UltraTech
Group of Labs

FCC TCB & IC CB

Ultratech's Accreditations:

0685

FCC
91038

1309

Industry Canada
Industrie Canada
Approved Test Facility
46390-2049

NVLAP
NVLAP Lab Code 200093-0

SL2-IN-E-1119R

Korea KCC-RRL
CA2049

3000 Bristol Circle,
Oakville, Ontario,
Canada L6H 6G4

Tel.: (905) 829-1570
Fax.: (905) 829-8050

Website: www.ultratech-labs.com
Email: vic@ultratech-labs.com

September 1, 2010

FEDERAL COMMUNICATIONS COMMISSION
7435 Oakland Mills Road
Columbia, MD 21046
USA

Subject: **Equipment Authorization under FCC 47 CFR, Parts 2, 80 (Marine in 156.025-157.425 MHz Band) - Non-Broadcast Radio Transceivers.**

Applicant: **ICOM Incorporated**
Product: **VHF Marine Transceiver**
Model: **IC-M412**
FCC ID: **AFJ305400**

Dear Sir/Madam,

As appointed agent for **ICOM Incorporated**, We would like to submit FCC certification application of the above product. Please find report and application documents uploaded your E-filing site.

If you have any queries, please do not hesitate to contact us.

Yours truly,

xutianlu

Steven (Xu Tian) Lu
Authorized Agent

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Group of Labs

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Email: vic@ultratech-labs.com

September 1, 2010

Icom America, Inc.
2380 116th Ave. N.E.
Bellevue, Washington 98004
USA

Attn.: **Mr. Masaaki Takahashi**

Subject: **Certification Testing in accordance with FCC 47 CFR, Parts 2, 80 (Marine in 156.025-157.425 MHz Band) - Non-Broadcast Radio Transceivers.**

Product: **VHF Marine Transceiver**
Model: **IC-M412**

Dear Mr. Takahashi,

The product sample has been tested in accordance with **FCC CFR 47, Parts 2, 80 (Marine in 156.025-157.425 MHz) - Non-Broadcast Radio Transceivers Operating ,** and the results and observation were recorded in the engineering report, Our File No.: ICOM-238F80

Enclosed you will find copy of the engineering report. If you have any queries, please do not hesitate to contact us.

Yours truly,

xutianlu

Steven (Xu Tian) Lu
Authorized Agent

Encl.

ENGINEERING TEST REPORT

VHF Marine Transceiver
Model No.: IC-M412
FCC ID: AFJ305400

Applicant:

ICOM Incorporated
1-1-32, Kaminami, Hirano-ku
Osaka
Japan, 547-0003

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, Part 2, Part 80 (Marine in 156.025-157.425 MHz)

UltraTech's File No.: ICOM-238F80

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: September 1, 2010	
Report Prepared by: Steven (Xu Tian) Lu Issued Date: September 1, 2010	Tested by: Hung Trinh, Technician Test Dates: August 13, 22~24, 2010

The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com, Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com

FCC	VCCI	Industry Canada / Industrie Canada Approved Test Facility	NVLAP	BSMI	Korea KCC-RRL
91038	1309	46390-2049	NVLAP Lab Code 200093-0	SL2-IN-E-1119R	CA2049

TABLE OF CONTENTS

EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Parts 2 and 80
Title:	Telecommunication - Code of Federal Regulations, 47CFR, Parts 2 and 80
Purpose of Test:	To gain FCC Equipment Authorization for Radio operating in the frequency bands, 156.025-157.425 MHz (Marine)
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with TIA/EIA Standard TIA/EIA-603 (01-Nov-2002) – Land Mobile FM or PM Communications Equipment Measurement and performance Standards.
Categories of Station:	Ship station transceiver operating in 156.025-157.425 MHz band

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2009	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 16-1	2003	Specification for Radio Disturbance and Immunity measuring apparatus and methods
TIA-603-B	2002	Land Mobile FM or PM Communications Equipment, Measurement and Performance Standards.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Icom Incorporated
Address:	1-1-32, Kamiminami Hirano-ku, Oaska Japan, 547-0003
Contact Person:	Mr. Yoshiteru Yano Phone #: +81-66-793-5302 Fax #: +81-66-793-0013 Email Address: export@icom.co.jp

MANUFACTURER	
Name:	Icom Incorporated
Address:	1-1-32, Kamiminami Hirano-ku, Oaska Japan, 547-0003
Contact Person:	Mr. Yoshiteru Yano Phone #: +81-66-793-5302 Fax #: +81-66-793-0013 Email Address: export@icom.co.jp

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	ICOM Incorporated
Product Name:	VHF Marine Transceiver
Model Name or Number:	IC-M412
Serial Number:	0000012
Type of Equipment:	Non-broadcast Radio Communication Equipment
External Power Supply Requirement:	N/A
Transmitting/Receiving Antenna Type:	Non-integral
Primary User Functions of EUT:	Voice wireless communication for Marine in 156.025-157.425 MHz band.

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	Mobile
Intended Operating Environment:	Marine
Power Supply Requirement:	13.8 VDC
RF Output Power Rating:	25 Watts (High) and 1 Watt (Low)
Operating Frequency Range:	156.025-157.425 MHz (Marine)
RF Output Impedance:	50 Ohms
Channel Spacing:	25 kHz
Occupied Bandwidth (99%):	14.85 kHz
Emission Designation*:	16K0G3E, 16K0G2B (DSC CH70)
Antenna Connector Type:	UHF type connector

For an average case of commercial telephony, the Necessary Bandwidth is calculated as follows:

Channel Spacing = 25 KHz, D = 5 KHz max, K = 1, M = 3 KHz
B_n = 2M + 2DK = 2(3) + 2(5)(1) = **16 KHz**
Emission designation: 16K0G3E

Receiver	
Power Supply Requirement:	13.8 VDC
Operating Frequency Range:	156.05-163.275 MHz (Marine)
RF Input Impedance:	50 Ohms
Channel Spacing:	25 kHz
IF Frequencies	21.7 MHz (1st IF), 450 kHz (2nd IF)
Antenna Connector Type	UHF type connector

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Antenna	1	UHF type	N/A
2	SP/MIC Jack	1	Plug-in Jack	N/A

2.5. ANCILLARY EQUIPMENT

None.

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	13.8 VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	N/A
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT is tested with the transmitter antenna port terminated to a 50 Ohms RF Load.

Transmitter Test Signals	
Frequency Band(s):	▪ 156.025 - 157.425 MHz
Test Frequency(ies): (Near lowest & near highest frequencies in the frequency range of operation.)	▪ 156.025 MHz, 157.425 MHz & 156.525 MHz (DSC)
Transmitter Wanted Output Test Signals:	
• Transmitter Power (measured maximum output power):	25 Watts High, 1 Watt Low
• Normal Test Modulation:	Variable reactance frequency modulation
• Modulating signal source:	External

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2011-05-01.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
80.215 & 2.1046	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
80.209 & 2.1055	Frequency Stability	Yes
80.213(e) & 2.1047(a)	Audio Frequency Response	Yes
80.213 & 2.1047(b)	Modulation Limiting	Yes
80.205, 80.211(f) & 2.1049	Emission Limitation / Emission Mask	Yes
80.211(f)(3), 2.1051 & 2.1057	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
80.211(f)(3), 2.1053 & 2.1057	Emission Limits - Field Strength of Spurious Emissions	Yes
80.217	Suppression of Interference aboard ships	Yes (complies with FCC Part 15, Subpart B – Radio Receivers and Class B Digital Devices)
VHF Marine Transceiver, **Model No.: IC-M412**, by **ICOM Incorporated** has also been tested and found to comply with **FCC Part 15, Subpart B - Radio Receivers and Class B Digital Devices**. The engineering test report has been documented and it is available upon FCC request.		

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

4.4. DEVIATION OF STANDARD TEST PROCEDURES

None.

EXHIBIT 5. TEST DATA

5.1. RF POWER OUTPUT [§ 2.1046 & 80.215]

5.1.1. Limits

§ 80.215- For 156-162 MHz Band:

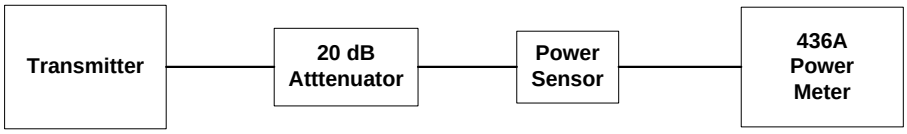
Ship stations: 25W (Reducible to 1 watt or less, except for transmitters limited to public correspondence channels and used in an automated system.)

5.1.2. Method of Measurements

Refer to 7.1 (Conducted) and 7.2 (Radiated) in this test report for test procedures and test setup.

5.1.3. Test Arrangement

Power at RF Power Output Terminals



5.1.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Power Meter	Hewlett Packard	436A	2347A17246	10 kHz – 50 GHz, sensor dependent	July 09, 2011
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz	July 21, 2011
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.1.5. Test Data

Transmitter Channel Output	Fundamental Frequency (MHz)	Measured (Average) Conducted Power (Watts)	Power Rating (Watts)
Power Setting: High			
Lowest	156.025	21.83	25.0
Highest	157.425	21.93	25.0
DSC	156.525	21.83	25.0
Power Setting: Low			
Lowest	156.025	0.81	1.0
Highest	157.425	0.83	1.0
DSC	156.525	0.82	1.0

5.2. RF EXPOSURE REQUIREMENTS @ 1.1310 & 2.1091

5.2.1. Limits

1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
30-300	61.4	0.163	1.0	6
(B) Limits for General Population/Uncontrolled Exposure				
30-300	27.5	0.073	0.2	30

5.2.2. Method of Measurements

Calculation Method of RF Safety Distance:

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

Where, P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

$$r = \sqrt{\frac{PG}{4\pi \cdot S}} = \sqrt{\frac{EIRP}{4\pi \cdot S}}$$

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device.

5.2.3. Evaluation of RF Exposure Compliance Requirements

MPE Limit for Occupational/Controlled Exposure, $\mathbf{S_{controlled}[mW/cm^2]}$ = 1.0

MPE Limit for General Population/Uncontrolled Exposure, $\mathbf{S_{uncontrolled}[mW/cm^2]}$ = 0.2

Maximum RF Power conducted, $\mathbf{P_{conducted}[dBm]}$ = 43.98

Maximum Antenna Gain, **G[dBi]** = 9

Maximum EIRP, $\mathbf{P_{EIRP}}$ = 52.98 dBm or 198582 mwatts

User-based time-average for PTT = 50%

Calculated RF Safety Distance for Occupational/Controlled Exposure, $\mathbf{r_{safety\_controlled}[cm]}$ = 89 cm

Calculated RF Safety Distance for General Population/Uncontrolled Exposure, $\mathbf{r_{safety\_uncontrolled}[cm]}$ = 199 cm

5.3. FREQUECNY STABILITY [§ 80.209 & § 2.1055]

5.3.1. Limits

§ 80.209

Operating Frequency Band (MHz)	Coast Stations		Ship Stations
	Below 3 W	3 to 100 W	
156–162	10 ppm	[1]5 ppm	[2]10 ppm

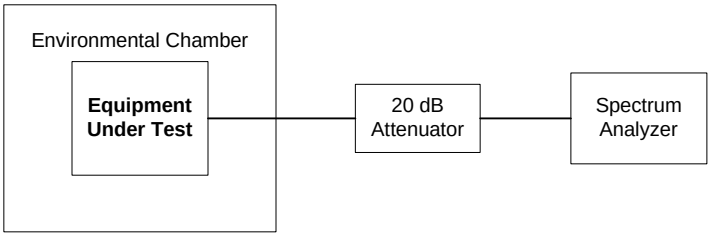
1 For transmitters operated at private coast stations with antenna heights less than 6 meters (20 feet) above ground and output power of 26 Watts or less the frequency tolerance is 10 parts in 10^6.

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 10^6.

5.3.2. Method of Measurements

Refer to 7.3 of this report for measurement details

5.3.3. Test Arrangement

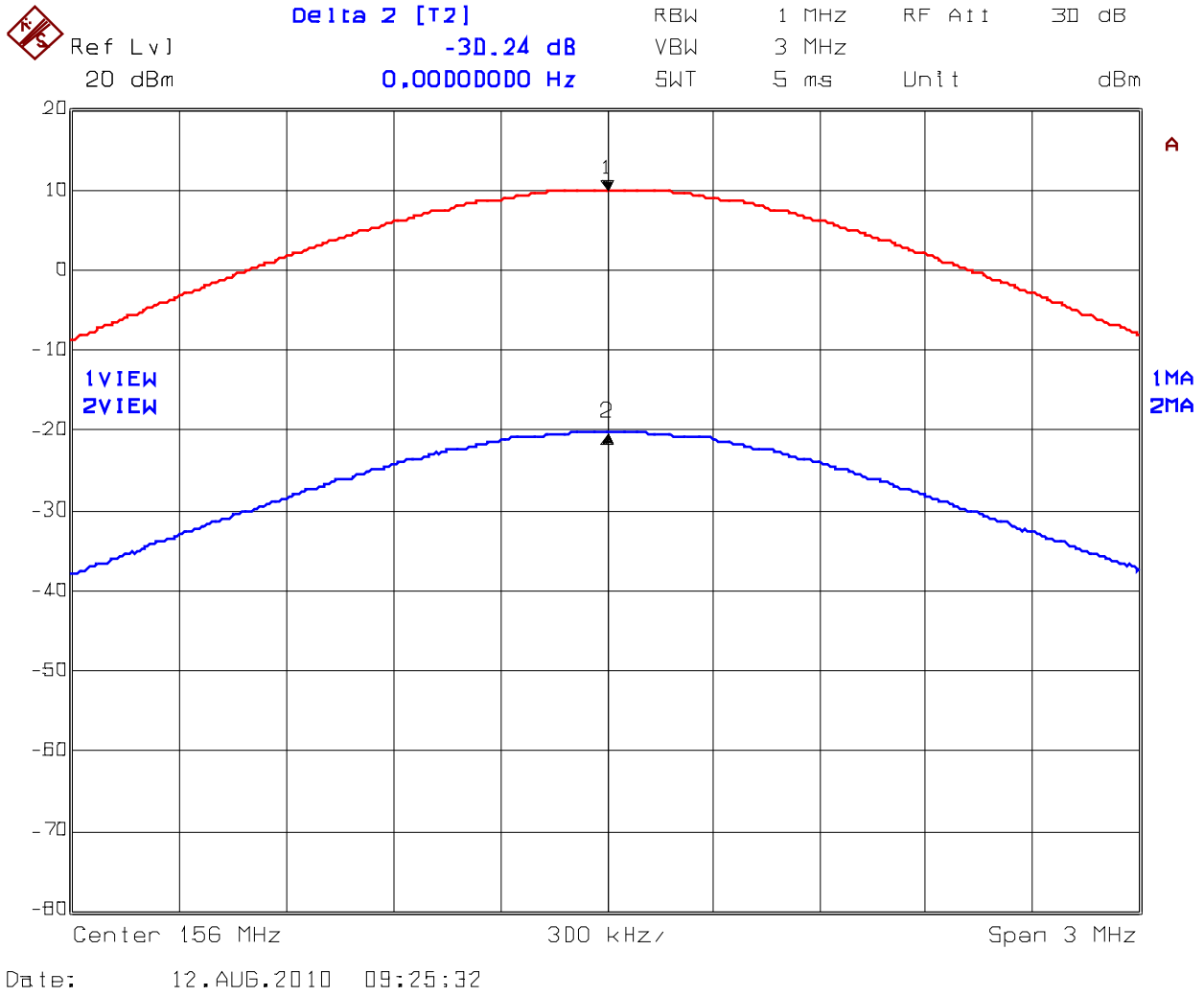


5.3.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Frequency Counter	EIP	545A	02683	10 Hz – 18 GHz	Jan 11, 2011
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A
Temperature & Humidity Chamber	Tenney	T5	72-6202	-40 ºC – +80 ºC range	July 30, 2010

5.3.5. System Cable Loss

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80 & RSS-182
Date:	August 12, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	20dB&10dB Pasternack attenuator + DC Block + SMA31&SMA3 cables. PE7019-10&PE7019-20, HP DC Block



5.3.6. Test Data

5.3.6.1. Frequency Tolerance versus Ambient Temperature

Product Name: **Model No.:**	**VHF Marine Transceiver** **IC-M412**
Center Frequency:	156.025 MHz
Full Power Level:	43 dBm
Frequency Tolerance Limit (Worst Case):	±10 ppm or 1560.25 Hz
Max. Frequency Tolerance Measured:	590 Hz or 3.8 ppm
Input Voltage Rating:	13.8 VDC

CENTER FREQUENCY & RF POWER OUTPUT VARIATION			
Ambient Temperature (^{o}C)	**Supply Voltage (Nominal) 13.8 Volts**	**Supply Voltage (Minimum before switch-off)) 11.73 Volts**	**Supply Voltage (115% of Nominal) 15.87 Volts**
	Hz	**Hz**	**Hz**
-20	429	N/A	N/A
-10	590	N/A	N/A
0	452	N/A	N/A
+10	191	N/A	N/A
+20	0	-2	-18
+30	187	N/A	N/A
+40	-270	N/A	N/A
+50	-298	N/A	N/A
+60	-135	N/A	N/A

5.4. MODULATION LIMITING [§ 80.213 & § 2.1047(b)]

5.4.1. Limits

§ 80.213 (a)(2) When phase or frequency modulation is used in the 156-162 MHz band the peak modulation must be maintained between 75 and 100 percent. A frequency deviation of ±5 kHz is defined as 100 percent peak modulation; and

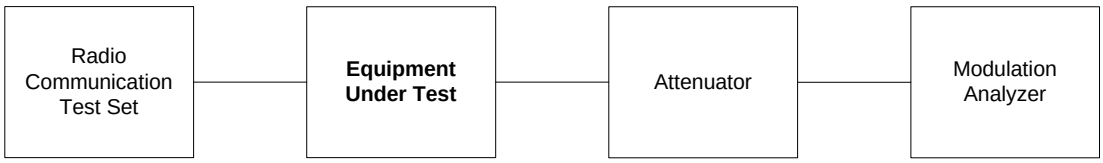
§ 80.213 (b) Radiotelephone transmitters using A3E, F3E and G3E emission must have a modulation limiter to prevent any modulation over 100 percent. This requirement does not apply to survival craft transmitters, to transmitters that do not require a license or to transmitters whose output power does not exceed 3 watts.

§ 80.213 (d) Ship and coast station transmitters operating in the 156-162 MHz and 216-220 bands must be capable of proper operation with a frequency deviation that does not exceed ±5 kHz when using any emission authorized by Sec. 80.207.

5.4.2. Method of Measurements

For Audio Transmitter:- The carrier frequency deviation was measured with the tone input signal level varied from 0 Vp to audio input rating level plus 16 dB at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

5.4.3. Test Arrangement

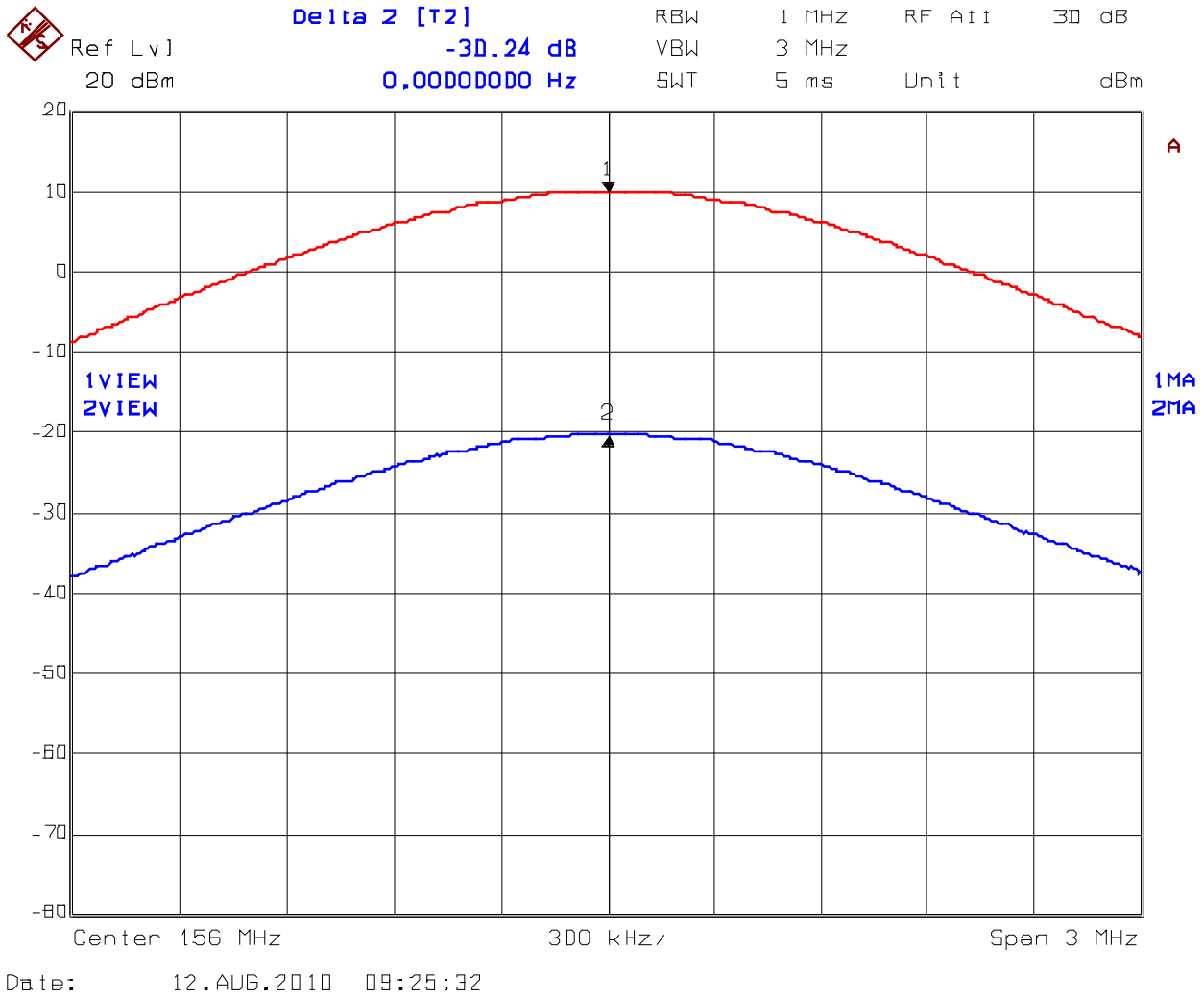


5.4.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Modulation Analyzer	Hewlett Packard	8910B	3226A04606	150 kHz – 1300 MHz	Dec 09, 2010
Function Generator	Stanford Research Systems	DS345	34591	1 µHz – 30.2 MHz	Oct 06, 2010
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.4.5. System Cable Loss

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80 & RSS-182
Date:	August 12, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	20dB&10dB Pasternack attenuator + DC Block + SMA31&SMA3 cables. PE7019-10&PE7019-20, HP DC Block



5.4.6. Test Data

5.4.6.1. Voice Modulation Limiting

Voice Signal Input Level = STD MOD Level + 16 dB = 23.60 dB(mVrms) or 15.14 mVrms

MODULATING FREQUENCY (KHz)	PEAK FREQUENCY DEVIATION (KHz)	MAXIMUM LIMIT (KHz)
0.1	1.08	5.0
0.2	3.71	5.0
0.4	4.16	5.0
0.6	4.12	5.0
0.8	4.12	5.0
1.0	4.11	5.0
1.2	4.08	5.0
1.4	4.05	5.0
1.6	4.08	5.0
1.8	4.13	5.0
2.0	4.21	5.0
2.5	4.22	**5.0**
3.0	3.59	5.0
3.5	2.62	5.0
4.0	1.79	5.0
4.5	1.25	5.0
5.0	0.89	5.0
6.0	0.50	5.0
7.0	0.30	5.0
8.0	0.20	5.0
9.0	0.14	5.0
10.0	0.11	5.0

5.5. Frequency Response of the Audio Low Pass Filter [§ 80.213(e) & 2.1047(a)]

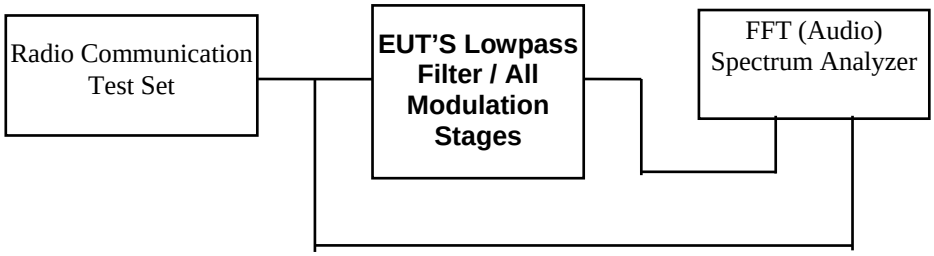
5.5.1. Limits

(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 60log10(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

5.5.2. Method of Measurements

The rated audio input signal was applied to the input of the audio lowpass filter (or of all modulation stages) using an audio oscillator, this input signal level and its corresponding output signal were then measured and recorded using the FFT (Audio) spectrum analyzer. Tests were repeated at different audio signal frequencies from 0 to 50 kHz.

5.5.3. Test Arrangement

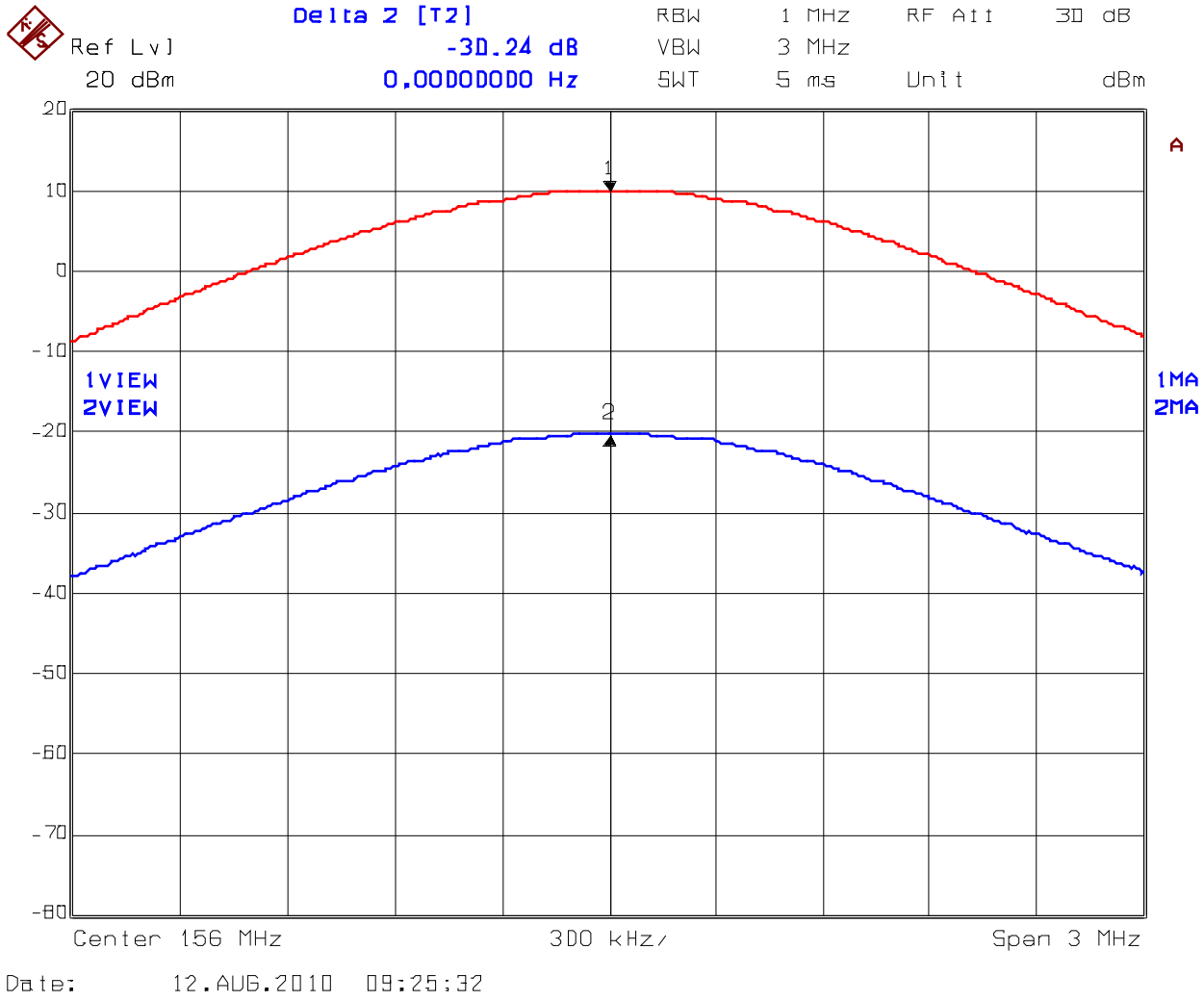


5.5.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Modulation Analyzer	Hewlett Packard	8910B	3226A04606	150 kHz – 1300 MHz	Dec 09, 2010
Function Generator	Stanford Research Systems	DS345	34591	1 µHz – 30.2 MHz	Oct 06, 2010
FFT (audio) EMI Receiver	Advantest	R9211E	82020336	10 mHz – 100 kHz, 1 MHz Input Impedance	Oct 26, 2010
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.5.5. System Cable Loss

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80 & RSS-182
Date:	August 12, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	20dB&10dB Pasternack attenuator + DC Block + SMA31&SMA3 cables. PE7019-10&PE7019-20, HP DC Block



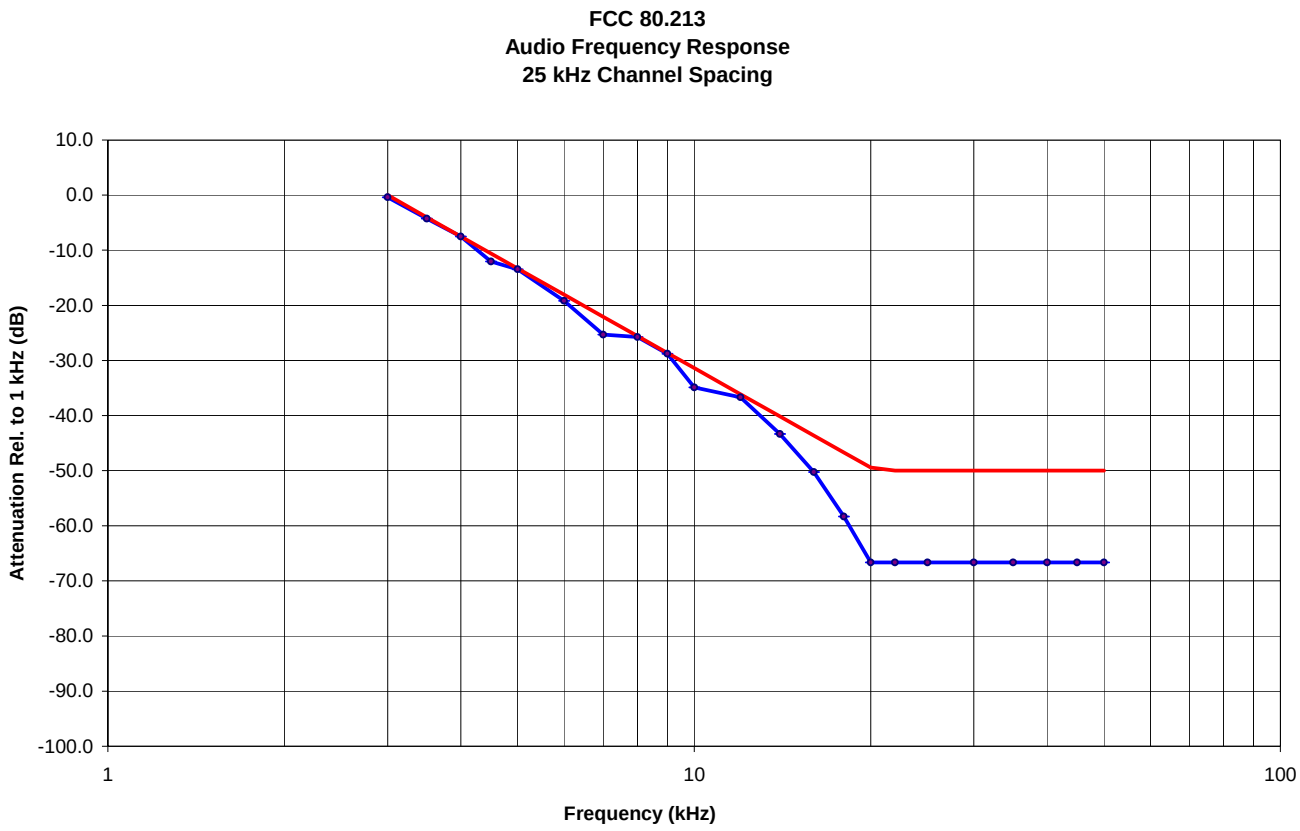
5.5.6. Test Data

Note: Due to the difficulty of measuring the Frequency Response of the internal lowpass filter, the Frequency Response of All Modulation States are performed to show the roll-off at 3 kHz in comparison with Industry Canada Limit for audio lowpass filter.

- **Minimum Attenuation Rel. to 1 kHz Attenuation (25 kHz channel spacing)**

Frequency (kHz)	Audio IN (dBV)	Audio OUT (dBV)	Attenuation (OUT - IN) (dB)	Attenuation wrt. 1 kHz (dB)	Recommended FCC Limit (dB)
0.1	-62.35	-14.24	48.1	-20.6	--
0.2	-62.35	-7.66	54.7	-14.1	--
0.4	-62.35	-1.98	60.4	-8.4	--
0.6	-62.35	-1.39	61.0	-7.8	--
0.8	-62.35	4.29	66.6	-2.1	--
1.0	-62.35	6.40	68.8	0.0	--
1.5	-62.35	9.26	71.6	2.9	--
2.0	-62.35	-10.28	52.1	-16.7	--
2.5	-62.35	-10.72	51.6	-17.1	--
3.0	-62.35	6.01	68.4	-0.4	0
3.5	-62.35	2.15	64.5	-4.3	-4
4.0	-62.35	-1.12	61.2	-7.5	-7
4.5	-62.35	-5.62	56.7	-12.0	-11
5.0	-62.35	-7.05	55.3	-13.5	-13
6.0	-62.35	-12.78	49.6	-19.2	-18
7.0	-62.35	-18.92	43.4	-25.3	-22
8.0	-62.35	-19.35	43.0	-25.8	-26
9.0	-62.35	-22.36	40.0	-28.8	-29
10.0	-62.35	-28.46	33.9	-34.9	-31
12.0	-62.35	-30.28	32.1	-36.7	-36
14.0	-62.35	-36.95	25.4	-43.4	-40
16.0	-62.35	-43.85	18.5	-50.3	-44
18.0	-62.35	-51.93	10.4	-58.3	-47
20.0	-62.35	-60.25	2.1	-66.7	-49
22.0	-62.35	-60.25	2.1	-66.7	-50
25.0	-62.35	-60.25	2.1	-66.7	-50
30.0	-62.35	-60.25	2.1	-66.7	-50
35.0	-62.35	-60.25	2.1	-66.7	-50
40.0	-62.35	-60.25	2.1	-66.7	-50
45.0	-62.35	-60.25	2.1	-66.7	-50
50.0	-62.35	-60.25	2.1	-66.7	-50

Plot # 1.:



5.6. EMISSION MASK [§ 80.205, § 80.211 & § 2.1049]

5.6.1. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

§ 80.205 (a)

Emission designator	Maximum Authorized BW (KHz)	Channel Spacing (KHz)	Recommended Frequency Deviation (KHz)	FCC Applicable Mask
16K0G3E	20.0	25.0	5.0	See **§ 80.211** (f)

§ 80.211 (f)(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

§ 80.211 (f)(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

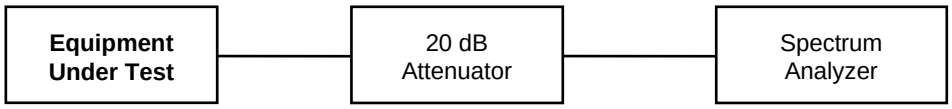
§ 80.211 (f)(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus 10log10 (mean power in watts) dB.

Remark: More stringent IC/RSS-182 maximum authorization bandwidth of 16 kHz for voice is applied instead of 20 kHz specified in Sec. 80.205 to verify and confirm compliance with both FCC and IC using single set of test data.

5.6.2. Method of Measurements

Refer to 7.4 of this report for measurement details

5.6.3. Test Arrangement

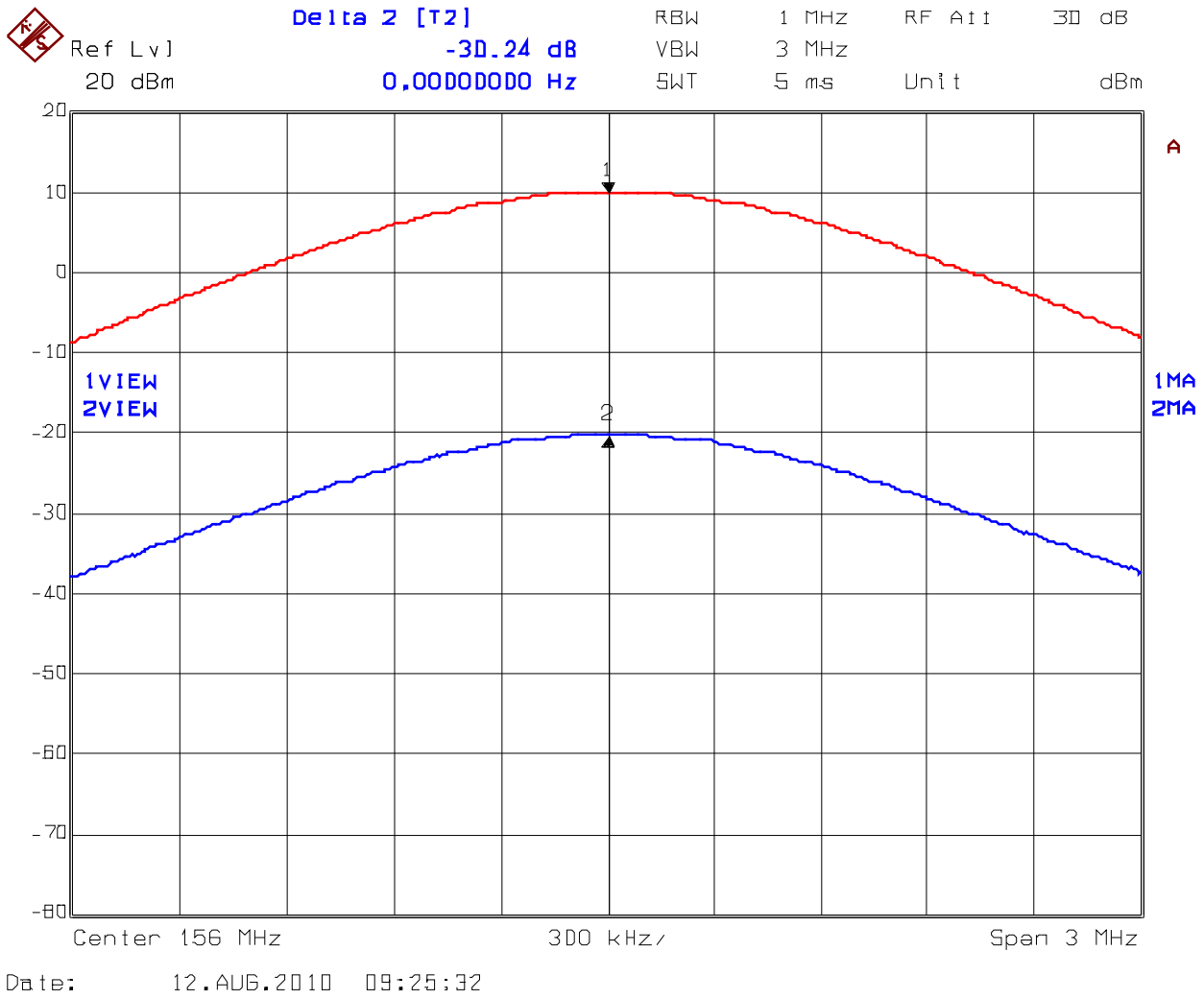


5.6.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK 30	100077	20 Hz – 40 GHz	Aug 14, 2011
Function Generator	Stanford Research Systems	DS345	34591	1 µHz – 30.2 MHz	Oct 06, 2010
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.6.5. System Cable Loss

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80 & RSS-182
Date:	August 12, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	20dB&10dB Pasternack attenuator + DC Block + SMA31&SMA3 cables. PE7019-10&PE7019-20, HP DC Block


Delta 2 [T2]
-30.24 dB
0.00D0D0D0 Hz
Ref Lvl
20 dBm
RBW 1 MHz
VBW 3 MHz
SWT 5 ms
RF Att 30 dB
Unit dBm
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
1VIEW
2VIEW
1MA
2MA
A
Center 156 MHz
300 kHz/
Span 3 MHz
Date: 12.AUG.2010 09:25:32

5.6.6. Test Data

5.6.6.1. 99% Occupied Bandwidth

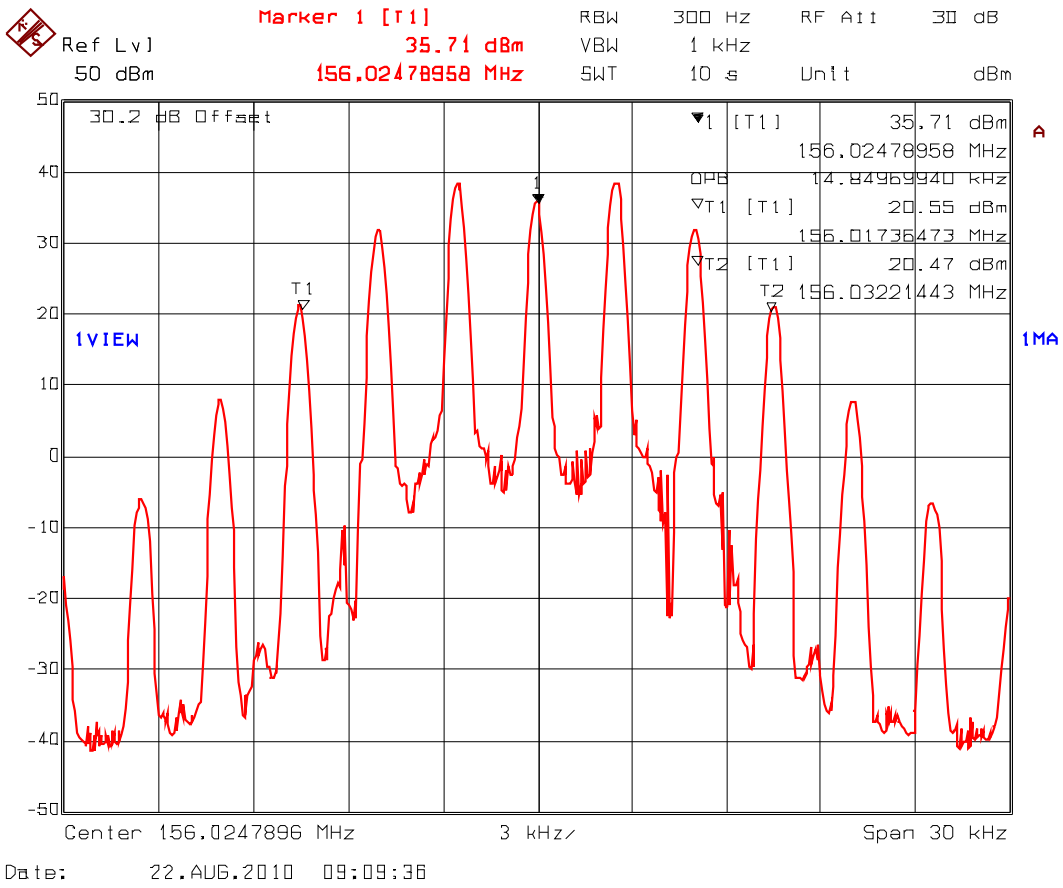
Frequency (MHz)	Channel Spacing (kHz)	Measured 99% OBW (kHz)	Authorized Bandwidth (kHz)
156.025	25.0	14.85	16
157.425	25.0	14.73	16
156.525 (1300 Hz)	25.0	7.89	16
156.525 (2100 Hz)	25.0	12.68	16
156.525 (1700 Hz)	25.0	11.36	16

Remark: 99% Occupied Bandwidth measurements were done using the built-in auto function of the analyzer.

See the following plots (2 – 6) for details of measurements.

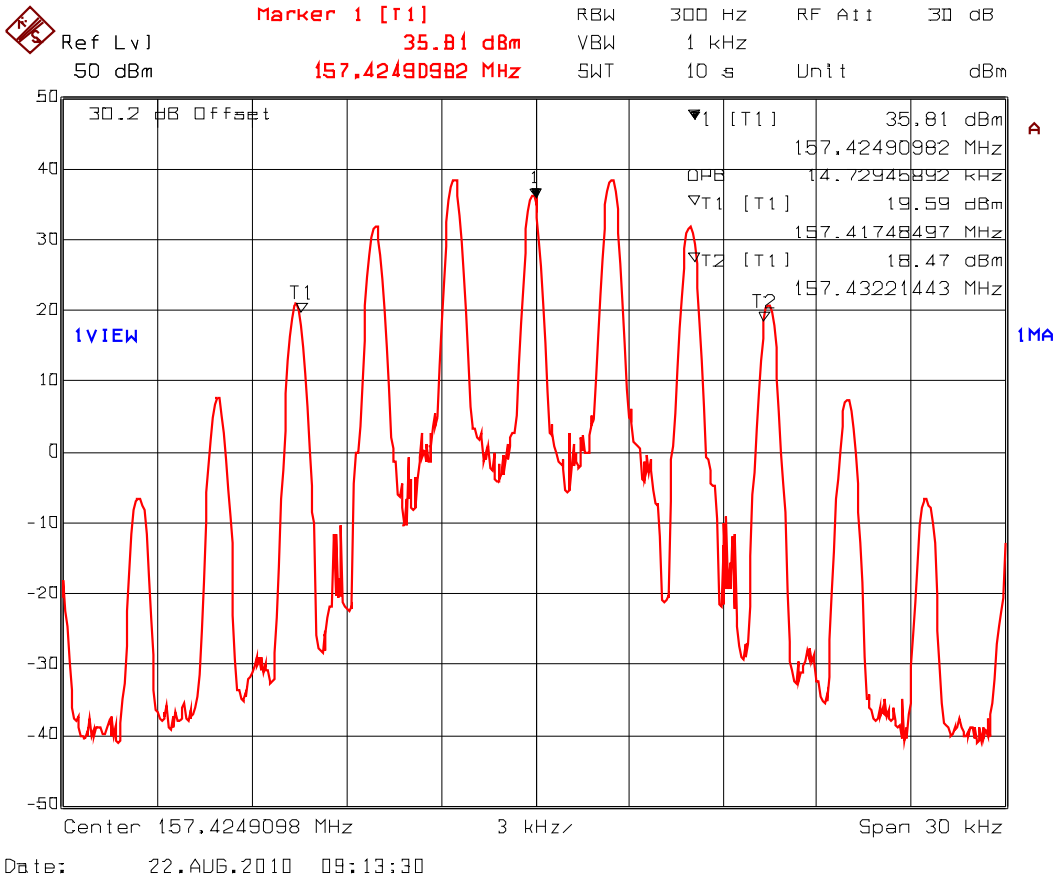
Plot # 2.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211 99% Occupied Bandwidth
Date:	August 22, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	Channel 60 (International) 156.025 MHz with G3E 2.5 kHz Sine Wave



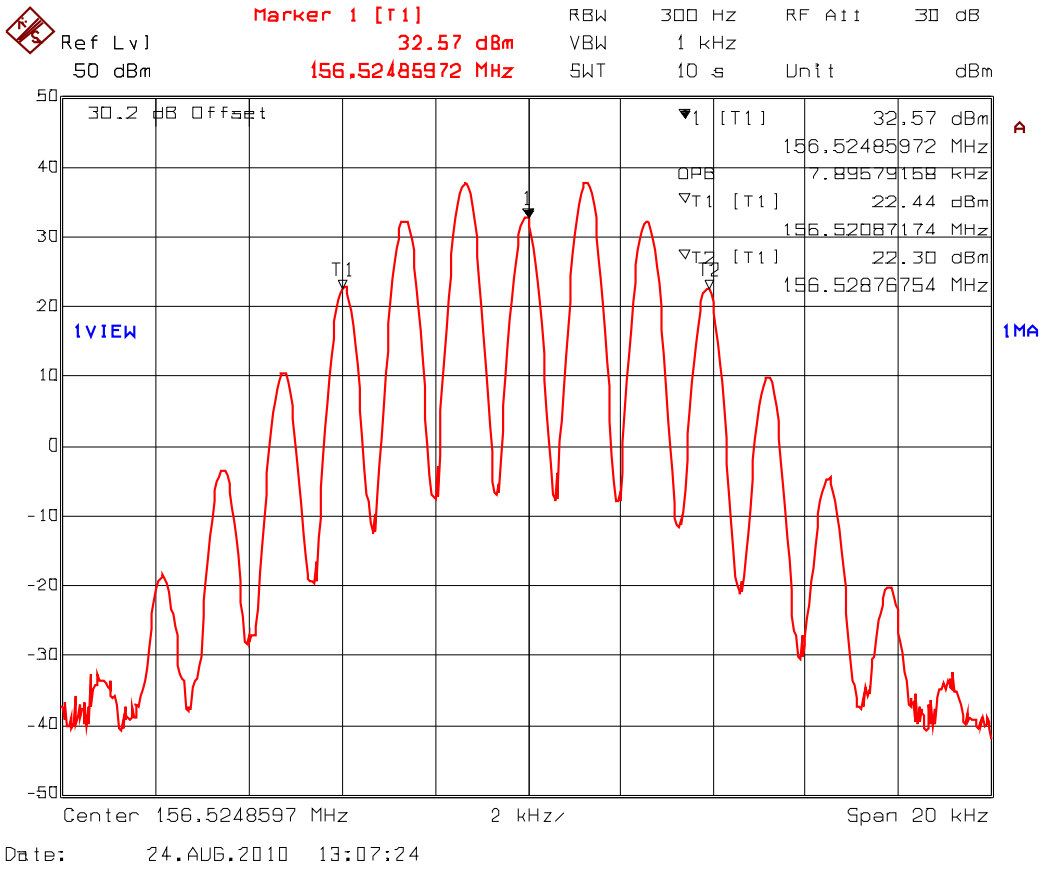
Plot # 3.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211 99% Occupied Bandwidth
Date:	August 22, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	Channel 88A (USA) 157.425 MHz with G3E 2.5 kHz Sine Wave



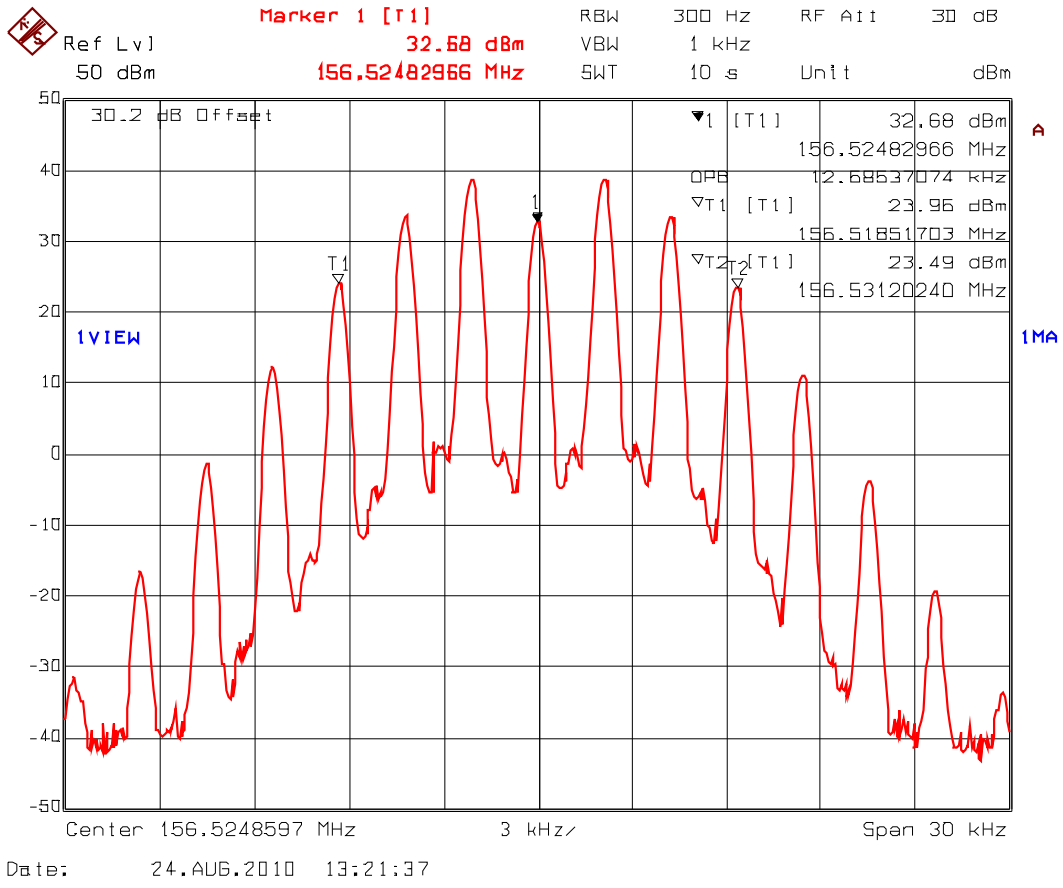
Plot # 4.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211 99% Occupied Bandwidth
Date:	August 23, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	DSC Channel 70 156.525 MHz (1300 Hz shift frequency tone)



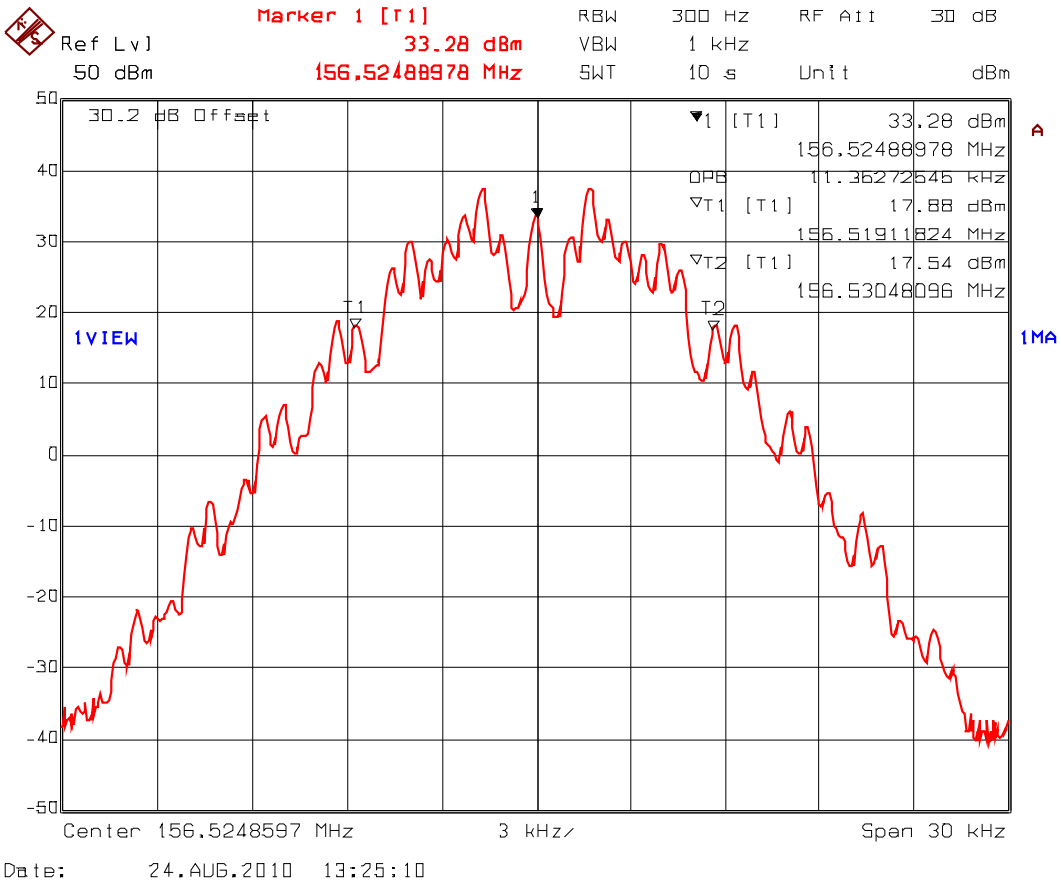
Plot # 5.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211 99% Occupied Bandwidth
Date:	August 23, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	DSC Channel 70 156.525 MHz (2100 Hz shift frequency tone)



Plot # 6.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211 99% Occupied Bandwidth
Date:	August 23, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	DSC Channel 70 156.525 MHz (1700 Hz sub-carrier tone)



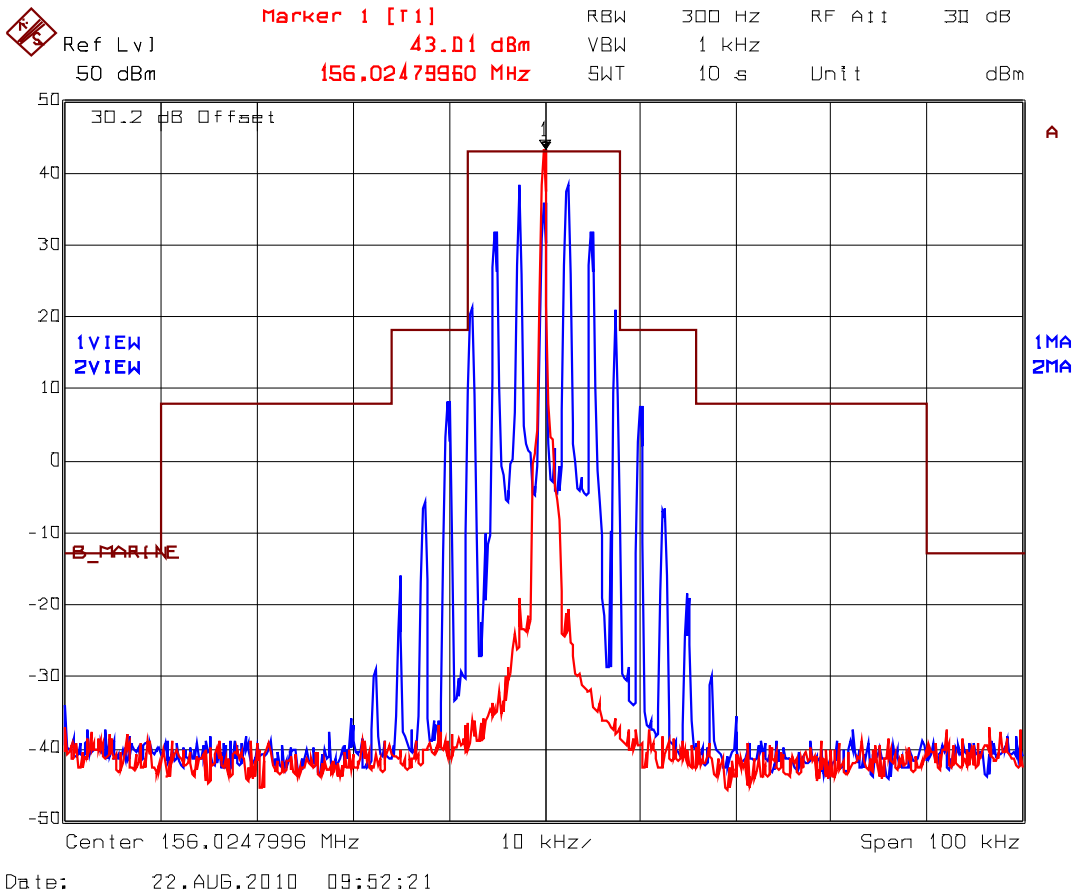
5.6.6.2. Emission Masks

Remark: More stringent IC/RSS-182 maximum authorization bandwidth of 16 kHz for voice is applied instead of 20 kHz specified in Sec. 80.205 to verify and confirm compliance with both FCC and IC using single set of test data.

Conform. See the following test data plots (7 through 16) for details.

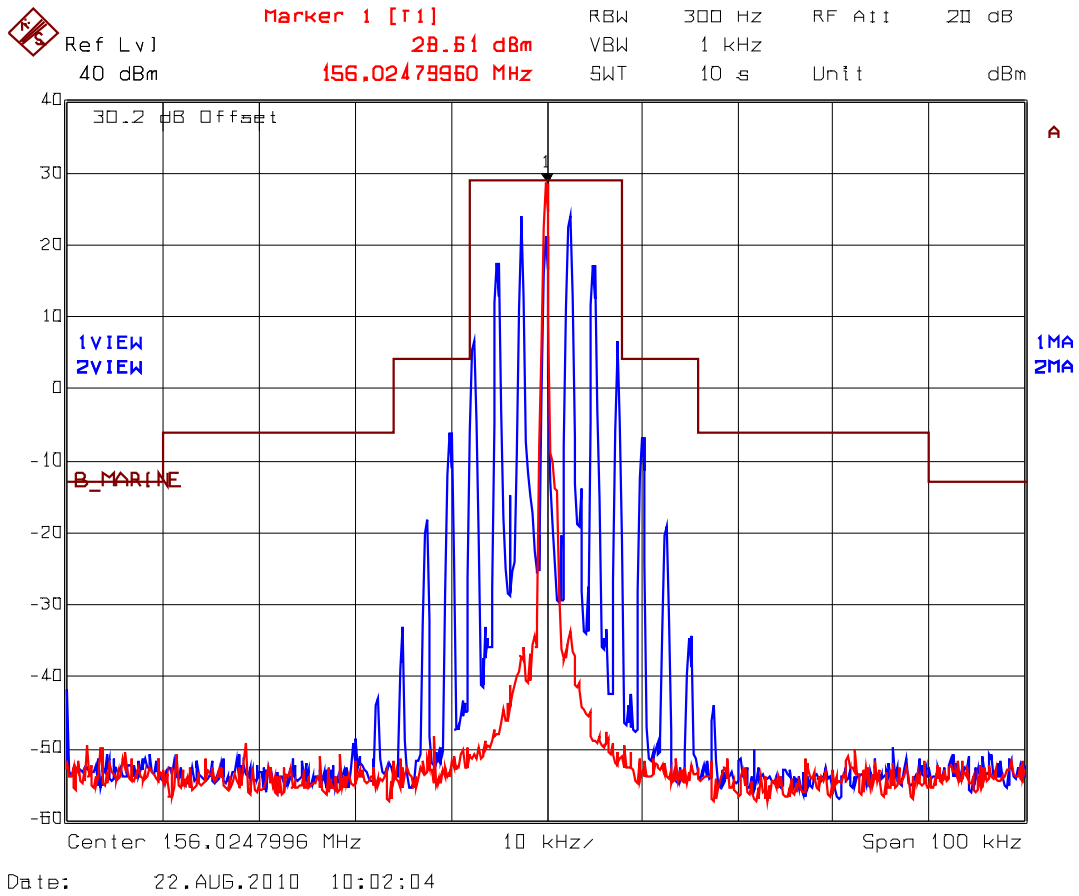
Plot # 7.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 22, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	High Power Channel 60 (International) 156.025 MHz with G3E 2.5 kHz Sine Wave



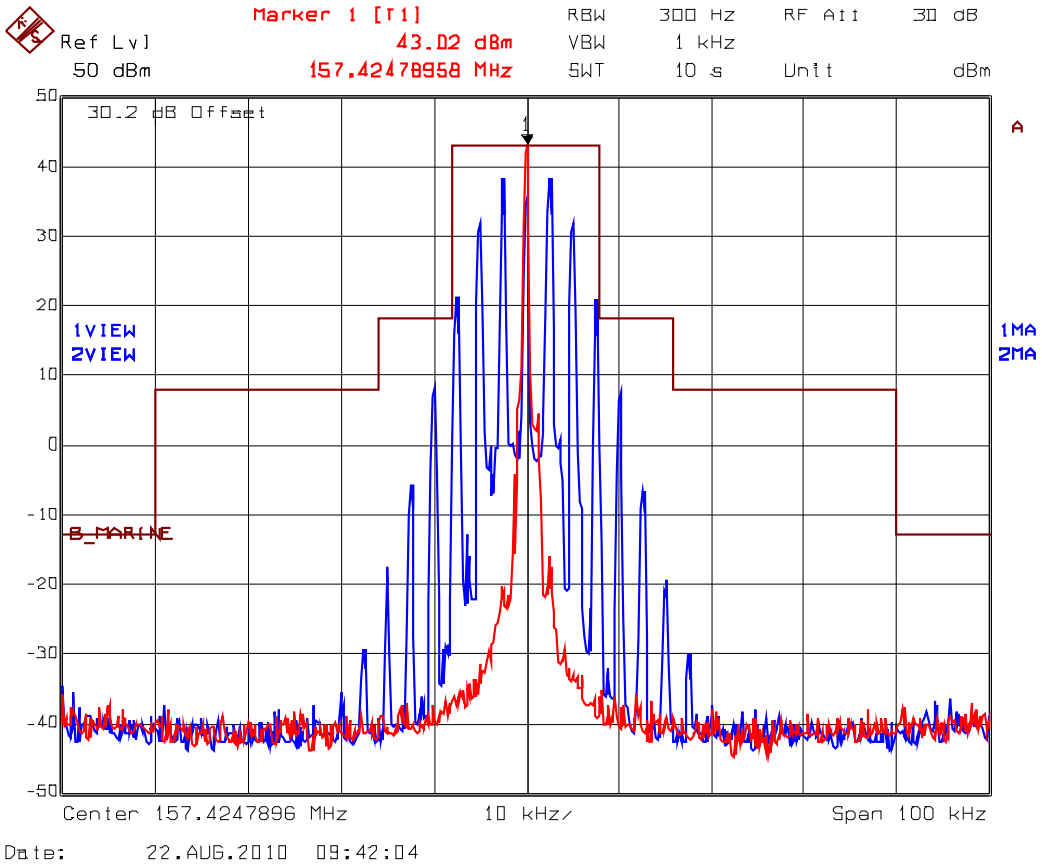
Plot # 8.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 22, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	Low Power Channel 60 (International) 156.025 MHz with G3E 2.5 kHz Sine Wave



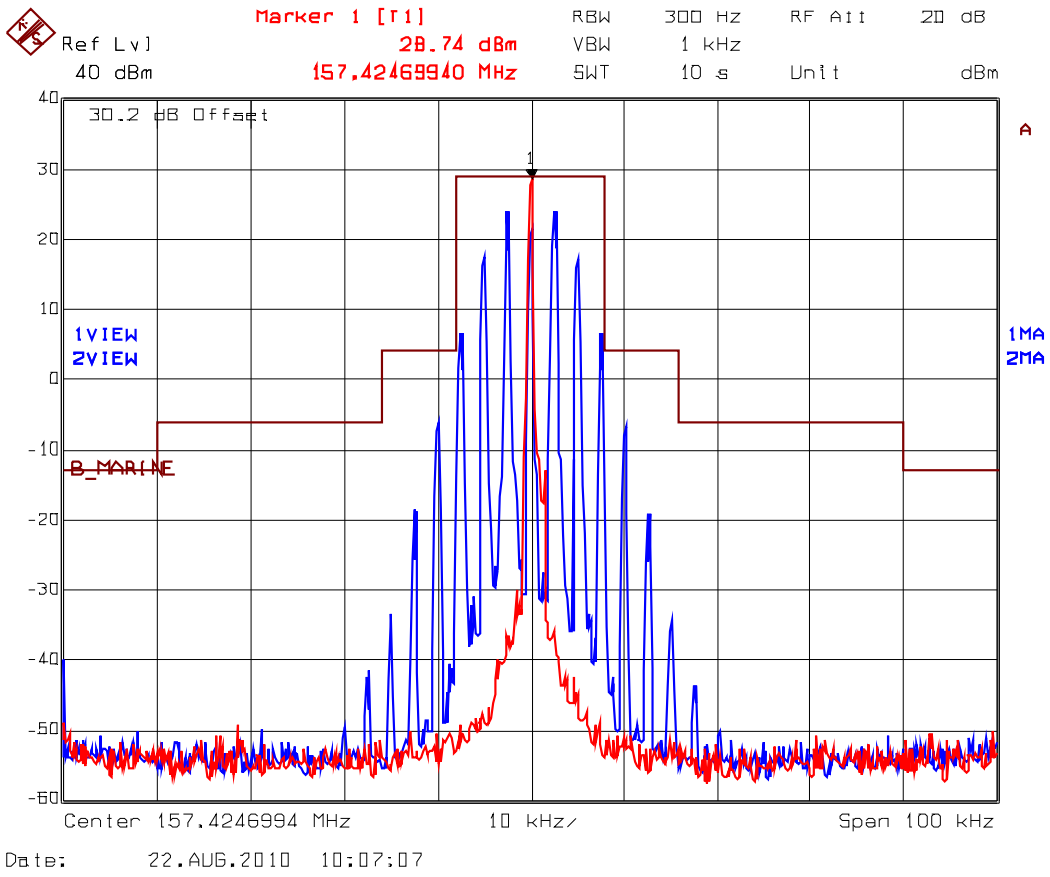
Plot # 9.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 22, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	High Power Channel 88A (USA) 157.425 MHz with G3E 2.5 kHz Sine Wave



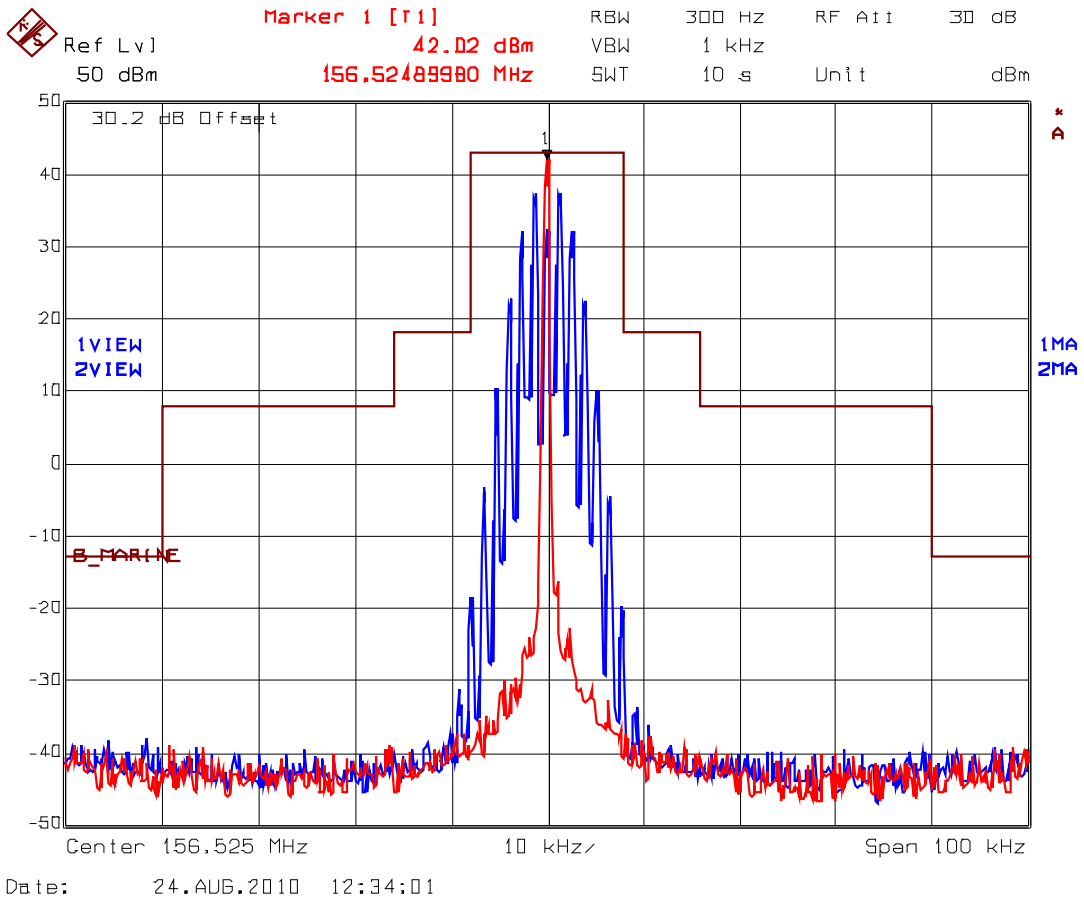
Plot # 10.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 22, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	Low Power Channel 88A (USA) 157.425 MHz with G3E 2.5 kHz Sine Wave



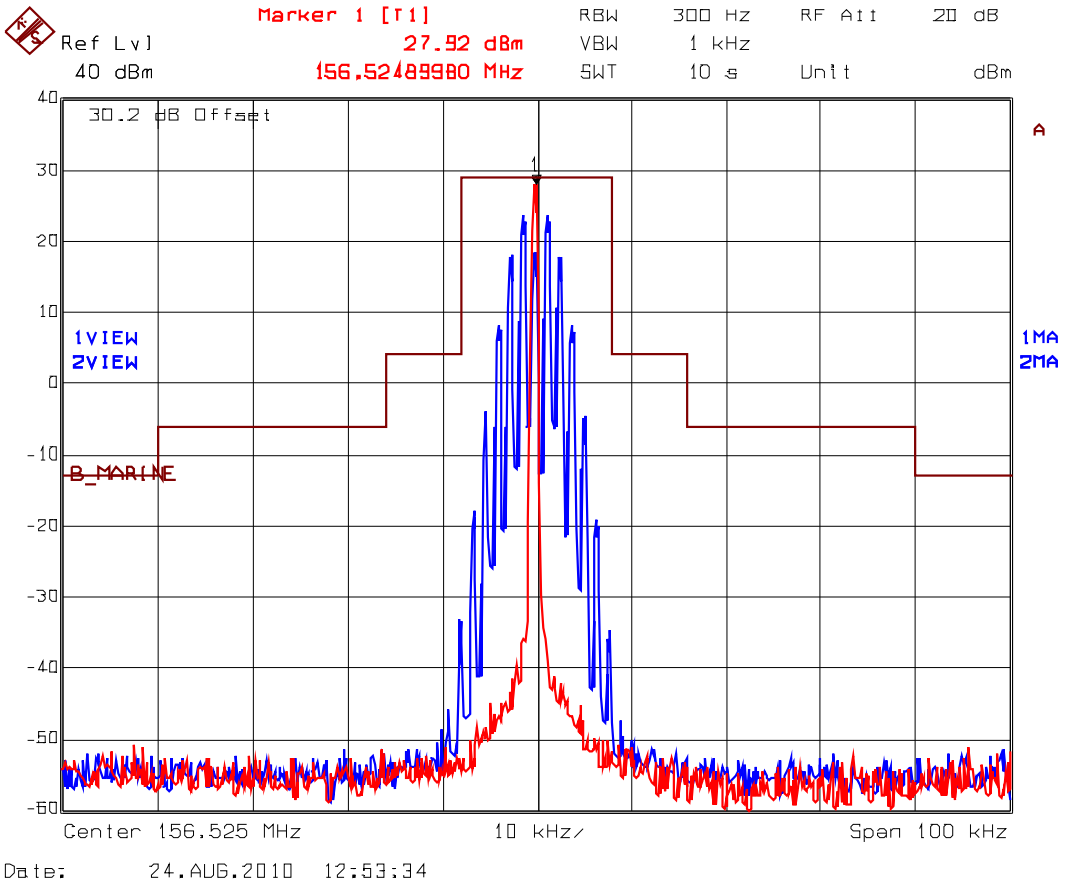
Plot # 11.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	DSC High Power Channel 70 156.525 MHz with G2B (1300 Hz shift frequency tone)



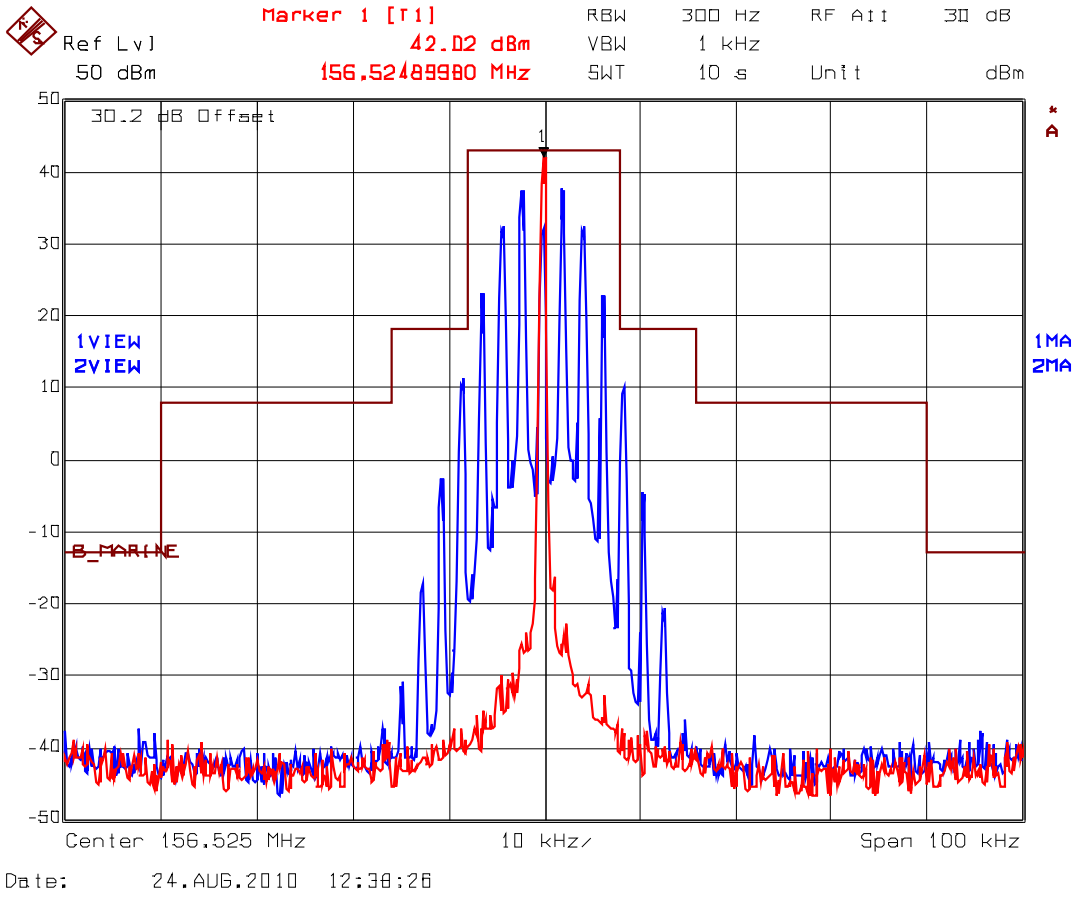
Plot # 12.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	DSC Low Power Channel 70 156.525 MHz with G2B (1300 Hz shift frequency tone)



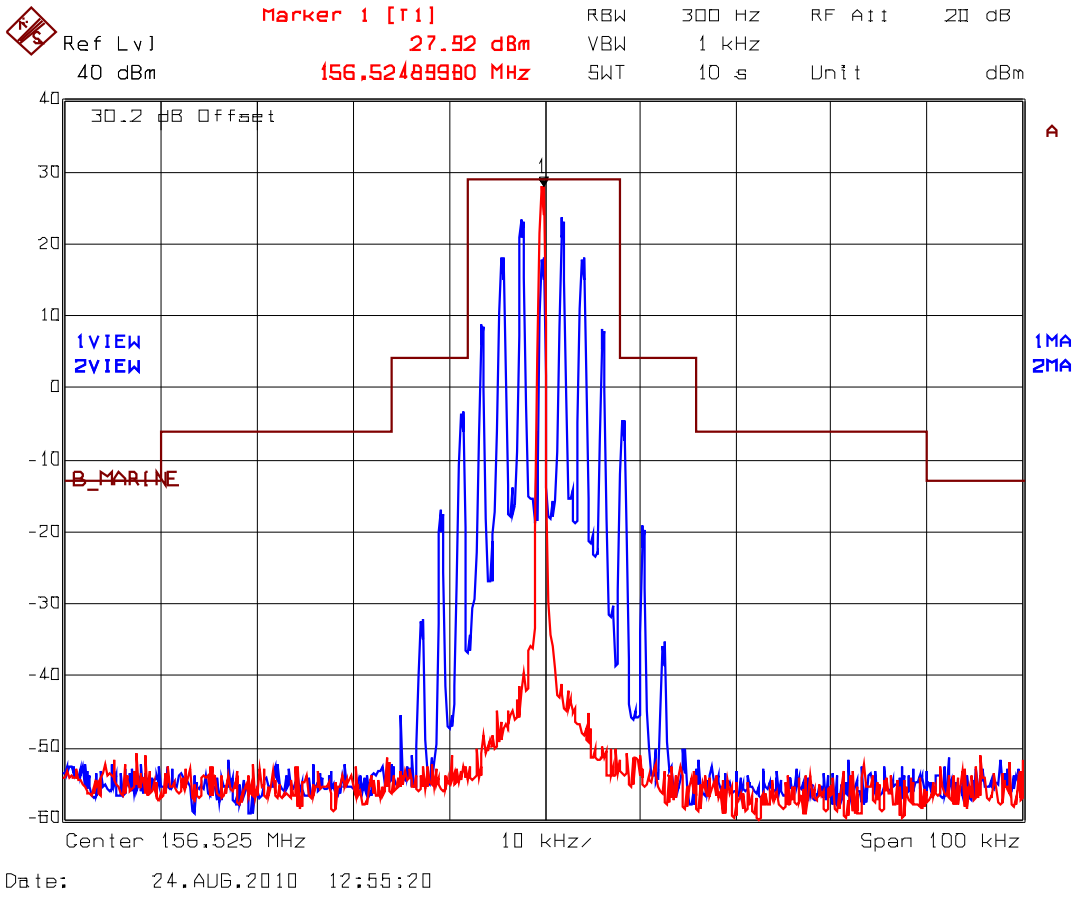
Plot # 13.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	DSC High Power Channel 70 156.525 MHz with G2B (2100 Hz shift frequency tone)



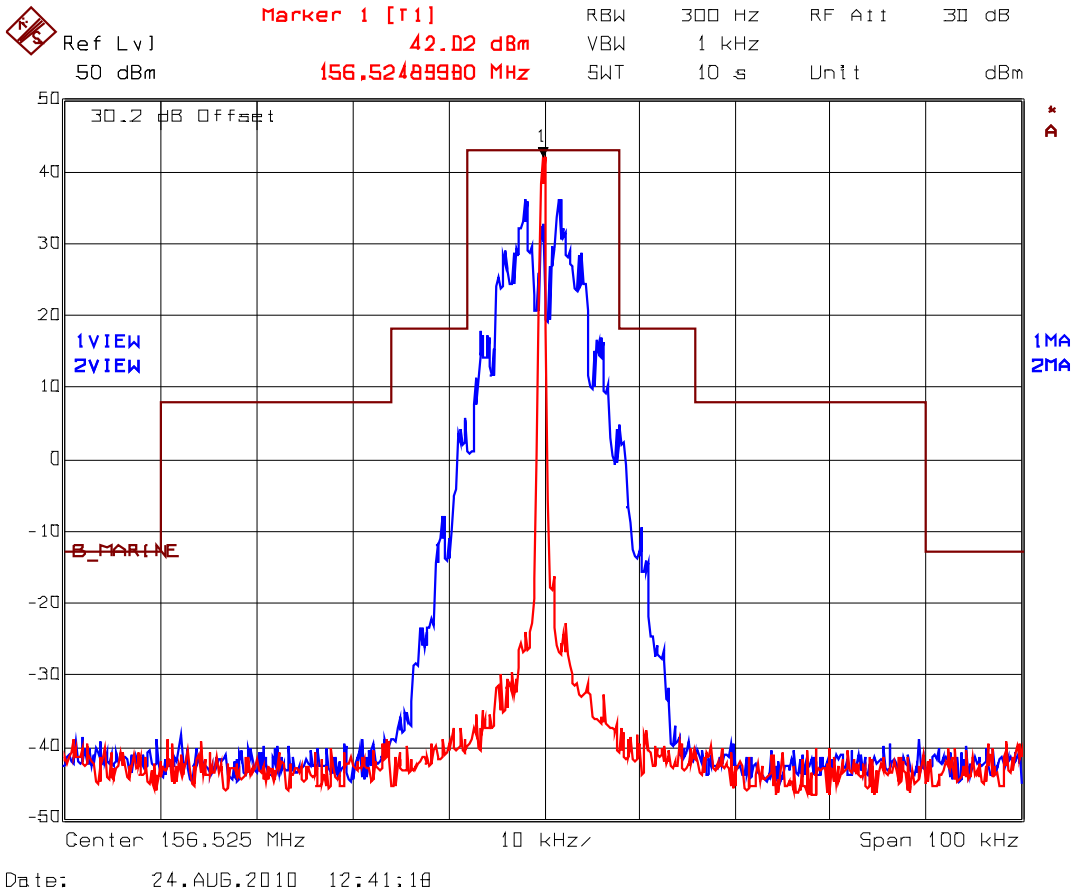
Plot # 14.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	DSC Low Power Channel 70 156.525 MHz with G2B (2100 Hz shift frequency tone)



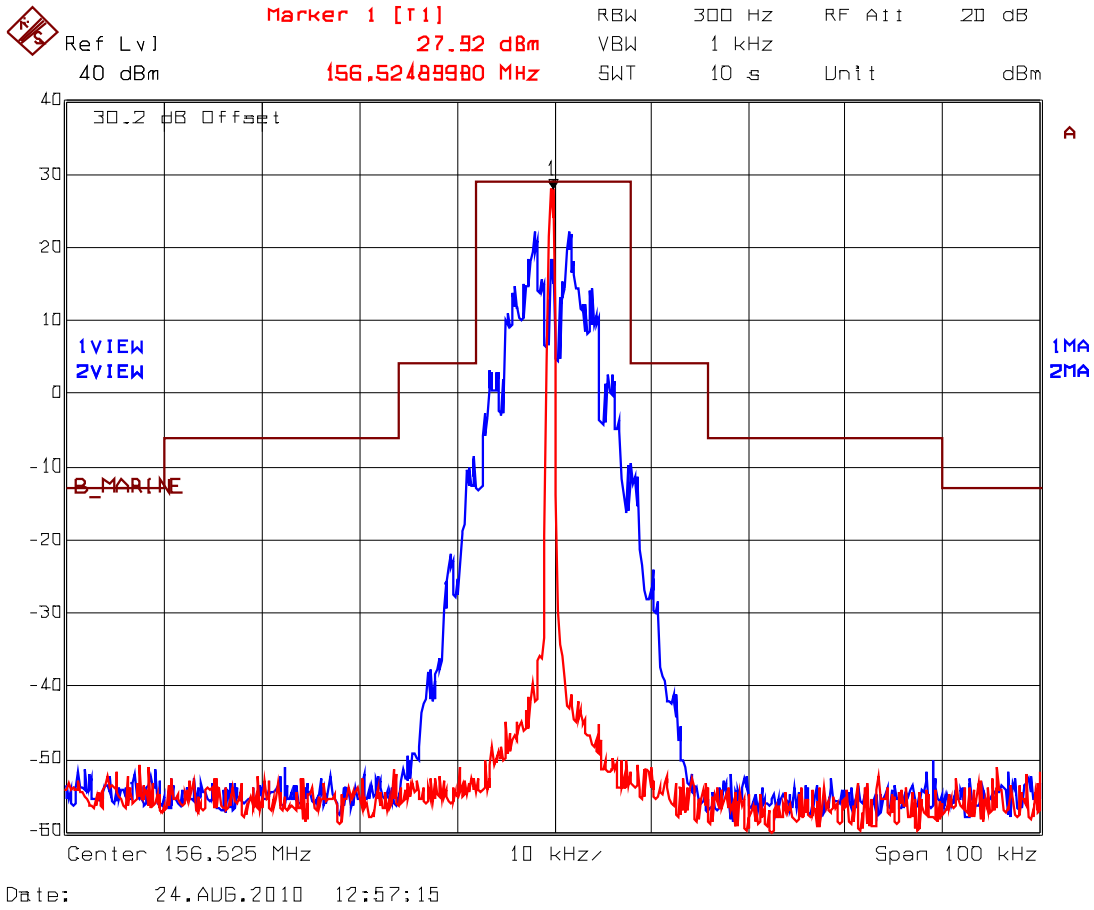
Plot # 15.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	DSC High Power Channel 70 156.525 MHz with G2B (1700 Hz sub-carrier tone)



Plot # 16.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f) & RSS-182 6.3.1 Emission Mask
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	DSC Low Power Channel 70 156.525 MHz with G2B (1700 Hz sub-carrier tone)



5.7. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS [§ 80.211(f)(3)]

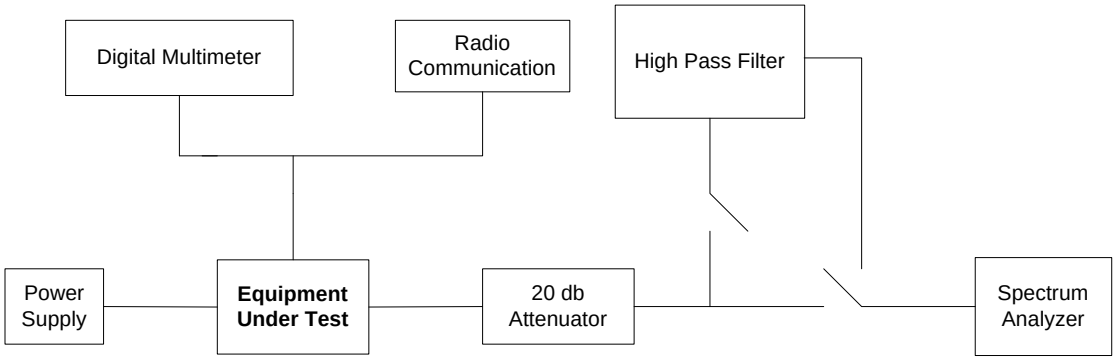
5.7.1. Limits

§ 80.211 (f)(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus 10log10 (mean power in watts) dB.

5.7.2. Method of Measurements

Refer to 7.5 of this report for measurement details

5.7.3. Test Arrangement

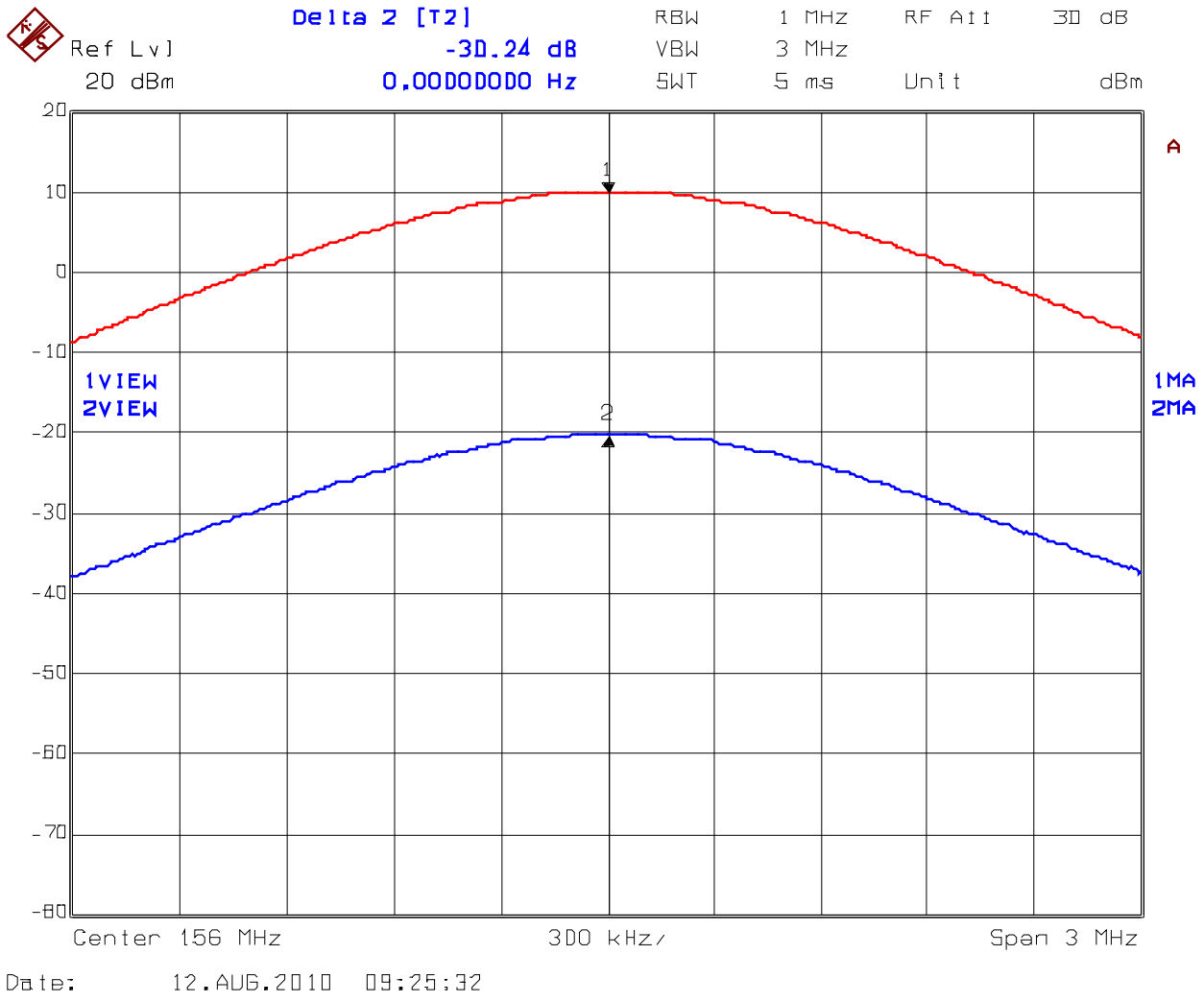


5.7.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK 30	100077	20 Hz – 40 GHz	Aug 14, 2011
Function Generator	Stanford Research Systems	DS345	34591	1 µHz – 30.2 MHz	Oct 06, 2010
High Pass filter	Mini-Circuits	SHP-300	10427	Cut off 158 MHz	Inhouse calibrated at tests
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.7.5. System Cable Loss

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80 & RSS-182
Date:	August 12, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	20dB&10dB Pasternack attenuator + DC Block + SMA31&SMA3 cables. PE7019-10&PE7019-20, HP DC Block



5.7.6. Test Data

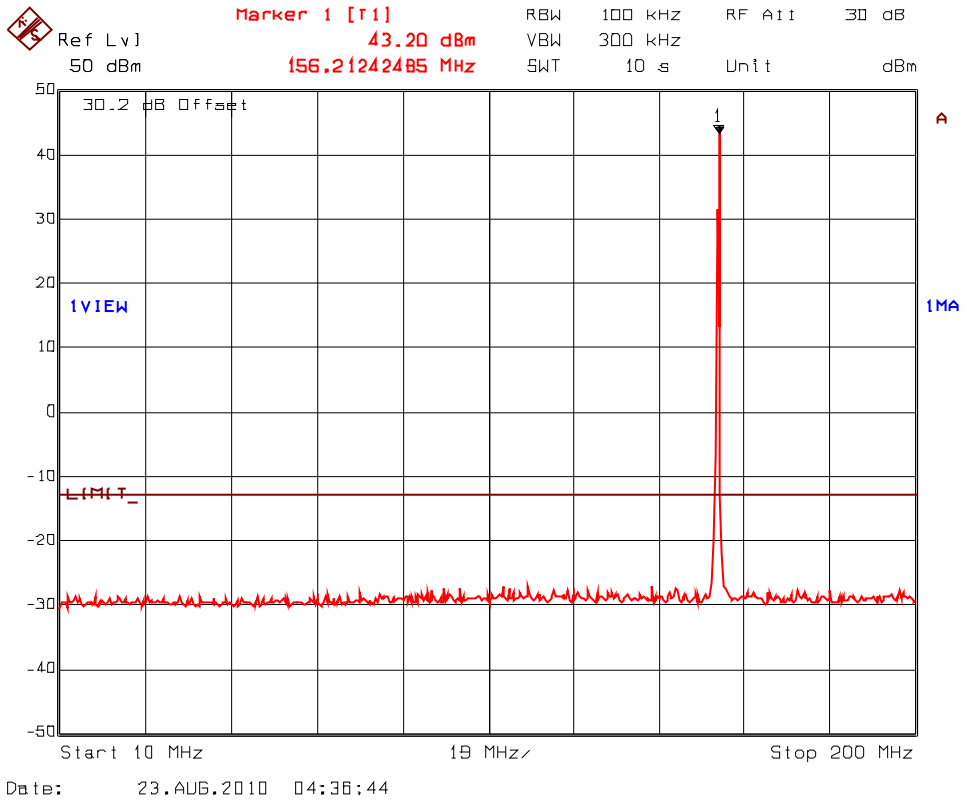
5.7.6.1. Near Lowest Frequency (156.025 MHz)

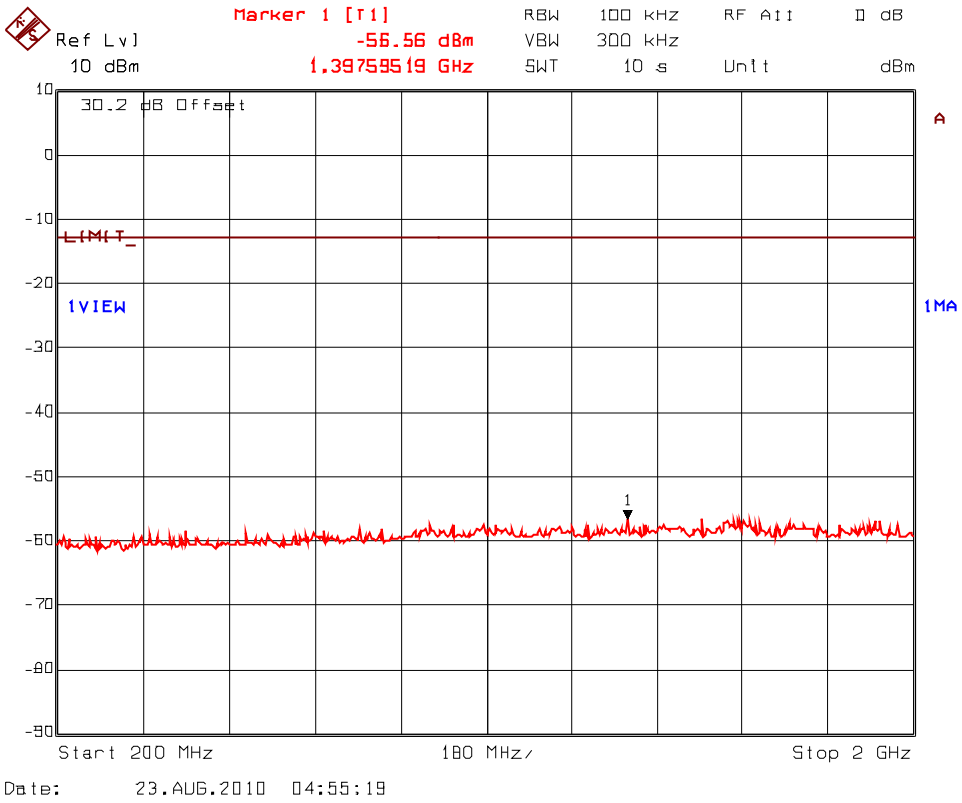
Carrier Frequency (MHz):	156.025
Power (dBm):	43.39
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

Plot # 17.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 23, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	High Power Channel 60 (International) 156.025 MHz with G3E 2.5 kHz Sine Wave




Marker 1 [T1]
-56.56 dBm
1.39759519 GHz
RBW 100 kHz
VBW 300 kHz
SWT 10 s
RF Att 0 dB
Unit dBm
Ref Lvl
10 dBm
30.2 dB Offset
LIMIT
1VIEW
1MA
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 23.AUG.2010 04:55:19

Carrier Frequency (MHz): 156.025

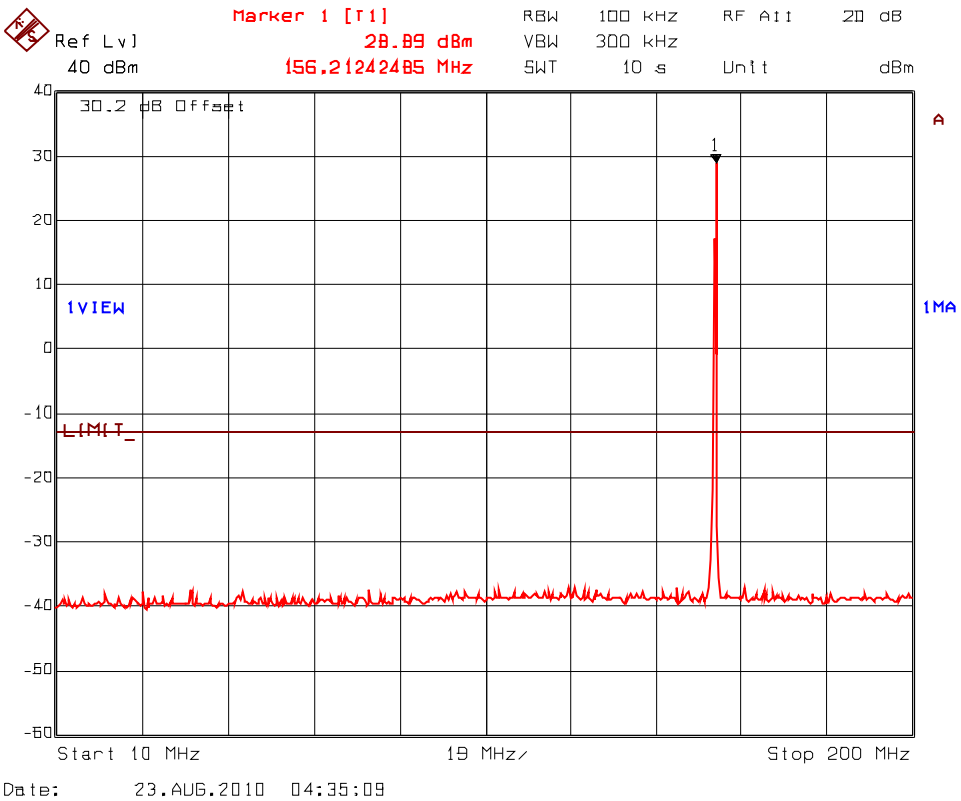
Power (dBm): 29.10

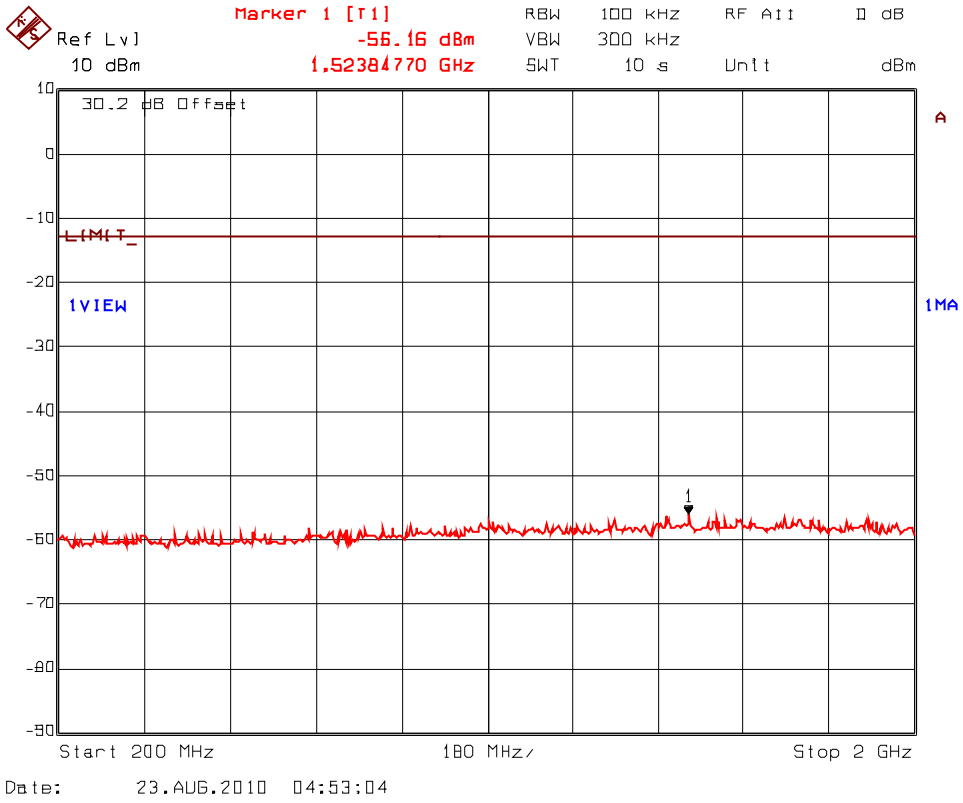
Limit (dBm): -13

All emissions found were more than 20 dB below the permissible limits.

Plot # 18.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 23, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	Low Power Channel 60 (International) 156.025 MHz with G3E 2.5 kHz Sine Wave




Marker 1 [T1]
-56.16 dBm
1.52384770 GHz
RBW 100 kHz
VBW 300 kHz
SWT 10 s
RF Att 0 dB
Unit dBm
Ref Lvl
10 dBm
30.2 dB Offset
LIMIT
1VIEW
1MA
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 23.AUG.2010 04:53:04

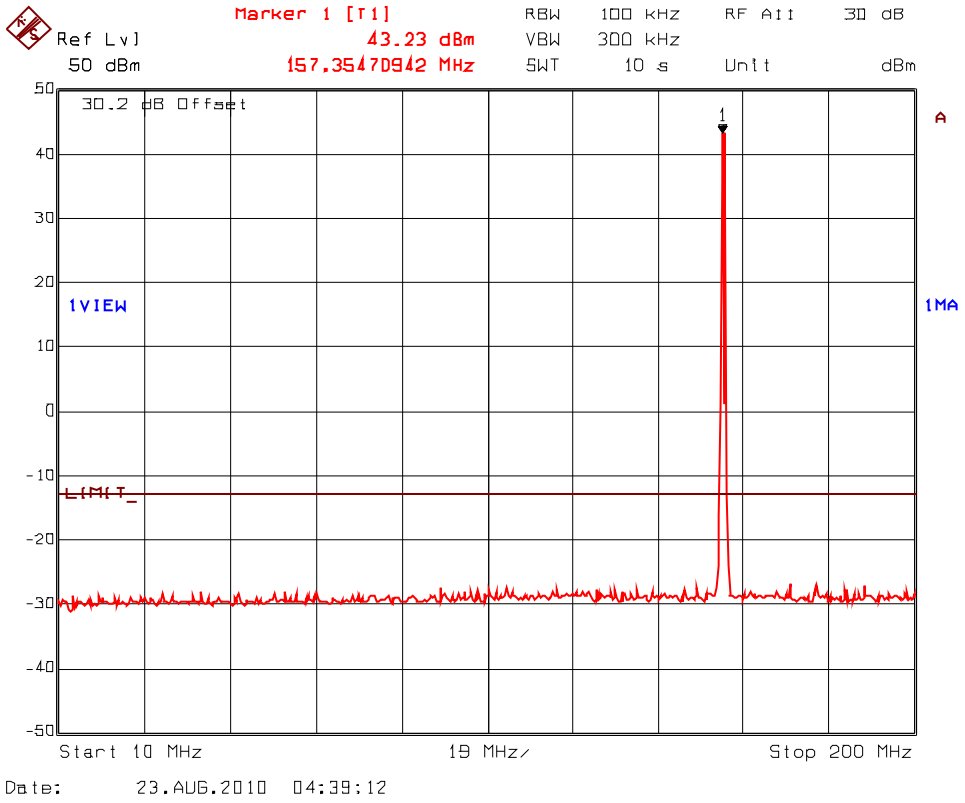
5.7.6.2. Near Highest Frequency (157.425 MHz)

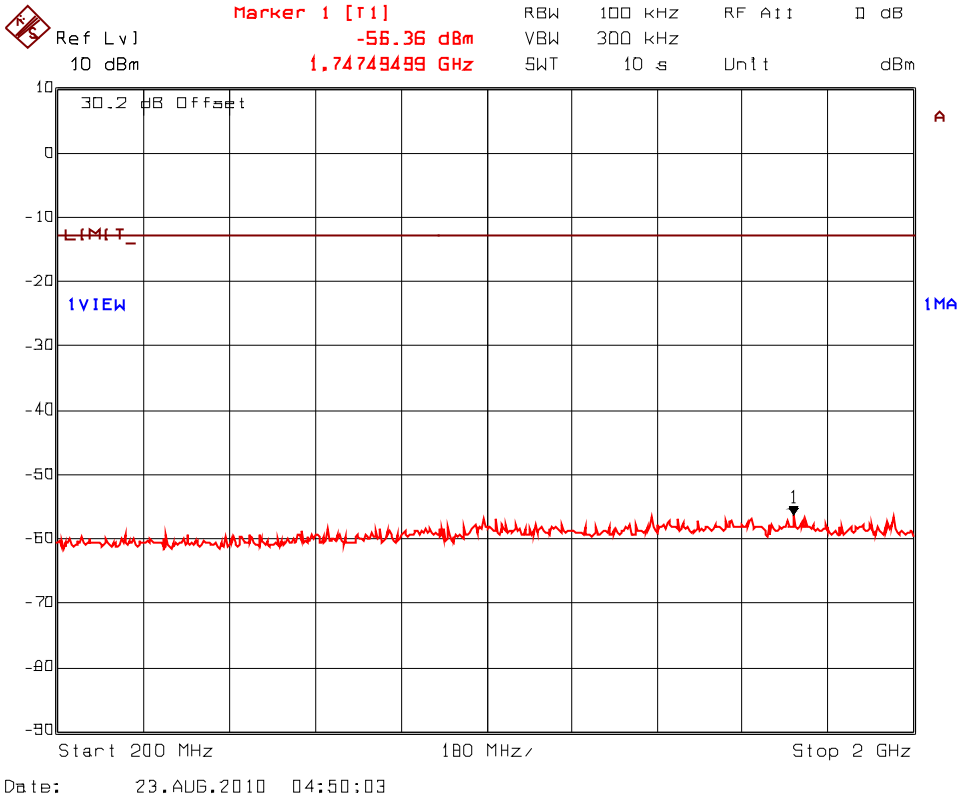
Carrier Frequency (MHz): 157.425
Power (dBm): 43.41
Limit (dBm): -13

All emissions found were more than 20 dB below the permissible limits.

Plot # 19.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 23, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	High Power Channel 88A (USA) 157.425 MHz with G3E 2.5 kHz Sine Wave



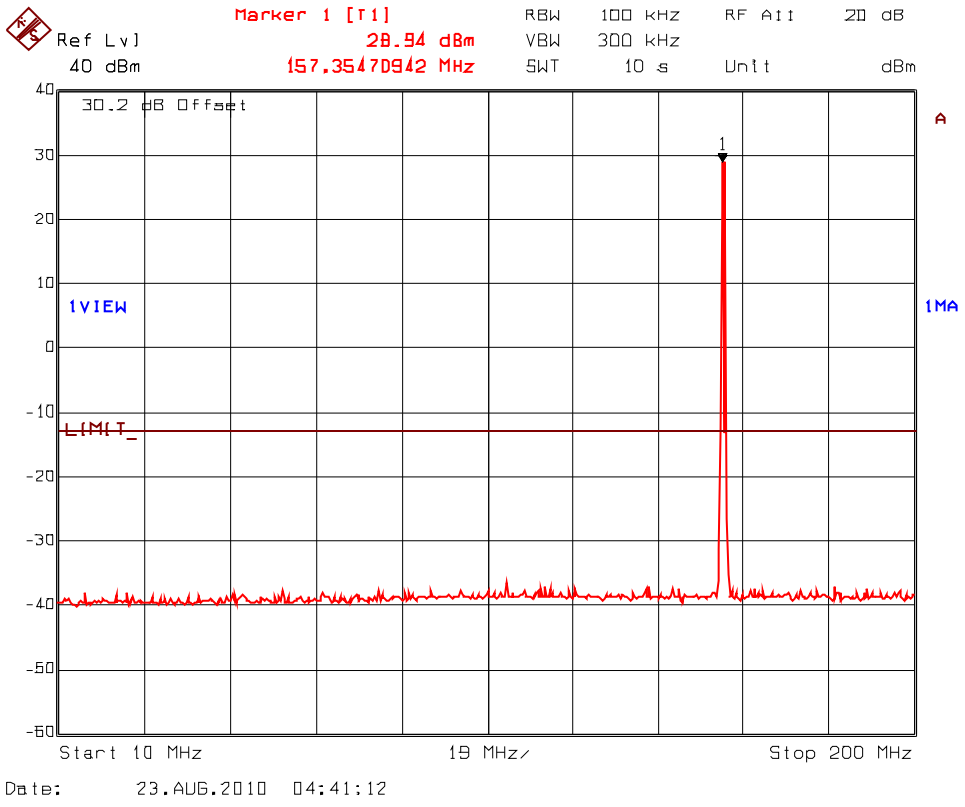

Marker 1 [T1]
-56.36 dBm
1.74749499 GHz
RBW 100 kHz
VBW 300 kHz
SWT 10 s
RF Att 0 dB
Unit dBm
Ref Lvl
10 dBm
30.2 dB Offset
LIMIT
1VIEW
1MA
A
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 23.AUG.2010 04:50:03

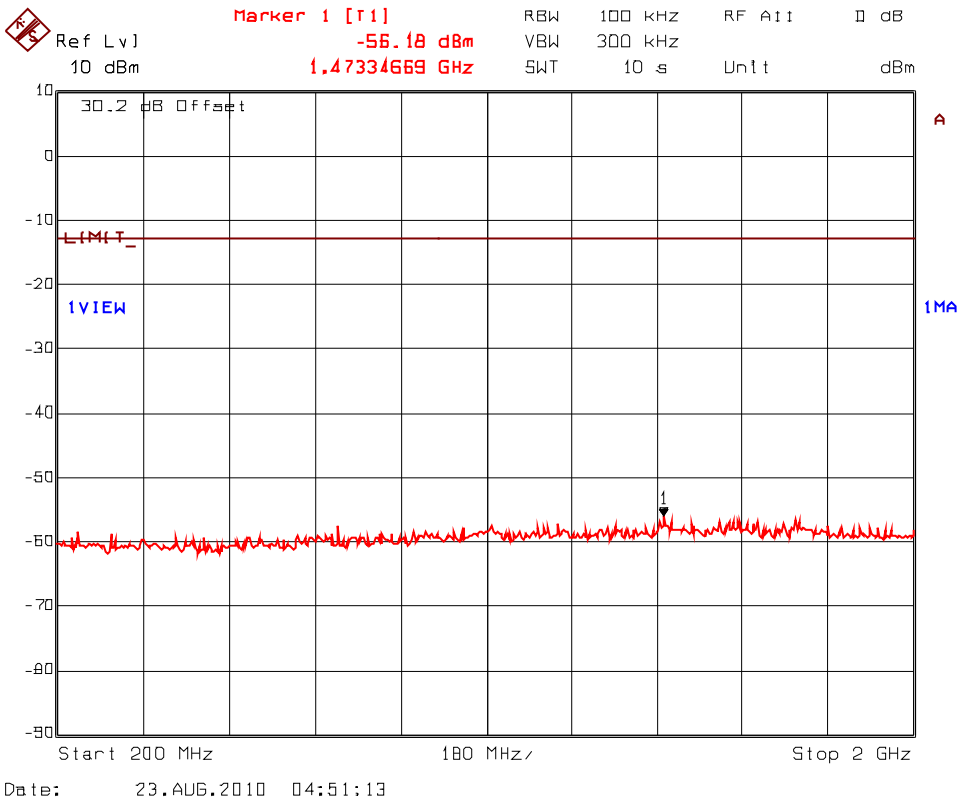
Carrier Frequency (MHz):	157.425
Power (dBm):	29.21
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

Plot #20.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 23, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	Low Power Channel 88A (USA) 157.425 MHz with G3E 2.5 kHz Sine Wave




Marker 1 [T1]
-56.18 dBm
1.47334669 GHz
RBW 100 kHz
VBW 300 kHz
SWT 10 s
RF Att 0 dB
Unit dBm
Ref Lvl
10 dBm
30.2 dB Offset
LIMIT
VIEW
1MA
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 23.AUG.2010 04:51:13

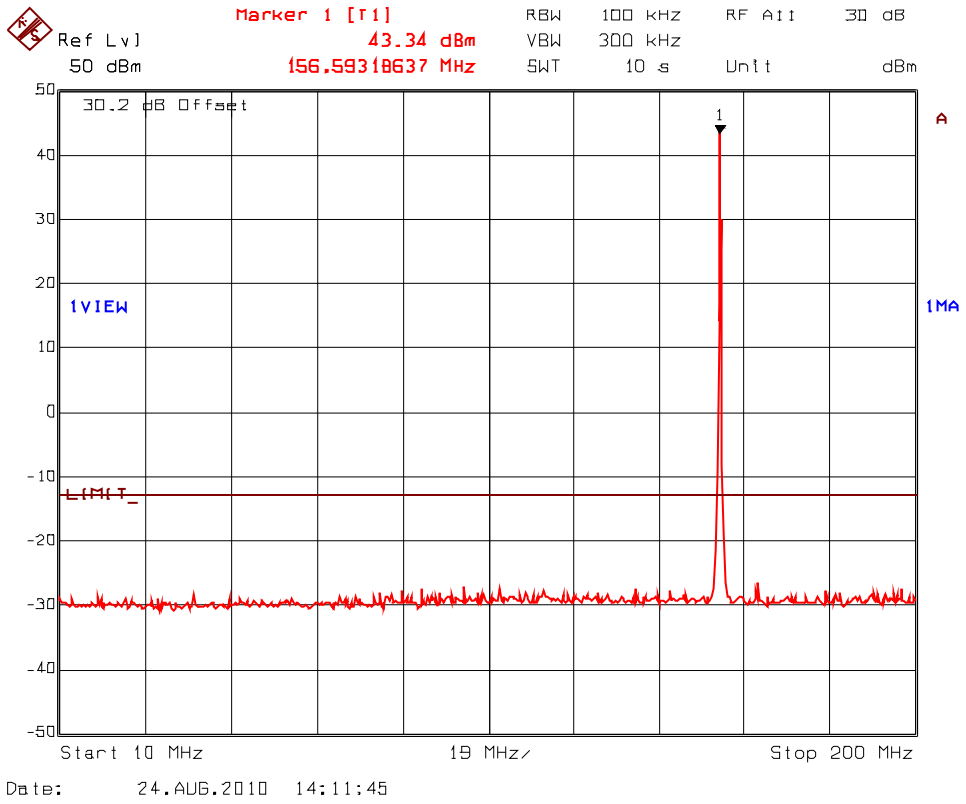
5.7.6.3. DSC Frequency (156.525 MHz) with the 1300Hz shift tone signal

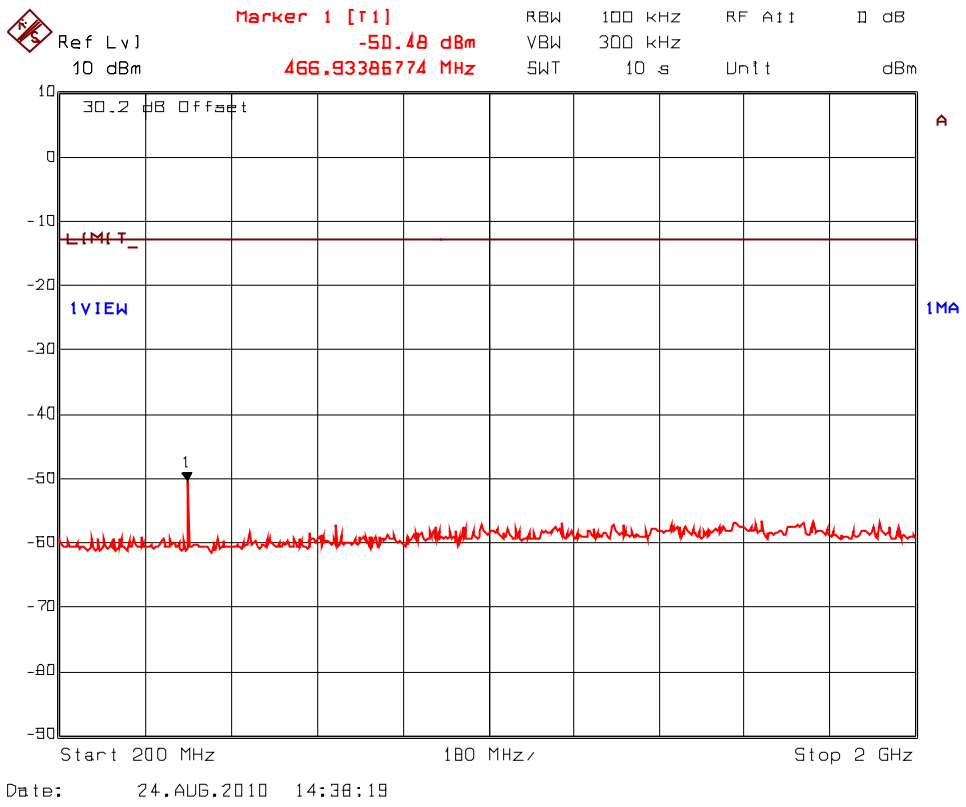
Carrier Frequency (MHz):	156.525
Shift-tone Frequency (Hz)	1300
Power (dBm):	43.39
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

Plot # 21.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	High Power DSC Channel 70 156.525 MHz (1300 Hz shift frequency tone)



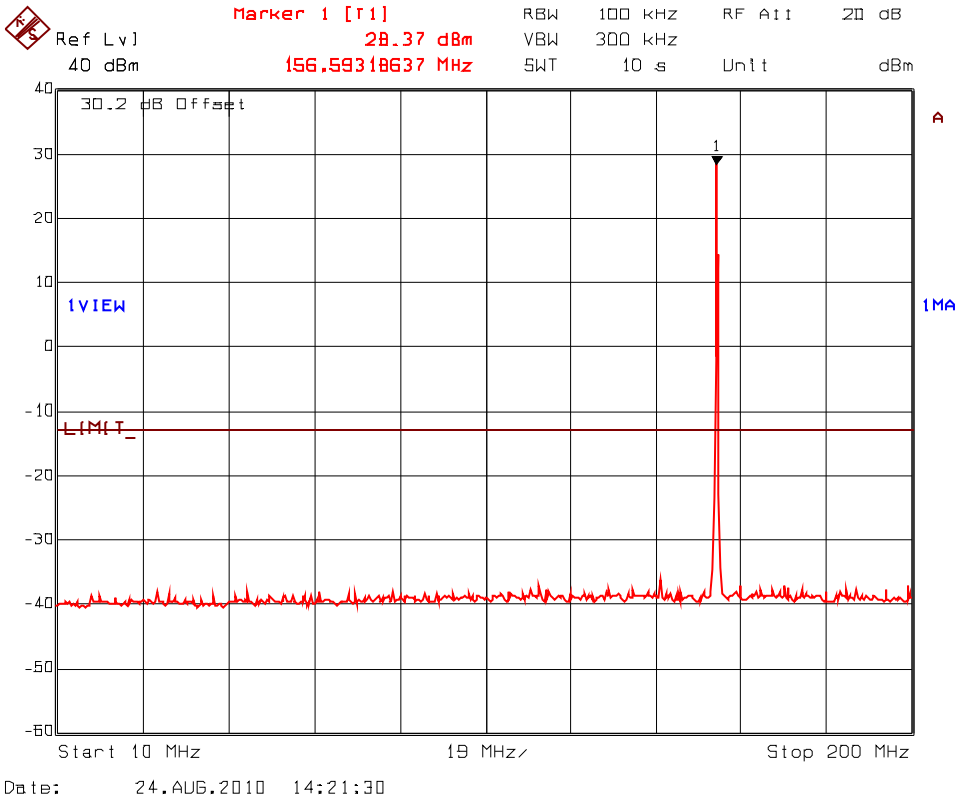

Marker 1 [T1]
-50.48 dBm
466.93386774 MHz
RBW 100 kHz
VBW 300 kHz
SWT 10 s
RF Att 0 dB
Unit dBm
Ref Lvl
10 dBm
30.2 dB Offset
LIMIT
VIEW
1MA
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 24.AUG.2010 14:38:19

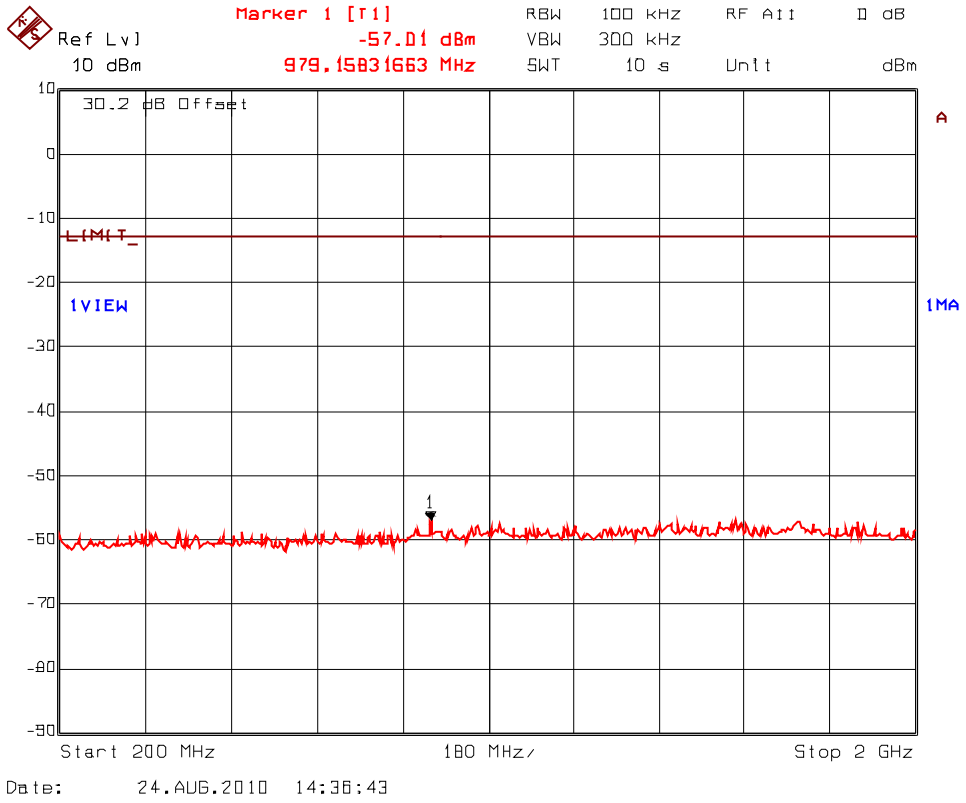
Carrier Frequency (MHz):	156.525
Shift-tone Frequency (Hz)	1300
Power (dBm):	29.13
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

Plot # 22.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 23, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	Low Power DSC Channel 70 156.525 MHz (1300 Hz shift frequency tone)




Marker 1 [T1]
-57.01 dBm
979.158316631 MHz
RBW 100 kHz
VBW 300 kHz
SWT 10 s
RF Att 0 dB
Unit dBm
Ref Lvl
10 dBm
30.2 dB Offset
LIMIT
1VIEW
1MA
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 24.AUG.2010 14:36:43

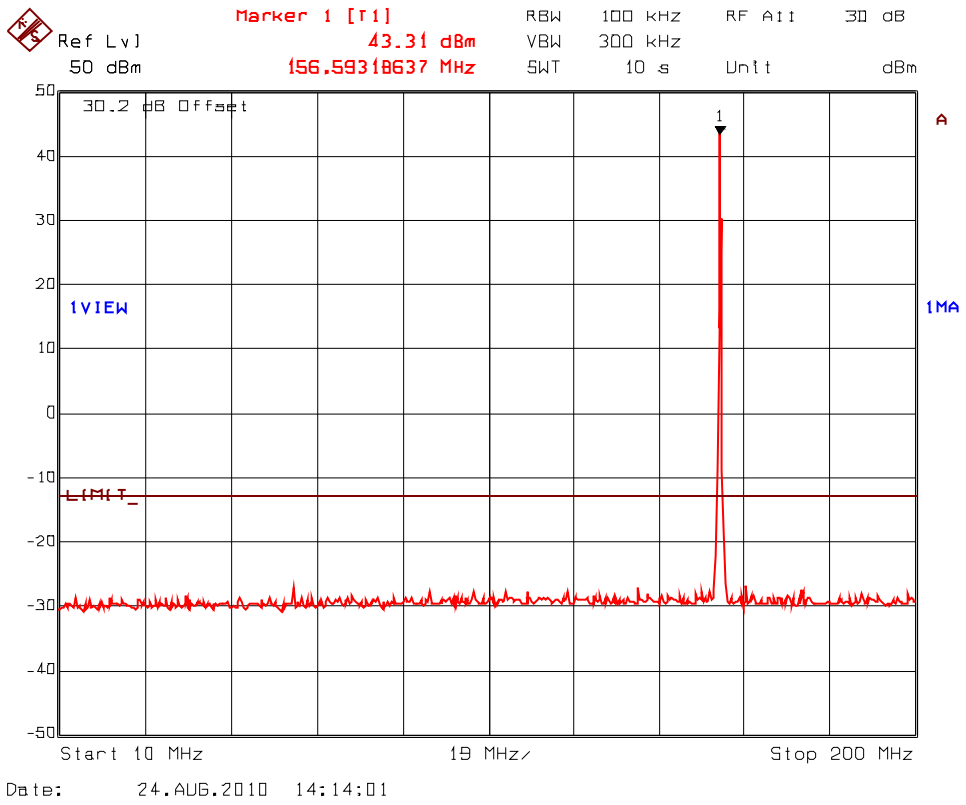
5.7.6.4. DSC Frequency (156.525 MHz) with the 2100Hz shift tone signal

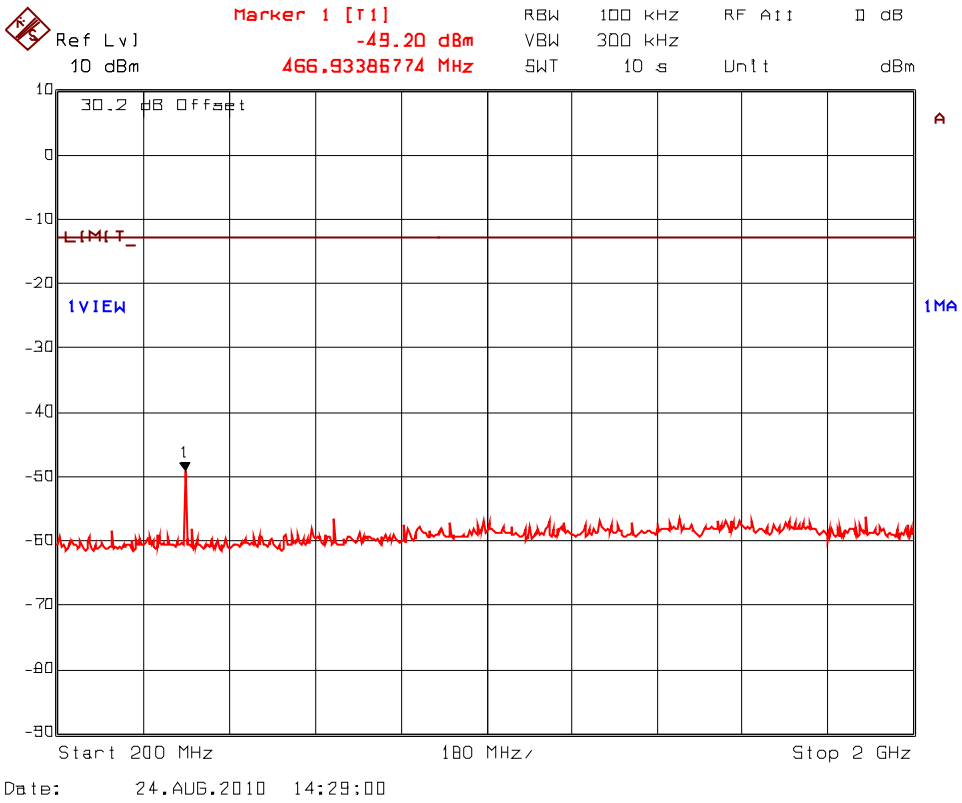
Carrier Frequency (MHz):	156.525
Shift-tone Frequency (Hz)	2100
Power (dBm):	43.39
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

Plot # 23.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	High Power DSC Channel 70 156.525 MHz (2100 Hz shift frequency tone)



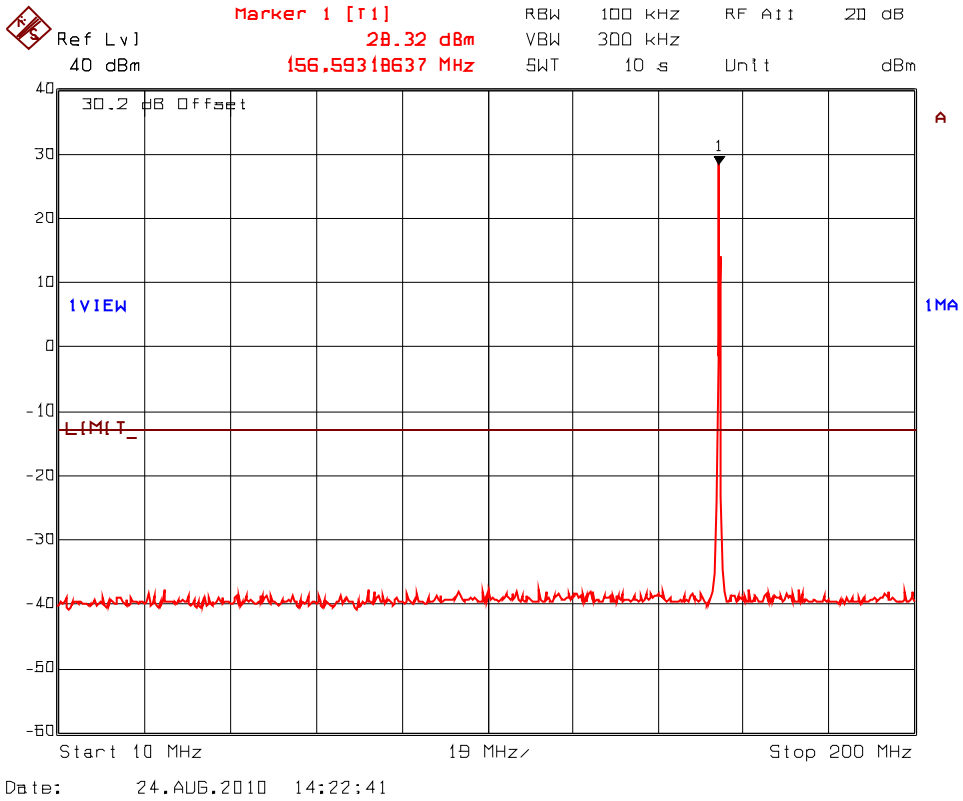

Marker 1 [T1]
-49.20 dBm
466.93386774 MHz
RBW 100 kHz
VBW 300 kHz
SWT 10 s
RF Att 0 dB
Unit dBm
Ref Lvl
10 dBm
30.2 dB Offset
LIMIT
1VIEW
1MA
A
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 24.AUG.2010 14:29:00

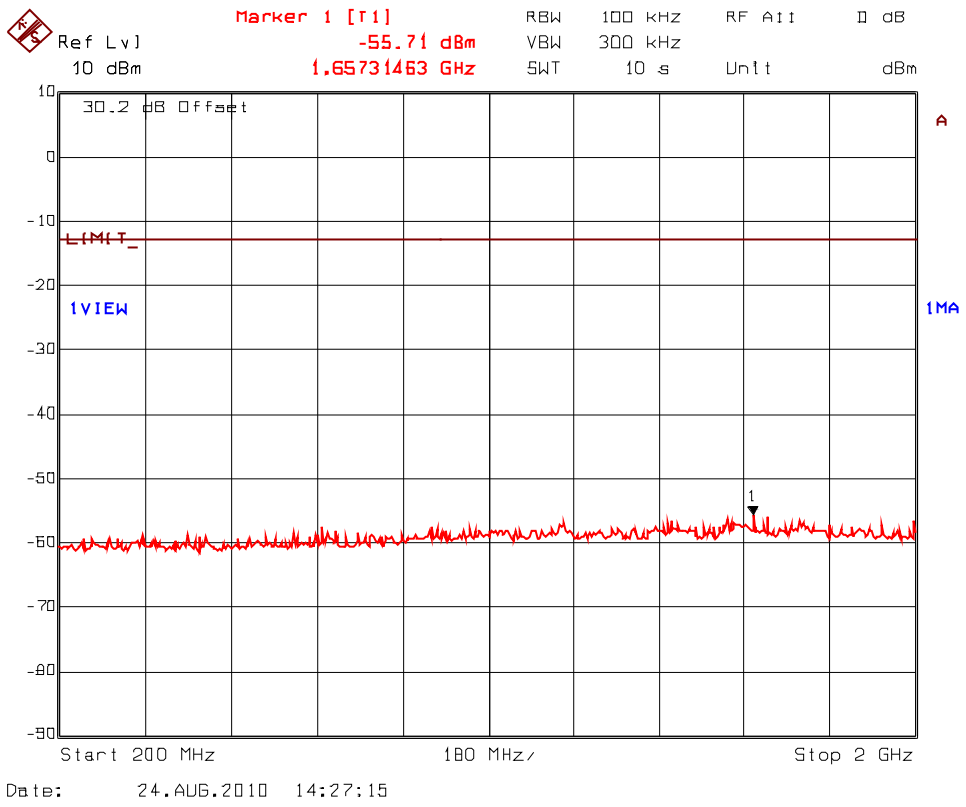
Carrier Frequency (MHz):	156.525
Shift-tone Frequency (Hz)	2100
Power (dBm):	29.13
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

Plot # 24.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	Low Power DSC Channel 70 156.525 MHz (2100 Hz shift frequency tone)




Marker 1 [T1]
Ref Lvl
10 dBm
-55.71 dBm
1.65731463 GHz
RBW 100 kHz
VBW 300 kHz
SWT 10 s
RF Att 0 dB
Unit dBm
30.2 dB Offset
LIMIT
1VIEW
1MA
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 24.AUG.2010 14:27:15

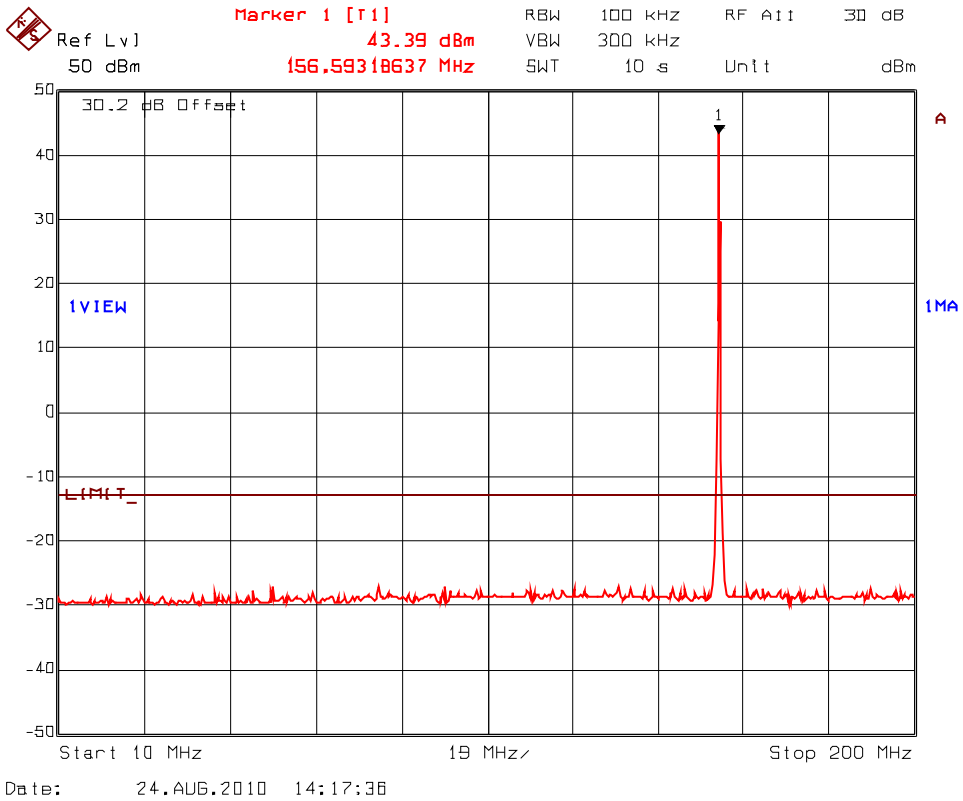
5.7.6.5. DSC Frequency (156.525 MHz) with the 1700Hz shift tone signal

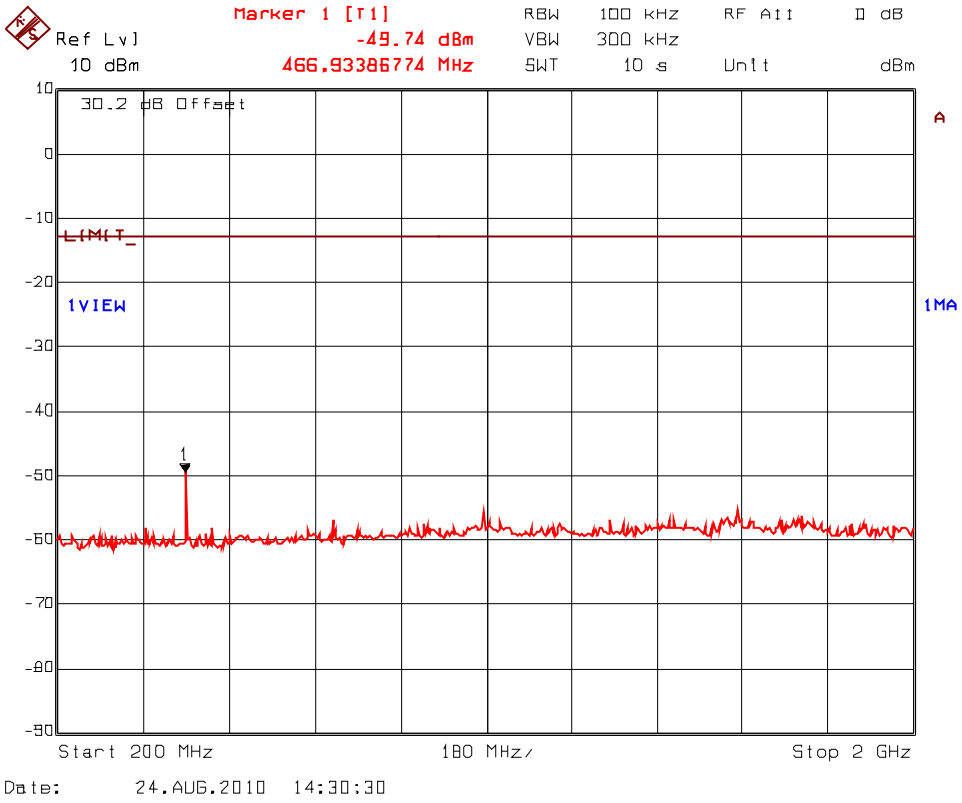
Carrier Frequency (MHz):	156.525
Shift-tone Frequency (Hz)	1700
Power (dBm):	43.39
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

Plot # 25.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	High Power DSC Channel 70 156.525 MHz (1700 Hz sub-carrier tone)



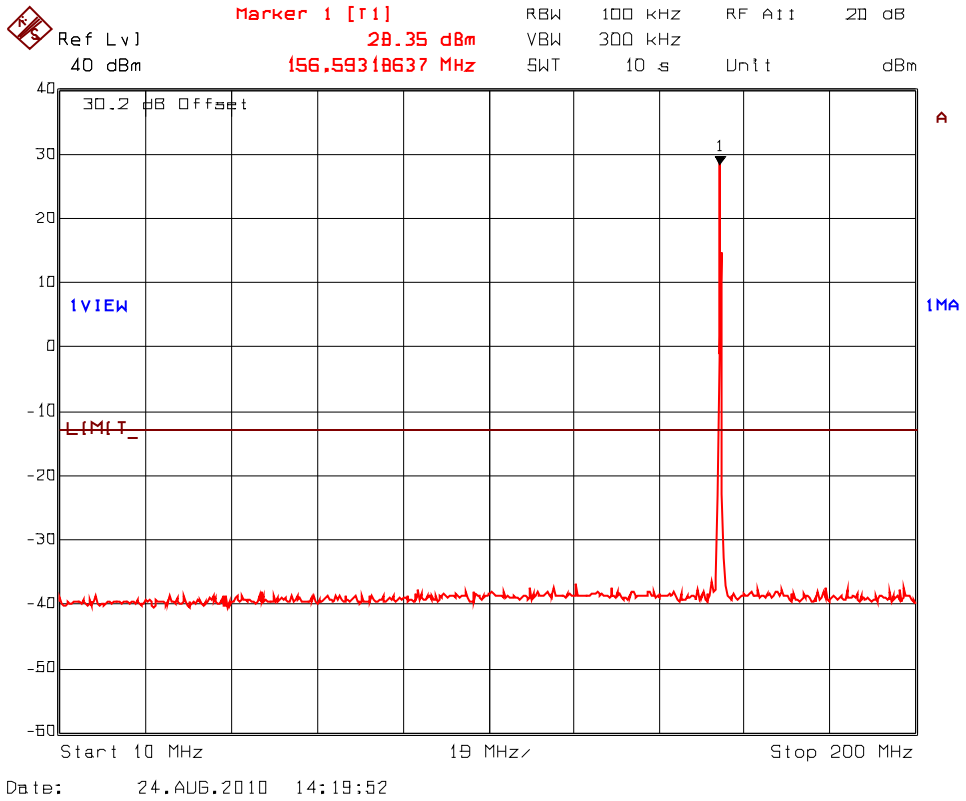

Marker 1 [T1]
RBW 100 kHz
RF Att 0 dB
Ref Lvl
-49.74 dBm
VBW 300 kHz
10 dBm
466.93386774 MHz
SWT 10 s
Unit dBm
30.2 dB Offset
A
LIMIT
1VIEW
1MA
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 24.AUG.2010 14:30:30

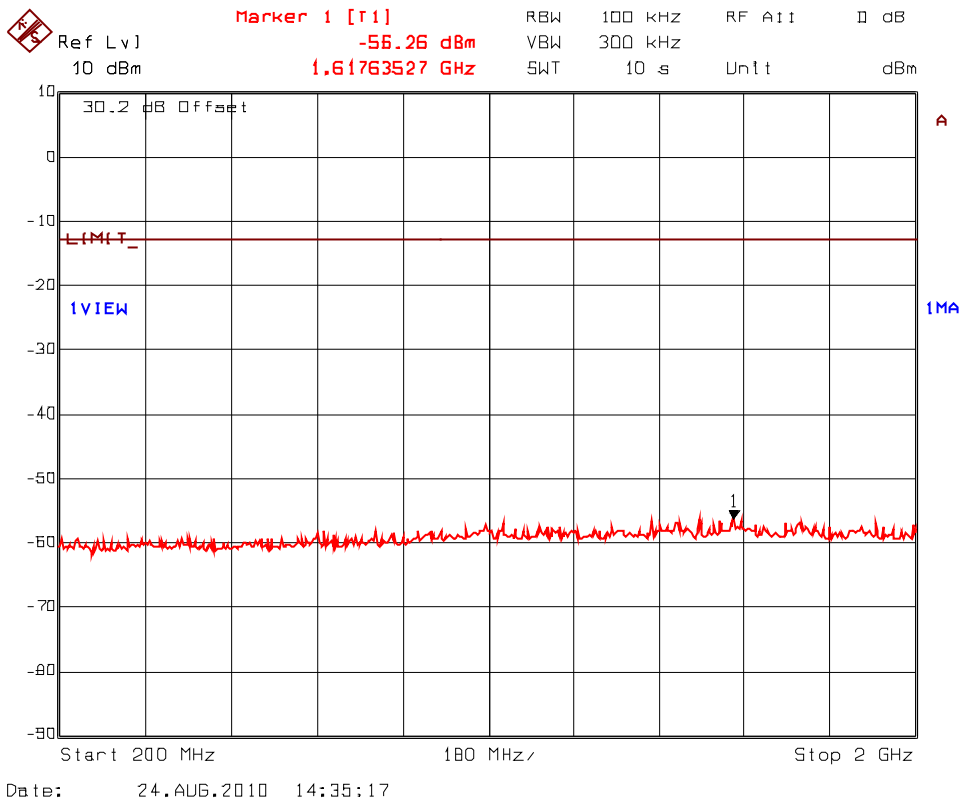
Carrier Frequency (MHz):	156.525
Shift-tone Frequency (Hz)	1700
Power (dBm):	29.13
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

Plot # 26.:

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80.211(f)(3) RSS-182 6.3 TX Conducted Emissions
Date:	August 24, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	Low Power DSC Channel 70 156.525 MHz (1700 Hz sub-carrier tone)




Marker 1 [T1]
-56.26 dBm
1.61763527 GHz
RBW 100 kHz
VBW 300 kHz
SWT 10 s
RF Att 0 dB
Unit dBm
Ref Lvl
10 dBm
30.2 dB Offset
LIMIT
1VIEW
1MA
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 200 MHz
180 MHz/
Stop 2 GHz
Date: 24.AUG.2010 14:35:17

5.8. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 80.211(f)(3)]

5.8.1. Limits

§ 80.211 (f)(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus 10log10 (mean power in watts) dB.

5.8.2. Method of Measurements

The spurious/harmonic ERP measurements are using substitution method specified in 7.2 of this report and its value in dBc is calculated as follows:

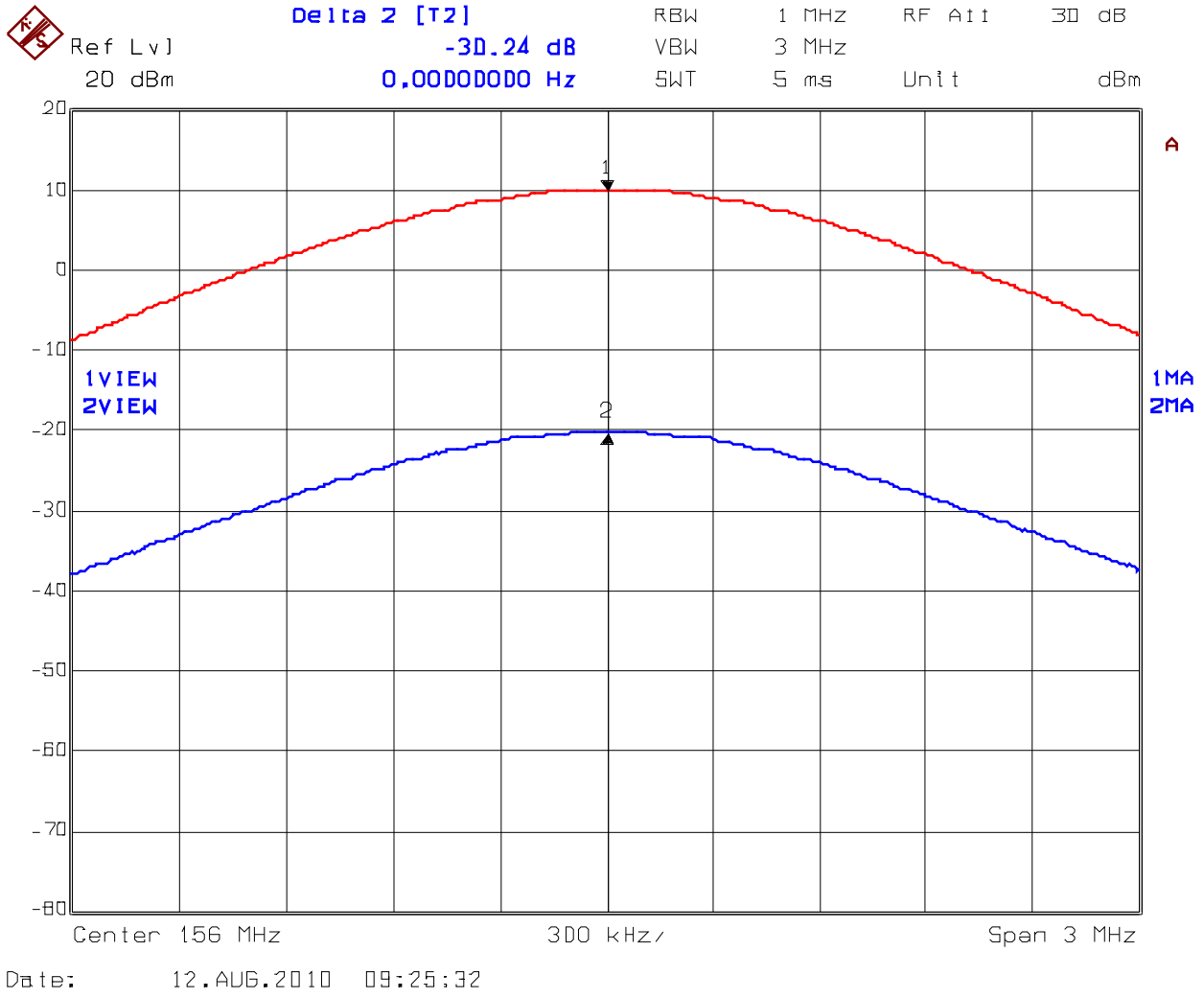
(1) If the transmitter's antenna is an integral part of the EUT, the ERP is measured using substitution method.
(2) If the transmitter's antenna is non-integral and diverse, the lowest ERP of the carrier with 0 dBi antenna gain is used for calculation of the spurious/harmonic emissions in dBc:
Lowest ERP of the carrier = EIRP – 2.15 dB = Pc + G - 2.15 dB = Pc dBm (conducted) + 0 dBi – 2.15 dB

5.8.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK 30	100077	20 Hz – 40 GHz	Aug 14, 2011
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	March 09, 2011
Signal Generator	Hewlett Packard	8648C	3443U00391	100 kHz – 3200 MHz	Dec 16, 2011
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	Nov 2, 2011
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	April 18, 2011
Biconi-Log Antenna	Emco	3142C	00026873	26 – 3000 MHz	April 18, 2011
Horn Antenna	Emco	3155	9701-6570	1 – 18 GHz	Nov 20, 2010
Horn Antenna	Emco	3155	9701-5061	1 – 18 GHz	21 Sep 2010
Dipole Antenna	Emco	3121C	434	26 - 1000 MHz	Aug 16, 2011
High Pass filter	Mini-Circuits	SHP-300	10427	Cut off 158 MHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-10	-	DC - 18 GHz	Inhouse calibrated at tests
Attenuator	Pasternack	PE7019-20	-	DC - 18 GHz	Inhouse calibrated at tests
DC Power Supply	Tenma Laboratory	72-6153	0001526	0-18V, 10A	N/A

5.8.4. System Cable Loss

File No.:	ICOM-238Q
Client:	Icom America
Product Description:	VHF Marine Transceiver
Model(s):	IC-M412
Test (specified rules):	FCC 80 & RSS-182
Date:	August 12, 2010
Tested by: Name	Hung Trinh
Deviation:	None
Comment(s):	20dB&10dB Pasternack attenuator + DC Block + SMA31&SMA3 cables. PE7019-10&PE7019-20, HP DC Block



5.8.5. Test Data

Remarks: The radiated emissions are performed with high power setting (25 Watts) at 3 meters distance to represents the worst-case test configuration.

5.8.5.1. Near Lowest Frequency (156.025 MHz)

Carrier Frequency (MHz):	156.025
Power (dBm):	43.39
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

5.8.5.2. Near Highest Frequency (157.425 MHz)

Carrier Frequency (MHz):	157.425
Power (dBm):	43.41
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

5.8.5.3. DSC Frequency (156.525 MHz)

Carrier Frequency (MHz):	156.525
Power (dBm):	43.39
Limit (dBm):	-13

All emissions found were more than 20 dB below the permissible limits.

EXHIBIT 6. Test Instruments & MEASUREMENT UNCERTAINTY (k=2, 95% Confidence Level)

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

Radiated Emission Measurement Uncertainty

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.15**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.30**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 1.87**	Under consideration
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	Under consideration

EXHIBIT 7. MEASUREMENT METHODS

7.1. CONDUCTED POWER MEASUREMENTS

The following shall be applied to the combination(s) of the radio device and its intended antenna(e).

- I f the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
  - The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
  - The measurement shall be performed using normal operation of the equipment with modulation.

- Test procedure shall be as follows:

Step 1: Duty Cycle measurements if the transmitter's transmission is transient

- Using a EMI Receiver with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with 0<x<1, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

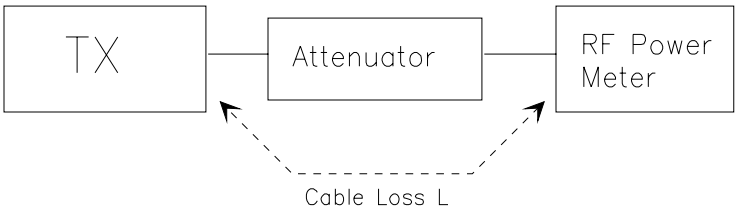
Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF average power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

EIRP = A + G + 10log(1/x)

{ X = 1 for continuous transmission => 10log(1/x) = 0 dB }

Figure 1.



7.2. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

7.2.1. Maximizing RF Emission Level (E-Field)

- The measurements was performed with full rf output power and modulation.
- Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
- The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
- The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
- 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
  E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

- Set the EMI Receiver #1 and #2 as follows:

Center Frequency:	test frequency
Resolution BW:	100 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

- The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
- The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
- The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
- The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
- The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
- Repeat for all different test signal frequencies

7.2.2. Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

- Set the EMI Receiver (for measuring E-Field) and Receiver #2 (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

- 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
  E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)

- Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.
- 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 }.
- Mount the transmitting antenna at 1.5 meter high from the ground plane.
- 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 }.
- If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
- Adjust both transmitting and receiving antenna in a VERTICAL polarization.
- Tune the EMI Receivers to the test frequency.
- Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
- The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
- Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
- 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.
- Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

  P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
  EIRP = P + G1 = P3 + L2 - L1 + A + G1
  ERP = EIRP – 2.15 dB
  Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1

  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

- Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
- Repeat step (d) to (o) for different test frequency
- Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
- 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.

Figure 2

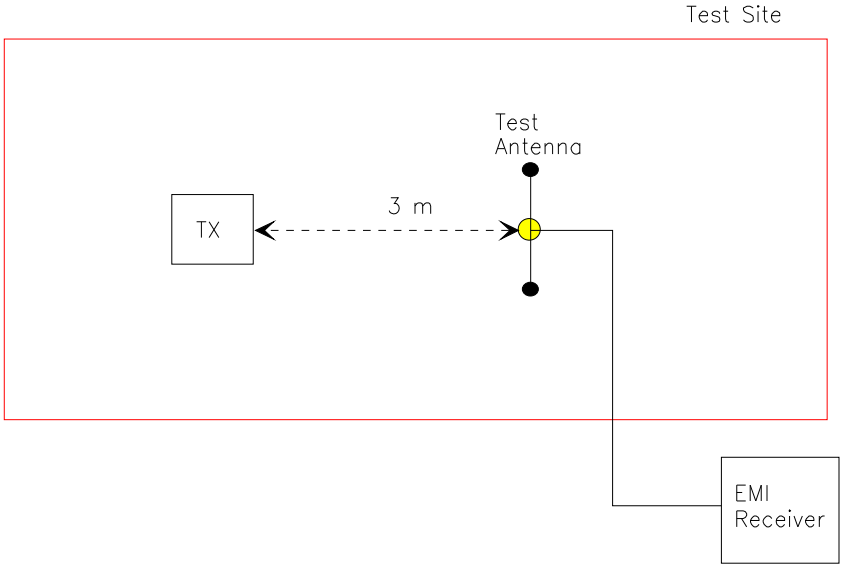
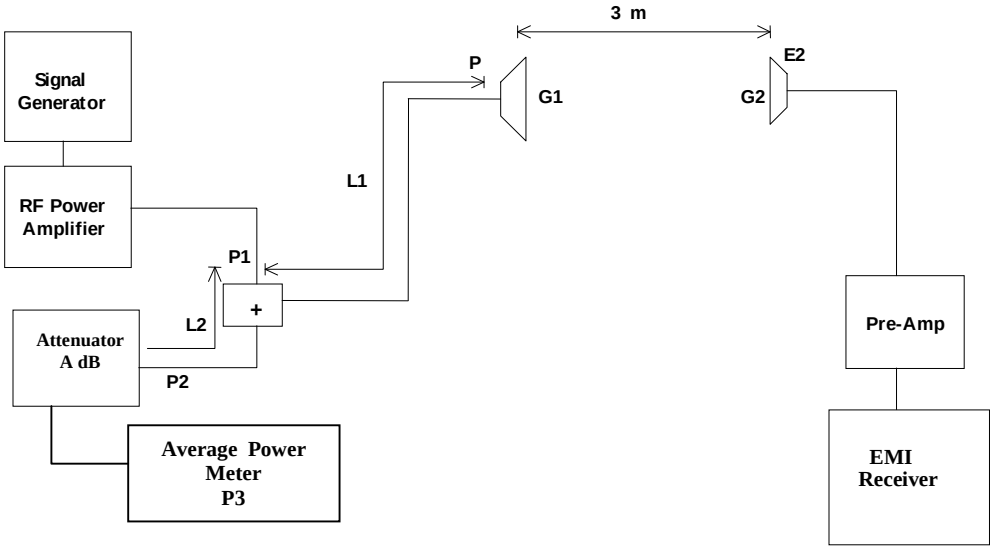


Figure 3



7.3. FREQUENCY STABILITY

Refer to § 2.1055.

(a) The frequency stability shall be measured with variation of ambient temperature as follows: From -30 to +50 centigrade except that specified in subparagraph (2) & (3) of this paragraph.

(b) Frequency measurements shall be made at extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stability circuitry need be subjected to the temperature variation test.

(d) The frequency stability supply shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provide with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment).

7.4. EMISSION MASK

Voice or Digital Modulation Through a Voice Input Port @ 2.1049(c)(i):- The transmitter was modulated by a 2.5 KHz tone signal at an input level 16 dB greater than that required to produce 50% modulation (e.g.: $\pm$2.5 KHz peak deviation at 1 KHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

Digital Modulation Through a Data Input Port @ 2.1049(h):- Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the Emission Masks shall be shown for operation with any devices used for modifying the spectrum when such devices are operational at the discretion of the user.

The following EMI Receiver bandwidth shall be used for measurement of Emission Mask/Out-of-Band Emission Measurements:

For 25 kHz Channel Spacing: RBW = 300 Hz
For 12.5 kHz or 6.25 kHz Channel Spacings: RBW = 100 Hz

The all cases the Video Bandwidth shall be equal or greater than the measuring bandwidth.

7.5. SPURIOUS EMISSIONS (CONDUCTED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the EMI Receiver controls set as RBW = 30 kHz minimum , VBW $\geq$ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC 47 CFR 2.1057 - Frequency Spectrum to be investigated: The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The
amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC 47 CFR 2.1051 - Spurious Emissions at Antenna Terminal: The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.