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Report On

FCC Testing of the
Jotron AS Tron TR30 GMDSS and Maritime VHF Radio
In accordance with FCC 47 CFR Part 80 and FCC 47 CFR Part 2

COMMERCIAL-IN-CONFIDENCE

FCC ID: VRVTRONTR30

Document 75933035 Report 02 Issue 2

November 2016



Product Service

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COMMERCIAL-IN-CONFIDENCE

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Jotron AS Tron TR30 GMDSS and Maritime VHF Radio
In accordance with FCC 47 CFR Part 80 and FCC 47 CFR Part 2

Document 75933035 Report 02 Issue 2

November 2016

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DATED

28 November 2016

This report has been up-issued to Issue 2 to include additional test results.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 80 and FCC 47 CFR Part 2. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

M Russell

T Guy



G Lawler



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SECTION 1

REPORT SUMMARY

FCC Testing of the
Jotron AS Tron TR30 GMDSS and Maritime VHF Radio
In accordance with FCC 47 CFR Part 80 and FCC 47 CFR Part 2



Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC Testing of the Jotron AS Tron TR30 GMDSS and Maritime VHF Radio to the requirements of FCC 47 CFR Part 80 and FCC 47 CFR Part 2.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Jotron AS
Model Number(s)	Tron TR30 GMDSS and Maritime VHF Radio
Serial Number(s)	810 806
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 80 (2015) FCC 47 CFR Part 2 (2015)
Incoming Release Date	Application Form 30 March 2016
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	SP1551001 14 December 2015
Start of Test	13 May 2016
Finish of Test	1 November 2016
Name of Engineer(s)	M Russell T Guy G Lawler



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 80 and FCC 47 CFR Part 2 is shown below.

Section	Specification Clause		Test Description	Result	Comments/Base Standard
VHF					
2.1	80.205	2.1049	Bandwidths	Pass	
2.2	80.209	2.1055	Transmitter Frequency Tolerances	Pass	
2.3	80.211	2.1051	Spurious Emissions at Antenna Terminal	Pass	
2.4	80.211	2.1051	Radiated Spurious Emissions	Pass	
2.5	80.213	2.1047	Modulation Requirements	Pass	
2.6	80.215	2.1046	Transmitter Power	Pass	
2.7	80.217 (b)	-	Suppression of Interference Aboard Ships	Pass	



1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	Tron TR30 GMDSS and Maritime VHF radio
Part Number	87950
Hardware Version	R1610
Software Version	2.0.2
FCC ID (if applicable)	VRVTRONTR30
Industry Canada ID (if applicable)	2131A-TRONTR30
Technical Description (Please provide a brief description of the intended use of the equipment)	"Tron TR30 GMDSS and Maritime VHF radio" has the ultimate functional design, both in an emergency situation and in general on board communications. The radio switches automatically between standard simplex and duplex maritime channels and 21 emergency simplex channels depending on which battery, rechargeable or sealed lithium, is connected

POWER SOURCE	
<input type="checkbox"/> AC mains	State voltage
AC supply frequency (Hz)	
VAC	
Max Current	
Hz	
<input type="checkbox"/> Single phase	<input type="checkbox"/> Three phase
And / Or	
<input type="checkbox"/> External DC supply	
Nominal voltage	V Max Current A
Extreme upper voltage	V
Extreme lower voltage	V
Battery	
<input type="checkbox"/> Nickel Cadmium	<input type="checkbox"/> Lead acid (Vehicle regulated)
<input type="checkbox"/> Alkaline	<input type="checkbox"/> Leclanche
<input checked="" type="checkbox"/> Lithium	<input type="checkbox"/> Other Details :
NON GMDSS 7,4 Volts nominal.	
GMDSS 6,0 V	
End point voltage as quoted by equipment manufacturer	NON GMDSS 6,0 V
	GMDSS 4,1 V

FREQUENCY INFORMATION					
Frequency Range	154 to 161,875	MHz			
Channel Spacing (where applicable)	25 KHz				
Receiver Frequency Range (if different)	154 to 163	MHz			
Channel Spacing (if different)					
Test Frequencies*	Bottom	154.050	MHz	Channel Number (if applicable)	T1
	Middle	156.050	MHz	Channel Number (if applicable)	T2
	Top	161.875	MHz	Channel Number (if applicable)	T3
Intermediate Frequencies		45MHz, 0,455 MHz			
Highest Internally Generated Frequency :		161,875X2=323,750 MHz			



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POWER CHARACTERISTICS			
Maximum TX power	GMDSS 2W	W	
	NON GMDSS 5W		
Minimum TX power	GMDSS 1	W (if variable)	
	NON GMDSS 1W		
Is transmitter intended for :			
Continuous duty		<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Intermittent duty		<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
If intermittent state DUTY CYCLE			
Transmitter ON	50% @ 1W seconds		
Transmitter OFF	50% @ 1W seconds		

ANTENNA CHARACTERISTICS					
<input checked="" type="checkbox"/>	Antenna connector		State impedance	50	Ohm
<input type="checkbox"/>	Temporary antenna connector		State impedance		Ohm
<input type="checkbox"/>	Integral antenna	Type	State impedance		dBi
<input checked="" type="checkbox"/>	External antenna	Type Helical	State impedance	-4	dBi

MODULATION CHARACTERISTICS			
<input type="checkbox"/>	Amplitude	<input type="checkbox"/>	Frequency
<input checked="" type="checkbox"/>	Phase	<input type="checkbox"/>	Other (please provide details):
Can the transmitter operate un-modulated?			<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

CLASS OF EMISSION USED	
ITU designation or Class of Emission:	
1 G3E	
(if applicable) 2	
(if applicable) 3	
If more than three classes of emission, list separately:	

BATTERY POWER SUPPLY			
Model name/number	Battery Emergency Lithium / Battery Chargeable Li Polymer	Identification/Part number	87086 /8708 7
Manufacturer	Jotron	Country of Origin	Norway



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ANCILLARIES (If applicable)			
Model name/number	RCH-30 Battery charger	Identification/Part number	87685
Manufacturer	Jotron AS	Country of Origin	Norway

EXTREME CONDITIONS					
Extreme test voltages (Max)	NON GMDSS 8,4V	V	Extreme test voltages (Mix)	8,4	V
Nominal DC Voltage	NON GMDSS 7,4V	V	DC Maximum Current	2	A
Maximum temperature	GMDSS 6,0V	+55 °C	Minimum temperature	-20	°C

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Name: Frank Løke

Position held: Certification Manager M&E

Date:

19.08.2016





1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Jotron AS Tron TR30 GMDSS and Maritime VHF Radio. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 6.0 V DC supply.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard were made during testing.

1.7 MODIFICATION RECORD

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: 806			
0	As supplied by manufacturer.	N/A	N/A
Serial Number: 810			
0	As supplied by manufacturer.	N/A	N/A
1	Modification of audio amplifier. Updated with circuit which secure below 1W in working radio mode. Modification of TX release, modified audio transient when turn off transmitter with monophone. Squelch open level in max position, changed to opens at sensitivity limit.	Arnt Løke	01/06/2016
2	Adjusted audio response receiver	Arnt Løke	14/07/2016

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.



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SECTION 2

TEST DETAILS

FCC Testing of the
Jotron AS Tron TR30 GMDSS and Maritime VHF Radio
In accordance with FCC 47 CFR Part 80 and FCC 47 CFR Part 2



Product Service

2.1 BANDWIDTHS

2.1.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.205
FCC 47 CFR Part 2, Clause 2.1049

2.1.2 Equipment Under Test and Modification State

Tron TR30 GMDSS and Maritime VHF Radio S/N: 806 - Modification State 0

2.1.3 Date of Test

01 November 2016

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

This test was performed in accordance with the test method requirements of FCC Part 2, Clause 2.1049.

Remarks

The modulating input voltage was set to a level 20 dB greater than that resulting in a frequency deviation of 3 kHz using a 1 kHz audio frequency tone to ensure that the modulation limiting capability of the EUT was under test.

2.1.6 Environmental Conditions

Ambient Temperature	22.2°C
Relative Humidity	42.4%



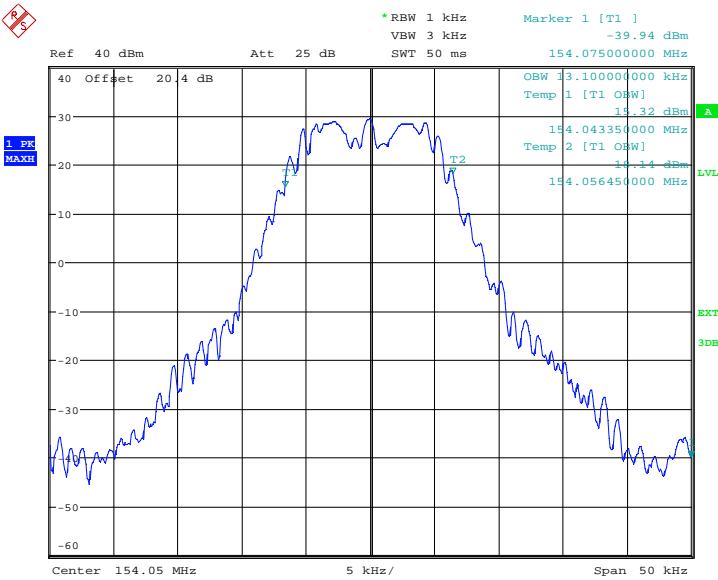
Product Service

2.1.7 Test Results

VHF, Bandwidths Results

	154.050 MHz	156.025 MHz	156.800 MHz	157.425 MHz	161.875 MHz
Authorised Bandwidth	20 kHz	20 kHz	20 kHz	20 kHz	20 kHz
Result (kHz)	13.10	13.05	12.95	13.20	13.15

VHF, 154.050 MHz, Bandwidths Plot

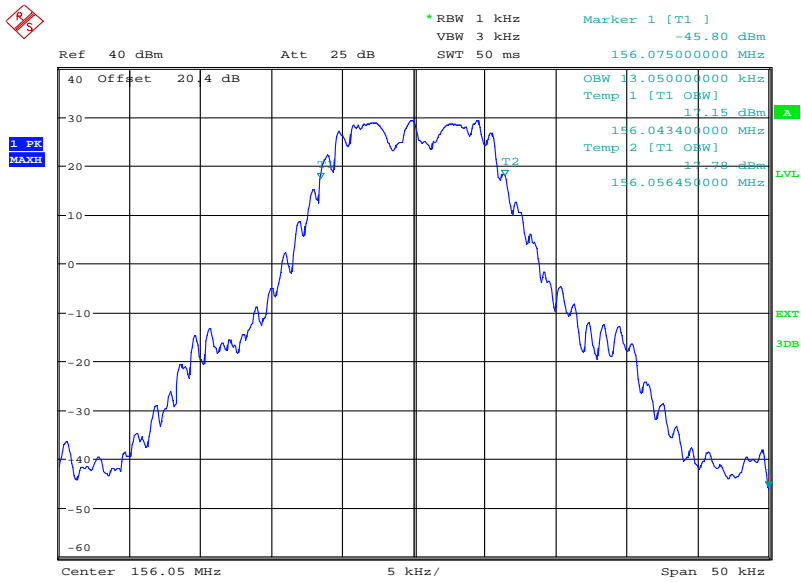


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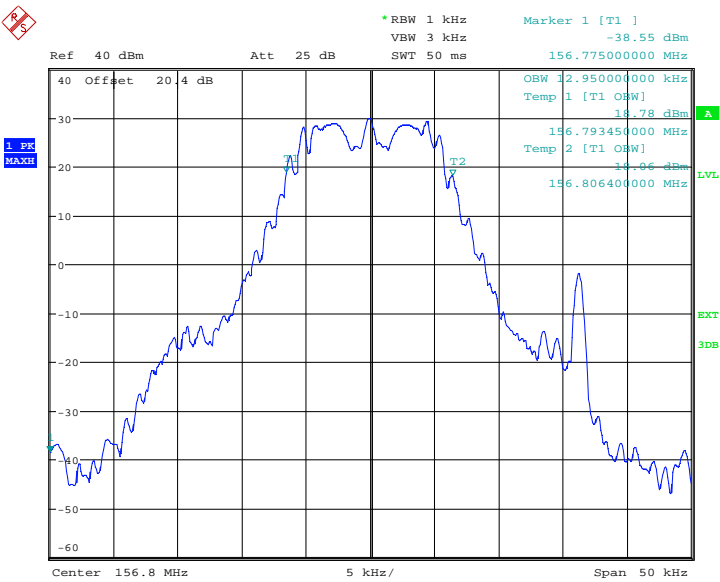
Product Service

VHF, 156.025 MHz, Bandwidths Plot



Date: 1.NOV.2016 14:03:27

VHF, 156.800 MHz, Bandwidths Plot

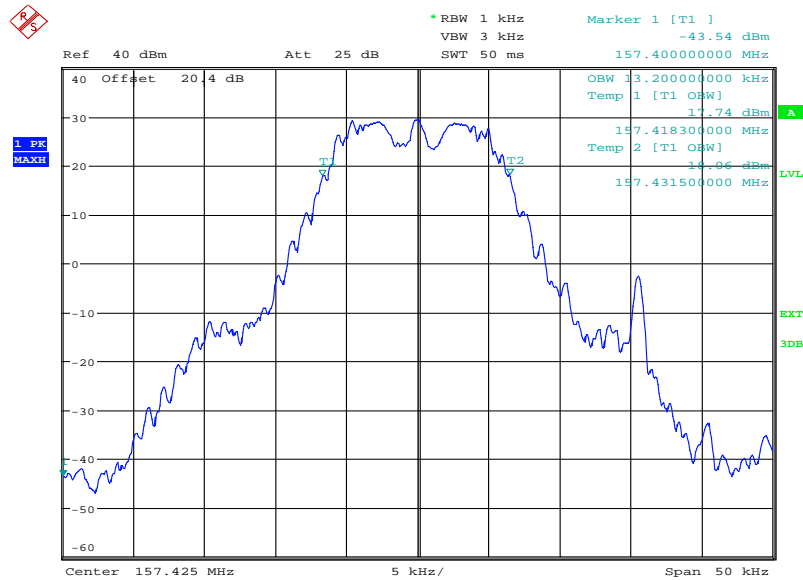


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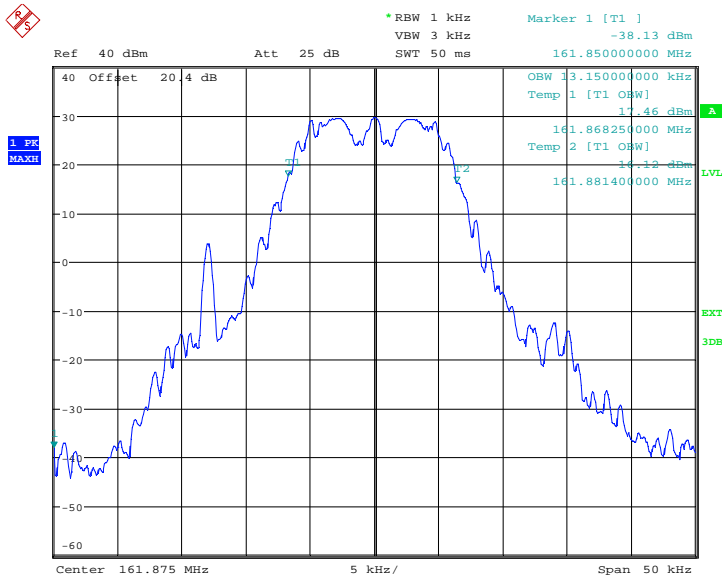
Product Service

VHF, 157.425 MHz, Bandwidths Plot



Date: 1.NOV.2016 14:03:55

VHF, 161.875 MHz, Bandwidths Plot



Date: 1.NOV.2016 14:07:49

FCC 47 CFR Part 80, Limit Clause 80.205

The nominal authorised channel bandwidth for voice is 20 kHz.



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2.2 TRANSMITTER FREQUENCY TOLERANCES

2.2.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.209
FCC 47 CFR Part 2, Clause 2.1055

2.2.2 Equipment Under Test and Modification State

Tron TR30 GMDSS and Maritime VHF Radio S/N: 810 - Modification State 0

2.2.3 Date of Test

25 May 2016

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

The test was performed in accordance with FCC Part 2, Clause 2.1055.

Remarks

The measurement was performed using a frequency counter with the EUT transmitting an unmodulated carrier.

2.2.6 Environmental Conditions

Ambient Temperature	22.5°C
Relative Humidity	32.8%



Product Service

2.2.7 Test Results

Temperature °C	Frequency Error (ppm)
-20	-0.204
-10	0.249
0	0.312
+10	0.236
+20	0.599
+30	0.542
+40	0.497
+50	0.529

VHF, 156.800 MHz, Transmitter Frequency Tolerance Under Voltage Variations Results

Voltage	Frequency Error (ppm)
4.2 V DC	0.574
7.2 V DC	0.619

FCC 47 CFR Part 80, Limit Clause 80.209 ± 10 ppm.



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2.3 SPURIOUS EMISSIONS AT ANTENNA TERMINAL

2.3.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.211
FCC 47 CFR Part 2, Clause 2.1051

2.3.2 Equipment Under Test and Modification State

Tron TR30 GMDSS and Maritime VHF Radio S/N: 810 - Modification State 0
Tron TR30 GMDSS and Maritime VHF Radio S/N: 806 - Modification State 0

2.3.3 Date of Test

13 May 2016 & 1 November 2016

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

This test was performed in accordance with the test method requirements of FCC Part 2, Clause 2.1051

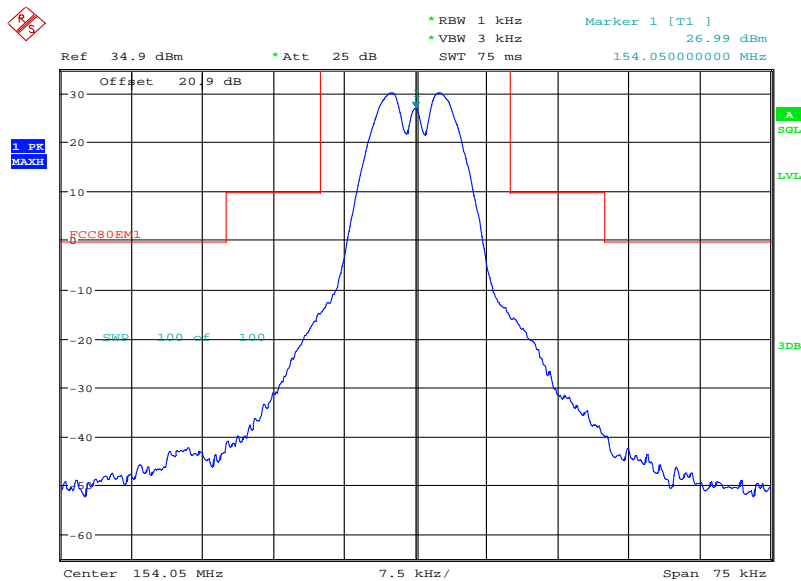
2.3.6 Environmental Conditions

Ambient Temperature	22.2 - 23.6°C
Relative Humidity	39.4 - 42.4%

2.3.7 Test Results

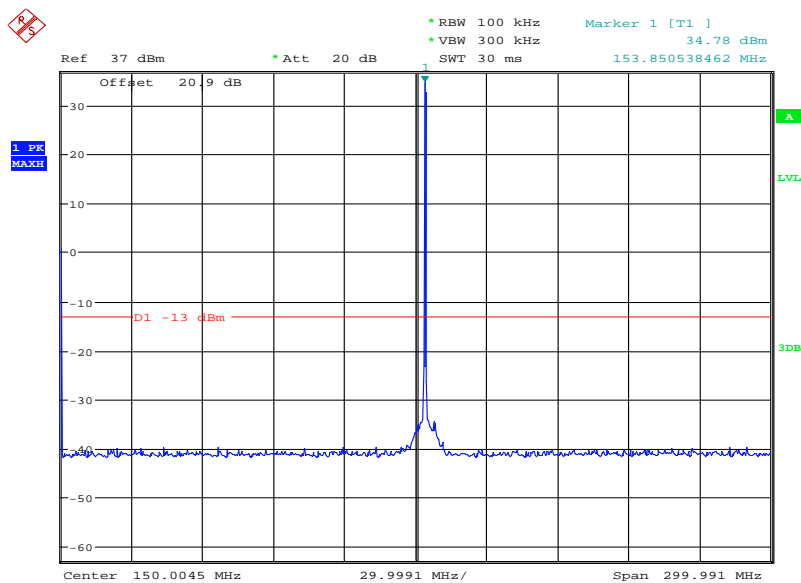
6.0 V DC Supply

VHF, 154.050 MHz, Emission Mask, Spurious Emissions at Antenna Terminal Plot



Date: 13.MAY.2016 15:50:31

VHF, 154.050 MHz, 9 kHz to 300 MHz, Spurious Emissions at Antenna Terminal Plot

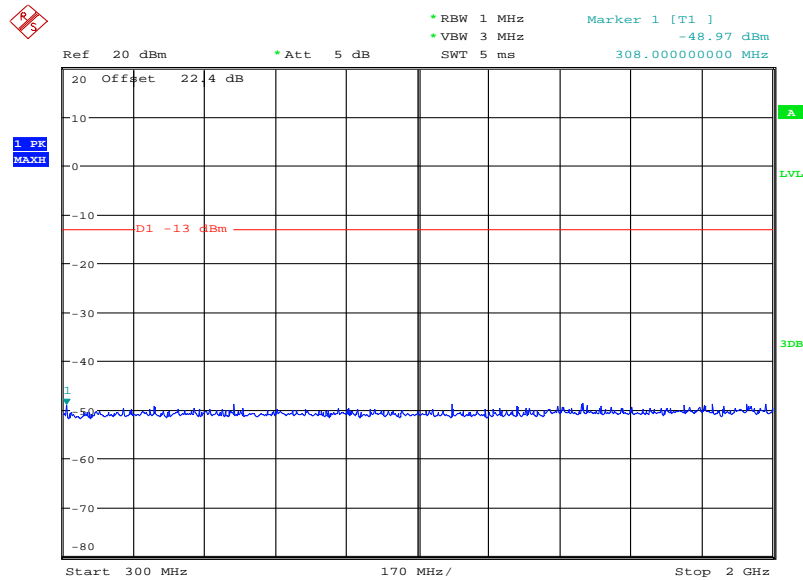


Date: 13.MAY.2016 15:01:24



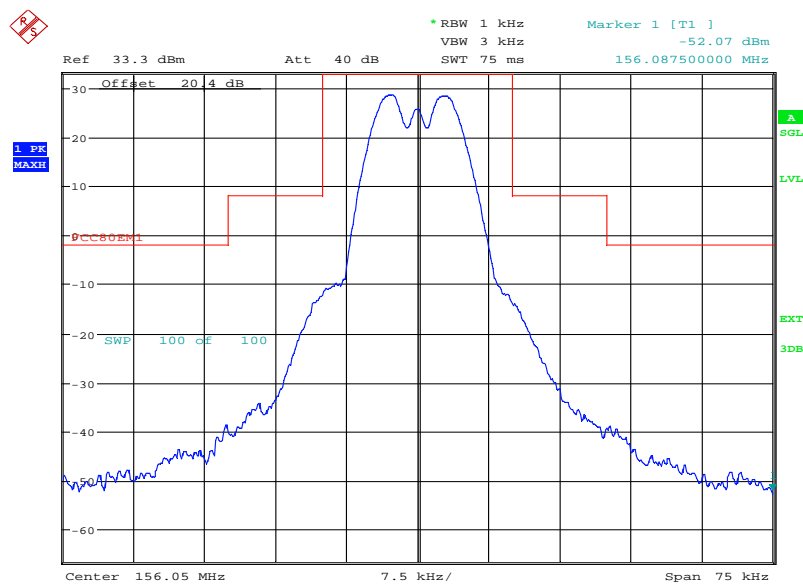
Product Service

VHF, 154.050 MHz, 300 MHz to 2 GHz, Spurious Emissions at Antenna Terminal Plot



Date: 13.MAY.2016 15:07:50

VHF, 156.025 MHz, Emission Mask, Spurious Emissions at Antenna Terminal Plot

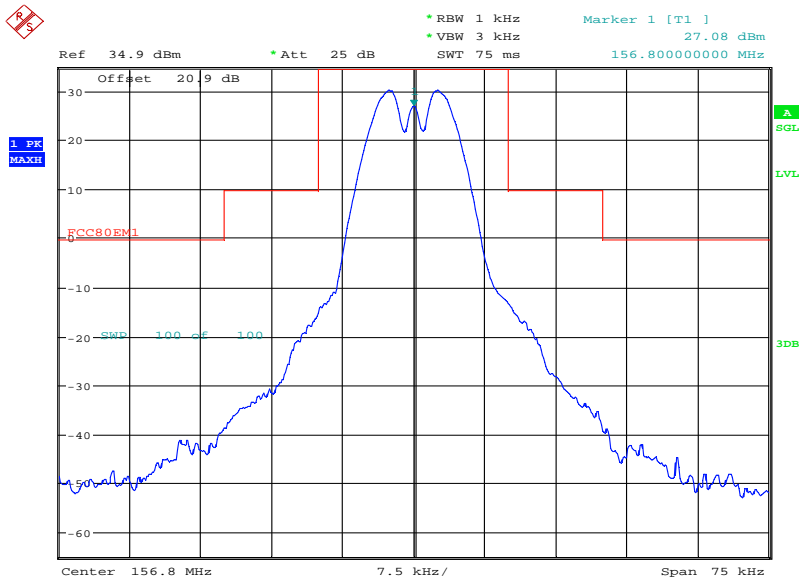


Date: 1.NOV.2016 15:39:39



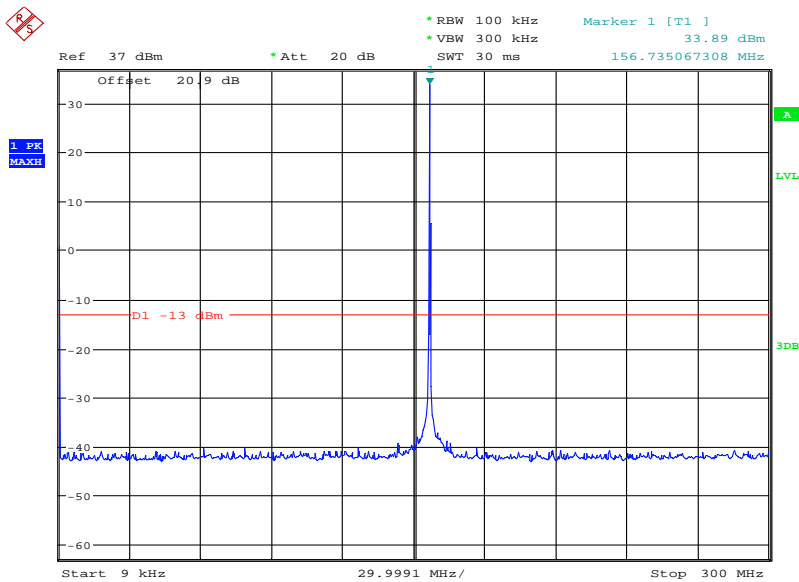
Product Service

VHF, 156.800 MHz, Emission Mask, Spurious Emissions at Antenna Terminal Plot



Date: 13.MAY.2016 15:44:58

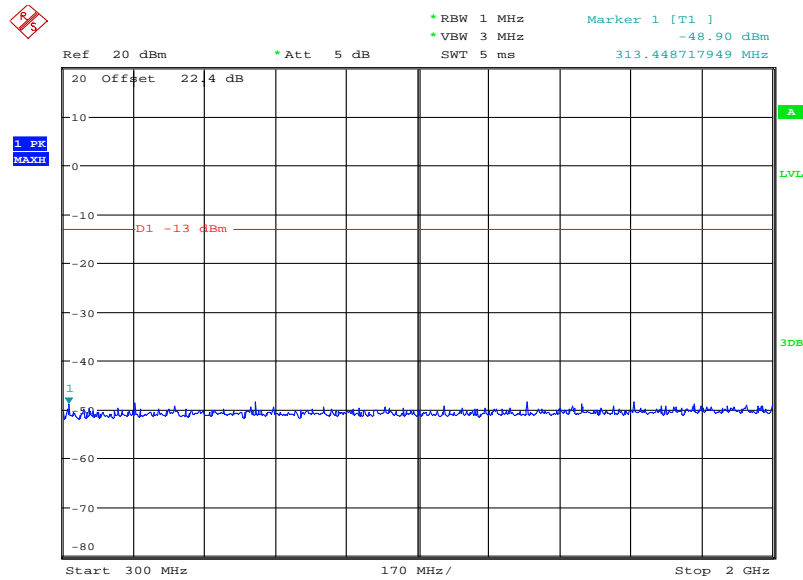
VHF, 156.800 MHz, 9 kHz to 300 MHz, Spurious Emissions at Antenna Terminal Plot



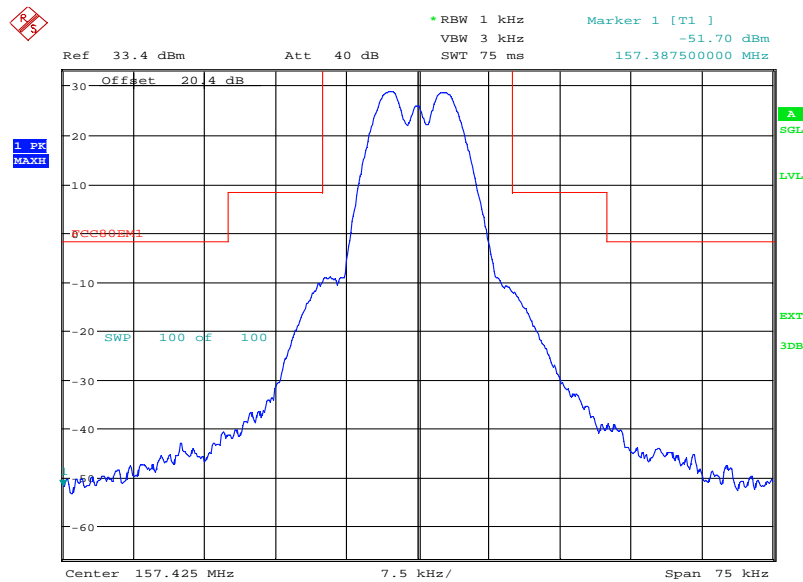
Date: 13.MAY.2016 14:21:46



Product Service

VHF, 156.800 MHz, 300 MHz to 2 GHz, Spurious Emissions at Antenna Terminal Plot

Date: 13.MAY.2016 15:09:07

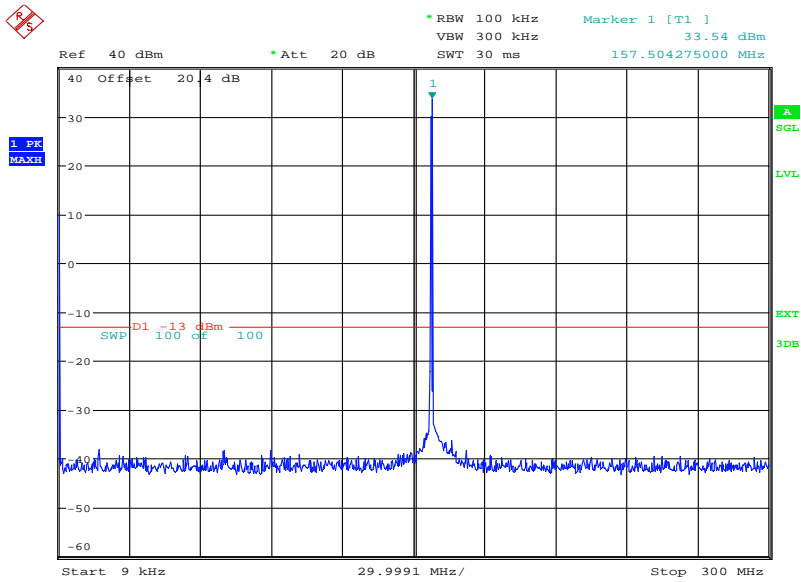
VHF, 157.425 MHz, Emission Mask, Spurious Emissions at Antenna Terminal Plot

Date: 1.NOV.2016 15:38:48



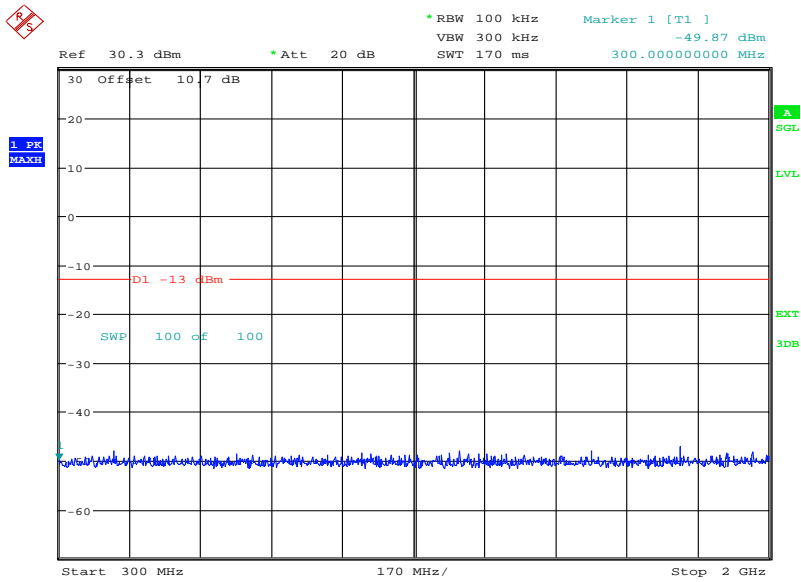
Product Service

VHF, 157.425 MHz, 9 kHz to 300 MHz, Spurious Emissions at Antenna Terminal Plot



Date: 1.NOV.2016 15:42:14

VHF, 157.425 MHz, 300 MHz to 2 GHz, Spurious Emissions at Antenna Terminal Plot

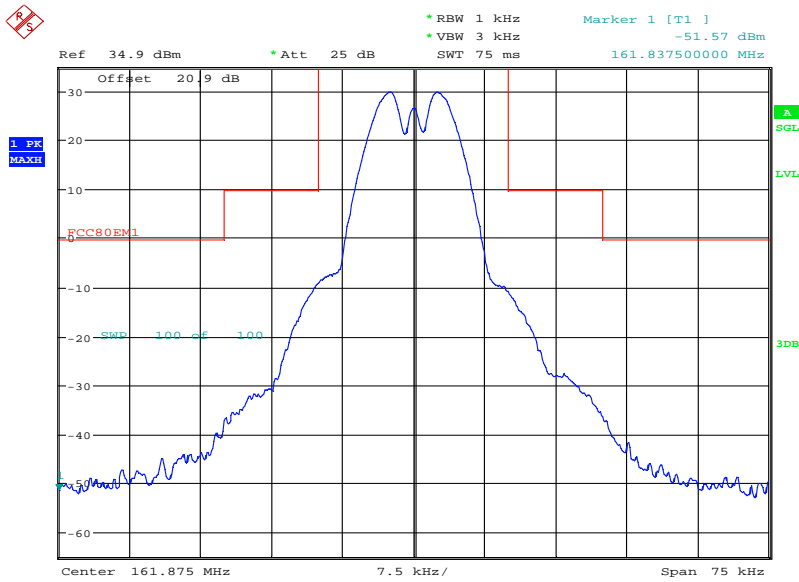


Date: 1.NOV.2016 15:44:43



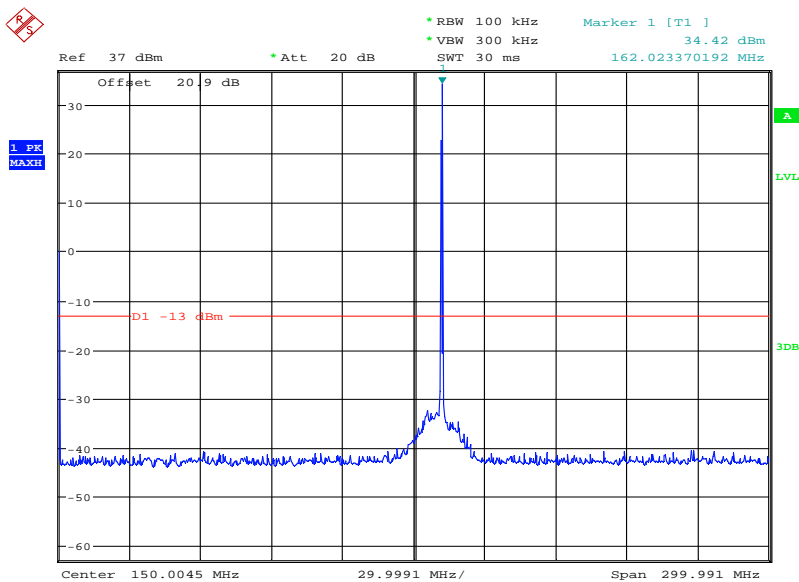
Product Service

VHF, 161.875 MHz, Emission Mask, Spurious Emissions at Antenna Terminal Plot



Date: 13.MAY.2016 15:52:27

VHF, 161.875 MHz, 9 kHz to 300 MHz, Spurious Emissions at Antenna Terminal Plot

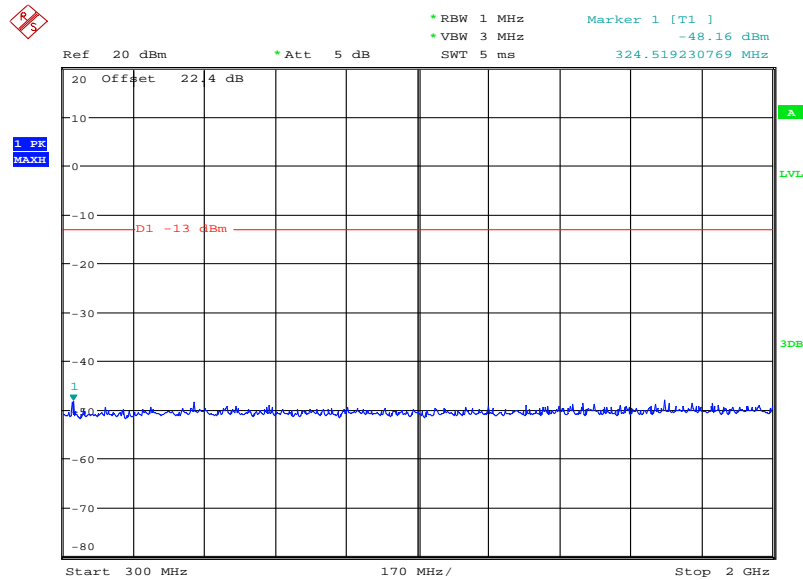


Date: 13.MAY.2016 15:02:14



Product Service

VHF, 161.875 MHz, 300 MHz to 2 GHz, Spurious Emissions at Antenna Terminal Plot



Date: 13.MAY.2016 15:06:17

FCC 47 CFR Part 80, Limit Clause 80.211

Emission Mask

The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

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;

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

Outside the Emission Mask

On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.



Product Service

2.4 RADIATED SPURIOUS EMISSIONS

2.4.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.211
FCC 47 CFR Part 2, Clause 2.1051

2.4.2 Equipment Under Test and Modification State

Tron TR30 GMDSS and Maritime VHF Radio S/N: 806 - Modification State 0

2.4.3 Date of Test

30 July 2016 & 30 October 2016

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC Part 80, Clause 80.211(f).

Remarks

Radiated; A preliminary profile of the Spurious Radiated Emissions was obtained up to the 10th harmonic by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisation. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, the list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

The EUT was set to transmit on maximum power. An Audio signal was delivered to the EUT for transmission, it was modulated with a signal at the maximum response frequency of 2.5 kHz [assessed during test] the level of the audio signal was calibrated at 50% then increased by 16dB.

For any emissions found within 10dB of the limit the EUT was then removed from the chamber and replaced with a substitution antenna. Using a signal generator the level was adjusted to achieve the same value on the measuring instrument as previously recorded with the EUT. The final result was determined by a calculation using the signal generator level, antenna gain and cable loss.

The measurements were performed at a 3m distance unless otherwise stated.



Product Service

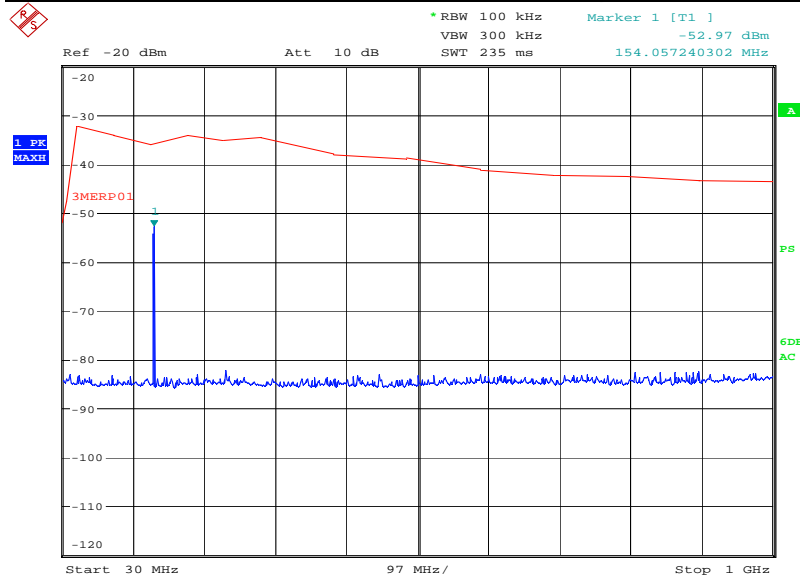
2.4.6 Environmental Conditions

Ambient Temperature 20.3 - 20.5°C
Relative Humidity 45.7 - 48.0%

2.4.7 Test Results

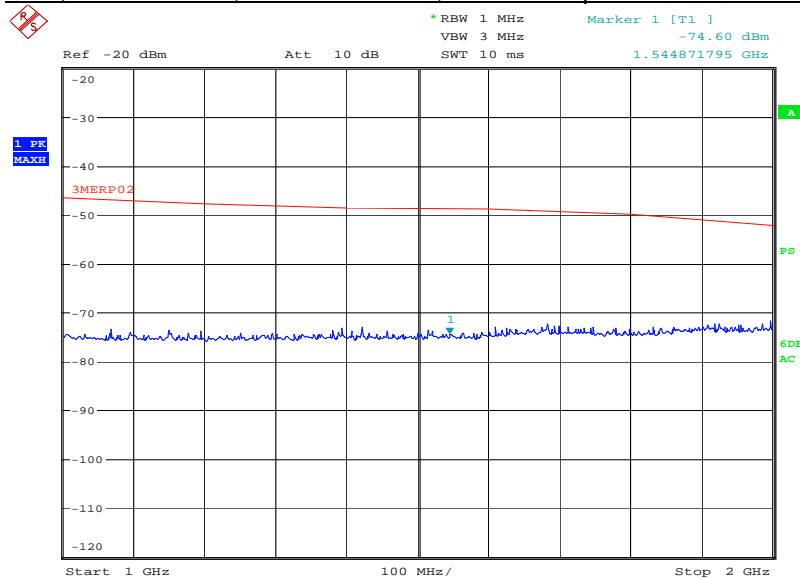
6.0 V DC Supply

VHF, 154.050 MHz, 30 MHz to 1 GHz, Radiated Spurious Emissions Plot



Date: 30.JUL.2016 11:53:11

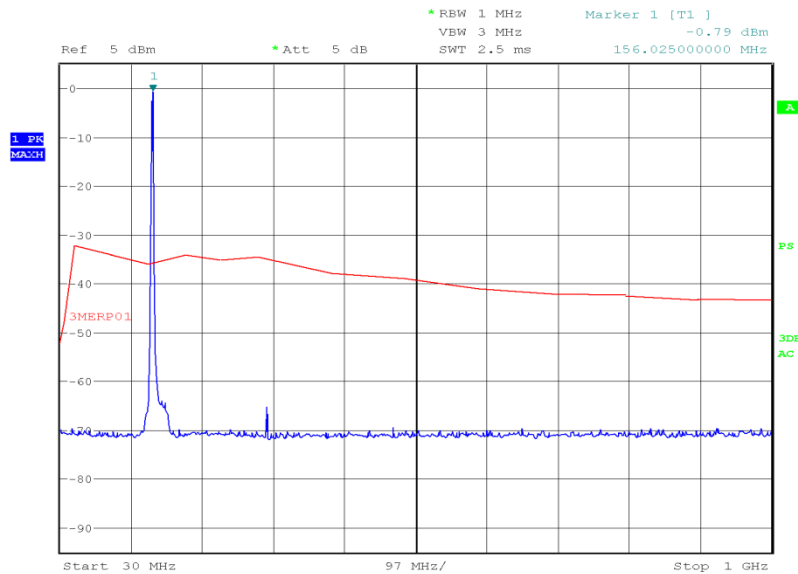
VHF, 154.050 MHz, 1 GHz to 2 GHz, Radiated Spurious Emissions Plot



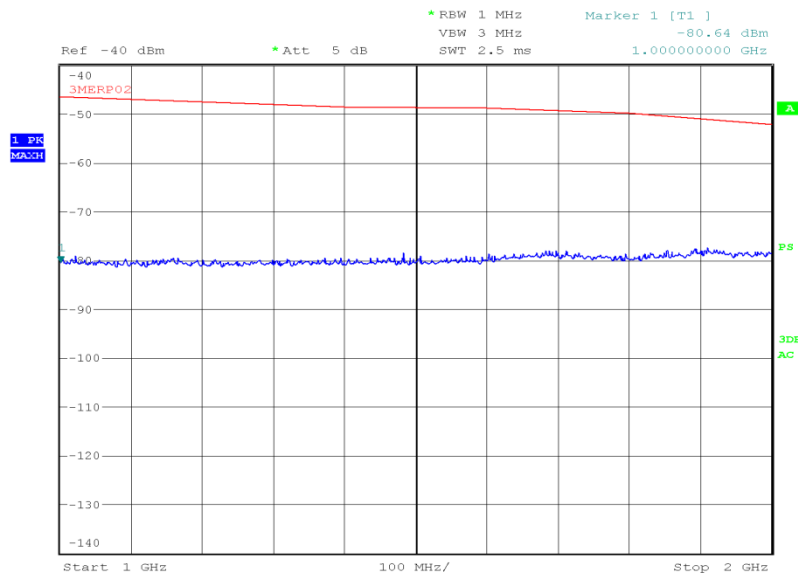
Date: 30.JUL.2016 15:30:26



Product Service

VHF, 156.025 MHz, 30 MHz to 1 GHz, Radiated Spurious Emissions Plot

Date: 30.OCT.2016 10:07:31

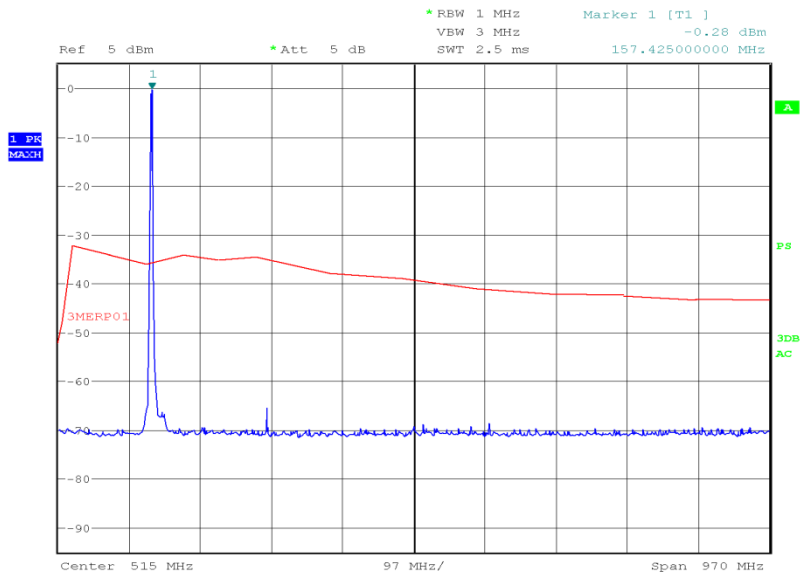
VHF, 156.025 MHz, 1 GHz to 2 GHz, Radiated Spurious Emissions Plot

Date: 30.OCT.2016 10:20:02



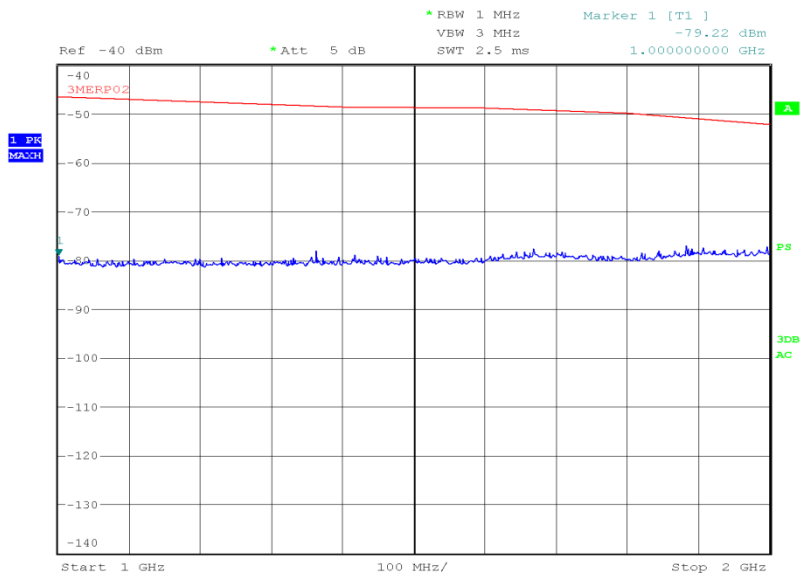
Product Service

VHF, 157.425 MHz, 30 MHz to 1 GHz, Radiated Spurious Emissions Plot



Date: 30.OCT.2016 10:13:23

VHF, 157.425 MHz, 1 GHz to 2 GHz, Radiated Spurious Emissions Plot

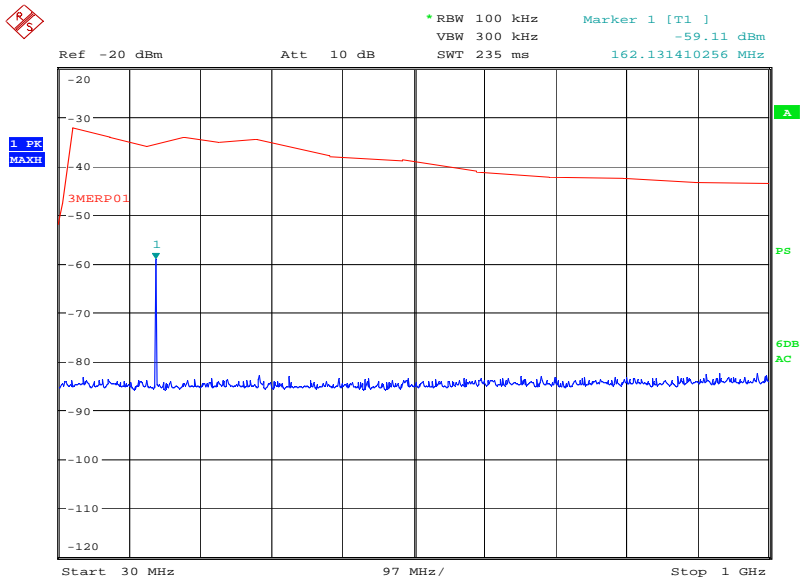


Date: 30.OCT.2016 10:17:35



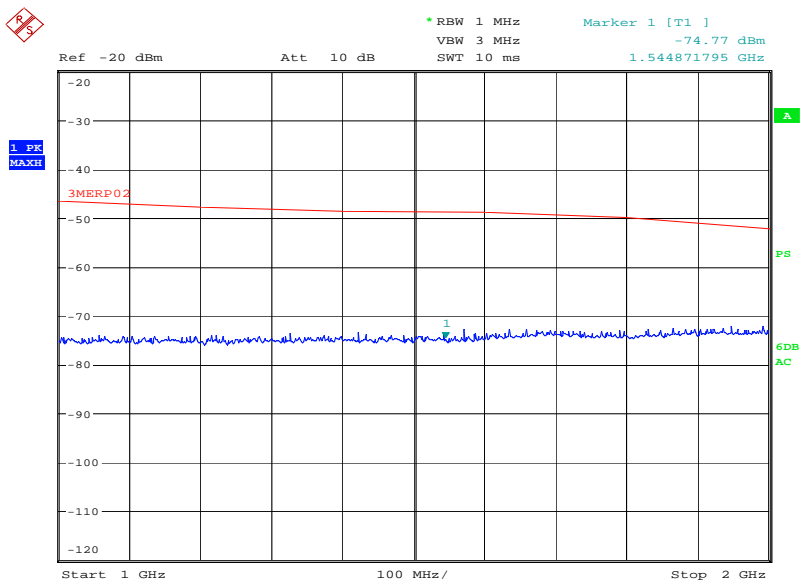
Product Service

VHF, 161.875 MHz, 30 MHz to 1 GHz, Radiated Spurious Emissions Plot



Date: 30.JUL.2016 12:09:36

VHF, 161.875 MHz, 1 GHz to 2 GHz, Radiated Spurious Emissions Plot



Date: 30.JUL.2016 15:35:32



Product Service

FCC 47 CFR Part 80, Limit Clause 80.211

Emission Mask

On any frequency removed from the assigned frequency by more than 50 % up to and including 150 % of the authorized bandwidth: At least 28 dB

On any frequency removed from the assigned frequency by more than 150 % up to and including 250 % of the authorized bandwidth: At least 35 dB

Outside the Emission Mask

>250 % of authorised bandwidth $43+10 \log P$ OR -13 dBm



Product Service

2.5 MODULATION REQUIREMENTS

2.5.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.213
FCC 47 CFR Part 2, Clause 2.1047

2.5.2 Equipment Under Test and Modification State

Tron TR30 GMDSS and Maritime VHF Radio S/N: 810 - Modification State 0

2.5.3 Date of Test

23 May 2016

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Procedure

This test was performed in accordance with the test method requirements of FCC Part2, Clause 2.1047.

Remarks

To obtain the frequency response of the EUT the modulating input voltage was set to a level 20 dB greater than that resulting in a frequency deviation of 3 kHz using a 1 kHz audio frequency tone to ensure that the modulation limiting capability of the EUT was under test.

The modulation limiting capability of the EUT was then tested by varying the amplitude of the modulation input voltage using audio tones at 100 Hz, 1 kHz and 5 kHz.

2.5.6 Environmental Conditions

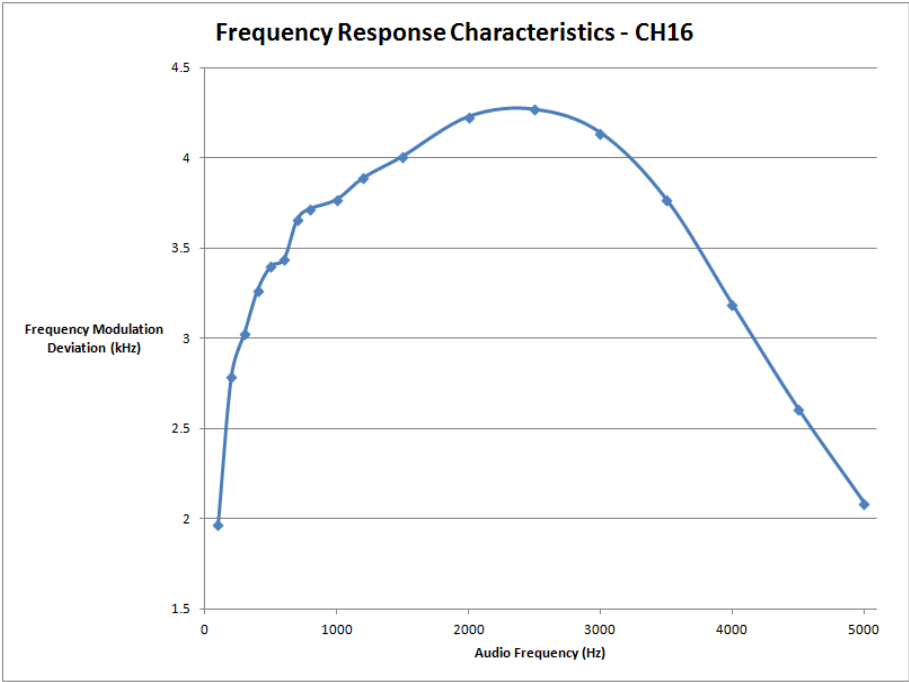
Ambient Temperature	22.2°C
Relative Humidity	42.4%



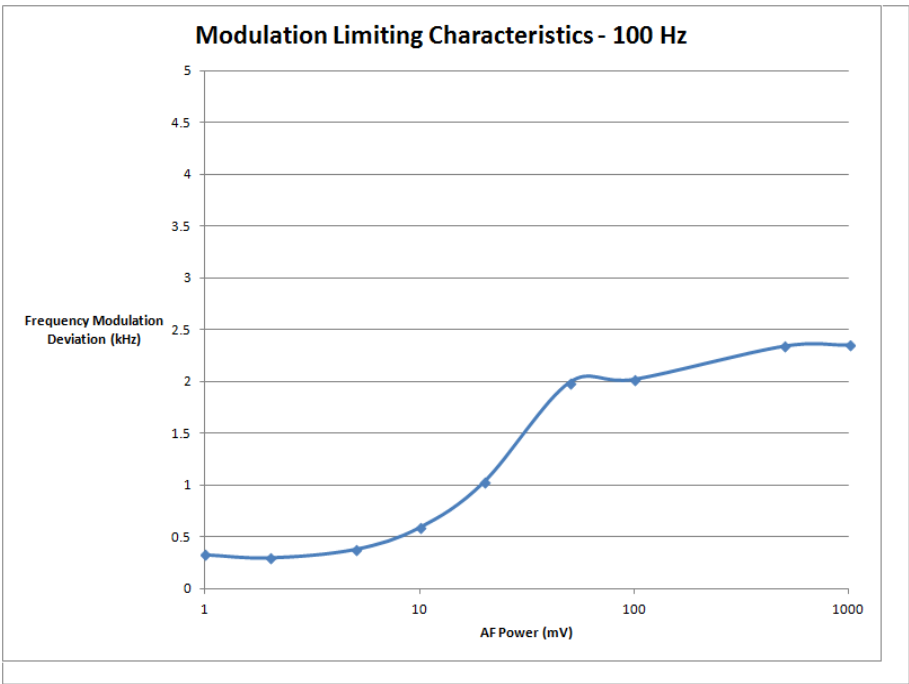
Product Service

2.5.7 Test Results

VHF, 156.800 MHz, Frequency Response, Modulation Requirement Plot



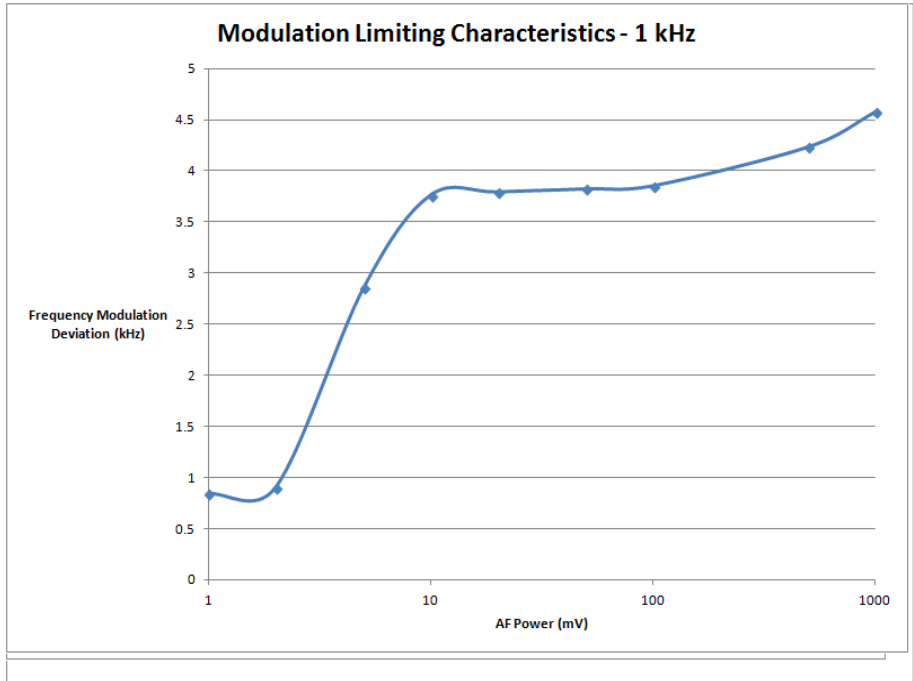
VHF, 156.800 MHz, Modulation Limiting Capability – 100 Hz, Modulation Requirement Plot



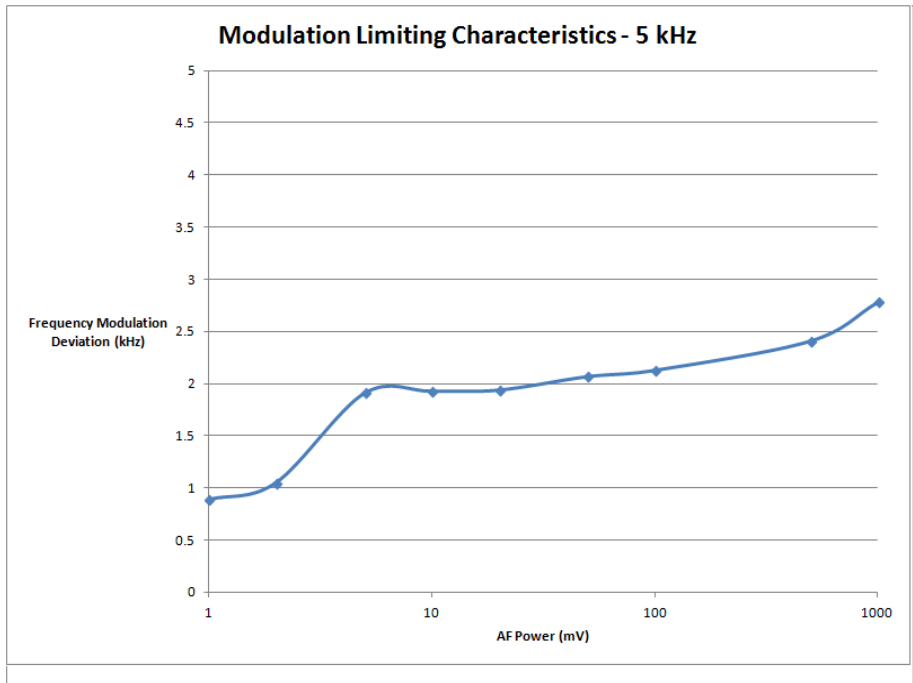


Product Service

VHF, 156.800 MHz, Modulation Limiting Capability – 1 kHz, Modulation Requirement Plot



VHF, 156.800 MHz, Modulation Limiting Capability – 5 kHz, Modulation Requirement Plot





Product Service

FCC 47 CFR Part 80, Limit Clause 80.213

Radiotelephone transmitters using A3E, F3E and G3E emission must have a modulation limiter to prevent any modulation over 100 percent.

FCC 47 CFR Part 2, Limit Clause 2.1047

Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.



Product Service

2.6 TRANSMITTER POWER

2.6.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.215
FCC 47 CFR Part 2, Clause 2.1046

2.6.2 Equipment Under Test and Modification State

Tron TR30 GMDSS and Maritime VHF Radio S/N: 810 - Modification State 0
Tron TR30 GMDSS and Maritime VHF Radio S/N: 806 - Modification State 0

2.6.3 Date of Test

23 May 2016 & 1 November 2016

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Procedure

This test was performed in accordance with the test method requirements of FCC Part 2, Clause 2.1046

Remarks

The EUT was transmitted with an unmodulated carrier and a spectrum analyser was used to measure the carrier power.

2.6.6 Environmental Conditions

Ambient Temperature	22.8 - 23.6°C
Relative Humidity	36.7 - 39.4%



2.6.7 Test Results

VHF, 154.050 MHz, Transmitter Power Results

Result (dBm)	Result (W)
33.81	2.40

VHF, 156.025 MHz, Transmitter Power Results

Result (dBm)	Result (W)
33.30	2.14

VHF, 156.800 MHz, Transmitter Power Results

Result (dBm)	Result (W)
33.88	2.44

VHF, 157.425 MHz, Transmitter Power Results

Result (dBm)	Result (W)
33.41	2.19

VHF, 161.875 MHz, Transmitter Power Results

Result (dBm)	Result (W)
33.40	2.19

FCC 47 CFR Part 80, Limit Clause 80.215 (d)

Ship station frequencies above 27500 kHz. The maximum power must not exceed the values listed below:

- Ships Stations: 156 to 162 MHz - 25 W
- Marine Utility Stations and Handheld Portable Transmitters: 156 to 162 MHz - 10 W



Product Service

2.7 SUPPRESSION OF INTERFERENCE ABOARD SHIPS

2.7.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.217 (b)

2.7.2 Equipment Under Test and Modification State

Tron TR30 GMDSS and Maritime VHF Radio S/N: 810 - Modification State 0

2.7.3 Date of Test

24 May 2016

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC Part 2, Clause 2.1051.

Remarks

A network analyser was used to measure the path loss and the worst case was entered as a reference level offset in to the spectrum analyser for each frequency range of interest. The EUT was connected to a spectrum analyser via a cable and attenuator. The EUT was configured in a receive only state. The spectrum analyser settings were configured with an RBW of 100 kHz. The trace set to max hold using a peak detector and the plots recorded as shown.

2.7.6 Environmental Conditions

Ambient Temperature	230.0°C
Relative Humidity	33.2%



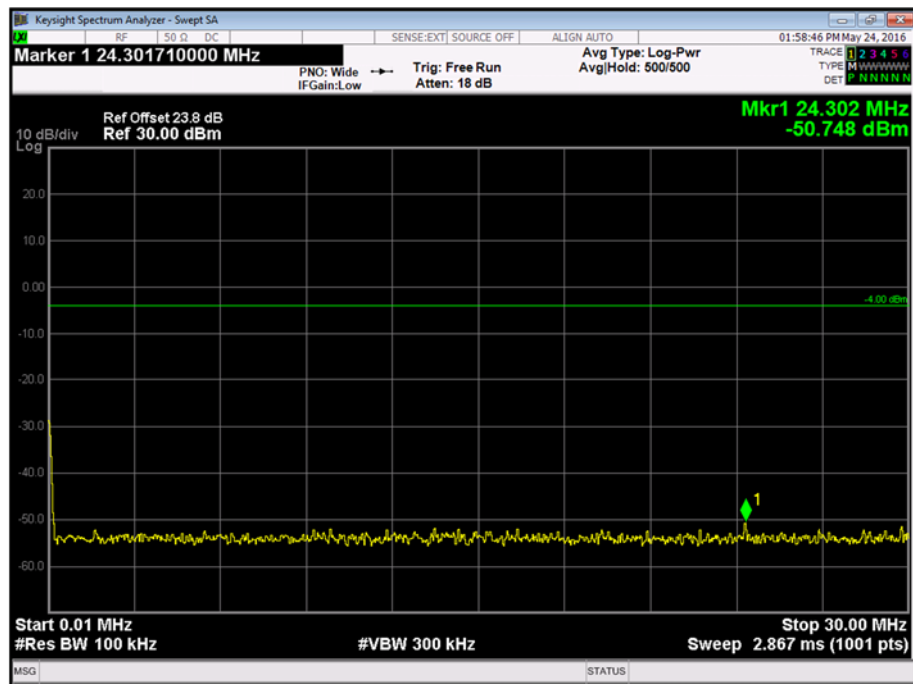
Product Service

2.7.7 Test Results

VHF, 156.800 MHz, Suppression of Interference Aboard Ships Results

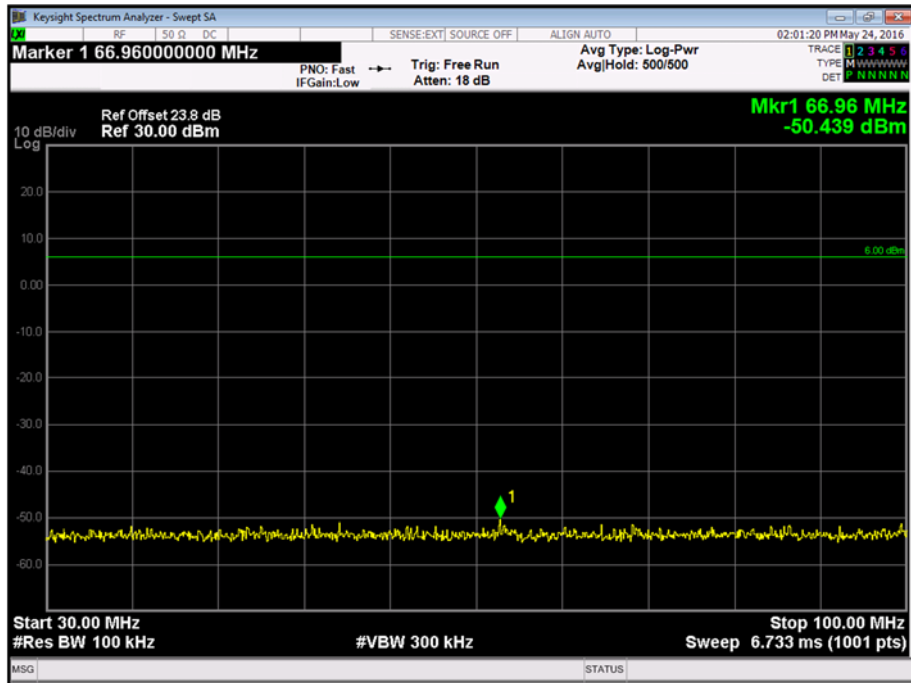
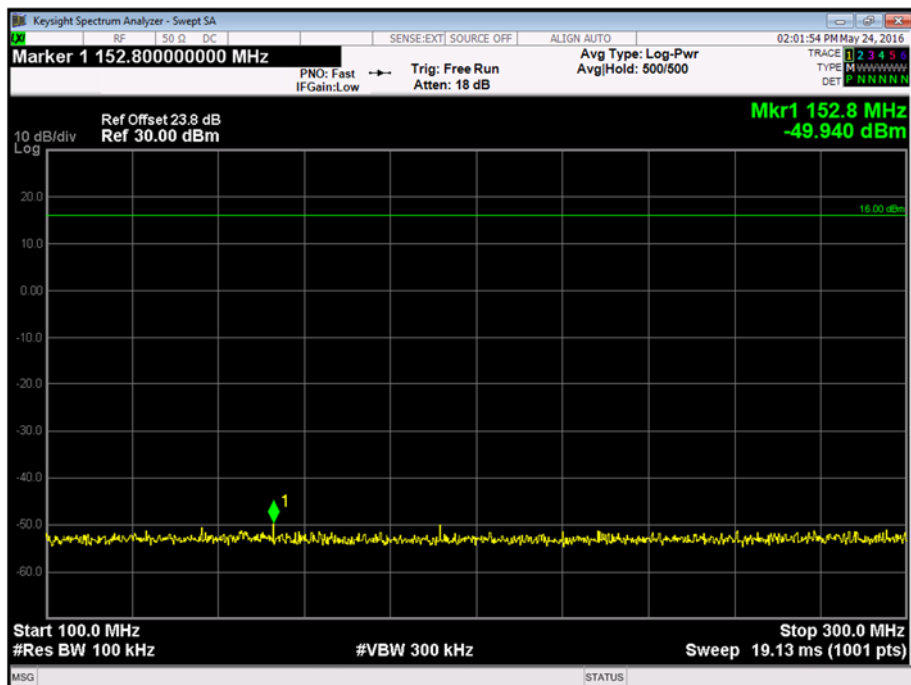
Frequency of Interfering Emissions	Power to Artificial Antenna (μ W)	Power to Artificial Antenna (dBm)
9 kHz to 30 MHz	0.008	-50.748
30 MHz to 100 MHz	0.009	-50.439
100 MHz to 300 MHz	0.010	-49.940
300 MHz to 1000 MHz	0.012	-49.262

VHF, 156.800 MHz, 9 kHz to 30 MHz, Suppression of Interference Aboard Ships Plot





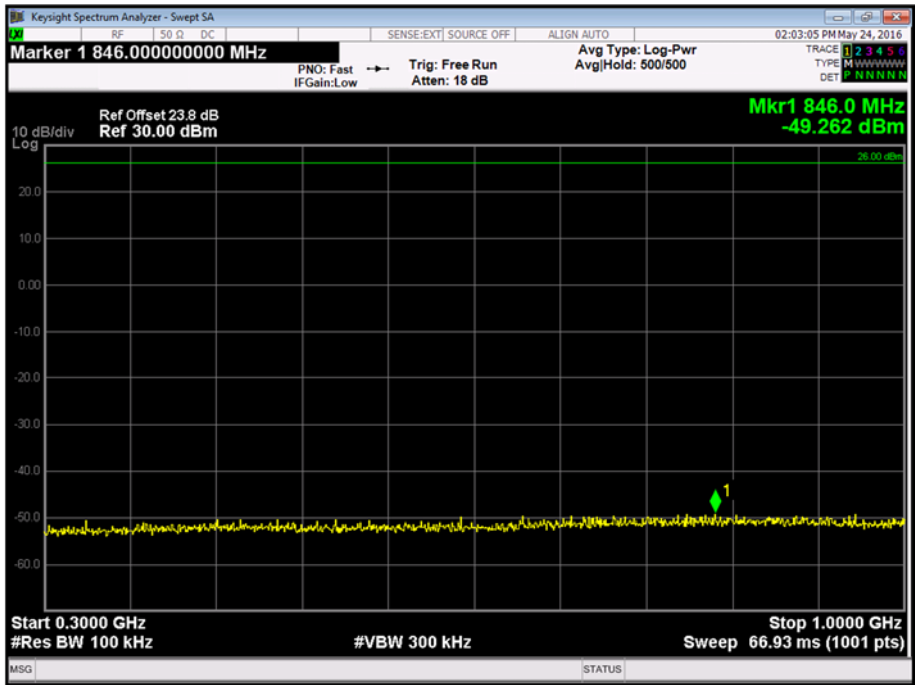
Product Service

VHF, 156.800 MHz, 30 MHz to 100 MHz, Suppression of Interference Aboard Ships PlotVHF, 156.800 MHz, 100 MHz to 300 MHz, Suppression of Interference Aboard Ships Plot



Product Service

VHF, 156.800 MHz, 300 MHz to 1000 MHz, Suppression of Interference Aboard Ships Plot



FCC 47 CFR Part 80, Limit Clause 80.217 (b)

The EUT shall 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:

Frequency of interfering emissions	Power to artificial antenna in μ W
Below 30 MHz	400
30 to 100 MHz	4,000
100 to 300 MHz	40,000
Over 300 MHz	400,000



Product Service

SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 - Bandwidths					
Power Supply Unit	Hewlett Packard	6253A	441	-	O/P Mon
Multimeter	Fluke	75 Mk3	455	12	10-Sep-2016
Audio Analyser	Hewlett Packard	8903B	1350	12	16-Nov-2016
Audio Analyser	Hewlett Packard	8903B	1881	12	16-Nov-2016
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Attenuator (20dB, 150W)	Narda	769-20	3367	12	29-May-2016
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	19-Aug-2016
Section 2.2 - Transmitter Frequency Tolerances					
Digital Temperature Indicator + T/C	Fluke	51	412	12	2-Mar-2017
Power Supply Unit	Hewlett Packard	6253A	441	-	O/P Mon
Multimeter	Fluke	75 Mk3	455	12	10-Sep-2016
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Modulation Analyser	Hewlett Packard	8901B	555	12	1-Dec-2016
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	3-Sep-2016
Sensor Module	Hewlett Packard	11722A	3293	12	3-Dec-2016
Attenuator (20dB, 150W)	Narda	769-20	3367	12	29-May-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	3-Sep-2016
Section 2.3 - Spurious Emissions at Antenna Terminal					
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	26-Aug-2017
Multimeter	Iso-tech	IDM-101	466	12	11-Sep-2016
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	05-Mar-2017
Audio Analyser	Hewlett Packard	8903B	1350	12	16-Nov-2016
High Pass Filter	Mini-Circuits	NHP-300	1640	12	17-Sep-2016
Audio Analyser	Hewlett Packard	8903B	1881	12	16-Nov-2016
Programmable Power Supply	Iso-tech	IPS 2010	2435	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Attenuator (20dB, 150W)	Narda	769-20	3367	12	29-May-2016
Attenuator (20dB, 150W)	Narda	769-20	3368	12	31-May-2017
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
TRUE RMS MULTIMETER	Fluke	179	4006	12	09-Dec-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	05-Mar-2017
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	TU
Section 2.4 - Radiated Spurious Emissions					
Modulation Analyser	Hewlett Packard	8903B	44	12	7-Oct-2016
Audio Analyser	Hewlett Packard	8903B	576	12	8-Jun-2016
Modulation Analyser	Hewlett Packard	8901B	773	12	27-Jun-2016
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	matur GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	matur GmbH	NCD	3917	-	TU
PXI RF Synthesizer	Aeroflex	3011	4014	24	29-Jan-2018
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	TU
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	29-Dec-2016



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.5 – Modulation Requirements					
Power Supply Unit	Hewlett Packard	6253A	441	-	O/P Mon
Multimeter	Fluke	75 Mk3	455	12	10-Sep-2016
Audio Analyser	Hewlett Packard	8903B	1881	12	16-Nov-2016
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Attenuator (20dB, 150W)	Narda	769-20	3367	12	29-May-2016
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	19-Aug-2016
Section 2.6 - Transmitter Power					
Power Supply Unit	Hewlett Packard	6253A	441	-	O/P Mon
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	26-Aug-2017
Multimeter	Fluke	75 Mk3	455	12	10-Sep-2016
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Attenuator (20dB, 150W)	Narda	769-20	3367	12	29-May-2016
Attenuator (10dB, 150W)	Narda	769-10	3368	12	31-May-2017
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	19-Aug-2016
Signal Analyser	Rohde & Schwarz	FSQ 26	3548	12	15-Sep-2017
Calibration Unit	Rohde & Schwarz	ZV-Z54	4006	12	09-Dec-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	TU
Section 2.7 - Suppression of Interface Aboard Ships					
Power Supply Unit	Hewlett Packard	6253A	441	-	O/P Mon
Multimeter	Fluke	75 Mk3	455	12	10-Sep-2016
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Attenuator (20dB, 150W)	Narda	769-20	3367	12	29-May-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016

TU – Traceability Unscheduled

O/P MON – Output Monitored with Calibrated Equipment



3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	MU
Radiated Spurious Emissions	± 3.08 dB
Spurious Emissions at Antenna Terminal	± 3.454 dB
Modulation Requirements	-
Suppression of Interference Aboard Ships	-
Bandwidths	± 58.05 Hz
Transmitter Power	± 0.70 dB
Transmitter Frequency Tolerances	± 11 Hz



Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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