

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

*For*

**Two-way Radio**

**Model Name: TC-310U(2)**

**Brand Name: HYT**

**FCC ID: R74TC-310U2, IC: 5465A-TC310U2**

**Report No.: AGC10200906SZ18E6**

**Date of Issue: Jul.04, 2009**

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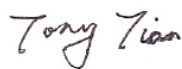
## VERIFICATION OF COMPLIANCE


Applicant:	SHENZHEN HYT SCIENCE&TECHNOLOGY CO., LTD.
	HYT TOWER, SHENZHEN H1-TECH INDUSTRIAL PARK NORTH, BEIHUAN RD., NANSHAN DISTRICT, SHENZHEN, P.R.C.
Manufacturer:	SHENZHEN HYT SCIENCE&TECHNOLOGY CO., LTD.
	HYT TOWER, SHENZHEN H1-TECH INDUSTRIAL PARK NORTH, BEIHUAN RD., NANSHAN DISTRICT, SHENZHEN, P.R.C.
Product Description:	Two-way Radio
Brand Name:	HYT
Model Number:	TC-310U(2)
File Number:	AGC10200906SZ18E6
Date of Test:	Jun.28 to Jul.04, 2009

### We hereby certify that:

The above equipment was tested by Attestation of Global Compliance 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 and RSS-119.

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

Checked By:   
Tony Tian Jul.04, 2009

Authorized By   
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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	FM
Emission Type	16K0F3E/11K0F3E
Emission Bandwidth	10.09 KHz (Limit:11.25 KHz for 12.5 KHz channel separation)
	15.09 KHz (Limit: 20 KHz for 25 KHz channel Separation)
Peak Frequency Deviation	1.76 KHz for 12.5 KHz Channel Separation (Limit< $\pm 2.5$ KHz)
	3.48 KHz for 25 KHz Channel Separation (Limit< $\pm 5$ KHz)
Audio Frequency Response	2.17 KHz (Limit<3.125 KHz)
Maximum Transmitter Power	32.98 dBm/32.95 dBm for 12.5 KHz/25.0KHz Channel Separation (2W)
Output power Modification	2W/1W
Antenna Designation	Detachable
Power Supply	DC 3.8V by battery
Battery Endpoint	DC 3.6V
Operation Frequency Range and Channel	Frequency Range: 450 MHz to 470MHz Channel Separation: 12.5KHz and 25KHz
	Top Channel: 468.800 MHz
	Centre Channel: 459.400 MHz
	Bottom Channel: 451.300 MHz
Frequency Tolerance	1.09 ppm for 12.5 KHz Channel Separation 1.08 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-310U2, IC: 5465A-TC310U2 filing to comply with the FCC Part 90 and RSS-119 requirements.

## **1.3 TEST METHODOLOGY**

The radiated emission testing was performed according to the procedures of ANSI C 63.4: 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 World Standardization Certification & Testing Co., Ltd. 1-2/F, Dachong Keji Building, No.28 of Tonggu Road, Nanshan District, Shenzhen, China. The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003.

FCC register No.: 276008 and IC register No.: 7700A-1.

## **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	Note
1	Two-way Radio	TC-310U(2)	FCC ID: R74TC-310U2 IC: 5465A-TC310U2	EUT
--	--	--	--	--
--	--	--	--	--

### 3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	Conducted Emission	Compliant
§90.205	Maximum Transmitter Power	Compliant
§90.207	Modulation Characteristic	Compliant
§90.209	Occupied Bandwidth	Compliant
§90.210	Emission Mask	Compliant
§90.213	Frequency Tolerance	Compliant
§90.214	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

### 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.

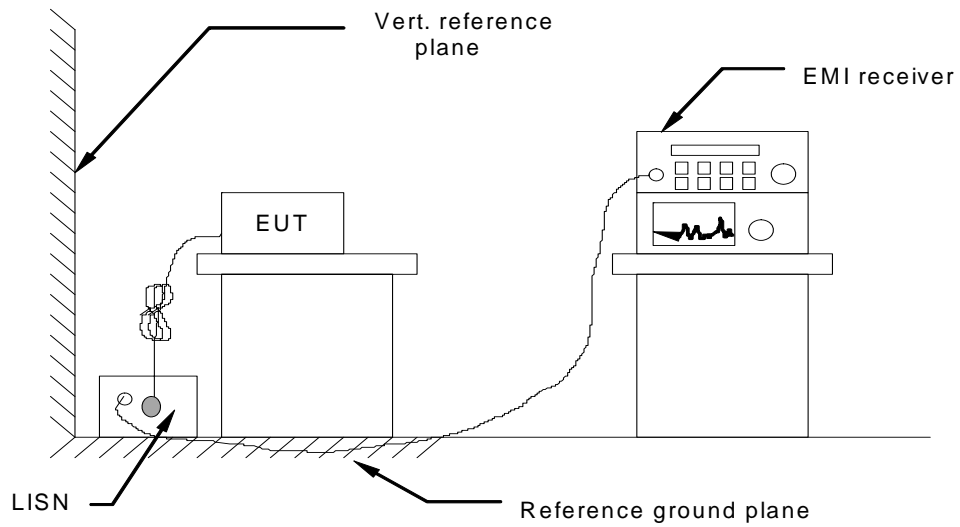
Frequency of Emission (MHz)	Conducted Limit(dBuV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

\* 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

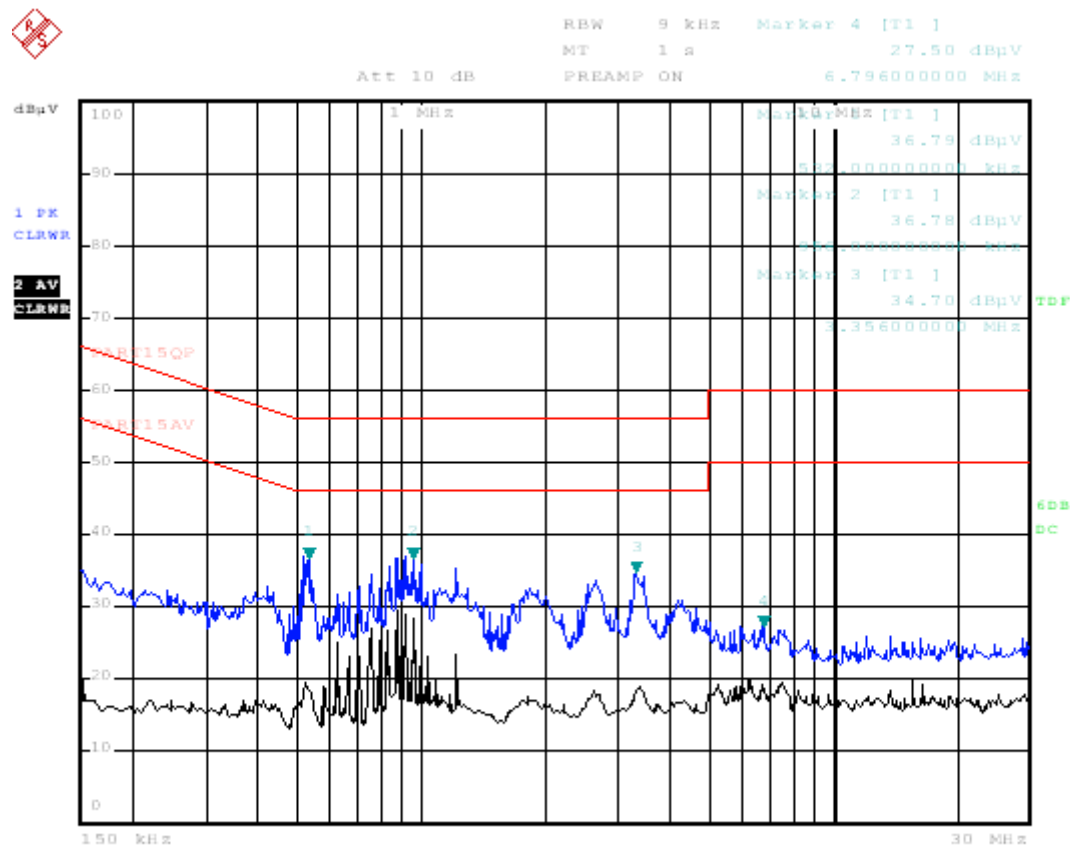


### 5.4 TEST EQUIPMENT USED

Conducted Emission Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Cal. Date
TEST RECEIVER	R&S	FCKL1528	A0304230	2009.06
LISN	SCHWARZBECK	NSLK8127	A0304233	2009.06

5.5 TEST RESULT

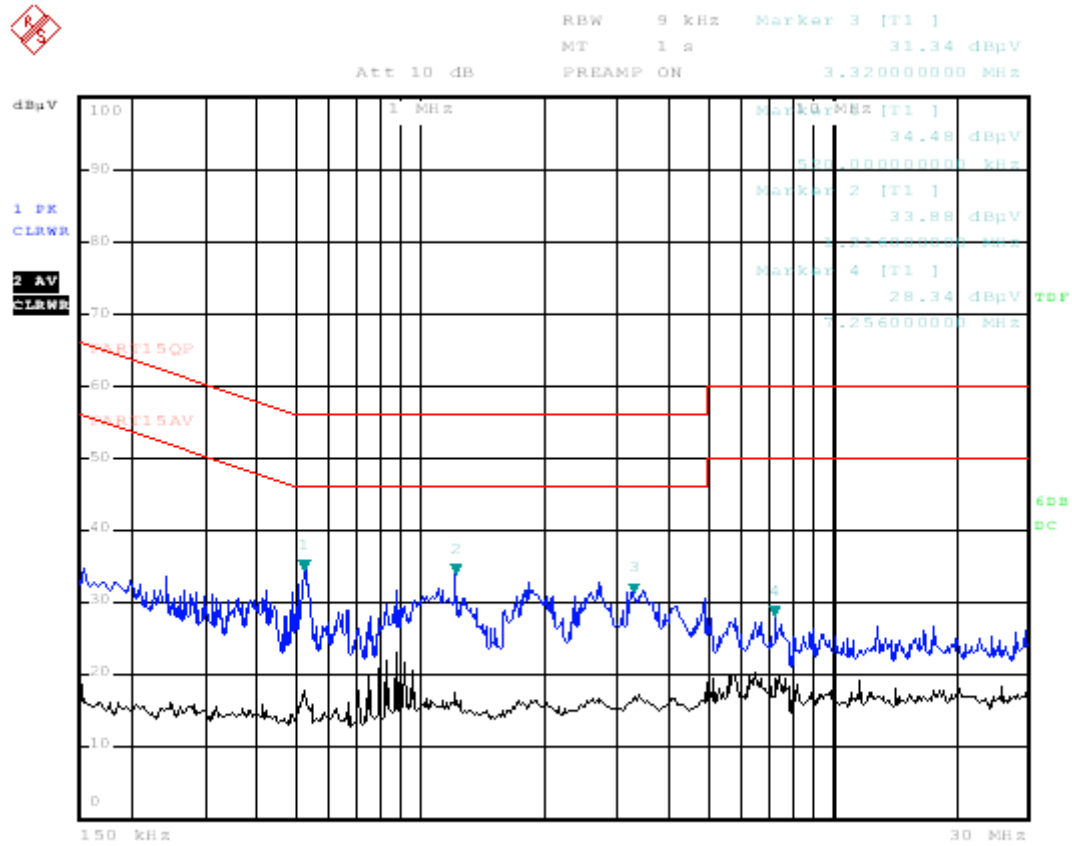
LINE CONDUCTED EMISSION TEST-L



TC-310U(2)-L

Date: 02.Jul.2009 11:42:47

# LINE CONDUCTED EMISSION TEST-N



TC-310U(2)-N

Date: 02.Jul.2009 11:44:47

## **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 manufacturer.
- 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**

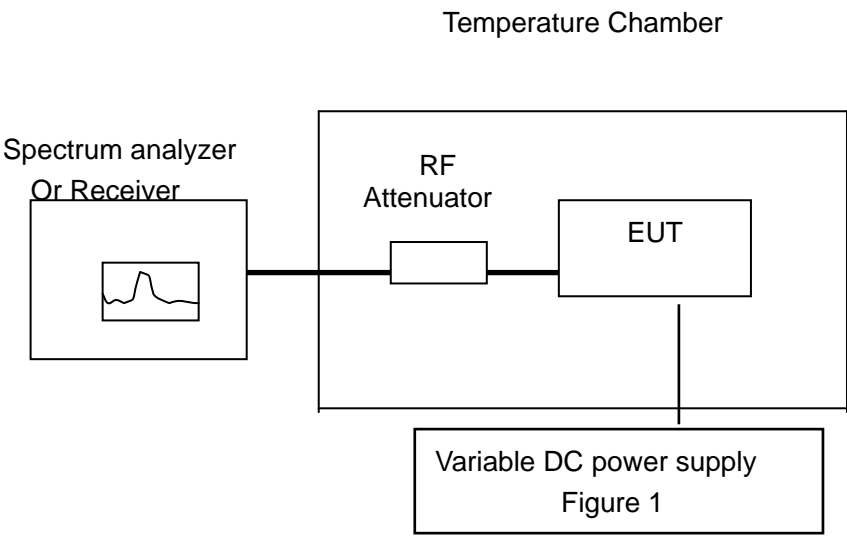
#### **6.2.1 Frequency stability versus environmental temperature**

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 3.8 V
2. Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz 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
Receiver	R&S	ESIB26	A0304218	2009.06
Climate Chamber	Albatross	--	--	2009.12

6.5 TEST RESULT

(1) Frequency stability versus input voltage (battery operation end point voltage is 3.6V)

**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	468.800	468.799637	0.77	2.5
Middle	459.400	459.399718	0.61	2.5
Bottom	451.300	451.299563	0.97	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	468.800	468.799628	0.79	5.0
Middle	459.400	459.399725	0.60	5.0
Bottom	451.300	451.299579	0.93	5.0



## (2)Frequency stability versus ambient temperature

**Bottom Channel @ 12.5 KHz Channel Separation**

Reference Frequency: 451.300 MHz		Limit: 2.5 ppm	
Environment Temperature (°C)	Power Supply (V)	Frequency deviation	
		(MHz)	ppm
50	3.8	451.299507	1.09
40	3.8	451.299542	1.01
30	3.8	451.299593	0.90
20	3.8	451.299614	0.86
10	3.8	451.299647	0.78
0	3.8	451.299682	0.70
-10	3.8	451.299725	0.61
-20	3.8	451.299753	0.55
-30	3.8	451.299782	0.48

**Middle Channel @ 12.5 KHz Channel Separation**

Reference Frequency: 459.400 MHz		Limit: 2.5 ppm	
Environment Temperature (°C)	Power Supply (V)	Frequency deviation	
		(MHz)	ppm
50	3.8	459.399515	1.06
40	3.8	459.399543	0.99
30	3.8	459.399582	0.91
20	3.8	459.399619	0.83
10	3.8	459.399652	0.76
0	3.8	459.399687	0.68
-10	3.8	459.399721	0.61
-20	3.8	459.399763	0.52
-30	3.8	459.399787	0.46

**Top Channel @ 12.5KHz Channel Separation**

Reference Frequency: 468.800 MHz		Limit: 2.5 ppm	
Environment Temperature(°C)	Power Supply (V)	Frequency deviation	
		(MHz)	ppm
50	3.8	468.799503	1.06
40	3.8	468.799534	0.99
30	3.8	468.799585	0.89
20	3.8	468.799619	0.81
10	3.8	468.799647	0.75
0	3.8	468.799685	0.67
-10	3.8	468.799729	0.58
-20	3.8	468.799754	0.52
-30	3.8	468.799788	0.45

**Bottom Channel @ 25.0 KHz Channel Separation**

Reference Frequency: 451.300 MHz		Limit: 5.0 ppm	
Environment Temperature (°C)	Power Supply (V)	Frequency deviation	
		(MHz)	ppm
50	3.8	451.299512	1.08
40	3.8	451.299553	0.99
30	3.8	451.299598	0.89
20	3.8	451.299618	0.85
10	3.8	451.299653	0.77
0	3.8	451.299689	0.69
-10	3.8	451.299729	0.60
-20	3.8	451.299759	0.53
-30	3.8	451.299791	0.46

**Middle Channel @ 25.0 KHz Channel Separation**

Reference Frequency: 459.400 MHz		Limit: 5.0 ppm	
Environment Temperature (°C)	Power Supply (V)	Frequency deviation	
		(MHz)	ppm
50	3.8	459.399503	1.08
40	3.8	459.399546	0.99
30	3.8	459.399593	0.89
20	3.8	459.399623	0.82
10	3.8	459.399663	0.73
0	3.8	459.399694	0.67
-10	3.8	459.399731	0.59
-20	3.8	459.399772	0.50
-30	3.8	459.399791	0.45

**Top Channel @ 25.0 KHz Channel Separation**

Reference Frequency: 468.800 MHz		Limit: 5.0 ppm	
Environment Temperature(°C)	Power Supply (V)	Frequency deviation	
		(MHz)	ppm
50	3.8	468.799512	1.04
40	3.8	468.799545	0.97
30	3.8	468.799592	0.87
20	3.8	468.799624	0.80
10	3.8	468.799653	0.74
0	3.8	468.799691	0.66
-10	3.8	468.799732	0.57
-20	3.8	468.799763	0.51
-30	3.8	468.799794	0.44

## 7. EMISSION BANDWIDTH

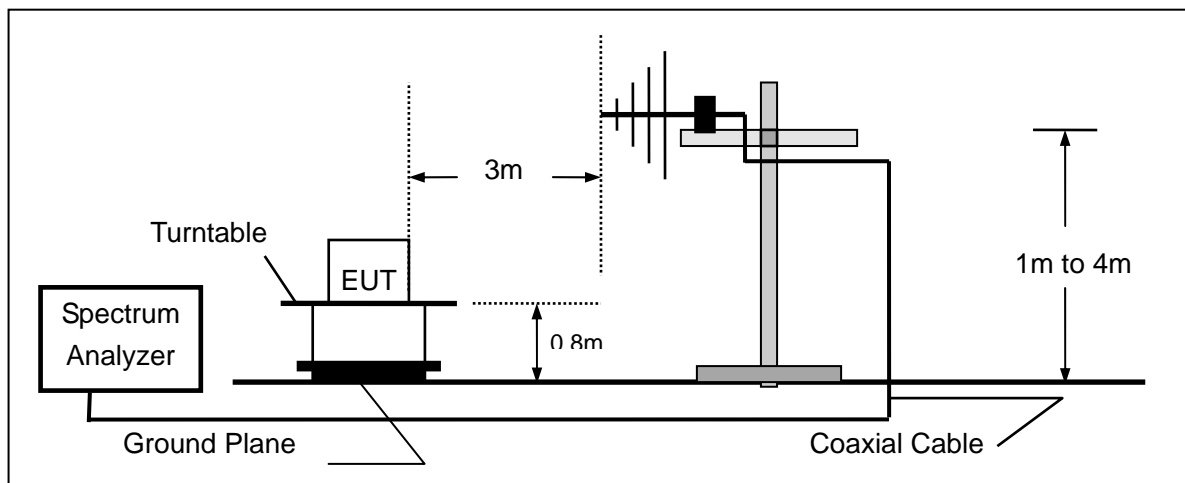
### 7.1 PROVISIONS APPLICABLE

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



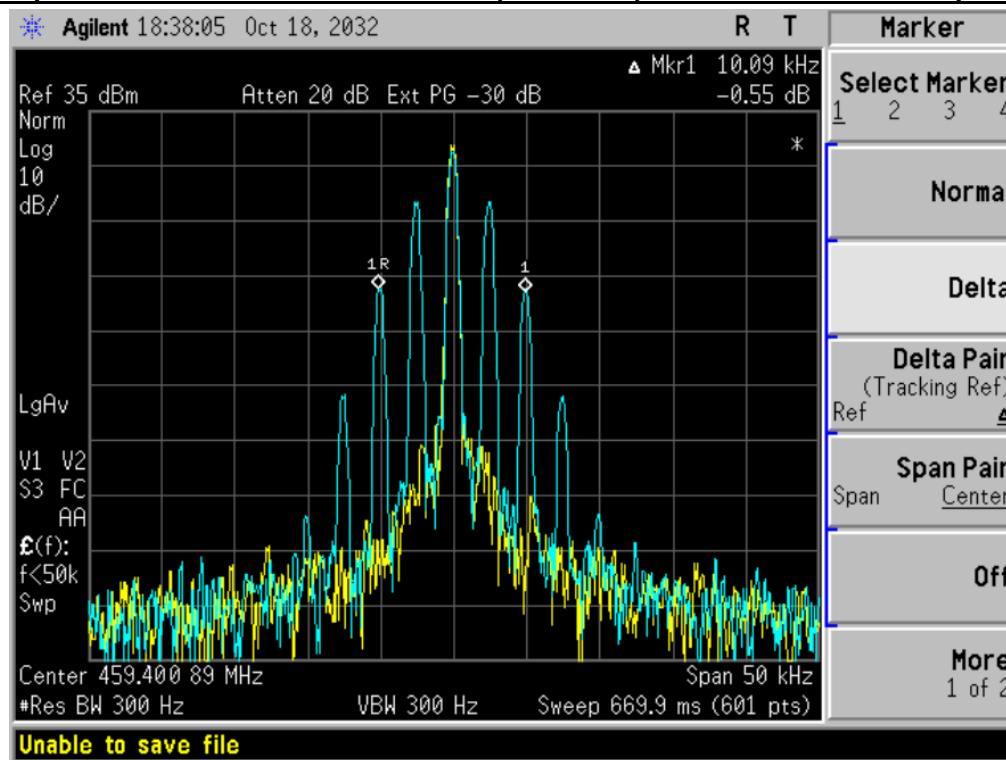
### 7.4 MEASUREMENT EQUIPMENT USED:

NAME OF EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL. DATE
SPECTRUM ANALYZER	AGILENT	E4440A	US44300399	2009.06
MODULATION ANALYZER	HP	8901B	3104A03367	2009.06
BROADBAND ANT.	R&S	HL562	A0304224	2009.06

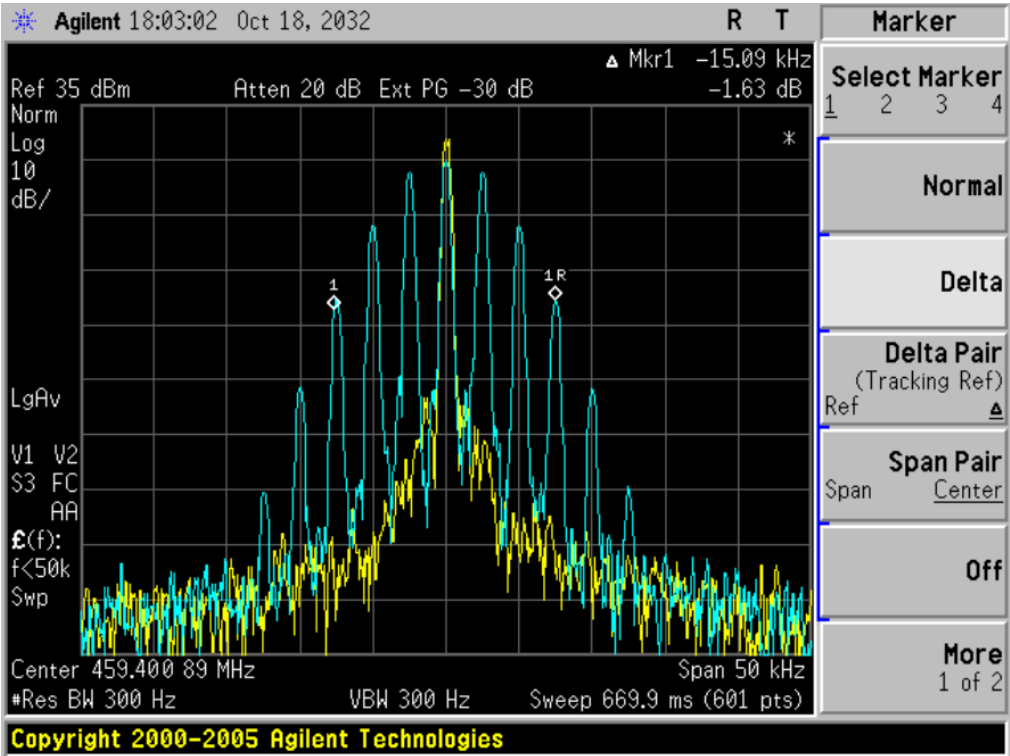
## 7.5 MEASUREMENT RESULT:

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	10.07 KHz	11.25 KHz	Pass	15.06KHz	20.00 KHz	Pass
Middle Channel	10.09KHz	11.25 KHz	Pass	15.09 KHz	20.00 KHz	Pass
Top Channel	10.06 KHz	11.25 KHz	Pass	15.07 KHz	20.00 KHz	Pass

### Occupied bandwidth of Middle Channel (Maximum) @ 12.5KHz Channel Separation



**Occupied bandwidth of Middle Channel (Maximum) @ 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, whichever is lesser attenuation.

8.1.2 According to Section 90.210, Emission mask B. 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:

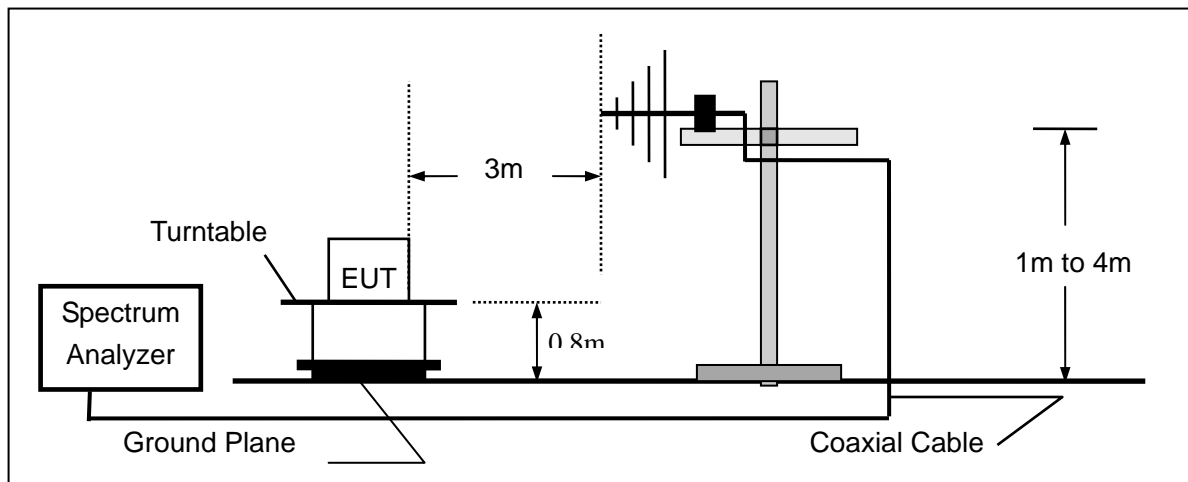
- (1), On any frequency removed from the assigned frequency by more than 50 percent, but no more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2), On any frequency removed from the assigned frequency by more than 100 percent, but no more than 250 percent of the authorized bandwidth: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

### 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.

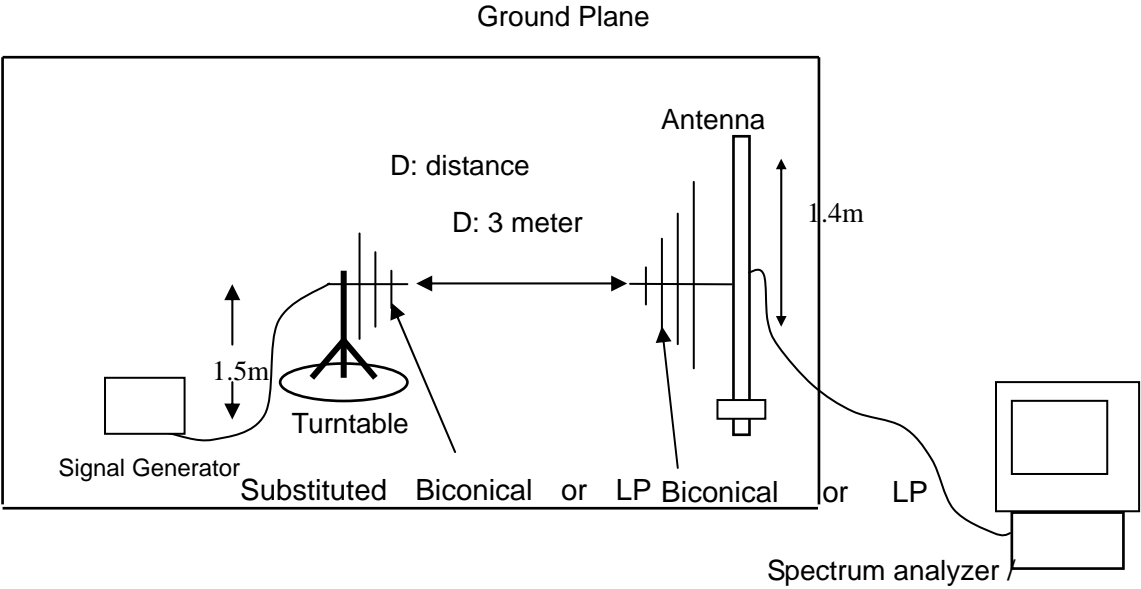
- (8) The maximum signal level detected by the measuring receiver shall be noted.
- (9) The measurement shall be repeated with the test antenna set to horizontal polarization.
- (10) Replace the antenna with a proper Antenna (substitution antenna).
- (11) The substitution antenna shall be oriented for 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

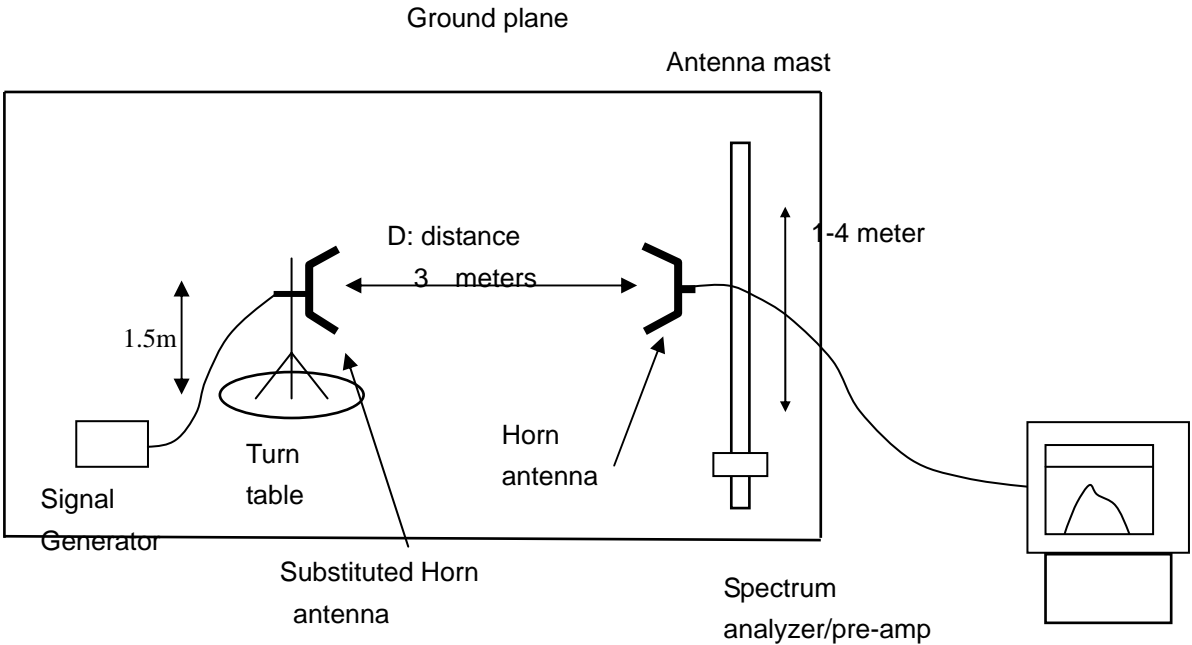


**SUBSTITUTION METHOD: (Radiated Emissions)**

**Radiated Below 1GHz**



**Radiated Above 1 GHz**





#### 8.4 MEASUREMENT EQUIPMENT USED:

NAME OF EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL. DATE
SPECTRUM ANALYZER	AGILENT	E4440A	US44300399	2009.06
TEST RECEIVER	R&S	ESIB26	A0304218	2009.06
LOOP ANTENNA	R&S	HFH2-Z2	A0304220	2009.06
HORN ANT.	R&S	HF906	100150	2009.06
BROADBAND ANT.	R&S	HL562	A0304224	2009.06

#### 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 33.01 dBm.

Limit (dBm)=33.01-50-10log 10 (2) = -20

**Bottom Channel**

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

**Middle Channel**

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

**Top Channel**

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

**Middle Channel**

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

**Top Channel**

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

**Notes:**

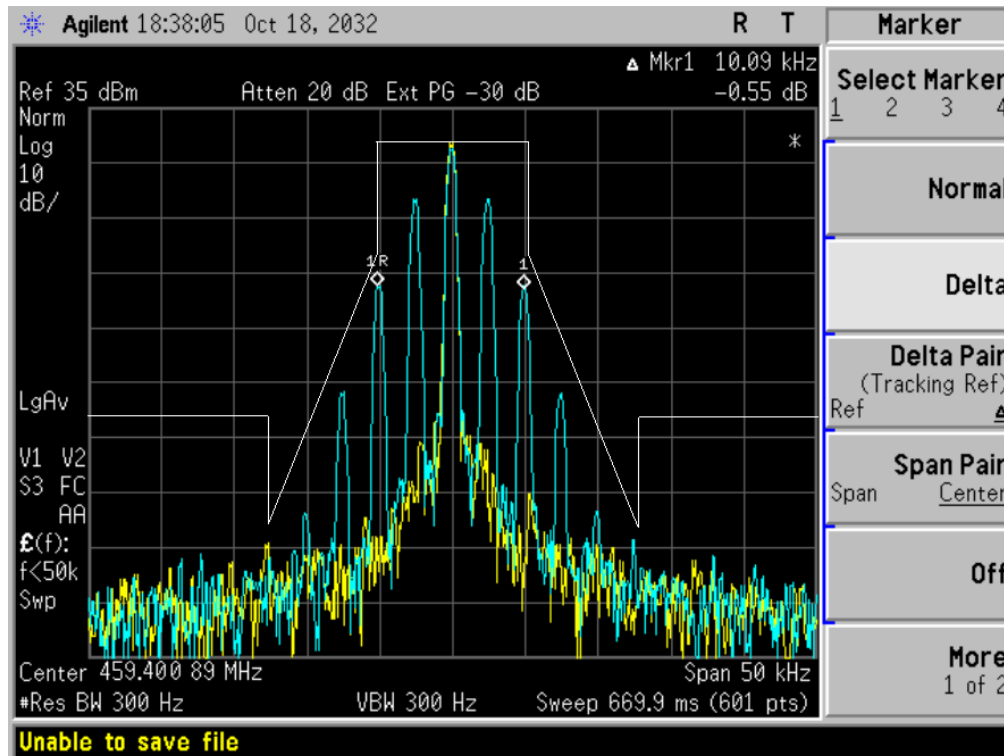
-- means that the emission level is too low to be measured or at least 20 dB down than the limit.

## 8.6 EMISSION MASK PLOT

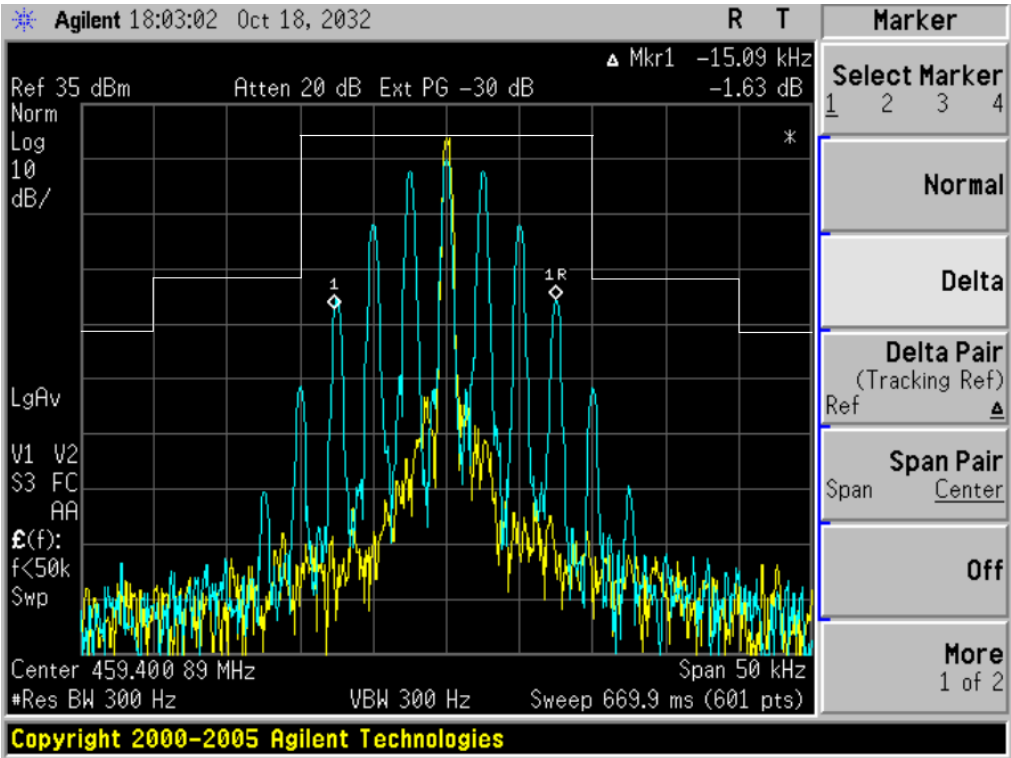
The detailed procedure employed for Emission Mask measurements are specified as following:

- 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.

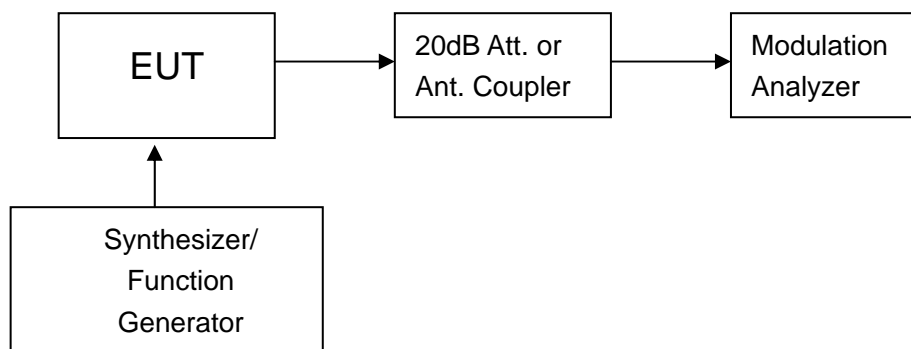
### 9.2 MEASUREMENT METHOD

#### 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, 1500 and 3000Hz 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 =  $20\log_{10} (\text{Deviation of test frequency} / \text{Deviation of 1 KHz reference})$ .



**Figure 1: Modulation characteristic measurement configuration**

### 9.3 MEASUREMENT INSTRUMENTS

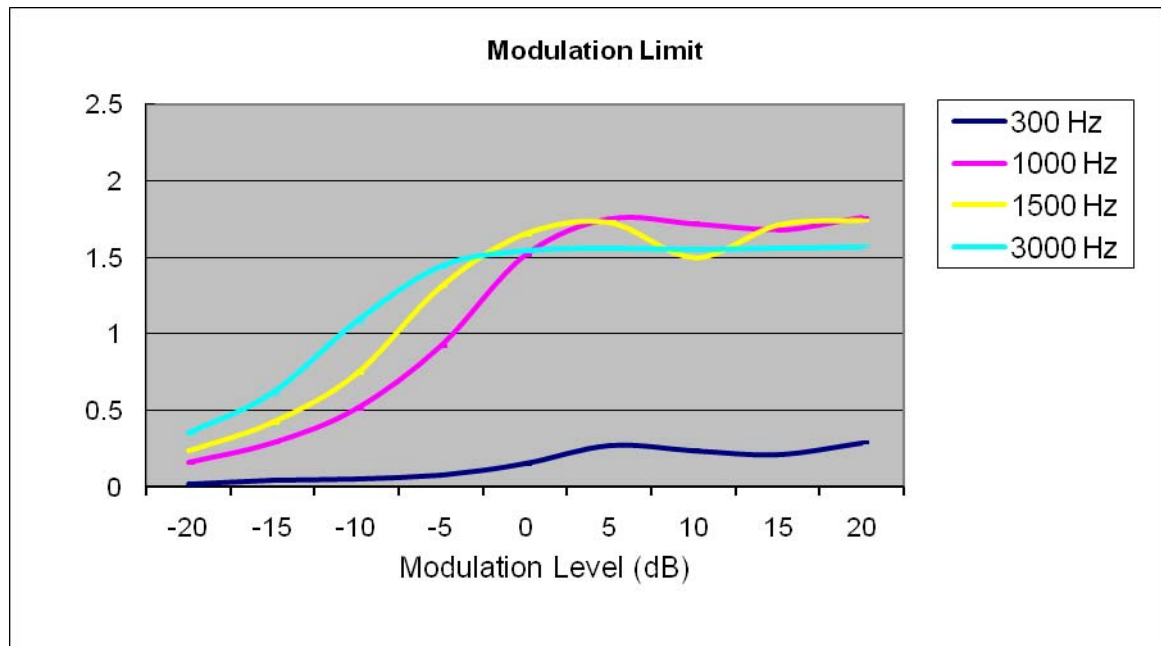
NAME OF EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL. DATE
Modulation Analyzer	HP	8901B	3104A03367	2009.06

## 9.4 MEASUREMENT RESULT

### (a). Modulation Limit:

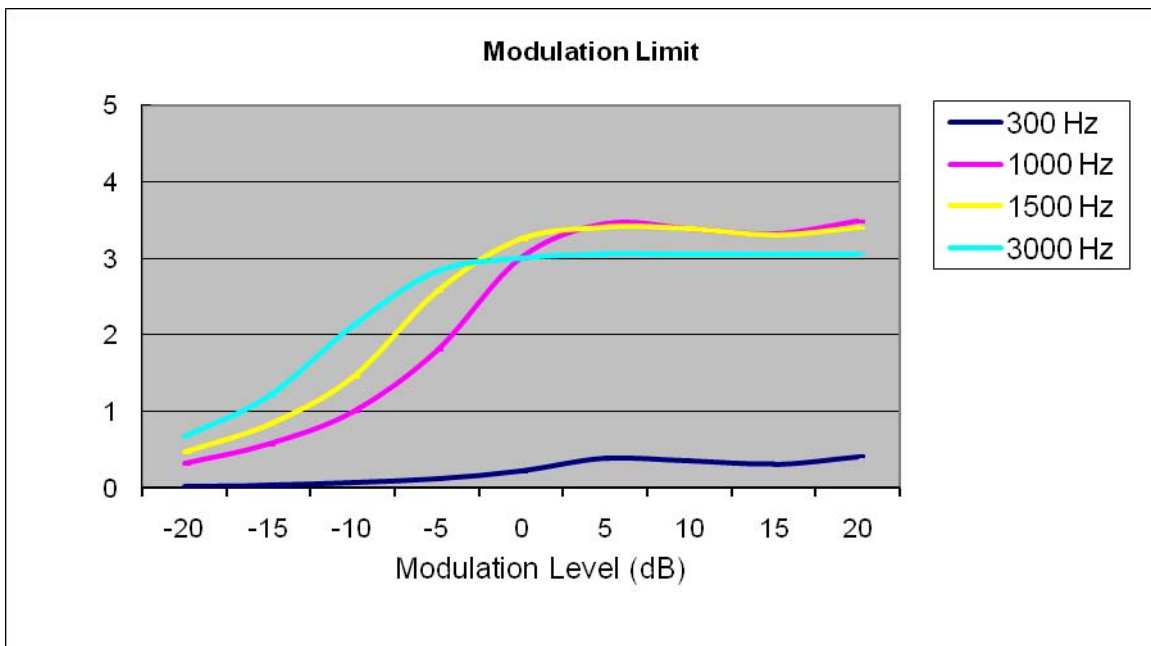
#### Middle Channel @ 12.5 KHz Channel Separations

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	0.02	0.16	0.24	0.35
-15	0.04	0.29	0.42	0.61
-10	0.05	0.51	0.74	1.08
-5	0.08	0.92	1.31	1.44
0	0.15	1.51	1.65	1.54
+5	0.27	1.75	1.73	1.56
+10	0.24	1.72	1.50	1.55
+15	0.21	1.68	1.71	1.56
+20	0.29	1.76	1.74	1.57



**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	0.02	0.32	0.47	0.68
-15	0.03	0.57	0.83	1.20
-10	0.07	1.00	1.45	2.12
-5	0.12	1.80	2.57	2.83
0	0.22	3.00	3.25	3.01
+5	0.39	3.45	3.41	3.06
+10	0.35	3.39	3.39	3.05
+15	0.31	3.32	3.31	3.05
+20	0.41	3.48	3.40	3.06

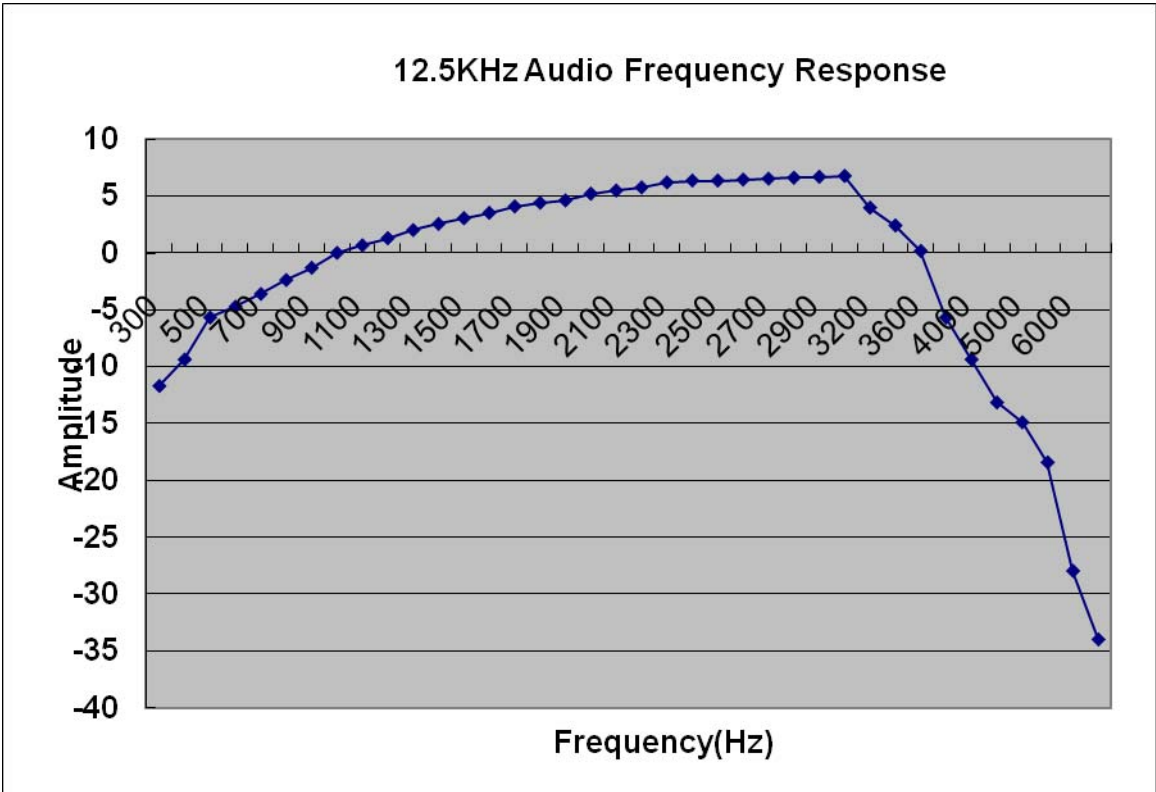




**(b). Audio Frequency Response:****12.5 KHz Channel Separation**

<b>Frequency (Hz)</b>	<b>Deviation (KHz)</b>
100	--
200	--
300	0.13
400	0.17
500	0.26
600	0.29
700	0.33
800	0.38
900	0.43
1000	0.50
1100	0.54
1200	0.58
1300	0.63
1400	0.67
1500	0.71
1600	0.75
1700	0.80
1800	0.83
1900	0.85
2000	0.91
2100	0.94
2200	0.97
2300	1.02
2400	1.04
2500	1.04
2600	1.05
2700	1.06
2800	1.07
2900	1.08
3000	1.09
3200	0.79
3400	0.66
3600	0.51
3800	0.26
4000	0.17
4500	0.11
5000	0.09
5500	0.06
6000	0.02
6500	0.01
7000	--
7500	--
8000	--
8500	--
9000	--
9500	--

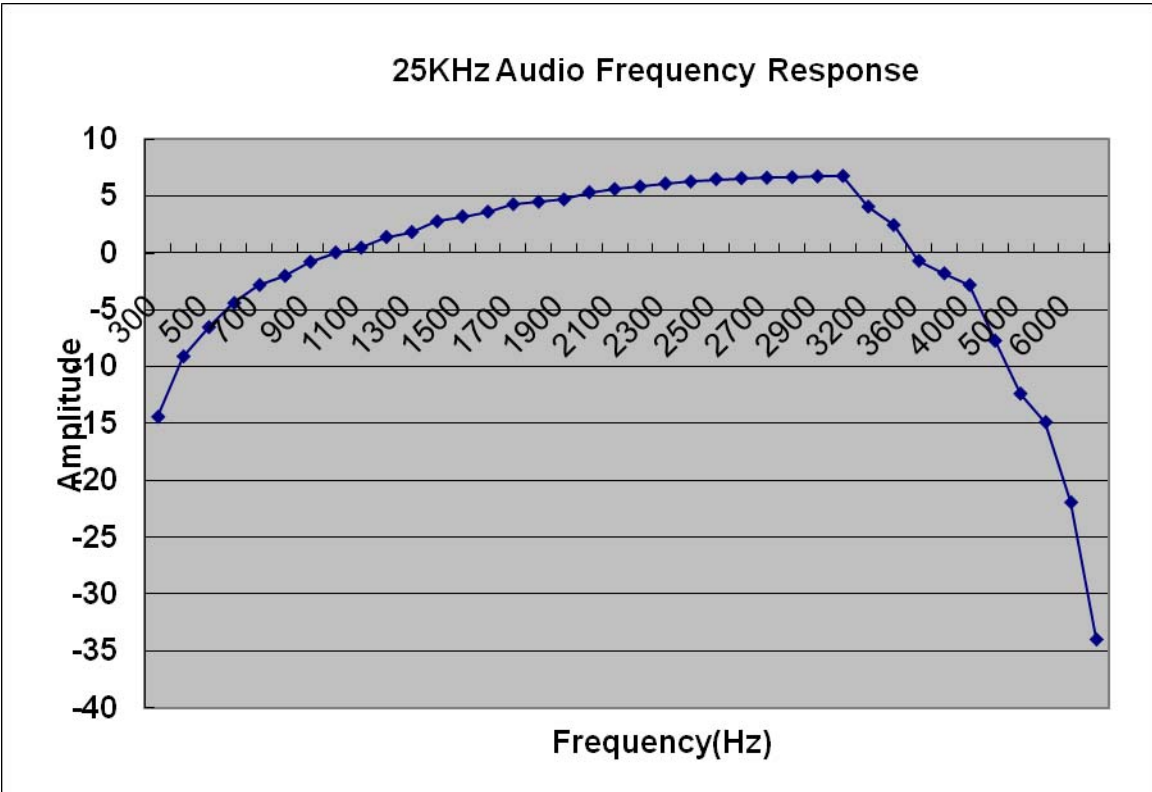
**Frequency Response of Middle Channel**



**25 KHz Channel Separation**

<b>Frequency (Hz)</b>	<b>Deviation (KHz)</b>
100	--
200	--
300	0.19
400	0.35
500	0.47
600	0.60
700	0.72
800	0.79
900	0.91
1000	1.00
1100	1.05
1200	1.17
1300	1.23
1400	1.37
1500	1.44
1600	1.51
1700	1.63
1800	1.67
1900	1.71
2000	1.84
2100	1.90
2200	1.95
2300	2.01
2400	2.05
2500	2.10
2600	2.12
2700	2.13
2800	2.14
2900	2.16
3000	2.17
3200	1.59
3400	1.32
3600	0.92
3800	0.81
4000	0.72
4500	0.41
5000	0.24
5500	0.18
6000	0.08
6500	0.02
7000	--
7500	--
8000	--
8500	--
9000	--
9500	--
10000	--

**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 Two-way Radio 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	E4440A	US44300399	2009.06

**10.4 TEST RESULT**

The maximum Conducted Power (CP) is

2 W /1Wfor 12.5 KHz Channel Separation

2 W /1W for 25.0 KHz Channel Separation

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

\* Note:

CP: The final Conducted Power

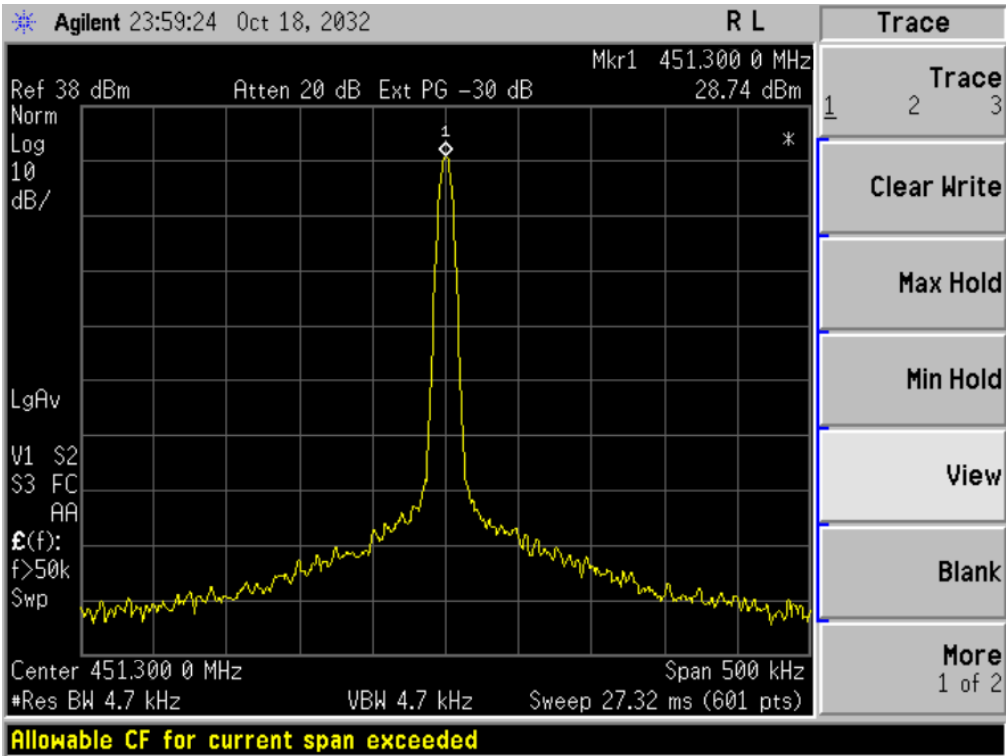
R : The reading value from spectrum analyzer

A : The attenuation value of the used attenuator

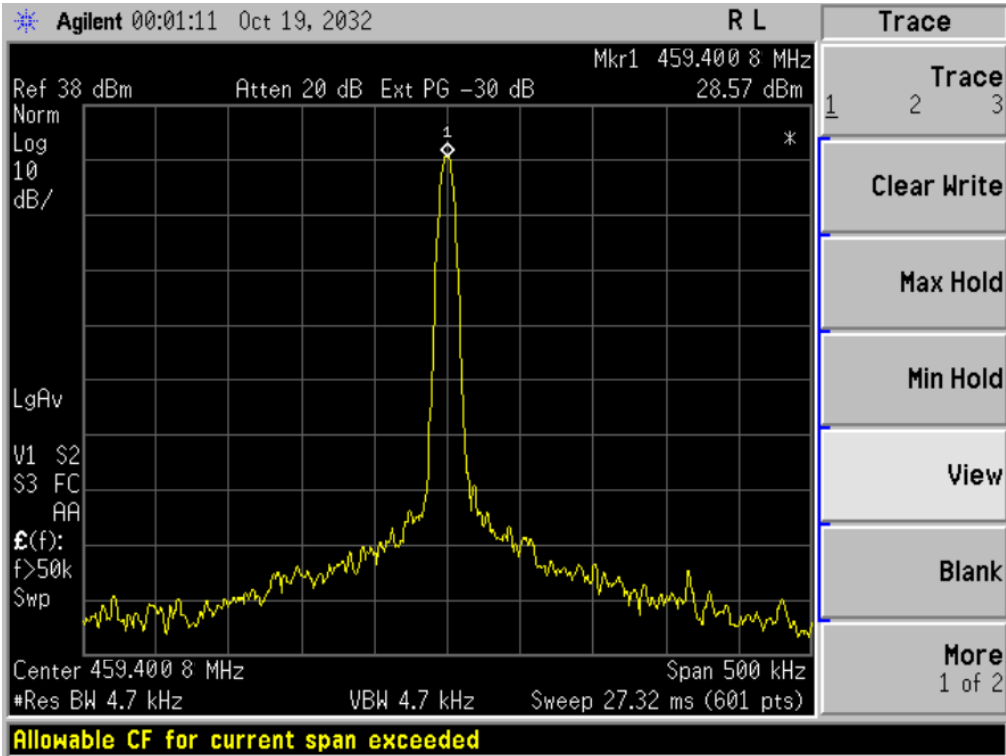
L : The loss of all connection cables

Conducted Power Measurement Results			
Channel Separation	Channel	Measurement Result (dBm)	
		For 1W	For 2 W
12.5 KHz	Bottom	28.74	32.98
	Middle	28.57	32.97
	Top	28.43	32.96
25 KHz	Bottom	28.71	32.95
	Middle	28.52	32.94
	Top	28.42	32.93

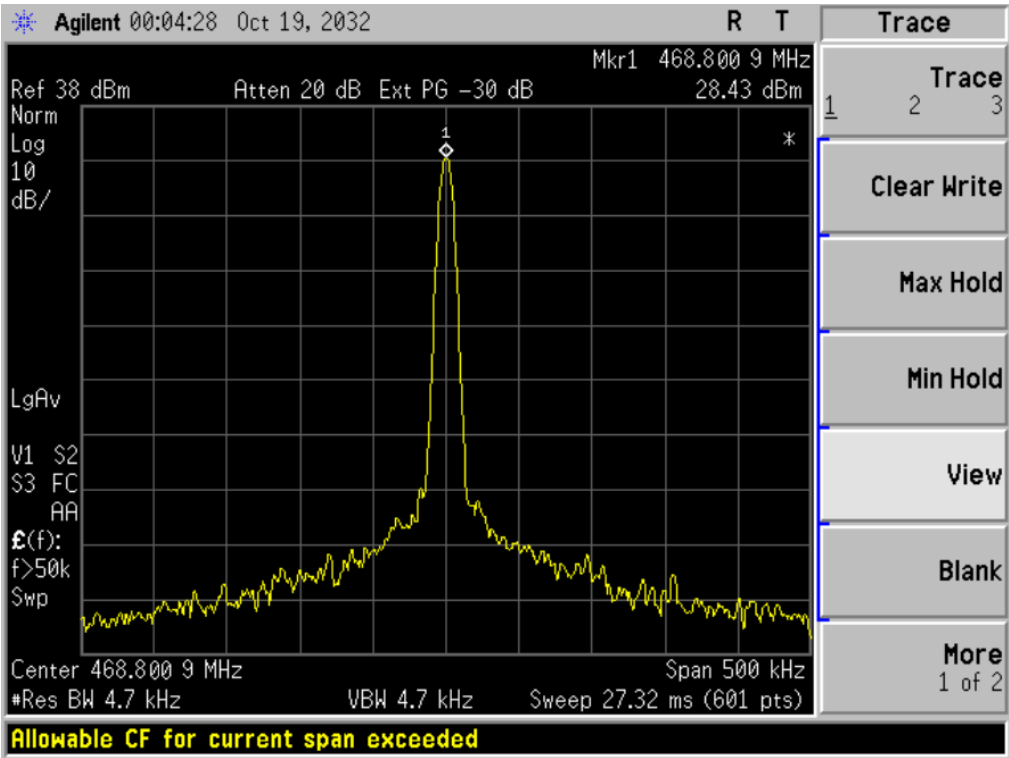
OUTPUT POWER (MAXIMUM) FOR 1W (451.300M)



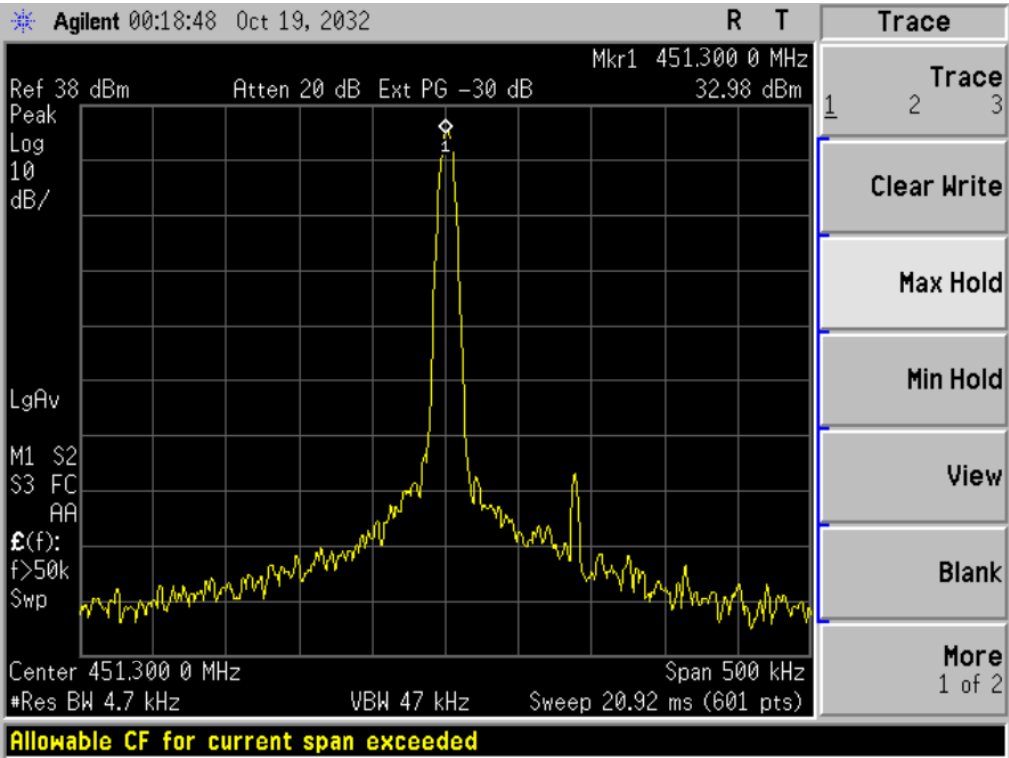
OUTPUT POWER (MAXIMUM) FOR 1W (459.400M)



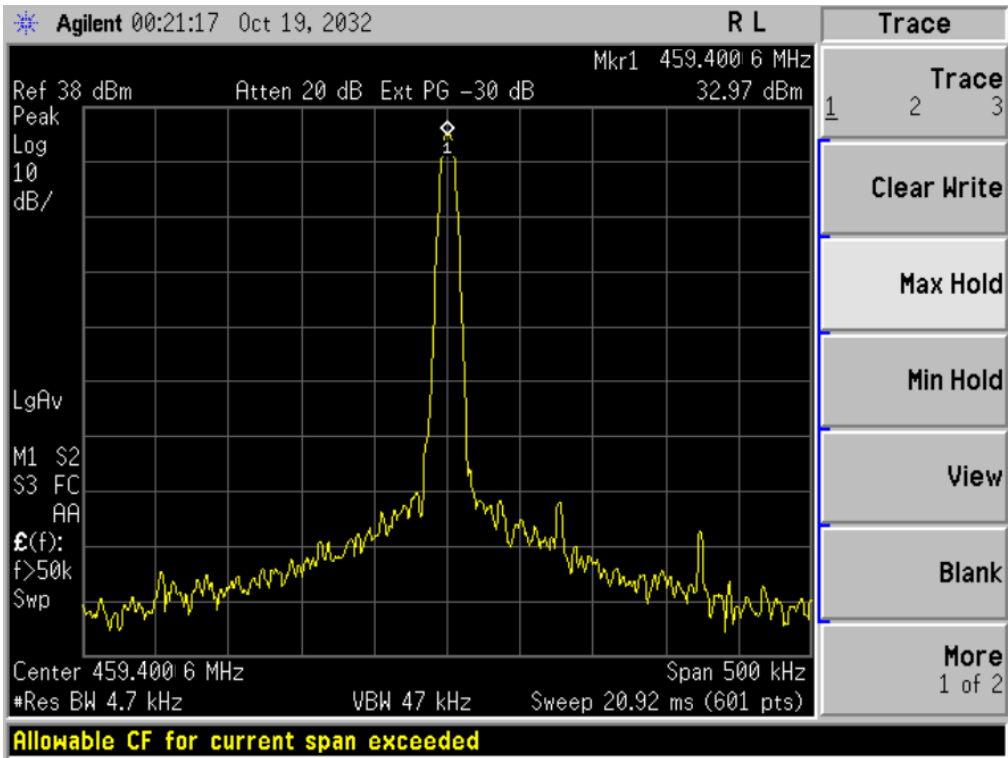
OUTPUT POWER (MAXIMUM) FOR 1W (468.800M)



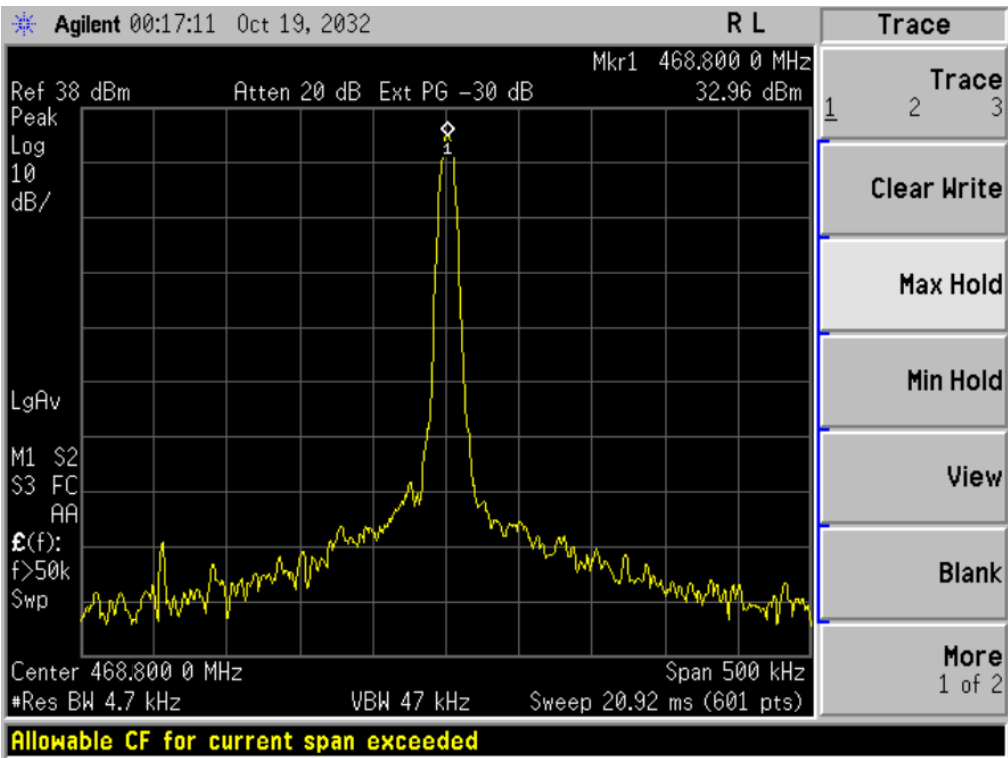
OUTPUT POWER (MAXIMUM) FOR 2W (451.300M)



OUTPUT POWER (MAXIMUM) FOR SEPERATION 2W (459.400M)



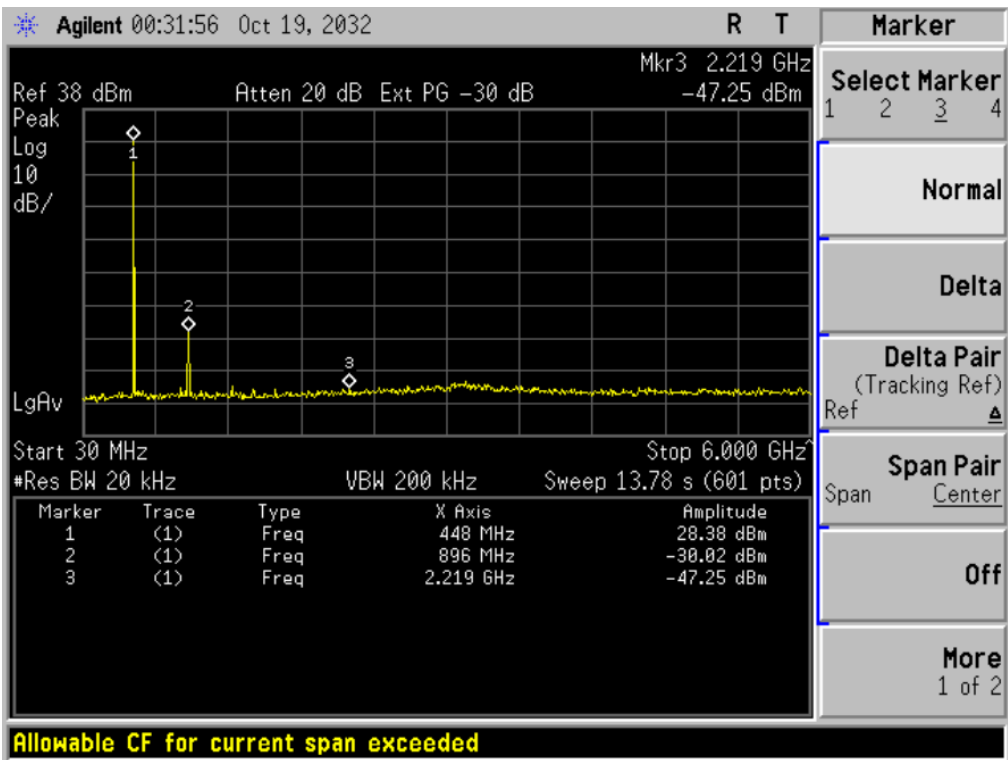
OUTPUT POWER (MAXIMUM) FOR 2W (468.800M)



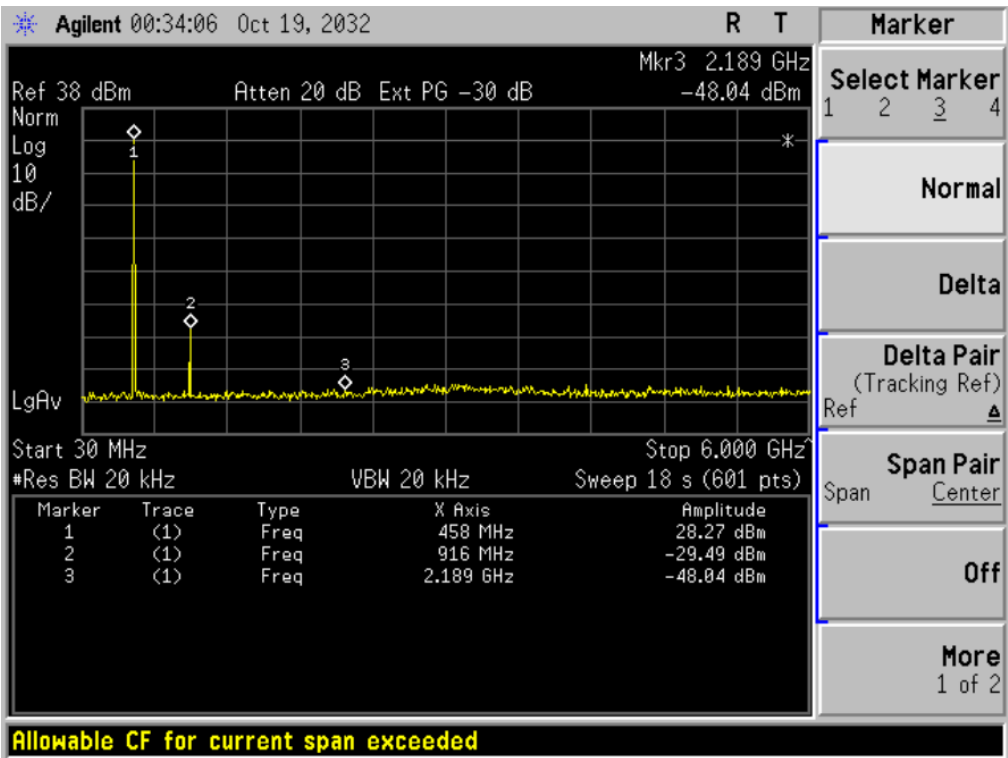


10.4 CONDUCT SPURIOUS PLOT

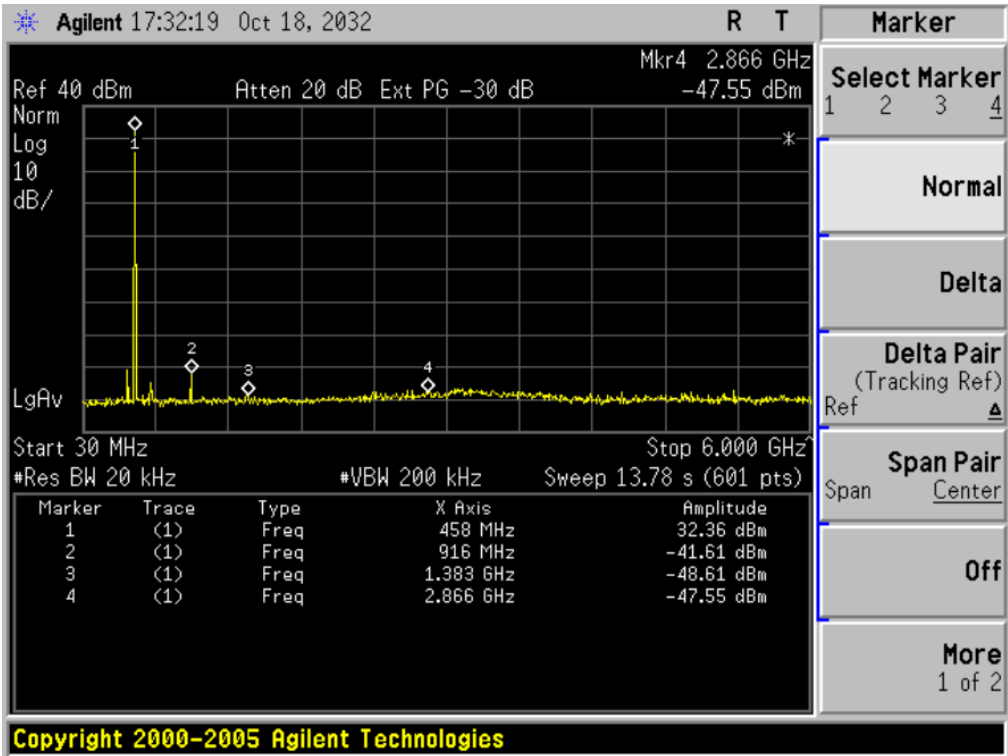
The Worst Case (1 W) of The Three Channels for Conduct Spurious Emission @ 12.5KHz



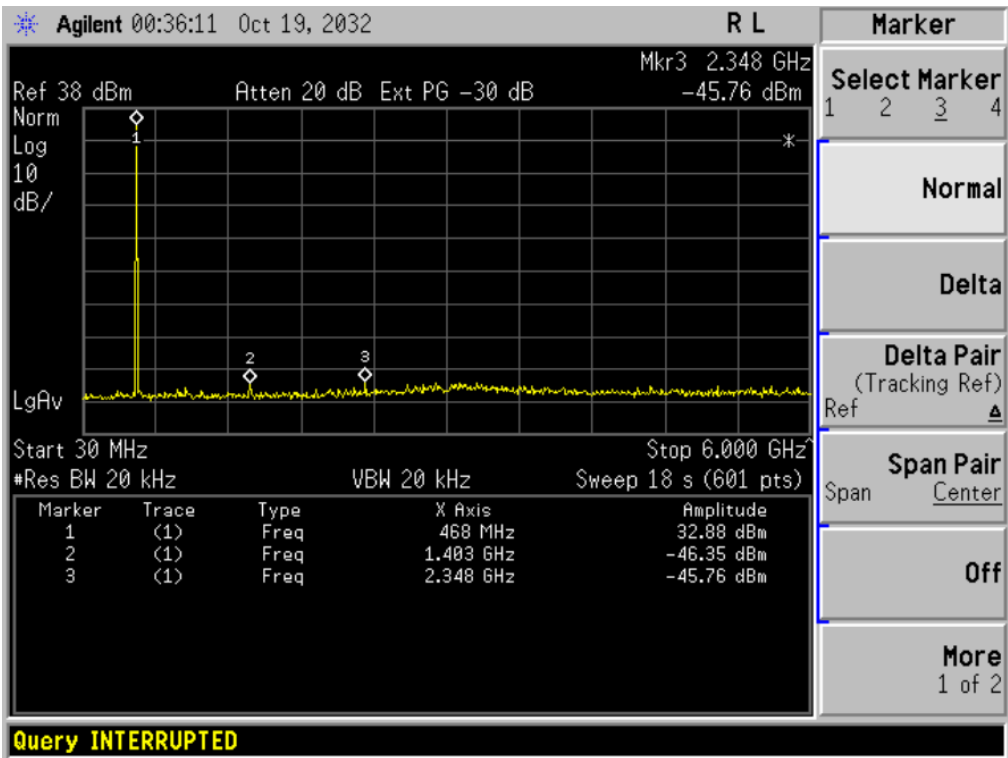
The Worst Case (1w) of The Three Channels for Conduct Spurious Emission @ 25KHz



**The Worst Case (2W)of The Three Channels for Conduct Spurious Emission @ 12.5KHz**



**The Worst Case (2W)of The Three Channels for Conduct Spurious Emission @ 25.0 KHz**



## **11. TRANSMITTER FREQUENCY BEHAVIOR**

### **11.1 PROVISIONS APPLICABLE**

Section 90.214

### **11.2 TEST METHOD**

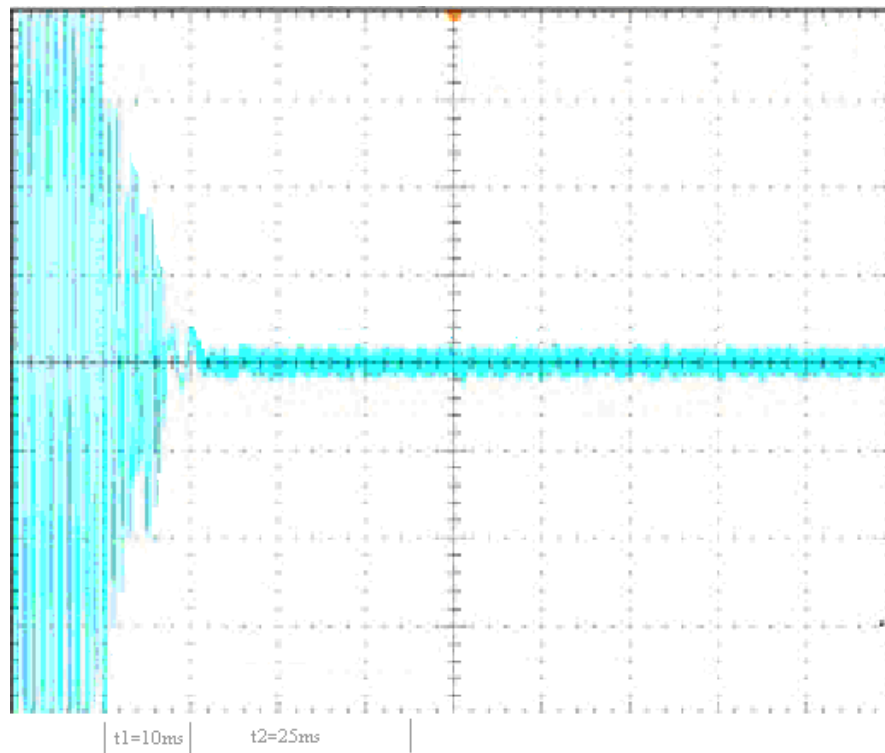
TIA/EIA-603 2.2.19

### **11.3 TEST INSTRUMENTS**

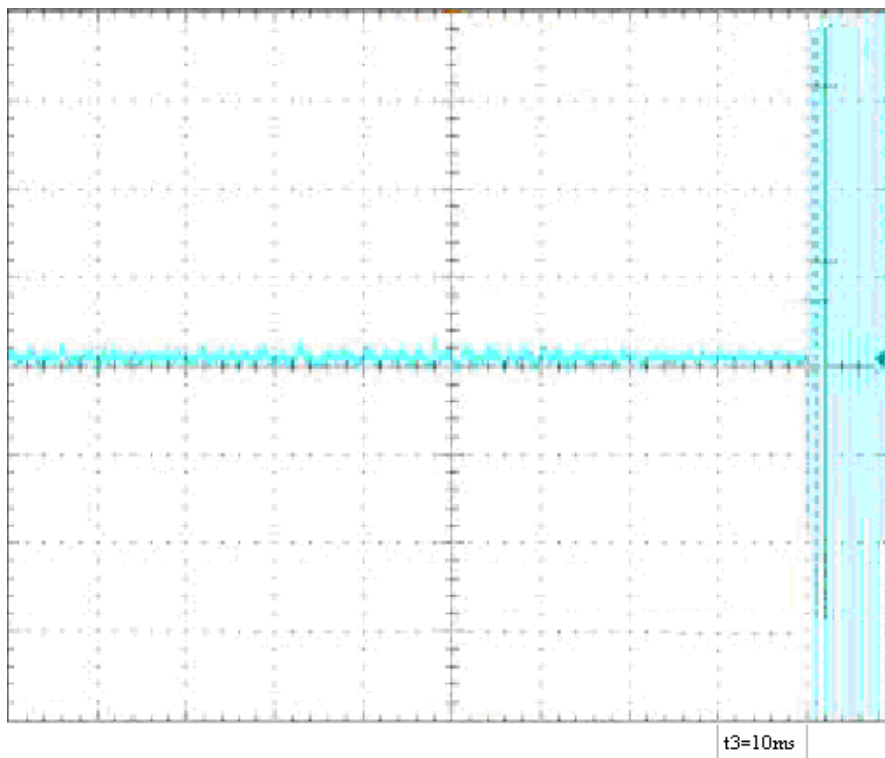
NAME OF EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER	CAL. DATE
Signal Generator	R&S	SMT02	A0304261	2009.06
Storage Oscilloscope	Tektronix	TDS3052	B017447	2008.12

### **11.4 MEASURE RESULT**

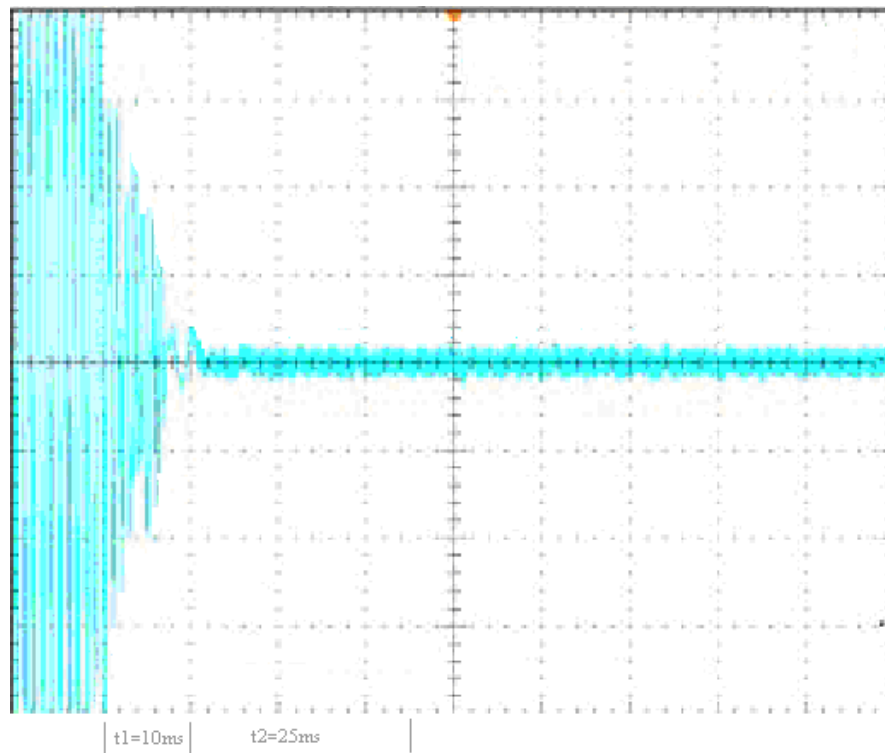
Transmitter Frequency Behavior @ 25 KHz Channel Separation--Off to On



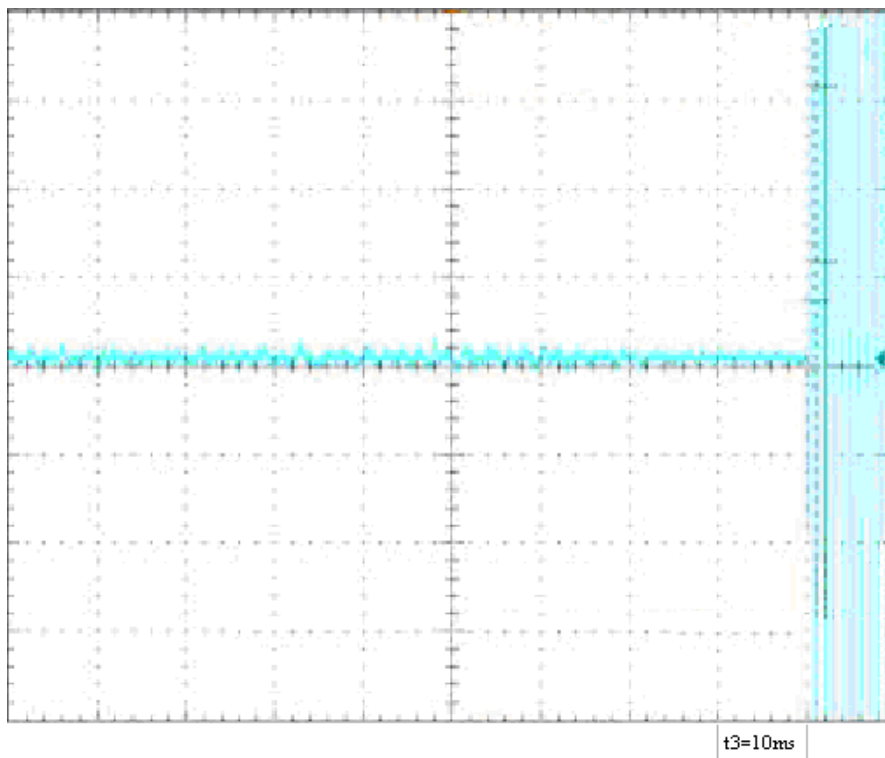
Transmitter Frequency Behaviour @ 25 KHz Channel Separation--On to Off



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



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



## 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
SPECTRUM ANALYZER	AGILENT	E4440A	US44300399	2009.06
TEST RECEIVER	R&S	ESIB26	A0304218	2009.06
LOOP ANTENNA	R&S	HFH2-Z2	A0304220	2009.06
HORN ANT.	R&S	HF906	100150	2009.06
BROADBAND ANT.	R&S	HL562	A0304224	2009.06

## 12.4 MEASURE RESULT (MEASURED AT 3M USING FCC PART15 B LIMITS)

### RADIATED EMISSION TEST RESULTS – HORIZONTAL



Site 966 Chamber #1

Polarization: **Horizontal**

Temperature: 26

Limit: FCC Part15 RE-Class B\_30-1000MHz

Power:

Humidity: 60 %

EUT:

Distance: 3m

M/N:

Mode:

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree degree	Comment
1		123.6316	38.86	-4.73	34.13	43.50	-9.37	peak			
2	*	133.7510	40.15	-6.01	34.14	43.50	-9.36	peak			
3		203.8616	34.81	-6.47	28.34	43.50	-15.16	peak			
4		367.7807	35.71	-2.66	33.05	46.00	-12.95	peak			
5		529.9346	30.51	1.73	32.24	46.00	-13.76	peak			
6		637.9095	29.64	3.68	33.32	46.00	-12.68	peak			

## RADIATED EMISSION TEST RESULTS – VERTICAL



Site 966 Chamber #1

Polarization: **Vertical**

Temperature: 26

Limit: FCC Part15 RE-Class B\_30-1000MHz

Power:

Humidity: 60 %

EUT:

Distance: 3m

M/N:

Mode:

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree degree	Comment
1	*	42.0293	33.71	-4.17	29.54	40.00	-10.46	peak			
2		46.2424	36.13	-8.51	27.62	40.00	-12.38	peak			
3		165.5909	35.96	-6.49	29.47	43.50	-14.03	peak			
4		367.7808	35.44	-1.06	34.38	46.00	-11.62	peak			
5		463.0736	31.98	-0.16	31.82	46.00	-14.18	peak			
6		637.9096	30.69	1.86	32.55	46.00	-13.45	peak			



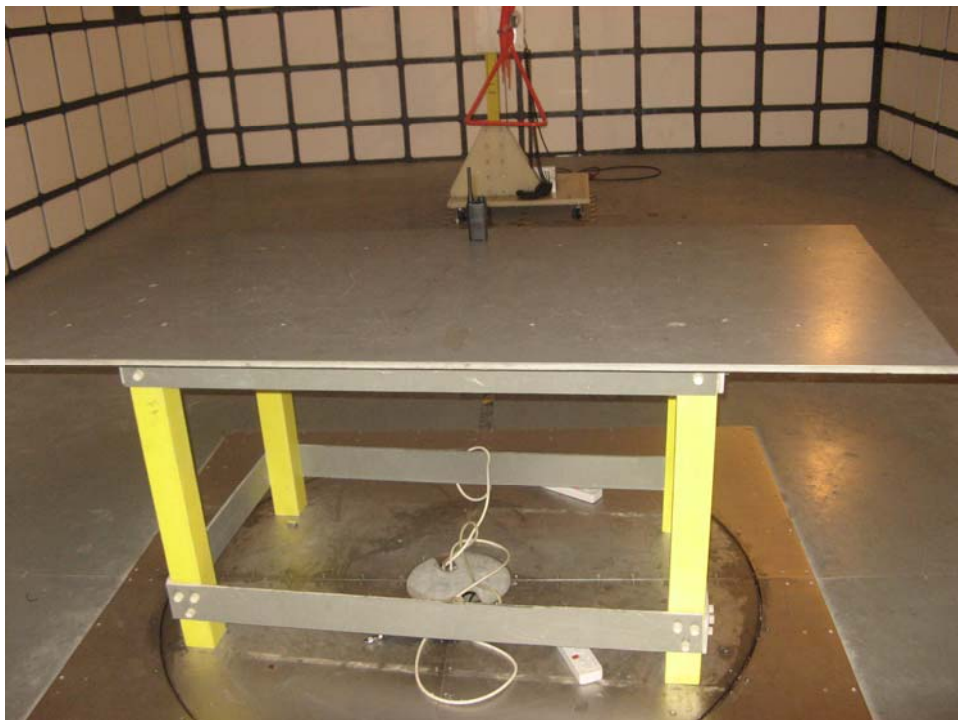
## **APPENDIX I**

### **PHOTOGRAPHS OF SETUP**

### CONDUCTED EMISSION TEST SETUP



### RADIATED TEST SETUP



## **APPENDIX II**

### **PHOTOGRAPHS 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

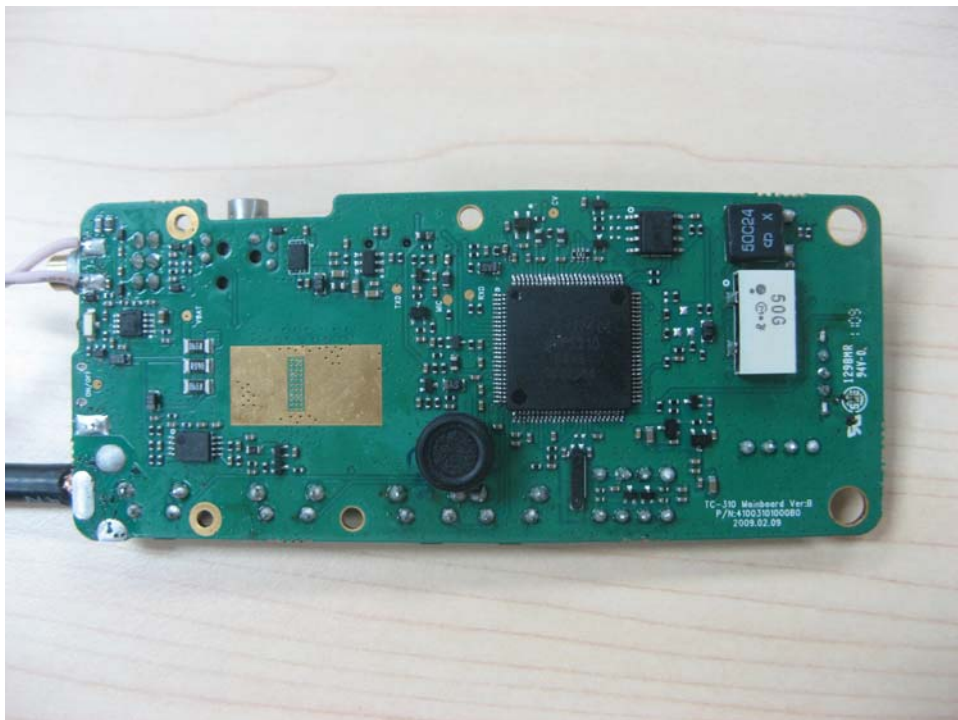




INTERNAL VIEW OF EUT – 1



INTERNAL VIEW OF EUT – 2



----END OF REPORT----