

Digital Control, Inc.

FX

Report No. DIGC0070

Report Prepared By



www.nwemc.com
1-888-EMI-CERT

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EMC Test Report

Certificate of Test

Last Date of Test: October 16, 2009
Digital Control, Inc.
Model: FX

Emissions			
Test Description	Specification	Test Method	Pass/Fail
Radiated Emissions of Digital Portion	FCC 15.109:2009	ANSI C63.4:2003	Pass
Field Strength of Fundamental	FCC 15.209:2009	ANSI C63.4:2003	Pass
Field Strength of Spurious Emissions	FCC 15.205:2009	ANSI C63.4:2003	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: (763) 425-2281 Fax: (763) 424-3469

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:



Don Facteau, IS 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

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.



NVLAP

Northwest EMC, Inc. is accredited under the United States Department of Commerce, National Institute of Standards and Technology, and National Voluntary Laboratory Accreditation Program for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. 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.



NVLAP LAB CODE 200629-0
NVLAP LAB CODE 200630-0
NVLAP LAB CODE 200676-0
NVLAP LAB CODE 200761-0
NVLAP LAB CODE 200881-0

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)



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.



NEMKO

Assessed and accredited by NEMKO (Norwegian testing and certification body) for European emissions and immunity testing. As a result of NEMKO's laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification (Authorization No. ELA 119).





Accreditations and Authorizations

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).



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, C-2687, T-289, and R-2318, Irvine: R-1943, C-2766, and T-298, Sultan: R-871, C-1784, and T-294, Brooklyn Park: R-3125, C-3464, and T-1634).



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). License No.SL2-IN-E-1017.

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



KCC

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



SCOPE

For details on the Scopes of our Accreditations, please visit:
<http://www.nwemc.com/accreditations/>



Northwest EMC Locations



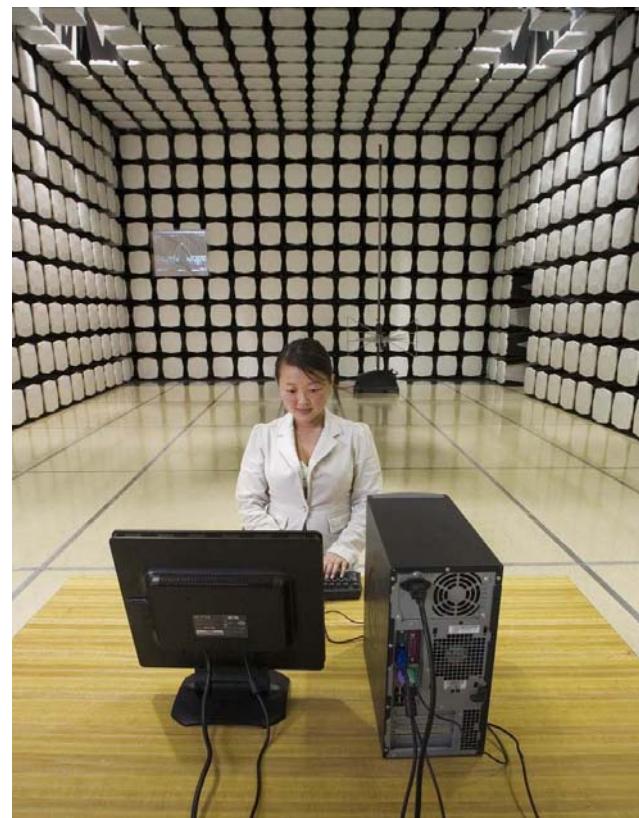
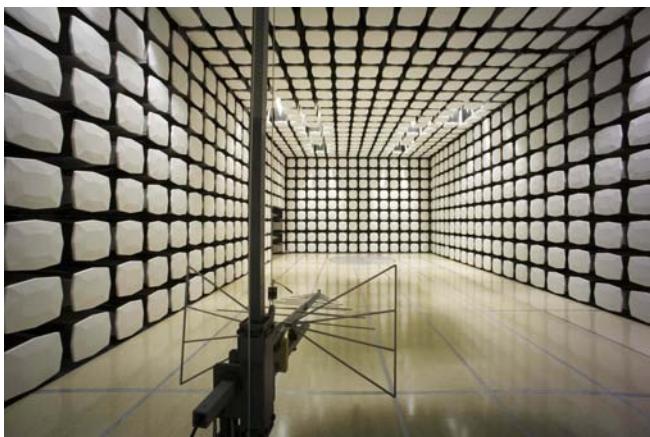
Oregon
Labs EV01-EV12
22975 NW Evergreen Pkwy
Suite 400
Hillsboro, OR 97124
(503) 844-4066

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 339th 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

Company Name:	Digital Control, Inc.
Address:	19625 62nd Avenue South, Suite B103
City, State, Zip:	Kent, WA 98032
Test Requested By:	Rudy Zeller
Model:	FX
First Date of Test:	October 15, 2009
Last Date of Test:	October 16, 2009
Receipt Date of Samples:	October 15, 2009
Equipment Design Stage:	Production
Equipment Condition:	No Damage

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

kHz transmitter in Drill Head

Testing Objective:

Seeking TCB authorization of the kHz transmitter in the Drill Head.

CONFIGURATION 1 DIGC0070

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
FX Long Range Transmitter	Digital Control Incorporated	FX	None

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Small Test Head	Digital Control Incorporated	None	None

Equipment modifications					
Item	Date	Test	Modification	Note	Disposition of EUT
1	10/15/2009	Radiated Emissions of Digital Portion	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	10/15/2009	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.
3	10/16/2009	Field Strength of Spurious Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was 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.

MODES OF OPERATION

Normal Operating mode, EUT horizontal.
Normal Operating mode, EUT vertical.

MODE USED FOR FINAL DATA

Normal Operating mode, EUT horizontal.

POWER SETTINGS INVESTIGATED

Internal Battery

FREQUENCY RANGE INVESTIGATED

Start Frequency	10kHz	Stop Frequency	30MHz
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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	11/17/2008	12
EV11 Cables		3m Test Distance Cables	EVM	7/13/2009	13
Antenna, Loop	EMCO	6502	AOA	7/1/2009	24

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 bandwidths and detectors specified. No video filter 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. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. The measurement uncertainty estimation is 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.

Field Strength of Fundamental

EUT: FX	Work Order: DIGC0070
Serial Number: None	Date: 10/15/09
Customer: Digital Control, Inc.	Temperature: 22.7 °C
Attendees: None	Humidity: 45%
Project: None	Barometric Pres.: 1016.8mb
Tested by: Dan Haas	Job Site: EV11

TEST SPECIFICATIONS

FCC 15.209:2009 | ANSI C63.4:2003

TEST PARAMETERS

Antenna Height(s) (m) | 1.85 - 2.5 | Test Distance (m) | 3

COMMENTS

See comments for EUT and Antenna orientation.

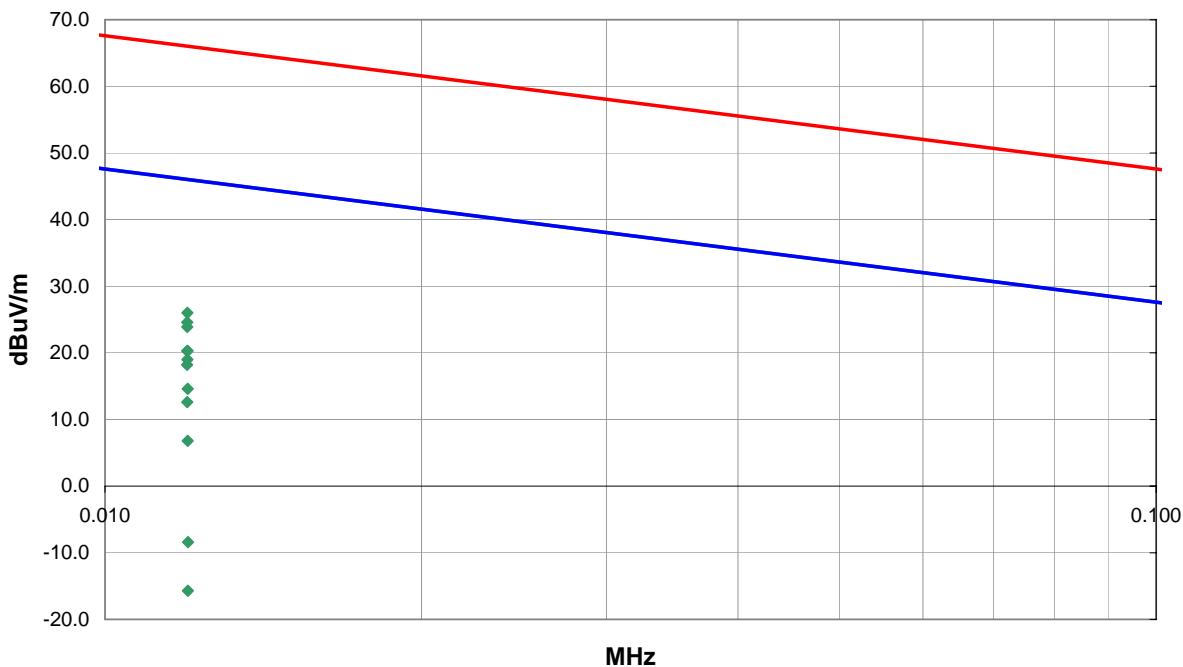
EUT OPERATING MODES

Normal Operating mode.

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	4
Configuration #	1
Results	Pass

Signature 

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
0.012	82.2	18.1	275.0	1.9	3.0	0.0	oop/Active	AV	-80.0	20.3	46.0	-25.7
0.012	80.9	18.1	280.0	2.1	3.0	0.0	oop/Active l	AV	-80.0	19.0	46.0	-27.0
0.012	80.1	18.1	0.0	1.9	3.0	0.0	oop/Active	AV	-80.0	18.2	46.0	-27.8
0.012	76.5	18.1	2.0	1.9	3.0	0.0	oop/Active l	AV	-80.0	14.6	46.0	-31.4
0.012	68.7	18.1	125.0	2.5	3.0	0.0	oop/Active	AV	-80.0	6.8	46.0	-39.2
0.012	87.9	18.1	275.0	1.9	3.0	0.0	oop/Active	PK	-80.0	26.0	66.0	-40.0
0.012	86.5	18.1	280.0	2.1	3.0	0.0	oop/Active l	PK	-80.0	24.6	66.0	-41.4
0.012	85.8	18.1	0.0	1.9	3.0	0.0	oop/Active	PK	-80.0	23.9	66.0	-42.1
0.012	82.2	18.1	2.0	1.9	3.0	0.0	oop/Active l	PK	-80.0	20.3	66.0	-45.7
0.012	74.5	18.1	125.0	2.5	3.0	0.0	oop/Active	PK	-80.0	12.6	66.0	-53.4
0.012	46.2	18.1	1.0	2.0	3.0	0.0	oop/Active	AV	-80.0	-15.7	46.0	-61.7
0.012	53.5	18.1	1.0	2.0	3.0	0.0	oop/Active	PK	-80.0	-8.4	66.0	-74.4





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MODES OF OPERATION

Normal Operating mode. EUT horizontal.
Normal Operating mode. EUT vertical.

MODE USED FOR FINAL DATA

Normal Operating mode. EUT horizontal.

POWER SETTINGS INVESTIGATED

Internal Battery

FREQUENCY RANGE INVESTIGATED

Start Frequency	10kHz	Stop Frequency	30MHz
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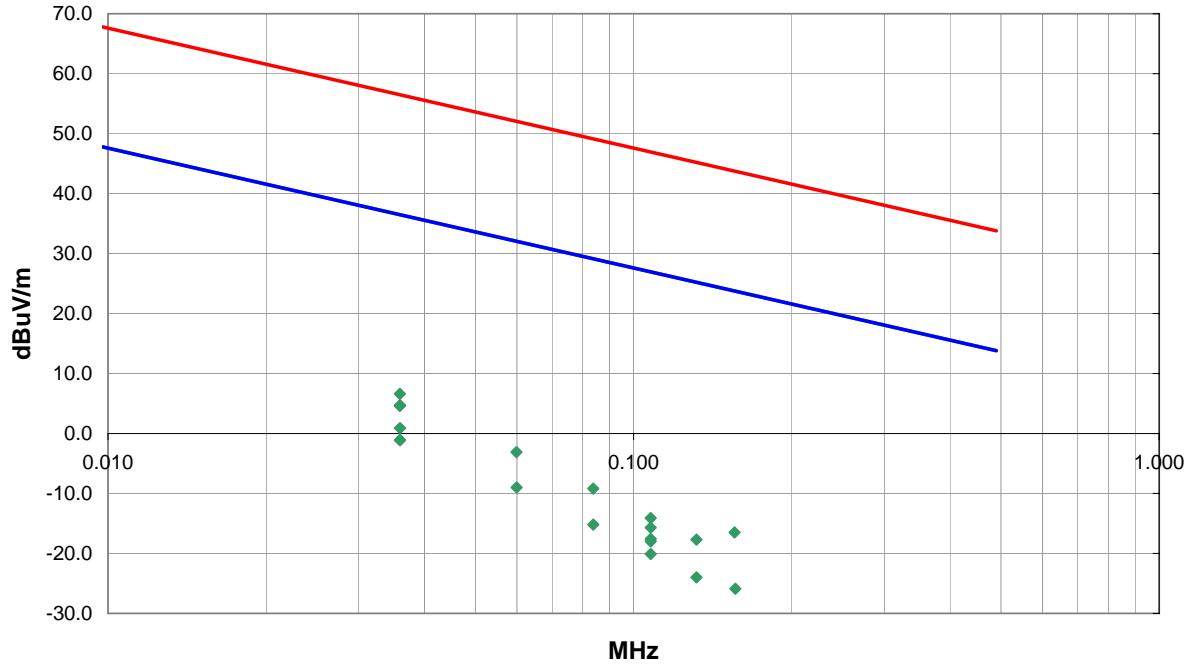
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Field Strength of Spurious Emissions												PSA 2008.07.21	EMI 2009.8.29																																																																																																																																																																																																																																																																						
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 <p>The graph plots Spurious Emission Field Strength (dBuV/m) on the Y-axis (ranging from -30.0 to 70.0) against Frequency (MHz) on the X-axis (ranging from 0.010 to 1.000). Two downward-sloping lines represent the test limits: a red line for the upper limit and a blue line for the lower limit. Data points are represented by green diamonds. Most points fall well below the lower limit line, indicating compliance.</p>																																																																																																																																																																																																																																																																																			
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Limit dBuV/m	Compared to Spec. (dB)	0.036	68.2	12.7	273.0	1.9	3.0	0.0	oop/Active	AV	-80.0	0.9	36.5	-35.6	0.036	66.2	12.7	0.0	1.9	3.0	0.0	oop/Active	AV	-80.0	-1.1	36.5	-37.6	0.036	66.2	12.7	277.0	2.5	3.0	0.0	oop/Active I	AV	-80.0	-1.1	36.5	-37.6	0.060	59.8	11.2	274.0	1.9	3.0	0.0	oop/Active	AV	-80.0	-9.0	32.0	-41.0	0.108	53.5	10.8	272.0	1.9	3.0	0.0	oop/Active	QP	-80.0	-15.7	26.9	-42.6	0.084	53.9	10.9	269.0	1.9	3.0	0.0	oop/Active	AV	-80.0	-15.2	29.1	-44.3	0.108	51.6	10.8	279.0	2.5	3.0	0.0	oop/Active I	QP	-80.0	-17.6	26.9	-44.5	0.108	51.2	10.8	182.0	1.9	3.0	0.0	oop/Active	QP	-80.0	-18.0	26.9	-44.9	0.108	49.1	10.8	272.0	1.9	3.0	0.0	oop/Active	AV	-80.0	-20.1	26.9	-47.0	0.132	45.2	10.8	271.0	1.9	3.0	0.0	oop/Active	AV	-80.0	-24.0	25.2	-49.2	0.156	43.3	10.8	271.0	1.9	3.0	0.0	oop/Active	AV	-80.0	-25.9	23.7	-49.6	0.036	73.9	12.7	273.0	1.9	3.0	0.0	oop/Active	PK	-80.0	6.6	56.5	-49.9	0.036	72.0	12.7	277.0	2.5	3.0	0.0	oop/Active I	PK	-80.0	4.7	56.5	-51.8	0.036	71.9	12.7	0.0	1.9	3.0	0.0	oop/Active	PK	-80.0	4.6	56.5	-51.9	0.060	65.7	11.2	274.0	1.9	3.0	0.0	oop/Active	PK	-80.0	-3.1	52.0	-55.1	0.084	59.9	10.9	269.0	1.9	3.0	0.0	oop/Active	PK	-80.0	-9.2	49.1	-58.3	0.156	52.7	10.8	271.0	1.9	3.0	0.0	oop/Active	PK	-80.0	-16.5	43.8	-60.3	0.108	55.1	10.8	272.0	1.9	3.0	0.0	oop/Active	PK	-80.0	-14.1	46.9	-61.0	0.132	51.5	10.8	271.0	1.9	3.0	0.0	oop/Active	PK	-80.0	-17.7	45.2	-62.9
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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.

MODES OF OPERATION

Normal Operating mode.

MODE USED FOR FINAL DATA

Normal Operating mode.

POWER SETTINGS INVESTIGATED

Internal Battery

FREQUENCY RANGE INVESTIGATED

Start Frequency	30MHz	Stop Frequency	1000MHz
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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	11/17/2008	12
EV11 Cables		3m Test Distance Cables	EVM	7/13/2009	13
Pre-Amplifier	Miteq	AM-1551	AOY	7/13/2009	13
Antenna, Biconilog	EMCO	3142	AXB	1/15/2008	24

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	0.2
0.15 - 30.0	10.0	9.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0	120.0
Above 1000	1000.0	N/A	N/A	1000.0

Measurements were made using the bandwidths and detectors specified. No video filter was used.

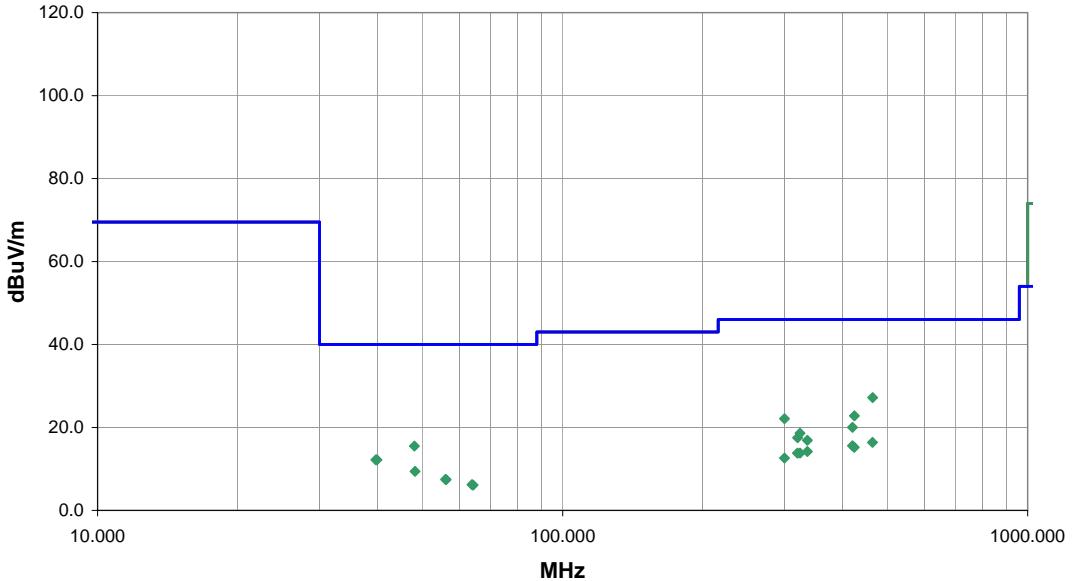
MEASUREMENT UNCERTAINTY

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. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. The measurement uncertainty estimation is available upon request.

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, a final radiated emissions test was performed. The frequency range investigated (scanned), is also noted in this report. Radiated emissions measurements were made at the EUT azimuth and antenna height such that the maximum radiated emissions level will be detected. This requires the use of a turntable and an antenna positioner. The preferred method of a continuous azimuth search is utilized for frequency scans of the EUT field strength with both polarities of the measuring antenna. A calibrated, linearly polarized antenna was positioned at the specified distance from the periphery of the EUT.

Tests were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna was varied in height above the conducting ground plane to obtain the maximum signal strength. Though specified in the report, the measurement distance shall be 3 meters or 10 meters. At any measurement distance, the antenna height was varied from 1 meter to 4 meters. These height scans apply for both horizontal and vertical polarization, except that for vertical polarization the minimum height of the center of the antenna shall be increased so that the lowest point of the bottom of the antenna clears the ground surface by at least 25 cm.

Radiated Emissions of Digital Portion												PSA 2008.07.21 EMI 2009.8.29			
EUT: FX							Work Order: DIGC0070								
Serial Number: None				Customer: Digital Control, Inc.				Date: 10/15/09							
Attendees: None								Temperature: 21.0 °C							
Project: None								Humidity: 41%							
Tested by: Dan Haas				Power: Internal Battery				Barometric Pres.: 1019.7mb							
TEST SPECIFICATIONS															
FCC 15.109:2009							Test Method: ANSI C63.4:2003								
TEST PARAMETERS															
Antenna Height(s) (m) 1 - 4				Test Distance (m) 3											
COMMENTS															
See notes for EUT orientation.															
EUT OPERATING MODES															
Normal Operating mode.															
DEVIATIONS FROM TEST STANDARD															
No deviations.															
Run #	1														
Configuration #	1														
Results	Pass														
															
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments		
463.998	41.5	-14.3	23.0	1.6	3.0	0.0	H-Bilog	QP	0.0	27.2	46.0	-18.8	EUT Vertical.		
423.996	37.9	-15.1	207.0	1.6	3.0	0.0	H-Bilog	QP	0.0	22.8	46.0	-23.2	EUT Vertical.		
300.001	39.8	-17.7	152.0	1.0	3.0	0.0	H-Bilog	QP	0.0	22.1	46.0	-23.9	EUT Vertical.		
48.004	37.6	-22.1	15.0	1.6	3.0	0.0	V-Bilog	QP	0.0	15.5	40.0	-24.5	EUT Horizontal.		
419.997	35.2	-15.2	187.0	1.6	3.0	0.0	H-Bilog	QP	0.0	20.0	46.0	-26.0	EUT Vertical.		
323.997	35.2	-16.6	149.0	1.7	3.0	0.0	H-Bilog	QP	0.0	18.6	46.0	-27.4	EUT Vertical.		
39.655	31.6	-19.4	-5.0	1.0	3.0	0.0	H-Bilog	QP	0.0	12.2	40.0	-27.8	EUT Horizontal.		
39.882	31.7	-19.5	-5.0	1.0	3.0	0.0	V-Bilog	QP	0.0	12.2	40.0	-27.8	EUT Horizontal.		
319.969	34.3	-16.8	119.0	1.6	3.0	0.0	H-Bilog	QP	0.0	17.5	46.0	-28.5	EUT Vertical.		
335.999	33.4	-16.5	314.0	1.6	3.0	0.0	H-Bilog	QP	0.0	16.9	46.0	-29.1	EUT Vertical.		
463.871	30.7	-14.3	223.0	2.2	3.0	0.0	V-Bilog	QP	0.0	16.4	46.0	-29.6	EUT Vertical.		
420.000	30.8	-15.2	213.0	1.6	3.0	0.0	V-Bilog	QP	0.0	15.6	46.0	-30.4	EUT Vertical.		
48.144	31.5	-22.1	309.0	2.7	3.0	0.0	H-Bilog	QP	0.0	9.4	40.0	-30.6	EUT Horizontal.		
423.780	30.3	-15.1	63.0	1.6	3.0	0.0	V-Bilog	QP	0.0	15.2	46.0	-30.8	EUT Vertical.		
335.893	30.7	-16.5	272.0	1.7	3.0	0.0	V-Bilog	QP	0.0	14.2	46.0	-31.8	EUT Vertical.		
319.887	30.6	-16.8	125.0	1.6	3.0	0.0	V-Bilog	QP	0.0	13.8	46.0	-32.2	EUT Vertical.		
324.024	30.4	-16.6	52.0	1.7	3.0	0.0	V-Bilog	QP	0.0	13.8	46.0	-32.2	EUT Vertical.		
56.022	31.4	-23.9	173.0	2.2	3.0	0.0	V-Bilog	QP	0.0	7.5	40.0	-32.5	EUT Horizontal.		
56.143	31.4	-24.0	45.0	1.6	3.0	0.0	H-Bilog	QP	0.0	7.4	40.0	-32.6	EUT Horizontal.		
299.836	30.3	-17.7	310.0	1.6	3.0	0.0	V-Bilog	QP	0.0	12.6	46.0	-33.4	EUT Vertical.		



