

FCC PART 80
RSS-GEN ISSUE 4, NOVEMBER 2014
RSS-182, ISSUE 5 JANUARY 2012
MEASUREMENT AND TEST REPORT

TEST REPORT

For

Navico Auckland Limited

44 Arrenway Drive, Rosedale, Auckland, New Zealand

FCC ID: RAYVHFRS20
IC: 4697A-VHFRS20

Report Type: Original Report	Product Type: MARINE FIXED MOUNT DSC VHF RADIO
Report Number: RDG161026005B	
Report Date: 2017-05-25	
Reviewed By: Oscar Ye 	
Engineer	
Prepared By: Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn	

Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
MEASUREMENT UNCERTAINTY	5
TEST FACILITY	5
SYSTEM TEST CONFIGURATION.....	6
DESCRIPTION OF TEST CONFIGURATION	6
EQUIPMENT MODIFICATIONS	6
SUPPORT EQUIPMENT LIST AND DETAILS	6
EXTERNAL I/O CABLE.....	6
LOAD	6
BLOCK DIAGRAM OF TEST SETUP	6
SUMMARY OF TEST RESULTS.....	7
TEST EQUIPMENT LIST	8
FCC§1.1307 (b) (1) & §2.1091& RSS-102 - MAXIMUM PERMISSIBLE EXPOSURE (MPE).....	9
APPLICABLE STANDARD	9
FCC LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE).....	9
RESULT	11
FCC §2.1046 & §80.215 & RSS-182 - RF OUTPUT POWER.....	12
APPLICABLE STANDARD	12
TEST PROCEDURE	12
TEST DATA	12
FCC §2.1047 §80.213 &RSS-182 - MODULATION REQUIREMENTS	14
APPLICABLE STANDARD	14
TEST PROCEDURE	14
TEST DATA	14
FCC §2.1049 & §80.205 & RSS-182 –BANDWIDTH.....	22
APPLICABLE STANDARD	22
TEST PROCEDURE	22
TEST DATA	22
§2.1051 &§80.211& RSS-182 - EMISSION LIMITATIONS.....	27
APPLICABLE STANDARD	27
TEST PROCEDURE	27
TEST DATA	27
FCC§80.217 - SUPPRESSION OF INTERFERENCE ABOARD SHIPS.....	34
APPLICABLE STANDARD	34
TEST PROCEDURE	34
TEST DATA	34
FCC §2.1053&§80.211&RSS-182§7.9 - RADIATED SPURIOUS EMISSIONS	38
APPLICABLE STANDARD	38
TEST PROCEDURE	38

TEST DATA	38
FCC §2.1055 & §80.209&§ RSS-182- TRANSMITTER FREQUENCY TOLERANCES.....	41
APPLICABLE STANDARD	41
TEST PROCEDURE	41
TEST DATA	41

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The Navico Auckland Limited's product, model number: LINK-6 (FCC ID: RAYVHFRS20, IC: 4697A-VHFRS20) or the "EUT" in this report was a MARINE FIXED MOUNT DSC VHF RADIO, which was measured approximately: 16.5 mm (L) x 14.4 mm (W) x 8.7 mm(H), rated with input voltage: DC 13.6V.

Notes: This series products model: LINK-6W (Brand: LOWRANCE), RS20 (Brand: SIMRAD), V20 (Brand: B&G) and LINK-6 (Brand: LOWRANCE) are identical; they have the same PCB, Material and function, the difference among them is the appearance, NMEA2K function and brand name. Model LINK-6 was selected for fully testing, the detailed information can be referred to the attached declaration which was stated and guaranteed by the applicant.

Brand:

LOWRANCE: LINK-6, LINK-6W

SIMRAD: RS20

B&G: V20

** All measurement and test data in this report was gathered from production sample serial number: 161026005 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2016-10-26.*

Objective

This test report is prepared on behalf of Navico Auckland Limited in accordance with Part 2 and Part 80 of the Federal Communication Commissions rules and in accordance with RSS-182 of the Innovation, science and Economic Development Canada rules.

Related Submittal(s)/Grant(s)

No related submittal(s)

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the RSS-182 and the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 80 –Stations in the Maritime Services Applicable Standards: TIA 603-D and ANSI 63.4-2014.

Applicable Standards: RSS-182, Issue5 January 2012. Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 156-162.5 MHz.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
RF conducted test with spectrum		$\pm 0.9\text{dB}$
Radiated emission	30MHz~1GHz	$\pm 5.91\text{dB}$
	Above 1G	$\pm 4.92\text{dB}$
Occupied Bandwidth		$\pm 0.5\text{kHz}$
Temperature		$\pm 1.0^{\circ}\text{C}$
Humidity		$\pm 6\%$

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

Equipment Modifications

No modification was made to the EUT tested.

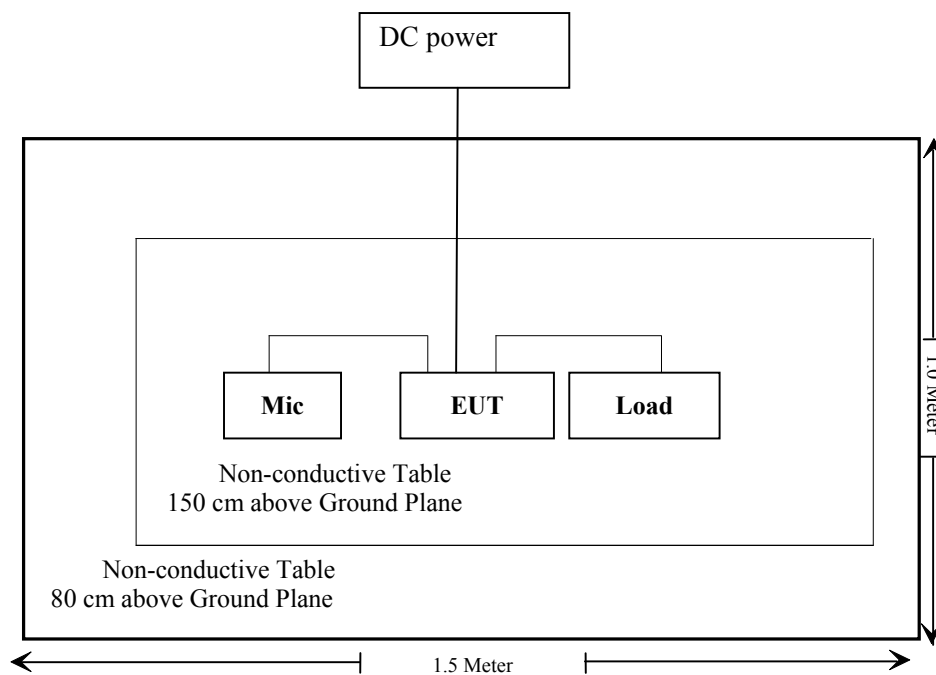
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From/Port	To
Shielded Detachable RF Cable	0.5	EUT Transmitter port	Load

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC& RSS-GEN& RSS-182 Rules	Description of Test	Results
FCC Part §1.1307 (b)(1), §2.1091;RSS-102	Maximum Permissible Exposure (MPE)	Compliance
FCC Part §2.1046,§80.215; RSS-182 § 7.5	RF Output Power	Compliance
FCC Part §2.1047,§80.213; RSS-182 § 7.3,7.8	Modulation requirements	Compliance
FCC Part §2.1049,§80.205; RSS-182 § 7.3	Bandwidth	Compliance
FCC Part §2.1051,§80.211 RSS-182 § 7.9	Emission limitations	Compliance
FCC Part §80.217	Suppression of Interference Aboard Ships	Compliance
FCC Part §2.1051,§80.211; RSS-182 § 7.9	Radiated Spurious Emissions	Compliance
FCC Part §2.1055,§80.209; RSS-182 § 7.4	Transmitter Frequency Tolerances	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Sonoma Instrument	Amplifier	330	171377	2016-12-12	2017-12-12
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Sunol Sciences	Broadband Antenna	JB3	A090314-1	2016-01-09	2019-01-08
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-25
ETS	Horn Antenna	3115	6229	2016-01-11	2017-01-10
ETS	Horn Antenna	3115	9311-4159	2016-01-11	2017-01-10
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
haojintech	Coaxial Cable	Cable-1	001	2015-12-12	2016-12-12
haojintech	Coaxial Cable	Cable-2	002	2015-12-12	2016-12-12
haojintech	Coaxial Cable	Cable-3	003	2015-12-12	2016-12-12
MICRO-COAX	Coaxial Cable	Cable-4	004	2015-12-12	2016-12-12
MICRO-COAX	Coaxial Cable	Cable-5	005	2015-12-12	2016-12-12
MICRO-COAX	Coaxial Cable	Cable-7	007	2015-12-12	2016-12-12
HP	Signal Generator	8341B	2624A00116	2016-08-29	2017-08-29
RF Conducted test					
BACL	TS 8997 Cable-01	T-KS-EMC086	T-KS-EMC086	2015-12-10	2016-12-09
BACL	TS 8997 Cable-01	T-KS-EMC086	T-KS-EMC086	2016-12-10	2017-12-09
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15
BACL	RF cable	KS-LAB-012	KS-LAB-012	2016-12-15	2017-12-15
Rohde & Schwarz	OSP120 BASE UNIT	OSP120	101247	2016-07-04	2017-07-03
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
HEWLETT PACKARD	RF Communications Test SET	8920A	3438A05201	2016-09-21	2017-09-21
HONOVA	Power Splitter	ZFRSC-14-S+	019411452	2016-06-12	2017-06-12
N/A	30dB Attenuator	100W 30dB	N/A	2016-06-18	2017-06-18

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§1.1307 (b) (1) & §2.1091& RSS-102 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz *Plane-wave equivalent power density

According to RSS-102:

**Table 4: RF Field Strength Limits for Devices Used by the General Public
(Uncontrolled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

Table 6: RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²³	170	180	-	Instantaneous*
0.1-10	-	1.6/ f	-	6**
1.29-10	193/ $f^{0.5}$	-	-	6**
10-20	61.4	0.163	10	6
20-48	129.8/ $f^{0.25}$	0.3444/ $f^{0.25}$	44.72/ $f^{0.5}$	6
48-100	49.33	0.1309	6.455	6
100-6000	15.60 $f^{0.25}$	0.04138 $f^{0.25}$	0.6455 $f^{0.5}$	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/ $f^{1.2}$
150000-300000	0.354 $f^{0.5}$	9.40 x 10 ⁻⁴ $f^{0.5}$	3.33 x 10 ⁻⁴ f	616000/ $f^{1.2}$
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

Result**Calculated Formulary:**

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm² for FCC, and W/m² for IC)

P = power input to the antenna (in appropriate units, e.g., mW for FCC, and W for IC).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm for FCC, and m for IC)

For FCC calculation:

Frequency (MHz)	Antenna Gain		Rated Power (W)	The minimum Distance (cm)	MPE Limit (mW/cm ²)	Note
	(dBi)	(numeric)				
156.8	3	2.0	25	70	1.0	Controlled Environment
156.8	3	2.0	25	150	0.2	UnControlled Environment

For IC calculation:

Frequency (MHz)	Antenna Gain		Rated Power (W)	The minimum Distance (m)	MPE Limit (W/m ²)	Note
	(dBi)	(numeric)				
156.8	3	2.0	25	0.8	8.083	Controlled Environment
156.8	3	2.0	25	1.8	1.291	UnControlled Environment

Note: The Maximum power is 25 W which declared by manufacture

Radiation Exposure Statement:

To comply with RF exposure requirements, the minimum permissible distance is 1.8 m required between the antenna and the body of the user or nearby persons.

Result: Compliance

FCC §2.1046 & §80.215 & RSS-182 - RF OUTPUT POWER**Applicable Standard**

FCC §2.1046, §80.215 and RSS-182, Issue 5 §7.5

Ship station limit: 25W

Test Procedure

Conducted RF Output Power:

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

Spectrum Analyzer Setting:

R B/W	Video B/W
100 kHz	300 kHz

Test Data**Environmental Conditions**

Temperature:	23 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Ada Yu on 2016-12-07.

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Output power for Radio telephony:

Frequency	Power Level	Output Power (dBm)	Output Power (W)	Limit (dBm)
156.025	High	43.91	24.604	43 - 45
	Low	29.26	0.843	29 - 31
156.8	High	43.87	24.378	43 - 45
	Low	29.19	0.830	29 - 31
157.425	High	43.81	24.044	43 - 45
	Low	29.55	0.902	29 - 31

Output power for DSC:

Frequency	Test Mode	Power Level	Output Power (dBm)	Output Power (W)	Limit (dBm)
156.525	1300 Hz	High	43.82	24.10	43 - 45
		Low	29.23	0.838	29 - 31
	2100 Hz	High	43.83	24.15	43 - 45
		Low	29.15	0.822	29 - 31

Note: Ship station limit (25W), The output power shall be within ± 1.0 dB of the manufacturer's rated power
The high power is 25W and low power is 1W that declared by manufacturer.

FCC §2.1047 §80.213 &RSS-182 - MODULATION REQUIREMENTS**Applicable Standard**

FCC §2.1047 and §80.213 §RSS-182, Issue 5 §7.3, §7.8

- (a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
- (b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

Test Procedure

Test Method: TIA/EIA-603 2.2.3

Test Data**Environmental Conditions**

Temperature:	26 °C
Relative Humidity:	53 %
ATM Pressure:	100.1 kPa

The testing was performed by Ada Yu on 2016-12-12.

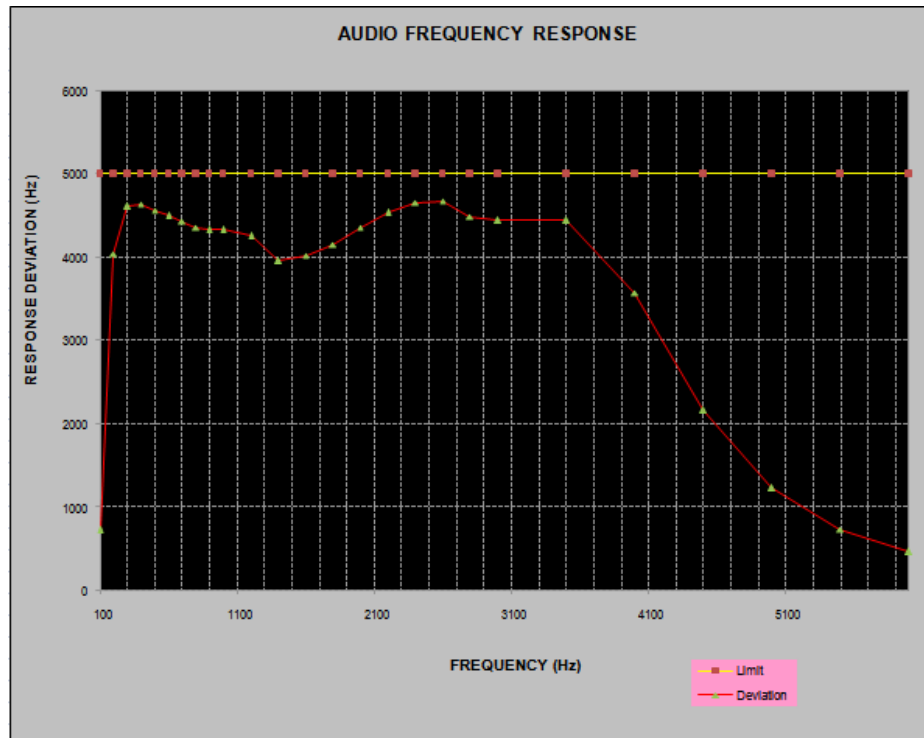
Test Mode: Transmitting

Result: Compliance.

Analog Modulation:**Maximum Deviation**

Carrier Frequency: 156.8 MHz

Modulation Frequency (Hz)	Maximum Deviation (Hz)	Limit (Hz)
100	722	5000
200	4043	5000
300	4605	5000
400	4635	5000
500	4562	5000
600	4493	5000
700	4435	5000
800	4352	5000
900	4328	5000
1000	4331	5000
1200	4252	5000
1400	3954	5000
1600	4024	5000
1800	4156	5000
2000	4355	5000
2200	4537	5000
2400	4658	5000
2600	4669	5000
2800	4492	5000
3000	4439	5000
3500	4439	5000
4000	3571	5000
4500	2160	5000
5000	1231	5000
5500	736	5000
6000	461	5000



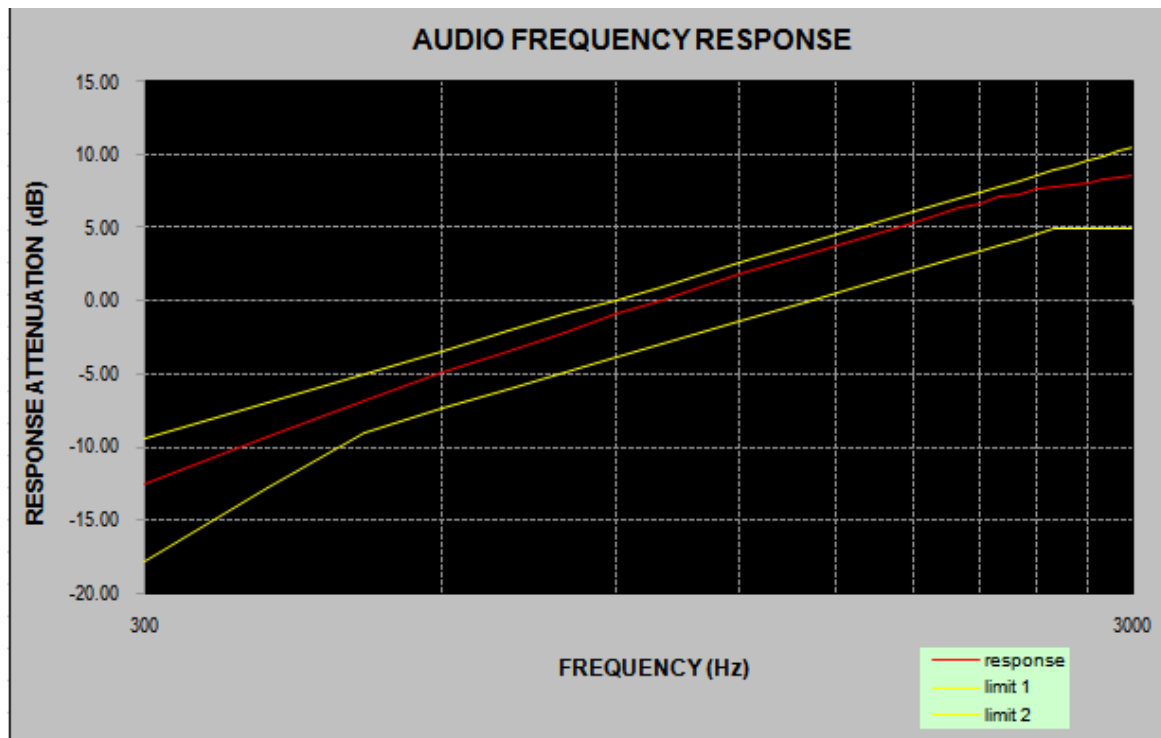
Carrier Frequency: 156.525 MHz, For DSC

Test Mode	Frequency Deviation(kHz)
1300Hz	2.567
2100Hz	4.196

Audio Frequency Response

Carrier Frequency: 156.8 MHz

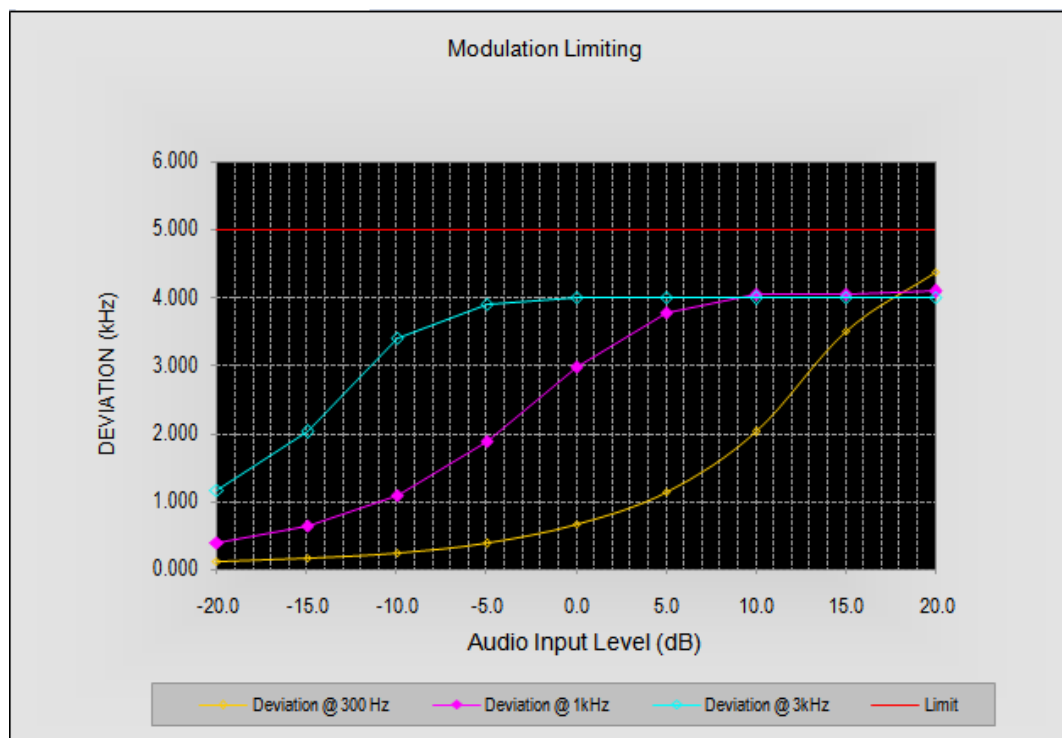
Modulation Frequency (kHz)	Response data (dB)
300	-12.54
400	-9.29
500	-6.84
600	-4.93
700	-3.48
800	-2.12
900	-0.91
1000	0.00
1200	1.80
1400	3.15
1600	4.33
1800	5.34
2000	6.32
2100	6.65
2200	7.14
2300	7.24
2400	7.63
2500	7.86
2600	7.93
2700	8.12
2800	8.28
2900	8.41
3000	8.54



MODULATION LIMITING

Carrier Frequency: 156.8 MHz

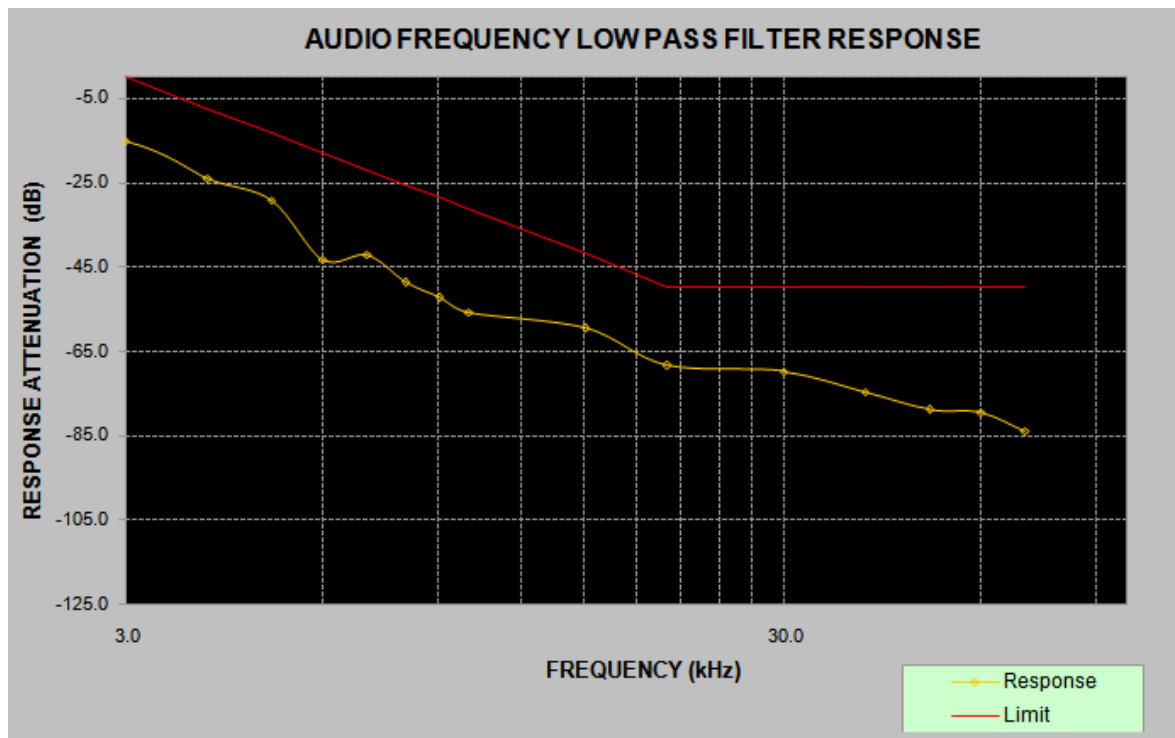
Audio Input Level [mV]	Frequency Deviation (kHz)			Limit [kHz]
	@ 300 Hz	@ 1kHz	@ 3 kHz	
186	4.389	4.102	4.010	5.0
104	3.521	4.070	4.006	5.0
58.7	2.037	4.061	4.001	5.0
33	1.150	3.791	4.019	5.0
18.6	0.682	3.000	4.014	5.0
10.4	0.401	1.899	3.907	5.0
5.87	0.260	1.102	3.416	5.0
3.30	0.192	0.659	2.039	5.0
1.86	0.132	0.409	1.173	5.0



Audio Frequency Low Pass Filter Response

Carrier Frequency: 156.8 MHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-15.2	0.0
4.0	-24.1	-7.5
5.0	-29.2	-13.3
6.0	-43.4	-18.1
7.0	-42.2	-22.1
8.0	-48.8	-25.6
9.0	-52.3	-28.6
10.0	-55.8	-31.4
15.0	-59.6	-41.9
20.0	-68.4	-50.0
30.0	-69.8	-50.0
40.0	-74.7	-50.0
50.0	-78.9	-50.0
60.0	-79.5	-50.0
70.0	-84.0	-50.0



FCC §2.1049 & §80.205 & RSS-182 –BANDWIDTH

Applicable Standard

FCC §2.1049 and §80.205, RSS-182 §7.3

(a) An emission designator shows the necessary bandwidth for each class of emission of a station except that in ship earth stations it shows the occupied or necessary bandwidth, whichever is greater. The class of emission and corresponding emission designator and authorized bandwidth can refer to §80.205

(b) For land stations the maximum authorized frequency deviation for F3E or G3E emission is as follows:

(1) 5 kHz in the 72.0-73.0 MHz, 75.4-76.0 MHz and 156-162 MHz bands;

(2) 15 kHz for stations which were authorized for operation before December 1, 1961, in the 73.0-74.6 MHz band.

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band ± 30 kHz from the carrier frequency.

Test Data

Environmental Conditions

Temperature:	25~26 °C
Relative Humidity:	50~53 %
ATM Pressure:	100.1~101.0 kPa

The testing was performed by Ada Yu from 2016-11-05 to 2016-11-15.

Test Mode: Transmitting

Test mode		Frequency(MHz)	Power level	99% Bandwidth(kHz)	26 dB Emission Bandwidth(kHz)	Limit (kHz)
Radio Telephony		156.8	High	15.03	15.75	20
			Low	15.03	15.75	
DSC	2100Hz	156.525	High	12.87	17.07	
			Low	12.87	17.19	
	1300Hz		High	8.06	10.58	
			Low	8.06	10.58	

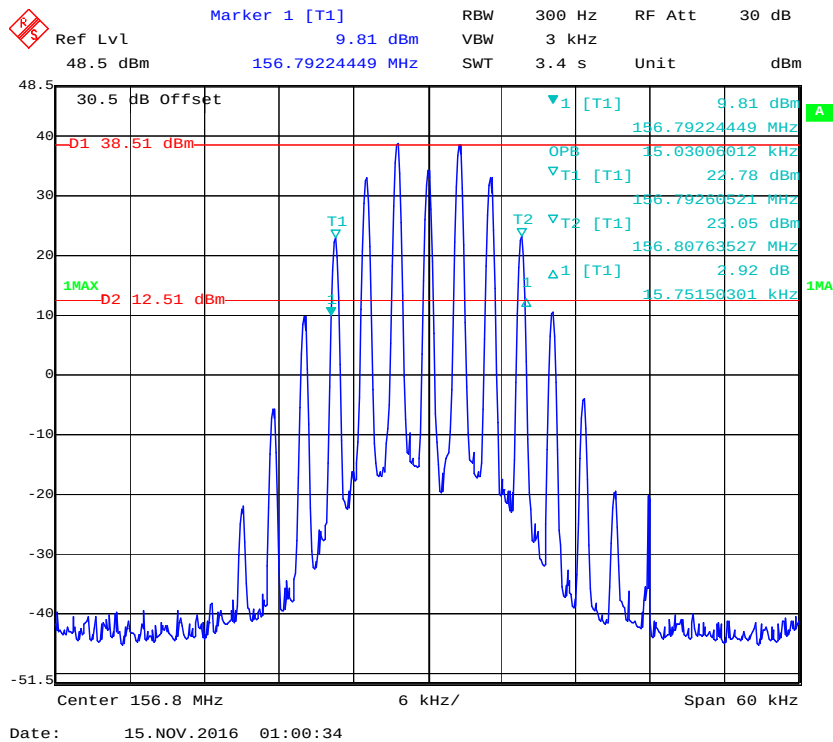
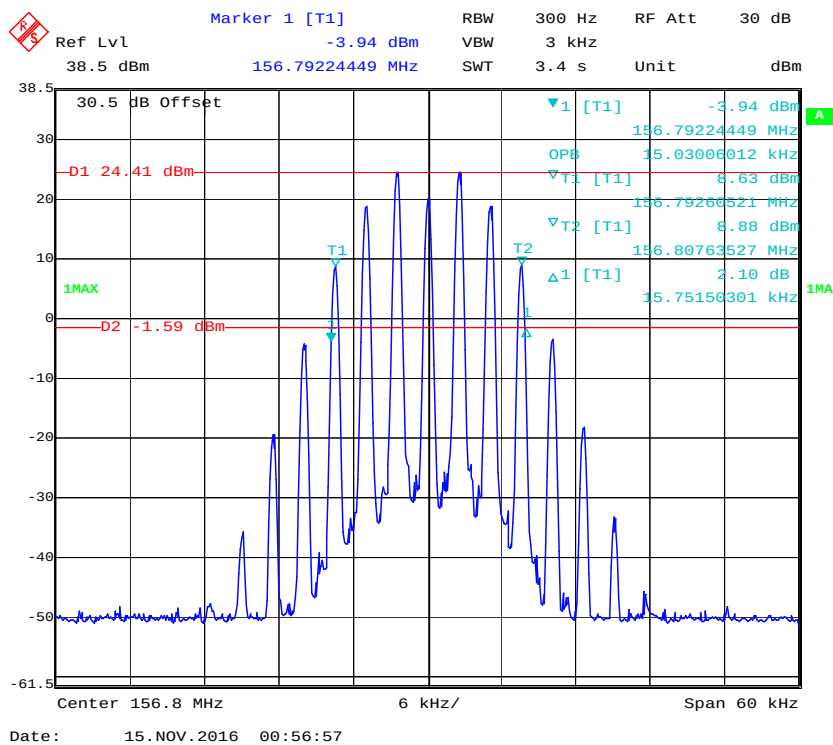
Emission Designator Per CFR 47 §2.201& §2.202&, $B_n = 2M + 2D$

Emission Designator 16K0G3E and 16K0G2B

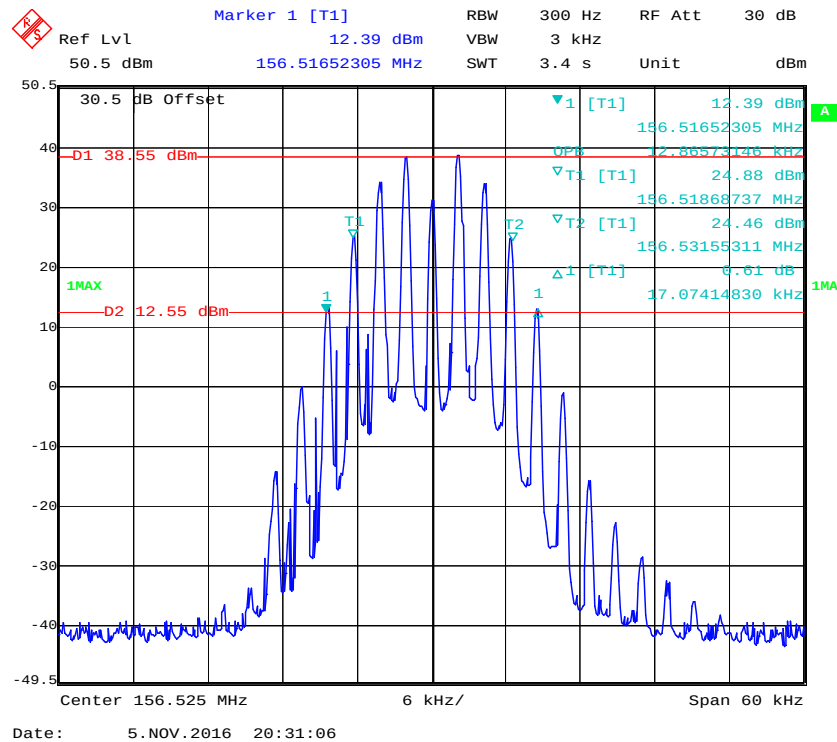
In this case, the maximum modulating frequency is 5.0 kHz with a 3 kHz deviation.
 $BW = 2(M+D) = 2*(5.0 \text{ kHz} + 3.0 \text{ kHz}) = 16 \text{ kHz} \rightarrow 16K0$

G3E portion of the designator represents a Radiotelephony operating in 27.5-470 MHz for ship stations, Therefore, the entire designator for FM mode is 16K0G3E.

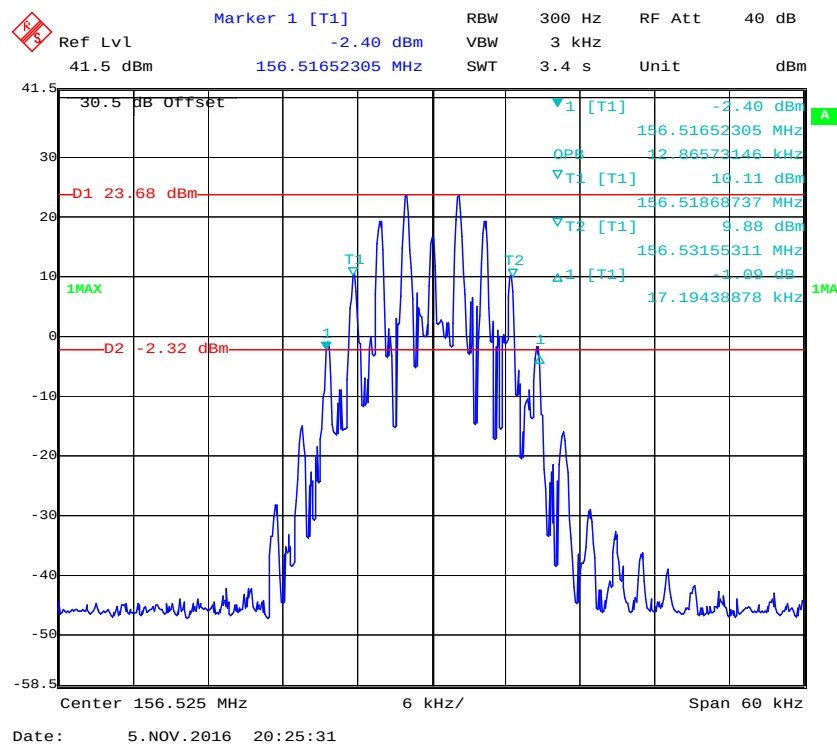
Per FCC §80.207, the Classes emission of DSC is G2B, so the entire designator for DSC is 16K0G2B.

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (156.8 MHz, High Power)**99% Occupied Bandwidth & 26 dB Emissions Bandwidth (156.8 MHz, Low Power)**

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (156.525 MHz, DSC2100, High Power)



99% Occupied Bandwidth & 26 dB Emissions Bandwidth (156.525 MHz, DSC2100, Low Power)



§2.1051 & §80.211 & RSS-182 - EMISSION LIMITATIONS.

Applicable Standard

According to FCC §80.211 & RSS-182 §7.9

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 at 100 kHz for below 1GHz, and 1MHz for above 1GHz. sufficient scans were taken to show any out of band emissions up to 10th harmonic.

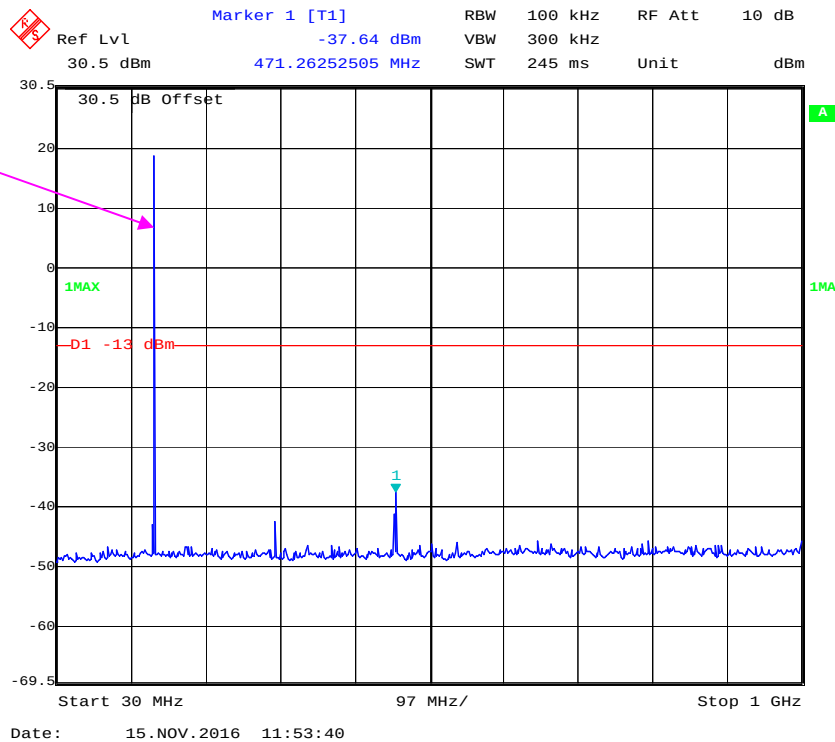
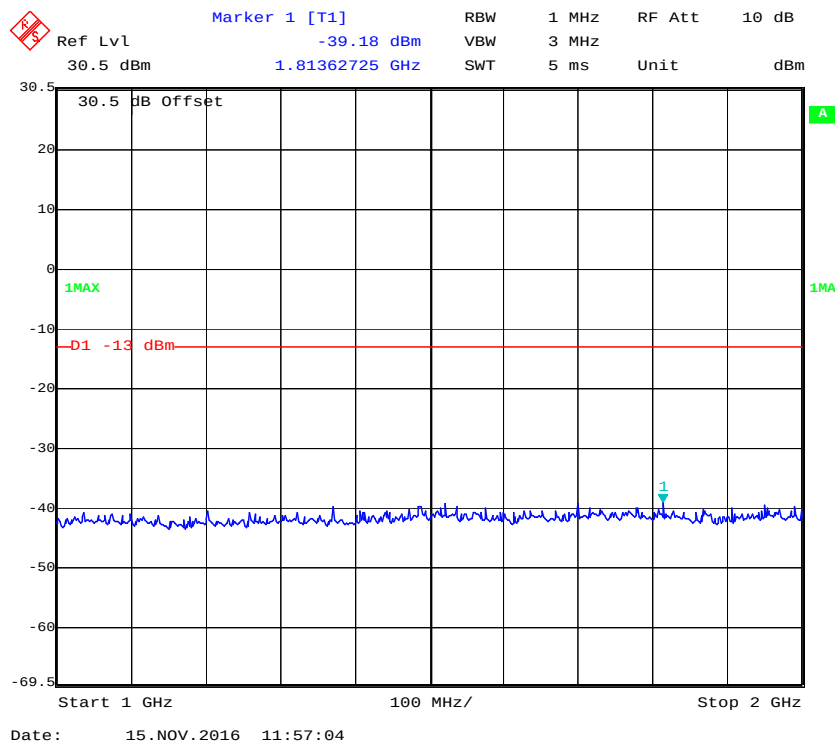
Test Data**Environmental Conditions**

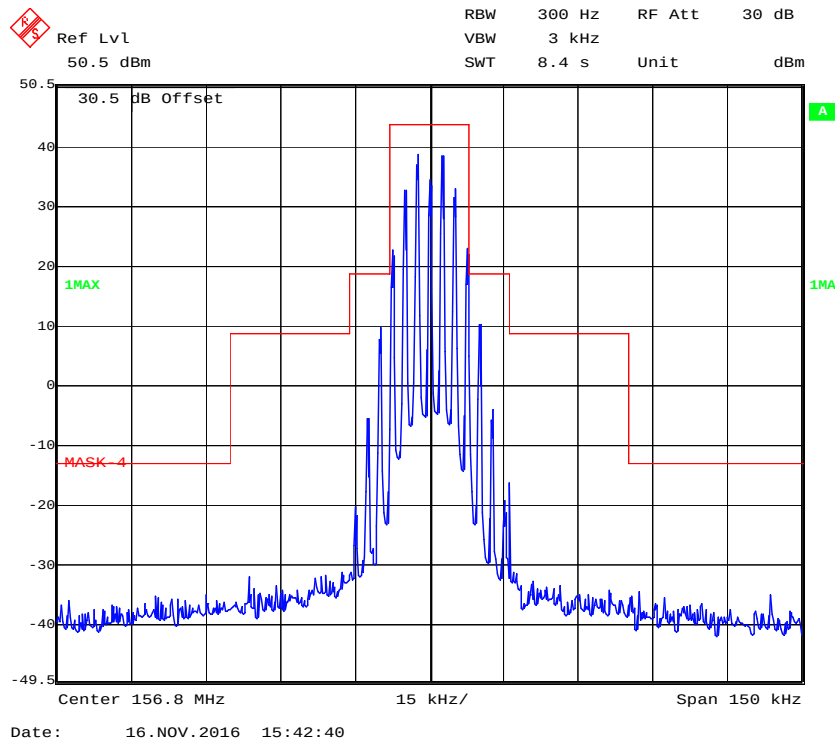
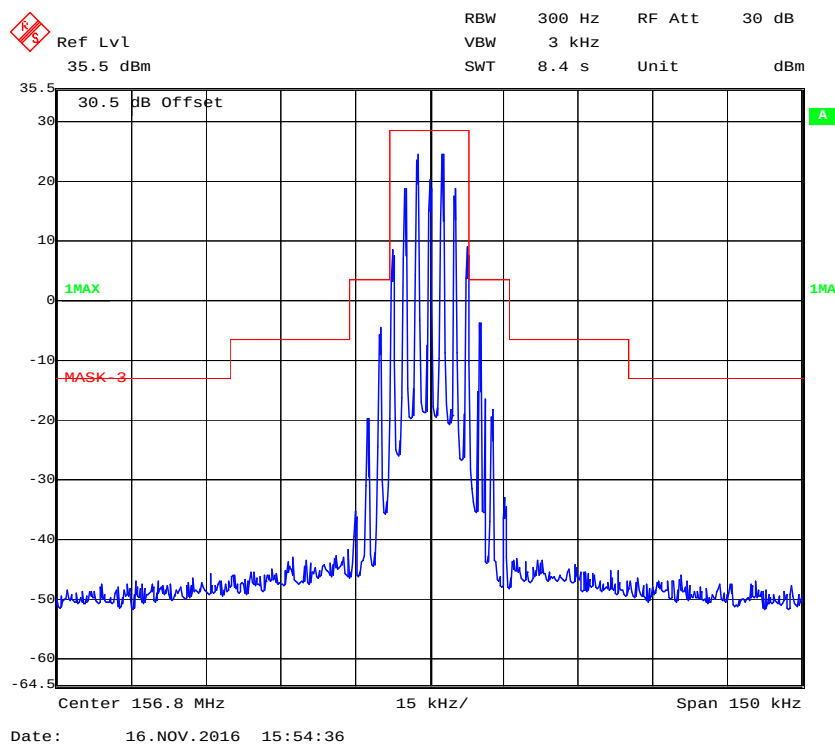
Temperature:	25~26 °C
Relative Humidity:	50~53 %
ATM Pressure:	100.1-101.0 kPa

The testing was performed by Ada Yu from 2016-11-05 to 2016-11-16.

Test Mode: Transmitting

Please refer to the following plots.

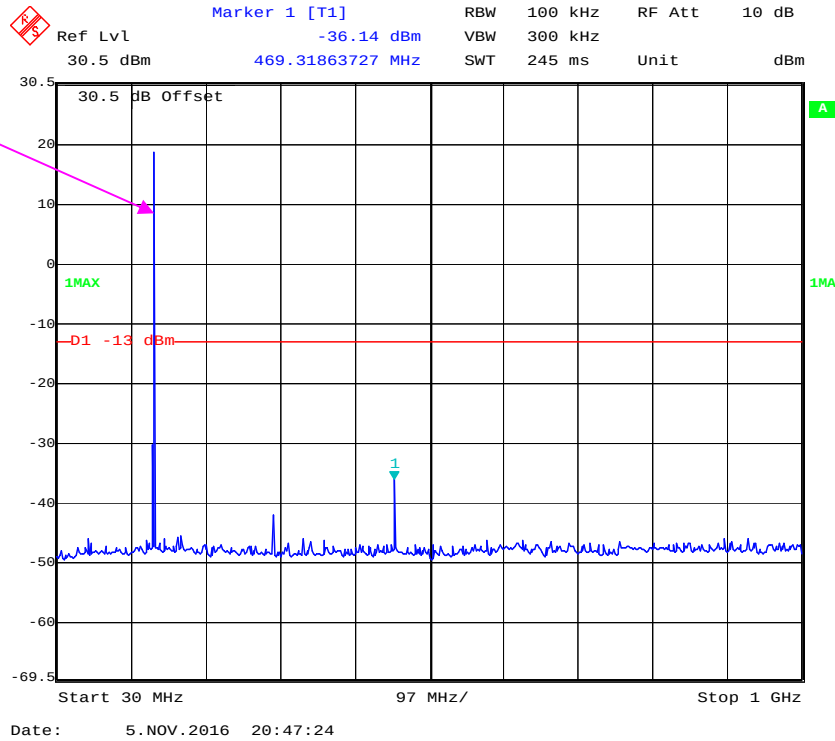
Radio Telephony (156.8 MHz):**30 MHz – 1 GHz, High Power**Fund.test with
notch filter**1 GHz – 2 GHz, High Power**

Emission Mask, High Power**Emission Mask, Low Power**

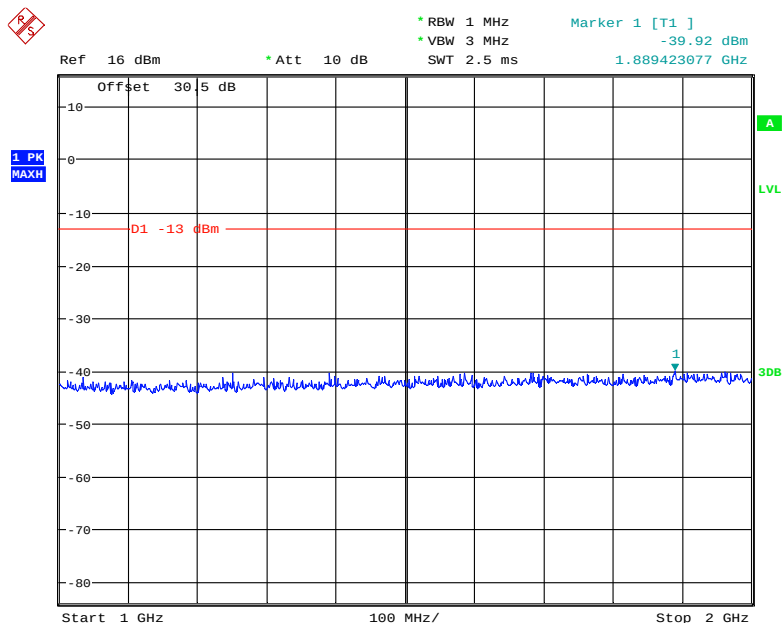
DSC (152.525 MHz):

30 MHz – 1 GHz (DSC1300 Hz) , High Power

Fund.test with notch filter



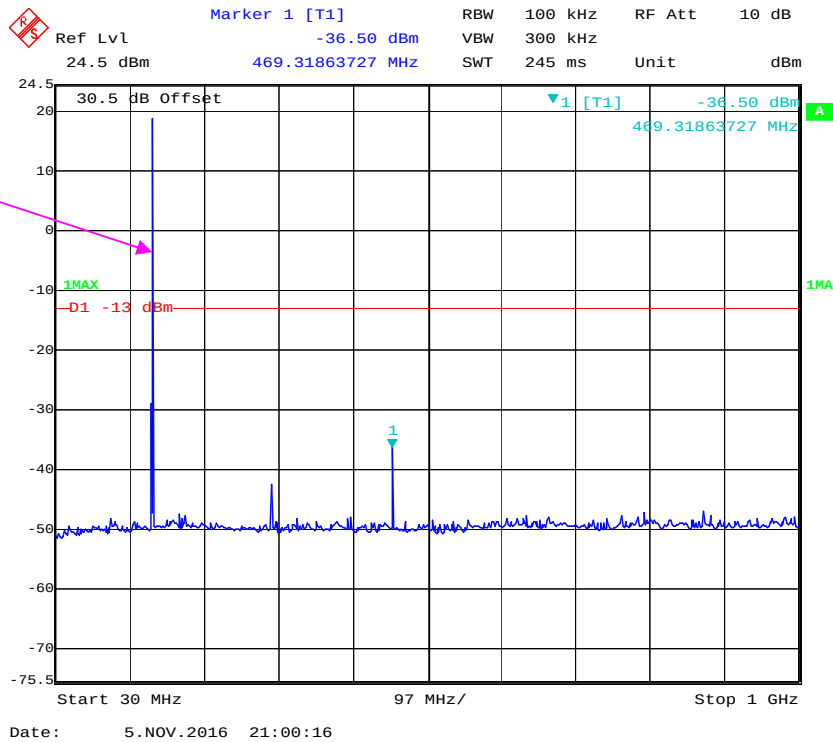
1 GHz – 2 GHz (DSC1300 Hz), High Power



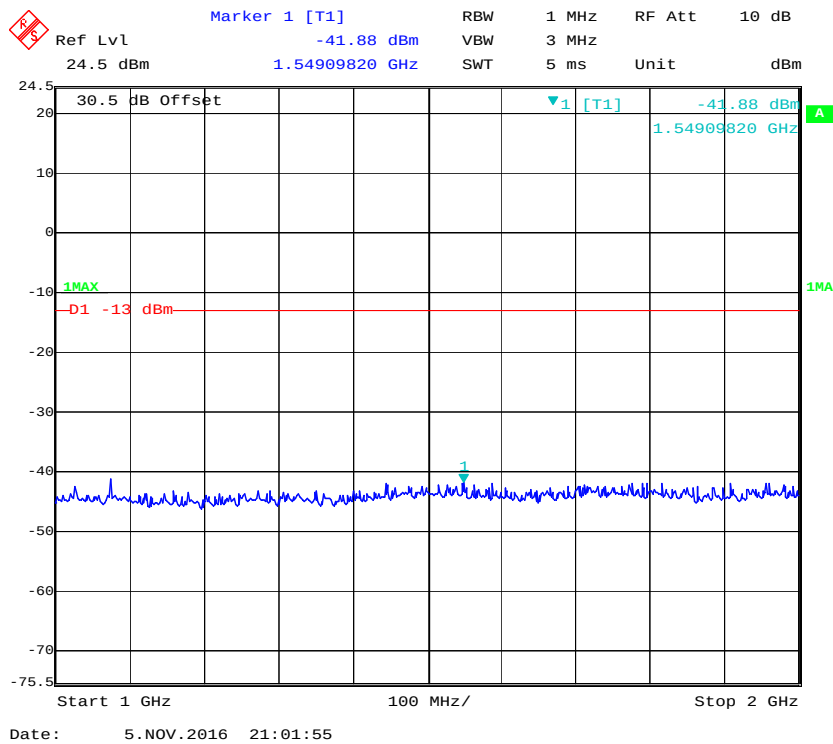
Date: 12.DEC.2016 15:26:11

30 MHz – 1 GHz (DSC2100 Hz) , High Power

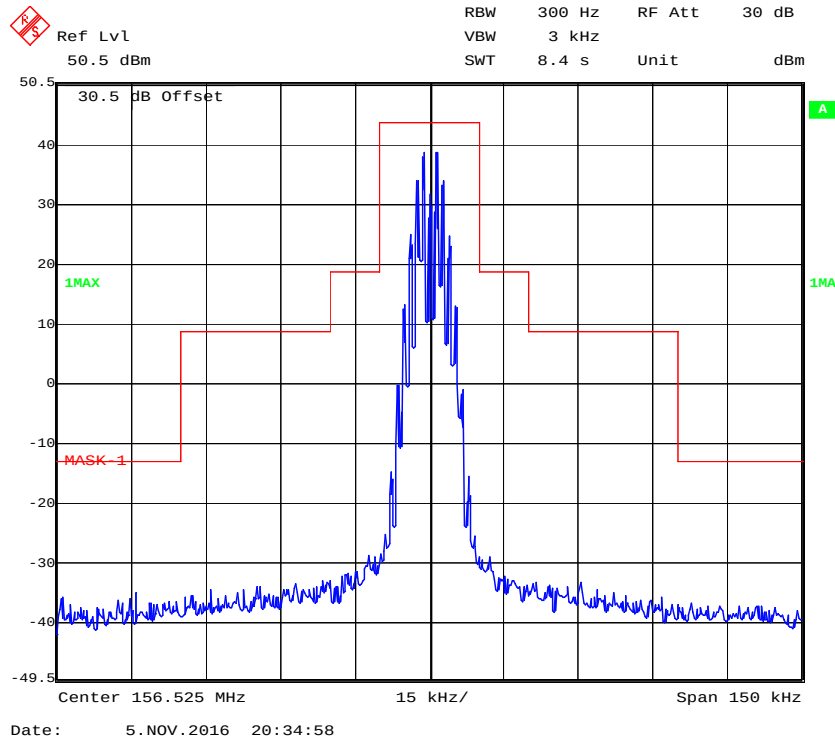
Fund.test with notch filter



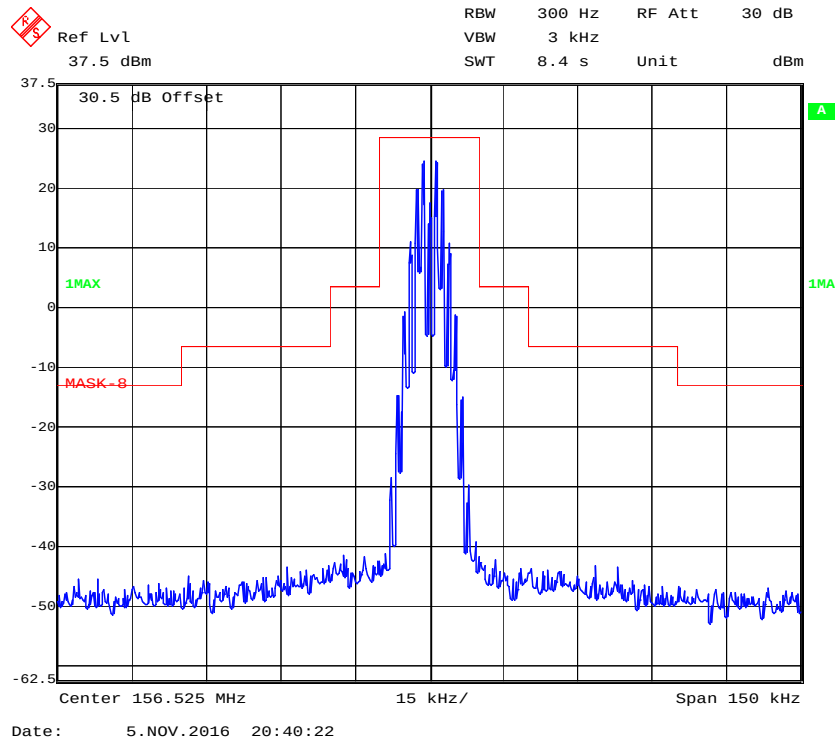
1 GHz – 2 GHz (DSC2100Hz), High Power



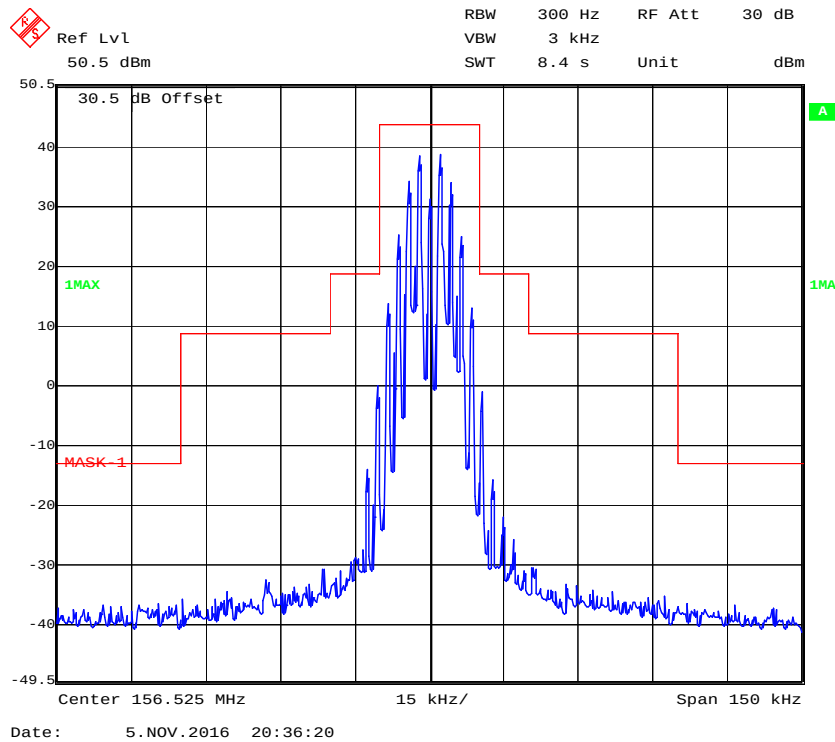
Emission Mask, (DSC1300Hz, High Power)



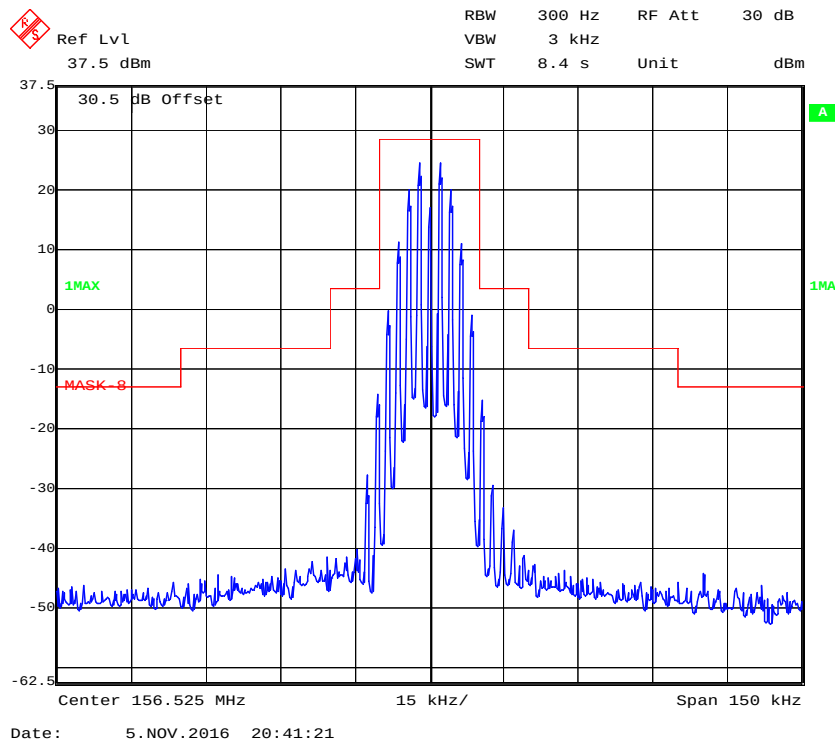
Emission Mask, (DSC1300Hz, Low Power)



Emission Mask, (DSC2100Hz, High Power)



Emission Mask, (DSC2100Hz, Low Power)



FCC§80.217 - SUPPRESSION OF INTERFERENCE ABOARD SHIPS**Applicable Standard**

FCC §80.217

- (a) A voluntarily equipped ship station receiver must not cause harmful interference to any receiver required by statute or treaty.
- (b) The electromagnetic field from receivers required by statute or treaty must not exceed the following value at a distance over sea water of one nautical mile from the receiver or Deliver not more than the following amounts of power, to an artificial antenna having electrical characteristics equivalent to those of the average receiving antenna(s) use on shipboard:

Test Procedure

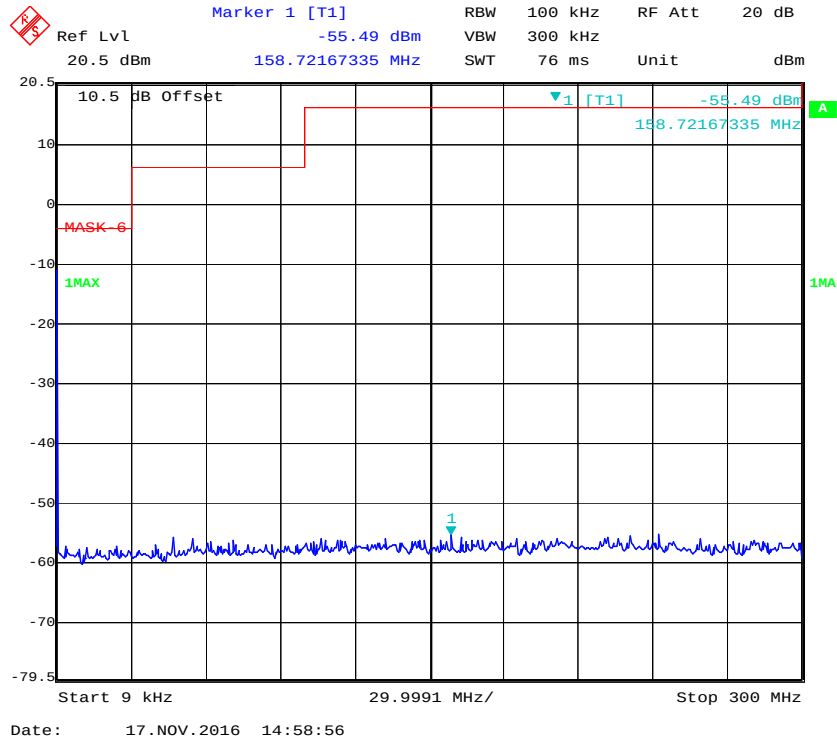
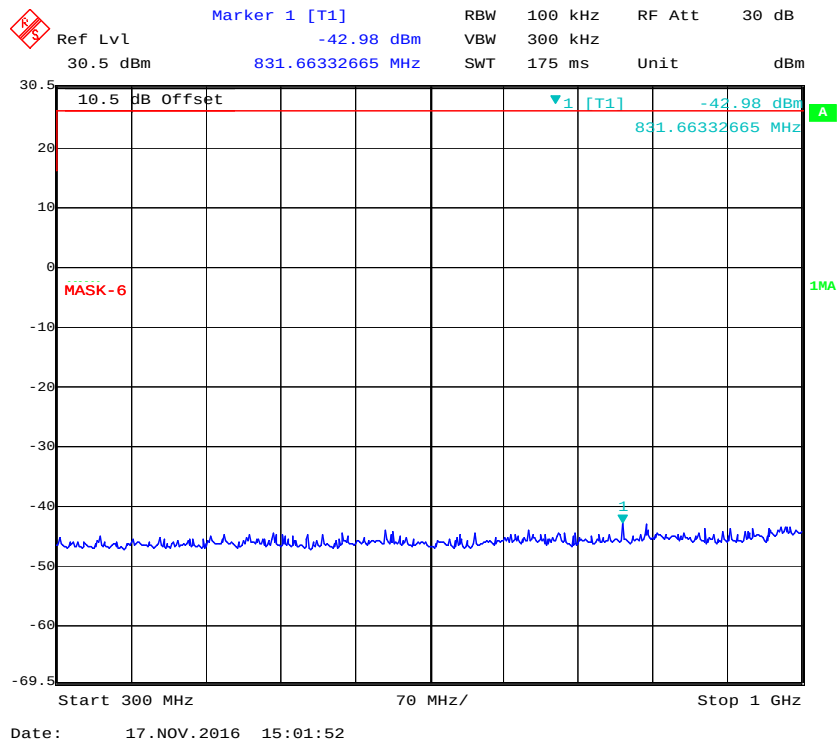
The EUT was connected to a spectrum analyser via a 10 dB attenuator. The spectrum was measured between 9 kHz to 2 GHz. A resolution bandwidth of 100 kHz was used below 1GHz and 1 MHz was used above 1GHz. The traces were recorded as shown on the following pages.

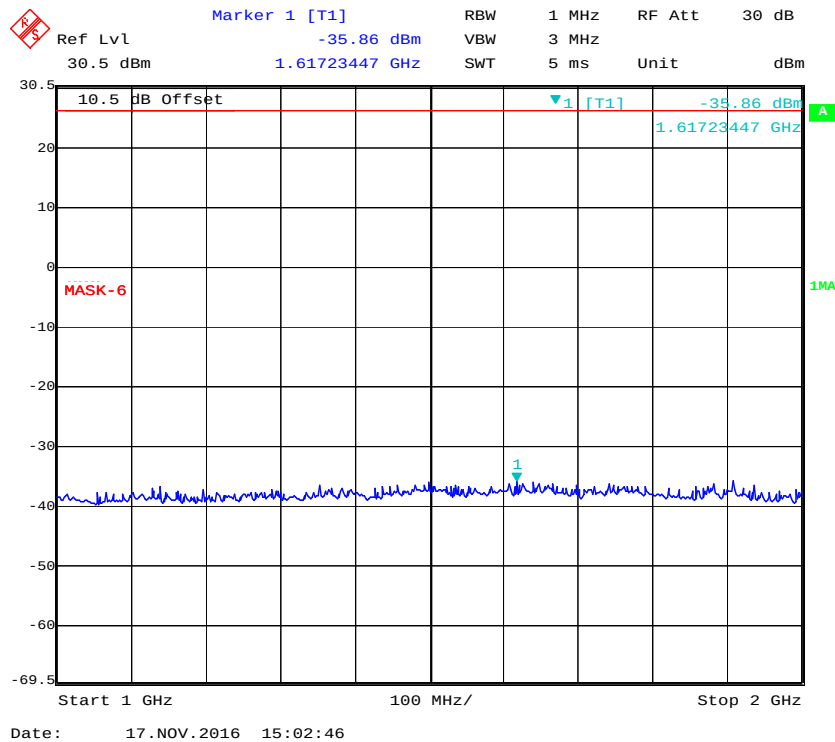
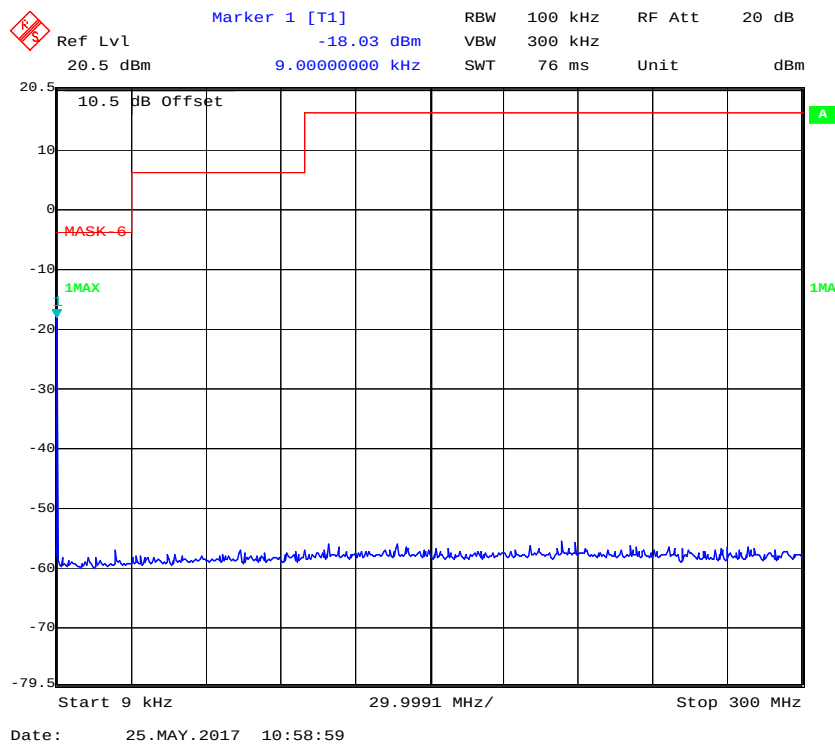
Test Data**Environmental Conditions**

Temperature:	23~25 °C
Relative Humidity:	50~56 %
ATM Pressure:	100.0~101.0 kPa

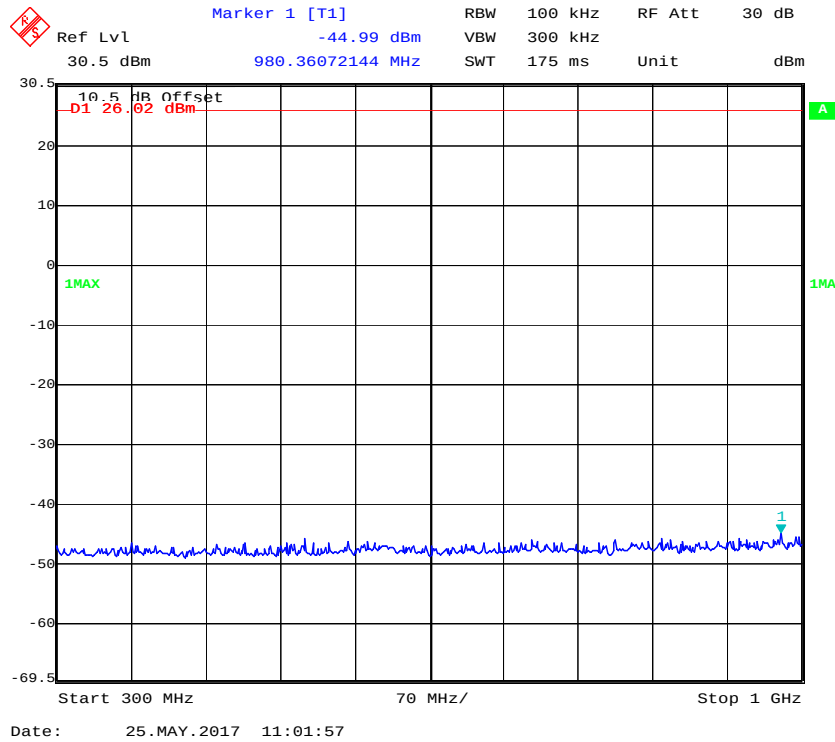
The testing was performed by Ada Yu on 2016-11-17 and 2017-05-25.

Test Mode: Transmitting

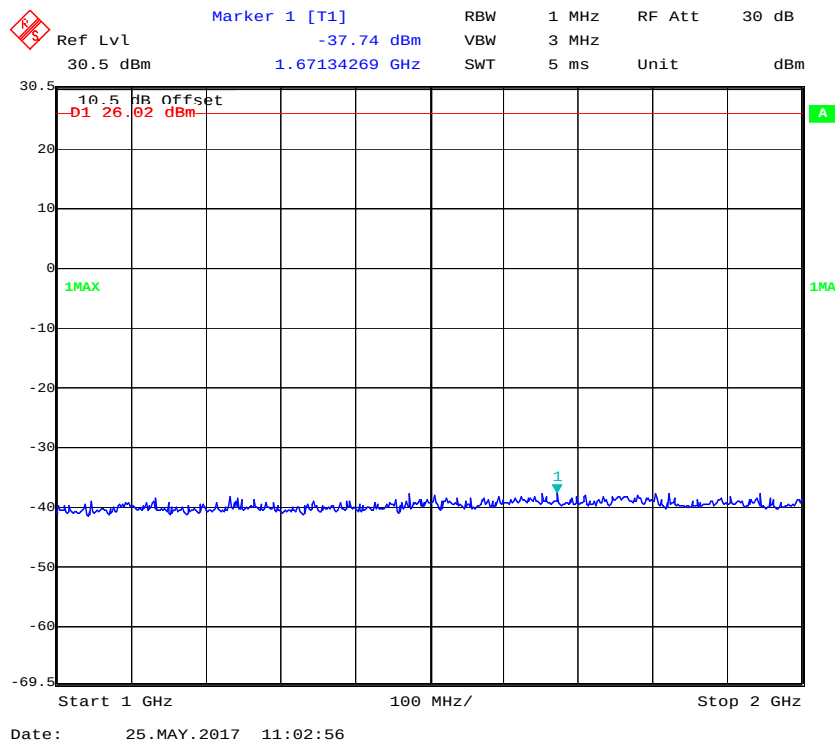
FM mode:**9 kHz – 300 MHz, 156.8 MHz****300 MHz – 1 GHz, 156.8 MHz**

1 GHz – 2 GHz, 156.8 MHz**DSC mode:****9 kHz – 300 MHz, 156.8 MHz**

300 MHz – 1 GHz, 156.8 MHz



1 GHz – 2 GHz, 156.8 MHz



FCC §2.1053&§80.211&RSS-182§7.9 - RADIATED SPURIOUS EMISSIONS**Applicable Standard**

FCC §2.1053, § 80.211 and RSS-182 §7.9

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to teeth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB = 43 + 10 Log₁₀ (power out in Watts)

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Ada Yu on 2016-11-17.

Test Mode: Transmitting

30 MHz – 2 GHz:

Model: LINK-6

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 80/RSS-182	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
Radio telephony: 156.8 MHz										
313.6	52.01	32	1.5	H	-57.7	0.2	3.85	-54.05	-13	41.05
313.6	47.72	314	1.4	V	-59.4	0.2	3.85	-55.75	-13	42.75
470.4	52.88	45	1.6	H	-52.6	0.23	4.05	-48.78	-13	35.78
470.4	47.92	170	1.7	V	-54.3	0.23	4.05	-50.48	-13	37.48
627.2	37.81	66	1.5	H	-61.6	0.24	5.35	-56.49	-13	43.49
627.2	41.94	89	1.4	V	-60.0	0.24	5.35	-54.89	-13	41.89
1254.4	39.33	331	1.8	H	-65.0	0.32	7.64	-57.68	-13	44.68
1254.4	40.19	313	1.8	V	-65.9	0.32	7.64	-58.58	-13	45.58
DSC: 156.525 MHz										
469.58	50.78	43	1.9	H	-54.7	0.23	4.05	-50.88	-13	37.88
469.58	46.92	249	1.7	V	-55.3	0.23	4.05	-51.48	-13	38.48
626.1	41.08	300	2.2	H	-61.7	0.24	5.35	-56.59	-13	43.59
626.1	41.4	91	1.5	V	-61.3	0.24	5.35	-56.19	-13	43.19
782.63	43.02	103	2	H	-52.2	0.26	4.75	-47.71	-13	34.71
782.63	45.84	192	1.8	V	-53.4	0.26	4.75	-48.91	-13	35.91
1252.2	38.93	261	2.2	H	-65.4	0.32	7.64	-58.08	-13	45.08
1252.2	39.69	200	2.1	V	-66.4	0.32	7.64	-59.08	-13	46.08

Model: RS20 & V20

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	FCC Part 80/RSS-182	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
Radio telephony: 156.8 MHz										
470.4	52.68	337	1.0	H	-52.8	0.23	4.05	-48.98	-13	35.98
470.4	48.52	329	1.5	V	-53.7	0.23	4.05	-49.88	-13	36.88
627.2	38.51	168	1.3	H	-60.9	0.24	5.35	-55.79	-13	42.79
627.2	41.94	133	1.9	V	-60.0	0.24	5.35	-54.89	-13	41.89
784	42.82	353	1.6	H	-52.4	0.26	4.75	-47.91	-13	34.91
784	44.74	322	2.4	V	-54.5	0.26	4.75	-50.01	-13	37.01
1254.4	39.43	217	1.0	H	-64.9	0.32	7.64	-57.58	-13	44.58
1254.4	42.19	201	1.4	V	-63.9	0.32	7.64	-56.58	-13	43.58
DSC: 156.525 MHz										
469.58	51.98	250	2.5	H	-53.5	0.23	4.05	-49.68	-13	36.68
469.58	48.32	236	2.3	V	-53.9	0.23	4.05	-50.08	-13	37.08
626.1	38.91	168	2.4	H	-60.5	0.24	5.35	-55.39	-13	42.39
626.1	42.14	9	1.9	V	-59.8	0.24	5.35	-54.69	-13	41.69
782.63	41.92	143	1.5	H	-53.3	0.26	4.75	-48.81	-13	35.81
782.63	46.94	269	1.7	V	-52.3	0.26	4.75	-47.81	-13	34.81
1252.2	40.43	297	1.5	H	-63.9	0.32	7.64	-56.58	-13	43.58
1252.2	41.79	60	1.3	V	-64.3	0.32	7.64	-56.98	-13	43.98

Note:

Absolute Level = SG Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

FCC §2.1055 & §80.209&§ RSS-182- TRANSMITTER FREQUENCY TOLERANCES

Applicable Standard

FCC §2.1055, §80.209 and RSS-182 §7.4

Test Procedure

Frequency Stability vs. Temperature:

From -20° to +50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

The frequency stability 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 provided 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.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Ada Yu on 2016-11-17.

Test Mode: Transmitting

For Radio Telephony mode:

Reference Frequency: 156.8 MHz, Limit: ± 5.0 ppm			
Test Environment		Frequency Measure with Time Elapsed	
Temperature (°C)	Power Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
Frequency Stability versus Input Temperature			
55	13.6	156.800039	0.2487
40	13.6	156.800036	0.2296
30	13.6	156.800037	0.2360
20	13.6	156.800040	0.2551
10	13.6	156.800035	0.2232
0	13.6	156.800030	0.1913
-10	13.6	156.800032	0.2041
-20	13.6	156.800038	0.2423
Frequency Stability Ver. Input Voltage			
20	11.6	156.800037	0.2360

For DSC mode:

Reference Frequency: 156.525 MHz			
Test Conditions		Transmitter Frequency (Hz)	
Environment Temperature (°C)	Power Supplied (V _{dc})	B-State(2100Hz)	B-State(1300Hz)
25	13.6	2100.01	1300.02

***** END OF REPORT *****