Test Report to EN 303 413 V1.1.1

Satellite Earth Stations and Systems (SES); Global Navigation Satellite System (GNSS) receivers; Radio equipment operating in the 1 164 MHz to 1 300 MHz and 1 559 MHz to 1 610 MHz frequency bands; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

Report Number: AT72132224-1R1

Manufacturer: Johnson Outdoors Marine Electronics, Inc.

Model(s): Solix 10 SI

Test Begin Date: November 9, 2017
Test End Date: November 9, 2017

Report Issue Date: December 22, 2017

FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number AT-2021

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, NIST, or any agency of the Federal Government.

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This report contains 19 pages

Table of Contents

1.0 GENERAL 3
1.1 PURPOSE 3
1.2 MANUFACTURER INFORMATION 3
1.3 PRODUCT DESCRIPTION 3
1.4 TEST METHODOLOGY AND CONSIDERATIONS 4
1.5 MODIFICATIONS OF EUT 4
1.6 REFERENCES 4
2.0 TEST FACILITIES 5
2.1 LOCATION 5
2.2 LABORATORY ACCREDITATIONS/RECOGNITIONS/CERTIFICATIONS 5
2.3 RADIATED EMISSIONS TEST SITE DESCRIPTION 6
3.0 EQUIPMENT UNDER TEST SYSTEM BLOCK DIAGRAM 8
4.0 TEST SETUP BLOCK DIAGRAM(S) 9
5.0 CONCLUSIONS, OBSERVATIONS AND COMMENTS 11
6.0 MEASUREMENT UNCERTAINTY 11
7.0 TEST RESULTS SUMMARY 12
8.0 TEST RESULTS 13
8.1 TEST RESULTS DETAILS 13
8.1.1 Receiver spurious emissions *13*
9.0 TEST SETUP PHOTOGRAPHS 14
10.0 PHOTOGRAPHS OF THE EQUIPMENT (UUT) 15
11.0 TEST EQUIPMENT 18

1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with EN 303 413.

1.2 Manufacturer Information

Johnson Outdoors Marine Electronics, Inc.
678 Humminbird Ln
Eufaula, AL 36027

1.3 Product Description

Product Name: Solix 10
Solix 10 SI (Tested Variant)

The Humminbird Solix series is a Sonar/Fishfinder/GPS product to be used in the marine environment. The Solix 10 has a 10" display with a PCAP touchscreen, 10 keypad buttons, encoder and joystick, 2 SD card slots and displays sonar return information on the display. The Solix 10 SI has down imaging and side imaging sonar, while the Solix 10 has 2D sonar. Both variants contain a Bluetooth Low Energy and Bluetooth classic radio. This test report documents the compliance of the GNSS receiver only.

Serial number: 171012020103

Technical Information:

Detail	Description
Receiver Frequency / Alignment Range:	1575.42 MHz
Operating Voltage:	3.3Vdc
Internal Antenna Type / Gain:	18.4mm x 18.4mm x 4mm ceramic patch / 1.76dBi
Receiver Category:	3
Constellations Supported:	GPS: L1 GLONASS: G1
Temperature Category:	I (General): -20 °C to +55 °C
Type of equipment:	Mobile
Hardware version:	GNSS Receiver: 00080000
Software release:	GNSS Engine FW Rev.: 3.01

1.4 Test Methodology and Considerations

No deviation from the test method was applied.

For radiated emissions, the EUT was configured such that all accessory and support equipment was located outside the test environment to the extent possible. Those components related to the GNSS receivers were included in the test environment to facilitate measurement of emissions only related to the GNSS receiver. The EUT remained in a continuous receive state throughout the duration of the testing.

For Adjacent Band Selectivity measurements, the testing was performed on the Helix 12 CHIRP SI GPS G2N and documented in a separate test report. All models listed in this test report have the same GNSS radio layout as the Helix 12 CHIRP SI GPS G2N, therefore the Helix 12 CHIRP SI GPS G2N was used to show compliance of the Adjacent Band Selectivity for all models listed in this test report.

The data presented in this report represents the worst case where applicable.

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.5 Modifications of EUT

No modification of the EUT were required for compliance.

1.6 References

- ETSI EN 303 413 V1.1.1: Satellite Earth Stations and Systems (SES); Global Navigation Satellite System (GNSS) receivers; Radio equipment operating in the 1 164 MHz to 1 300 MHz and 1 559 MHz to 1 610 MHz frequency bands; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

TÜV SÜD America, Inc.
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the ANSI-ASQ National Accreditation Board/ANAB accreditation program, and has been issued certificate number AT-2021 in recognition of this accreditation. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, ISED Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 391271
ISED Canada Lab Code: IC 4175A
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

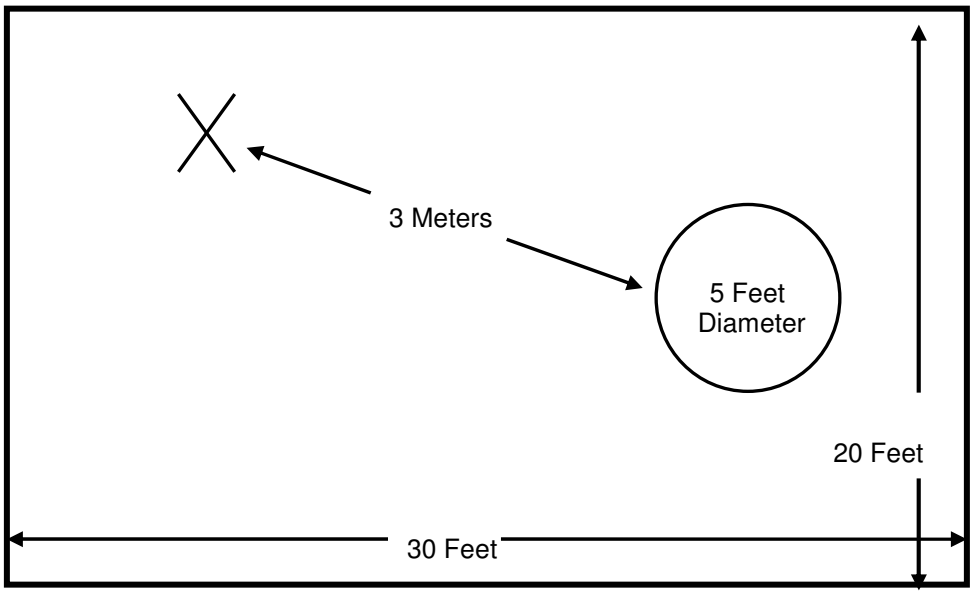

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.10.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

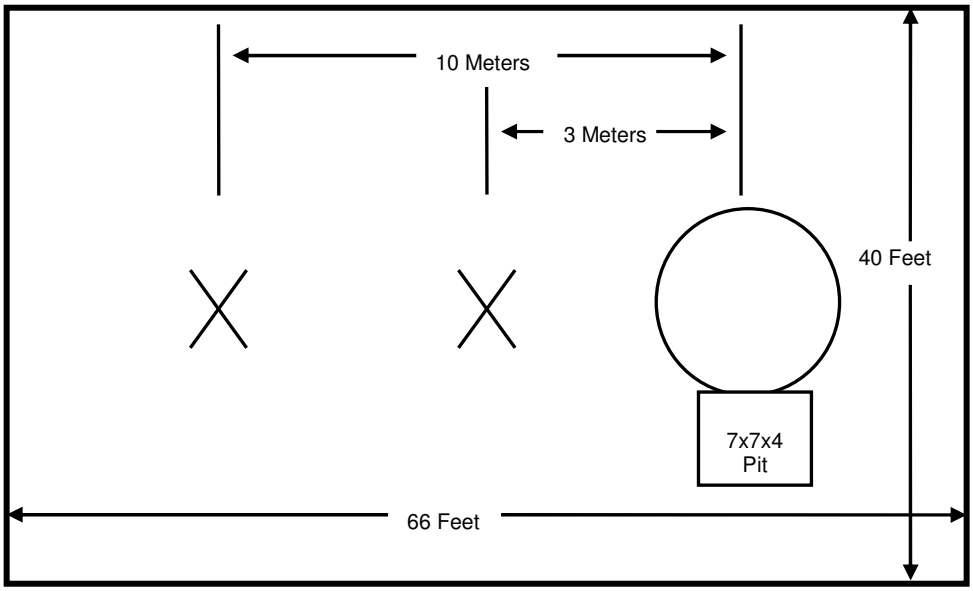

Figure 2.3-2: Open Area Test Site

3.0 EQUIPMENT UNDER TEST SYSTEM BLOCK DIAGRAM

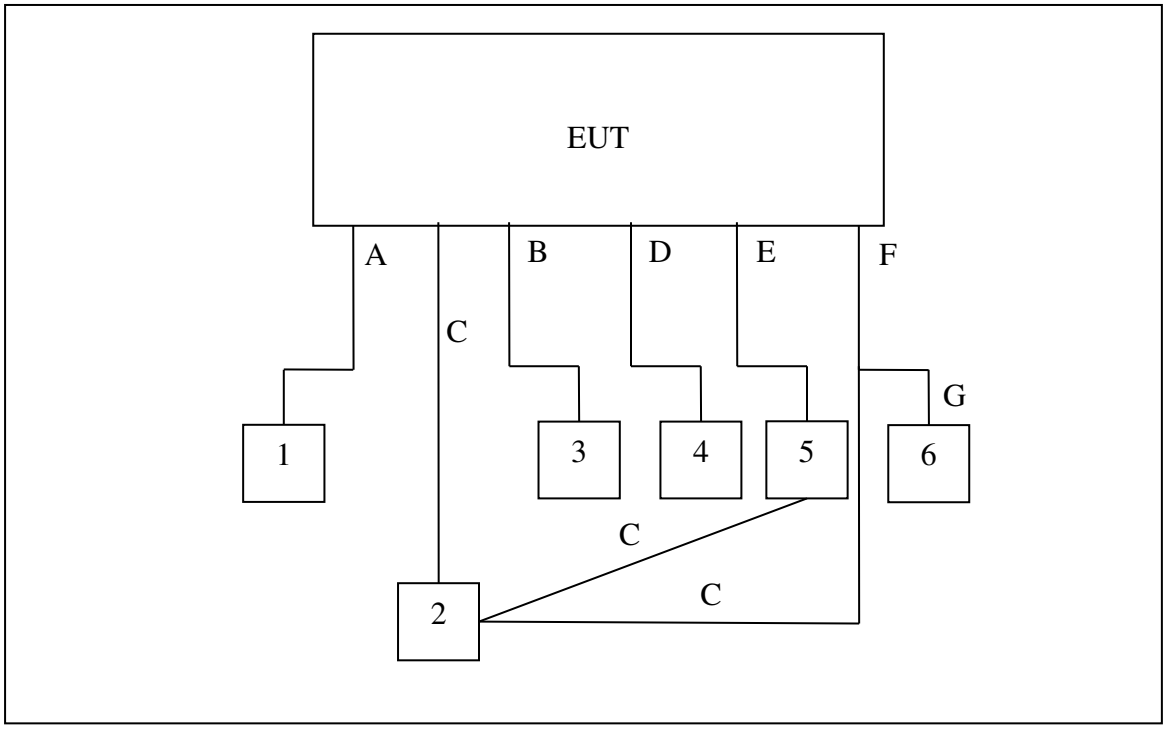

Figure 3-1: EUT System Block Diagram

Table 3-1: EUT and Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	External GPS Receiver	Johnson Outdoors	AS GPS HS	12071842-0039
2	Marine Battery	AUTOCRAFT	29HM	N/A
3	Transducer	Johnson Outdoors	N/A	N/A
4	Remote Unit	Johnson Outdoors	Solix 10 SI	171012020121
5	GEO NAV	Techsonic Industries	GTX AIS	46090073
6	NMEA2000 Antenna	Maretron	N/A	N/A

Table 3-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	GPS Cable	600 cm	No	EUT – External GPS Receiver
B	Transducer Cable	600 cm	No	EUT – Transducer
C	DC Power Cable	190 cm	No	EUT – Marine Battery GEO NAV – Marine Battery NMEA2000 Cable – Marine Battery
D	Ethernet Cable	500 cm	No	EUT – Remote Unit
E	Signal Cable	600 cm	No	EUT – GEO NAV
F	NMEA2000 Cable	500 cm	No	EUT – NMEA2000 Antenna
G	NMEA2000 Signal Cable	190 cm	No	NMEA2000 Cable – NMEA2000 Antenna

4.0 TEST SETUP BLOCK DIAGRAM(S)

RECEIVER SPURIOUS EMISSIONS MEASUREMENTS

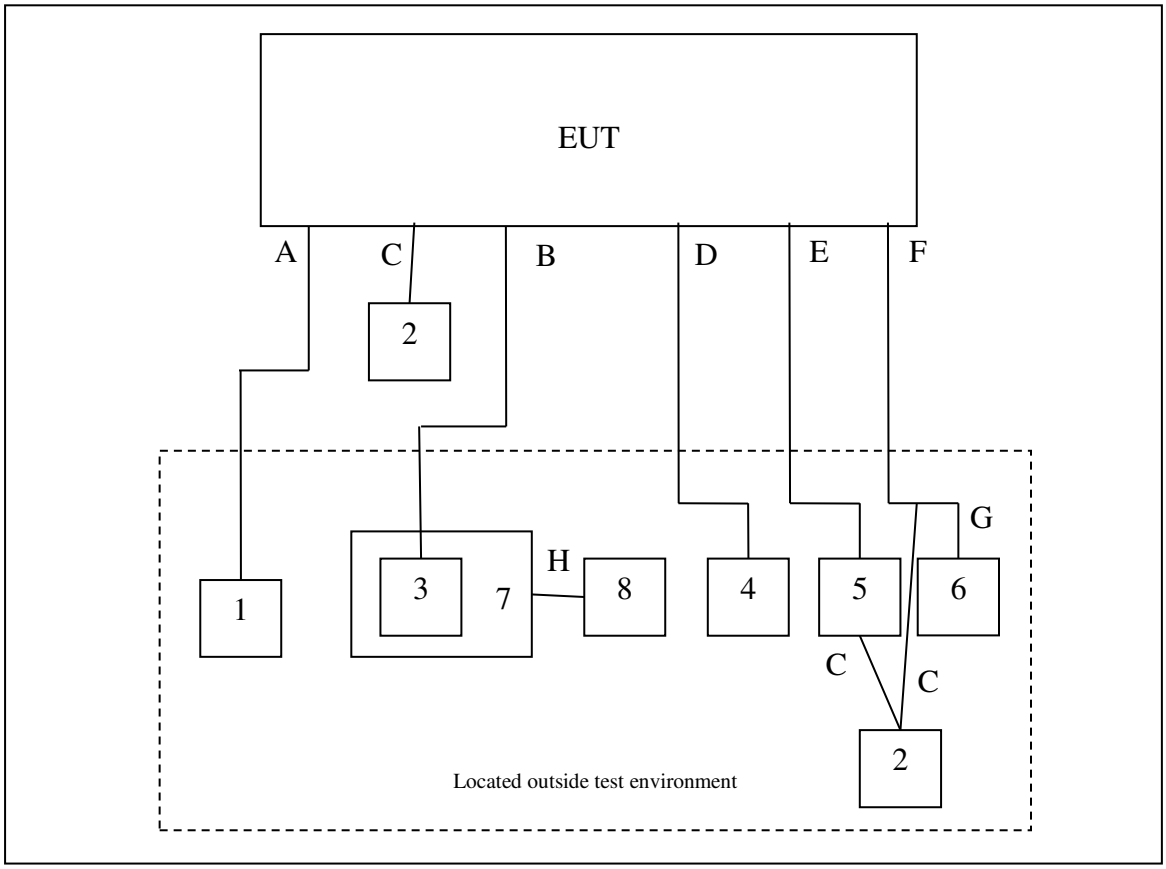

Figure 4-1: Test Setup Block

Table 4-1: Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	External GPS Receiver	Johnson Outdoors	AS GPS HS	12071842-0039
2	Marine Battery	AUTOCRAFT	29HM	N/A
3	Transducer	Johnson Outdoors	N/A	N/A
4	Remote Unit	Johnson Outdoors	Solix 10 SI	171012020121
5	GEO NAV	Techsonic Industries	GTX AIS	46090073
6	NMEA2000 Antenna	Maretron	N/A	N/A
7	Depth Simulator Transducer	Johnson Outdoors	N/A	N/A
8	Depth Simulator	Johnson Outdoors	N/A	N/A

Table 4-2: Support Equipment Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	GPS Cable	600 cm	No	EUT – External GPS Receiver
B	Transducer Cable	600 cm	No	EUT – Transducer
C	DC Power Cable	190 cm	No	EUT – Marine Battery GEO NAV – Marine Battery NMEA2000 Cable – Marine Battery
D	Ethernet Cable	500 cm	No	EUT – Remote Unit
E	Signal Cable	600 cm	No	EUT – GEO NAV
F	NMEA2000 Cable	500 cm	No	EUT – NMEA2000 Antenna
G	NMEA2000 Signal Cable	190 cm	No	NMEA2000 Cable – NMEA2000 Antenna
H	BNC Cable	85 cm	Yes	Depth Simulator Transducer – Depth Simulator

5.0 CONCLUSIONS, OBSERVATIONS AND COMMENTS

The test report will be filed at TÜV SÜD America, Inc. for a period of 10 years following the issue of this report. It may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval from TÜV SÜD America, Inc.

The results of the tests as stated in this report are exclusively applicable to the EUT as identified in this report. TÜV SÜD America, Inc. cannot be held liable for properties of the EUT that have not been observed during these tests.

TÜV SÜD America, Inc. assumes the sample to comply with the requirements of EN 303 413 for the respective test sector, if the test results turn out positive.

Comments: The provider was responsible for ensuring the test samples provided were representative of final production units.

6.0 MEASUREMENT UNCERTAINTY

In accordance with ETSI TR 100 028, measurement uncertainties associated with each test have been estimated and expressed in Table 6-1 below:

Table 6-1: Measurement Uncertainties

Parameter	U_{std}	U_{lab}
Occupied Channel Bandwidth	±5 %	± 0.009 %
RF Output Power, Conducted	±1.5 dB	± 0.349 dB
Power Spectral Density, Conducted	±3 dB	± 0.372 dB
Unwanted Emissions, Conducted	±3 dB	± 1.264 dB
All Emissions, Radiated	±6 dB	± 5.814 dB
Temperature	±1 °C	± 0.860 °C
Supply Voltages	±3 %	± 0.566 %
Time (slower than 10us)	±5 %	± 5.000 %

The expressed measurement uncertainties shown in the above table have been calculated using a coverage factor of k=2 resulting in a confidence level of 95%.

7.0 TEST RESULTS SUMMARY

Table 7-1 summarizes the results for the tested EUT corresponding with the essential requirements defined in EN 303 413. Table 7-2 summarizes the frequencies evaluated for each essential requirement.

Table 7-1: Test results summary

Harmonized Standard EN 303 413 The following requirements and test specifications are relevant to the presumption of conformity under the article 3.2 of the RE Directive					
Test Parameter	**Test plan (Yes/No)**	**Test Result**	**Test Specification Reference: Clause No**	**Test Report Page No.**	**Comment**
Adjacent Band Selectivity	N	--	5.3	--	
Receiver spurious emissions	Y	PASS	5.5	13	

Table 7-2: Test Frequencies / Results

Test	**Frequency (MHz)**	**Result**
Receiver Spurious Emissions	**1575.420**	**PASS**

8.0 TEST RESULTS

8.1 Test Results Details

8.1.1 Receiver spurious emissions

Test Conditions		Test Specification Reference: Clause No	Test Equip. Used with Equip Number	Method
Normal		5.5	30, 40, 73, 167, 329, 338, 412, 422, 609, 616, 622, 676, 701	Radiated
Tnom	+23 °C			

Solix 10 SI

Frequency (MHz)	level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarity (H/V)	Result
36.03	-84.32	-57.00	27.32	**H**	**PASS**
36.03	-74.32	-57.00	17.32	**V**	**PASS**
36.58	-82.79	-57.00	25.79	**H**	**PASS**
36.58	-72.69	-57.00	15.69	**V**	**PASS**
38.41	-102.02	-57.00	45.02	**H**	**PASS**
38.41	-76.02	-57.00	19.02	**V**	**PASS**
41.05	-83.99	-57.00	26.99	**H**	**PASS**
41.05	-78.89	-57.00	21.89	**V**	**PASS**
46.91	-90.08	-57.00	33.08	**H**	**PASS**
46.91	-85.08	-57.00	28.08	**V**	**PASS**
250	-65.65	-57.00	8.65	**H**	**PASS**
250	-66.55	-57.00	9.55	**V**	**PASS**
350.05	-72.95	-57.00	15.95	**H**	**PASS**
350.05	-76.25	-57.00	19.25	**V**	**PASS**
375.05	-58.64	-57.00	1.64	**H**	**PASS**
375.05	-61.84	-57.00	4.84	**V**	**PASS**
600	-85.85	-57.00	28.85	**H**	**PASS**
600	-86.95	-57.00	29.95	**V**	**PASS**
801.95	-69.97	-57.00	12.97	**H**	**PASS**
801.95	-69.77	-57.00	12.77	**V**	**PASS**
1000.33	-59.92	-47.00	12.92	**H**	**PASS**
1000.33	-66.32	-47.00	19.32	**V**	**PASS**
1066.98	-62.09	-47.00	15.09	**H**	**PASS**
1066.98	-65.79	-47.00	18.79	**V**	**PASS**
1202.93	-64.72	-47.00	17.72	**H**	**PASS**
1202.93	-63.62	-47.00	16.62	**V**	**PASS**

*NOTE: Some of the emissions detected are results of emanations from the digital device or peripheral circuitry and components. Those emissions determined to be directly related to the digital device or peripheral circuitry and components are not included.

9.0 TEST SETUP PHOTOGRAPHS

Figure 9-1: Radiated Emissions Test Setup

Figure 9-2: Radiated Emissions Test Setup

10.0 PHOTOGRAPHS OF THE EQUIPMENT (UUT)

Figure 10-1: External Photo

Figure 10-2: External Photo

Figure 10-3: External Photo

Figure 10-4: External Photo

Figure 10-5: External Photo

Figure 10-6: External Photo

11.0 TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 11-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
30	Spectrum Technologies	DRH-0118	Antennas	970102	5/9/2017	5/9/2019
40	EMCO	3104	Antennas	3211	6/8/2016	6/8/2018
73	Agilent	8447D	Amplifiers	2727A05624	7/24/2017	7/24/2018
167	ACS	Chamber EMI Cable Set	Cable Set	167	9/29/2017	9/29/2018
329	A.H.Systems	SAS-571	Antennas	721	8/3/2017	8/3/2019
338	Hewlett Packard	8449B	Amplifiers	3008A01111	7/11/2017	7/11/2019
412	Electro Metrics	LPA-25	Antennas	1241	8/8/2016	8/8/2018
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	10/27/2016	11/27/2017
609	Rohde & Schwarz	SMB100A	Signal Generators	175334	8/16/2016	8/16/2018
616	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	N/A	10/7/2017	10/7/2018
622	Rohde & Schwarz	FSV 40	Spectrum Analzyers	101338	7/15/2016	7/15/2018
676	Florida RF Labs	SMS-290AW-480.0-SMS	Cables	MFR2Y194	11/4/2016	12/4/2017
701	United Microwave Products Inc.	AA-190-20.00.0	Cables	N/A	7/25/2017	7/25/2018

NCR = No Calibration Required
NOTE: All Equipment only used during active calibration cycles.

END REPORT