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FCC PART 80 TEST REPORT

FCC Part 80

Report Reference No.: TRE12110048 R/C: 70799

FCC ID: RIPHM360

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Date of issue: Dec 14, 2012

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

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

Applicant's name: Shenzhen Jiuzhou Himunication Technology Co., Ltd

Address: B712, 7F, Jiuzhou Electric Building, Southern No.12 Road, Hi-tech Industrial Park, Nanshan District, Shenzhen, China

Test specification:

Standard: FCC Part 80: STATIONS IN THE MARITIME SERVICES

TRF Originator: Shenzhen Huatongwei International Inspection CO., Ltd

Master TRF: Dated 2006-06

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Test item description: Handheld marine radio

Trade Mark: /

Manufacturer: Shenzhen Jiuzhou Himunication Technology Co., Ltd

Model/Type reference: HM360

List Model: /

Modulation: FM

Channel Separation: 25KHz

Operation Frequency: From 156.05 MHz to 157.425 MHz

Rated Power: 5 Watts(36.99dBm)/1 Watts(30.00dBm)

Ratings: DC 7.4 V

Result: Positive

TEST REPORT

Test Report No. : TRE12110048	Dec 14, 2012 Date of issue
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Equipment under Test : Handheld marine radio

Model /Type : HM360

Listed Models : /

Applicant : **Shenzhen Jiuzhou Himunication Technology Co.,Ltd**

Address : B712, 7F, Jiuzhou Electric Building, Southern No.12
Road, Hi-tech Industrial Park, Nanshan District,
Shenzhen, China

Manufacturer : **Shenzhen Jiuzhou Himunication Technology Co.,Ltd**

Address : B712, 7F, Jiuzhou Electric Building, Southern No.12
Road, Hi-tech Industrial Park, Nanshan District,
Shenzhen, China

Test Result according to the standards on page 4:	Positive
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The test report merely corresponds to the test sample.

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

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1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 80: STATIONS IN THE MARITIME SERVICES.

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

47 CFR FCC Part 15 Subpart B - Unintentional Radiators

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

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Nov 20, 2012
Testing commenced on	:	Nov 20, 2012
Testing concluded on	:	Dec 14, 2012

2.2. Product Description

The Shenzhen Jiuzhou Himunication Technology Co.,Ltd's Model: HM360 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Handheld marine radio	
Model Number	HM360	
Rated Output Power	5 Watts(36.99 dBm)/1 Watts(30.00 dBm)	
Modulation Type	FM for Analog Voice	
Emission Designator	Analog	16K0F3E for 25KHz Channel Separation
Channel Separation	Analog Voice	25KHz
Antenna Type	External	
Frequency Range	From 156.05 MHz to 157.425 MHz	

2.3. Equipment under Test

Power supply system utilised

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

DC 7.4 V

Test frequency list

Modulation Type	Test Channel	Test Frequency
Analog/FM	Low Channel(CH1)	156.050 MHz
	Middle Channel(CH16)	156.800 MHz
	High Channel(CH88)	157.425 MHz
	DSC (CH70)	156.525 MHz

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

156.05-157.425 MHz V frequency band Digital Portable Repeater with GPS function.

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

Serial number: Prototype

2.5. EUT Configuration

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

2.6. EUT operation mode

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

2.7. EUT configuration

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

● - supplied by the manufacturer

○ - supplied by the lab

<input type="radio"/>	Power Cable	Length (m) :	/
<input type="radio"/>		Shield :	/
<input type="radio"/>		Detachable :	/
<input type="radio"/>	Multimeter	Manufacturer :	/
<input type="radio"/>		Model No. :	/

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

This submittal(s) (test report) is intended for FCC ID: **RIPHM360** filing to comply with FCC Part 80 Rules

2.9. Modifications

No modifications were implemented to meet testing criteria.

2.10. Note

The EUT is is a V frequency band (156.05-157.425MHz) Digital Portable Repeater with GPS function, The functions of the EUT listed as below:

	Test Standards	Reference Report
Radio	FCC Part 80	TRE12110048

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

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

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

3.2. Test Facility

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

CNAS-Lab Code: L1225

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

A2LA-Lab Cert. No. 2243.01

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

FCC-Registration No.: 662850

Shenzhen Huatongwei International Inspection Co., Ltd, EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 662850, Renewal date June 01, 2015.

IC-Registration No.: 5377

The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377 on Jan 25, 2011. Valid time is until Jan 24, 2014

ACA

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

NEMKO-Aut. No.: ELA125

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

VCCI

The 3m Semi-anechoic chamber (12.2m×7.95m×6.7m) and Shielded Room (8m×4m×3m) of Shenzhen Huatongwei International Inspection Co., Ltd has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2484. Date of Registration: December 20, 2009. Valid time is until December 19, 2013.

Main Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-2726. Date of Registration: December 20, 2009. Valid time is until December 19, 2013.

DNV

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

3.3. Environmental conditions

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

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

3.4. Configuration of Tested System

Fig. 2-1 Configuration of Tested System

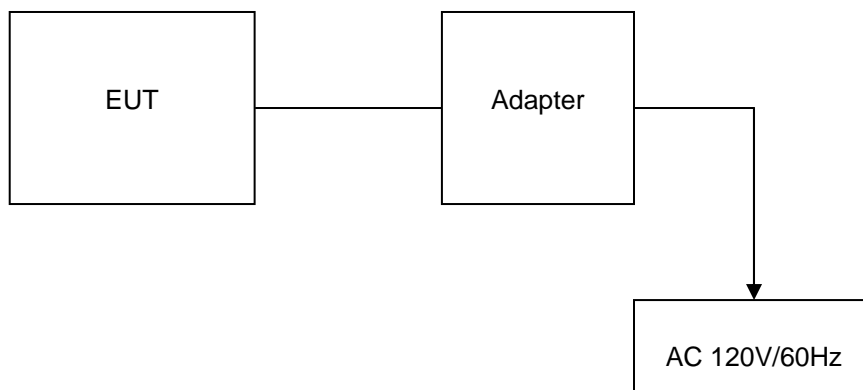


Table 2-1 Equipment Used in Tested System

Adapter:

Model: SW-090100

Input:100-240V~, 50/60Hz

Output: DC 9V 1000mA

Power Cable: 100cm

◇ Shielded ◆ Unshielded

3.5. Discription of Tested Modes

The EUT (Didital Covert Radio) has been tested under normal operating condition. Five channels (the high, the middle and the low) are chosen for testing at each channel separation (25 KHz).

3.6. Statement of the measurement uncertainty

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

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

Test Items	Measurement Uncertainty	Notes
Frequency stability	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission 9KHz-12.75 GHz	1.60 dB	(1)
Conducted Emission 9KHz-30MHz	3.39 dB	(1)
Radiated Emission 30~1000MHz	4.24 dB	(1)
Radiated Emission 1~18GHz	5.16 dB	(1)
Radiated Emission 18-40GHz	5.54 dB	(1)
Occupied Bandwidth	-----	(1)
Emission Mask	-----	(1)
Modulation Characteristic	-----	(1)
Transmitter Frequency Behavior	-----	(1)

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

3.7. Test Description

FCC Rules	Description of Test	Test Result
§ 15.107	Conducted Emission	Complies
§ 15.109	Receiver Radiated Spurious Emssion	Complies
§ 15.109	Receiver Conducted Spurious Emssion	Complies
§ 80.215	Maximum Transmitter Power	Complies
§ 80.213	Modulation Characteristic	Complies
§ 80.205	Occupied Bandwidth	Complies
§ 80.211(f)	Emission Mask	Complies
§ 80.209	Frequency Stability	Complies
§ 80.211(f)(3)	Transmitter Radiated Spurious Emssion	Complies
§ 80.211(f)(3)	Spurious Emssion On Antenna Port	Complies

3.8. Equipments Used during the Test

AC Power Conducted Emission				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Artificial Mains	Rohde&Schwarz	ESH2-Z5	100028	10/27/2013
EMI Test Receiver	Rohde&Schwarz	ESCS 30	100038	10/27/2013
Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	10/27/2013
EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	10/27/2013
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/27/2013

Modulation Characteristic				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/27/2013

Transient Frequency Behavior				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Signal Generator	Rohde&Schwarz	SMT03	100059	10/27/2013
Storage Oscilloscope	Tektronix	TDS3054B	B033027	10/27/2013
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/27/2013

Transmitter Radiated Spurious Emssion & Receiver Radiated Spurious Emssion				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Ultra-Broadband Antenna	Rohde&Schwarz	HL562	100015	10/27/2013
EMI Test Receiver	Rohde&Schwarz	ESI 26	100009	10/27/2013
RF Test Panel	Rohde&Schwarz	TS / RSP	335015/ 0017	N/A
HORN ANTENNA	Rohde&Schwarz	HF906	100039	10/27/2013
Turntable	ETS	2088	2149	N/A
Antenna Mast	ETS	2075	2346	N/A
EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	10/27/2013
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/27/2013
Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	10/27/2013
Ultra-Broadband Antenna	ShwarzBeck	VULB9163	539	10/27/2013
HORN ANTENNA	ShwarzBeck	9120D	1012	10/27/2013
HORN ANTENNA	ShwarzBeck	9120D	1011	10/27/2013
TURNTABLE	MATURO	TT2.0	----	10/27/2013
ANTENNA MAST	MATURO	TAM-4.0-P	----	10/27/2013

Frequency Stability				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Communication Test Set	HP	HP8920B	US35010135	10/27/2013
Signal Generator	Rohde&Schwarz	SMT03	100059	10/27/2013
Climate Chamber	ESPEC	EL-10KA	05107008	10/27/2013

Maximum Transmitter Power & Spurious Emission On Antenna Port & Occupied Bandwidth & Emission Mask				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Receiver	Rohde&Schwarz	ESI 26	100009	10/27/2013
Attenuator	R&S	ESH3-22	100449	10/27/2013
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	10/27/2013
High-Pass Filter	Anritsu	MP526B	6220875256	10/27/2013
High-Pass Filter	Anritsu	MP526D	6220878392	10/27/2013
Spectrum Analyzer	Agilent	E4407B	MY44210775	10/27/2013
Spectrum Analyzer	Rohde&Schwarz	FSP40	1164.4391.40	10/27/2013

The calibration interval was one year.

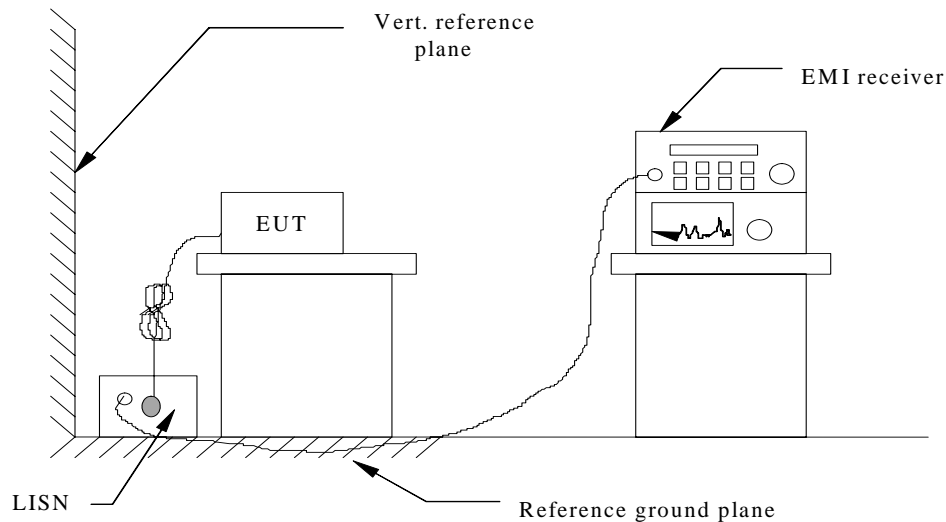
4. TEST CONDITIONS AND RESULTS

4.1. Conducted Emissions Test

TEST APPLICABLE

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

TEST CONFIGURATION



TEST PROCEDURE

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

Conducted Power Line Emission Limit

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

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

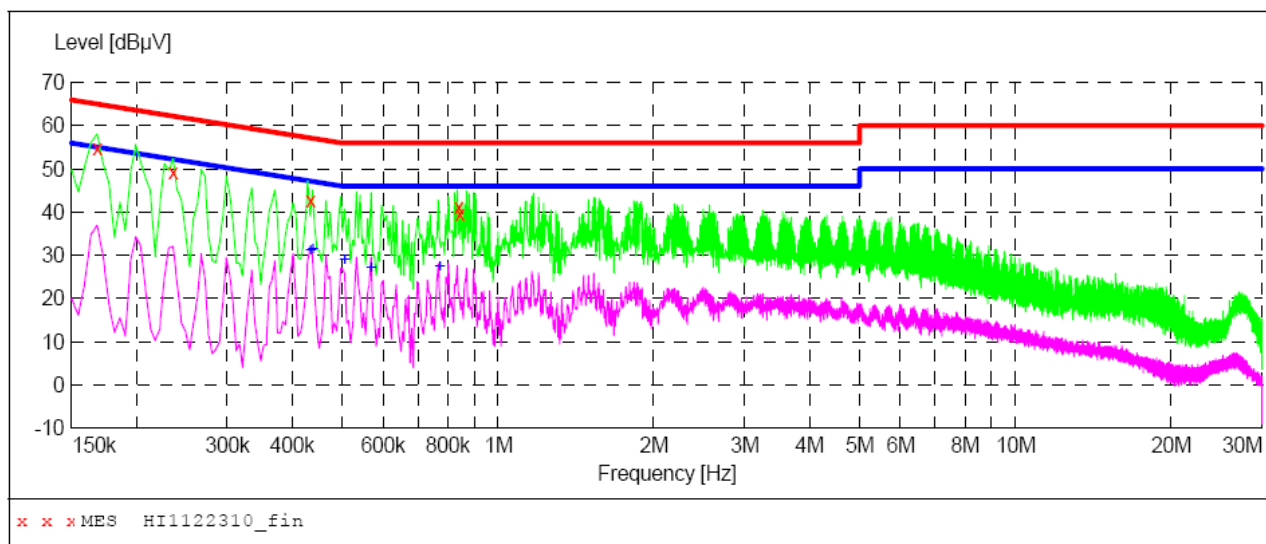
* Decreasing linearly with the logarithm of the frequency

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

TEST RESULTS

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

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "HI1122310_fin"

11/22/2012 1:39PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.168000	54.90	10.1	65	10.2	QP	N	GND
0.235500	49.20	10.1	62	13.1	QP	N	GND
0.433500	42.80	10.1	57	14.4	QP	N	GND
0.838500	41.30	10.1	56	14.7	QP	N	GND
0.843000	39.60	10.1	56	16.4	QP	N	GND

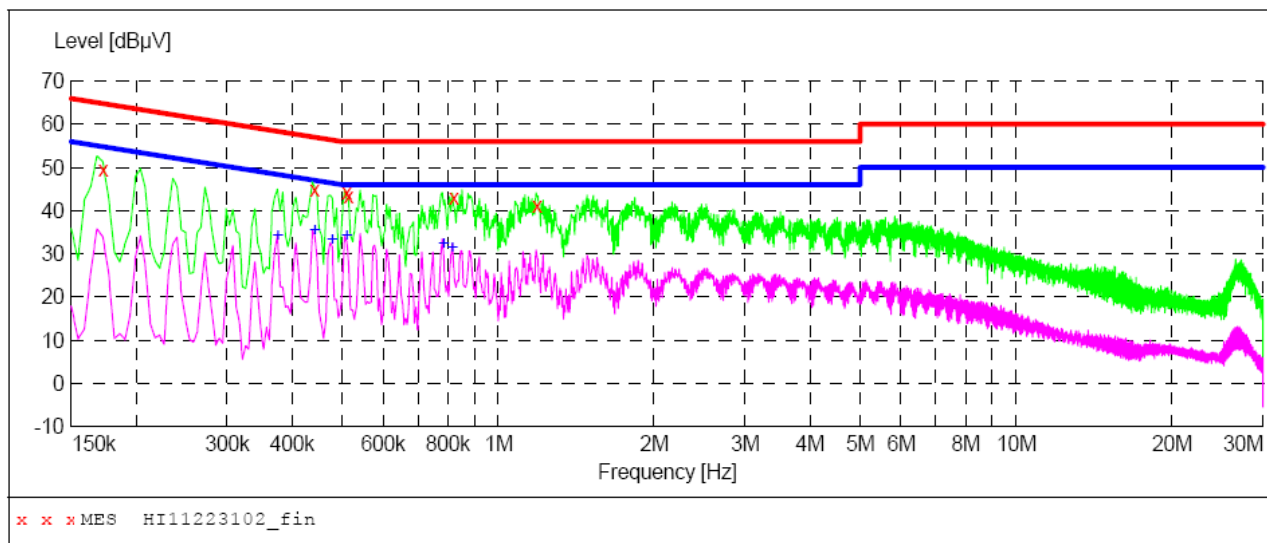
MEASUREMENT RESULT: "HI1122310_fin2"

11/22/2012 1:39PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.433500	31.40	10.1	47	15.8	AV	N	GND
0.438000	31.70	10.1	47	15.4	AV	N	GND
0.505500	29.00	10.1	46	17.0	AV	N	GND
0.568500	27.20	10.1	46	18.8	AV	N	GND
0.771000	27.40	10.1	46	18.6	AV	N	GND

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

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "HI11223102_fin"**

11/22/2012 1:45PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.172500	49.60	10.1	65	15.2	QP	L1	GND
0.442500	45.00	10.1	57	12.0	QP	L1	GND
0.510000	44.20	10.1	56	11.8	QP	L1	GND
0.514500	43.40	10.1	56	12.6	QP	L1	GND
0.820500	43.20	10.1	56	12.8	QP	L1	GND
1.189500	41.20	10.2	56	14.8	QP	L1	GND

MEASUREMENT RESULT: "HI11223102_fin2"

11/22/2012 1:45PM

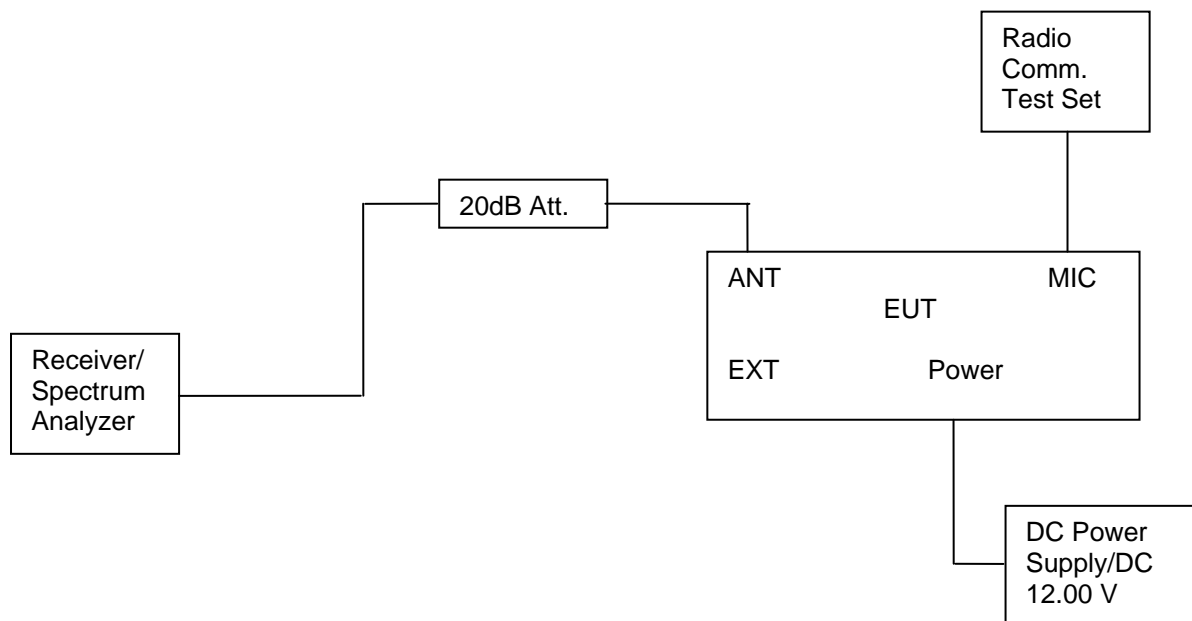
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.375000	34.40	10.1	48	14.0	AV	L1	GND
0.442500	35.60	10.1	47	11.4	AV	L1	GND
0.478500	33.40	10.1	46	13.0	AV	L1	GND
0.510000	34.30	10.1	46	11.7	AV	L1	GND
0.784500	32.60	10.1	46	13.4	AV	L1	GND
0.816000	31.50	10.1	46	14.5	AV	L1	GND

4.2. Occupied Bandwidth and Emission Mask Test

TEST APPLICABLE

- (a). Occupied Bandwidth: The EUT was connected to the audio signal generator and the spectrum analyzer via the main RF connector, and through an appropriate attenuator. The EUT was controlled to transmit its maximum power. Then the bandwidth of 99% power can be measured by the spectrum analyzer.
- (b). Emission Mask B: For transmitters that are equipped with an audio low-pass filter pursuant to §80.211(f), the power of any emission must be below the unmodulated carrier power (P) as follows:
- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
 - (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
 - (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.
- (c). Emission Mask D, 25 KHz channel bandwidth equipment: For transmitters designed to operate with a 25 KHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
- (1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.
 - (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 25 KHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
 - (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 25 KHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

TEST CONFIGURATION



TEST PROCEDURE

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

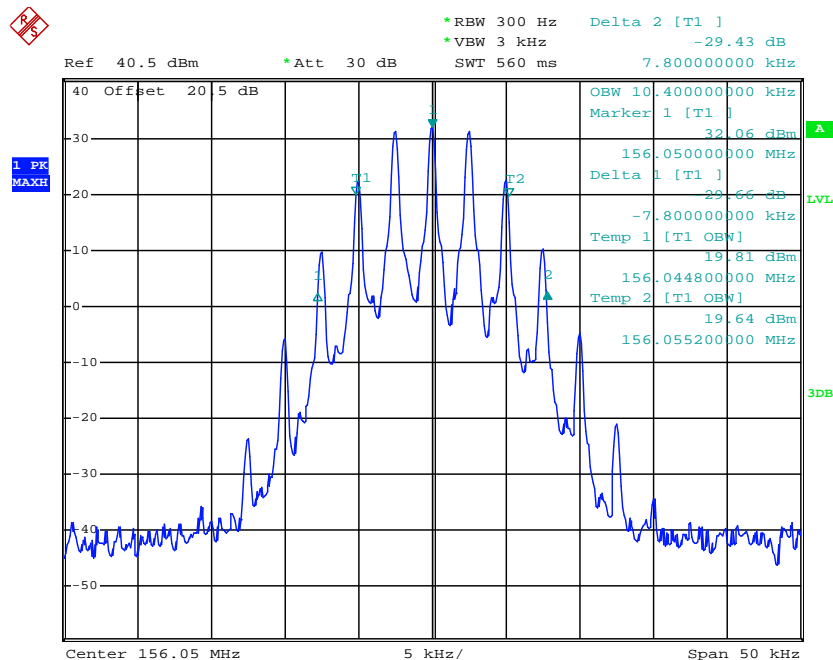
TEST RESULTS

4.2.1 Occupied Bandwidth

Modulation Type	Channel Sparation	Test Channel	Test Frequency	99% Occupied Bandwidth	26dB Occupied Band width
FM	25KHz	Low	156.0500 MHz	9.50 KHz	10.50 KHz
		Middle	156.8000 MHz	9.70 KHz	10.60 KHz
		High	157.4250 MHz	9.80 KHz	10.60 KHz
		DSC	156.525 MHz	9.10 KHz	13.20 KHz
Limit		20 KHz for 25KHz Channel Separation			
Test Results		Compliance			

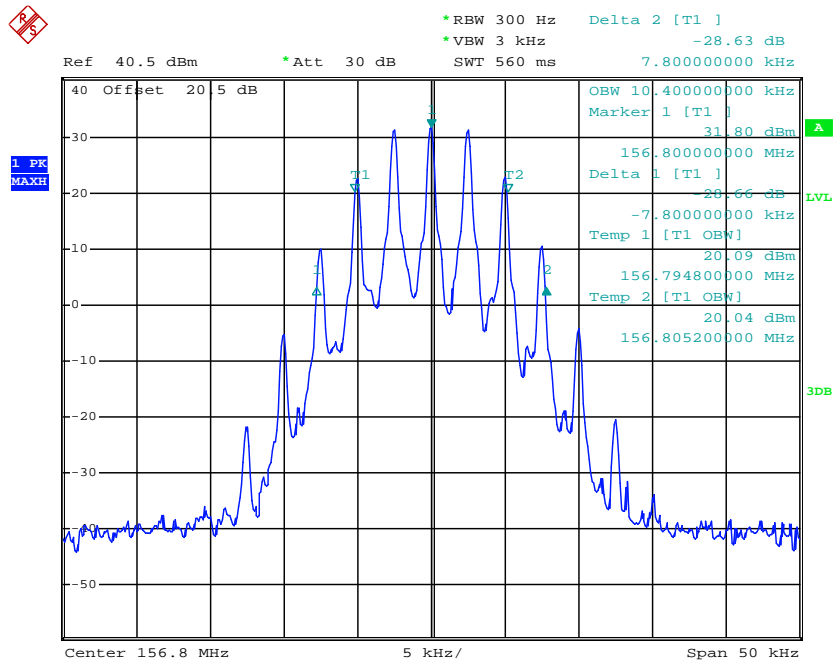
Plots of 99% and 26dB Bandwidth Measurement

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	25 KHz	156.0500	10.40	15.60	20	Compliance



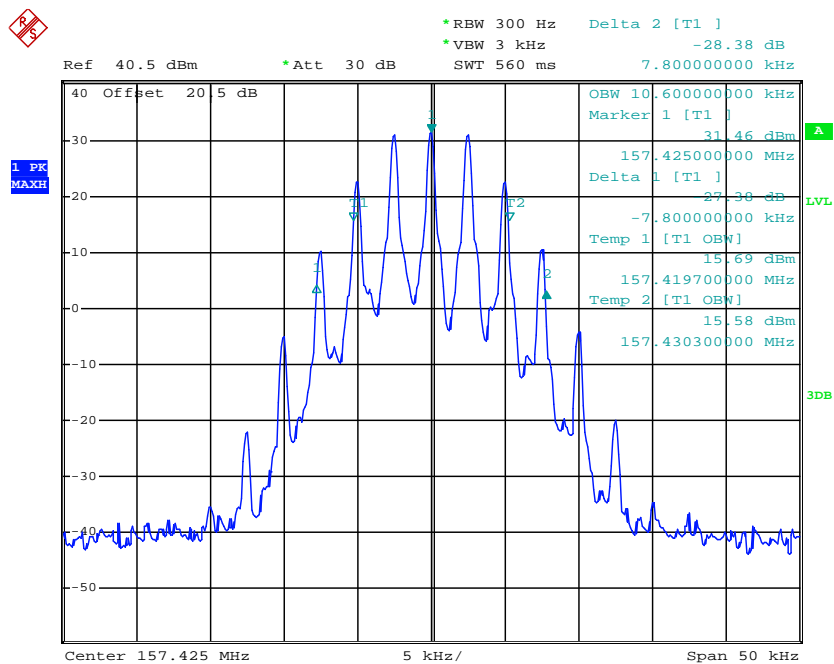
Date: 26.NOV.2012 10:09:33

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	25 KHz	156.8000	10.40	15.60	20	Complicance



Date: 26.NOV.2012 10:04:30

Modulation Type	Channel Separation	Freq.(MHz)	99% Bandwidth (KHz)	26dB Bandwidth (KHz)	FCC Limit (KHz)	Results
FM	25 KHz	157.4250	10.60	15.60	20	Complicance



Date: 26.NOV.2012 09:55:18

4.2.2 Emission Mask

Modulation Type	Channel Sparation	Test Channel	Test Frequency	FCC Applicable Mask	RBW
FM	25 KHz	Low	156.0500 MHz	B	100 Hz
		Middle	156.8000 MHz	B	100 Hz
		High	157.4250 MHz	B	100 Hz
		DSC	156.5250 MHz	B	100 Hz
Test Results		Compliance			

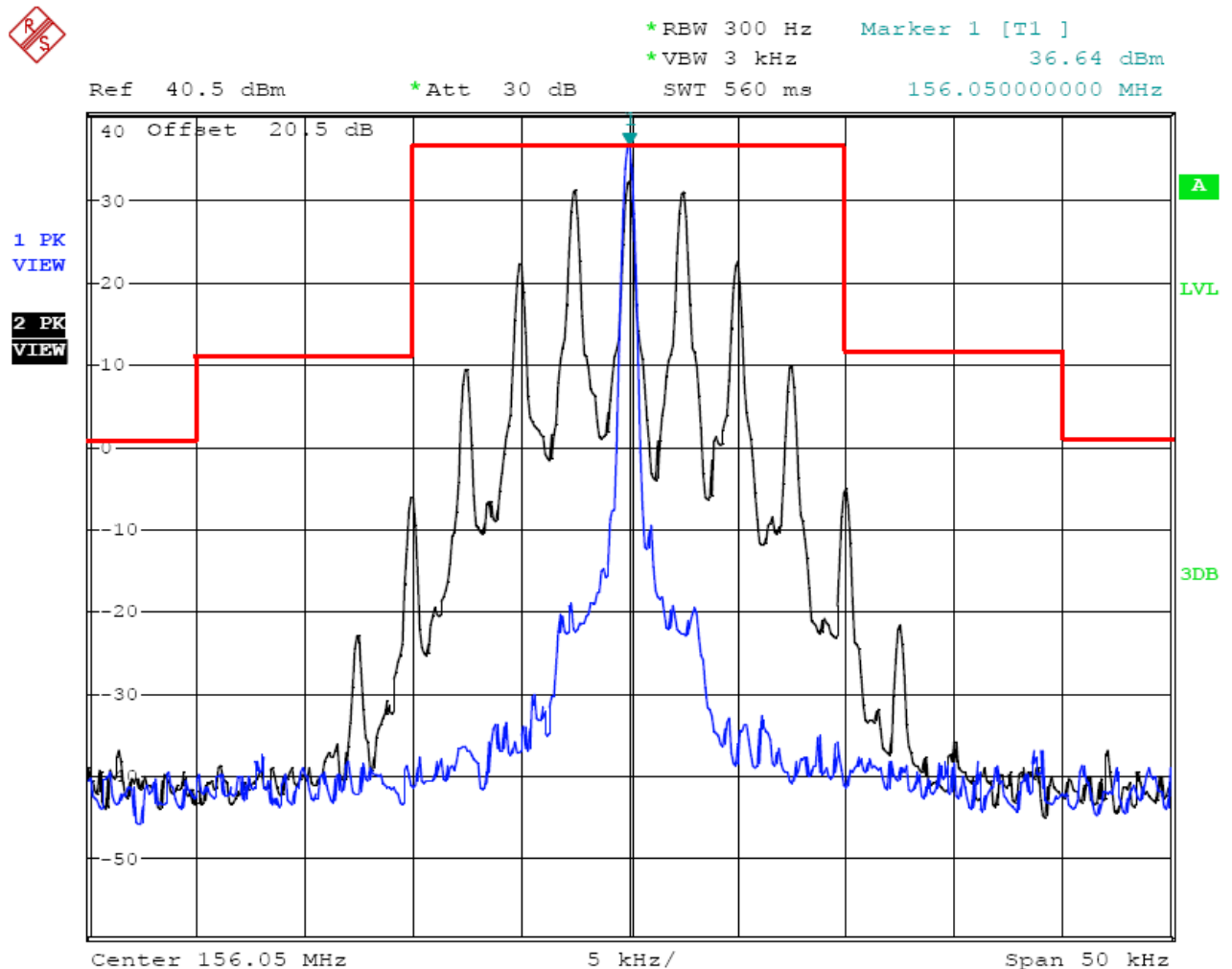
Plots of Emission Mask Measurement

Referred as the attached plot hereinafter

Note: The Blue curve represents unmodulated signal.

The Black curve represents modulated signal.

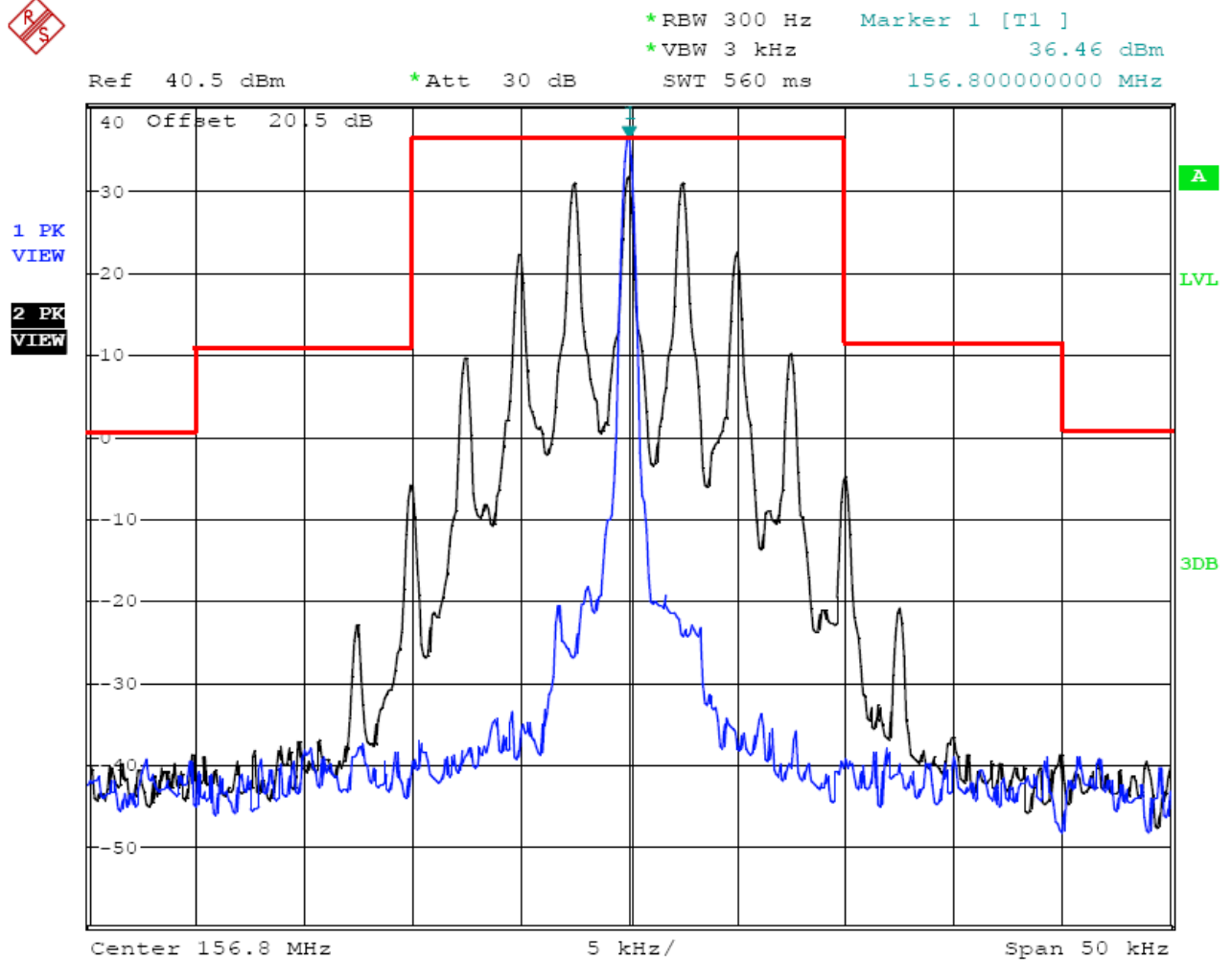
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	25 KHz	156.0500	B	300	2.5	Compliance



Date: 26.NOV.2012 10:11:11

25 KHz Channel Spacing, 156.0500 MHz, 2500 Hz Audio Modulation Only

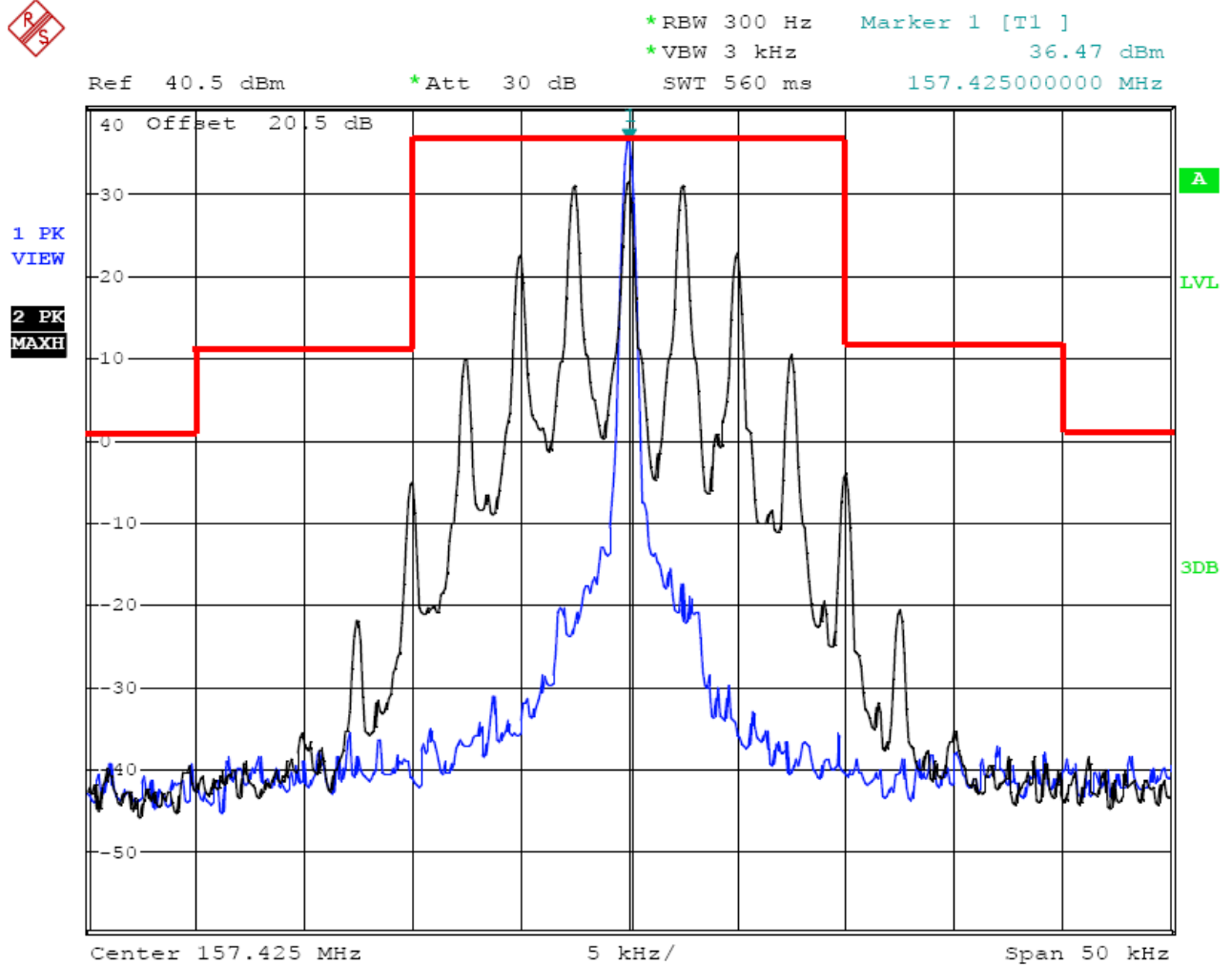
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	25 KHz	156.8000	B	300Hz	2.5	Compliance



Date: 26.NOV.2012 10:05:41

25 KHz Channel Spacing, 156.8000 MHz, 2500 Hz Audio Modulation Only

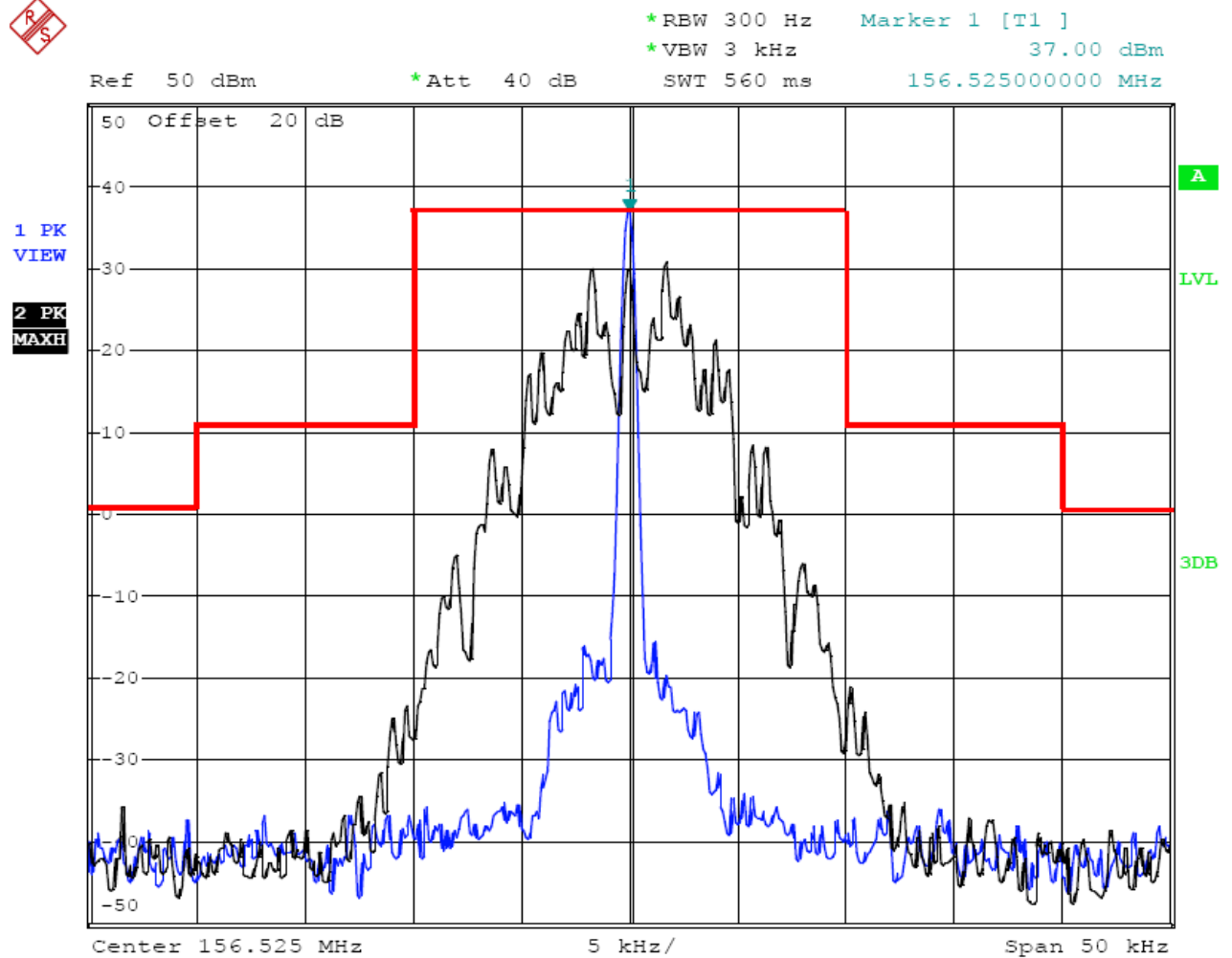
Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	25 KHz	157.4250	B	300Hz	2.5	Compliance



Date: 26.NOV.2012 09:56:18

25 KHz Channel Spacing, 157.4250 MHz, 2500 Hz Audio Modulation Only

Modulation Type	Channel Separation	Freq.(MHz)	FCC Applicable Mask	RBW	Audio Freq. (KHz)	Results
FM	25 KHz	156.5250	B	300	2.5	Compliance



Date: 19.FEB.2013 11:15:53

25 KHz Channel Spacing, 156.5250 MHz, 2500 Hz Audio Modulation Only

4.3. Transmitter Radiated Spurious Emission

TEST APPLICABLE

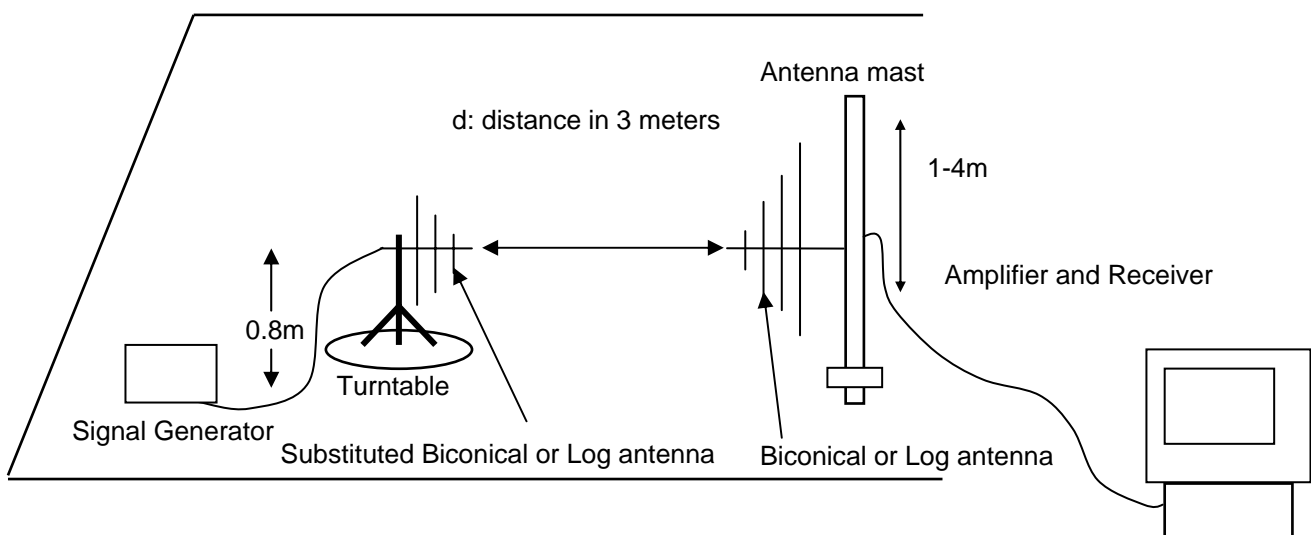
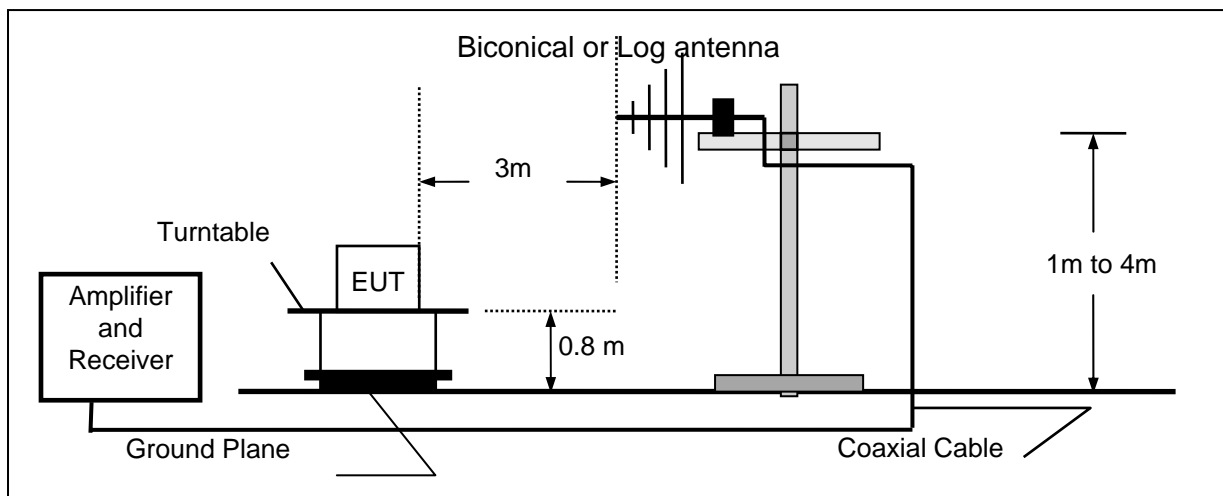
According to the TIA/EIA 603 test method, and according to Section 80.211, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 25 KHz channel bandwidth:

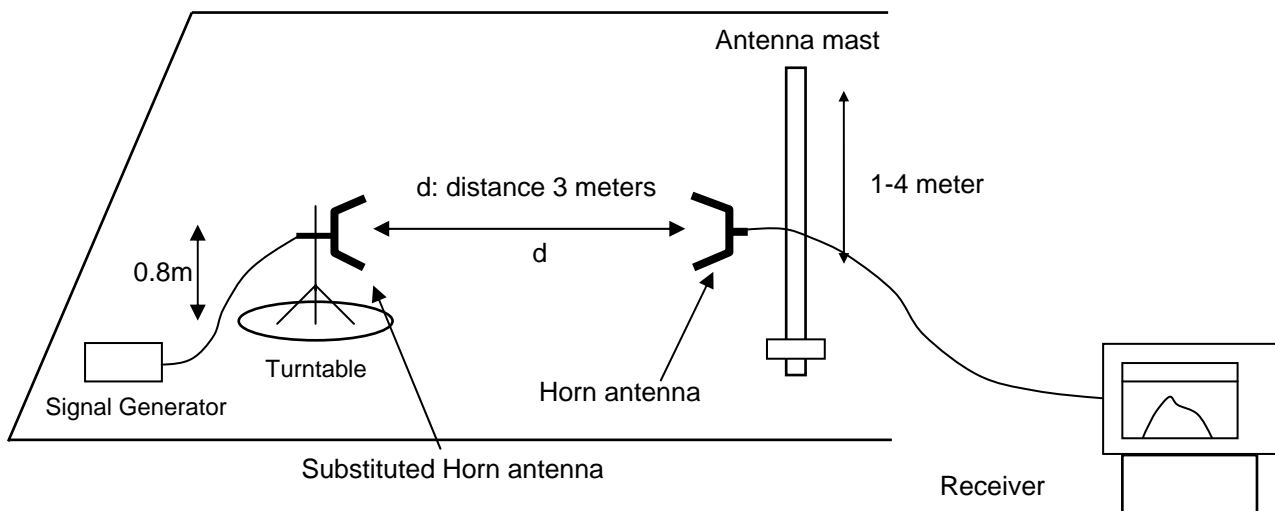
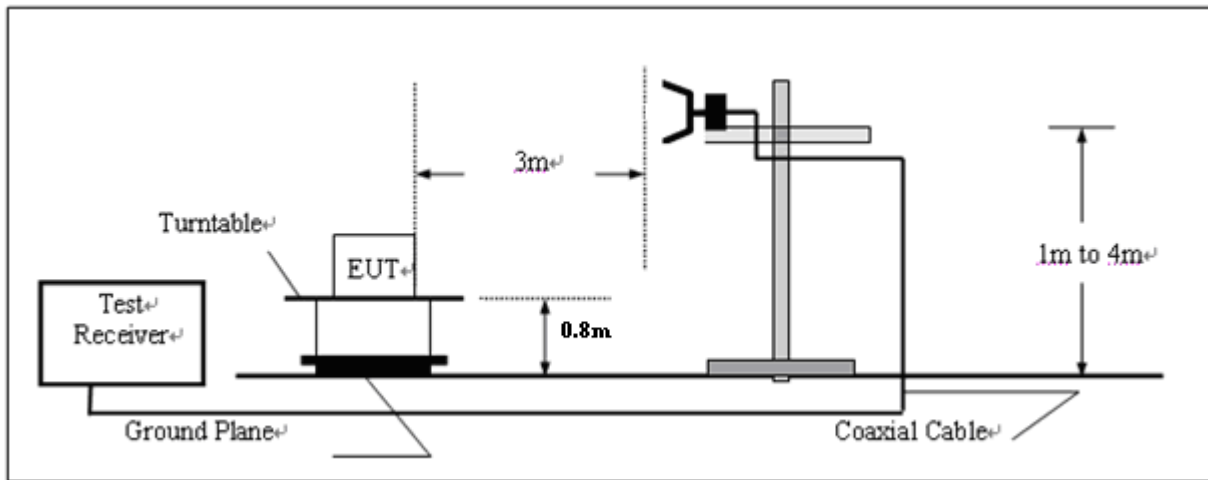
- 1 On any frequency removed from the center of the authorized bandwidth f_0 to 5.625 KHz removed from f_0 : Zero dB
 - 2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) f_0 of more than 5.625 KHz but no more than 25 KHz: At least 7.27dB
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

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

TEST CONFIGURATION

Below 1GHz



Above 1GHz**TEST PROCEDURE**

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

- 11 The transmitter was rotated through 360° about a vertical axis until a higher maximum signal was received.
- 12 Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
- 13 Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
- 14 Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

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

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

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

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

Where:

 - P: Actual RF Power fed into the substitution antenna port after corrected.
 - P₁: Power output from the signal generator
 - P₂: Power measured at attenuator A input
 - P₃: Power reading on the Average Power Meter
 - EIRP: EIRP after correction
 - ERP: ERP after correction
- 15 Adjust both transmitting and receiving antenna in a Horizontal polarization, then repeat step (11) to (14).
- 16 Repeat step (4) to (16) for different test frequency
- 17 Repeat steps (3) to (12) with the substitution antenna oriented in horizontal polarization.
- 18 Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

TEST RESULTS

The Transmitter Radiated Spurious Emission was performed to the Rated high power (5Watt) and Rated low power (1Watt) the datum that reported below is the worst case (Rated high power) of the two rated power conditions.

Modulation Type: FM

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

Low: $43 + 10 \log (\text{Pwatts}) = 43 + 10 \log (11.67) = 60.67 \text{ dB}$

High: $43 + 10 \log (\text{Pwatts}) = 43 + 10 \log (11.80) = 60.72 \text{ dB}$

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

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

Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 40.72 dBm.

Limit (dBm) = 40.72-43-10log10 (11.80) = -20 dBm

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

2. The measurement frequency range from 30 MHz to 4 GHz.

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

Modulation		FM		Channel Separation		25 KHz		
Test Channel		Low Channel		Test Frequency		156.0500 MHz		
Frequency (MHz)	E-Field Level (dBuV/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method (dBm)	Limit (dBm)	Margin (dB)
312.10	52.27	Peak	H	200	254	-45.73	-13	25.73
624.20	49.11	Peak	H	102	187	-43.22	-13	23.22
1404.45	46.64	Peak	H	100	265	-46.48	-13	26.48
...	...		H					
312.10	53.92	Peak	V	150	189	-44.08	-13	24.08
624.20	48.95	Peak	V	106	07	-43.71	-13	23.71
1404.45	45.58	Peak	V	120	310	-46.98	-13	26.98
...	...		V					

Modulation		FM		Channel Separation		25 KHz		
Test Channel		Middle Channel		Test Frequency		156.8000 MHz		
Frequency (MHz)	E-Field Level (dBuV/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method (dBm)	Limit (dBm)	Margin (dB)
313.60	53.17	Peak	H	100	312	-44.83	-13	24.83
627.20	52.01	Peak	H	125	85	-40.32	-13	20.32
1411.20	44.86	Peak	H	120	165	-48.26	-13	28.26
...	...		H					
313.60	53.19	Peak	V	100	45	-44.81	-13	24.81
627.20	50.81	Peak	V	100	123	-41.85	-13	21.85
1411.20	42.91	Peak	V	120	163	-49.65	-13	29.65
...	...		V					

Modulation		FM		Channel Separation		25 KHz		
Test Channel		High Channel		Test Frequency		157.4250 MHz		
Frequency (MHz)	E-Field Level (dBuV/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method (dBm)	Limit (dBm)	Margin (dB)
314.85	52.21	Peak	H	220	256	-45.79	-13	25.79
629.70	48.82	Peak	H	150	360	-43.51	-13	23.51
1259.40	43.66	Peak	H	210	112	-49.46	-13	29.46
...	...		H					
314.85	51.95	Peak	V	100	258	-46.05	-13	26.05
629.70	48.58	Peak	V	125	125	-44.08	-13	24.08
1259.40	43.57	Peak	V	150	352	-48.99	-13	28.99
...	...		V					

Modulation		FM		Channel Separation		25 KHz		
Test Channel		Low Channel		Test Frequency		156.5250 MHz		
Frequency (MHz)	E-Field Level (dBuV/m)	EMI Detector (Peak/QP)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	ERP measured by Substitution Method (dBm)	Limit (dBm)	Margin (dB)
313.05	53.25	Peak	H	100	125	-43.25	-13	30.25
626.10	48.69	Peak	H	100	205	-42.05	-13	29.05
1252.20	47.21	Peak	H	100	221	-45.22	-13	32.22
...	...		H					
313.05	54.25	Peak	V	120	320	-46.25	-13	33.25
626.10	47.25	Peak	V	100	35	-42.25	-13	29.25
1252.20	46.21	Peak	V	120	41	-45.20	-13	32.20
...	...		V					

4.4. Spurious Emission on Antenna Port

TEST APPLICABLE

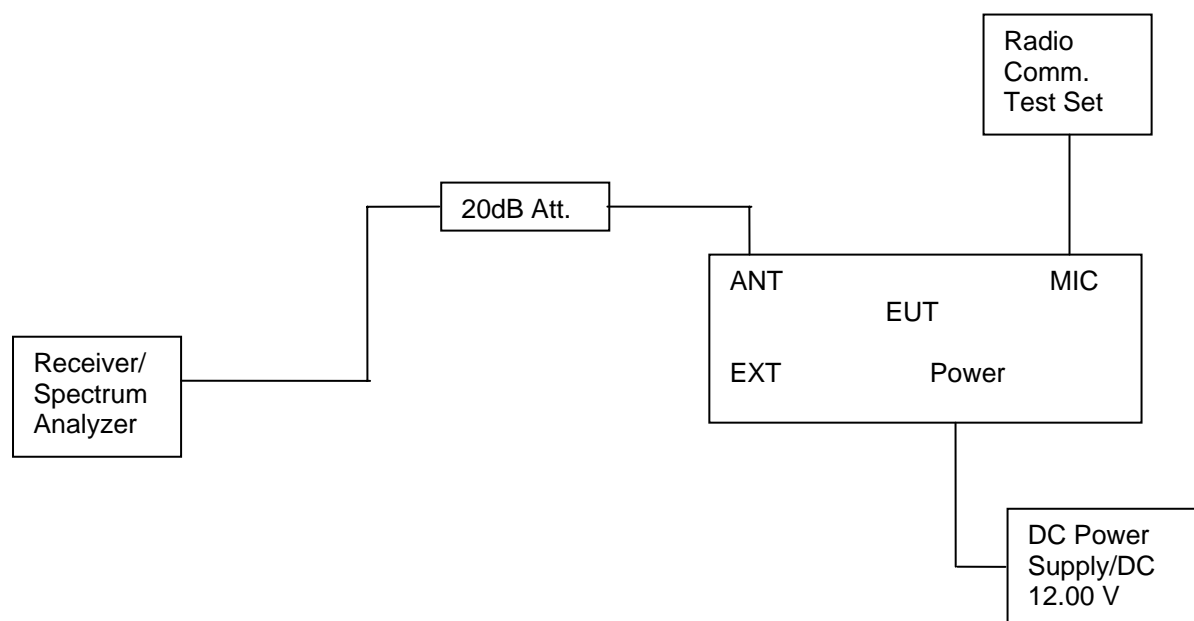
The same as Section 4.3

TEST PROCEDURE

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

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

TEST CONFIGURATION



TEST RESULTS

Modulation Type: FM

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

Low: $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (11.67) = 60.67 \text{ dB}$

High: $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (11.80) = 60.72 \text{ dB}$

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

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

Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 40.72 dBm.

Limit (dBm) = 40.72-43-10log10 (11.80) = -20 dBm

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

2. The measurement frequency range from 30MHz to 4 GHz.

For Rated High Power (5Watt)

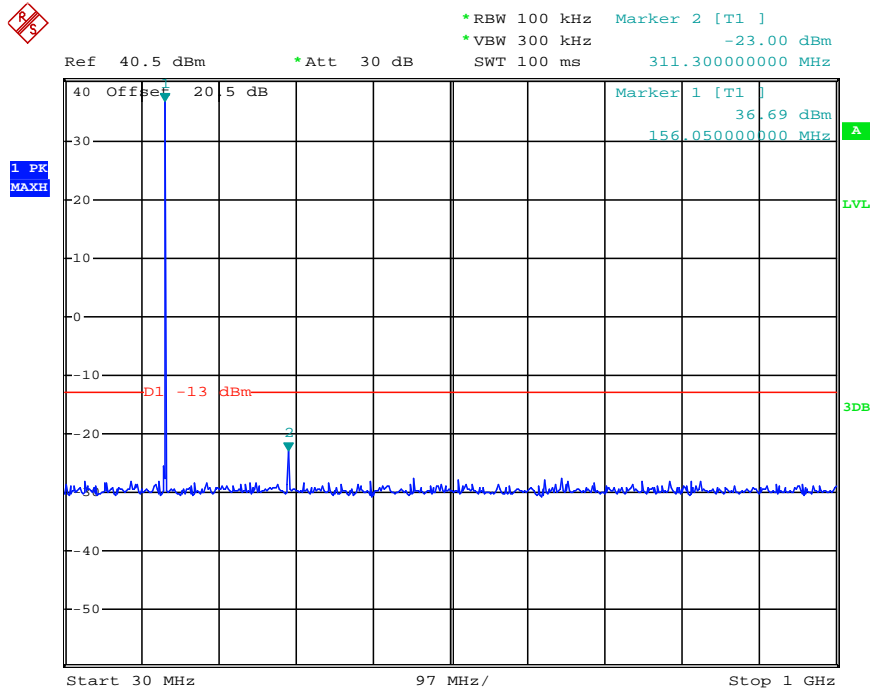
Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz	
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)
FM	25 KHz	Low	156.0500	311.30	--23.00	1216.00	-31.22
		Middle	156.8000	313.24	-23.35	1176.00	-30.53
		High	157.4250	315.18	-24.06	1708.00	-30.65
		DSC	156.5250	313.24	-22.60	1252.00	-30.97
Limit		-13dBm for 25 KHz Channel Separation					
Test Results		Compliance					

For Rated Low Power (1Watt)

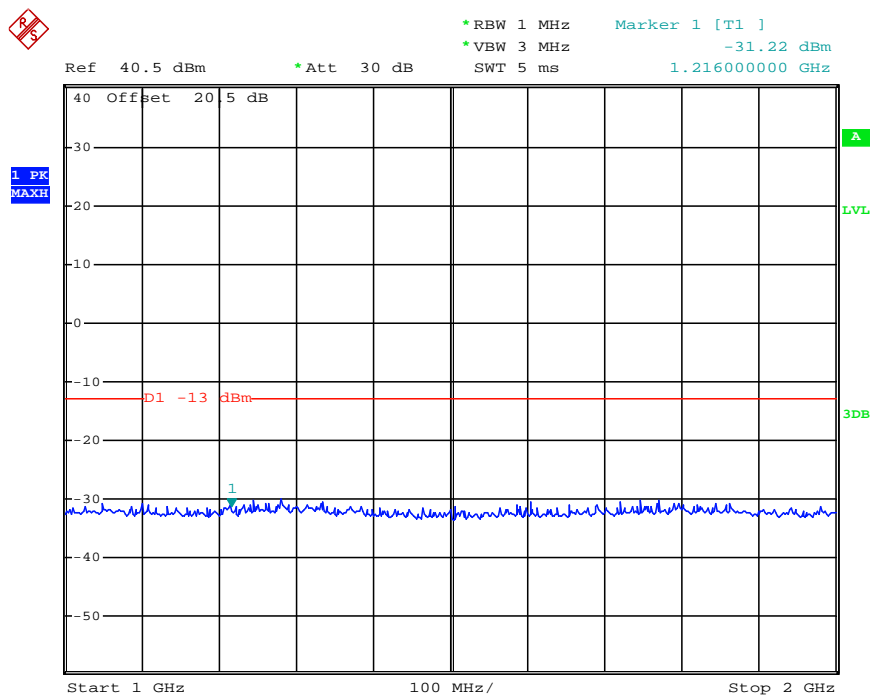
Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz	
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)
FM	25 KHz	Low	156.0500	311.30	-30.54	1310.00	-30.50
		Middle	156.8000	313.24	-29.67	1768.00	-30.61
		High	157.4250	315.18	-27.76	1082.00	-31.12
Limit		-13dBm for 25 KHz Channel Separation					
Test Results		Compliance					

Plots of Spurious Emission on Antenna Port Measurement**For Rated High Power (5Watt)**

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	Low	156.0500	311.30	--23.00	1216.00	-31.22	-13dBm
Test Results				Compliance				

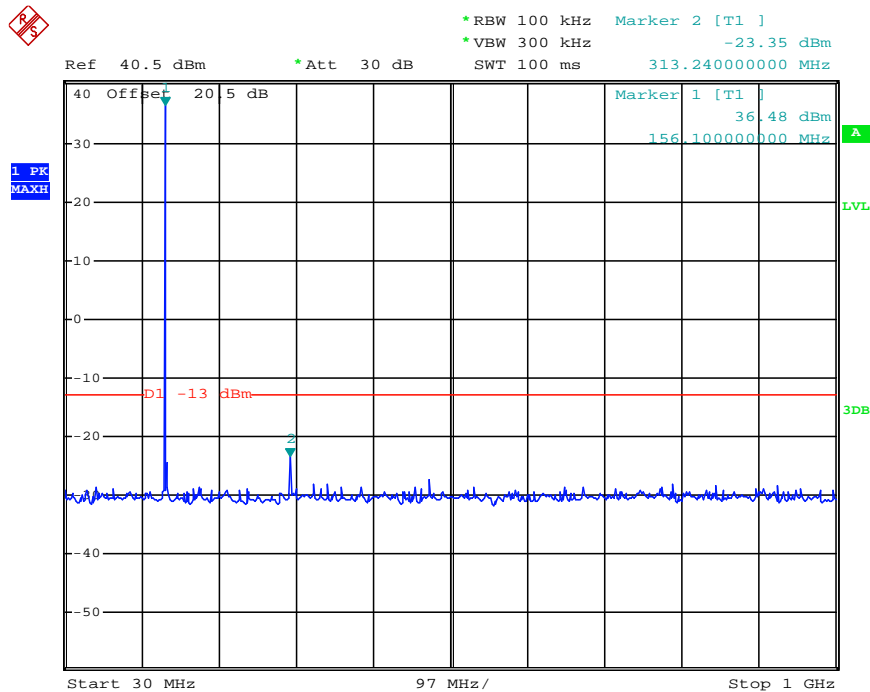


Date: 26.NOV.2012 09:44:42

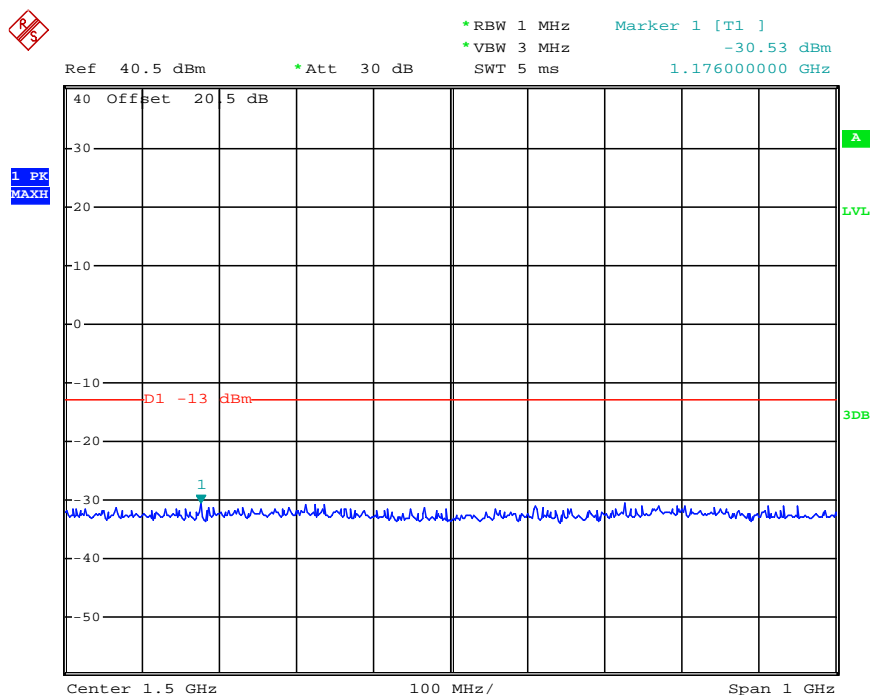


Date: 26.NOV.2012 09:46:34

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	Middle	156.8000	313.24	-23.35	1176.00	-30.53	-13dBm
Test Results				Compliance				

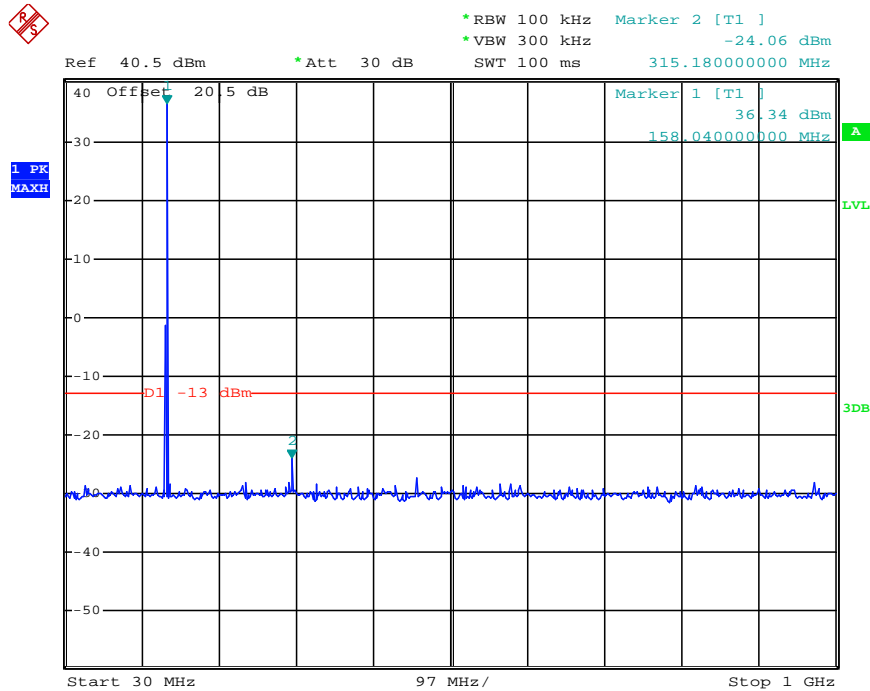


Date: 26.NOV.2012 09:48:18

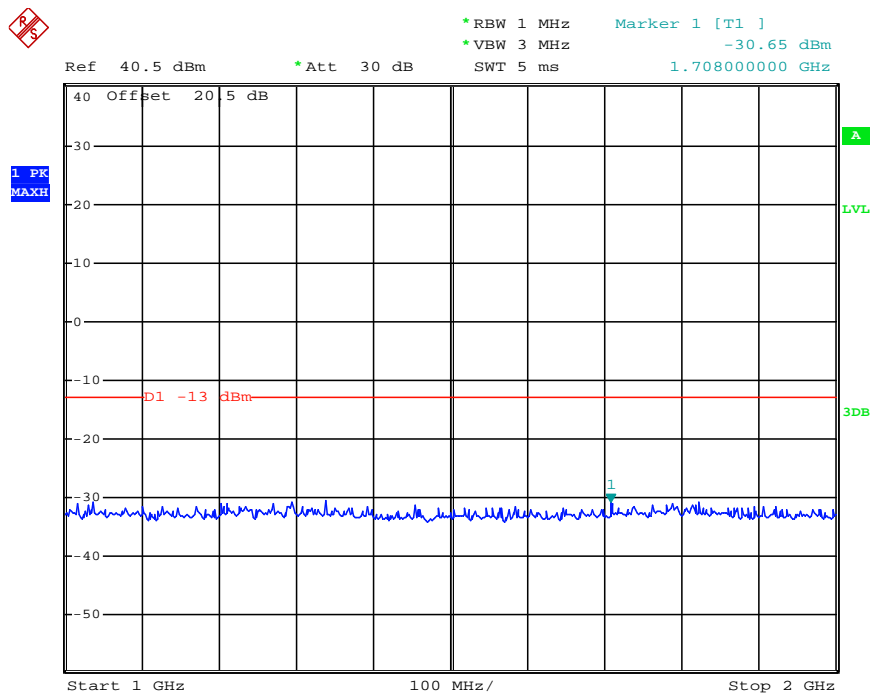


Date: 26.NOV.2012 09:47:30

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	High	157.4250	315.18	-24.06	1708.00	-30.65	-13dBm
Test Results				Compliance				

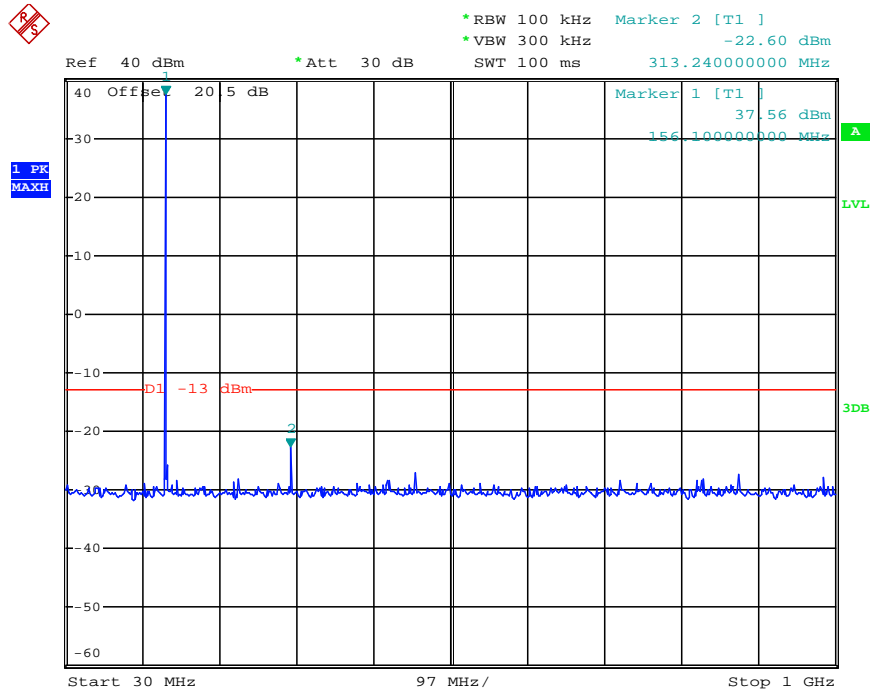


Date: 26.NOV.2012 09:49:22

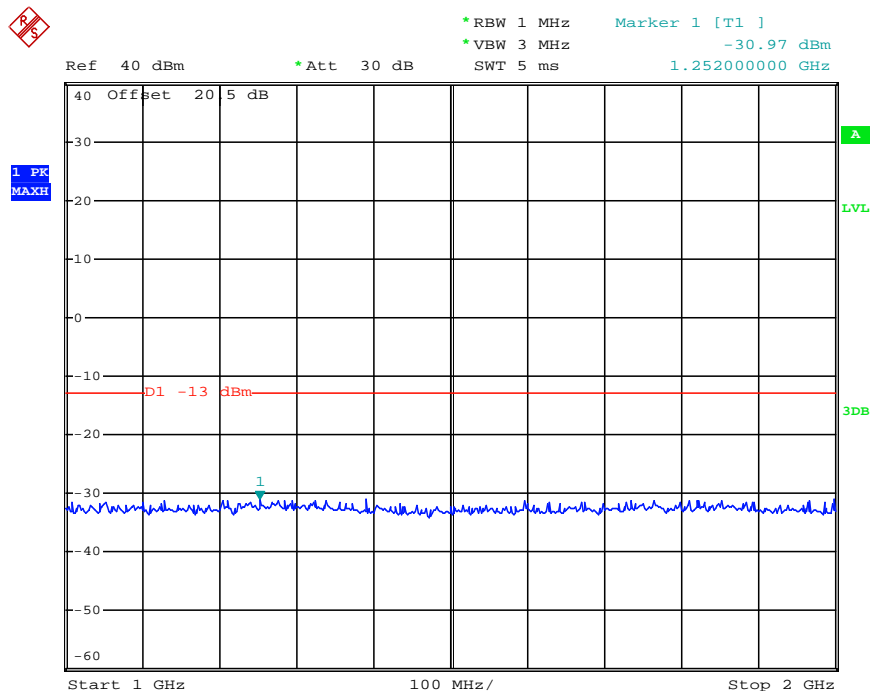


Date: 26.NOV.2012 09:51:07

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	DSC	156.5250	313.24	-22.60	1252.00	-30.97	-13dBm
Test Results				Compliance				



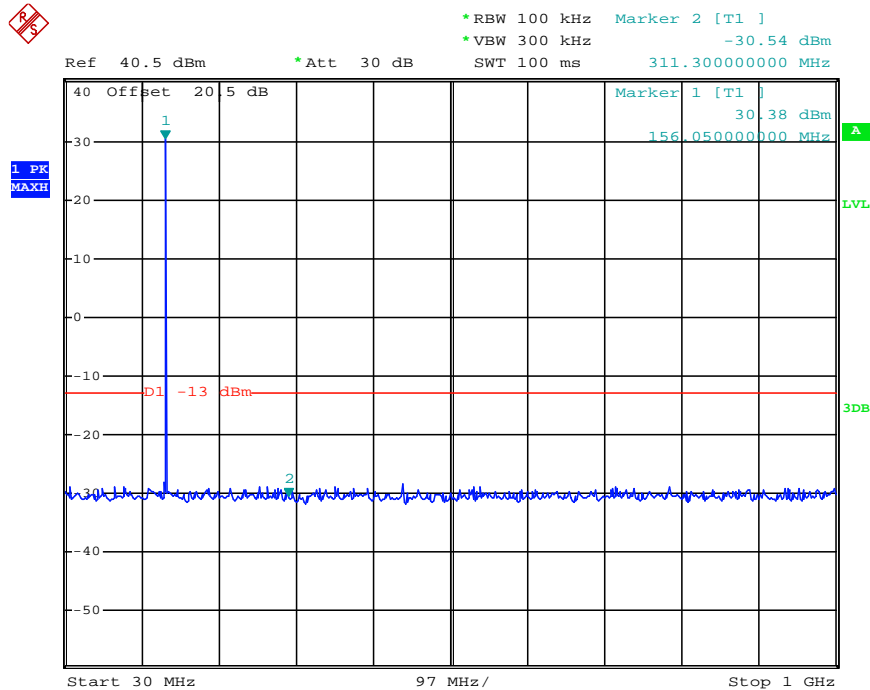
Date: 19.FEB.2013 10:23:29



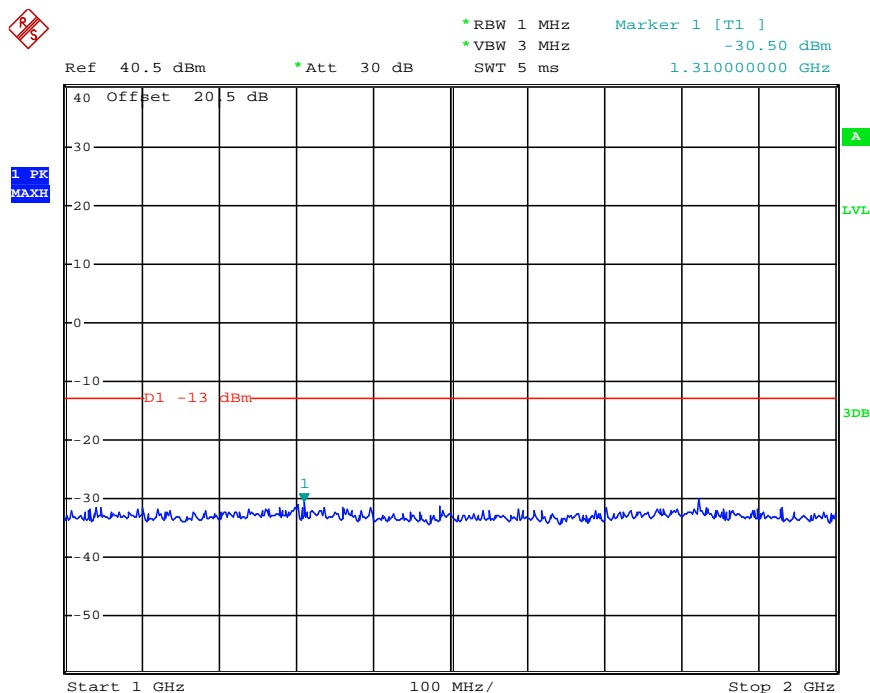
Date: 19.FEB.2013 10:24:01

For Rated Low Power (1Watt)

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	Low	156.0500	311.30	-30.54	1310.00	-30.50	-13dBm
Test Results				Compliance				

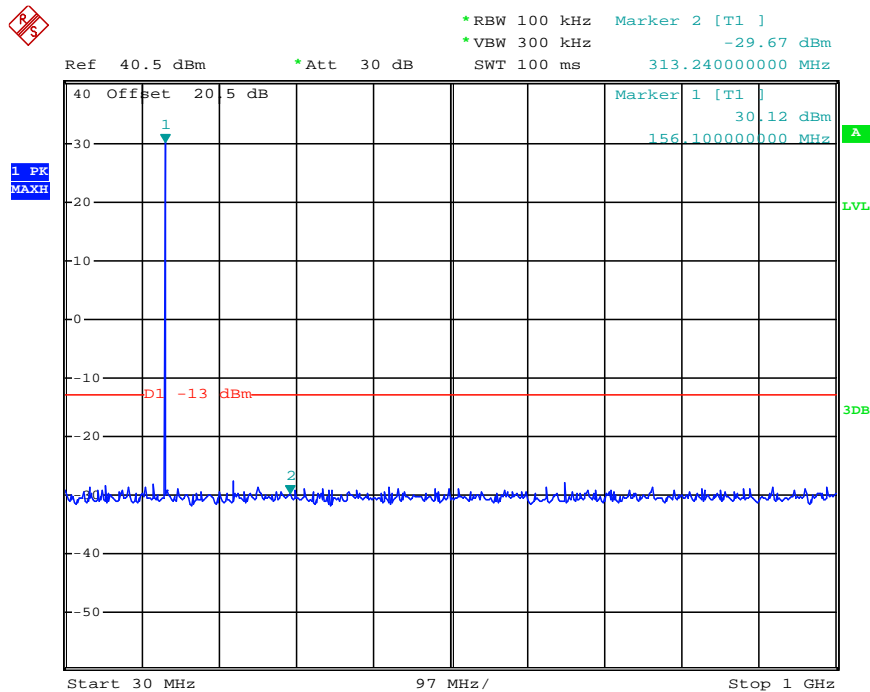


Date: 26.NOV.2012 09:45:01

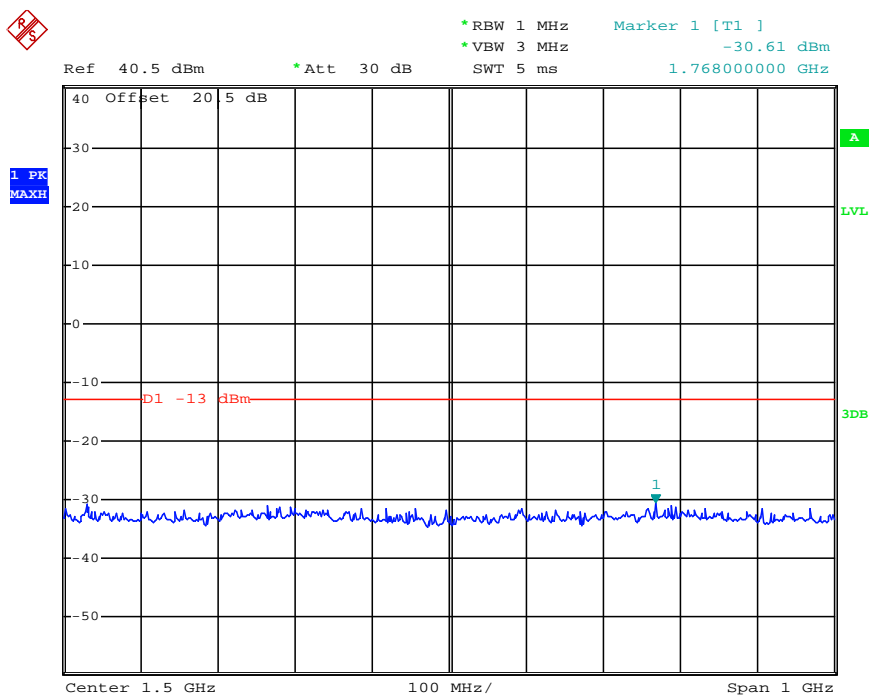


Date: 26.NOV.2012 09:46:53

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	Middle	156.8000	313.24	-29.67	1768.00	-30.61	-13dBm
Test Results				Compliance				

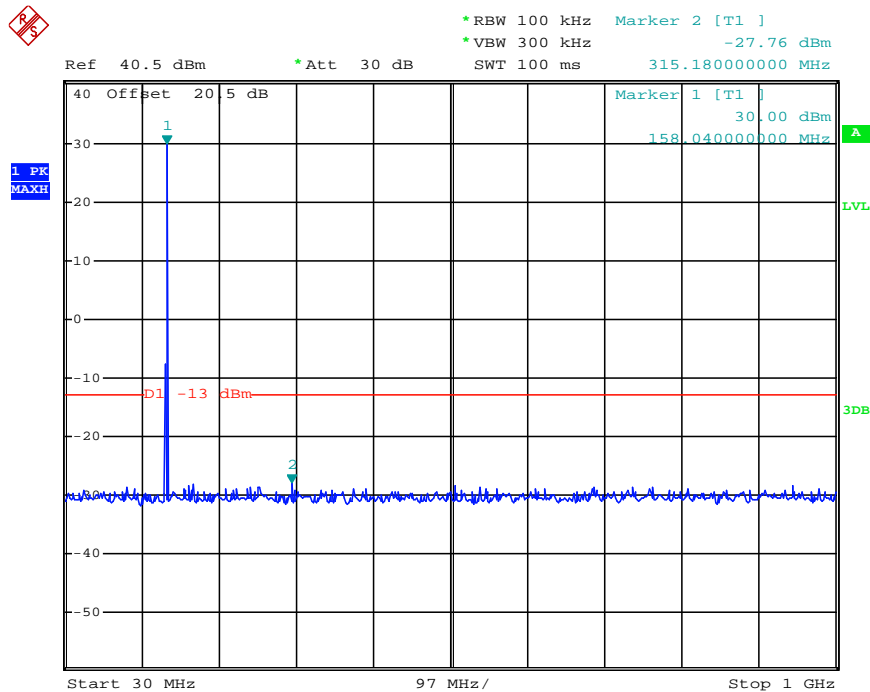


Date: 26.NOV.2012 09:48:37

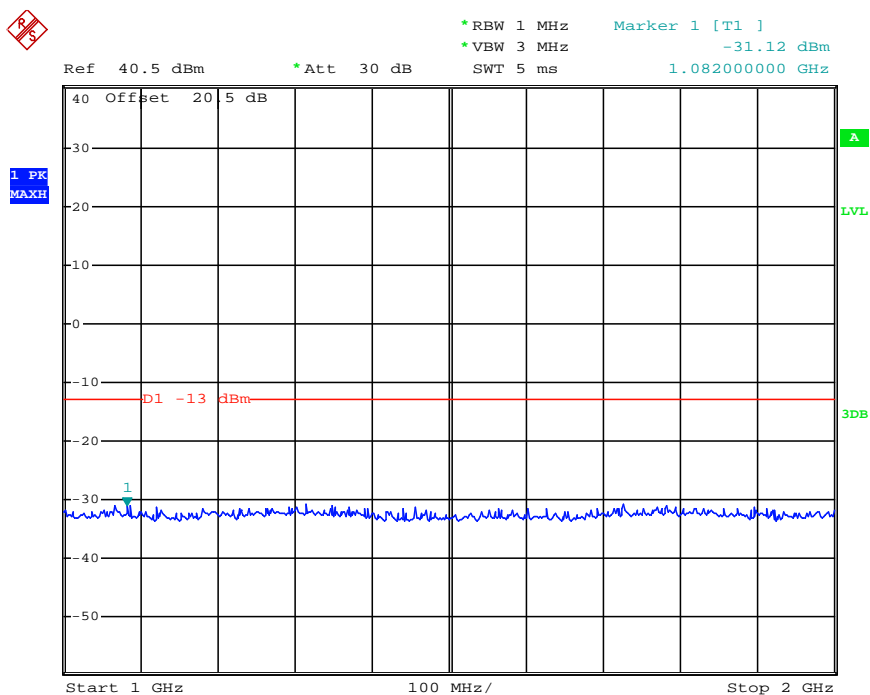


Date: 26.NOV.2012 09:47:46

Modulation Type	Channel SpARATION	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	High	157.4250	315.18	-27.76	1082.00	-31.12	-13dBm
Test Results				Compliance				



Date: 26.NOV.2012 09:49:52



Date: 26.NOV.2012 09:50:48

4.5. Modulation Characteristics

TEST APPLICABLE

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

TEST PROCEDURE

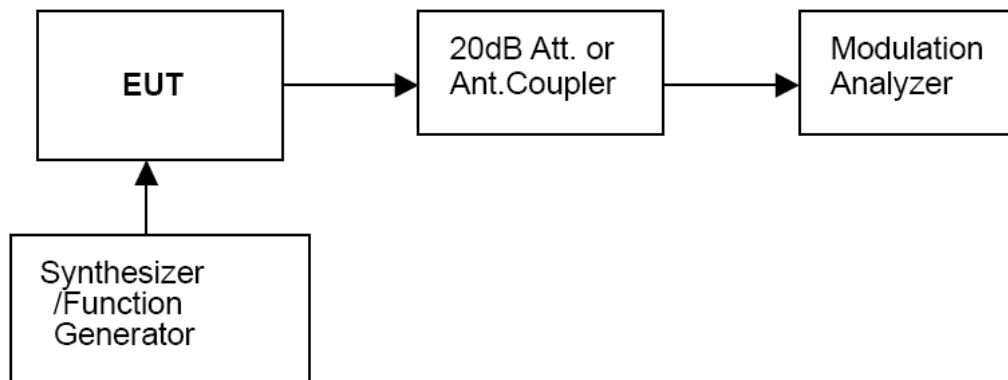
Modulation Limit

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

Audio Frequency Response

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

TEST CONFIGURATION

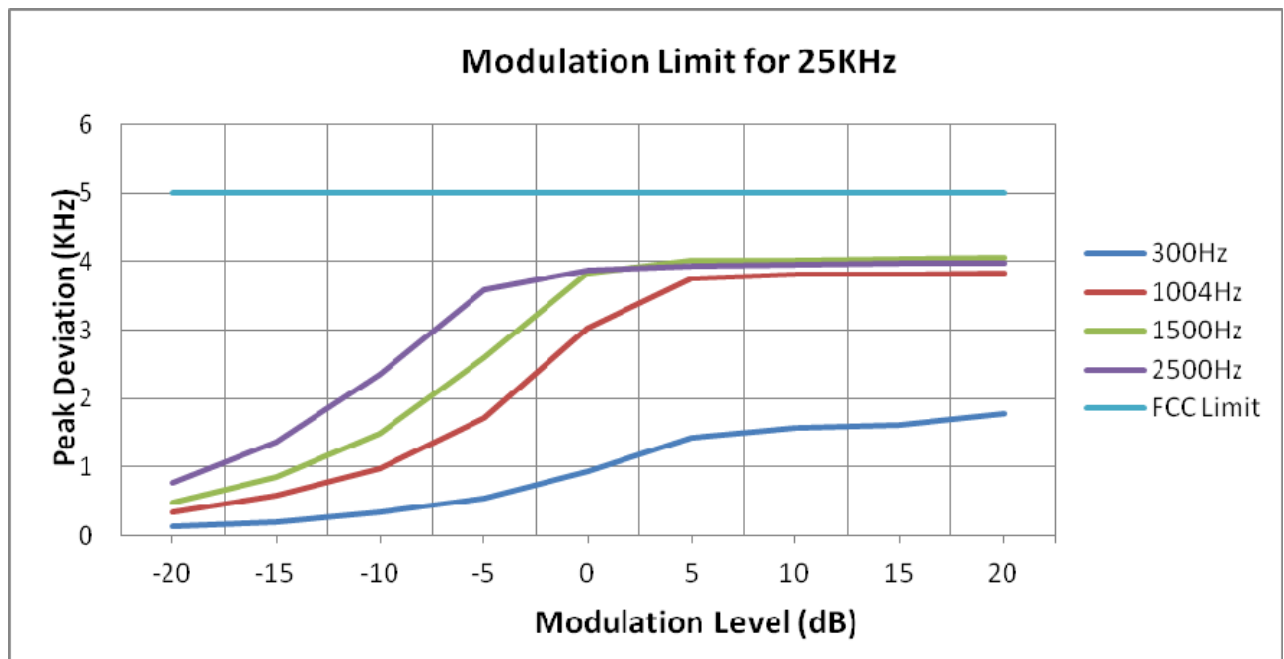


TEST RESULTS

Modulation Type: FM

25 KHz Channel Separation

Modulation Level(dB)	Peak Freq. Deviation At 300 Hz(KHz)	Peak Freq. Deviation At 1004 H(KHz)	Peak Freq. Deviation At 1500 Hz(KHz)	Peak Freq. Deviation At 2500 Hz(KHz)
-20	0.14	0.34	0.49	0.77
-15	0.2	0.58	0.85	1.36
-10	0.34	0.98	1.49	2.35
-5	0.55	1.72	2.61	3.58
0	0.94	3.03	3.83	3.87
+5	1.42	3.76	4.01	3.94
+10	1.58	3.81	4.02	3.95
+15	1.62	3.82	4.05	3.97
+20	1.78	3.84	4.07	3.98



b). Audio Frequency Response:

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

Method of Measurement:

The audio frequency response was measured in accordance with TIA/EIA Specification 603 with no exception. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 300-3000Hz shall be submitted and Audio Post Limiter Low Pass Filter Response from 3.0 KHz to 50KHz. However, the audio frequency response should test from 100Hz to 5.0 KHz according to FCC Part 80.

Modulation Type: FM

The audio frequency response curve is show below.and

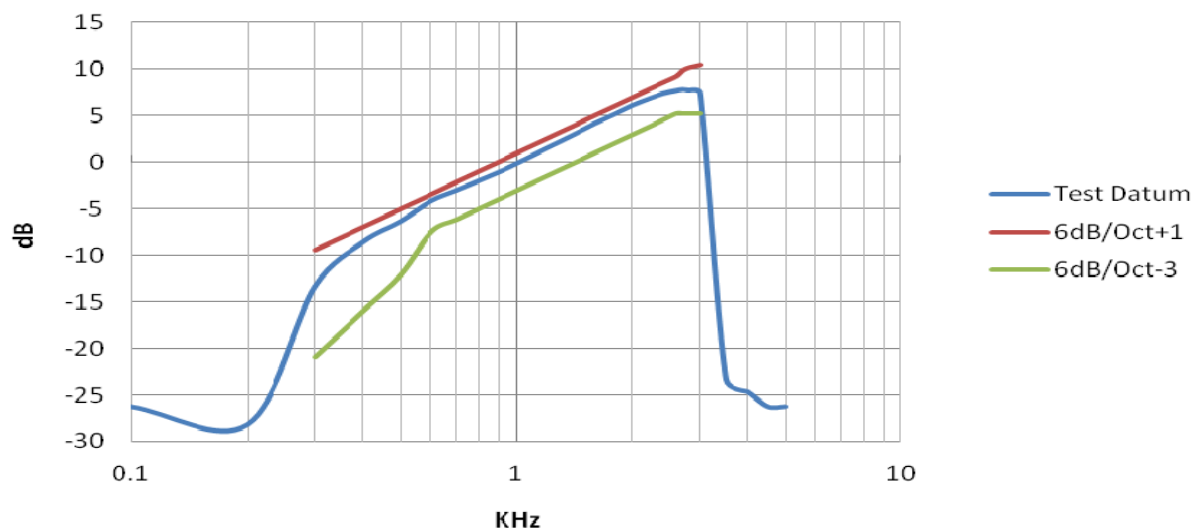
Test Audio Level (1 KHz and 20% maximum deviation) is 2.70mv for 25 KHz channel separation.

Note:

- 1 Not applicable to new standard. However, tests are conducted under FCC's recommendation.
- 2 The Audio Frequency Response is identical for 25 KHz channel separation

25 KHz Channel Separation

Frequency (KHz)	Frequency Deviation (KHz)	1KHz Reference Deviation (KHz)	Audio Frequency Response (dB)
0.1	0.05	1.02	-26.19
0.2	0.04	1.02	-28.13
0.3	0.22	1.02	-13.32
0.4	0.38	1.02	-8.57
0.5	0.49	1.02	-6.3
0.6	0.63	1.02	-4.18
0.7	0.72	1.02	-3.02
0.8	0.81	1.02	-2.00
0.9	0.90	1.02	-1.08
1.0	1.00	1.02	-0.17
1.2	1.21	1.02	1.48
1.4	1.42	1.02	2.87
1.6	1.64	1.02	4.12
1.8	1.84	1.02	5.12
2.0	2.05	1.02	6.06
2.2	2.22	1.02	6.75
2.4	2.37	1.02	7.32
2.6	2.46	1.02	7.64
2.7	2.49	1.02	7.75
2.8	2.47	1.02	7.68
3.0	2.39	1.02	7.39
3.5	0.07	1.02	-23.27
4.0	0.06	1.02	-24.60
4.5	0.05	1.02	-26.19
5.0	0.05	1.02	-26.19

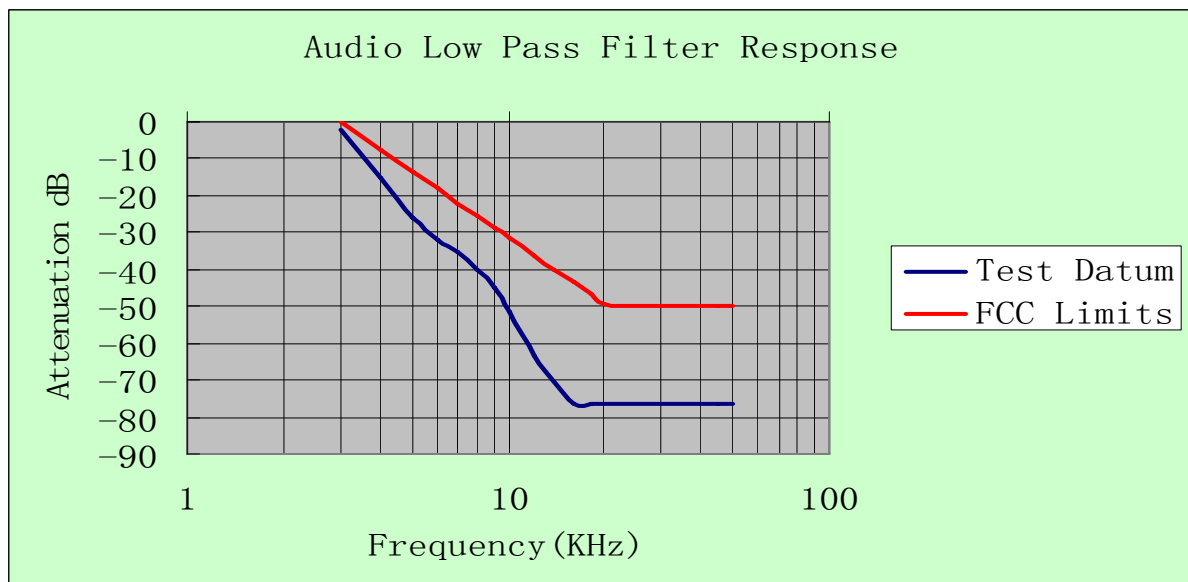
Audio Frequency Response for 25KHz

C). THE AUDIO LOW PASS FILTER:

80.213 (e) Coast station transmitters operated in the 156–162 MHz band must be equipped with an audio low-pass filter. The filter must be installed between the modulation limiter and the modulated radio frequency stage. At frequencies between 3 kHz and 20 kHz it must have an attenuation greater than at 1 kHz by at least $60\log_{10}(f/3)$ dB where “f” is the audio frequency in kilohertz. At frequencies above 20 kHz the attenuation must be at least 50 dB greater than at 1 kHz.

TEST RESULTS

Frequency (KHz)	1KHz Reference attenuation (dB)	Limit (dB)
3.0	-2.00	-0.00
4.0	-15.23	-7.50
5.0	-26.02	-13.31
6.0	-32.20	-18.06
7.0	-35.20	-22.08
8.0	-40.26	-25.56
9.0	-45.25	-28.63
10.0	-51.25	-31.37
12.0	-63.25	-36.12
14.0	-70.25	-40.14
16.0	-76.25	-43.62
18.0	-76.25	-46.69
20.0	-76.25	-49.43
25.0	-76.25	-50.00
30.0	-76.25	-50.00
35.0	-76.25	-50.00
40.0	-76.25	-50.00
45.0	-76.25	-50.00
50.0	-76.25	-50.00



4.6. Frequency Stability Test

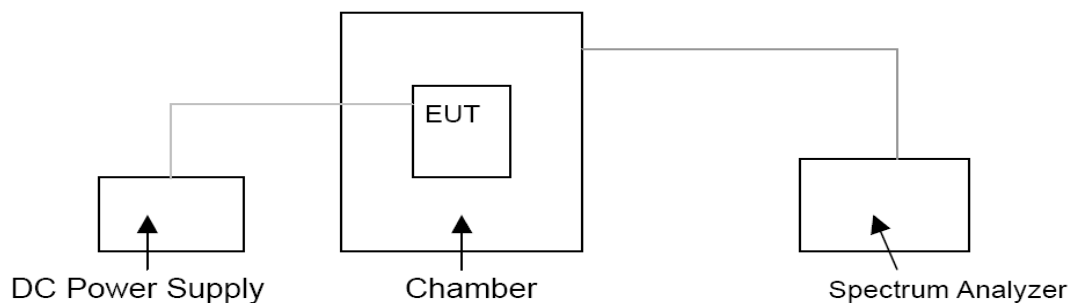
TEST APPLICABLE

- 1 According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30°C to +50°C centigrade.
- 2 According to FCC Part 2 Section 2.1055 (a) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
- 3 Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and the end voltage point was 6.67V.
- 4 According to §90.213, the frequency stability limit is 2.5 ppm for 25 KHz channel separation

TEST PROCEDURE

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

TEST CONFIGURATION



TEST LIMITS

According to 80.209, Transmitters used must have minimum frequency stability as specified in the following table.

Frequency Band	Coast stations		Ship stations
	Below 3W	3 to 100W	
156-162 MHz	10ppm	5 ¹ ppm	10 ² ppm

1 For transmitters operated at private coast stations with antenna heights less than 6 meters (20 feet) above ground and output power of 25 Watts or less the frequency tolerance is 10 parts in 10⁶

2 For transmitters in the radiolocation and associated telecommand service operating on 154.585 MHz, 159.480 MHz, 160.725 MHz and 160.785 MHz the frequency tolerance is 15 parts in 10⁶

TEST RESULTS

Modulation Type	Channel Separation	Test conditions		Frequency error (ppm)			
		Voltage(V)	Temp(℃)	156.050 MHz	156.800 MHz	157.425 MHz	156.525 MHz
Analog/FM	25 KHz	7.40	-30	0.52	0.75	0.80	0.62
			-20	0.96	0.85	0.55	0.74
			-10	0.58	0.65	0.65	0.68
			0	0.96	0.58	0.99	0.85
			10	0.58	0.78	0.59	0.68
			20	0.85	0.77	0.71	0.69
			30	0.45	0.58	0.51	0.45
			40	0.69	0.86	0.83	0.55
			50	0.78	0.53	0.59	0.62
		6.67(End Point)	20	0.70	0.72	0.67	0.85
		6.30 (85% Rated)	20	0.74	0.73	0.91	0.85
		8.50(115% Rated)	20	0.88	0.83	0.51	0.55
Limit			5.0 ppm				
Conclusion			Complies				

4.7. Maximum Transmitter Power

TEST APPLICABLE

80.215(e)(1) Ship stations 156–162 MHz - 25W^{1,2}

Marine utility stations and hand-held portable transmitters: 156–162 MHz -10W

1 Reducible to 1 watt or less, except for transmitters limited to public correspondence channels and used in an automated system.

2 The frequencies 156.775 and 156.825 MHz are available for navigation-related port operations or ship movement only, and all precautions must be taken to avoid harmful interference to channel 16. Transmitter output power is limited to 1 watt for ship stations, and 10 watts for coast stations.

TEST PROCEDURE

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

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

The EUT connect to the Receiver through 20 dB attenuator.

Measurement with Spectrum Analyzer FSP40 conducted, external power supply with 7.4 V stabilized supply voltage.

TEST CONFIGURATION

EUT		Attenuator		Spectrum Analyzer/Receiver

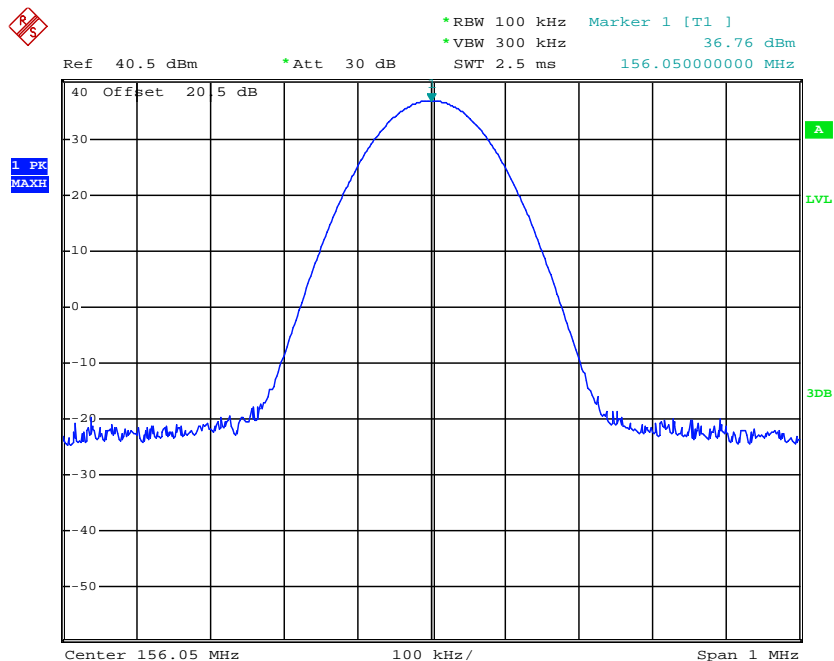
The EUT was directly connected to a RF Communication
Test set by a 20 dB attenuator

TEST RESULTS

Modulation Type	Channel Separation	Test Channel	Test Frequency	Maximum Transmitter Power at Rated High Power Level(dBm)	Maximum Transmitter Power at Rated Low Power Level(dBm)
Analog/FM	25 KHz	Low	156.0500 MHz	36.76	30.44
		Middle	156.8000 MHz	36.67	30.32
		High	157.4250 MHz	36.46	30.06
		DSC	156.5250 MHz	36.83	N/A
Limit		High rating power 5W, Low rating power 1W			
Test Results		Complicance			

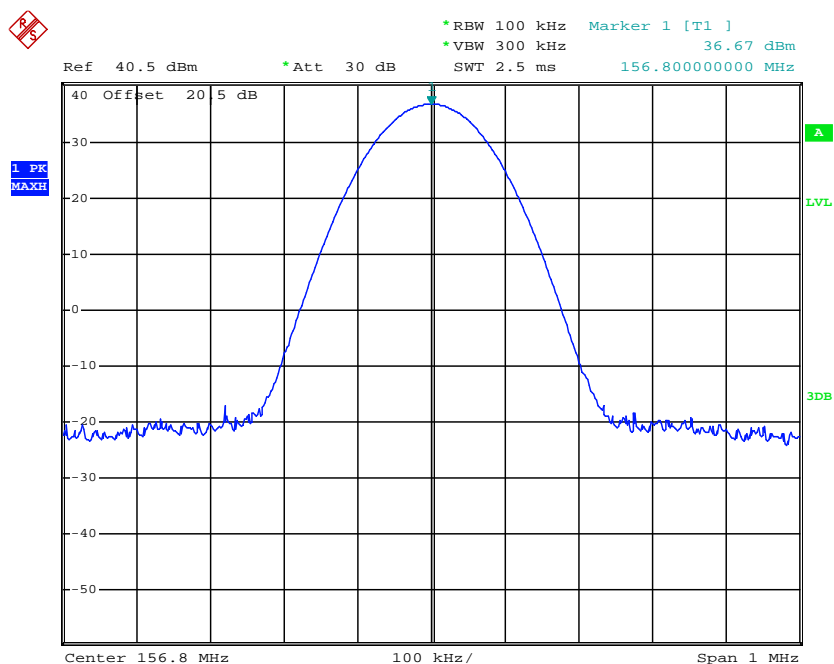
Plots of Maximum Transmitter Power Measurement

Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Results
FM	25 KHz	156.0500	5	36.76	Varies	Complicance



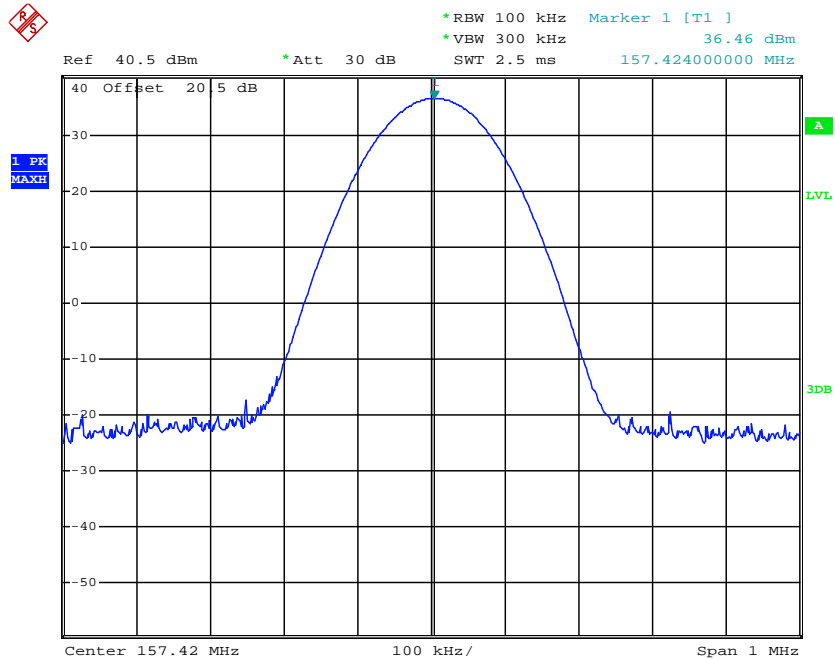
Date: 26.NOV.2012 09:43:17

Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Results
FM	25 KHz	156.8000	5	36.67	Varies	Complicance



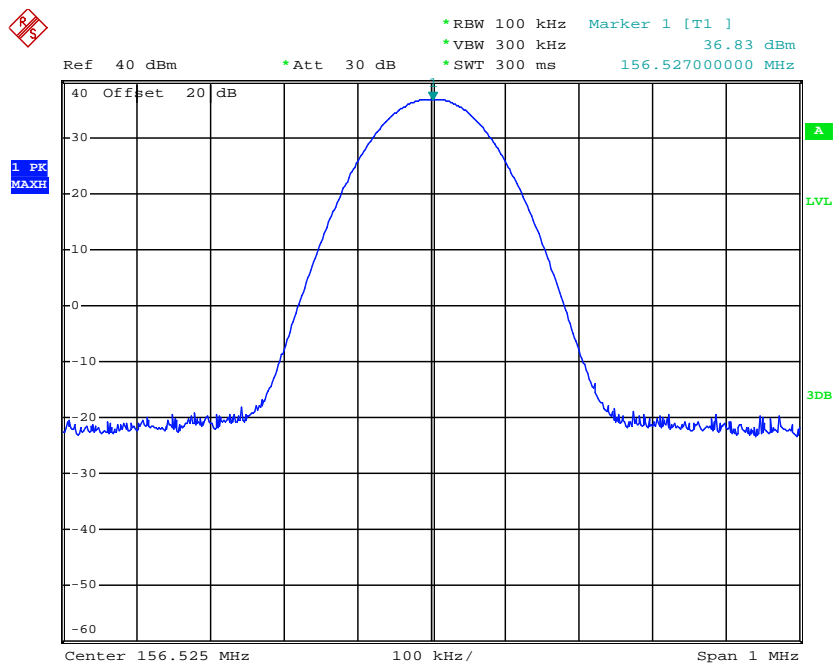
Date: 26.NOV.2012 09:40:33

Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Results
FM	25 KHz	157.4250	5	36.46	Varies	Complicance



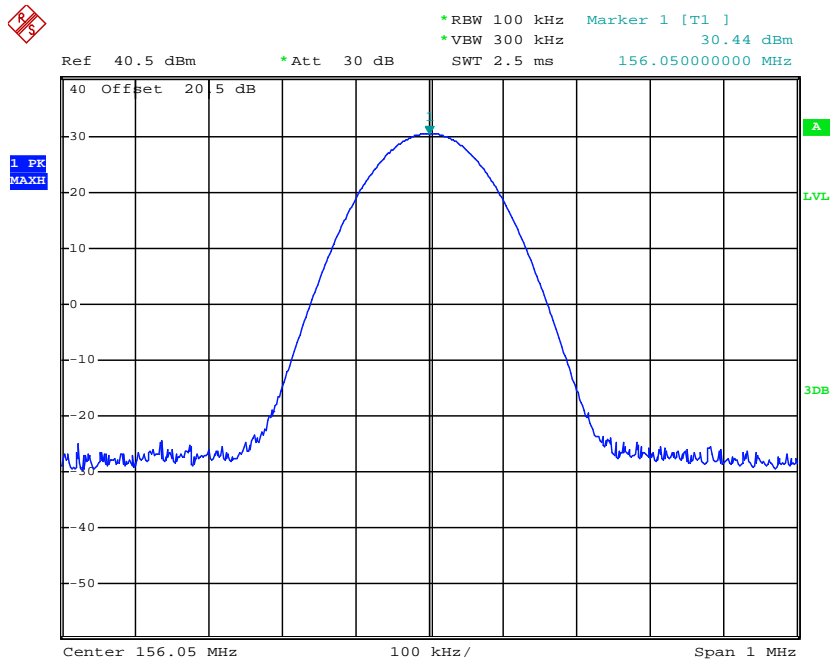
Date: 26.NOV.2012 09:42:48

Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Results
FM	25 KHz	156.5250	5	36.83	Varies	Complicance



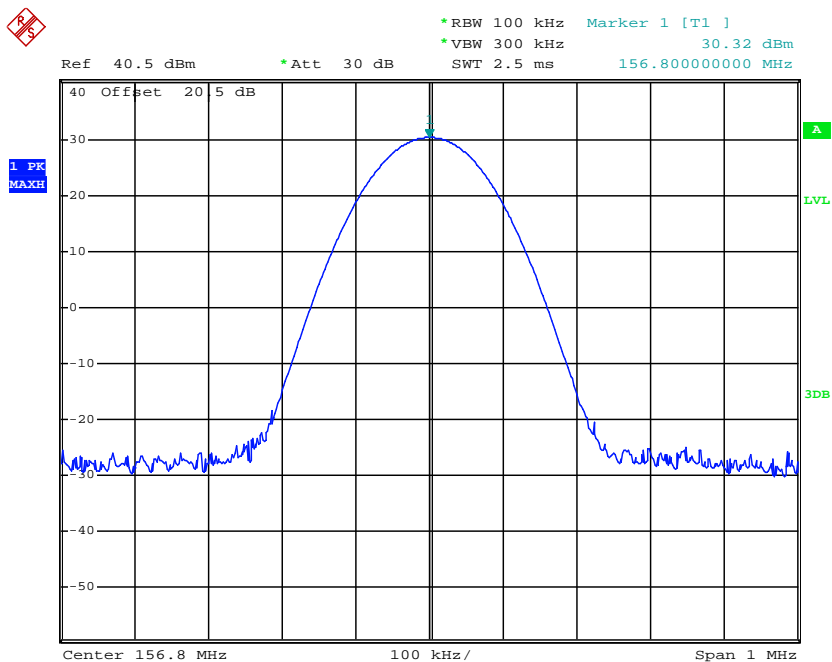
Date: 18.FEB.2013 15:59:20

Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Results
FM	25 KHz	156.0500	1	30.44	Varies	Complicance



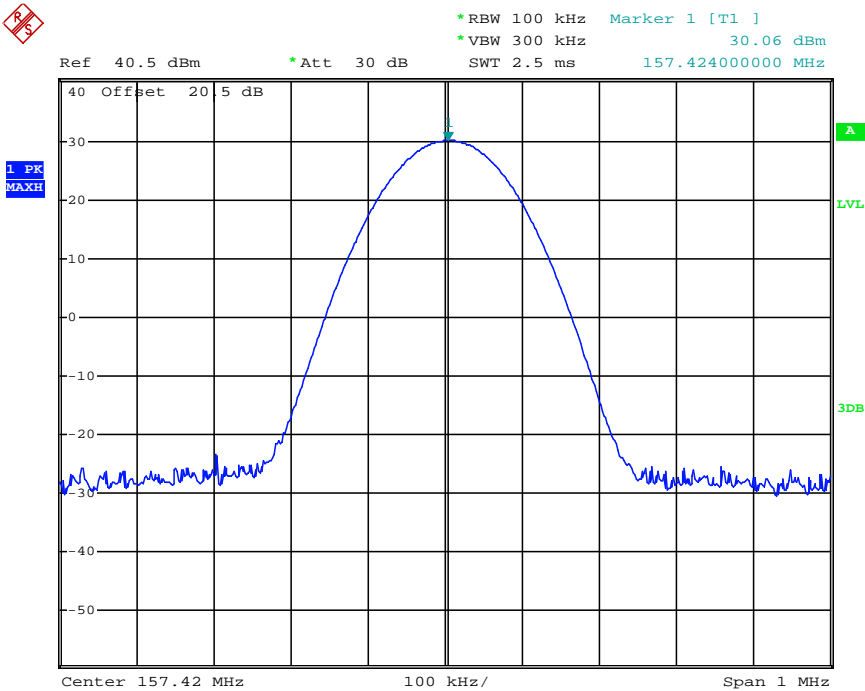
Date: 26.NOV.2012 09:41:35

Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Results
FM	25 KHz	156.8000	1	30.32	Varies	Complicance



Date: 26.NOV.2012 09:40:52

Modulation Type	Channel Separation	Freq.(MHz)	Rated Power (Watt)	Measurement (dBm)	FCC Limit	Results
FM	25 KHz	157.4250	1	30.06	Varies	Compliance



Date: 26.NOV.2012 09:42:28

4.8. Receiver Radiated Spurious Emission

TEST APPLICABLE

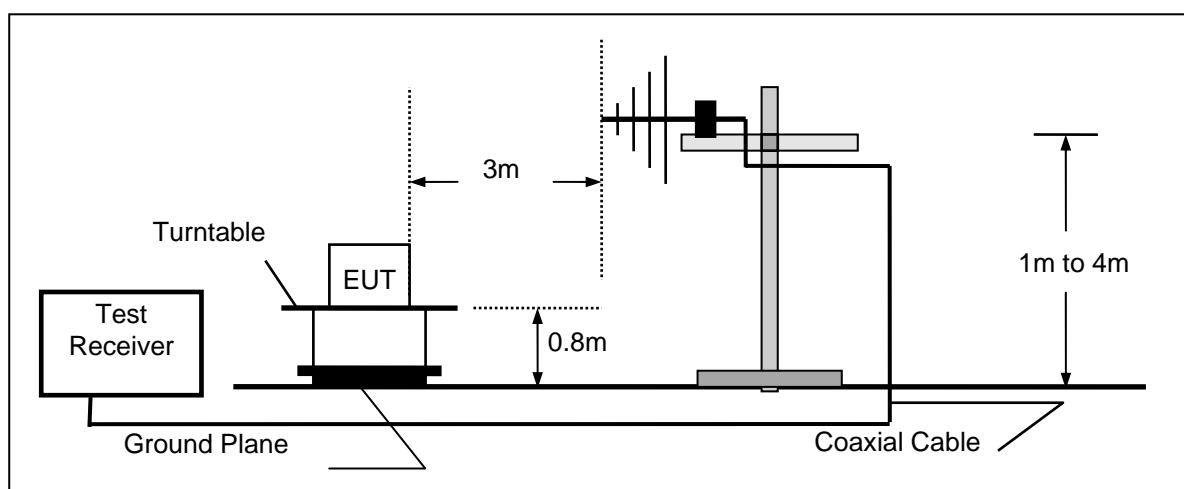
The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

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

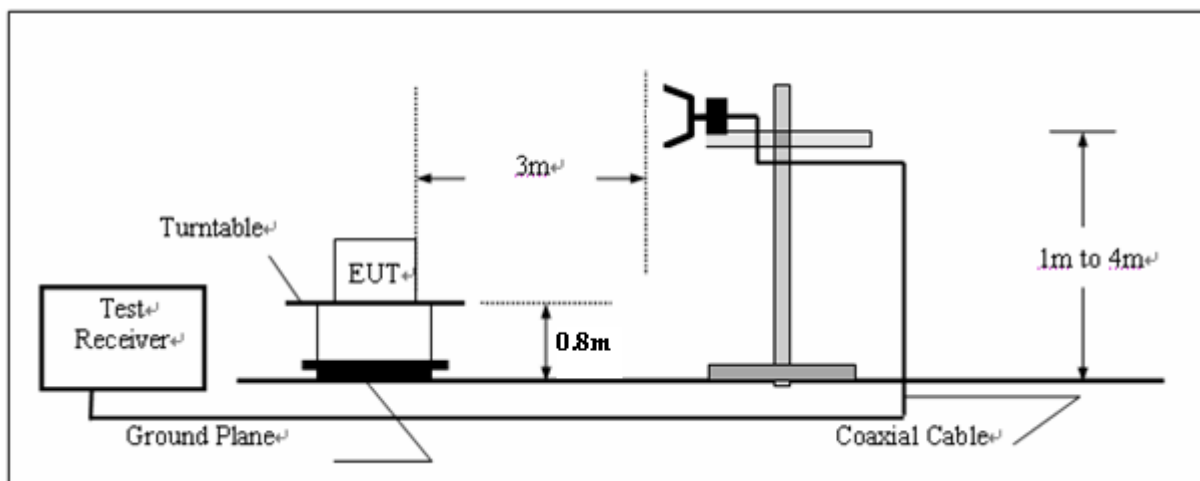
Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

TEST CONFIGURATION

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



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



TEST PROCEDURE

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

RECEIVER RADIATED SPOUIOUS LIMIT

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

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

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

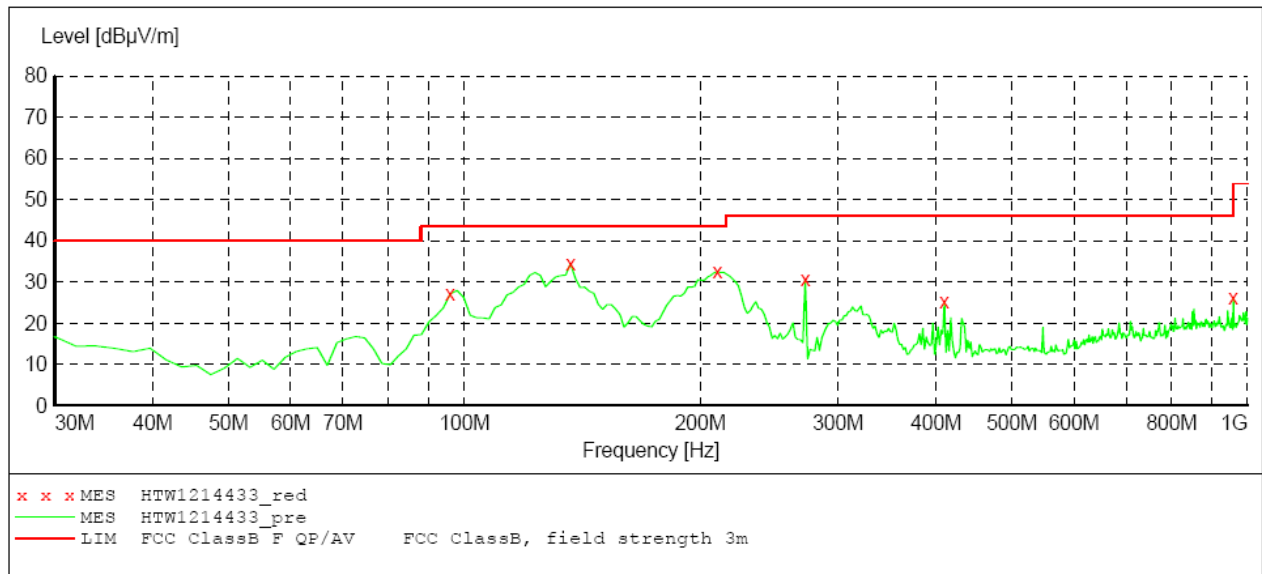
TEST RESULTS

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

Modulation Type	Channel Separation	Test Frequency (MHz)	Polar.	Maximum Radiated Emissions		FCC Limit (dBuV/m)
				Frequency (MHz)	Datum (dBuV/m)	
FM	25 KHz	156.8000	H	136.70	34.50	43.50
			V	136.70	36.80	43.50
Test Results			Compliance			

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

Short Description: Field Strength
Start Stop Detector Meas. IF Transducer
Frequency Frequency Time Bandw.
30.0 MHz 1.0 GHz MaxPeak Coupled 100 kHz HL562 201106

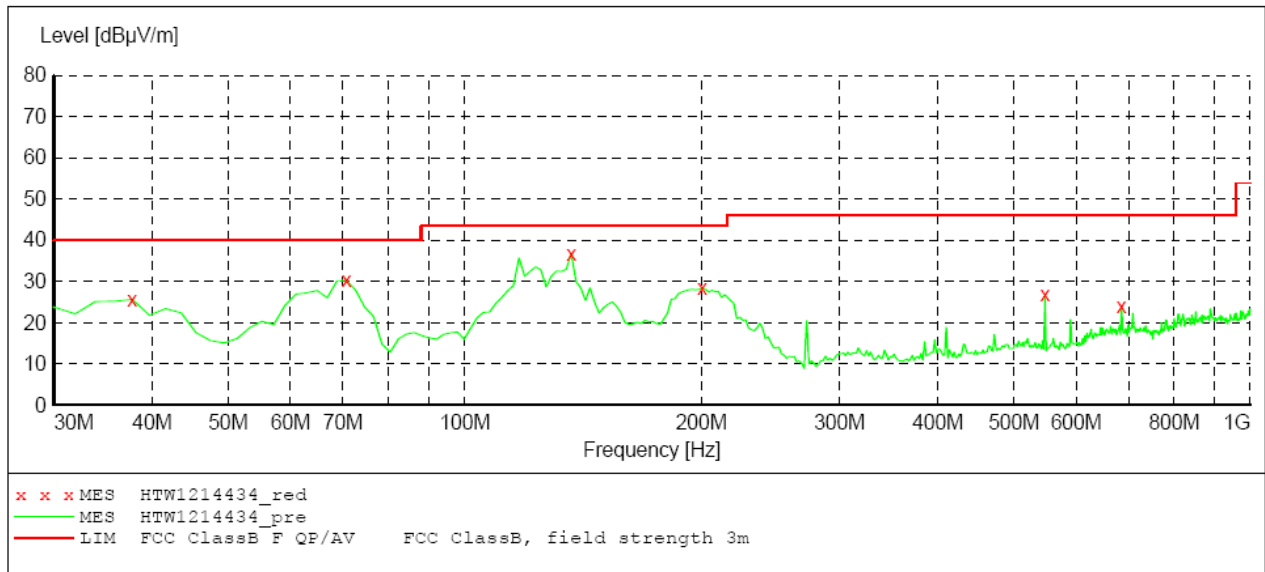
**MEASUREMENT RESULT: "HTW1214433_red"**

12/17/2012 11:01AM

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
95.960000	27.10	-20.1	43.5	16.4	PK	300.0	24.00	HORIZONTAL
136.700000	34.50	-21.2	43.5	9.0	PK	300.0	89.00	HORIZONTAL
210.420000	32.40	-21.0	43.5	11.1	PK	100.0	110.00	HORIZONTAL
272.500000	30.60	-18.1	46.0	15.4	PK	100.0	72.00	HORIZONTAL
410.240000	25.20	-15.3	46.0	20.8	PK	100.0	125.00	HORIZONTAL
959.260000	26.20	-7.1	46.0	19.8	PK	100.0	131.00	HORIZONTAL

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

Short Description:		Field Strength			
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	HL562 201106

***MEASUREMENT RESULT: "HTW1214434_red"***

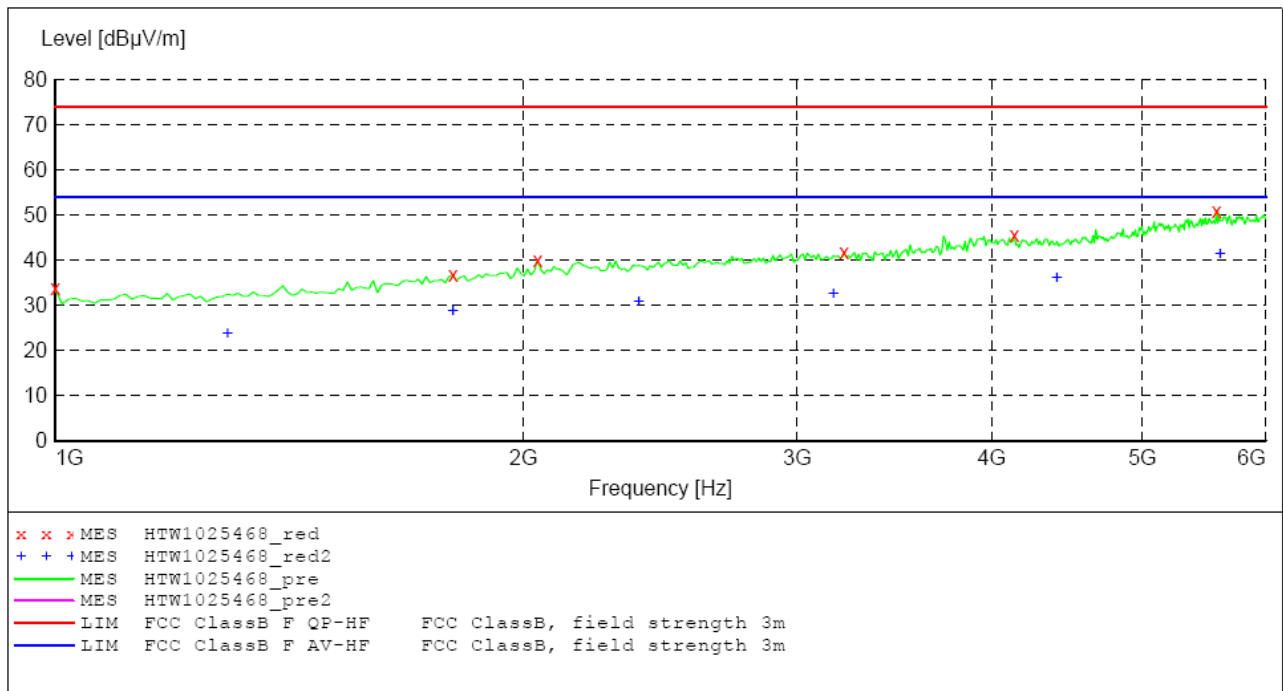
12/17/2012 11:03AM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
37.760000	25.60	-15.1	40.0	14.4	PK	100.0	273.00	VERTICAL
70.740000	30.30	-23.1	40.0	9.7	PK	100.0	255.00	VERTICAL
136.700000	36.80	-21.2	43.5	6.7	PK	100.0	333.00	VERTICAL
200.720000	28.30	-21.4	43.5	15.2	PK	100.0	327.00	VERTICAL
547.980000	26.80	-13.9	46.0	19.2	PK	100.0	160.00	VERTICAL
685.720000	24.00	-10.0	46.0	22.0	PK	100.0	351.00	VERTICAL

Modulation Type	Channel Separation	Test Frequency (MHz)	Polar.	Maximum Radiated Emissions		FCC Limit (dBuV/m)
				Frequency (MHz)	Datum (dBuV/m)	
FM	25 KHz	156.8000	H	5969.93	41.00	54.00
			V	5609.21	41.40	54.00
Test Results			Compliance			

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

Short Description: EN 55022 Field Strength
 Start Stop Detector Meas. IF Transducer
 Frequency Frequency Time Bandw.
 1.0 GHz 18.0 GHz MaxPeak 500.0 ms 1 MHz HF906

***MEASUREMENT RESULT: "HTW1025468_red"***

10/25/2012 6:28PM

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1000.000000	33.80	-12.3	74.0	40.2	PK	100.0	47.00	VERTICAL
1801.603206	36.60	-7.9	74.0	37.4	PK	100.0	151.00	VERTICAL
2042.084168	39.90	-6.4	74.0	34.1	PK	100.0	266.00	VERTICAL
3214.428858	41.80	-2.9	74.0	32.2	PK	100.0	80.00	VERTICAL
4136.272545	45.50	-0.5	74.0	28.5	PK	100.0	215.00	VERTICAL
5579.158317	50.80	2.3	74.0	23.2	PK	100.0	171.00	VERTICAL

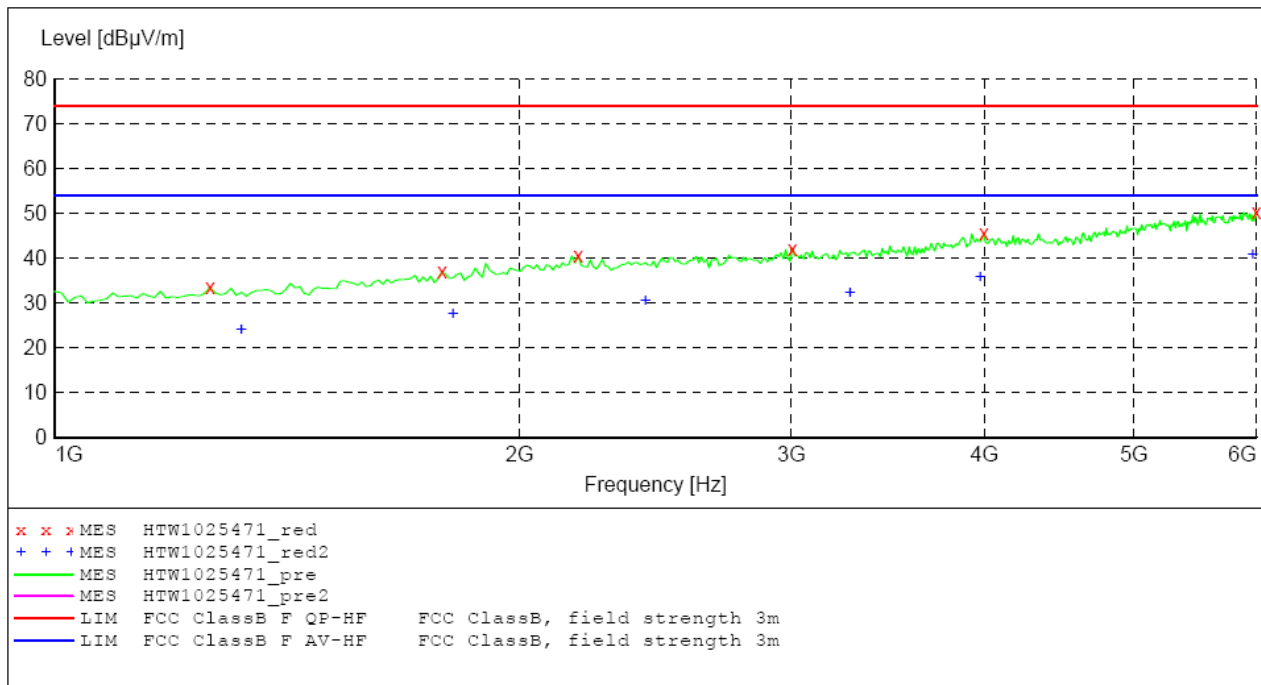
MEASUREMENT RESULT: "HTW1025468_red2"

10/25/2012 6:28PM

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1290.581162	23.90	-10.9	54.0	30.1	AV	100.0	347.00	VERTICAL
1801.603206	28.80	-7.9	54.0	25.2	AV	100.0	80.00	VERTICAL
2372.745491	31.00	-5.1	54.0	23.0	AV	100.0	56.00	VERTICAL
3164.328657	32.70	-3.0	54.0	21.3	AV	100.0	106.00	VERTICAL
4406.813627	36.10	-0.6	54.0	17.9	AV	100.0	341.00	VERTICAL
5609.218437	41.40	2.3	54.0	12.6	AV	100.0	320.00	VERTICAL

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

Short Description: EN 55022 Field Strength
Start Stop Detector Meas. IF Transducer
Frequency Frequency Time Bandw.
1.0 GHz 18.0 GHz MaxPeak 500.0 ms 1 MHz HF906

***MEASUREMENT RESULT: "HTW1025471_red"***

10/25/2012 6:34PM

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1260.521042	33.60	-11.0	74.0	40.4	PK	100.0	220.00	HORIZONTAL
1781.563126	37.00	-8.0	74.0	37.0	PK	100.0	126.00	HORIZONTAL
2182.364729	40.60	-5.8	74.0	33.4	PK	100.0	214.00	HORIZONTAL
3004.008016	42.20	-3.3	74.0	31.8	PK	100.0	359.00	HORIZONTAL
3995.991984	45.60	-0.4	74.0	28.4	PK	100.0	114.00	HORIZONTAL
6000.000000	50.40	2.6	74.0	23.6	PK	100.0	197.00	HORIZONTAL

MEASUREMENT RESULT: "HTW1025471_red2"

10/25/2012 6:34PM

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1320.641283	24.20	-10.8	54.0	29.8	AV	100.0	286.00	HORIZONTAL
1811.623246	27.50	-7.8	54.0	26.5	AV	100.0	78.00	HORIZONTAL
2412.825651	30.60	-4.9	54.0	23.4	AV	100.0	48.00	HORIZONTAL
3274.549098	32.40	-2.9	54.0	21.6	AV	100.0	208.00	HORIZONTAL
3975.951904	35.90	-0.4	54.0	18.1	AV	100.0	244.00	HORIZONTAL
5969.939880	41.00	2.6	54.0	13.0	AV	100.0	244.00	HORIZONTAL

4.9. Receiver Conducted Spurious Emission

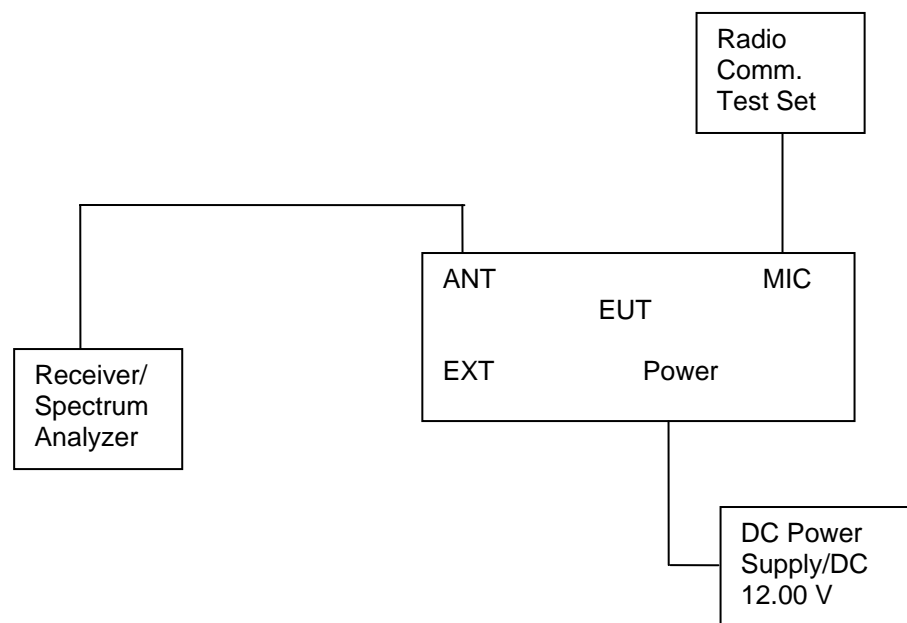
TEST APPLICABLE

The same as Section 4.3

TEST PROCEDURE

The spectrum analyzer was connected to the RF output power of the EUT, the EUT was setup in receiving mode; The RBW of the spectrum analyzer was set to 100 kHz and the VBW set to 300 KHz below the test frequency 1GHz. While the RBW of the spectrum analyzer was set to the 1MHz and VBW set to the 3MHz from 1GHz to the 10th harmonic.

TEST CONFIGURATION



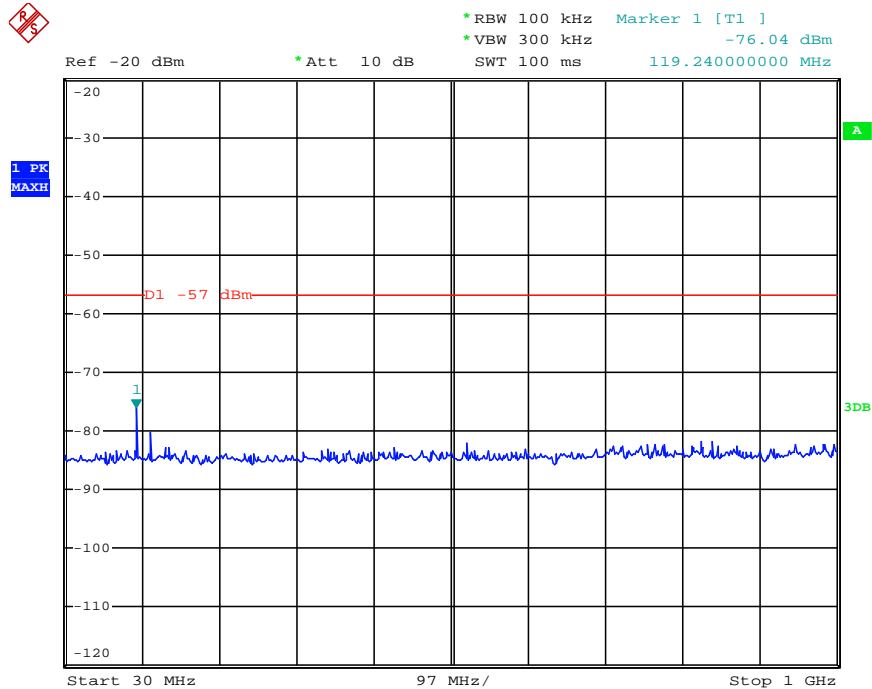
LIMIT

The power at the antenna terminal shall not exceed 2.0 nanowatts (-57dBm).

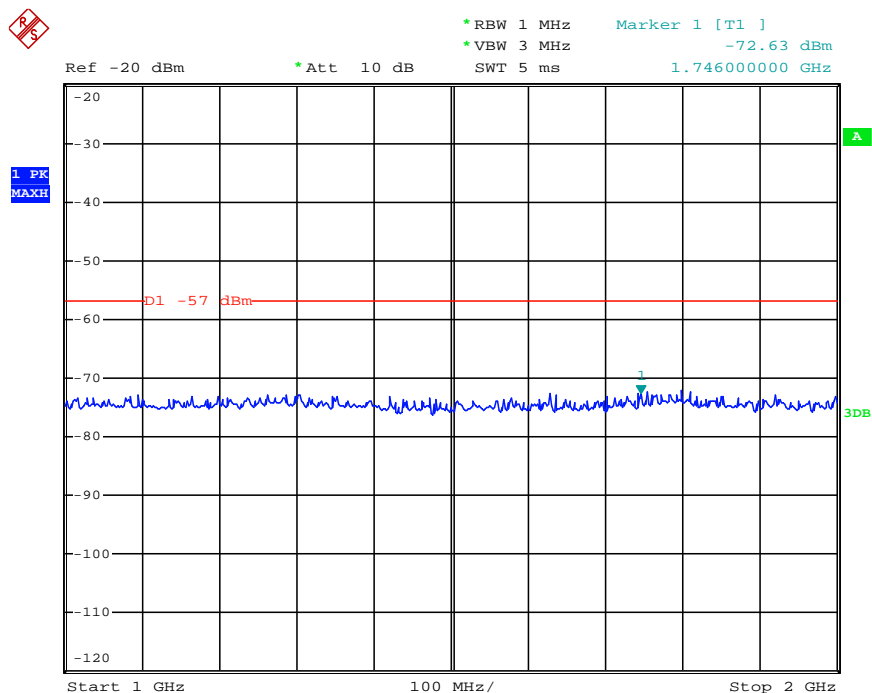
TEST RESULTS

The Receiver Conducted Spurious Emissions Measurement is performed to the five channels (the top channel, the middle channel and the bottom channel), the datums recorded below were for the five channels; and the EUT shall be scanned from 30 MHz to the 2 GHz.

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	Low	156.0500	119.24	-76.04	1746.00	-72.63	-57dBm
Test Results				Compliance				

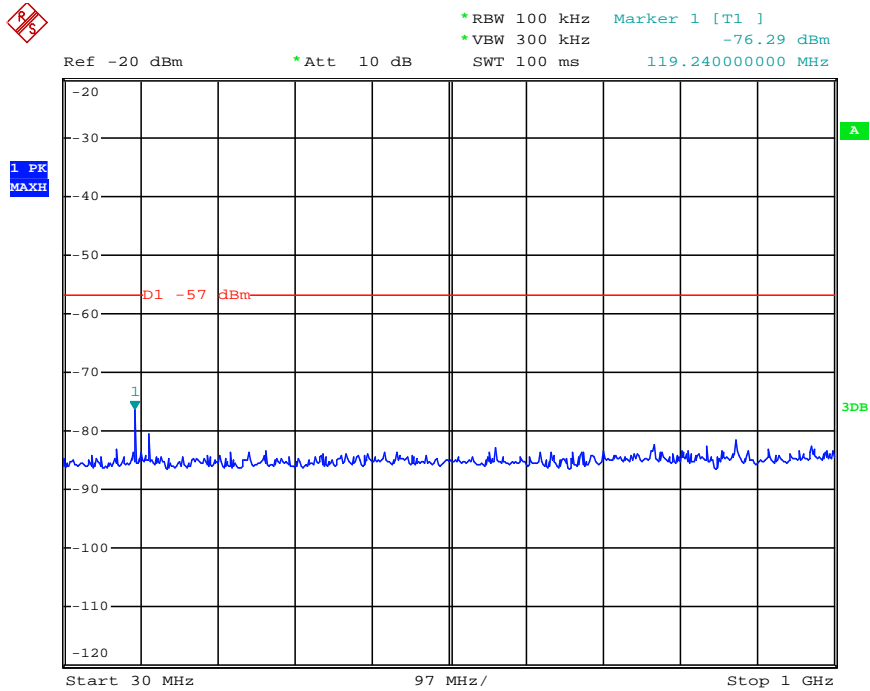


Date: 26.NOV.2012 10:16:12

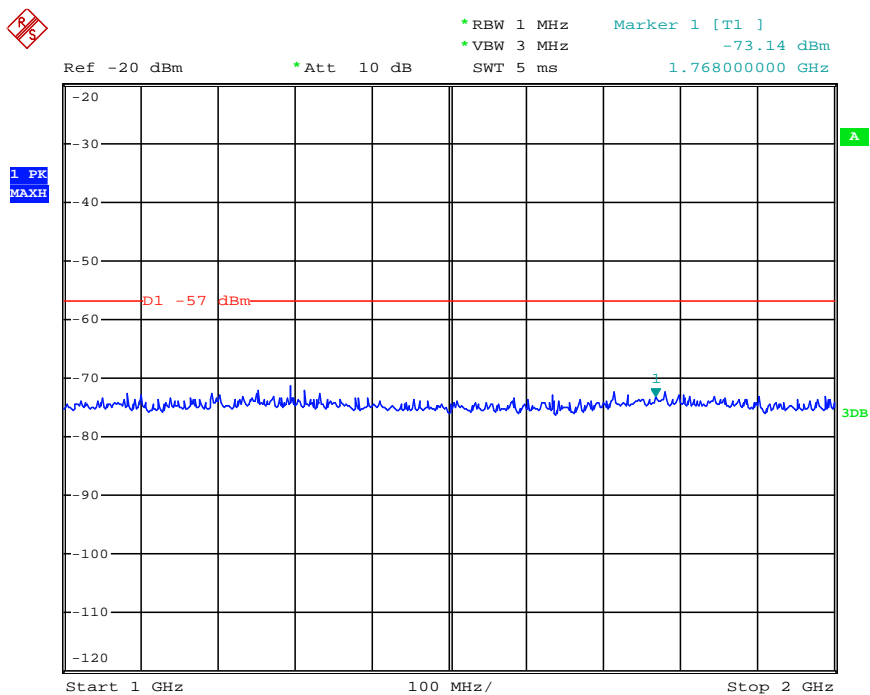


Date: 26.NOV.2012 10:20:41

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	Middle	156.8000	119.24	-76.29	1768.00	-73.14	-57dBm
Test Results				Compliance				

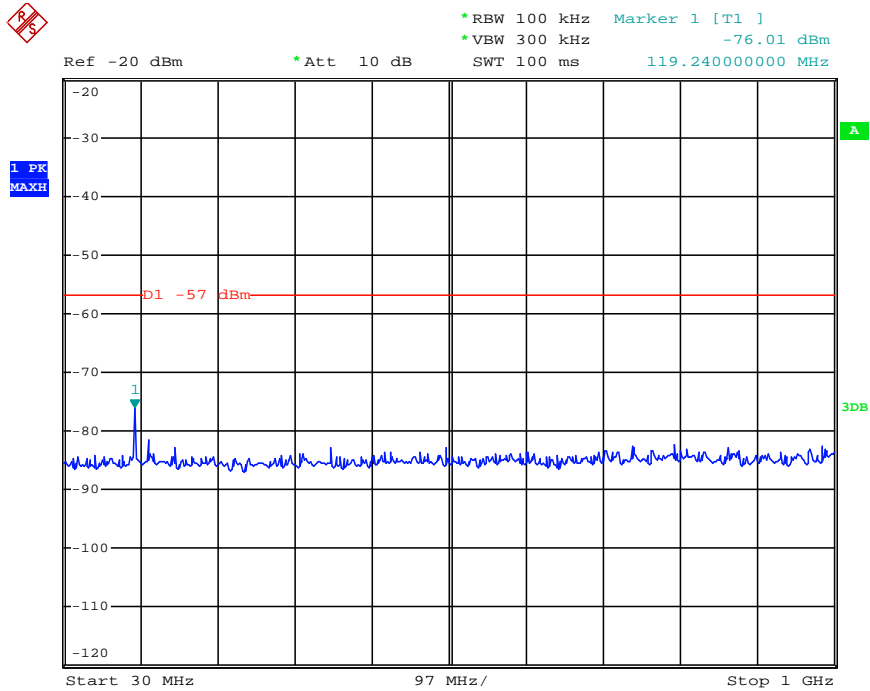


Date: 26.NOV.2012 10:16:43

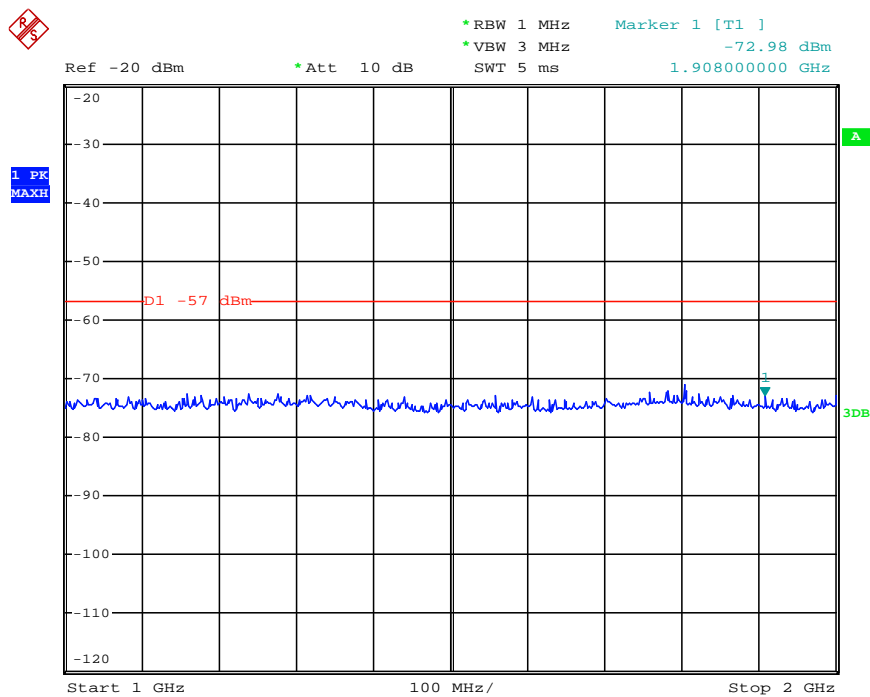


Date: 26.NOV.2012 10:19:48

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	High	157.4250	119.24	-76.01	1908.00	-72.98	-57dBm
Test Results				Compliance				

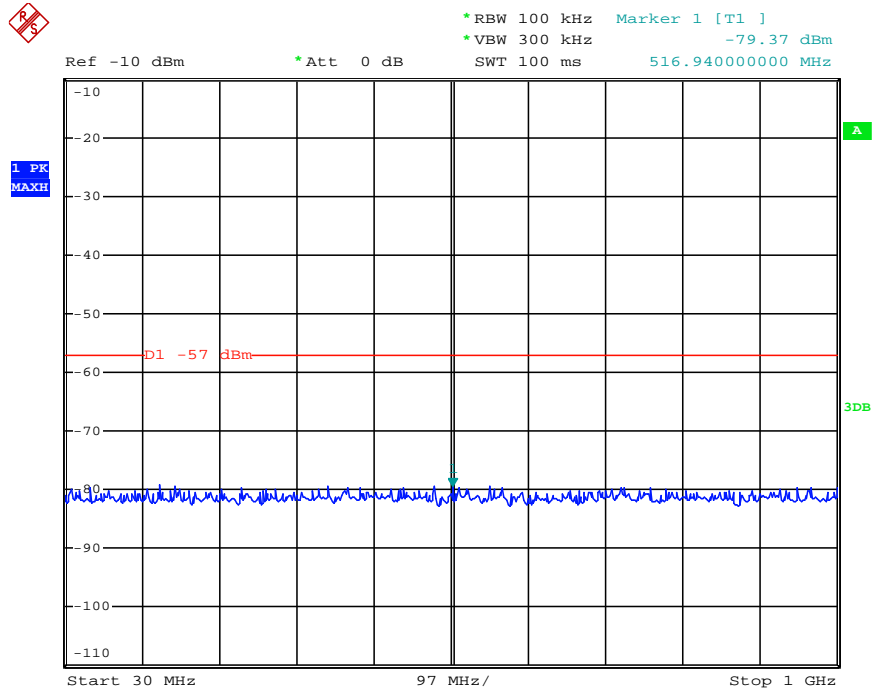


Date: 26.NOV.2012 10:16:29

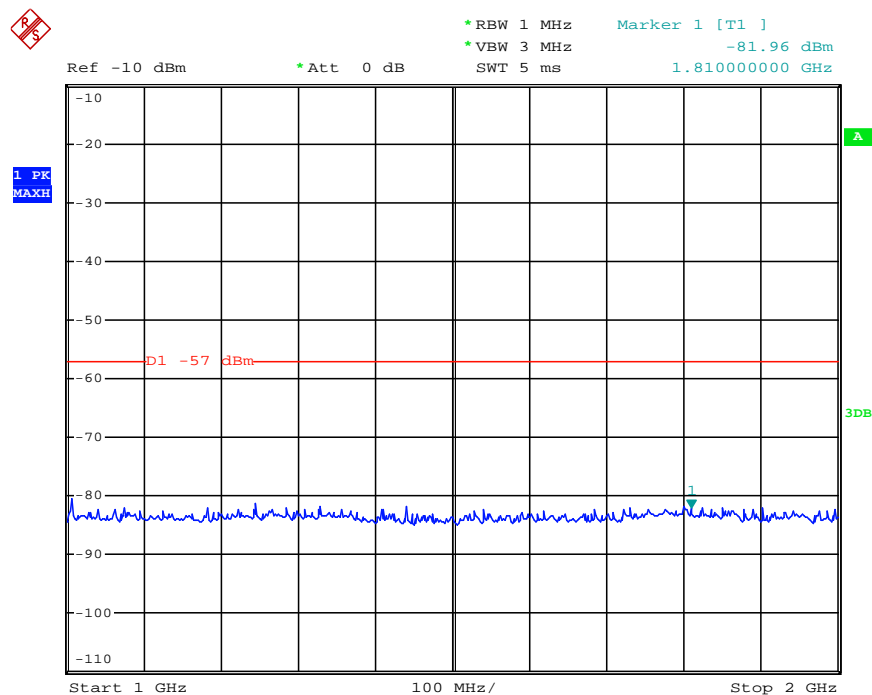


Date: 26.NOV.2012 10:20:59

Modulation Type	Channel Sparation	Test Channel	Test Frequency (MHz)	Maximum Conducted Spurious Emissions Below 1GHz		Maximum Conducted Spurious Emissions Above 1GHz		FCC Limit
				Frequency (MHz)	Datum (dBm)	Frequency (MHz)	Datum (dBm)	
FM	25 KHz	High	156.5250	516.94	-79.37	1810.00	-81.96	-57dBm
Test Results				Compliance				

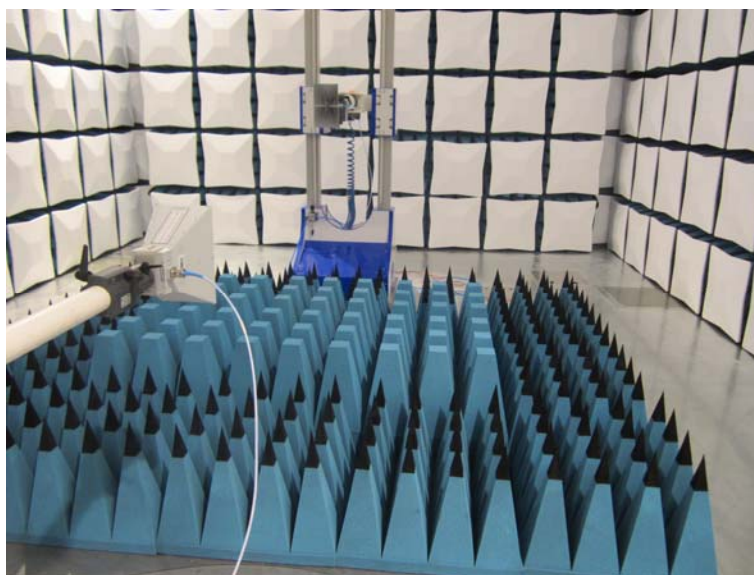


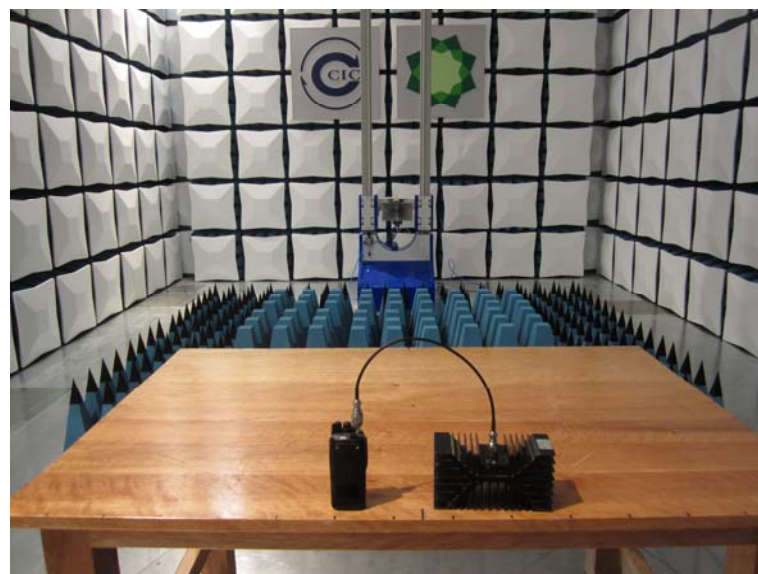
Date: 19.FEB.2013 10:31:11

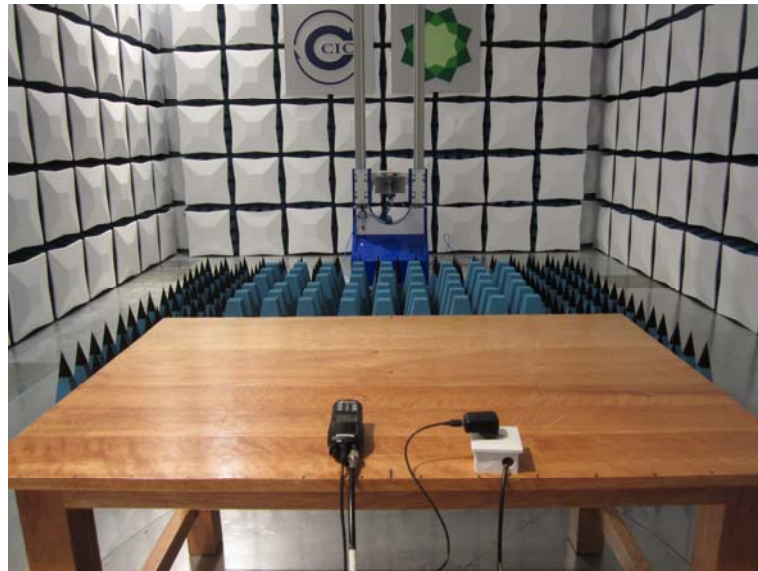


Date: 19.FEB.2013 10:30:47

5. Test Setup Photos of the EUT







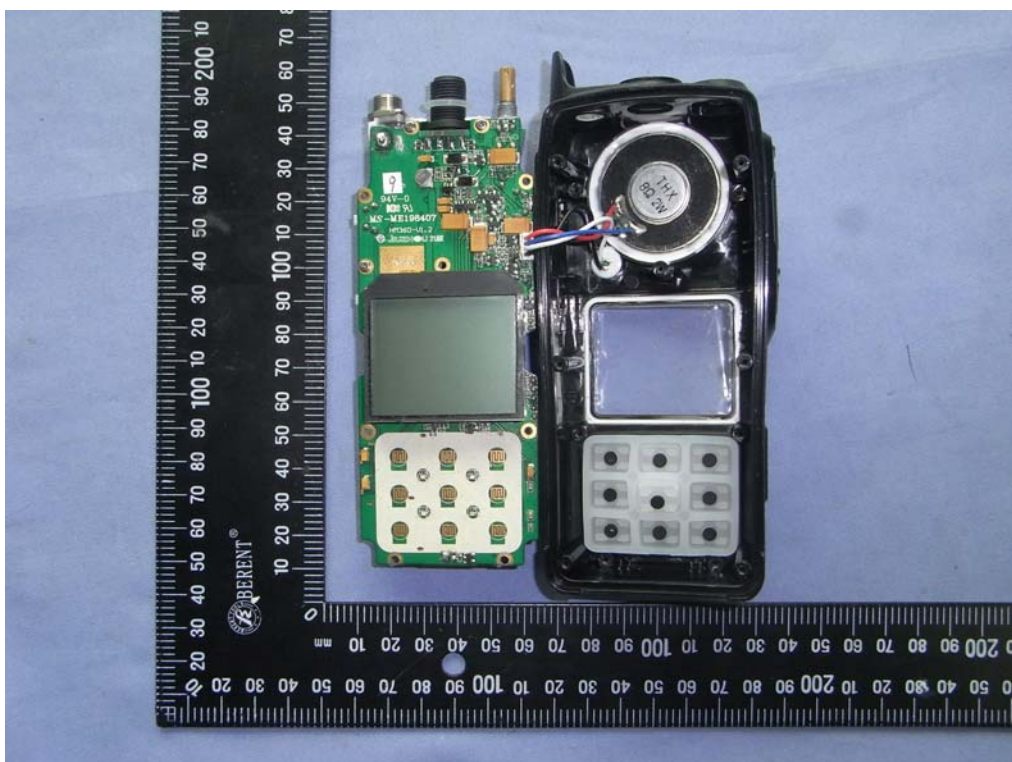
6. External and Internal Photos of the EUT

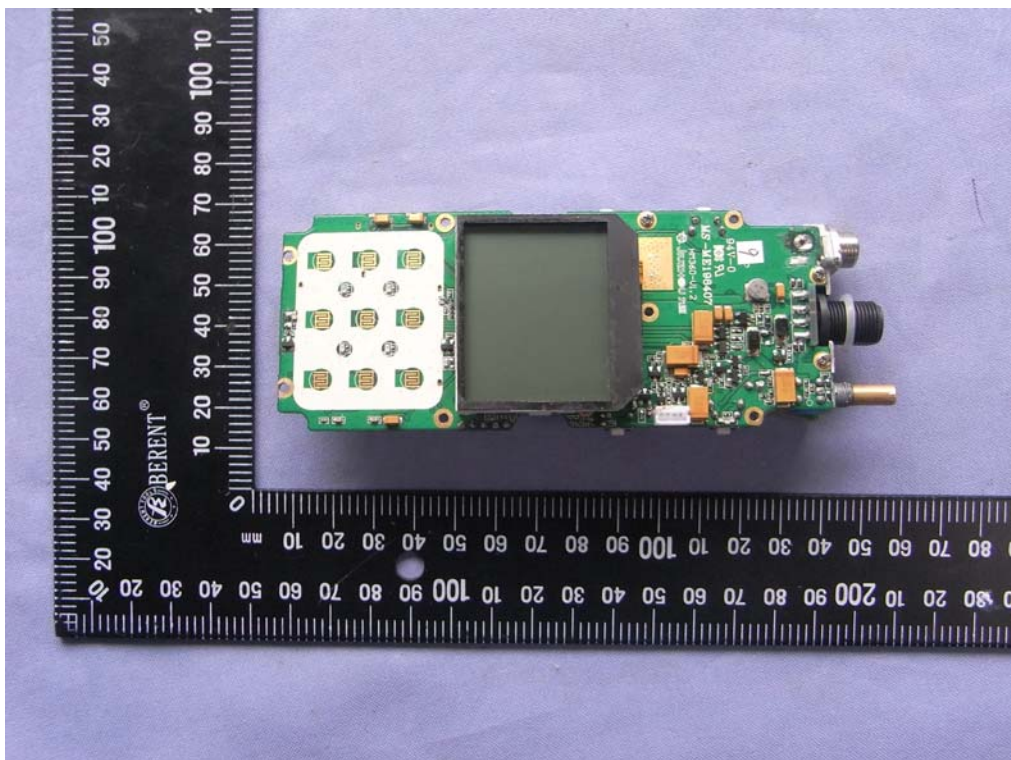
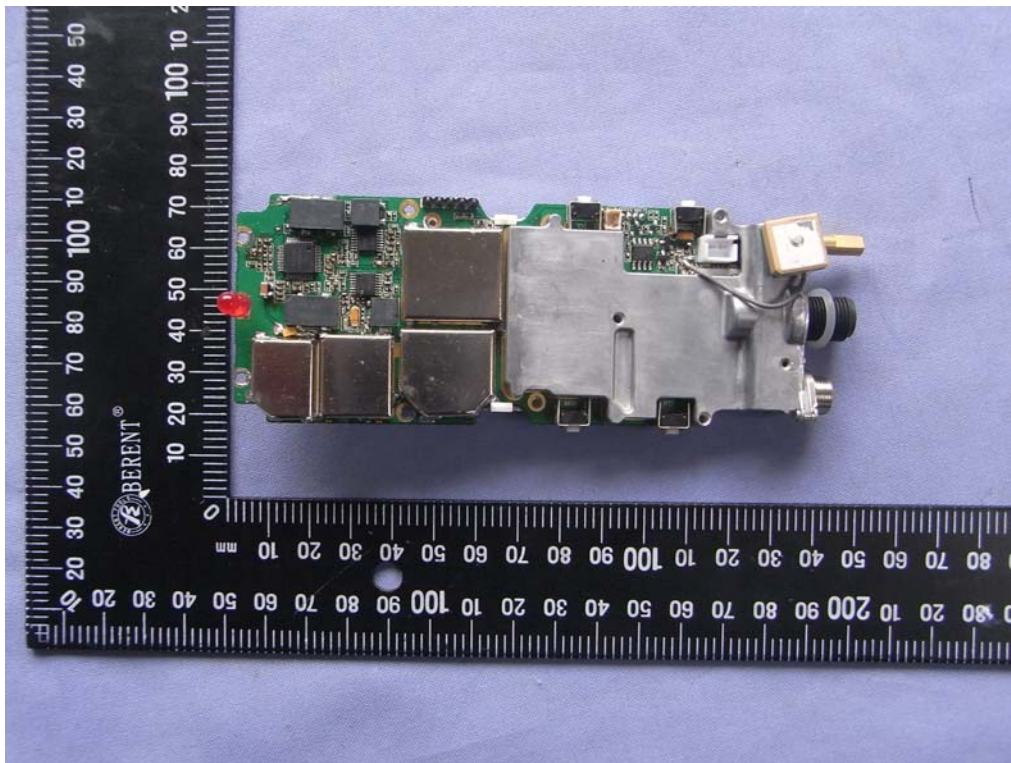
External photos of the EUT

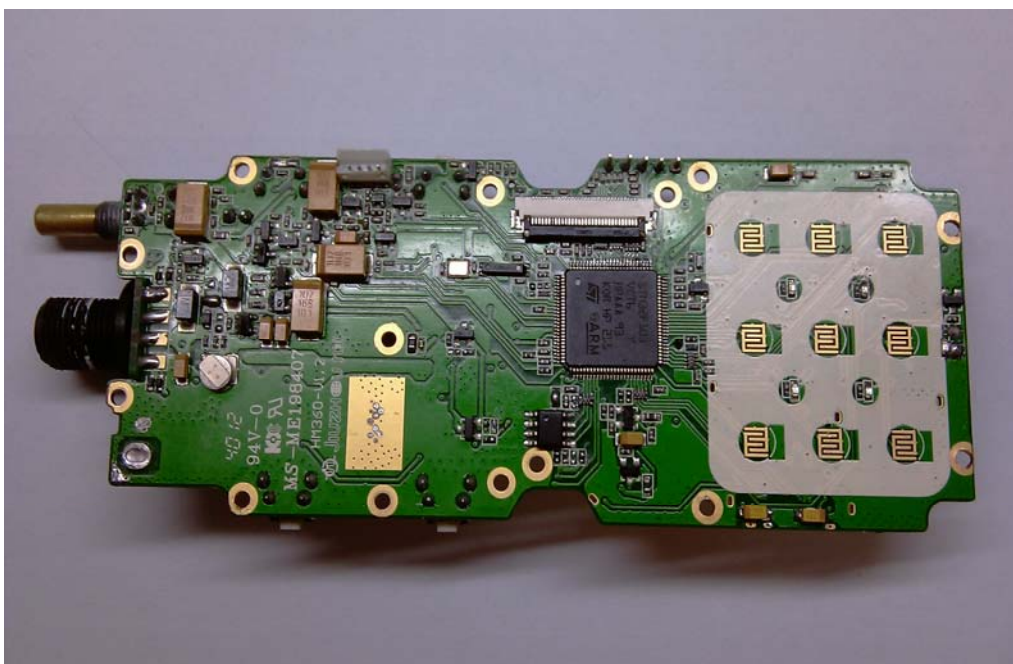
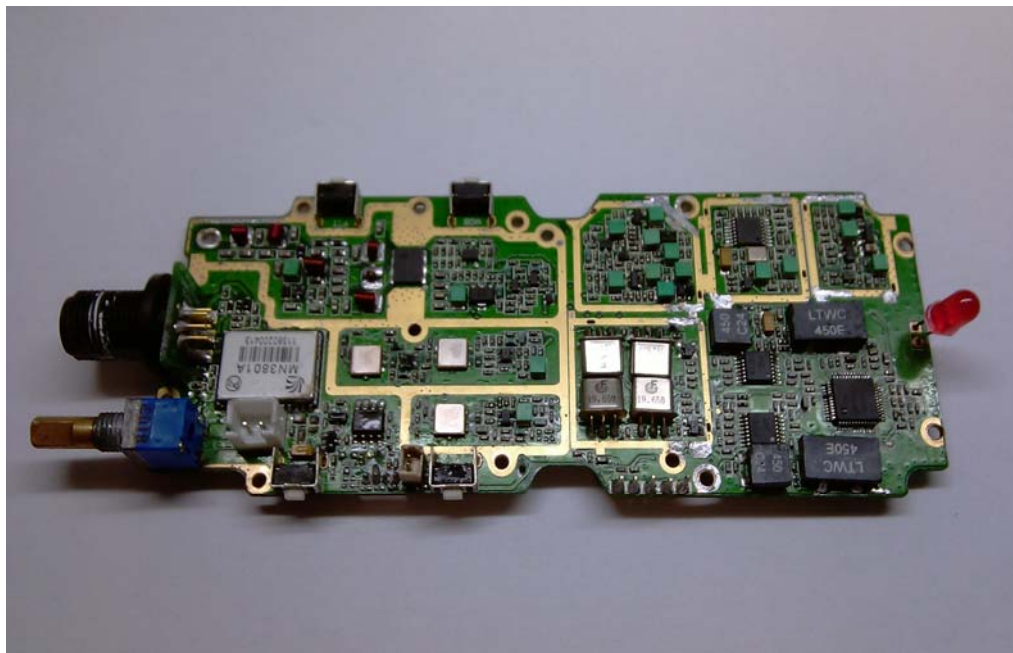




Internal photos of the EUT







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