



TEST REPORT

Report Reference No..... : TRE15040013 **R/C.....:** 39408

FCC ID..... : XYH-MR240

Applicant's name..... : RCA Communications Systems

Address..... : 133 West Market Street Suite 227 Indianapolis IN USA

Manufacturer.....: RCA Communications Systems

Address..... : 133 West Market Street Suite 227 Indianapolis IN USA

Test item description : VHF Marine Two-Way Radio

Trade Mark : RCA

Model/Type reference..... : MR240

Listed Model(s) : RS-36M

Standard : FCC Part 80/FCC Part 2/ FCC Part 15B

Date of receipt of test sample..... : Apr 7, 2015

Date of testing..... : Apr 8, 2015- Apr 28, 2015

Date of issue..... : Apr 28, 2015

Result..... : PASS

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

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

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1. TEST STANDARDS AND TEST DESCRIPTION

1.1. Test Standards

The tests were performed according to following standards:

[FCC Rules Part 80 :2014](#) Stations In The Maritime Services.

[TIA/EIA 603 C:August 2004](#) Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

[FCC Part 15 Subpart B:2014](#) Unintentional Radiators

[FCC Part 2: 2014](#) Frequency allocations and radio treaty matters, general rules and regulations.

1.2. Test Description

Test specification clause	Test case	Verdict
FCC Part 15.207	Conducted Emission	PASS
FCC Part 80.215	Maximum Transmitter Power	PASS
FCC Part 80.213	Modulation Characteristic	PASS
FCC Part 80.205	Occupied Bandwidth	PASS
FCC Part 80.211(f)	Emission Mask	PASS
FCC Part 80.209	Frequency Stability	PASS
FCC Part 80. 211(f)(3)	Transmitter Radiated Spurious Emssion	PASS
FCC Part 80. 211(f)(3)	Spurious Emssion On Antenna Port	PASS
RSS-Gen	Receiver Radiated Spurious Emssion	PASS

Remark:

This device is not equipped with the function of DSC .

2. SUMMARY

2.1. Client Information

Applicant:	RCA Communications Systems
Address:	133 West Market Street Suite 227 Indianapolis IN USA
Manufacturer:	RCA Communications Systems
Address:	133 West Market Street Suite 227 Indianapolis IN USA

2.2. Product Description

Name of EUT	VHF Marine Two-Way Radio
Trade Mark:	RCA
Model/Type reference:	MR240
Listed Model(s):	RS-36M
Power supply:	DC 3.70V
Charger information:	/
Battery information:	Model:B2418LI 3.7Vd.c., 1500mAh, 5.55Wh
Adapter information:	Model: PS2401 Input: 100-240Va.c., 50/60Hz, 0.2A MAX Output:6.0Vd.c., 0.5A
Operation Frequency Range:	From 156.05MHz to 157.425MHz
Rated Output Power:	High Power:4 Watts(36.02dBm)/Low Power:1Watts(30.00dBm)
Modulation Type:	FM for Analog Voice
Channel Separation:	Analog Voice 25kHz
Antenna Type:	External
Hard version:	6PM7-7033-HMA
Soft version:	M-7033HM-A0703

Note: The product has the same digital working characters when operating in both two digitized voice/data mode. So only one set of test results for digital modulation modes are provided in this test report.

Test frequency list

Modulation Type	Channel Separation	Test Frequency (MHz)
Analog/FM	25kHz	156.05(CH1)
		156.8(CH16)
		157.425(CH88)

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above listed frequency for testing.

2.3. 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.

EUT operation mode no.	Description of operation mode	Additional information
Op 1	FM+BW25kHz+TX	The equipment is set with FM modulation and 25kHz bandwidth at maximum rated power for transmitter, powered by DC 3.70V
Op 2	FM+BW25kHz+TX	The equipment is set with FM modulation and 25kHz bandwidth at minimum rated power for transmitter, powered by DC 3.70V
Op 3	FM+BW25kHz+RX	The equipment is set with FM modulation and 25kHz bandwidth at receiver or standby, powered by AC 120V/60Hz from adapter

2.4. EUT configuration

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

● - supplied by the manufacturer

○ - supplied by the lab

●	Power Cable	Length (m) :	3.00
		Shield :	Unshielded
		Detachable :	Undetachable
○	Multimeter	Manufacturer :	/
		Model No. :	/

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

This submittal(s) (test report) is intended for FCC ID: XYH-MR240 filing to comply with FCC Part 80 rules.

2.6. Modifications

No modifications were implemented to meet testing criteria.

3 . TEST ENVIRONMENT

3.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.
Address: Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China
Phone: 86-755-26748019 Fax: 86-755-26748089

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: Feb. 28, 2015. Valid time is until February 27, 2018.

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, 2015.

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 Jul. 01, 2012, valid time is until Jun. 01, 2015.

FCC-Registration No.: 317478

Shenzhen Huatongwei International Inspection Co., Ltd. (Gongming 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 317478, Renewal date July 18, 2014, valid time is until July. 18, 2017.

IC-Registration No.: 5377A

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. 5377A on Dec. 31, 2013, valid time is until Dec. 31, 2016.

IC-Registration No.: 5377B

The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. (Gongming EMC Laboratory) has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B on September 3, 2014, valid time is until September 3, 2017.

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.

VCCI

The 3m Semi-anechoic chamber (12.2m×7.95m×6.7m) 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: Dec. 20, 2012. Valid time is until Dec. 29, 2015.

Radiated disturbance above 1GHz measurement of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-292. Date of Registration: Dec. 24, 2013. Valid time is until Dec. 23, 2016.

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: Dec. 20, 2012. Valid time is until Dec. 19, 2015.

Telecommunication 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.: T-1837. Date of Registration: May 07, 2013. Valid time is until May 06, 2016.

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, 2016.

3.3. Environmental conditions

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

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

3.4. 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-40 GHz	1.60 dB	(1)
Conducted Emission 9KHz-30MHz	3.39 dB	(1)
Radiated Emission 30~1000MHz	4.65 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)

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

3.5. Equipments Used during the Test

AC&DC Power Conducted Emission				
Name of Equipment	Manufacturer	Model	Serial Number	Last Cal.
Artificial Mains	Rohde&Schwarz	ESH2-Z5	100028	2014/11/1
EMI Test Receiver	Rohde&Schwarz	ESCS 30	100038	2014/11/1
Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	2014/11/1
EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2014/11/1

Modulation Characteristic				
Name of Equipment	Manufacturer	Model	Serial Number	Last Cal.
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2014/11/1

Frequency Stability				
Name of Equipment	Manufacturer	Model	Serial Number	Last Cal.
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2014/11/1
Signal Generator	Rohde&Schwarz	SMT03	100059	2014/11/1
Climate Chamber	ESPEC	EL-10KA	05107008	2014/11/1

Transmitter Radiated Spurious Emission				
Name of Equipment	Manufacturer	Model	Serial Number	Last Cal.
Ultra-Broadband Antenna	Rohde&Schwarz	HL562	100015	2014/11/1
EMI Test Receiver	Rohde&Schwarz	ESI 26	100009	2014/11/1
RF Test Panel	Rohde&Schwarz	TS / RSP	335015/ 0017	N/A
HORN ANTENNA	Rohde&Schwarz	HF906	100039	2014/11/1
Turntable	ETS	2088	2149	N/A
Antenna Mast	ETS	2075	2346	N/A
EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2014/11/1
Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	2014/11/1
Ultra-Broadband Antenna	ShwarzBeck	VULB9163	539	2014/11/1
HORN ANTENNA	ShwarzBeck	9120D	1012	2014/11/1
HORN ANTENNA	ShwarzBeck	9120D	1011	2014/11/1
TURNTABLE	MATURO	TT2.0	----	N/A
ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A

Maximum Transmitter Power & Spurious Emssion On Antenna Port & Occupied Bandwidth & Emission Mask				
Name of Equipment	Manufacturer	Model	Serial Number	Last Cal.
Receiver	Rohde&Schwarz	ESI 26	100009	2014/11/1
Attenuator	R&S	ESH3-22	100449	2014/11/1
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2014/11/1
High-Pass Filter	Anritsu	MP526B	6220875256	2014/11/1
High-Pass Filter	Anritsu	MP526D	6220878392	2014/11/1
Spectrum Analyzer	Aglient	E4407B	MY44210775	2014/11/1
Spectrum Analyzer	Rohde&Schwarz	FSP40	1164.4391.40	2014/11/1
SPECTRUM ANALYZER	Agilent	E4407B	MY44210775	2014/11/1

Transient Frequency Behavior				
Name of Equipment	Manufacturer	Model	Serial Number	Last Cal.
Signal Generator	Rohde&Schwarz	SMT03	100059	2014/11/1
Storage Oscilloscope	Tektronix	TDS3054B	B033027	2014/11/1
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2014/11/1

The calibration interval was one year.

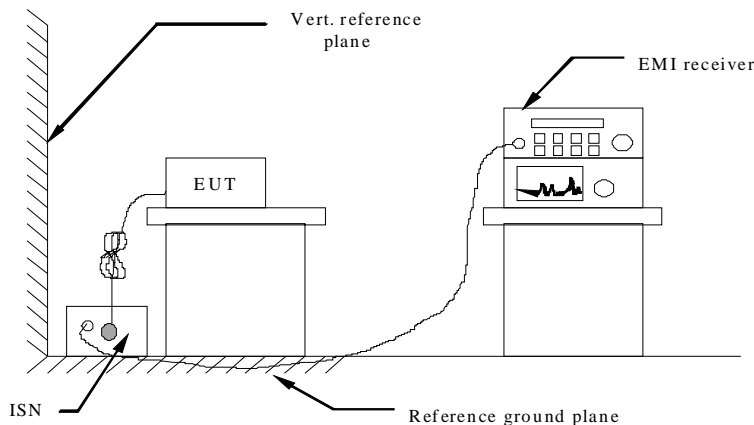
4. TEST CONDITIONS AND RESULTS

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 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 intentional device, according to § 15.207(a) and RSS-Gen for Conducted Emission Limits is as following:

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

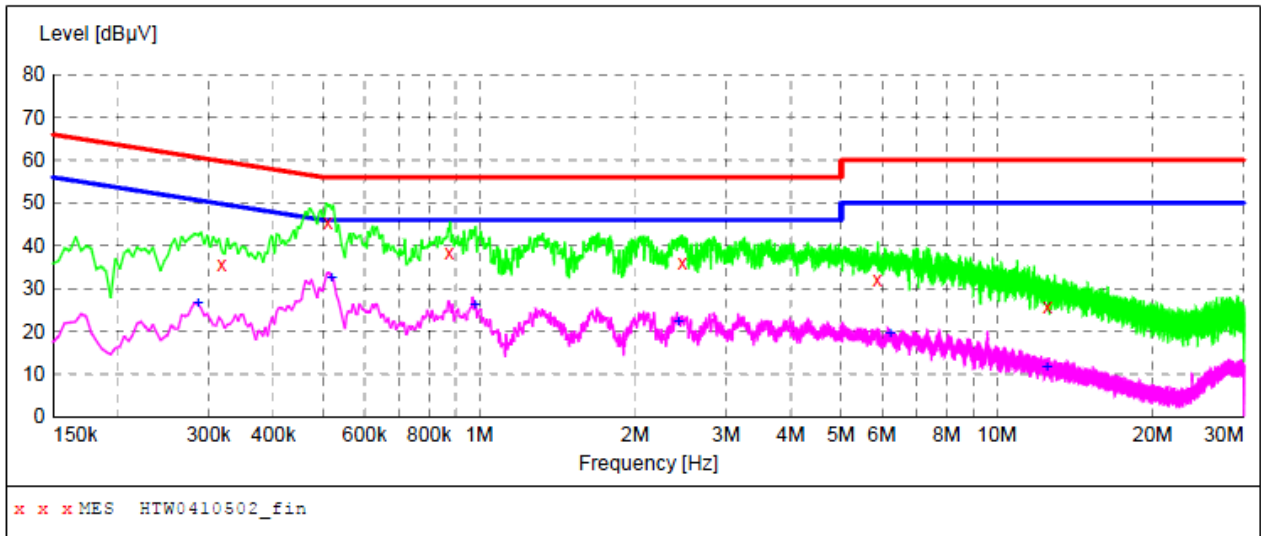
* Decreasing linearly with the logarithm of the frequency

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

TEST RESULTS

Remark: we tested and recorded all Op 3.

Test mode: Op 3:156.05MHz Polarization L1



MEASUREMENT RESULT: "HTW0410502_fin"

4/10/2015 9:46AM

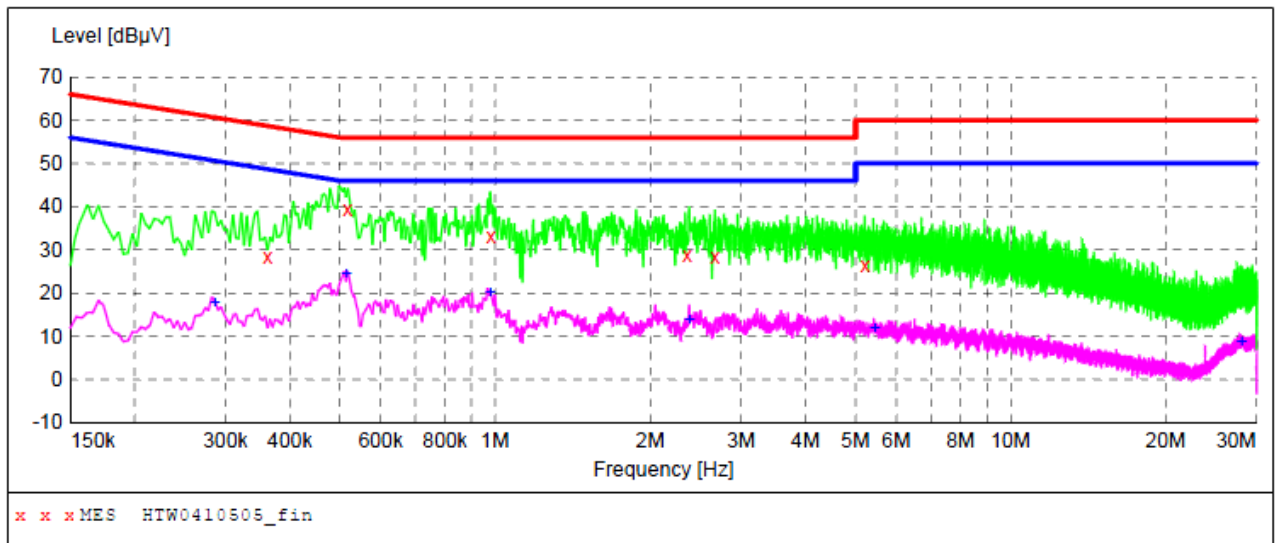
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.318000	35.80	10.2	60	24.0	QP	L1	GND
0.510000	45.40	10.2	56	10.6	QP	L1	GND
0.874000	38.30	10.2	56	17.7	QP	L1	GND
2.470000	36.00	10.3	56	20.0	QP	L1	GND
5.866000	31.90	10.4	60	28.1	QP	L1	GND
12.534000	25.60	10.8	60	34.4	QP	L1	GND

MEASUREMENT RESULT: "HTW0410502_fin2"

4/10/2015 9:46AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.286000	26.40	10.2	51	24.2	AV	L1	GND
0.518000	32.60	10.2	46	13.4	AV	L1	GND
0.982000	26.20	10.2	46	19.8	AV	L1	GND
2.422000	22.40	10.3	46	23.6	AV	L1	GND
6.214000	19.50	10.5	50	30.5	AV	L1	GND
12.486000	11.70	10.8	50	38.3	AV	L1	GND

Test mode:	Op 3:156.05MHz	Polarization	N
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MEASUREMENT RESULT: "HTW0410505_fin"

4/10/2015 9:56AM

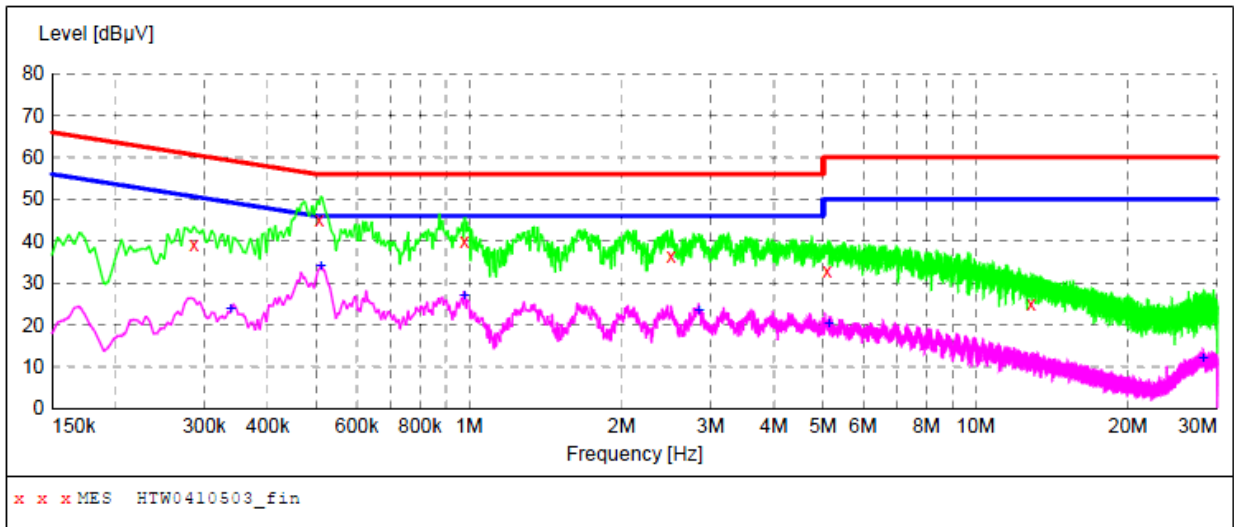
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.362000	28.40	10.2	59	30.3	QP	N	GND
0.518000	39.30	10.2	56	16.7	QP	N	GND
0.982000	33.00	10.2	56	23.0	QP	N	GND
2.358000	28.80	10.3	56	27.2	QP	N	GND
2.670000	28.50	10.3	56	27.5	QP	N	GND
5.218000	26.30	10.4	60	33.7	QP	N	GND

MEASUREMENT RESULT: "HTW0410505_fin2"

4/10/2015 9:56AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.286000	17.60	10.2	51	33.0	AV	N	GND
0.514000	24.60	10.2	46	21.4	AV	N	GND
0.978000	20.10	10.2	46	25.9	AV	N	GND
2.382000	13.80	10.3	46	32.2	AV	N	GND
5.442000	12.00	10.4	50	38.0	AV	N	GND
27.982000	8.80	11.1	50	41.2	AV	N	GND

Test mode: Op 3:156.8MHz Polarization L1



MEASUREMENT RESULT: "HTW0410503_fin"

4/10/2015 9:49AM

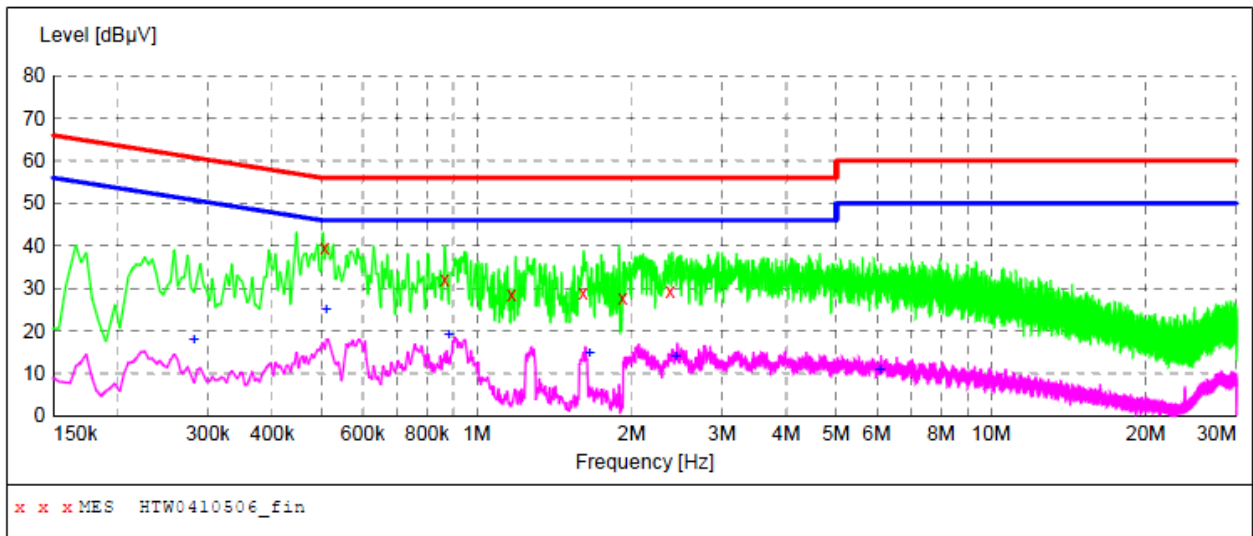
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.286000	39.00	10.2	61	21.6	QP	L1	GND
0.506000	45.00	10.2	56	11.0	QP	L1	GND
0.978000	40.00	10.2	56	16.0	QP	L1	GND
2.506000	36.30	10.3	56	19.7	QP	L1	GND
5.094000	32.80	10.4	60	27.2	QP	L1	GND
12.870000	24.90	10.8	60	35.1	QP	L1	GND

MEASUREMENT RESULT: "HTW0410503_fin2"

4/10/2015 9:49AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.338000	23.70	10.2	49	25.6	AV	L1	GND
0.510000	34.20	10.2	46	11.8	AV	L1	GND
0.978000	26.80	10.2	46	19.2	AV	L1	GND
2.842000	23.30	10.3	46	22.7	AV	L1	GND
5.134000	20.10	10.4	50	29.9	AV	L1	GND
28.134000	11.80	11.1	50	38.2	AV	L1	GND

Test mode: Op 3:156.8MHz Polarization N



MEASUREMENT RESULT: "HTW0410506_fin"

4/10/2015 9:59AM

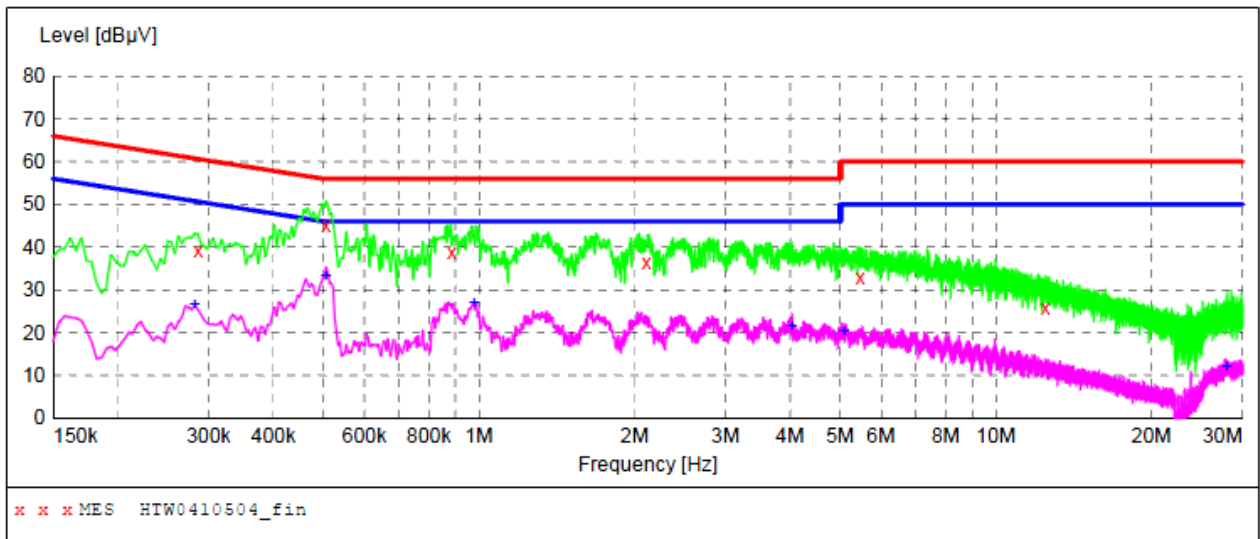
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.506000	39.60	10.2	56	16.4	QP	N	GND
0.866000	31.90	10.2	56	24.1	QP	N	GND
1.170000	28.40	10.2	56	27.6	QP	N	GND
1.610000	29.10	10.2	56	26.9	QP	N	GND
1.922000	27.80	10.2	56	28.2	QP	N	GND
2.374000	29.20	10.3	56	26.8	QP	N	GND

MEASUREMENT RESULT: "HTW0410506_fin2"

4/10/2015 9:59AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.282000	18.00	10.2	51	32.8	AV	N	GND
0.510000	25.10	10.2	46	20.9	AV	N	GND
0.882000	19.10	10.2	46	26.9	AV	N	GND
1.658000	14.90	10.2	46	31.1	AV	N	GND
2.438000	13.90	10.3	46	32.1	AV	N	GND
6.078000	10.90	10.4	50	39.1	AV	N	GND

Test mode: Op 3:157.425MHz Polarization L1



MEASUREMENT RESULT: "HTW0410504_fin"

4/10/2015 9:53AM

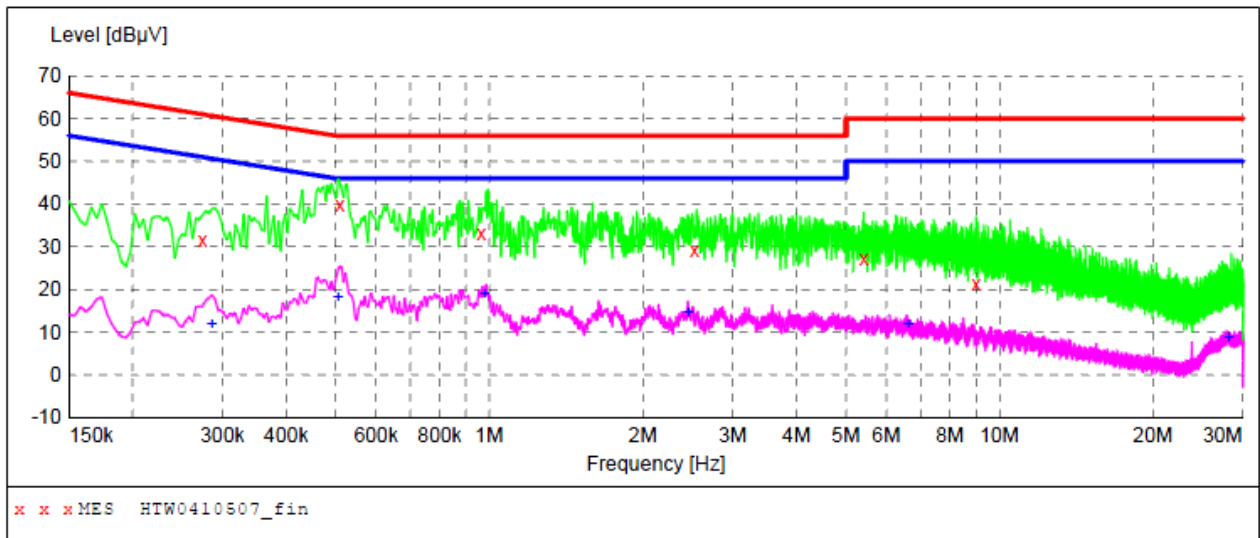
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.286000	39.20	10.2	61	21.4	QP	L1	GND
0.506000	45.20	10.2	56	10.8	QP	L1	GND
0.886000	38.70	10.2	56	17.3	QP	L1	GND
2.106000	36.30	10.2	56	19.7	QP	L1	GND
5.458000	33.00	10.4	60	27.0	QP	L1	GND
12.462000	25.90	10.8	60	34.1	QP	L1	GND

MEASUREMENT RESULT: "HTW0410504_fin2"

4/10/2015 9:53AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.282000	26.60	10.2	51	24.2	AV	L1	GND
0.506000	33.40	10.2	46	12.6	AV	L1	GND
0.978000	26.80	10.2	46	19.2	AV	L1	GND
4.030000	21.50	10.3	46	24.5	AV	L1	GND
5.082000	20.40	10.4	50	29.6	AV	L1	GND
27.914000	11.80	11.1	50	38.2	AV	L1	GND

Test mode: Op 3:157.425MHz Polarization N



MEASUREMENT RESULT: "HTW0410507_fin"

4/10/2015 10:03AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.274000	31.70	10.2	61	29.3	QP	N	GND
0.510000	39.90	10.2	56	16.1	QP	N	GND
0.966000	33.30	10.2	56	22.7	QP	N	GND
2.522000	29.20	10.3	56	26.8	QP	N	GND
5.426000	27.10	10.4	60	32.9	QP	N	GND
9.002000	21.10	10.7	60	38.9	QP	N	GND

MEASUREMENT RESULT: "HTW0410507_fin2"

4/10/2015 10:03AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.286000	12.00	10.2	51	38.6	AV	N	GND
0.506000	18.30	10.2	46	27.7	AV	N	GND
0.978000	18.80	10.2	46	27.2	AV	N	GND
2.454000	14.40	10.3	46	31.6	AV	N	GND
6.618000	11.70	10.5	50	38.3	AV	N	GND
28.122000	8.60	11.1	50	41.4	AV	N	GND

4.2. Maximum Transmitter Power

TEST APPLICABLE

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

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

FCC Part 2.1046 and 80.215(e)(1) Ship stations 156–162 MHz - 25W^{1,2}

Marine utility stations and hand-held portable transmitters: 156–162 MHz -10W , the output power shall be within ±1.0 dB of the manufacturer’s rated power.

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.

FCC Part 2.1046 and 80.215(e)(1) Marine utility stations and hand-held portable transmitters: 156-162 MHz-10W, the output power shall be within ±1.0 dB of the manufacturer’s rated power.

TEST PROCEDURE

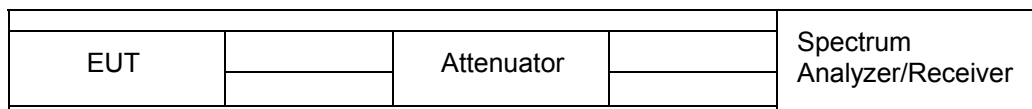
Measurements shall be made to establish the radio frequency power delivered by the transmitter the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted bellow:

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 3.70 V stabilized supply voltage.

TEST CONFIGURATION

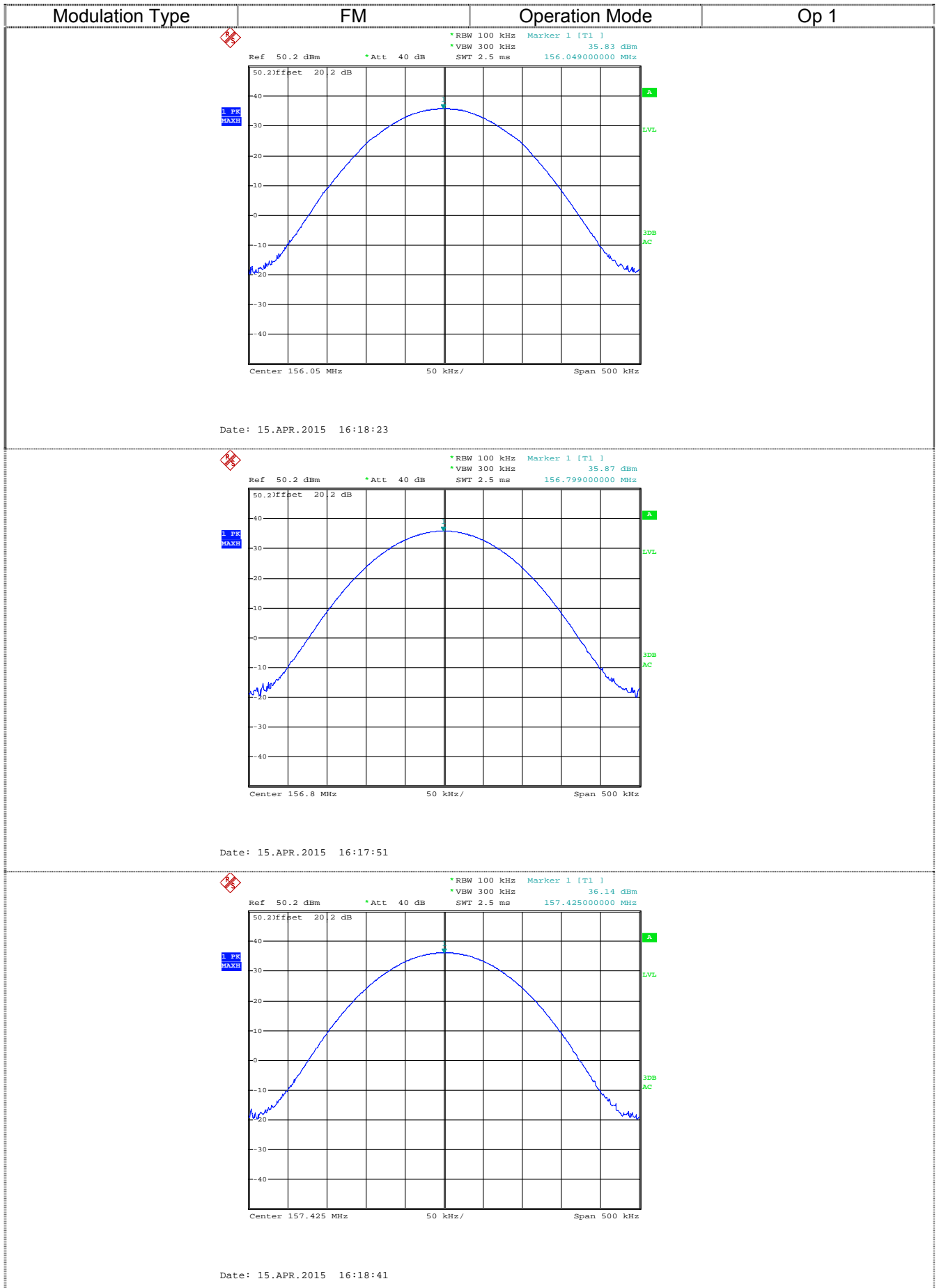


The EUT was directly connected to a RF Communication Test set by a 20 dB attenuator

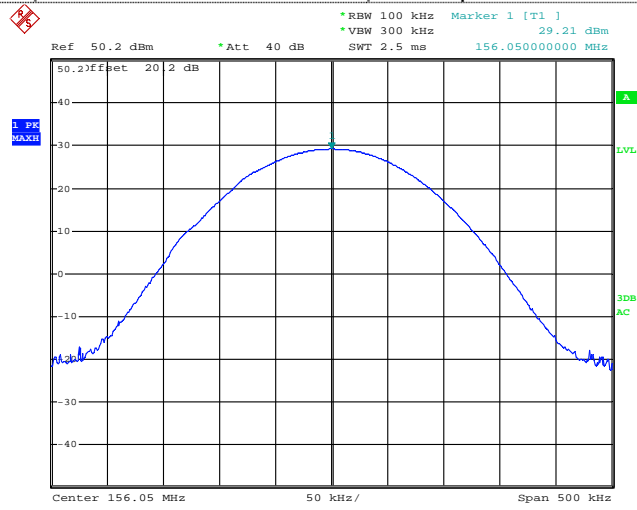
TEST RESULTS

Operation Mode	Test Frequency (MHz)	Measured power (dBm)	Difference (dB)	Limit (dB)	Result
Op 1	156.05	35.83	-0.19	-1 ~ +1	Pass
	156.8	35.87	-0.15		
	157.425	36.14	0.12		
Op 2	156.05	29.21	-0.79	-1 ~ +1	Pass
	156.8	30.68	0.68		
	157.425	29.25	-0.75		

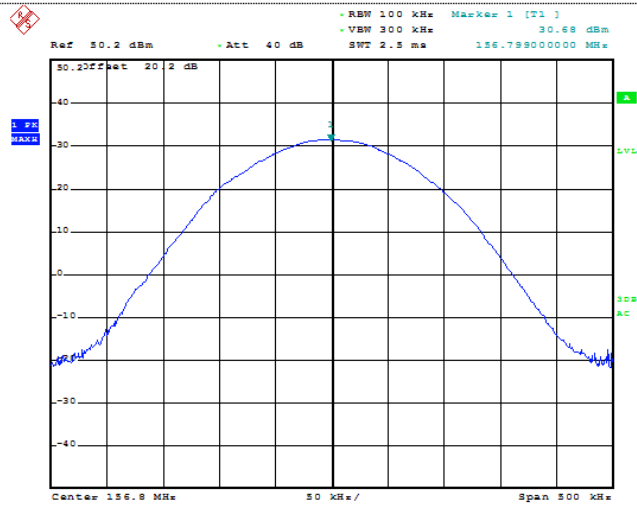
Test plot as follows:



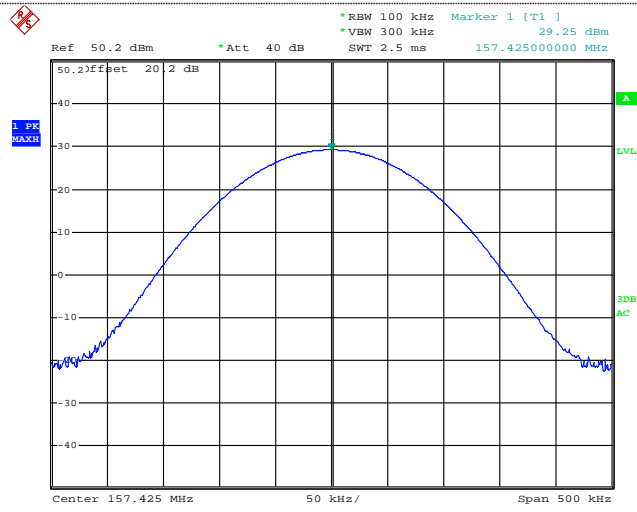
Modulation Type	FM	Operation Mode	Op 2
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Date: 15.APR.2015 16:18:11



Date: 15.APR.2015 16:17:32



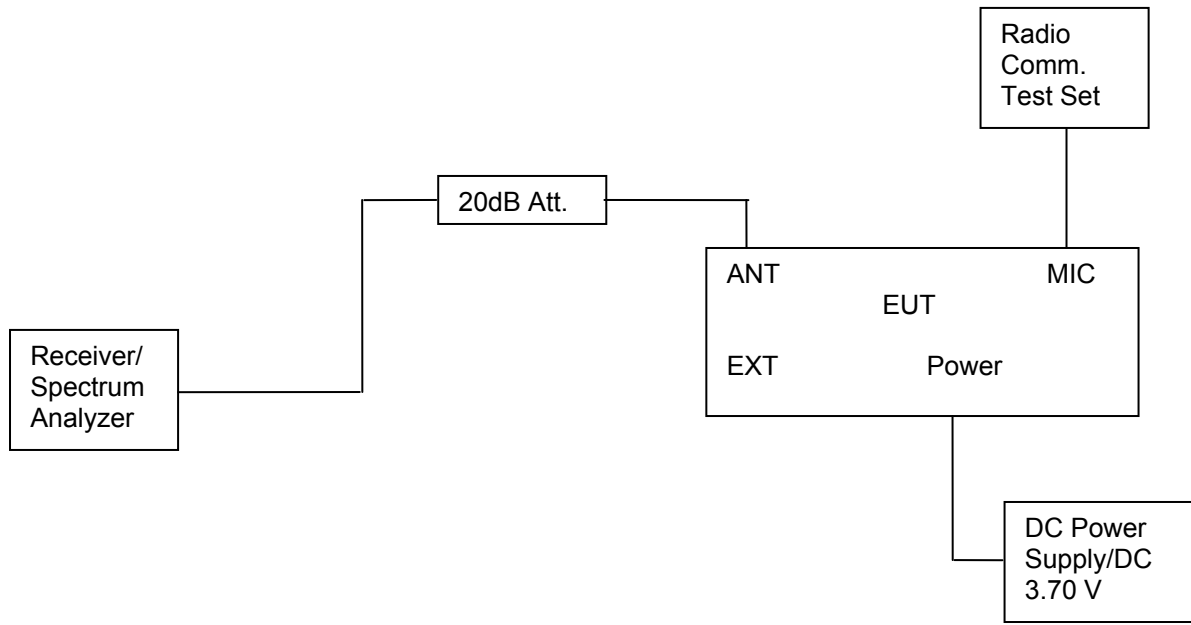
Date: 15.APR.2015 16:18:51

4.3. Occupied Bandwidth

TEST APPLICABLE

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.

TEST CONFIGURATION



TEST PROCEDURE

- 1 The EUT was modulated by 2.5kHz 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 (12.5kHz channel spacing) and 5 kHz (25 kHz channel spacing).
- 2 Set EUT as normal operation.
 - 1)Set SPA Center Frequency = fundamental frequency, RBW=100Hz, VBW=300Hz,span=50kHz for 12.5KHz channel spacing.
 - 2)Set SPA Center Frequency = fundamental frequency, RBW=300Hz, VBW=1kHz,span=50kHz for 25kHz channel spacing.
- 3 Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.
- 4 Set SPA Center Frequency=fundamental frequency, set =100Hz, VBW=300Hz, span=50kHz for 12.5KHz channel spacing.
Set SPA Center Frequency=fundamental frequency, set =300Hz,VBW=1kHz,span=50kHz for 25kHz channel spacing.

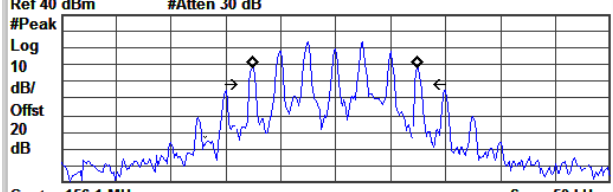
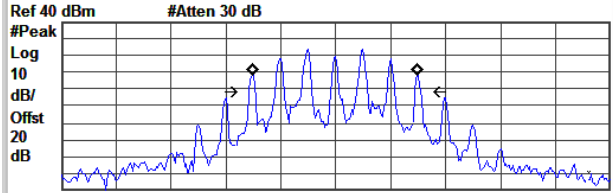
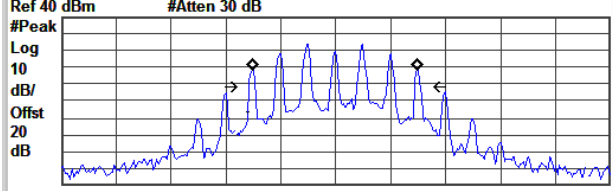
TEST RESULTS

Remark:We tested and reocrded Op 1 to Op 2.

Operation Mode	Test Frequency (MHz)	Occupied Bandwidth (kHz)		Limit (kHz)	Result
		99%	26dB		
Op 1	156.05	14.94	15.63	≤20.0	Pass
	156.8	14.93	15.64		
	157.425	14.95	15.62		
Op 2	156.05	15.01	15.63	≤20.0	Pass
	156.8	14.98	15.61		
	157.425	15.01	15.64		

Test plot as follows:

Modulation Type	FM	Operation Mode	Op 1
			<p>Freq/Channel</p> <p>Center Freq 156.050000 MHz</p> <p>Start Freq 156.025000 MHz</p> <p>Stop Freq 156.075000 MHz</p> <p>CF Step 5.00000000 kHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>
			<p>Trace/View</p> <p>Trace 1 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>
			<p>Freq/Channel</p> <p>Center Freq 157.425000 MHz</p> <p>Start Freq 157.400000 MHz</p> <p>Stop Freq 157.450000 MHz</p> <p>CF Step 5.00000000 kHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>

Modulation Type	FM	Operation Mode	Op 2
<p>Agilent R T</p> <p>Ch Freq 156.05 MHz Trig Free</p> <p>Occupied Bandwidth</p> <hr/> <p>Ref 40 dBm #Atten 30 dB</p>  <p>Center 156.1 MHz Span 50 kHz #Res BW 300 Hz #VBW 1 kHz Sweep 2.226 s (401 pts)</p> <p>Occupied Bandwidth Occ BW % Pwr 99.00 % 15.0101 kHz x dB -26.00 dB</p> <p>Transmit Freq Error -75.046 Hz x dB Bandwidth 15.632 kHz</p>		<p>Freq/Channel</p> <p>Center Freq 156.050000 MHz</p> <p>Start Freq 156.025000 MHz</p> <p>Stop Freq 156.075000 MHz</p> <p>CF Step 5.00000000 kHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>	
<p>Agilent R T</p> <p>Ch Freq 156.8 MHz Trig Free</p> <p>Occupied Bandwidth</p> <hr/> <p>Ref 40 dBm #Atten 30 dB</p>  <p>Center 156.8 MHz Span 50 kHz #Res BW 300 Hz #VBW 1 kHz Sweep 2.226 s (401 pts)</p> <p>Occupied Bandwidth Occ BW % Pwr 99.00 % 14.9769 kHz x dB -26.00 dB</p> <p>Transmit Freq Error -74.425 Hz x dB Bandwidth 15.614 kHz</p>		<p>Trace/View</p> <p>Trace 1 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>	
<p>Agilent R T</p> <p>Ch Freq 157.425 MHz Trig Free</p> <p>Occupied Bandwidth</p> <hr/> <p>Ref 40 dBm #Atten 30 dB</p>  <p>Center 157.4 MHz Span 50 kHz #Res BW 300 Hz #VBW 1 kHz Sweep 2.226 s (401 pts)</p> <p>Occupied Bandwidth Occ BW % Pwr 99.00 % 15.0050 kHz x dB -26.00 dB</p> <p>Transmit Freq Error -92.439 Hz x dB Bandwidth 15.644 kHz</p>		<p>Freq/Channel</p> <p>Center Freq 157.425000 MHz</p> <p>Start Freq 157.400000 MHz</p> <p>Stop Freq 157.450000 MHz</p> <p>CF Step 5.00000000 kHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>	

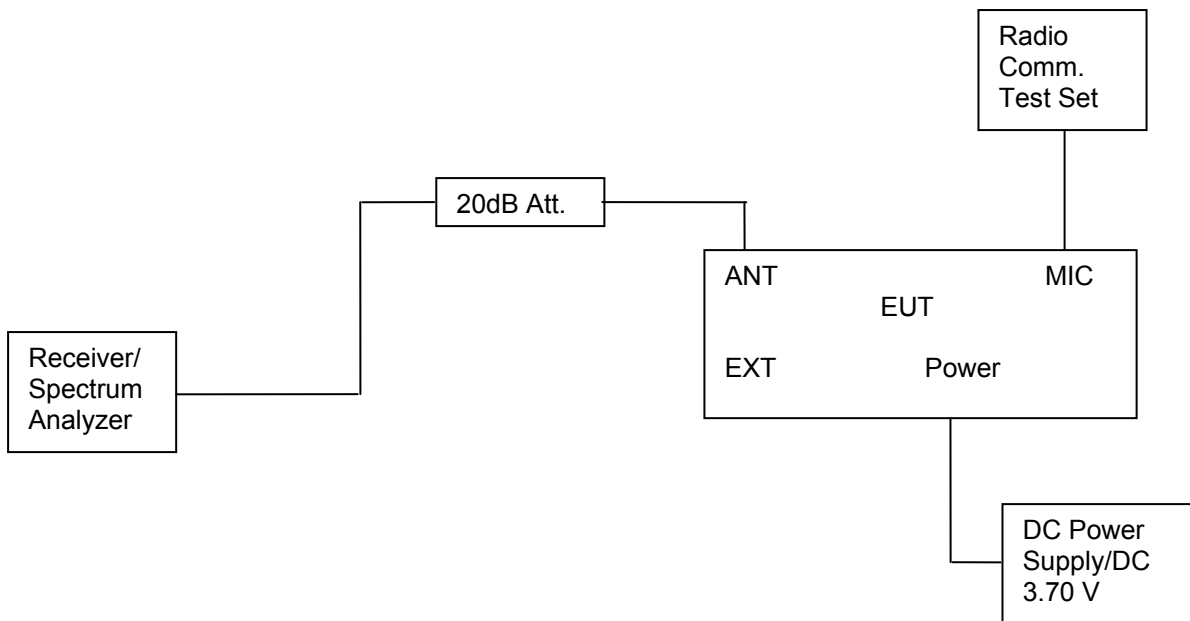
4.4. Emission Mask

TEST APPLICABLE

According to §80.211

- (a). 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.
- (b). Emission Mask D:12.5 kHz channel bandwidth equipment: For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
 - (1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.
 - (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
 - (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

TEST CONFIGURATION



TEST PROCEDURE

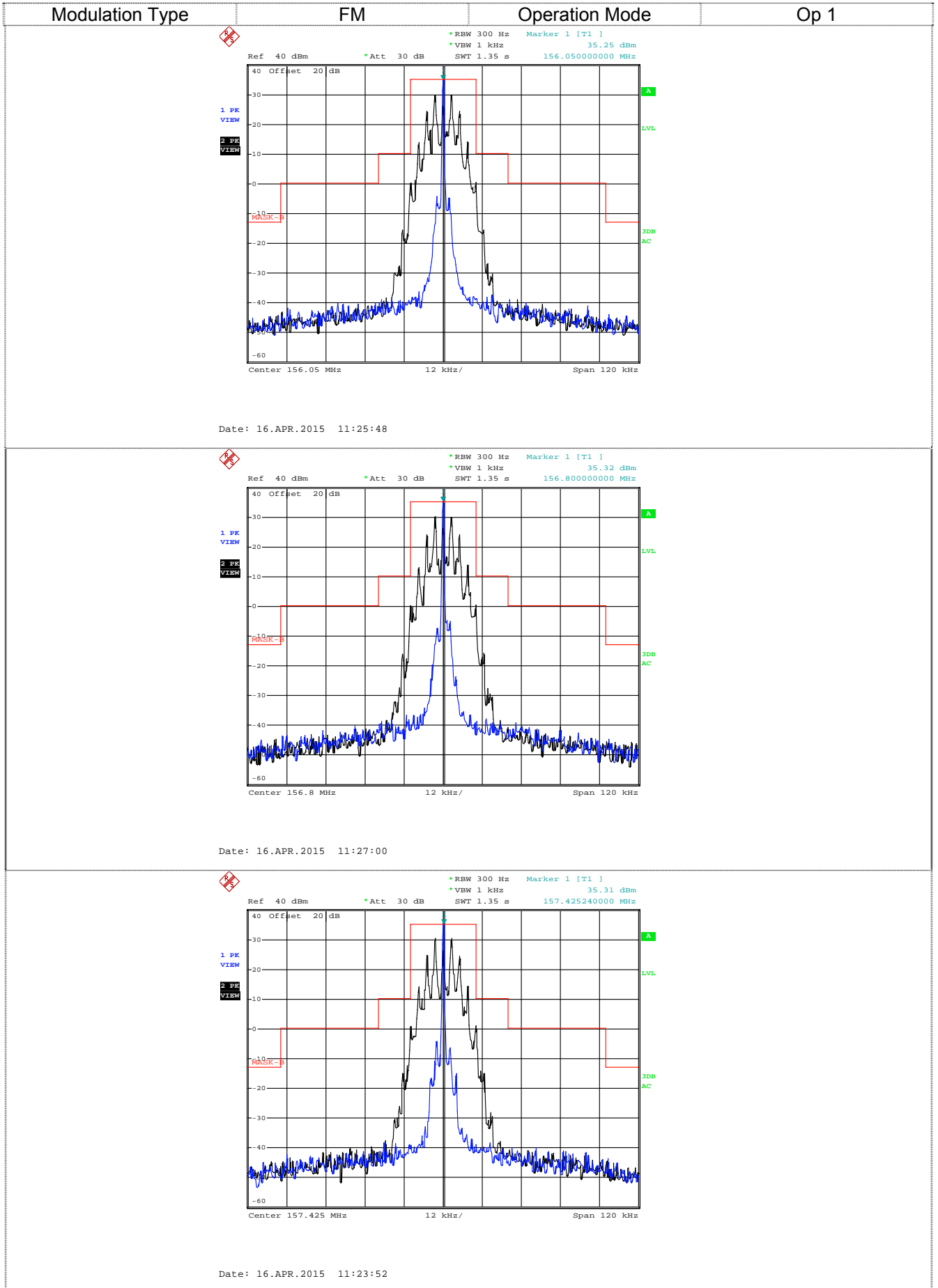
1. The EUT was modulated by 2.5kHz Sine wave audio signal; the level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz (12.5kHz channel spacing) and 5kHz (25 kHz channel spacing).
2. Set EUT as normal operation.
 - 1) Set SPA Center Frequency = fundamental frequency, RBW=100Hz, VBW=300Hz, span=50kHz for 12.5kHz channel spacing.
 - 2) Set SPA Center Frequency = fundamental frequency, RBW=300Hz, VBW=1kHz, span=120kHz for 25kHz channel spacing.

TEST RESULTS

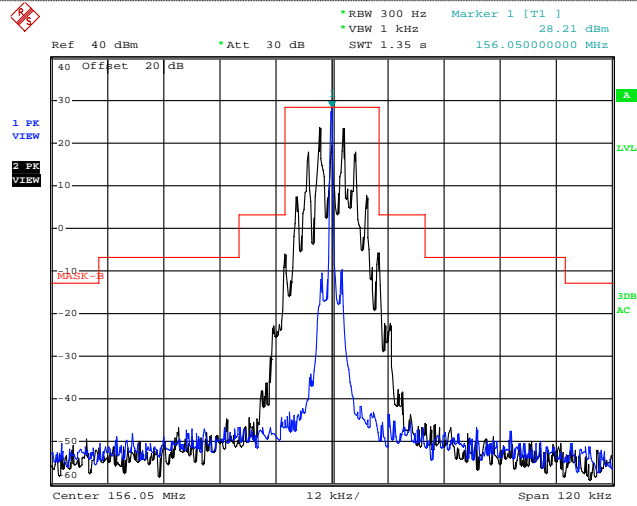
Remark: We tested and recorded Op 1 to Op2.

Operation Mode	Test Frequency (MHz)	RBW (Hz)	Applicable Mask	Result
Op 1	156.05	300.00	B	Pass
	156.8			
	157.425			
Op 2	156.05	300.00	B	Pass
	156.8			
	157.425			

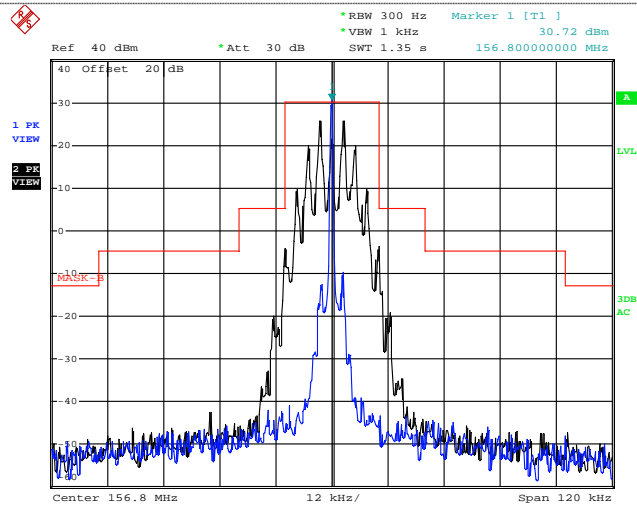
Test plot as follows:



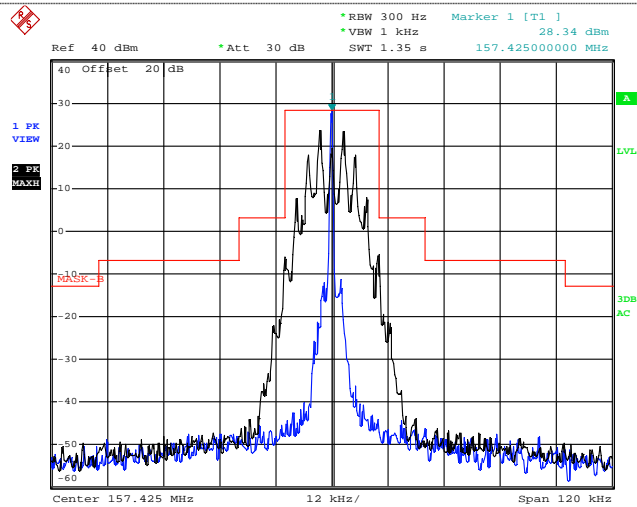
Modulation Type	FM	Operation Mode	Op 2
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Date: 16.APR.2015 11:31:46



Date: 16.APR.2015 11:29:10



Date: 16.APR.2015 11:32:58

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.

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. The Audio Low Pass Filter

RSS-182 Clause show Coast station shall be equipped with an audio low-pass filter. 6 dB pre-emphasis network is required; it is to be connected before the deviation limiter in the transmit path.

TEST PROCEDURE

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, 1004, 1500 and 2500Hz in sequence.

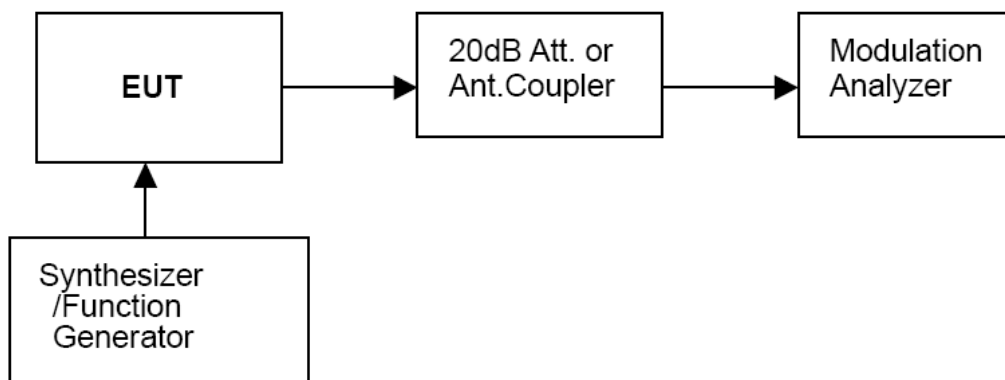
Audio Frequency Response

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

Audio Low Pass Filter

1. Configure the EUT as shown in figure 1.
2. Apply a 1000 Hz tone from the audio frequency generator and adjust the level per manufacturer's specifications
3. Set the audio frequency generator to the desired test frequency between 3000 Hz and the upper low pass .filter limit
4. Low pass frequency response = $LEV_{\text{FREQ}} - LEV_{\text{REF}}$.

TEST CONFIGURATION



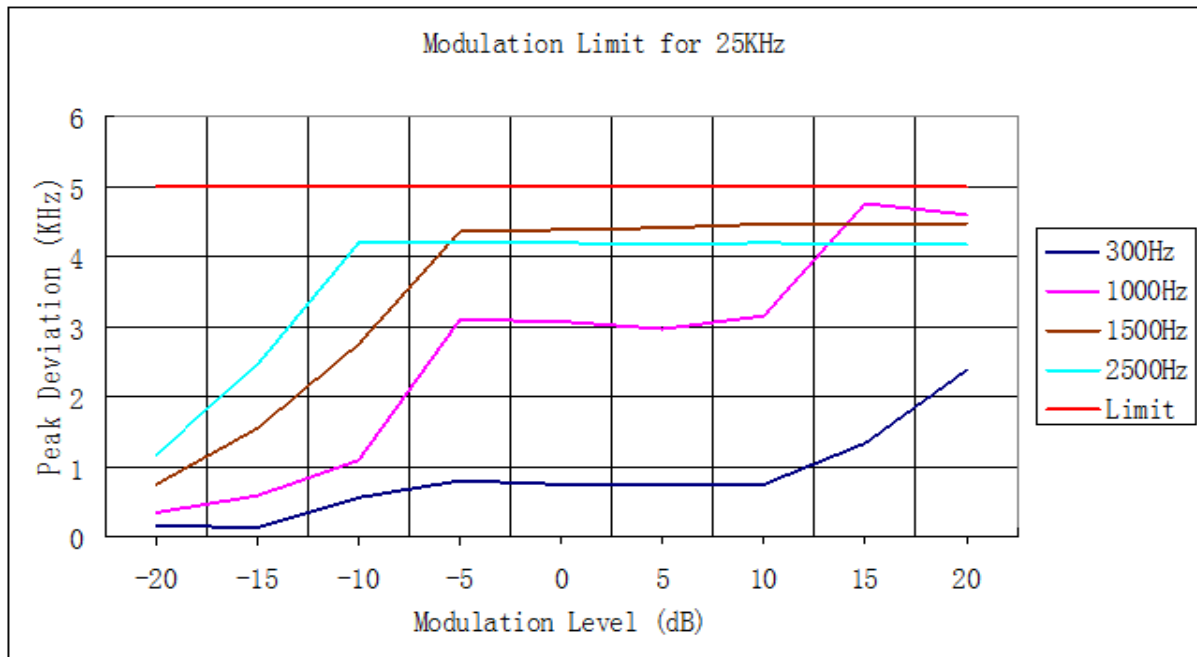
TEST RESULTS

Remark: We tested Op 1 to Op 2. recorded worst case at Op 1 for 156.8MHz.

a).Modulation Limit:

Op 1: 156.8MHz						
Modulation Level (dB)	Peak Freq. Deviation At 300Hz (kHz)	Peak Freq. Deviation At 1004Hz (kHz)	Peak Freq. Deviation At 1500Hz (kHz)	Peak Freq. Deviation At 2500 Hz (kHz)	Limit (kHz)	Result
-20	0.14	0.34	0.74	1.16	5.0	Pass
-15	0.12	0.56	1.55	2.44		
-10	0.53	1.07	2.74	4.17		
-5	0.77	3.08	4.33	4.15		
0	0.75	3.06	4.32	4.14		
5	0.73	2.94	4.38	4.13		
10	0.72	3.13	4.44	4.19		
15	1.35	4.72	4.43	4.16		
20	2.37	4.57	4.42	4.14		

Test plot as follows:



b). Audio Frequency Response:

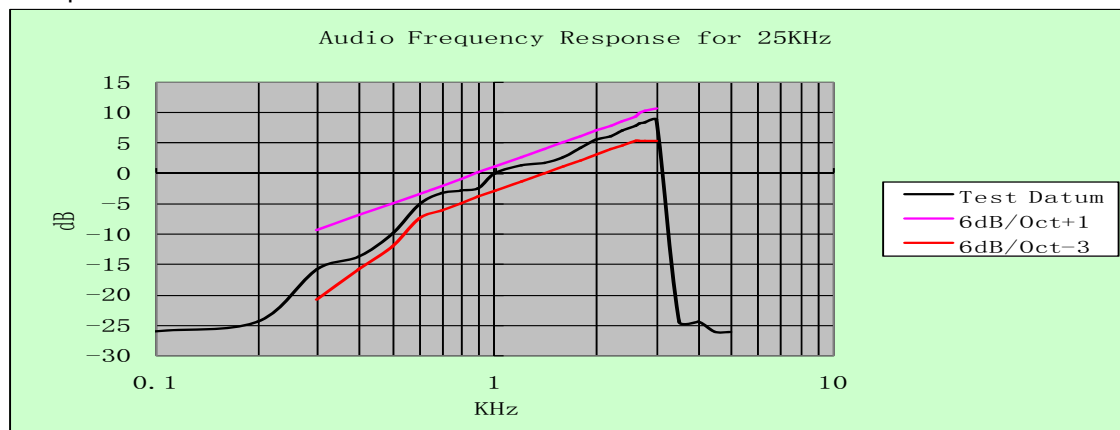
Method of Measurement:

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 3.0kHz to 50kHz. However, the audio frequency response should test from 100Hz to 5.0 kHz according to FCC Part 2.1047(a).

Note:The Audio Frequency Response is identical for 25kHz channel separation

Op 1: 156.8MHz			
Frequency (kHz)	Frequency Deviation (kHz)	1KHz Reference Deviation (kHz)	Audio Frequency Response (dB)
0.1	0.04	1.03	-28.22
0.2	0.05	1.03	-26.28
0.3	0.16	1.03	-16.17
0.4	0.21	1.03	-13.81
0.5	0.31	1.03	-10.43
0.6	0.57	1.03	-5.14
0.7	0.69	1.03	-3.48
0.8	0.73	1.03	-2.99
0.9	0.75	1.03	-2.76
1	1.03	1.03	0
1.2	1.15	1.03	0.96
1.4	1.22	1.03	1.47
1.6	1.36	1.03	2.41
1.8	1.63	1.03	3.99
2	1.89	1.03	5.27
2.2	2.03	1.03	5.89
2.4	2.25	1.03	6.79
2.6	2.46	1.03	7.56
2.7	2.58	1.03	7.98
2.8	2.62	1.03	8.11
3	2.77	1.03	8.59
3.5	0.04	1.03	-28.22
4	0.04	1.03	-28.22
4.5	0.04	1.03	-28.22
5	0.04	1.03	-28.22

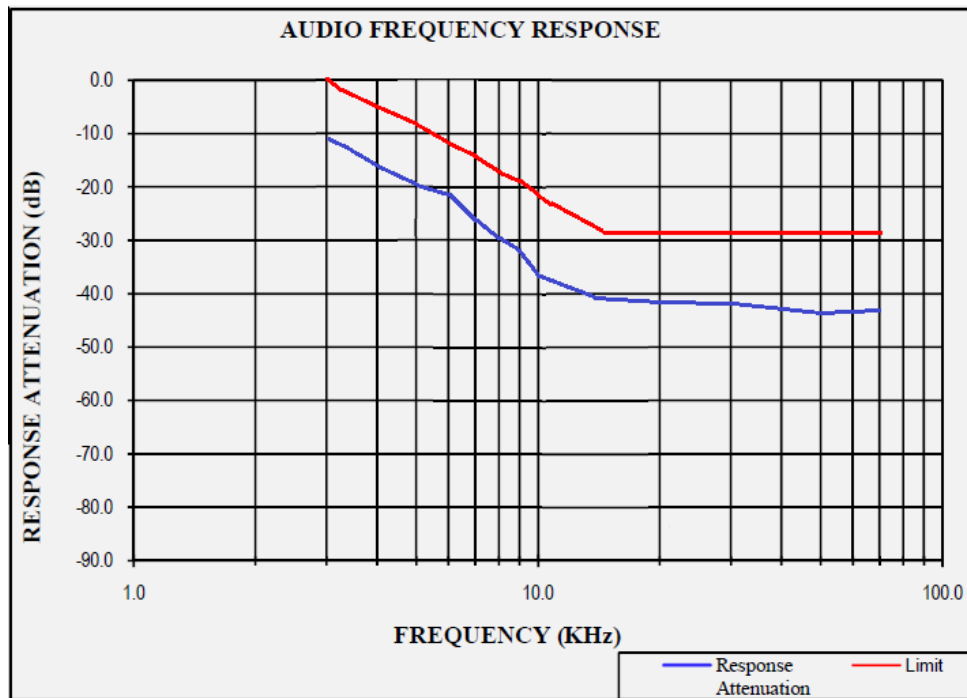
Test plot as follows:



c). Audio Low Pass Filter:

Op 1: 156.8MHz		
Audio Frequency (kHz)	1kHz Reference Response Attenuation (dB)	Limit (dB)
3.0	-11.50	0.00
3.5	-14.76	-2.68
4.0	-17.80	-5.00
5.0	-19.85	-8.87
6.0	-21.85	-12.04
7.0	-25.93	-14.72
8.0	-29.90	-17.04
9.0	-32.01	-19.08
10.0	-36.15	-20.92
15.0	-40.55	-28.00
20.0	-41.84	-28.00
30.0	-42.70	-28.00
50.0	-44.87	-28.00
70.0	-44.73	-28.00

Test plot as follows:



4.6. Frequency Stability Test

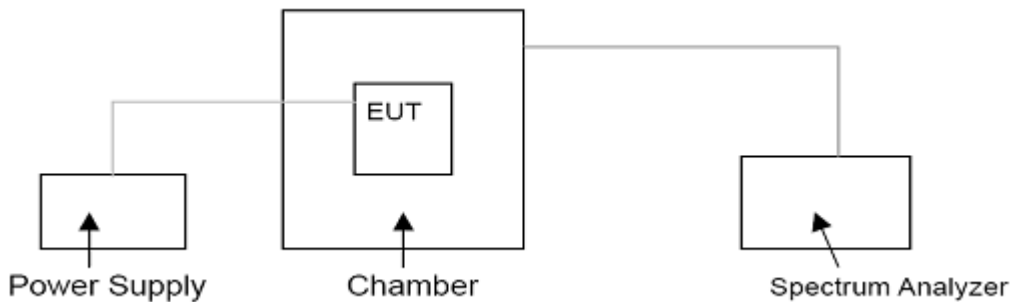
TEST APPLICABLE

- 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 (d) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
- 3 Vary primary supply voltage from 85 to 115 percent of the nominal value.
- 4 According to §80.209(a), the frequency stability limit:
 - 1) Ship stations:10ppm
 - 2) Coast stations:
 - For carriers licensed to operate with a carrier power:
 - i) Below 3 watts:10ppm
 - ii)3 to 100 watts:5ppm

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(a)(5), Transmitters used must have minimum frequency stability as specified in the following table:

(5) Band 156-162 MHz:	
(i) Coast stations:	
For carriers licensed to operate with a carrier power:	
Below 3 watts	10.
3 to 100 watts	5. ⁷
(ii) Ship stations	10. ⁴
(iii) Survival craft stations operating on 121.500 MHz	50.
(iv) EPIRBs:	
Operating on 121.500 and 243.000 MHz	50.
Operating on 156.750 and 156.800 MHz. ⁶	10.

TEST RESULTS

Remark:We tested and recorded Op 1 to Op 2.

Op 1						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage(V)	Temp(°C)	156.05MHz	156.8MHz	157.425MHz		
3.7	-30	0.12	-0.09	0.14	5.0	Pass
	-20	0.21	0.12	0.16		
	-10	0.16	-0.13	-0.21		
	0	-0.13	-0.08	0.18		
	10	-0.17	0.13	0.14		
	20	0.23	0.07	0.16		
	30	-0.24	0.23	-0.17		
	40	-0.09	0.15	-0.19		
	50	-0.11	0.12	0.18		
3.145(85% Rated)	20	0.17	0.17	0.13		
4.255(115% Rated)	20	0.22	0.20	0.15		

Op 2						
Test conditions		Frequency error (ppm)			Limit (ppm)	Result
Voltage(V)	Temp(°C)	156.05MHz	156.8MHz	157.425MHz		
3.7	-30	-0.14	-0.11	-0.15	10.0	Pass
	-20	0.16	0.09	0.14		
	-10	0.18	-0.14	-0.23		
	0	-0.15	-0.07	0.17		
	10	-0.16	0.15	0.18		
	20	0.21	0.08	0.17		
	30	-0.22	0.20	-0.14		
	40	-0.10	0.14	-0.18		
	50	0.13	0.13	0.16		
3.145(85% Rated)	20	0.15	0.15	0.15		
4.255(115% Rated)	20	0.21	0.21	0.14		

4.7. Spurious Emssion on Antenna Port

TEST APPLICABLE

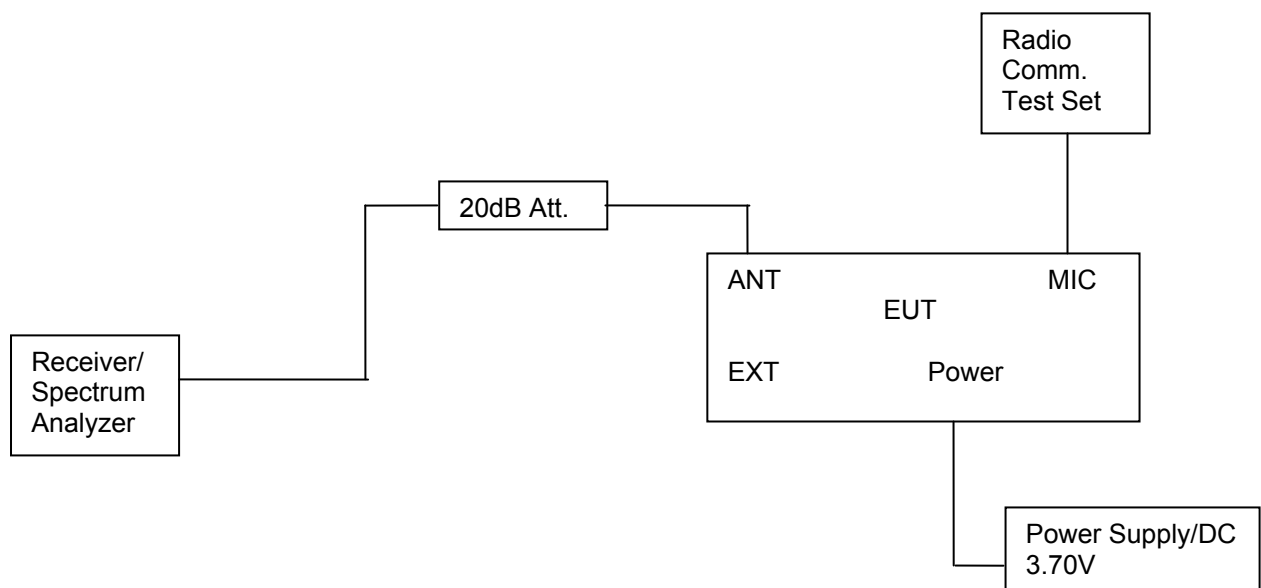
The same as Section 4.4

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



LIMIT

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 assigned channel by more than 250 percent at least:

Low: $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (4.11) = 49.14 \text{ dB}$

High: $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (3.83) = 48.83 \text{ dB}$

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 36.69 dBm.

Limit (dBm) = 36.69-43-10log₁₀ (4.11) = -13 dBm

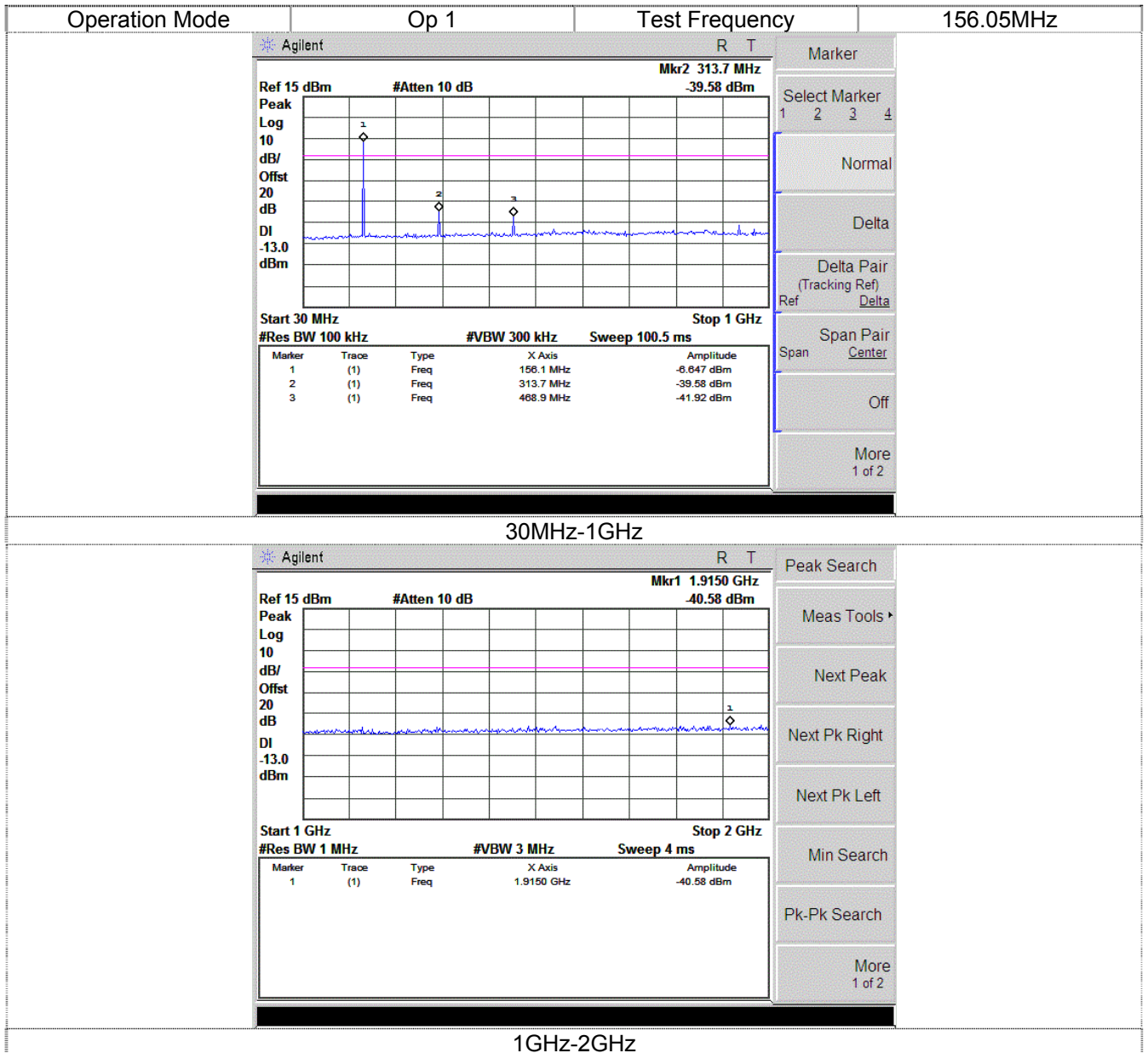
TEST RESULTS

Remark: We tested Op 1 to Op 2, recorded worst case at Op 1.

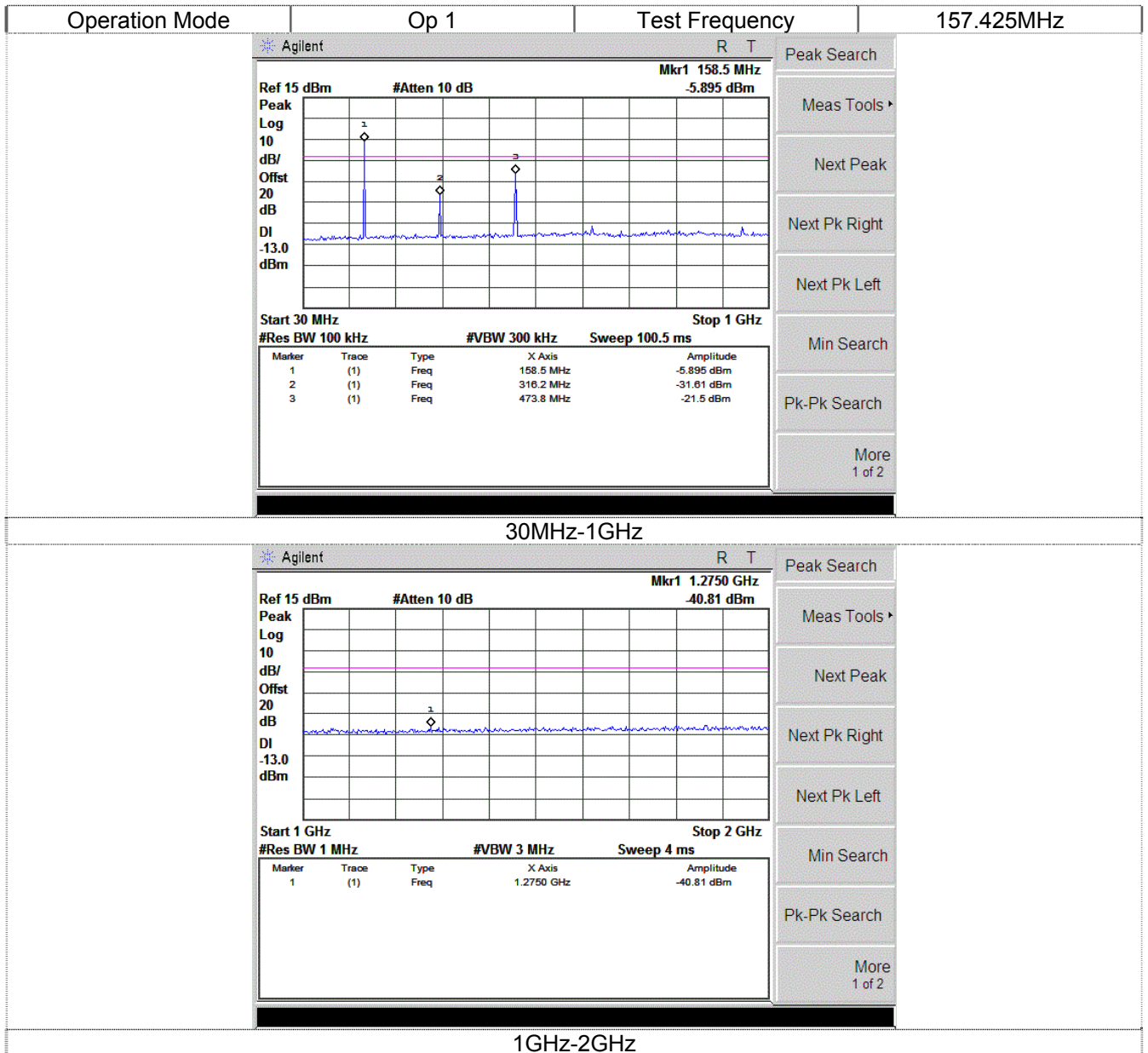
Note:

1. In general, the worse case attenuation requirement shown above was applied.
2. The measurement frequency range from 30 MHz to 2GHz.

Test plot as follows:







4.8. 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 12.5 kHz channel bandwidth:

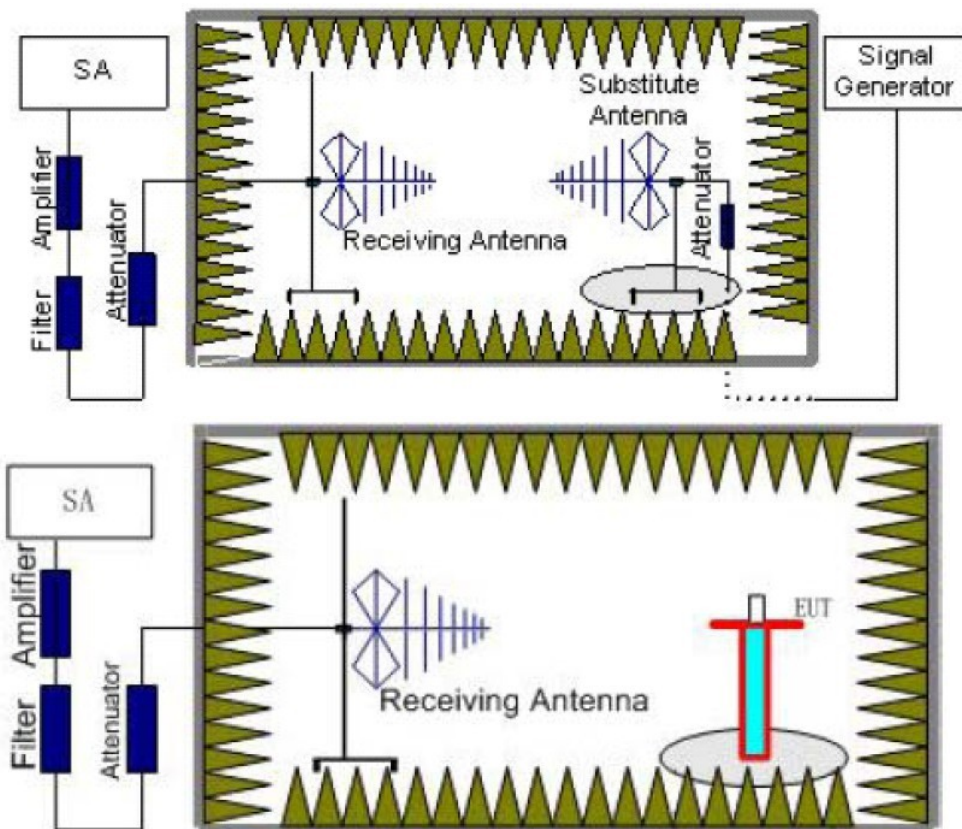
- 1 On any frequency removed from the center of the authorized bandwidth f_0 to 5.625kHz removed from f_0 : Zero dB
- 2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) f_0 of more than 5.625kHz but no more than 12.5 kHz: At least 7.27dB
- 3 On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) f_0 of more than 12.5 kHz: At least $50+10 \log (P)$ dB or 70 dB, which ever is lesser attenuation.

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

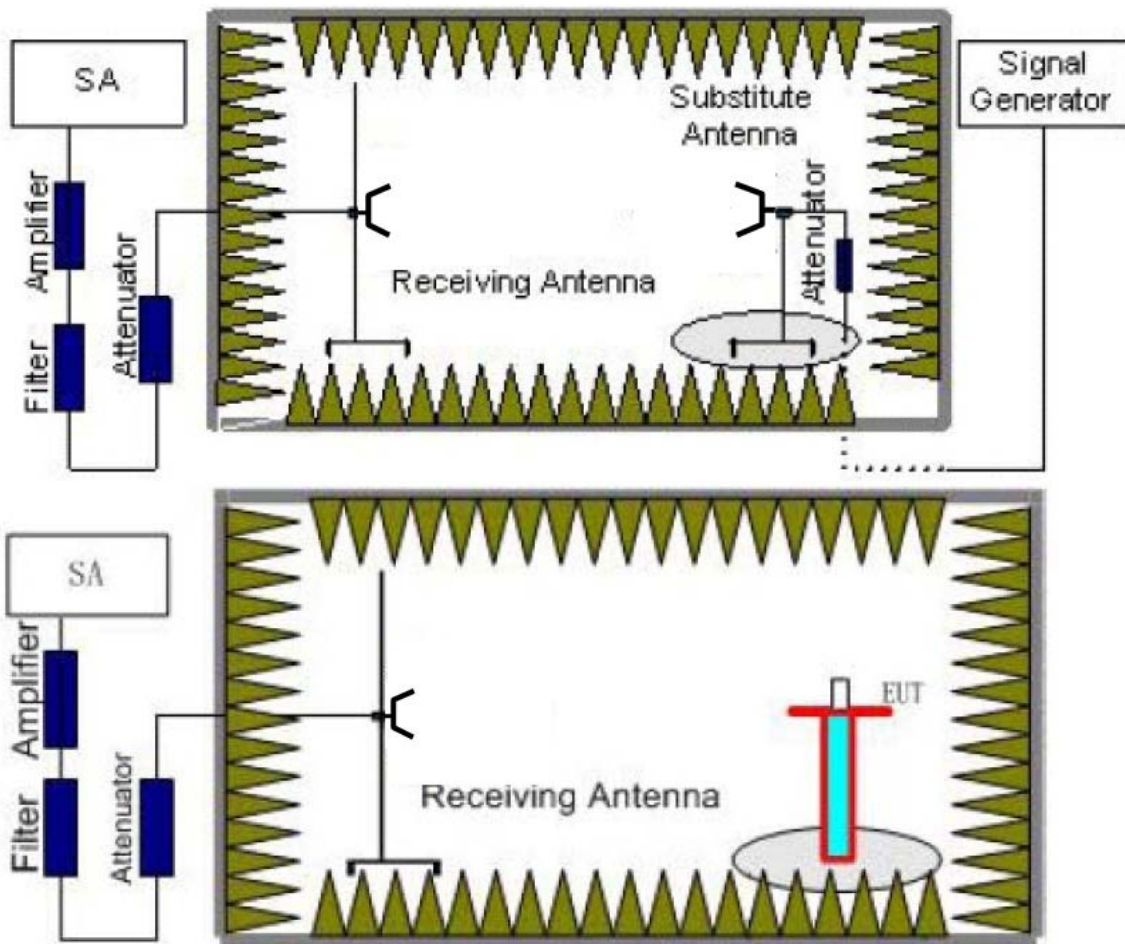
- 1 On any frequency removed from the assigned frequency by more than 50 percent, but no more than 100 percent of the authorized bandwidth: At least 25 dB.
- 2 On any frequency removed from the assigned frequency by more than 100 percent, but no more than 250 percent of the authorized bandwidth: At least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

TEST CONFIGURATION

Below 1GHz:



Above 1GHz:



TEST PROCEDURE

1. EUT was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.0 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in six channels were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz for above 1GHz and RBW=100kHz, VBW=300kHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}), the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test. The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{\text{Mea}} - P_{\text{Ag}} - P_{\text{cl}} - G_a$$
 We used SMF100A microwave signal generator which signal level can up to 33dBm, so we not used power Amplifier for substitution test; The measurement results are amend as described below:

$$\text{Power(EIRP)} = P_{\text{Mea}} - P_{\text{cl}} - G_a$$
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.

7. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15 \text{dBi}$.

LIMIT

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 assigned channel by more than 250 percent at least:

Low: $43 + 10 \log(\text{Pwatts}) = 43 + 10 \log(4.11) = 49.14 \text{ dB}$

High: $43 + 10 \log(\text{Pwatts}) = 43 + 10 \log(3.83) = 48.83 \text{ dB}$

Calculation: Limit (dBm) = $EL - 43 - 10 \log_{10}(\text{TP})$

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

In this application, the EL is 36.69 dBm.

Limit (dBm) = $36.69 - 43 - 10 \log_{10}(4.11) = -13 \text{ dBm}$

TEST RESULTS

Remark: We tested Op 1 to Op 2. recorded worst case at Op 1.

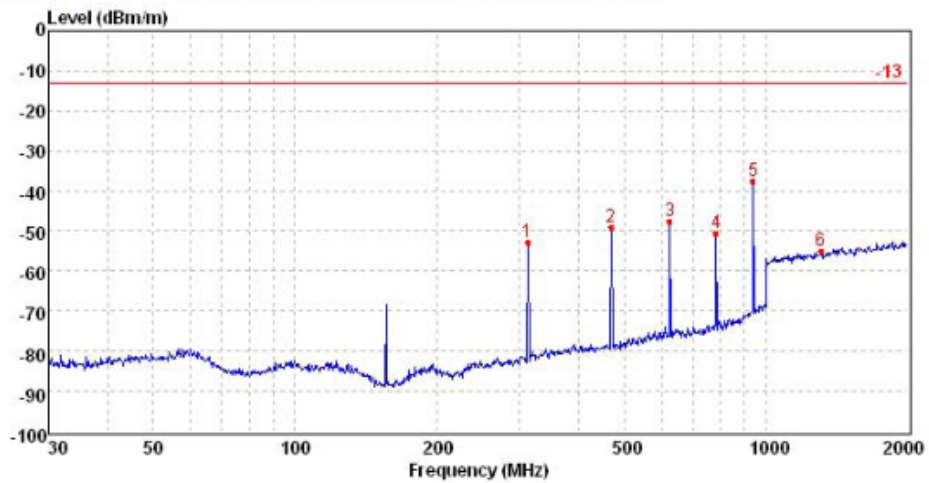
Note: 1. In general, the worse case attenuation requirement shown above was applied.

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

Test plot as follows:

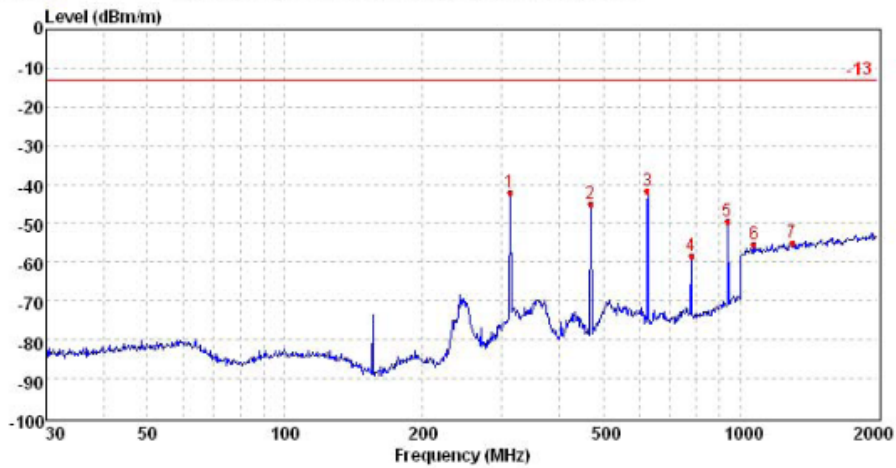
Op 1

Test Frequency: 156.05 MHz Polarity: Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	312.18	-52.44	26.50	1.96	28.86	-52.84	-13.00	-39.84	Peak
2	468.88	-51.92	29.34	2.42	28.91	-49.07	-13.00	-36.07	Peak
3	625.08	-53.72	31.75	2.95	28.73	-47.75	-13.00	-34.75	Peak
4	782.35	-58.47	33.03	3.27	28.53	-50.70	-13.00	-37.70	Peak
5	938.83	-49.29	36.45	3.64	28.38	-37.58	-13.00	-24.58	Peak
6	1310.39	-70.61	39.48	4.37	28.21	-54.97	-13.00	-41.97	Peak

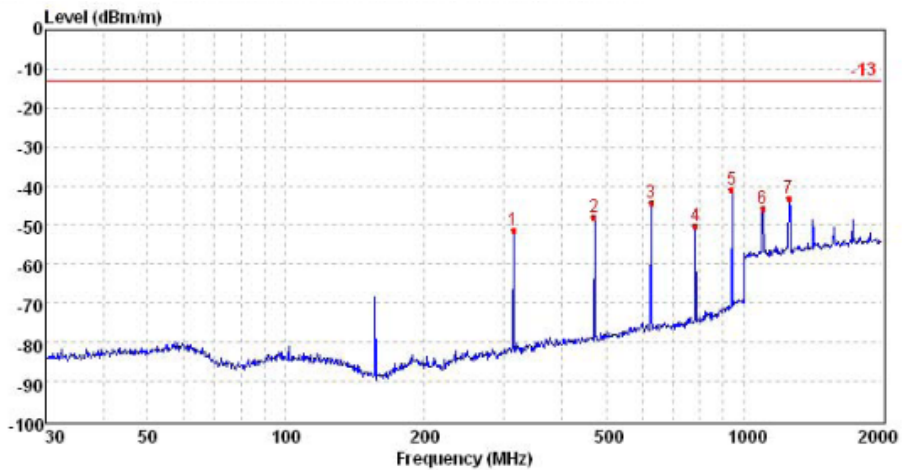
Test Frequency: 156.05MHz Polarity: Vertical



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	312.06	-41.58	26.50	1.96	28.86	-41.98	-13.00	-28.98	Peak
2	469.24	-47.96	29.34	2.42	28.91	-45.11	-13.00	-32.11	Peak
3	626.07	-47.73	31.76	2.95	28.73	-41.75	-13.00	-28.75	Peak
4	781.33	-66.03	33.03	3.27	28.54	-58.27	-13.00	-45.27	Peak
5	938.10	-61.21	36.45	3.64	28.38	-49.50	-13.00	-36.50	Peak
6	1070.29	-69.58	38.62	3.83	28.29	-55.42	-13.00	-42.42	Peak
7	1300.44	-70.45	39.45	4.34	28.21	-54.87	-13.00	-41.87	Peak

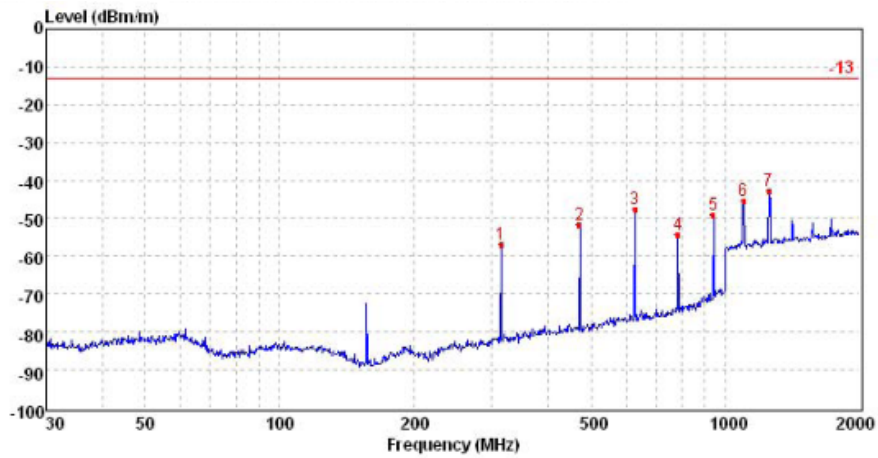
Op 1

Test Frequency: 156.8 MHz Polarity: Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	314.26	-51.04	26.55	1.97	28.86	-51.38	-13.00	-38.38	Peak
2	470.89	-50.71	29.34	2.42	28.91	-47.86	-13.00	-34.86	Peak
3	628.27	-50.28	31.76	2.95	28.72	-44.29	-13.00	-31.29	Peak
4	784.08	-57.95	33.09	3.27	28.53	-50.12	-13.00	-37.12	Peak
5	941.41	-52.79	36.64	3.64	28.37	-40.88	-13.00	-27.88	Peak
6	1097.33	-60.05	38.73	3.90	28.28	-45.70	-13.00	-32.70	Peak
7	1254.40	-58.35	39.29	4.24	28.23	-43.05	-13.00	-30.05	Peak

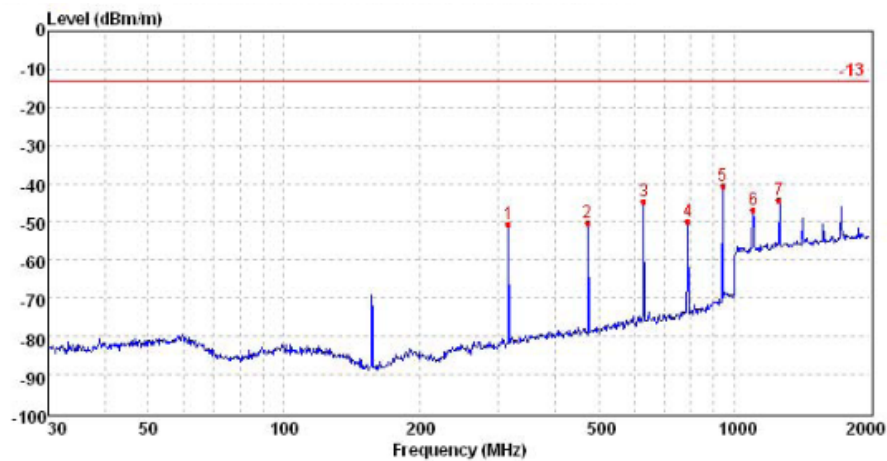
Test Frequency: 156.8MHz Polarity: Vertical



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	314.26	-56.66	26.55	1.97	28.86	-57.00	-13.00	-44.00	Peak
2	470.89	-54.69	29.34	2.42	28.91	-51.84	-13.00	-38.84	Peak
3	628.27	-53.63	31.76	2.95	28.72	-47.64	-13.00	-34.64	Peak
4	784.08	-62.13	33.09	3.27	28.53	-54.30	-13.00	-41.30	Peak
5	941.41	-60.91	36.64	3.64	28.37	-49.00	-13.00	-36.00	Peak
6	1097.33	-59.66	38.73	3.90	28.28	-45.31	-13.00	-32.31	Peak
7	1254.40	-57.94	39.29	4.24	28.23	-42.64	-13.00	-29.64	Peak

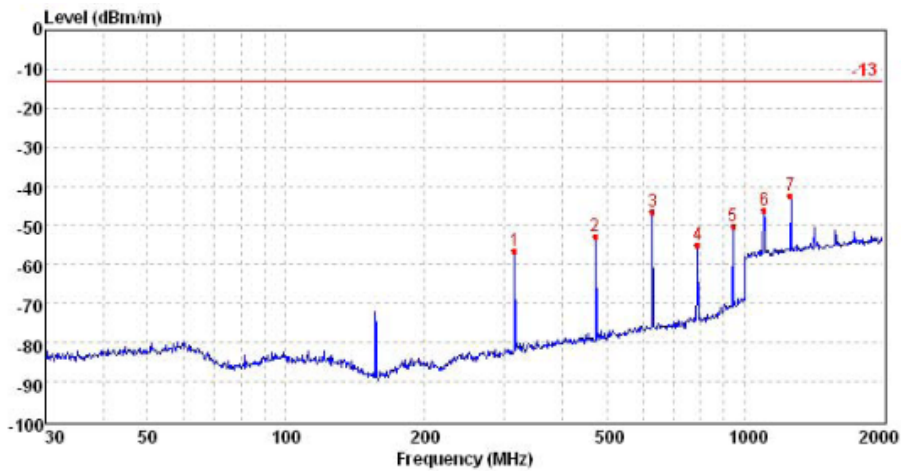
Op 1

Test Frequency: 157.425 MHz Polarity: Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	315.37	-50.15	26.55	1.97	28.86	-50.49	-13.00	-37.49	Peak
2	472.55	-53.10	29.39	2.43	28.91	-50.19	-13.00	-37.19	Peak
3	630.49	-50.76	31.78	2.95	28.72	-44.75	-13.00	-31.75	Peak
4	789.62	-57.60	33.15	3.28	28.53	-49.70	-13.00	-36.70	Peak
5	944.72	-52.59	36.64	3.64	28.37	-40.68	-13.00	-27.68	Peak
6	1101.91	-61.20	38.73	3.90	28.28	-46.85	-13.00	-33.85	Peak
7	1259.63	-59.47	39.32	4.27	28.22	-44.10	-13.00	-31.10	Peak

Test Frequency: 157.425MHz Polarity: Vertical



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	315.37	-56.06	26.55	1.97	28.86	-56.40	-13.00	-43.40	Peak
2	472.55	-55.66	29.39	2.43	28.91	-52.75	-13.00	-39.75	Peak
3	630.49	-52.60	31.78	2.95	28.72	-46.59	-13.00	-33.59	Peak
4	789.62	-63.09	33.15	3.28	28.53	-55.19	-13.00	-42.19	Peak
5	944.72	-62.19	36.64	3.64	28.37	-50.28	-13.00	-37.28	Peak
6	1101.91	-60.61	38.73	3.90	28.28	-46.26	-13.00	-33.26	Peak
7	1259.63	-57.80	39.32	4.27	28.22	-42.43	-13.00	-29.43	Peak

4.9. Receiver Radiated Spurious Emission

TEST APPLICABLE

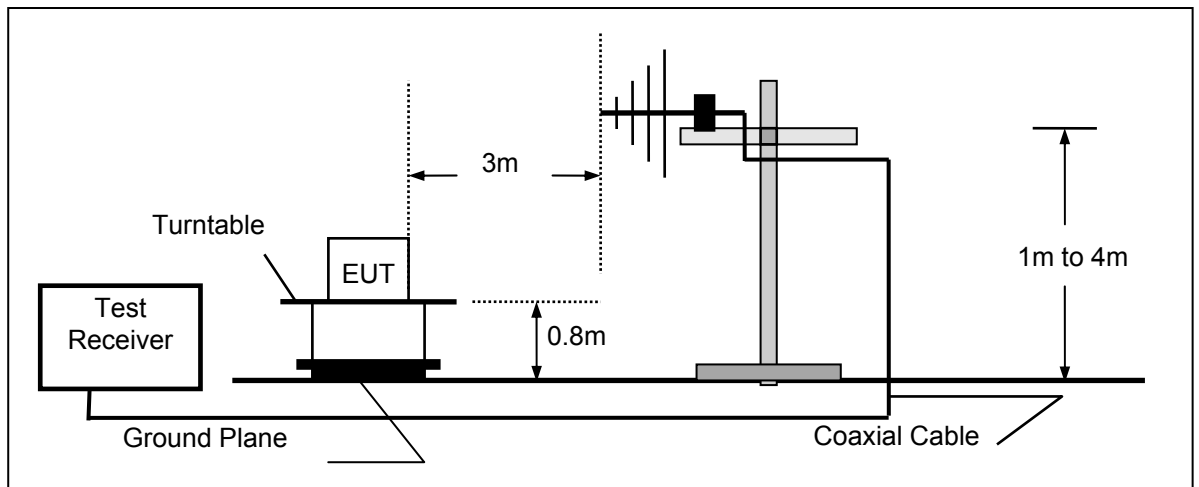
The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

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

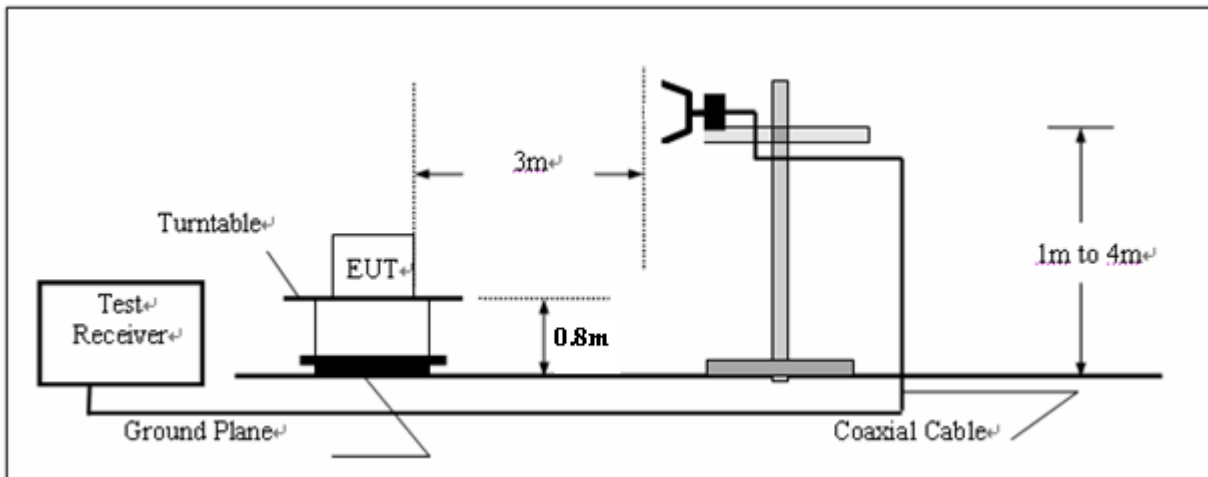
Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

TEST CONFIGURATION

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



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



TEST PROCEDURE

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

RECEIVER RADIATED SPOUIOUS LIMIT

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

Frequency (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.

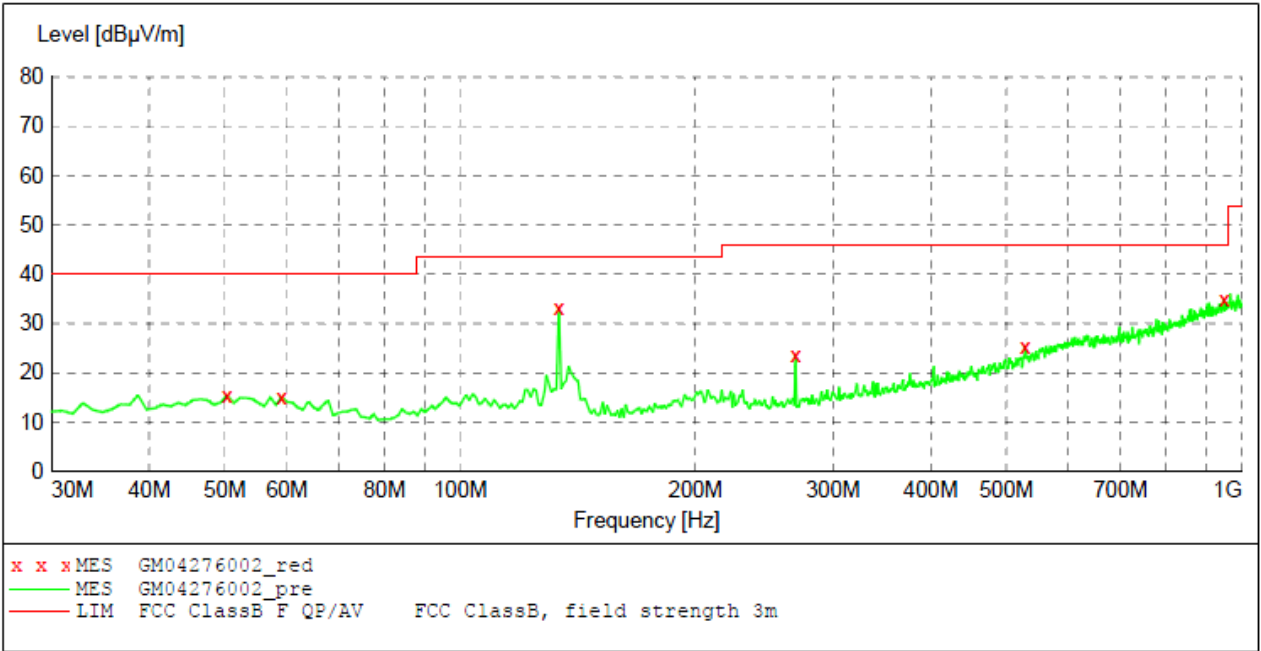
TEST RESULTS

Remak:

- 1.The Radiated Measurement (Standby mode /Receiver mode) are performed to the three channels (the high channel, the middle channel and the low 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.
- 2.Test performed at Op 3 operation mode respectively.

Op 3

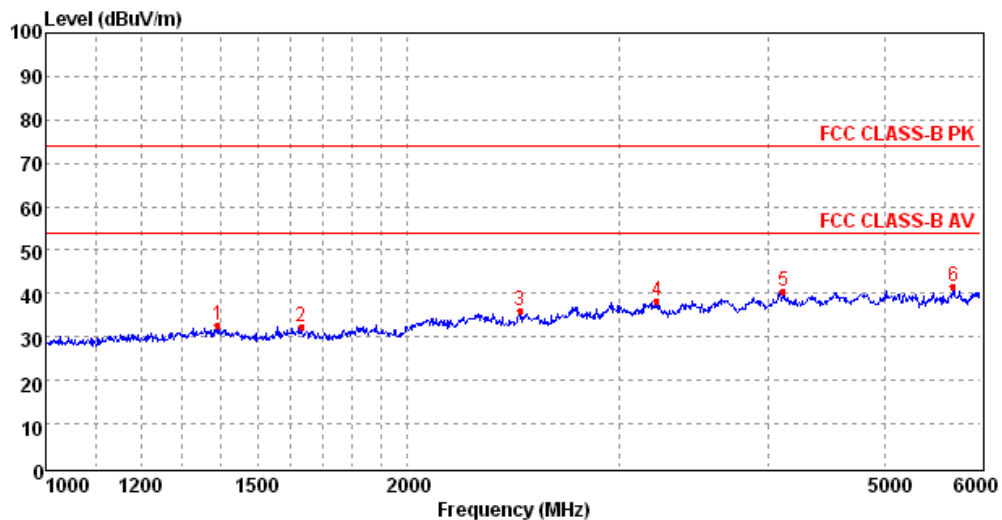
Test Frequency: 156.05MHz Polarity: Horizontal



MEASUREMENT RESULT: "GM04276002_red"

4/27/2015 8:55AM

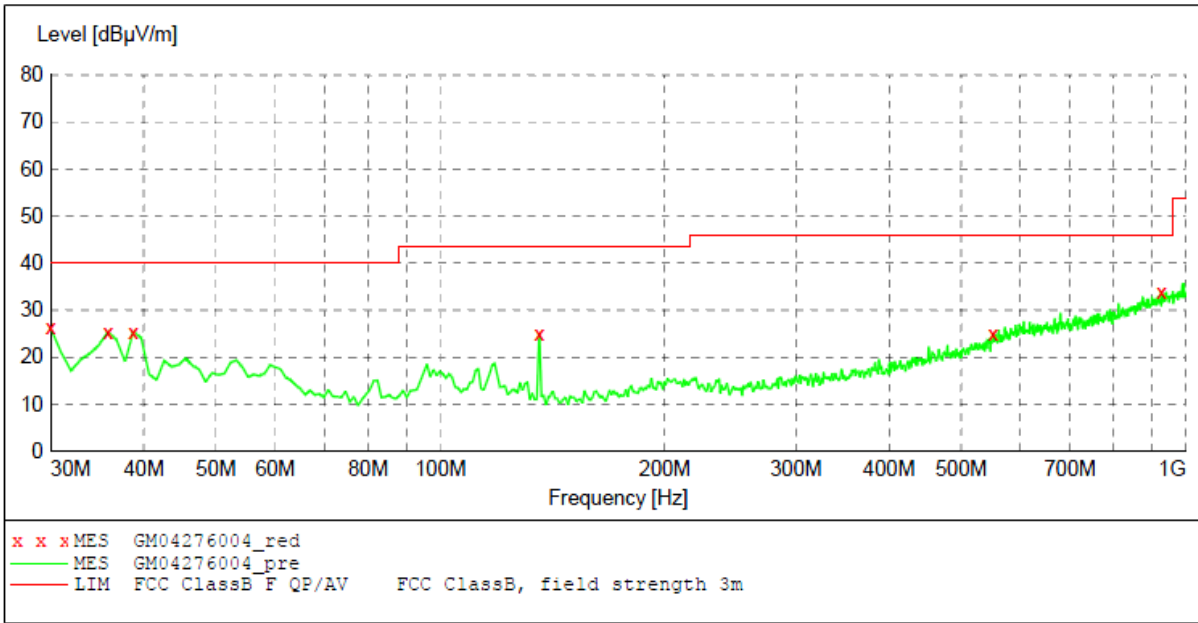
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
50.370000	15.50	-14.3	40.0	24.5	QP	100.0	136.00	HORIZONTAL
59.100000	15.10	-14.8	40.0	24.9	QP	100.0	171.00	HORIZONTAL
133.790000	33.20	-17.6	43.5	10.3	QP	300.0	334.00	HORIZONTAL
268.620000	23.40	-14.8	46.0	22.6	QP	100.0	218.00	HORIZONTAL
528.580000	25.40	-5.9	46.0	20.6	QP	300.0	360.00	HORIZONTAL
949.560000	34.90	3.7	46.0	11.1	QP	100.0	268.00	HORIZONTAL



Mark	Frequency MHz	Level dBuV/m	Factor dB	Reading dBuV/m	Limit dBuV/m	Margin dB	Polarization	Det.
1	1390.53	32.58	-8.08	40.66	74.00	41.42	HORIZONTAL	Peak
2	1630.93	32.51	-8.38	40.89	74.00	41.49	HORIZONTAL	Peak
3	2480.41	36.03	-5.22	41.25	74.00	37.97	HORIZONTAL	Peak
4	3227.83	38.45	-2.84	41.29	74.00	35.55	HORIZONTAL	Peak
5	4111.13	40.46	0.03	40.43	74.00	33.54	HORIZONTAL	Peak
6	5696.20	41.66	3.62	38.04	74.00	32.34	HORIZONTAL	Peak

Op 3

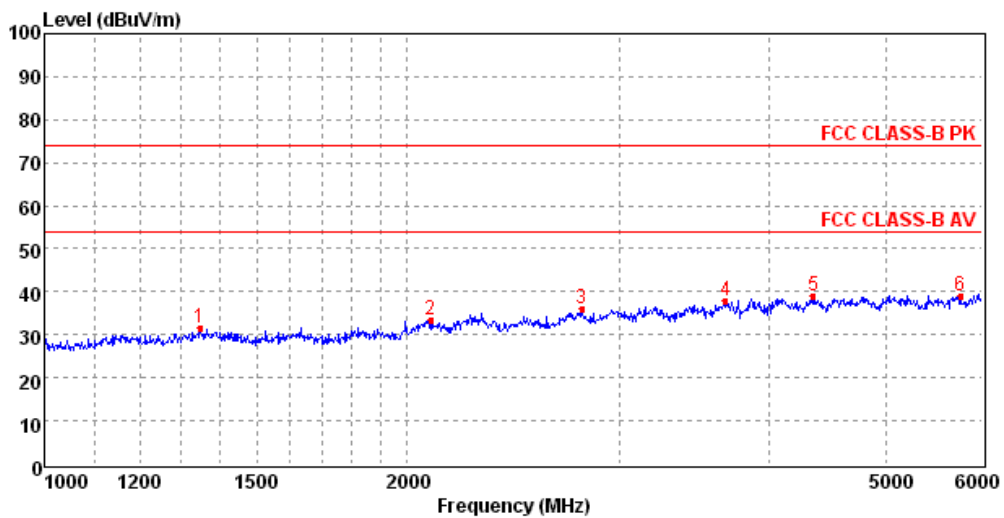
Test Frequency: 156.05MHz Polarity: Vertical



MEASUREMENT RESULT: "GM04276004_red"

4/27/2015 9:01AM

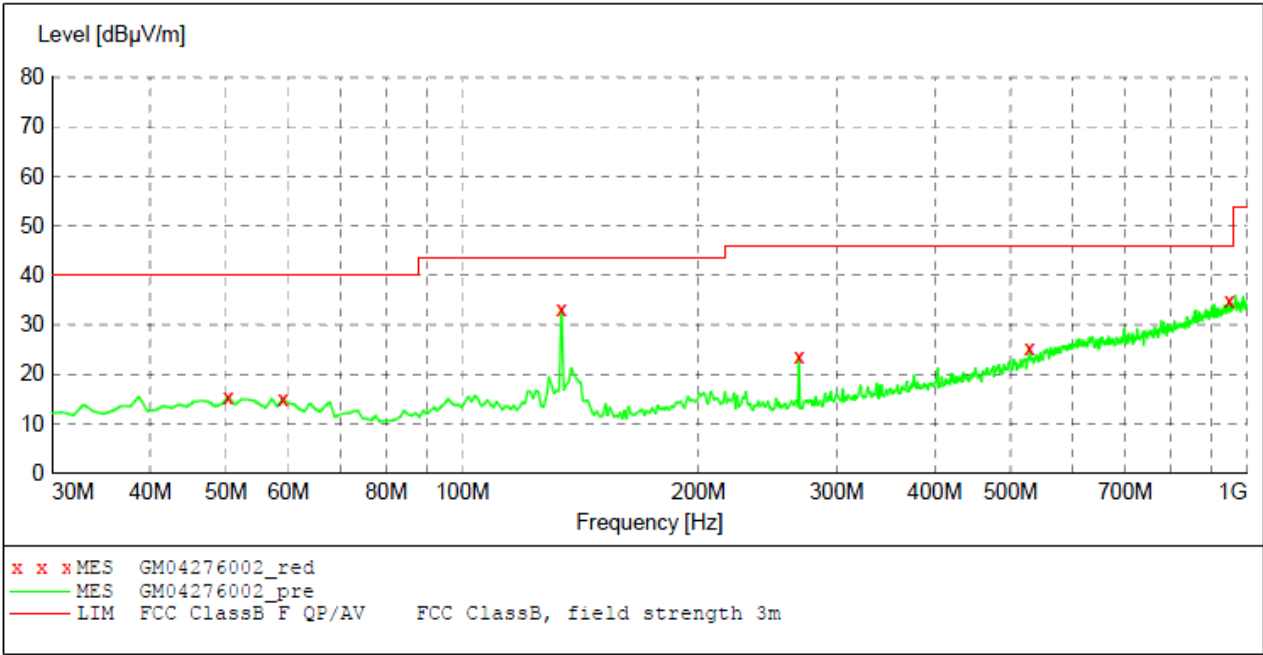
Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	26.20	-16.8	40.0	13.8	QP	100.0	0.00	VERTICAL
35.820000	25.40	-15.9	40.0	14.6	QP	100.0	79.00	VERTICAL
38.730000	25.30	-15.5	40.0	14.7	QP	100.0	203.00	VERTICAL
135.730000	25.10	-17.8	43.5	18.4	QP	100.0	190.00	VERTICAL
551.860000	24.90	-4.7	46.0	21.1	QP	100.0	140.00	VERTICAL
928.220000	33.90	3.3	46.0	12.1	QP	100.0	203.00	VERTICAL



Mark	Frequency MHz	Level dBµV/m	Factor dB	Reading dBµV/m	Limit dBµV/m	Margin dB	Polarization	Det.
1	1346.40	31.51	-8.02	39.53	74.00	42.49	VERTICAL	Peak
2	2092.18	33.49	-5.99	39.48	74.00	40.51	VERTICAL	Peak
3	2791.78	36.24	-3.85	40.09	74.00	37.76	VERTICAL	Peak
4	3678.88	38.02	-1.50	39.52	74.00	35.98	VERTICAL	Peak
5	4345.94	39.04	0.73	38.31	74.00	34.96	VERTICAL	Peak
6	5757.76	39.14	3.90	35.24	74.00	34.86	VERTICAL	Peak

Op 3

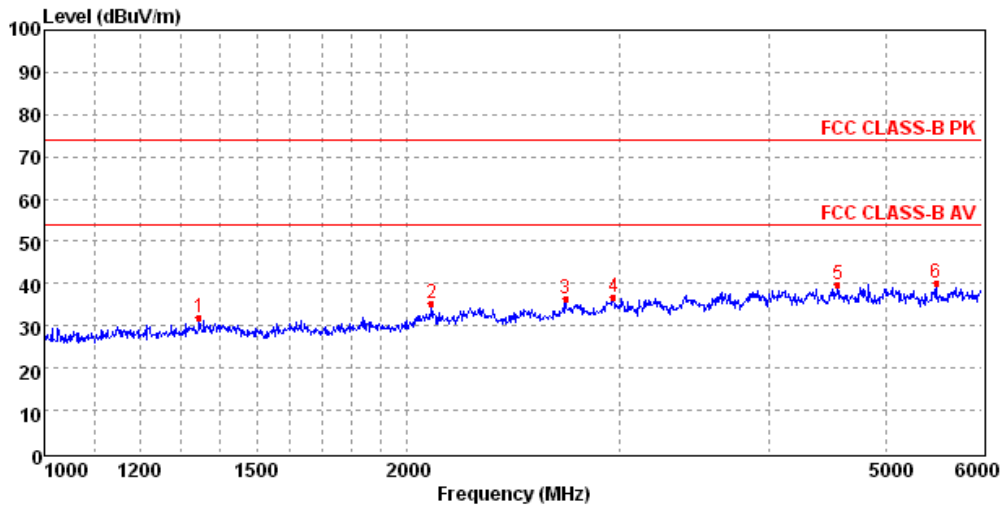
Test Frequency: 156.8MHz Polarity: Horizontal



MEASUREMENT RESULT: "GM04276002_red"

4/27/2015 8:55AM

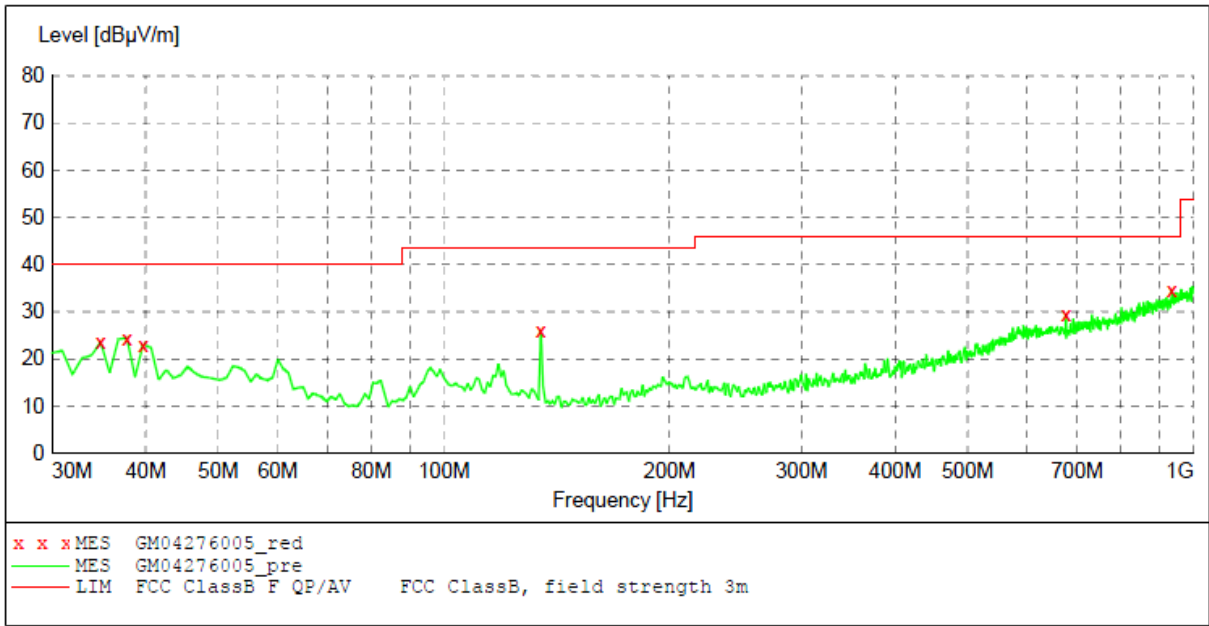
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
50.370000	15.50	-14.3	40.0	24.5	QP	100.0	136.00	HORIZONTAL
59.100000	15.10	-14.8	40.0	24.9	QP	100.0	171.00	HORIZONTAL
133.790000	33.20	-17.6	43.5	10.3	QP	300.0	334.00	HORIZONTAL
268.620000	23.40	-14.8	46.0	22.6	QP	100.0	218.00	HORIZONTAL
528.580000	25.40	-5.9	46.0	20.6	QP	300.0	360.00	HORIZONTAL
949.560000	34.90	3.7	46.0	11.1	QP	100.0	268.00	HORIZONTAL



Mark	Frequency MHz	Level dBuV/m	Factor dB	Reading dBuV/m	Limit dBuV/m	Margin dB	Polarization	Det.
1	1343.99	31.91	-8.01	39.92	74.00	42.09	HORIZONTAL	Peak
2	2095.93	35.33	-5.95	41.28	74.00	38.67	HORIZONTAL	Peak
3	2708.02	36.29	-4.28	40.57	74.00	37.71	HORIZONTAL	Peak
4	2967.14	36.86	-3.34	40.20	74.00	37.14	HORIZONTAL	Peak
5	4553.19	39.74	1.26	38.48	74.00	34.26	HORIZONTAL	Peak
6	5495.69	40.18	3.46	36.72	74.00	33.82	HORIZONTAL	Peak

Op 3

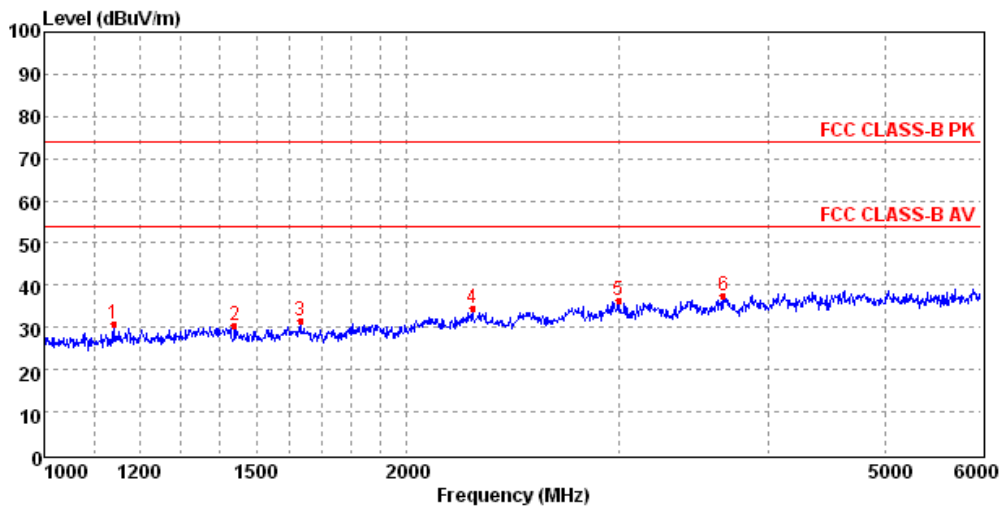
Test Frequency: 156.8MHz Polarity: Vertical



MEASUREMENT RESULT: "GM04276005_red"

4/27/2015 9:04AM

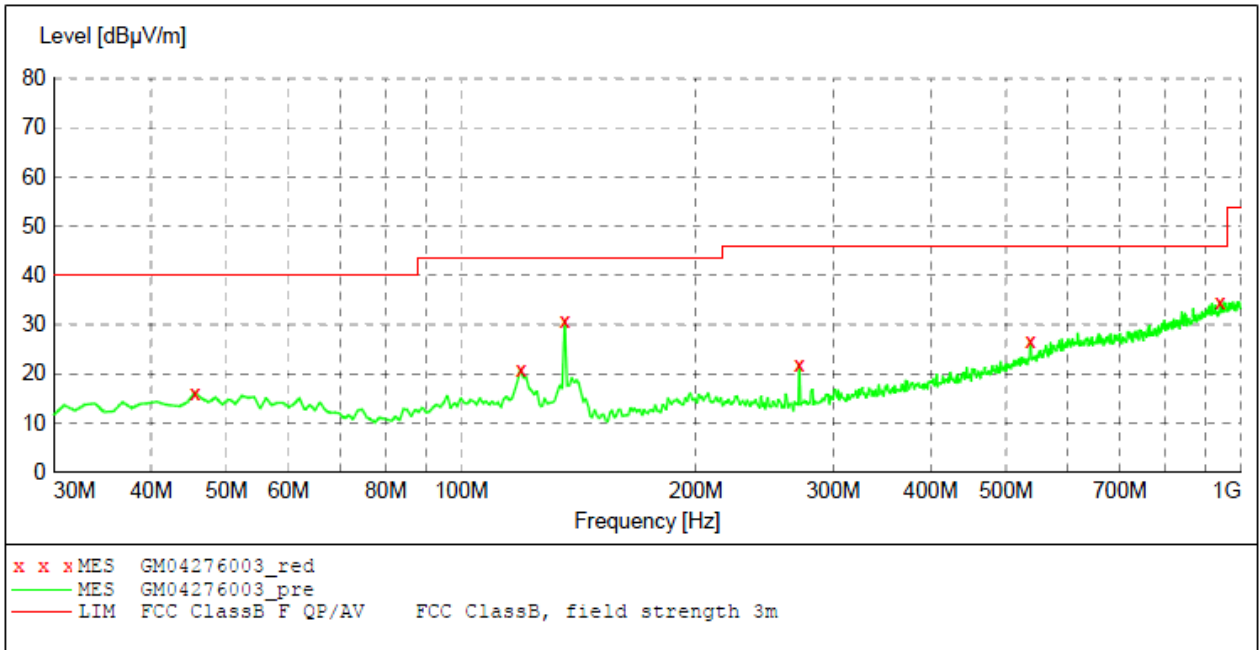
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
34.850000	23.50	-16.0	40.0	16.5	QP	100.0	257.00	VERTICAL
37.760000	24.40	-15.6	40.0	15.6	QP	100.0	338.00	VERTICAL
39.700000	23.00	-15.3	40.0	17.0	QP	100.0	100.00	VERTICAL
134.760000	25.90	-17.7	43.5	17.6	QP	100.0	168.00	VERTICAL
676.020000	29.40	-2.0	46.0	16.6	QP	100.0	5.00	VERTICAL
935.980000	34.60	3.4	46.0	11.4	QP	100.0	338.00	VERTICAL



Mark	Frequency MHz	Level dBuV/m	Factor dB	Reading dBuV/m	Limit dBuV/m	Margin dB	Polarization	Det.
1	1141.78	30.77	-9.43	40.20	74.00	43.23	VERTICAL	Peak
2	1438.68	30.54	-8.19	38.73	74.00	43.46	VERTICAL	Peak
3	1630.93	31.44	-8.38	39.82	74.00	42.56	VERTICAL	Peak
4	2267.85	34.58	-4.97	39.55	74.00	39.42	VERTICAL	Peak
5	2999.21	36.50	-3.34	39.84	74.00	37.50	VERTICAL	Peak
6	3665.72	37.42	-1.54	38.96	74.00	36.58	VERTICAL	Peak

Op 3

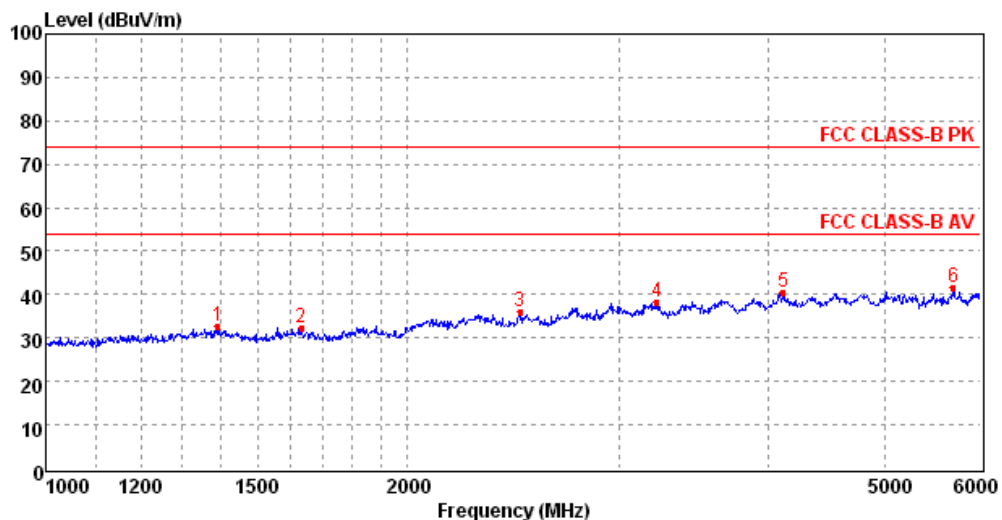
Test Frequency: 157.425MHz Polarity: Horizontal



MEASUREMENT RESULT: "GM04276003_red"

4/27/2015 8:59AM

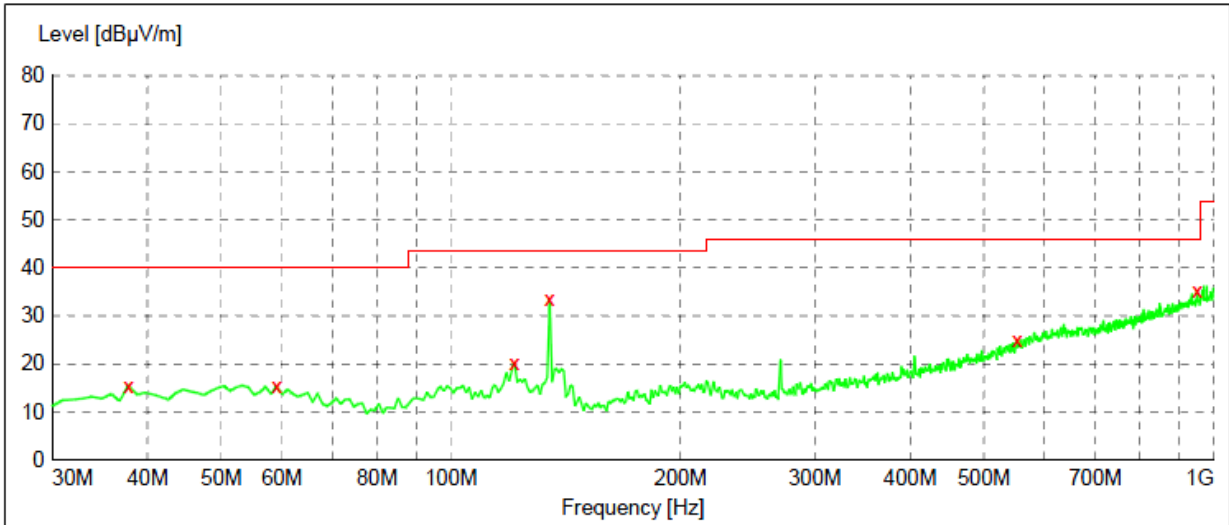
Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
45.520000	16.20	-14.7	40.0	23.8	QP	100.0	69.00	HORIZONTAL
119.240000	20.90	-15.8	43.5	22.6	QP	300.0	161.00	HORIZONTAL
135.730000	30.80	-17.8	43.5	12.7	QP	300.0	283.00	HORIZONTAL
271.530000	21.90	-14.7	46.0	24.1	QP	100.0	196.00	HORIZONTAL
537.310000	26.60	-5.4	46.0	19.4	QP	300.0	138.00	HORIZONTAL
940.830000	34.70	3.5	46.0	11.3	QP	300.0	354.00	HORIZONTAL



Mark	Frequency MHz	Level dBµV/m	Factor dB	Reading dBµV/m	Limit dBµV/m	Margin dB	Polarization	Det.
1	1390.53	32.58	-8.08	40.66	74.00	41.42	HORIZONTAL	Peak
2	1630.93	32.51	-8.38	40.89	74.00	41.49	HORIZONTAL	Peak
3	2480.41	36.03	-5.22	41.25	74.00	37.97	HORIZONTAL	Peak
4	3227.83	38.45	-2.84	41.29	74.00	35.55	HORIZONTAL	Peak
5	4111.13	40.46	0.03	40.43	74.00	33.54	HORIZONTAL	Peak
6	5696.20	41.66	3.62	38.04	74.00	32.34	HORIZONTAL	Peak

Op 3

Test Frequency: 157.425MHz Polarity: Vertical

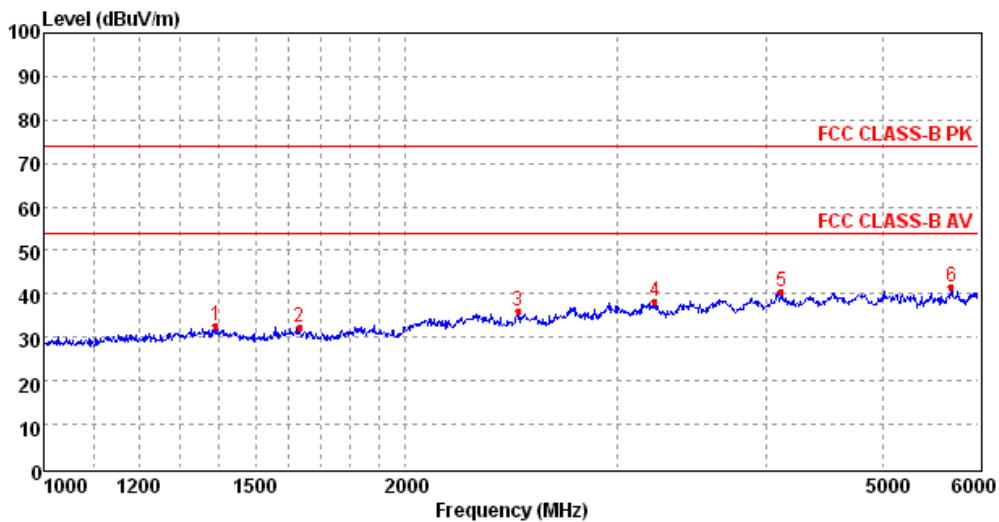


x x x MES GM04276006_red
 — MES GM04276006_pre
 — LIM FCC ClassB F QP/AV FCC ClassB, field strength 3m

MEASUREMENT RESULT: "GM04276006_red"

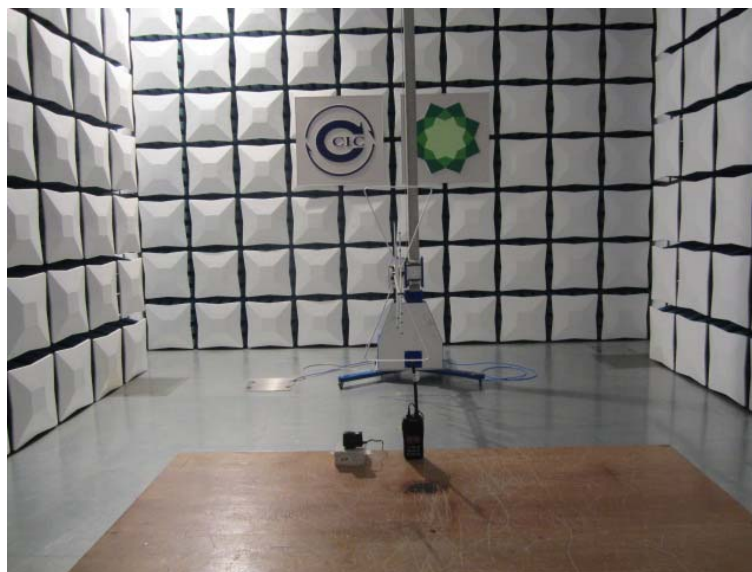
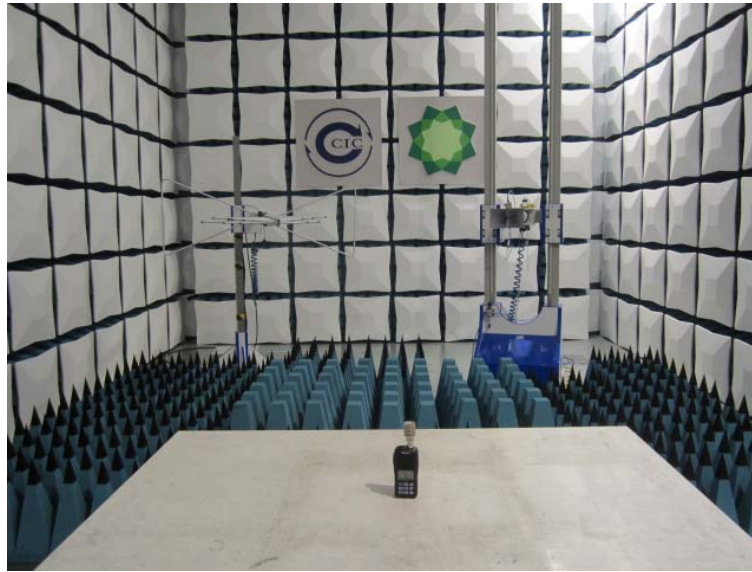
4/27/2015 9:08AM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
37.760000	15.50	-15.6	40.0	24.5	QP	100.0	62.00	HORIZONTAL
59.100000	15.50	-14.8	40.0	24.5	QP	300.0	359.00	HORIZONTAL
121.180000	20.30	-16.0	43.5	23.2	QP	300.0	176.00	HORIZONTAL
134.760000	33.40	-17.7	43.5	10.1	QP	300.0	297.00	HORIZONTAL
552.830000	24.80	-4.7	46.0	21.2	QP	100.0	206.00	HORIZONTAL
951.500000	35.30	3.7	46.0	10.7	QP	300.0	353.00	HORIZONTAL



Mark	Frequency MHz	Level dBuV/m	Factor dB	Reading dBuV/m	Limit dBuV/m	Margin dB	Polarization	Det.
1	1390.53	32.58	-8.08	40.66	74.00	41.42	HORIZONTAL	Peak
2	1630.93	32.51	-8.38	40.89	74.00	41.49	HORIZONTAL	Peak
3	2480.41	36.03	-5.22	41.25	74.00	37.97	HORIZONTAL	Peak
4	3227.83	38.45	-2.84	41.29	74.00	35.55	HORIZONTAL	Peak
5	4111.13	40.46	0.03	40.43	74.00	33.54	HORIZONTAL	Peak
6	5696.20	41.66	3.62	38.04	74.00	32.34	HORIZONTAL	Peak

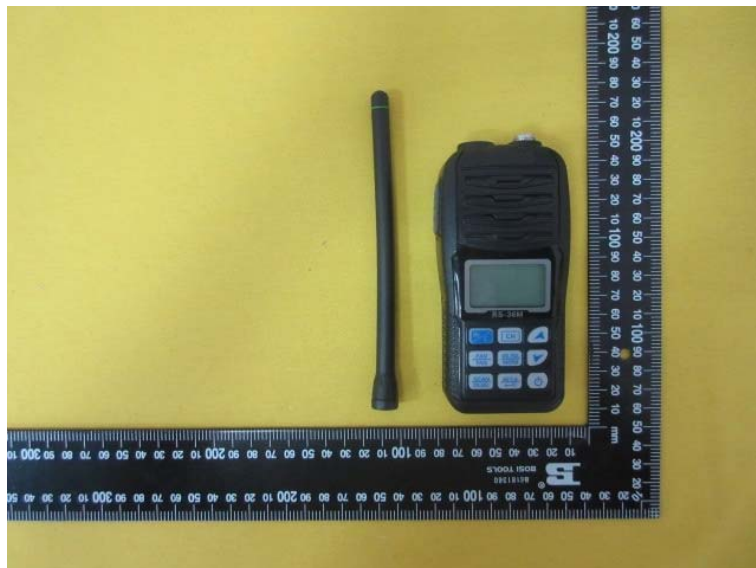
5. Test Setup Photos of the EUT

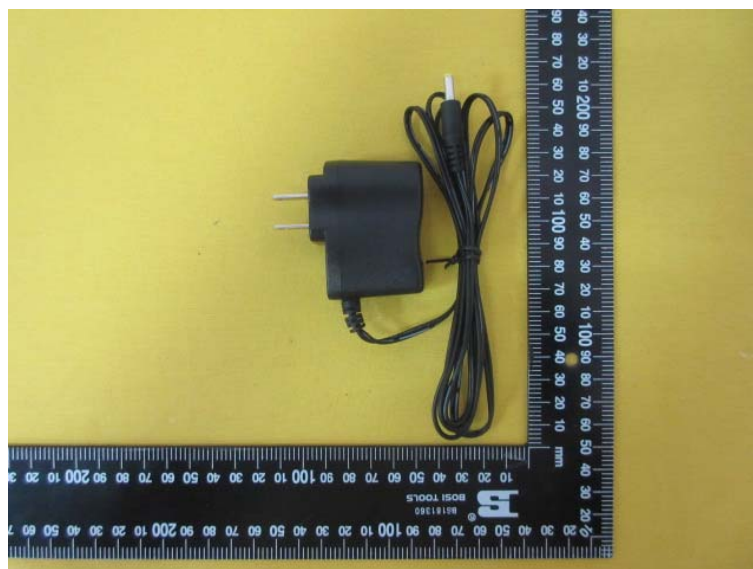
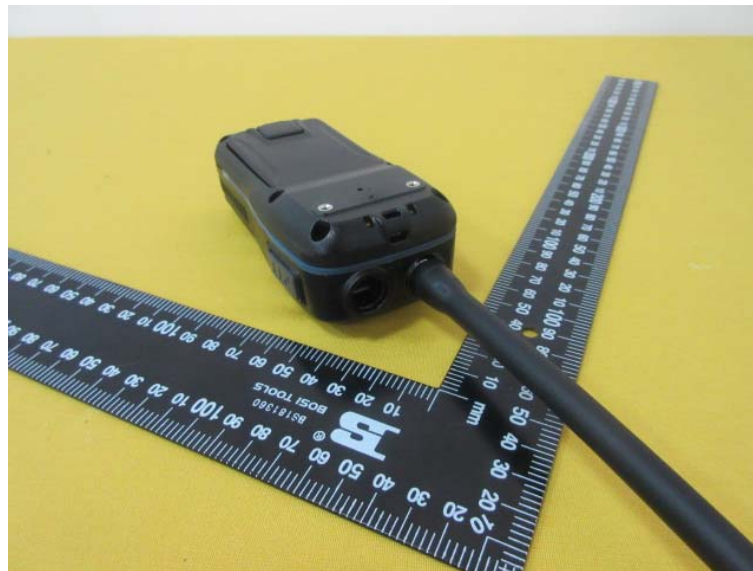




6. External and Internal Photos of the EUT

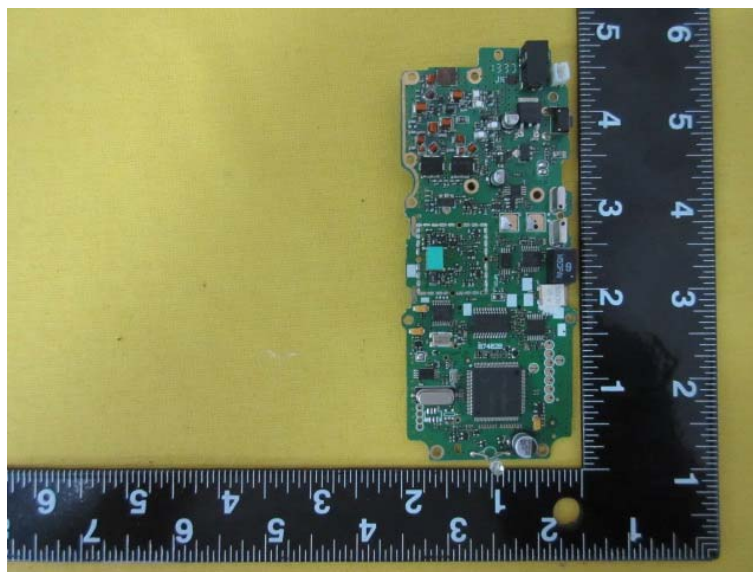
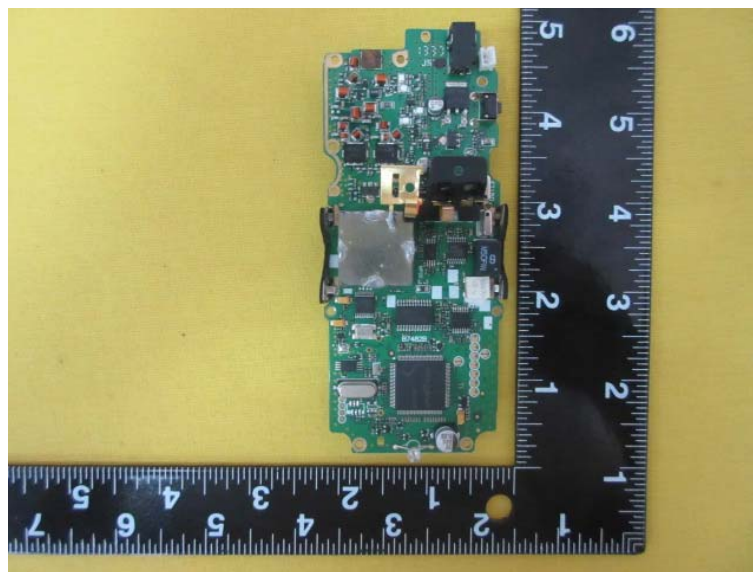
External photos of the EUT

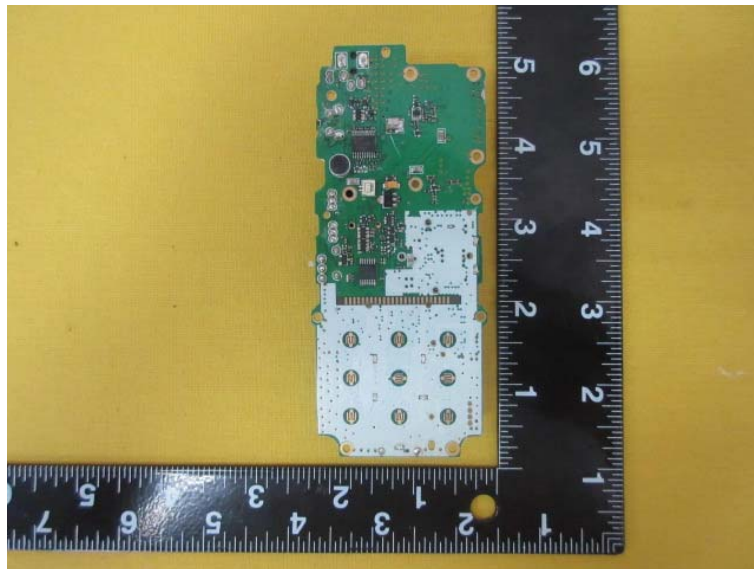
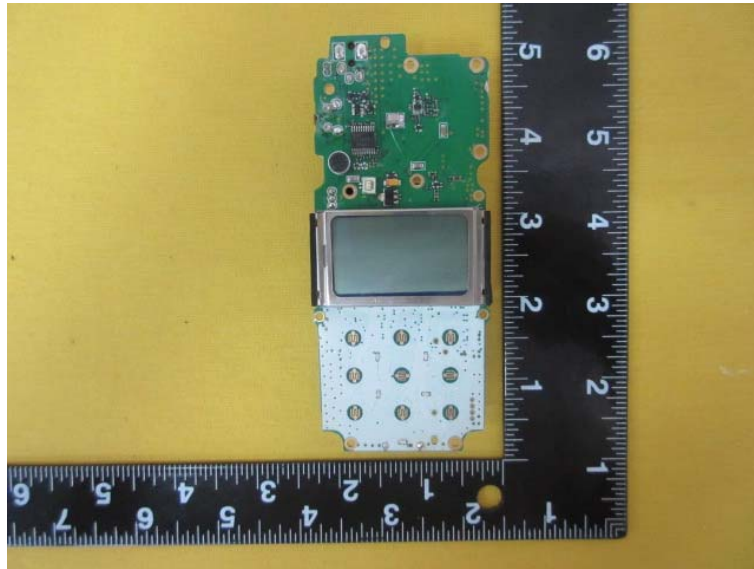




Internal photos of the EUT







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