TIMCO ENGINEERING, Inc.

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

APPLICANT	COBRA ELECTRONICS CORPORATION
	6500 WEST CORTLAND STREET CHICAGO IL 60707 USA
FCC ID	BBOMRHH125B
IC CERTIFICATION	906A-MRHH125B
MODEL NUMBER	MR HH125+
PRODUCT DESCRIPTION	HANDHELD MARINE TRANSCEIVER
DATE SAMPLE RECEIVED	4/22/2014
DATE TESTED	4/28/2014
TESTED BY	Cory Leverett
APPROVED BY	Cory Leverett
TIMCO REPORT NO.	657AUT14TestReport
TEST RESULTS	☒ PASS ☐ FAIL

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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: **April 30, 2014**

GENERAL INFORMATION

DUT Specification

DUT Description	HANDHELD MARINE TRANSCEIVER
FCC ID	BBOMRHH125B
IC Certification	906A-MRHH125B
Model Number	MR HH125+
Operating Frequency	156.025-157.425 MHz
Test Frequencies	156.300, 156.700, 157.425MHz
No. of Channels	All U.S., Canadian, International and NOAA Weather Channels
Type of Emission	16K0G3E, 16K0F3E
Modulation	Phase Modulation
DUT Power Source	☐ 110–120Vac/50– 60Hz
	☐ DC Power 12V
	☒ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☐ Fixed
	☐ Mobile
	☒ Portable
Antenna Connector	Fixed Antenna
Test Conditions	The temperature was 26ºC Relative humidity of 50%.
Modification to the DUT	None
Test Exercise	The DUT was placed in continuous transmit mode.
Applicable Standards	ANSI/TIA 603-C:2004, FCC CFR 47 Part 80, IC RSS-182 (issue 5) and RSS-GEN (issue 3)
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

TEST PROCEDURES

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-C: 2004 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 10^{th} 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 C63.4-2004 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.

TECHNICAL DATA

80.203 (b)	**External Controls:** The transmitter is capable of changing frequency between 156.025 – 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, 59seconds as displayed by the external digital clock.
80.873; 80.956	The transmitter was connected to 50 ohm resistive wattmeter and the frequency was set to 156.700 and to 157.425 MHz. With normal modulation, the output power displayed was 3 Watts at the high power setting and 1 watt at low power setting, consistent with previous measurements.
80.911 (a)	80.956 G3E Transmissions: This radio is capable of G3E emission on 156.700 and 157.425 MHz
80.911 (c)	With 7.4 VDC applied and with the radio connected to a 50 ohm resistive wattmeter, the output power was measured at 156.300 and 157.475 MHz with a measured reading shown later in this report under normal speech modulation.

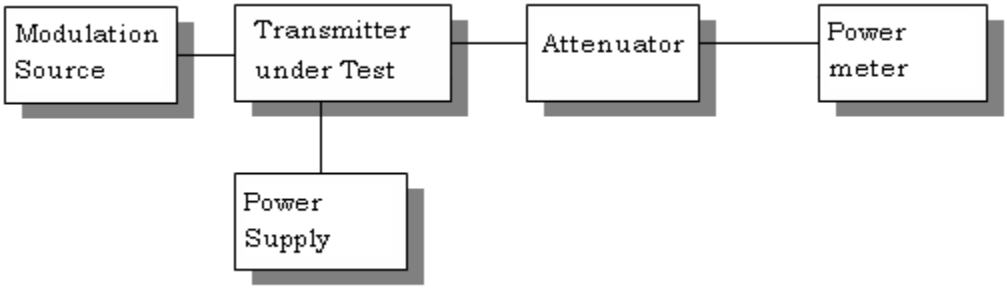
RF POWER OUTPUT

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: HIGH – 3.1w @ 156.300MHz & 157.475MHz
LOW - 1.2w @ 156.300MHz & 157.475MHz

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

FOR LOW POWER SETTING INPUT POWER: (7.4)(0.7A) = 5.2Watts
FOR HIGH POWER SETTING INPUT POWER: (7.4)(1.5) = 11.1Watts

MODULATION CHARACTERISTICS

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

Bn = 2M + 2DK
M = 3000
D = 4.3kHz (Peak Deviation)
K =1
Bn = 2(3000)+2(4.3K)(1) = 14.6K

80.205(a) ALLOWED AUTHORIZED BANDWIDTH – 20.00 kHz

AUDIO FREQUENCY RESPONSE

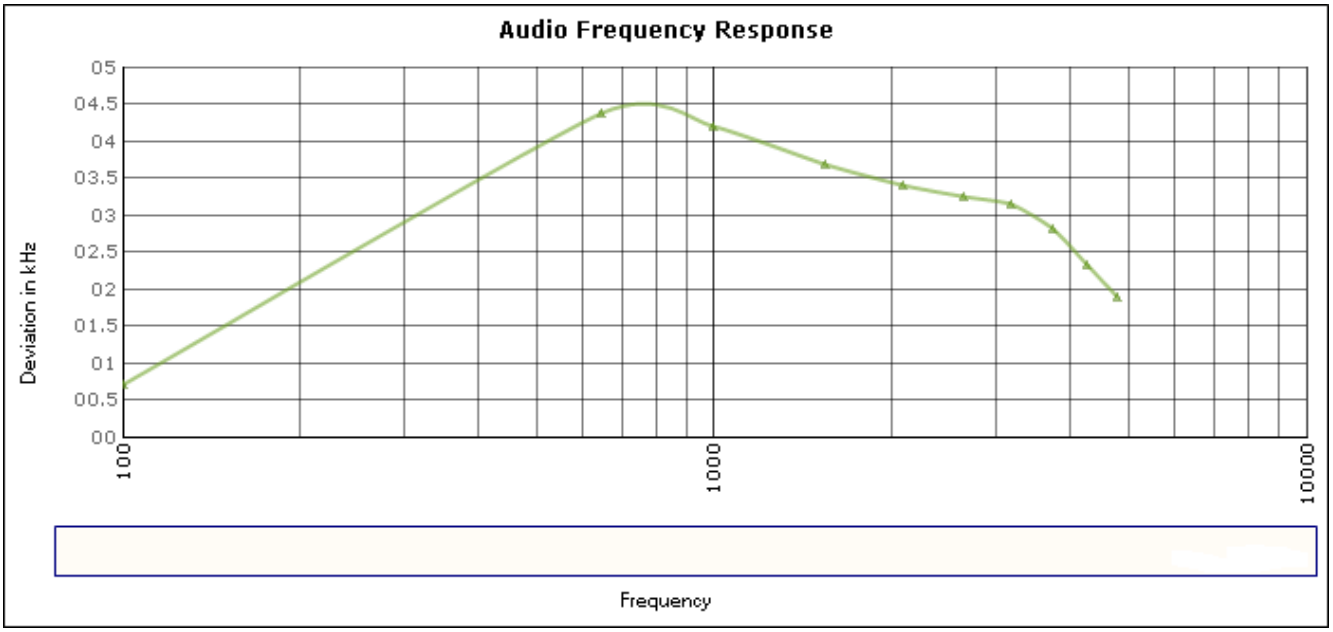
Rule Part No.: FCC Part 2.1047(a)(b), IC RSS-182

Test Requirements:

Method of Measurement:

The audio frequency response was measured in accordance with ANSI/TIA 603-C: 2004. 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



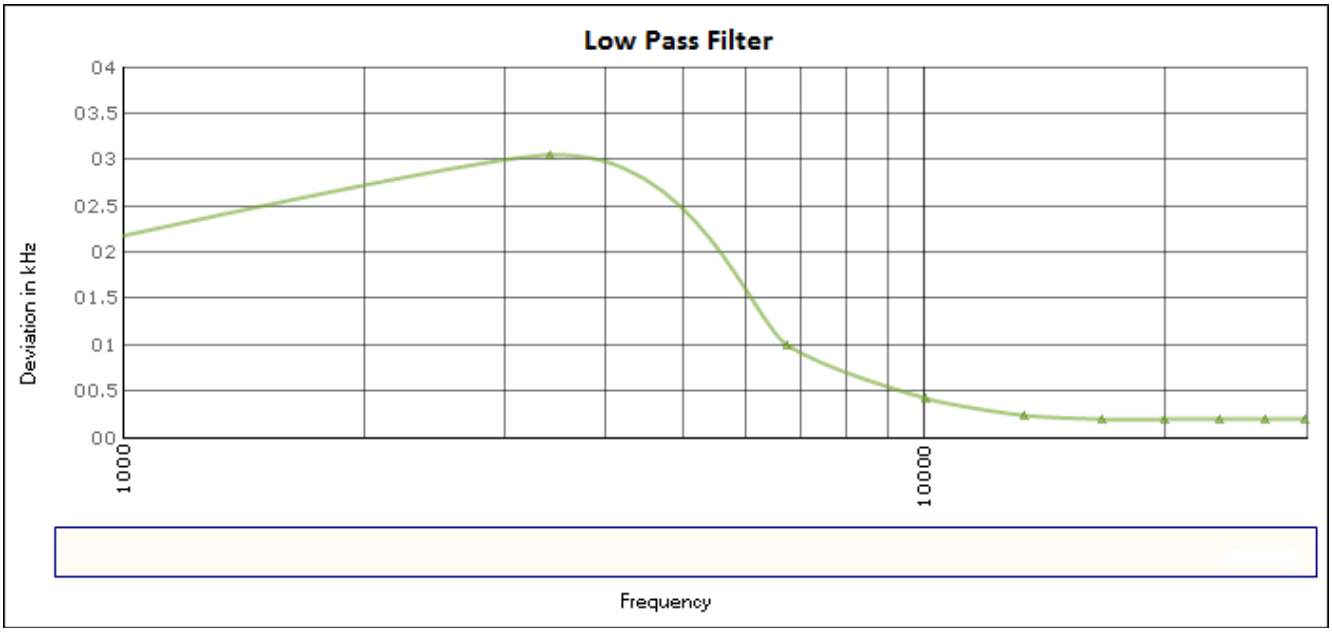
AUDIO LOW PASS FILTER

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



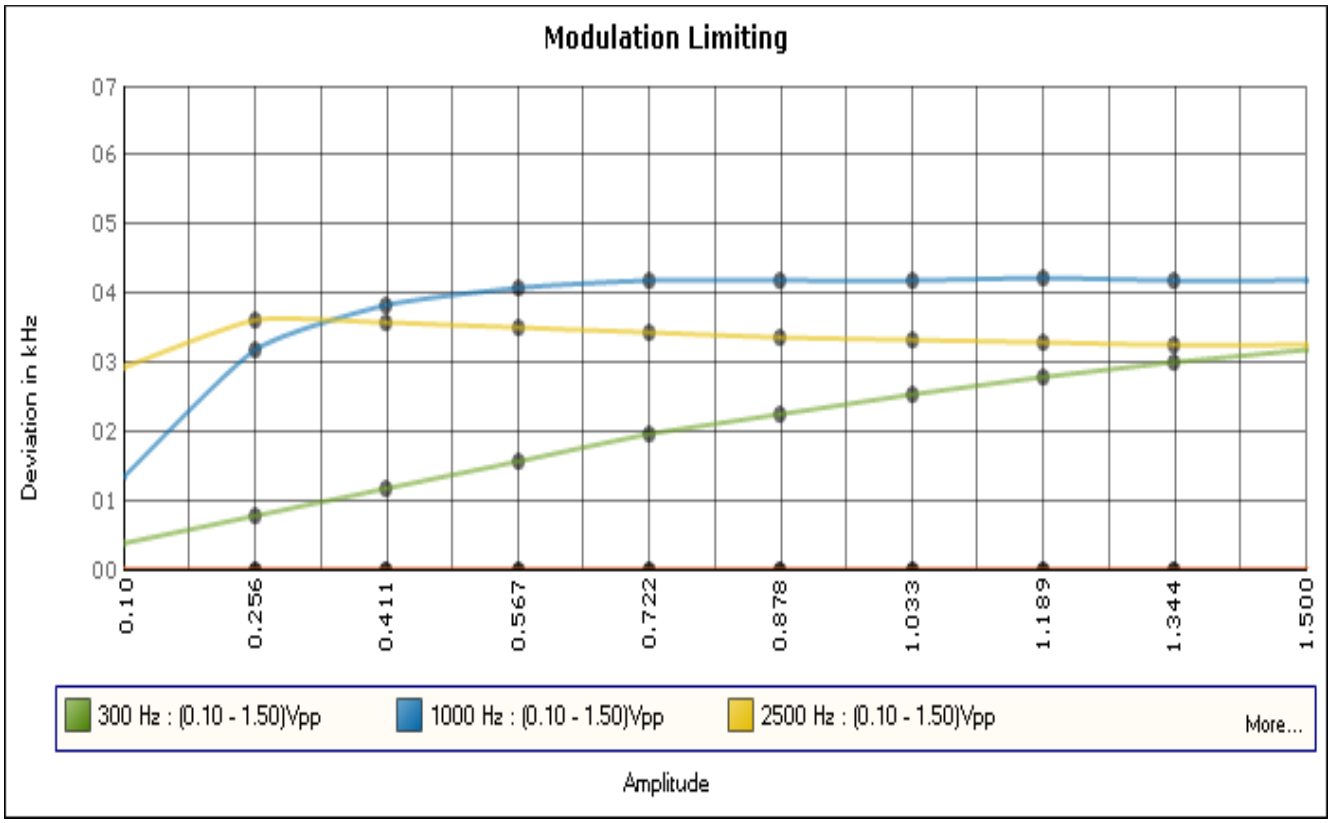
AUDIO INPUT VERSUS MODULATION

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-C: 2004. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

Test data:



OCCUPIED BANDWIDTH

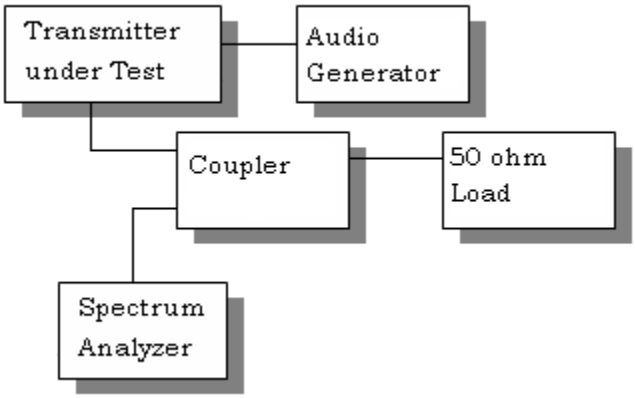
FCC Part 2.1049(c), RSS-GEN 4.6 EMISSION BANDWIDTH
FCC Part 80.213(b) RSS-182

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 + 10log(P)dB.

Method of Measurement: ANSI/TIA-603-C: 2004

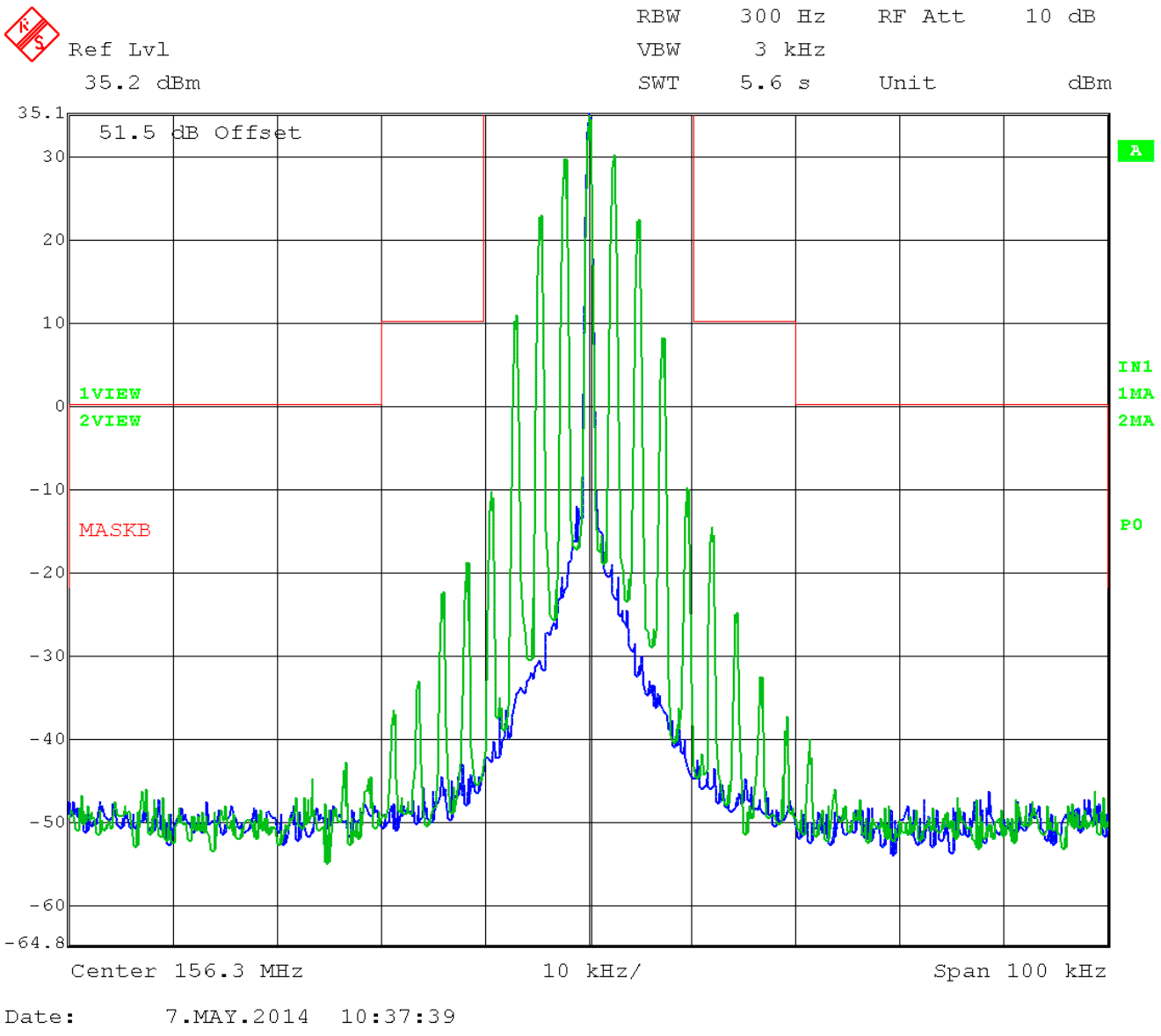
Test Setup Diagram:

OCCUPIED BANDWIDTH MEASUREMENT



Test Data: See the plot on the following page.

Occupied bandwidth High Power 156.300MHz



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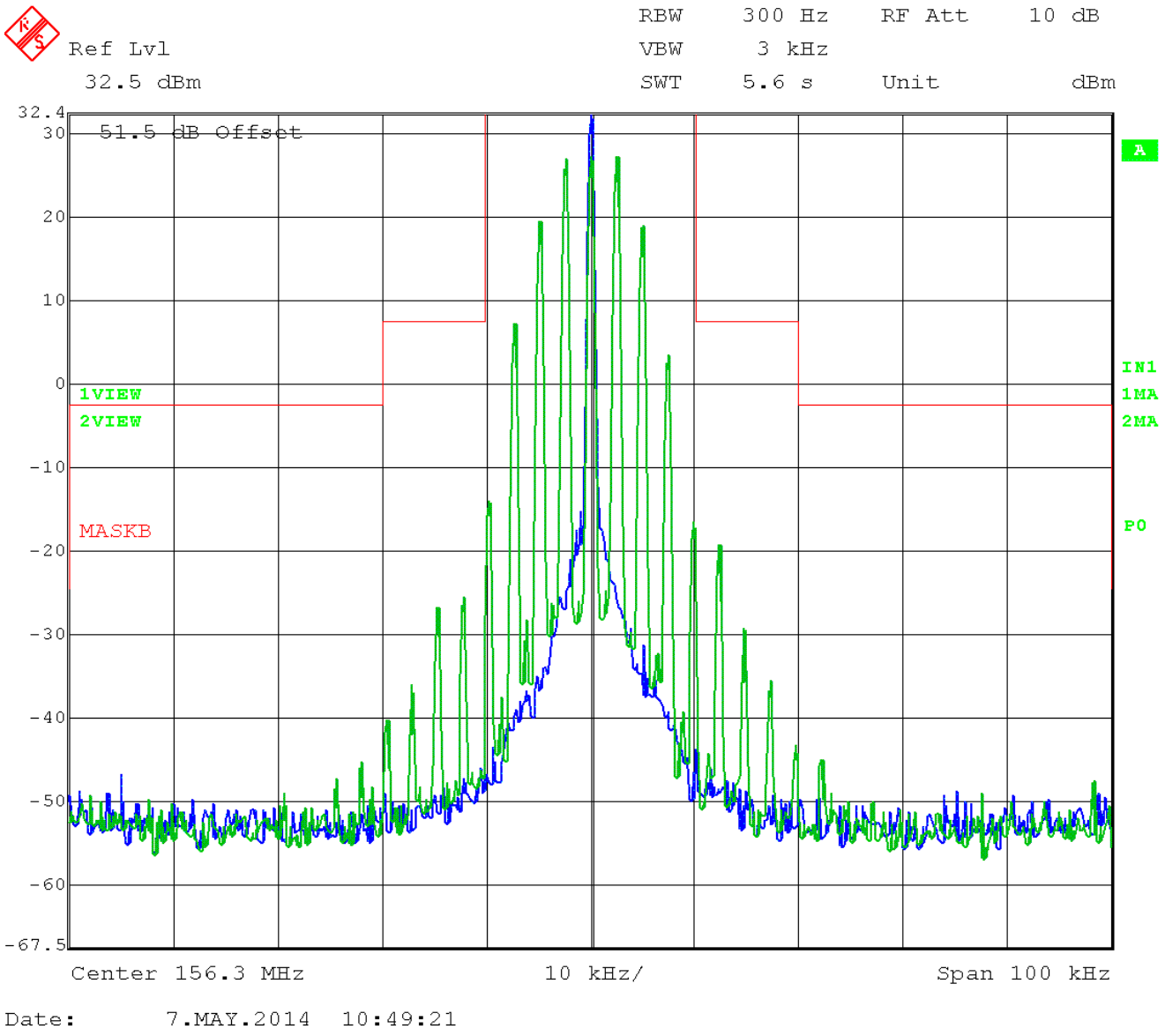
Occupied bandwidth Low Power 156.300MHz



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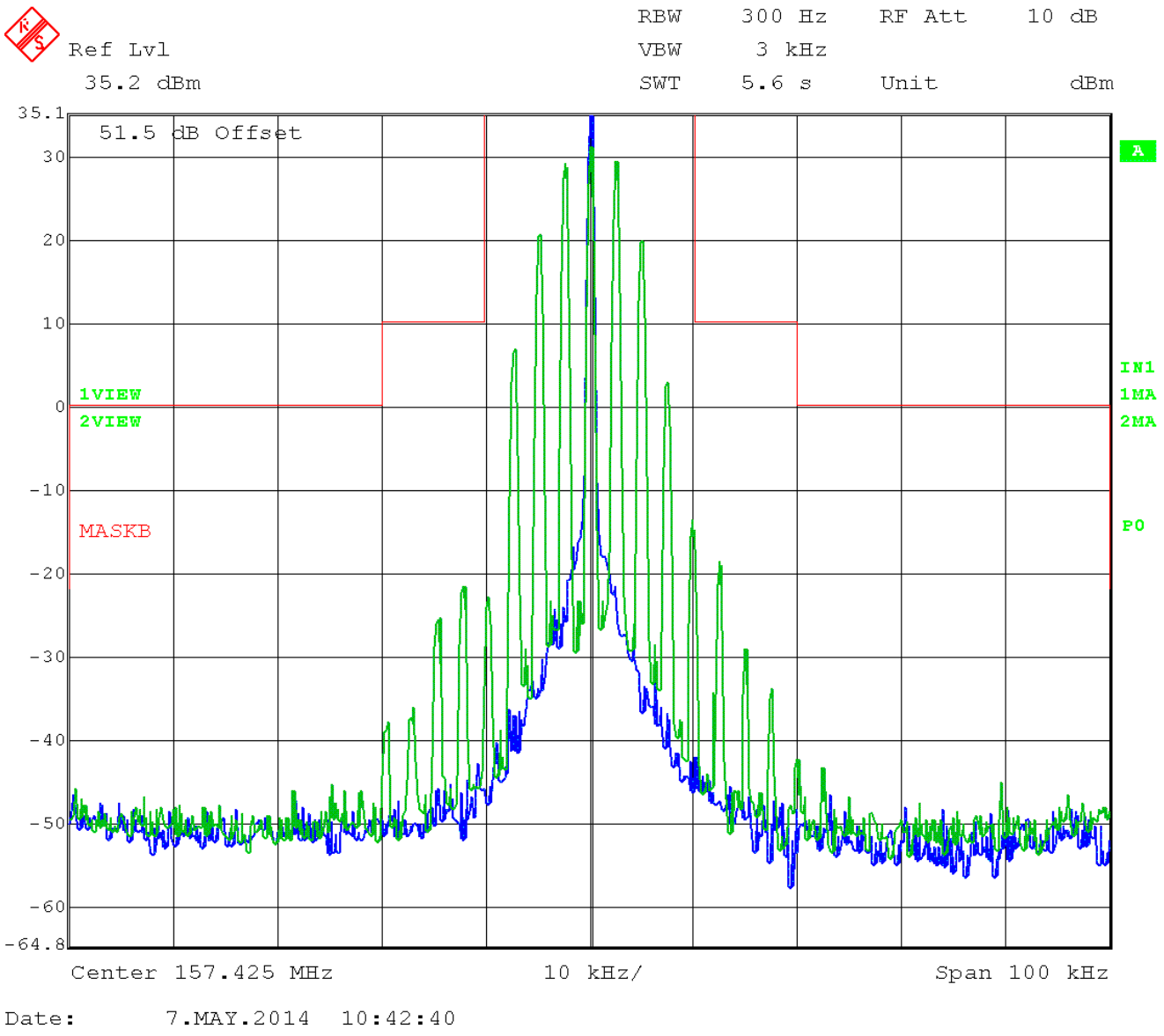
Occupied bandwidth High Power 157.425MHz



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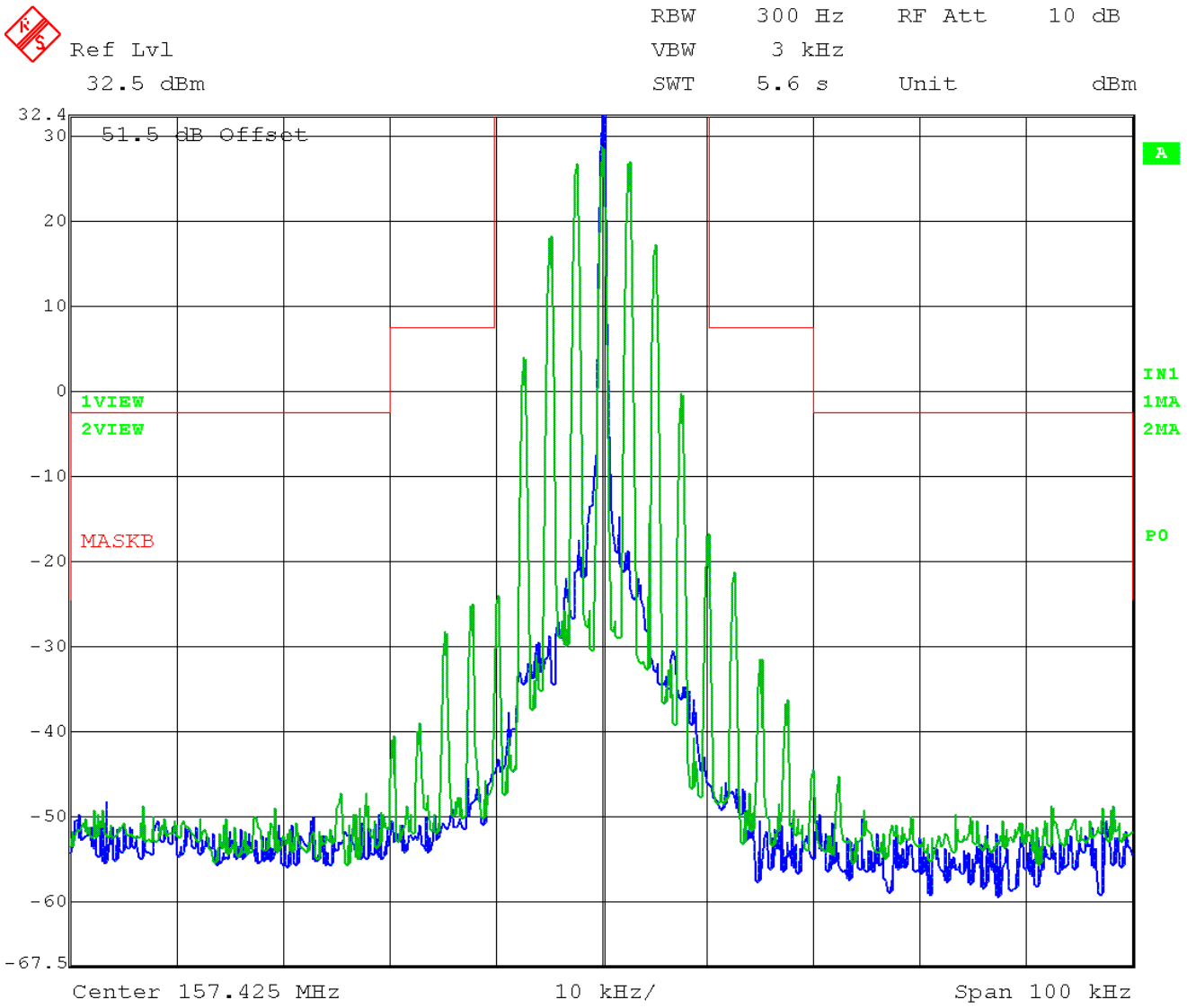
Occupied bandwidth Low Power 157.425MHz



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Report: C\COBRA\657AUT14\657AUT14TestReport

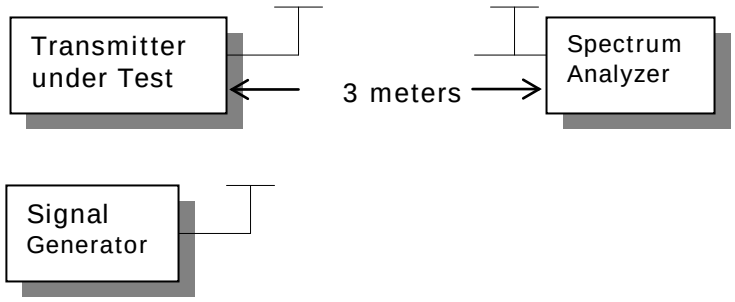
FIELD STRENGTH OF SPURIOUS EMISSIONS

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

Requirements: Emissions must be 43+10log(3W) 46dB 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-C: 2004 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:



Test Data: **Please see the tables on the following pages.**

Ch 14 156.700MHz Low Power		
Emission Frequency MHz	**Ant. Polarity**	**dB Below Carrier (dBc)**
156.70	H	0
313.40	H	76.91
470.10	V	73.46
626.80	H	76.17
783.50	H	77.93
940.20	V	75.88
1096.90	H/V	NE
1253.60	H/V	NE
1410.30	H/V	NE
1723.70	H/V	NE
1880.40	H/V	NE

Ch 14 156.700MHz High Power		
Emission Frequency MHz	**Ant. Polarity**	**dB Below Carrier (dBc)**
156.70	H	0
313.40	H	77.1
470.10	H	85.77
626.80	V	78.32
783.50	H	80.89
940.20	H	80.46
1096.90	H/V	NE
1253.60	H/V	NE
1410.30	H/V	NE
1723.70	H/V	NE
1880.40	H/V	NE

Ch 88 157.425MHz Low Power		
Emission Frequency MHz	**Ant. Polarity**	**dB Below Carrier (dBc)**
157.43	V	0.00
314.85	H	75.72
472.28	V	76.87
629.70	H	82.14
787.13	H	78.25
944.55	V	77.20
1101.97	H/V	NE
1259.40	H/V	NE
1416.82	H/V	NE
1574.25	H/V	NE
1731.67	H/V	NE

Ch 88 157.425MHz High Power		
Emission Frequency MHz	**Ant. Polarity**	**dB Below Carrier (dBc)**
157.43	H	0.00
314.85	H	81.63
472.28	V	86.47
629.70	V	81.39
787.13	H	82.66
944.55	V	81.51
1101.97	H/V	NE
1259.40	H/V	NE
1416.82	H/V	NE
1574.25	H/V	NE
1731.67	H/V	NE

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-C: 2004

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		156.3001
Temperature (°C)	**Frequency (MHz)**	**Frequency Stability (PPM)**
-30	156.2987	-8.98
-20	156.2994	-4.63
-10	156.2998	-2.06
0	156.3	-0.74
+10	156.3001	0.22
+20	156.3001	0.19
+30	156.3001	-0.29
+40	156.3	-0.75
+50	156.3001	-0.08

Assigned Frequency (Ref. Frequency) (MHz)		156.3001
% Battery (%)	**Frequency (MHz)**	**Frequency Stability (PPM)**
-15%	156.3001	-0.03
0	156.3001	-0.04
+15%	156.3001	-0.05

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical	Eaton	94455-1	1096	05/10/13	05/10/15
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/09/13	05/09/15
Frequency Counter	HP	5385A	2730A03025	08/22/13	08/22/15
Signal Generator	HP	8640B	2308A21464	02/23/14	02/23/16
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
Digital Multimeter	Fluke	77	35053830	08/22/13	08/22/15
Temperature Chamber	Thermotron Corp.	S1.2 Mini Max	25-1420-09	07/03/12	07/03/14
Antenna: Double-Ridged Horn	ETS-Lindgren	3117	00035923	12/07/13	12/07/15
Antenna: Double-Ridged Horn	Electro-Metrics	RGA-180	2319	06/19/12	06/19/14
Function Generator	SRS	DS345/12	38435	06/19/13	06/19/15
Software: Field Strength	Timco	N/A	Version 4.0	N/A	N/A
EMI Test Receiver	Rhode & Schwarz	ESIB 40	100274	02/15/13	02/15/2015
DC Power Supply	HP	6264B	2032A04119	05/06/13	05/06/15
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	06/14/12	06/14/14
RF Power Meter	Boonton	4531	11793	01/19/17	01/19/15
EMI Test Receiver	Rhode & Schwarz	ESU 40	100320	03/21/13	03/21/15
Temperature Chamber	Tenney Engineering	TTRC	11717-7	07/03/12	07/03/14
Frequency Counter	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
Signal Generator	Aeroflex	82536	V08X02B87	06/28/13	06/28/15
DC Power Supply	HP	6286A	1744A03842	N/A	N/A
Modulation Analyzer	HP	8901A	3050A05856	09/26/12	09/26/14

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3