



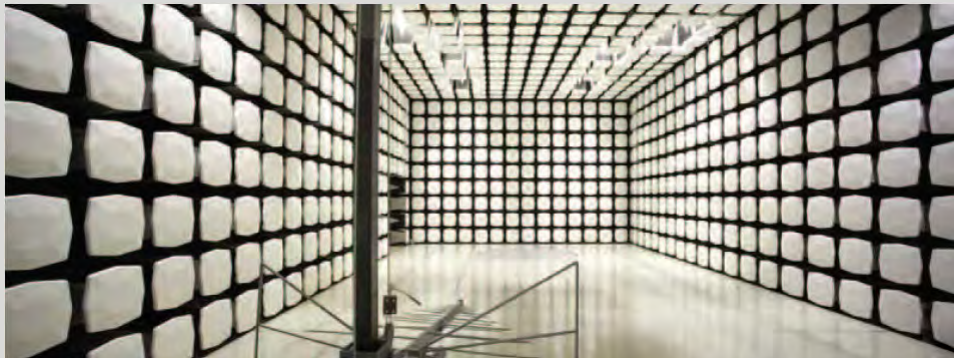
Synapse

xBRv4

FCC 15.247:2013

FCC 15.207:2013

Report #: SYNA0130



Report Prepared By Northwest EMC Inc.

NORTHWEST EMC – (888) 364-2378 – www.nwemc.com

California – Minnesota – Oregon – New York – Washington

CERTIFICATE OF TEST

Last Date of Test: May 16, 2013
Synapse
Model: xBRv4

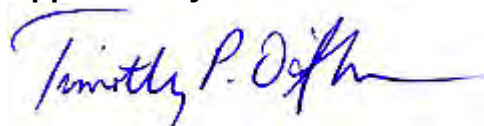
Emissions

Test Description	Specification	Test Method	Pass/Fail
Occupied Bandwidth	FCC 15.247:2013	ANSI C63.10:2009	Pass
Output Power	FCC 15.247:2013	ANSI C63.10:2009	Pass
Band Edge Compliance	FCC 15.247:2013	ANSI C63.10:2009	Pass
Spurious Conducted Emissions	FCC 15.247:2013	ANSI C63.10:2009	Pass
Power Spectral Density	FCC 15.247:2013	ANSI C63.10:2009	Pass
Spurious Radiated Emissions	FCC 15.247:2013	ANSI C63.10:2009	Pass
AC Powerline Conducted Emissions	FCC 15.207:2013	ANSI C63.10:2009	Pass

Deviations From Test Standards

None

Approved By:



Tim O'Shea, Operations Manager



NVLAP Lab Code: 200629-0

Test Facility

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

Northwest EMC, Inc.
14128 339th Avenue SE
Sultan, WA 98294

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 #2834C-1).

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 HISTORY

Revision Number	Description	Date	Page Number
00	None		

Barometric Pressure

The recorded barometric pressure has been normalized to sea level.

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

KCC / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Hong Kong

OFTA – Recognized by OFTA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

Russia

GOST – Accredited by Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC to perform EMC and Hygienic testing for Information Technology products to GOST standards.

SCOPE

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

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

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

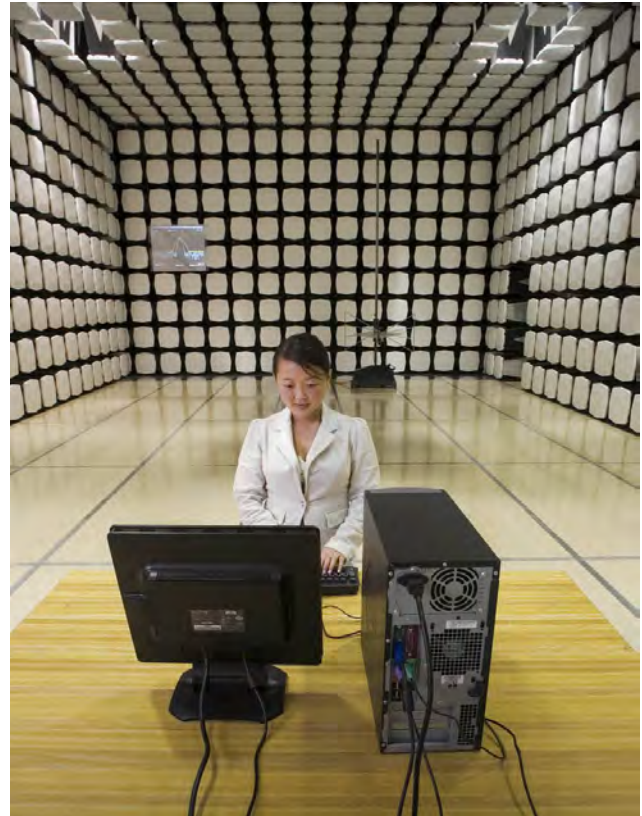
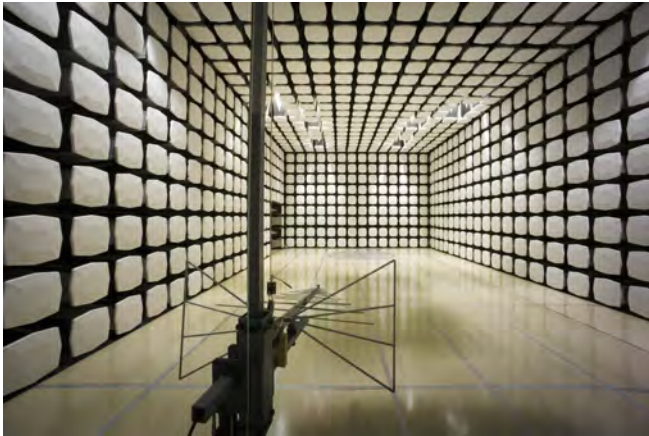
A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is listed below. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-1 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.12	-0.01
Amplitude Accuracy (dB)	0.49	-0.49
Conducted Power (dB)	0.41	-0.41
Radiated Power via Substitution (dB)	0.69	-0.68
Temperature (degrees C)	0.81	-0.81
Humidity (% RH)	2.89	-2.89
Field Strength (dB)	3.80	-3.80
AC Powerline Conducted Emissions (dB)	2.94	-2.94



Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	California Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	Minnesota Labs MN01-08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	Washington Labs NC01-05, SU02, SU07 19201 120 th Ave. NE Bothell, WA 98011 (425) 984-6600
VCCI				
A-0108	A-0029		A-0109	A-0110
Industry Canada				
2834D-1, 2834D-2	2834B-1, 2834B-2, 2834B-3		2834E-1	2834C-1
NVLAP				
NVLAP Lab Code: 200630-0	NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200629-0



Client and Equipment Under Test (EUT) Information

Company Name:	Synapse Strategic Product Development LLC
Address:	1511 6th Ave. 4th Floor
City, State, Zip:	Seattle, WA 98101
Test Requested By:	Jim Hite
Model:	xBRv4
First Date of Test:	May 15, 2013
Last Date of Test:	May 16, 2013
Receipt Date of Samples:	May 15, 2013
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):

A system that contains 32 receive radios and 8 antennas. Each 4 radio section shares a single antenna through a 4 - 1 splitter. One DTS transmit radio with 1 transmit antenna, with an emission bandwidth at 1 MHz that transmits only at 2482 MHz. The system also uses a LSR pre-certified 802.11abgn module that is getting a C2PC change through LSR to approve a custom antenna for this application.

Testing Objective:

To demonstrate compliance to FCC 15.247 requirements.

Configuration SYNA0130- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Location Device	Synapse Strategic Product Development LLC	xBRv4	0091FA001A36

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Switch with PoE	Cisco	SFE2000P	DNI1612B20G

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Cat-5e Ethernet	No	8.0m	No	Wireless Location Device	Switch with PoE
AC Mains	No	2m	No	Switch with PoE	AC Mains
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Configuration SYNA0130- 2

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Location Device	Synapse Strategic Product Development LLC	xBRv4	0091FA001A36

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Switch with PoE	Cisco	SFE2000P	DNI1612B20G

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Mains	No	2m	No	Switch with PoE	AC Mains
Cat-5e Ethernet	Yes	8.0m	No	Wireless Location Device	Switch with PoE
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	5/15/2013	Spurious Radiated 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.
2	5/15/2013	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.
3	5/15/2013	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.
4	5/15/2013	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	5/15/2013	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.
6	5/15/2013	Band Edge Compliance	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.
7	5/16/2013	AC Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

Duty Cycle

TEST DESCRIPTION

The Duty Cycle (x) were measured for each of the EUT operating modes. The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

The EUT was operated in a test mode that resulted in a 100% Duty Cycle.

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
Attenuator	Fairview Microwave	SA4014-20	TKE	2/12/2013	12
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
Spectrum Analyzer	Agilent	E4440A	AAW	2/21/2013	24

TEST DESCRIPTION

The 6dB occupied bandwidth was measured using 100kHz resolution bandwidth and 300kHz video bandwidth. The 26 dB (99.9%) emission bandwidth (EBW) was also measured at the same time.

The EUT was set to a single transmit frequency. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the modulation type listed in the datasheet.



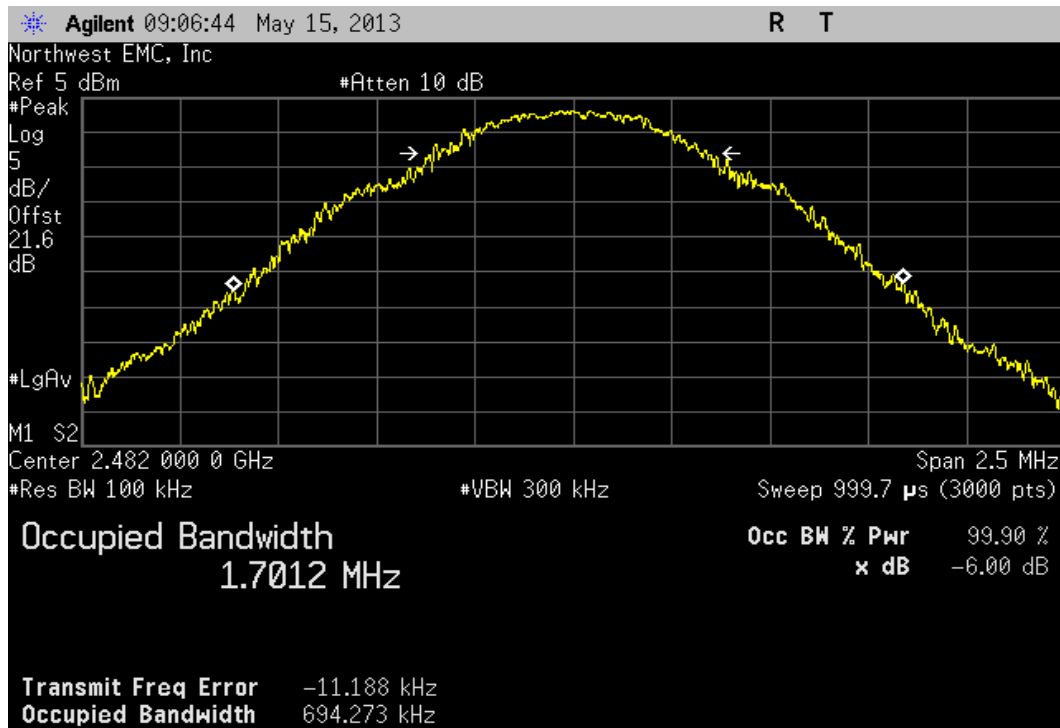
Occupied Bandwidth

XMit 2013.02.28
PsaTx 2013.01.10

EUT: xBRv4		Work Order: SYNA0130	
Serial Number: 0091FA001A36		Date: 05/15/13	
Customer: Synapse		Temperature: 22.4 C°	
Attendees: Jim Hite		Humidity: 35%	
Project: xBRv4		Barometric Pres.: 1019.3 mb	
Tested by: Richard Mellroth, Rod Peloquin, Matthew Barnes		Power: PoE	
Job Site: NC01			
TEST SPECIFICATIONS			
FCC 15.247:2013		ANSI C63.10:2009	
COMMENTS			
EUT was operating in a test mode that was verified at 100% duty cycle.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Richard Mellroth</i>	
		Value	Limit
GFSK		694.272 kHz	Pass
2482 MHz Channel		> 500 kHz	

GFSK, 2482 MHz Channel

				Value	Limit	Result
				694.272 kHz	> 500 kHz	Pass



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	Fairview Microwave	SA4014-20	TKE	2/12/2013	12
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
Spectrum Analyzer	Agilent	E4440A	AAW	2/21/2013	24

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

Prior to measuring peak transmit power, the emission bandwidth (B) and the transmission pulse duration (T) were measured. Both are required to determine the method of measuring Maximum Conducted Output Power. The Transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

Method found in KDB 558074 DTS D01 Measurement Section 9.1.1 was used because the RBW on the analyzer was greater than the Emission Bandwidth of the radio.

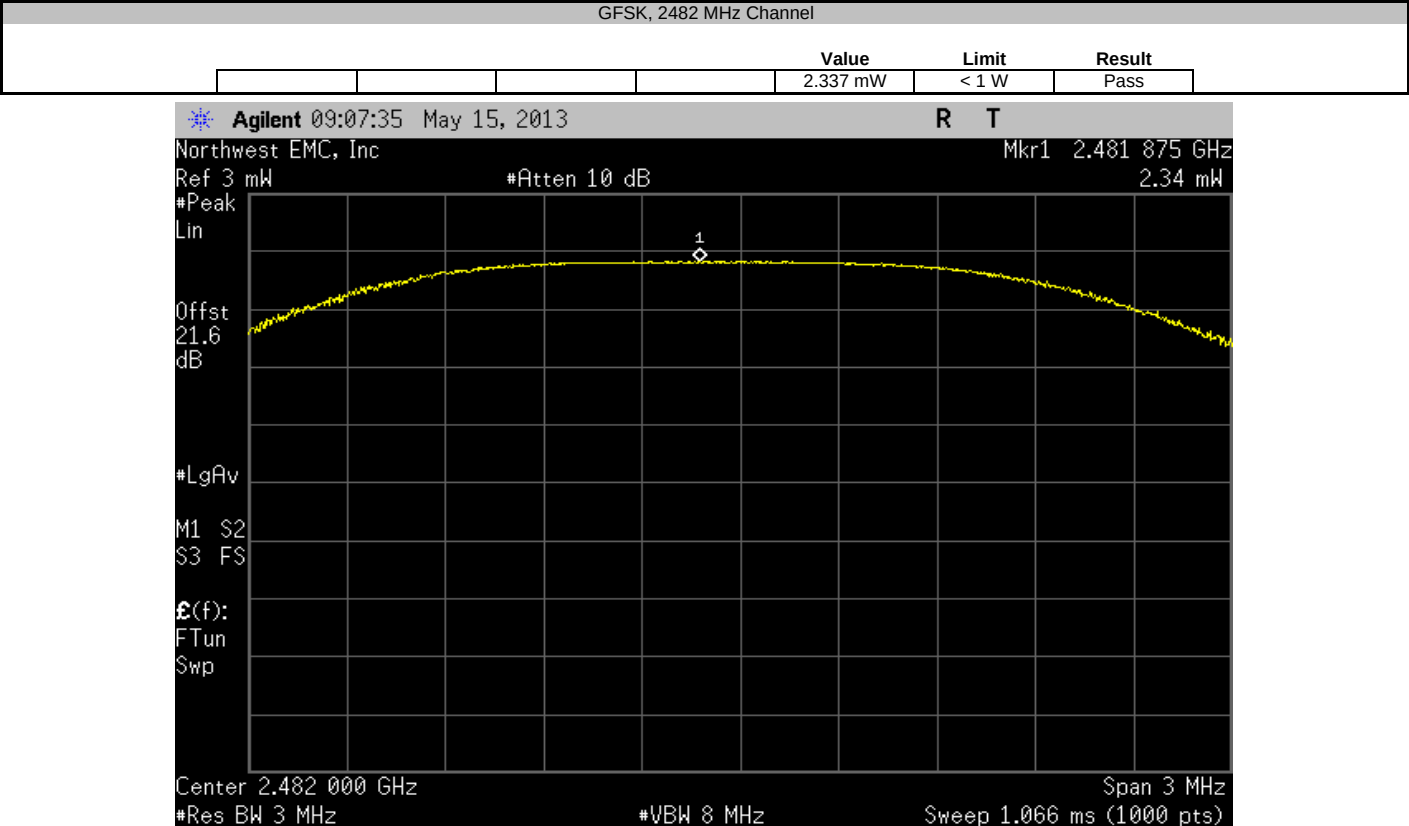
De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36 dBm.



Output Power

XMit 2013.02.28
PsaTx 2013.01.10

EUT: xBRv4		Work Order: SYNA0130	
Serial Number: 0091FA001A36		Date: 05/15/13	
Customer: Synapse		Temperature: 22.4 C	
Attendees: Jim Hite		Humidity: 35%	
Project: xBRv4		Barometric Pres.: 1019.3 mb	
Tested by: Richard Mellroth, Rod Peloquin, Matthew Barnes		Power: PoE	
Job Site: NC01			
TEST SPECIFICATIONS			
FCC 15.247:2013		ANSI C63.10:2009	
COMMENTS			
EUT was operating in a test mode that was verified at 100% duty cycle.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Richard Mellroth</i>	
		Value	Limit
GFSK		2.337 mW	< 1 W
2482 MHz Channel			Pass



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
Attenuator	Fairview Microwave	SA4014-20	TKE	2/12/2013	12
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
Spectrum Analyzer	Agilent	E4440A	AAW	2/21/2013	24

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 modulation type listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.



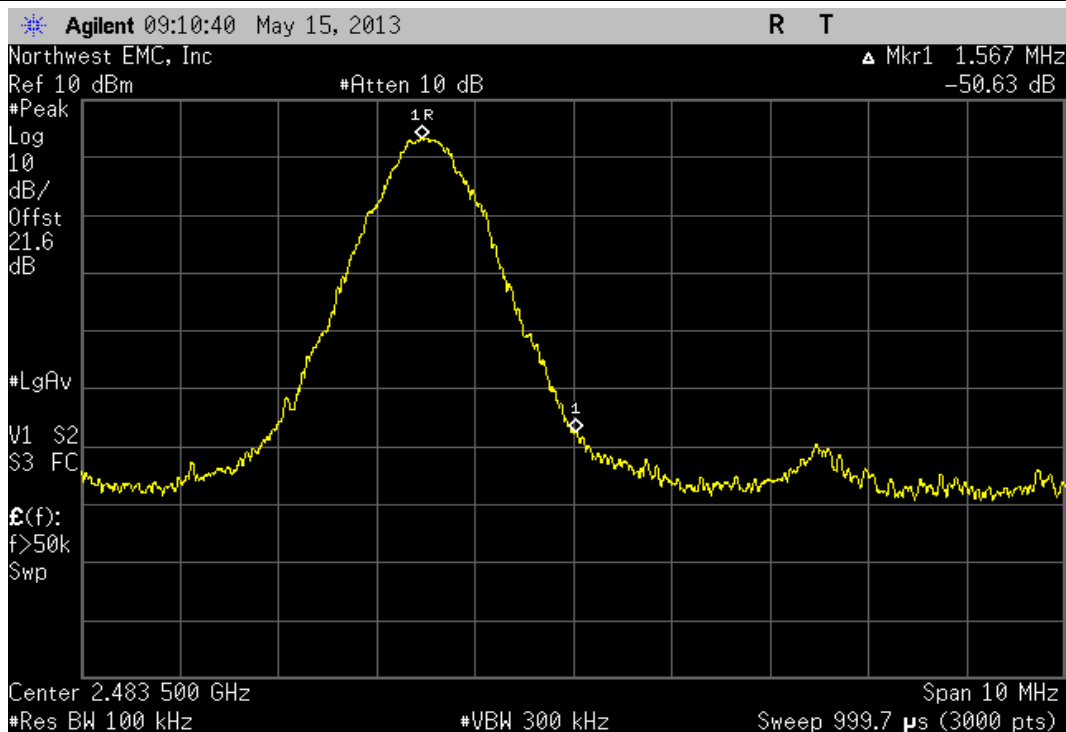
Band Edge Compliance

XMit 2013.02.28
PsaTx 2013.01.10

EUT: xBRv4		Work Order: SYNA0130	
Serial Number: 0091FA001A36		Date: 05/15/13	
Customer: Synapse		Temperature: 22.4 C° C	
Attendees: Jim Hite		Humidity: 35%	
Project: xBRv4		Barometric Pres.: 1019.3 mb	
Tested by: Richard Mellroth, Matt Barnes, Rod Peloquin		Power: PoE	
		Job Site: NC01	
TEST SPECIFICATIONS			
FCC 15.247:2013		Test Method	
		ANSI C63.10:2009	
COMMENTS			
EUT was operating in a test mode that was verified at 100% duty cycle.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Richard Mellroth</i>	
		Value	Limit
GFSK			Result
2482 MHz Channel		-50.63 dBc	≤ -20 dBc
			Pass

GFSK, 2482 MHz Channel

				Value	Limit	Result
				-50.63 dBc	≤ -20 dBc	Pass



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
Attenuator	Fairview Microwave	SA4014-20	TKE	2/12/2013	12
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
Spectrum Analyzer	Agilent	E4440A	AAW	2/21/2013	24

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 the modulation type listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

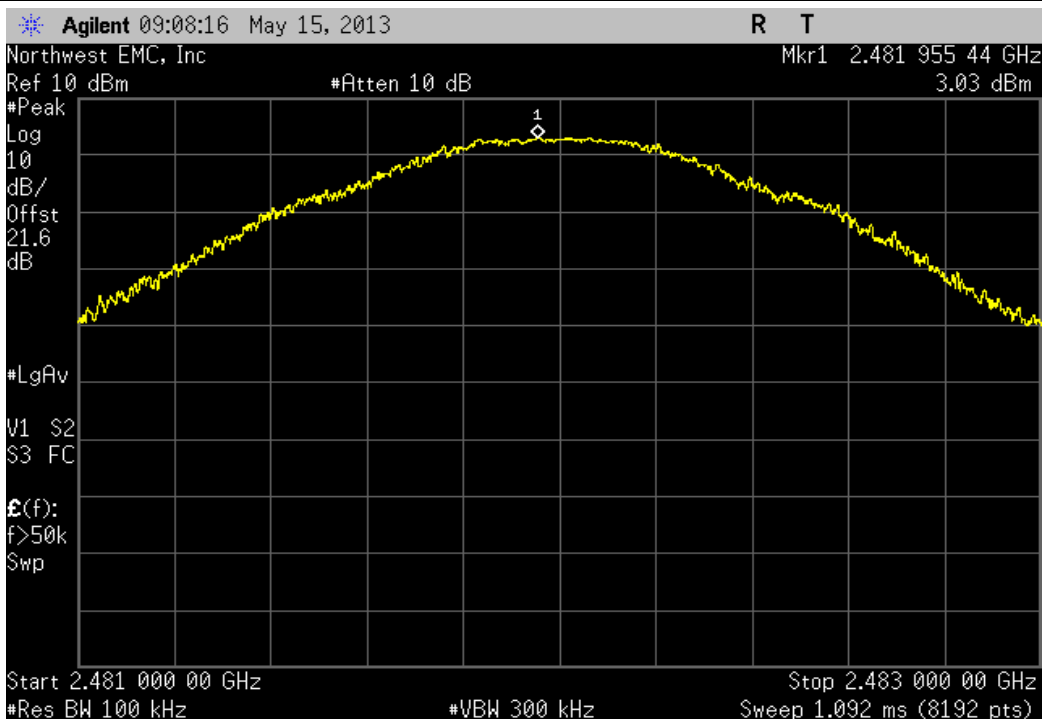


Spurious Conducted Emissions

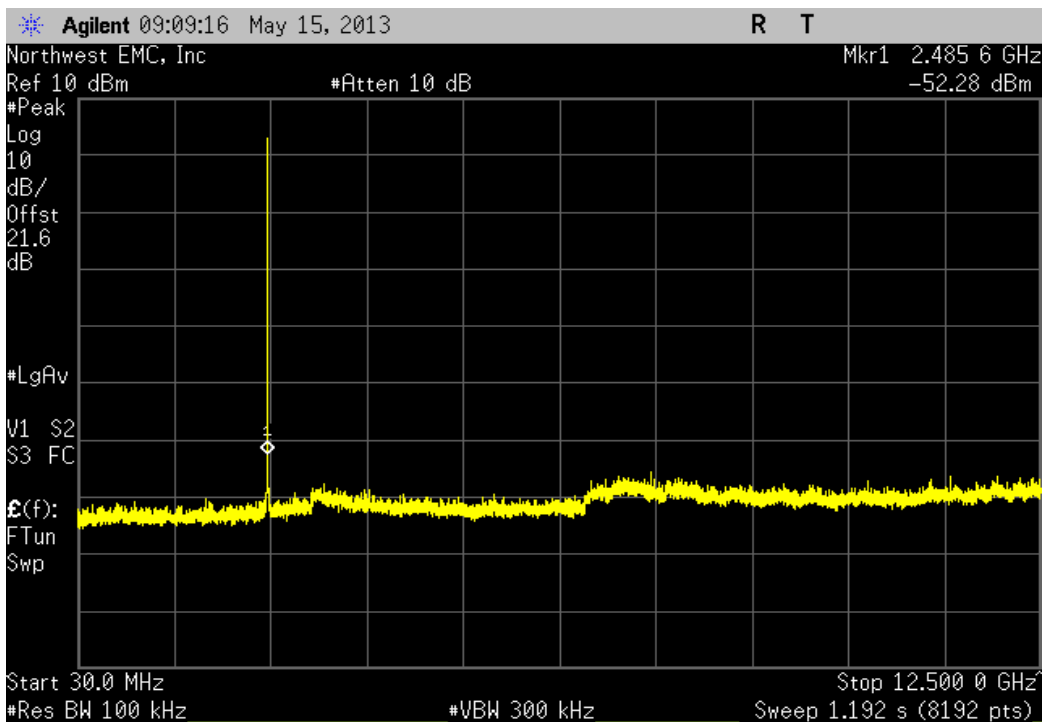
XMit 2013.02.28
PsaTx 2013.01.10

EUT: xBRv4		Work Order: SYNA0130				
Serial Number: 0091FA001A36		Date: 05/15/13				
Customer: Synapse		Temperature: 22.4 C°				
Attendees: Jim Hite		Humidity: 35%				
Project: xBRv4		Barometric Pres.: 1019.3 mb				
Tested by: Richard Mellroth, Matt Barnes, Rod Peloquin		Power: PoE				
		Job Site: NC01				
TEST SPECIFICATIONS						
FCC 15.247:2013		ANSI C63.10:2009				
TEST METHOD						
FCC 15.247:2013						
ANSI C63.10:2009						
COMMENTS						
EUT was operating in a test mode that was verified at 100% duty cycle.						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	1	Signature <i>Richard Mellroth</i>				
		Frequency Range	Value	Limit	Result	
GFSK		2482 MHz Channel	Fundamental	N/A	N/A	N/A
		2482 MHz Channel	30 MHz - 12.5 GHz	-55.31 dBc	≤ -20 dBc	Pass
		2482 MHz Channel	12.5 GHz - 25 GHz	-53.71 dBc	≤ -20 dBc	Pass

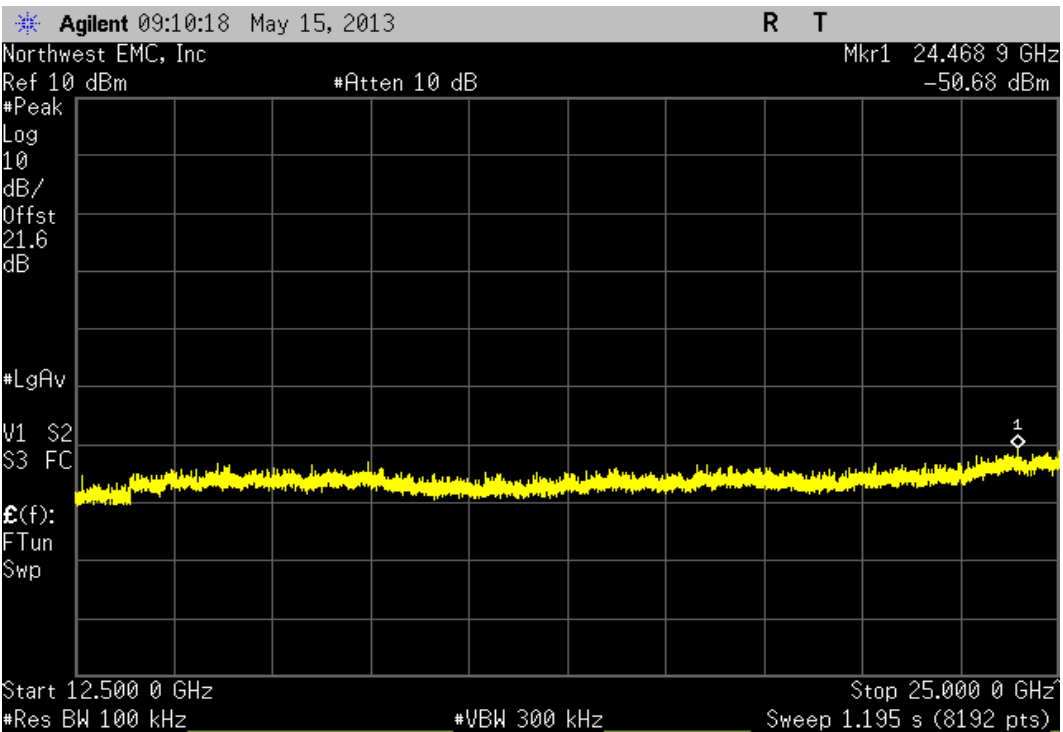
GFSK, 2482 MHz Channel				
Frequency Range		Value	Limit	Result
Fundamental		N/A	N/A	N/A



GFSK, 2482 MHz Channel				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-55.31 dBc	≤ -20 dBc	Pass



GFSK, 2482 MHz Channel				
Frequency Range	Value	Limit	Result	
12.5 GHz - 25 GHz	-53.71 dBc	≤ -20 dBc	Pass	



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
Attenuator	Fairview Microwave	SA4014-20	TKE	2/12/2013	12
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
Spectrum Analyzer	Agilent	E4440A	AAW	2/21/2013	24

TEST DESCRIPTION

The maximum power spectral density measurements were measured with the EUT set to the required transmit frequencies in each band. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the lowest, middle, and maximum data rate for each modulation type available.

Per the procedure outlined in FCC KDB 558074 D01 DTS Measurement Section 5.3.1, the spectrum analyzer was used as follows:

- RBW = 100 kHz
- VBW = 300 kHz
- Detector = Peak (to match method used for power measurement)
- Trace = Max hold

The observed power level is then scaled to an equivalent value in 3 kHz by adding a Bandwidth Correction Factor (BWCF) where:

$$\text{BWCF} = 10 \cdot \text{LOG} (3 \text{ kHz} / 100 \text{ kHz}) = -15.2 \text{ dB}$$

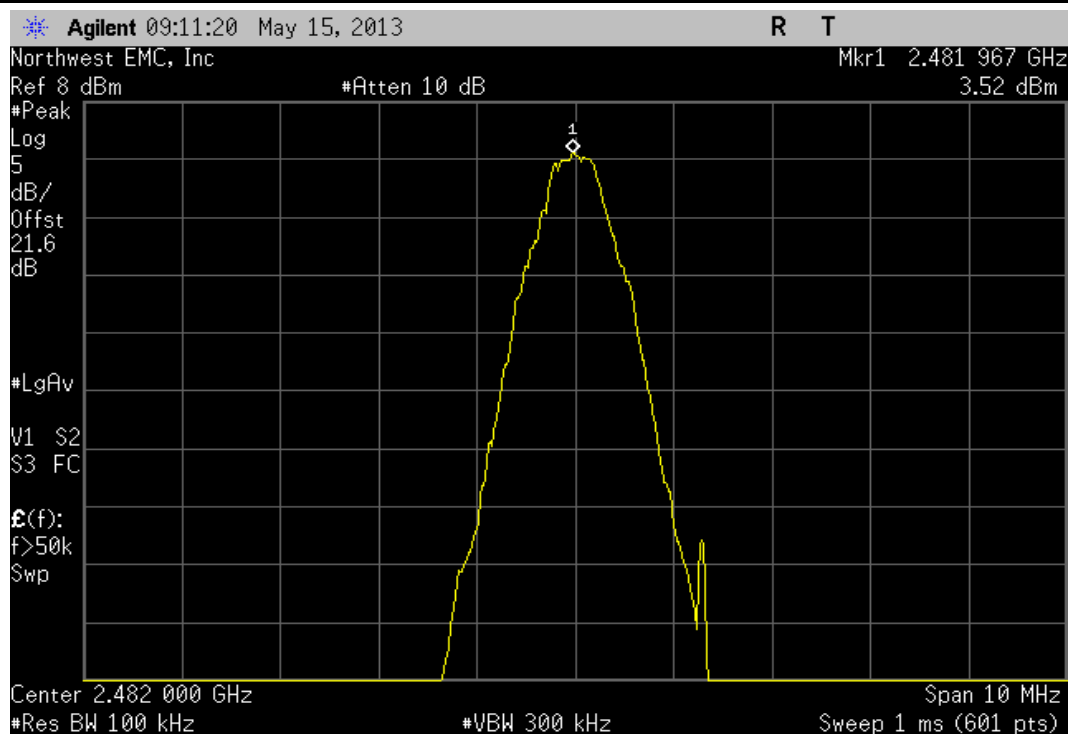


Power Spectral Density

XMit 2013.02.28
PsaTx 2013.01.10

EUT: xBRv4		Work Order: SYNA0130	
Serial Number: 0091FA001A36		Date: 05/15/13	
Customer: Synapse		Temperature: 22.4 C°	
Attendees: Jim Hite		Humidity: 35%	
Project: xBRv4		Barometric Pres.: 1019.3 mb	
Tested by: Richard Mellroth, Matt Barnes, Rod Peloquin		Power: PoE	
		Job Site: NC01	
TEST SPECIFICATIONS			
		Test Method	
COMMENTS			
EUT was operating in a test mode that was verified at 100% duty cycle.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Rod Peloquin</i>	
		Value dBm/100kHz	dBm/100kHz To dBm/3kHz
		Value dBm/3kHz	Limit dBm/3kHz
		Result	
GFSK			
2482 MHz Channel		3.516	-15.2
		-11.684	8
		Pass	

GFSK, 2482 MHz Channel					
	Value	dBm/100kHz	Value	Limit	Result
	dBm/100kHz	To dBm/3kHz	dBm/3kHz	dBm/3kHz	
	3.516	-15.2	-11.684	8	Pass



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. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmit Mode at 2482 MHz

POWER SETTINGS INVESTIGATED

PoE

CONFIGURATIONS INVESTIGATED

SYNA0130 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26000 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
HP Filter	Micro-Tronics	HPM50111	HHI	1/18/2013	24 mo
Attenuator	Fairview Microwave	SA18E-20	AQV	1/18/2013	12 mo
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AOD	7/12/2012	12 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AOJ	12/14/2012	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AOK	12/14/2012	12 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVZ	12/13/2012	12 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAB	12/13/2012	12 mo
Antenna, Horn	ETS	3160-09	AIY	NCR	0 mo
Antenna, Horn	EMCO	3160-08	AHO	NCR	0 mo
Antenna, Horn	EMCO	3160-07	AHP	NCR	0 mo
Antenna, Horn	EMCO	3115	AHM	6/19/2012	24 mo
Antenna, Biconilog	EMCO	3142	AXJ	5/16/2012	36 mo
Cable I	N/A	N/A	SUM	7/12/2012	12 mo
NC01 Cables	N/A	Standard Gain Horn Cable	NC3	12/14/2012	12 mo
NC01 Cables	N/A	3115 Horn Cable	NC2	12/13/2012	12 mo
NC01 Cables	N/A	Bilog Cables	NC1	12/13/2012	12 mo
Spectrum Analyzer	Agilent	E4440A	AAW	2/21/2013	24 mo

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

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. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.



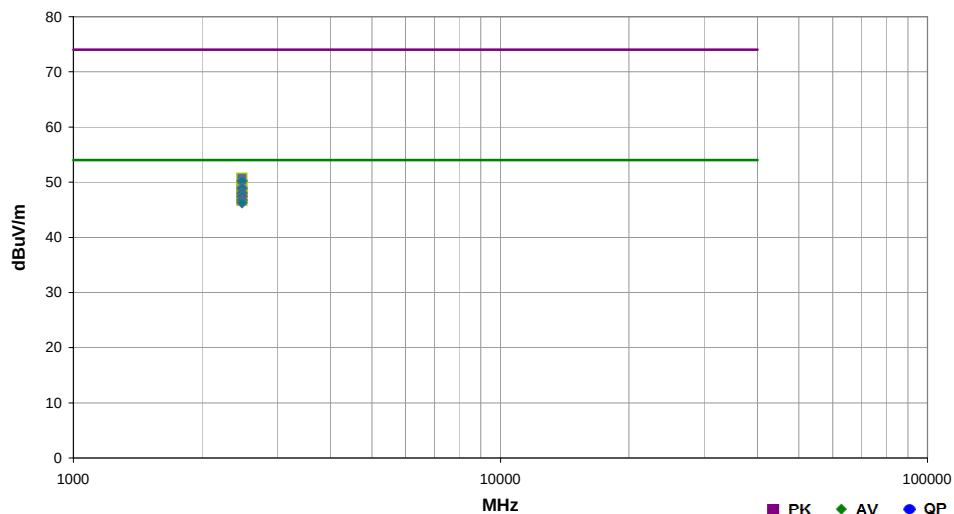
Spurious Radiated Emissions

PSA-ESCI 2012.12.14
PSA-ESCI Version 2013.2.20

Work Order:	SYNA0130	Date:	05/15/13		
Project:	xBRv4	Temperature:	22.8 °C		
Job Site:	NC01	Humidity:	34.7% RH		
Serial Number:	0091FA001A36	Barometric Pres.:	1018.8 mbar	Tested by:	Richard Mellroth, Matt Barnes, Rod Peloquin
EUT:	xBRv4				
Configuration:	1				
Customer:	Synapse				
Attendees:	Jim Hite				
EUT Power:	PoE				
Operating Mode:	Transmit Mode at 2482 MHz				
Deviations:	None				
Comments:	EUT was operating in a test mode that was verified at 100% duty cycle.				

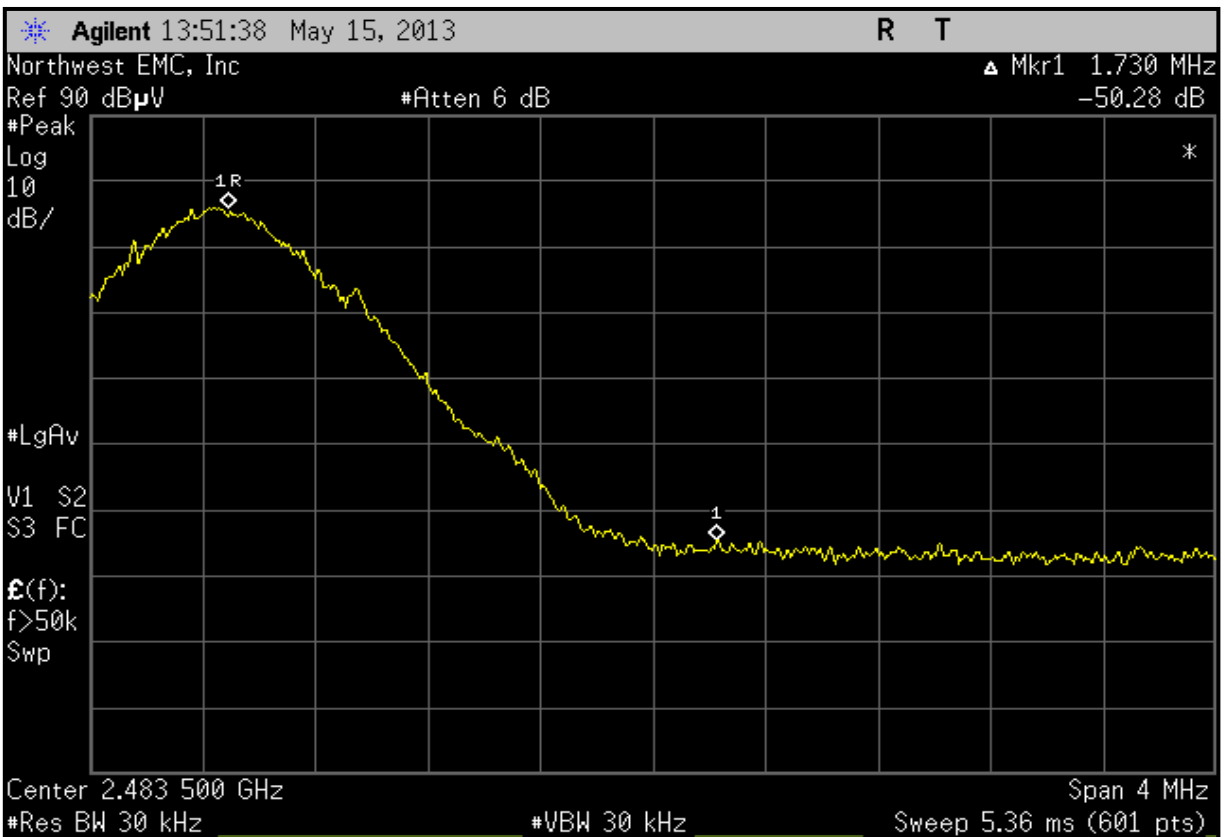
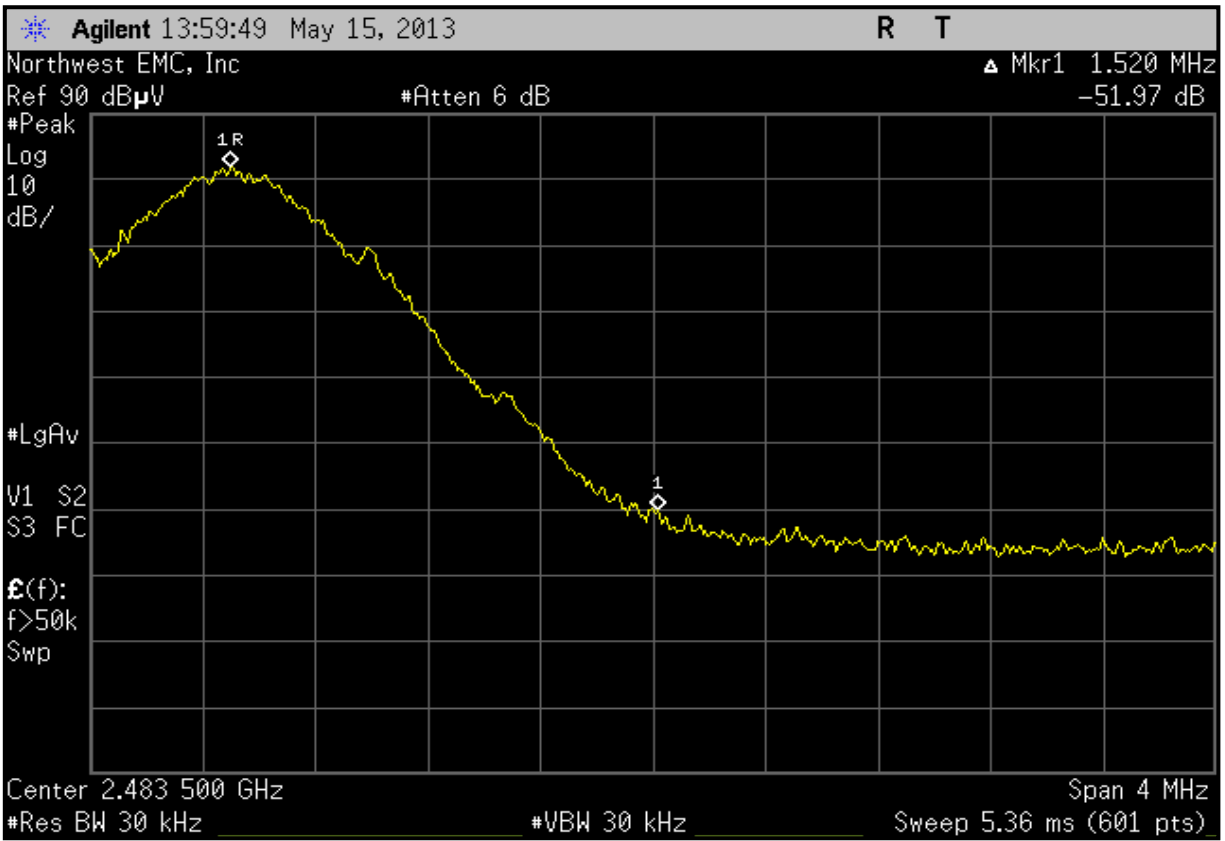
Test Specifications	Test Method
FCC 15.205:2013	

Run #	6	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass
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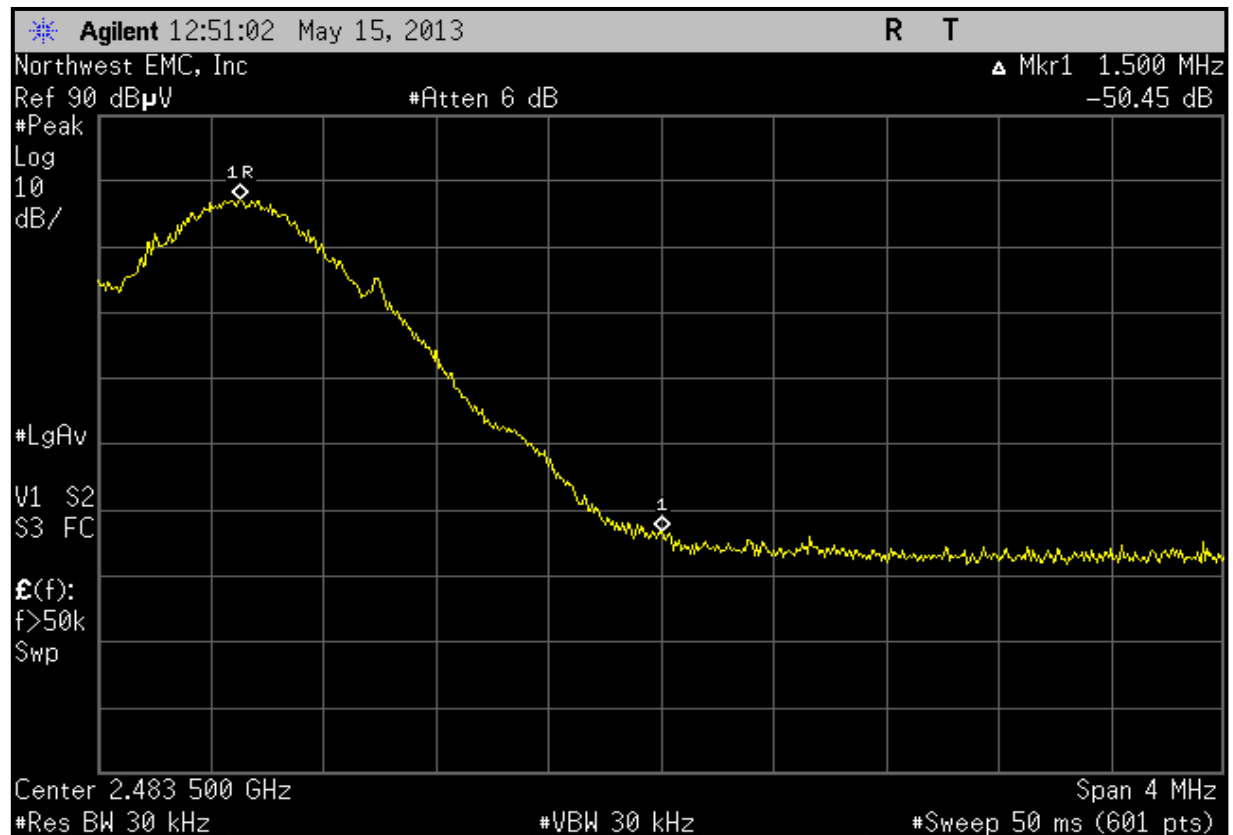
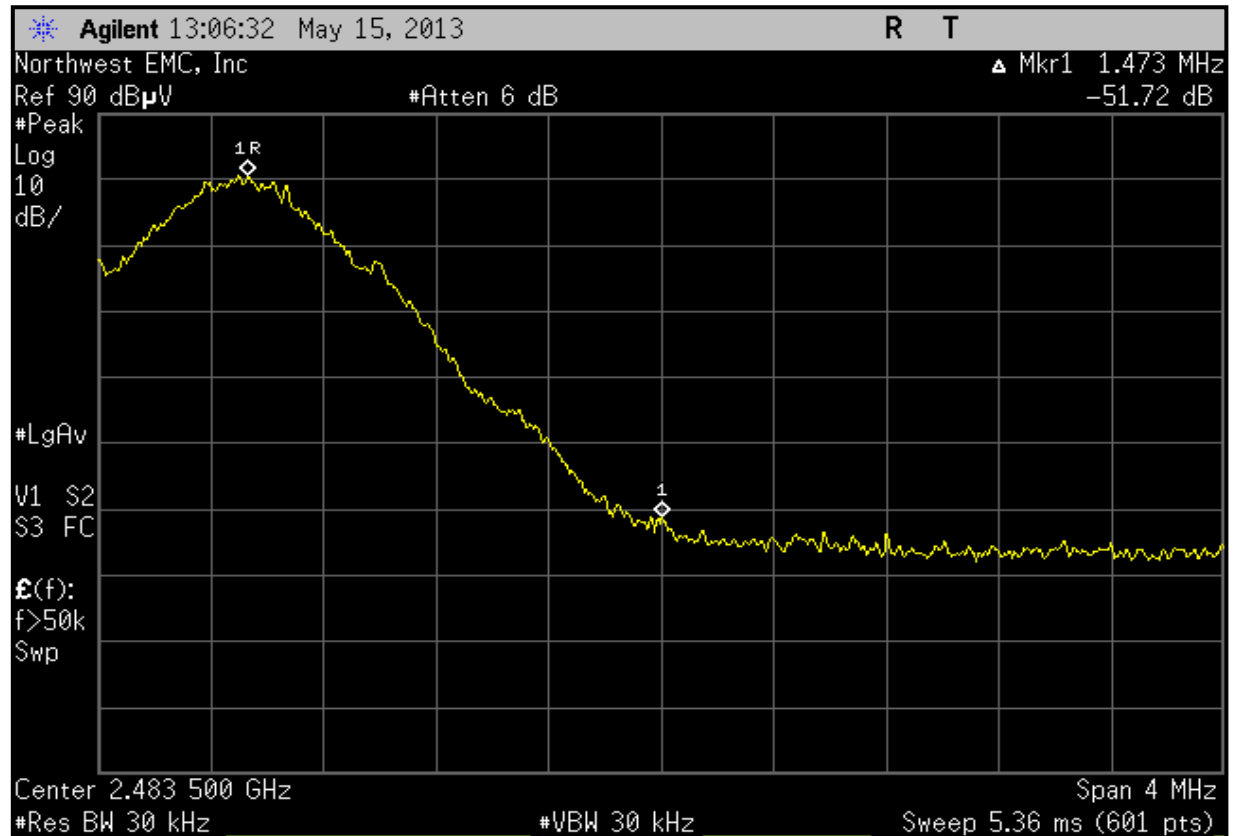


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2481.980	83.7	-1.5	1.1	189.0	3.0	0.0	Horz	AV	0.0	82.2			Fundamental, ANT Horiz, EUT End
2483.500			1.1	189.0	3.0	20.0	Horz	AV	0.0	50.2	54.0	-3.8	AV 102.2 + (-51.97) = 50.23
2481.997	82.1	-1.5	1.3	154.0	3.0	20.0	Horz	AV	0.0	100.6			Fundamental, ANT Horiz, EUT Horiz
2483.500			1.3	154.0	3.0	20.0	Horz	AV	0.0	48.9	54.0	-5.1	AV 100.6 + (-51.72) = 48.88
2482.020	81.5	-1.5	1.1	150.0	3.0	20.0	Vert	AV	0.0	100.0			Fundamental, ANT Vert, EUT Side
2483.500			1.1	150.0	3.0	20.0	Vert	AV	0.0	48.0	54.0	-6.0	AV 100 + (-51.96) = 48.04
2481.987	79.5	-1.5	1.6	255.0	3.0	20.0	Vert	AV	0.0	98.0			Fundamental, ANT Vert, EUT Horiz
2483.500			1.6	255.0	3.0	20.0	Vert	AV	0.0	47.5	54.0	-6.5	AV 98 + (-50.54) = 47.46
2481.997	78.1	-1.5	1.1	202.0	3.0	20.0	Horz	AV	0.0	96.6			Fundamental, ANT Horiz, EUT Side
2483.500			1.1	202.0	3.0	20.0	Horz	AV	0.0	46.8	54.0	-7.2	AV 96.6 + (-49.84) = 46.76
2481.987	78.1	-1.5	1.1	138.0	3.0	20.0	Vert	AV	0.0	96.6			Fundamental, ANT Vert, EUT End
2483.500			1.1	138.0	3.0	20.0	Vert	AV	0.0	46.3	54.0	-7.7	AV 96.6 + (-50.28) = 46.32
2482.340	84.2	-1.5	1.1	189.0	3.0	20.0	Horz	PK	0.0	102.7			Fundamental, ANT Horiz, EUT End
2483.500			1.1	189.0	3.0	20.0	Horz	PK	0.0	50.7	74.0	-23.3	PK 102.7 + (-51.97) = 50.73
2481.667	82.6	-1.5	1.3	154.0	3.0	20.0	Horz	PK	0.0	101.1			Fundamental, ANT Horiz, EUT Horiz
2483.500			1.3	154.0	3.0	20.0	Horz	PK	0.0	49.4	74.0	-24.6	PK 101.1 + (-51.72) = 49.38
2481.863		-1.5	1.1	150.0	3.0	20.0	Vert	PK	0.0	100.5			Fundamental, ANT Vert, EUT Side
2483.500	82.0		1.1	150.0	3.0	20.0	Vert	PK	0.0	48.5	74.0	-25.5	PK 100.5 + (-51.96) = 48.54
2481.977	80.0	-1.5	1.6	255.0	3.0	20.0	Vert	PK	0.0	98.5			Fundamental, ANT Vert, EUT Horiz
2483.500			1.6	255.0	3.0	20.0	Vert	PK	0.0	48.0	74.0	-26.0	PK 98.5 + (-50.54) = 47.96
2481.827	78.7	-1.5	1.1	202.0	3.0	20.0	Horz	PK	0.0	97.2			Fundamental, ANT Horiz, EUT Side
2483.500			1.1	202.0	3.0	20.0	Horz	PK	0.0	47.4	74.0	-26.6	PK 97.2 + (-49.84) = 47.36
2481.787	78.5	-1.5	1.1	138.0	3.0	20.0	Vert	PK	0.0	97.0			Fundamental, ANT Vert, EUT End
2483.500			1.1	138.0	3.0	20.0	Vert	PK	0.0	46.7	74.0	-27.3	PK 97.0 + (-50.28) = 46.72

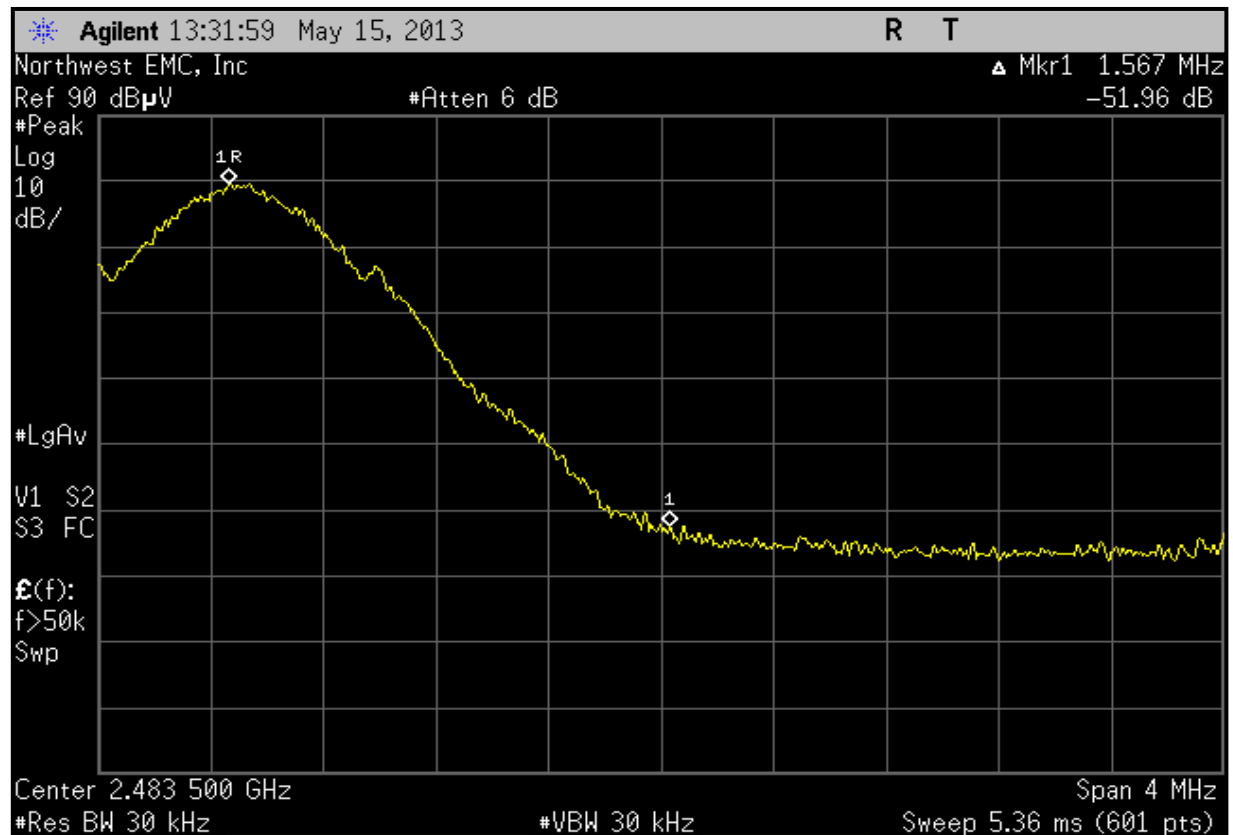
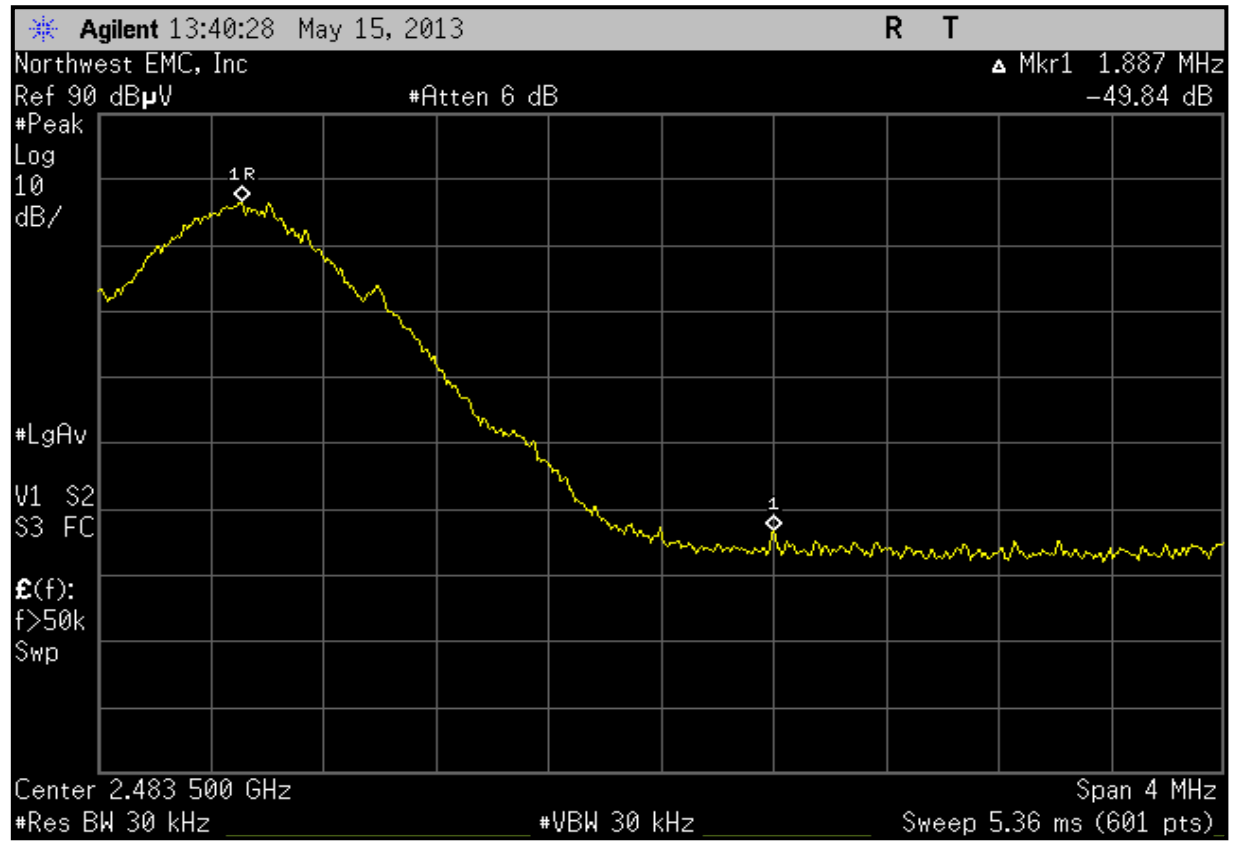
Spurious Radiated Emissions



Spurious Radiated Emissions



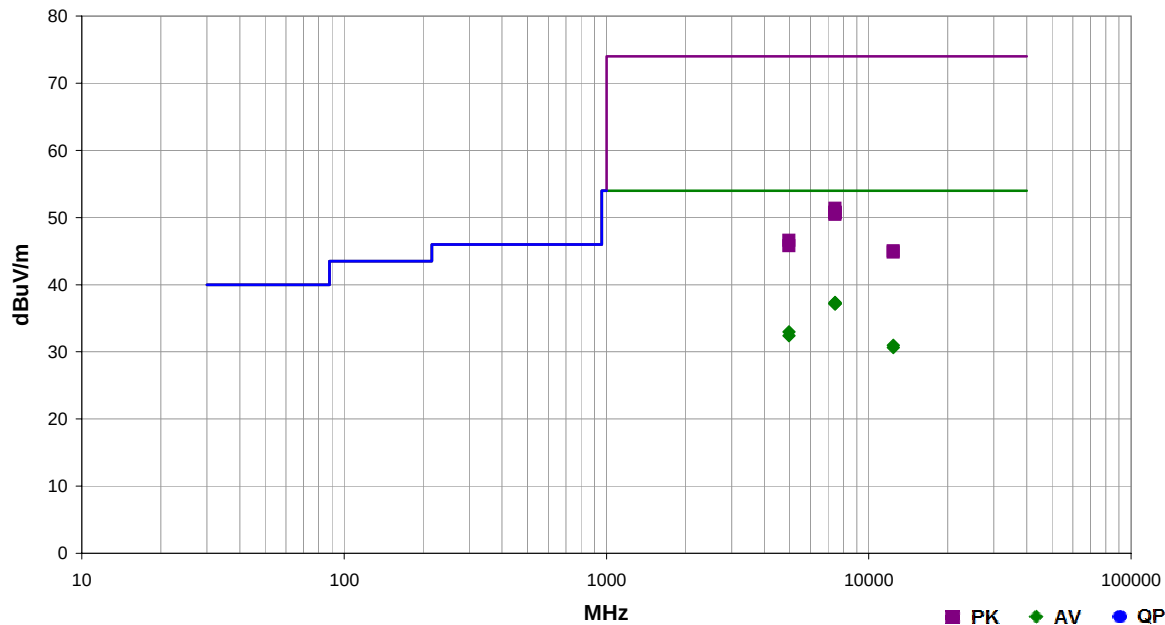
Spurious Radiated Emissions



Work Order:	SYNA0130	Date:	05/15/13	<i>Richard Mellroth</i>	
Project:	xBRv4	Temperature:	24.1 °C		
Job Site:	NC01	Humidity:	33.7% RH		
Serial Number:	0091FA001A36	Barometric Pres.:	1019.3 mbar	Tested by:	Richard Mellroth, Matt Barnes, Rod Peloquin
EUT:	xBRv4				
Configuration:	1				
Customer:	Synapse				
Attendees:	Jim Hite				
EUT Power:	PoE				
Operating Mode:	Transmit Mode at 2482 MHz				
Deviations:	None				
Comments:	EUT was operating in a test mode that was verified at 100% duty cycle.				

Test Specifications	Test Method
FCC 15.247:2013	ANSI C63.10:2009

Run #	7	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7446.097	24.4	12.9	1.0	115.0	3.0	0.0	Vert	AV	0.0	37.3	54.0	-16.7	EUT - Horiz
7445.940	24.3	12.9	1.0	46.0	3.0	0.0	Horz	AV	0.0	37.2	54.0	-16.8	EUT - Side
7446.697	24.2	12.9	1.0	349.0	3.0	0.0	Vert	AV	0.0	37.1	54.0	-16.9	EUT - Side
7446.080	24.2	12.9	3.3	228.0	3.0	0.0	Vert	AV	0.0	37.1	54.0	-16.9	EUT - End
7446.010	24.2	12.9	3.3	360.0	3.0	0.0	Horz	AV	0.0	37.1	54.0	-16.9	EUT - End
7446.497	24.2	12.9	1.1	287.0	3.0	0.0	Horz	AV	0.0	37.1	54.0	-16.9	EUT - Horiz
4963.973	24.4	8.6	1.1	89.0	3.0	0.0	Vert	AV	0.0	33.0	54.0	-21.0	EUT - Horiz
4963.713	23.8	8.6	1.1	220.0	3.0	0.0	Horz	AV	0.0	32.4	54.0	-21.6	EUT - Horiz
7446.283	38.4	12.9	1.0	115.0	3.0	0.0	Vert	PK	0.0	51.3	74.0	-22.7	EUT - Horiz
12410.050	28.5	2.4	1.0	121.0	3.0	0.0	Vert	AV	0.0	30.9	54.0	-23.1	EUT - Horiz
7446.030	37.8	12.9	3.3	360.0	3.0	0.0	Horz	PK	0.0	50.7	74.0	-23.3	EUT - End
7446.227	37.8	12.9	1.0	349.0	3.0	0.0	Vert	PK	0.0	50.7	74.0	-23.3	EUT - Side
7445.933	37.8	12.9	3.3	228.0	3.0	0.0	Vert	PK	0.0	50.7	74.0	-23.3	EUT - End
12409.910	28.2	2.4	1.4	13.0	3.0	0.0	Horz	AV	0.0	30.6	54.0	-23.4	EUT - Horiz
7446.823	37.7	12.9	1.0	46.0	3.0	0.0	Horz	PK	0.0	50.6	74.0	-23.4	EUT - Side
7445.157	37.5	12.9	1.1	287.0	3.0	0.0	Horz	PK	0.0	50.4	74.0	-23.6	EUT - Horiz
4963.937	38.0	8.6	1.1	89.0	3.0	0.0	Vert	PK	0.0	46.6	74.0	-27.4	EUT - Horiz
4964.047	37.2	8.6	1.1	220.0	3.0	0.0	Horz	PK	0.0	45.8	74.0	-28.2	EUT - Horiz
12409.120	42.6	2.4	1.0	121.0	3.0	0.0	Vert	PK	0.0	45.0	74.0	-29.0	EUT - Horiz
12409.380	42.4	2.4	1.4	13.0	3.0	0.0	Horz	PK	0.0	44.8	74.0	-29.2	EUT - Horiz

AC POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50 Ω measuring port is terminated by a 50 Ω EMI meter or a 50 Ω resistive load. All 50 Ω measuring ports of the LISN are terminated by 50 Ω .

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4407B	AAU	10/23/2012	24 mo
LISN	Solar	9252-50-R-24-BNC	LIM	01/16/2013	12 mo
NC01 Cables	N/A	Conducted / NF Probe Cable	NC4	12/14/2012	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HHF	02/01/2012	24 mo

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.94 dB	-2.94 dB

CONFIGURATIONS INVESTIGATED

SYNA0130-2

MODES INVESTIGATED

Transmit Mode at 2482 MHz

AC POWERLINE CONDUCTED EMISSIONS

EUT:	xBRv4	Work Order:	SYNA0130
Serial Number:	0091FA001A36	Date:	05/16/2013
Customer:	Synapse	Temperature:	24.1°C
Attendees:	Jim Hite	Relative Humidity:	42.7%
Customer Project:	xBRv4	Bar. Pressure:	1016 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	PoE	Configuration:	SYNA0130-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2013	ANSI C63.10:2009

TEST PARAMETERS

Run #:	8	Line:	High Line	Ext. Attenuation (dB):	20
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COMMENTS

EUT was operating in a test mode that was verified at 100% duty cycle, Shielded Cat-5e Ethernet Cable

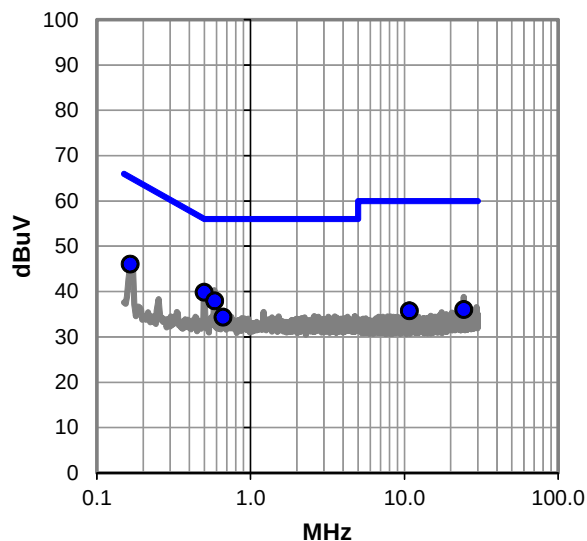
EUT OPERATING MODES

Transmit Mode at 2482 MHz

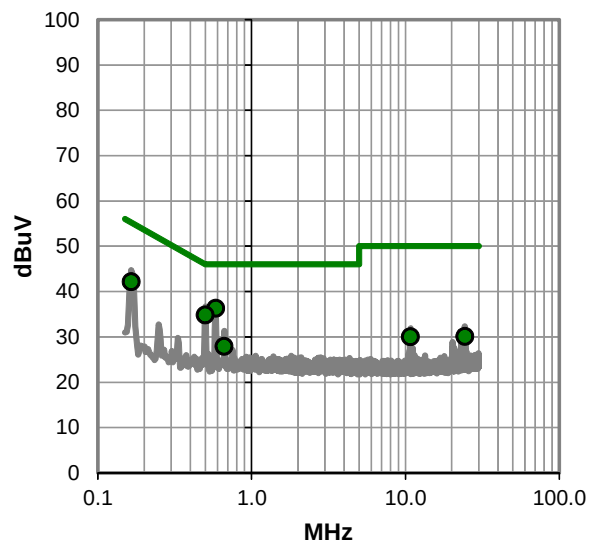
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #8

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.500	19.6	20.2	39.8	56.0	-16.2
0.584	17.7	20.2	37.9	56.0	-18.1
0.165	25.7	20.4	46.1	65.2	-19.2
0.664	14.1	20.2	34.3	56.0	-21.7
24.351	14.5	21.5	36.0	60.0	-24.0
10.795	15.0	20.7	35.7	60.0	-24.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.584	16.1	20.2	36.3	46.0	-9.7
0.500	14.6	20.2	34.8	46.0	-11.2
0.165	21.8	20.4	42.2	55.2	-13.1
0.664	7.7	20.2	27.9	46.0	-18.1
24.351	8.6	21.5	30.1	50.0	-19.9
10.795	9.3	20.7	30.0	50.0	-20.0

CONCLUSION

Pass



Tested By

AC POWERLINE CONDUCTED EMISSIONS

EUT:	xBRv4	Work Order:	SYNA0130
Serial Number:	0091FA001A36	Date:	05/16/2013
Customer:	Synapse	Temperature:	24.1°C
Attendees:	Jim Hite	Relative Humidity:	42.7%
Customer Project:	xBRv4	Bar. Pressure:	1016 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	PoE	Configuration:	SYNA0130-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2013	ANSI C63.10:2009

TEST PARAMETERS

Run #:	13	Line:	Neutral	Ext. Attenuation (dB):	20
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COMMENTS

EUT was operating in a test mode that was verified at 100% duty cycle, Shielded Cat-5e Ethernet Cable

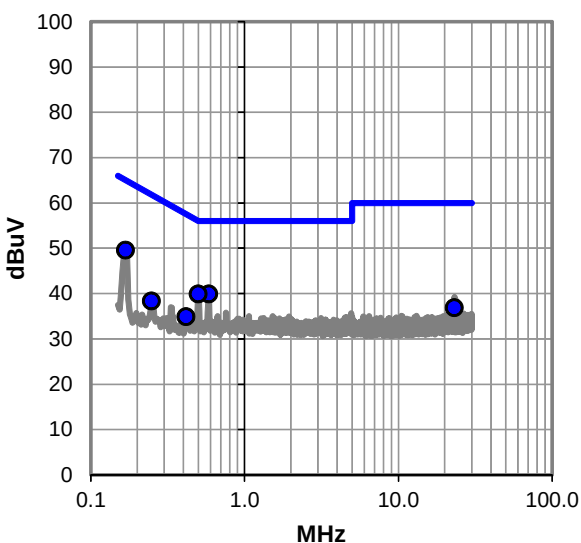
EUT OPERATING MODES

Transmit Mode at 2482 MHz

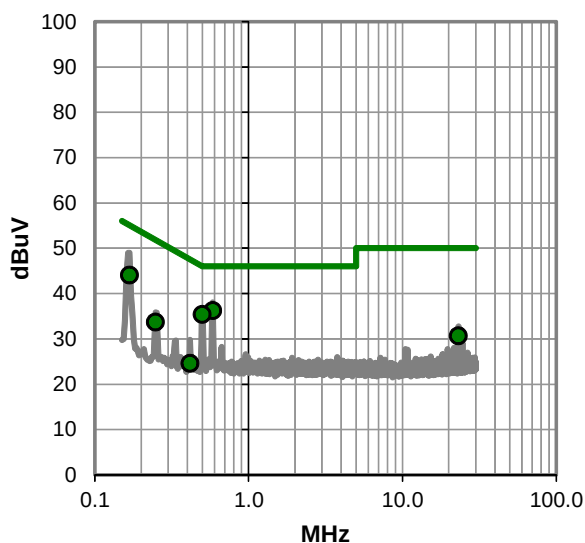
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #12

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.168	29.2	20.4	49.6	65.1	-15.5
0.584	19.7	20.2	39.9	56.0	-16.1
0.500	19.7	20.2	39.9	56.0	-16.1
0.416	14.6	20.3	34.9	57.5	-22.6
23.131	15.4	21.4	36.8	60.0	-23.2
0.248	18.1	20.2	38.3	61.8	-23.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.584	16.0	20.2	36.2	46.0	-9.8
0.500	15.2	20.2	35.4	46.0	-10.6
0.168	23.7	20.4	44.1	55.1	-11.0
0.248	13.5	20.2	33.7	51.8	-18.1
23.131	9.2	21.4	30.6	50.0	-19.4
0.416	4.3	20.3	24.6	47.5	-22.9

CONCLUSION

Pass



Tested By