

# Digital Control, Inc.

## Eclipse SST

Report No. DIGC0126.2

Report Prepared By



[www.nwemc.com](http://www.nwemc.com)  
1-888-EMI-CERT

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EMC Test Report



22975 NW Evergreen Parkway  
Suite 400  
Hillsboro, Oregon 97124

## Certificate of Test

Last Date of Test: January 12, 2011

Digital Control, Inc.

Model: Eclipse SST

Emissions			
Test Description	Specification	Test Method	Pass/Fail
Field Strength of Fundamental	FCC 15.209:2011	ANSI C63.10:2009	Pass
Field Strength of Spurious Emissions	FCC 15.209:2011	ANSI C63.10:2009	Pass

### Modifications made to the product

See the Modifications section of this report

### Test Facility

The measurement facility used to collect the data is located at:

Northwest EMC, Inc.  
22975 NW Evergreen Parkway, Suite 400  
Hillsboro, OR 97124

Phone: (503) 844-4066 Fax: 844-3826

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada (Site filing #2834D-1).

Approved By:

Tim O'Shea, Operations Manager



NVLAP Lab Code: 200630-0

*This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.*

*Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test.*

Revision Number	Description	Date	Page Number
00	None		

**Barometric Pressure**

The recorded barometric pressure has been normalized to sea level.



# Accreditations and Authorizations

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## FCC

Accredited by NVLAP for performance of FCC radio, digital, and ISM device testing. Our Open Area Test Sites, certification chambers, and conducted measurement facilities have been fully described in reports filed with the FCC and accepted by the FCC in letters maintained in our files. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by the FCC as a Telecommunications Certification Body (TCB). This allows Northwest EMC to certify transmitters to FCC specifications in accordance with 47 CFR 2.960 and 2.962.

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## NVLAP

Northwest EMC, Inc. is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. NVLAP is administered by the National Institute of Standards and Technology (NIST), an agency of the U.S. Commerce Department. The NVLAP accreditation encompasses Electromagnetic Compatibility Testing in accordance with the European Union EMC Directive 2004/108/EC, and ANSI C63.4. Additionally, Northwest EMC is accredited by NVLAP to perform radio testing in accordance with the European Union R&TTE Directive 1999/5/EEC, the requirements of FCC, and the RSS radio standards for Industry Canada.

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## Industry Canada

Accredited by NVLAP for performance of Industry Canada RSS and ICES testing. Our Open Area Test Sites and certification chambers comply with RSS-Gen, Issue 2 and have been filed with Industry Canada and accepted. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by NIST and recognized by Industry Canada as a Certification Body (CB) per the APEC Mutual Recognition Arrangement (MRA). This allows Northwest EMC to certify transmitters to Industry Canada technical requirements. (*Site Filing Numbers - Hillsboro: 2834D-1, 2834D-2, Sultan: 2834C-1, Irvine: 2834B-1, 2834B-2, Brooklyn Park: 2834E-1*)

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## CAB

Designated by NIST and validated by the European Commission as a Conformity Assessment Body (CAB) to conduct tests and approve products to the EMC directive and transmitters to the R&TTE directive, as described in the U.S. - EU Mutual Recognition Agreement.

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## Australia/New Zealand

The National Association of Testing Authorities (NATA), Australia has been appointed by the ACA as an accreditation body to accredit test laboratories and competent bodies for EMC standards. Accredited test reports or assessments by competent bodies must carry the NATA logo. Test reports made by an overseas laboratory that has been accredited for the relevant standards by an overseas accreditation body that has a Mutual Recognition Agreement (MRA) with NATA are also accepted as technical grounds for product conformity. The report should be endorsed with the respective logo of the accreditation body (NVLAP).

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# Accreditations and Authorizations

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## VCCI

Accepted as an Associate Member to the VCCI, Acceptance No. 564. Conducted and radiated measurement facilities have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. *(Registration Numbers. - Hillsboro: C-1071, R-1025, G-84, C-2687, T-1658, and R-2318, Irvine: R-1943, G-85, C-2766, and T-1659, Sultan: R-871, G-83, C-1784, and T-1511, Brooklyn Park: R-3125, G-86, G-141, C-3464, and T-1634).*

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## BSMI

Northwest EMC has been designated by NIST and validated by C-Taipei (BSMI) as a CAB to conduct tests as described in the APEC Mutual Recognition Agreement (US0017).

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## GOST

Northwest EMC, Inc. has been assessed and accredited by the Russian Certification bodies Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC, to perform EMC and Hygienic testing for Information Technology Products. As a result of their laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification

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## KCC

Northwest EMC, Inc is a CAB designated by MRA partners and recognized by Korea. *(Assigned Lab Numbers: Hillsboro: US0017, Irvine: US0158, Sultan: US0157, Brooklyn Park: US0175)*

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## VIETNAM

Vietnam MIC has approved Northwest EMC as an accredited test lab. Per Decision No. 194/QD-QLCL (dated December 15, 2009), Northwest EMC test reports can be used for Vietnam approval submissions.

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## SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/accreditations/>



## Northwest EMC Locations



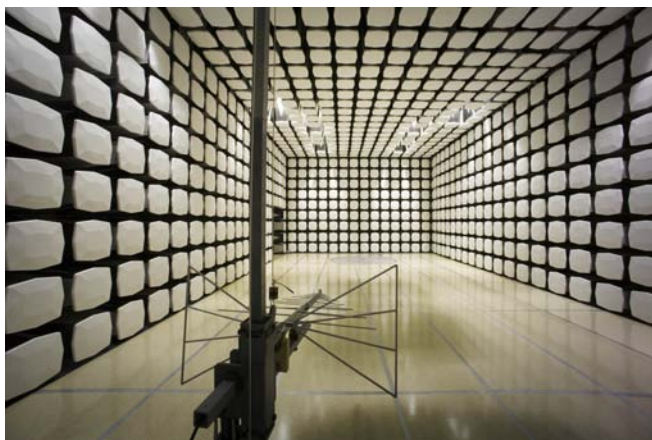
Oregon  
Labs EV01-EV12  
22975 NW Evergreen Pkwy  
Suite 400  
Hillsboro, OR 97124  
(503) 844-4066

California  
Labs OC01-OC13  
41 Tesla  
Irvine, CA 92618  
(949) 861-8918

Minnesota  
Labs MN01-MN08  
9349 W Broadway Ave.  
Brooklyn Park,  
MN 55445  
(763) 425-2281

Washington  
Labs SU01-SU07  
14128 339<sup>th</sup> Ave. SE  
Sultan, WA 98294  
(360) 793-8675

New York  
Labs WA01-WA04  
4939 Jordan Rd.  
Elbridge, NY 13060  
(315) 685-0796



**Party Requesting the Test**

<b>Company Name:</b>	Digital Control, Inc.
<b>Address:</b>	19625 62nd Avenue South, Suite B103
<b>City, State, Zip:</b>	Kent, WA 98032
<b>Test Requested By:</b>	Amanda Hamm
<b>Model:</b>	Eclipse SST
<b>First Date of Test:</b>	January 10, 2011
<b>Last Date of Test:</b>	January 12, 2011
<b>Receipt Date of Samples:</b>	January 10, 2011
<b>Equipment Design Stage:</b>	Production
<b>Equipment Condition:</b>	No Damage

**Information Provided by the Party Requesting the Test****Functional Description of the EUT (Equipment Under Test):**

12kHz transmitters. The transmitter, during use, is located in a HDD (Horizontal Directional Drill) Head. The power cable may be up to 1000ft long when used with one battery, if the bore-length increases beyond 1000 ft, an additional battery can be added.

**Testing Objective:**

To demonstrate compliance to FCC 15.209 requirements.

**CONFIGURATION 2 DIGC0126**

<b>EUT</b>			
<b>Description</b>	<b>Manufacturer</b>	<b>Model/Part Number</b>	<b>Serial Number</b>
EUT	Digital Control, Inc.	Eclipse SST	SST0096

<b>Remote Equipment Outside of Test Setup Boundary</b>			
<b>Description</b>	<b>Manufacturer</b>	<b>Model/Part Number</b>	<b>Serial Number</b>
Power Supply	Topward Electric	TPS-2000	TPD (NWEMC)

<b>Cables</b>					
<b>Cable Type</b>	<b>Shield</b>	<b>Length (m)</b>	<b>Ferrite</b>	<b>Connection 1</b>	<b>Connection 2</b>
DC Leads	No	2.0m	No	Power Supply	EUT
<b>PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.</b>					



Equipment modifications					
Item	Date	Test	Modification	Note	Disposition of EUT
1	1/10/2011	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	1/12/2011	Field Strength of Spurious Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing is completed.

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

**MODES OF OPERATION**

Tx

**POWER SETTINGS INVESTIGATED**

15VDC

**CONFIGURATIONS INVESTIGATED**

DIGC0126 - 2

**FREQUENCY RANGE INVESTIGATED**

Start Frequency	9 kHz	Stop Frequency	20 kHz
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**CLOCKS AND OSCILLATORS**

4 MHz

**SAMPLE CALCULATIONS**

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

**TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna, Loop	EMCO	6502	AZC	8/3/2009	24 mo
EV11 Cables	N/A	3m Test Distance Cables	EVM	8/26/2010	13 mo
Spectrum Analyzer	Agilent	E4443A	AFB	2/1/2010	12 mo

**MEASUREMENT BANDWIDTHS**

	Frequency Range	Peak Data	Quasi-Peak Data	Average Data
	(MHz)	(kHz)	(kHz)	(kHz)
	0.01 - 0.15	1.0	0.2	0.2
	0.15 - 30.0	10.0	9.0	9.0
	30.0 - 1000	100.0	120.0	120.0
	Above 1000	1000.0	N/A	1000.0

Measurements were made using the IF bandwidths and detectors specified. No video filter was used, except in the case of the FCC Average Measurements above 1GHz. In that case, a peak detector with a 10Hz video bandwidth was used.

**MEASUREMENT UNCERTAINTY**

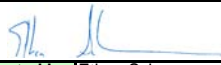
A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

**TEST DESCRIPTION**

The antenna to be used with the EUT was tested. The EUT was transmitting at the channel available. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.10.2009). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

## EMC

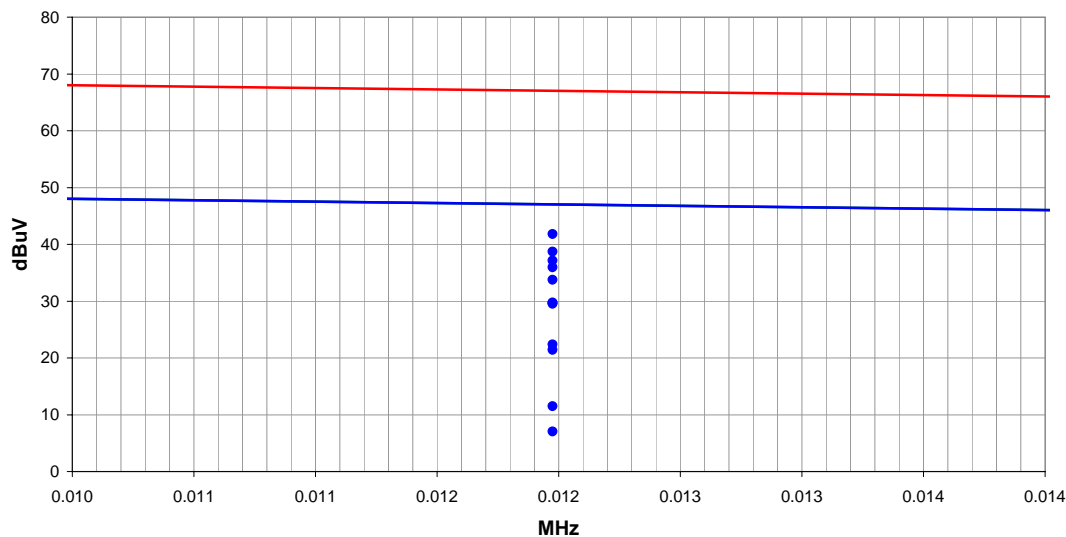
## Field Strength of Fundamental

Work Order:	DIGC0126	Date:	01/10/11	
Project:	None	Temperature:	19.9	
Job Site:	EV11	Humidity:	30.7	
Serial Number:	SST0096	Barometric Pres.:	1027	
			Tested by: Ethan Schoonover	
EUT:	Eclipse SST			
Configuration:	2			
Customer:	Digital Control, Inc.			
Attendees:	none			
EUT Power:	15VDC			
Operating Mode:	Tx			
Deviations:	None			
Comments:	None			

Test Specifications  
FCC 15.209:2011

Test Method  
ANSI C63.10:2009

Run #	2	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted -200	Spec. Limit -200	Compared to Spec. (dB)	Comments
0.012	95.7	18.0	1.9	298.0	3.0	0.0	Horz	AV	-80.0	33.7	45.9	-12.1	Ant par to EUT, Perp to ground EUT Horz
0.012	91.8	17.8	1.9	-3.0	3.0	0.0	Horz	AV	-80.0	29.6	45.6	-16.0	Ant perp to EUT, Perp to ground EUT Horz.
0.012	91.6	18.2	1.9	46.0	3.0	0.0	Vert	AV	-80.0	29.8	46.0	-16.3	Ant perp to EUT, Par to ground EUT Vert.
0.012	84.1	18.3	2.4	349.0	3.0	0.0	Horz	AV	-80.0	22.4	46.2	-23.8	Ant par to EUT, Perp to ground EUT Vert.
0.012	103.7	18.1	1.9	298.0	3.0	0.0	Horz	PK	-80.0	41.8	66.0	-24.2	Ant par to EUT, Perp to ground EUT Horz
0.012	83.3	18.1	1.9	295.0	3.0	0.0	Vert	AV	-80.0	21.4	46.0	-24.6	Ant perp to EUT, Par to ground EUT Horz.
0.012	100.6	18.1	1.9	-3.0	3.0	0.0	Horz	PK	-80.0	38.7	66.0	-27.3	Ant perp to EUT, Perp to ground EUT Horz.
0.012	99.0	18.1	1.9	295.0	3.0	0.0	Vert	PK	-80.0	37.1	66.0	-28.9	Ant perp to EUT, Par to ground EUT Horz.
0.012	97.8	18.1	1.9	46.0	3.0	0.0	Vert	PK	-80.0	35.9	66.0	-30.1	Ant perp to EUT, Par to ground EUT Vert.
0.012	91.4	18.1	2.4	349.0	3.0	0.0	Horz	PK	-80.0	29.5	66.0	-36.5	Ant par to EUT, Perp to ground EUT Vert.
0.012	68.8	18.3	1.9	1.0	3.0	0.0	Horz	AV	-80.0	7.1	46.2	-39.1	Ant perp to EUT, Perp to ground EUT Vert.
0.012	73.4	18.1	1.9	1.0	3.0	0.0	Horz	PK	-80.0	11.5	66.0	-54.5	Ant perp to EUT, Perp to ground EUT Vert.

**EMC****Field Strength of Spurious Emissions**

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

**MODES OF OPERATION**

Tx

**POWER SETTINGS INVESTIGATED**

15VDC

**CONFIGURATIONS INVESTIGATED**

DIGC0126 - 2

**FREQUENCY RANGE INVESTIGATED**

Start Frequency	10 kHz	Stop Frequency	30 MHz
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**CLOCKS AND OSCILLATORS**

4 MHz

**SAMPLE CALCULATIONS**

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

**TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4443A	AFB	2/1/2010	12 mo
EV11 Cables	N/A	3m Test Distance Cables	EVM	8/26/2010	13 mo
Antenna, Loop	EMCO	6502	AOA	7/1/2009	24 mo

**MEASUREMENT BANDWIDTHS**

	Frequency Range	Peak Data	Quasi-Peak Data	Average Data
	(MHz)	(kHz)	(kHz)	(kHz)
	0.01 - 0.15	1.0	0.2	0.2
	0.15 - 30.0	10.0	9.0	9.0
	30.0 - 1000	100.0	120.0	120.0
	Above 1000	1000.0	N/A	1000.0

Measurements were made using the IF bandwidths and detectors specified. No video filter was used, except in the case of the FCC Average Measurements above 1GHz. In that case, a peak detector with a 10Hz video bandwidth was used.

**MEASUREMENT UNCERTAINTY**


A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

**TEST DESCRIPTION**

The antennas to be used with the EUT were tested. The EUT was transmitting and receiving while set at the channel available. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and orientation in 3 orthogonal plane, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.4:2003). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

## EMC

## Field Strength of Spurious Emissions

Work Order:	DIGC0126	Date:	01/12/11	
Project:	None	Temperature:	19.9	
Job Site:	EV11	Humidity:	30.7	
Serial Number:	None	Barometric Pres.:	1027	
EUT:	Eclipse SST			
Configuration:	2 - Eclipse SST			
Customer:	Digital Control, Inc.			
Attendees:	None			
EUT Power:	15VDC			
Operating Mode:	Tx			
Deviations:	None			
Comments:	None			

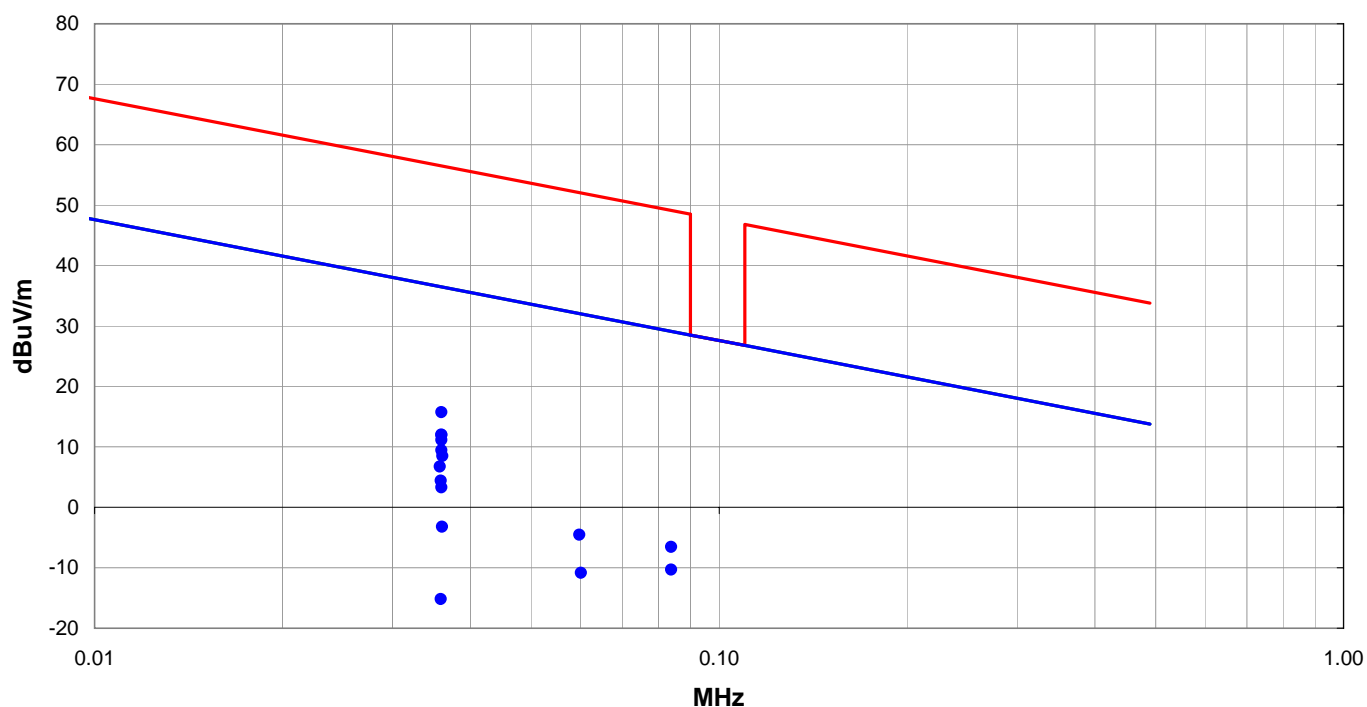
## Test Specifications

FCC 15.209:2011

## Test Method

ANSI C63.10:2009

<b>Run #</b>	3	<b>Test Distance (m)</b>	3	<b>Antenna Height(s)</b>	1.85-2.5m	<b>Results</b>	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.036	79.2	12.7	1.9	282.0	3.0	0.0	Horz	AV	-80.0	11.9	36.5	-24.6
0.036	75.8	12.7	1.9	6.0	3.0	0.0	Horz	AV	-80.0	8.5	36.4	-27.9
0.036	74.0	12.7	2.1	297.0	3.0	0.0	Vert	AV	-80.0	6.7	36.5	-29.8
0.036	71.7	12.7	1.9	309.0	3.0	0.0	Vert	AV	-80.0	4.4	36.5	-32.1
0.084	58.7	11.0	1.9	270.0	3.0	0.0	Horz	AV	-80.0	-10.3	29.1	-39.5
0.036	64.1	12.7	2.4	307.0	3.0	0.0	Horz	AV	-80.0	-3.2	36.5	-39.6
0.036	83.0	12.7	1.9	282.0	3.0	0.0	Horz	PK	-80.0	15.7	56.5	-40.8
0.060	57.9	11.3	1.9	105.0	3.0	0.0	Horz	AV	-80.0	-10.8	32.0	-42.8
0.036	79.3	12.7	1.9	6.0	3.0	0.0	Horz	PK	-80.0	12.0	56.5	-44.5
0.036	78.4	12.7	2.1	297.0	3.0	0.0	Vert	PK	-80.0	11.1	56.5	-45.4
0.036	76.7	12.7	1.9	309.0	3.0	0.0	Vert	PK	-80.0	9.4	56.5	-47.1