For Scope of Accreditation Under Certificate Number: 2955.09

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EMC Technical Report

Prepared For: Johnson Outdoors Marine Electronics, Inc.

Model Covered: Helix 7X CHIRP MSI GPS G3N
Model Variants: See Product Description

In Accordance with:

Emissions Product Standard(s): Annex 14 (KN 60945)

Report Number: AT72144771.3N0
Report Revision: A
Report Issue Date: January 14, 2019

This report contains Page 31 pages

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This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

REVISION HISTORY
Report Number: AT72144771.3N0
Manufacturer: Johnson Outdoors Marine Electronics, Inc.
Model: Helix 7X CHIRP MSI GPS G3N

DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
January 14, 2019	---	A	Initial Release	All	Ryan McGann

Project Information Sheet

Applicant Details

Manufacturer: Johnson Outdoors Marine Electronics, Inc.
Street Address: 678 Humminbird Lane
City, State/Province and Postal Code: Eufaula, AL 36027
Country: USA
Contact: Seth Bergman

Phone: 334-687-6613
Fax:
Email: sbergman@johnsonoutdoors.com

Sample Information

Model: Helix 7X CHIRP MSI GPS G3N
Model Variant(s): See Product Description
Environment of Use: Residential
Sample Receive Date: August 13, 2018
Sample Receive Condition: Good
Test Mode Description: Battery powered, monitoring depth via sonar, and GPS active.
Highest Data Rate: 800MHz
Source: Main processor

Product Description

The Humminbird Helix 7X CHIRP MSI GPS G3N (411080-1M) is a fishfinder/GPS product with side imaging sonar capability. It is comprised of a keypad, 7" LCD display, two SD card slots, internal GPS, Bluetooth capability, Ethernet capability, transducer and power cable. All G3N CHIRP model variations are built exactly the same. The non G3N variations do not have Bluetooth. They all differ by installed options, SELV circuits and languages.

HELIX 7 CHIRP GPS G3
HELIX 7X CHIRP GPS G3
HELIX 7 CHIRP MDI GPS G3
HELIX 7X CHIRP MDI GPS G3
HELIX 7 CHIRP MSI GPS G3
HELIX 7X CHIRP MSI GPS G3
HELIX 7 CHIRP GPS G3N
HELIX 7X CHIRP GPS G3N
HELIX 7 CHIRP MDI GPS G3N
HELIX 7X CHIRP MDI GPS G3N
HELIX 7 CHIRP MSI GPS G3N
HELIX 7X CHIRP MSI GPS G3N (Tested variant)
ICE HELIX 7 CHIRP GPS G2N

Test Information

Test Start Date: August 13, 2018
Test End Date: August 17, 2018
Emissions Pre-scan Site: SAC
Final Emissions Site: OATS
EMI Freq. Band: 10kHz - 4GHz
Radiated Emissions Equipment Class: Class B

Test Methods/Standards Applied

(Check all that apply):

☒ RRA Public Notification 2018-99, Oct 12, 2018 Korea Technical Requirements for Electromagnetic Compatibility

☒ KN 60945 (Annex 14) Test Methods for Electromagnetic Compatibility with RRA Announce 2015-110 (Dec 3, 2015)

Table of Contents

SECTION A: GENERAL INFORMATION

1.0 Introduction

1.1 Scope
This report documents conformance with the requirements set forth in Annex 14 (KN 60945) and details the results of testing performed on August 13, 2018 through August 17, 2018 on the model Helix 7X CHIRP MSI GPS G3N manufactured by Johnson Outdoors Marine Electronics, Inc..

1.2 Purpose
Testing was performed to evaluate the EUT with regard to EMC regulatory requirements in accordance with the European Unions CE Marking arrangements.

1.3 Results Summary

Product Standard or Test Method Applied	Description	Result
	Product Standards	
Annex 14 (KN 60945)	Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results	Pass

N/A = Test Not Applicable to this EUT N/P = Not Performed. See Test Justification for Details

1.4 Performance Criteria

1.4.1 Emissions Performance Criteria

For model Helix 7X CHIRP MSI GPS G3N the limits which apply are Annex 14 (KN 60945) Class B. These limits are found in Table 1.4.1-1 below:

Table 1.4.1-1 Emissions Limits Annex 14 (KN 60945)

	Portable	Protected	Exposed	Submerged
Conducted emissions (9.2)		10 kHz – 150 kHz 150 kHz – 350 kHz 350 kHz – 30 MHz	63 mV – 0,3 mV (96 dBµV – 50 dBµV) 1 mV – 0,3 mV (60 dBµV – 50 dBµV) 0,3 mV (50 dBµV)	
Radiated emissions (9.3)	150 kHz – 300 kHz 300 kHz – 30 MHz 30 MHz – 2 GHz 156 MHz – 165 MHz	10 mV/m – 316 µV/m (80 dBµV/m – 52 dBµV/m) 316 µV/m – 50µV/m (52 dBµV/m – 34 dBµV/m) 500 µV/m (54 dBµV/m) except for 16 µV/m (24 dBµV/m) quasi-peak or 32 µV/m (30 dBµV/m) peak		

2.0 Test Facilities & Environment

2.1 Test Facilities
All testing was performed at the following address:

TÜV SÜD America Inc.
5945 Cabot Parkway
Suite 100
Alpharetta, GA 30005
Phone: (678) 341-5900
www.TUVamerica.com

The laboratory is fully equipped to carry out the tests outlined in section 1.0

2.2 Laboratory Accreditations/Recognitions/Certifications
TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation/A2LA accreditation program and has been issued certificate number 2955.09 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.

2.3 Test Environment
Unless otherwise specified by the generic or product standard, the EUT was evaluated within the climate conditions of the EUT as specified by the manufacturer.

Where the manufacturer does not specify climate parameters for the EUT, all test are performed within the climate parameters given below:

- Ambient temperature 15° to 35° C
- Relative Humidity 30% to 60%
- Atmospheric Pressure 860mbar to 1060mbar

2.4 Test Equipment Calibration Statement
Test equipment used for each test is specified in the relevant sections of this test report. Unless expressly given, all test equipment is calibrated on an annual basis, where applicable. All test equipment is operated within the climate specifications as defined by the manufacturer.

3.0 Equipment Under Test (EUT)

3.1 Manufacturer
Johnson Outdoors Marine Electronics, Inc.
678 Humminbird Lane
Eufaula, AL 36027

Seth Bergman
334-687-6613

sbergman@johnsonoutdoors.com

3.2 Modifications

Table 3.2-1 below describes any modification required to bring the EUT into compliance with the test standard. Photographs of the modifications, if any, are contained in appendix a.

Table 3.2-1: EUT Modifications

☒ **Modifications were not required to bring the EUT into compliance with the requirements.** ☐ **Modifications were required to bring the EUT into compliance with the requirements.**

Modification Type	Component/Material Description (Model)	Location	Test Required For	Specific Need	Photograph Designation

3.3 System Block Diagram and Support Equipment

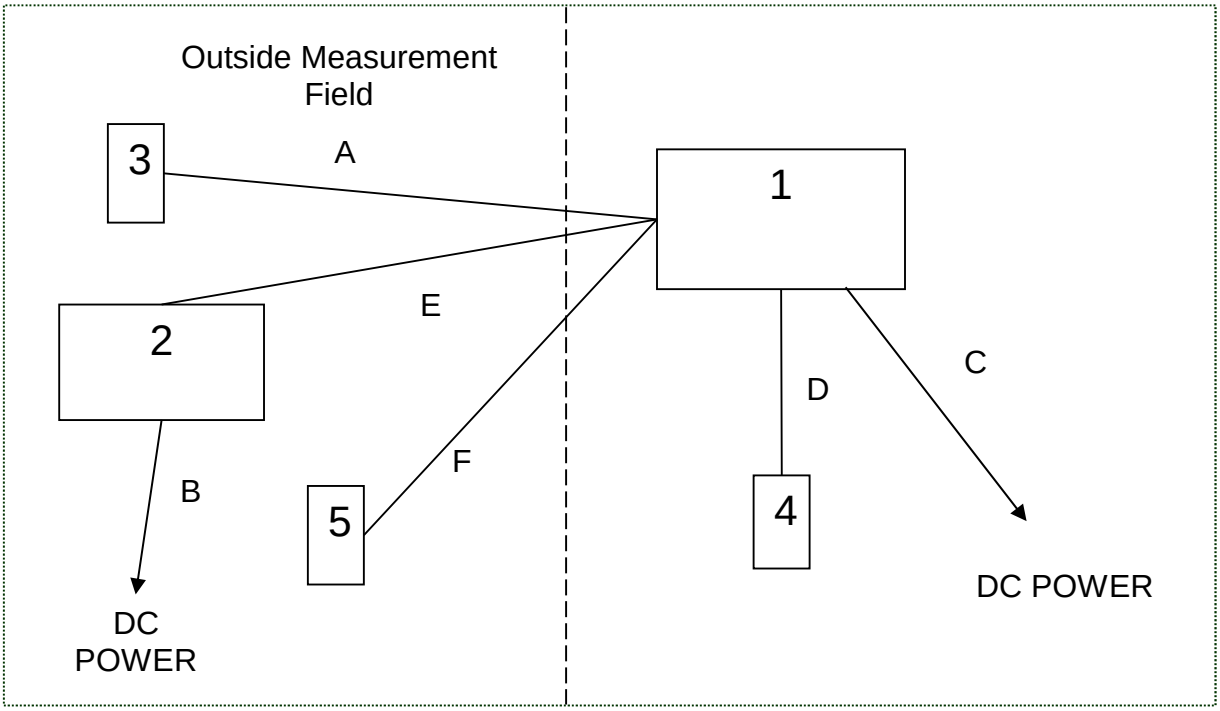

Figure 3.3-1: System Block Diagram

Table 3.3-1: EUT and Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Johnson Outdoors	HELIX 7 CHIRP G3	n/a
2	Auxiliary Equipment	Johnson Outdoors	HELIX 7	n/a
3	GPS antenna	Humminbird	AS*GPS HS	12071842-0039
4	Transducer	Johnson Outdoors	n/a	n/a
5	Speed sensor	Johnson Outdoors	n/a	n/a

Table 3.3-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	GPS	20’	No	1 - 3
B	DC leads	4’	No	2 – DC power
C	DC leads	5’	No	1 – DC power
D	Transducer cable	20’	No	1 - 4
E	Ethernet	30’	No	1 - 2
F	Speed Sensor cable	20’	No	1 - 5

3.4 Observations

Any general observations regarding any part of the evaluation are given in table 3.4-1.

Table 3.4-1: Observations

Observation No.	Description

SECTION B: EMISSIONS – TEST INFORMATION AND RESULTS

4.0 Radiated and Conducted Emissions

4.1 Radiated Emissions

4.1.1 Test Site Description

4.1.1.1 Open Area Test Site (Buford Facility)
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 C63.4.

A diagram of the Open Area Test Site is shown in Figure 4.1.1.1-1 below:

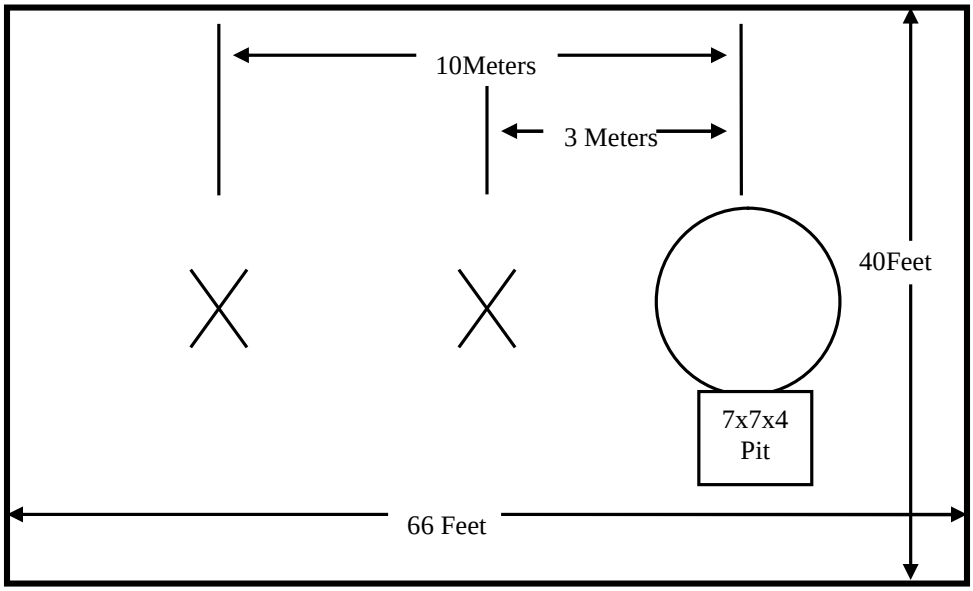

Figure 4.1.1.1-1: Open Area Test Site

4.1.1.2 Semi-Anechoic Chamber (Buford Facility)

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 4" x 4" x ¾" thick and weighs approximately 1.4lbs. 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 turntable. 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 chase 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.

To comply with the requirements of the test methods given on page 3, RF absorbing foam was placed inside the chamber in a configuration that provided the best results. First, an 8 ft. patch of 12" tall absorber was placed on the floor between the turntable and the receiving antenna. This absorber meets the absorption requirements specified in ANSI C63.4:2009. Next, three vertical structures (Fences) were created and covered with 8" pyramidal RF absorbing foam, two 4 ft. x 4 ft. and one 6 ft. x 4 ft. These fences were placed at locations to prevent high energy signals from reaching the back chamber wall and reflecting back to the receive antenna.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 4.1.1.2-1 below:

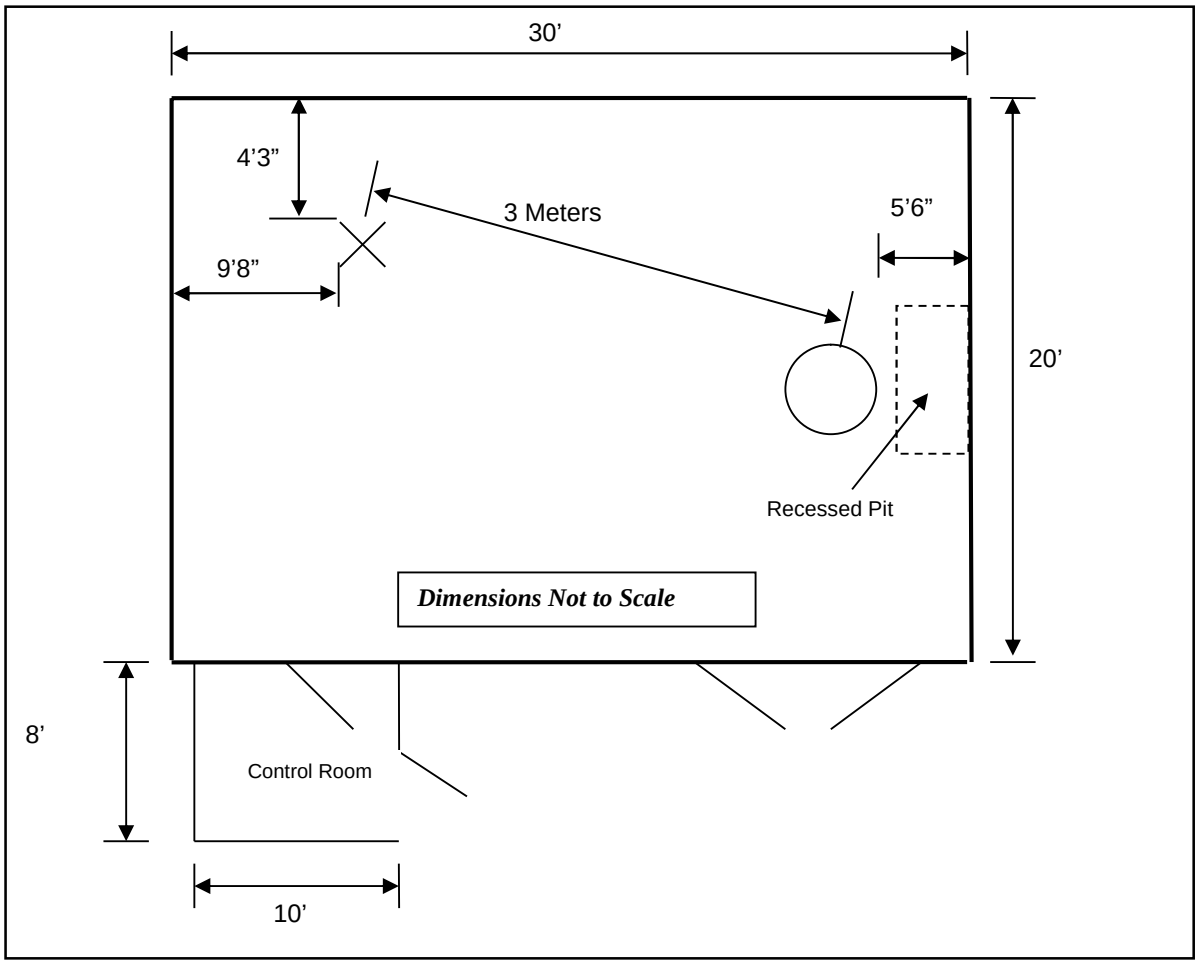

Figure 4.1.1.2-1: Semi-Anechoic Chamber Test Site

4.1.1.3 Semi-Anechoic Chamber Test Site (Alpharetta Facility)

The Semi-Anechoic Chamber Test Site consists of a 20’W x 30’L x 20’H shielded enclosure. The chamber is lined with ETS-Lindgren Ferrite Absorber, model number FT-1500. The ferrite tile 600 mm x 600 mm (2.62 in x 23.62 in) panels and are mounted directly on the inner walls of the chamber shield.

The specular regions of the chamber are lined with additional ETS-Lindgren PS-600 hybrid absorber to extend its frequency range up to 18GHz and beyond.

The turntable is a 2m ETS-Lindgren Model 2170, and installed off the center axis is located 5’6” 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 shield using #8 solid copper wire.

The antenna mast is an EMCO 1060 and is remotely controlled from the control room for both antenna height and polarization.

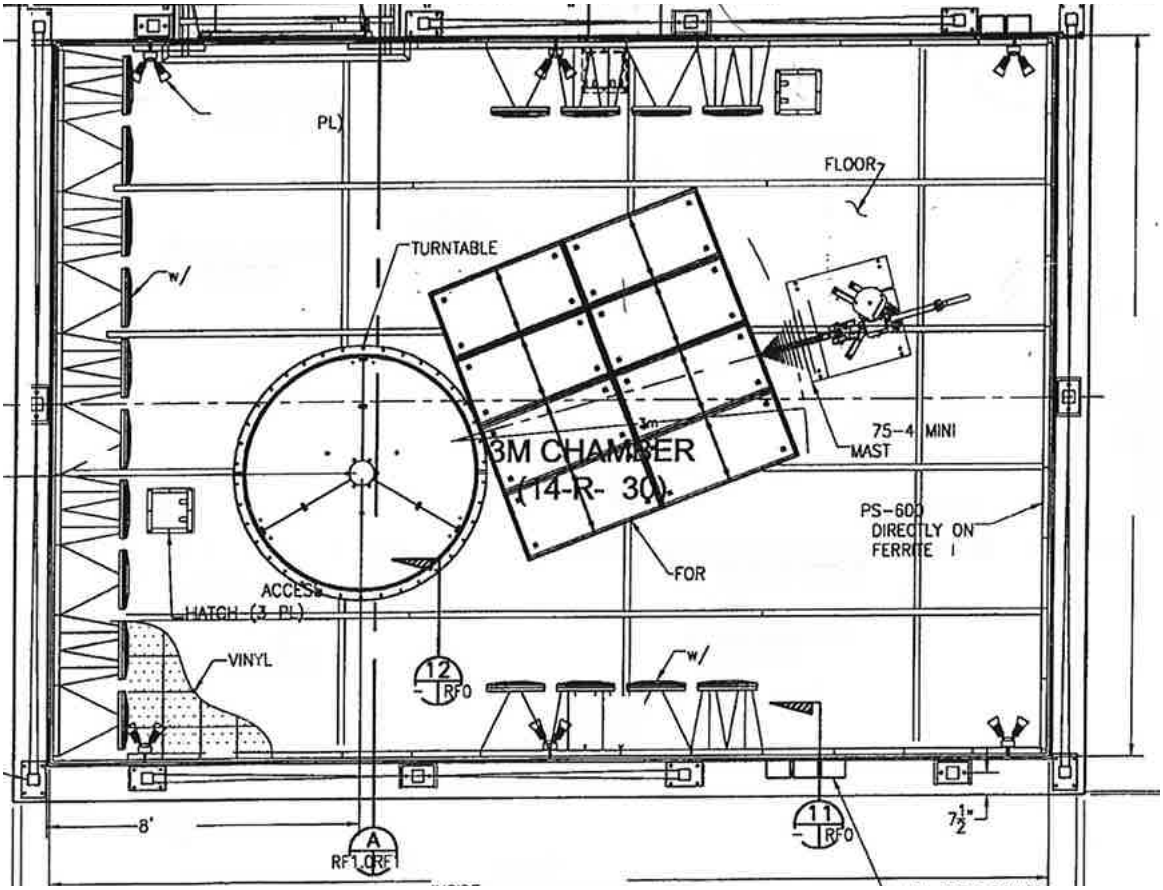

Figure 4.1.1.3-1: Semi-Anechoic Chamber Test Site (Alpharetta Facility)

4.1.2 Test Equipment

Table 4.1.2-1 identifies all equipment used for radiated emissions respectively.

Table 4.1.2-1 Test Equipment – SAC Radiated Emissions (2018)

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
30	Spectrum Technologies	DRH-0118	1-18GHz Horn Antenna	970102	05/09/2017	05/09/2019
90	Electro-metrics	LPA25	LPA Antenna	1476	01/03/2018	01/03/2020
144	Omega	RH411	Temp / Humidity Meter	H0103373	10/24/2018	10/24/2020
213	TEC	PA 102	Amplifier	44927	07/19/2018	07/19/2019
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	07/11/2017	07/11/2019
412	Electro Metrics	LPA-25	Log Periodic Antenna	1241	08/22/2018	08/22/2020
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	11/06/2018	11/06/2019
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	05/01/2018	05/01/2019
853	Teseq	CBL 6112D; 6804.17.A	Bilog Antenna; Attenuator	51616; 20181110A	10/15/2018	10/15/2019

NCR = No Calibration Required

Table 4.1.2-2 Test Equipment – Open Area Test Site (2018)

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
90	Electro-metrics	LPA25	LPA Antenna	1476	01/03/2018	01/03/2020
193	ACS	OATS cable Set	Consists of Cables 832, 360, 284	193	05/01/2018	05/01/2019
211	Eagle	C7RFM3NFNM	FM Band Reject Filter	HLC-700	10/31/2018	10/31/2019
213	TEC	PA 102	Amplifier	44927	07/19/2018	07/19/2019
731	EMCO	3104	Bicon Antenna	2659	11/09/2016	12/09/2018
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	11/06/2018	11/06/2019

NCR = No Calibration Required

4.1.3 Test Methodology

4.1.3.1 Pre-Scans Radiated pre-scans are performed on all EUTs in either the 3m Semi-Anechoic or the 3m Fully-Anechoic Chamber. Final emission testing for Class A equipment is performed on the 3/10m Open Area Test Site (OATS) as described in section 4.1.1.1. Final emission testing on Class B equipment can be performed either in the 3m Semi-Anechoic chamber described in section 4.1.1.2 or on the OATS.

Pre-scans are a method by which the 10 highest emissions can be identified for final evaluation. This is achieved by taking automated emission snapshots of the EUT at various azimuths and antenna heights. The software is programmed to perform a peak sweep of the band using the maxhold function. This sweep is performed every 90º in both horizontal and vertical polarities and at antenna heights of 100cm and 300cm. Although not a fully maximized scan, the pre-scan gives a good indication of pass or fail.

4.1.3.2 Final Scans
Radiated emissions measurements were made over the frequency range of 30MHz to 4GHz. Quasi-Peak measurements are taken with the Spectrum Analyzer's resolution bandwidth was set to 120KHz and video bandwidth set to 300 kHz for measurements below 1000MHz. Average measurements above 1000MHz are taken using measurement instruments average detector. The calculation for the radiated emissions field strength is as follows:

Corrected Reading = Analyzer Reading + Cable Loss + Antenna Factor
Margin (dB) = Applicable Limit - Corrected Reading

4.1.3.3 Test Criteria
The EUT must meet the Class A Limits as given in table 1.2-1.

4.1.3.4 Test Justification

☒ **No justification - The EUT was tested per the appropriate test methods and test plan.**
☐ **The test method, standard, and/or test plan was deviated from for the following reason:**

4.1.4 Test Setup Photographs

Figure 4.1.4-1: Radiated Emissions - Front View

Figure 4.1.4-2: Radiated Emissions - Rear View

4.1.5 Test Data

Final tabulated radiated emissions data are reported in the Test Data Table below:

Test Parameters:

Test Date:	**8/13/2018**	**Temperature (ºC)**	**25**
Technician:	**A Sumner**	**Humidity (%)**	**47**
Equipment Class:	**Class B**	**Barometric Pressure (mBar)**	**1012**
Tested Modes:	**GPS Active; Sonar Measuring Depth (7.2 ft), Speed/Temp Sensor Active**		
AC Input Power:	**N/A**		
DC Input Power:	**12Vdc**		

Test Data Table:

Measurement Distance:

☐ FAC ☒ SAC ☐ OATS
☐ 1 Meter ☒ 3 Meter ☐ 10 Meter

Frequency (MHz)	Measured Level (dBuV)		Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Position (o)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	Pk	Qpk/Av					Pk	Qpk/Av	Pk	Qpk/Av	Pk	Qpk/Av
14.135	34.60	20.60	V	n/a	0	11.85	---------	32.45	--------	34.0	---------	1.6
25.56	27.30	12.10	H	n/a	0	10.48	---------	22.58	--------	34.0	---------	11.4
43.47	61.20	45.10	H	100	0	-13.33	---------	31.77	--------	54.0	---------	22.2
62	52.10	44.00	V	100	0	-13.02	---------	30.98	--------	54.0	---------	23.0
99.4	54.50	48.00	H	100	181	-11.52	---------	36.48	--------	54.0	---------	17.5
48.6	49.00	45.10	V	100	105	-13.16	---------	31.94	--------	54.0	---------	22.1
168.55	45.60	42.20	V	100	109	-6.93	---------	35.27	--------	54.0	---------	18.7
248.6	52.50	47.40	V	100	191	-10.12	---------	37.28	--------	54.0	---------	16.7
297.85	52.60	49.80	V	100	231	-9.76	---------	40.04	--------	54.0	---------	14.0
162.34	-----	37.40	V	100	108	-7.77	---------	29.63	--------	30.0	---------	0.4
163.5	-----	30.40	V	100	108	-7.65	---------	22.75	--------	40.5	---------	17.7

Qpk = Quasi-Peak Measurement or Limit (< 1GHz)
AV = Average Measurement or Limit (>1GHz)

Notes:

4.2 Conducted Emissions

4.2.1 Conducted Emissions Test Site (Buford Facility)

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal ground reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

A diagram of the room is shown below in figure 4.2.1-1:

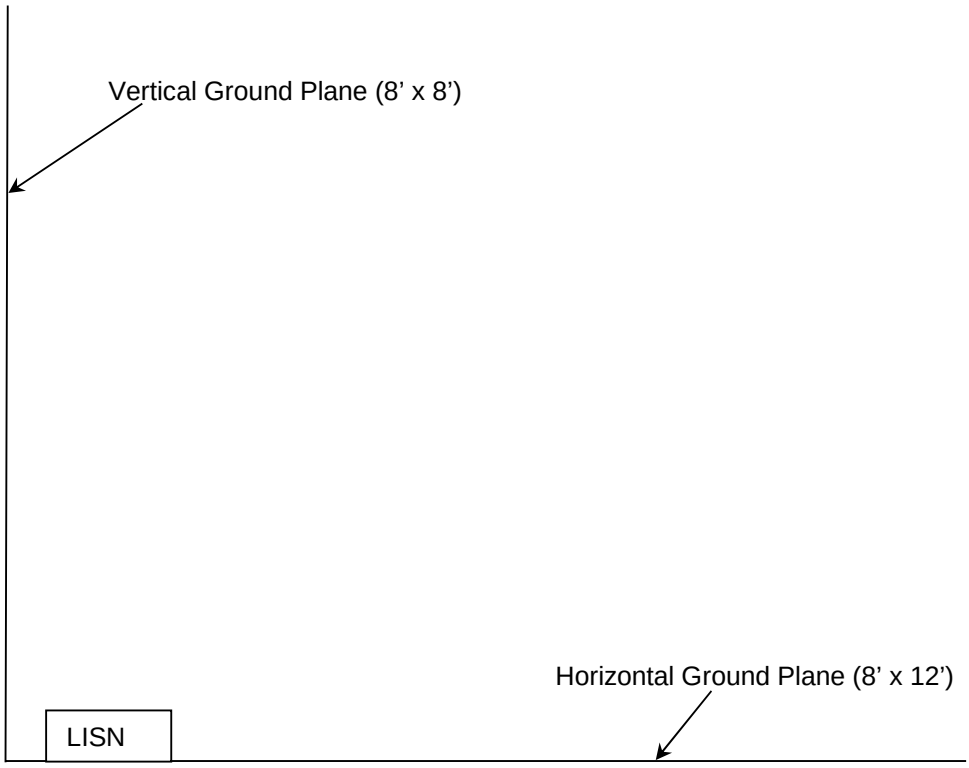

Figure 4.2-1: AC Mains Conducted EMI Site

4.2.2 Conducted Emissions Test Site (Alpharetta Facility)

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal ground reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The AC mains conducted EMI site is located in the main EMC lab. It consists of a 12' x 10' horizontal coupling plane(HCP) as well as a 12'x8' vertical coupling plane(VCP). The HGP is constructed of 4' x 10' sheets of particle board sandwiched by galvanized steel sheets. These panels are bonded using 11AWG 1/8" x 2" by 10' galvanized sheet steel secured to the panels via by screws. The VCP is constructed of three 4'x8' sheets of 11AWG solid aluminum.

The HCP and VCP are electrically bonded together using 1"x1" angled aluminum secured with screws.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4:2003 and 2009.

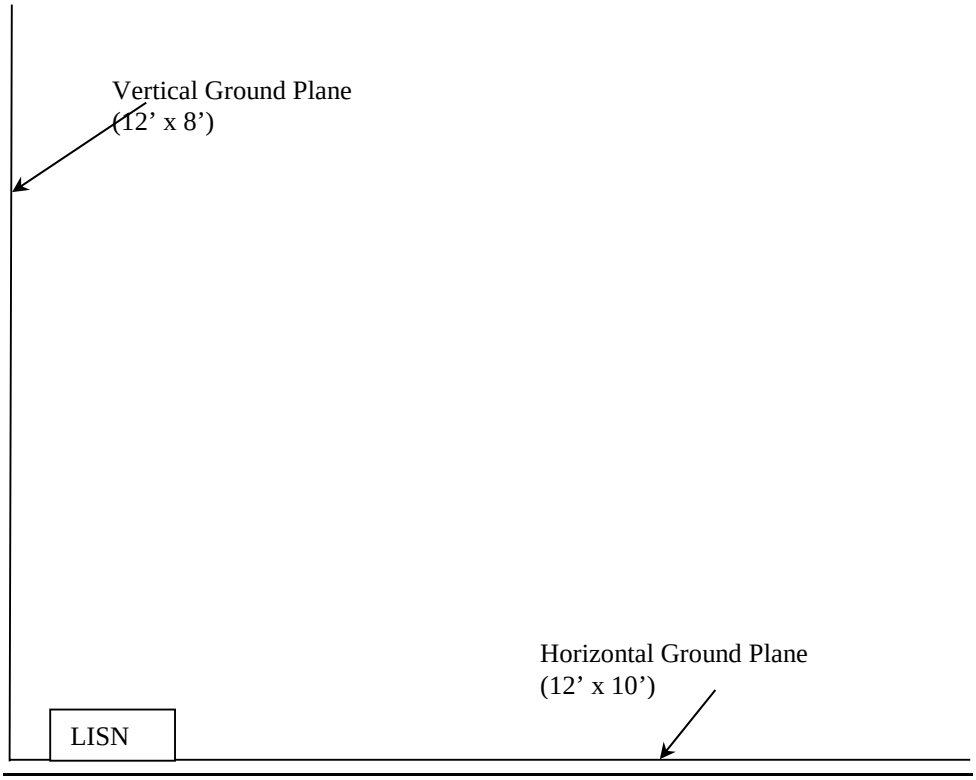

Figure 4.2.2: AC Mains Conducted EMI Site (Alpharetta Facility)

4.2.2 Test Equipment

Table 4.2.2-1 Test Equipment – Conducted Emissions

Conducted Emissions

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
324	ACS	Belden	Cables	8214	4/5/2018	4/5/2019
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019
3010	Rohde & Schwarz	ENV216	LISN	3010	7/11/2018	7/11/2019
813	PMM	9010	Receiver	697WW30606	2/12/2018	2/12/2019

Conducted Emissions Telecom

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
168	Hewlett Packard	11947A	Attenuators	44829	1/22/2018	1/22/2019
324	ACS	Belden	Cables	8214	4/5/2018	4/5/2019
419	Teseq	ISN T800	LISN	25203	8/9/2017	2/09/20
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019
561	Teseq	ISN ST08	Coupler	31286	7/11/2018	7/11/2019
813	PMM	9010	Receiver	697WW30606	2/12/2018	2/12/2019

NCR = No Calibration Required

4.2.3 Test Methodology

Conducted emissions were performed from 150 kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

4.2.3.1 Test Criteria

The EUT must meet the limits as given in section 1.2-1.

4.2.3.2 Test Justification

☒ **No justification - The EUT was tested per the appropriate test methods and test plan.**
☐ **The test method, standard, and/or test plan was deviated from for the following reason:**

4.2.4 Test Setup Photographs

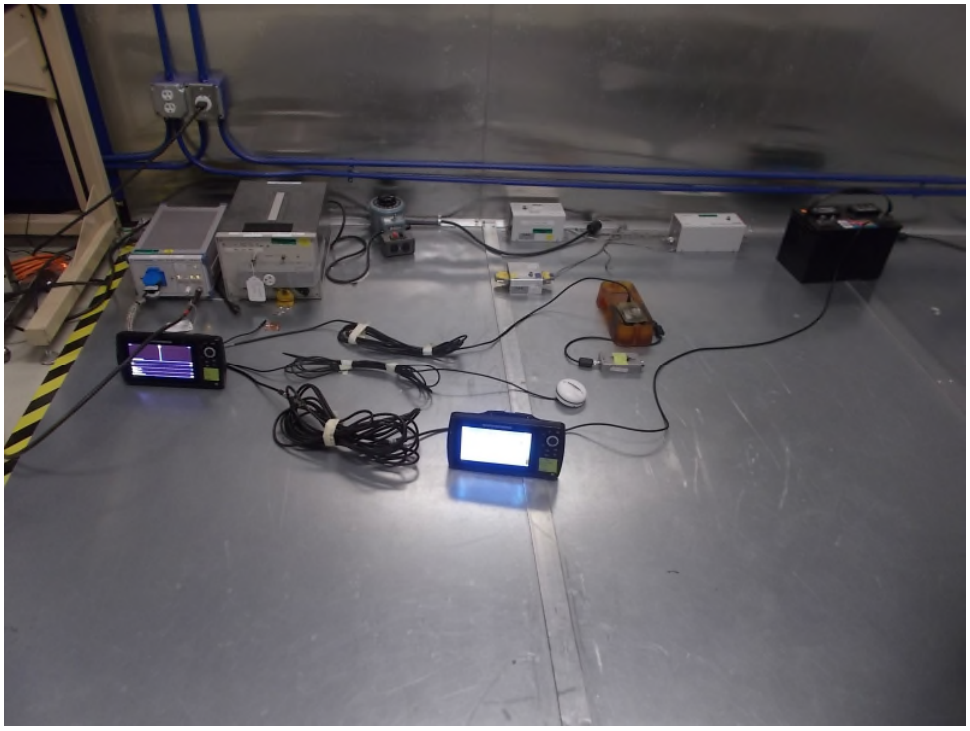

Figure 4.2.4-1: Conducted Emissions Test Setup – Front View

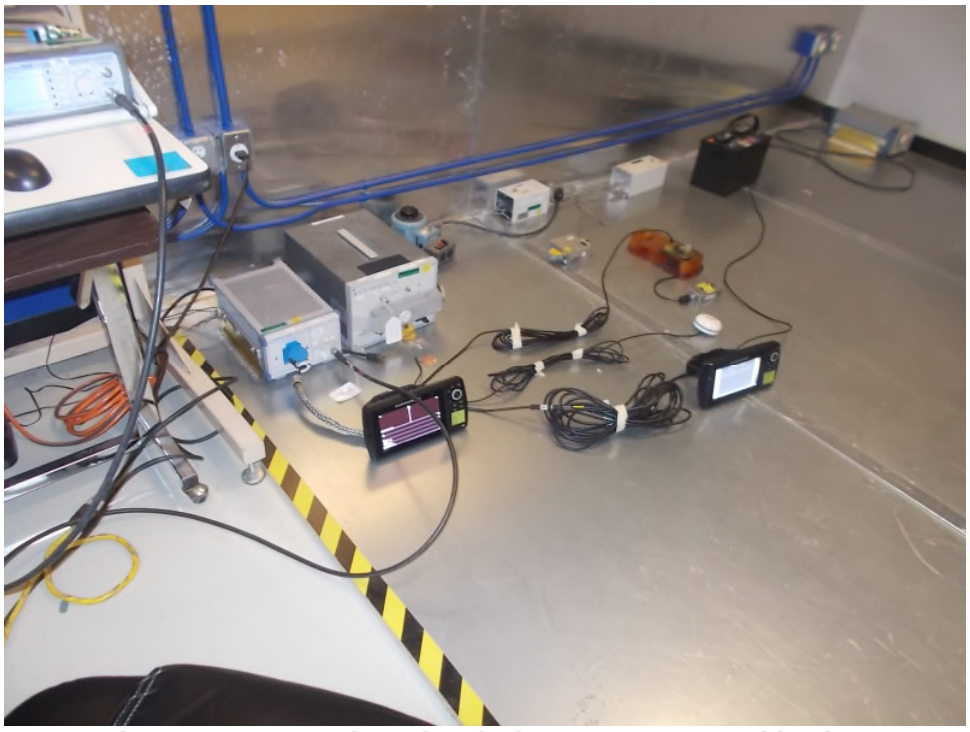

Figure 4.2.4-2: Conducted Emissions Test Setup – Side View

4.2.5 Test Data

Tabulated data is given in the Test Data Tables below.

Test Parameters:

Test Date:	**8/17/2018**	**Temperature (ºC)**	**23**
Technician:	**A Sumner**	**Humidity (%)**	**44**
Equipment Class:	**Class B**	**Barometric Pressure (mBar)**	**1018**
Tested Modes:	**EUT on; Monitoring depth; BT connected to phone and remote**		
AC Input Power:	**N/A**		
DC Input Power:	**12Vdc**		

Tested Leads:

☐ **AC Mains – Number of Lines:**
☒ **DC Mains – Number of Lines: 2**
☐ **Telecom Port – Quantity:**

Test Data Tables:

Check All That Apply to This Data
☒ **Line 1** ☐ **Line 2** ☐ **Line 3** ☐ **Line 4**
☐ **To Ground** ☒ **Floating**
☐ **Telecom Port _____**
☒ **dBµV** ☐ **dBµA**

Power Supply Description: 12Vdc

72141218CE01L1 Helix 7x Final 9-150k 17/08/2018 16:12:48
Rel. SW 2.27 (August 2016)
Rel. FW 2.56 12/01/15
Margin: 100 dB

	Frequency [MHz]	QPeak [dBµV]	Limit CE AC mai.. [dBµV]	Delta [dB]	Factor LISN 3010.. [dB]	Factor AEMC00324.. [dB]
1	0.01	23.42	96.00	-72.58	10.07	0.00
2	0.121	35.87	53.65	-17.78	9.59	0.00

Notes:

Check All That Apply to This Data
☐ **Line 1** ☒ **Line 2** ☐ **Line 3** ☐ **Line 4**
☐ **To Ground** ☒ **Floating**
☐ **Telecom Port** _____
☒ **dBµV** ☐ **dBµA**

Power Supply Description: **12Vdc**

72141218CE01L2 Helix 7x Final 9-150k 17/08/2018 16:17:36
Rel. SW 2.27 (August 2016)
Rel. FW 2.56 12/01/15
Margin: 100 dB

	Frequency [MHz]	QPeak [dBµV]	Limit CE AC mai.. [dBµV]	Delta [dB]	Factor LISN 3010.. [dB]	Factor AEMC00324.. [dB]
1	0.01	23.35	96.00	-72.65	10.00	0.00
2	0.1209	38.24	53.66	-15.42	9.59	0.00
3	0.1405	30.81	51.11	-20.30	9.59	0.00

Notes:

Check All That Apply to This Data
☒ **Line 1** ☐ **Line 2** ☐ **Line 3** ☐ **Line 4**
☐ **To Ground** ☒ **Floating**
☐ **Telecom Port** _____
☒ **dBµV** ☐ **dBµA**

Power Supply Description: **12Vdc**

72141218CE02L1 Helix 7x Final 150-30M 17/08/2018 16:23:39
Rel. SW 2.27 (August 2016)
Rel. FW 2.56 12/01/15
Margin: 100 dB

	Frequency [MHz]	QPeak [dBµV]	Limit CE AC mai.. [dBµV]	Delta [dB]	Factor LISN 3010.. [dB]	Factor AEMC00324.. [dB]
1	0.15	26.65	50.00	-23.35	9.59	0.00
2	0.205	43.23	56.31	-13.08	9.58	0.00
3	2.8	19.02	50.00	-30.98	9.62	0.00
4	2.84	19.03	50.00	-30.97	9.62	0.00
5	2.88	19.04	50.00	-30.96	9.62	0.00
6	3	19.10	50.00	-30.90	9.62	0.00
7	6.535	25.32	50.00	-24.68	9.66	0.00
8	10.555	19.37	50.00	-30.63	9.69	0.01
9	11.11	19.40	50.00	-30.60	9.69	0.02
10	25.07	20.26	50.00	-29.74	9.78	0.10

Notes:

Check All That Apply to This Data
☐ **Line 1** ☒ **Line 2** ☐ **Line 3** ☐ **Line 4**
☐ **To Ground** ☒ **Floating**
☐ **Telecom Port** _____
☒ **dBµV** ☐ **dBµA**

Power Supply Description: **12Vdc**

72141218CE02L2 Helix 7x Final 150-30M 17/08/2018 16:28:14
Rel. SW 2.27 (August 2016)
Rel. FW 2.56 12/01/15
Margin: 100 dB

	Frequency [MHz]	QPeak [dBµV]	Limit CE AC mai.. [dBµV]	Delta [dB]	Factor LISN 3010.. [dB]	Factor AEMC00324.. [dB]
1	0.155	30.32	59.61	-29.29	9.58	0.00
2	0.2	43.54	56.60	-13.06	9.58	0.00
3	2.75	19.00	50.00	-31.00	9.62	0.00
4	2.82	19.02	50.00	-30.98	9.62	0.00
5	2.865	19.04	50.00	-30.96	9.62	0.00
6	3	19.10	50.00	-30.90	9.62	0.00
7	6.705	25.28	50.00	-24.72	9.66	0.00
8	9.97	20.08	50.00	-29.92	9.69	0.00
9	10.89	19.39	50.00	-30.61	9.70	0.02
10	26.325	26.95	50.00	-23.05	9.86	0.10

Notes:

SECTION D: MEASUREMENT UNCERTAINTY

General
Measurement Uncertainty is based on the following publications:

- CISPR 16-4-2: Uncertainties, statistics and limit modeling – Uncertainty in EMC measurements
- The Guide to the Expression of Uncertainty in Measurement(GUM): 1995
- ANSI / NCSL Z540.2-1997 (R2002) U.S. Guide to Expression of Uncertainty in Measurement

Calculations for measurement uncertainty are available upon request.

Emissions:

Test Method	U_{Lab}	U_{CISPR}	Uncertainty Units
Radiated Emissions 30MHz-1000MHz	3.68	5.2	dB
Radiated Emissions 30MHz to 200MHz	3.79	5.2	dB
Radiated Emissions 200 to 1000MHz	3.62	5.2	dB
Radiated Emissions 1-18GHz	3.65	---	dB
Conducted Emissions .150k-30MHz	1.52	3.6	dB
Radiated Disturbances 5MHz to 30MHz	2.81	4.5	dB
Radiated Disturbances 30MHz to 950MHz	2.21	4.5	dB
Harmonic Current Emissions	1.7	---	%
Voltage Fluctuations & Flicker	1.7	---	%
Insertion Loss/Internal Calibrations	.65	---	dB
Radiated Immunity 80-1000MHz	1.21	---	dB
Conducted Immunity .150-80MHz	1.64	---	dB
Frequency Interpolations	.81 (ave)	---	dB

NOTE U_{cispr} resembles a value of measurement uncertainty for a specific test, which was determined by considering uncertainties associated with the quantities listed in CISPR 16-4-2:2003 Section 4.2. Where no value is given for U_{cispr} the procedure below does not apply.

Compliance or non-compliance with a disturbance limit shall be determined in the following manner.

If U_{Lab} is less than or equal to U_{cispr} in Table 5.0-1, then:

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If U_{Lab} is greater than U_{cispr}, then:

- compliance is deemed to occur if no measured disturbance, increased by ($U_{Lab} – U_{cispr}$), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance, increased by ($U_{Lab} – U_{cispr}$), exceeds the disturbance limit.

The calculated MU is much less than the internationally accepted MU, therefore an adjustment to the measured result as mentioned above is not necessary.

Immunity
The EUT was subjected to the appropriate test levels required by the standard with a confidence level of 95%(k=2).

SECTION E: CONCLUSION
The EUT is determined to meet the requirements as defined in the applicable regulations.