

Digital Control, Inc.

F2 Receiver (F2R)

Report No. DIGC0046

Report Prepared By



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1-888-EMI-CERT

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EMC Test Report

Certificate of Test

Last Date of Test: January 26, 2009
Digital Control, Inc.
Model: F2 Receiver (F2R)

Emissions			
Test Description	Specification	Test Method	Pass/Fail
Output Power	FCC 2.1046:2009, FCC 90.217:2009	ANSI/TIA/EIA-603-C-2004	Pass
Spurious Radiated Emissions	FCC 2.1053:2009, FCC 90.217:2009	ANSI/TIA/EIA-603-C-2004	Pass
Occupied Bandwidth	FCC 2.1049:2009, FCC 90.217:2009	ANSI/TIA/EIA-603-C-2004	Pass
Frequency Stability	FCC 2.1055:2009, FCC 90.217:2009	ANSI/TIA/EIA-603-C-2004	Pass
Spurious Conducted Emissions	FCC 2.1051:2009, FCC 90.217:2009	ANSI/TIA/EIA-603-C-2004	Pass
Emission Mask	FCC 2.1049:2009, FCC 90.217:2009	ANSI/TIA/EIA-603-C-2004	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-2).

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		

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

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)



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



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

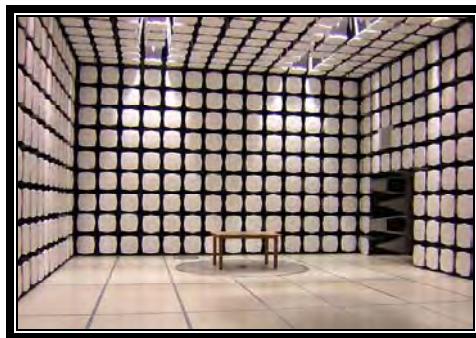


KCC: Northwest EMC, Inc is a CAB designated by MRA partners and recognized by Korea. (Assigned Lab Numbers: Hillsboro: US0017, Irvine: US0158, Sultan: US0157)



SCOPE

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



**California – Orange County Facility
Labs OC01 – OC13**

41 Tesla Ave. Irvine, CA 92618
(888) 364-2378 Fax: (503) 844-3826



**Oregon – Evergreen Facility
Labs EV01 – EV11**

22975 NW Evergreen Pkwy. Suite 400 Hillsboro, OR 97124
(503) 844-4066 Fax: (503) 844-3826



**Washington – Sultan Facility
Labs SU01 – SU07**

14128 339th Ave. SE Sultan, WA 98294
(888) 364-2378

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:	F2 Receiver (F2R)
First Date of Test:	January 19, 2009
Last Date of Test:	January 26, 2009
Receipt Date of Samples:	January 19, 2009
Equipment Design Stage:	Preproduction
Equipment Condition:	No Damage

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

UHF transmitter contained in a handheld locating device that receives a kHz signal and transmits in the UHF band to a remote display device.

Testing Objective:

FCC Part 90.217 certification

CONFIGURATION 1 DIGC0046

Software/Firmware Running during test	
Description	Version
Factory Settings	None

EUT				
Description	Manufacturer	Model/Part Number	Serial Number	
UHF Transmitter	Digital Control, Inc.	F2 Receiver (F2R)	Field-09	
Internal 9 inch Dipole Antenna	Digital Control, Inc.	610-5101-00	None	

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
External Power Supply Adapter	Digital Control, Inc.	None	None

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	1.2m	PA	External Power Supply Adapter	DC Power Supply (Test Equipment)
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

CONFIGURATION 2 DIGC0046

Software/Firmware Running during test	
Description	Version
Factory Settings	None

EUT				
Description	Manufacturer	Model/Part Number	Serial Number	
UHF Transmitter	Digital Control, Inc.	F2 Receiver (F2R)	Field-09	

CONFIGURATION 3 DIGC0046

Software/Firmware Running during test	
Description	Version
Factory Settings	None

EUT				
Description	Manufacturer	Model/Part Number	Serial Number	
UHF Transmitter	Digital Control, Inc.	F2 Receiver (F2R)	Field-09	
Internal 9 inch Dipole Antenna	Digital Control, Inc.	610-5101-00	None	

Equipment modifications					
Item	Date	Test	Modification	Note	Disposition of EUT
1	1/19/2009	Frequency Stability	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	1/20/2009	Occupied Bandwidth	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	1/23/2009	Emission Mask	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.
4	1/23/2009	Output Power	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.
5	1/23/2009	Radiated 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.
6	1/26/2009	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was complete.

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

Transmitting with normal modulation

CHANNELS TESTED

Channel 1, 464.5 MHz

Channel 4, 469.55 MHz

POWER SETTINGS INVESTIGATED

14.4 VDC nominal

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	5000 MHz
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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	E4440A	AAW	1/15/2009	13
Signal Generator	Hewlett-Packard	8648D	TGC	12/9/2008	13
Power Sensor	Gigatronics	80701A	SPL	12/10/2008	13
Power Meter	Gigatronics	8651A	SPM	12/10/2008	13
Signal Generator	Agilent	E8257D	TGX	12/10/2008	13
Antenna, Horn	EMCO	3115	AHJ	8/12/2008	24
Antenna, Horn	EMCO	3115	AHC	8/12/2008	24
Antenna, Dipole	ETS	3121C-DB4	ADE	NCR	0
Pre-Amplifier	Miteq	AM-1616-1000	AVM	6/17/2008	13
Antenna, Biconilog	EMCO	3141	AXG	11/4/2008	13
EV12 Cables		Bilog Cables	EVS	6/17/2008	13
High Pass Filter	Micro-Tronics	50108	HGF	5/14/2008	13
Pre-Amplifier	Miteq	AMF-3D00100800-32-13P	AVF	6/17/2008	13
Antenna, Horn	ETS	3115	AIB	8/25/2008	24
EV12 Cables		Double Ridge Horn Cables	EVT	6/17/2008	13

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		1000.0

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

MEASUREMENT UNCERTAINTY

Measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" or theoretically correct value. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. In the case of transient tests our test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements. The measurement uncertainty for any test is available upon request.

TEST DESCRIPTION

The Field Strength of Spurious Radiation was measured in the far-field at an FCC Listed OATS up to 10 GHz. Spectrum analyzer, signal generator, and linearly polarized antennas were used to measure radiated harmonics and spurious emissions. The orientation of the EUT and measurement antenna were manipulated to maximize the level of emissions. The EUT was configured to transmit at the highest output power.

For licensed transmitters, the FCC references TIA/EIA-603 as the measurement procedure standard. TIA/EIA-603 Section 2.2.12 describes a method for measuring radiated spurious emissions that utilizes an antenna substitution method:

At an approved test site, the transmitter is placed on a remotely controlled turntable, and the measurement antenna is placed 3 meters from the transmitter. The turntable azimuth is varied to maximize the level of spurious emissions. The height of the measurement antenna is also varied from 1 to 4 meters. The amplitude and frequency of the highest emissions are noted. The transmitter is then replaced with a 1/2 wave dipole that is successively tuned to each of the highest spurious emissions. A signal generator is connected to the dipole (horn antenna for frequencies above 1 GHz), and its output is adjusted to match the level previously noted for each frequency. The output of the signal generator is recorded, and by factoring in the cable loss to the dipole antenna and its gain; the power (dBm) into an ideal 1/2 wave dipole antenna is determined for each radiated spurious emission.

For the purposes of preliminary measurements, the field strength of the spurious emissions can be measured and compared with a 3 meter limit. The 3 meter limit was calculated to be 87.4 dBuV/m at 3 meters. The final measurements must be made utilizing the substitution method described above and applied against the ERP limit of -10 dBm determined from the maximum allowable power of 120 mW and a -30 dBc emission mask for 12.5 kHz channel bandwidth devices.

SPURIOUS RADIATED EMISSIONS

EUT:	F2 Receiver (F2R)	Work Order:	DIGC0046
Serial Number:	Field-09	Date:	01/22/09
Customer:	Digital Control, Inc.	Temperature:	20°C
Attendees:	None	Humidity:	32%
Project:	None	Barometric Pres.:	30.37 in
Tested by:	Ethan Schoonover	Power:	14.4 VDC nominal
Job Site:	EV12		

TEST SPECIFICATIONS

FCC 2.1053:2009, FCC 90.217:2009 | ANSI/TIA/EIA-603-C-2004

TEST PARAMETERS

Antenna Height(s) (m) | 1 - 4 | Test Distance (m) | 3

COMMENTS

UHF Transmitter portion. Normal modulation

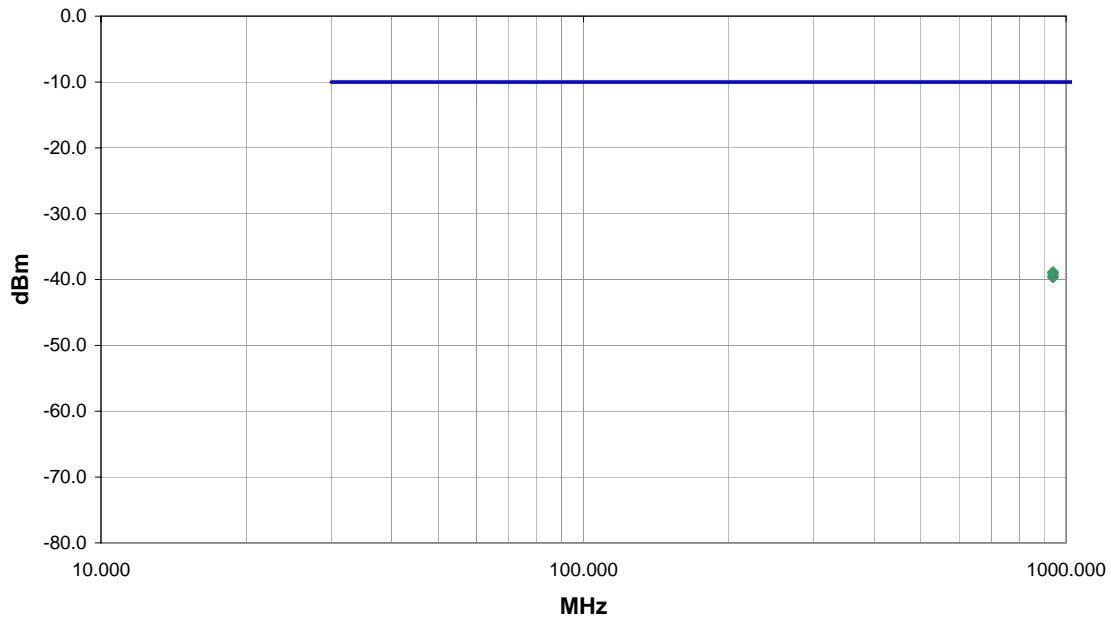
EUT OPERATING MODES

High

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	1	Signature
Configuration #	3	
Results	Pass	



Freq (MHz)			Azimuth (degrees)	Height (meters)			Polarity	Detector	ERP (Watts)	ERP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
939.129			163.0	1.9			V-Bilog	PK	1.30E-07	-38.9	-10.0	-28.9	y
939.108			218.0	1.9			V-Bilog	PK	1.27E-07	-39.0	-10.0	-29.0	z
939.114			1.0	2.4			H-Bilog	PK	1.27E-07	-39.0	-10.0	-29.0	y
939.117			360.0	2.4			H-Bilog	PK	1.18E-07	-39.3	-10.0	-29.3	z
939.098			53.0	1.0			H-Bilog	PK	1.08E-07	-39.7	-10.0	-29.7	x
939.139			134.0	1.8			V-Bilog	PK	1.08E-07	-39.7	-10.0	-29.7	x

SPURIOUS RADIATED EMISSIONS

EUT:	F2 Receiver (F2R)	Work Order:	DIGC0046
Serial Number:	Field-09	Date:	01/22/09
Customer:	Digital Control, Inc.	Temperature:	20°C
Attendees:	None	Humidity:	32%
Project:	None	Barometric Pres.:	30.37 in
Tested by:	Ethan Schoonover	Power:	14.4 VDC nominal
Job Site:	EV12		

TEST SPECIFICATIONS

FCC 2.1053:2009, FCC 90.217:2009 | Test Method: ANSI/TIA/EIA-603-C-2004

TEST PARAMETERS

Antenna Height(s) (m) | 1 - 4 | Test Distance (m) | 3

COMMENTS

UHF Transmitter portion. Normal modulation

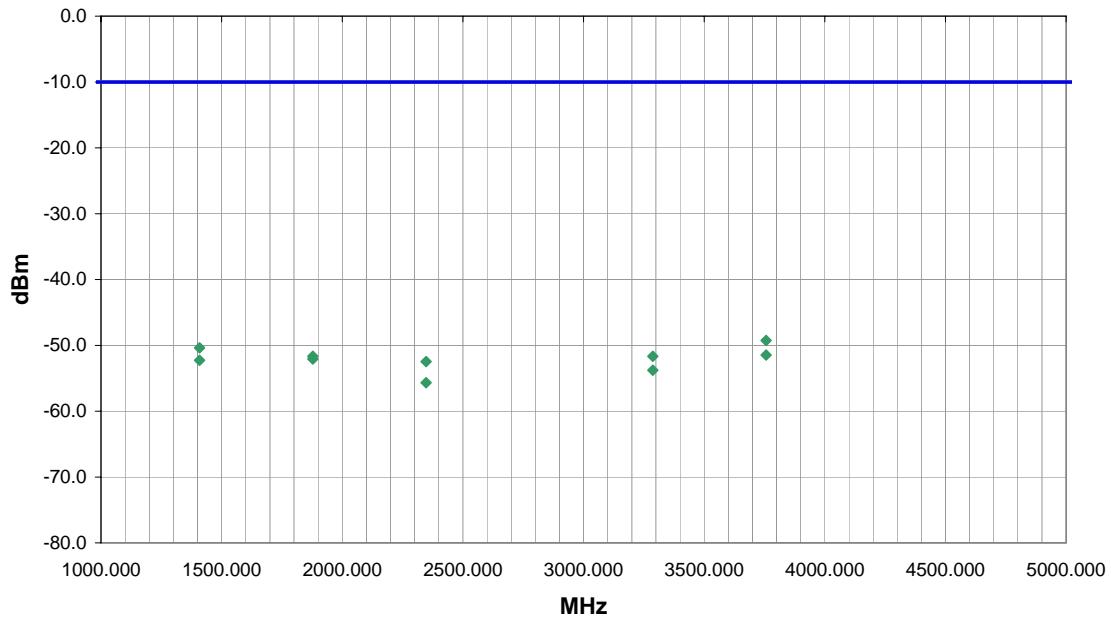
EUT OPERATING MODES

High

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	1
Configuration #	3
Results	Pass

Signature: 

Freq (MHz)			Azimuth (degrees)	Height (meters)			Polarity	Detector	ERP (Watts)	ERP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
3756.400			236.0	1.0			H-Horn	PK	1.18E-08	-49.3	-10.0	-39.3	
1408.642			92.0	1.0			V-Horn	PK	9.19E-09	-50.4	-10.0	-40.4	
3756.433			226.0	1.0			V-Horn	PK	7.13E-09	-51.5	-10.0	-41.5	
3286.958			251.0	1.0			H-Horn	PK	6.81E-09	-51.7	-10.0	-41.7	
1878.158			272.0	1.0			V-Horn	PK	6.81E-09	-51.7	-10.0	-41.7	
1878.042			344.0	1.0			H-Horn	PK	6.21E-09	-52.1	-10.0	-42.1	
1408.617			49.0	1.0			H-Horn	PK	5.93E-09	-52.3	-10.0	-42.3	
2347.800			225.0	1.0			V-Horn	PK	5.66E-09	-52.5	-10.0	-42.5	
3286.908			227.0	1.4			V-Horn	PK	4.20E-09	-53.8	-10.0	-43.8	
2347.667			260.0	1.0			H-Horn	PK	2.71E-09	-55.7	-10.0	-45.7	

SPURIOUS RADIATED EMISSIONS

EUT: F2 Receiver (F2R)	Work Order: DIGC0046
Serial Number: Field-09	Date: 01/23/09
Customer: Digital Control, Inc.	Temperature: 22°C
Attendees: None	Humidity: 38%
Project: None	Barometric Pres.: 30.15
Tested by: Rod Peloquin	Job Site: EV12

TEST SPECIFICATIONS

Test Method

FCC 2.1053:2009, FCC 90.217:2009

ANSI/TIA/EIA-603-C-2004

TEST PARAMETERS

Antenna Height(s) (m) 1 - 4 | Test Distance (m) 3

COMMENTS

UHF Transmitter portion. Normal modulation

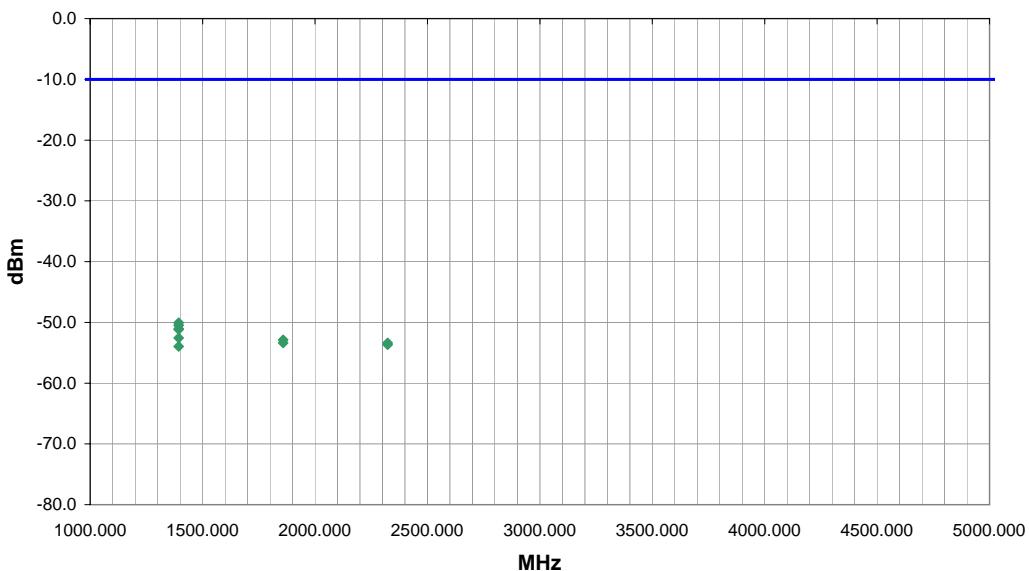
EUT OPERATING MODES

Transmitting with normal modulation, low channel

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	2
Configuration #	3
Results	Pass

Signature 

Freq (MHz)			Azimuth (degrees)	Height (meters)			Polarity	Detector	ERP (Watts)	ERP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
1393.635			98.0	1.0			H-Horn	PK	9.84E-09	-50.1	-10.0	-40.1	EUT on end
1393.460			166.0	1.0			H-Horn	PK	8.98E-09	-50.5	-10.0	-40.5	EUT on side
1393.530			198.0	1.1			V-Horn	PK	7.82E-09	-51.1	-10.0	-41.1	EUT on end
1393.590			88.0	1.0			V-Horn	PK	7.64E-09	-51.2	-10.0	-41.2	EUT typical orientation
1393.440			189.0	1.1			V-Horn	PK	5.54E-09	-52.6	-10.0	-42.6	EUT on side
1858.310			296.0	1.1			V-Horn	PK	5.17E-09	-52.9	-10.0	-42.9	EUT on end
1858.045			201.0	1.1			H-Horn	PK	4.60E-09	-53.4	-10.0	-43.4	EUT on end
2322.560			54.0	1.8			H-Horn	PK	4.60E-09	-53.4	-10.0	-43.4	EUT on end
2322.700			87.0	1.0			V-Horn	PK	4.30E-09	-53.7	-10.0	-43.7	EUT on end
1393.535			43.0	1.0			H-Horn	PK	4.01E-09	-54.0	-10.0	-44.0	EUT typical orientation

SPURIOUS RADIATED EMISSIONS

EUT: F2 Receiver (F2R)	Work Order: DIGC0046
Serial Number: Field-09	Date: 01/23/09
Customer: Digital Control, Inc.	Temperature: 22°C
Attendees: None	Humidity: 34%
Project: None	Barometric Pres.: 30.15
Tested by: Rod Peloquin	Power: 14.4 VDC nominal
	Job Site: EV12

TEST SPECIFICATIONS

FCC 2.1053:2009, FCC 90.217:2009 | ANSI/TIA/EIA-603-C-2004

TEST PARAMETERS

Antenna Height(s) (m) | 1 - 4 | Test Distance (m) | 3

COMMENTS

UHF Transmitter portion. Normal modulation

EUT OPERATING MODES

Transmitting with normal modulation, low channel

DEVIATIONS FROM TEST STANDARD

No deviations.

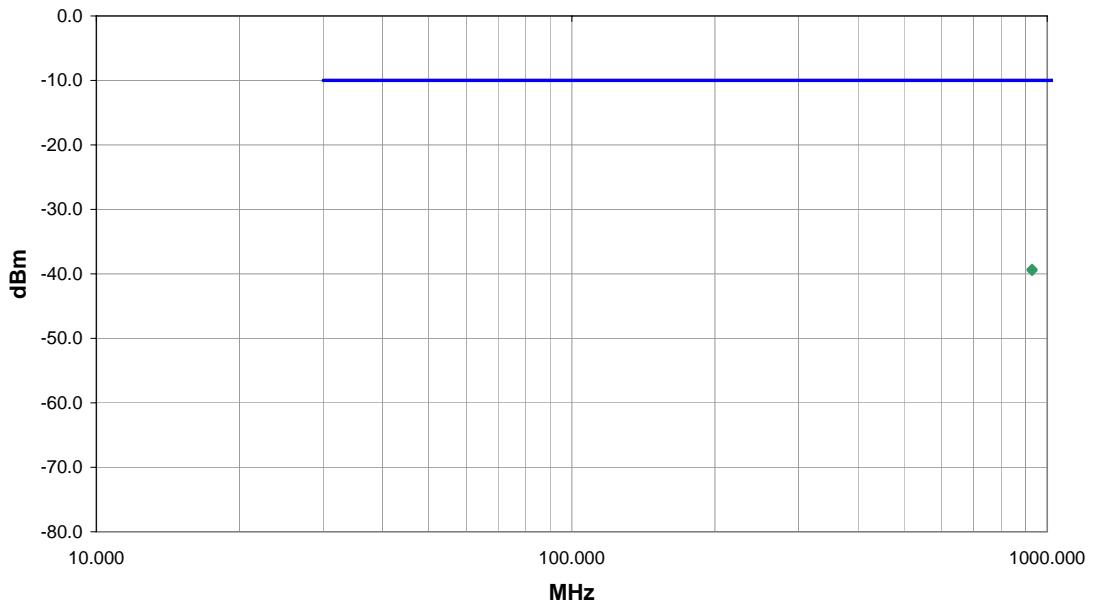
Run # | 3

Configuration # | 3

Results | Pass

Rod Peloquin

Signature



Freq (MHz)			Azimuth (degrees)	Height (meters)			Polarity	Detector	ERP (Watts)	ERP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
928.969			270.0	1.0			V-Bilog	PK	1.18E-07	-39.3	-10.0	-29.3	EUT on end
929.003			69.0	1.0			H-Bilog	PK	1.13E-07	-39.5	-10.0	-29.5	EUT on end

OCCUPIED BANDWIDTH

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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4407B	AAU	12/12/2008	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	6/27/2008	13
Power Meter	Gigatronics	8651A	SPM	12/10/2008	13
Power Sensor	Gigatronics	80701A	SPL	12/10/2008	13
Signal Generator	Hewlett-Packard	8648D	TGC	12/9/2008	13

MEASUREMENT UNCERTAINTY

Measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" or theoretically correct value. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. In the case of transient tests our test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements. The measurement uncertainty for any test is available upon request.

TEST DESCRIPTION

The 99% bandwidth was measured utilizing the analyzer's peak detector and measuring the carrier's 20 dB occupied bandwidth.

A direct connection was made between the EUT and a spectrum analyzer. At 300Hz the spectrum analyzer's resolution bandwidth was sufficiently narrow to plot the actual bandwidth of the signal and not the filter response curve of the spectrum analyzer. The resolution bandwidth was >1% of the 20dB bandwidth and the video bandwidth was greater than or equal to the resolution bandwidth.

The occupied bandwidth was measured with the EUT configured for continuous modulated operation at the lowest, middle and highest channels of the operational band.

EMC

OCCUPIED BANDWIDTH

EUT: F2 Receiver (F2R)

Work Order: DIGC0046

Serial Number: Field-09

Date: 01/20/09

Customer: Digital Control, Inc.

Temperature: 20°C

Attendees: None

Humidity: 32%

Project: None

Barometric Pres.: 30.37 in

Tested by: Rod Peloquin

Power: 14.4 VDC nominal

Job Site: EV06

TEST SPECIFICATIONS

Test Method

FCC 2.1049:2009, FCC 90.217:2009

ANSI C63.4:2003, ANSI/TIA/EIA-603-C-2004

COMMENTS

UHF Transmitter portion. Normal modulation

DEVIATIONS FROM TEST STANDARD

No Deviations

Configuration #

2

Signature



Low Channel

Value

Limit

Results

High Channel

10.216 kHz

12.5 kHz

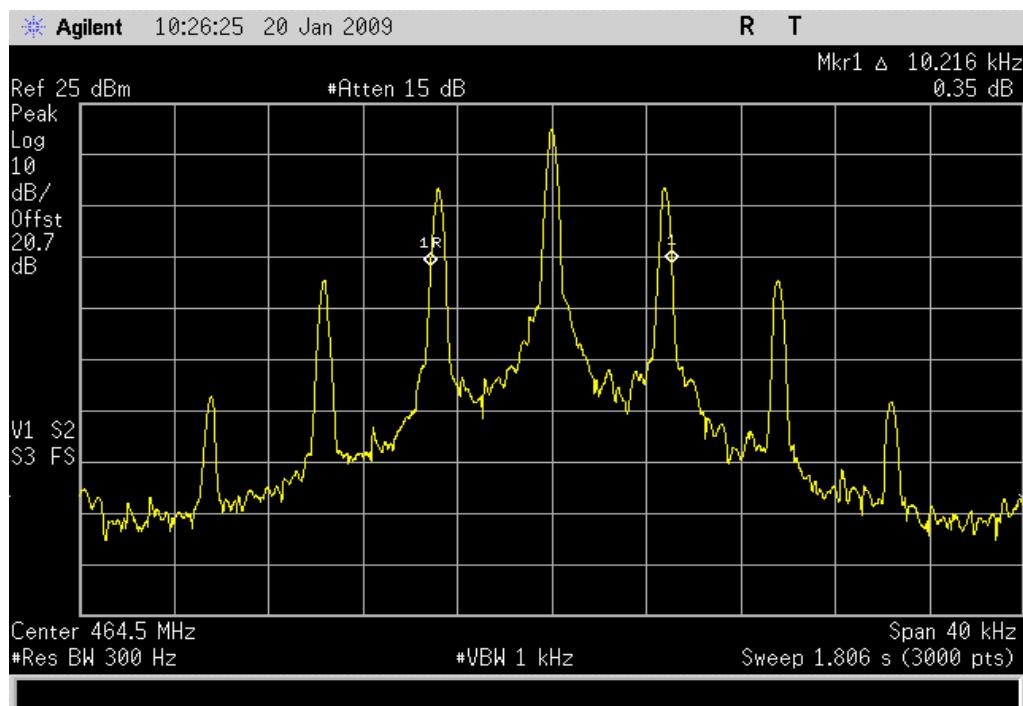
Pass

10.243 kHz

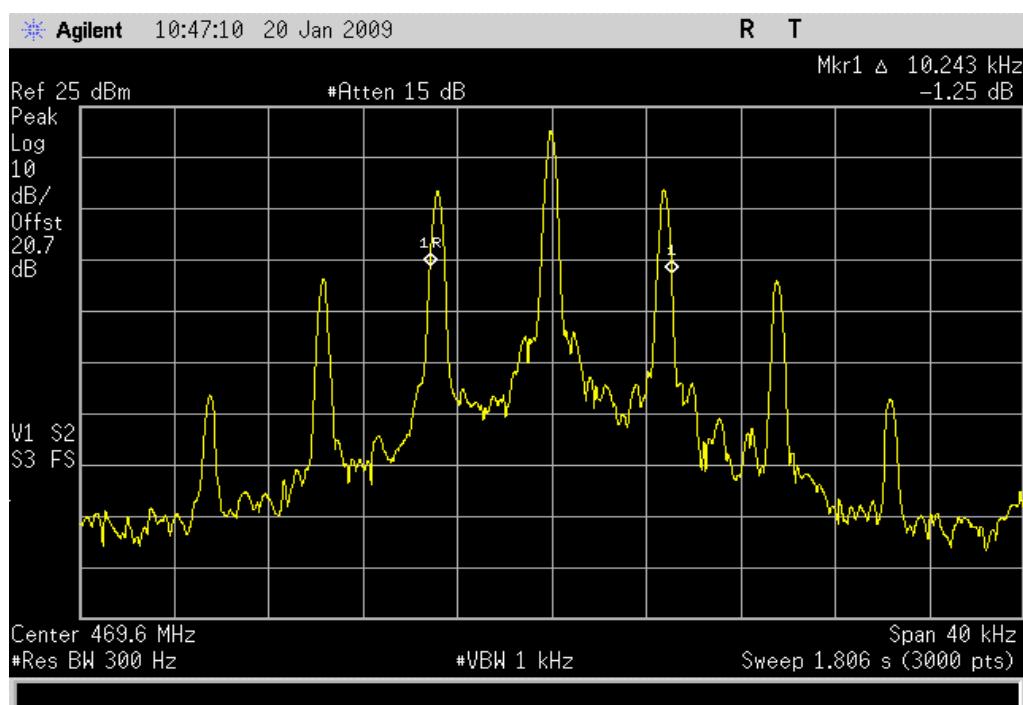
12.5 kHz

Pass

Low Channel		
Result: Pass	Value: 10.216 kHz	Limit: 12.5 kHz



High Channel		
Result: Pass	Value: 10.243 kHz	Limit: 12.5 kHz



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MODES OF OPERATION

Transmitting with normal modulation

CHANNELS TESTED

Channel 1, 464.5 MHz

Channel 4, 469.55 MHz

POWER SETTINGS INVESTIGATED

14.4 VDC nominal

FREQUENCY RANGE INVESTIGATED

Start Frequency	464 MHz	Stop Frequency	470 MHz
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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
EV12 Cables		Bilog Cables	EVS	6/17/2008	13
Spectrum Analyzer	Agilent	E4440A	AAW	1/15/2009	13
Antenna, Biconilog	EMCO	3141	AXG	11/4/2008	13
Signal Generator	Hewlett-Packard	8648D	TGC	12/9/2008	13
Power Sensor	Gigatronics	80701A	SPL	12/10/2008	13
Power Meter	Gigatronics	8651A	SPM	12/10/2008	13
Antenna, Dipole	ETS	3121C-DB4	ADE	NCR	0

MEASUREMENT BANDWIDTHS

	Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (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

Measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" or theoretically correct value. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. In the case of transient tests our test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements. The measurement uncertainty for any test is available upon request.

TEST DESCRIPTION

The fundamental emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height (1-4 meters) and polarization and manipulating the EUT antenna in 3 orthogonal planes.

The antennas to be used with the EUT were tested. The EUT was transmitting while set at the lowest channel, and the highest channel available. The amplitude and frequency were noted. The EUT was then replaced with a 1/2 wave dipole that was successively tuned to the highest emission. A signal generator was connected to the dipole antenna and its output was adjusted to match the level previously noted for each frequency. The output of the signal generator was recorded, and by factoring in the gain (dBi) of the dipole antenna the effective radiated power for each emission was determined.

OUTPUT POWER

EUT: F2 Receiver (F2R)	Work Order: DIGC0046
Serial Number: Field-09	Date: 01/23/09
Customer: Digital Control, Inc.	Temperature: 22
Attendees: None	Humidity: 38%
Project: None	Barometric Pres.: 30.15
Tested by: Rod Peloquin	Power: 14.4 VDC nominal
	Job Site: EV12

TEST SPECIFICATIONS

Test Method

FCC 2.1046:2009, FCC 90.217:2009

ANSI C63.4:2003, ANSI/TIA/EIA-603-C-2004

TEST PARAMETERS

Antenna Height(s) (m) 1 - 4 Test Distance (m) 3

COMMENTS

UHF Transmitter portion. Normal modulation

EUT OPERATING MODES

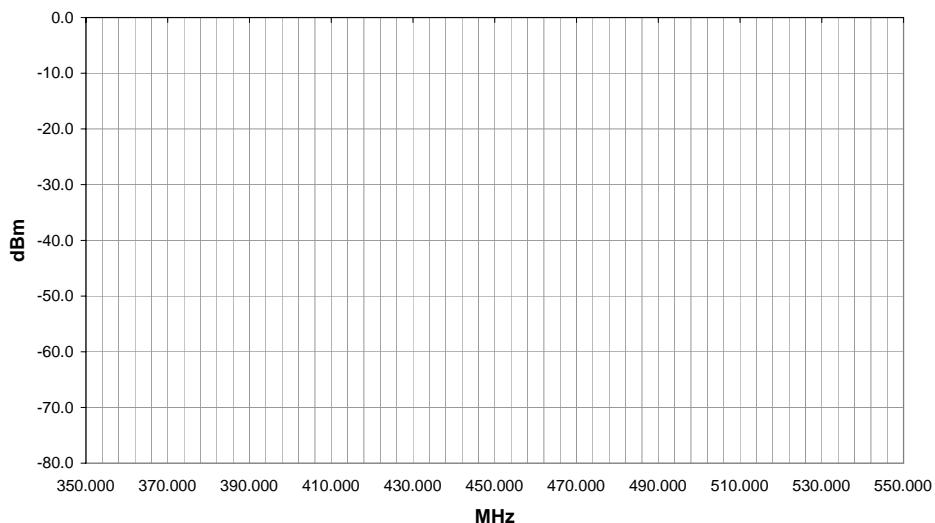
Transmitting with normal modulation

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	4
Configuration #	3
Results	Pass

Signature

Rod Peloquin

Freq (MHz)			Azimuth (degrees)	Height (meters)			Polarity	Detector	ERP (Watts)	ERP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
464.497				185.0	1.1		V-Bilog	PK	7.47E-02	18.7	20.8	-2.1	Low Channel, EUT typical orientation
469.553				169.0	1.1		V-Bilog	PK	6.97E-02	18.4	20.8	-2.4	High channel, EUT typical orientation
469.553				172.0	1.8		H-Bilog	PK	6.65E-02	18.2	20.8	-2.6	High Channel, EUT on side
464.503				166.0	2.1		H-Bilog	PK	5.80E-02	17.6	20.8	-3.2	Low Channel, EUT on side
464.496				232.0	1.9		H-Bilog	PK	3.04E-02	14.8	20.8	-6.0	Low Channel, EUT on end
464.500				233.0	1.9		V-Bilog	PK	3.04E-02	14.8	20.8	-6.0	Low Channel, EUT on end
464.499				108.0	1.6		H-Bilog	PK	6.36E-03	8.0	20.8	-12.8	Low Channel, EUT typical orientation
464.502				245.0	1.1		V-Bilog	PK	6.07E-03	7.8	20.8	-13.0	Low Channel, EUT on side
469.553				108.0	1.5		H-Bilog	PK	5.93E-03	7.7	20.8	-13.1	High channel, EUT typical orientation

OUTPUT POWER

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.

TEST EQUIPMENT						
Description	Manufacturer	Model	ID	Last Cal.	Interval	
Spectrum Analyzer	Agilent	E4407B	AAU	12/12/2008	13	
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	6/27/2008	13	
Power Meter	Gigatronics	8651A	SPM	12/10/2008	13	
Power Sensor	Gigatronics	80701A	SPL	12/10/2008	13	
Signal Generator	Hewlett-Packard	8648D	TGC	12/9/2008	13	

MEASUREMENT UNCERTAINTY

Measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" or theoretically correct value. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. In the case of transient tests our test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements. The measurement uncertainty for any test is available upon request.

TEST DESCRIPTION

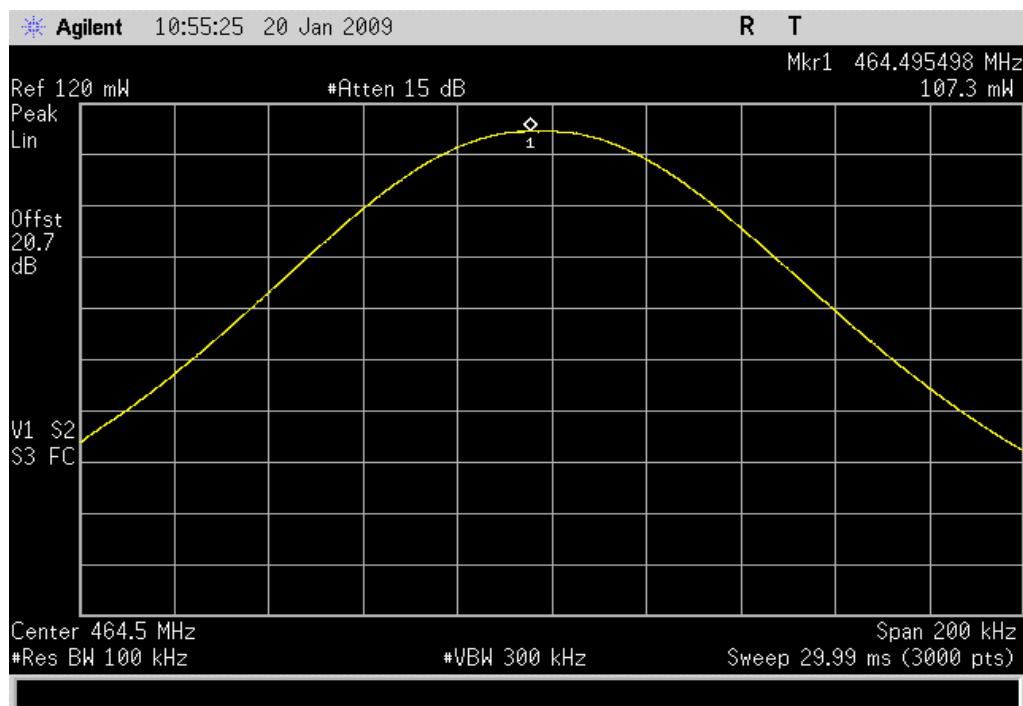
The peak output power was measured with the EUT set to the parameters called out in the data sheets. The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. Prior to making the measurements the setup including cables and attenuator was calibrated with a signal generator and a power meter.

EMC

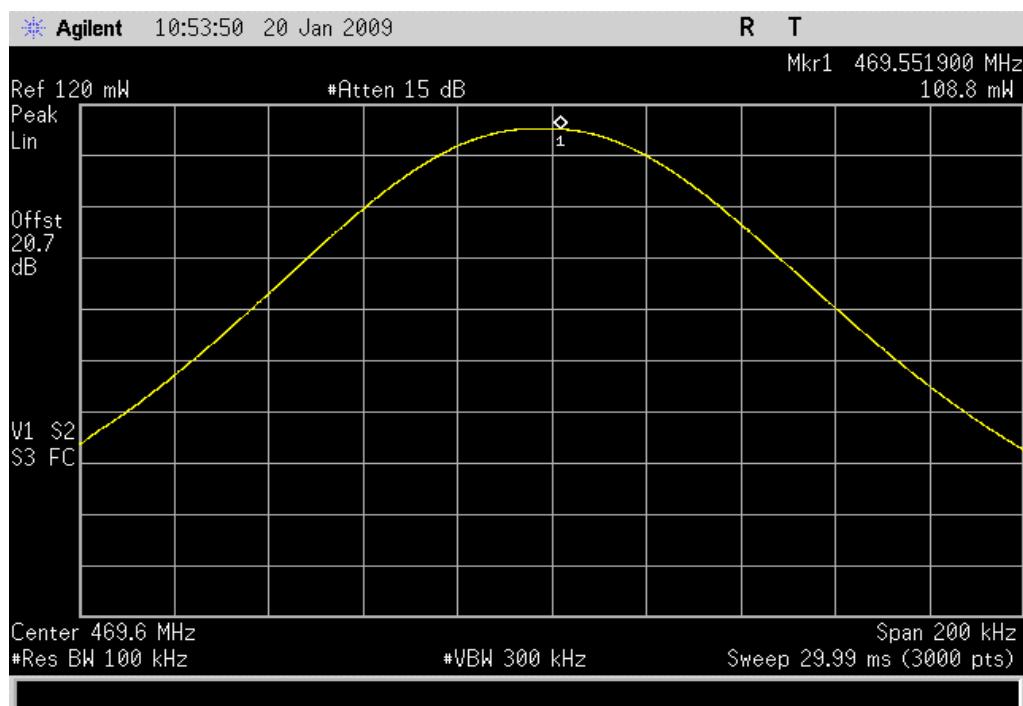
OUTPUT POWER

EUT: F2 Receiver (F2R)	Work Order: DIGC0046			
Serial Number: Field-09	Date: 01/20/09			
Customer: Digital Control, Inc.	Temperature: 20°C			
Attendees: None	Humidity: 32%			
Project: None	Barometric Pres.: 30.37 in			
Tested by: Rod Peloquin	Power: 14.4 VDC nominal			
Job Site: EV06				
TEST SPECIFICATIONS				
FCC 2.1046:2009, FCC 90.217:2009				
Test Method				
ANSI C63.4:2003, ANSI/TIA/EIA-603-C-2004				
COMMENTS				
UHF Transmitter portion. Normal modulation				
DEVIATIONS FROM TEST STANDARD				
No Deviations				
Configuration #	2			
Signature				
		Value	Limit	Results
Low Channel		107.3 mW	120 mW	Pass
High Channel		108.8 mW	120 mW	Pass

Low Channel		
Result: Pass	Value: 107.3 mW	Limit: 120 mW



High Channel		
Result: Pass	Value: 108.8 mW	Limit: 120 mW



EMISSION MASK

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.

TEST EQUIPMENT						
Description	Manufacturer	Model	ID	Last Cal.	Interval	
Spectrum Analyzer	Agilent	E4407B	AAU	12/12/2008	13	
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	6/27/2008	13	
Power Meter	Gigatronics	8651A	SPM	12/10/2008	13	
Power Sensor	Gigatronics	80701A	SPL	12/10/2008	13	
Signal Generator	Hewlett-Packard	8648D	TGC	12/9/2008	13	

MEASUREMENT UNCERTAINTY

Measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" or theoretically correct value. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. In the case of transient tests our test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements. The measurement uncertainty for any test is available upon request.

TEST DESCRIPTION

The emission mask defined by 90.217(b) for 12.5 kHz channel bandwidth devices is shown on each plot. The 0 dB reference for the mask is the measured output power of the un-modulated carrier at that frequency.

A 20 dB external attenuator was used. The attenuator and coaxial cable loss were compensated in the spectrum analyzer. A 300Hz resolution bandwidth with no video filtering and a peak detector were used.

EMISSION MASK

EUT: F2 Receiver (F2R)	Work Order: DIGC0046
Serial Number: Field-09	Date: 01/23/09
Customer: Digital Control, Inc.	Temperature: 20°C
Attendees: None	Humidity: 32%
Project: None	Barometric Pres.: 30.37 in
Tested by: Rod Peloquin	Job Site: EV06

TEST SPECIFICATIONS

FCC 2.1049:2009, FCC 90.217:2009	Test Method: ANSI C63.4:2003, ANSI/TIA/EIA-603-C-2004
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COMMENTS

UHF Transmitter portion. Normal modulation

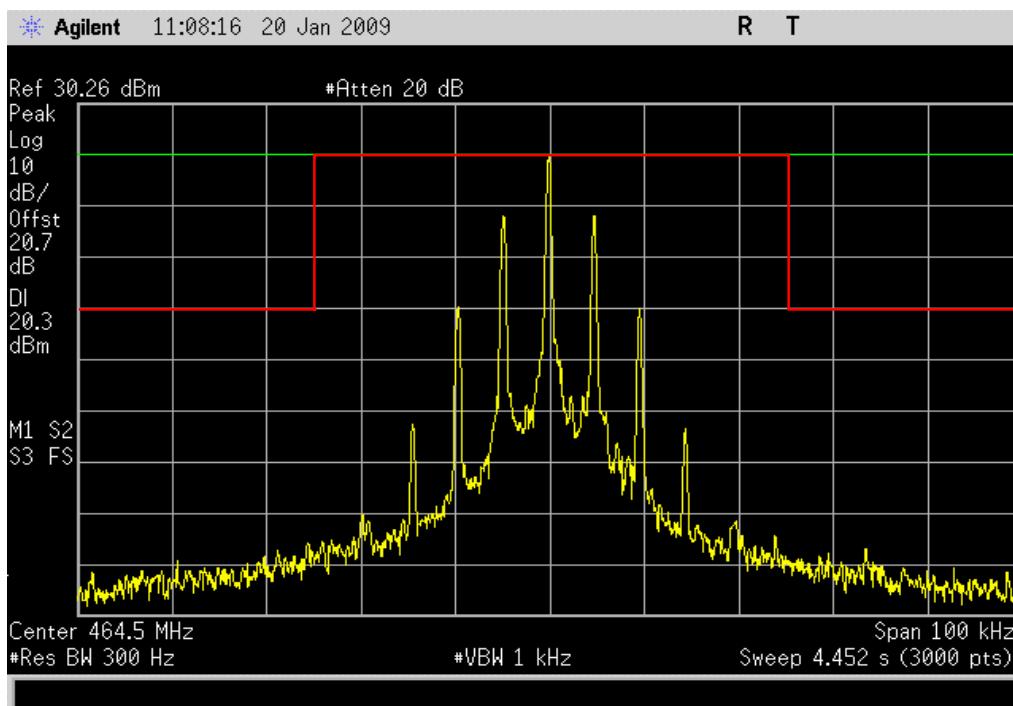
DEVIATIONS FROM TEST STANDARD

No Deviations

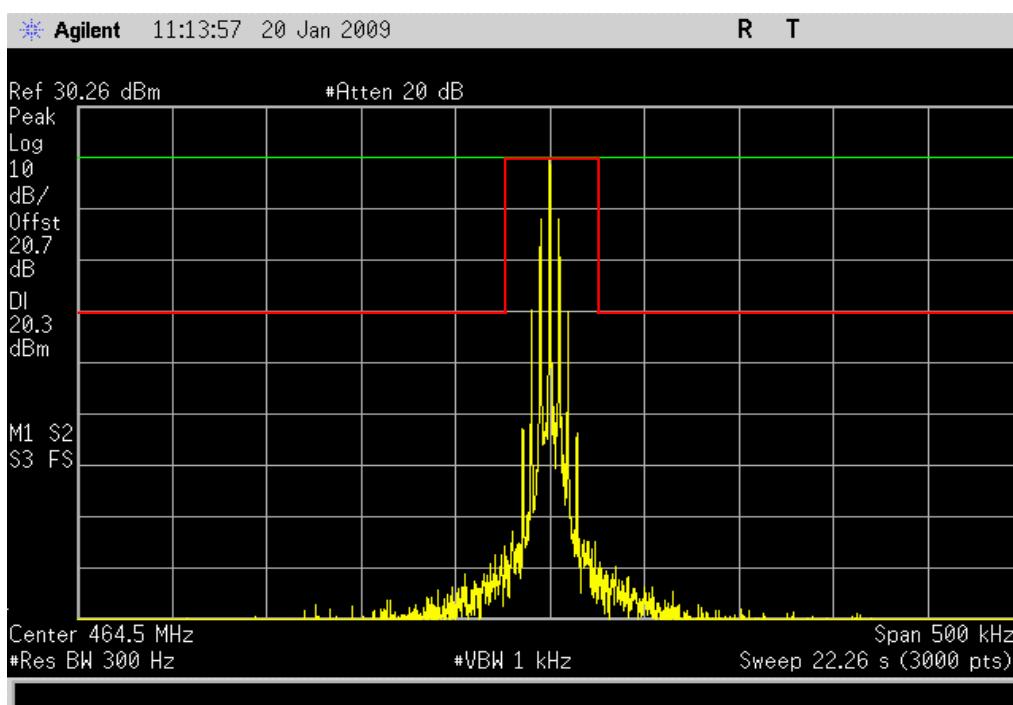
Configuration #	2	
		Signature

		Value	Limit	Results
Low Channel	Center Frequency, ± 50 kHz	See Graph	See Mask	Pass
	Center Frequency, ± 250 kHz	See Graph	See Mask	Pass
High Channel	Center Frequency, ± 50 kHz	See Graph	See Mask	Pass
	Center Frequency, ± 250 kHz	See Graph	See Mask	Pass

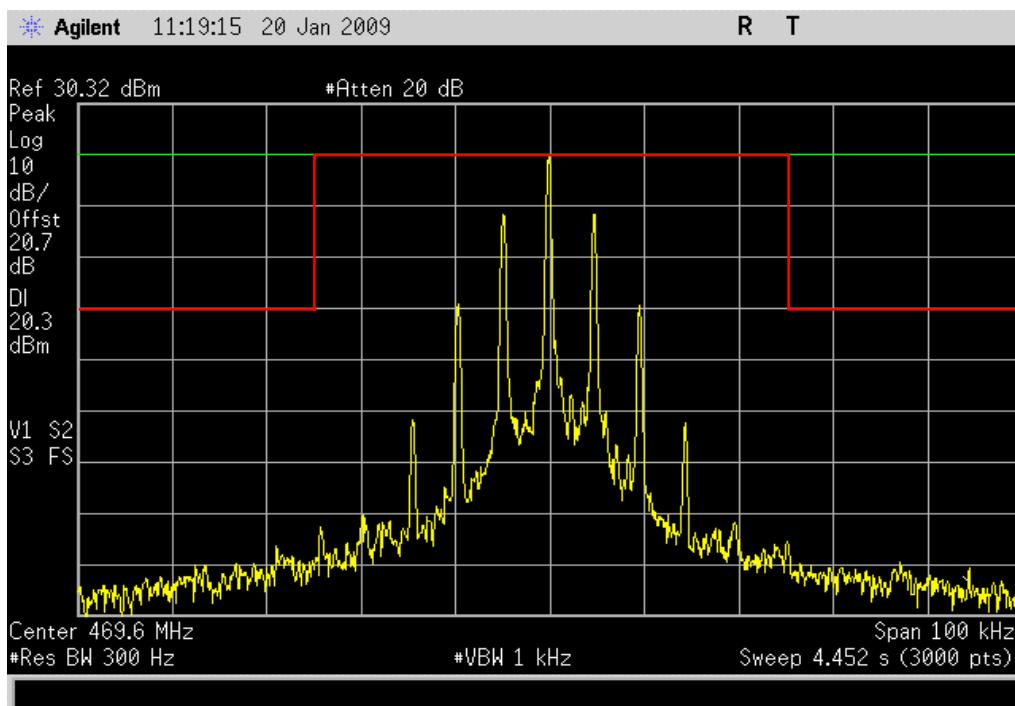
Low Channel, Center Frequency, ± 50 kHz		
Result: Pass	Value: See Graph	Limit: See Mask



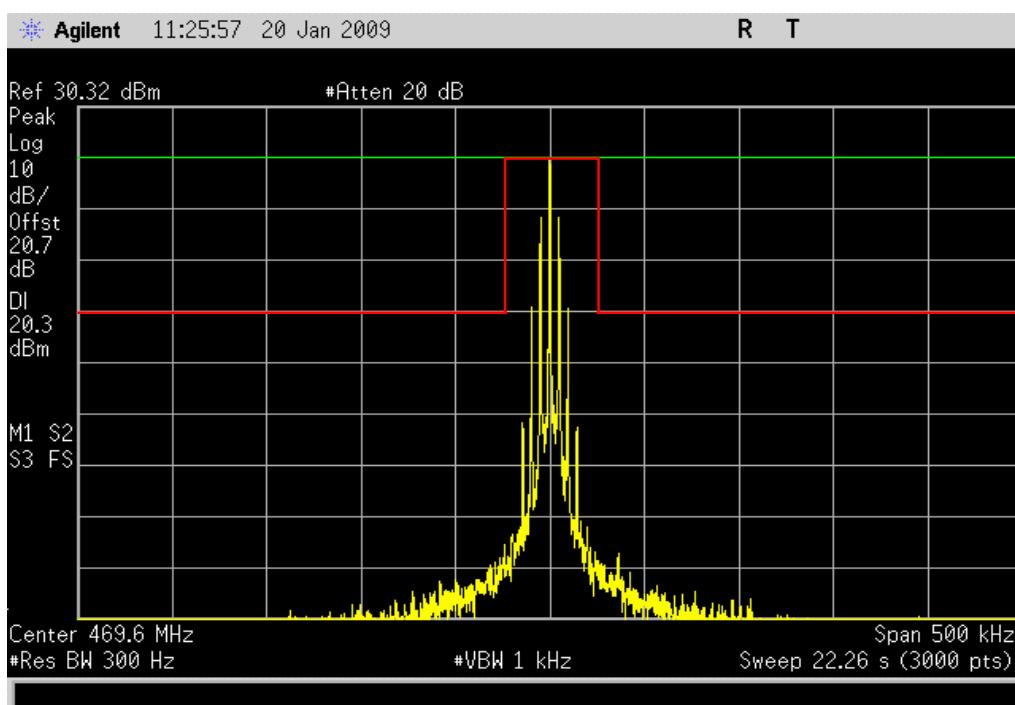
Low Channel, Center Frequency, ± 250 kHz		
Result: Pass	Value: See Graph	Limit: See Mask



High Channel, Center Frequency, ± 50 kHz		
Result: Pass	Value: See Graph	Limit: See Mask



High Channel, Center Frequency, ± 250 kHz		
Result: Pass	Value: See Graph	Limit: See Mask



FREQUENCY STABILITY

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.

TEST EQUIPMENT						
Description	Manufacturer	Model	ID	Last Cal.	Interval	
Spectrum Analyzer	Agilent	E4407B	AAU	12/12/2008	13	
Near Field Probe	EMCO	7405	IPD	NCR	0	
Multimeter	Tektronix	DMM912	MMH	12/10/2008	13	
DC Power Supply	Topward	TPS-2000	TPD	NCR	0	
Chamber Temp. & Humidity Controller	ESZ / Eurotherm	Dimension II	TBC	7/23/2008	12	
Chamber, Temp./Humidity Chamber	Cincinnati Sub Zero (CSZ)	ZH-32-2-2-H/AC	TBA	7/23/2008	12	

MEASUREMENT UNCERTAINTY

Measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" or theoretically correct value. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. In the case of transient tests our test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements. The measurement uncertainty for any test is available upon request.

TEST DESCRIPTION

Variation of Supply Voltage

The primary supply voltage was varied from 85% to 115% of nominal. The EUT can only be battery operated, so a DC lab supply was used to vary the supply voltage up to 115% of 9V and down to the EUT's voltage end point.

Variation of Ambient Temperature

Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range (-30° to +50° C) and at 10°C intervals.

The antenna is integral to the EUT, so a radiated measurement was made using a spectrum analyzer and a near field probe. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

FREQUENCY STABILITY

EUT: F2 Receiver (F2R)	Work Order: DIGC0046		
Serial Number: Field-09	Date: 01/19/09		
Customer: Digital Control, Inc.	Temperature: 20°C		
Attendees: None	Humidity: 32%		
Project: None	Barometric Pres.: 30.37 in		
Tested by: Rod Peloquin	Job Site: EV09		
TEST SPECIFICATIONS			
FCC 2.1055:2009, FCC 90.217:2009			
Test Method			
ANSI C63.4:2003, ANSI/TIA/EIA-603-C-2004			
COMMENTS			
UHF Transmitter portion. CW carrier			
DEVIATIONS FROM TEST STANDARD			
No Deviations			
Configuration #	1		
Signature			
	Value	Limit	Results

FREQUENCY STABILITY

Frequency Stability with Variation of DC Voltage (Ambient Temperature = 20°C)				
Voltage (VDC)	Assigned Frequency (MHz)	Measured Frequency (MHz)	Tolerance (ppm)	Specification (ppm)
16.6 (115%)	464.500000	464.499966	0.07	n/a
14.4 (100%)	464.500000	464.499969	0.07	n/a
12.2 (85%)	464.500000	464.499966	0.07	n/a

Frequency Stability with Variation of Ambient Temperature (Primary Supply = 14.4 VDC)				
Temp (°C)	Assigned Frequency (MHz)	Measured Frequency (MHz)	Tolerance (ppm)	Specification (ppm)
50	464.500000	464.499762	0.51	n/a
40	464.500000	464.499910	0.19	n/a
30	464.500000	464.499956	0.09	n/a
20	464.500000	464.499969	0.07	n/a
10	464.500000	464.499884	0.25	n/a
0	464.500000	464.499955	0.10	n/a
-10	464.500000	464.499959	0.09	n/a
-20	464.500000	464.499976	0.05	n/a
-30	464.500000	464.499997	0.01	n/a

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.

TEST EQUIPMENT						
Description	Manufacturer	Model	ID	Last Cal.	Interval	
Spectrum Analyzer	Agilent	E4407B	AAU	12/12/2008	13	
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	6/27/2008	13	
Power Meter	Gigatronics	8651A	SPM	12/10/2008	13	
Power Sensor	Gigatronics	80701A	SPL	12/10/2008	13	
Signal Generator	Hewlett-Packard	8648D	TGC	12/9/2008	13	

MEASUREMENT UNCERTAINTY

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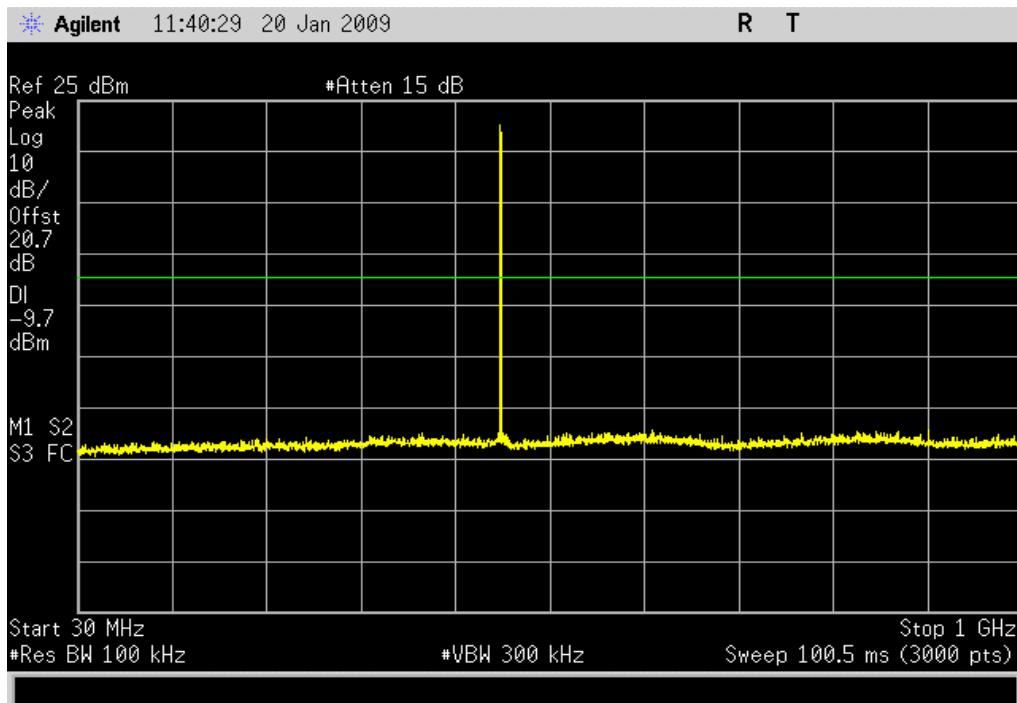
TEST DESCRIPTION

The antenna port spurious conducted emissions were measured at the RF output terminal of the EUT with 20dB of external attenuation on the RF input of the spectrum analyzer. Analyzer plots were made from 30 MHz to 5 GHz. The peak conducted power of spurious emissions, up to the 10th harmonic of the transmit frequency, were investigated to ensure they were less than or equal to the -30 dBc emission mask limit of -9.7 dBm.

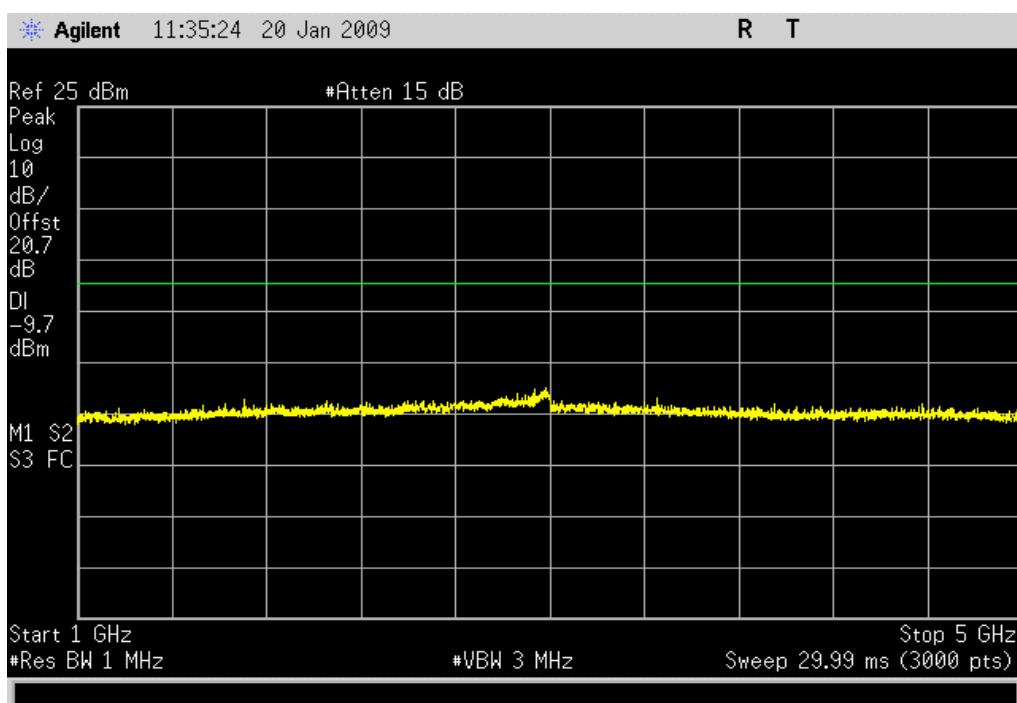
SPURIOUS CONDUCTED EMISSIONS

EUT: F2 Receiver (F2R)	Work Order: DIGC0046			
Serial Number: Field-09	Date: 01/26/09			
Customer: Digital Control, Inc.	Temperature: 20°C			
Attendees: None	Humidity: 20%			
Project: None	Barometric Pres.: 30.15 in			
Tested by: Rod Peloquin	Job Site: EV06			
TEST SPECIFICATIONS				
FCC 2.1051:2009, FCC 90.217:2009				
Test Method				
ANSI C63.4:2003, ANSI/TIA/EIA-603-C-2004				
COMMENTS				
UHF Transmitter portion. Normal modulation				
DEVIATIONS FROM TEST STANDARD				
No Deviations				
Configuration #	2			
Signature				
		Value	Limit	Results
Low Channel				
30 MHz - 1 GHz		< -20 dBm	-9.7 dBm	Pass
1 GHz - 5 GHz		< -20 dBm	-9.7 dBm	Pass
High Channel				
30 MHz - 1 GHz		< -20 dBm	-9.7 dBm	Pass
1 GHz - 5 GHz		< -20 dBm	-9.7 dBm	Pass

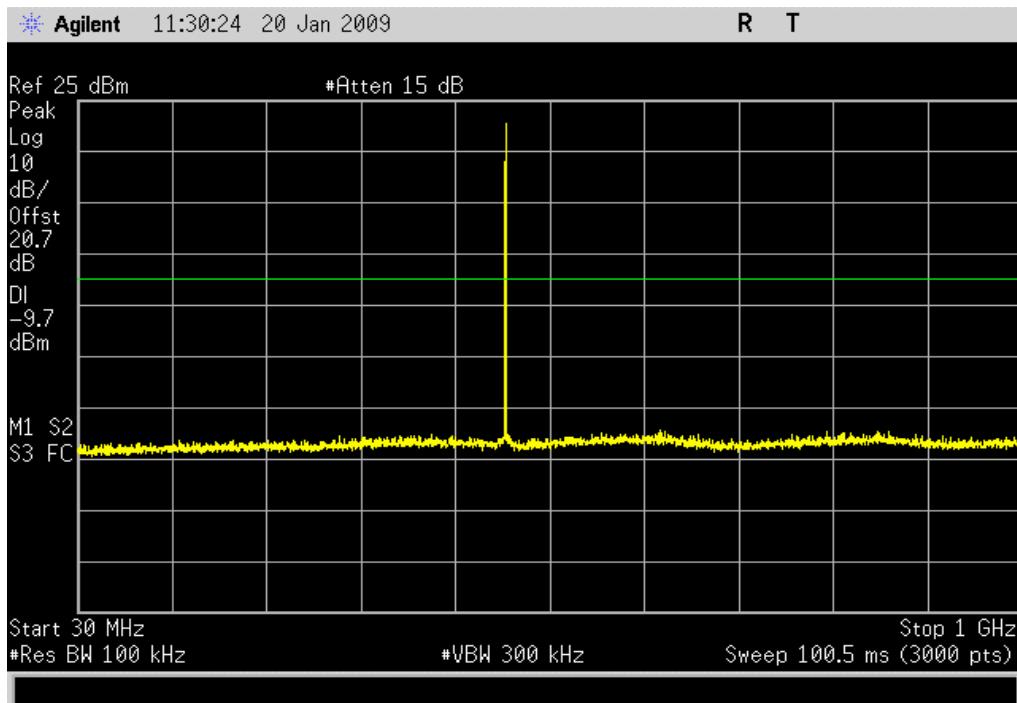
Low Channel, 30 MHz - 1 GHz		
Result: Pass	Value: < -20 dBm	Limit: -9.7 dBm



Low Channel, 1 GHz - 5 GHz		
Result: Pass	Value: < -20 dBm	Limit: -9.7 dBm



High Channel, 30 MHz - 1 GHz		
Result: Pass	Value: < -20 dBm	Limit: -9.7 dBm



High Channel, 1 GHz - 5 GHz		
Result: Pass	Value: < -20 dBm	Limit: -9.7 dBm

