

Digital Control, Inc.

ST

Report No. DIGC0114

Report Prepared By



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

© 2010 Northwest EMC, Inc

EMC Test Report



22975 NW Evergreen Parkway
Suite 400
Hillsboro, Oregon 97124

Certificate of Test
Last Date of Test: July 20, 2010
Digital Control, Inc.
Model: ST

| Emissions | | | |
|--------------------------------------|-------------------------|------------------|-----------|
| Test Description | Specification | Test Method | Pass/Fail |
| Field Strength of Fundamental | FCC 15.209:2010 | ANSI C63.10:2009 | Pass |
| Field Strength of Spurious Emissions | FCC 15.209:2010 | ANSI C63.10:2009 | Pass |
| Radiated Emissions | FCC 15.109:2010 Class A | 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: (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

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).



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, 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).



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)



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.



SCOPE

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

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



Northwest EMC Locations



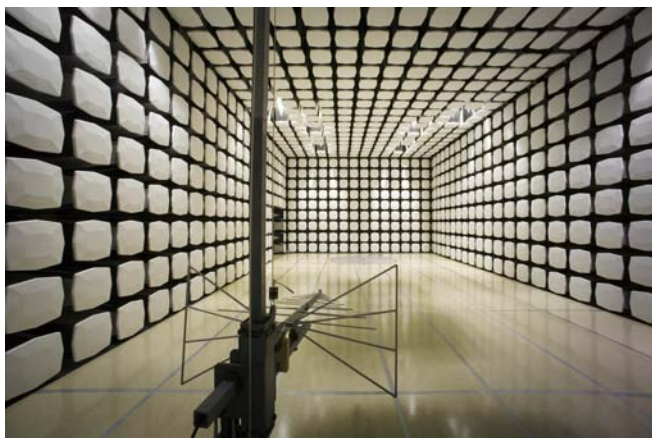
Oregon
Labs EV01-EV12
22975 NW Evergreen Pkwy
Suite 400
Hillsboro, OR 97124
(503) 844-4066

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: | Amanda Hamm |
| Model: | ST |
| First Date of Test: | July 20, 2010 |
| Last Date of Test: | July 20, 2010 |
| Receipt Date of Samples: | July 20, 2010 |
| Equipment Design Stage: | Production |
| Equipment Condition: | No Damage |

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

11.976 kHz transmitter located in a horizontal Drill Head

Testing Objective:

To demonstrate compliance to FCC 15.209 requirements.

Northwest

EMC

Configurations

Revision 9/21/05

CONFIGURATION 1 DIGC0114

| EUT | | | |
|---|-----------------------|-------------------|---------------|
| Description | Manufacturer | Model/Part Number | Serial Number |
| Horizontal Drill Head with Standard Range Transmitter | Digital Control, Inc. | ST | 1148108 |

| Equipment modifications | | | | | |
|-------------------------|-----------|--------------------------------------|--------------------------------------|---|---|
| Item | Date | Test | Modification | Note | Disposition of EUT |
| 1 | 7/20/2010 | 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 | 7/20/2010 | Field Strength of Spurious Emissions | 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 | 7/20/2010 | Radiated 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. 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

Battery

CONFIGURATIONS INVESTIGATED

DIGC0114 - 1

FREQUENCY RANGE INVESTIGATED

| | | | |
|-----------------|-----------|----------------|-----------|
| Start Frequency | 11.976kHz | Stop Frequency | 11.976kHz |
|-----------------|-----------|----------------|-----------|

CLOCKS AND OSCILLATORS

11.976kHz

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 | 7/13/2009 | 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 | 0.2 | 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 while set 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: | DIGC0114 | Date: | 07/20/10 |  |
| Project: | None | Temperature: | 22 | |
| Job Site: | EV11 | Humidity: | 44 | |
| Serial Number: | 1148108 | Barometric Pres.: | 1018.3 | Tested by: Jennifer Herrett |
| EUT: | ST | | | |
| Configuration: | 1 - Basic Configuration | | | |
| Customer: | Digital Control, Inc. | | | |
| Attendees: | None | | | |
| EUT Power: | Battery | | | |
| Operating Mode: | Tx | | | |
| Deviations: | None | | | |
| Comments: | None | | | |

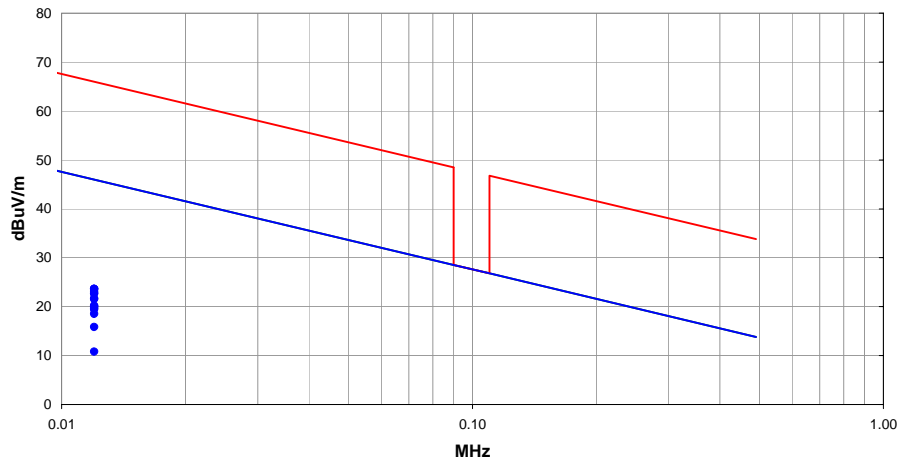
Test Specifications

FCC 15.209:2010

Test Method

ANSI C63.10:2009

| | | | | | | | |
|-------|---|-------------------|---|-------------------|-----------|---------|------|
| Run # | 6 | Test Distance (m) | 3 | Antenna Height(s) | 1.85-2.5m | Results | Pass |
|-------|---|-------------------|---|-------------------|-----------|---------|------|



| 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) | Comments |
|------------|------------------|-------------|-------------------------|-------------------|------------------------|---------------------------|--------------------------|----------|--------------------------|-------------------|----------------------|------------------------|--|
| 0.012 | 83.5 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | 21.6 | 46.0 | -24.4 | Antenna perp to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.012 | 83.4 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | 21.5 | 46.0 | -24.5 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN up. |
| 0.012 | 81.9 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | 20.0 | 46.0 | -26.0 | Antenna perp to EUT, perp to ground. EUT horizontal with SN up. |
| 0.012 | 81.8 | 18.1 | 2.2 | 0.0 | 3.0 | 0.0 | Vert | AV | -80.0 | 19.9 | 46.0 | -26.1 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN to the side. |
| 0.012 | 81.5 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | AV | -80.0 | 19.6 | 46.0 | -26.4 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN up. |
| 0.012 | 81.3 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | AV | -80.0 | 19.4 | 46.0 | -26.6 | Antenna perp to EUT, parallel to ground. EUT vertical. |
| 0.012 | 80.4 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | 18.5 | 46.0 | -27.5 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.012 | 72.7 | 18.1 | 2.5 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | 10.8 | 46.0 | -35.2 | Antenna parallel to EUT, perp to ground. EUT vertical. |
| 0.012 | 85.5 | 18.1 | 2.2 | 0.0 | 3.0 | 0.0 | Vert | PK | -80.0 | 23.6 | 66.0 | -42.4 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN to the side. |
| 0.012 | 85.5 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | 23.6 | 66.0 | -42.4 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.012 | 85.5 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | 23.6 | 66.0 | -42.4 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN up. |
| 0.012 | 85.0 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | PK | -80.0 | 23.1 | 66.0 | -42.9 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN up. |
| 0.012 | 84.6 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | 22.7 | 66.0 | -43.3 | Antenna perp to EUT, perp to ground. EUT horizontal with SN up. |
| 0.012 | 84.5 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | 22.6 | 66.0 | -43.4 | Antenna perp to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.012 | 82.1 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | PK | -80.0 | 20.2 | 66.0 | -45.8 | Antenna perp to EUT, parallel to ground. EUT vertical. |
| 0.012 | 77.7 | 18.1 | 2.5 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | 15.8 | 66.0 | -50.2 | Antenna parallel to EUT, perp to ground. EUT vertical. |
| 0.012 | 48.0 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | -13.9 | 46.0 | -59.9 | Antenna perp to EUT, perp to ground. EUT vertical. |
| 0.012 | 52.6 | 18.1 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | -9.3 | 66.0 | -75.3 | Antenna perp to EUT, perp to ground. EUT vertical. |

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

Battery

CONFIGURATIONS INVESTIGATED

DIGC0114 - 1

FREQUENCY RANGE INVESTIGATED

| | | | |
|-----------------|--------|----------------|--------|
| Start Frequency | 10 kHz | Stop Frequency | 30 MHz |
|-----------------|--------|----------------|--------|

CLOCKS AND OSCILLATORS

None Provided

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 | 7/13/2009 | 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 | 0.2 | 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 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.

NORTHWEST

PSA-ESCI 2010.04.06
Version 2010.3.17

EMCField Strength of Spurious Emissions

Work Order: DIGC0114

Date: 07/20/10

Project: None

Temperature: 22

Job Site: EV11

Humidity: 44

Serial Number: 1148108

Barometric Pres.: 1018.3

Tested by: Jennifer Herrett

EUT: ST

Configuration: 1 - Basic Configuration

Customer: Digital Control, Inc.

Attendees: None

EUT Power: Battery

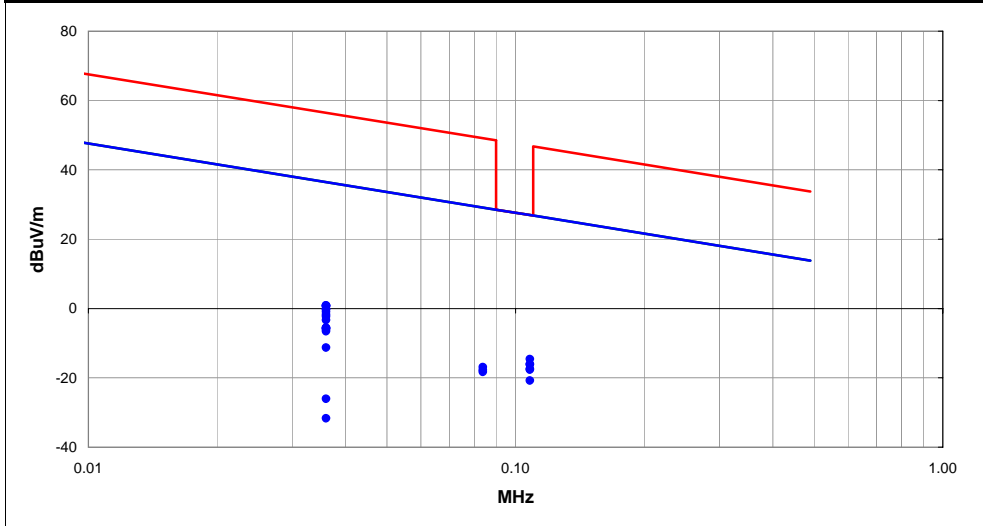
Operating Mode: Tx

Deviations: None

Comments: None

| | |
|---------------------|------------------|
| Test Specifications | Test Method |
| FCC 15.209:2010 | ANSI C63.10:2009 |

| | | | | | | | |
|-------|---|-------------------|---|-------------------|------|---------|------|
| Run # | 7 | Test Distance (m) | 3 | Antenna Height(s) | 1-4m | Results | Pass |
|-------|---|-------------------|---|-------------------|------|---------|------|



| 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) | Comments |
|------------|------------------|-------------|-------------------------|-------------------|------------------------|---------------------------|---------------------------|----------|--------------------------|-------------------|----------------------|------------------------|--|
| 0.036 | 66.3 | 12.7 | 2.0 | 0.0 | 3.0 | 0.0 | Vert | AV | -80.0 | -1.0 | 36.5 | -37.5 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN to the side. |
| 0.036 | 65.5 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | -1.8 | 36.5 | -38.3 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.036 | 63.9 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | -3.4 | 36.5 | -39.9 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN up. |
| 0.108 | 54.6 | 10.8 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | PK | -80.0 | -14.6 | 27.0 | -41.6 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN to the side. |
| 0.036 | 61.7 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | -5.6 | 36.5 | -42.1 | Antenna perp to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.036 | 61.6 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | -5.7 | 36.5 | -42.2 | Antenna perp to EUT, perp to ground. EUT horizontal with SN up. |
| 0.036 | 61.5 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | AV | -80.0 | -5.8 | 36.5 | -42.3 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN up. |
| 0.036 | 61.3 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | AV | -80.0 | -6.0 | 36.5 | -42.5 | Antenna perp to EUT, parallel to ground. EUT vertical. |
| 0.108 | 53.1 | 10.8 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | -16.1 | 27.0 | -43.1 | Antenna perp to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.108 | 53.0 | 10.8 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | AV | -80.0 | -16.2 | 27.0 | -43.2 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN to the side. |
| 0.108 | 51.7 | 10.8 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | -17.5 | 27.0 | -44.5 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.108 | 51.5 | 10.8 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | -17.7 | 27.0 | -44.7 | Antenna perp to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.084 | 52.1 | 11.0 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | QP | -80.0 | -16.9 | 29.1 | -46.1 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN to the side. |
| 0.084 | 51.3 | 11.0 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | QP | -80.0 | -17.7 | 29.1 | -46.9 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.084 | 50.7 | 11.0 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | QP | -80.0 | -18.3 | 29.1 | -47.5 | Antenna perp to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.036 | 56.0 | 12.7 | 2.5 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | -11.3 | 36.5 | -47.8 | Antenna parallel to EUT, perp to ground. EUT vertical. |
| 0.108 | 48.4 | 10.8 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | -20.8 | 27.0 | -47.8 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.036 | 68.2 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | PK | -80.0 | 0.9 | 56.5 | -55.6 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN up. |
| 0.036 | 68.1 | 12.7 | 2.0 | 0.0 | 3.0 | 0.0 | Vert | PK | -80.0 | 0.8 | 56.5 | -55.7 | Antenna perp to EUT, parallel to ground. EUT horizontal with SN to the side. |
| 0.036 | 68.0 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | 0.7 | 56.5 | -55.8 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN up. |
| 0.036 | 67.9 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | 0.6 | 56.5 | -55.9 | Antenna parallel to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.036 | 67.1 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | -0.2 | 56.5 | -56.7 | Antenna perp to EUT, perp to ground. EUT horizontal with SN to the side. |
| 0.036 | 67.1 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | PK | -80.0 | -0.2 | 56.5 | -56.7 | Antenna perp to EUT, perp to ground. EUT horizontal with SN up. |
| 0.036 | 65.0 | 12.7 | 1.9 | 0.0 | 3.0 | 0.0 | Vert | PK | -80.0 | -2.3 | 56.5 | -58.8 | Antenna perp to EUT, parallel to ground. EUT vertical. |
| 0.036 | 60.7 | 12.7 | 2.5 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | -6.6 | 56.5 | -63.1 | Antenna parallel to EUT, perp to ground. EUT vertical. |
| 0.036 | 35.6 | 12.7 | 2.0 | 0.0 | 3.0 | 0.0 | Horz | AV | -80.0 | -31.7 | 36.5 | -68.2 | Antenna perp to EUT, perp to ground. EUT vertical. |
| 0.036 | 41.2 | 12.7 | 2.0 | 0.0 | 3.0 | 0.0 | Horz | PK | -80.0 | -26.1 | 56.5 | -82.6 | Antenna perp to EUT, perp to ground. EUT vertical. |

EMC**RADIATED 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

Battery

CONFIGURATIONS INVESTIGATED

DIGC0114 - 1

FREQUENCY RANGE INVESTIGATED

| | | | |
|-----------------|--------|----------------|----------|
| Start Frequency | 30 MHz | Stop Frequency | 1000 MHz |
|-----------------|--------|----------------|----------|

CLOCKS AND OSCILLATORS

None Provided

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 |
| Pre-Amplifier | Miteq | AM-1551 | AOY | 7/13/2009 | 13 mo |
| EV11 Cables | N/A | 10m Test Distance Cables | EVL | 7/13/2009 | 13 mo |
| Antenna, Biconilog | EMCO | 3142 | AXB | 1/14/2010 | 13 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


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 was detected. This required the use of a turntable and an antenna positioner. The preferred method of a continuous azimuth search was 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 was 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 was increased so that the lowest point of the bottom of the antenna cleared the ground surface by at least 25 cm.

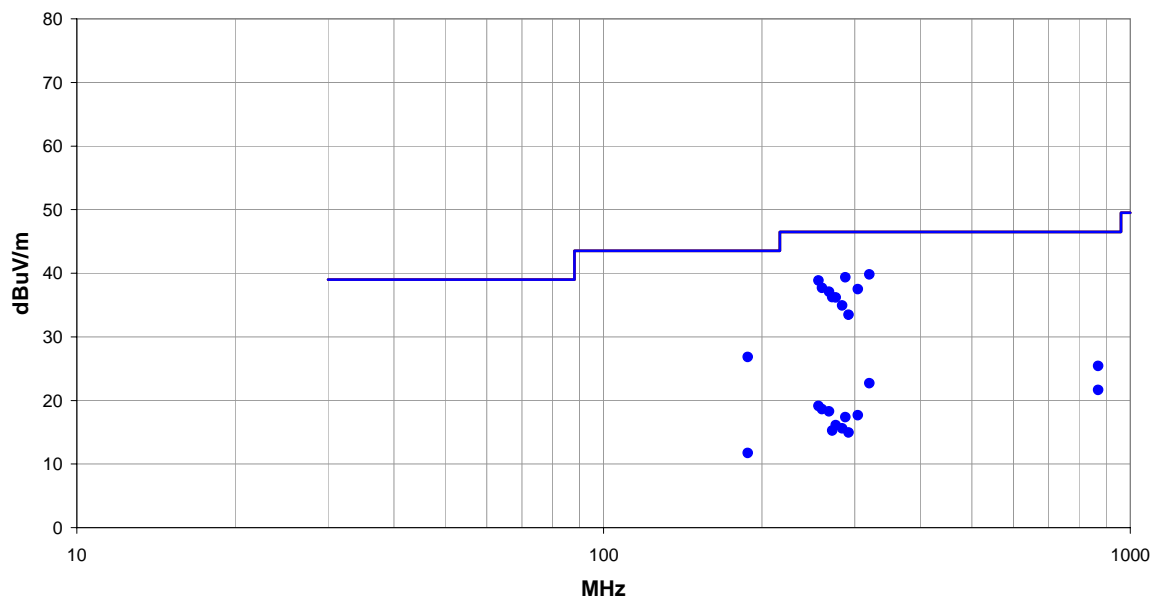
If measurements above 1 GHz were required, the test setup was modified to meet the regulatory requirements for higher frequency measurements. If required, RF absorber was placed on the floor between the measurement antenna and EUT. Measurements were made at a 3 meter test distance with the EUT placed on a 0.8 meter high table. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.

EMC

RADIATED EMISSIONS

| | | | | |
|-----------------|-------------------------|-------------------|----------|--|
| Work Order: | DIGC0114 | Date: | 07/20/10 |  |
| Project: | None | Temperature: | 22 | |
| Job Site: | EV11 | Humidity: | 44 | |
| Serial Number: | 1148108 | Barometric Pres.: | 1018.3 | |
| | | | | Tested by: Jennifer Herrett |
| EUT: | ST | | | |
| Configuration: | 1 - Basic Configuration | | | |
| Customer: | Digital Control, Inc. | | | |
| Attendees: | None | | | |
| EUT Power: | Battery | | | |
| Operating Mode: | Tx | | | |
| Deviations: | None | | | |
| Comments: | None | | | |

| | | | | | | |
|---------------------|---|-------------------|---------|-------------------|------|---------|
| Test Specifications | | | Class A | Test Method | | |
| FCC 15.109:2010 | | | | ANSI C63.4:2003 | | |
| Run # | 1 | Test Distance (m) | 10 | Antenna Height(s) | 1-4m | Results |
| | | | | | | Pass |



| 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) |
|------------|------------------|-------------|-------------------------|-------------------|------------------------|---------------------------|--------------------------|----------|--------------------------|-------------------|----------------------|------------------------|
| 320.002 | 59.8 | -20.0 | 1.0 | 87.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 39.8 | 46.5 | -6.7 |
| 288.001 | 60.4 | -21.1 | 1.0 | 98.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 39.3 | 46.5 | -7.2 |
| 256.001 | 60.0 | -21.2 | 1.0 | 197.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 38.8 | 46.5 | -7.7 |
| 260.004 | 58.8 | -21.1 | 1.0 | 77.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 37.7 | 46.5 | -8.8 |
| 304.003 | 58.5 | -21.0 | 1.0 | 294.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 37.5 | 46.5 | -9.0 |
| 268.003 | 58.0 | -20.9 | 1.0 | 95.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 37.1 | 46.5 | -9.4 |
| 272.004 | 57.1 | -20.9 | 1.0 | 290.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 36.2 | 46.5 | -10.3 |
| 276.001 | 57.0 | -20.8 | 1.0 | 91.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 36.2 | 46.5 | -10.3 |
| 284.002 | 55.9 | -21.0 | 1.0 | 117.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 34.9 | 46.5 | -11.6 |
| 292.003 | 54.6 | -21.1 | 1.0 | 70.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 33.5 | 46.5 | -13.0 |
| 188.005 | 50.5 | -23.7 | 1.1 | 102.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 26.8 | 43.5 | -16.7 |
| 869.388 | 35.9 | -10.5 | 1.2 | 142.0 | 10.0 | 0.0 | Vert | QP | 0.0 | 25.4 | 46.5 | -21.1 |
| 320.000 | 42.7 | -20.0 | 1.1 | 214.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 22.7 | 46.5 | -23.8 |
| 869.389 | 32.1 | -10.5 | 2.2 | 130.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 21.6 | 46.5 | -24.9 |
| 256.001 | 40.3 | -21.2 | 1.0 | 64.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 19.1 | 46.5 | -27.4 |
| 260.001 | 39.7 | -21.1 | 1.6 | 86.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 18.6 | 46.5 | -27.9 |
| 267.998 | 39.2 | -20.9 | 1.7 | 61.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 18.3 | 46.5 | -28.2 |
| 304.000 | 38.7 | -21.0 | 1.0 | 42.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 17.7 | 46.5 | -28.8 |
| 288.001 | 38.4 | -21.1 | 1.0 | 264.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 17.3 | 46.5 | -29.2 |
| 275.999 | 36.9 | -20.8 | 1.0 | 113.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 16.1 | 46.5 | -30.4 |
| 284.000 | 36.6 | -21.0 | 1.0 | 286.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 15.6 | 46.5 | -30.9 |
| 272.007 | 36.1 | -20.9 | 1.0 | 69.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 15.2 | 46.5 | -31.3 |
| 292.000 | 36.1 | -21.1 | 1.0 | 95.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 15.0 | 46.5 | -31.5 |
| 188.004 | 35.4 | -23.7 | 1.3 | 35.0 | 10.0 | 0.0 | Horz | QP | 0.0 | 11.7 | 43.5 | -31.8 |