



FreeWave Technologies, Inc.

FGRM

FCC 15.247:2013

FCC 15.207:2013

Report #: FREW0013



Report Prepared By Northwest EMC Inc.

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

California – Minnesota – Oregon – New York – Washington

Last Date of Test: October 15, 2013
FreeWave Technologies, Inc.
Model: FGRM

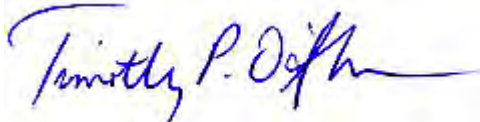
Emissions

Test Description	Specification	Test Method	Pass/Fail
Duty Cycle	FCC 15.247:2013	ANSI C63.10:2009	Pass
Output Power	FCC 15.247:2013	ANSI C63.10:2009	Pass
Occupied Bandwidth	FCC 15.247:2013	ANSI C63.10:2009	Pass
Spurious Conducted Emissions	FCC 15.247:2013	ANSI C63.10:2009	Pass
Band Edge Compliance	FCC 15.247:2013	ANSI C63.10:2009	Pass
Channel Separation	FCC 15.247:2013	ANSI C63.10:2009	Pass
Number of Hopping Channels	FCC 15.247:2013	ANSI C63.10:2009	Pass
Dwell Time	FCC 15.247:2013	ANSI C63.10:2009	Pass
Band Edge Compliance-Hopping Mode	FCC 15.247:2013	ANSI C63.10:2009	Pass
Spurious Radiated Emissions	FCC 15.247:2013	ANSI C63.10:2009	Pass
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
 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.

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.

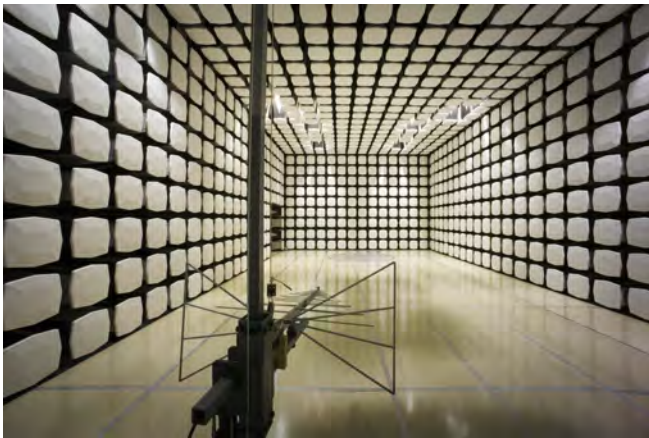
A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is listed below. Our measurement 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





WTD 12.5.23

PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	FreeWave Technologies, Inc.
Address:	5395 Pearl Parkway, Suite 100
City, State, Zip:	Boulder, CO 80301
Test Requested By:	Dean Busch
Model:	FGRM
First Date of Test:	October 10, 2013
Last Date of Test:	October 15, 2013
Receipt Date of Samples:	October 10, 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):
900 MHz FHSS radio module with 1 antenna(s). Max power is 1 W
Testing Objective:
To demonstrate compliance to FCC 15.247 requirements.

Configuration FREW0011-1

Software/Firmware Running during test	
Description	Version
Putty	1.0

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Industrial Radio	FreeWave Technologies, Inc.	FGRM	956-8447

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Remote Laptop	Dell	Inspiron 6000	J5896 A04
AC/DC Adapter	Dell	DA90PS0-00	CN-0XD75748661-6BIMCKA

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Serial to USB Adapter	No	1.3m	No	Remote Laptop	Serial to I/O Adapter
Serial to I/O Adapter	No	.5m	No	Serial to USB Adapter	EUT
DC Power Lead x2	No	.5m	No	DC Power supply	EUT
AC Power Cable	No	1.8m	No	AC mains	DC Power Supply
AC Power Cable	No	1m	No	AC/DC Power Adapter	AC mains
DC Power Cable	No	1.2m	Yes	Remote Laptop	AC/DC Power Adapter

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Configuration FREW0013- 1

Software/Firmware Running during test	
Description	Version
Putty	1.0

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Industrial Radio	FreeWave Technologies, Inc.	FGRM	956-8447

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Remote Laptop	Dell	Inspiron 6000	J5896 A04
AC/DC Adapter	Dell	DA90PS0-00	CN-0XD75748661-6BIMCKA

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Serial to USB Adapter	No	1.3m	No	Remote Laptop	Serial to I/O Adapter
Serial to I/O Adapter	No	.5m	No	Serial to USB Adapter	EUT
DC Power Lead x2	No	.5m	No	DC Power supply	EUT
AC Power Cable	No	1.8m	No	AC mains	DC Power Supply
AC Power Cable	No	1m	No	AC/DC Power Adapter	AC mains
DC Power Cable	No	1.2m	Yes	Remote Laptop	AC/DC Power Adapter

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Configuration FREW0013- 2

Software/Firmware Running during test	
Description	Version
Embedded	2.7 B

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Industrial Radio	FreeWave Technologies, Inc.	FGRM	956-8447

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
DC Power Supply	HP	HP 6266B	2549A-05642
6dB Gain Omni-Directional Antenna	Laird	FG9026	05091306

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power Cable	No	1.8m	No	AC mains	DC Power Supply
Coaxial Cable	Yes	6m	No	Industrial Radio	Antenna
DC Power Leads	No	1m	No	DC Power Supply	Serial I/O Adapter Power Connector
Serial to I/O Adapter	No	0.5m	No	DC Power Leads Connector	Industrial Radio

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Configuration FREW0013- 3

Software/Firmware Running during test	
Description	Version
Embedded	2.7 B

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Industrial Radio	FreeWave Technologies, Inc.	FGRM	956-8447

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
DC Power Supply	HP	HP 6266B	2549A-05642
6dB Gain Omni-Directional Antenna	Laird	FG9026	05091306

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power Cable	No	1.8m	No	AC mains	DC Power Supply
Coaxial Cable	Yes	6m	No	Industrial Radio	Antenna
DC Power Leads	No	1m	No	DC Power Supply	Serial I/O Adapter Power Connector
Serial to I/O Adapter	No	0.5m	No	DC Power Leads Connector	Industrial Radio

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	10/10/2013	Number of Hopping Channels	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	10/10/2013	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	10/10/2013	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.
4	10/10/2013	Channel Separation	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	10/10/2013	Dwell Time	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	10/10/2013	Band Edge Compliance-Hopping Mode	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	10/10/2013	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.
8	10/10/2013	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.
9	10/10/2013	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.
10	10/15/2013	Powerline 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.
11	10/15/2013	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

Duty Cycle

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
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Multimeter	Tektronix	DMM912	MMH	2/5/2013	24
Attenuator, 'Precision N'	S.M. Electronics	SA18N-06/SM4032	REE	12/11/2012	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
Power Meter	Gigatronics	8651A	SPM	1/9/2012	24
Power Sensor	Gigatronics	80701A	SPL	7/8/2011	36
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/30/2013	12
40GHz DC Block	Miteq	DCB4000	AMD	5/16/2013	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	24

TEST DESCRIPTION

The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was 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.

If the transmit duty cycle < 98 percent, burst gating was used during some of the other tests in this report to only measure during the burst duration.



Duty Cycle

XMit 2013.08.15
PsaTx 2013.07.11

EUT: FGRM	Work Order: FREW0011
Serial Number: 956-8447	Date: 10/10/13
Customer: FreeWave Technologies, Inc.	Temperature: 22.1°C
Attendees: None	Humidity: 40%
Project: None	Barometric Pres.: 1015.9
Tested by: Brandon Hobbs	Power: 12 VDC
	Job Site: EV06
TEST SPECIFICATIONS	
Test Method	
FCC 15.247:2013	ANSI C63.10:2009

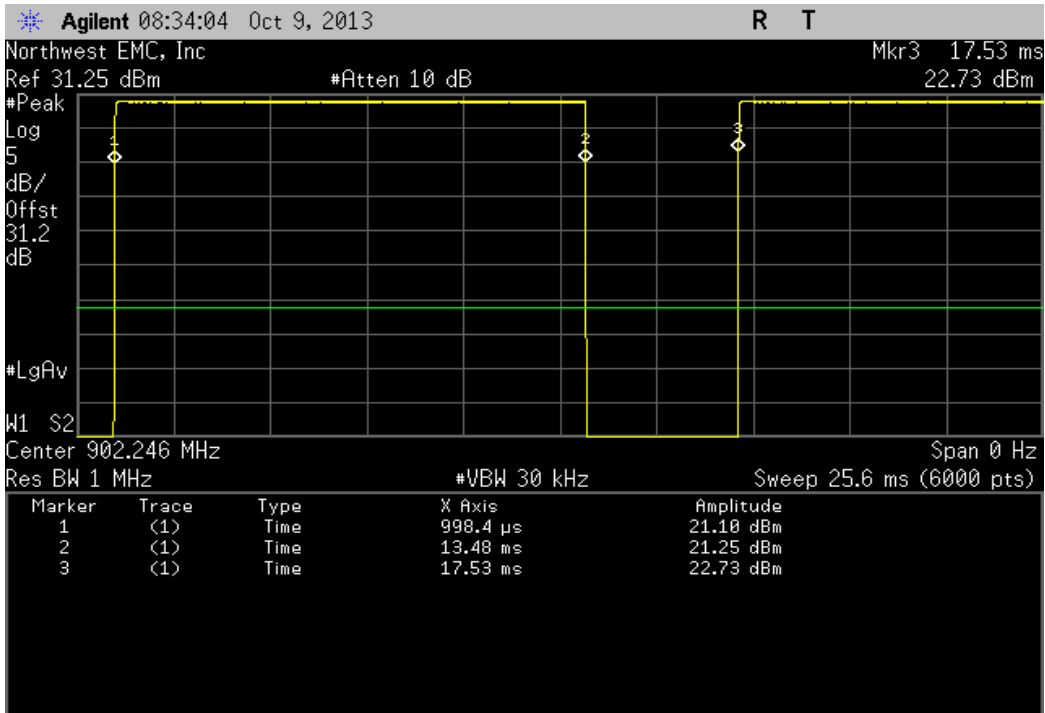
COMMENTS
An added 10 dB 5w attenuator was used while under test. All cable losses were accounted for prior to testing. Output power level at 10, Full Power.

DEVIATIONS FROM TEST STANDARD
None

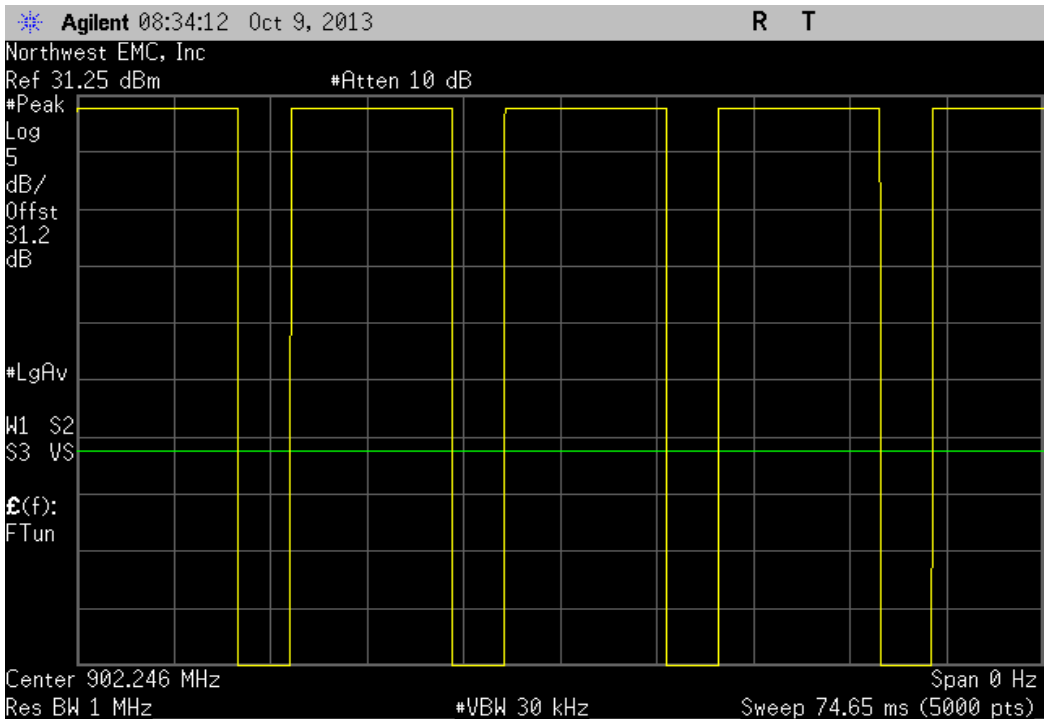
Configuration #	1	Signature 
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		Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
GFSK							
115.2 kbps							
	Low Channel, 902.2464 MHz	12.48 mS	16.529 mS	1	75.5	N/A	N/A
	Low Channel, 902.2464 MHz	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel, 916.0704 MHz	12.484 mS	16.529 mS	1	75.5	N/A	N/A
	Mid Channel, 916.0704 MHz	N/A	N/A	5	N/A	N/A	N/A
	High Channel, 927.8208 MHz	12.484 mS	16.529 mS	1	75.5	N/A	N/A
	High Channel, 927.8208 MHz	N/A	N/A	5	N/A	N/A	N/A
153.6 kbps							
	Low Channel, 902.2464 MHz	12.616 mS	16.525 mS	1	76.3	N/A	N/A
	Low Channel, 902.2464 MHz	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel, 916.0704 MHz	12.621 mS	16.529 mS	1	76.4	N/A	N/A
	Mid Channel, 916.0704 MHz	N/A	N/A	4	N/A	N/A	N/A
	High Channel, 927.8208 MHz	12.621 mS	16.529 mS	1	76.4	N/A	N/A
	High Channel, 927.8208 MHz	N/A	N/A	5	N/A	N/A	N/A

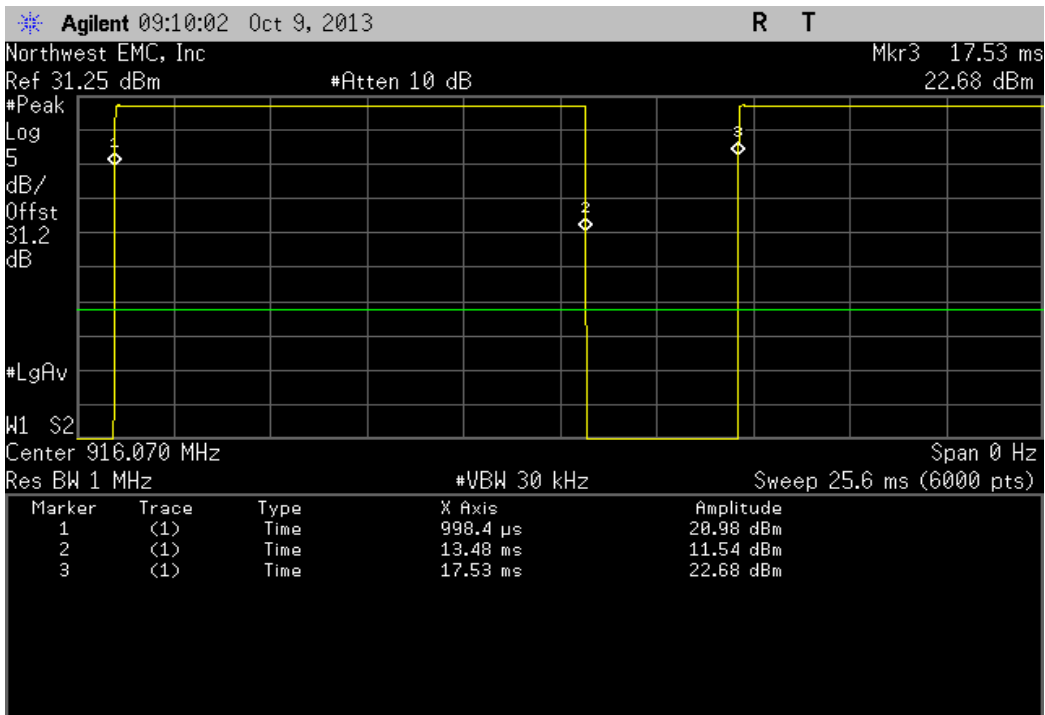
GFSK, 115.2 kbps, Low Channel, 902.2464 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	12.48 mS	16.529 mS	1	75.5	N/A	N/A



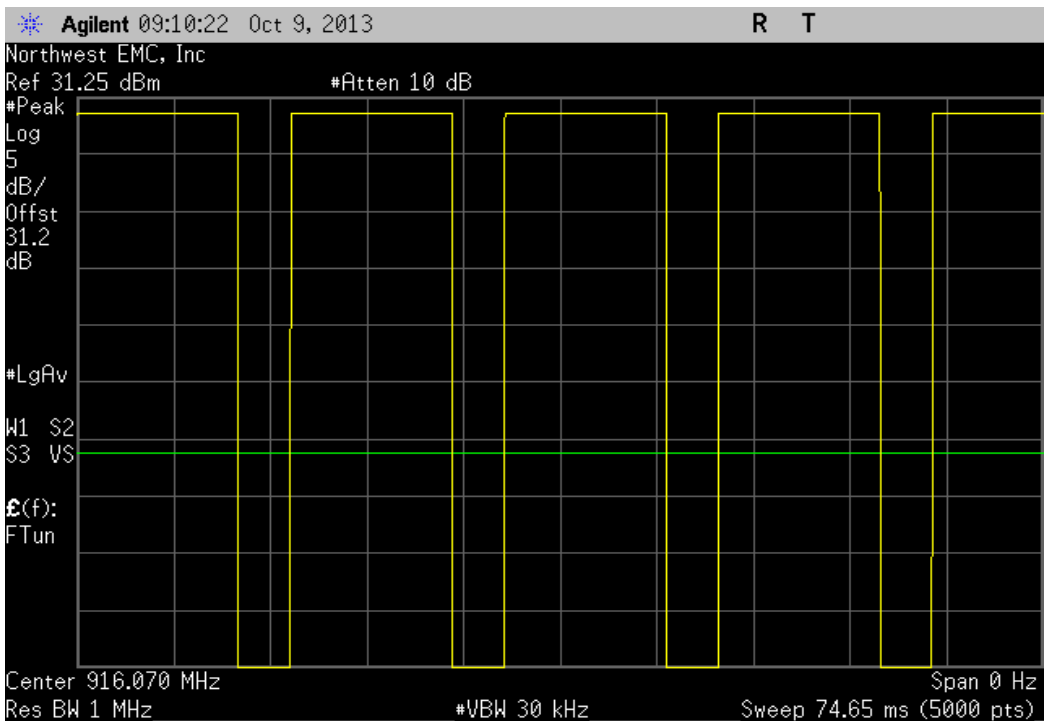
GFSK, 115.2 kbps, Low Channel, 902.2464 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A



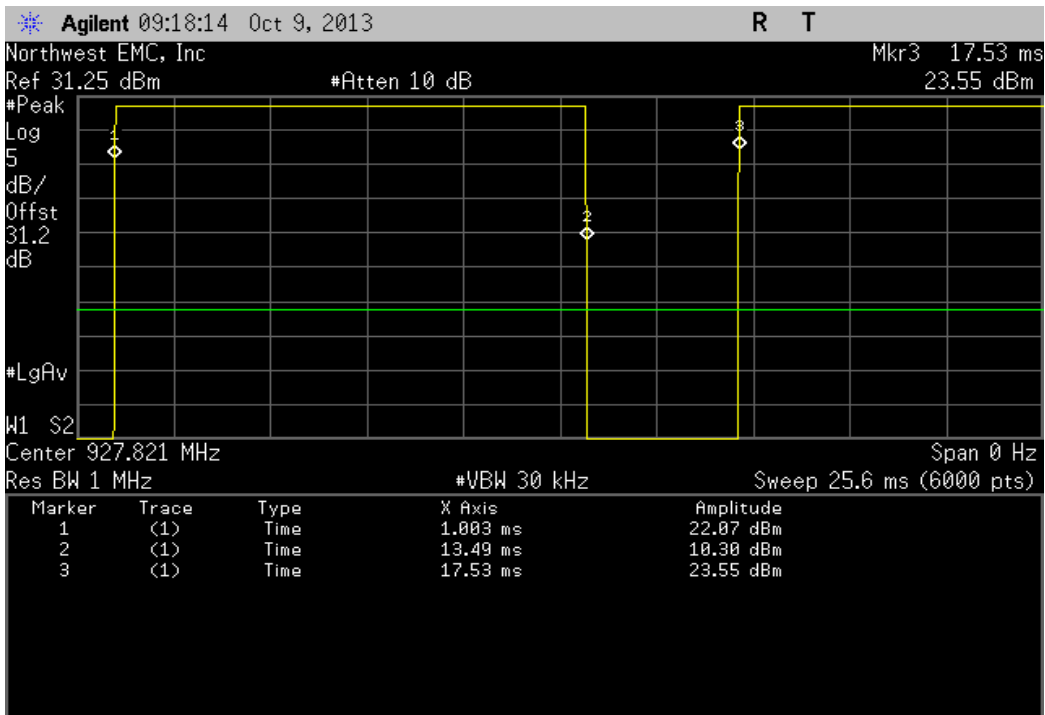
GFSK, 115.2 kbps, Mid Channel, 916.0704 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	12.484 mS	16.529 mS	1	75.5	N/A	N/A



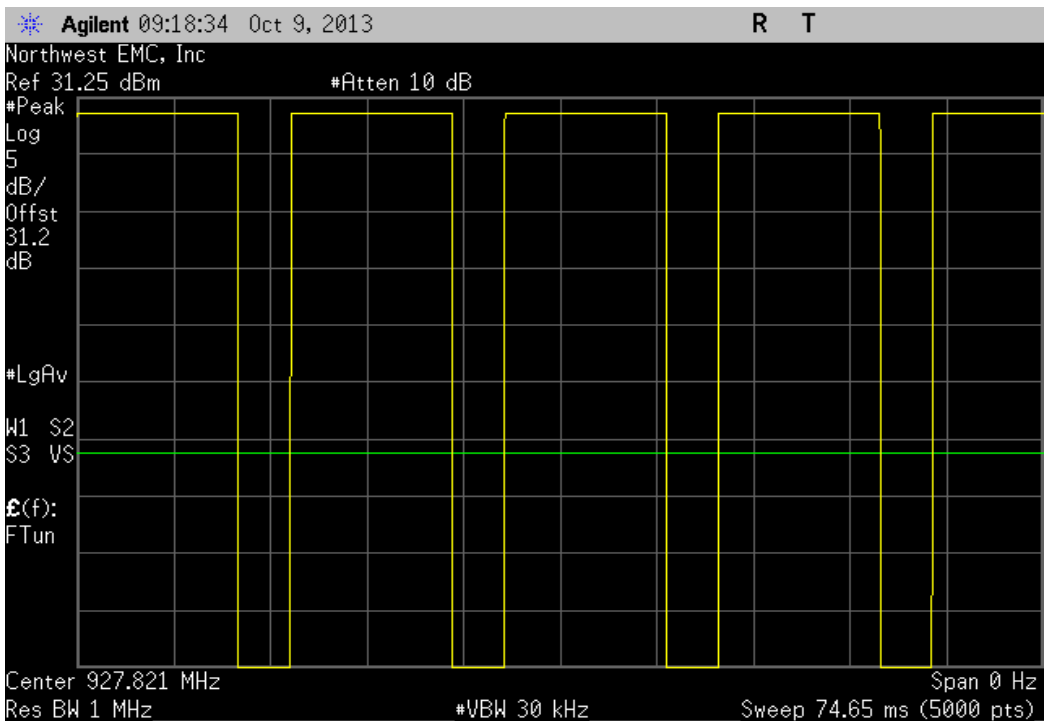
GFSK, 115.2 kbps, Mid Channel, 916.0704 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A



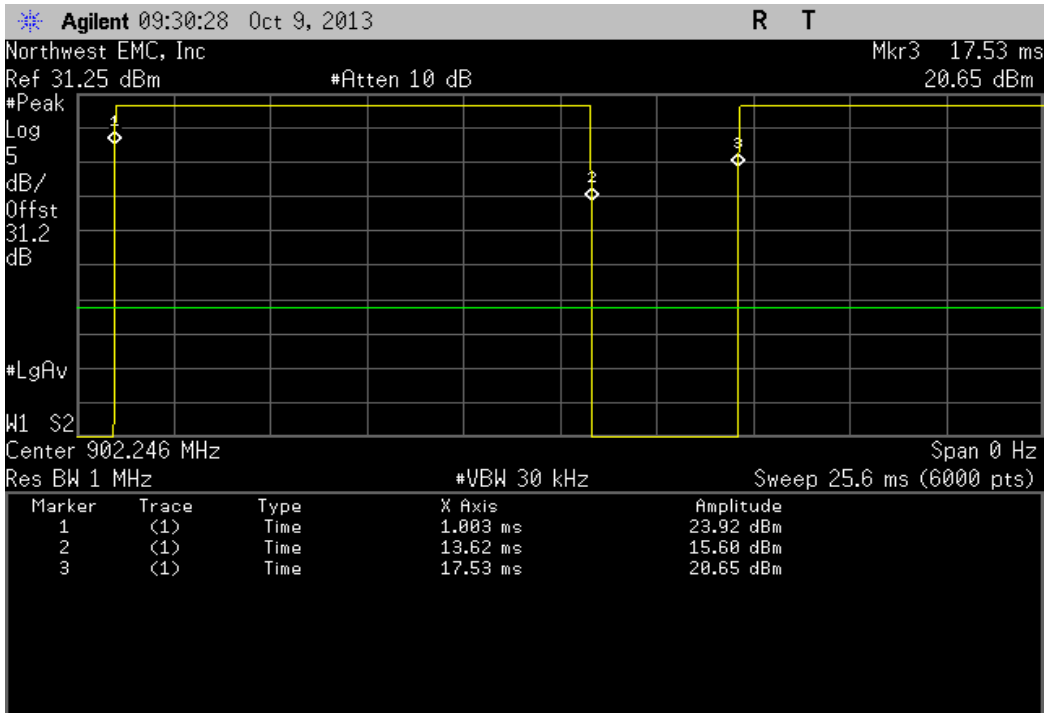
GFSK, 115.2 kbps, High Channel, 927.8208 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	12.484 mS	16.529 mS	1	75.5	N/A	N/A



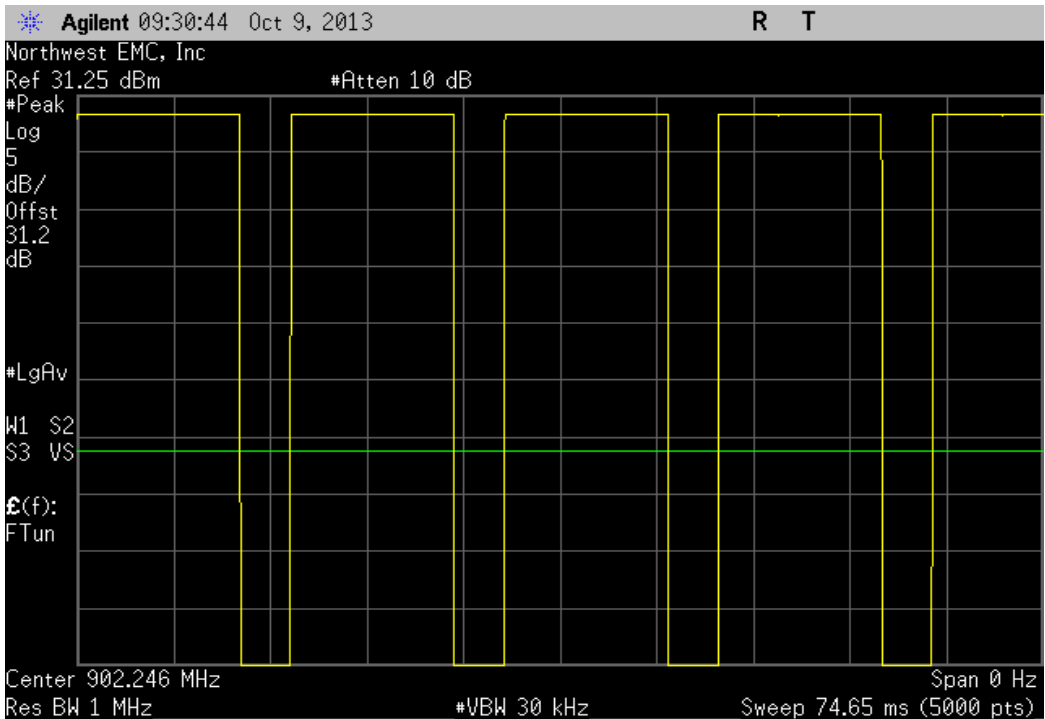
GFSK, 115.2 kbps, High Channel, 927.8208 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A



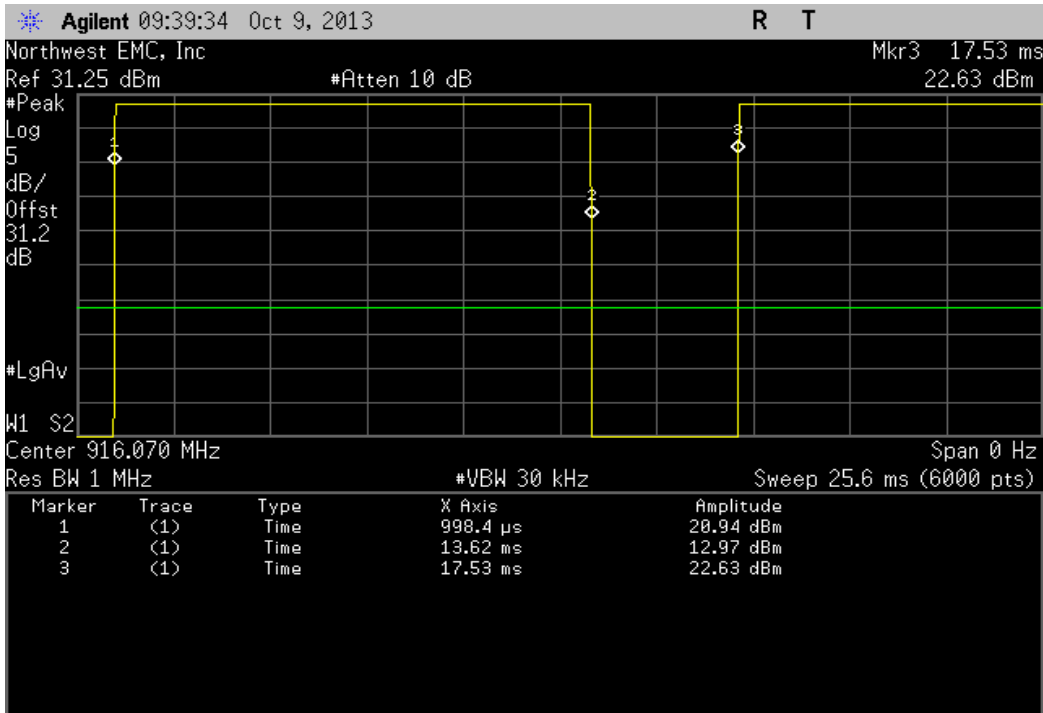
GFSK, 153.6 kbps, Low Channel, 902.2464 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	12.616 mS	16.525 mS	1	76.3	N/A	N/A



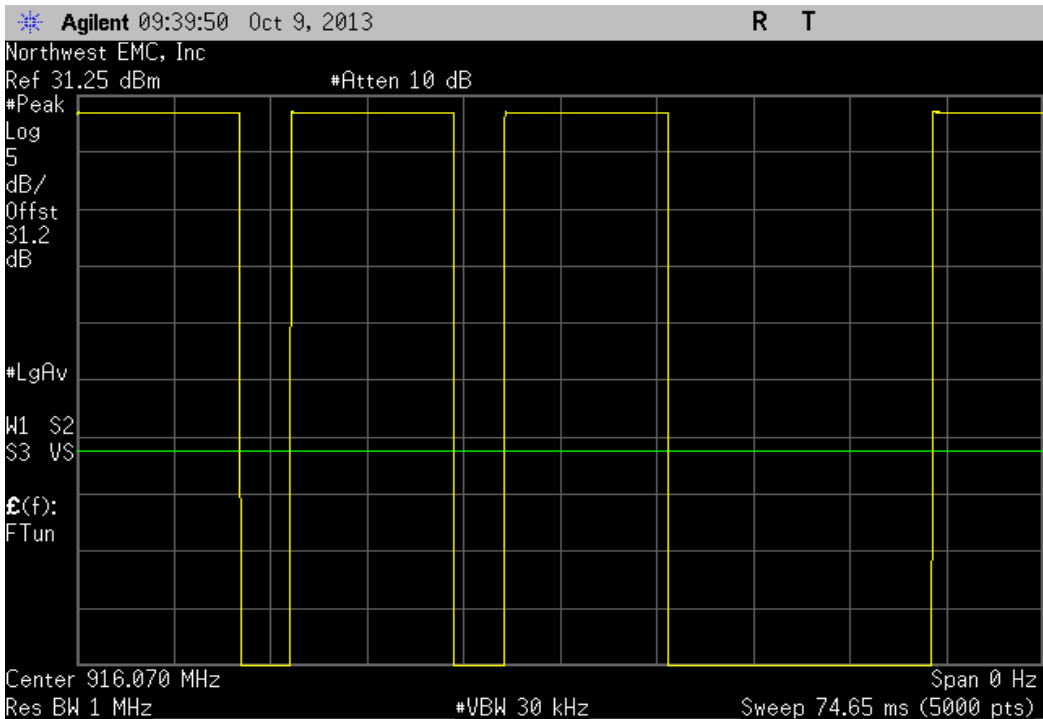
GFSK, 153.6 kbps, Low Channel, 902.2464 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A



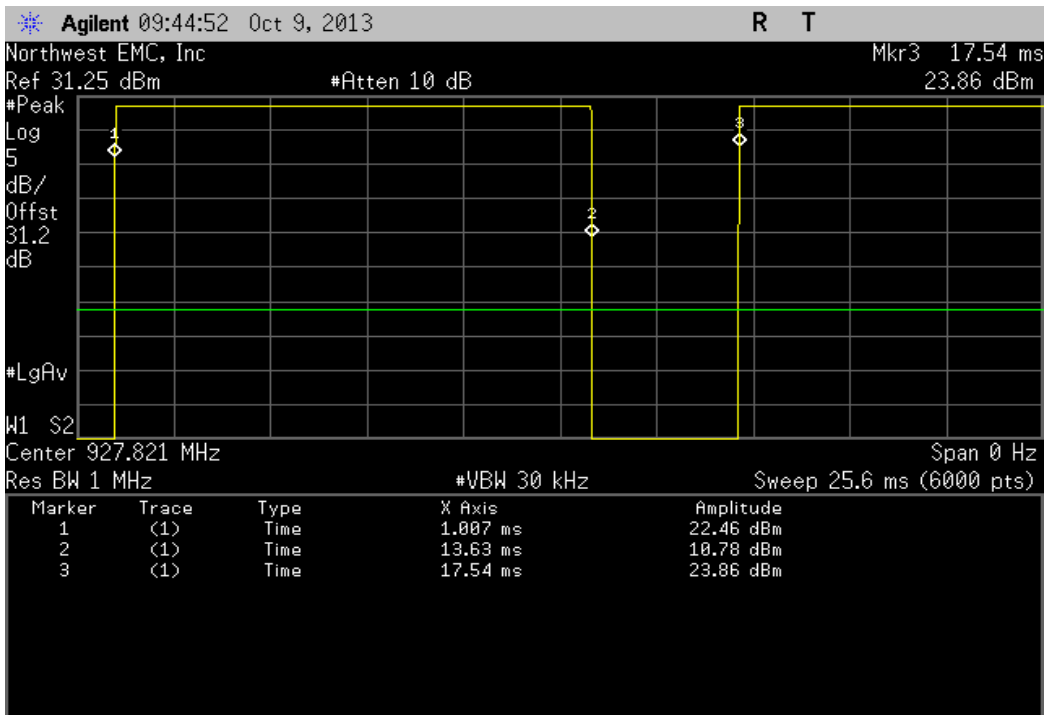
GFSK, 153.6 kbps, Mid Channel, 916.0704 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	12.621 mS	16.529 mS	1	76.4	N/A	N/A



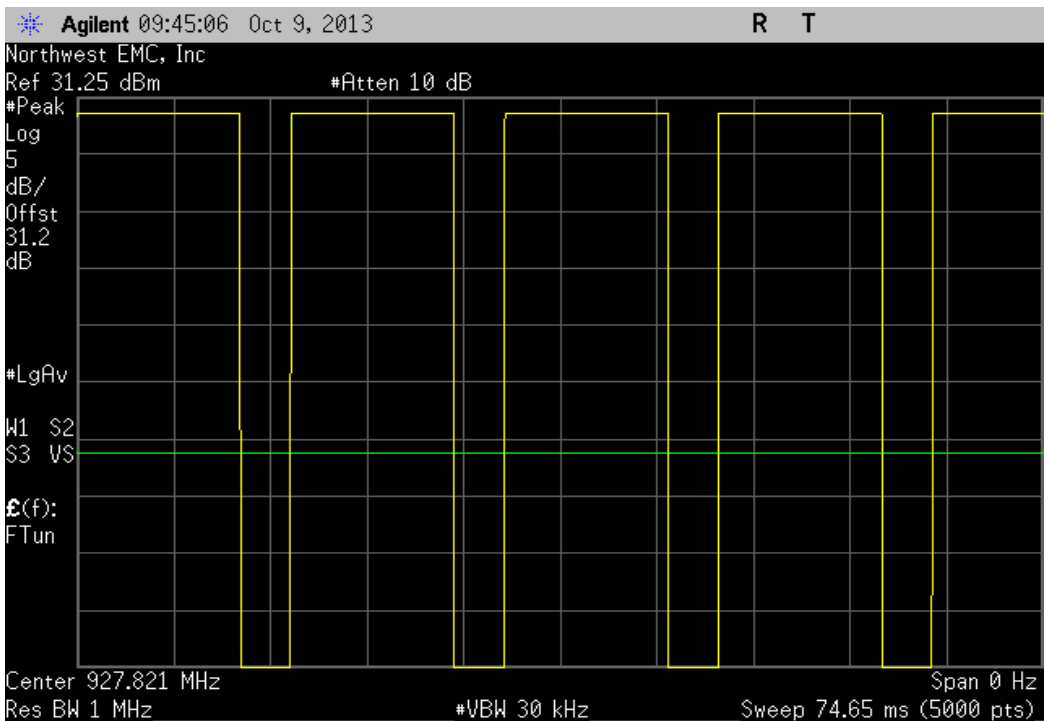
GFSK, 153.6 kbps, Mid Channel, 916.0704 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	4	N/A	N/A	N/A



GFSK, 153.6 kbps, High Channel, 927.8208 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	12.621 mS	16.529 mS	1	76.4	N/A	N/A



GFSK, 153.6 kbps, High Channel, 927.8208 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A



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
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Multimeter	Tektronix	DMM912	MMH	2/5/2013	24
Attenuator, 'Precision N'	S.M. Electronics	SA18N-06/SM4032	REE	12/11/2012	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
Power Meter	Gigatronics	8651A	SPM	1/9/2012	24
Power Sensor	Gigatronics	80701A	SPL	7/8/2011	36
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/30/2013	12
40GHz DC Block	Miteq	DCB4000	AMD	5/16/2013	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	24

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 in a no hop mode at the data rate(s) listed in the datasheet.

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 2013.08.15
PsaTx 2013.07.11

EUT: FGRM	Work Order: FREW0011
Serial Number: 956-8447	Date: 10/10/13
Customer: FreeWave Technologies, Inc.	Temperature: 22.1°C
Attendees: None	Humidity: 40%
Project: None	Barometric Pres.: 1015.9
Tested by: Brandon Hobbs	Power: 12 VDC
	Job Site: EV06

TEST SPECIFICATIONS	FCC 15.247:2013	Test Method	ANSI C63.10:2009
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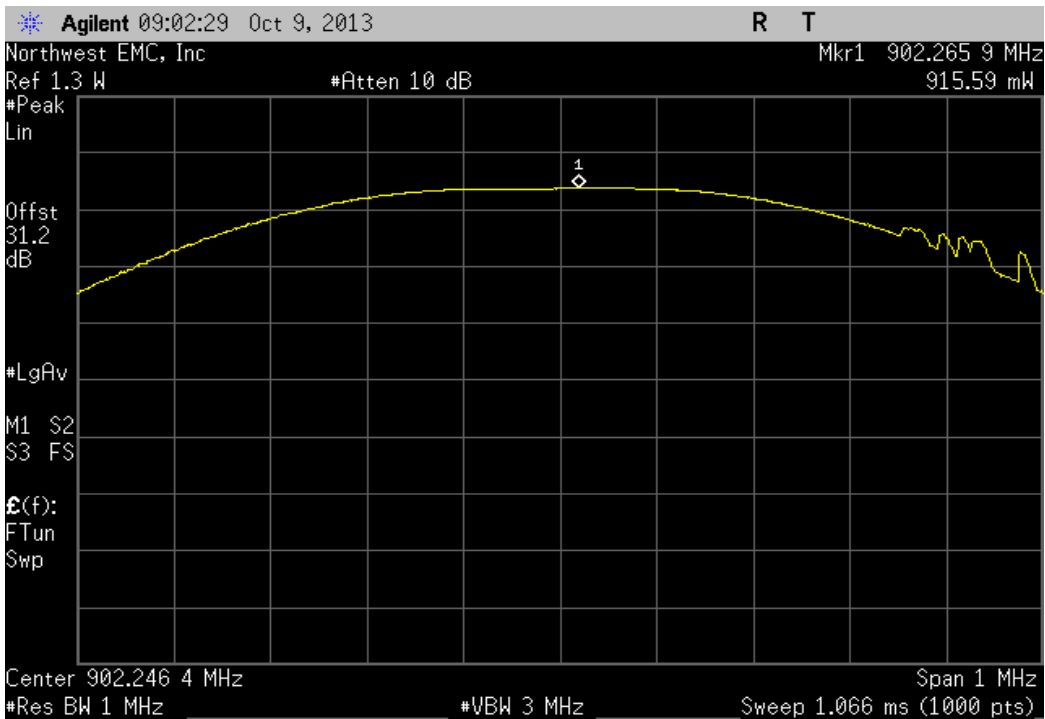
COMMENTS
An added 10 dB 5w attenuator was used while under test. All cable losses were accounted for prior to testing. Output power level at 10, Full Power.

DEVIATIONS FROM TEST STANDARD
None

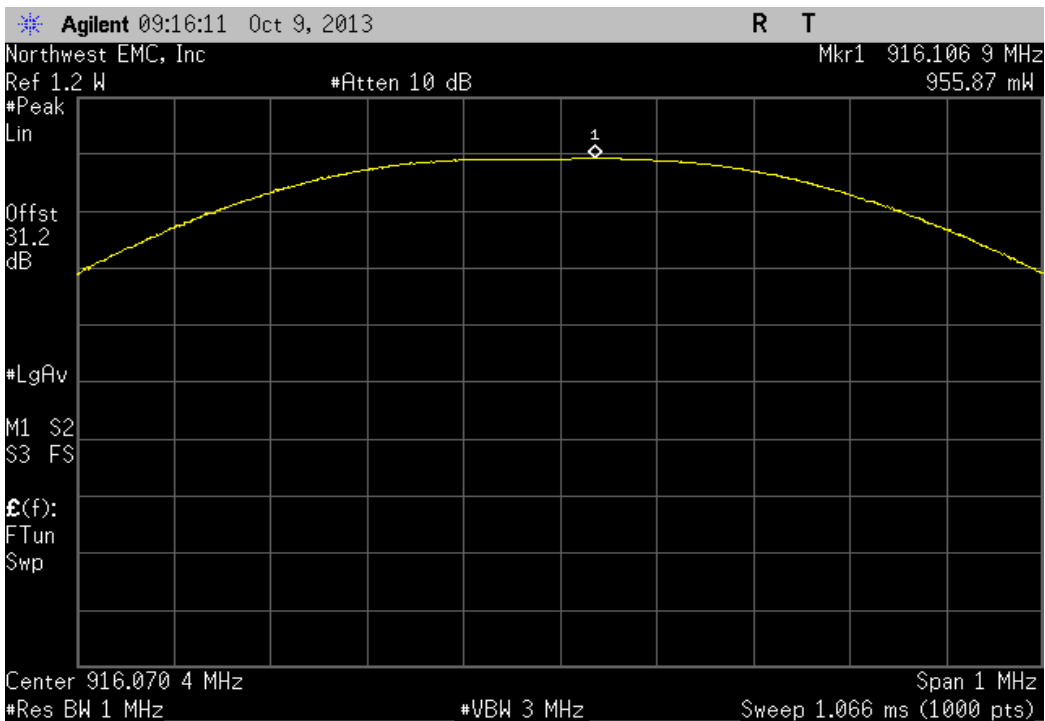
Configuration #	1	Signature	
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		Value	Limit	Result
GFSK	115.2 kbps			
	Low Channel, 902.2464 MHz	915.588 mW	< 1 W	Pass
	Mid Channel, 916.0704 MHz	955.873 mW	< 1 W	Pass
	High Channel, 927.8208 MHz	965.162 mW	< 1 W	Pass
153.6 kbps	Low Channel, 902.2464 MHz	901.986 mW	< 1 W	Pass
	Mid Channel, 916.0704 MHz	948.2 mW	< 1 W	Pass
	High Channel, 927.8208 MHz	962.498 mW	< 1 W	Pass

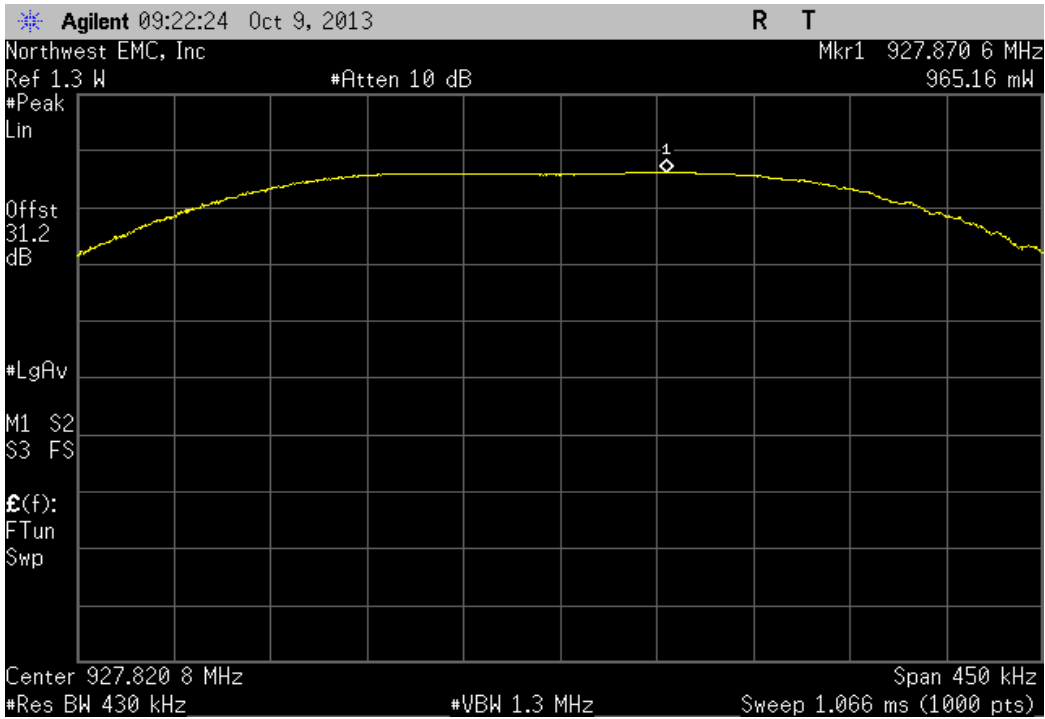
GFSK, 115.2 kbps, Low Channel, 902.2464 MHz			
	Value	Limit	Result
	915.588 mW	< 1 W	Pass



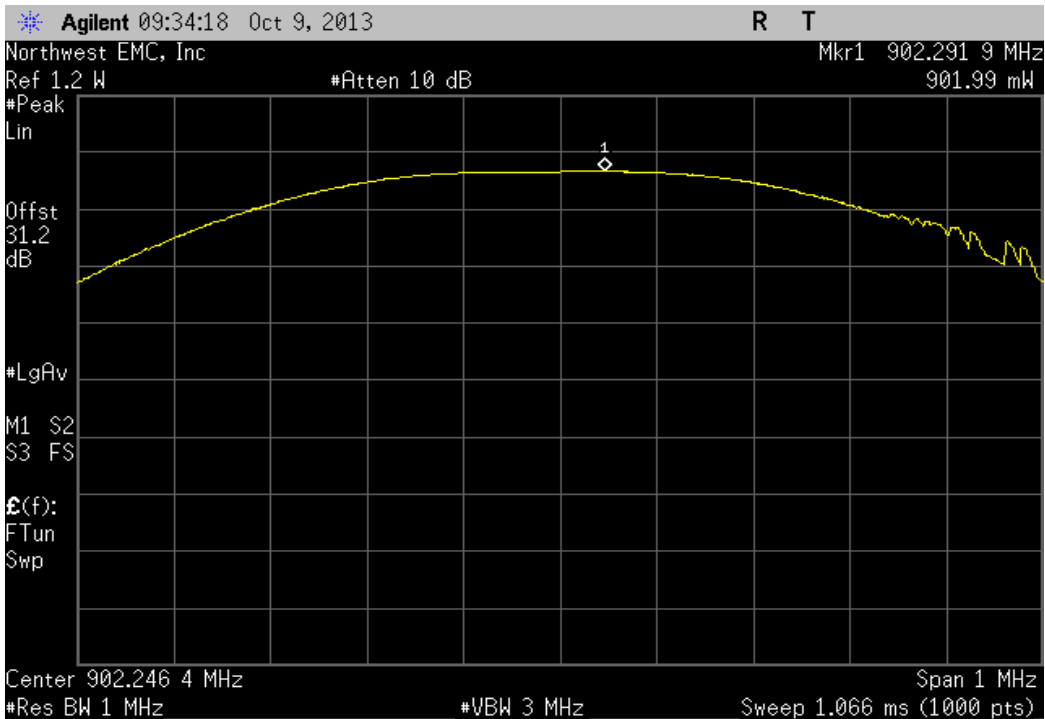
GFSK, 115.2 kbps, Mid Channel, 916.0704 MHz			
	Value	Limit	Result
	955.873 mW	< 1 W	Pass



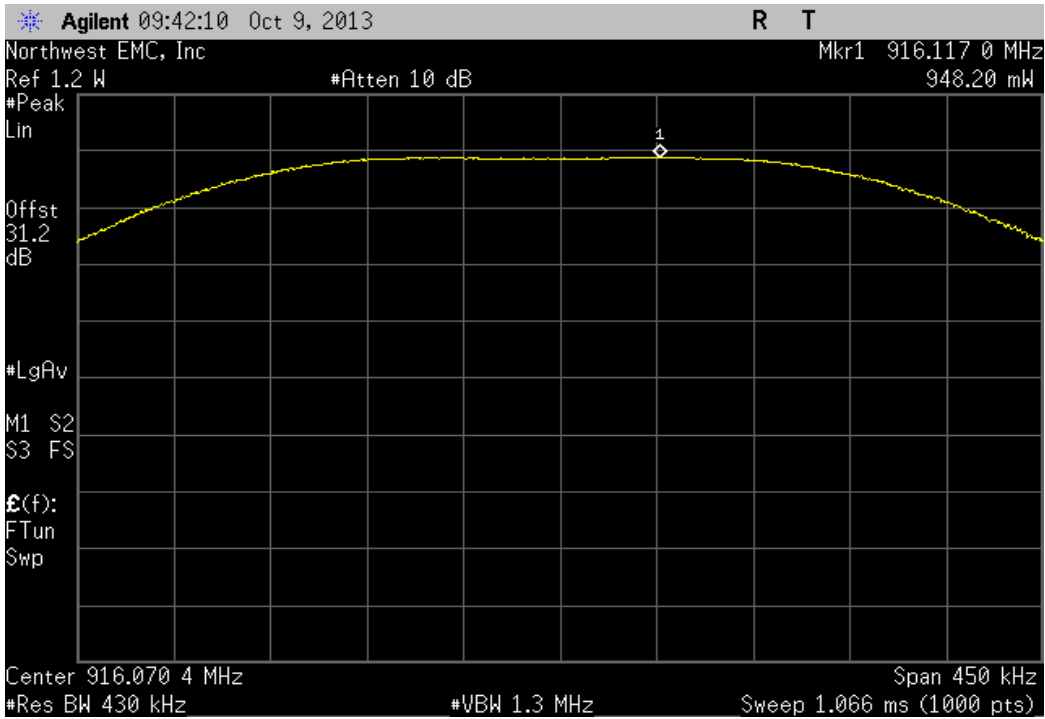
GFSK, 115.2 kbps, High Channel, 927.8208 MHz			
	Value	Limit	Result
	965.162 mW	< 1 W	Pass



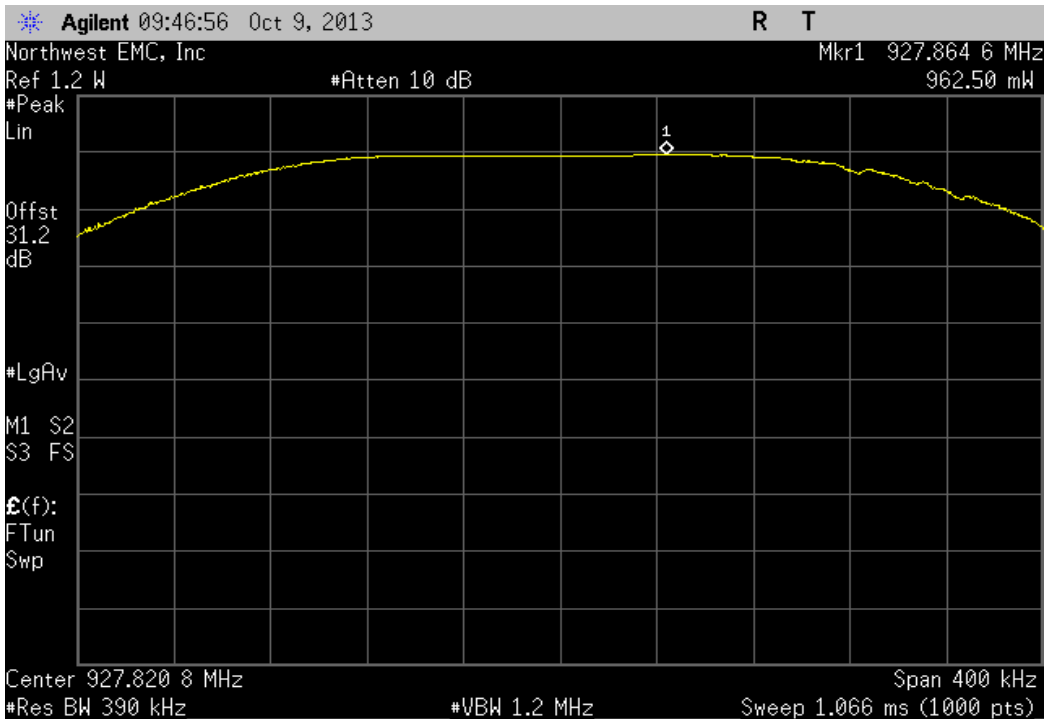
GFSK, 153.6 kbps, Low Channel, 902.2464 MHz			
	Value	Limit	Result
	901.986 mW	< 1 W	Pass



GFSK, 153.6 kbps, Mid Channel, 916.0704 MHz			
	Value	Limit	Result
	948.2 mW	< 1 W	Pass



GFSK, 153.6 kbps, High Channel, 927.8208 MHz			
	Value	Limit	Result
	962.498 mW	< 1 W	Pass



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
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Multimeter	Tektronix	DMM912	MMH	2/5/2013	24
Attenuator, 'Precision N'	S.M. Electronics	SA18N-06/SM4032	REE	12/11/2012	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
Power Meter	Gigatronics	8651A	SPM	1/9/2012	24
Power Sensor	Gigatronics	80701A	SPL	7/8/2011	36
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/30/2013	12
40GHz DC Block	Miteq	DCB4000	AMD	5/16/2013	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	24

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 the data rate(s) listed in the datasheet in a no-hop mode.



Occupied Bandwidth

XMit 2013.08.15
PsaTx 2013.07.11

EUT: FGRM	Work Order: FREW0011
Serial Number: 956-8447	Date: 10/10/13
Customer: FreeWave Technologies, Inc.	Temperature: 22.1°C
Attendees: None	Humidity: 40%
Project: None	Barometric Pres.: 1015.9
Tested by: Brandon Hobbs	Power: 12 VDC
	Job Site: EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2013	ANSI C63.10:2009

COMMENTS
An added 10 dB 5w attenuator was used while under test. All cable losses were accounted for prior to testing. Output power level at 10, Full Power.

DEVIATIONS FROM TEST STANDARD
None

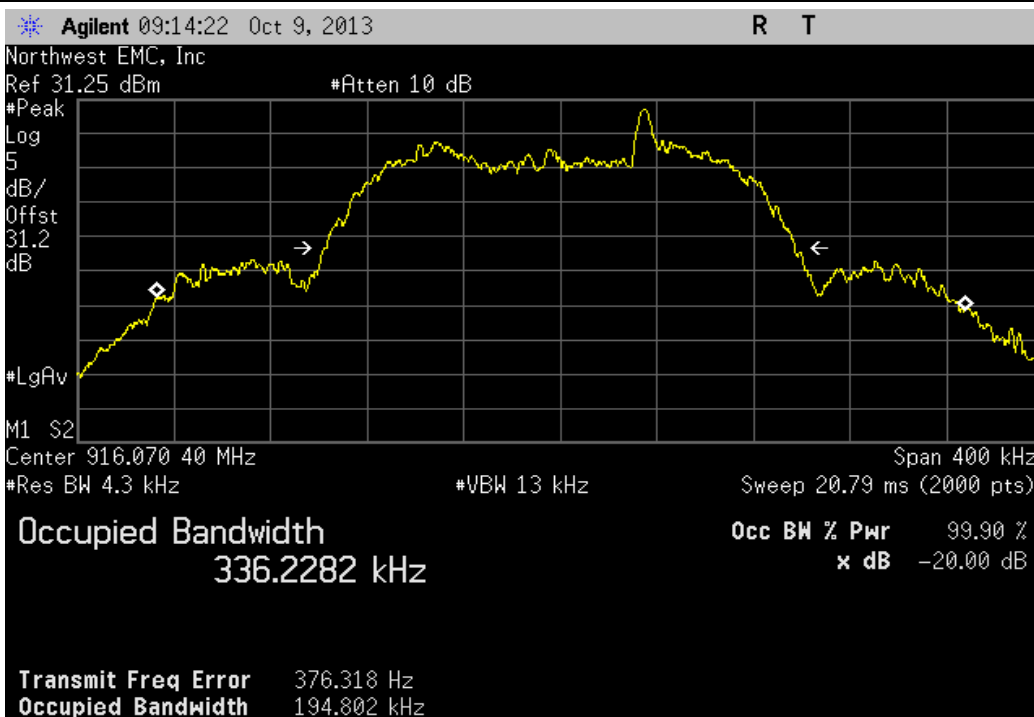
Configuration #	1	Signature 
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		Value	Limit	Result
GFSK	115.2 kbps			
	Low Channel, 902.2464 MHz	231.642 kHz	< 500 kHz	Pass
	Mid Channel, 916.0704 MHz	194.802 kHz	< 500 kHz	Pass
	High Channel, 927.8208 MHz	192.298 kHz	< 500 kHz	Pass
153.6 kbps	Low Channel, 902.2464 MHz	397.421 kHz	< 500 kHz	Pass
	Mid Channel, 916.0704 MHz	202.412 kHz	< 500 kHz	Pass
	High Channel, 927.8208 MHz	188.149 kHz	< 500 kHz	Pass

GFSK, 115.2 kbps, Low Channel, 902.2464 MHz			
	Value	Limit	Result
	231.642 kHz	< 500 kHz	Pass



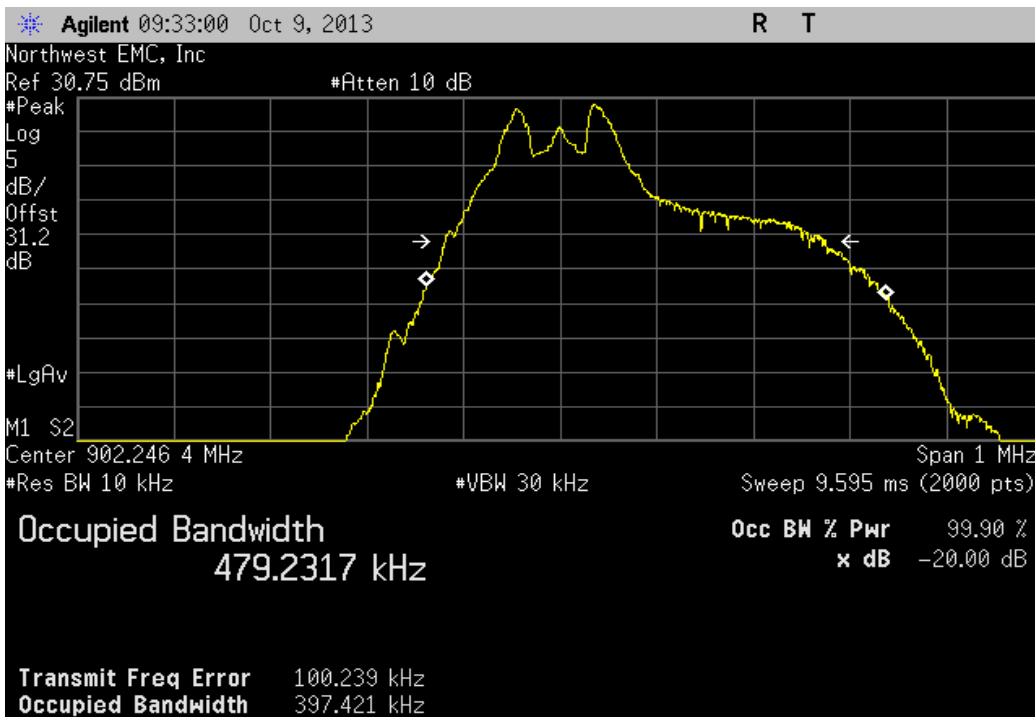
GFSK, 115.2 kbps, Mid Channel, 916.0704 MHz			
	Value	Limit	Result
	194.802 kHz	< 500 kHz	Pass



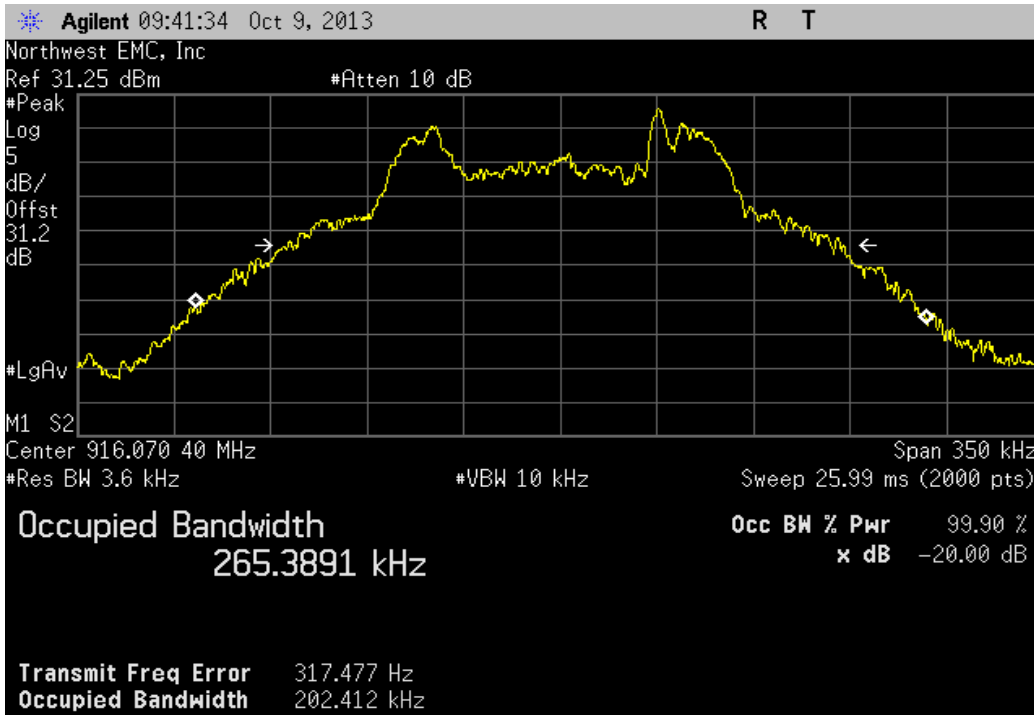
GFSK, 115.2 kbps, High Channel, 927.8208 MHz			
	Value	Limit	Result
	192.298 kHz	< 500 kHz	Pass



GFSK, 153.6 kbps, Low Channel, 902.2464 MHz			
	Value	Limit	Result
	397.421 kHz	< 500 kHz	Pass



GFSK, 153.6 kbps, Mid Channel, 916.0704 MHz			
	Value	Limit	Result
	202.412 kHz	< 500 kHz	Pass



GFSK, 153.6 kbps, High Channel, 927.8208 MHz			
	Value	Limit	Result
	188.149 kHz	< 500 kHz	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
Multimeter	Tektronix	DMM912	MMH	2/5/2013	24
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Attenuator, 'Precision N'	S.M. Electronics	SA18N-06/SM4032	REE	12/11/2012	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
Power Meter	Gigatronix	8651A	SPM	1/9/2012	24
Power Sensor	Gigatronix	80701A	SPL	7/8/2011	36
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/30/2013	12
40GHz DC Block	Miteq	DCB4000	AMD	5/16/2013	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	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 data rate(s) listed in the datasheet in a no-hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.



Spurious Conducted Emissions

XMit 2013.08.15
PsaTx 2013.07.11

EUT: FGRM	Work Order: FREW0011
Serial Number: 956-8447	Date: 10/10/13
Customer: FreeWave Technologies, Inc.	Temperature: 22.1°C
Attendees: None	Humidity: 40%
Project: None	Barometric Pres.: 1015.9
Tested by: Brandon Hobbs	Power: 12 VDC
	Job Site: EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2013	ANSI C63.10:2009

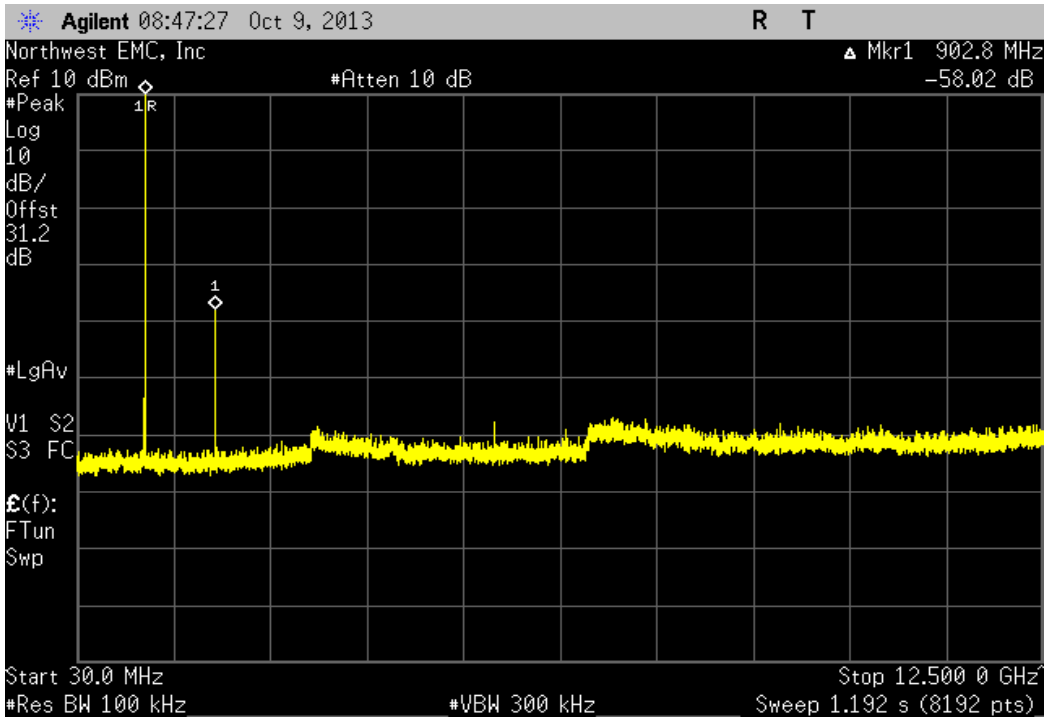
COMMENTS
An added 10 dB 5w attenuator was used while under test. All cable losses were accounted for prior to testing. Output power level at 10, Full Power.

DEVIATIONS FROM TEST STANDARD
None

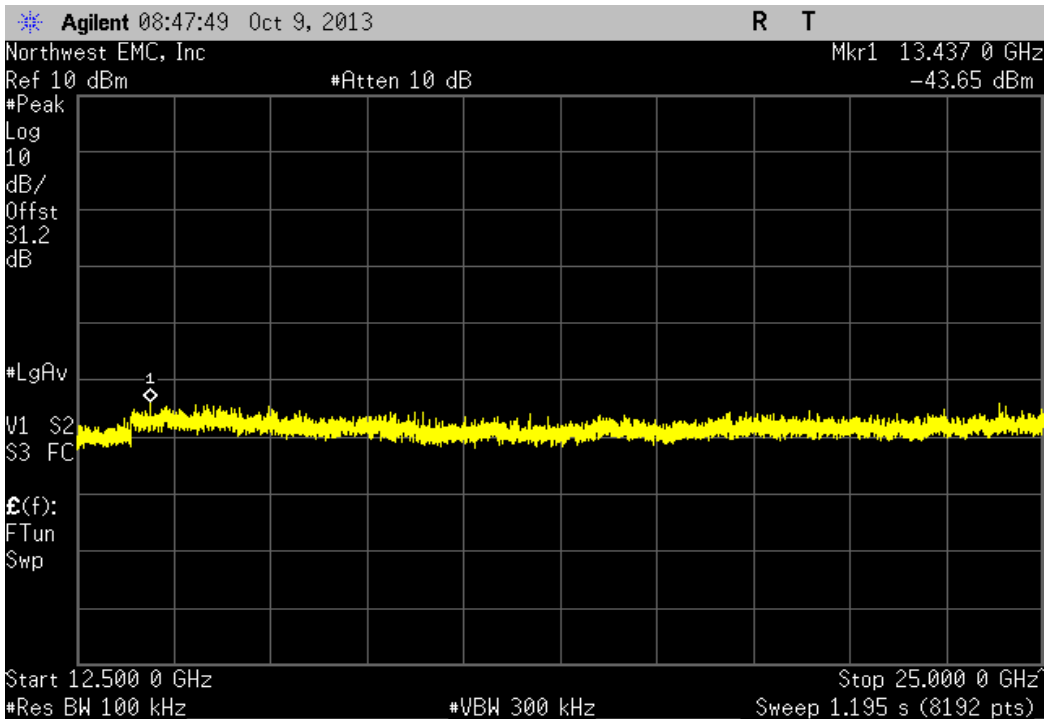
Configuration #	1	Signature 
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		Frequency Range	Value	Limit	Result
GFSK	115.2 kbps				
	Low Channel, 902.2464 MHz	30 MHz - 12.5 GHz	-58.02 dBc	≤ -20 dBc	Pass
	Low Channel, 902.2464 MHz	12.5 GHz - 25 GHz	-73.86 dBc	≤ -20 dBc	Pass
	Mid Channel, 916.0704 MHz	30 MHz - 12.5 GHz	-54.26 dBc	≤ -20 dBc	Pass
	Mid Channel, 916.0704 MHz	12.5 GHz - 25 GHz	-73.7 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz	30 MHz - 12.5 GHz	-56.34 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz	12.5 GHz - 25 GHz	-74.25 dBc	≤ -20 dBc	Pass
	153.6 kbps				
	Low Channel, 902.2464 MHz	30 MHz - 12.5 GHz	-58.27 dBc	≤ -20 dBc	Pass
	Low Channel, 902.2464 MHz	12.5 GHz - 25 GHz	-73.21 dBc	≤ -20 dBc	Pass
	Mid Channel, 916.0704 MHz	30 MHz - 12.5 GHz	-54.65 dBc	≤ -20 dBc	Pass
	Mid Channel, 916.0704 MHz	12.5 GHz - 25 GHz	-74.21 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz	30 MHz - 12.5 GHz	-56.47 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz	12.5 GHz - 25 GHz	-73.02 dBc	≤ -20 dBc	Pass

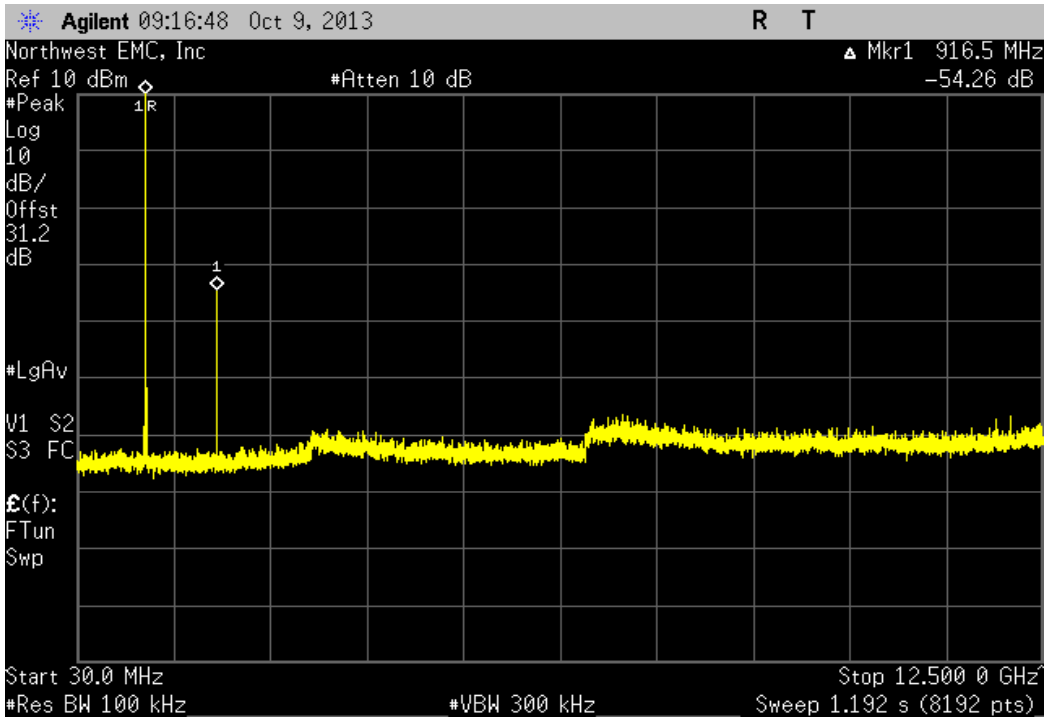
GFSK, 115.2 kbps, Low Channel, 902.2464 MHz			
Frequency Range	Value	Limit	Result
30 MHz - 12.5 GHz	-58.02 dBc	≤ -20 dBc	Pass



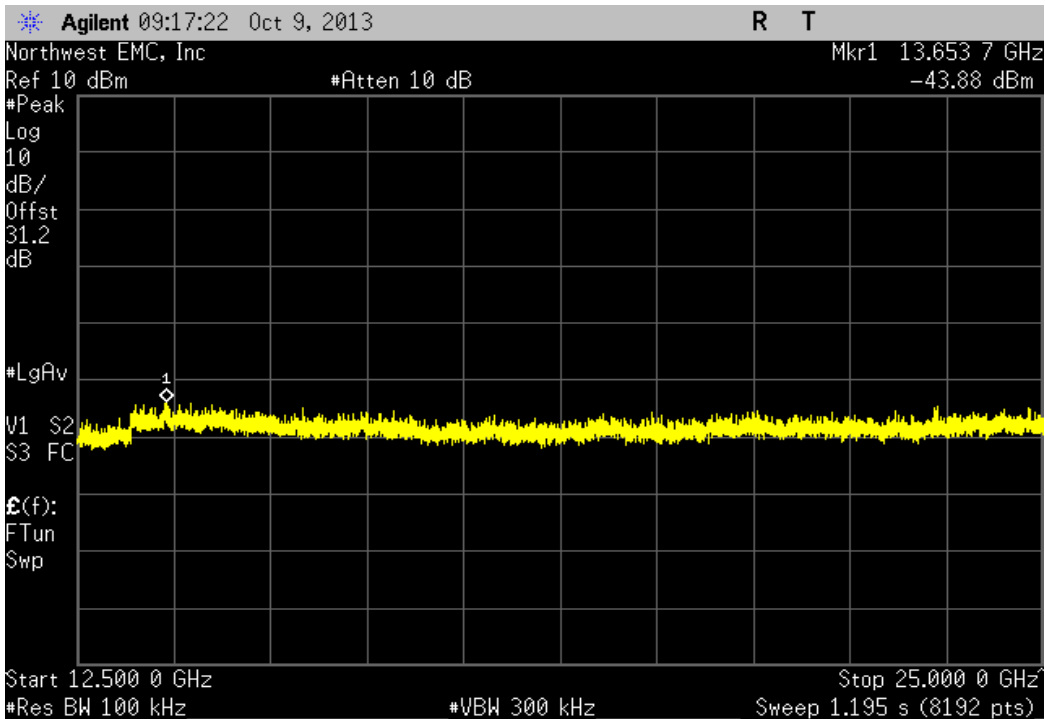
GFSK, 115.2 kbps, Low Channel, 902.2464 MHz			
Frequency Range	Value	Limit	Result
12.5 GHz - 25 GHz	-73.86 dBc	≤ -20 dBc	Pass



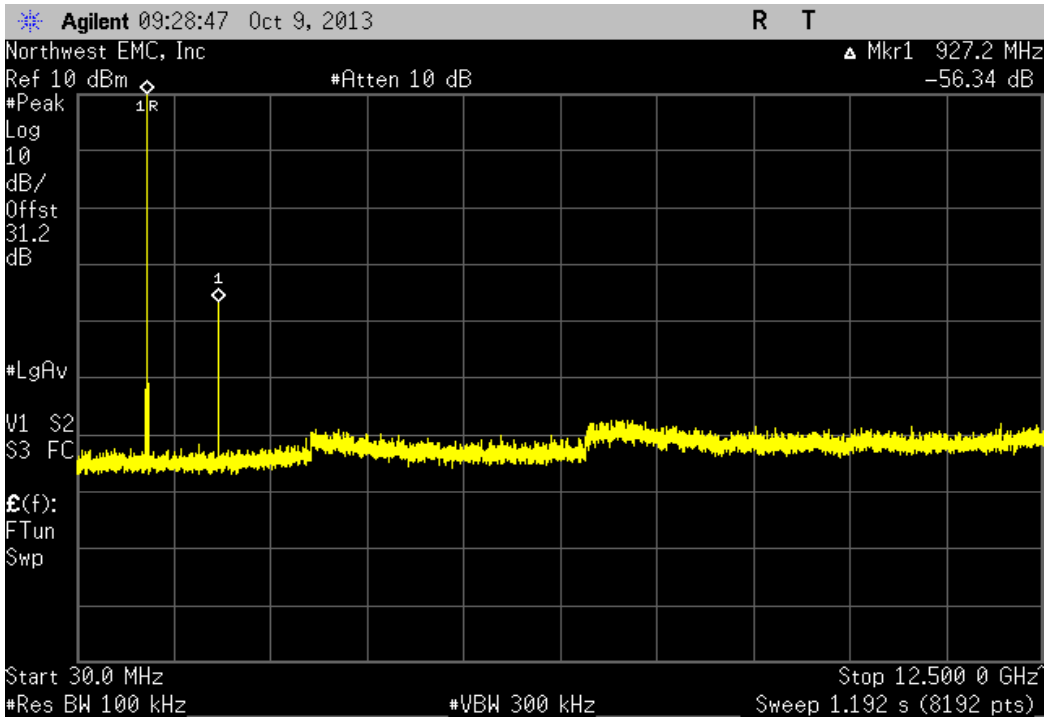
GFSK, 115.2 kbps, Mid Channel, 916.0704 MHz			
Frequency Range	Value	Limit	Result
30 MHz - 12.5 GHz	-54.26 dBc	≤ -20 dBc	Pass



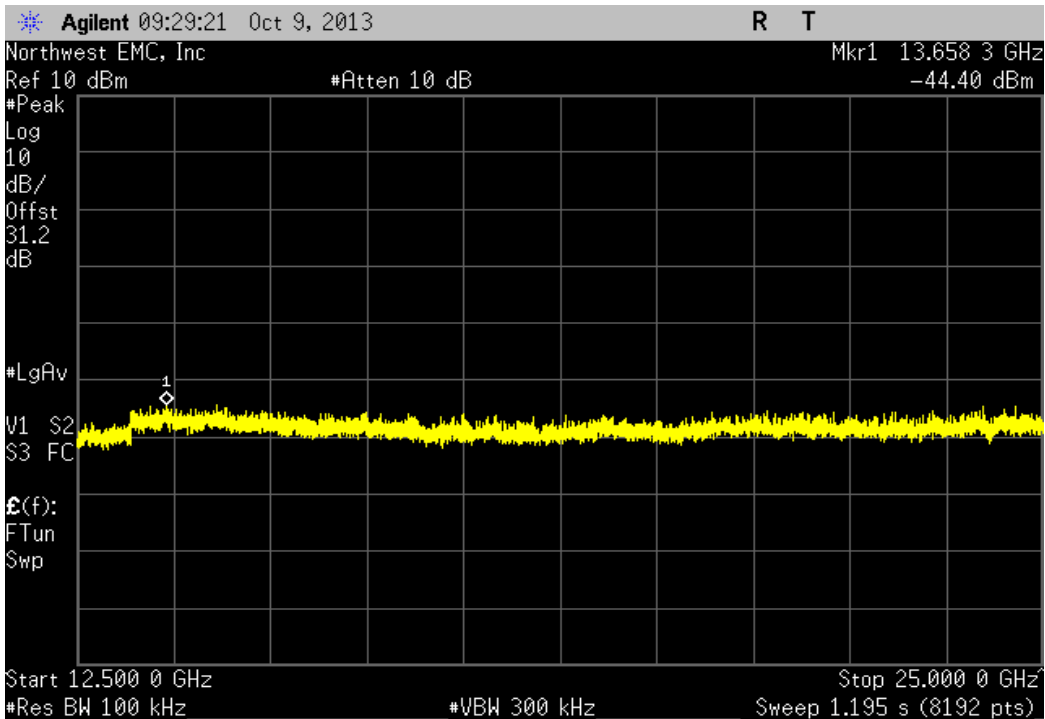
GFSK, 115.2 kbps, Mid Channel, 916.0704 MHz			
Frequency Range	Value	Limit	Result
12.5 GHz - 25 GHz	-73.7 dBc	≤ -20 dBc	Pass



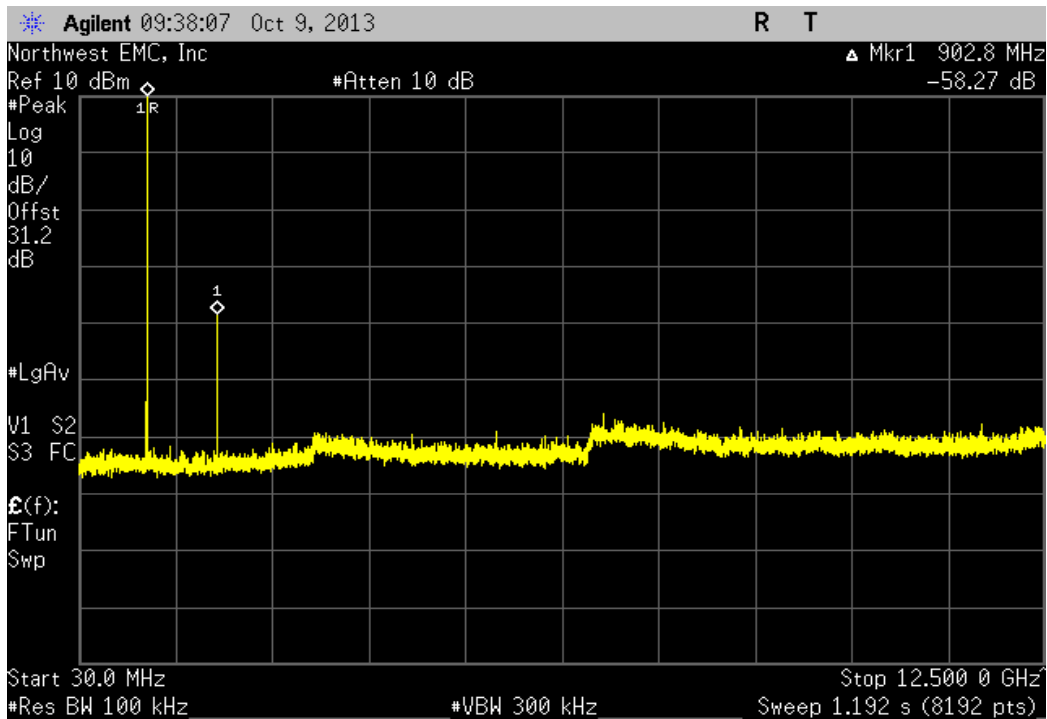
GFSK, 115.2 kbps, High Channel, 927.8208 MHz			
Frequency Range	Value	Limit	Result
30 MHz - 12.5 GHz	-56.34 dBc	≤ -20 dBc	Pass



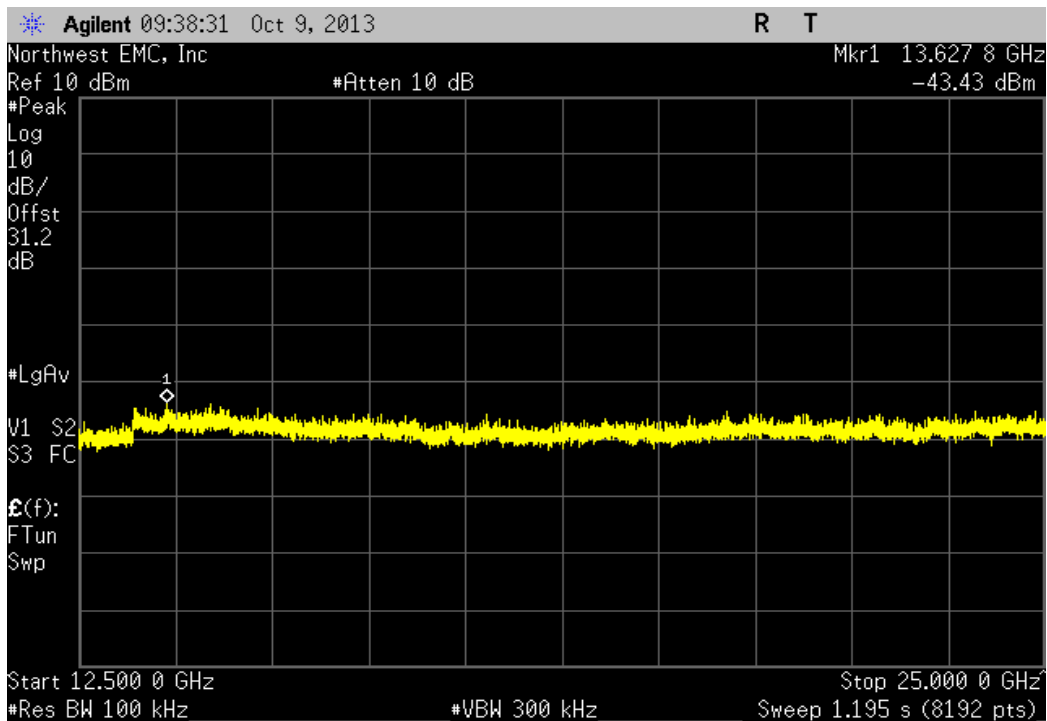
GFSK, 115.2 kbps, High Channel, 927.8208 MHz			
Frequency Range	Value	Limit	Result
12.5 GHz - 25 GHz	-74.25 dBc	≤ -20 dBc	Pass



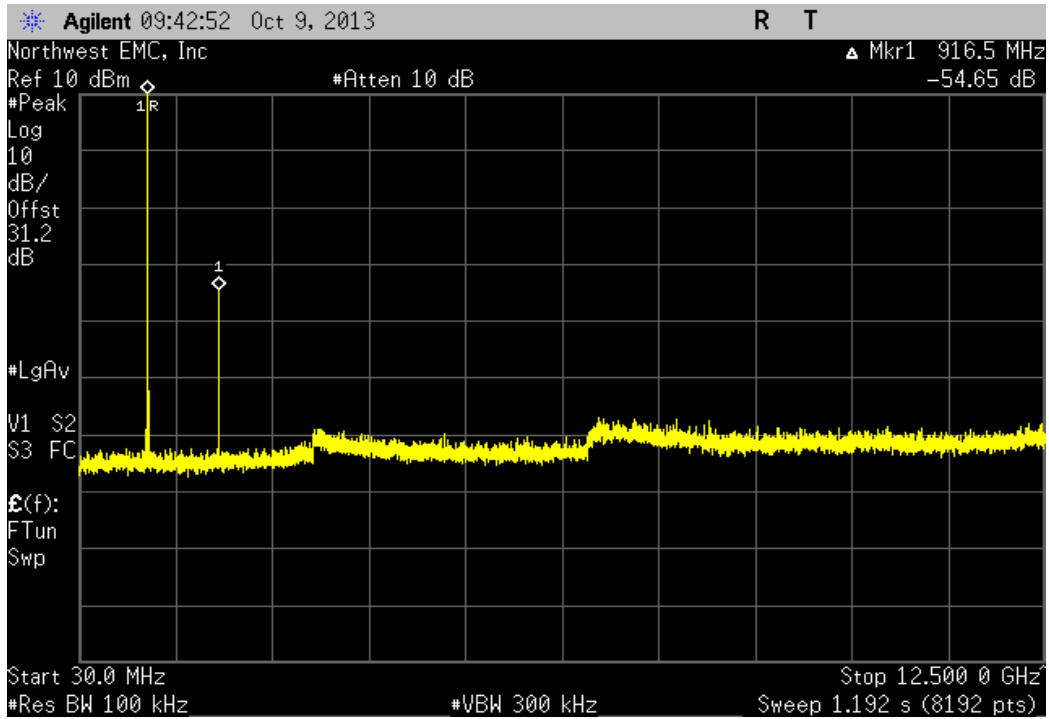
GFSK, 153.6 kbps, Low Channel, 902.2464 MHz			
Frequency Range	Value	Limit	Result
30 MHz - 12.5 GHz	-58.27 dBc	≤ -20 dBc	Pass



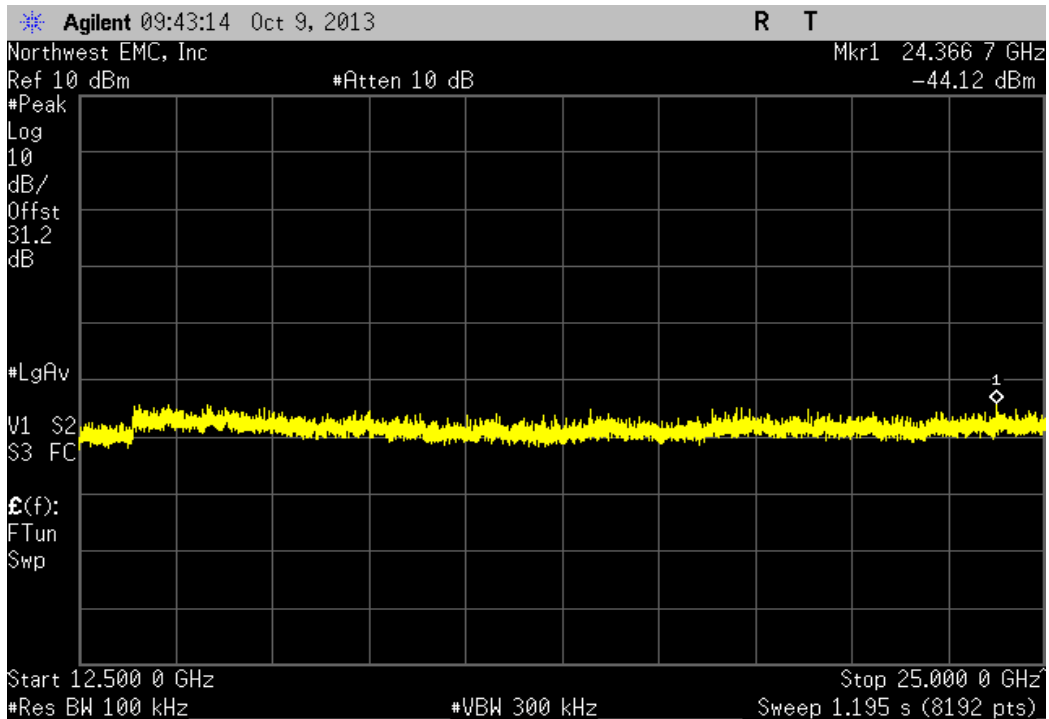
GFSK, 153.6 kbps, Low Channel, 902.2464 MHz			
Frequency Range	Value	Limit	Result
12.5 GHz - 25 GHz	-73.21 dBc	≤ -20 dBc	Pass



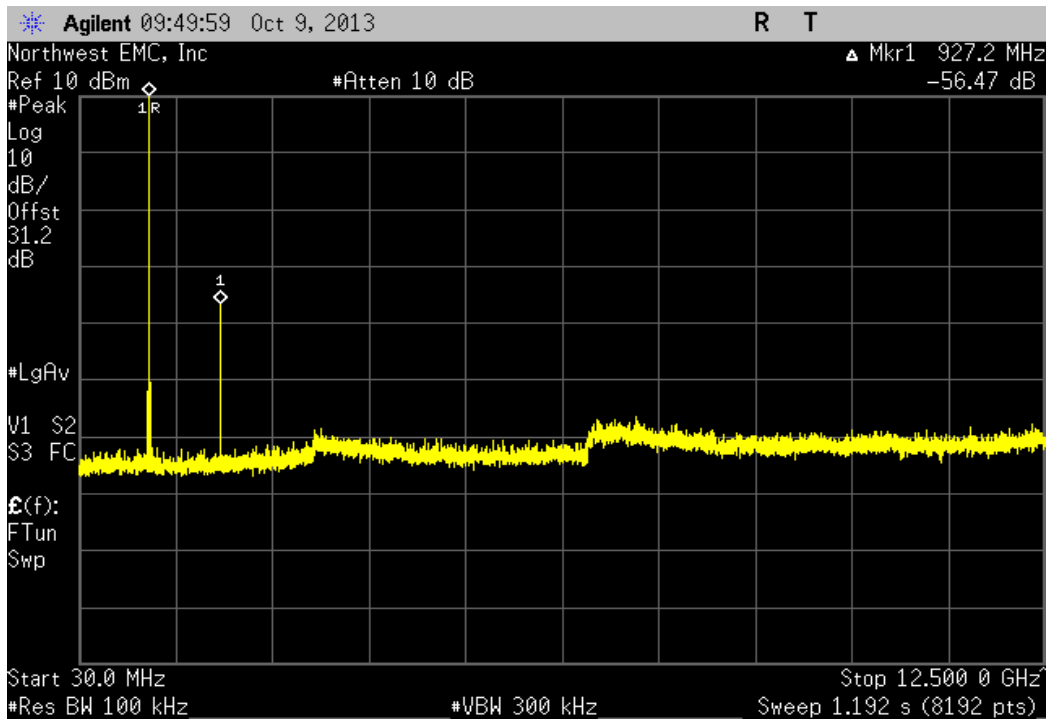
GFSK, 153.6 kbps, Mid Channel, 916.0704 MHz			
Frequency Range	Value	Limit	Result
30 MHz - 12.5 GHz	-54.65 dBc	≤ -20 dBc	Pass



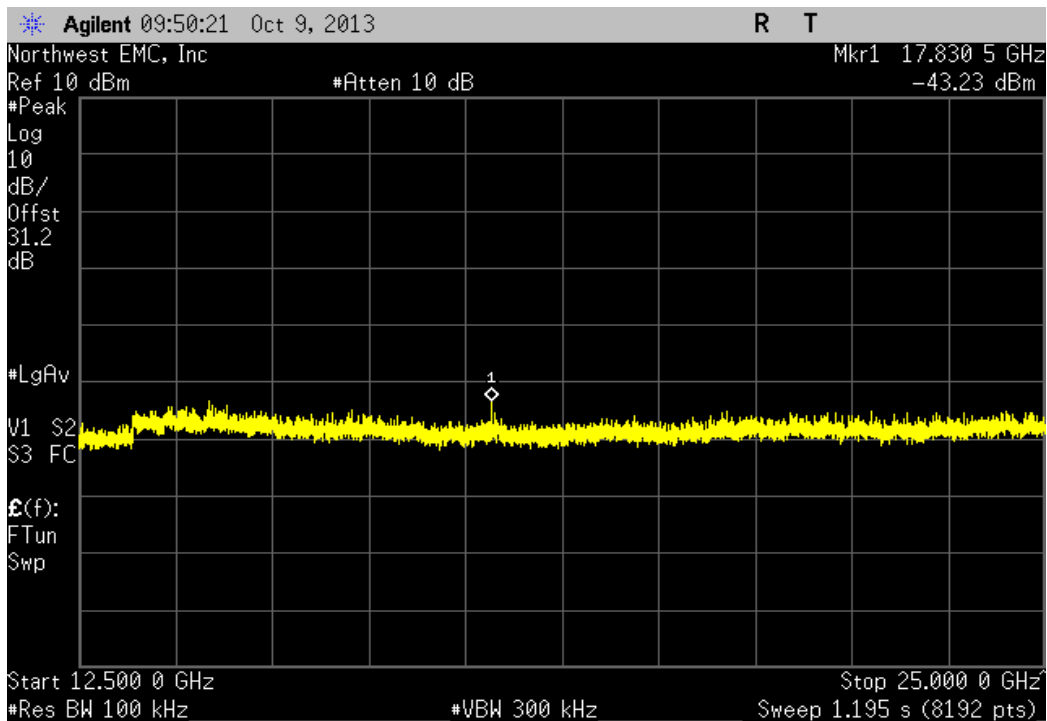
GFSK, 153.6 kbps, Mid Channel, 916.0704 MHz			
Frequency Range	Value	Limit	Result
12.5 GHz - 25 GHz	-74.21 dBc	≤ -20 dBc	Pass



GFSK, 153.6 kbps, High Channel, 927.8208 MHz			
Frequency Range	Value	Limit	Result
30 MHz - 12.5 GHz	-56.47 dBc	≤ -20 dBc	Pass



GFSK, 153.6 kbps, High Channel, 927.8208 MHz			
Frequency Range	Value	Limit	Result
12.5 GHz - 25 GHz	-73.02 dBc	≤ -20 dBc	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
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Multimeter	Tektronix	DMM912	MMH	2/5/2013	24
Attenuator, 'Precision N'	S.M. Electronics	SA18N-06/SM4032	REE	12/11/2012	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
Power Meter	Gigatronix	8651A	SPM	1/9/2012	24
Power Sensor	Gigatronix	80701A	SPL	7/8/2011	36
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/30/2013	12
40GHz DC Block	Miteq	DCB4000	AMD	5/16/2013	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	24

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low 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 the data rate(s) listed in the datasheet in a no hop mode. The channels closest to the band edges were selected. The measurements were taken per ANSI C63.10.2009 section 7.7.9.

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW \geq 1 % of spectrum analyzer display span

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

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



Band Edge Compliance

XMit 2013.08.15
PsaTx 2013.07.11

EUT: FGRM	Work Order: FREW0011
Serial Number: 956-8447	Date: 10/10/13
Customer: FreeWave Technologies, Inc.	Temperature: 22.1°C
Attendees: None	Humidity: 40%
Project: None	Barometric Pres.: 1015.9
Tested by: Brandon Hobbs	Power: 12 VDC
	Job Site: EV06
TEST SPECIFICATIONS	
FCC 15.247:2013	Test Method
	ANSI C63.10:2009

COMMENTS
An added 10 dB 5w attenuator was used while under test. All cable losses were accounted for prior to testing. Output power level at 10, Full Power.

DEVIATIONS FROM TEST STANDARD
None

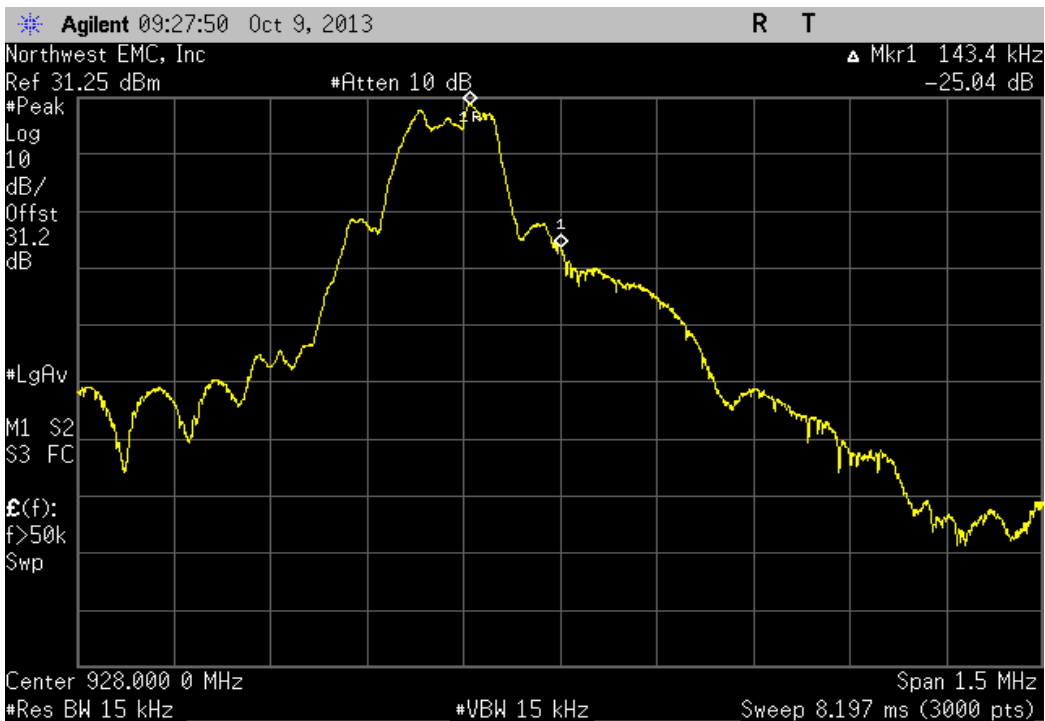
Configuration #	1	Signature 
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		Value	Limit	Result
GFSK	115.2 kbps			
	Low Channel, 902.2464 MHz	-41.87 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz	-25.04 dBc	≤ -20 dBc	Pass
	153.6 kbps			
	Low Channel, 902.2464 MHz	-52.86 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz	-27.68 dBc	≤ -20 dBc	Pass

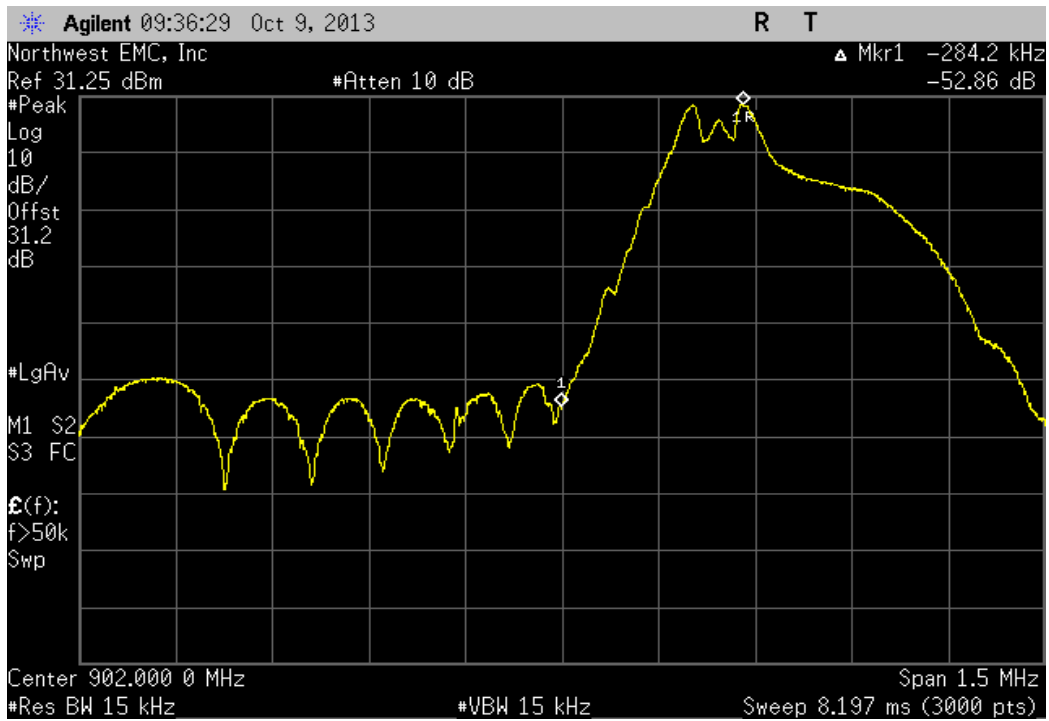
GFSK, 115.2 kbps, Low Channel, 902.2464 MHz		
Value	Limit	Result
-41.87 dBc	≤ -20 dBc	Pass



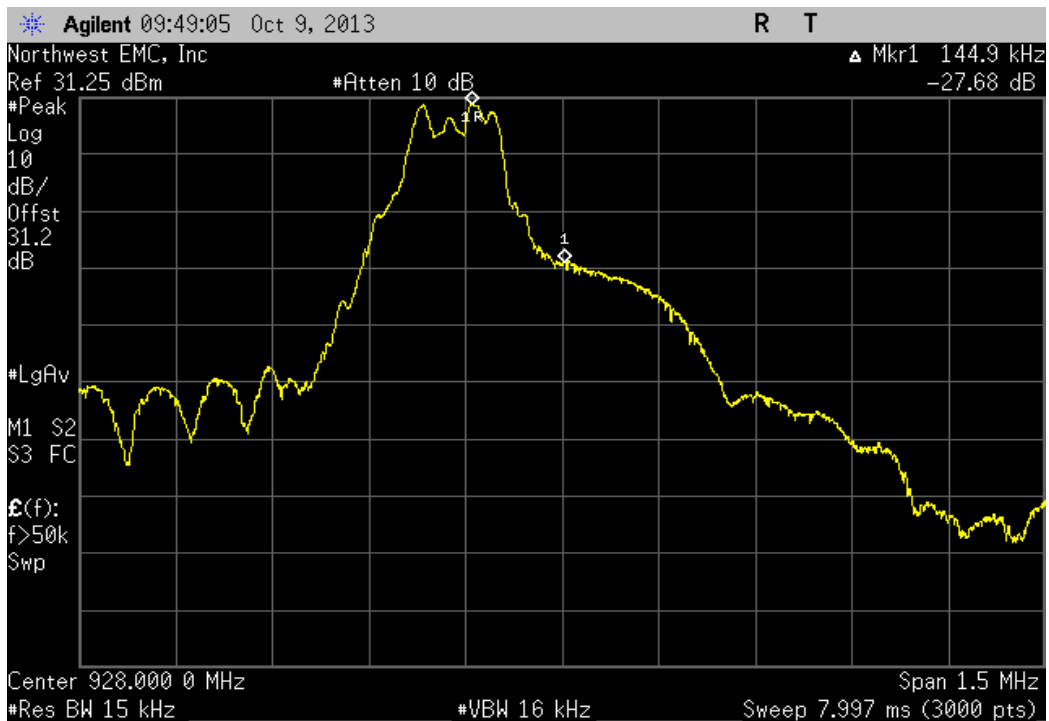
GFSK, 115.2 kbps, High Channel, 927.8208 MHz		
Value	Limit	Result
-25.04 dBc	≤ -20 dBc	Pass



GFSK, 153.6 kbps, Low Channel, 902.2464 MHz			
	Value	Limit	Result
	-52.86 dBc	≤ -20 dBc	Pass



GFSK, 153.6 kbps, High Channel, 927.8208 MHz			
	Value	Limit	Result
	-27.68 dBc	≤ -20 dBc	Pass



Channel Separation

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
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Multimeter	Tektronix	DMM912	MMH	2/5/2013	24
Attenuator, 'Precision N'	S.M. Electronics	SA18N-06/SM4032	REE	12/11/2012	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
Power Meter	Gigatronics	8651A	SPM	1/9/2012	24
Power Sensor	Gigatronics	80701A	SPL	7/8/2011	36
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/30/2013	12
40GHz DC Block	Miteq	DCB4000	AMD	5/16/2013	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	24

TEST DESCRIPTION

The channel carrier frequencies in the 902-928MHz band must be separated by 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. The EUT was operated in pseudorandom hopping mode. The spectrum was scanned across two adjacent peaks. The separation between the peaks of these channels was measured.



Channel Separation

XMit 2013.08.15
PsaTx 2013.07.11

EUT: FGRM	Work Order: FREW0011
Serial Number: 956-8447	Date: 10/10/13
Customer: FreeWave Technologies, Inc.	Temperature: 22.1°C
Attendees: None	Humidity: 40%
Project: None	Barometric Pres.: 1015.9
Tested by: Brandon Hobbs	Power: 12 VDC
	Job Site: EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2013	ANSI C63.10:2009

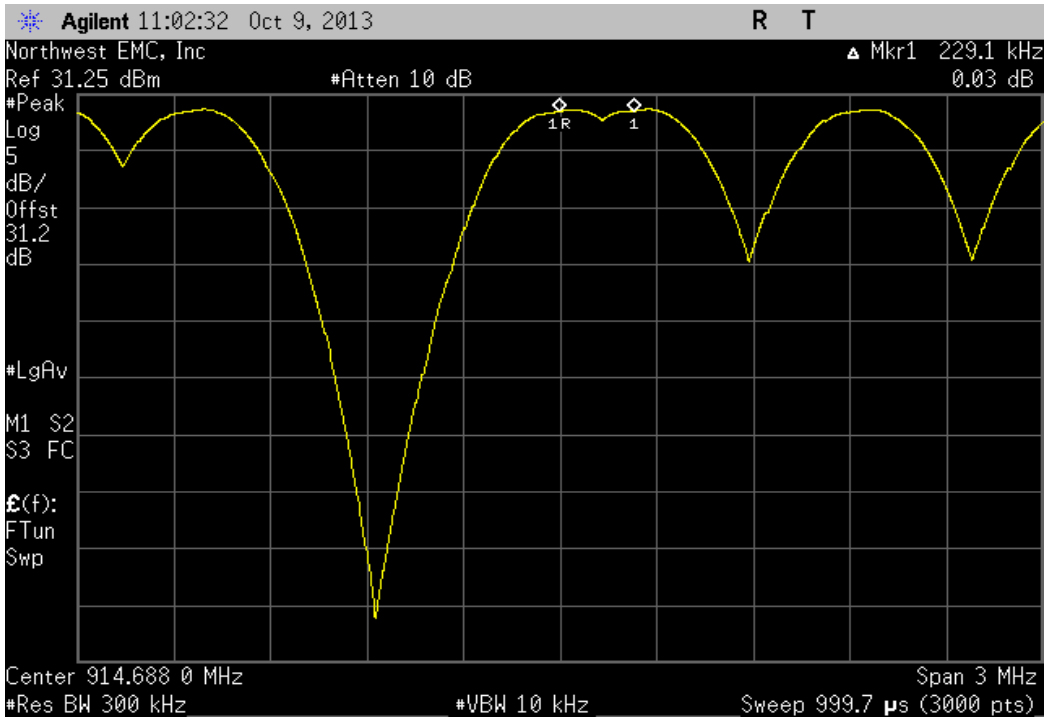
COMMENTS
An added 10 dB 5w attenuator was used while under test. All cable losses were accounted for prior to testing. Output power level at 10, Full Power.

DEVIATIONS FROM TEST STANDARD
None

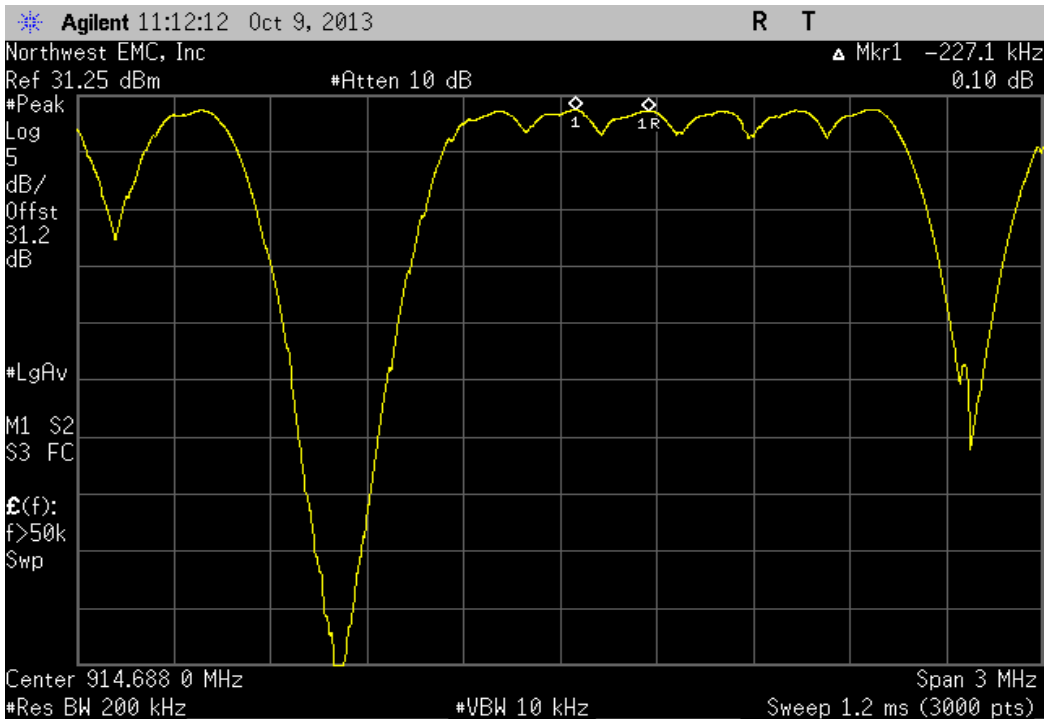
Configuration #	1	Signature 
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		Value	Limit	Result
GFSK	115.2 kbps			
	Mid Channel, 914.6880 MHz 50 Hopping Channels	229 kHz	≥ 188 kHz	Pass
	Mid Channel, 914.6880 MHz 80 Hopping Channels	227 kHz	≥ 188 kHz	Pass
	Mid Channel, 914.6880 MHz 112 Hopping Channels	223 kHz	≥ 188 kHz	Pass
153.6 kbps	Mid Channel, 914.6880 MHz 50 Hopping Channels	227 kHz	≥ 188 kHz	Pass
	Mid Channel, 914.6880 MHz 80 Hopping Channels	231 kHz	≥ 188 kHz	Pass
	Mid Channel, 914.6880 MHz 112 Hopping Channels	243 kHz	≥ 188 kHz	Pass

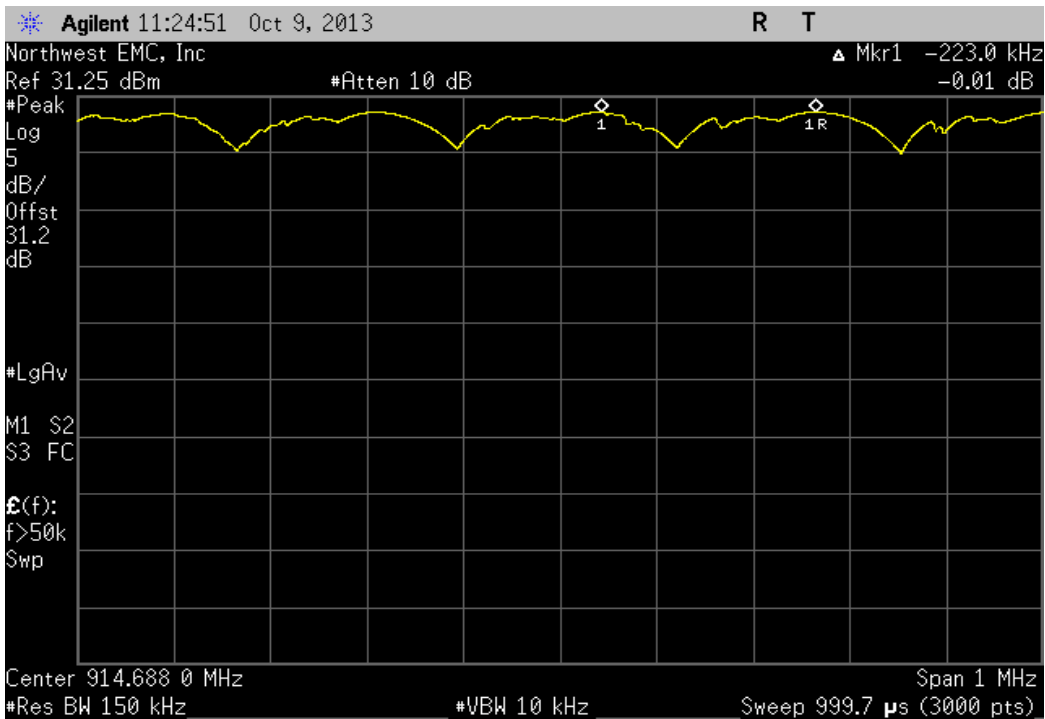
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels			
	Value	Limit	Result
	229 kHz	≥ 188 kHz	Pass



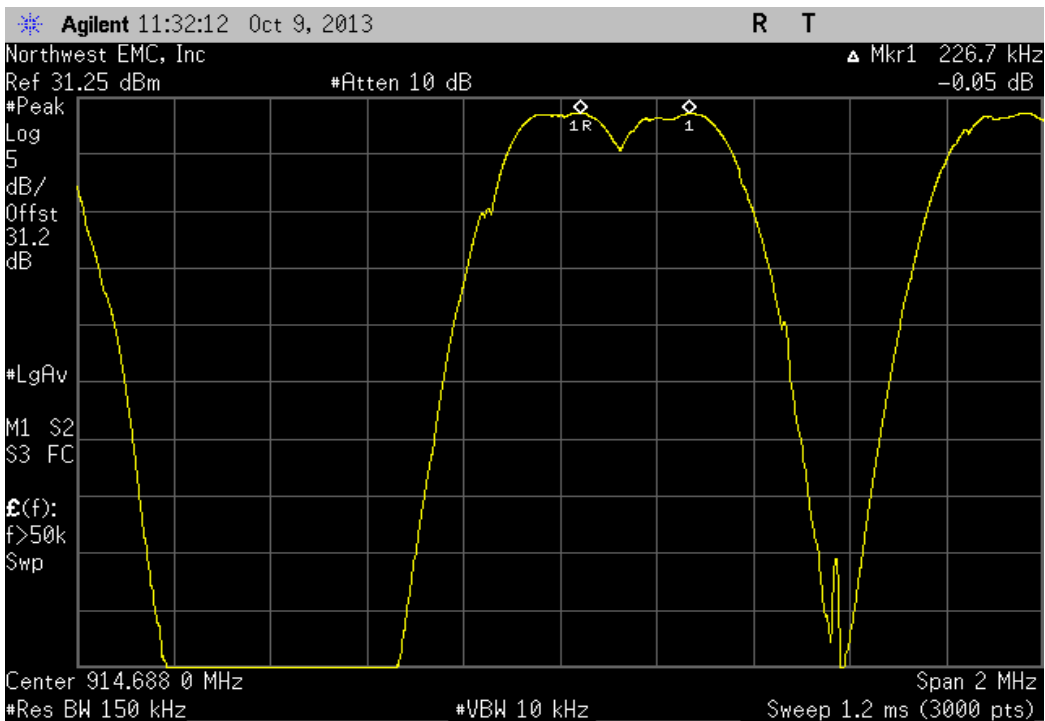
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels			
	Value	Limit	Result
	227 kHz	≥ 188 kHz	Pass



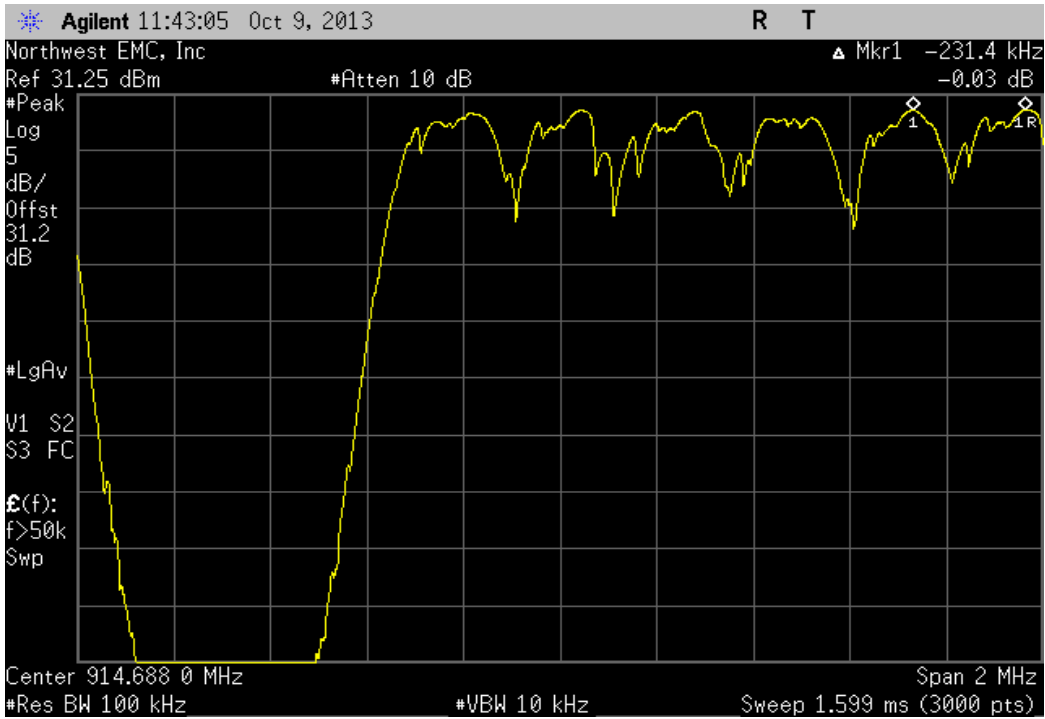
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels			
	Value	Limit	Result
	223 kHz	≥ 188 kHz	Pass



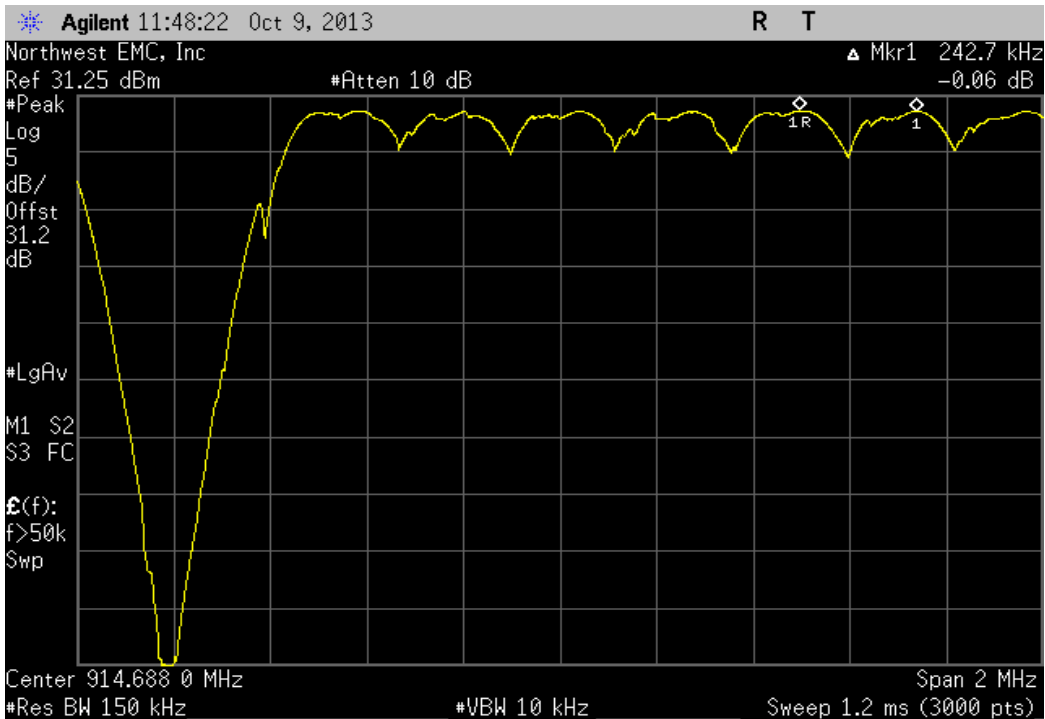
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels			
	Value	Limit	Result
	227 kHz	≥ 188 kHz	Pass



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels		
Value	Limit	Result
231 kHz	≥ 188 kHz	Pass



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels		
Value	Limit	Result
243 kHz	≥ 188 kHz	Pass



Number of Hopping Channels

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
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Multimeter	Tektronix	DMM912	MMH	2/5/2013	24
Attenuator, 'Precision N'	S.M. Electronics	SA18N-06/SM4032	REE	12/11/2012	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
Power Meter	Gigatronix	8651A	SPM	1/9/2012	24
Power Sensor	Gigatronix	80701A	SPL	7/8/2011	36
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/30/2013	12
40GHz DC Block	Miteq	DCB4000	AMD	5/16/2013	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	24

TEST DESCRIPTION

The number of hopping frequencies was measured across the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.



Number of Hopping Channels

EUT: FGRM	Work Order: FREW0013
Serial Number: 956-8447	Date: 10/10/13
Customer: FreeWave Technologies, Inc.	Temperature: 22.1°C
Attendees: None	Humidity: 40%
Project: None	Barometric Pres.: 1015.9
Tested by: Brandon Hobbs	Power: 12 VDC
	Job Site: EV06
TEST SPECIFICATIONS	
FCC 15.247:2013	Test Method
	ANSI C63.10:2009

COMMENTS
 An added 10 dB 5w attenuator was used while under test. All cable losses were accounted for prior to testing. Output power level at 10, Full Power.

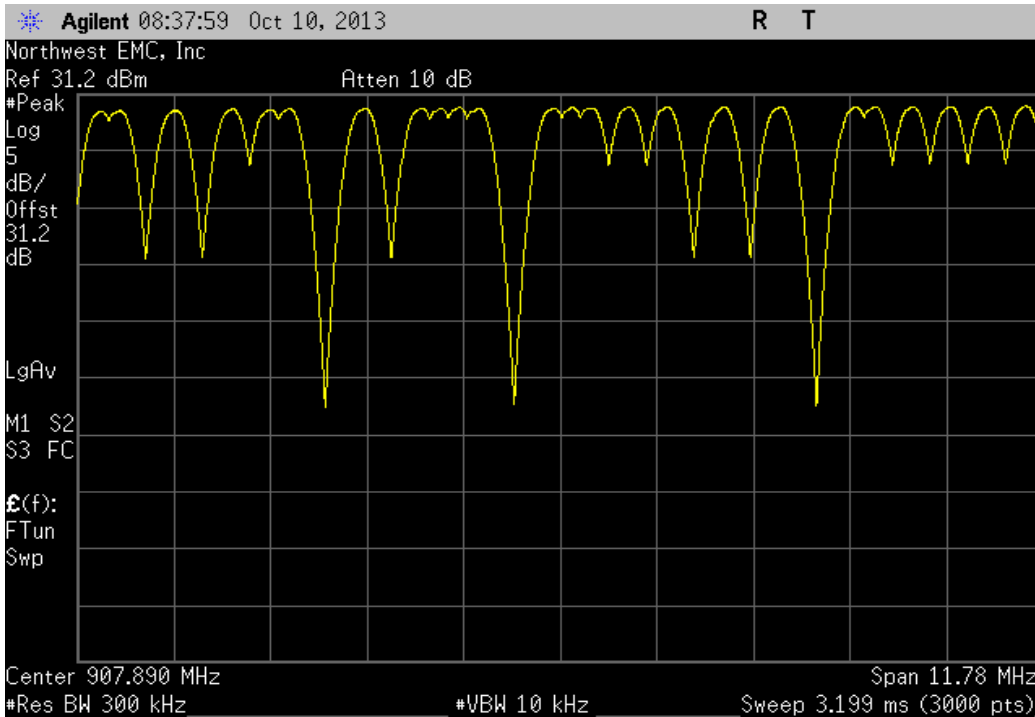
DEVIATIONS FROM TEST STANDARD
 None

Configuration #	1	Signature 
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		Value	Limit	Result		
GFSK	115.2 kbps	Mid Channel, 914.6880 MHz 50 Hopping Channels				
		902.000 MHz - 913.780 MHz	N/A	≥ 50	N/A	
		913.780 MHz - 928.000 MHz	50	≥ 50	Pass	
		Mid Channel, 914.6880 MHz 80 Hopping Channels				
		902.000 MHz - 913.780 MHz	N/A	≥ 50	N/A	
		913.780 MHz - 928.000 MHz	80	≥ 50	Pass	
	153.6 kbps	Mid Channel, 914.6880 MHz 112 Hopping Channels	902.000 MHz - 913.780 MHz	N/A	≥ 50	N/A
			913.780 MHz - 928.000 MHz	112	≥ 50	Pass
			Mid Channel, 914.6880 MHz 50 Hopping Channels			
		902.000 MHz - 913.780 MHz	N/A	≥ 50	N/A	
		913.780 MHz - 928.000 MHz	50	≥ 50	Pass	
		Mid Channel, 914.6880 MHz 80 Hopping Channels	902.000 MHz - 913.780 MHz	N/A	≥ 50	N/A
913.780 MHz - 928.000 MHz	80		≥ 50	Pass		
Mid Channel, 914.6880 MHz 112 Hopping Channels						
902.000 MHz - 913.780 MHz	N/A	≥ 50	N/A			
913.780 MHz - 928.000 MHz	112	≥ 50	Pass			

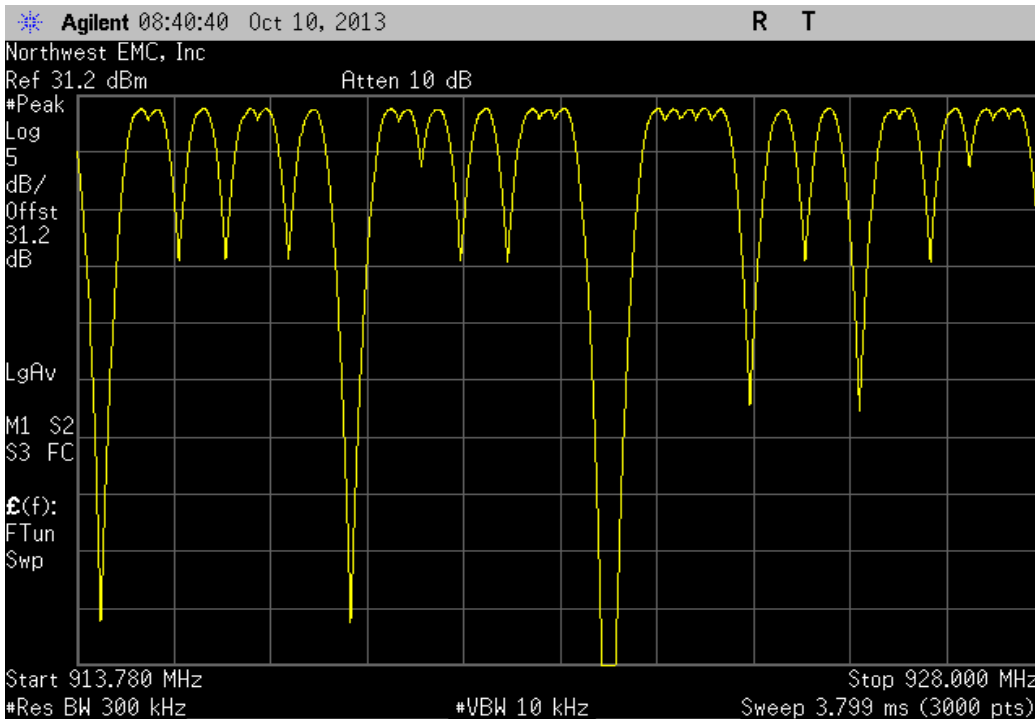
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels , 902.000 MHz - 913.780 MHz

Value	Limit	Result
N/A	≥ 50	N/A



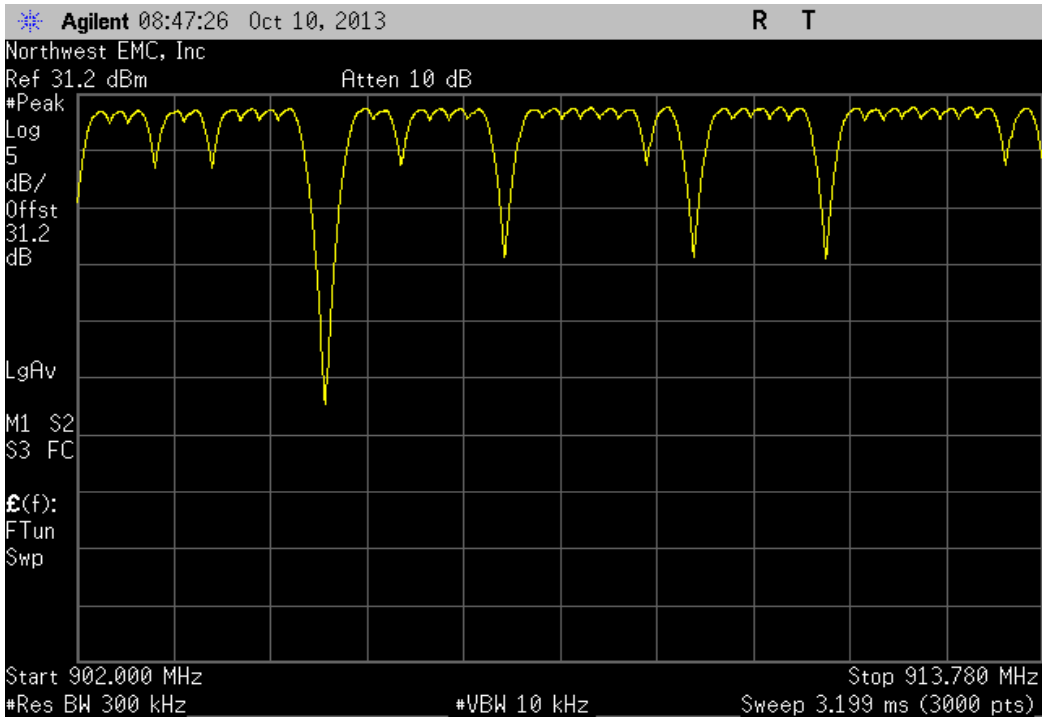
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels , 913.780 MHz - 928.000 MHz

Value	Limit	Result
50	≥ 50	Pass



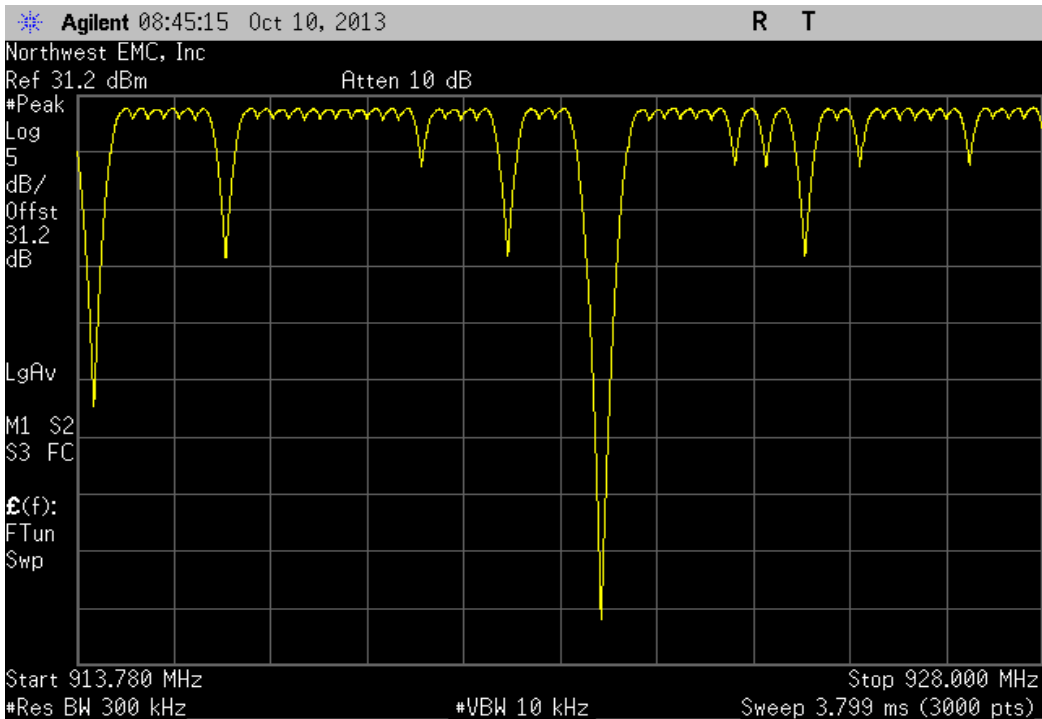
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels , 902.000 MHz - 913.780 MHz

Value	Limit	Result
N/A	≥ 50	N/A



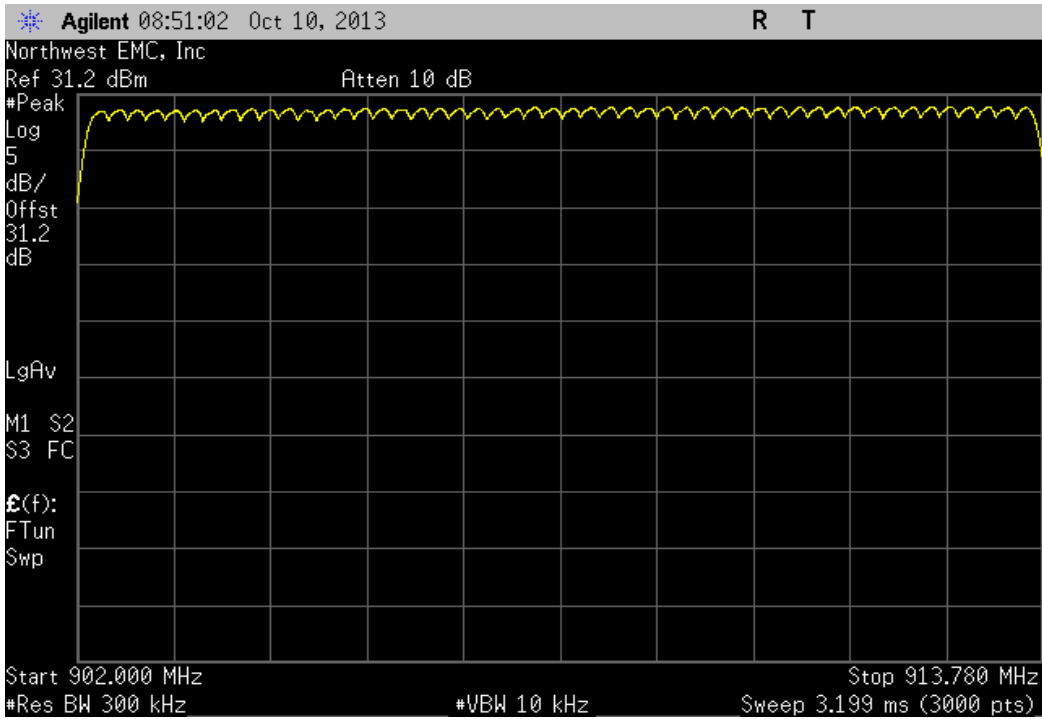
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels , 913.780 MHz - 928.000 MHz

Value	Limit	Result
80	≥ 50	Pass



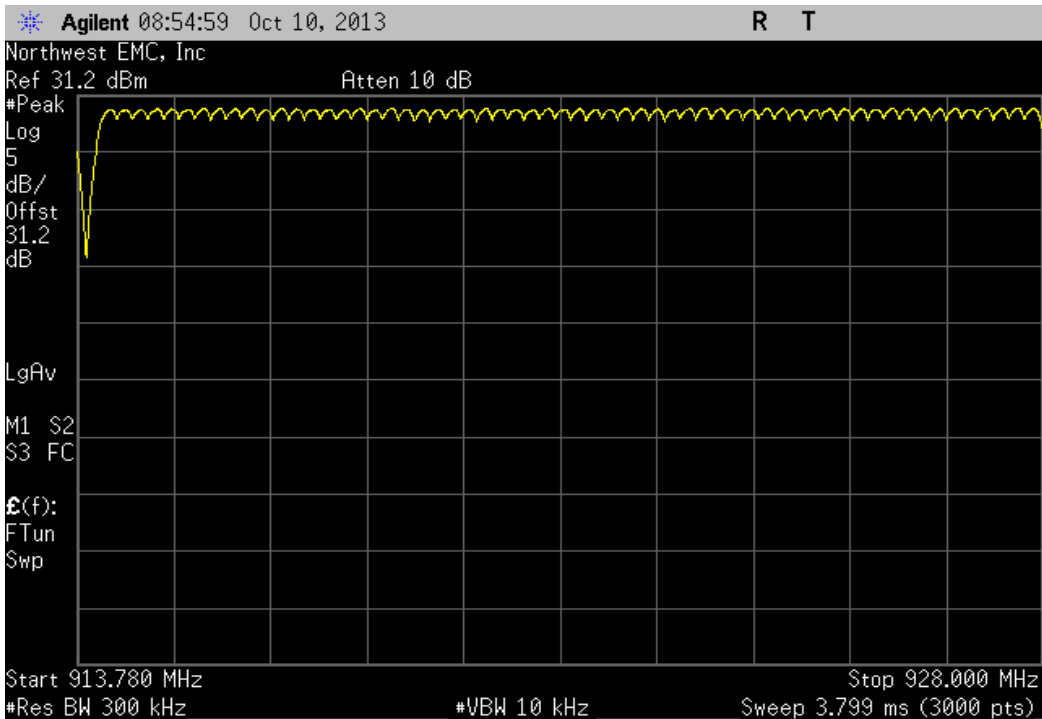
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels , 902.000 MHz - 913.780 MHz

Value	Limit	Result
N/A	≥ 50	N/A



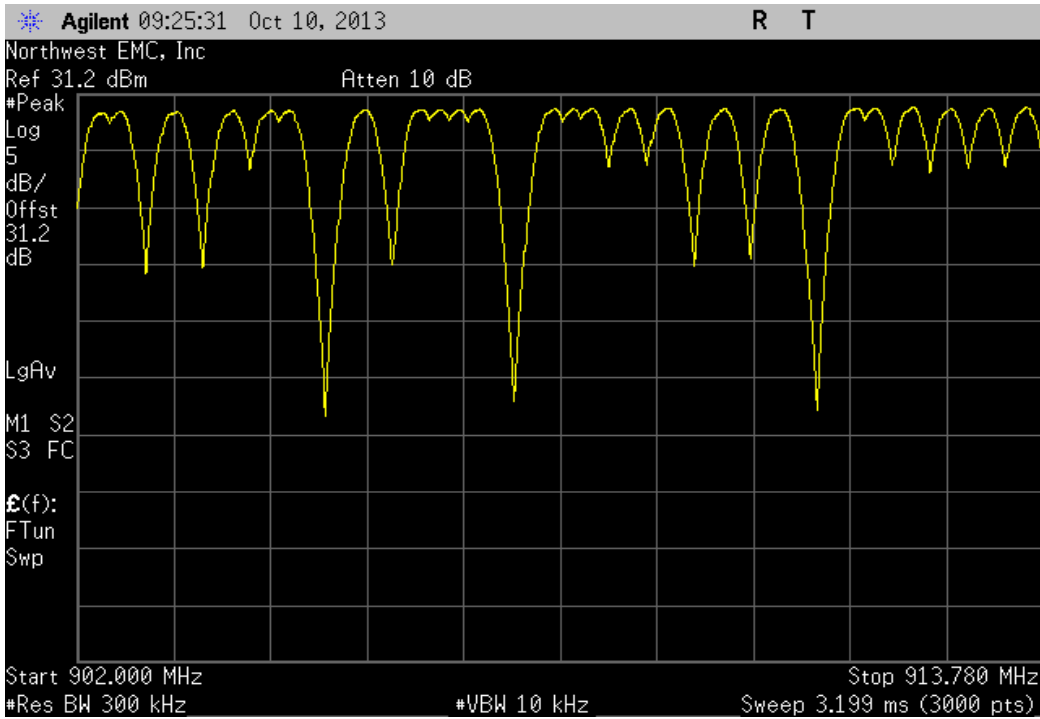
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels , 913.780 MHz - 928.000 MHz

Value	Limit	Result
112	≥ 50	Pass



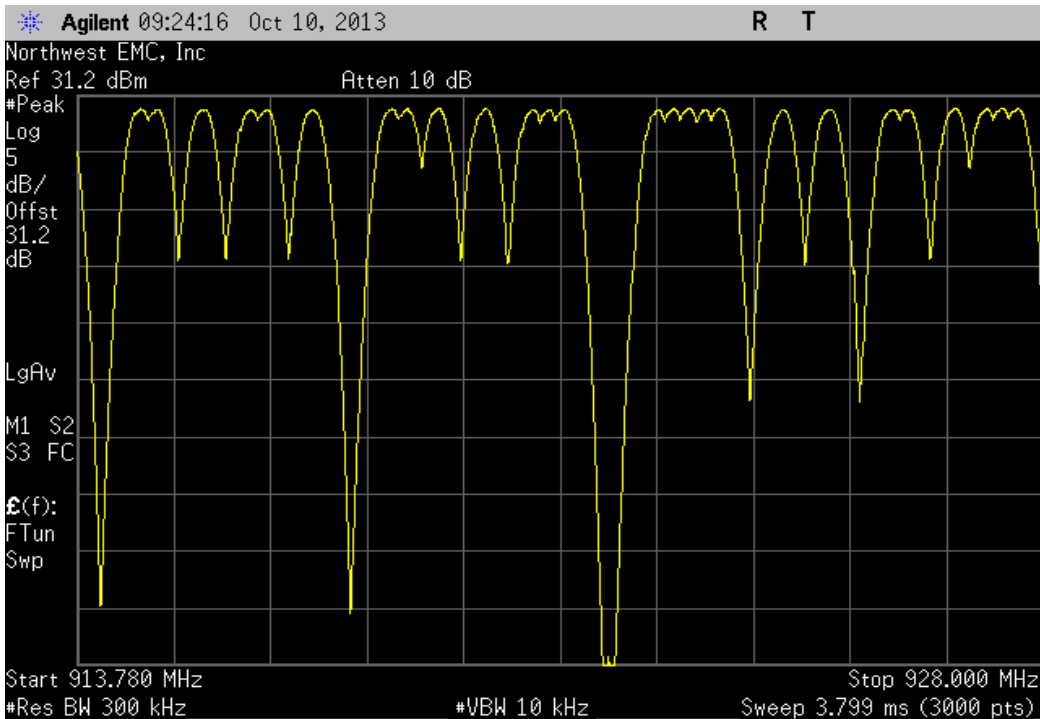
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels , 902.000 MHz - 913.780 MHz

Value	Limit	Result
N/A	≥ 50	N/A



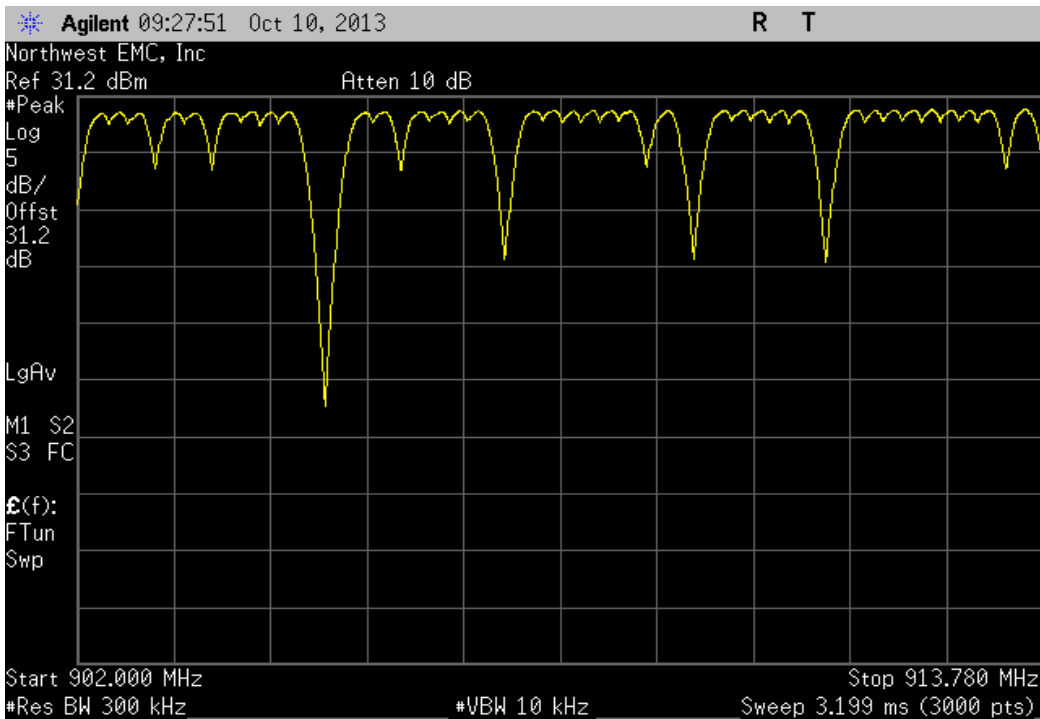
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels , 913.780 MHz - 928.000 MHz

Value	Limit	Result
50	≥ 50	Pass



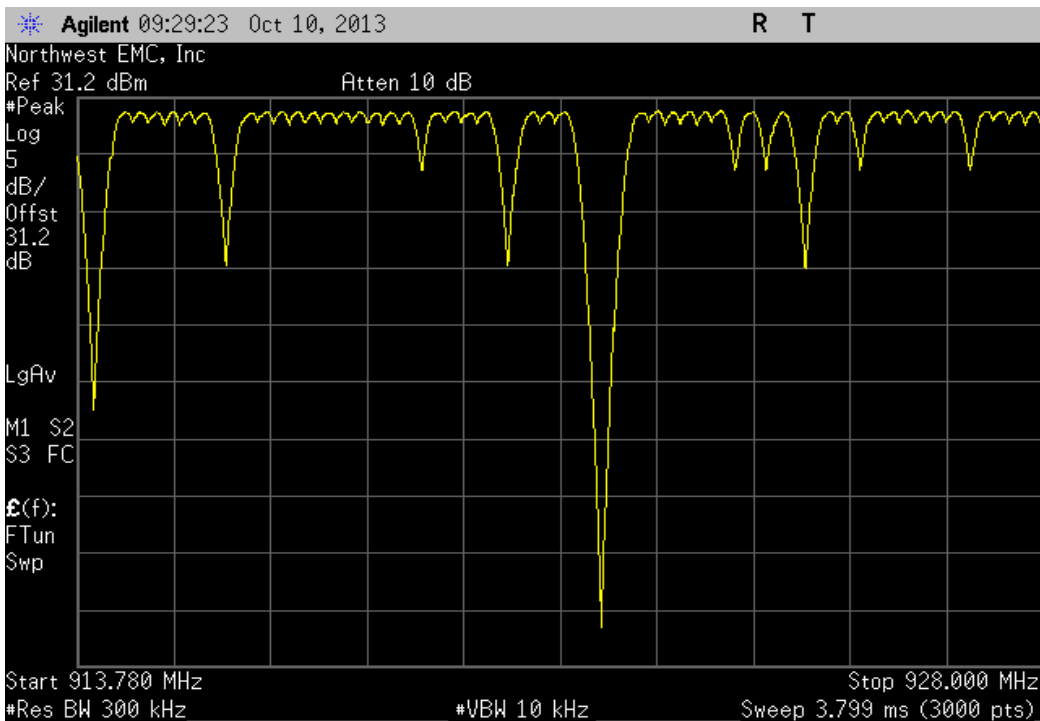
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels , 902.000 MHz - 913.780 MHz

Value	Limit	Result
N/A	≥ 50	N/A



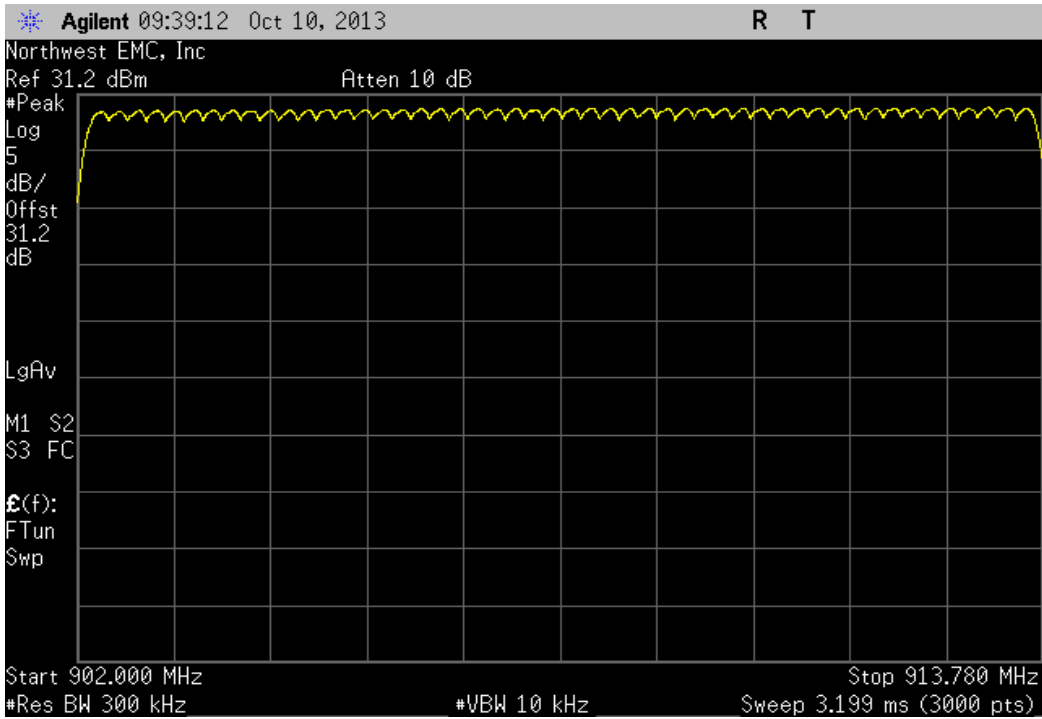
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels , 913.780 MHz - 928.000 MHz

Value	Limit	Result
80	≥ 50	Pass



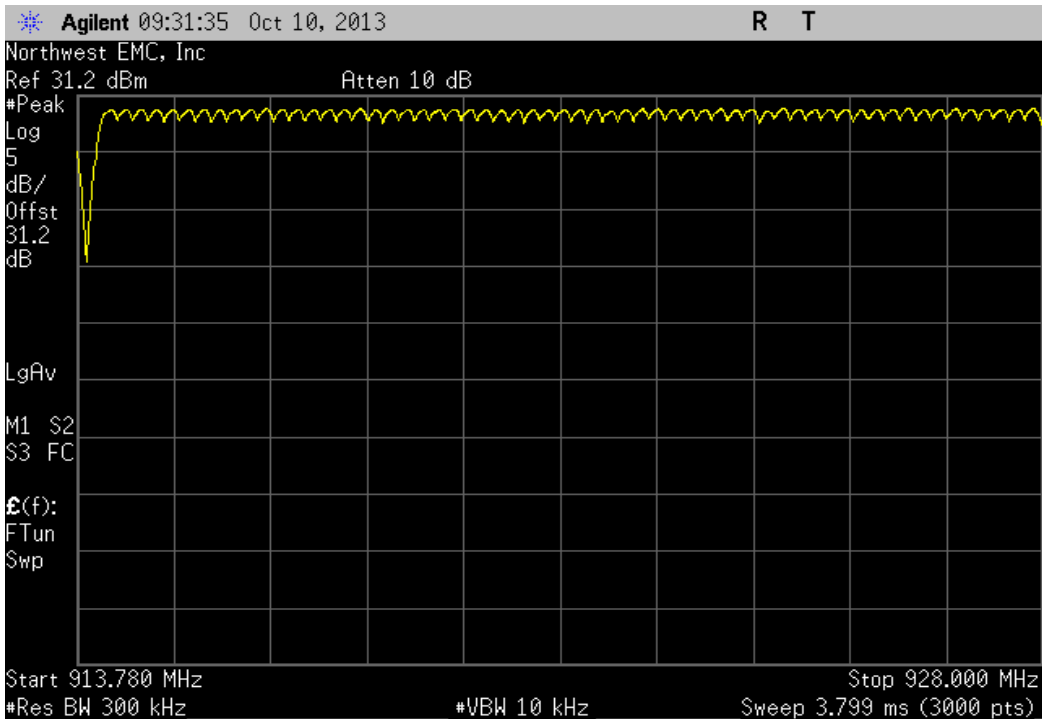
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels , 902.000 MHz - 913.780 MHz

Value	Limit	Result
N/A	≥ 50	N/A



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels , 913.780 MHz - 928.000 MHz

Value	Limit	Result
112	≥ 50	Pass



Dwell Time

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
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Multimeter	Tektronix	DMM912	MMH	2/5/2013	24
Attenuator, 'Precision N'	S.M. Electronics	SA18N-06/SM4032	REE	12/11/2012	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
Power Meter	Gigatronix	8651A	SPM	1/9/2012	24
Power Sensor	Gigatronix	80701A	SPL	7/8/2011	36
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/30/2013	12
40GHz DC Block	Miteq	DCB4000	AMD	5/16/2013	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	24

TEST DESCRIPTION

The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer.

The hopping function of the EUT was enabled. The number of hopping channels provided a range from 50 to 112. The EUT was hopping on 50, 80 and 112 channels as seen in the datasheets.

The dwell time limit is 0.4 Sec (400mS) in a 20 Sec period.

The calculation is based on taking a measurement of the pulse on time for each data rate and hopping set, then taking captures of 5 pulses. The sweep time required to capture the five pulses is divided into the 20 Sec required period and a scaling factor determined. The final calculation is:

Pulse Width * Average Number of Pulses * Scale Factor



Dwell Time

EUT: FGRM	Work Order: FREW0011
Serial Number: 956-8447	Date: 10/10/13
Customer: FreeWave Technologies, Inc.	Temperature: 22.1°C
Attendees: None	Humidity: 40%
Project: None	Barometric Pres.: 1015.9
Tested by: Brandon Hobbs	Power: 12 VDC
	Job Site: EV06
TEST SPECIFICATIONS	
FCC 15.247:2013	Test Method
	ANSI C63.10:2009

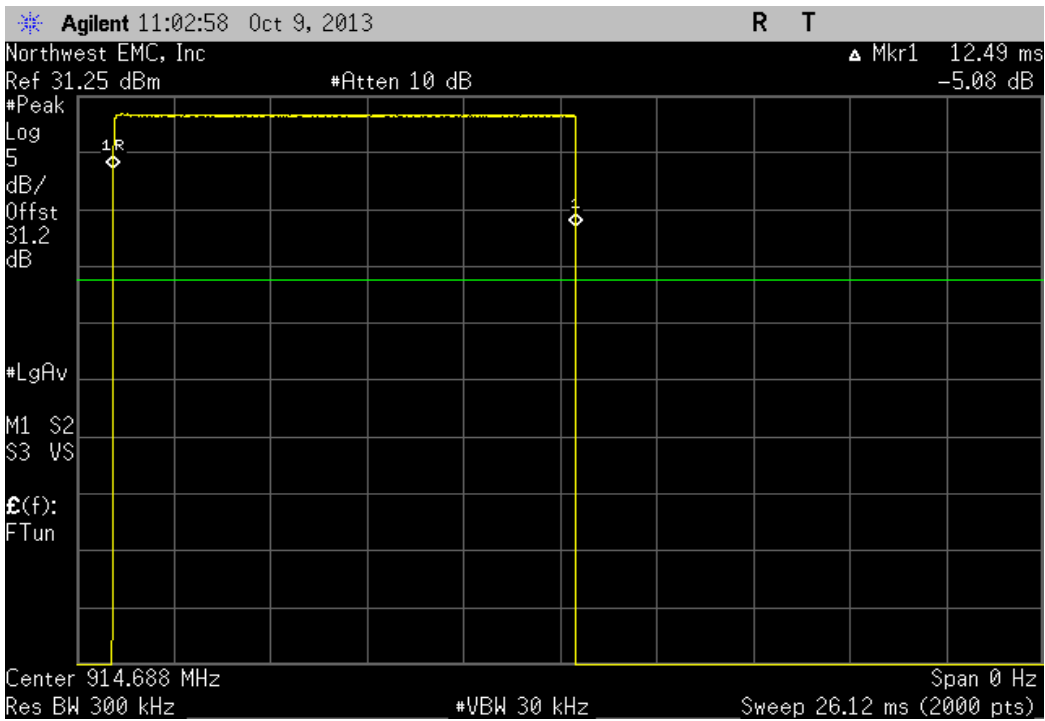
COMMENTS
An added 10 dB 5w attenuator was used while under test. All cable losses were accounted for prior to testing. Output power level at 10, Full Power.

DEVIATIONS FROM TEST STANDARD
None

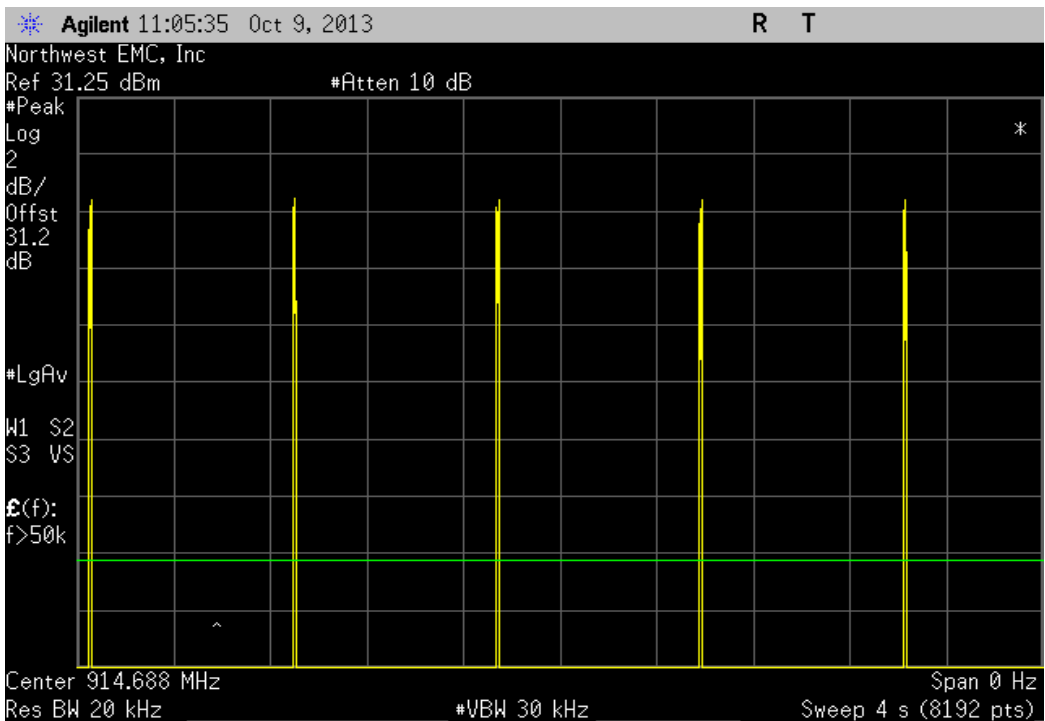
Configuration #	1	Signature
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			Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
GFSK									
115.2 kbps									
	Mid Channel, 914.6880 MHz	50 Hopping Channels	12.492	N/A	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	12.492	N/A	5	5	312.3	400	Pass
	Mid Channel, 914.6880 MHz	80 Hopping Channels	12.492	N/A	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	12.492	N/A	5	3.125	195.2	400	Pass
	Mid Channel, 914.6880 MHz	112 Hopping Channels	12.492	N/A	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	12.492	N/A	5	2.23	139.3	400	Pass
153.6 kbps									
	Mid Channel, 914.6880 MHz	50 Hopping Channels	12.622	N/A	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	50 Hopping Channels	12.622	N/A	5	5	315.55	400	Pass
	Mid Channel, 914.6880 MHz	80 Hopping Channels	12.622	N/A	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	80 Hopping Channels	12.622	N/A	5	3.125	197.2	400	Pass
	Mid Channel, 914.6880 MHz	112 Hopping Channels	12.622	N/A	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	N/A	5	N/A	N/A	N/A	N/A	N/A
	Mid Channel, 914.6880 MHz	112 Hopping Channels	12.622	N/A	5	2.23	140.74	400	Pass

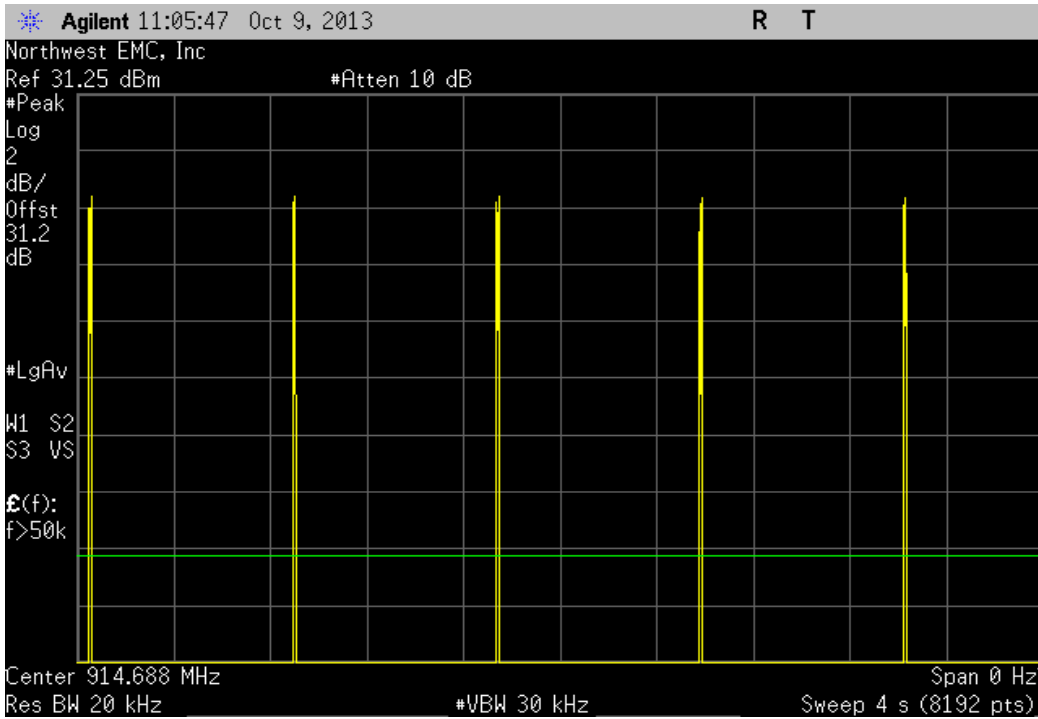
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.492	N/A	N/A	N/A	N/A	N/A	N/A



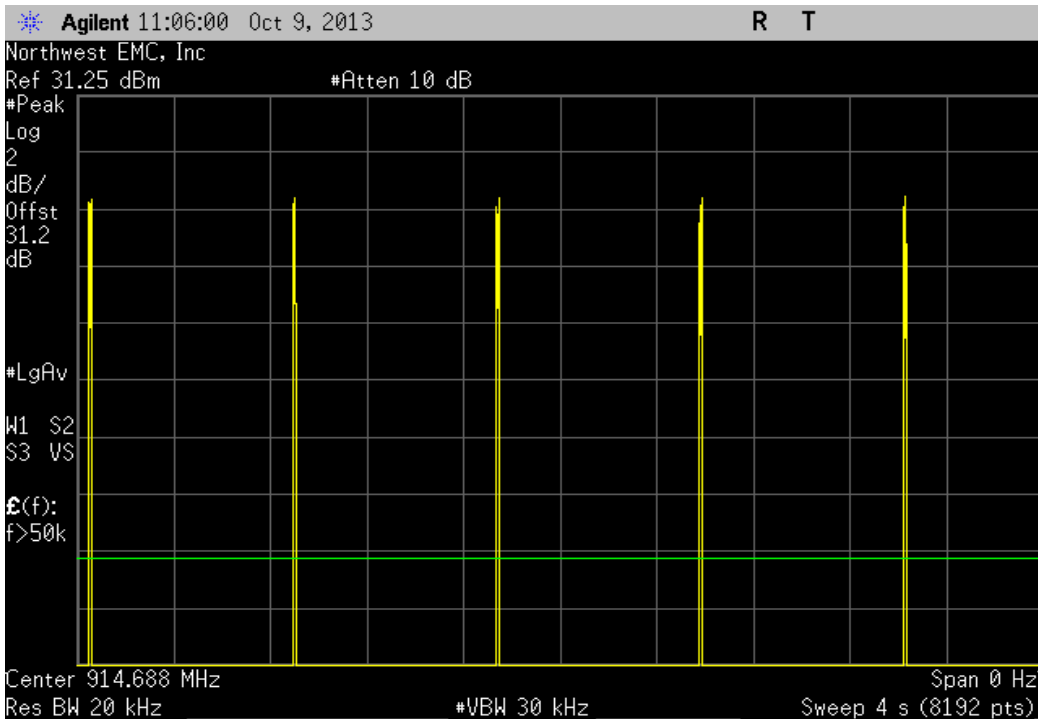
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



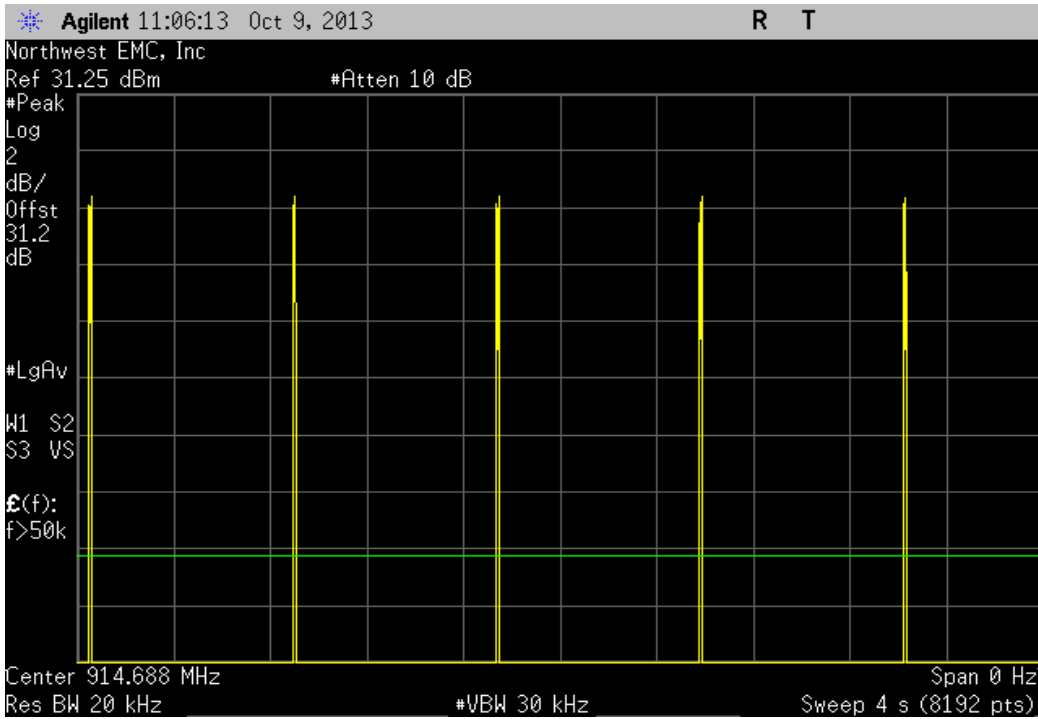
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A

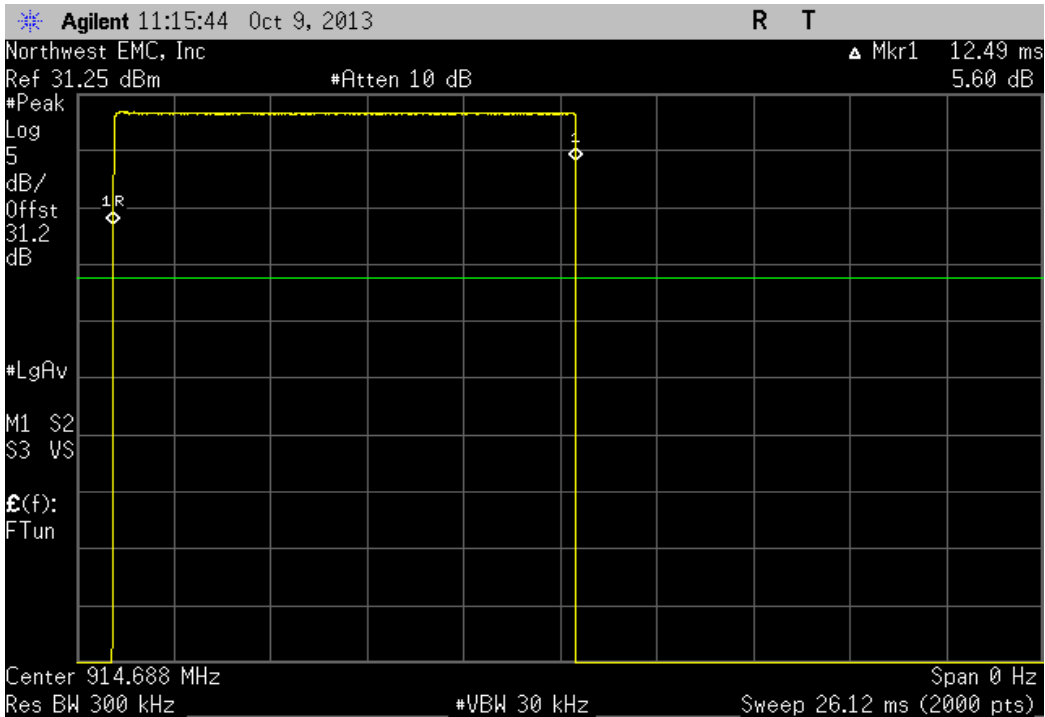


GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.492	N/A	5	5	312.3	400	Pass

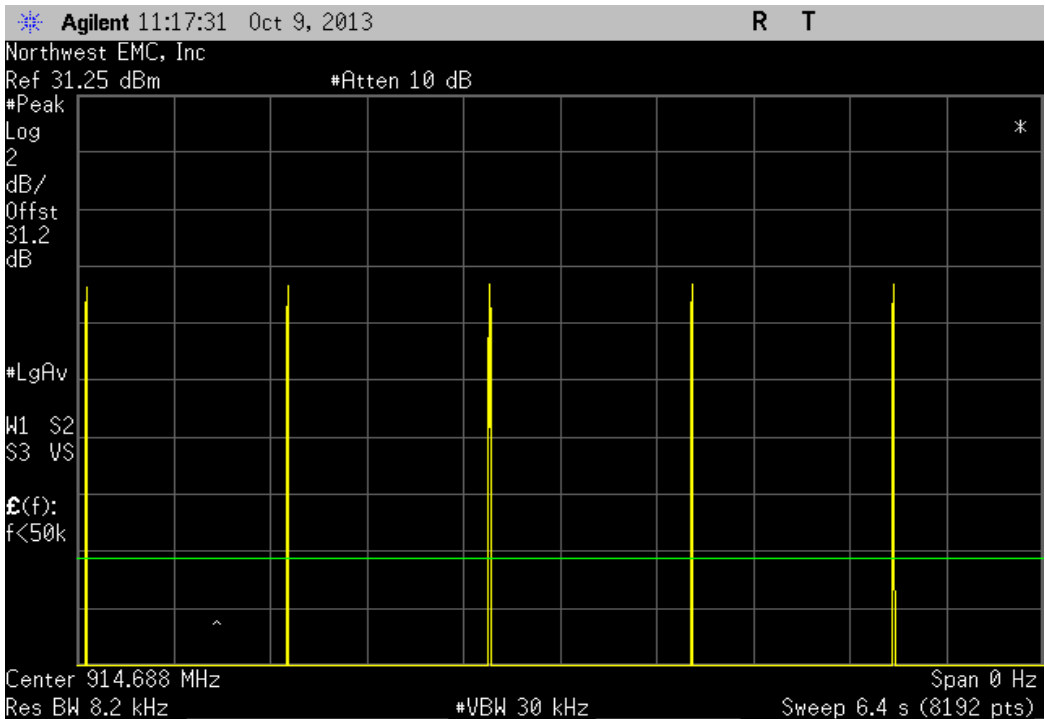
Calculation Only

No Screen Capture Required

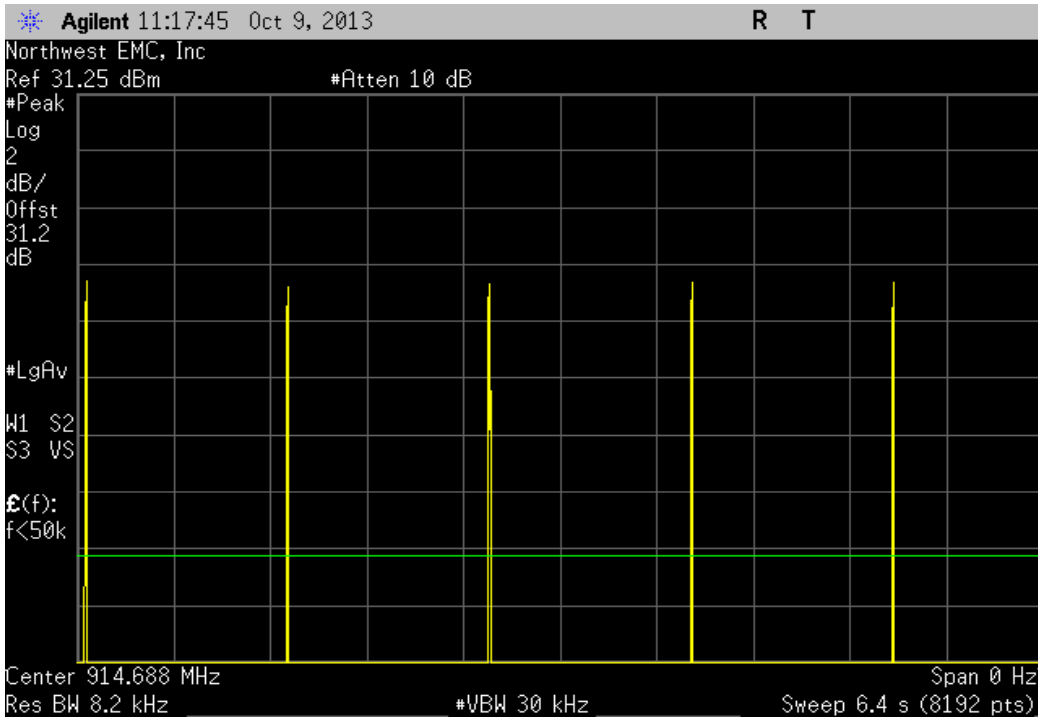
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.492	N/A	N/A	N/A	N/A	N/A	N/A



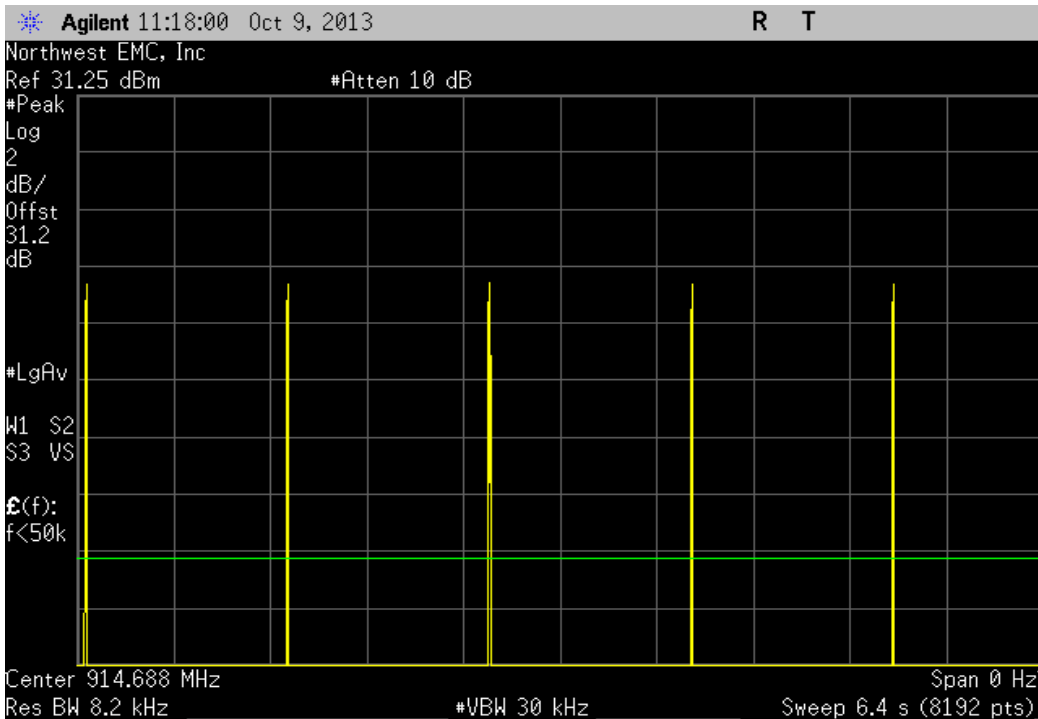
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



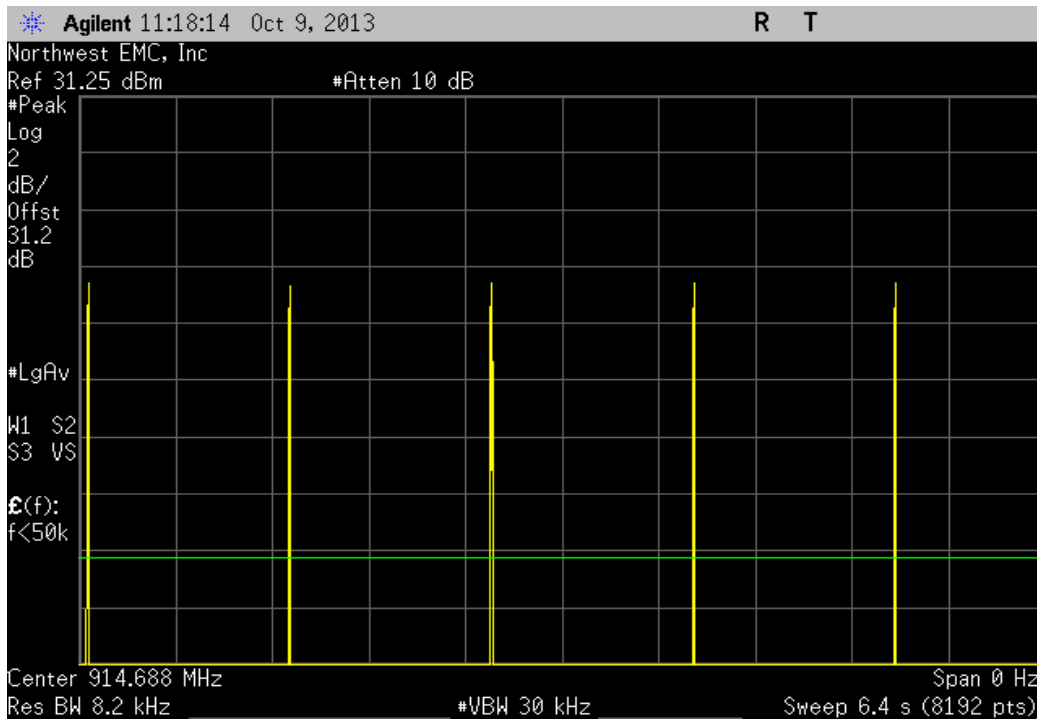
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A

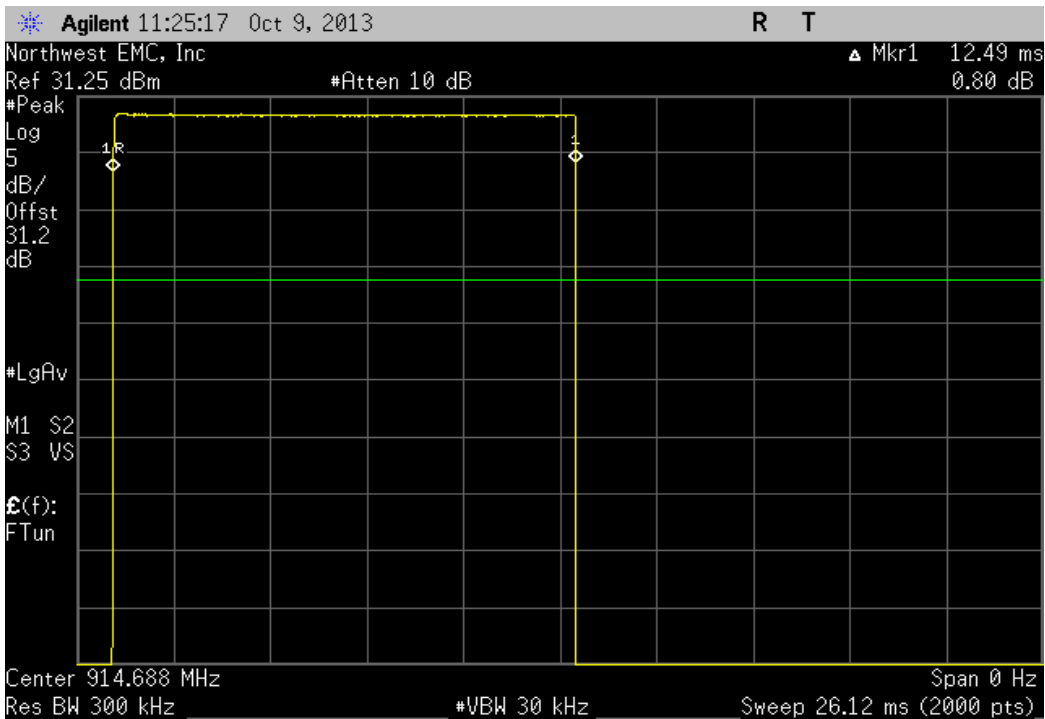


GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.492	N/A	5	3.125	195.2	400	Pass

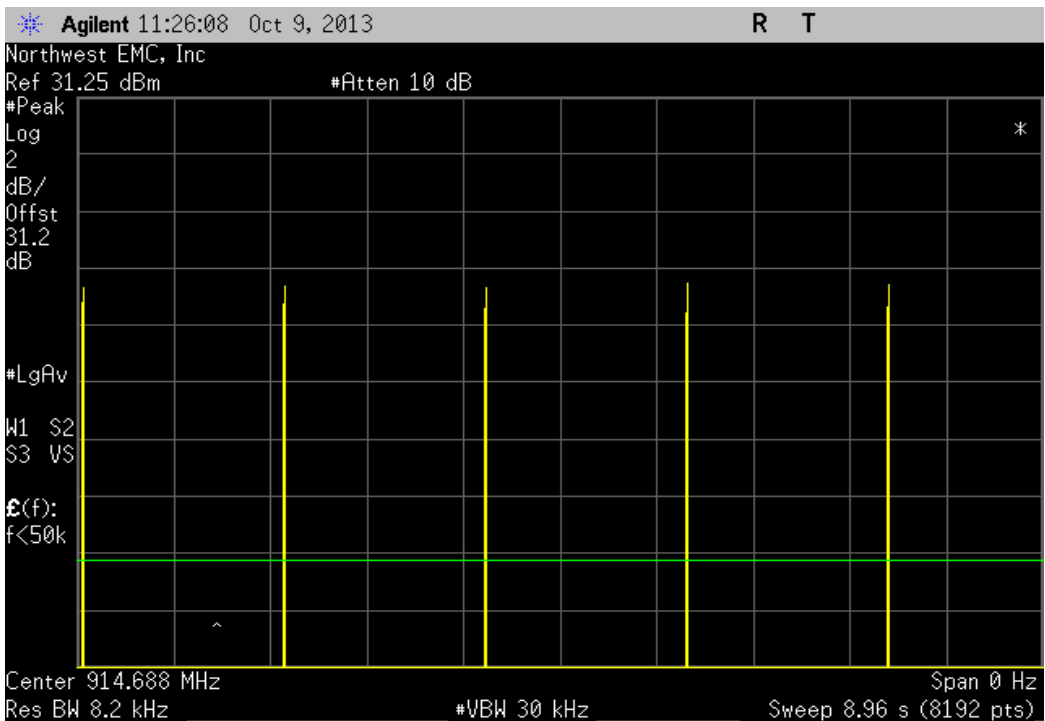
Calculation Only

No Screen Capture Required

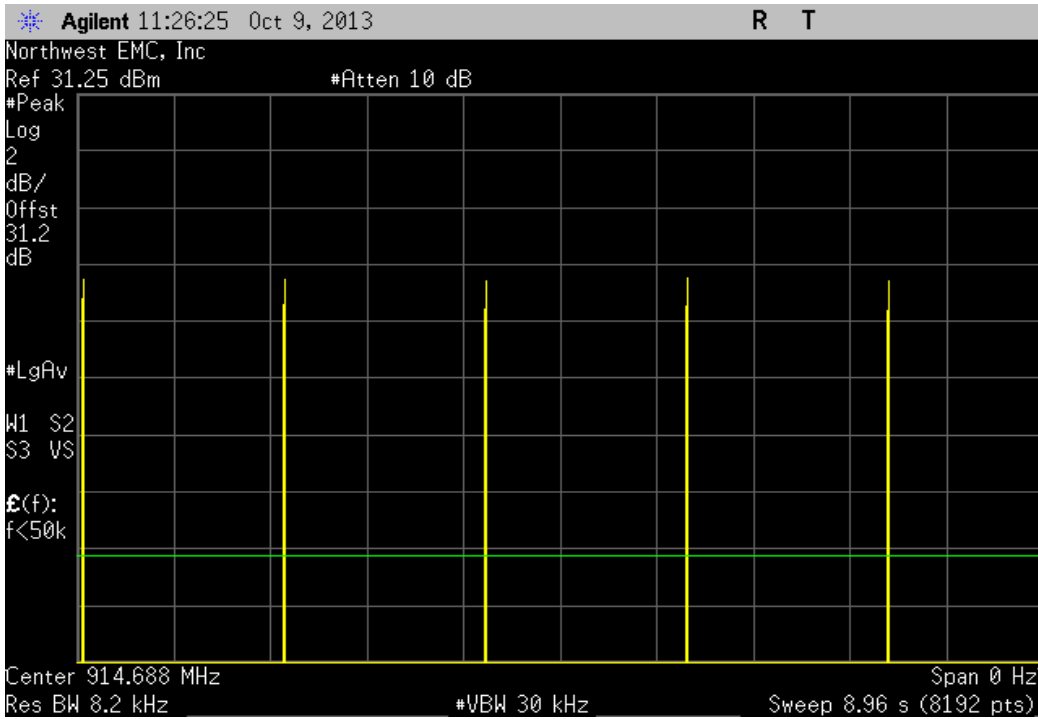
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.492	N/A	N/A	N/A	N/A	N/A	N/A



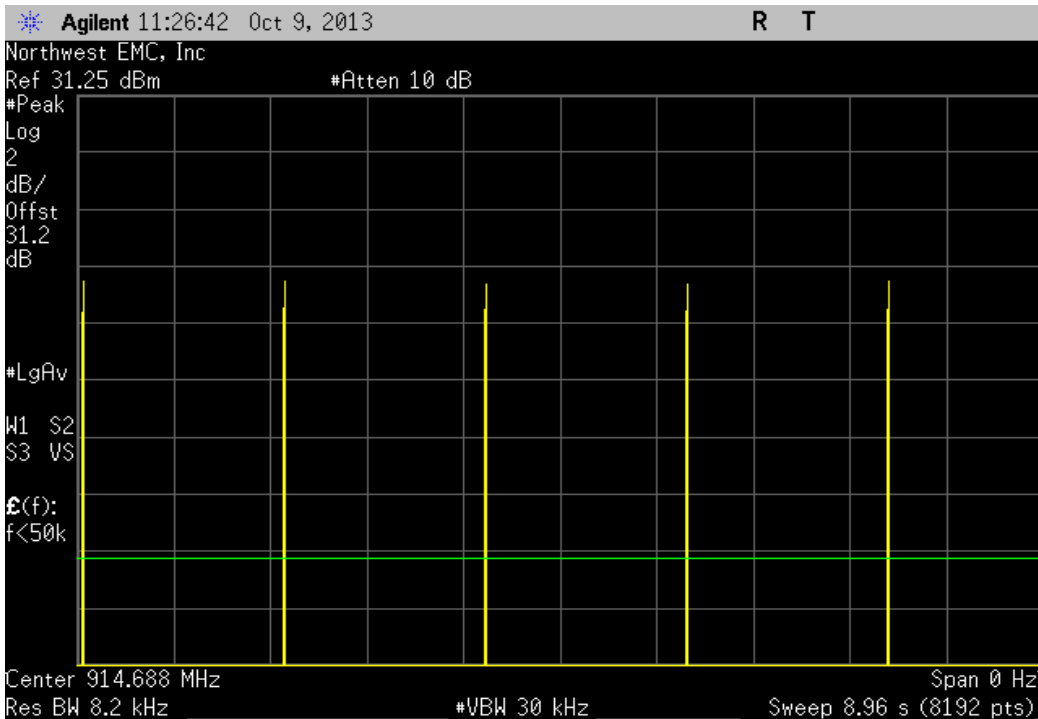
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



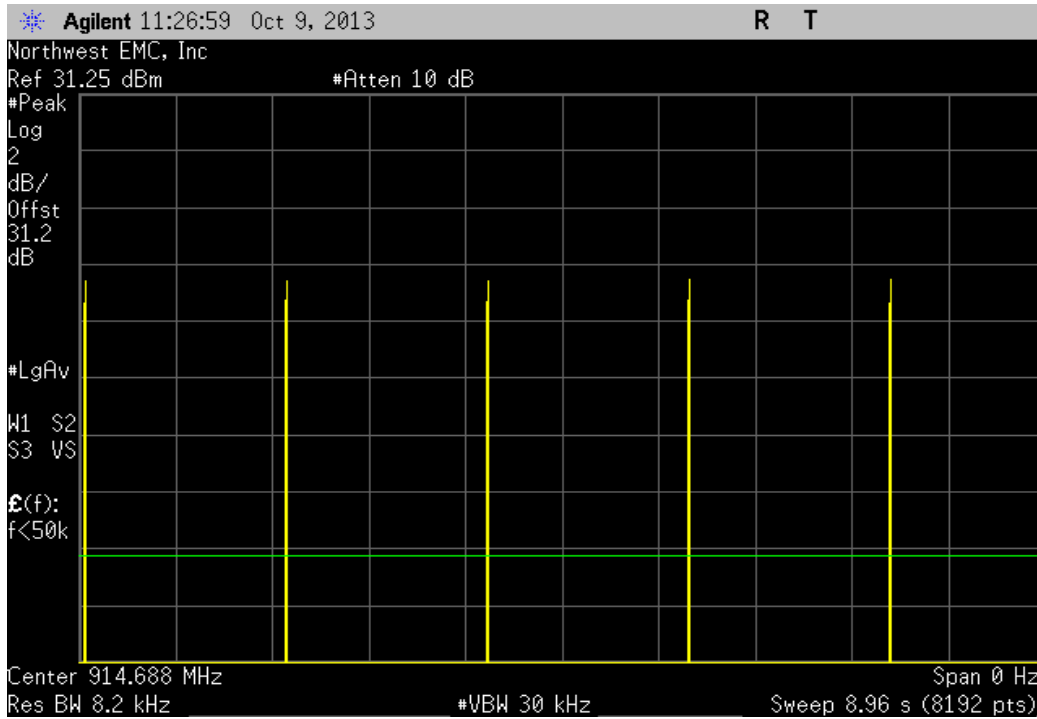
GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A

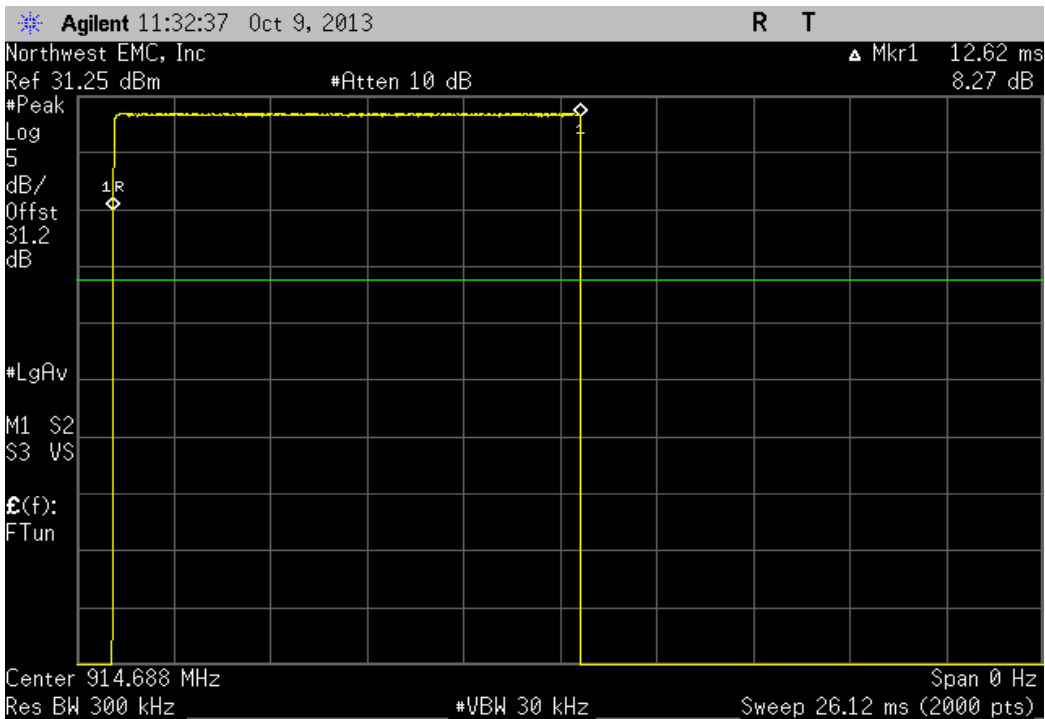


GFSK, 115.2 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.492	N/A	5	2.23	139.3	400	Pass

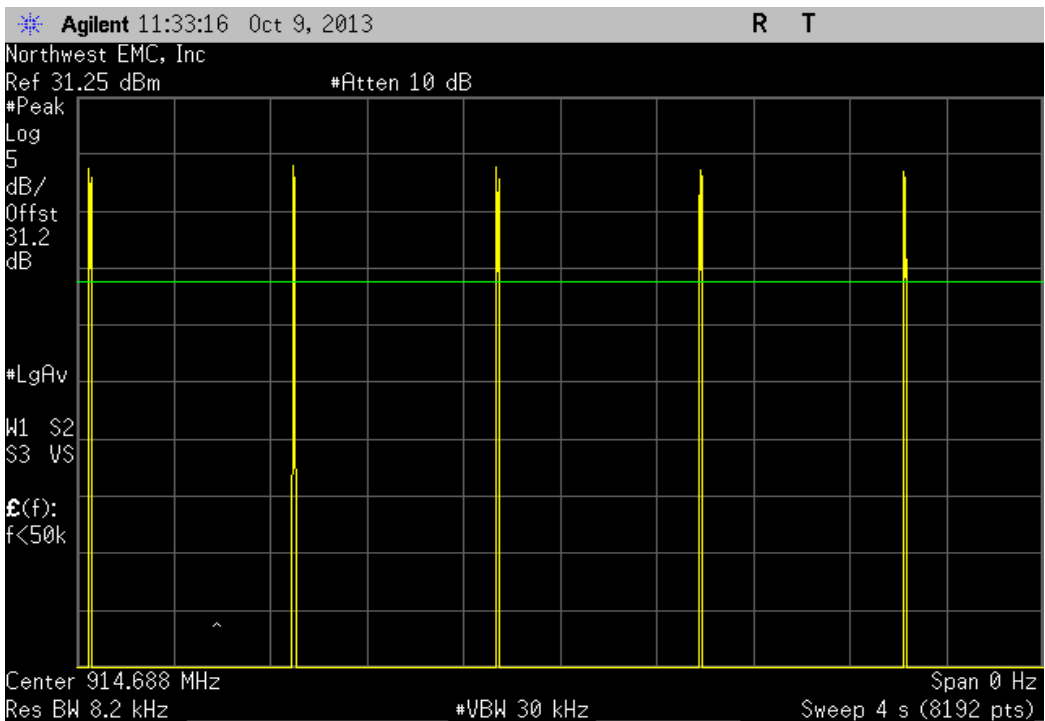
Calculation Only

No Screen Capture Required

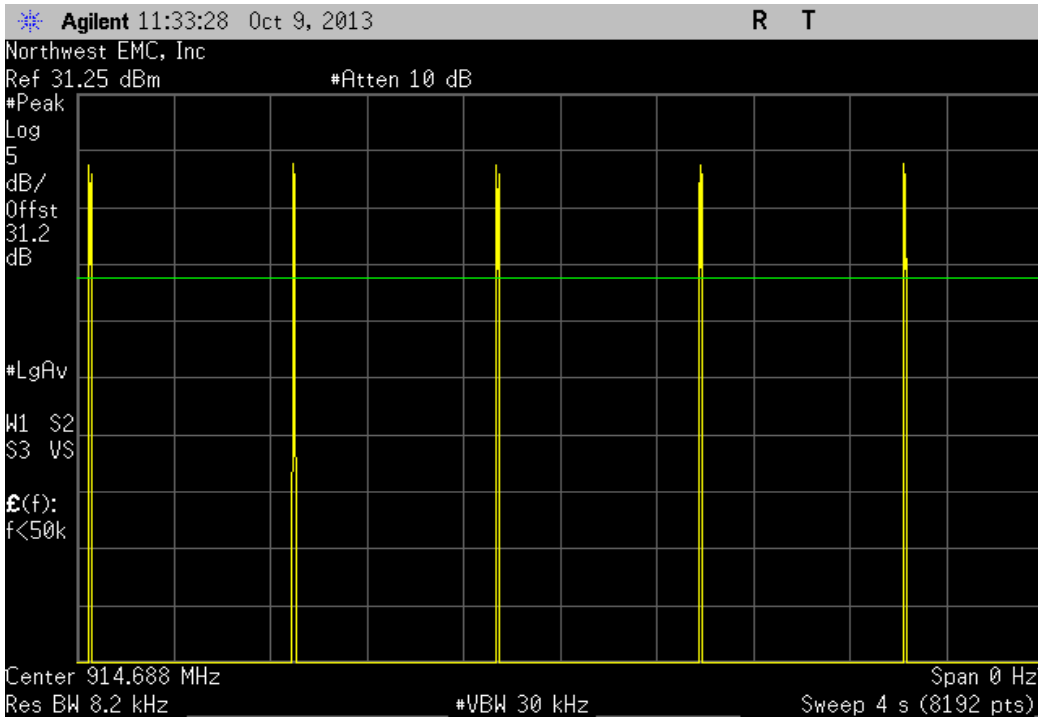
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.622	N/A	N/A	N/A	N/A	N/A	N/A



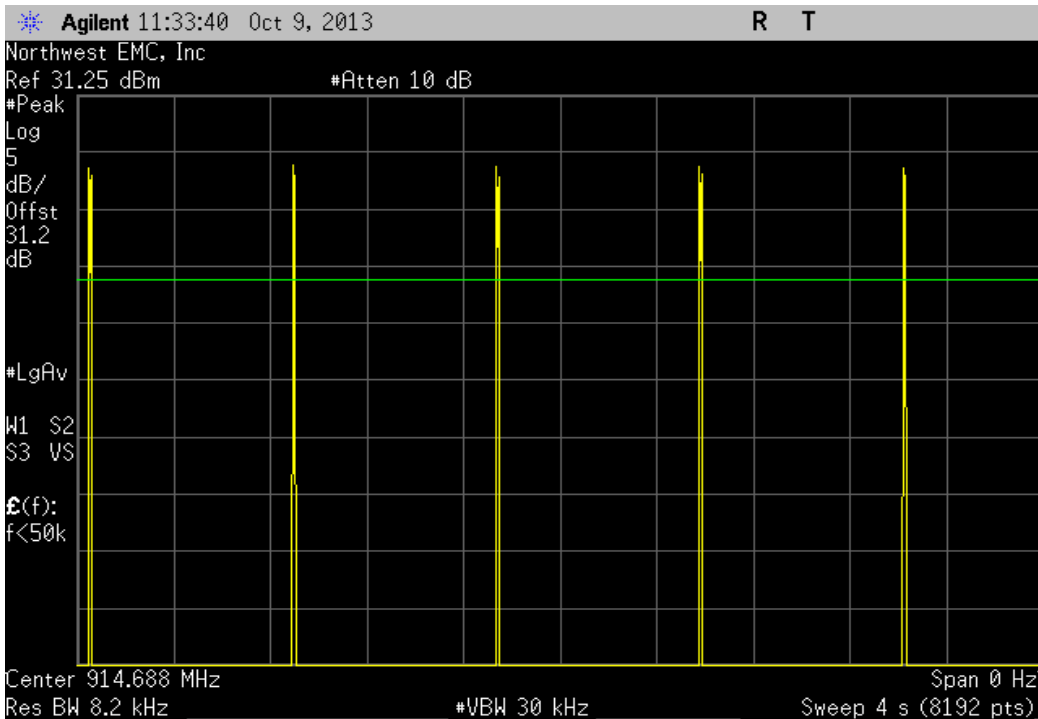
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



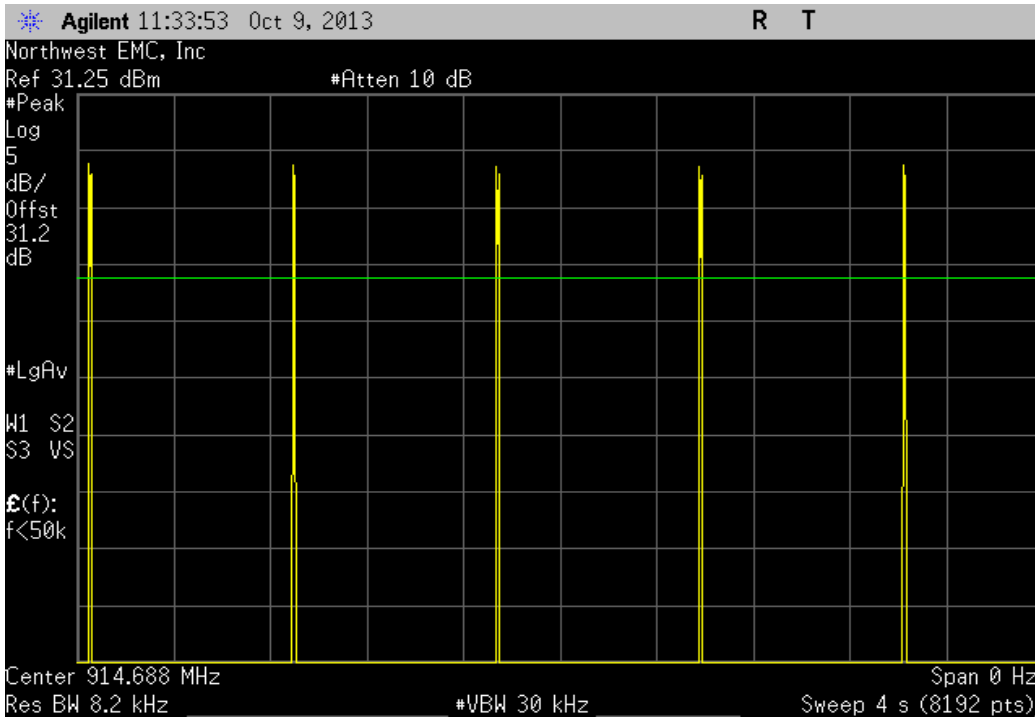
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A

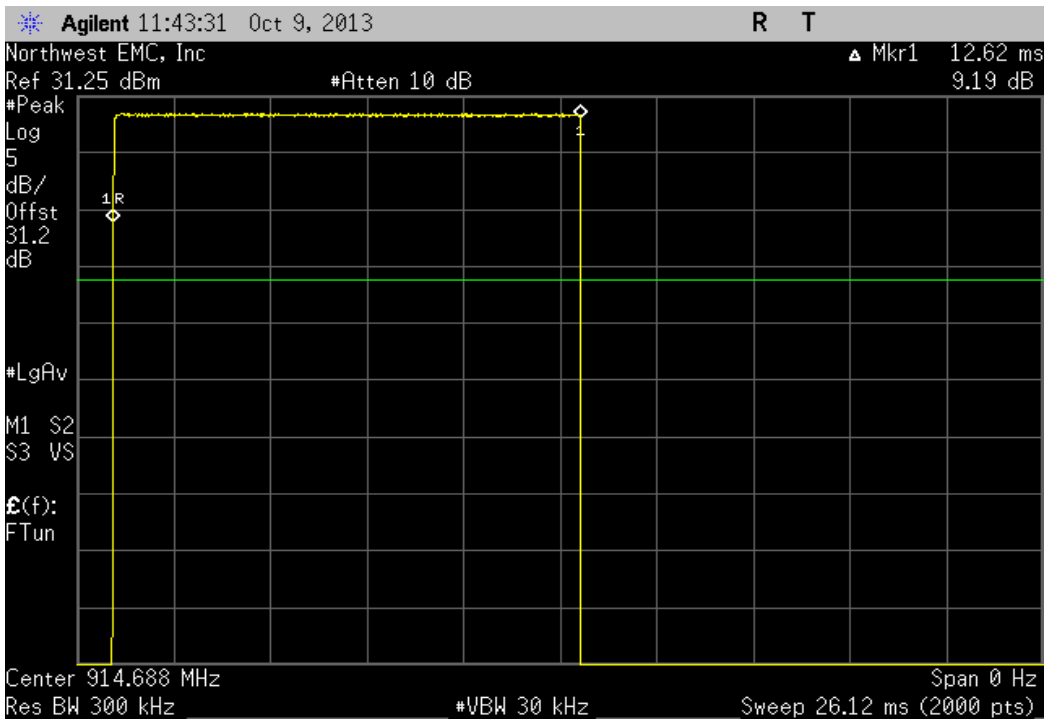


GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 50 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.622	N/A	5	5	315.55	400	Pass

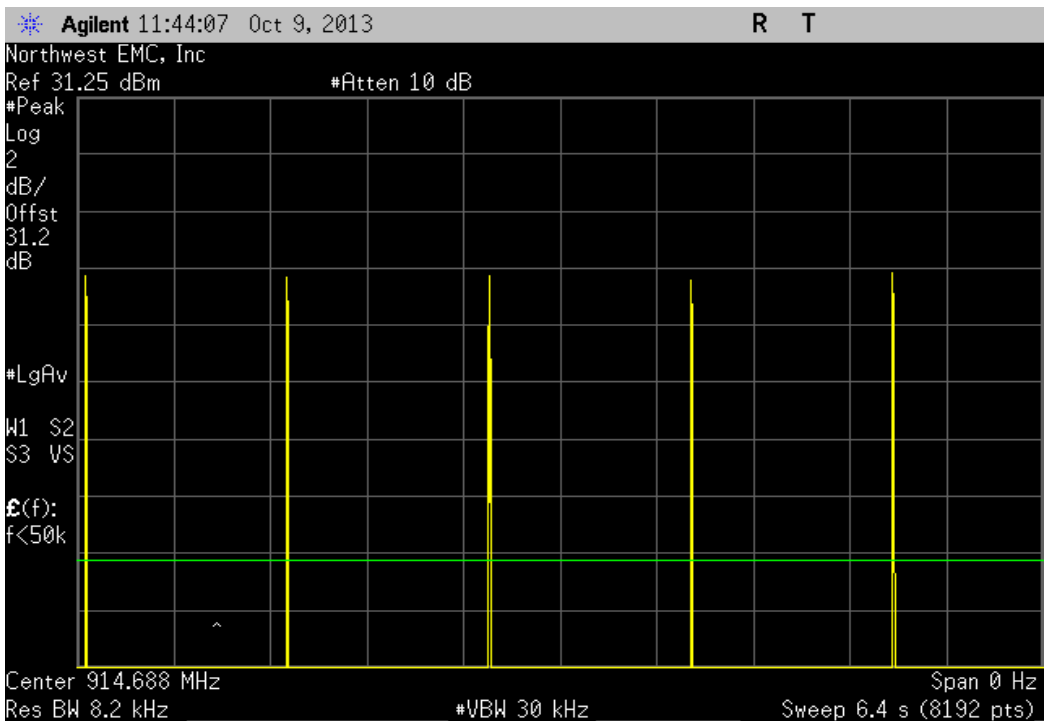
Calculation Only

No Screen Capture Required

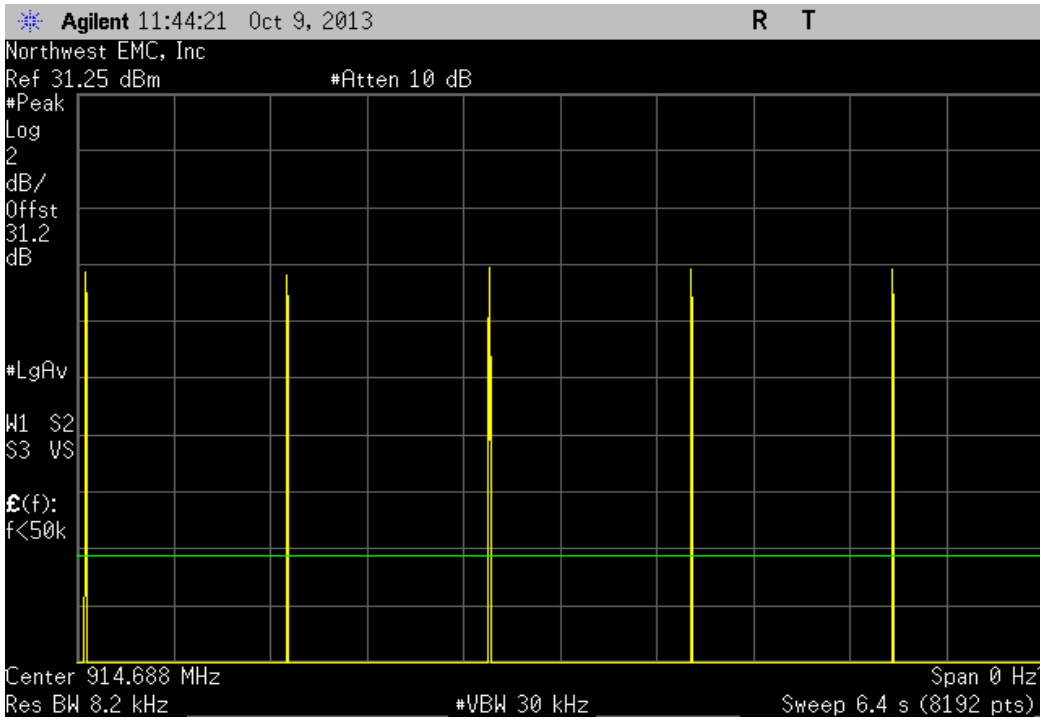
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.622	N/A	N/A	N/A	N/A	N/A	N/A



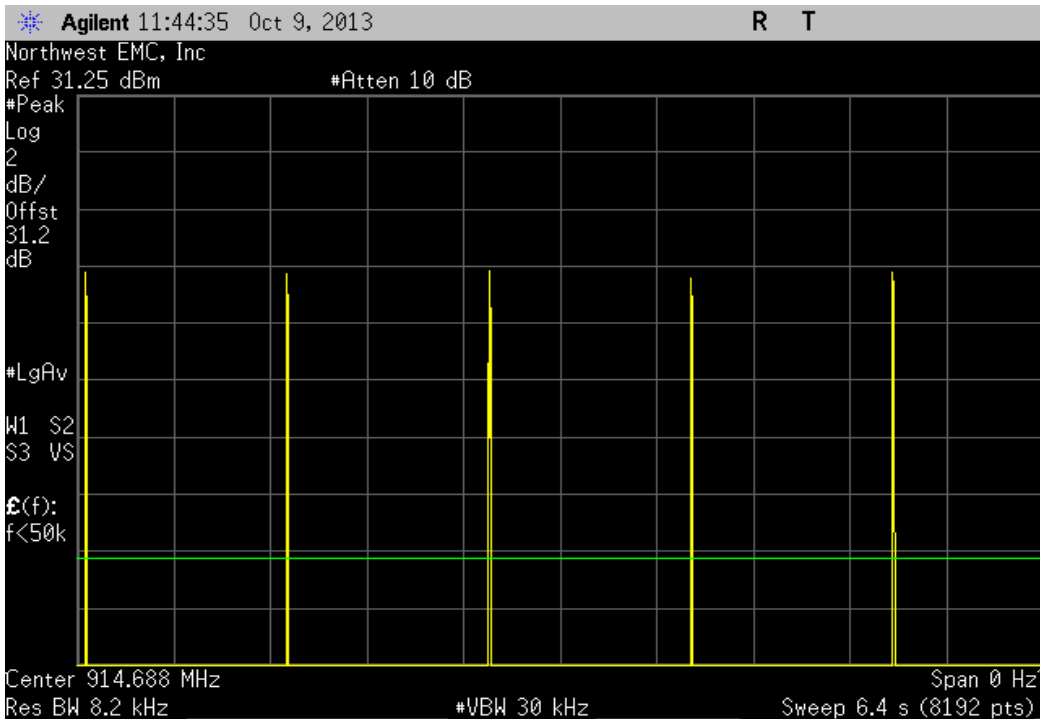
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



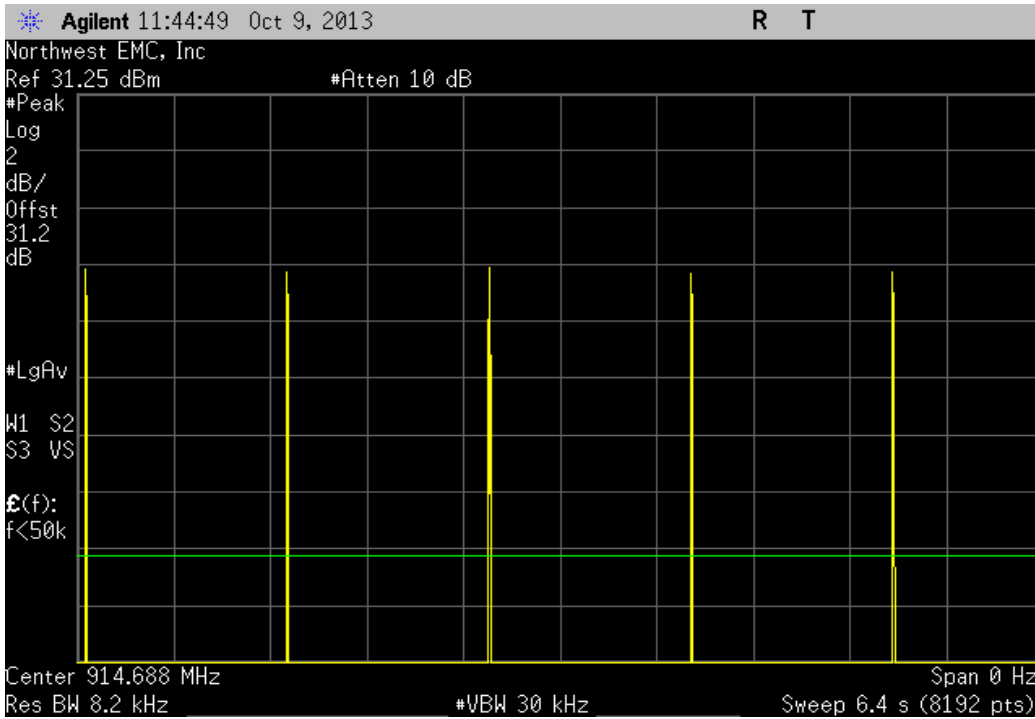
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A

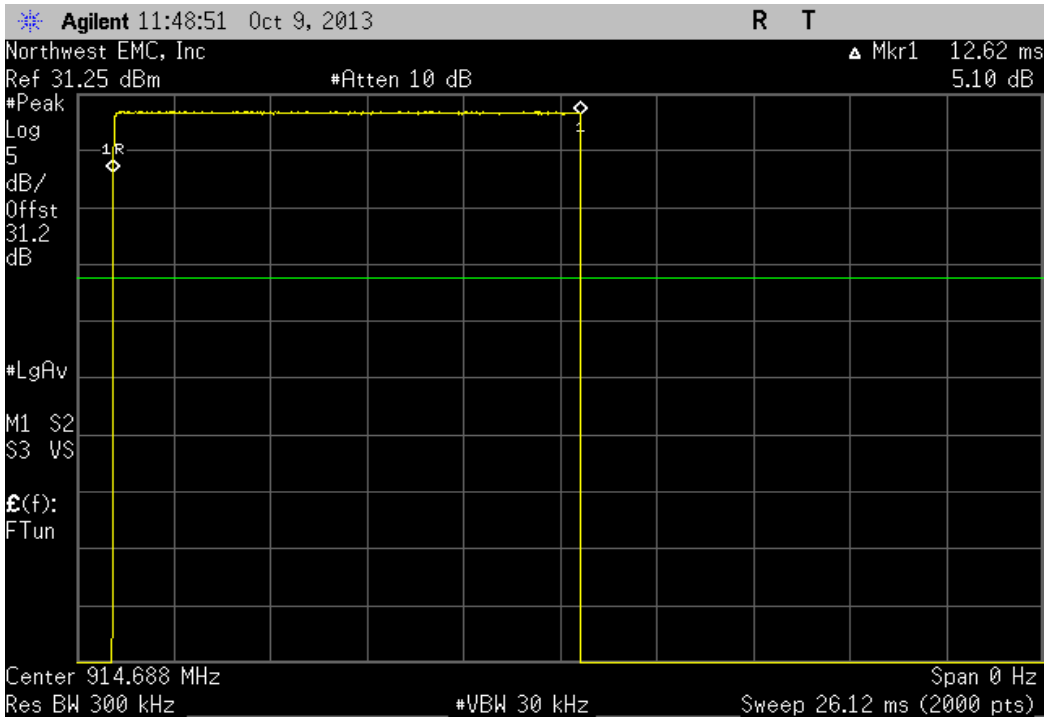


GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 80 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.622	N/A	5	3.125	197.2	400	Pass

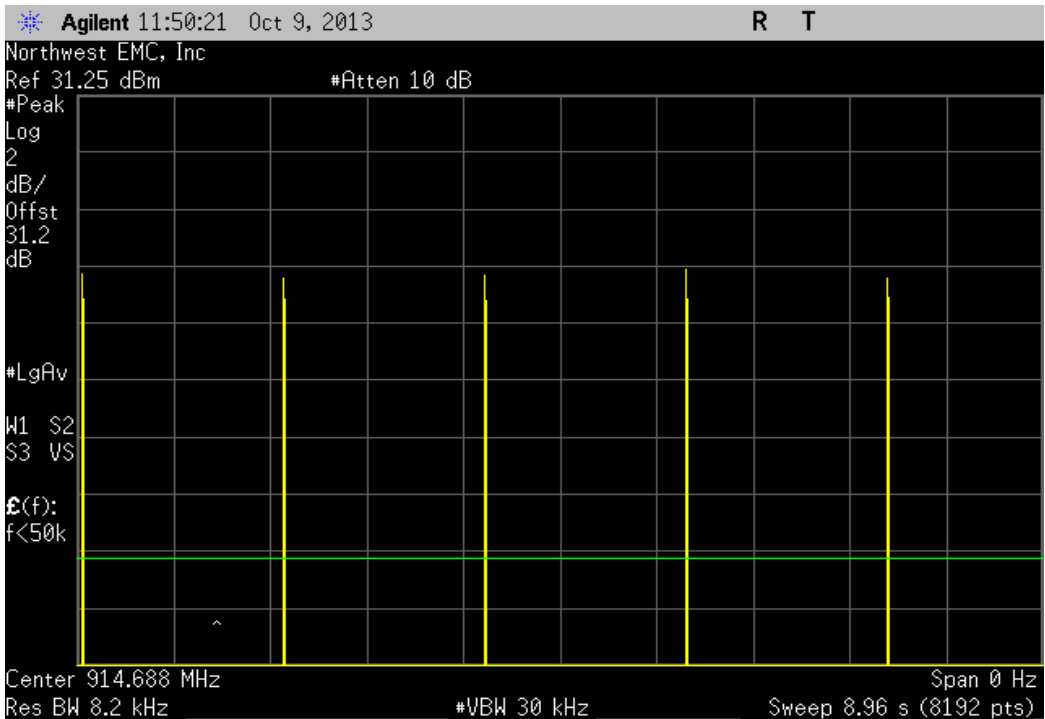
Calculation Only

No Screen Capture Required

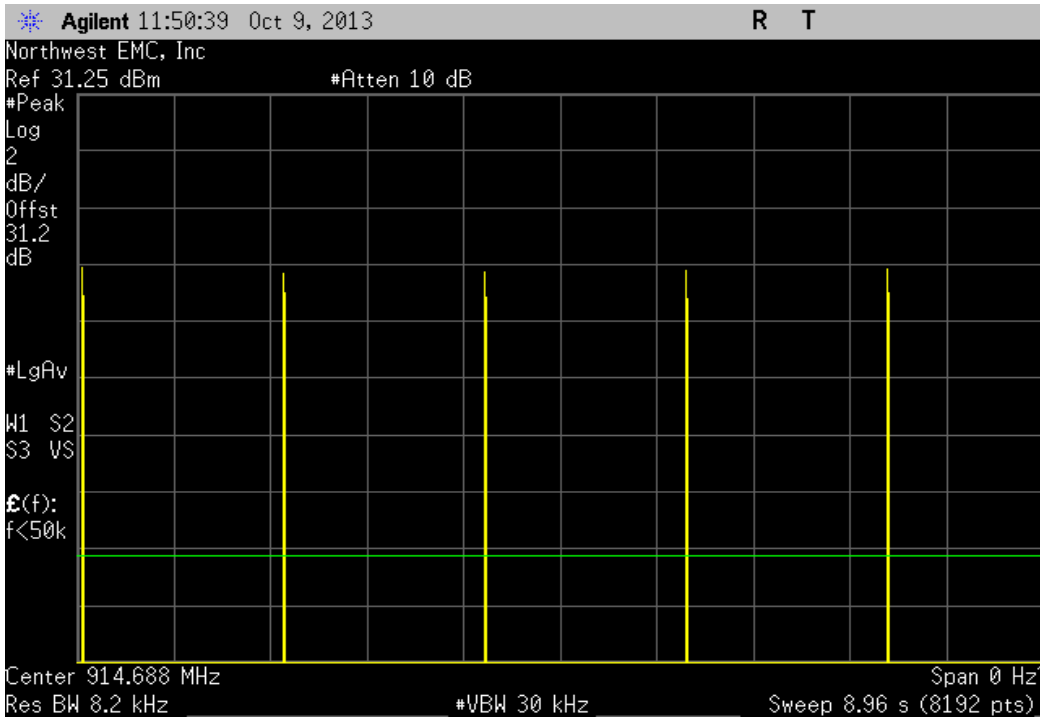
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.622	N/A	N/A	N/A	N/A	N/A	N/A



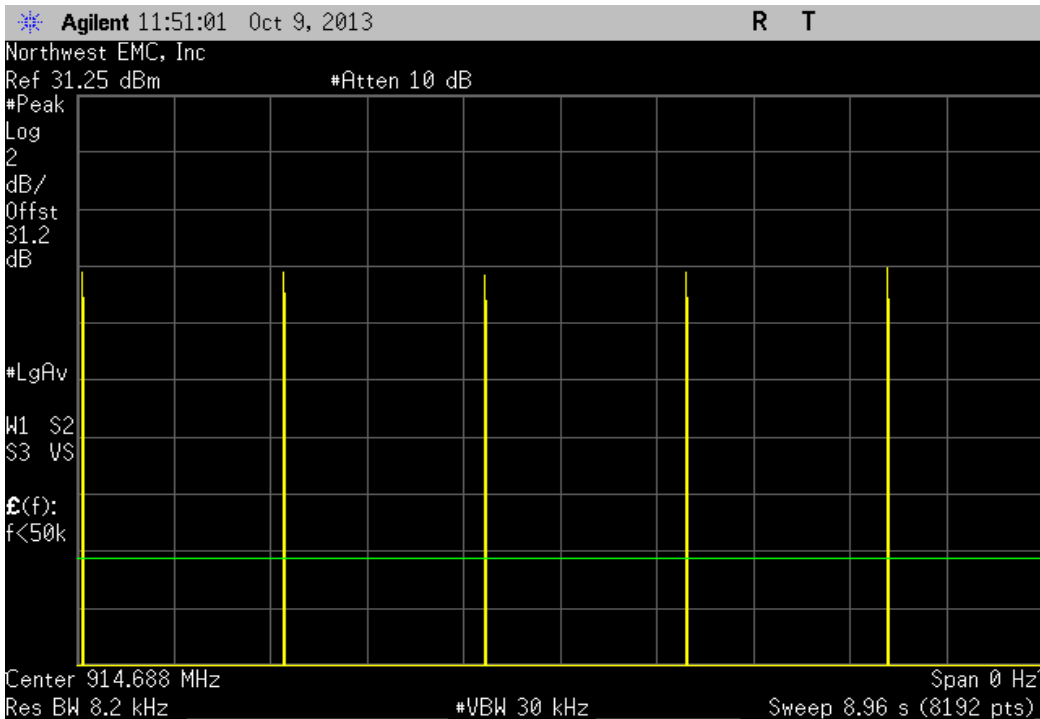
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



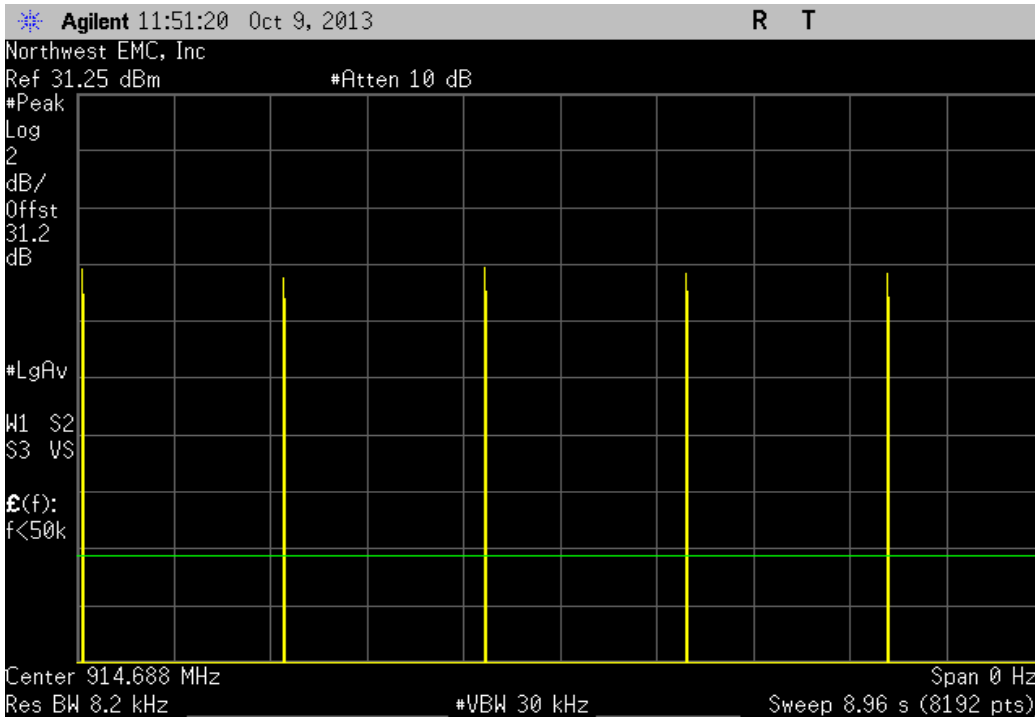
GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
N/A	5	N/A	N/A	N/A	N/A	N/A



GFSK, 153.6 kbps, Mid Channel, 914.6880 MHz 112 Hopping Channels						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 S	Limit (ms)	Result
12.622	N/A	5	2.23	140.74	400	Pass

Calculation Only

No Screen Capture Required

Band Edge Compliance-Hopping Mode

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
Multimeter	Tektronix	DMM912	MMH	2/5/2013	24
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Attenuator, 'Precision N'	S.M. Electronics	SA18N-06/SM4032	REE	12/11/2012	12
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0
Power Meter	Gigatronics	8651A	SPM	1/9/2012	24
Power Sensor	Gigatronics	80701A	SPL	7/8/2011	36
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	7/30/2013	12
40GHz DC Block	Miteq	DCB4000	AMD	5/16/2013	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	24

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to its normal pseudo-random hopping sequence. 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 data rate(s) listed in the datasheet. The measurements were taken per ANSI C63.10.2009 section 7.7.9.

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW \geq 1 % of spectrum analyzer display span

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

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



Band Edge Compliance- Hopping Mode

XMit 2013.08.15
PsaTx 2013.07.11

EUT: FGRM	Work Order: FREW0011
Serial Number: 956-8447	Date: 10/10/13
Customer: FreeWave Technologies, Inc.	Temperature: 22.1°C
Attendees: None	Humidity: 40%
Project: None	Barometric Pres.: 1015.9
Tested by: Brandon Hobbs	Power: 12 VDC
	Job Site: EV06
TEST SPECIFICATIONS	
FCC 15.247:2013	Test Method
	ANSI C63.10:2009

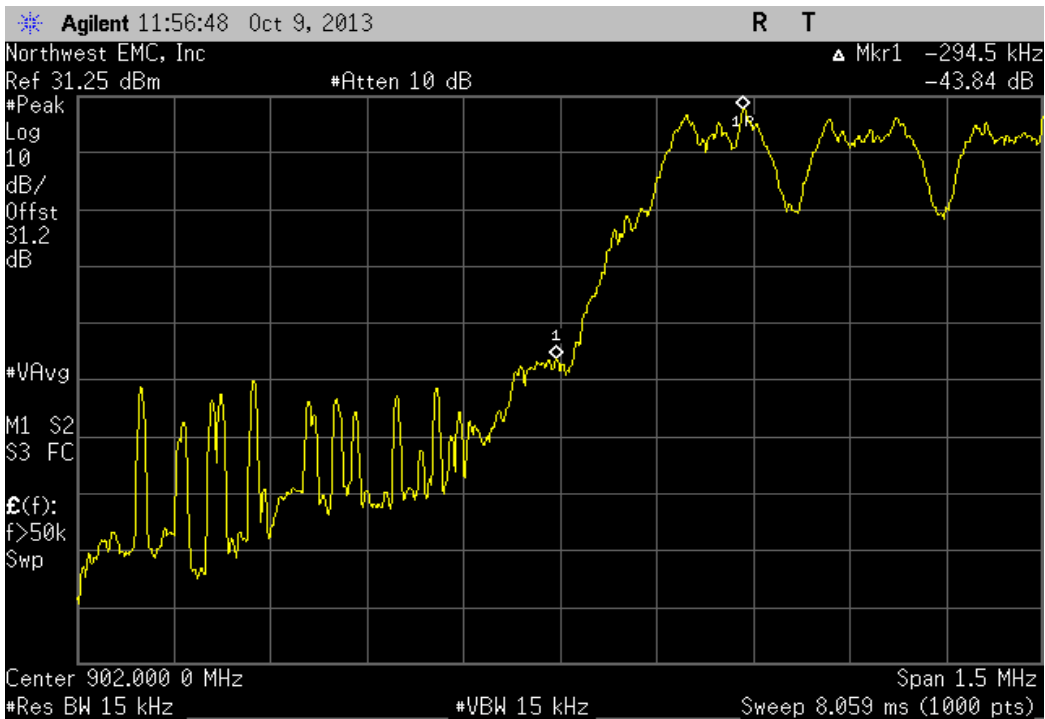
COMMENTS
An added 10 dB 5w attenuator was used while under test. All cable losses were accounted for prior to testing. Output power level at 10, Full Power.

DEVIATIONS FROM TEST STANDARD
None

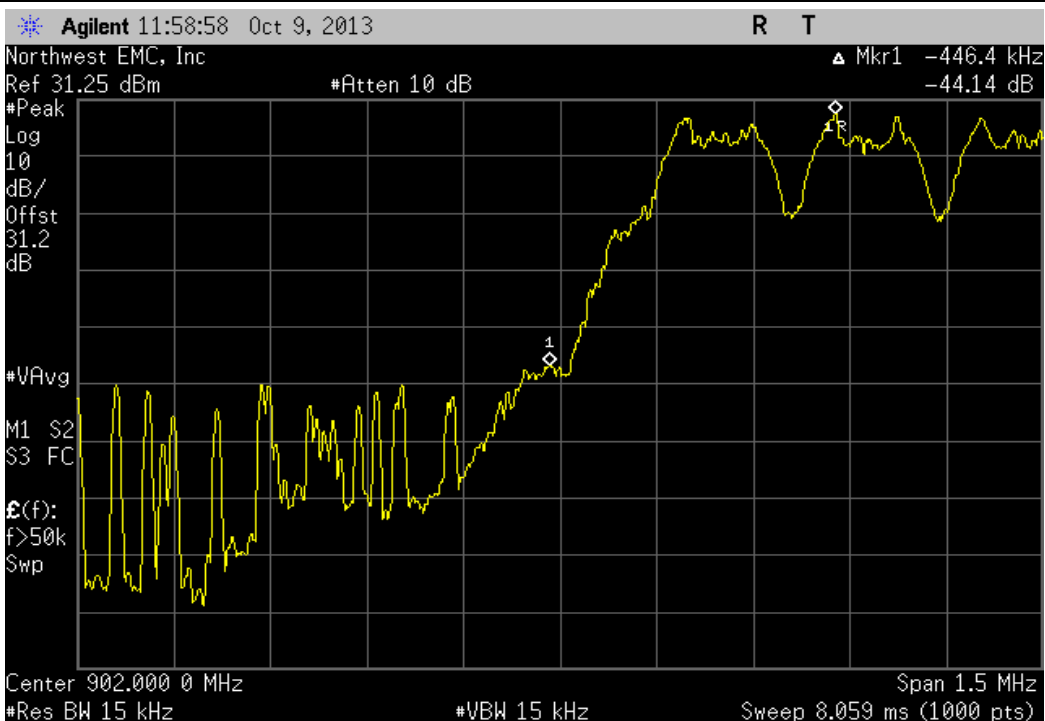
Configuration #	1	Signature 
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		Value	Limit	Result
GFSK				
115.2 kbps				
	Low Channel, 902.2464 MHz 50 Hopping Channels	-43.84 dBc	≤ -20 dBc	Pass
	Low Channel, 902.2464 MHz 80 Hopping Channels	-44.14 dBc	≤ -20 dBc	Pass
	Low Channel, 902.2464 MHz 112 Hopping Channels	-44.7 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz 50 Hopping Channels	-27.55 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz 80 Hopping Channels	-26.73 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz 112 Hopping Channels	-26.9 dBc	≤ -20 dBc	Pass
153.6 kbps				
	Low Channel, 902.2464 MHz 50 Hopping Channels	-48.3 dBc	≤ -20 dBc	Pass
	Low Channel, 902.2464 MHz 80 Hopping Channels	-47.8 dBc	≤ -20 dBc	Pass
	Low Channel, 902.2464 MHz 112 Hopping Channels	-48.22 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz 50 Hopping Channels	-49.04 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz 80 Hopping Channels	-31.40 dBc	≤ -20 dBc	Pass
	High Channel, 927.8208 MHz 112 Hopping Channels	-29.75 dBc	≤ -20 dBc	Pass

GFSK, 115.2 kbps, Low Channel, 902.2464 MHz 50 Hopping Channels			
	Value	Limit	Result
	-43.84 dBc	≤ -20 dBc	Pass

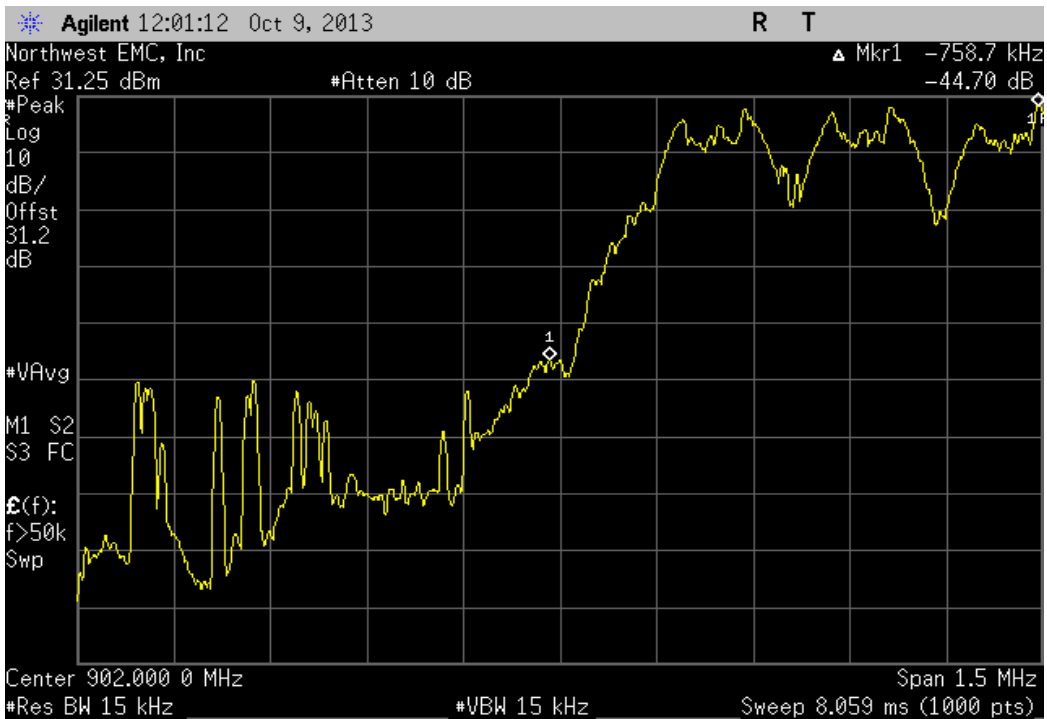


GFSK, 115.2 kbps, Low Channel, 902.2464 MHz 80 Hopping Channels			
	Value	Limit	Result
	-44.14 dBc	≤ -20 dBc	Pass



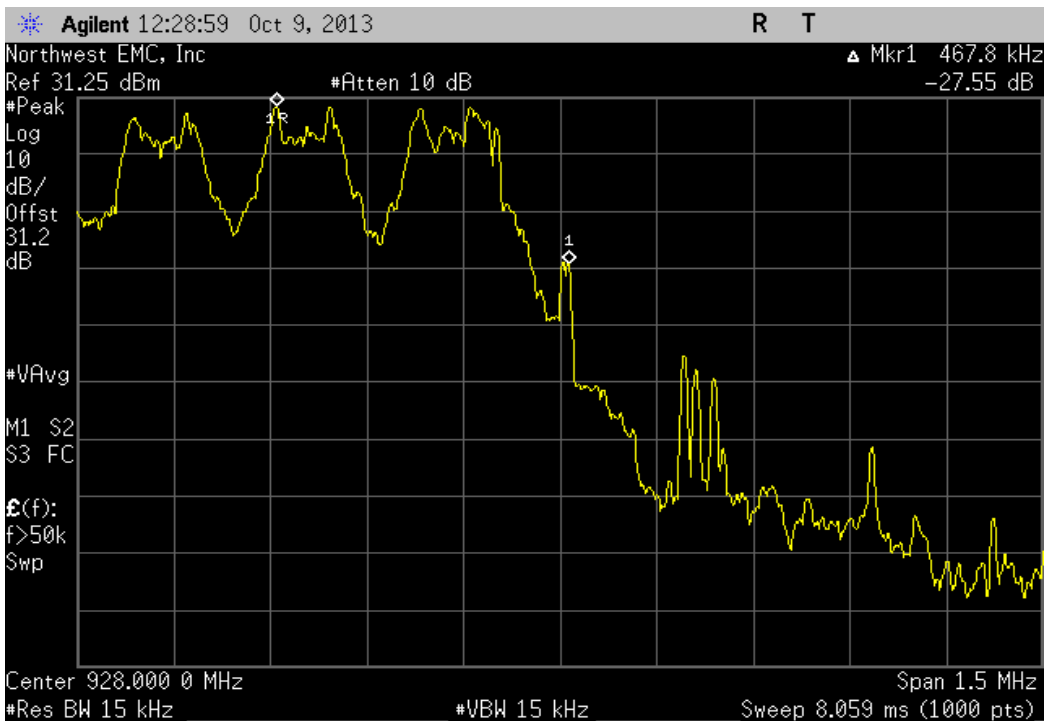
GFSK, 115.2 kbps, Low Channel, 902.2464 MHz 112 Hopping Channels

Value	Limit	Result
-44.7 dBc	≤ -20 dBc	Pass

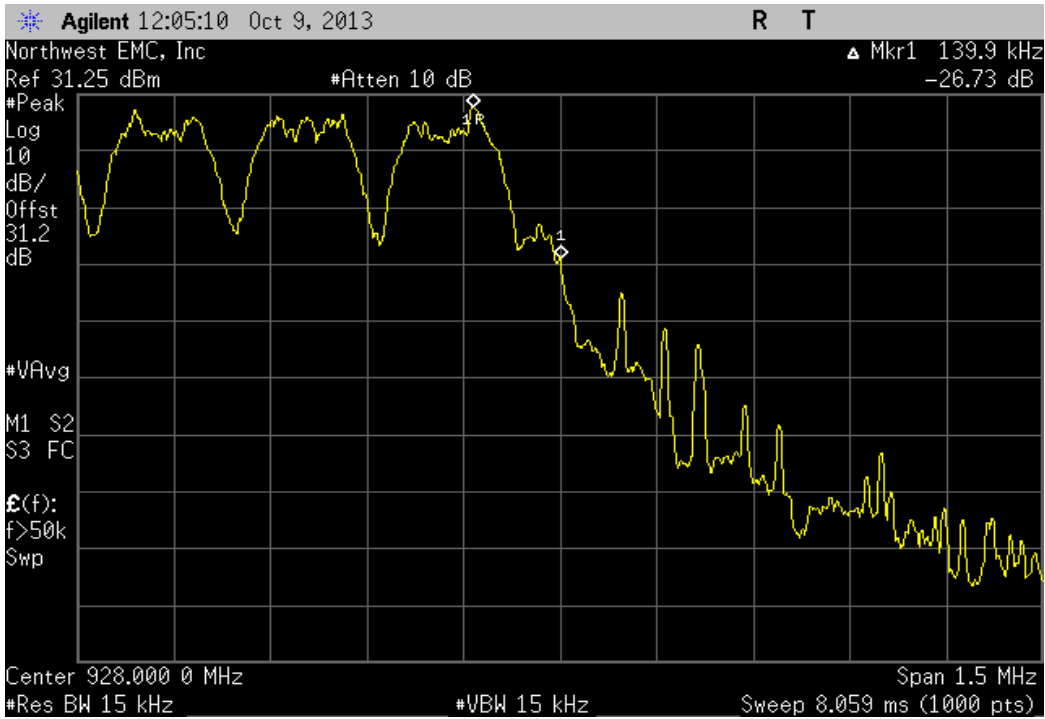


GFSK, 115.2 kbps, High Channel, 927.8208 MHz 50 Hopping Channels

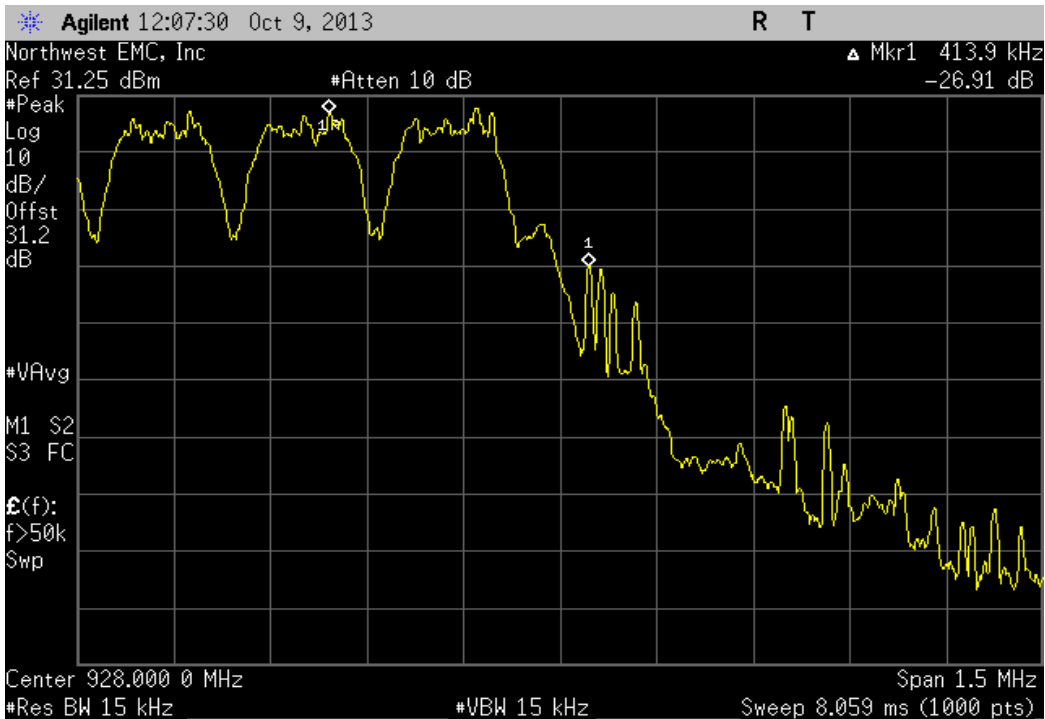
Value	Limit	Result
-27.55 dBc	≤ -20 dBc	Pass



GFSK, 115.2 kbps, High Channel, 927.8208 MHz 80 Hopping Channels			
	Value	Limit	Result
	-26.73 dBc	≤ -20 dBc	Pass

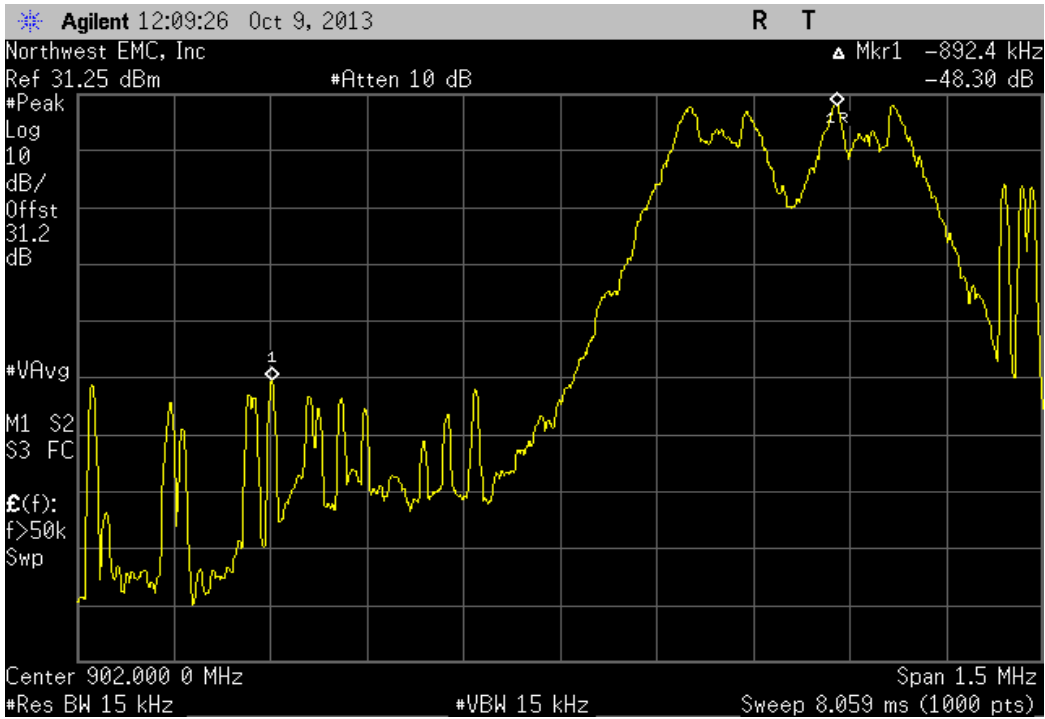


GFSK, 115.2 kbps, High Channel, 927.8208 MHz 112 Hopping Channels			
	Value	Limit	Result
	-26.9 dBc	≤ -20 dBc	Pass



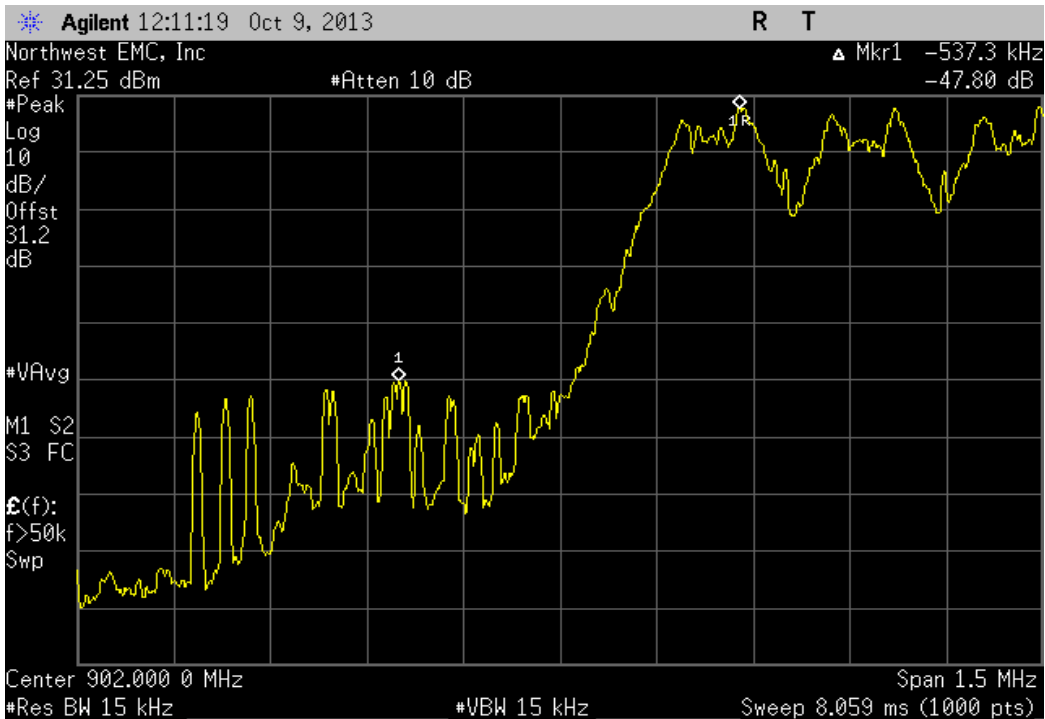
GFSK, 153.6 kbps, Low Channel, 902.2464 MHz 50 Hopping Channels

Value	Limit	Result
-48.3 dBc	≤ -20 dBc	Pass

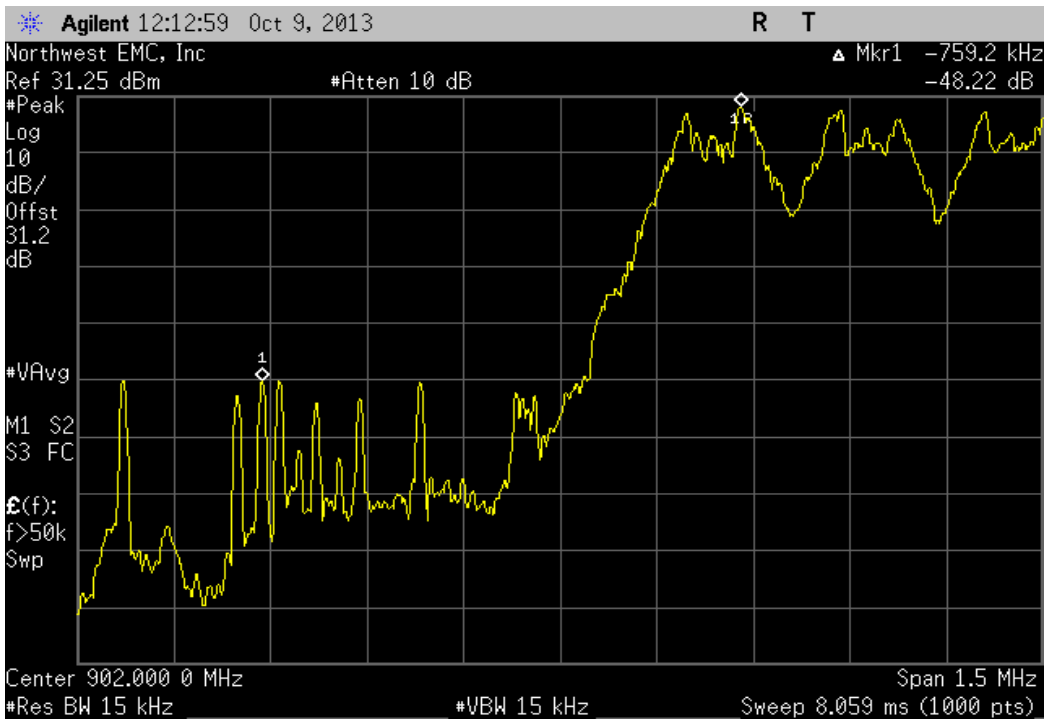


GFSK, 153.6 kbps, Low Channel, 902.2464 MHz 80 Hopping Channels

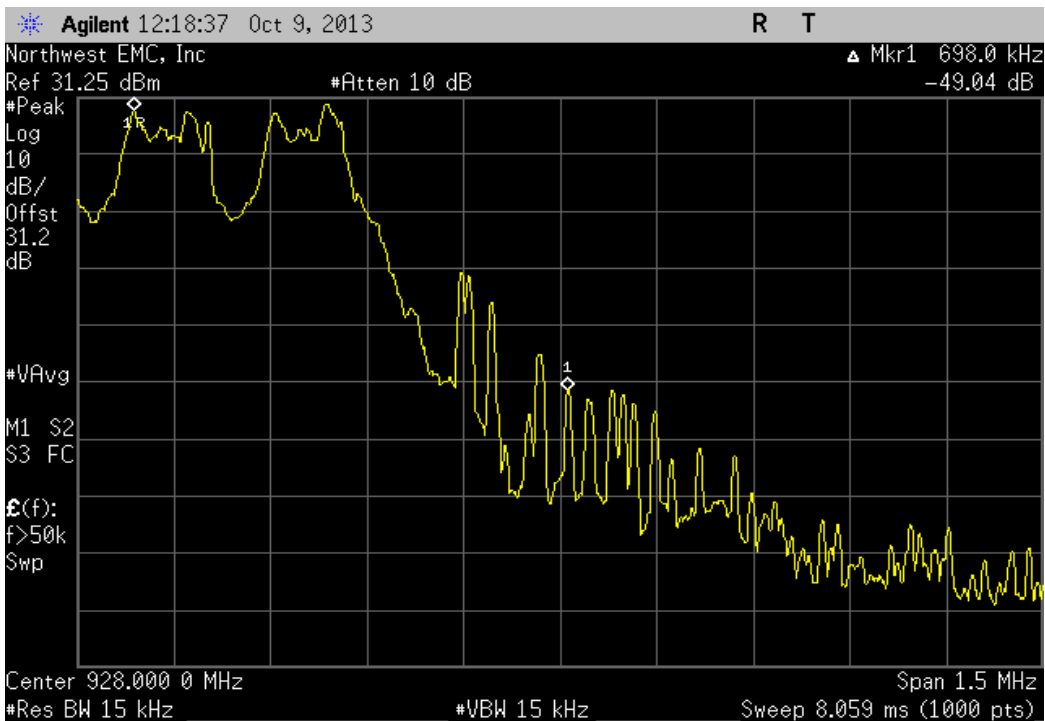
Value	Limit	Result
-47.8 dBc	≤ -20 dBc	Pass



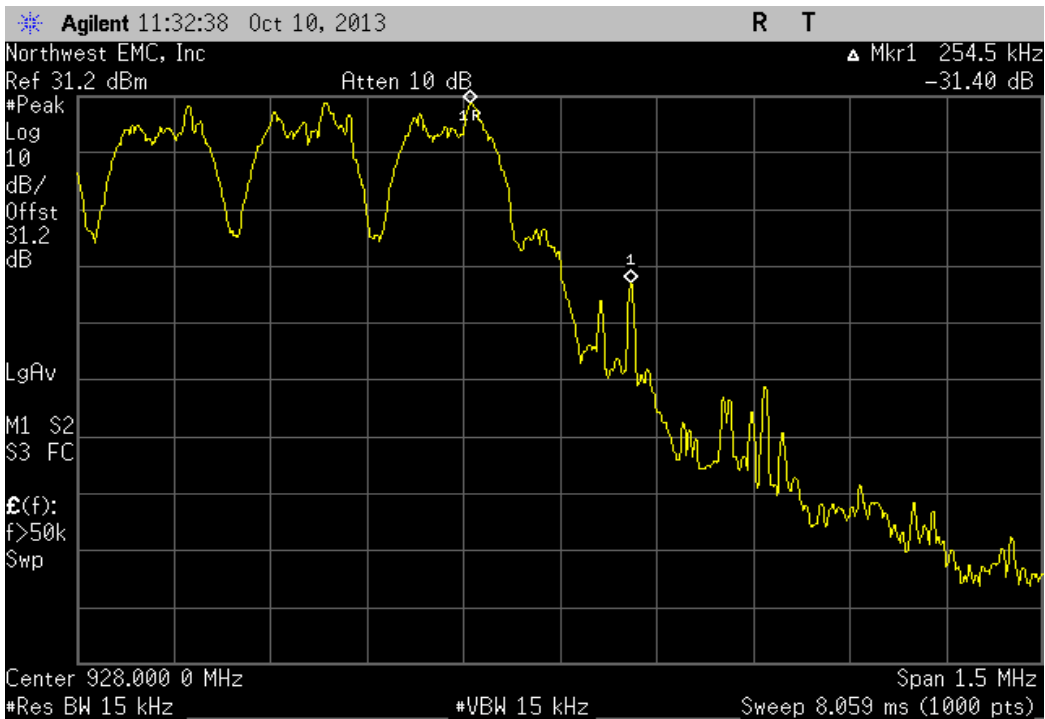
GFSK, 153.6 kbps, Low Channel, 902.2464 MHz 112 Hopping Channels			
	Value	Limit	Result
	-48.22 dBc	≤ -20 dBc	Pass



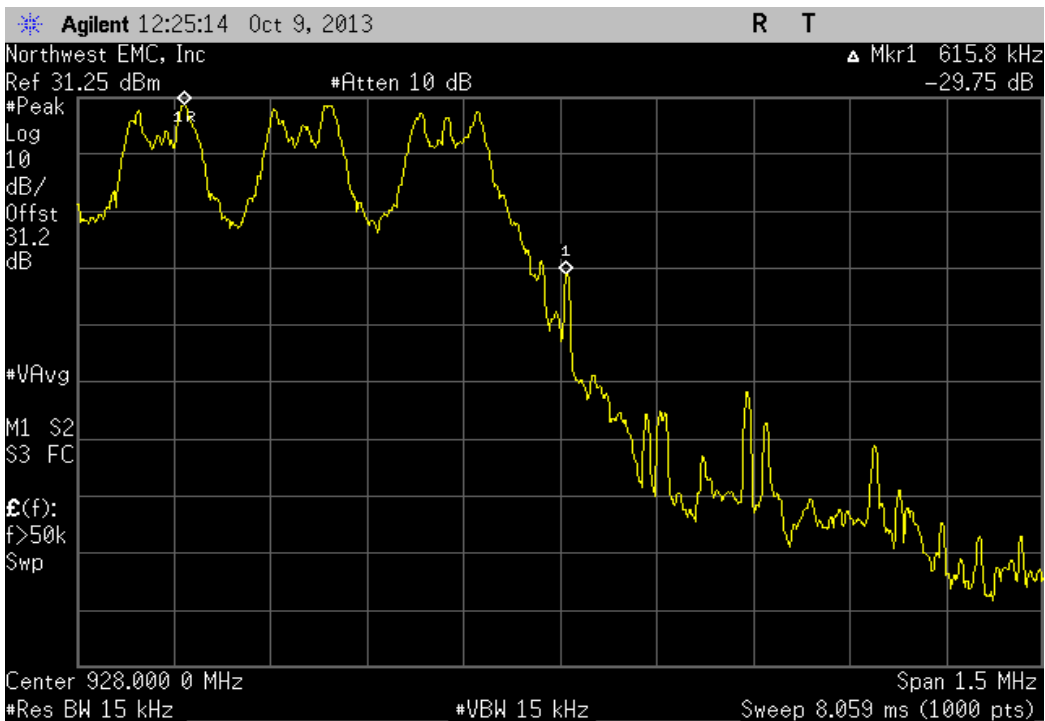
GFSK, 153.6 kbps, High Channel, 927.8208 MHz 50 Hopping Channels			
	Value	Limit	Result
	-49.04 dBc	≤ -20 dBc	Pass



GFSK, 153.6 kbps, High Channel, 927.8208 MHz 80 Hopping Channels			
	Value	Limit	Result
	-31.40 dBc	≤ -20 dBc	Pass



GFSK, 153.6 kbps, High Channel, 927.8208 MHz 112 Hopping Channels			
	Value	Limit	Result
	-29.75 dBc	≤ -20 dBc	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, 900 MHz Band

No Hop, 115 kbps

No Hop, 154 kbps

Channels Tested, 900 MHz Band

No Hop, Low Channel, 902.25 MHz

No Hop, Mid Channel, 916.07 MHz

No Hop, High Channel, 927.82 MHz

POWER SETTINGS INVESTIGATED

12 VDC

CONFIGURATIONS INVESTIGATED

FREW0013 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency | 30 MHz

Stop Frequency | 12400 MHz

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
HP Filter	Micro-Tronics	HPM50114	HFN	1/18/2013	36 mo
Attenuator	Fairview Microwave	SA18E-20	AQV	1/18/2013	12 mo
Notch Filter	K&L Microwave	3TNF-500/1000-N/N	HHO	8/28/2013	12 mo
LP Filter	Micro-Tronics	LPM50003	LFE	1/18/2013	24 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AQJ	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
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
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
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.

The power level used while under test for the 900 MHz band was set at the maximum allowable by the test software. All average measurements above 1 GHz were performed using a RMS Average Detector unless otherwise noted. Particular average measurements were made using an average detector employing a 10 Hz VBW, as per FCC KDB 913591, which are noted in the comments section as 10 Hz Avg. The EUT was transmitting at its maximum allowable duty cycle.

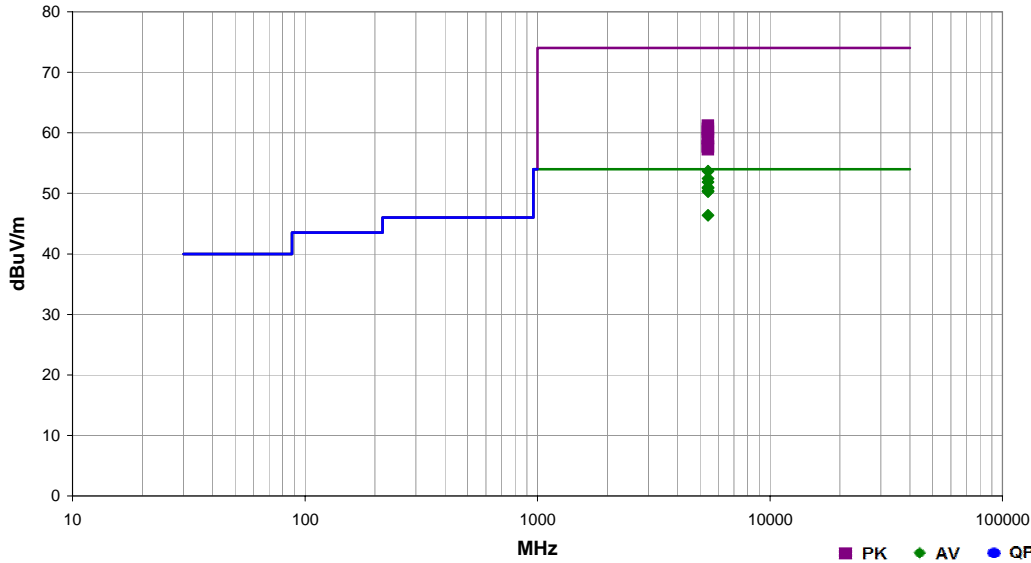


Spurious Radiated Emissions

Work Order:	FREW0013	Date:	10/14/13	
Project:	None	Temperature:	23 °C	
Job Site:	NC01	Humidity:	37% RH	
Serial Number:	956-8447	Barometric Pres.:	1032 mbar	
EUT:	FGRM			
Configuration:	2			
Customer:	FreeWave Technologies, Inc.			
Attendees:	Dean Busch			
EUT Power:	12 VDC			
Operating Mode:	Transmitting at maximum duty cycle. Low Channel, 902.25 MHz, Output power level set at 10, Full Power. See comments below for EUT orientation and data rate			
Deviations:	None			
Comments:	Maximizing EUT orientation for worst case emission. 2.8 GHz HPF in line			

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

Run #	17	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass
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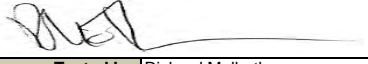


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
5413.440	44.7	9.0	1.0	330.0	3.0	0.0	Horz	AV	0.0	53.7	54.0	-0.3	Low Ch, EUT Flat, 115 kbps, 10Hz Avg
5413.465	43.5	9.0	1.1	224.0	3.0	0.0	Vert	AV	0.0	52.5	54.0	-1.5	Low Ch, EUT Flat, 154 kbps, 10Hz Avg
5413.495	42.9	9.0	1.1	288.0	3.0	0.0	Vert	AV	0.0	51.9	54.0	-2.1	Low Ch, EUT Vert, 154 kbps, 10Hz Avg
5413.510	42.0	9.0	1.0	86.0	3.0	0.0	Horz	AV	0.0	51.0	54.0	-3.0	Low Ch, EUT Vert, 154 kbps, 10Hz Avg
5413.450	41.9	9.0	1.4	327.0	3.0	0.0	Horz	AV	0.0	50.9	54.0	-3.1	Low Ch, EUT Flat, 154 kbps, 10Hz Avg
5413.540	41.4	9.0	1.1	343.0	3.0	0.0	Horz	AV	0.0	50.4	54.0	-3.6	Low Ch, EUT Horz, 154 kbps, 10Hz Avg
5413.510	41.3	9.0	1.3	338.0	3.0	0.0	Vert	AV	0.0	50.3	54.0	-3.7	Low Ch, EUT Horz, 154 kbps, 10Hz Avg
5413.455	37.4	9.0	1.1	224.0	3.0	0.0	Vert	AV	0.0	46.4	54.0	-7.6	Low Ch, EUT Flat, 115 kbps, 10Hz Avg
5413.205	52.2	9.0	1.0	330.0	3.0	0.0	Horz	PK	0.0	61.2	74.0	-12.8	Low Ch, EUT Flat, 115 kbps
5413.205	51.7	9.0	1.1	343.0	3.0	0.0	Horz	PK	0.0	60.7	74.0	-13.3	Low Ch, EUT Horz, 154 kbps
5413.080	51.2	9.0	1.1	224.0	3.0	0.0	Vert	PK	0.0	60.2	74.0	-13.8	Low Ch, EUT Flat, 115 kbps
5413.325	50.2	9.0	1.1	224.0	3.0	0.0	Vert	PK	0.0	59.2	74.0	-14.8	Low Ch, EUT Flat, 154 kbps
5413.795	50.1	9.0	1.1	288.0	3.0	0.0	Vert	PK	0.0	59.1	74.0	-14.9	Low Ch, EUT Vert, 154 kbps
5413.290	48.8	9.0	1.0	86.0	3.0	0.0	Horz	PK	0.0	57.8	74.0	-16.2	Low Ch, EUT Vert, 154 kbps
5413.385	48.7	9.0	1.4	327.0	3.0	0.0	Horz	PK	0.0	57.7	74.0	-16.3	Low Ch, EUT Flat, 154 kbps
5413.805	48.3	9.0	1.3	338.0	3.0	0.0	Vert	PK	0.0	57.3	74.0	-16.7	Low Ch, EUT Horz, 154 kbps



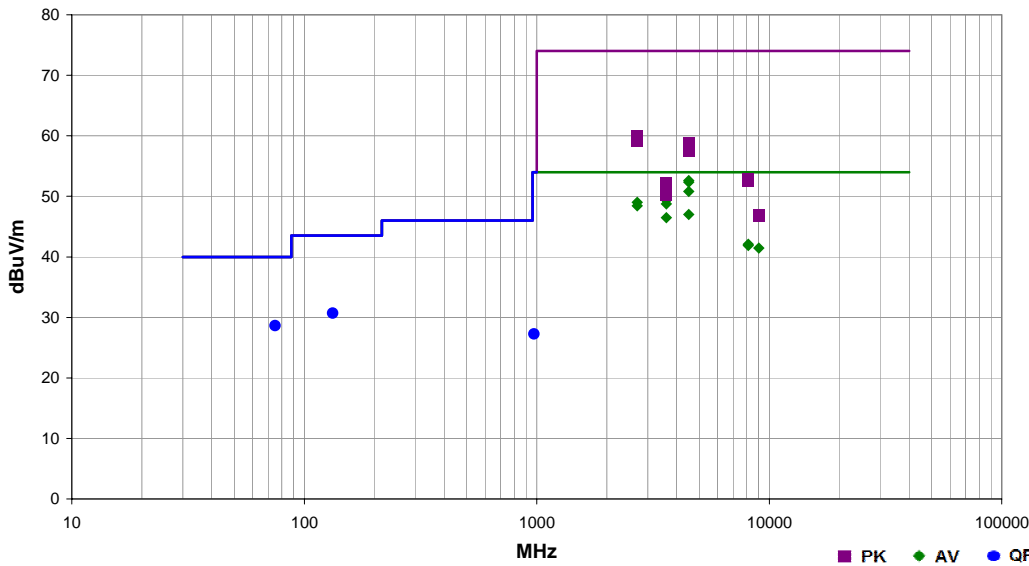
Spurious Radiated Emissions

PSA-ESCI 2012.12.14
EmiR5 2013.08.26

Work Order:	FREW0013	Date:	10/14/13	
Project:	None	Temperature:	23 °C	
Job Site:	NC01	Humidity:	37% RH	
Serial Number:	956-8447	Barometric Pres.:	1032 mbar	
EUT:	FGRM	Tested by: Richard Mellroth		
Configuration:	2			
Customer:	FreeWave Technologies, Inc.			
Attendees:	Dean Busch			
EUT Power:	12 VDC			
Operating Mode:	Transmitting at maximum duty cycle. Low Channel 902.25 MHz, Output power level set at 10, Full Power. See comments below for EUT orientation and data rate			
Deviations:	None			
Comments:	Low Channel Spurious Radiated Emissions			

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

Run #	18	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
4511.230	46.6	6.0	1.2	223.0	3.0	0.0	Vert	AV	0.0	52.6	54.0	-1.4	Low Ch, EUT Flat, 115 kbps, 10Hz Avg
4511.320	46.3	6.0	1.2	222.0	3.0	0.0	Vert	AV	0.0	52.3	54.0	-1.7	Low Ch, EUT Flat, 154 kbps, 10Hz Avg
4511.275	44.8	6.0	1.8	299.0	3.0	0.0	Horz	AV	0.0	50.8	54.0	-3.2	Low Ch, EUT Flat, 115 kbps, 10Hz Avg
3609.060	47.1	2.4	1.0	194.0	3.0	0.0	Vert	AV	0.0	49.5	54.0	-4.5	Low Ch, EUT Flat, 115 kbps
3609.070	47.0	2.4	1.0	193.0	3.0	0.0	Vert	AV	0.0	49.4	54.0	-4.6	Low Ch, EUT Flat, 154 kbps
2706.820	30.0	-1.0	1.0	45.0	3.0	20.0	Vert	AV	0.0	49.0	54.0	-5.0	Low Ch, EUT Flat, 115 kbps
3609.100	46.4	2.4	2.0	14.0	3.0	0.0	Horz	AV	0.0	48.8	54.0	-5.2	Low Ch, EUT Flat, 115 kbps
2706.835	29.4	-1.0	3.3	71.0	3.0	20.0	Horz	AV	0.0	48.4	54.0	-5.6	Low Ch, EUT Flat, 115 kbps
4511.330	41.0	6.0	1.4	299.0	3.0	0.0	Horz	AV	0.0	47.0	54.0	-7.0	Low Ch, EUT Flat, 154 kbps, 10Hz Avg
3609.065	44.1	2.4	1.5	203.0	3.0	0.0	Horz	AV	0.0	46.5	54.0	-7.5	Low Ch, EUT Flat, 154 kbps
74.957	36.8	-8.2	1.4	200.0	3.0	0.0	Vert	QP	0.0	28.6	40.0	-11.4	Low Ch, EUT Flat, 115 kbps
8120.520	28.5	13.6	1.0	226.0	3.0	0.0	Vert	AV	0.0	42.1	54.0	-11.9	Low Ch, EUT Flat, 115 kbps
8120.140	28.3	13.6	1.0	1.0	3.0	0.0	Horz	AV	0.0	41.9	54.0	-12.1	Low Ch, EUT Flat, 115 kbps
9022.765	47.2	-5.8	1.0	284.0	3.0	0.0	Horz	AV	0.0	41.4	54.0	-12.6	Low Ch, EUT Flat, 115 kbps
132.714	38.2	-7.6	1.0	336.0	3.0	0.0	Vert	QP	0.0	30.6	43.5	-12.9	Low Ch, EUT Flat, 115 kbps
9022.865	46.7	-5.8	1.1	338.0	3.0	0.0	Vert	AV	0.0	40.9	54.0	-13.1	Low Ch, EUT Flat, 115 kbps
2706.235	40.9	-1.0	3.3	71.0	3.0	20.0	Horz	PK	0.0	59.9	74.0	-14.1	Low Ch, EUT Flat, 115 kbps
2705.540	40.1	-1.0	1.0	45.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	Low Ch, EUT Flat, 115 kbps
4511.390	52.8	6.0	1.2	222.0	3.0	0.0	Vert	PK	0.0	58.8	74.0	-15.2	Low Ch, EUT Flat, 154 kbps
4510.990	52.6	6.0	1.2	223.0	3.0	0.0	Vert	PK	0.0	58.6	74.0	-15.4	Low Ch, EUT Flat, 115 kbps
4511.215	51.6	6.0	1.4	299.0	3.0	0.0	Horz	PK	0.0	57.6	74.0	-16.4	Low Ch, EUT Flat, 154 kbps
4511.160	51.4	6.0	1.8	299.0	3.0	0.0	Horz	PK	0.0	57.4	74.0	-16.6	Low Ch, EUT Flat, 115 kbps
8119.810	39.2	13.6	1.0	226.0	3.0	0.0	Vert	PK	0.0	52.8	74.0	-21.2	Low Ch, EUT Flat, 115 kbps
8118.990	39.0	13.6	1.0	1.0	3.0	0.0	Horz	PK	0.0	52.6	74.0	-21.4	Low Ch, EUT Flat, 115 kbps
3608.960	49.8	2.4	1.0	193.0	3.0	0.0	Vert	PK	0.0	52.2	74.0	-21.8	Low Ch, EUT Flat, 154 kbps
3608.735	49.8	2.4	1.0	194.0	3.0	0.0	Vert	PK	0.0	52.2	74.0	-21.8	Low Ch, EUT Flat, 115 kbps
3608.710	49.6	2.4	2.0	14.0	3.0	0.0	Horz	PK	0.0	52.0	74.0	-22.0	Low Ch, EUT Flat, 115 kbps
3608.760	47.9	2.4	1.5	203.0	3.0	0.0	Horz	PK	0.0	50.3	74.0	-23.7	Low Ch, EUT Flat, 154 kbps
975.954	14.6	12.6	1.4	200.0	3.0	0.0	Vert	QP	0.0	27.2	54.0	-26.8	Low Ch, EUT Flat, 115 kbps
9023.645	52.6	-5.7	1.1	338.0	3.0	0.0	Vert	PK	0.0	46.9	74.0	-27.1	Low Ch, EUT Flat, 115 kbps
9022.930	52.5	-5.8	1.0	284.0	3.0	0.0	Horz	PK	0.0	46.7	74.0	-27.3	Low Ch, EUT Flat, 115 kbps



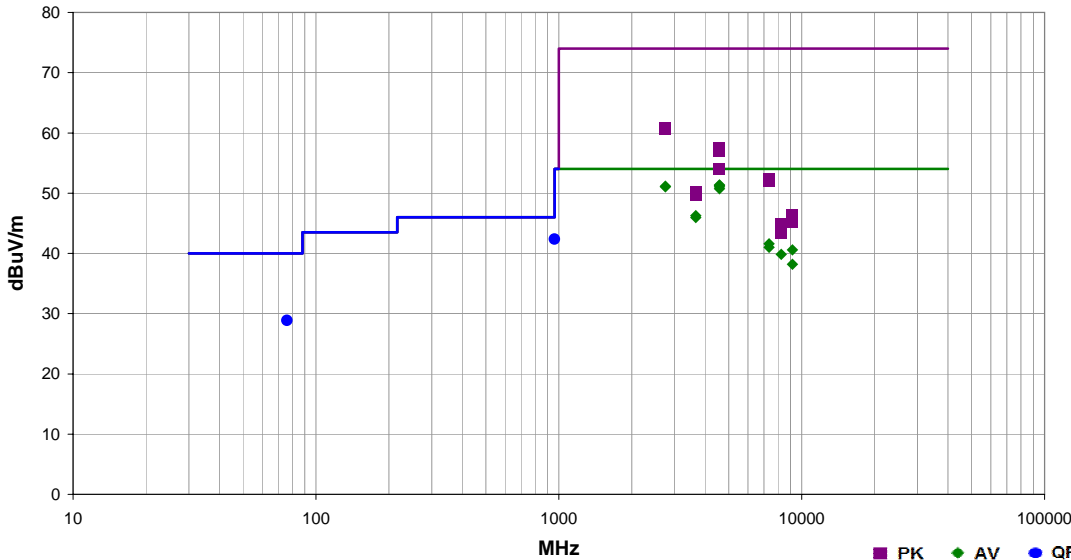
Spurious Radiated Emissions

PSA-ESCI 2012.12.14
EmiR5 2013.08.26

Work Order:	FREW0013	Date:	10/14/13	
Project:	None	Temperature:	23 °C	
Job Site:	NC01	Humidity:	37% RH	
Serial Number:	956-8447	Barometric Pres.:	1032 mbar	
EUT:	FGRM			
Configuration:	2			
Customer:	FreeWave Technologies, Inc.			
Attendees:	Dean Busch			
EUT Power:	12 VDC			
Operating Mode:	Transmitting at maximum duty cycle. Mid Channel 916.1 MHz, Output power level set at 10, Full Power. See comments below for EUT orientation and data rate.			
Deviations:	None			
Comments:	Mid Channel Spurious Radiated Emissions			

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

Run #	20	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass
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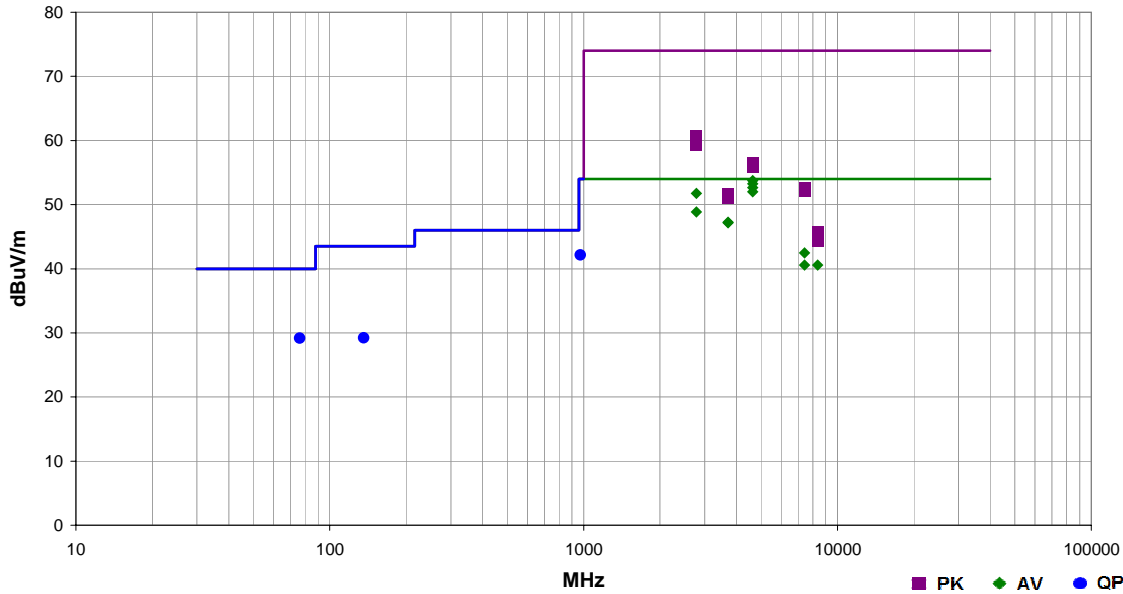
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4580.380	44.8	6.6	1.4	225.0	3.0	0.0	Vert	AV	0.0	51.4	54.0	-2.6	Mid Ch, EUT Flat, 154 kbps, 10Hz Avg
4580.385	44.7	6.6	1.4	298.0	3.0	0.0	Horz	AV	0.0	51.3	54.0	-2.7	Mid Ch, EUT Flat, 115 kbps, 10Hz Avg
2748.185	32.1	-0.9	1.0	74.0	3.0	20.0	Horz	AV	0.0	51.2	54.0	-2.8	Mid Ch, EUT Flat, 115 kbps
2748.185	32.0	-0.9	1.0	198.0	3.0	20.0	Vert	AV	0.0	51.1	54.0	-2.9	Mid Ch, EUT Flat, 115 kbps
4580.400	44.5	6.6	1.0	76.0	3.0	0.0	Vert	AV	0.0	51.1	54.0	-2.9	Mid Ch, EUT Flat, 115 kbps
4580.390	44.2	6.6	1.3	294.0	3.0	0.0	Horz	AV	0.0	50.8	54.0	-3.2	Mid Ch, EUT Flat, 154 kbps, 10Hz Avg
3664.350	43.4	2.9	1.0	74.0	3.0	0.0	Vert	AV	0.0	46.3	54.0	-7.7	Mid Ch, EUT Flat, 115 kbps
3664.365	43.1	2.9	1.0	323.0	3.0	0.0	Horz	AV	0.0	46.0	54.0	-8.0	Mid Ch, EUT Flat, 115 kbps
76.187	37.1	-8.3	1.0	191.0	3.0	0.0	Vert	QP	0.0	28.8	40.0	-11.2	Mid Ch, EUT Flat, 115 kbps
960.358	29.9	12.4	1.5	208.0	3.0	0.0	Vert	QP	0.0	42.3	54.0	-11.7	Mid Ch, EUT Flat, 115 kbps
7328.825	29.3	12.3	1.2	116.0	3.0	0.0	Vert	AV	0.0	41.6	54.0	-12.4	Mid Ch, EUT Flat, 115 kbps
7328.708	28.7	12.3	1.0	6.0	3.0	0.0	Horz	AV	0.0	41.0	54.0	-13.0	Mid Ch, EUT Flat, 115 kbps
2747.630	41.7	-0.9	1.0	74.0	3.0	20.0	Horz	PK	0.0	60.8	74.0	-13.2	Mid Ch, EUT Flat, 115 kbps
2749.025	41.6	-0.9	1.0	198.0	3.0	20.0	Vert	PK	0.0	60.7	74.0	-13.3	Mid Ch, EUT Flat, 115 kbps
9161.100	45.5	-4.9	1.0	308.0	3.0	0.0	Horz	AV	0.0	40.6	54.0	-13.4	Mid Ch, EUT Flat, 115 kbps
8244.983	46.7	-6.8	1.1	321.0	3.0	0.0	Horz	AV	0.0	39.9	54.0	-14.1	Mid Ch, EUT Flat, 115 kbps
9161.050	43.1	-4.9	1.0	331.0	3.0	0.0	Vert	AV	0.0	38.2	54.0	-15.8	Mid Ch, EUT Flat, 115 kbps
4580.650	50.9	6.6	1.4	298.0	3.0	0.0	Horz	PK	0.0	57.5	74.0	-16.5	Mid Ch, EUT Flat, 115 kbps
4580.110	50.9	6.6	1.4	225.0	3.0	0.0	Vert	PK	0.0	57.5	74.0	-16.5	Mid Ch, EUT Flat, 115 kbps
8244.925	43.8	-6.8	1.0	0.0	3.0	0.0	Vert	AV	0.0	37.0	54.0	-17.0	Mid Ch, EUT Flat, 115 kbps
4580.645	50.4	6.6	1.3	294.0	3.0	0.0	Horz	PK	0.0	57.0	74.0	-17.0	Mid Ch, EUT Flat, 154 kbps
4580.740	47.5	6.6	1.0	76.0	3.0	0.0	Vert	PK	0.0	54.1	74.0	-19.9	Mid Ch, EUT Flat, 115 kbps
7328.542	40.0	12.3	1.0	6.0	3.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	Mid Ch, EUT Flat, 115 kbps
7331.175	39.7	12.3	1.2	116.0	3.0	0.0	Vert	PK	0.0	52.0	74.0	-22.0	Mid Ch, EUT Flat, 115 kbps
3664.205	47.3	2.9	1.0	323.0	3.0	0.0	Horz	PK	0.0	50.2	74.0	-23.8	Mid Ch, EUT Flat, 115 kbps
3663.905	46.8	2.9	1.0	74.0	3.0	0.0	Vert	PK	0.0	49.7	74.0	-24.3	Mid Ch, EUT Flat, 115 kbps
9159.942	51.3	-4.9	1.0	308.0	3.0	0.0	Horz	PK	0.0	46.4	74.0	-27.6	Mid Ch, EUT Flat, 115 kbps
9160.925	50.1	-4.9	1.0	331.0	3.0	0.0	Vert	PK	0.0	45.2	74.0	-28.8	Mid Ch, EUT Flat, 115 kbps
8244.042	51.8	-6.8	1.1	321.0	3.0	0.0	Horz	PK	0.0	45.0	74.0	-29.0	Mid Ch, EUT Flat, 115 kbps
8244.667	50.2	-6.8	1.0	0.0	3.0	0.0	Vert	PK	0.0	43.4	74.0	-30.6	Mid Ch, EUT Flat, 115 kbps

Spurious Radiated Emissions

Work Order:	FREW0013	Date:	10/15/13	
Project:	None	Temperature:	23 °C	
Job Site:	NC01	Humidity:	35% RH	
Serial Number:	956-8447	Barometric Pres.:	1028 mbar	
EUT:	FGRM			
Configuration:	2			
Customer:	FreeWave Technologies, Inc.			
Attendees:	Dean Busch			
EUT Power:	12 VDC			
Operating Mode:	Transmitting at maximum duty cycle. High Channel 187, 927.8 MHz, Output power level set at 10, Full Power. See comments below for EUT orientation and data rate.			
Deviations:	None			
Comments:	High Channel Spurious Radiated Emissions			

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

Run #	22	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
4639.230	46.7	7.0	1.3	293.0	3.0	0.0	Horz	AV	0.0	53.7	54.0	-0.3	High Ch, EUT Flat, 115 kbps
4639.220	46.2	7.0	1.3	292.0	3.0	0.0	Horz	AV	0.0	53.2	54.0	-0.8	High Ch, EUT Flat, 154 kbps
4639.205	45.6	7.0	1.3	354.0	3.0	0.0	Vert	AV	0.0	52.6	54.0	-1.4	High Ch, EUT Flat, 115 kbps
4639.230	45.0	7.0	1.4	224.0	3.0	0.0	Vert	AV	0.0	52.0	54.0	-2.0	High Ch, EUT Flat, 154 kbps
2783.480	32.7	-0.9	1.0	198.0	3.0	20.0	Vert	AV	0.0	51.8	54.0	-2.2	High Ch, EUT Flat, 115 kbps
2783.435	29.8	-0.9	1.0	223.0	3.0	20.0	Horz	AV	0.0	48.9	54.0	-5.1	High Ch, EUT Flat, 115 kbps
3711.285	43.9	3.4	1.0	350.0	3.0	0.0	Horz	AV	0.0	47.3	54.0	-6.7	High Ch, EUT Flat, 115 kbps
3711.260	43.8	3.4	1.0	68.0	3.0	0.0	Vert	AV	0.0	47.2	54.0	-6.8	High Ch, EUT Flat, 115 kbps
76.182	37.4	-8.3	1.6	197.0	3.0	0.0	Vert	QP	0.0	29.1	40.0	-10.9	High Ch, EUT Flat, 115 kbps
7422.908	29.7	12.8	1.0	249.0	3.0	0.0	Vert	AV	0.0	42.5	54.0	-11.5	High Ch, EUT Flat, 115 kbps
972.105	29.6	12.5	1.5	211.0	3.0	0.0	Vert	QP	0.0	42.1	54.0	-11.9	High Ch, EUT Flat, 115 kbps
2783.540	41.6	-0.9	1.0	198.0	3.0	20.0	Vert	PK	0.0	60.7	74.0	-13.3	High Ch, EUT Flat, 115 kbps
7420.367	27.8	12.8	1.0	152.0	3.0	0.0	Horz	AV	0.0	40.6	54.0	-13.4	High Ch, EUT Flat, 115 kbps
8350.600	47.3	-6.7	1.0	317.0	3.0	0.0	Horz	AV	0.0	40.6	54.0	-13.4	High Ch, EUT Flat, 115 kbps
136.402	36.6	-7.4	1.0	341.0	3.0	0.0	Vert	QP	0.0	29.2	43.5	-14.3	High Ch, EUT Flat, 115 kbps
2782.090	40.3	-0.9	1.0	223.0	3.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	High Ch, EUT Flat, 115 kbps
8350.675	44.7	-6.7	1.0	28.0	3.0	0.0	Vert	AV	0.0	38.0	54.0	-16.0	High Ch, EUT Flat, 115 kbps
4639.605	49.5	7.0	1.4	224.0	3.0	0.0	Vert	PK	0.0	56.5	74.0	-17.5	High Ch, EUT Flat, 154 kbps
4638.895	49.4	7.0	1.3	293.0	3.0	0.0	Horz	PK	0.0	56.4	74.0	-17.6	High Ch, EUT Flat, 115 kbps
4639.380	49.2	7.0	1.3	354.0	3.0	0.0	Vert	PK	0.0	56.2	74.0	-17.8	High Ch, EUT Flat, 115 kbps
4639.495	48.8	7.0	1.3	292.0	3.0	0.0	Horz	PK	0.0	55.8	74.0	-18.2	High Ch, EUT Flat, 115 kbps
7423.158	39.8	12.8	1.0	249.0	3.0	0.0	Vert	PK	0.0	52.6	74.0	-21.4	High Ch, EUT Flat, 115 kbps
7422.550	39.4	12.8	1.0	152.0	3.0	0.0	Horz	PK	0.0	52.2	74.0	-21.8	High Ch, EUT Flat, 115 kbps
3711.120	48.2	3.4	1.0	350.0	3.0	0.0	Horz	PK	0.0	51.6	74.0	-22.4	High Ch, EUT Flat, 115 kbps
3711.290	47.7	3.4	1.0	68.0	3.0	0.0	Vert	PK	0.0	51.1	74.0	-22.9	High Ch, EUT Flat, 115 kbps
8350.708	52.4	-6.7	1.0	317.0	3.0	0.0	Horz	PK	0.0	45.7	74.0	-28.3	High Ch, EUT Flat, 115 kbps
8350.117	51.0	-6.7	1.0	28.0	3.0	0.0	Vert	PK	0.0	44.3	74.0	-29.7	High Ch, EUT Flat, 115 kbps

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 50Ω.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Receiver	Rohde & Schwarz	ESCI	ARE	05/30/2013	12 mo
NC05 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
LISN	Solar	9252-50-R-24-BNC	LIM	01/16/2013	12 mo

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.94 dB	-2.94 dB

CONFIGURATIONS INVESTIGATED

FREW0013-3

MODES INVESTIGATED

Transmitting High Channel, 927.8 MHz, 115 kbps
 Transmitting Low Channel, 902.25 MHz, 115 kbps
 Transmitting Mid Channel, 916.1 MHz, 115 kbps

EUT:	FGRM	Work Order:	FREW0013
Serial Number:	956-8447	Date:	10/15/2013
Customer:	FreeWave Technologies, Inc.	Temperature:	23°C
Attendees:	Dean Busch	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1028 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	FREW0013-3

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	5	Line:	High Line	Ext. Attenuation (dB):	20
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COMMENTS

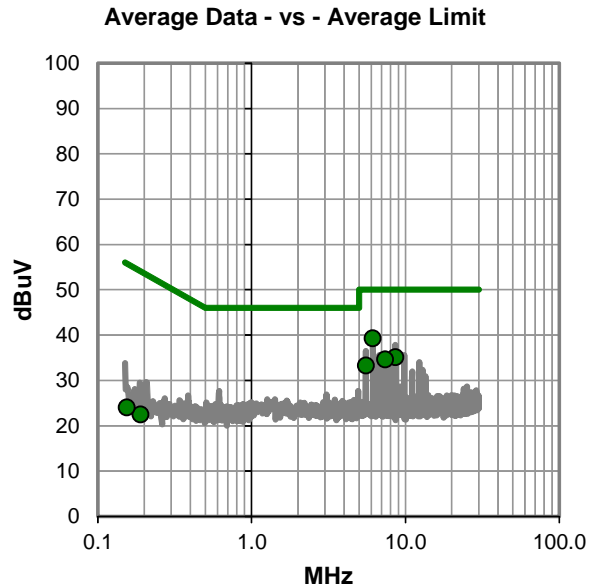
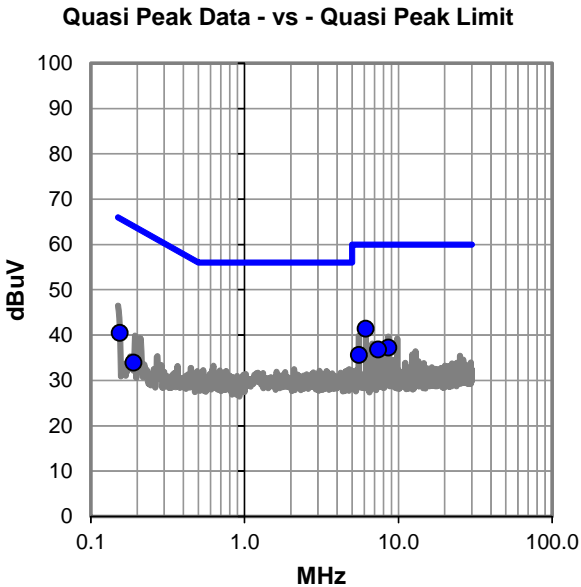
Output power level at 10, Full Power.

EUT OPERATING MODES

Transmitting Low Channel, 902.25 MHz, 115 kbps

DEVIATIONS FROM TEST STANDARD

None



RESULTS - Run #5

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	20.8	20.6	41.4	60.0	-18.6
8.600	16.5	20.7	37.2	60.0	-22.8
7.374	16.2	20.6	36.8	60.0	-23.2
5.530	15.0	20.6	35.6	60.0	-24.4
0.154	20.2	20.3	40.5	65.8	-25.3
0.190	13.5	20.4	33.9	64.0	-30.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	18.7	20.6	39.3	50.0	-10.7
8.600	14.4	20.7	35.1	50.0	-14.9
7.374	14.0	20.6	34.6	50.0	-15.4
5.530	12.7	20.6	33.3	50.0	-16.7
0.190	2.1	20.4	22.5	54.0	-31.6
0.154	3.7	20.3	24.0	55.8	-31.8

CONCLUSION

Pass



Tested By

EUT:	FGRM	Work Order:	FREW0013
Serial Number:	956-8447	Date:	10/15/2013
Customer:	FreeWave Technologies, Inc.	Temperature:	23°C
Attendees:	Dean Busch	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1028 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	FREW0013-3

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	6	Line:	Neutral	Ext. Attenuation (dB):	20
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COMMENTS

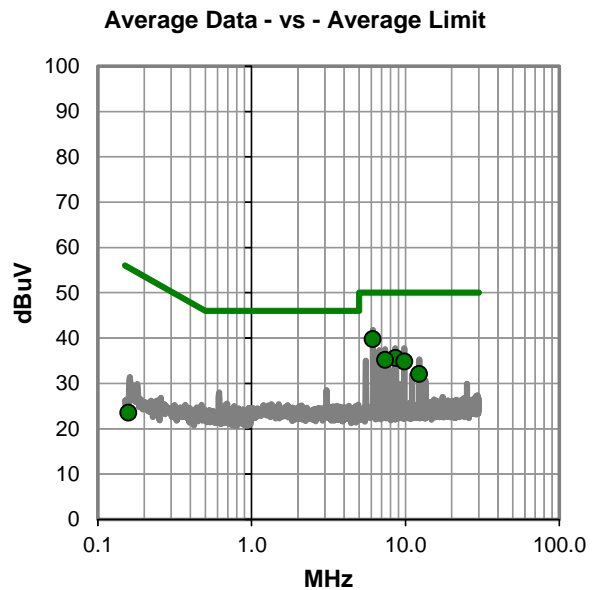
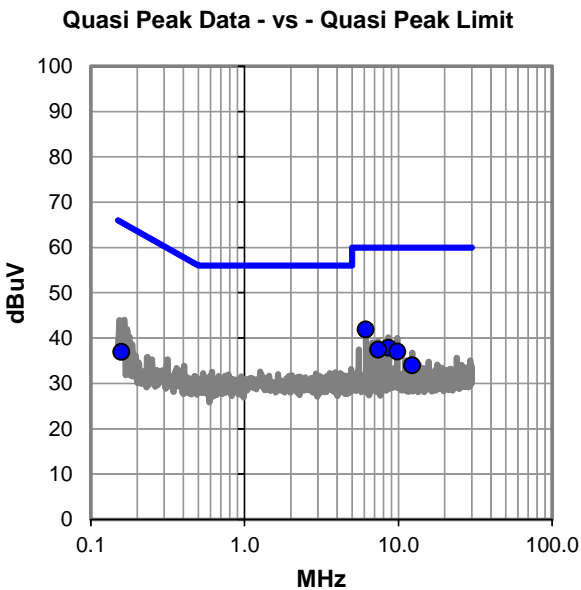
Output power level at 10, Full Power.

EUT OPERATING MODES

Transmitting Low Channel, 902.25 MHz, 115 kbps

DEVIATIONS FROM TEST STANDARD

None



RESULTS - Run #6

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	21.3	20.6	41.9	60.0	-18.1
8.600	17.1	20.7	37.8	60.0	-22.2
7.374	16.8	20.6	37.4	60.0	-22.6
9.832	16.3	20.7	37.0	60.0	-23.0
12.286	13.1	20.9	34.0	60.0	-26.0
0.158	16.6	20.3	36.9	65.6	-28.7

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	19.2	20.6	39.8	50.0	-10.2
8.600	14.9	20.7	35.6	50.0	-14.4
7.374	14.6	20.6	35.2	50.0	-14.8
9.832	14.1	20.7	34.8	50.0	-15.2
12.286	11.2	20.9	32.1	50.0	-17.9
0.158	3.2	20.3	23.5	55.6	-32.1

CONCLUSION

Pass



Tested By

EUT:	FGRM	Work Order:	FREW0013
Serial Number:	956-8447	Date:	10/15/2013
Customer:	FreeWave Technologies, Inc.	Temperature:	23°C
Attendees:	Dean Busch	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1028 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	FREW0013-3

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	7	Line:	High Line	Ext. Attenuation (dB):	20
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COMMENTS

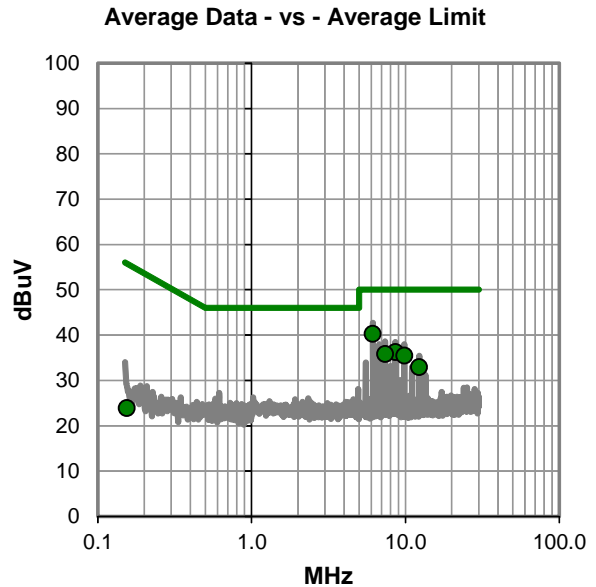
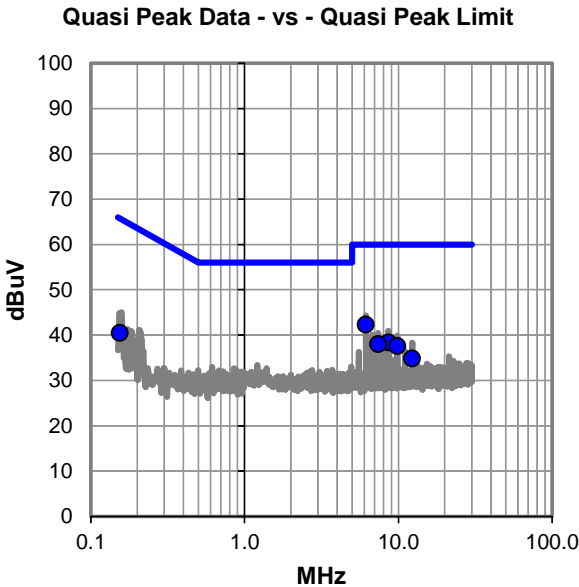
Output power level at 10, Full Power.

EUT OPERATING MODES

Transmitting Mid Channel, 916.1 MHz, 115 kbps

DEVIATIONS FROM TEST STANDARD

None



RESULTS - Run #7

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	21.7	20.6	42.3	60.0	-17.7
8.600	17.6	20.7	38.3	60.0	-21.7
7.374	17.4	20.6	38.0	60.0	-22.0
9.832	16.8	20.7	37.5	60.0	-22.5
12.286	13.9	20.9	34.8	60.0	-25.2
0.154	20.2	20.3	40.5	65.8	-25.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	19.7	20.6	40.3	50.0	-9.7
8.600	15.5	20.7	36.2	50.0	-13.8
7.374	15.2	20.6	35.8	50.0	-14.2
9.832	14.7	20.7	35.4	50.0	-14.6
12.286	12.0	20.9	32.9	50.0	-17.1
0.154	3.6	20.3	23.9	55.8	-31.9

CONCLUSION

Pass



Tested By

EUT:	FGRM	Work Order:	FREW0013
Serial Number:	956-8447	Date:	10/15/2013
Customer:	FreeWave Technologies, Inc.	Temperature:	23°C
Attendees:	Dean Busch	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1028 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	FREW0013-3

TEST SPECIFICATIONS

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

TEST PARAMETERS

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

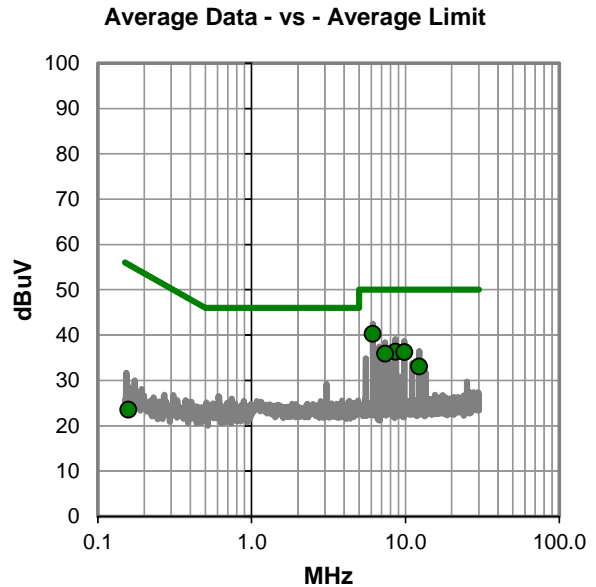
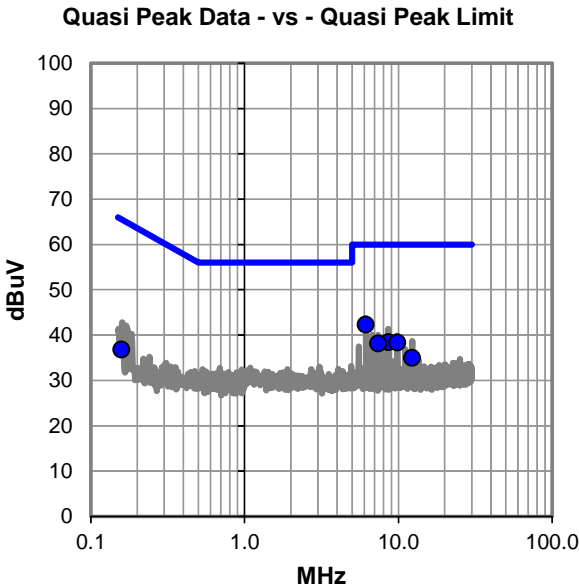
Output power level at 10, Full Power.

EUT OPERATING MODES

Transmitting Mid Channel, 916.1 MHz, 115 kbps

DEVIATIONS FROM TEST STANDARD

None



RESULTS - Run #8

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	21.7	20.6	42.3	60.0	-17.7
8.600	17.7	20.7	38.4	60.0	-21.6
9.830	17.6	20.7	38.3	60.0	-21.7
7.374	17.5	20.6	38.1	60.0	-21.9
12.286	14.1	20.9	35.0	60.0	-25.0
0.158	16.5	20.3	36.8	65.6	-28.8

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	19.7	20.6	40.3	50.0	-9.7
8.600	15.6	20.7	36.3	50.0	-13.7
9.830	15.5	20.7	36.2	50.0	-13.8
7.374	15.3	20.6	35.9	50.0	-14.1
12.286	12.2	20.9	33.1	50.0	-16.9
0.158	3.2	20.3	23.5	55.6	-32.1

CONCLUSION

Pass



Tested By

EUT:	FGRM	Work Order:	FREW0013
Serial Number:	956-8447	Date:	10/15/2013
Customer:	FreeWave Technologies, Inc.	Temperature:	23°C
Attendees:	Dean Busch	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1028 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	FREW0013-3

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	9	Line:	High Line	Ext. Attenuation (dB):	20
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COMMENTS

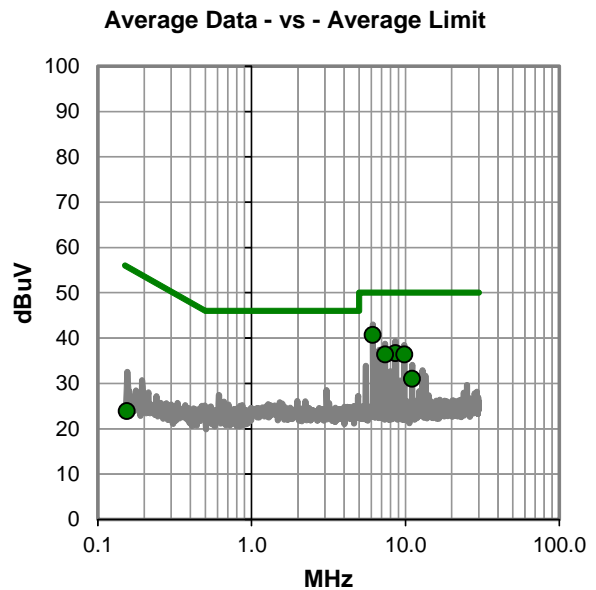
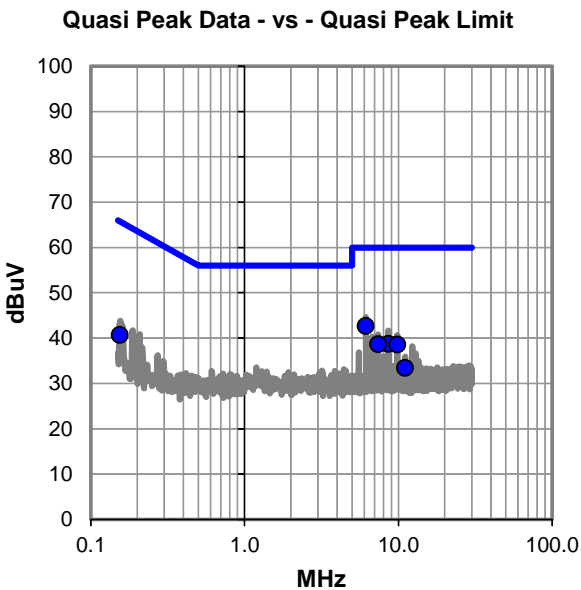
Output power level at 10, Full Power.

EUT OPERATING MODES

Transmitting High Channel, 927.8 MHz, 115 kbps

DEVIATIONS FROM TEST STANDARD

None



RESULTS - Run #9

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	22.1	20.6	42.7	60.0	-17.3
8.600	18.0	20.7	38.7	60.0	-21.3
7.374	18.0	20.6	38.6	60.0	-21.4
9.830	17.8	20.7	38.5	60.0	-21.5
0.154	20.4	20.3	40.7	65.8	-25.1
11.060	12.6	20.8	33.4	60.0	-26.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	20.1	20.6	40.7	50.0	-9.3
8.600	15.9	20.7	36.6	50.0	-13.4
7.374	15.8	20.6	36.4	50.0	-13.6
9.830	15.6	20.7	36.3	50.0	-13.7
11.060	10.2	20.8	31.0	50.0	-19.0
0.154	3.6	20.3	23.9	55.8	-31.9

CONCLUSION

Pass



Tested By

EUT:	FGRM	Work Order:	FREW0013
Serial Number:	956-8447	Date:	10/15/2013
Customer:	FreeWave Technologies, Inc.	Temperature:	23°C
Attendees:	Dean Busch	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1028 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	FREW0013-3

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	10	Line:	Neutral	Ext. Attenuation (dB):	20
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COMMENTS

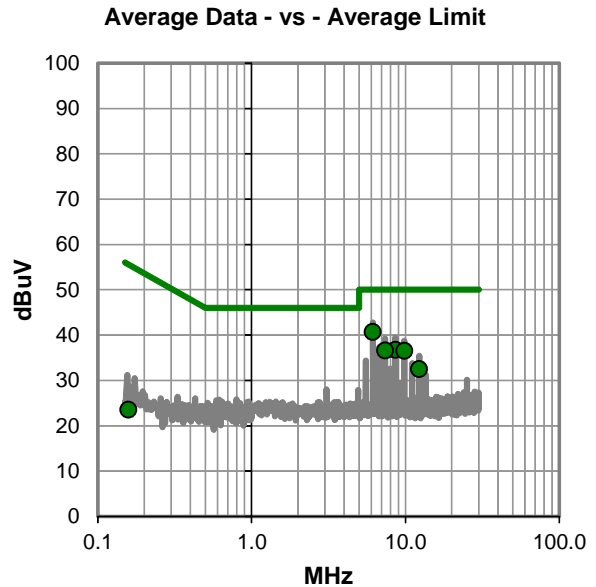
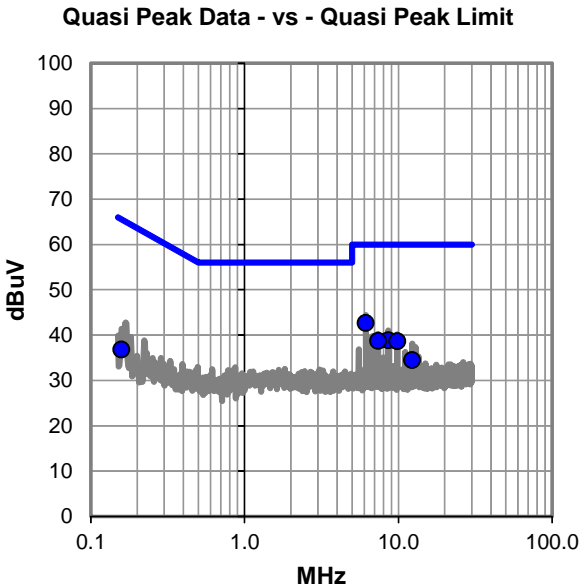
Output power level at 10, Full Power.

EUT OPERATING MODES

Transmitting High Channel, 927.8 MHz, 115 kbps

DEVIATIONS FROM TEST STANDARD

None



RESULTS - Run #10

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	22.1	20.6	42.7	60.0	-17.3
8.600	18.1	20.7	38.8	60.0	-21.2
7.374	18.1	20.6	38.7	60.0	-21.3
9.830	17.9	20.7	38.6	60.0	-21.4
12.286	13.6	20.9	34.5	60.0	-25.5
0.158	16.5	20.3	36.8	65.6	-28.8

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
6.144	20.1	20.6	40.7	50.0	-9.3
8.600	16.0	20.7	36.7	50.0	-13.3
7.374	16.0	20.6	36.6	50.0	-13.4
9.830	15.8	20.7	36.5	50.0	-13.5
12.286	11.6	20.9	32.5	50.0	-17.5
0.158	3.2	20.3	23.5	55.6	-32.1

CONCLUSION

Pass



Tested By