 7.4              | 460.574381                                                 | 1.34  |
| 40                               | 7.4              | 460.574423                                                 | 1.25  |
| 30                               | 7.4              | 460.574461                                                 | 1.17  |
| 20                               | 7.4              | 460.574507                                                 | 1.07  |
| 10                               | 7.4              | 460.574551                                                 | 0.97  |
| 0                                | 7.4              | 460.574589                                                 | 0.89  |
| -10                              | 7.4              | 460.574637                                                 | 0.79  |
| -20                              | 7.4              | 460.574681                                                 | 0.69  |
| -30                              | 7.4              | 460.574722                                                 | 0.60  |



**Top Channel @ 12.5KHz Channel Separation**

| Reference Frequency: 469.575 MHz |                  | Limit: 2.5PPM                                              |       |
|----------------------------------|------------------|------------------------------------------------------------|-------|
| Environment Temperature (°C)     | Power Supply (V) | Frequency deviation measured with time Elapse (10 minutes) |       |
|                                  |                  | (MHz)                                                      | (PPM) |
| 60                               | 7.4              | 469.574411                                                 | 1.25  |
| 50                               | 7.4              | 469.574457                                                 | 1.16  |
| 40                               | 7.4              | 469.574491                                                 | 1.08  |
| 30                               | 7.4              | 469.574447                                                 | 1.18  |
| 20                               | 7.4              | 469.574498                                                 | 1.07  |
| 10                               | 7.4              | 469.574539                                                 | 0.98  |
| 0                                | 7.4              | 469.574577                                                 | 0.90  |
| -10                              | 7.4              | 469.574614                                                 | 0.82  |
| -20                              | 7.4              | 469.574656                                                 | 0.73  |
| -30                              | 7.4              | 469.574699                                                 | 0.64  |

**Bottom Channel @ 25 KHz Channel Separation**

| Reference Frequency: 400.1095 MHz |                  | Limit: 5.0PPM                                              |       |
|-----------------------------------|------------------|------------------------------------------------------------|-------|
| Environment Temperature (°C)      | Power Supply (V) | Frequency deviation measured with time Elapse (10 minutes) |       |
|                                   |                  | (MHz)                                                      | (PPM) |
| 60                                | 7.4              | 450.574339                                                 | 1.47  |
| 50                                | 7.4              | 450.574389                                                 | 1.36  |
| 40                                | 7.4              | 450.574438                                                 | 1.25  |
| 30                                | 7.4              | 450.574461                                                 | 1.20  |
| 20                                | 7.4              | 450.574546                                                 | 1.01  |
| 10                                | 7.4              | 450.574588                                                 | 0.91  |
| 0                                 | 7.4              | 450.574629                                                 | 0.82  |
| -10                               | 7.4              | 450.574671                                                 | 0.73  |
| -20                               | 7.4              | 450.574711                                                 | 0.64  |
| -30                               | 7.4              | 450.574762                                                 | 0.53  |

### **Middle Channel @ 25 KHz Channel Separations**

| Reference Frequency: 435.9895 MHz |                  | Limit: 5.0PPM                                              |       |
|-----------------------------------|------------------|------------------------------------------------------------|-------|
| Environment Temperature (°C)      | Power Supply (V) | Frequency deviation measured with time Elapse (10 minutes) |       |
|                                   |                  | (MHz)                                                      | (PPM) |
| 60                                | 7.4              | 460.574346                                                 | 1.42  |
| 50                                | 7.4              | 460.574396                                                 | 1.31  |
| 40                                | 7.4              | 460.574437                                                 | 1.22  |
| 30                                | 7.4              | 460.574474                                                 | 1.14  |
| 20                                | 7.4              | 460.574522                                                 | 1.04  |
| 10                                | 7.4              | 460.574566                                                 | 0.94  |
| 0                                 | 7.4              | 460.574597                                                 | 0.87  |
| -10                               | 7.4              | 460.574651                                                 | 0.76  |
| -20                               | 7.4              | 460.574693                                                 | 0.67  |
| -30                               | 7.4              | 460.574731                                                 | 0.58  |

### **Top Channel @ 25 KHz Channel Separation**

| Reference Frequency: 469.9895 MHz |                  | Limit: 5.0PPM                                              |       |
|-----------------------------------|------------------|------------------------------------------------------------|-------|
| Environment Temperature (°C)      | Power Supply (V) | Frequency deviation measured with time Elapse (10 minutes) |       |
|                                   |                  | (MHz)                                                      | (PPM) |
| 60                                | 7.4              | 469.574417                                                 | 1.24  |
| 50                                | 7.4              | 469.574461                                                 | 1.15  |
| 40                                | 7.4              | 469.574496                                                 | 1.07  |
| 30                                | 7.4              | 469.574451                                                 | 1.17  |
| 20                                | 7.4              | 469.574502                                                 | 1.06  |
| 10                                | 7.4              | 469.574543                                                 | 0.97  |
| 0                                 | 7.4              | 469.574579                                                 | 0.90  |
| -10                               | 7.4              | 469.574618                                                 | 0.81  |
| -20                               | 7.4              | 469.574659                                                 | 0.73  |
| -30                               | 7.4              | 469.574703                                                 | 0.63  |

## 7. EMISSION BANDWIDTH

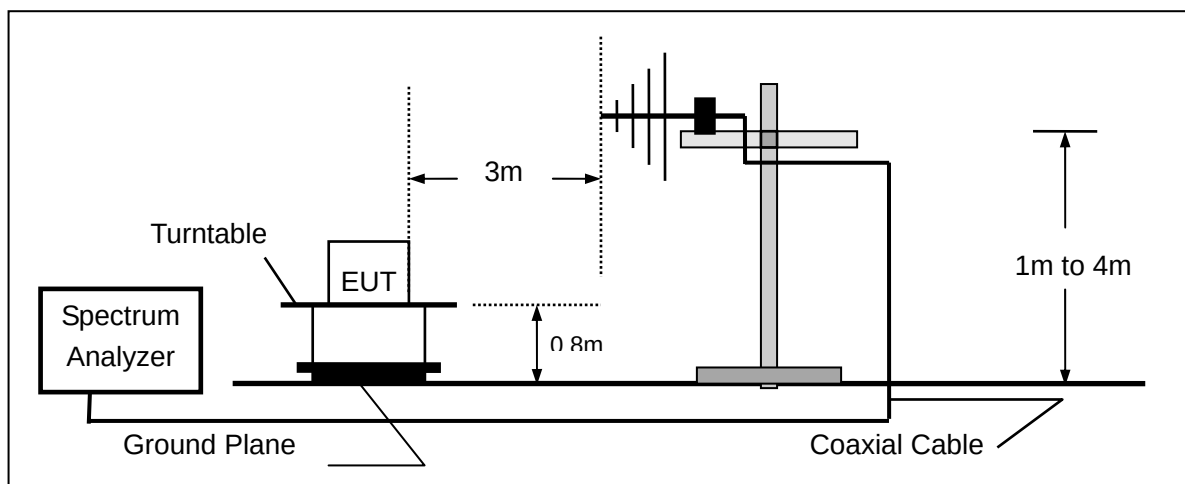
### 7.1 Provisions Applicable

According to FCC Part 90 Section 90.209: The authorized bandwidth shall be 11.25 KHz for 12.5 KHz and 20 KHz for 25 KHz

### 7.2 Measurement 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 SPA Center Frequency = fundamental frequency, RBW=VBW= 300 Hz, Span =50 KHz.
- 4). Set SPA Max hold. Mark peak, -26 dB.

### 7.3 Test Setup Block Diagram



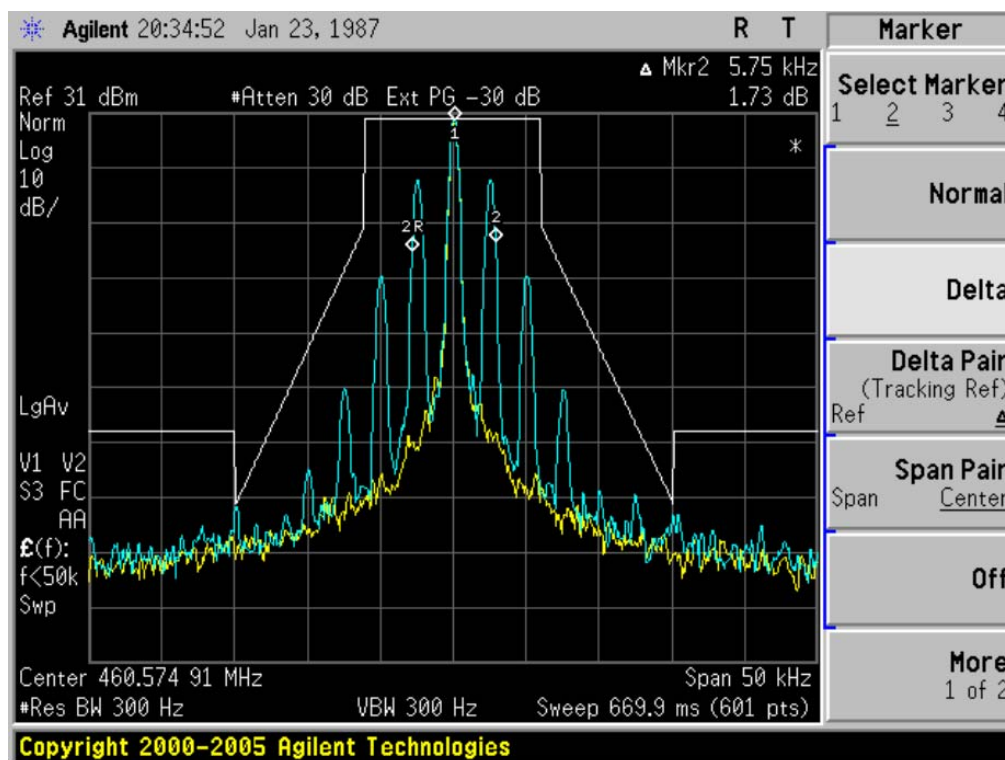
### 7.4 Measurement Equipment Used:

| NAME OF EQUIPMENT | MANUFACTURER         | MODEL   | SERIAL NUMBER | CAL. DATE  |
|-------------------|----------------------|---------|---------------|------------|
| EMI Test Receiver | R&S                  | ESCS30  | 100343        | 04/16/2008 |
| AMPLIFIER         | HP                   | HP8447E | 2945A02715    | 04/16/2008 |
| ANTENNA           | Sunol Sciences Corp. | JB3     | A021907       | 04/16/2008 |
| H&T Chamber       | EXPERY               | TN-400  | TN2007SR038   | 04/16/2008 |

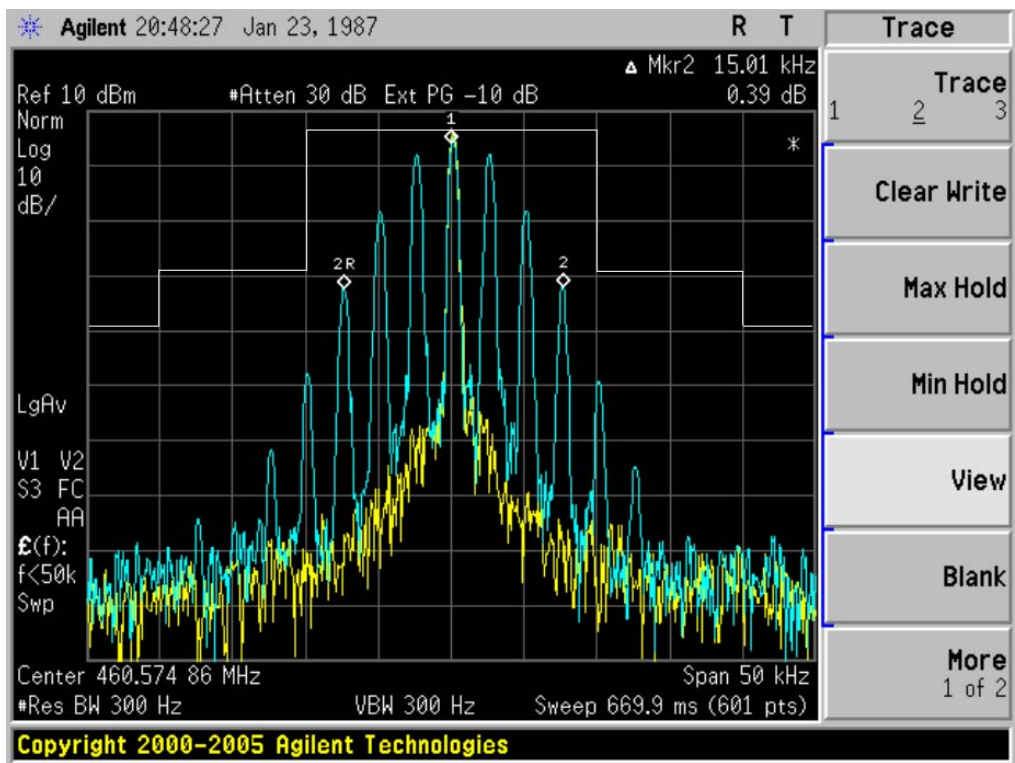
## 7.5 MEASUREMENT RESULT:

| 26 dB Bandwidth Measurement Result |                             |           |        |                           |           |        |
|------------------------------------|-----------------------------|-----------|--------|---------------------------|-----------|--------|
| Operating Frequency                | 12.5 KHz Channel Separation |           |        | 25 KHz Channel Separation |           |        |
|                                    | Test Data                   | Limits    | Result | Test Data                 | Limits    | Result |
| Bottom Channel                     | 5.73 KHz                    | 11.25 KHz | Pass   | 14.97KHz                  | 20.00 KHz | Pass   |
| Middle Channel                     | 5.75 KHz                    | 11.25 KHz | Pass   | 15.01 KHz                 | 20.00 KHz | Pass   |
| Top Channel                        | 5.71 KHz                    | 11.25 KHz | Pass   | 14.95 KHz                 | 20.00 KHz | Pass   |

### Occupied bandwidth of Middle Channel @ 12.5KHz Channel Separation



**Occupied bandwidth of Middle Channel @ 25 KHz Channel Separation**



## 8. UNWANTED RADIATION

### 8.1 Provisions Applicable

8.1.1 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  $7.27(f_d - 2.88 \text{ KHz})$  dB
- (3). On any frequency removed from the center of the authorized bandwidth by a displacement Frequency ( $f_d$  in KHz)  $f_0$  of more than 12.5 KHz: At least  $50 + 10 \log(P)$  dB or 70 dB, which ever is lesser attenuation.

8.1.2 According to Section 90.210, Emission mask B. For transmitters designed to transmit with 25KHz 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:

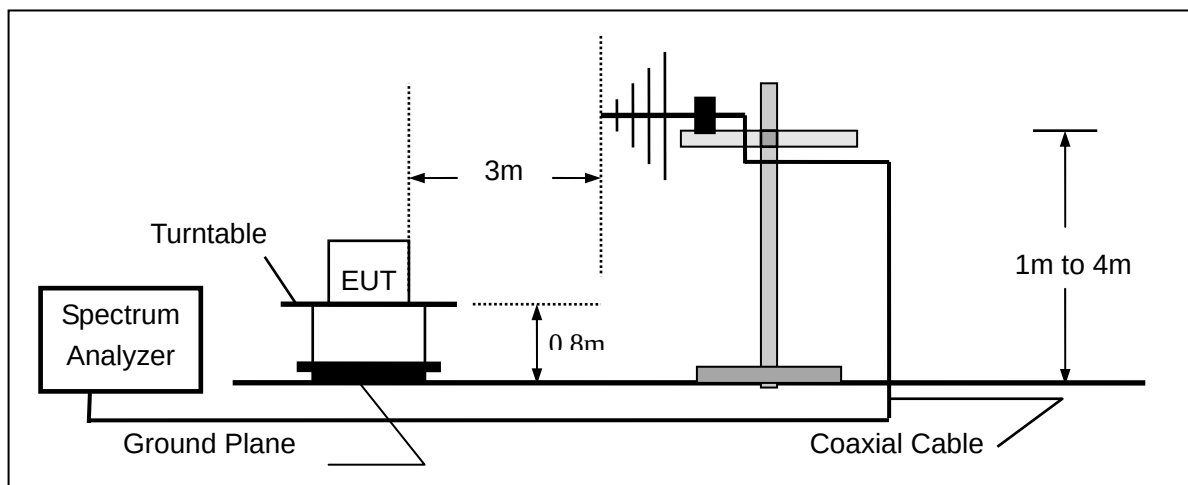
- (1), On any frequency removed from the assigned frequency by more than 50 percent, but no more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2), On any frequency removed from the assigned frequency by more than 100 percent, but no more than 250 percent of the authorized bandwidth: 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.

### 8.2 Measurement Procedure

- (1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- (2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
- (3). The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- (4). The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- (5). The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
- (6). The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- (7). The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
- (8). The maximum signal level detected by the measuring receiver shall be noted.

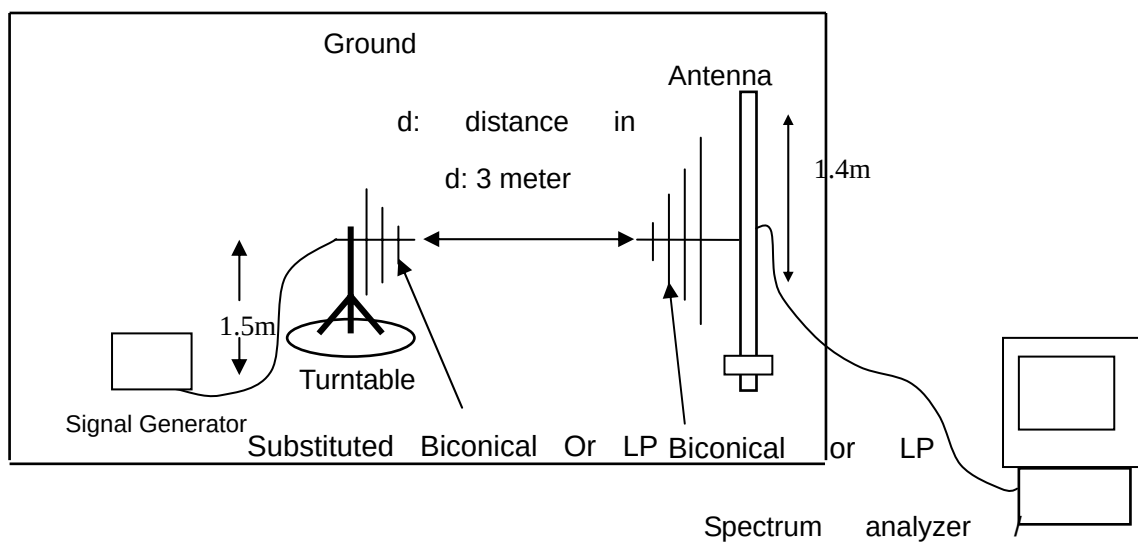
- (9). The measurement shall be repeated with the test antenna set to horizontal polarization.
- (10). Replace the antenna with a proper Antenna (substitution antenna).
- (11). The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
- (12). The substitution antenna shall be connected to a calibrated signal generator.
- (13). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- (14). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- (15). The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- (16). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- (17). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

### 8.3 Test Setup Block Diagram

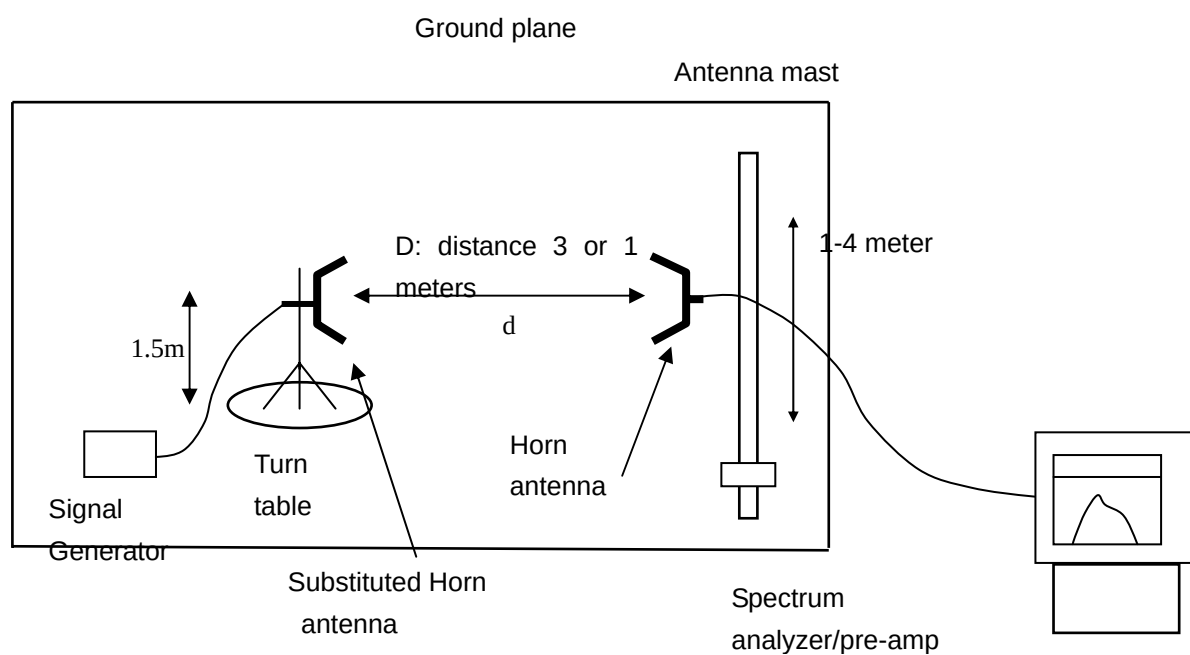


## SUBSTITUTION METHOD: (Radiated Emissions)

### Radiated Below 1GHz



### Radiated Above 1 GHz





#### 8.4 Measurement Equipment Used:

| NAME OF EQUIPMENT | MANUFACTURER         | MODEL   | SERIAL NUMBER | CAL. DATE  |
|-------------------|----------------------|---------|---------------|------------|
| EMI Test Receiver | R&S                  | ESCS30  | 100343        | 04/16/2008 |
| AMPLIFIER         | HP                   | HP8447E | 2945A02715    | 04/16/2008 |
| ANTENNA           | Sunol Sciences Corp. | JB3     | A021907       | 04/16/2008 |
| H&T Chamber       | EXPERY               | TN-400  | TN2007SR038   | 04/16/2008 |

#### 8.5 MEASUREMENT RESULTS:

##### Measurement Result for 12.5 KHz Channel Separation

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 36.99 dBm.

Limit (dBm)=36.99-50-10log 10 (5) = -20

**Bottom Channel**

| Frequency<br>(MHz) | Reading<br>level<br>(dBuV) | Antenna<br>Polarization | S.G.<br>(dBm) | Cable loss<br>(dB) | Correction<br>(dB) | Emission<br>level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|----------------------------|-------------------------|---------------|--------------------|--------------------|----------------------------|----------------|----------------|
| --                 | --                         | --                      | --            | --                 | --                 | --                         | -20            | --             |

**Middle Channel**

| Frequency<br>(MHz) | Reading<br>level<br>(dBuV) | Antenna<br>Polarization | S.G.<br>(dBm) | Cable loss<br>(dB) | Correction<br>(dB) | Emission<br>level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|----------------------------|-------------------------|---------------|--------------------|--------------------|----------------------------|----------------|----------------|
| --                 | --                         | --                      | --            | --                 | --                 | --                         | -20            | --             |

**Top Channel**

| Frequency<br>(MHz) | Reading<br>level<br>(dBuV) | Antenna<br>Polarization | S.G.<br>(dBm) | Cable loss<br>(dB) | Correction<br>(dB) | Emission<br>level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|----------------------------|-------------------------|---------------|--------------------|--------------------|----------------------------|----------------|----------------|
| --                 | --                         | --                      | --            | --                 | --                 | --                         | -20            | --             |

**Notes:**

“—” means that the emission level is too low to be measured or at least 20 dB down than the limit.

### **Measurement Result For 25 KHz Channel Separation**

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 10log10(P) dBm.

Limit (dBm)=10log10(P) - 43-10log 10 (P) = -13 dBm

#### **Bottom Channel**

| Frequency | Reading level | Antenna      | S.G.  | Cable loss | Correction | Emission level | Limit | Margin |
|-----------|---------------|--------------|-------|------------|------------|----------------|-------|--------|
| (MHz)     | (dBuV)        | Polarization | (dBm) | (dB)       | (dB)       | (dBm)          | (dBm) | (dB)   |
| --        | --            | --           | --    | --         | --         | --             | -13   | --     |

#### **Middle Channel**

| Frequency | Reading level | Antenna      | S.G.  | Cable loss | Correction | Emission level | Limit | Margin |
|-----------|---------------|--------------|-------|------------|------------|----------------|-------|--------|
| (MHz)     | (dBuV)        | Polarization | (dBm) | (dB)       | (dB)       | (dBm)          | (dBm) | (dB)   |
| --        | --            | --           | --    | --         | --         | --             | -13   | --     |

#### **Top Channel**

| Frequency | Reading level | Antenna      | S.G.  | Cable loss | Correction | Emission level | Limit | Margin |
|-----------|---------------|--------------|-------|------------|------------|----------------|-------|--------|
| (MHz)     | (dBuV)        | Polarization | (dBm) | (dB)       | (dB)       | (dBm)          | (dBm) | (dB)   |
| --        | --            | --           | --    | --         | --         | --             | -13   | --     |

#### **Notes:**

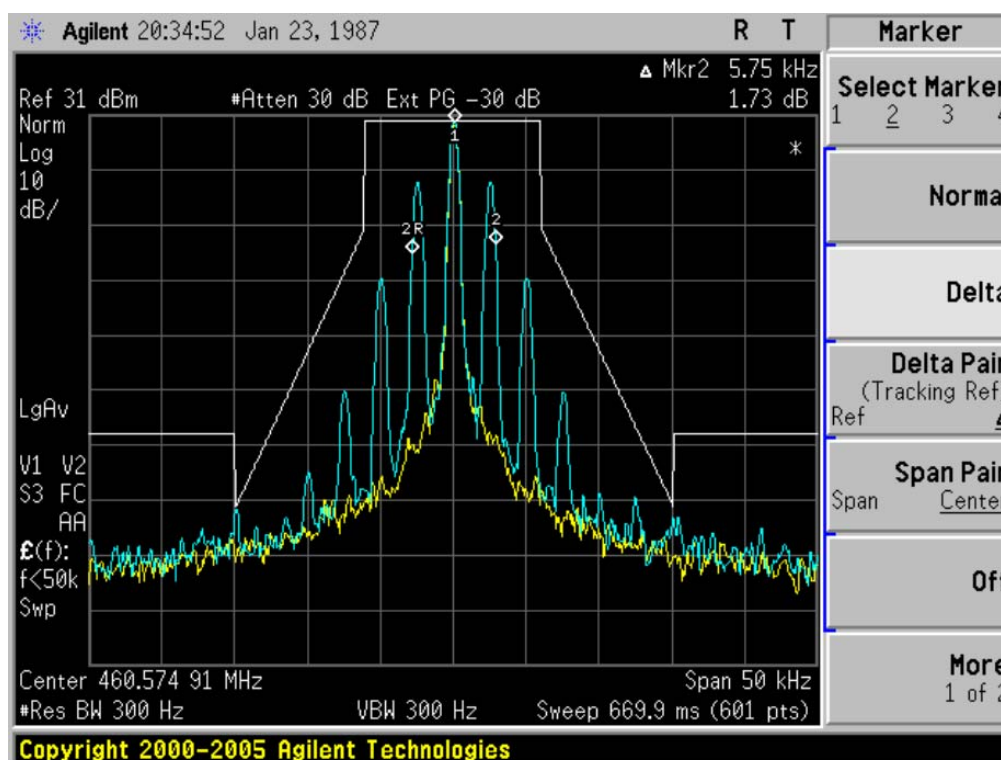
“—” means that the emission level is too low to be measured or at least 20 dB down than the limit.

## 8.6 Emission Mask Plot

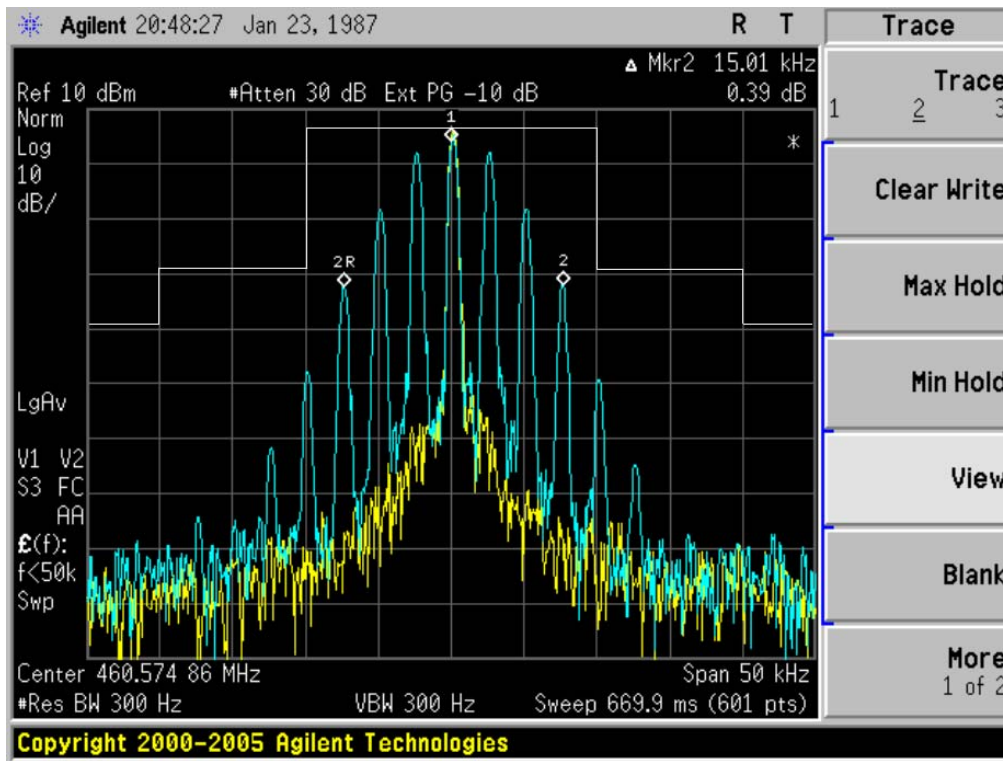
The detailed procedure employed for Emission Mask measurements are specified as following:

- The transmitter shall be modulated by a 2.5 kHz 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)

### The Worst Emission Mask for 12.5 KHz channel Separation



## The Worst Emission Mask for 25 KHz channel Separation



## 9. MODULATION CHARACTERISTICS

### 9.1 Provisions Applicable

According to CFR 47 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.

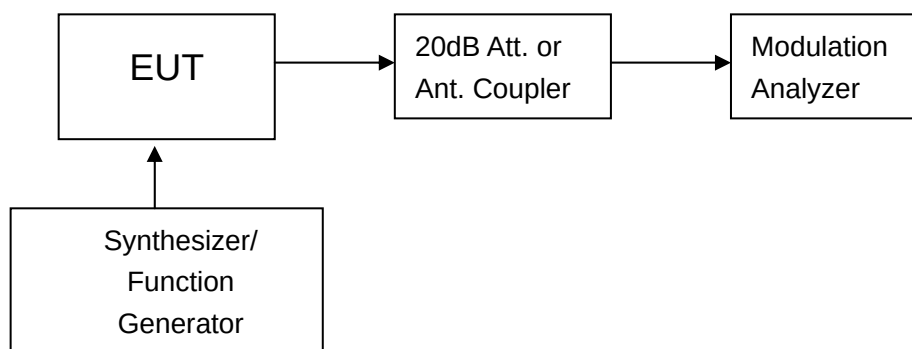
### 9.2 Measurement Method

#### 9.2.1 Modulation Limit

- (1). Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1KHz 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, 1000, and 2500Hz in sequence.

#### 9.2.2 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 (0 dB).
- (3). Vary the Audio frequency from 100 Hz to 10 KHz and record the frequency deviation.
- (4). Audio Frequency Response =  $20\log_{10} (\text{Deviation of test frequency} / \text{Deviation of 1KHz reference})$ .



**Figure 1: Modulation characteristic measurement configuration**

### 9.3 Measurement Instruments

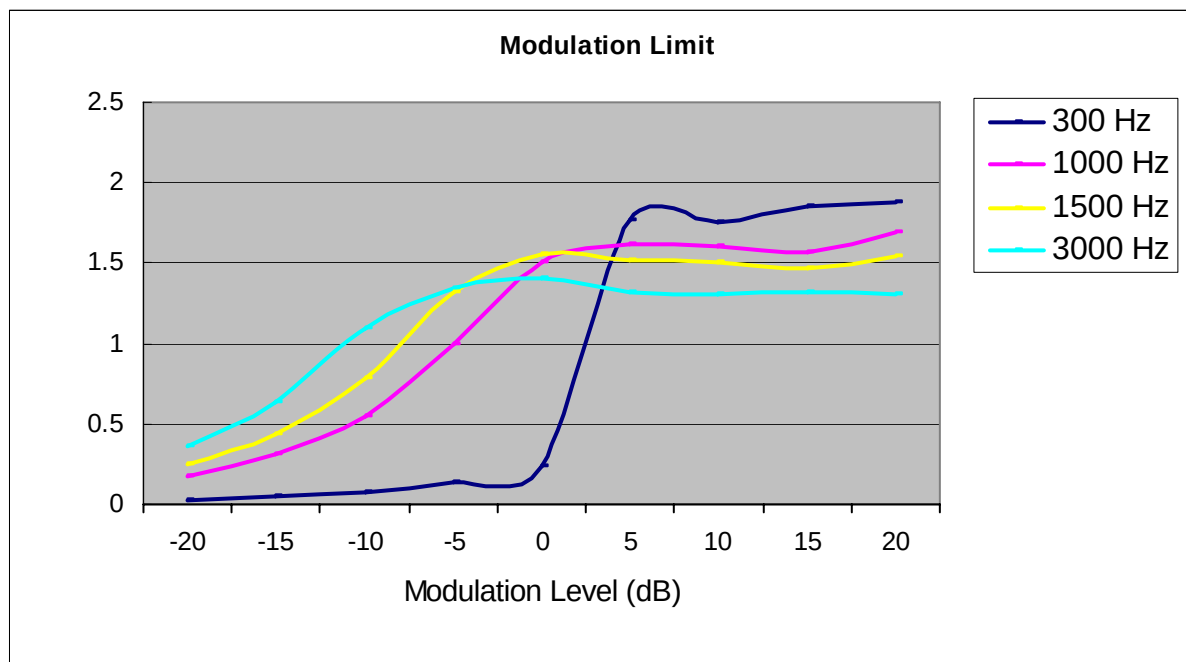
| NAME OF EQUIPMENT          | MANUFACTURER | MODEL | SERIAL NUMBER | CAL. DATE  |
|----------------------------|--------------|-------|---------------|------------|
| RF COMMUNICATIONS TEST SET | HP           | 8920B | --            | 2008.02.10 |

## 9.4 Measurement Result

### (a). Modulation Limit:

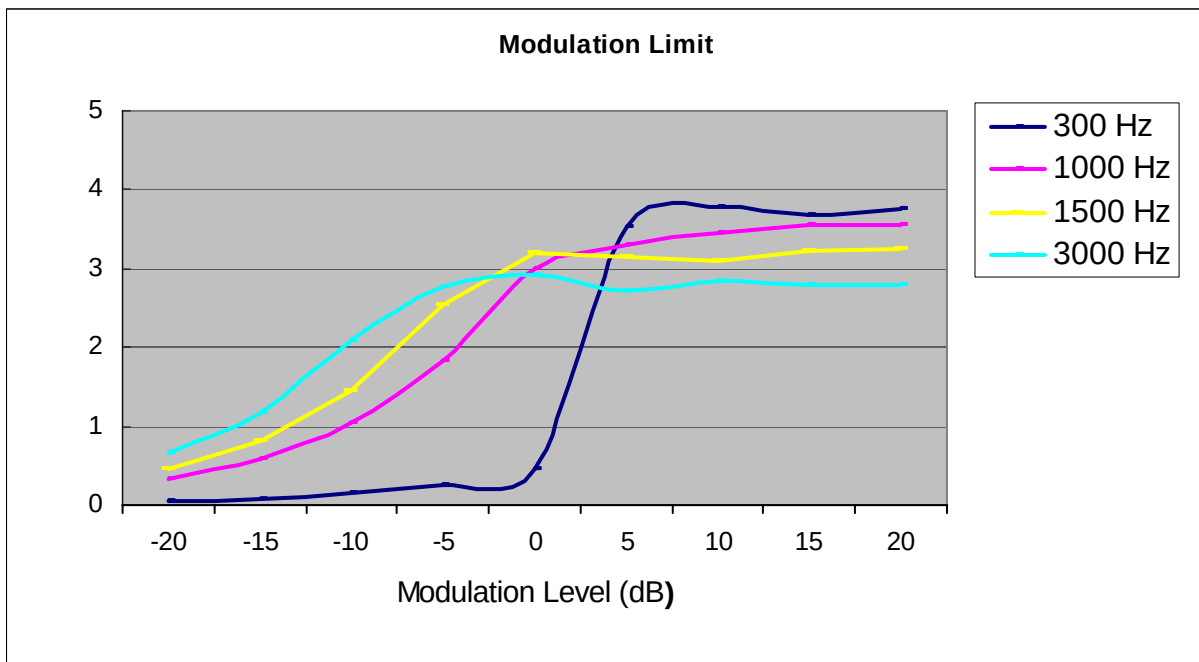
#### Middle Channel @ 12.5 KHz Channel Separations

| Modulation Level (dB) | Peak Freq. Deviation At 300 Hz | Peak Freq. Deviation At 1000 Hz | Peak Freq. Deviation At 1500 Hz | Peak Freq. Deviation At 3000 Hz |
|-----------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|
| -20                   | 0.03                           | 0.18                            | 0.25                            | 0.36                            |
| -15                   | 0.05                           | 0.31                            | 0.44                            | 0.64                            |
| -10                   | 0.08                           | 0.55                            | 0.78                            | 1.10                            |
| -5                    | 0.14                           | 0.99                            | 1.32                            | 1.34                            |
| 0                     | 0.24                           | 1.50                            | 1.55                            | 1.40                            |
| +5                    | 1.77                           | 1.62                            | 1.52                            | 1.32                            |
| +10                   | 1.75                           | 1.60                            | 1.51                            | 1.30                            |
| +15                   | 1.85                           | 1.57                            | 1.47                            | 1.32                            |
| +20                   | 1.88                           | 1.69                            | 1.54                            | 1.31                            |



### Middle Channel @ 25KHz Channel Separation

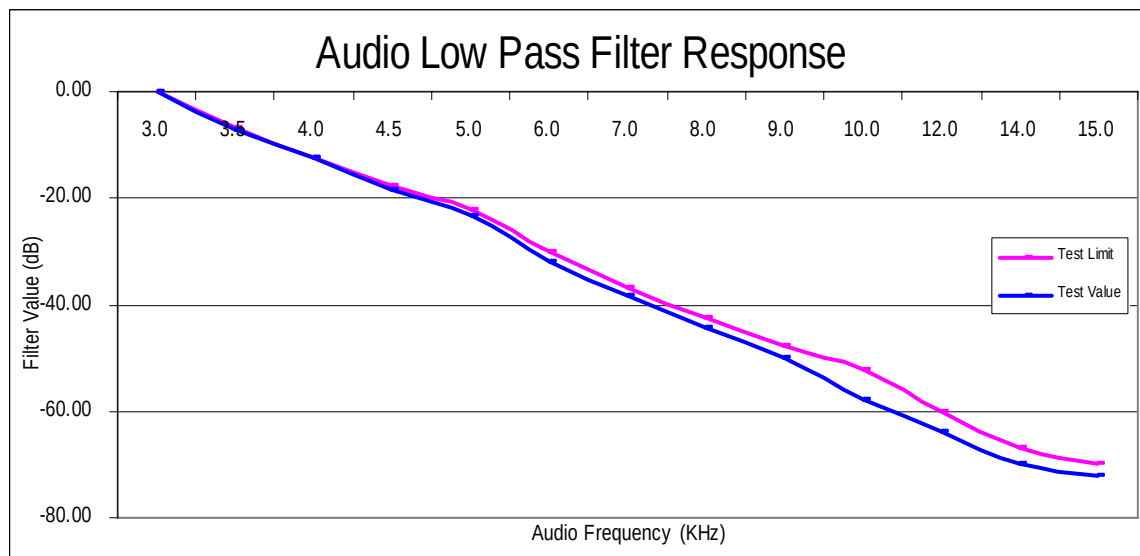
| Modulation Level (dB) | Peak Freq. Deviation At 300 Hz | Peak Freq. Deviation At 1000 Hz | Peak Freq. Deviation At 1500 Hz | Peak Freq. Deviation At 3000 Hz |
|-----------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|
| -20                   | 0.05                           | 0.32                            | 0.45                            | 0.65                            |
| -15                   | 0.08                           | 0.58                            | 0.81                            | 1.17                            |
| -10                   | 0.14                           | 1.03                            | 1.44                            | 2.07                            |
| -5                    | 0.25                           | 1.84                            | 2.54                            | 2.76                            |
| 0                     | 0.45                           | 3.00                            | 3.20                            | 2.92                            |
| +5                    | 3.54                           | 3.31                            | 3.14                            | 2.71                            |
| +10                   | 3.78                           | 3.45                            | 3.10                            | 2.83                            |
| +15                   | 3.69                           | 3.56                            | 3.23                            | 2.79                            |
| +20                   | 3.76                           | 3.56                            | 3.26                            | 2.80                            |



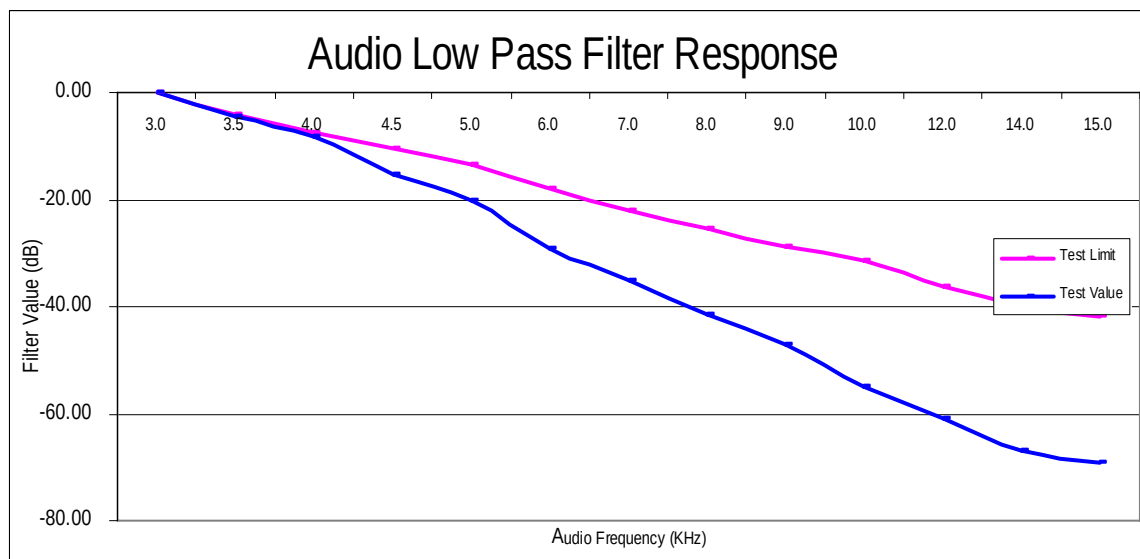


### AUDIO LOW PASS FILTER RESPONSE.

Narrow band (12.5KHz Channel Separation)



Wide band (25.0 KHz Channel Separation)

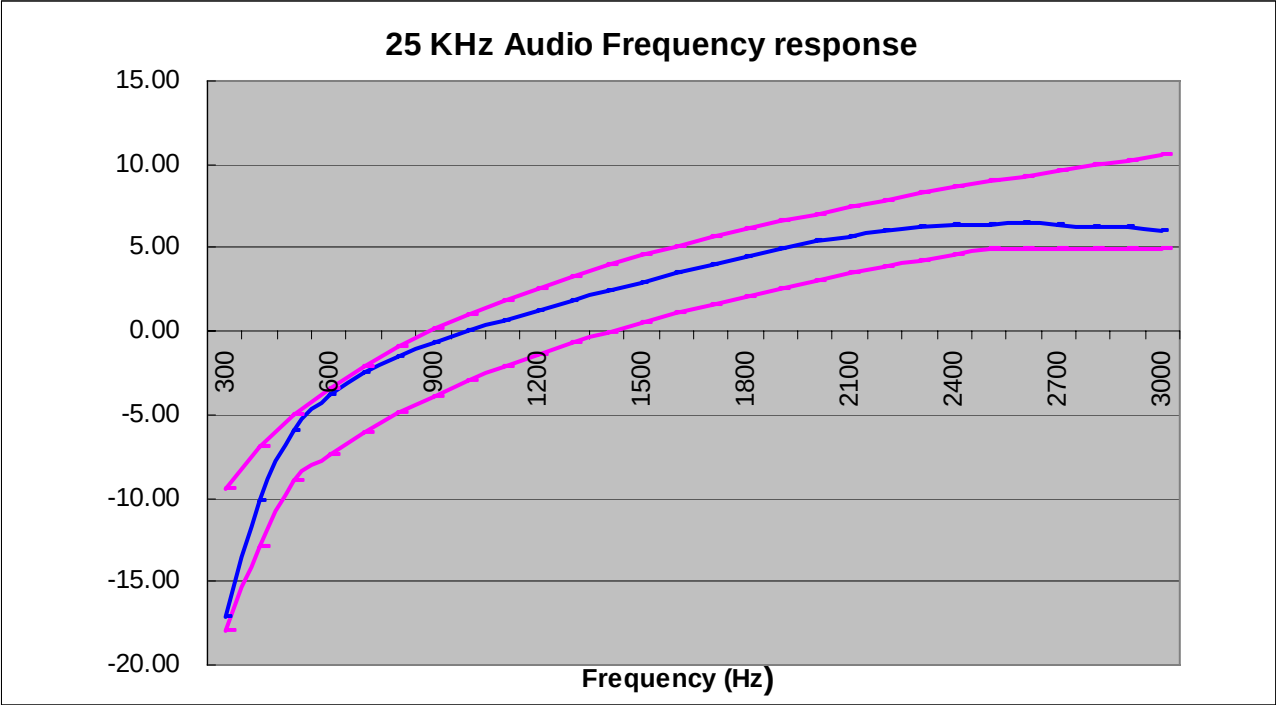


**(b). Audio Frequency Response:**

**25.0 KHz Channel Separations**

| <b>Frequency (Hz)</b> | <b>Deviation (KHz)</b> |
|-----------------------|------------------------|
| 300.00                | 0.14                   |
| 400.00                | 0.31                   |
| 500.00                | 0.50                   |
| 600.00                | 0.64                   |
| 700.00                | 0.75                   |
| 800.00                | 0.84                   |
| 900.00                | 0.92                   |
| 1000.00               | 1.00                   |
| 1100.00               | 1.07                   |
| 1200.00               | 1.15                   |
| 1300.00               | 1.23                   |
| 1400.00               | 1.32                   |
| 1500.00               | 1.40                   |
| 1600.00               | 1.49                   |
| 1700.00               | 1.58                   |
| 1800.00               | 1.68                   |
| 1900.00               | 1.76                   |
| 2000.00               | 1.86                   |
| 2100.00               | 1.92                   |
| 2200.00               | 1.99                   |
| 2300.00               | 2.06                   |
| 2400.00               | 2.08                   |
| 2500.00               | 2.09                   |
| 2600.00               | 2.10                   |
| 2700.00               | 2.07                   |
| 2800.00               | 2.06                   |
| 2900.00               | 2.04                   |
| 3000.00               | 2.01                   |

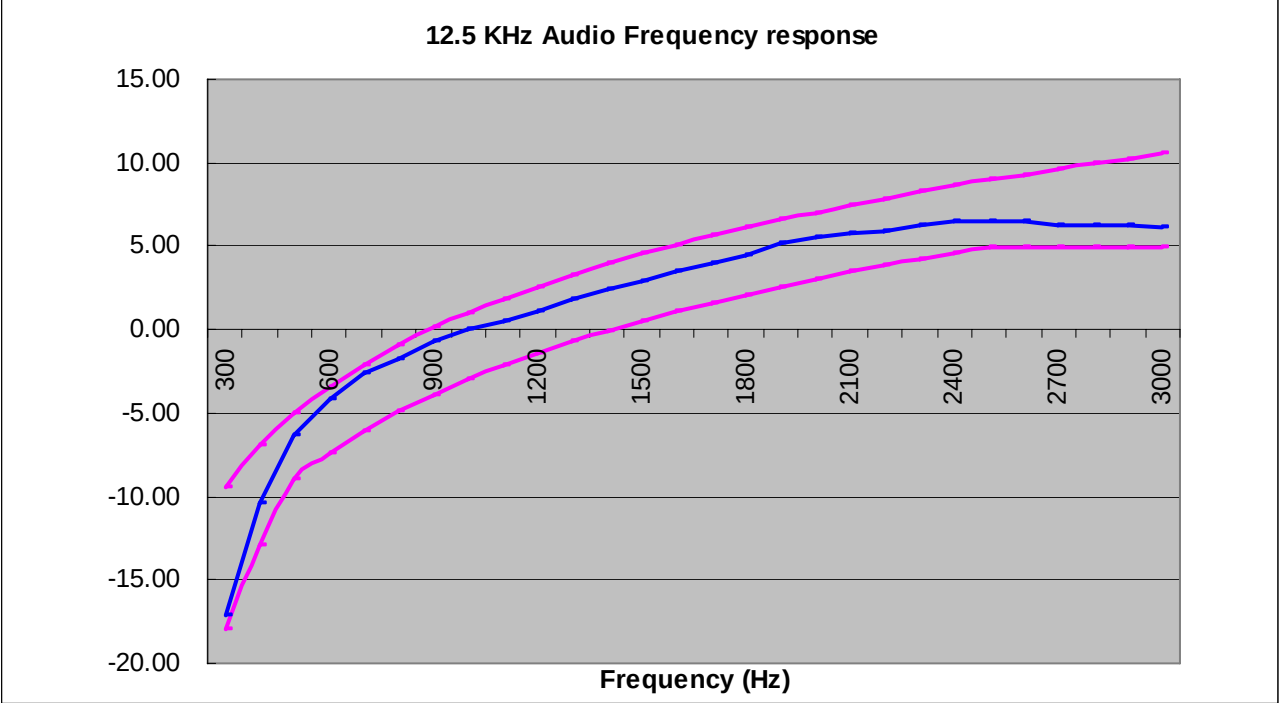
**Frequency Response of Middle Channel**



**12.5 KHz Channel Separation**

| <b>Frequency (Hz)</b> | <b>Deviation (KHz)</b> |
|-----------------------|------------------------|
| 300.00                | 0.07                   |
| 400.00                | 0.15                   |
| 500.00                | 0.24                   |
| 600.00                | 0.31                   |
| 700.00                | 0.37                   |
| 800.00                | 0.41                   |
| 900.00                | 0.46                   |
| 1000.00               | 0.50                   |
| 1100.00               | 0.53                   |
| 1200.00               | 0.57                   |
| 1300.00               | 0.62                   |
| 1400.00               | 0.66                   |
| 1500.00               | 0.70                   |
| 1600.00               | 0.75                   |
| 1700.00               | 0.79                   |
| 1800.00               | 0.84                   |
| 1900.00               | 0.91                   |
| 2000.00               | 0.94                   |
| 2100.00               | 0.97                   |
| 2200.00               | 0.99                   |
| 2300.00               | 1.03                   |
| 2400.00               | 1.05                   |
| 2500.00               | 1.06                   |
| 2600.00               | 1.05                   |
| 2700.00               | 1.02                   |
| 2800.00               | 1.02                   |
| 2900.00               | 1.02                   |
| 3000.00               | 1.01                   |

**Frequency Response of Middle Channel**



## 10. MAXIMUM TRANSMITTER POWER (CONDUCTED OUTPUT POWER)

### 10.1 Provisions Applicable

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

### 10.2 Test Procedure

The RF output of transceiver was conducted to a spectrum analyzer through an appropriate attenuator.

### 10.3 Test Instruments

| NAME OF EQUIPMENT | MANUFACTURER | MODEL  | SERIAL NUMBER | CAL. DATE  |
|-------------------|--------------|--------|---------------|------------|
| SPECTRUM ANALYZER | AGILENT      | E4446A | US44300399    | 2008-02-06 |

### 10.4 Test Result

The maximum Conducted Power (CP) is  
5 W for 12.5 KHz Channel Separation  
5 W for 25.0 KHz Channel Separation

Calculation Formula:  $CP = R + A + L$

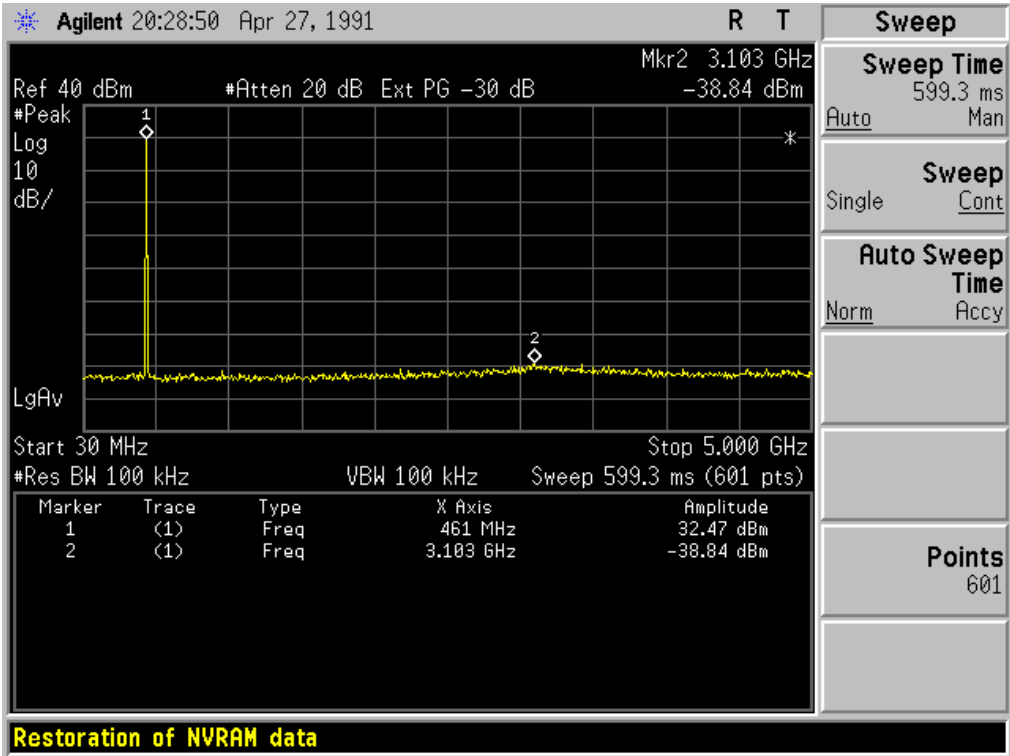
\* Note:

CP: The final Conducted Power  
R : The reading value from spectrum analyzer  
A : The attenuation value of the used attenuator  
L : The loss of all connection cables

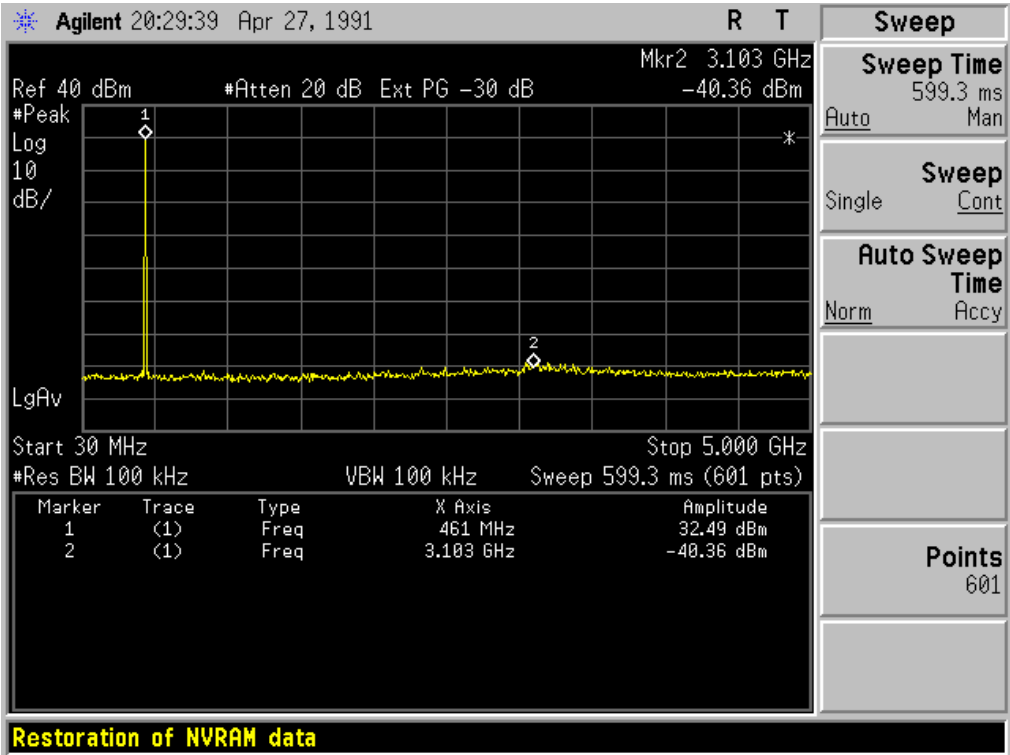
| Conducted Power Measurement Results |         |                    |
|-------------------------------------|---------|--------------------|
| Channel Separation                  | Channel | Measurement Result |
| 12.5 KHZ                            | BOTTOM  | 32.44              |
|                                     | MIDDLE  | 32.51              |
|                                     | TOP     | 32.46              |
| 25 KHZ                              | BOTTOM  | 32.46              |
|                                     | MIDDLE  | 32.53              |
|                                     | TOP     | 32.51              |

10.5 Conduct spurious plot

The Worst Case (5W@12.5KHz Channel space) of The Three Channels for Conduct Spurious Emission



The Worst Case (5W@25.0 KHz Channel space) of The Three Channels for Conduct Spurious Emission



## 11. TRANSMITTER FREQUENCY BEHAVIOR

### 11.1 Provisions Applicable

Section 90.214

### 11.2 Test Method

TIA/EIA-603 2.2.19

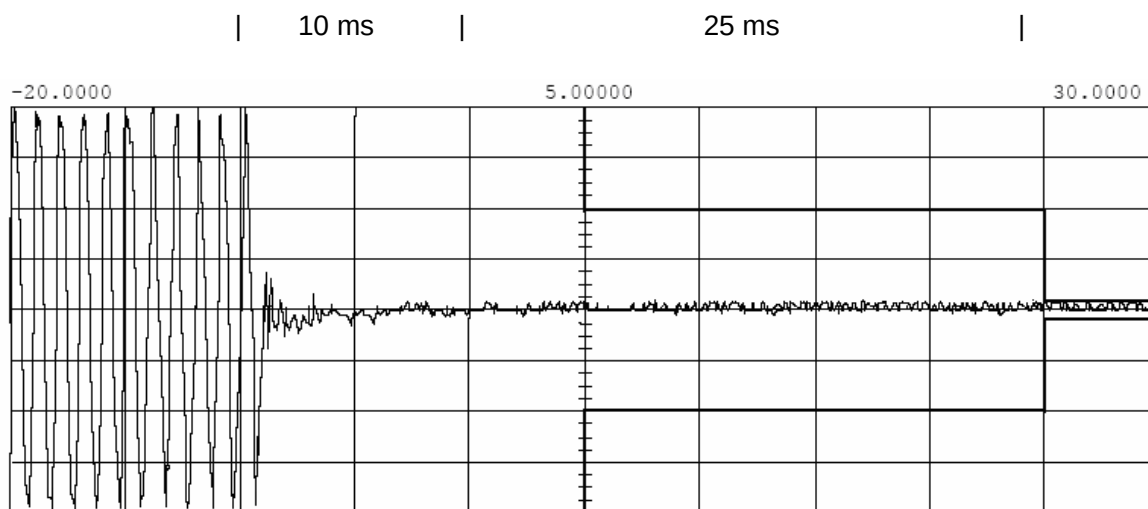
### 11.3 Test Instruments

| NAME OF EQUIPMENT   | MANUFACTURER | MODEL    | SERIAL NUMBER | CAL. DATE  |
|---------------------|--------------|----------|---------------|------------|
| OSILLICOPE          | TEKTRONIX    | TDS3012B | B042290       | 2008-04-16 |
| RF SIGNAL GENERATOR | IFA          | 2023B    | 202307/883    | 2008-04-16 |

### 11.4 Measure Result



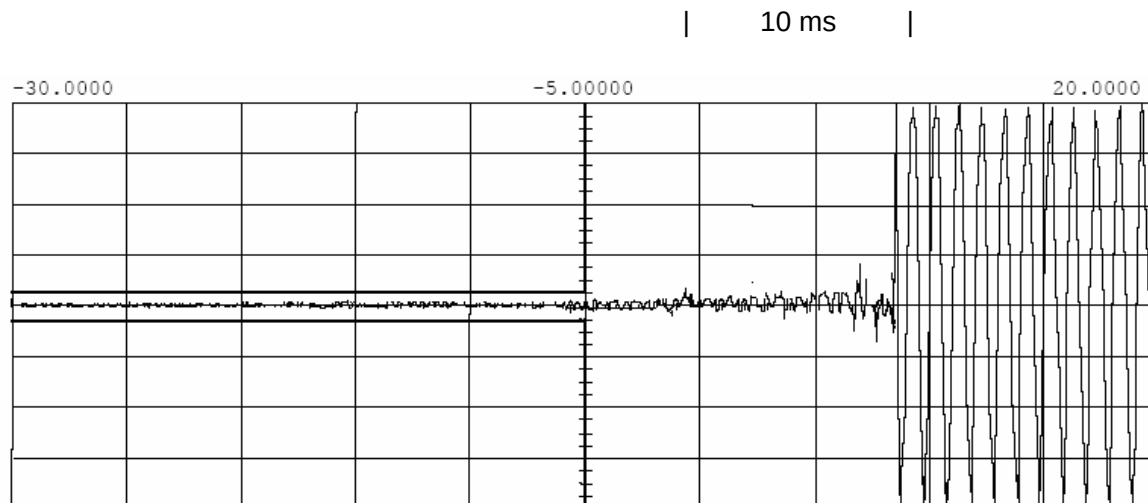
# Transmitter Frequency Behavior @ 25KHz Channel Separation-----Off to On



|           |                            |                          |                   |                                                                        |
|-----------|----------------------------|--------------------------|-------------------|------------------------------------------------------------------------|
| Main      | Timebase<br>5.00 ms/div    | Delay/Pos<br>-20.0000 ms | Left              | Measurements<br>V p-p (c1) = 39.223 mV<br>frequency (c1) = 1.00000 kHz |
| Channel 1 | Sensitivity<br>66.0 mV/div | Offset<br>0.00000 V      | Probe<br>1.000 :1 |                                                                        |

Trigger mode :  
On Negative Edge Of  
Trigger  
Chan2 = -440.000 mV (noise)  
Holdoff = -40.000

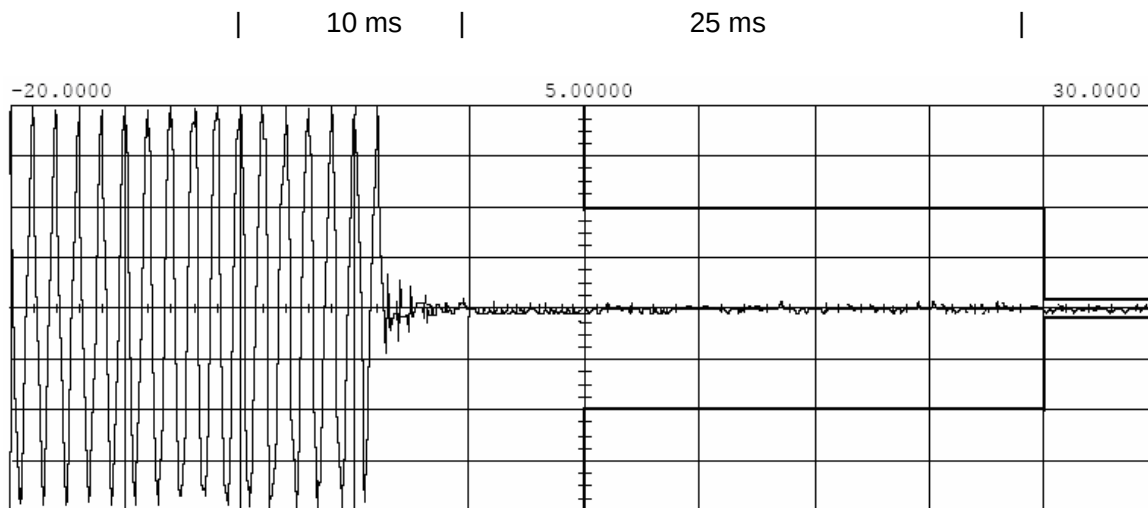
# Transmitter Frequency Behaviour @ 25 KHz Channel Separation-----On to Off



|           |                            |                         |                   |                                                                        |
|-----------|----------------------------|-------------------------|-------------------|------------------------------------------------------------------------|
| Main      | Timebase<br>5.00 ms/div    | Delay/Pos<br>20.0000 ms | Right             | Measurements<br>V p-p (c1) = 39.221 mV<br>frequency (c1) = 1.00000 kHz |
| Channel 1 | Sensitivity<br>66.0 mV/div | Offset<br>0.00000 V     | Probe<br>1.000 :1 |                                                                        |

Trigger mode :  
On Positive Edge Of  
Trigger  
Chan2 = -100.000 mV (noise)  
Holdoff = -40.000

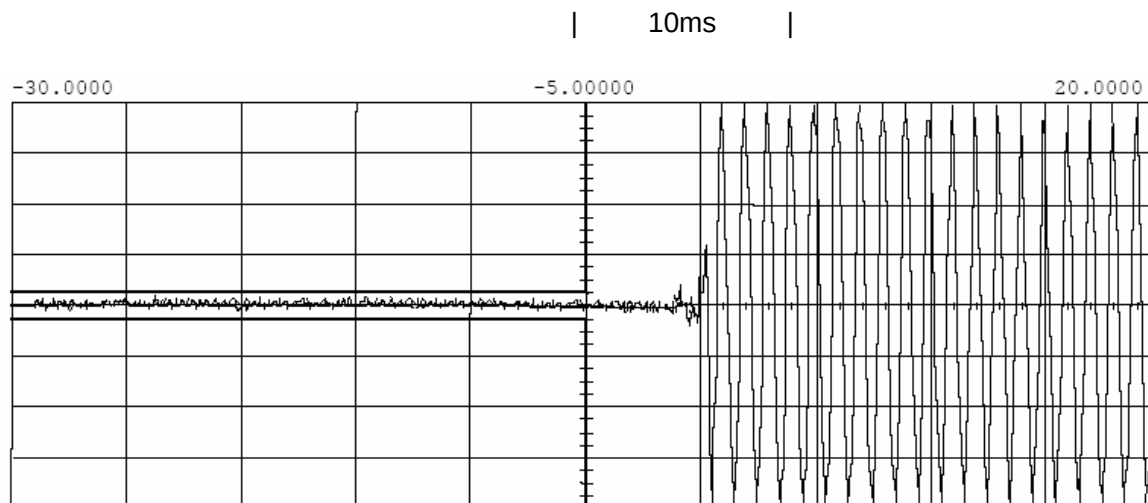
# Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation-----Off to On



|           |                           |                          |                   |                                                                        |
|-----------|---------------------------|--------------------------|-------------------|------------------------------------------------------------------------|
| Main      | Timebase<br>5.00 ms/div   | Delay/Pos<br>-20.0000 ms | Left              | Measurements<br>V p-p (c1) = 30.770 mV<br>frequency (c1) = 1.00000 kHz |
| Channel 1 | Sensitivity<br>122 mV/div | Offset<br>0.00000 V      | Probe<br>1.000 :1 |                                                                        |

Trigger mode :  
On Negative Edge Of  
Trigger  
Chan2 = -970.000 mV (noise)  
Holdoff =-40.000

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



|           |                           |                         |                   |                                                                        |
|-----------|---------------------------|-------------------------|-------------------|------------------------------------------------------------------------|
| Main      | Timebase<br>5.00 ms/div   | Delay/Pos<br>20.0000 ms | Right             | Measurements<br>V p-p (c1) = 30.772 mV<br>frequency (c1) = 1.00000 kHz |
| Channel 1 | Sensitivity<br>122 mV/div | Offset<br>0.00000 V     | Probe<br>1.000 :1 |                                                                        |

Trigger mode :  
On Positive Edge Of  
Trigger  
Chan2 = -100.000 mV (noise)  
Holdoff =-40.000

## 12. Radiated Emission on Receiving Mode

### 12.1 Provisions Applicable

FCC Part 15 Subpart B Section 15.109

### 12.2 Test Method

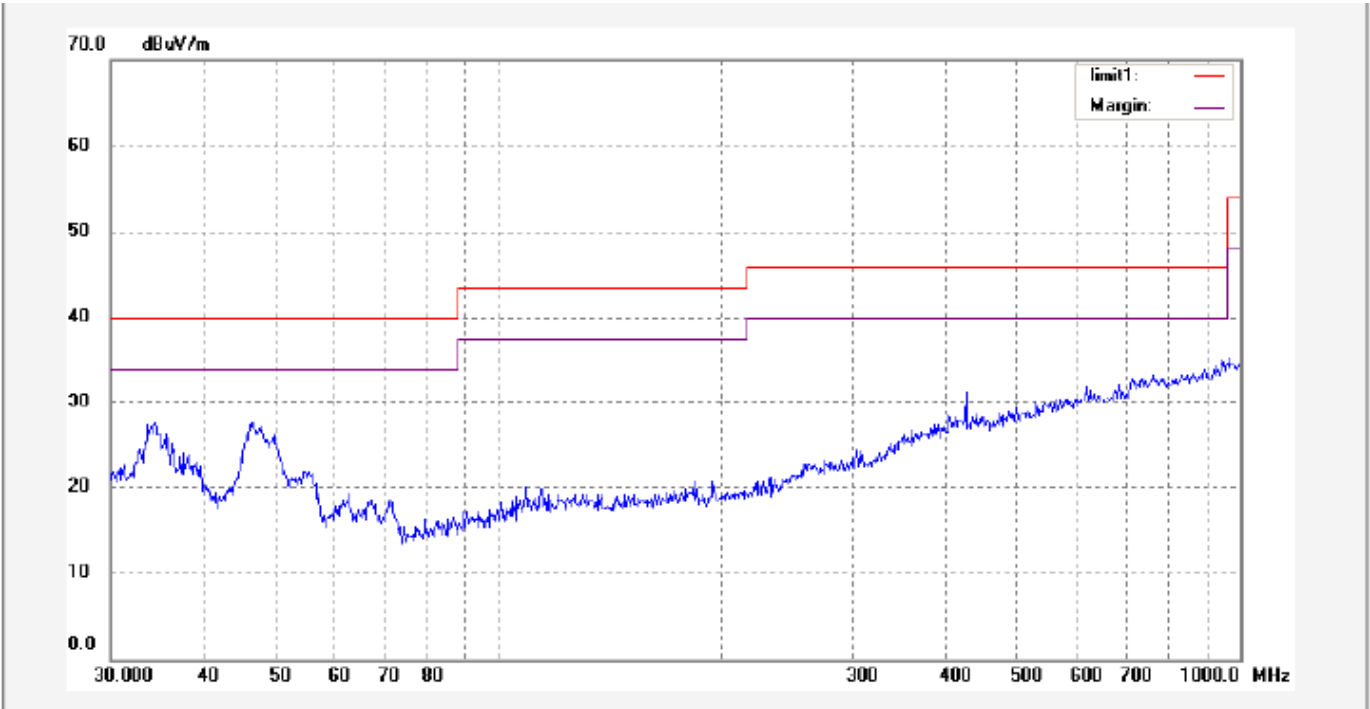
ANSI C 63.4: 2003

### 12.3 Test Instruments

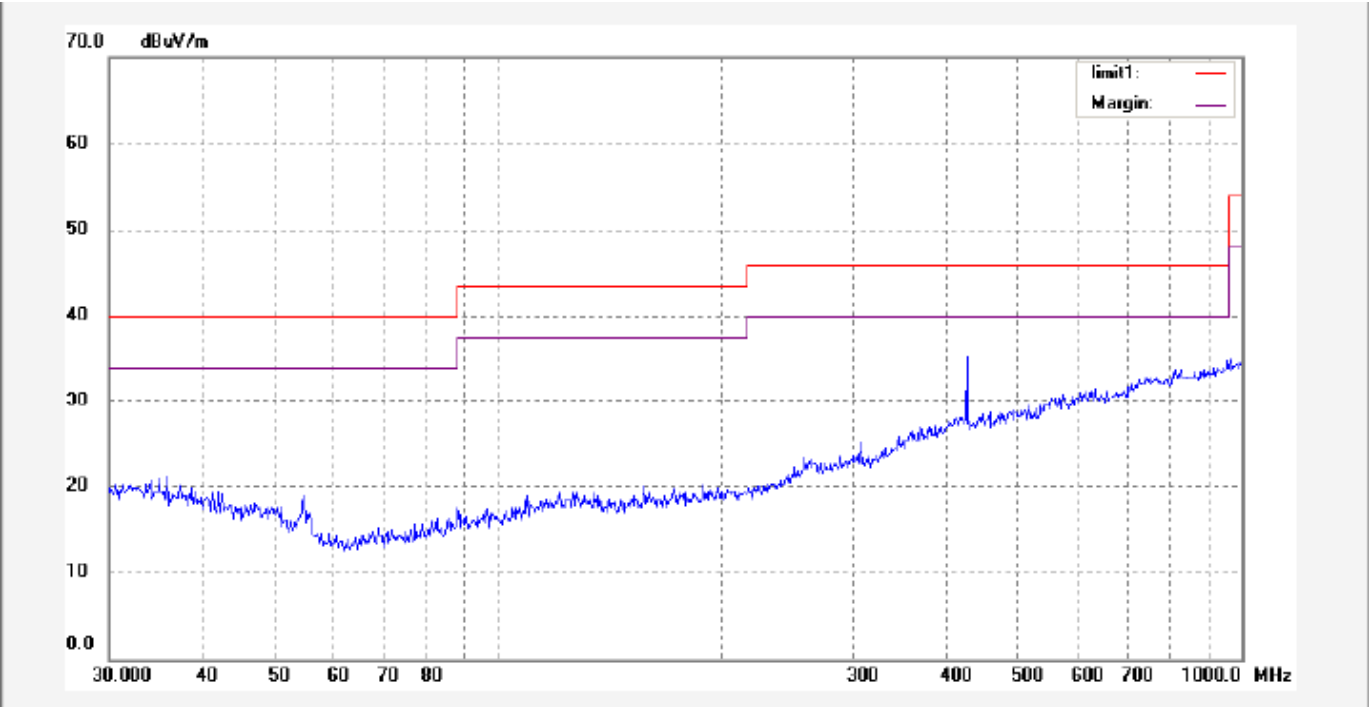
| NAME OF EQUIPMENT | MANUFACTURER         | MODEL   | SERIAL NUMBER | CAL. DATE  |
|-------------------|----------------------|---------|---------------|------------|
| EMI Test Receiver | R&S                  | ESCS30  | 100343        | 04/16/2008 |
| AMPLIFIER         | HP                   | HP8447E | 2945A02715    | 04/16/2008 |
| ANTENNA           | Sunol Sciences Corp. | JB3     | A021907       | 04/16/2008 |
| H&T Chamber       | EXPERY               | TN-400  | TN2007SR038   | 04/16/2008 |

### 12.4 Measure Result (Measured at 3m using FCC Part15 B Limits)

RADIATED EMISSION TEST - HORIZONTAL



RADIATED EMISSION TEST – VERTICAL



## **APPENDIX I PHOTOGRAPHS OF SETUP**

## RADIATED TEST SETUP



## **APPENDIX II EXTERNAL VIEW OF EUT**

TOP VIEW OF EUT



BOTTOM VIEW OF EUT





LEFT VIEW OF EUT



RIGHT VIEW OF EUT



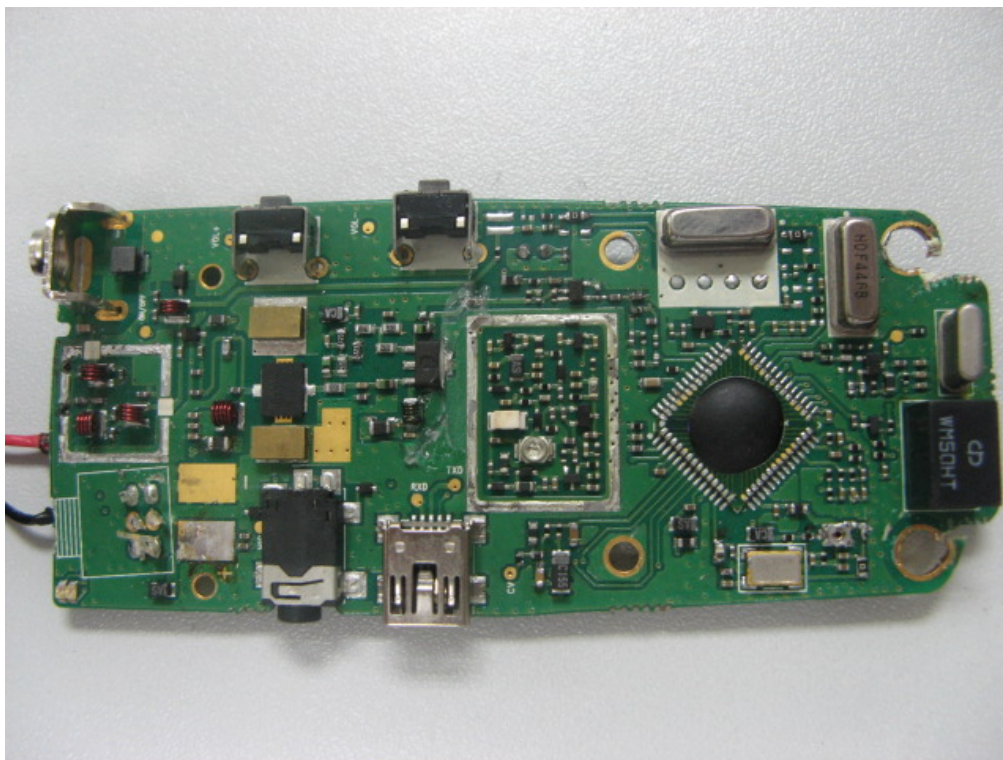
FRONT VIEW OF EUT



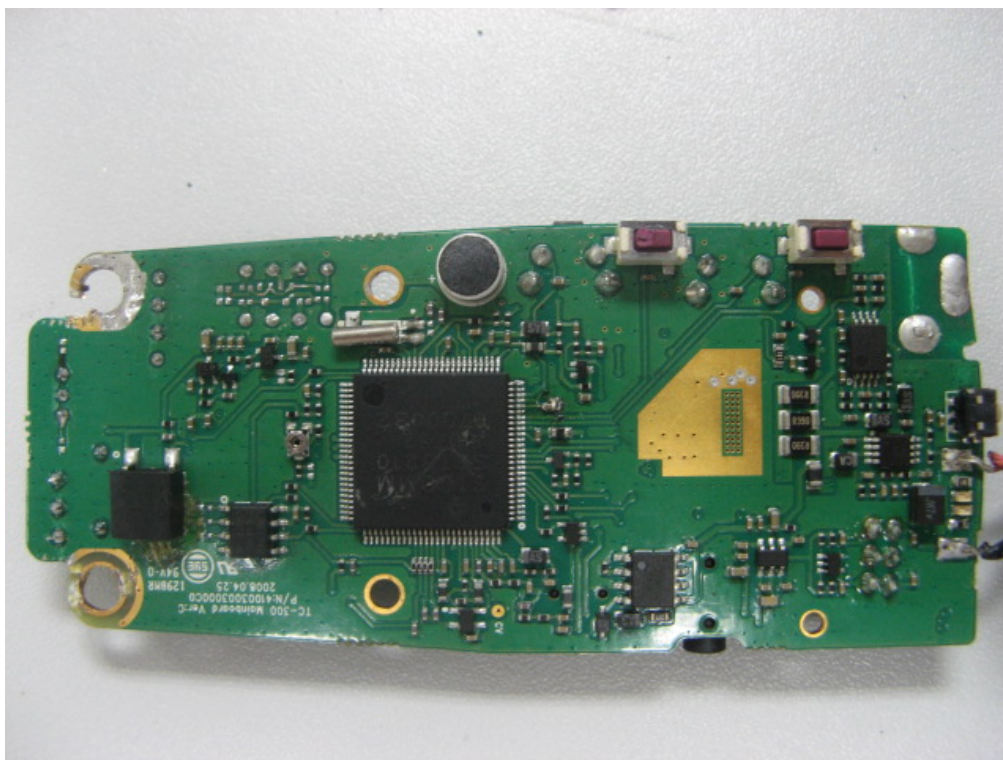
BACK VIEW OF EUT



INTERNAL VIEW-1 OF EUT



INTERNAL VIEW-2 OF EUT



----END OF REPORT----