OEM Controls, Inc

ST-900

EMC Test Report

Report No. SGST0011

Report Prepared By

NORTHWEST EMC

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

NORTHWEST EMC

22975 NW Evergreen Parkway
Suite 400
Hillsboro, Oregon 97124

Certificate of Test

Last Date of Test: March 31, 2010

OEM Controls, Inc

Model: ST-900

Emissions			
Test Description	**Specification**	**Test Method**	**Pass/Fail**
Spurious Radiated Emissions	FCC 15.247:2010	ANSI C63.10:2009	**Pass**
Occupied Bandwidth	FCC 15.247:2010	ANSI C63.10:2009	**Pass**
Output Power	FCC 15.247:2010	ANSI C63.10:2009	**Pass**
Band Edge Compliance	FCC 15.247:2010	ANSI C63.10:2009	**Pass**
Spurious Conducted Emissions	FCC 15.247:2010	ANSI C63.10:2009	**Pass**
Power Spectral Density	FCC 15.247:2010	ANSI C63.10:2009	**Pass**

Modifications made to the product
See the Modifications section of this report

Test Facility

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

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

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

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

Approved By:
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, 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

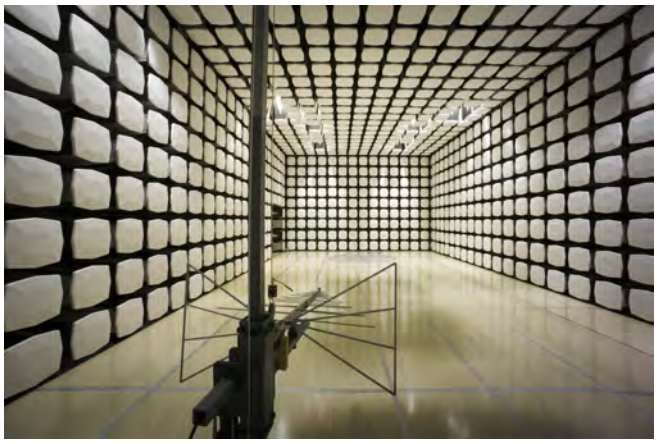
Oregon
Labs EV01-EV12
22975 NW Evergreen Pkwy
Suite 400
Hillsboro, OR 97124
(503) 844-4066

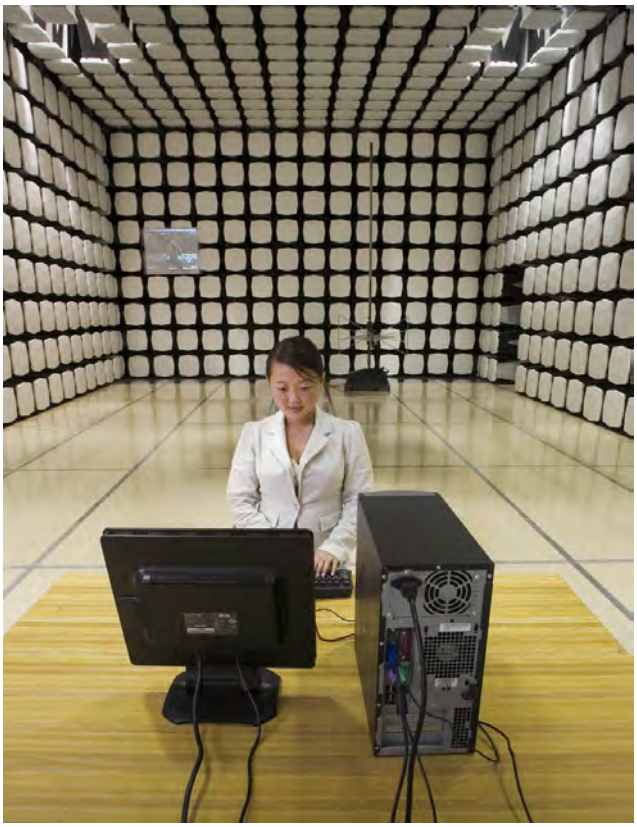
California
Labs OC01-OC13
41 Tesla
Irvine, CA 92618
(949) 861-8918

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:	SGS US Testing Company, Inc
Address:	16870 W. Bernardo Drive, Suite 250
City, State, Zip:	San Diego, CA 92127
Test Requested By:	Chris Wyman
Model:	ST-900
First Date of Test:	March 25, 2010
Last Date of Test:	March 31, 2010
Receipt Date of Samples:	March 24, 2010
Equipment Design Stage:	Preproduction
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):
2.4 GHz DTS (Zigbee) transmitter

Testing Objective:
Demonstrate compliance to FCC 15.247 requirements.

CONFIGURATION 1 SGST0011

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT in Host	OEM Controls, Inc	ST-900-100	WO#27022-001

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
GPS Receiver	Garmin	GPS18 LVC, 5m	17752426

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote PC	Advantech	ARK-1380-1M0ATE	TPAA178730

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
GPS power and data	PA	5.0m	PA	EUT - Radiated	GPS Receiver
DC Power	No	1.0m	No	EUT	Lab Power Supply
Data cable	Yes	2.0m	No	EUT	Remote PC
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

CONFIGURATION 2 SGST0011

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT in Host	OEM Controls, Inc	ST-900-100	WO#27022-001

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote PC	Advantech	ARK-1380-1M0ATE	TPAA178730

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Power	No	1.0m	No	EUT	Lab Power Supply
Data cable	Yes	2.0m	No	EUT	Remote PC
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Equipment modifications					
Item	Date	Test	Modification	Note	Disposition of EUT
1	3/25/2010	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.
2	3/29/2010	Radiated Spurious Emissions	Modified from delivered configuration. Initial or No Modification	Changed highest channel to 15, 2475 MHz for passing data. Turned off the 8 MHz unused clock on the Zigbee chip. Modification authorized by Ken Frost.	EUT remained at Northwest EMC following the test.
3	3/31/2010	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.
4	3/31/2010	Power Spectral Density	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	3/31/2010	Spurious Conducted 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	3/31/2010	Band Edge Compliance	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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFD	6/1/2009	24
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/21/2009	13
26 GHz DC Block, SMA	Pasternack	PE8210	AME	10/19/2009	13
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0

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 occupied bandwidth was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate with the typical modulation.

NORTHWEST EMC

OCCUPIED BANDWIDTH

XMit 2010.01.14

EUT:	ST-900			**Work Order:**	SGST0011
Serial Number:	WO#270222-001			**Date:**	03/25/10
Customer:	OEM Controls, Inc			**Temperature:**	22°C
Attendees:	David Student			**Humidity:**	36%
Project:	None			**Barometric Pres.:**	29.94
Tested by:	Rod Peloquin	**Power:**	13.8VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

COMMENTS

Default maximum output power. 100% duty cycle.

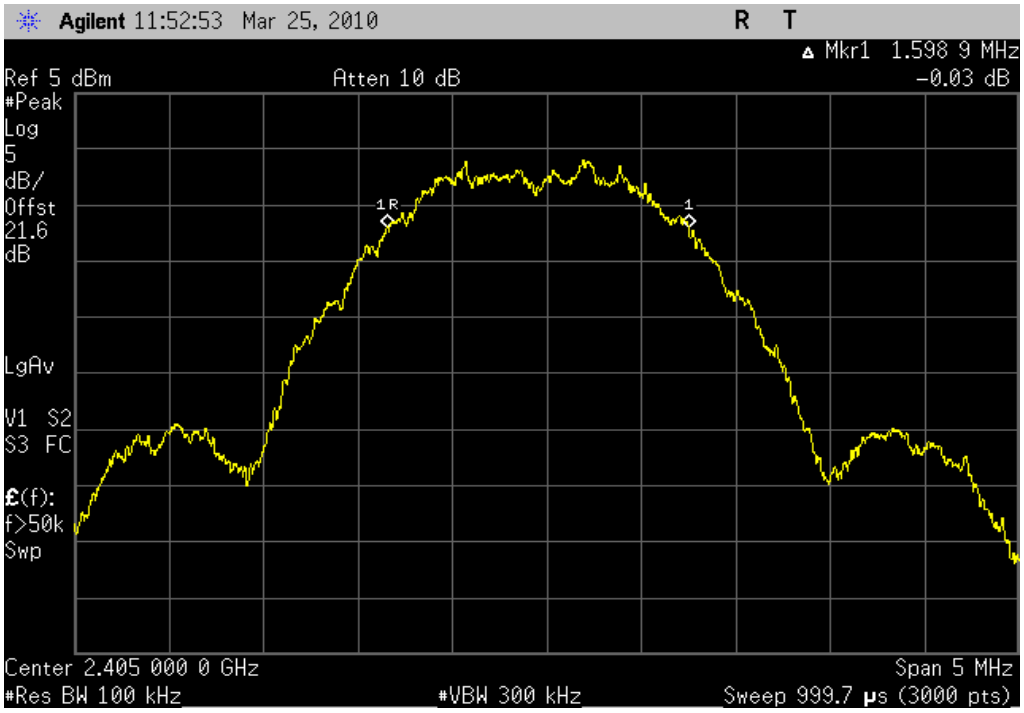
DEVIATIONS FROM TEST STANDARD

No deviations

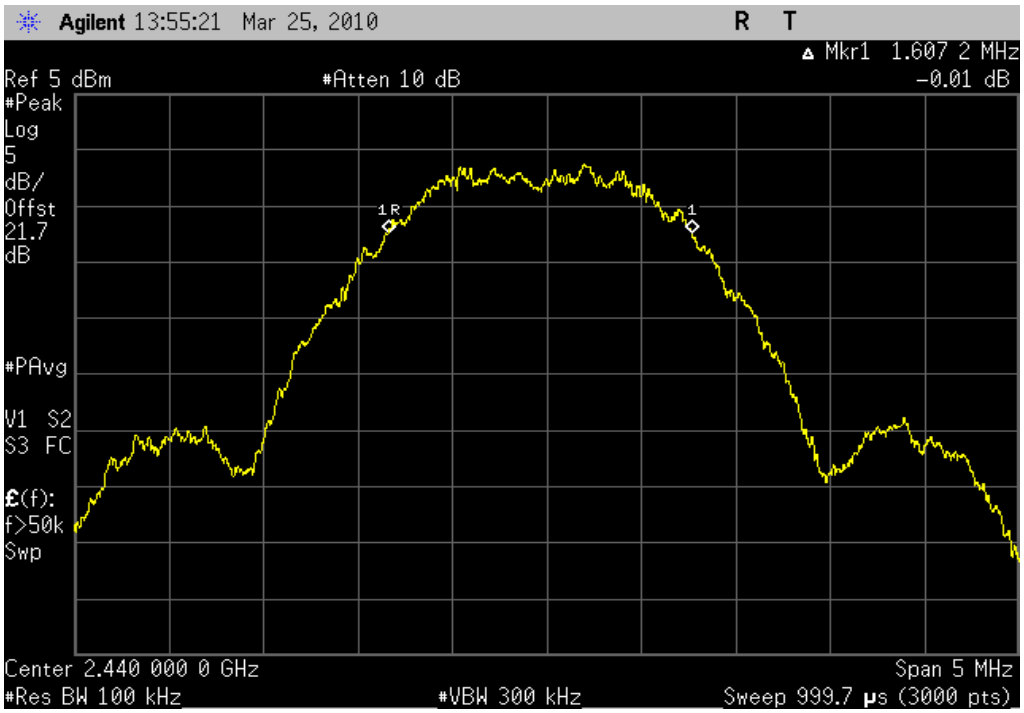
Configuration #	2	Signature

	Value	Limit	Results
Low Channel	1.599 MHz	> 500 kHz	Pass
Mid Channel	1.607 MHz	> 500 kHz	Pass
High Channel	1.622 MHz	> 500 kHz	Pass

Low Channel					
Result:	Pass	**Value:**	1.599 MHz	**Limit:**	> 500 kHz

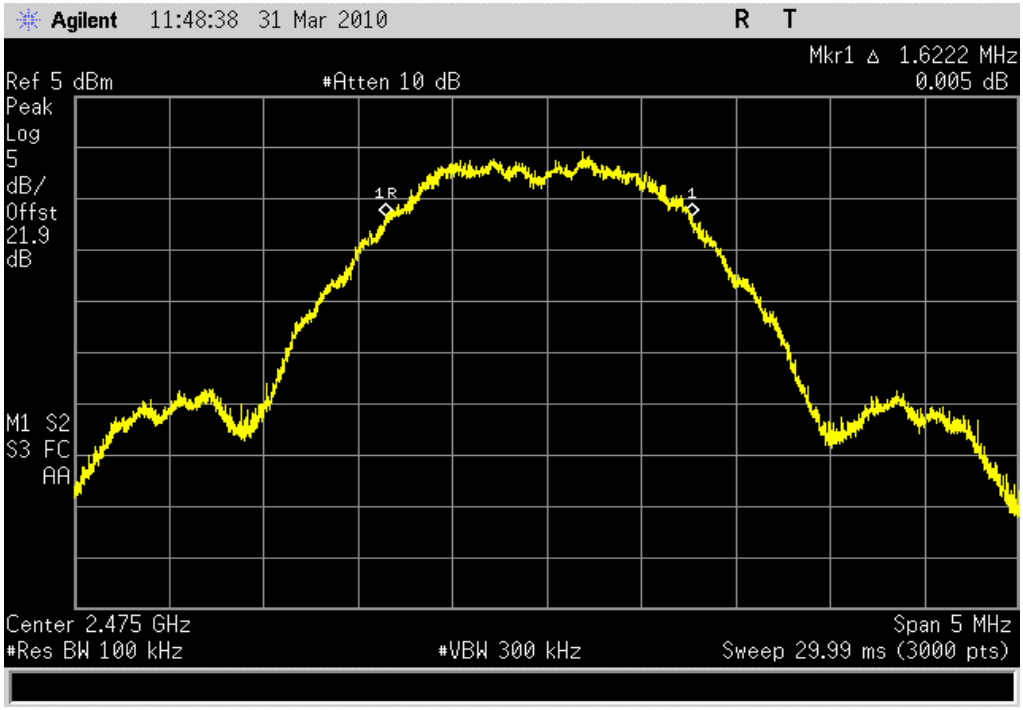


Mid Channel					
Result:	Pass	**Value:**	1.607 MHz	**Limit:**	> 500 kHz



OCCUPIED BANDWIDTH

High Channel					
Result:	Pass	**Value:**	1.622 MHz	**Limit:**	> 500 kHz



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
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/21/2009	13
26 GHz DC Block, SMA	Pasternack	PE8210	AME	10/19/2009	13
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Power Meter	Gigatronics	8651A	SPM	1/7/2010	13
Power Sensor	Gigatronics	80701A	SPL	1/7/2010	13
Signal Generator	Hewlett-Packard	8648D	TGC	12/9/2008	24

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 peak output power was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode.

De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36dBm.

NORTHWEST EMC

OUTPUT POWER

XMit 2010.01.14

EUT:	ST-900			**Work Order:**	SGST0011
Serial Number:	WO#270222-001			**Date:**	03/31/10
Customer:	OEM Controls, Inc			**Temperature:**	22°C
Attendees:	David Student			**Humidity:**	36%
Project:	None			**Barometric Pres.:**	29.94
Tested by:	Rod Peloquin	**Power:**	13.8VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

COMMENTS

Default maximum output power. 100% duty cycle. Measurement directly to board without adapter cable.

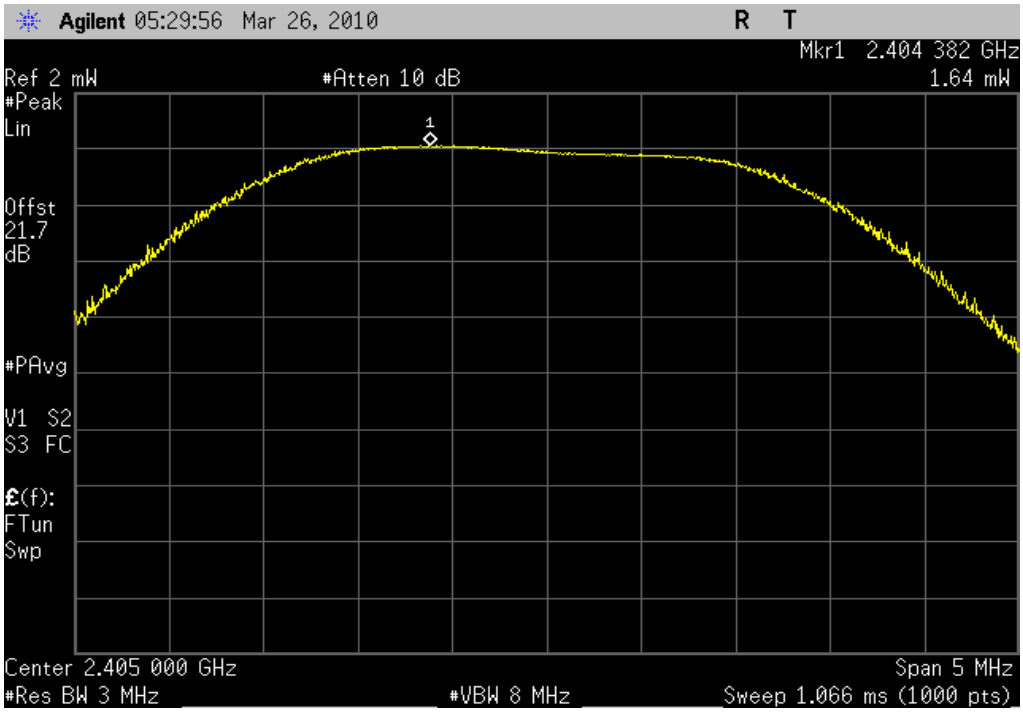
DEVIATIONS FROM TEST STANDARD

No deviations

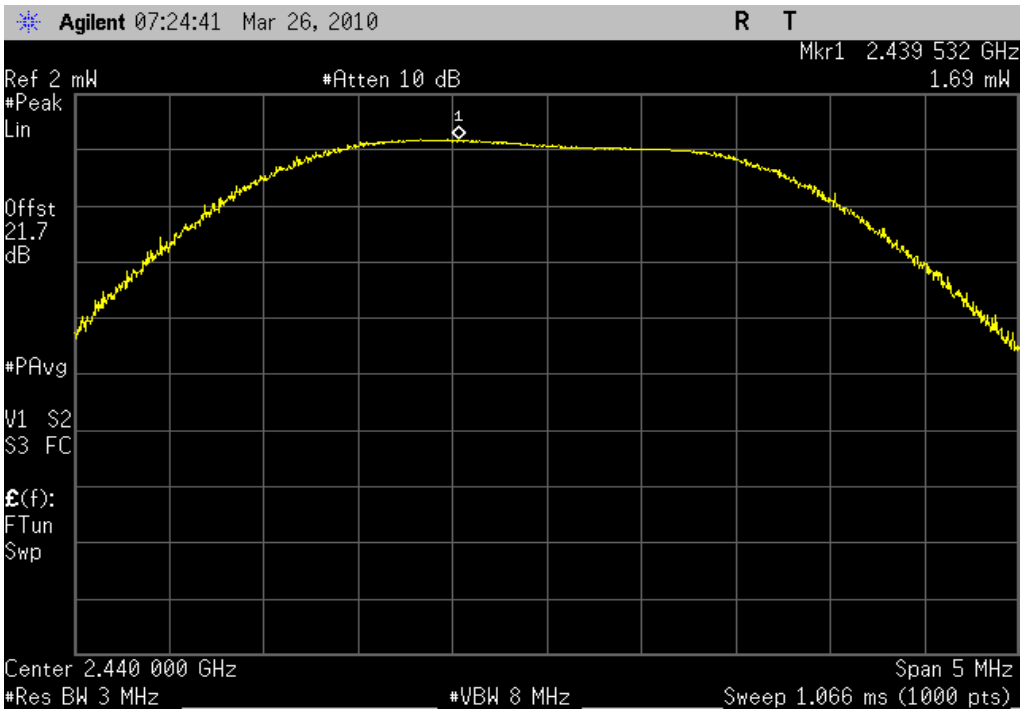
Configuration #	2	Signature

	Value	Limit	Results
Low Channel	1.64 mW	1 W	Pass
Mid Channel	1.69 mW	1 W	Pass
High Channel	1.60 mW	1 W	Pass

Low Channel					
Result:	Pass	**Value:**	1.64 mW	**Limit:**	1 W

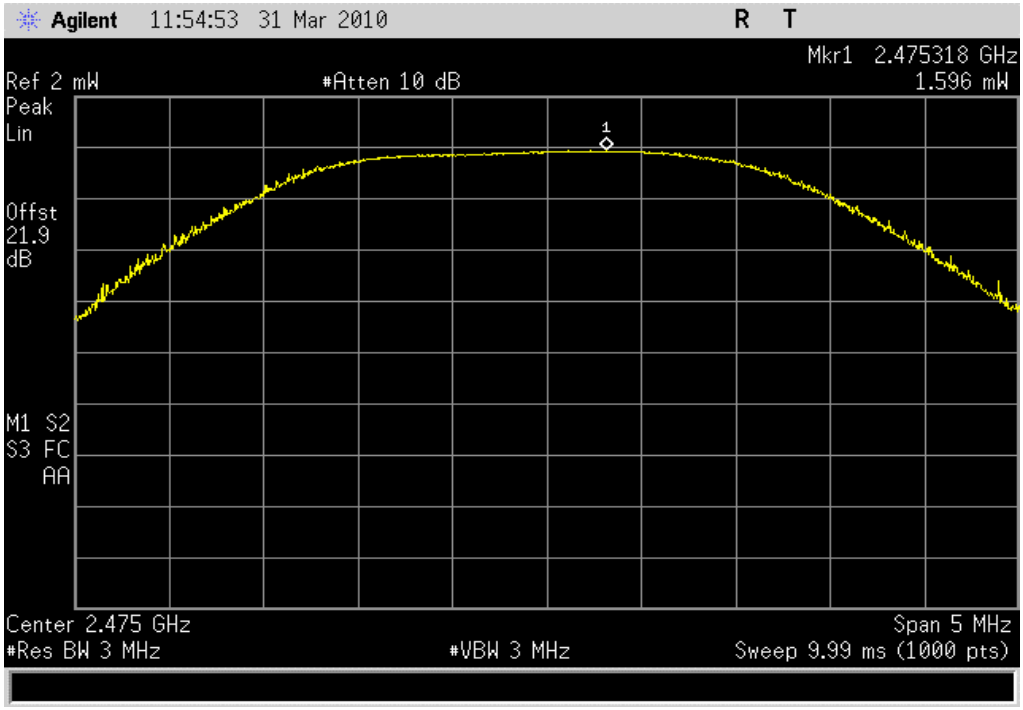


Mid Channel					
Result:	Pass	**Value:**	1.69 mW	**Limit:**	1 W



OUTPUT POWER

High Channel					
Result:	Pass	**Value:**	1.60 mW	**Limit:**	1 W



BAND EDGE COMPLIANCE

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
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Spectrum Analyzer	Agilent	E4440A	AFD	6/1/2009	24
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/21/2009	13
26 GHz DC Block, SMA	Pasternack	PE8210	AME	10/19/2009	13

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 spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its only data rate available.

The spectrum was scanned across each band edge from at least 10 MHz below the band edge to 10 MHz above the band edge.

NORTHWEST EMC

BAND EDGE COMPLIANCE

XMit 2010.01.14

EUT:	ST-900			Work Order:	SGST0011
Serial Number:	WO#270222-001			Date:	03/31/10
Customer:	OEM Controls, Inc			Temperature:	22°C
Attendees:	David Student			Humidity:	36%
Project:	None			Barometric Pres.:	29.94
Tested by:	Rod Peloquin	Power:	13.8VDC	Job Site:	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

COMMENTS

Default maximum output power. 100% duty cycle.

DEVIATIONS FROM TEST STANDARD

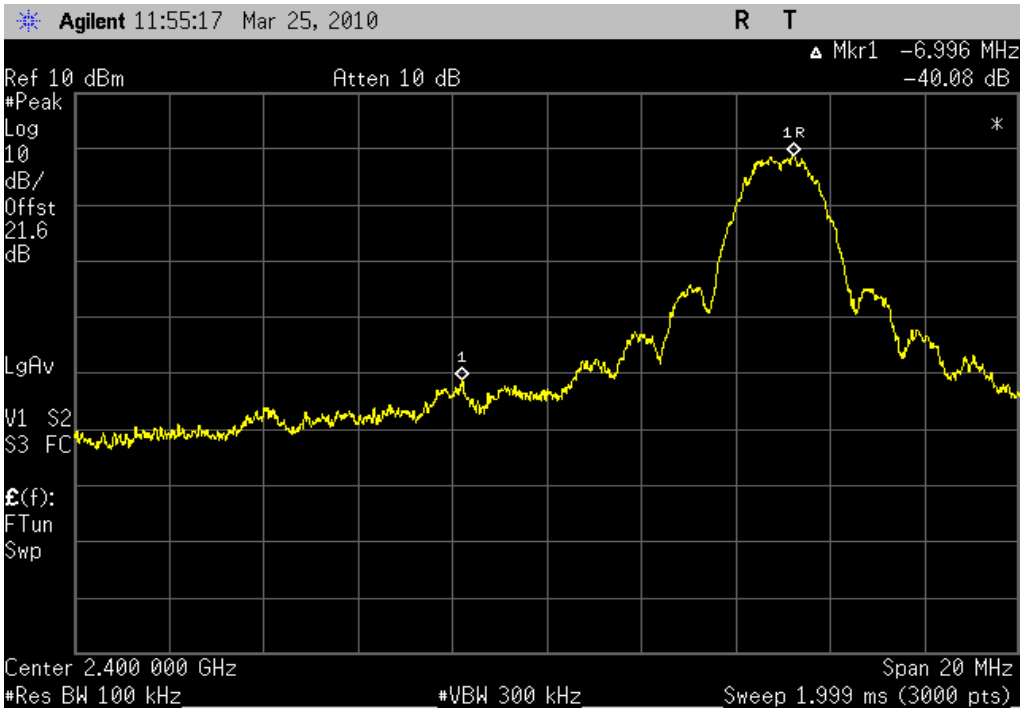
No deviations

Configuration #	2	Signature

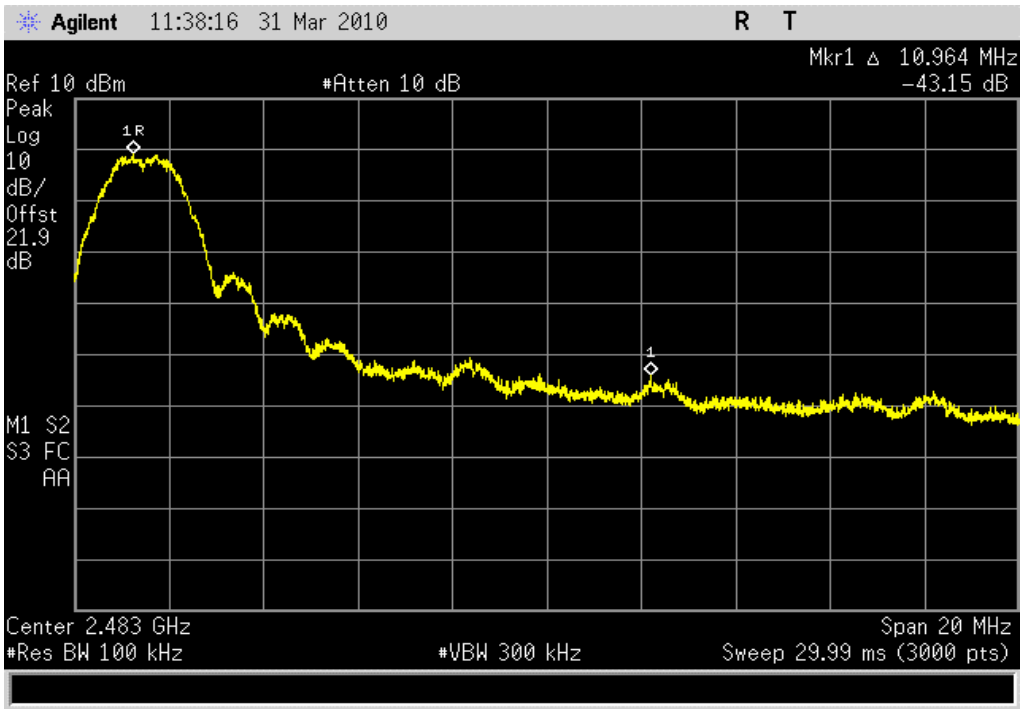
	Value	Limit	Results
Low Channel	-40.1 dBc	< -20 dBc	Pass
High Channel	-43.2 dBc	< -20 dBc	Pass

BAND EDGE COMPLIANCE

Low Channel					
Result:	Pass	**Value:**	-40.1 dBc	**Limit:**	< -20 dBc



High Channel					
Result:	Pass	**Value:**	-43.2 dBc	**Limit:**	< -20 dBc



SPURIOUS CONDUCTED 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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFD	6/1/2009	24
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/21/2009	13
26 GHz DC Block, SMA	Pasternack	PE8210	AME	10/19/2009	13
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0

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 spurious RF conducted emissions were measured with the EUT set to low, medium, and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

NORTHWEST EMC

SPURIOUS CONDUCTED EMISSIONS

XMit 2010.01.14

EUT:	ST-900			**Work Order:**	SGST0011
Serial Number:	WO#270222-001			**Date:**	03/31/10
Customer:	OEM Controls, Inc			**Temperature:**	22°C
Attendees:	David Student			**Humidity:**	36%
Project:	None			**Barometric Pres.:**	29.94
Tested by:	Rod Peloquin	**Power:**	13.8VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

COMMENTS

Default maximum output power. 100% duty cycle.

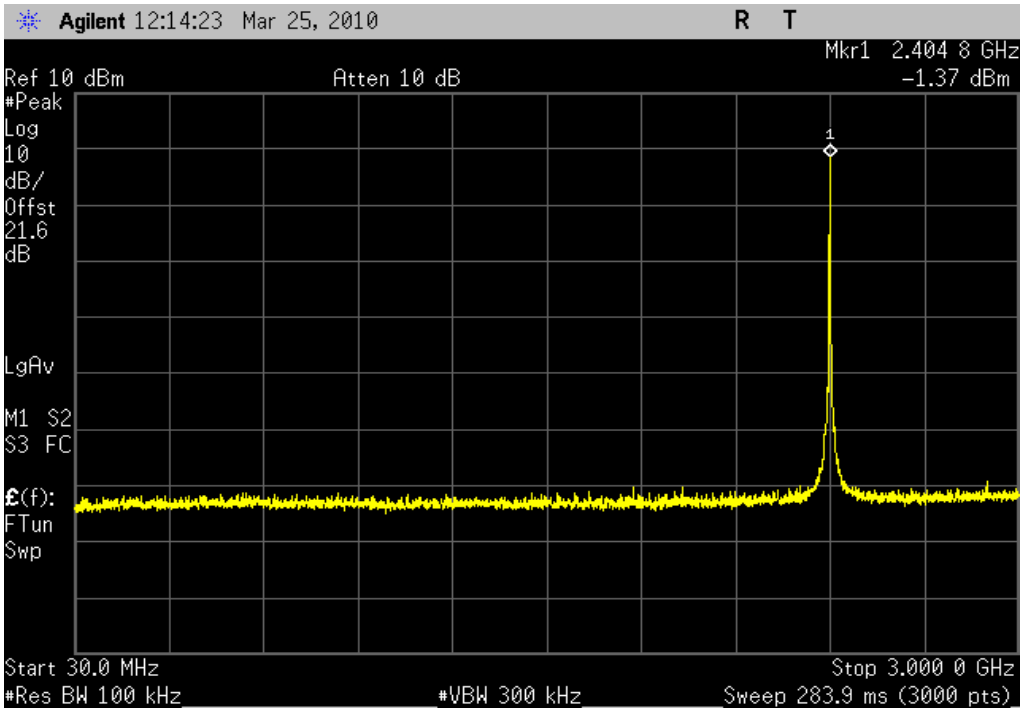
DEVIATIONS FROM TEST STANDARD

No Deviations

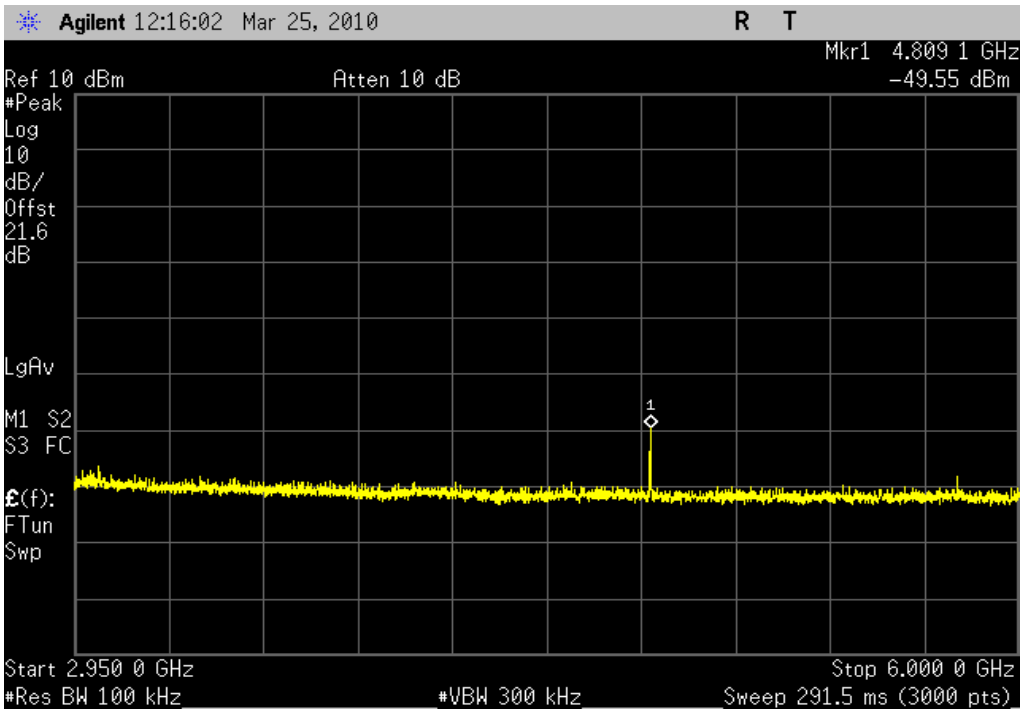
Configuration #	2	Signature

		Value	Limit	Results
Low Channel				
	30MHz - 3GHz	< -40 dBc	-20 dBc	Pass
	2.95GHz-6GHz	< -40 dBc	-20 dBc	Pass
	5.95GHz-12.5GHz	< -40 dBc	-20 dBc	Pass
	12.5GHz-25GHz	< -40 dBc	-20 dBc	Pass
Mid Channel				
	30MHz - 3GHz	< -40 dBc	-20 dBc	Pass
	2.95GHz-6GHz	< -40 dBc	-20 dBc	Pass
	5.95GHz-12.5GHz	< -40 dBc	-20 dBc	Pass
	12.5GHz-25GHz	< -40 dBc	-20 dBc	Pass
High Channel				
	30MHz - 3GHz	< -40 dBc	-20 dBc	Pass
	2.95GHz-6GHz	< -40 dBc	-20 dBc	Pass
	5.95GHz-12.5GHz	< -40 dBc	-20 dBc	Pass
	12.5GHz-25GHz	< -40 dBc	-20 dBc	Pass

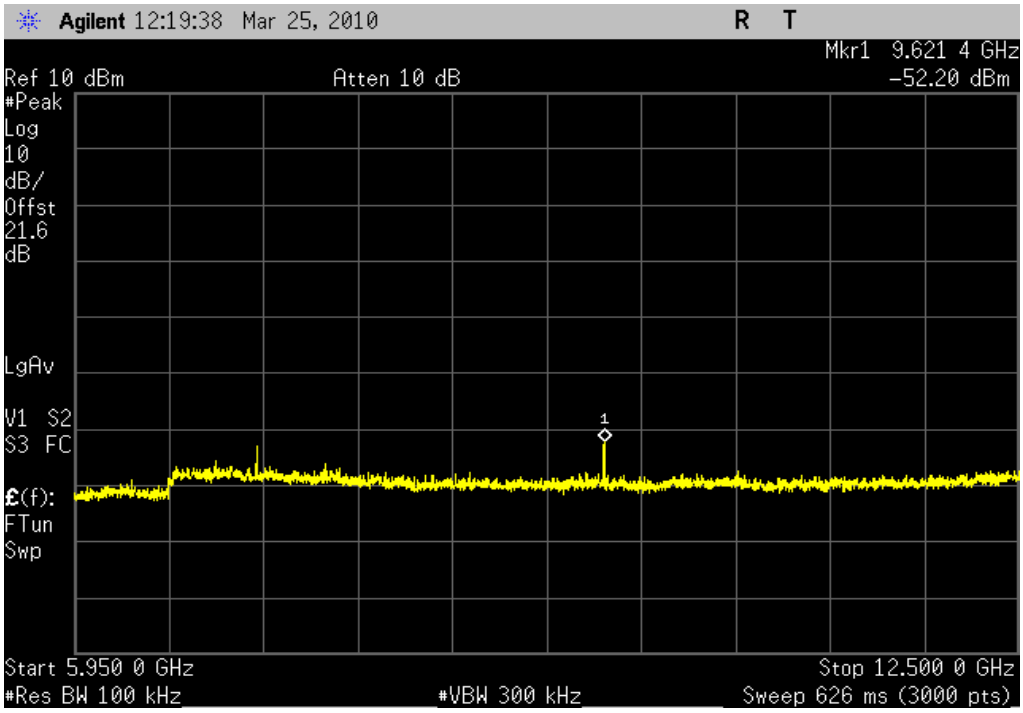
Low Channel, 30MHz - 3GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



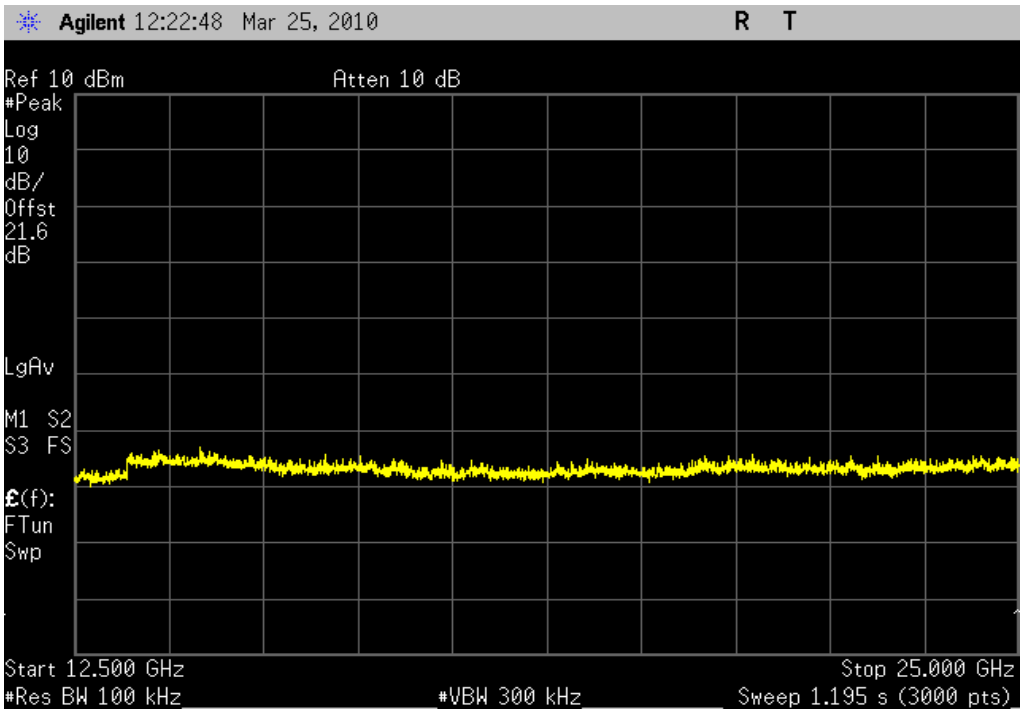
Low Channel, 2.95GHz-6GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



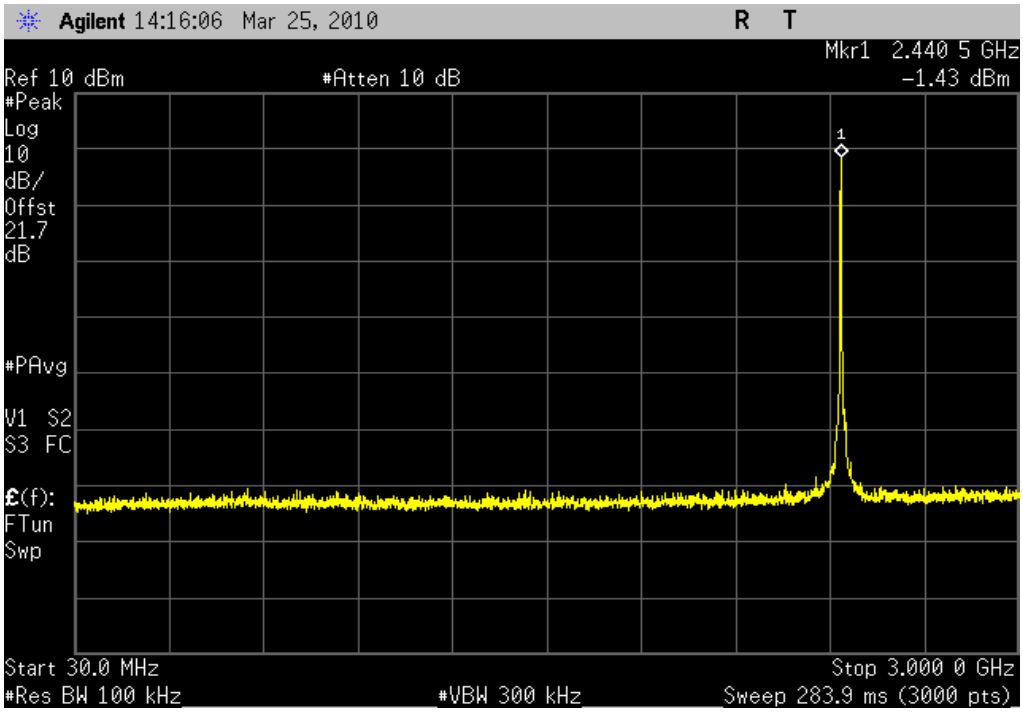
Low Channel, 5.95GHz-12.5GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



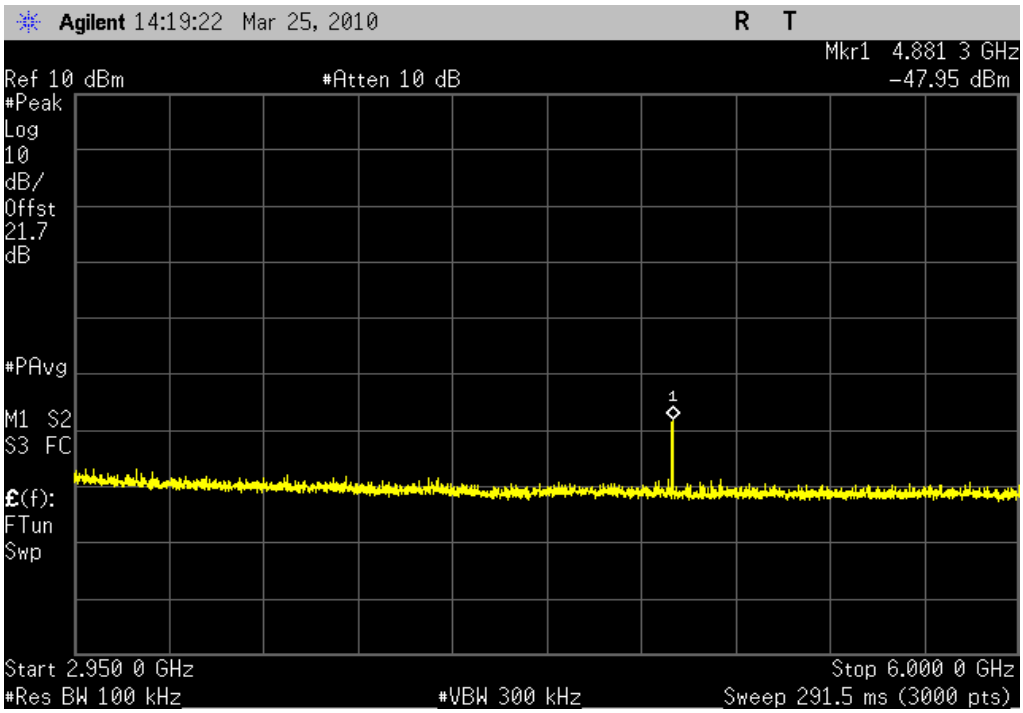
Low Channel, 12.5GHz-25GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



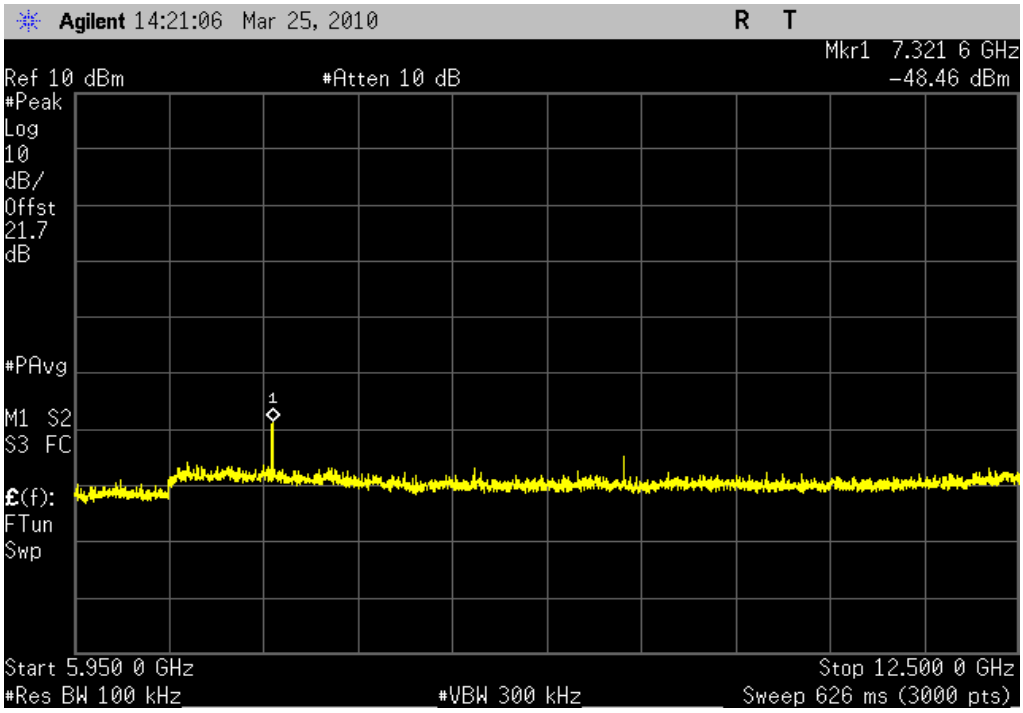
Mid Channel, 30MHz - 3GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



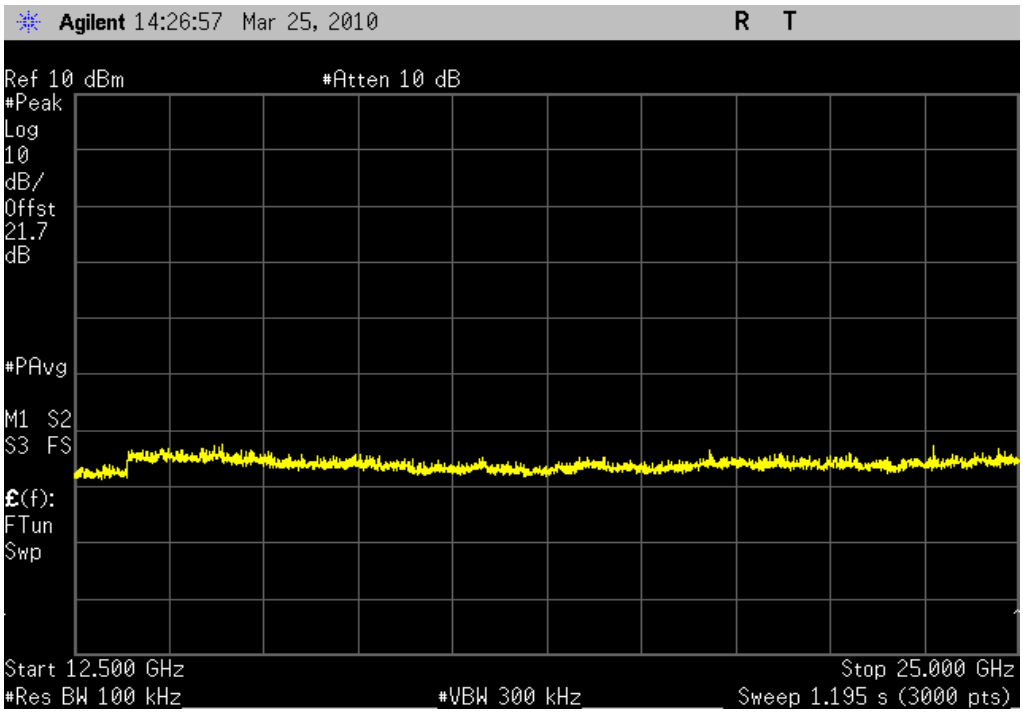
Mid Channel, 2.95GHz-6GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



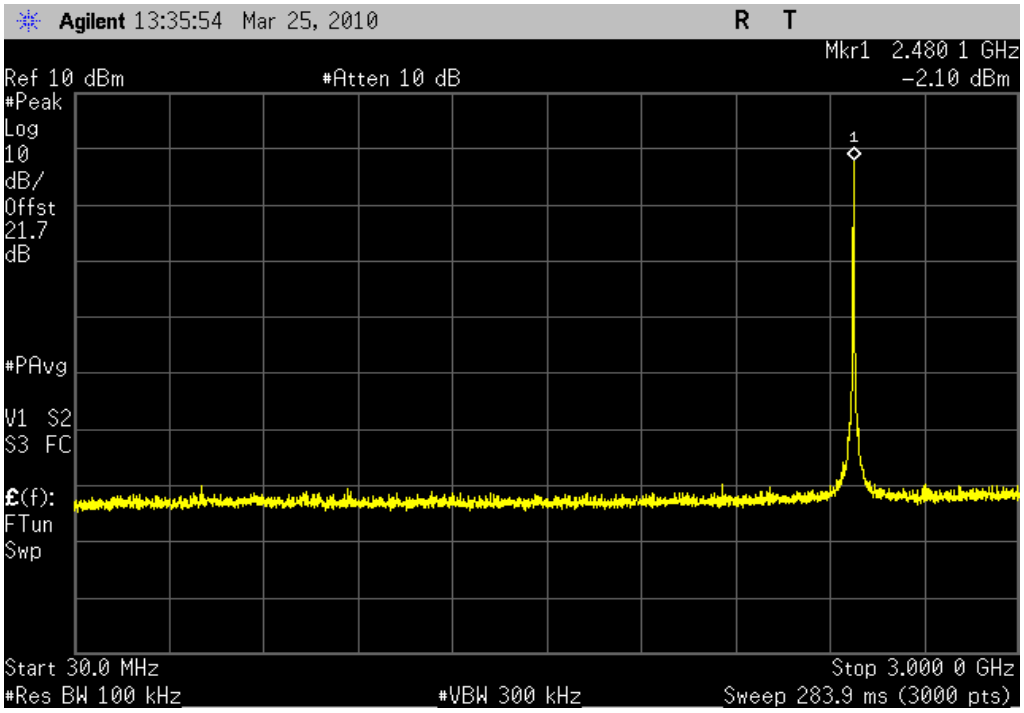
Mid Channel, 5.95GHz-12.5GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



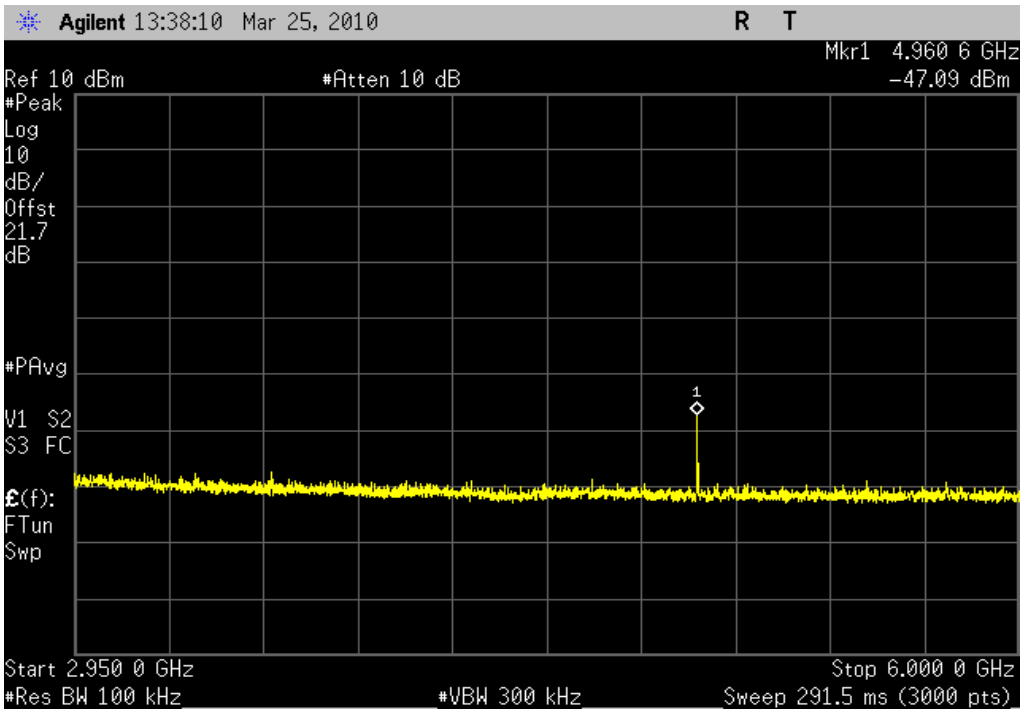
Mid Channel, 12.5GHz-25GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



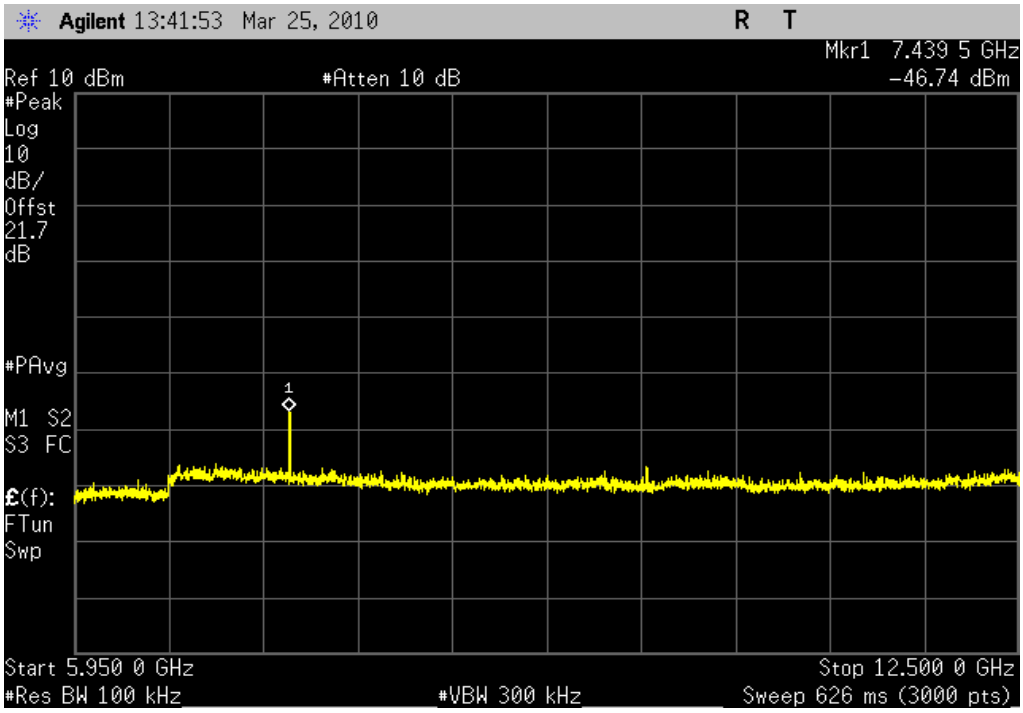
High Channel, 30MHz - 3GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



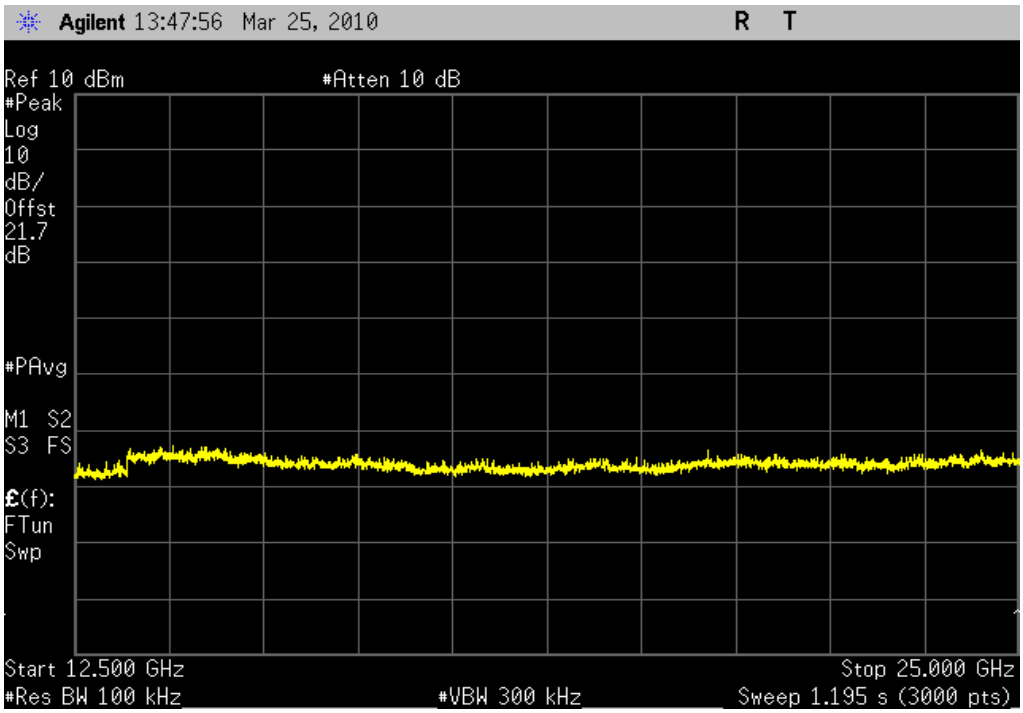
High Channel, 2.95GHz-6GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



High Channel, 5.95GHz-12.5GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



High Channel, 12.5GHz-25GHz					
Result:	Pass	**Value:**	< -40 dBc	**Limit:**	-20 dBc



POWER SPECTRAL DENSITY

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
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
26 GHz DC Block, SMA	Pasternack	PE8210	AME	10/19/2009	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/21/2009	13
Signal Generator	Hewlett-Packard	8648D	TGC	12/9/2008	24
Power Meter	Gigatronics	8651A	SPM	1/7/2010	13
Power Sensor	Gigatronics	80701A	SPL	1/7/2010	13
Spectrum Analyzer	Agilent	E4407B	AAU	12/12/2008	24

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 peak power spectral density measurements were measured with the EUT set to low, mid, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate for each modulation type available. Per the procedure outlined in ANSI C63.10:2009, the spectrum analyzer was used as follows:

> The emission peak(s) were located and zoom in on within the passband. The resolution bandwidth was set to 3 kHz, the video bandwidth was set to greater than or equal to the resolution bandwidth. The sweep speed was set equal to the span divided by 3 kHz (sweep = (SPAN/3 kHz)). For example, given a span of 1.5 MHz, the sweep should be 1.5 x 10^6 ÷ 3 x 10^3 = 500 seconds. External attenuation was used and added to the reading. The following FCC procedure was used for modifying the power spectral density measurements:

"If the spectrum line spacing cannot be resolved on the available spectrum analyzer, the noise density function on most modern conventional spectrum analyzers will directly measure the noise power density normalized to a 1 Hz noise power bandwidth. Add 35 dB for correction to 3 kHz."

NORTHWEST EMC

POWER SPECTRAL DENSITY

XMit 2010.01.14

EUT:	ST-900			**Work Order:**	SGST0011
Serial Number:	WO#270222-001			**Date:**	03/31/10
Customer:	OEM Controls, Inc			**Temperature:**	22°C
Attendees:	David Student			**Humidity:**	36%
Project:	None			**Barometric Pres.:**	29.94
Tested by:	Greg Kiemel	**Power:**	13.8VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

COMMENTS

Default maximum output power. 100% duty cycle. Measurement directly to board without adapter cable.

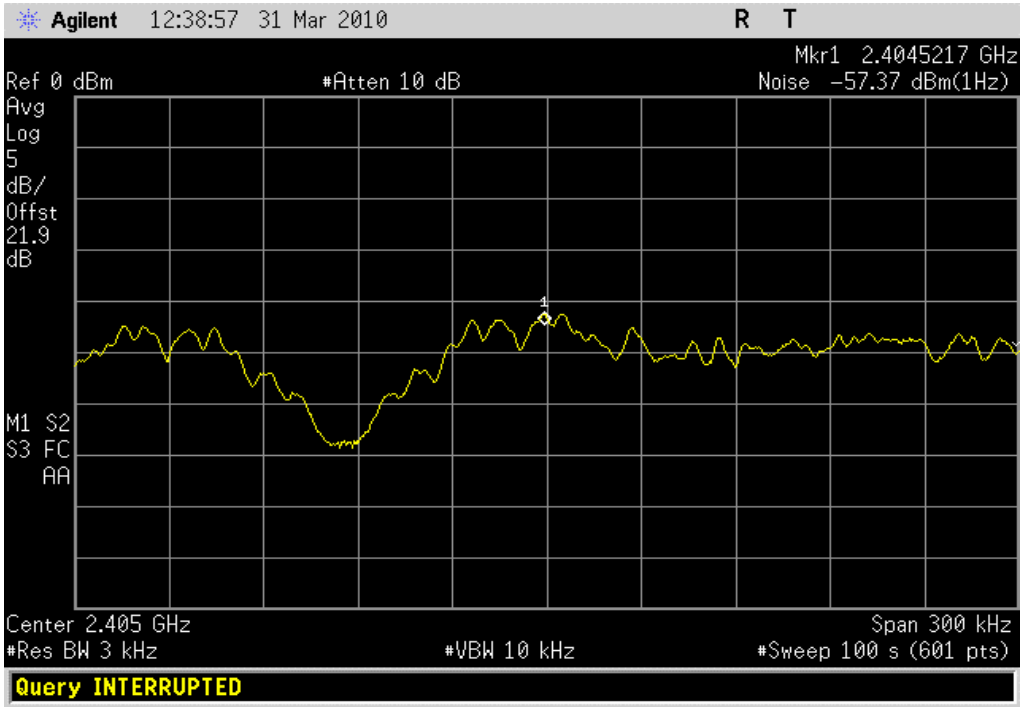
DEVIATIONS FROM TEST STANDARD

No deviations

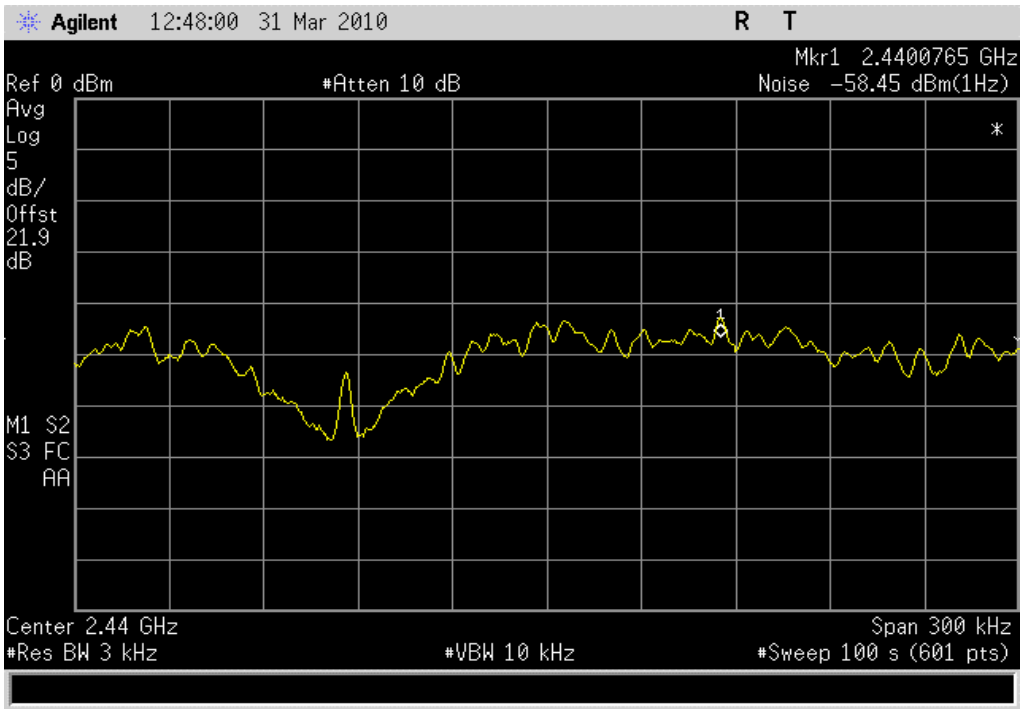
Configuration #	2	Signature

	Value	Limit	Results
Low Channel	-22.6 dBm / 3 kHz	+8 dBm / 3 kHz	Pass
Mid Channel	-23.7 dBm / 3 kHz	+8 dBm / 3 kHz	Pass
High Channel	-22.8 dBm / 3 kHz	+8 dBm / 3 kHz	Pass

Low Channel					
Result:	Pass	**Value:**	-22.6 dBm / 3 kHz	**Limit:**	+8 dBm / 3 kHz

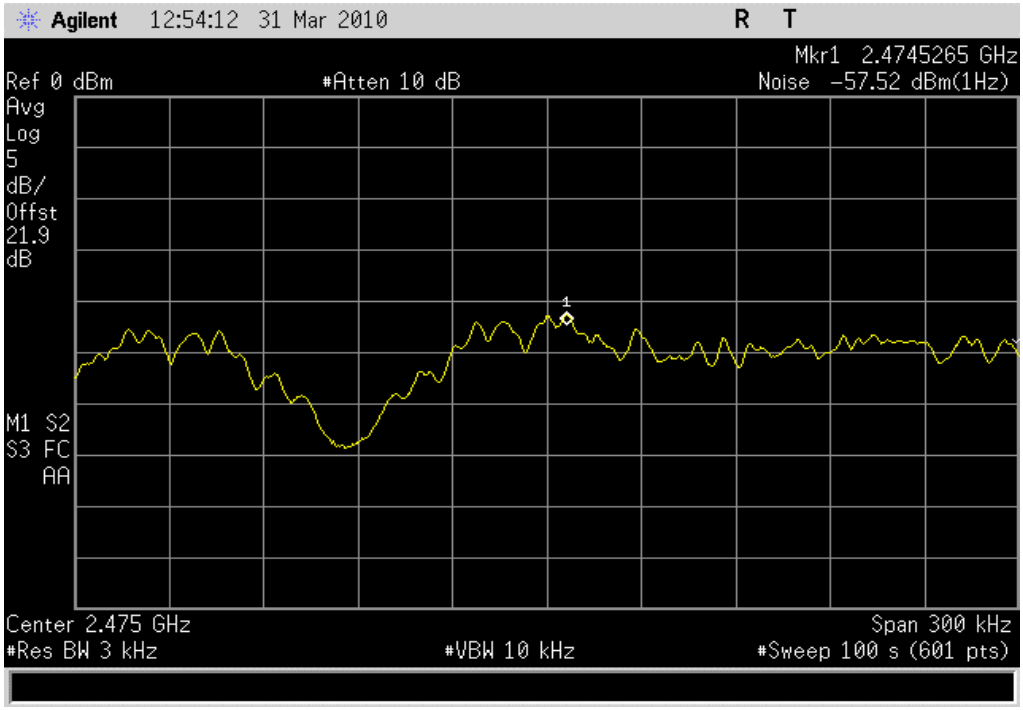


Mid Channel					
Result:	Pass	**Value:**	-23.7 dBm / 3 kHz	**Limit:**	+8 dBm / 3 kHz



POWER SPECTRAL DENSITY

High Channel					
Result:	Pass	**Value:**	-22.8 dBm / 3 kHz	**Limit:**	+8 dBm / 3 kHz



SPURIOUS 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.

MODES OF OPERATION
Transmitting low channel, 1, 2505 MHz, 100% duty cycle
Transmitting mid channel, 8, 2440 MHz, 100% duty cycle
Transmitting high channel, 15, 2475 MHz, 100% duty cycle

POWER SETTINGS INVESTIGATED
13.8 VDC

FREQUENCY RANGE INVESTIGATED			
Start Frequency	30 MHz	Stop Frequency	25 GHz

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	E4446A	AAQ	1/6/2010	13
High Pass Filter	Micro-Tronics	HPM50111	HFO	7/10/2009	13
Low Pass Filter 0-1000 MHz	Micro-Tronics	LPM50004	LFD	7/10/2009	13
Pre-Amplifier	Miteq	AM-1616-1000	AOL	7/10/2009	13
Antenna, Biconilog	EMCO	3141	AXE	1/14/2010	13
EV01 Cables		Bilog Cables	EVA	7/10/2009	13
Pre-Amplifier	Miteq	AMF-4D-010100-24-10P	APW	7/10/2009	13
Antenna, Horn	EMCO	3115	AHC	8/12/2008	24
EV01 Cables		Double Ridge Horn Cables	EVB	7/10/2009	13
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	7/10/2009	13
Antenna, Horn	ETS	3160-07	AHU	NCR	0
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	7/10/2009	13
Antenna, Horn	ETS	3160-08	AHV	NCR	0
EV01 Cables		Standard Gain Horns Cables	EVF	11/13/2008	17
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	5/19/2009	13
Antenna, Horn	ETS Lindgren	3160-09	AIV	NCR	0
Pre-Amplifier	Miteq	AM-1616-1000	AVY	7/1/2009	13

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

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 highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.10:2009). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

NORTHWEST EMC

SPURIOUS RADIATED EMISSIONS

PSA 2008.07.21
EMI 2009.8.29

EUT:	ST-900	Work Order:	SGST0011
Serial Number:	WO#27022-001	Date:	03/26/10
Customer:	OEM Controls, Inc	Temperature:	21
Attendees:	David Student	Humidity:	39%
Project:	None	Barometric Pres.:	29.85
Tested by:	Rod Peloquin	Power: 13.8 VDC	Job Site: EV01

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

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

COMMENTS

Remote PS, with GPS antenna and receiver

EUT OPERATING MODES

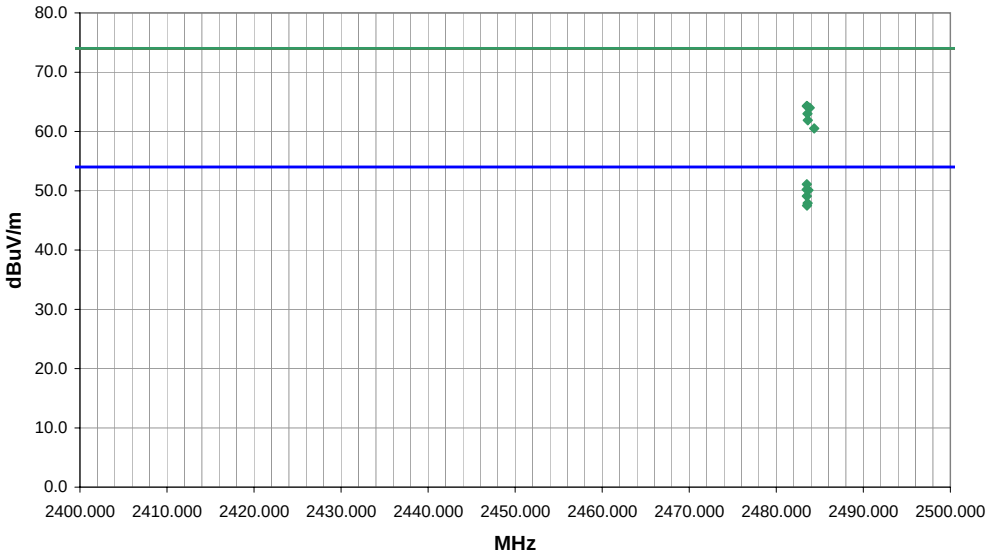
Transmitting high channel

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	1
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)	Comments
2483.510	28.4	2.7	246.0	1.1	3.0	20.0	V-Horn	AV	0.0	51.1	54.0	-2.9	Channel 15, EUT vertical
2483.500	27.5	2.7	97.0	1.4	3.0	20.0	H-Horn	AV	0.0	50.2	54.0	-3.8	Channel 15, EUT on side
2483.703	27.4	2.7	114.0	1.2	3.0	20.0	H-Horn	AV	0.0	50.1	54.0	-3.9	Channel 15, EUT horizontal
2483.503	26.4	2.7	172.0	1.1	3.0	20.0	V-Horn	AV	0.0	49.1	54.0	-4.9	Channel 15, EUT horizontal
2483.605	25.2	2.7	59.0	1.5	3.0	20.0	H-Horn	AV	0.0	47.9	54.0	-6.1	Channel 15, EUT vertical
2483.538	24.8	2.7	11.0	1.1	3.0	20.0	V-Horn	AV	0.0	47.5	54.0	-6.5	Channel 15, EUT on side
2483.505	41.6	2.7	97.0	1.4	3.0	20.0	H-Horn	PK	0.0	64.3	74.0	-9.7	Channel 15, EUT on side
2483.522	41.6	2.7	249.0	1.1	3.0	20.0	V-Horn	PK	0.0	64.3	74.0	-9.7	Channel 15, EUT vertical
2483.847	41.3	2.7	114.0	1.2	3.0	20.0	H-Horn	PK	0.0	64.0	74.0	-10.0	Channel 15, EUT horizontal
2483.590	40.3	2.7	172.0	1.1	3.0	20.0	V-Horn	PK	0.0	63.0	74.0	-11.0	Channel 15, EUT horizontal
2483.613	39.2	2.7	59.0	1.5	3.0	20.0	H-Horn	PK	0.0	61.9	74.0	-12.1	Channel 15, EUT vertical
2484.365	37.8	2.7	11.0	1.1	3.0	20.0	V-Horn	PK	0.0	60.5	74.0	-13.5	Channel 15, EUT on side

NORTHWEST EMC

SPURIOUS RADIATED EMISSIONS

PSA 2008.07.21
EMI 2009.8.29

EUT:	ST-900	Work Order:	SGST0011
Serial Number:	WO#27022-001	Date:	03/26/10
Customer:	OEM Controls, Inc	Temperature:	21
Attendees:	David Student	Humidity:	39%
Project:	None	Barometric Pres.:	29.85
Tested by:	Rod Peloquin	Power: 13.8 VDC	Job Site: EV01

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

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

COMMENTS

Remote PS, with GPS antenna and receiver

EUT OPERATING MODES

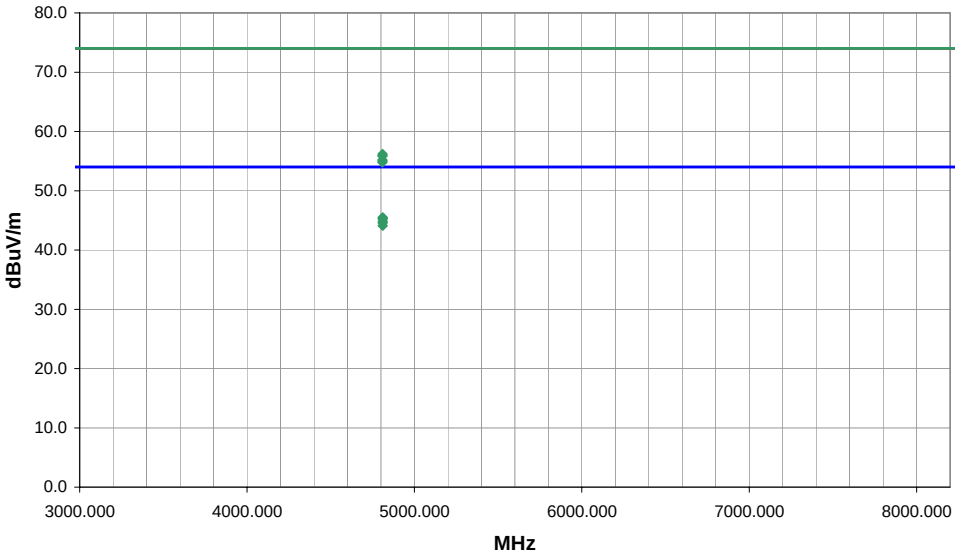
Transmitting low channel

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	2
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)	Comments
4810.776	36.0	9.5	182.0	1.0	3.0	0.0	H-Horn	AV	0.0	45.5	54.0	-8.5	Low Channel, EUT horizontal
4810.798	35.9	9.5	199.0	1.1	3.0	0.0	V-Horn	AV	0.0	45.4	54.0	-8.6	Low Channel, EUT on side
4810.778	35.7	9.5	66.0	1.1	3.0	0.0	V-Horn	AV	0.0	45.2	54.0	-8.8	Low Channel, EUT vertical
4810.725	35.3	9.5	225.0	1.0	3.0	0.0	V-Horn	AV	0.0	44.8	54.0	-9.2	Low Channel, EUT horizontal
4810.863	35.1	9.5	64.0	1.0	3.0	0.0	H-Horn	AV	0.0	44.6	54.0	-9.4	Low Channel, EUT on side
4810.810	34.6	9.5	178.0	1.0	3.0	0.0	H-Horn	AV	0.0	44.1	54.0	-9.9	Low Channel, EUT vertical
4809.030	46.7	9.5	182.0	1.0	3.0	0.0	H-Horn	PK	0.0	56.2	74.0	-17.8	Low Channel, EUT horizontal
4808.945	46.4	9.5	199.0	1.1	3.0	0.0	V-Horn	PK	0.0	55.9	74.0	-18.1	Low Channel, EUT on side
4809.031	46.4	9.5	66.0	1.1	3.0	0.0	V-Horn	PK	0.0	55.9	74.0	-18.1	Low Channel, EUT vertical
4808.898	45.7	9.5	225.0	1.0	3.0	0.0	V-Horn	PK	0.0	55.2	74.0	-18.8	Low Channel, EUT horizontal
4809.016	45.5	9.5	64.0	1.0	3.0	0.0	H-Horn	PK	0.0	55.0	74.0	-19.0	Low Channel, EUT on side
4808.943	45.3	9.5	178.0	1.0	3.0	0.0	H-Horn	PK	0.0	54.8	74.0	-19.2	Low Channel, EUT vertical

NORTHWEST EMC

SPURIOUS RADIATED EMISSIONS

PSA 2008.07.21
EMI 2009.4.13

EUT:	ST-900	Work Order:	SGST0011
Serial Number:	WO#27022-001	Date:	03/29/10
Customer:	OEM Controls, Inc	Temperature:	21
Attendees:	David Student	Humidity:	39%
Project:	None	Barometric Pres.:	29.85
Tested by:	Rod Peloquin	Power: 13.8 VDC	Job Site: EV01

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

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

COMMENTS

Remote PS, with GPS antenna and receiver

EUT OPERATING MODES

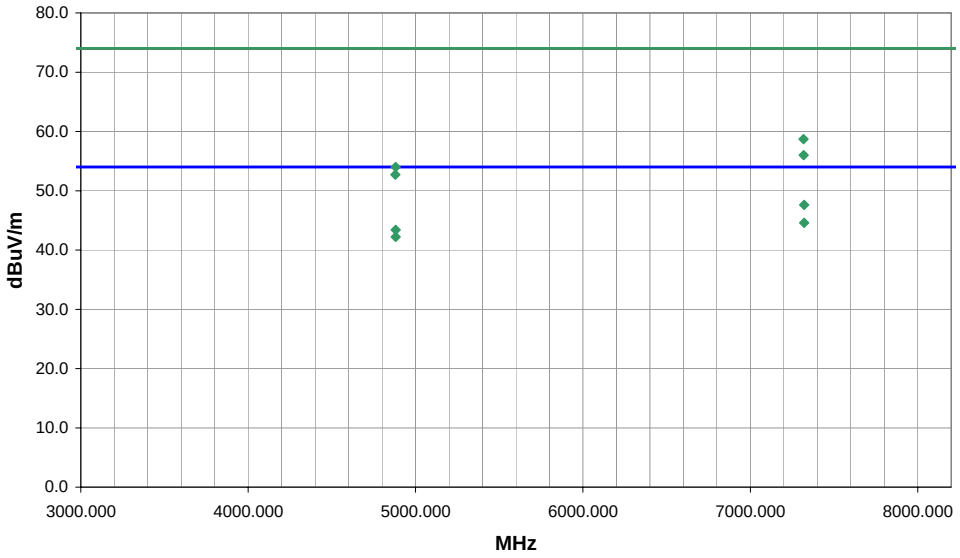
Transmitting mid channel

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	3
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)	Comments
7321.186	31.3	16.3	344.0	1.1	3.0	0.0	H-Horn	AV	0.0	47.6	54.0	-6.4	Mid Channel, EUT horizontal
7321.218	28.3	16.3	31.0	1.3	3.0	0.0	V-Horn	AV	0.0	44.6	54.0	-9.4	Mid Channel, EUT on side
4880.785	33.7	9.7	155.0	1.0	3.0	0.0	V-Horn	AV	0.0	43.4	54.0	-10.6	Mid Channel, EUT on side
4880.795	32.5	9.7	38.0	1.0	3.0	0.0	H-Horn	AV	0.0	42.2	54.0	-11.8	Mid Channel, EUT horizontal
7318.178	42.4	16.3	344.0	1.1	3.0	0.0	H-Horn	PK	0.0	58.7	74.0	-15.3	Mid Channel, EUT horizontal
7318.776	39.7	16.3	31.0	1.3	3.0	0.0	V-Horn	PK	0.0	56.0	74.0	-18.0	Mid Channel, EUT on side
4880.943	44.3	9.7	155.0	1.0	3.0	0.0	V-Horn	PK	0.0	54.0	74.0	-20.0	Mid Channel, EUT on side
4879.045	43.0	9.7	38.0	1.0	3.0	0.0	H-Horn	PK	0.0	52.7	74.0	-21.3	Mid Channel, EUT horizontal

NORTHWEST EMC

SPURIOUS RADIATED EMISSIONS

PSA 2008.07.21
EMI 2009.4.13

EUT:	ST-900	Work Order:	SGST0011
Serial Number:	WO#27022-001	Date:	03/29/10
Customer:	OEM Controls, Inc	Temperature:	21
Attendees:	David Student	Humidity:	39%
Project:	None	Barometric Pres.:	29.85
Tested by:	Rod Peloquin	Power: 13.8 VDC	Job Site: EV01

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

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

COMMENTS

Remote PS, with GPS antenna and receiver

EUT OPERATING MODES

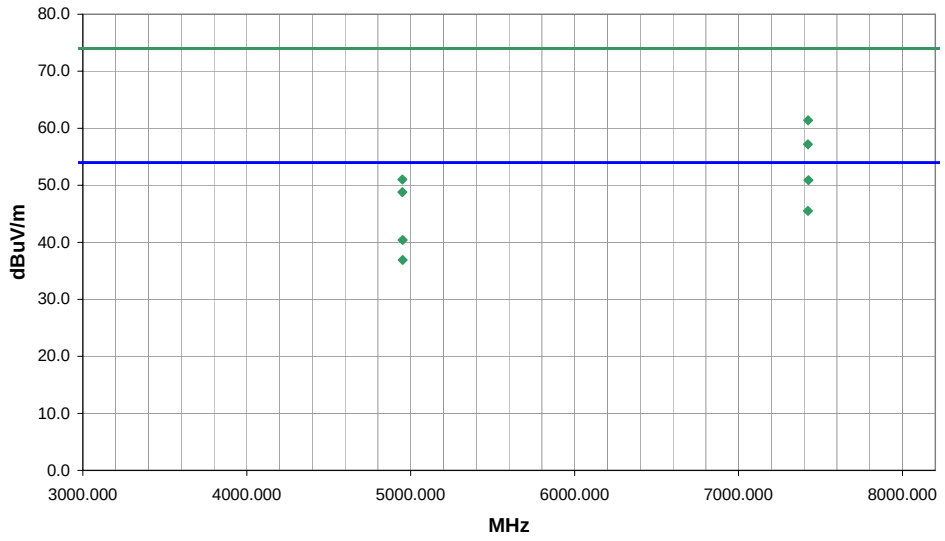
Transmitting high channel

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)	Comments
7426.186	34.0	16.9	338.0	1.1	3.0	0.0	H-Horn	AV	0.0	50.9	54.0	-3.1	High Channel, EUT horizontal
7423.610	28.6	16.9	174.0	1.2	3.0	0.0	V-Horn	AV	0.0	45.5	54.0	-8.5	High Channel, EUT on side
7423.653	44.5	16.9	338.0	1.1	3.0	0.0	H-Horn	PK	0.0	61.4	74.0	-12.6	High Channel, EUT horizontal
4950.795	30.4	10.0	232.0	1.0	3.0	0.0	H-Horn	AV	0.0	40.4	54.0	-13.6	High Channel, EUT horizontal
7423.110	40.3	16.9	174.0	1.2	3.0	0.0	V-Horn	PK	0.0	57.2	74.0	-16.8	High Channel, EUT on side
4950.768	26.9	10.0	132.0	1.0	3.0	0.0	V-Horn	AV	0.0	36.9	54.0	-17.1	High Channel, EUT on side
4949.120	41.0	10.0	232.0	1.0	3.0	0.0	H-Horn	PK	0.0	51.0	74.0	-23.0	High Channel, EUT horizontal
4948.760	38.8	10.0	132.0	1.0	3.0	0.0	V-Horn	PK	0.0	48.8	74.0	-25.2	High Channel, EUT on side

NORTHWEST EMC

SPURIOUS RADIATED EMISSIONS

PSA 2008.07.21
EMI 2009.4.13

EUT:	ST-900	**Work Order:**	SGST0011
Serial Number:	WO#27022-001	**Date:**	03/29/10
Customer:	OEM Controls, Inc	**Temperature:**	21
Attendees:	David Student	**Humidity:**	39%
Project:	None	**Barometric Pres.:**	29.85
Tested by:	Rod Peloquin	**Power:** 13.8 VDC	**Job Site:** EV01

TEST SPECIFICATIONS	Test Method
FCC 15.247:2010	ANSI C63.10:2009

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

COMMENTS

Remote PS, with GPS antenna and receiver

EUT OPERATING MODES

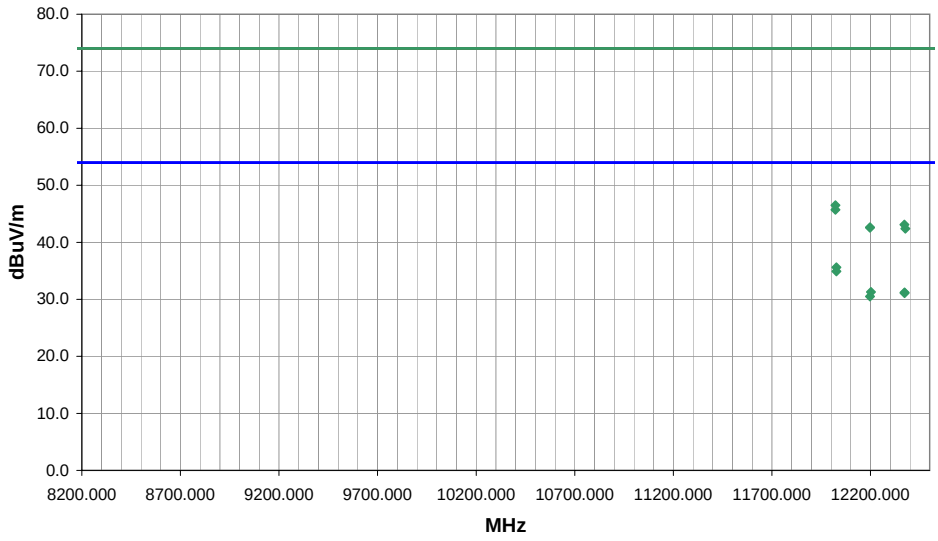
Transmitting

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	5
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)	Comments
12027.180	39.7	-4.1	266.0	1.2	3.0	0.0	H-Horn	AV	0.0	35.6	54.0	-18.4	Low Channel, EUT horizontal
12027.200	39.0	-4.1	18.0	1.0	3.0	0.0	V-Horn	AV	0.0	34.9	54.0	-19.1	Low Channel, EUTvertical
12202.200	34.6	-3.3	157.0	1.1	3.0	0.0	V-Horn	AV	0.0	31.3	54.0	-22.7	Mid Channel, EUTvertical
12372.380	33.6	-2.4	331.0	1.3	3.0	0.0	H-Horn	AV	0.0	31.2	54.0	-22.8	High Channel, EUT horizontal
12372.430	33.6	-2.5	56.0	1.0	3.0	0.0	V-Horn	AV	0.0	31.1	54.0	-22.9	High Channel, EUTvertical
12197.470	33.8	-3.3	180.0	1.0	3.0	0.0	H-Horn	AV	0.0	30.5	54.0	-23.5	Mid Channel, EUT horizontal
12022.000	50.6	-4.1	266.0	1.2	3.0	0.0	H-Horn	PK	0.0	46.5	74.0	-27.5	Low Channel, EUT horizontal
12022.050	49.8	-4.1	18.0	1.0	3.0	0.0	V-Horn	PK	0.0	45.7	74.0	-28.3	Low Channel, EUTvertical
12372.150	45.5	-2.4	56.0	1.0	3.0	0.0	V-Horn	PK	0.0	43.1	74.0	-30.9	High Channel, EUTvertical
12197.450	45.9	-3.3	157.0	1.1	3.0	0.0	V-Horn	PK	0.0	42.6	74.0	-31.4	Mid Channel, EUTvertical
12197.470	45.9	-3.3	180.0	1.0	3.0	0.0	H-Horn	PK	0.0	42.6	74.0	-31.4	Mid Channel, EUT horizontal
12376.770	44.8	-2.4	331.0	1.3	3.0	0.0	H-Horn	PK	0.0	42.4	74.0	-31.6	High Channel, EUT horizontal