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FCC PART 80 AND IC RSS-182 (i5) TEST REPORT

APPLICANT	YAESU MUSEN CO., LTD.
	TENNOZU PARKSIDE BUILDING 2-5-8 HIGASHI-SHINAGAWA, SHINAGAWA-KU, TOKYO 140-0002 JAPAN
FCC ID	K6630583X3D
IC CERTIFICATION	511B-30583X3D
MODEL NUMBER	GX1300
PRODUCT DESCRIPTION	CLASS D DSC MARINE TRANSCEIVER
DATE SAMPLE RECEIVED	12/15/2014
DATE TESTED	12/23/2014
TESTED BY	Cory Leverett
APPROVED BY	Sid Sanders
TIMCO REPORT NO.	2303AUT14TestReport.docx
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.



TABLE OF CONTENTS

GENERAL REMARKS	Error! Bookmark not defined.
GENERAL INFORMATION.....	Error! Bookmark not defined.
TEST PROCEDURES.....	Error! Bookmark not defined.
TECHNICAL DATA	Error! Bookmark not defined.
RF POWER OUTPUT.....	Error! Bookmark not defined.
MODULATION CHARACTERISTICS.....	Error! Bookmark not defined.
AUDIO FREQUENCY RESPONSE	Error! Bookmark not defined.
AUDIO LOW PASS FILTER	Error! Bookmark not defined.
AUDIO INPUT VERSUS MODULATION	Error! Bookmark not defined.
OCCUPIED BANDWIDTH	Error! Bookmark not defined.
SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED) ..	Error! Bookmark not defined.
FIELD STRENGTH OF SPURIOUS EMISSIONS.....	Error! Bookmark not defined.
RECEIVER RADIATED SPURIOUS EMISSIONS	Error! Bookmark not defined.
FREQUENCY STABILITY	Error! Bookmark not defined.
EMC EQUIPMENT LIST	Error! Bookmark not defined.

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

Summary

The device under test does:

fulfill the general approval requirements as identified in this test report
 not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025: 2005 requirements.

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Authorized Signatory Name:

Cory Leverett
Engineering Project Manager

Date: **12/23/2014**



TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

GENERAL INFORMATION

DUT Specification

DUT Description	CLASS D DSC MARINE TRANSCEIVER
FCC ID	K6630583X3D
IC Certification	511B-30583X3D
Model Number	GX1300
Operating Frequency	156.025-157.425 MHz
Test Frequencies	156.05 MHz, 157.425 MHz
No. of Channels	All authorized part 80 marine channels with wx band
Type of Emission	16K0G3E, 16K0G2B
Modulation	FM
DUT Power Source	<input type="checkbox"/> 110–120Vac/50– 60Hz
	<input checked="" type="checkbox"/> DC Power 12V
	<input type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
Type of Equipment	<input type="checkbox"/> Fixed
	<input checked="" type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
Antenna Connector	SO-239
Test Conditions	The temperature was 26°C Relative humidity of 50%.
Modification to the DUT	None
Test Exercise	The DUT was placed in continuous transmit mode.
Applicable Standards	ANSI/TIA 603-D:2010, FCC CFR 47 Part 80, IC RSS-182 (issue 5) and RSS-GEN (issue 4)
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
 FCC ID: K6630583X3D
 IC CERT #: 511B-30583X3D
 Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx



TEST PROCEDURES

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-D: 2010 using a 50uH LISN. Both lines were observed with the DUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Bandwidth 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

Power Output: The RF power output was measured at the antenna feed point using a peak power meter.

Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

Radiation Interference: The test procedure used was ANSI C63.4-2009 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a micro volt at the output of the antenna.

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

TECHNICAL DATA

80.203 (b) **External Controls:** The transmitter is capable of changing frequency between 156.05 – 157.425 MHz by external control. The available channels are shown in the User Manual description Channel List. These channels are preprogrammed by the manufacturer and change of frequency is inaccessible to the station operator.

80.203 (c) Five minutes continuous transmission test. The antenna was connected to a dummy load and the radio was locked in a transmit PTT mode. An external timer digital clock was used to observe the duration of the un-modulated transmission. The transmitter turned off and the radio went to receive mode at **4** minutes, **50** seconds as displayed by the external digital clock.

80.203 (n) This radio complies with the requirement for DSC capability in the 156 – 162 MHz band and in accordance with 80.225.

80.873; 80.956 Transmitter G3E emission capability: The transmitter was connected to 50 ohm resistive wattmeter and the frequency was set to 156.300 and to 156.800 MHz. With normal modulation, the output power displayed was 25 Watts at the high power setting and 1 watt at low power setting, consistent with previous measurements.

The transmitter has been demonstrated to be capable, with normal operating voltages applied, of delivering 25 watts of carrier power into a 50 ohm resistive load over the specified frequencies.

80.911 (a) 80.956 G3E Transmissions: This radio is capable of G3E emission on 156.300 and 156.800 MHz

80.911 (c) With 13.6 VDC applied and with the radio connected to a 50 ohm resistive wattmeter, the output power was measured at 156.300 and 156.800 MHz with a measured reading shown later in this report under normal speech modulation.

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

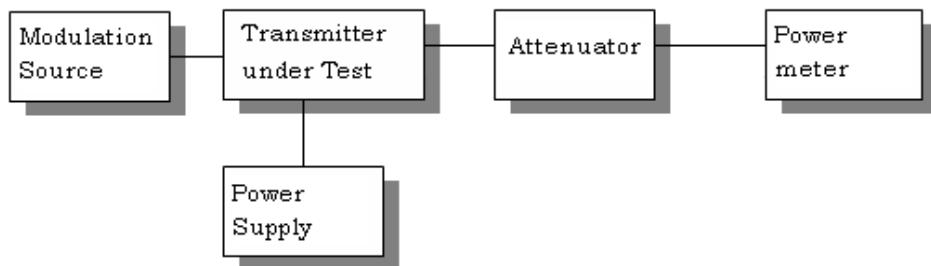
RF POWER OUTPUT

Rule Part No.: FCC Part 2.1046(a), 80.215(e)(1), IC RSS-82

Test Requirements:

Method of Measurement: RF power is measured by connecting as per setup diagram. With a nominal voltage, and the transmitter properly adjusted the RF output measures:

Test Setup Diagram:



Test Data:

OUTPUT POWER: Channel 1 156.05 MHz
 HIGH -24.88 Watts (43.96 dBm)
 LOW -.96 Watts (29.85 dBm)

Part 2.1033 (C)(8) DC Input into the final amplifier

FOR LOW POWER SETTING INPUT POWER: $(13.6V)(0.4A) = 5.44$ Watts
 FOR HIGH POWER SETTING INPUT POWER: $(13.6V)(2.9A) = 39.44$ Watts

Rule Part No.: FCC Part 80.911 (d)(2) 80.959

Test Requirements: With the power supply set to 13.6 VDC, and the output of the Transmitter terminated in a 50 ohm matching artificial load, the transmitter output power was monitored over a 10 minute continuous operational period while in full power. The output power varied from the nominal 25 Watts output power to 24.8 Watts output power

Test Data:

OUTPUT POWER: Start of Test Power Output = 24.88
 End of Test(Tx times out at 5 Minutes) Power = 24.81

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
 FCC ID: K6630583X3D
 IC CERT #: 511B-30583X3D
 Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx



MODULATION CHARACTERISTICS

Part 2.1033(c) (4) Type of Emission: 16K0G3E, 16K0F3E
FCC Part 80.205(a)
RSS-182, RSS-GEN

$$\begin{aligned}B_n &= 2M + 2DK \\M &= 3000 \\D &= 4.6\text{kHz} \text{ (Peak Deviation)} \\K &= 1 \\B_n &= 2(3000) + 2(4.6K)(1) = 16.0K\end{aligned}$$

80.205(a) ALLOWED AUTHORIZED BANDWIDTH – 20.00 kHz

The 99 % bandwidth for the DSC is 16 kHz. 16K0G2B

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

AUDIO FREQUENCY RESPONSE

Rule Part No.: FCC Part 2.1047(a)(b), IC RSS-182

Test Requirements:

Method of Measurement:

The audio frequency response was measured in accordance with ANSI/TIA 603-D: 2010. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted. The audio frequency response curve is shown below.

AUDIO FREQUENCY RESPONSE PLOT

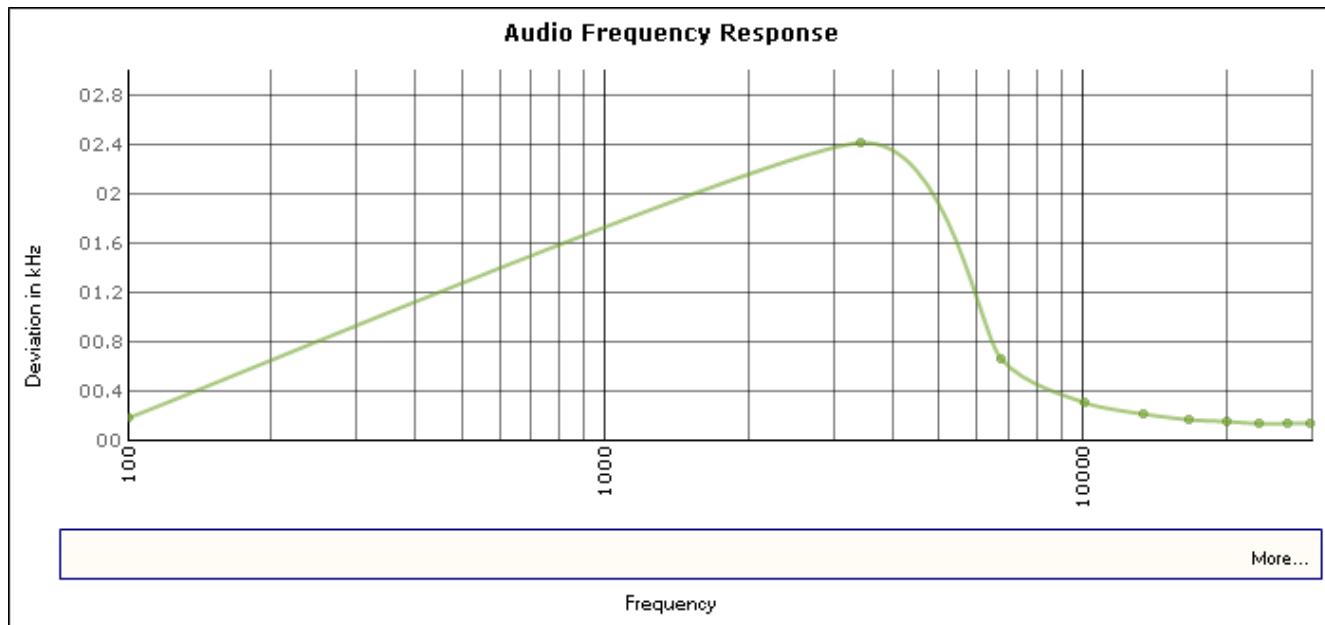


TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

AUDIO LOW PASS FILTER

VOICE MODULATED COMMUNICATION EQUIPMENT

Rule Part No.: 2.1047(a)

For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all the circuitry installed between the modulation limiter and the modulated stage shall be submitted.

AUDIO LOW PASS FILTER

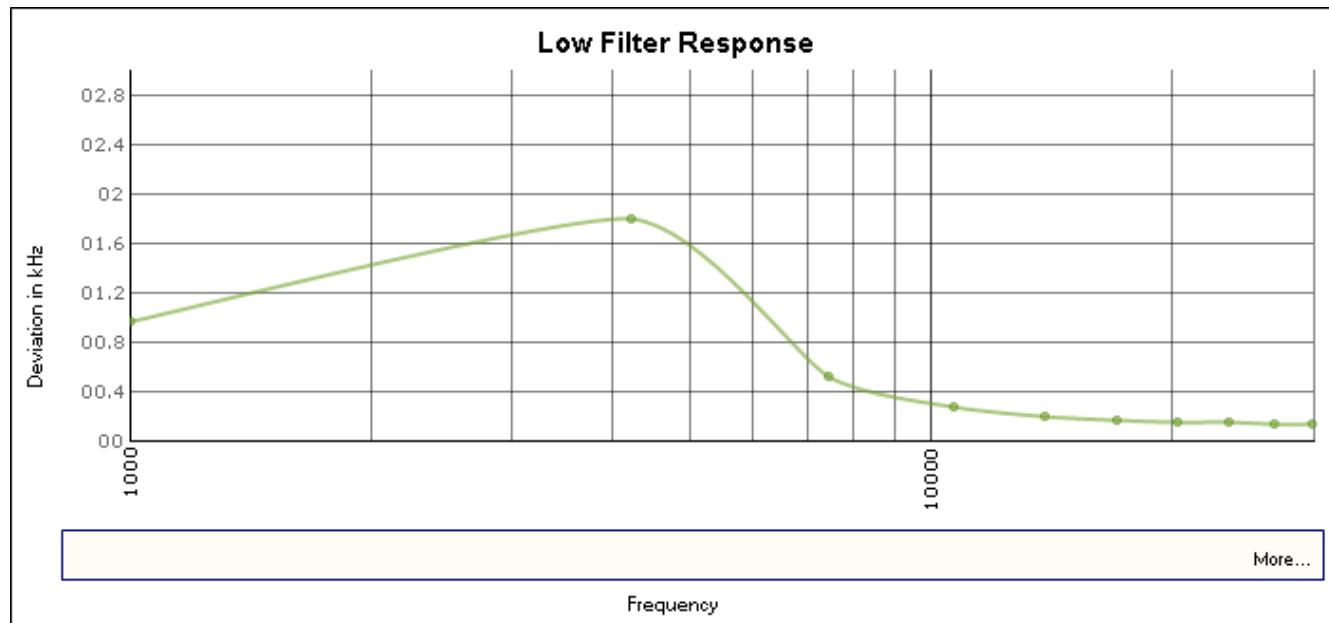


TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

AUDIO INPUT VERSUS MODULATION

Rule Part No.: FCC Part 2.1047(b) & 80, IC RSS-182

Test Requirements: Modulation cannot exceed 100%.

Method of Measurement: The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-D: 2010. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

Test data:

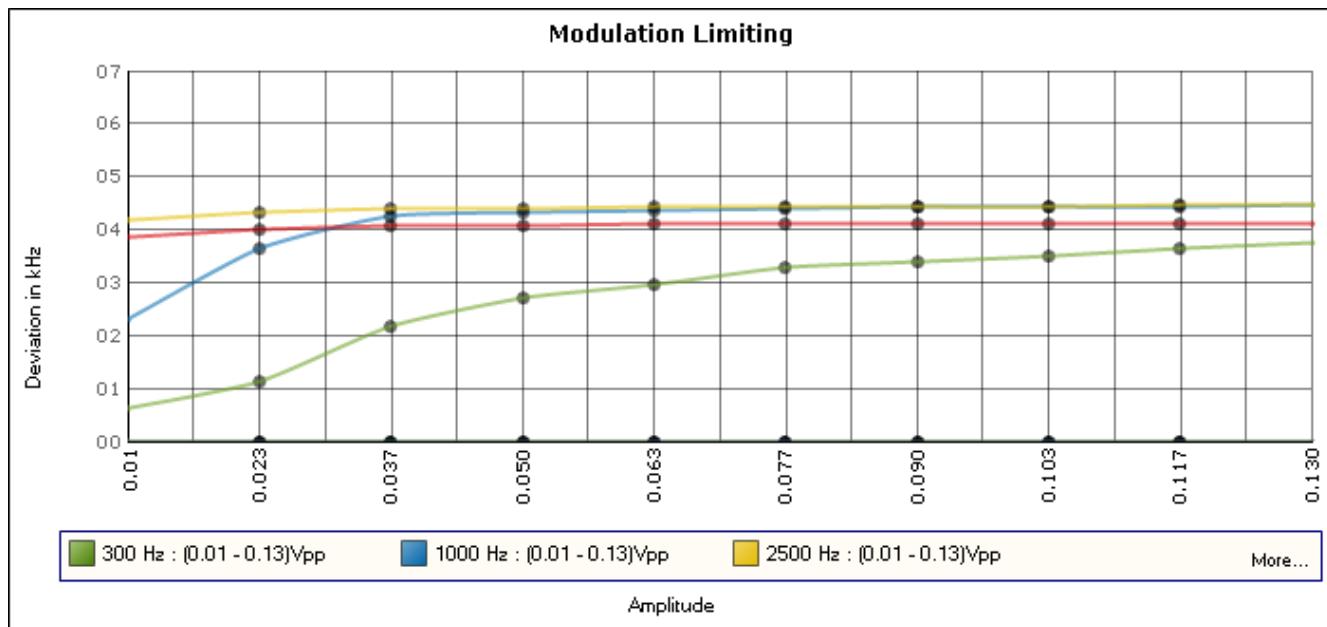


TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
 FCC ID: K6630583X3D
 IC CERT #: 511B-30583X3D
 Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

OCCUPIED BANDWIDTH

FCC Part 2.1049(c), RSS-GEN 4.6
FCC Part 80.213(b) RSS-182

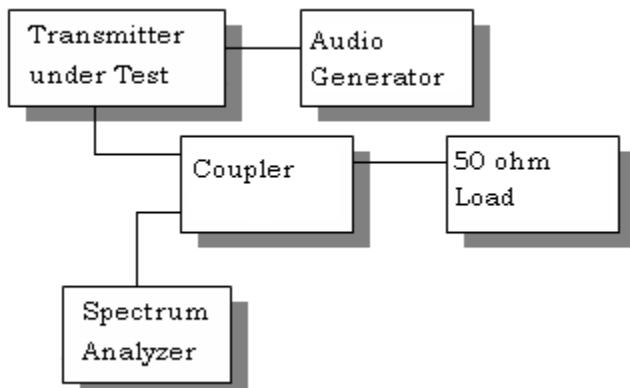
EMISSION BANDWIDTH

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least $43 + 10\log(P)$ dB.

Method of Measurement: ANSI/TIA-603-D: 2010

Test Setup Diagram:

OCCUPIED BANDWIDTH MEASUREMENT



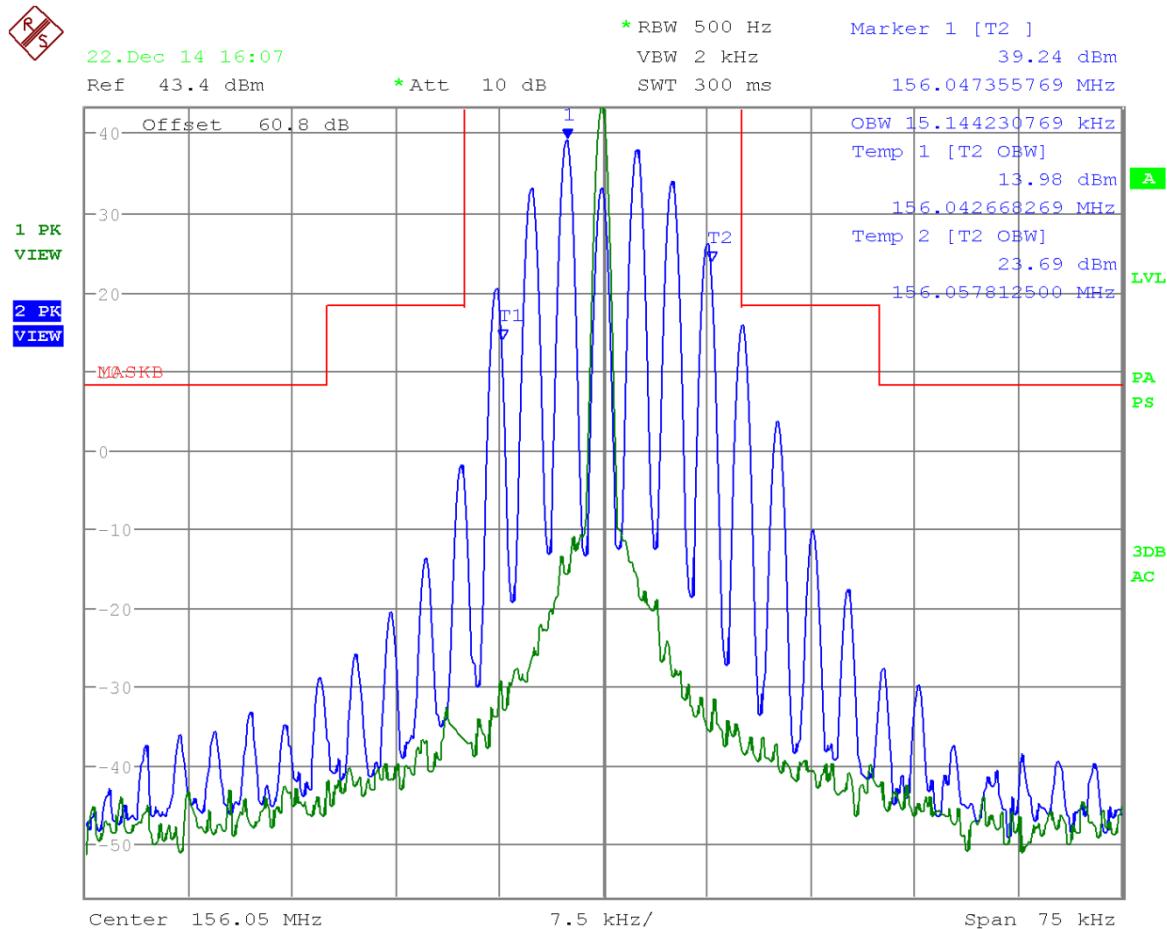
Test Data: See the plot below

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

Occupied bandwidth audio

High Power 156.05 MHz
99% Occupied Bandwidth = **15.14 KHz**



Date: 22.DEC.2014 16:07:07

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
 FCC ID: K6630583X3D
 IC CERT #: 511B-30583X3D
 Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx



SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Part 2.1051(a), 80.211, RSS-182

Requirements: Emissions must be $43 + 10\log(PO)$ dB below the mean power output of the transmitter.

Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-D: 2010.

Test Data:

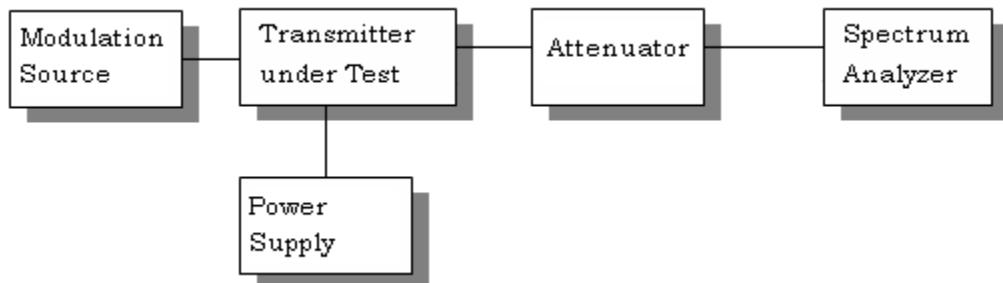
TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
156.05	312.1	89.84		156.05	312.1	80.5
	468.15	99.48			468.15	94.01
	624.2	103.9			624.2	93.21
	780.25	100.25			780.25	92.4
	936.3	108.8			936.3	93.05
	1092.35	107.97			1092.35	93.55
	1248.4	109.12			1248.4	94.01
	1404.45	108.09			1404.45	93.21
	1560.5	104.63			1560.5	94.68

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
157.425	314.85	91.23		157.425	314.85	82.98
	472.275	99.89			472.275	95.16
	629.7	104.99			629.7	94.31
	787.125	99.83			787.125	90.26
	944.55	108.59			944.55	93.5
	1101.975	108.73			1101.975	93.74
	1259.4	107.91			1259.4	93.26
	1416.825	107.61			1416.825	93.86
	1574.25	105.41			1574.25	93.28

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI/TIA 603-D: 2010.

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

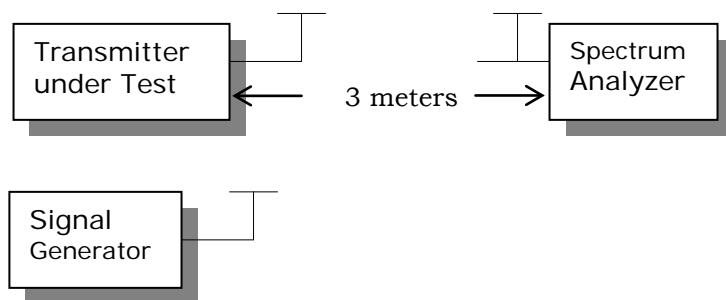
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 2.1053, RSS-182

Requirements: Emissions must be $43 + 10\log(PO)$ dB below the mean power output of the transmitter.

METHOD OF MEASUREMENT: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603-D: 2010 using the substitution method. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

Test Setup Diagram:



[TABLE OF CONTENTS](#)

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630583X3D
IC CERT #: 511B-30583X3D
Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

Test Data: LOW POWER: High End of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
157.42	Lo	30.00	1.00	43.00	25.00
Emission Frequency (MHz)	Ant. Polarity		Below Carrier (dBc)	Margin	
314.85		H	85.51		42.51
472.28		V	84.31		41.31
629.70		H	92.04		49.04
787.13		H	82.63		39.63
944.55		V	89.52		46.52
1,101.98		V	81.59		38.59
1,259.40		V	81.34		38.34
1,416.83		H	82.82		39.82
1,574.25		H	80.72		37.72

Test Data: HIGH POWER: Low End of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
157.42	Hi	44.00	25.12	57.00	25.00
Emission Frequency (MHz)	Ant. Polarity		Below Carrier (dBc)	Margin	
314.85		H	94.45		37.45
472.28		V	99.23		42.23
629.70		H	101.17		44.17
787.13		H	91.88		34.88
944.55		H	97.08		40.08
1,101.98		H	94.69		37.69
1,259.40		V	95.21		38.21
1,416.83		V	95.35		38.35
1,574.25		V	93.68		36.68

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
 FCC ID: K6630583X3D
 IC CERT #: 511B-30583X3D
 Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 80.209(a), RSS-182, RSS-GEN

Requirements: Temperature and voltage tests were performed to verify that the frequency remains within the .0010%, 10.0 ppm, specification limit, for 20 kHz spacing. The test was conducted as follows: The transmitter was placed in the temperature chamber at 25°C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15 second intervals. The worst-case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -20°C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute and was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute and again frequency readings were noted at 15 sec intervals. The worst-case number was recorded for temperature plotting. This procedure was repeated in 10-degree increments up to +50°C.

Method of Measurements: ANSI/TIA 603-D: 2010

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		156.6499
Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)
-30	156.6497	-0.89
-20	156.6498	-0.71
-10	156.6499	-0.2
0	156.6499	0.2
+10	156.6499	0.15
+20	156.6499	-0.04
+30	156.6498	-0.27
+40	156.6498	-0.45
+50	156.6498	-0.43

Assigned Frequency (Ref. Frequency) (MHz)		
% Battery (%)	Frequency (MHz)	Frequency Stability (PPM)
-15%	156.6499	0
0	156.6499	0
+15%	156.6499	0

TABLE OF CONTENTS

Applicant: YAESU MUSEN CO., LTD.
 FCC ID: K6630583X3D
 IC CERT #: 511B-30583X3D
 Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
12 Volt Power Supply	Astron	RS-12A	9312779	12/12/99	12/12/99
DC Power Supply	HP	6286A	1744A03842	12/12/99	12/12/99
Antenna: Biconical Chamber	Eaton Chamber	94455-1	1057	06/14/13	06/14/15
Antenna: Log-Periodic Chamber	Eaton	96005	1243	05/31/13	05/31/15
DC Power Supply	HP	6264B	2032A04119	05/06/13	05/06/15
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	08/19/14	08/19/16
AC Voltmeter	HP	400FL	2213A14728	06/26/13	06/26/15
Digital Multimeter	Fluke	77	35053830	08/22/13	08/22/15
DC Power Supply	HP	6286A	2411A09414	12/12/99	12/12/99
Frequency Counter Small Chamber	HP	5385A	3242A07460	06/16/13	06/16/15
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Ant: Double-Ridged Horn/ETS Horn 1 Ch	ETS-Lindgren Chamber	3117	00035923	06/13/14	06/13/16
Audio Analyzer	HP	8903A	2336A03066	08/30/13	08/30/15
Temperature Chamber Small	Thermotron Corp.	S1.2 Mini Max	25-1420-09	08/20/14	08/20/16
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/12/14	08/12/16
Software: Field Strength Program	Timco	N/A	Version 4.0	12/12/99	12/12/99
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
Signal Generator R & S SMIQ 02	Rohde & Schwarz	SMIQ02	DE24678	06/11/14	06/11/16
30 dB Attenuator	Narda	769-30	10267	03/15/13	03/15/15
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	03/11/14	03/11/16
Signal Generator HP 8648C	HP	8648C	3623A02898	08/29/13	08/29/15
Attenuator 30dB 500W	Bird	8325	1761	02/25/13	02/25/15

Receiver Firmware version:

The receiver firmware used was version 4.43 Service Pack 3

[TABLE OF CONTENTS](#)

Applicant: YAESU MUSEN CO., LTD.

FCC ID: K6630583X3D

IC CERT #: 511B-30583X3D

Report: Y\YAESU\2303AUT14\2303AUT14TestReport.docx