

64seconds, Inc. RE1 Radio Module FCC 15.207:2014 FCC 15.247:2014

Report # 64SE0001.1



NVLAP Lab Code: 200881-0

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. This Report may only be duplicated in its entirety



CERTIFICATE OF TEST

Last Date of Test: November 04, 2014 64seconds, Inc. Model: RE1 Radio Module

Radio Equipment Testing

Standards

Specification	Method	
FCC 15.207:2014	ANSI C63.10:2009	
FCC 15.247:2014	ANSI C63.10:2009	

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
6.7	Band Edge Compliance	Yes	Pass	
6.7	Spurious Conducted Emissions	Yes	Pass	
6.9.1	Occupied Bandwidth	Yes	Pass	
6.10.1	Equivalent Isotropic Radiated Power	Yes	Pass	
6.11.2	Power Spectral Density	Yes	Pass	
7.5	Duty Cycle	Yes	Pass	
7.7.2	Channel Spacing	Yes	Pass	
7.7.3	Number of Hopping Frequencies	Yes	N/A	No limit. Required for Dwell Time
7.7.4	Dwell Time	Yes	Pass	
7.7.9	Band Edge Compliance – Hopping Mode	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Tim O'Shea, Operations Manager

REVISION HISTORY



Revision Number	Description	Date Page Number	
00	None		

ACCREDITATIONS AND AUTHORIZATIONS



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

MSIP / 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.

Israel

MOC – Recognized by MOC 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.

SCOPE

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

NORTHWEST ENC

MEASUREMENT UNCERTAINTY

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 on each data sheet. 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 16-4-2 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)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	4.7 dB	-4.7 dB
AC Powerline Conducted Emissions (dB)	2.9 dB	-2.9 dB

FACILITIES





Oregon	California	New York	Minnesota	Washington			
Labs EV01-12 22975 NW Evergreen Pkwy	Labs OC01-13 41 Tesla	Labs NY01-04 4939 Jordan Rd.	Labs MN01-08 9349 W Broadway Ave.	Labs NC01-05,SU02,SU07 19201 120 th Ave. NE			
Hillsboro, OR 97124 (503) 844-4066	Irvine, CA 92618 (949) 861-8918	Elbridge, NY 13060 (315) 685-0796	Brooklyn Park, MN 55445 (763) 425-2281	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	2834F-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			









PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	64seconds, Inc.	
Address:	945 Concord Street	
City, State, Zip:	Framingham, MA 01701	
Test Requested By:	Paul Lander	
Model:	RE1	
First Date of Test:	October 30, 2014	
Last Date of Test:	November 04, 2014	
Receipt Date of Samples:	October 30, 2014	
Equipment Design Stage:	Prototype	
Equipment Condition:	No Damage	

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

Low-cost, low-power 2.4 GHz unlicensed-band radio module for general purpose RF communication between a Sensor unit and a Base unit. The radio operates as a FHSS Hybrid and utilizes 1 non-removable antenna.

Testing Objective:

To demonstrate compliance to FCC 15.247 requirements for modular approval.



Configuration 64SE0001-1

EUT					
Description	Manufacturer	Model/Part Number	Serial Number		
RE1 Radio Module	64seconds, Inc.	None	None		

Peripherals in test setup boundary						
Description	Manufacturer	Model/Part Number	Serial Number			
AA Battery Pack	N/A	None	None			

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Power Cable	No	25cm	No	RE1	AA Battery Pack



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	10/30/2014	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	11/3/2014	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.
3	11/3/2014	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.
4	11/3/2014	Number of Hopping Frequencies	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	11/4/2014	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	11/4/2014	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	11/4/2014	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.
8	11/4/2014	Equivalent Isotropic Radiated 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.
9	11/4/2014	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.
10	11/4/2014	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.
11	11/4/2014	Channel Spacing	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.
12	11/4/2014	Band Edge Compliance – Hopping Mode	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed



TEST DESCRIPTION

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Receiver	Rohde & Schwarz	ESR7	ARI	05/06/2014	12 mo
Attenuator 20dB, BNC	Fairview Microwave	SA01B-20	AQP	07/22/2014	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HGN	05/23/2014	24 mo
MN03 Cables	ESM Cable Corp.	Conducted Cables	MNC	12/05/2013	12 mo
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	05/15/2014	12 mo
Single Output DC Power Supply,					
30V/5A, 150W	Agilent	U8002A	TPZ	NCR	0 mo

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

64SE0001-1

MODES INVESTIGATED

Transmitting 2402 MHz		
Transmitting 2446 MHz		
Transmitting 2480 MHz		



EUT:	RE1 Radio Module	Work Order:	64SE0001
Serial Number:	None	Date:	11/03/2014
Customer:	64seconds, Inc.	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	21.3%
Customer Project:	None	Bar. Pressure:	1035.2 mb
Tested By:	Johnathan Lee	Job Site:	MN03
Power:	3.0VDC	Configuration:	64SE0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

-	-				
Run #:	3	Line:	Positive Lead	Ext. Attenuation (dB):	20
COMMENT	S				
None					
EUT OPER	ATING MODES				
Transmitting 2	2402 MHz				
DEVIATIO	NS FROM TEST	STANDA	RD		
NI					

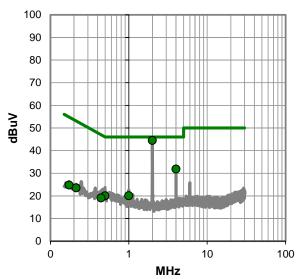
None

Angp 50

Quasi Peak Data - vs - Quasi Peak Limit

MHz

Average Data - vs - Average Limit





RESULTS - Run #3

Q	Quasi Peak Data - vs - Quasi Peak Limit					
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)	
2.000	24.5	20.3	44.8	56.0	-11.2	
0.173	22.6	20.3	42.9	64.8	-21.9	
0.213	19.2	20.2	39.4	63.1	-23.7	
4.000	11.7	20.4	32.1	56.0	-23.9	
0.444	9.9	20.2	30.1	57.0	-26.9	
0.497	8.4	20.2	28.6	56.1	-27.5	
1.000	2.9	20.3	23.2	56.0	-32.8	

Average Data - vs - Average Limit					
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
2.000	24.2	20.3	44.5	46.0	-1.5
4.000	11.5	20.4	31.9	46.0	-14.1
1.000	-0.2	20.3	20.1	46.0	-25.9
0.497	-0.2	20.2	20.0	46.1	-26.1
0.444	-1.1	20.2	19.1	47.0	-27.9
0.213	3.3	20.2	23.5	53.1	-29.6
0.173	4.5	20.3	24.8	54.8	-30.0

CONCLUSION

Pass

Tested By



EUT:	RE1 Radio Module	Work Order:	64SE0001
Serial Number:	None	Date:	11/03/2014
Customer:	64seconds, Inc.	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	21.3%
Customer Project:	None	Bar. Pressure:	1035.2 mb
Tested By:	Johnathan Lee	Job Site:	MN03
Power:	3.0VDC	Configuration:	64SE0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

Run #: 4	Line:	Negative Lead	Ext. Attenuation (dB):	20
COMMENTS				
None				
EUT OPERATING MODES				
Transmitting 2402 MHz				
DEVIATIONS FROM TEST	STANDA	RD		
Nono				

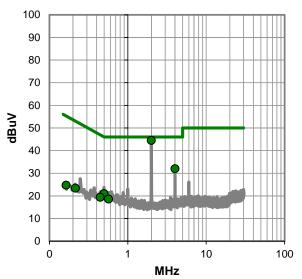
None

Angp 50

Quasi Peak Data - vs - Quasi Peak Limit

MHz

Average Data - vs - Average Limit





RESULTS - Run #4

Q	Quasi Peak Data - vs - Quasi Peak Limit					
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)	
2.000	24.5	20.3	44.8	56.0	-11.2	
0.164	22.6	20.3	42.9	65.3	-22.4	
0.215	19.2	20.2	39.4	63.0	-23.6	
4.000	11.9	20.4	32.3	56.0	-23.7	
0.446	10.8	20.2	31.0	56.9	-25.9	
0.570	9.2	20.2	29.4	56.0	-26.6	
0.499	8.3	20.2	28.5	56.0	-27.5	

Average Data - vs - Average Limit					
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
2.000	24.2	20.3	44.5	46.0	-1.5
4.000	11.6	20.4	32.0	46.0	-14.0
0.499	0.8	20.2	21.0	46.0	-25.0
0.570	-1.6	20.2	18.6	46.0	-27.4
0.446	-0.8	20.2	19.4	46.9	-27.5
0.215	3.2	20.2	23.4	53.0	-29.6
0.164	4.4	20.3	24.7	55.3	-30.6

CONCLUSION

Pass

Tested By



EUT:	RE1 Radio Module	Work Order:	64SE0001
Serial Number:	None	Date:	11/03/2014
Customer:	64seconds, Inc.	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	21.3%
Customer Project:	None	Bar. Pressure:	1035.2 mb
Tested By:	Johnathan Lee	Job Site:	MN03
Power:	3.0VDC	Configuration:	64SE0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

-	-						
Run #:	5	Line:	Negative Lead	Ext. Attenuation (dB):	20		
COMMENT	S						
None							
EUT OPER	EUT OPERATING MODES						
Transmitting 2	Transmitting 2446 MHz						
DEVIATIONS FROM TEST STANDARD							
Nana							

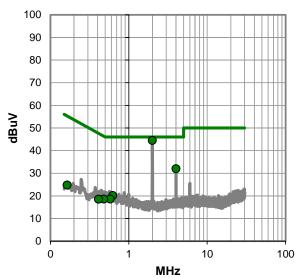
None

Angp 50

Quasi Peak Data - vs - Quasi Peak Limit

MHz

Average Data - vs - Average Limit





RESULTS - Run #5

Q	Quasi Peak Data - vs - Quasi Peak Limit					
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)	
2.000	24.5	20.3	44.8	56.0	-11.2	
0.163	22.7	20.3	43.0	65.3	-22.3	
4.000	11.9	20.4	32.3	56.0	-23.7	
0.580	9.7	20.2	29.9	56.0	-26.1	
0.479	8.5	20.2	28.7	56.4	-27.7	
0.411	9.4	20.2	29.6	57.6	-28.0	
0.626	4.3	20.2	24.5	56.0	-31.5	

Average Data - vs - Average Limit					
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
2.000	24.2	20.3	44.5	46.0	-1.5
4.000	11.6	20.4	32.0	46.0	-14.0
0.626	-0.1	20.2	20.1	46.0	-25.9
0.580	-1.6	20.2	18.6	46.0	-27.4
0.479	-1.6	20.2	18.6	46.4	-27.8
0.411	-1.7	20.2	18.5	47.6	-29.1
0.163	4.5	20.3	24.8	55.3	-30.5

CONCLUSION

Pass

Tested By



EUT:	RE1 Radio Module	Work Order:	64SE0001
Serial Number:	None	Date:	11/03/2014
Customer:	64seconds, Inc.	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	21.3%
Customer Project:	None	Bar. Pressure:	1035.2 mb
Tested By:	Johnathan Lee	Job Site:	MN03
Power:	3.0VDC	Configuration:	64SE0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

Run #: 6	Line:	Positive Lead	Ext. Attenuation (dB):	20			
COMMENTS							
None							
EUT OPERAT	EUT OPERATING MODES						
Transmitting 2446	6 MHz						
DEVIATIONS FROM TEST STANDARD							
Nono							

None

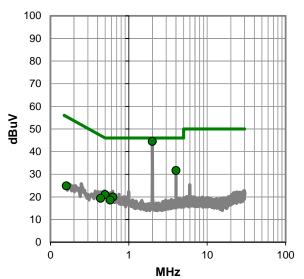
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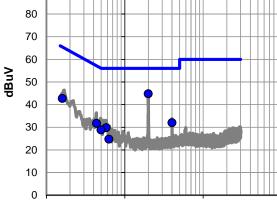
90

0

Quasi Peak Data - vs - Quasi Peak Limit

Average Data - vs - Average Limit





10

MHz

100

1



RESULTS - Run #6

Quasi Peak Data - vs - Quasi Peak Limit					
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
2.000	24.5	20.3	44.8	56.0	-11.2
0.160	22.4	20.3	42.7	65.5	-22.8
4.001	11.6	20.4	32.0	56.0	-24.0
0.436	11.5	20.2	31.7	57.1	-25.4
0.580	9.6	20.2	29.8	56.0	-26.2
0.499	8.6	20.2	28.8	56.0	-27.2
0.626	4.5	20.2	24.7	56.0	-31.3

Average Data - vs - Average Limit					
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
2.000	24.2	20.3	44.5	46.0	-1.5
4.001	11.3	20.4	31.7	46.0	-14.3
0.499	0.8	20.2	21.0	46.0	-25.0
0.626	-0.3	20.2	19.9	46.0	-26.1
0.580	-1.6	20.2	18.6	46.0	-27.4
0.436	-0.8	20.2	19.4	47.1	-27.7
0.160	4.6	20.3	24.9	55.5	-30.6

CONCLUSION

Pass

Tested By



EUT:	RE1 Radio Module	Work Order:	64SE0001
Serial Number:	None	Date:	11/03/2014
Customer:	64seconds, Inc.	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	21.3%
Customer Project:	None	Bar. Pressure:	1035.2 mb
Tested By:	Johnathan Lee	Job Site:	MN03
Power:	3.0VDC	Configuration:	64SE0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

Run #:	8	Line:	Positive Lead	Ext. Attenuation (dB):	20		
COMMENT	S						
None							
EUT OPER	EUT OPERATING MODES						
Transmitting 2	Transmitting 2480 MHz						
DEVIATIONS FROM TEST STANDARD							
Mana							

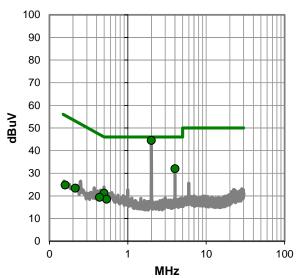
None

Angp 50

Quasi Peak Data - vs - Quasi Peak Limit

MHz

Average Data - vs - Average Limit





RESULTS - Run #8

Q	Quasi Peak Data - vs - Quasi Peak Limit									
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Margin (dB)							
2.000	24.5	20.3	44.8	56.0	-11.2					
0.159	22.3	20.3	42.6	65.5	-22.9					
0.213	19.1	20.2	39.3	63.1	-23.8					
4.000	11.8	20.4	32.2	56.0	-23.8					
0.436	11.5	20.2	31.7	57.1	-25.4					
0.538	8.9	20.2	29.1	56.0	-26.9					
0.499	8.4	20.2	28.6	56.0	-27.4					

	Average Data - vs - Average Limit										
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)						
2.000	24.2	20.3	44.5	46.0	-1.5						
4.000	11.6	20.4	32.0	46.0	-14.0						
0.499	1.0	20.2	21.2	46.0	-24.8						
0.538	-1.7	20.2	18.5	46.0	-27.5						
0.436	-0.8	20.2	19.4	47.1	-27.7						
0.213	3.2	20.2	23.4	53.1	-29.7						
0.159	4.5	20.3	24.8	55.5	-30.7						

CONCLUSION

Pass

Tested By



EUT:	RE1 Radio Module	Work Order:	64SE0001
Serial Number:	None	Date:	11/03/2014
Customer:	64seconds, Inc.	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	21.3%
Customer Project:	None	Bar. Pressure:	1035.2 mb
Tested By:	Johnathan Lee	Job Site:	MN03
Power:	3.0VDC	Configuration:	64SE0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

-	-				
Run #:	9	Line:	Negative Lead	Ext. Attenuation (dB):	20
COMMENT	ſS				
None					
EUT OPER	ATING MODES				
Transmitting 2	2480 MHz				
DEVIATIO	NS FROM TEST	STANDA	RD		
Nana					

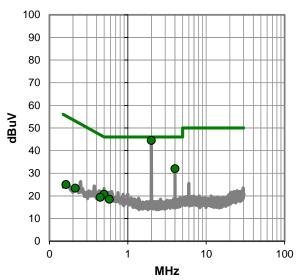
None

Angp 50

Quasi Peak Data - vs - Quasi Peak Limit

MHz

Average Data - vs - Average Limit





RESULTS - Run #9

Q	Quasi Peak Data - vs - Quasi Peak Limit									
Freq (MHz)	Amp. (dBuV)	Factor (dB)								
2.000	24.5	20.3	44.8	56.0	-11.2					
0.162	22.7	20.3	43.0	65.3	-22.3					
4.000	11.9	20.4	32.3	56.0	-23.7					
0.214	19.1	20.2	39.3	63.1	-23.8					
0.446	11.0	20.2	31.2	56.9	-25.7					
0.583	8.8	20.2	29.0	56.0	-27.0					
0.498	8.6	20.2	28.8	56.0	-27.2					

	Average Data - vs - Average Limit										
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)						
2.000	24.2	20.3	44.5	46.0	-1.5						
4.000	11.6	20.4	32.0	46.0	-14.0						
0.498	0.5	20.2	20.7	46.0	-25.3						
0.583	-1.7	20.2	18.5	46.0	-27.5						
0.446	-0.8	20.2	19.4	46.9	-27.5						
0.214	3.2	20.2	23.4	53.1	-29.7						
0.162	4.7	20.3	25.0	55.3	-30.3						

CONCLUSION

Pass

Tested By



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

Transmitting GFSK at 2404, 2446, and 2480 MHz.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

64SE0001 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz

Stop Frequency 26500 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
High Pass Filter	Micro-Tronics	HPM50111	HGQ	5/15/2014	24 mo
Attenuator, 20 dB, 'SMA'	SM Electronics	SA6-20	REO	5/15/2014	12 mo
Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	10/3/2014	12 mo
		18-26GHz Standard Gain Horn			
MN05 Cable	N/A	Cable	MNP	10/3/2014	12 mo
Antenna, Horn	ETS	3160-09	AHG	NCR	0 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	3/14/2014	12 mo
Antenna, Horn	ETS Lindgren	3160-08	AIQ	NCR	0 mo
MN05 Cables	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	3/14/2014	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	3/14/2014	12 mo
Antenna, Horn	ETS	3160-07	AXP	NCR	0 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	3/14/2014	12 mo
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12 mo
Antenna, Horn	ETS	3115	AJA	6/3/2014	24 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAD	3/14/2014	12 mo
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	3/14/2014	12 mo
Antenna, Biconilog	Teseq	CBL 6141B	AYD	12/17/2013	24 mo
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24 mo

MEASUREMENT BANDWIDTHS

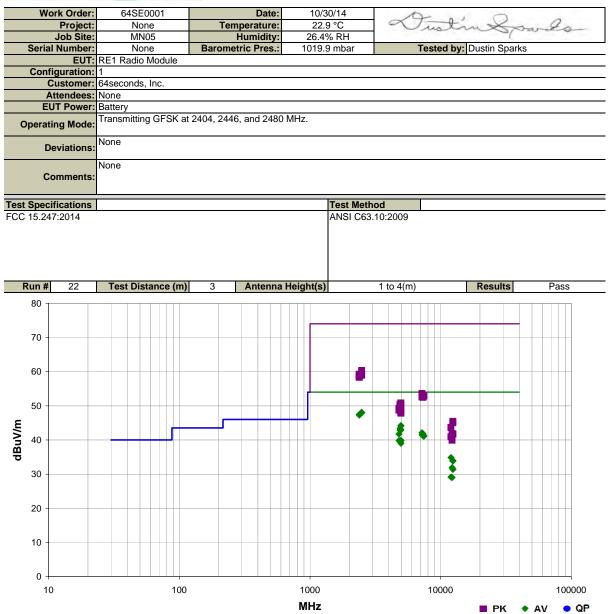
Frequency Range	Peak Data	Quasi-Peak Data	Average Data
(MHz)	(kHz)	(kHz)	(kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

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



SPURIOUS RADIATED EMISSIONS



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
2488.250	31.0	-3.0	1.2	193.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	GFSK, EUT vert, high ch
2486.400	31.0	-3.0	1.0	174.1	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	GFSK, EUT on side, high ch
2486.025	31.0	-3.0	1.0	111.0	3.0	20.0	Vert	AV	0.0	48.0	54.0	-6.0	GFSK, EUT horz, high ch
2485.217	31.0	-3.0	1.0	358.0	3.0	20.0	Vert	AV	0.0	48.0	54.0	-6.0	GFSK, EUT on side, high ch
2483.725	31.0	-3.0	1.3	261.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	GFSK, EUT horz, high ch
2483.625	31.0	-3.0	1.0	193.0	3.0	20.0	Vert	AV	0.0	48.0	54.0	-6.0	GFSK, EUT vert, high ch
2389.933	30.8	-3.3	1.0	57.0	3.0	20.0	Vert	AV	0.0	47.5	54.0	-6.5	GFSK, EUT horz, low ch
2388.767	30.7	-3.3	1.8	200.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	GFSK, EUT horz, low ch
2389.225	30.7	-3.3	1.0	256.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	GFSK, EUT on side, low ch
2389.825	30.7	-3.3	1.0	162.0	3.0	20.0	Vert	AV	0.0	47.4	54.0	-6.6	GFSK, EUT on side, low ch
2387.667	30.6	-3.3	1.0	79.0	3.0	20.0	Vert	AV	0.0	47.3	54.0	-6.7	GFSK, EUT vert, low ch
2389.175	30.6	-3.3	1.6	286.0	3.0	20.0	Horz	AV	0.0	47.3	54.0	-6.7	GFSK, EUT vert, low ch
4960.083	39.3	4.9	1.3	357.0	3.0	0.0	Horz	AV	0.0	44.2	54.0	-9.8	GFSK, EUT on side, high ch
4960.100	39.2	4.9	1.3	72.0	3.0	0.0	Vert	AV	0.0	44.1	54.0	-9.9	GFSK, EUT vert, high ch
4892.125	38.4	5.0	1.4	39.0	3.0	0.0	Vert	AV	0.0	43.4	54.0	-10.6	GFSK, EUT vert, mid ch
4960.075	38.0	4.9	1.4	344.9	3.0	0.0	Horz	AV	0.0	42.9	54.0	-11.1	GFSK, EUT vert, high ch
4892.100	37.9	5.0	1.0	358.9	3.0	0.0	Horz	AV	0.0	42.9	54.0	-11.1	GFSK, EUT on side, mid ch
7206.025	30.4	11.7	2.0	20.0	3.0	0.0	Vert	AV	0.0	42.1	54.0	-11.9	GFSK, EUT vert, low ch
7338.225	29.3	12.5	1.0	39.0	3.0	0.0	Horz	AV	0.0	41.8	54.0	-12.2	GFSK, EUT on side, mid ch
4804.125	36.2	5.5	1.3	350.0	3.0	0.0	Horz	AV	0.0	41.7	54.0	-12.3	GFSK, EUT on side, low ch
7206.633	29.8	11.7	1.0	229.9	3.0	0.0	Horz	AV	0.0	41.5	54.0	-12.5	GFSK, EUT on side, low ch
7439.608	28.3	13.0	1.0	18.0	3.0	0.0	Horz	AV	0.0	41.3	54.0	-12.7	GFSK, EUT on side, high ch

						External	Polarity/ Transducer		Distance			Compared to	
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	Attenuation (dB)	Туре	Detector	Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Spec. (dB)	
. ,													Comments
7338.325	28.8	12.5	1.0	143.0	3.0	0.0	Vert	AV	0.0	41.3	54.0	-12.7	GFSK, EUT vert, mid ch
7437.508	28.1	13.0	3.2	103.0	3.0	0.0	Vert	AV	0.0	41.1	54.0	-12.9	GFSK, EUT vert, high ch
2487.650	43.3	-3.0	1.3	261.0	3.0	20.0	Horz	PK	0.0	60.3	74.0	-13.7	GFSK, EUT horz, high ch
4960.025	35.0	4.9	1.2	97.0	3.0	0.0	Horz	AV	0.0	39.9	54.0	-14.1	GFSK, EUT horz, high ch
4804.158	34.3	5.5	1.4	62.1	3.0	0.0	Vert	AV	0.0	39.8	54.0	-14.2	GFSK, EUT vert, low ch
4960.017	34.8	4.9	1.6	69.1	3.0	0.0	Vert	AV	0.0	39.7	54.0	-14.3	GFSK, EUT horz, high ch
2483.625	42.3	-3.0	1.0	193.0	3.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	GFSK, EUT vert, high ch
2484.558	42.2	-3.0	1.0	111.0	3.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	GFSK, EUT horz, high ch
2387.333	42.5	-3.3	1.0	57.0	3.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	GFSK, EUT horz, low ch
2389.642	42.5	-3.3	1.0	162.0	3.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	GFSK, EUT on side, low ch
2487.292	42.0	-3.0	1.0	174.1	3.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	GFSK, EUT on side, high ch
2485.892	42.0	-3.0	1.0	358.0	3.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	GFSK, EUT on side, high ch
4960.183	34.1	4.9	1.0	354.9	3.0	0.0	Vert	AV	0.0	39.0	54.0	-15.0	GFSK, EUT on side, high ch
2484.733	41.9	-3.0	1.2	193.0	3.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	GFSK, EUT vert, high ch
2387.525	42.1	-3.3	1.0	79.0	3.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	GFSK, EUT vert, low ch
2389.367	42.0	-3.3	1.6	286.0	3.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	GFSK, EUT vert, low ch
2387.142	41.7	-3.3	1.0	256.0	3.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	GFSK, EUT on side, low ch
2386.300	41.6	-3.3	1.8	200.0	3.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	GFSK, EUT horz, low ch
12011.330	40.3	-5.5	1.1	351.0	3.0	0.0	Horz	AV	0.0	34.8	54.0	-19.2	GFSK, EUT on side, low ch
12402.450	33.4	0.5	3.8	217.1	3.0	0.0	Horz	AV	0.0	33.9	54.0	-20.1	GFSK, EUT on side, high ch
12401.360	33.3	0.5	1.0	54.0	3.0	0.0	Vert	AV	0.0	33.8	54.0	-20.2	GFSK, EUT vert, high ch
7206.642	41.9	11.7	2.0	20.0	3.0	0.0	Vert	PK	0.0	53.6	74.0	-20.4	GFSK, EUT vert, low ch
7441.450	40.0	13.0	3.2	103.0	3.0	0.0	Vert	PK	0.0	53.0	74.0	-21.0	GFSK, EUT vert, high ch
7440.583	39.8	13.0	1.0	18.0	3.0	0.0	Horz	PK	0.0	52.8	74.0	-21.2	GFSK, EUT on side, high ch
7205.692	40.9	11.7	1.0	229.9	3.0	0.0	Horz	PK	0.0	52.6	74.0	-21.4	GFSK, EUT on side, low ch
7336.033	40.1	12.5	1.0	143.0	3.0	0.0	Vert	PK	0.0	52.6	74.0	-21.4	GFSK, EUT vert, mid ch
7335.758	40.0	12.5	1.0	39.0	3.0	0.0	Horz	PK	0.0	52.5	74.0	-21.5	GFSK, EUT on side, mid ch
12231.270	36.9	-5.0	1.1	2.0	3.0	0.0	Horz	AV	0.0	31.9	54.0	-22.1	GFSK, EUT on side, mid ch
12399.280	35.9	-4.4	1.4	328.0	3.0	0.0	Vert	AV	0.0	31.5	54.0	-22.5	GFSK, EUT vert, high ch
12399.390	35.8	-4.4	1.0	347.9	3.0	0.0	Horz	AV	0.0	31.4	54.0	-22.6	GFSK, EUT on side, high ch
4960.575	45.9	4.9	1.3	357.0	3.0	0.0	Horz	PK	0.0	50.8	74.0	-23.2	GFSK, EUT on side, high ch
4891.775	45.5	5.0	1.0	358.9	3.0	0.0	Horz	PK	0.0	50.5	74.0	-23.5	GFSK, EUT on side, mid ch
4960.592	45.4	4.9	1.3	72.0	3.0	0.0	Vert	PK	0.0	50.3	74.0	-23.7	GFSK, EUT vert, high ch
4892.583	45.0	5.0	1.4	39.0	3.0	0.0	Vert	PK	0.0	50.0	74.0	-24.0	GFSK, EUT vert, mid ch
4960.492	44.8	4.9	1.4	344.9	3.0	0.0	Horz	PK	0.0	49.7	74.0	-24.3	GFSK, EUT vert, high ch
4803.658	43.7	5.5	1.3	350.0	3.0	0.0	Horz	PK	0.0	49.2	74.0	-24.8	GFSK, EUT on side, low ch
12011.450	34.6	-5.5	1.0	107.0	3.0	0.0	Vert	AV	0.0	29.1	54.0	-24.9	GFSK, EUT vert, low ch
12231.320	34.0	-5.0	1.0	88.1	3.0	0.0	Vert	AV	0.0	29.0	54.0	-25.0	GFSK, EUT vert, mid ch
4804.225	43.2	5.5	1.4	62.1	3.0	0.0	Vert	PK	0.0	48.7	74.0	-25.3	GFSK, EUT vert, low ch
4960.517	43.5	4.9	1.6	69.1	3.0	0.0	Vert	PK	0.0	48.4	74.0	-25.6	GFSK, EUT horz, high ch
4960.375	43.3	4.9	1.2	97.0	3.0	0.0	Horz	PK	0.0	48.2	74.0	-25.8	GFSK, EUT horz, high ch
4959.558	42.9	4.9	1.0	354.9	3.0	0.0	Vert	PK	0.0	47.8	74.0	-26.2	GFSK, EUT on side, high ch
12400.150	44.9	0.5	1.0	54.0	3.0	0.0	Vert	PK	0.0	45.4	74.0	-28.6	GFSK, EUT vert, high ch
12400.430	44.5	0.5	3.8	217.1	3.0	0.0	Horz	PK	0.0	45.0	74.0	-29.0	GFSK, EUT on side, high ch
12011.560	49.1	-5.5	1.1	351.0	3.0	0.0	Horz	PK	0.0	43.6	74.0	-30.4	GFSK, EUT on side, low ch
12228.980	46.9	-5.0	1.1	2.0	3.0	0.0	Horz	PK	0.0	41.9	74.0	-32.1	GFSK, EUT on side, mid ch
12399.150	46.1	-4.4	1.0	347.9	3.0	0.0	Horz	PK	0.0	41.7	74.0	-32.3	GFSK, EUT on side, high ch
12398.830	46.1	-4.4	1.4	328.0	3.0	0.0	Vert	PK	0.0	41.7	74.0	-32.3	GFSK, EUT vert, high ch
12010.660	46.4	-5.5	1.0	107.0	3.0	0.0	Vert	PK	0.0	40.9	74.0	-33.1	GFSK, EUT vert, low ch
12232.330	44.9	-5.0	1.0	88.1	3.0	0.0	Vert	PK	0.0	39.9	74.0	-34.1	GFSK, EUT vert, mid ch

ENC

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
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12
Antenna, Horn	ETS	3115	AJA	6/3/2014	24
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24

TEST DESCRIPTION

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

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



Desult
Result
Result Pass 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
Antenna, Horn	ETS	3115	AJA	6/3/2014	24
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24

TEST DESCRIPTION

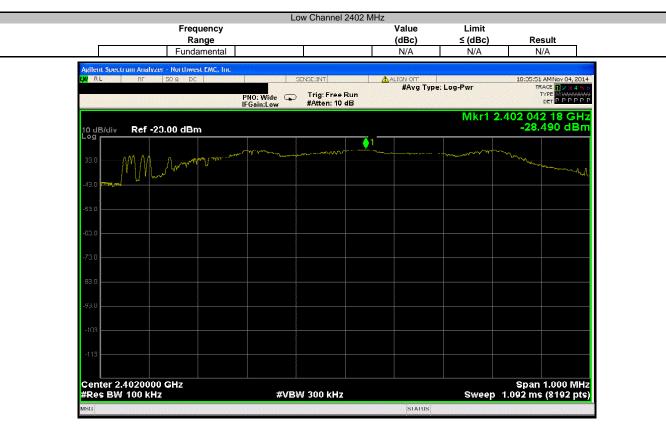
The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

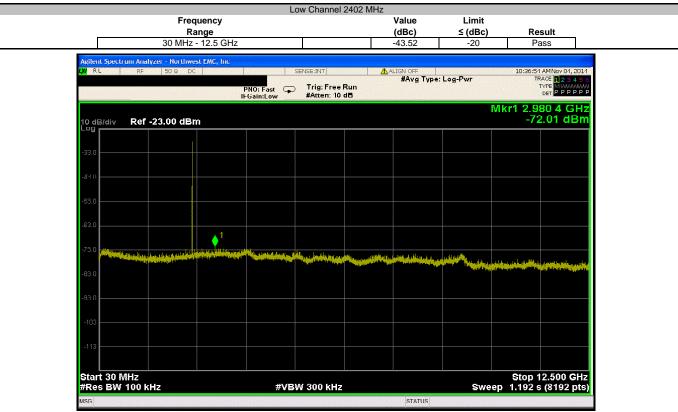


	RE1 Radio Module		Work Order:		
Serial Number:				11/04/14	
Customer:	64seconds, Inc.		Temperature:	23.1°C	
Attendees:			Humidity:		
Project:			Barometric Pres.:		
	Bryan Weller	Power: Battery	Job Site:	MN05	
EST SPECIFICATI	IONS	Test Method			
CC 15.247:2014		ANSI C63.10:2009, KDB 453039			
COMMENTS					
lone					
	M TEST STANDARD				
DEVIATIONS FROM	M TEST STANDARD				
None	M TEST STANDARD	A man weller			
lone	M TEST STANDARD	Bryan Weller			
	M TEST STANDARD	Signature pryan Welles	Webur	Undi	
lone	N TEST STANDARD	Frequency	Value	Limit	Descrit
one onfiguration #	1	Frequency Range	(dBc)	≤ (dBc)	Result
one configuration # ow Channel 2402 M	1 MHz	Frequency Range Fundamental	(dBc) N/A	≤ (dBc) N/A	N/A
ow Channel 2402 M ow Channel 2402 M	1 MHz MHz	Frequency Range Fundamental 30 MHz - 12.5 GHz	(dBc) N/A -43.52	≤ (dBc) N/A -20	N/A Pass
one onfiguration # ow Channel 2402 M ow Channel 2402 M ow Channel 2402 M	1 MHz MHz MHz	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	(dBc) N/A -43.52 -45.18	≤ (dBc) N/A -20 -20	N/A Pass Pass
one onfiguration # bow Channel 2402 N bow Channel 2402 N bow Channel 2404 M id Channel 2446 M	1 MHz MHz MHz MHz	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental	(dBc) N/A -43.52 -45.18 N/A	≤ (dBc) N/A -20 -20 N/A	N/A Pass Pass N/A
one onfiguration # ow Channel 2402 M ow Channel 2402 M ow Channel 2402 M id Channel 2446 M id Channel 2446 M	1 MHz MHz MHz MHz MHz MHz	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz	(dBc) N/A -43.52 -45.18 N/A -43.52	≤ (dBc) N/A -20 -20 N/A -20	N/A Pass Pass N/A Pass
one onfiguration # ow Channel 2402 M ow Channel 2402 M ow Channel 2446 M id Channel 2446 M id Channel 2446 M	1 MHz MHz MHz AHz AHz AHz	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	(dBc) N/A -43.52 -45.18 N/A -43.52 -45.33	≤ (dBc) N/A -20 -20 N/A -20 -20 -20	N/A Pass Pass N/A Pass Pass
one onfiguration # ow Channel 2402 M ow Channel 2402 M ow Channel 2402 M id Channel 2446 M id Channel 2446 M id Channel 2446 M	1 MHz MHz MHz MHz AHz MHz MHz	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental	(dBc) N/A -43.52 -45.18 N/A -43.52 -45.33 N/A	≤ (dBc) N/A -20 -20 N/A -20	N/A Pass Pass N/A Pass
one configuration # ow Channel 2402 M	1 MHz MHz MHz MHz MHz MHz MHz MHz	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	(dBc) N/A -43.52 -45.18 N/A -43.52 -45.33	≤ (dBc) N/A -20 -20 N/A -20 -20 -20	N/A Pass Pass N/A Pass Pass



XMit 2014.02.07 NweTx 2014.10.15





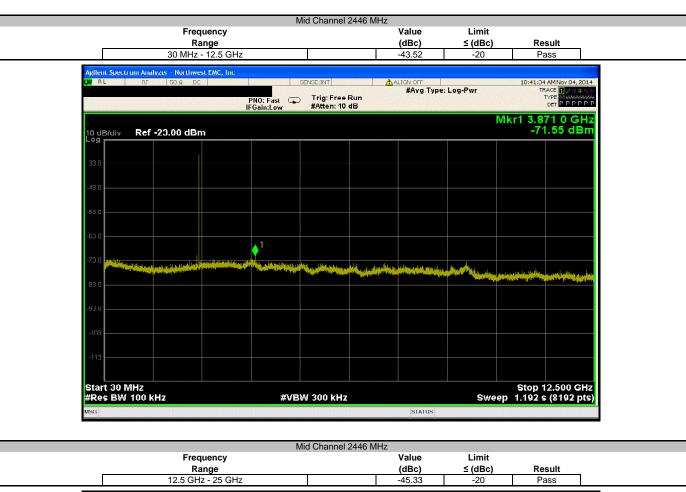


XMit 2014.02.07 NweTx 2014.10.15

		Lo	ow Channel 24	402 MHz			
	Frequency				Value	Limit	
	Range		1		(dBc)	≤ (dBc)	Result
	12.5 GHz - 25 GHz				-45.18	-20	Pass
	ialyzer - Northwest EMC, Inc						
LXII RI RI	- 50 ณ DC		GENGE:INT	A		e: Log-Pwr	10:07:51 AM Nov 04, 2014 TRACE 12 2 3 4 5 6
		PNO: Fast 🔾	Trig: Free Ru #Atten: 10 dE	in			
		Gain:Low	#Atten: 10 dE			E.41	
10 dB/div Re	f -23.00 dBm					1411	kr1 23.106 2 GHz -73.67 dBm
	1 -23.00 ubiii						
-33.0							
-43.0							
-53.0							
55.0							
-60.0							
							1
-73.0						lassister (satisfier	
	التبييدا بالترق فالحي والمصاد الأسبوليا براس						The part of the second s
-83.0							
-93.0							
-95.0							
-103							
-113							
Start 12.500 C	GHz	1					Stop 25.000 GHz
#Res BW 100		#VBI	W 300 kHz			Swee	p 1.195 s (8192 pts)
MSG					STATUS		
	Frequency	N	lid Channel 24	146 MHZ	Value	Limit	

Freque Rang Fundam	ncy e	nnel 2446 MHz Value (dBc) N/A	Limit ≤ (dBc) N/A	Result N/A
Adient Spectrum Analyzer - Northwest E	AC, Inc SENSE:INT PNO: Wide Trig:	ALIGN OFF	e: Log-Pwr	10:10:37 AMNov 01, 2011 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P
10 dB/div Ref -23.00 dBm		1	Mkr1 2.4	46 039 25 GHz -28.032 dBm
-33.0	Mandal			- March
-4311 W (1997)				
.63.0				
-73.0				
-93 በ				
-103				
Center 2.4460000 GHz #Res BW 100 kHz	#VBW 300	kH7	Sween 1	Span 1.000 MHz 092 ms (8192 pts)
MSG	*********	STATUS	эмсер н	992 ma (8792 pta)





RL RF 50 Q DC	PNO: Fast C Trig: Free F		10:12:33 AMNov 01, 2014 TRACE 1 2 3 4 5 (TVPE MVMMMM DET P P P P F
	IFGain:Low #Atten: 10 c	10	Mkr1 23.515 1 GHz
0 dB/div Ref -23.00 dBm			-73.36 dBm
33.0			
G11			
3.0			
3.0			
73.0			↓ 1
and the second		وجادته فأفتد بالمتعاطين فالمراجع والمتعاطين	
33.0			
0.5.0			
103			
113			
itart 12.500 GHz Res BW 100 kHz	#VBW 300 kHz		Stop 25.000 GHz weep 1.195 s (8192 pts
		STATUS	



_		High Chan	nel 2480 MH			
	quency			Value	Limit	
	lange			(dBc)	≤ (dBc)	Result
Fun	damental			N/A	N/A	N/A
Agilent Spectrum Analyzer - Northw	vest EMC, Inc					
LX/ RL RF 50Ω E		SENSE:INT		ALIGN OFF		10:46:24 AM Nov 04, 2014
	PNO: Wid IFGain:Lo	e 😱 Trig: Fr w #Atten:	ee Run 10 dB	#Avg Type	e: Log-Pwr	
10 dB/div Ref -25.00 dB	im				Mkr1 2.4	180 032 90 GHz -29.993 dBm
Log		~	·····			
-35.0	revenue -					and the second second
-45.0 With and the second seco						
-55.0						
-65.0						
-75.0						
86.0						
-95.0						
-105						
-115						
Center 2.4800000 GHz #Res BW 100 kHz		#VBW 300 k	-Iz		Sweep 1	Span 1.000 MHz .092 ms (8192 pts)
MSG				STATUS		

	Frequency		ligh Channel	2 100 Mil 12	Value	Limit		
	Range				(dBc)	≤ (dBc)	Re	sult
30	MHz - 12.5 GHz				-41.17	-20		ass
-						20	· `	
Agilent Spectrum Analyzer - No								
LXI RL RF 50 S	2 DC		SENSE:INT	<u>A</u> ,	ALIGN OFF #Avg Type	: Log-Pwr		0 AM Nov 04, 2014 RACE 1 2 3 4 5 6
	P	NO: Fast 🖕	Trig: Free F					
	IFO	Gain:Low	#Atten: 10 d	8				
								10.7 MHz 1.15 dBm
10 dB/div Ref -25.00	dBm		,				-1	1. 15 UBIII
-35.0								
-45 11								
-55.0								
-65.0 - 1								
• • • • • • • • • • • • • • • • • • •								
-75.0	and the second second second		A CONTRACTOR OF THE OWNER OF	an. mandate		Mari Maria		
And the second	All Carlos				A State of the sta	A CONTRACTOR OF CONTRACTOR		الله در در وساله داد الدرار رواند رواند در المسلم الم
-85.0								
-95.0								
-105								
-115								
Start 30 MHz			1				Stop '	12.500 GHz
#Res BW 100 kHz		#VB	W 300 kHz			Swe	ep 1.192	s (8192 pts)
ISG					STATUS	n o na constanta da la constant		



		Channel 2480 MH			
	lency		Value	Limit	
	nge		(dBc)	≤ (dBc)	Result
12.5 GHz	- 25 GHz		-43.08	-20	Pass
Agilent Spectrum Analyzer - Northwes	ENC Im				
LM RL RF 50 2 DC		INT	ALIGN OFF		10:40:10 AMNov 04, 201
			#Avg Type:	Log-Pwr	TRACE 1 2 3 4 5
	PNO: Fast 😱 T IFGain:Low #	rig: Free Run Atten: 10 dB			TRACE 1 2 3 4 5 TYPE M WARKAN DET P P P P P
	ii Gain.Eow			Mike	1 24.284 3 GH
				IVINI	-73.07 dBn
10 dB/div Ref -25.00 dBm Log	1				-/0.0/ 00/
-35.0					
-45.0					
-55.0					
-65.0					
00.0					<u>↓</u> 1
-75.0					
والمترجيع المترابية ويتباله والألبين والمرور والمرور والمالي	ويتلاحة الشقيط بشرح والمتطالب ألتك ويتبتك بتوجيبتهم	ورفيته مانية أذار أنداء أرخبته والم		ad the design of the local distance	In the second second second second
-85.0	a contract transfer contract or deliver of				
-55.5					
-95.0					
-90.0					
105					
-105					
-115					
Start 12.500 GHz					Stop 25.000 GH
#Res BW 100 kHz	#VBW 3	00 kHz		Sweep	1.195 s (8192 pts
MSG			STATUS	C DECEMBER OF COLOR OF COLOR	

ENC

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.

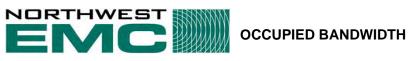
TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna, Horn	ETS	3115	AJA	6/3/2014	24
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24

TEST DESCRIPTION

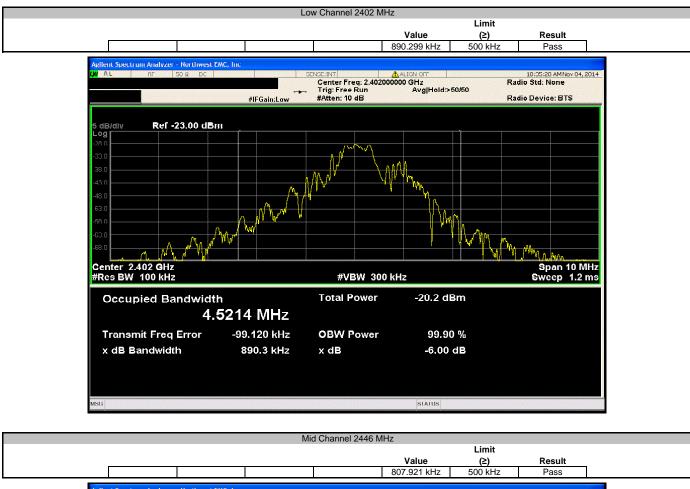
The 6dB occupied bandwidth was measured. The 26 dB (99.9%) emission bandwidth (EBW) was also measured at the same time.

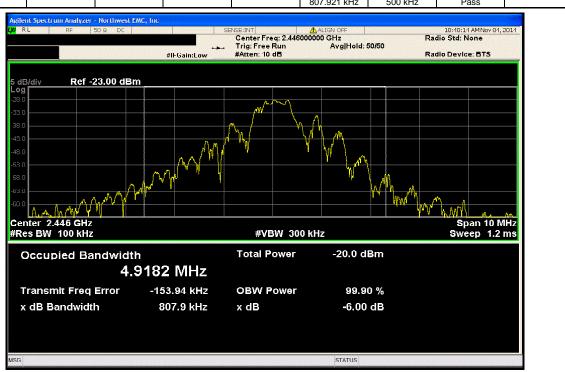
The EUT was set to low, medium and high transmit frequencies. The measurement was made in a radiated configuration in a semi-anechoic chamber with the fundamental of the carrier full maximized for its highest radiated power. The EUT was transmitting at the data rate(s) listed in the datasheet.



EUT:	RE1 Radio Module				Work Order:	64SE0001	
Serial Number:	None				Date:	11/04/14	
Customer:	64seconds, Inc.				Temperature:	23.1°C	
Attendees:	None				Humidity:	27%	
Project:	None				Barometric Pres.:	1015.5	
Tested by:	Bryan Weller		Powe	r: Battery	Job Site:	MN05	
TEST SPECIFICAT	IONS			Test Method			
FCC 15.247:2014				ANSI C63.10:2009, KDB 453039			
							-
COMMENTS							
None							
DEVIATIONS FROM	I TEST STANDARD						
None							
Configuration #	1	Signature	pryan	Wellez			
						Limit	
					Value	(≥)	Result
Low Channel 2402	MHz				890.299 kHz	500 kHz	Pass
Mid Channel 2446 M	/Hz				807.921 kHz	500 kHz	Pass
High Channel 2480	MHz				692.833 kHz	500 kHz	Pass
-							









OCCUPIED BANDWIDTH



ENC

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

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

Transmitting Low Channel 2402Mhz, Mid channel 2446MHz, High Channel 2480 Mhz. GFSK Modulation, data rate 1 Mbps.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

64SE0001 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency 2400 MHz

Stop Frequency 2483.5 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
MXG Vector Signal Generator	Agilent	N5182A	TIF	8/12/2014	36 mo
Power Sensor	Agilent	N8481A	SQN	8/22/2014	12 mo
Power Meter	Agilent	N1913A	SQL	8/22/2014	12 mo
Antenna, Horn	ETS	3115	AIB	8/12/2014	24 mo
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24 mo
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12 mo
Antenna, Horn	ETS	3115	AJA	6/3/2014	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 EUT was operated in three orthogonal axis in transmit mode. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height (1-4 meters) and polarization. The amplitude and frequency of the highest emissions were noted. The EUT was then replaced with a horn antenna. A signal generator was connected to the horn antenna and its output was adjusted to match the level previously noted for each frequency. The output of the signal generator was recorded, and by factoring in the cable loss to the horn antenna and its gain (dBi); the EIRP for the fundamental emission was determined.

EMC

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

myan Welles Work Order: 64SE0001 Date: 11/03/14 22.8 °C Project: None **Temperature:** Job Site: **MN05** Humidity: 26.7% RH Tested by: Bryan Weller Serial Number: None **Barometric Pres.:** 1015.2 mbar EUT: RE1 Radio Module Configuration: 1 Customer: 64seconds, Inc. Attendees: None EUT Power: Battery Transmitting Low Channel 2402Mhz, Mid channel 2446MHz, High Channel 2480 Mhz. GFSK Modulation, data rate 1 Mbps. **Operating Mode:** Deviations: None None Comments: **Test Specifications** Test Method FCC 15.247:2014 ANSI C63.10:2009 Test Distance (m) Antenna Height(s) Run # 44 3 1 to 4(m) Results Pass 30 20 10 dBm 0 ľ -10 -20 -30 2400 2410 2420 2430 2440 2450 2460 2470 2480

MHz

	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
	2446.283	2.8	191.1	Horz	PK	5.09E-04	-2.9	36.0	-38.9	Mid Channel 2446 MHz EUT Horizontal
	2445.833	1.2	220.1	Vert	PK	5.01E-04	-3.0	36.0	-39.0	Mid Channel 2446 MHz EUT on Side
	2479.825	1.0	163.1	Vert	PK	4.04E-04	-3.9	36.0	-39.9	High Channel 2402 MHz EUT on Side
	2480.258	1.0	216.0	Horz	PK	3.94E-04	-4.1	36.0	-40.1	High Channel 2480 Mhz EUT Horizontal
	2401.858	1.0	225.0	Vert	PK	3.98E-04	-4.0	36.0	-40.0	Low Channel 2402 MHz EUT on Side
	2402.242	1.0	202.1	Horz	PK	3.75E-04	-4.3	36.0	-40.3	Low Channel 2402 MHz EUT Horizontal
	2445.908	1.1	94.1	Vert	PK	3.63E-04	-4.4	36.0	-40.4	Mid Channel 2446 MHz EUT Vertical
	2446.233	1.3	13.0	Horz	PK	1.99E-04	-7.0	36.0	-43.0	Mid Channel 2446 MHz EUT Vertical
	2445.900	1.1	115.0	Vert	PK	1.82E-04	-7.4	36.0	-43.4	Mid Channel 2446 MHz EUT Horizontal
	2445.842	1.2	219.0	Horz	PK	5.87E-05	-12.3	36.0	-48.3	Mid Channel 2446 MHz EUT on Side

O QP

AV

PK

EMC

POWER SPECTRAL DENSITY

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna, Horn	ETS	3115	AJA	6/3/2014	24
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24

TEST DESCRIPTION

The maximum power spectral density measurements were measured with the EUT set to the required transmit frequencies in each band. The EUT was transmitting at the lowest, middle, and maximum data rate for each modulation type available.

The final data was converted from a field strength to a radiated power value. Equation 5 found in ANSI C63.10:2009, was used to derive this conversion formula:

dBm/m (field strength) + 11.77 = dBm EIRP

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

≻RBW = 100 kHz

≻VBW = 300 kHz

>Detector = Peak (to match method used for power measurement)

➤Trace = Max hold

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

BWCF = 10*LOG (3 kHz / 100 kHz) = -15.2 dB



	1 Radio Module							Work Order:		
Serial Number: No									11/04/14	
Customer: 64s								Temperature:		
Attendees: No								Humidity:		
Project: No	ne							Barometric Pres.:	1015.5	
Tested by: Bry	yan Weller			Powe	er: Battery			Job Site:	MN05	
FEST SPECIFICATION	S				Test Method					
CC 15.247:2014					ANSI C63.10:2009, K	(DB 453039				
					1					
COMMENTS										
lone										
None										
None										
	ST STANDARD									
DEVIATIONS FROM TE	EST STANDARD									
	EST STANDARD									
DEVIATIONS FROM TE None	EST STANDARD		A	A	wellon					
DEVIATIONS FROM TE	EST STANDARD		B	mjan	Weller					
DEVIATIONS FROM TE None	EST STANDARD	Signature	Þ	nyan	Wellez					
DEVIATIONS FROM TE None	EST STANDARD	Signature	Þ	nyan	Value	dBm/m to	dBm/100kHz	Value	Limit	
DEVIATIONS FROM TE None Configuration #	1	Signature	Þ	mjan	Value dBm/100kHz	dBm/m to dBm	To dBm/3kHz	dBm/3kHz	dBm/3kHz	Results
DEVIATIONS FROM TE lone	1	Signature	Þ	mjan	Value dBm/100kHz -19.639	dBm/m to dBm 11.77	To dBm/3kHz -15.2	dBm/3kHz -23.069		Pass
DEVIATIONS FROM TE None	1	Signature	Þ	mjan	Value dBm/100kHz	dBm/m to dBm	To dBm/3kHz	dBm/3kHz	dBm/3kHz	



ISG

POWER SPECTRAL DENSITY

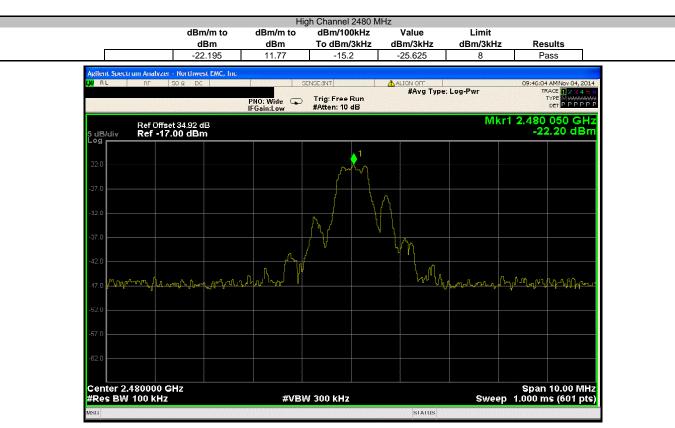


Mid Channel 2446 MHz dBm/m to dBm/m to dBm/100kHz Value Limit dBm dBm To dBm/3kHz dBm/3kHz dBm/3kHz Results -23.359 11.77 -26.789 Pass -152 8 ilent Spectrum Analyzer - Northwest EMC, In RL 00:41:53 AMNov 04, 2014 RF 50 Q DC SENSE:INT ALI. TRACE 1 2 3 4 5 6 TYPE MWAMAAAA DET P P P P P P #Avg Type: Log-Pwr PNO: Wide Trig: Free Run Il-Gain:Low #Atten: 10 dB Mkr1 2.445 983 GHz Ref Offset 34.92 dB Ref -19.00 dBm -23.36 dBm 5 dB/div Log ----ø ካ |{} | ann ar lard fifty հոլ www.www. Center 2.446000 GHz #Res BW 100 kHz Span 10.00 MHz Sweep 1.000 ms (601 pts) #VBW 300 kHz

STATUS



POWER SPECTRAL DENSITY





Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12
Antenna, Horn	ETS	3115	AJA	6/3/2014	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.

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.



	1Hz			2 131 mS	2.27 mS		03.0	N/A	NI/A
				Pulse Width	Period	Pulses	value (%)	(%)	Results
		Signature				Number of	Value	Limit	
onfiguration #	1	Signature	Bryan						
nfiguration #	4		Andread	Weller					
one									
	TEST STANDARD								
	TEAT ATANDADD								
ne									
OMMENTS									
CC 15.247:2014				ANSI C63.10:2009,	KDB 453039				
EST SPECIFICATIO	ONS			Test Method					
Tested by:	Bryan Weller		Po	wer: Battery			Job Site:	MN05	
Project:	None						Barometric Pres.:	1015.5	
Attendees:							Humidity:	27%	
Customer:	64seconds, Inc.						Temperature:	23.1°C	
Serial Number:								11/04/14	
	RE1 Radio Module						Work Order:	64SE0001	

	Pulse Width	Period	Pulses	(%)	(%)	Results
Low Channel 2402 MHz	2.131 mS	2.27 mS	1	93.9	N/A	N/A
Low Channel 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel 2446 MHz	2.131 mS	2.238 mS	1	95.2	N/A	N/A
Mid Channel 2446 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel 2480 MHz	2.134 mS	2.238 mS	1	95.4	N/A	N/A
High Channel 2480 MHz	N/A	N/A	5	N/A	N/A	N/A



DUTY CYCLE

		Lc	w Channel 2402 M	Hz		
			Number of	Value	Limit	
	Pulse Width	Period	Pulses	(%)	(%)	Results
	2.131 mS	2.27 mS	1	93.9	N/A	N/A
Auliuut Suurteum Au	alyzer - Northwest EMC, Inc					
Agrient Spectrum And		G	ENGE:INT	ALIGN OFF		10:04:41 AMNov 04, 2014
			Trig Delay-1.000 ms Trig: Video	a #Avg Type	e: Log-Pwr	TRACE
		PNO: Fast IFGain:Low	#Atten: 10 dB			
						Mkr3 3.278 ms
5 dB/dly Rel	-23.00 dBm					-38.03 dBm
Log						
-28.0					-+	(
-33.0						3
-38.0	<u> </u>					
-43.0						
-48.0						
-53.0						
-58.0						TRIG LVL
63.0					2	
-68.0					$\langle \rangle^2 /$	
				i.		
Center 2.4020		<i>"</i>				Span 0 Hz
Res BW 1.0 M		#VBV	V 30 kHz			1.000 ms (8192 pts
MKR MODE TRC SCL		т -39.28 (FUNCTION	FUNCTION WIDTH	FUNCI	
2 N 1 t	3.140 n	is -67.67∢	dBm			
3 N 1 t	3.278 n	is -38.03 (dBm			
6						-
7						
8						
10						
						~
MSG				STATUS		

		Lov	v Channel 2402 N			
	Dulas Width	Devied	Number of	Value	Limit	Desults
	Pulse Width N/A	Period N/A	Pulses 5	(%) N/A	(%)	Results N/A
	IN/A	N/A	5	N/A	N/A	N/A
Agilent Spectrum Analyzer -	Northwest EMC, Inc					
<mark>I,XI</mark> RL RF 5	10 Ω DC	SEI	NSE:INT		pe: Log-Pwr	10:34:55 AMNov 04, 2014 TRACE 2, 2, 3, 4, 5, 6
		PNO: Fast 🔸	Trig: Video #Atten: 10 dE			TRACE 1 2 3 4 5 6 TYPE WWWWWWW DET P P P P P P
		+Gain:Low	#Atten: 10 db			001
5 dB/div Ref -23.0	00 dBm					
-28.0						
-20.0	an an an an air an	and the second secon	.) [·····		and the second
-33.0						
-38.0						
-43.0						
-48.0						
52.0						
-53.0						
-58.0						TRIG I VI
-63.0						
-68.0						
Center 2.40200000	0 GHz					Span 0 Hz
Res BW 1.0 MHz		#VBW	30 kHz		Sweep	10.38 ms (8192 pts)
MSG				STATUS		



DUTY CYCLE

Number of Pulse Width Period Period Number of Pulses Value (%) Limit 2.131 mS 2.238 mS 1 95.2 N/A N/A Addent Spectrum Analyzer - Northwest EMC, Inc. W RL OCLOCINT Auton orr 10:39:04 AMNov Trig Delay-1.000 ms 4Avg Type: Log-Pwr 10:39:04 AMNov Trig: Video PN0: Fast IFGain:Low PN0: Fast IFGain:Low Trig: Video Mkr3 3.24 -38.03	
2.131 mS 2.238 mS 1 95.2 N/A N/A Artlent Spectrum Analyzer - Northwest EMC, Inc. Anton orr 10:39:34 AMNov Of RL nr 50 x DC CENSE:INT Anton orr 10:39:34 AMNov PNO: Fast Trig Delay-1.000 ms #Avg Type: Log-Pwr TinAcc Em Trige Delay-1.000 ms #Avg Type: Log-Pwr TinAcc Em S dB/dIV Ref -23.00 dBm 430 33 330 300	
Adlent Spectrum Andvzer - Northwest EMC, Inc. OCNSCENT Auton orr 10:39:34 AMNov V RL RF 50 x DC OCNSCENT Auton orr 10:39:34 AMNov PN0: Fast	
Off RL RF 50 R DC CENSE:INT ALIGN OFF 10:39:34 AMMov PN0: Fast Trig Delay-1.000 ms #Avg Type: Log-Pwr Trace II Trice Diagonal PN0: Fast Trig Delay-1.000 ms #Avg Type: Log-Pwr Trice Diagonal Trice Diagonal 6 dB/div Ref -23.00 dBm -38.03 -38.03 -38.03 -28 D	
PNO: Fast Trig Delay-1.000 ms #Avg Type: Log-Pwr TRACE IN PNO: Fast Trig: Video #Atten: 10 dB 000 S dB/dIv Ref -23.00 dBrm -38.03 -38.03 -28.0 -33.0 -38.03 -38.03 -30.0 -33.0 -38.03 -38.03	
PHO: Fast IFGain:Low Trig: Video #Atten: 10 dB Trig: Video Mkr3 3.24 280	12345
Mkr3 3.24 5 dB/dlv Ref -23.00 dBm -28.0 -33.0 -33.0 -4.0 -33.0 -4.0 -33.0 -4.0	
All of the second sec	
Log	47 me
-280	aBm
-33.0 -30.0 -3	
-00.0 43.0 -43.0 -53.0	
43.0 	
-48.0 	
-530	
-58.0	
	TRIG LVL
-bs u	
	an 0 Hz
Res BW 1.0 MHz #VBW 30 kHz Sweep 4.000 ms (819	92 pts
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE 1 N 1 t 1.009 mp 37.99 dBm 57.99	
2 N 1 t 3.141 ms -67.82 dBm	
3 N 1 t 3.247 ms -38.03 dBm	
5	
9 10	
	~
MSG SIAIOS	

.	natur David i	Number of	Value	Limit	Desults
Pulse W N/A		Pulses 5	(%) N/A	(%) N/A	Results N/A
Agilent Spectrum Analyzer - Northwest E		•			
Agreent Spectrum Analyzer - Northwest L	mc, IIIc	SENSE:INT	ALIGN OFF		10:39:41 AMNov 04, 2014
	PNO: Fast 🔸	_ Trig: Video	#Avg Type	Log-Pwr	TRACE 1 2 3 4 5 6 TYPE WWWWWWW DET PPPPP
	IFGain:Low	#Atten: 10 dB			DETPPPPP
5 dB/div Ref -23.00 dBm					
Log					
-28.0					
			التناز أعتر فأعتب		
-33.0					
-38.0					
-43.0					
-48.0					
40.0					
-53.0					
-58.0					TRIG I VI
-63.0					
-68.0					
-60.0					
Center 2.446000000 GHz					Span 0 Hz
Res BW 1.0 MHz	#VE	3W 30 kHz		Sweep 1	10.38 ms (8192 pts)



DUTY CYCLE

			Number of	Value	Limit	
	Pulse Width	Period	Pulses	(%)	(%)	Results
	2.134 mS	2.238 mS	1	95.4	N/A	N/A
Agilent Spectrum Analy	zer - Northwest EMC, Inc					
LX/ RL RF	50 Ω DC	SD	NSE:INT	ALIGN OFF		10:45:19 AMNov 04, 20:
		PNO: Fast	Trig Delay-1.000 m Trig: Video	s #Avg Type	: Log-Pwr	TRACE 2345 TYPE WWWWWW DET PPPP
		IFGain:Low	#Atten: 10 dB			DET <u>P P P P</u>
						Mkr3 3.246 m
	25.00 dBm					-39.47 dBr
-30.0						
-35.0						
	(↓ · ·	
-40.0						
-45.0						
-50.0						
-55.0						
-60.0						TRIG LY
65.0					A2/	
-70.0					¥.	
Center 2.48000						Span 0 H
Res BW 1.0 MH		#VBW	30 kHz		Sweep 4	.000 ms (8192 pt
MKR MODE TRC SCL	X	Ϋ́	FUNCTION	FUNCTION WIDTH	FUNCT	ION VALUE
1 N 1 t	1.009 m		Bm			
2 N 1 t 3 N 1 t	3.142 n 3.246 n	1s -69.42 d 1s -39.47 d	Bm Bm			
4						
6						
7 8						
9						
10						
<			.400			

	e Width Perio	Number d Pulses 5	Limit (%) N/A	Results N/A
Agilent Spectrum Analyzer - Northwo (X) RL RF 50 Q DC		SENSE:INT → Trig: Video #Atten: 10 d	Type: Log-Pwr	10:15:31 AMNov 01, 20 TRACE 1 2 3 4 9 TYPE WAAWAW DET P P P P
5 dB/div Ref -25.00 dBi	m		 	8
-30.0	a) (مستعمينا لتعصي		and have a second for the second s
20611				
-40.0				
-45.0				
-50.0				
-55.0				
-60.0				TRIGI
-65.0				
-70.0				
Center 2.480000000 GHz Res BW 1.0 MHz		≠VBW 30 kHz	Sweep	Span 0 H 10.38 ms (8192 pt



CHANNEL SPACING

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12
Antenna, Horn	ETS	3115	AJA	6/3/2014	24

TEST DESCRIPTION

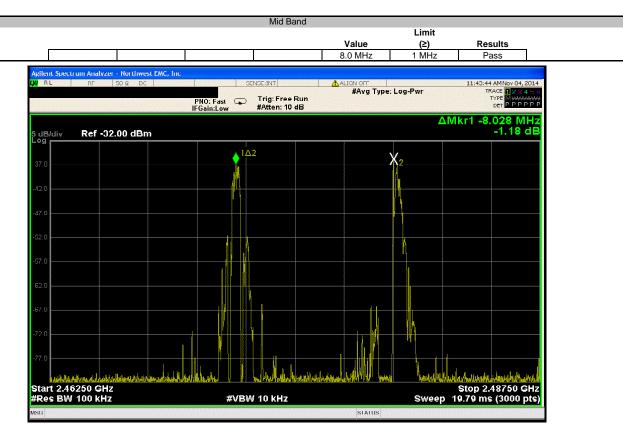
The channel carrier frequencies in the 2400-2483.5MHz band must be separated by 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Or, if the output power is less than 125 mW, the channel separation can be 25 kHz or 2/3 of the 20dB bandwidth. The EUT was operated in pseudorandom hopping mode. The spectrum was scanned across two adjacent peaks. The separation between the peaks of these channels was measured.



XMit 2014.02.07
NweTx 2014.10.15

EUT: RE1 Radio Module	Work Order:		
Serial Number: None		11/04/14	
Customer: 64seconds, Inc.	Temperature:	23.1°C	
Attendees: None	Humidity:		
Project: None	Barometric Pres.:		
Tested by: Bryan Weller Power: Battery	Job Site:	MN05	
TEST SPECIFICATIONS Test Method			
FCC 15.247:2014 ANSI C63.10:2009, KDB 453039			
COMMENTS			
None			
DEVIATIONS FROM TEST STANDARD			
None			
A loss of the State of the Stat			
Configuration # 1 Signature Bryan Welles			
		Limit	
	Value	(≥)	Results
Mid Band	8.0 MHz	1 MHz	Pass







NUMBER OF HOPPING FREQUENCIES

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12
Antenna, Horn	ETS	3115	AJA	6/3/2014	24

TEST DESCRIPTION

The number of hopping frequencies was measured across the authorized band. The hopping function of the EUT was enabled.

For Hybrid systems there is no minumum or maximum number of channels specified. The number of channels is measured to characterize the system and for dwell time calculations contained elsewhere in the report.

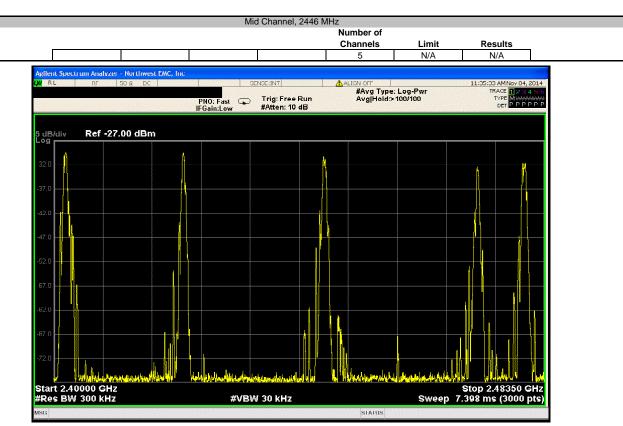


NORTHWEST NUMBER OF HOPPING FREQUENCIES

EUT: RE1 Radio Module	Work Order:		
Serial Number: None	Date:	11/04/14	
Customer: 64seconds, Inc.	Temperature:		
Attendees: None	Humidity:		
Project: None	Barometric Pres.:	1015.5	
Tested by: Bryan Weller Power: Battery	Job Site:	MN05	
TEST SPECIFICATIONS Test Method			
FCC 15.247:2014 ANSI C63.10:2009, KDB 453039			
COMMENTS			
None			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration # 1 Signature Dryan Welles			
Configuration # 1 Drugan and the			
Signature P 0 404			
	Number of		
	Channels	Limit	Results
Mid Channel, 2446 MHz		N/A	N/A



NUMBER OF HOPPING FREQUENCIES





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
Antenna, Horn	ETS	3115	AJA	6/3/2014	24
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	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 dwell time limit is based on the Number of Hopping Channels * 400 mS. This would be 5 Channels * 400mS = 2 Sec.

On Time During 2 Sec = Pulse Width * Average Number of Pulses * Scale Factor

>Average Number of Pulses is based on 4 samples.

Scale Factor = 2 Sec / Screen Capture Sweep Time = 2 Sec / 0.4 Sec = 5



EUT: RE1 Radio Module		Work Order:	
Serial Number: None		Date:	11/04/14
Customer: 64seconds, Inc.	64seconds, Inc.		
Attendees: None	None		
Project: None	None		
Tested by: Bryan Weller	Power: Battery	Job Site:	MN05
TEST SPECIFICATIONS	Test Method		
FCC 15.247:2014	ANSI C63.10:2009, KDB 453039		
COMMENTS			
None			

DEVIATIONS FROM TEST STANDARD None

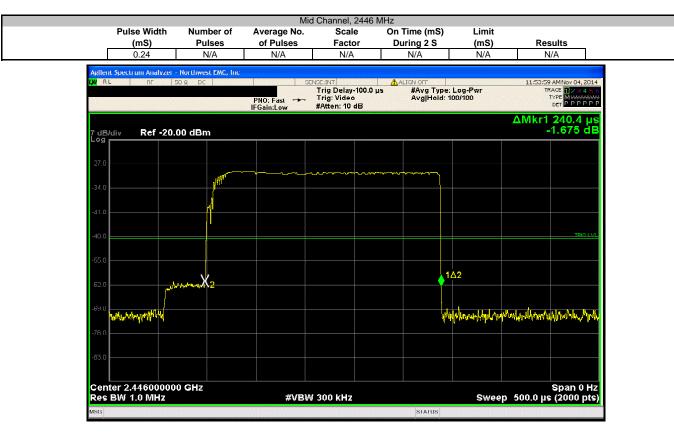
Config

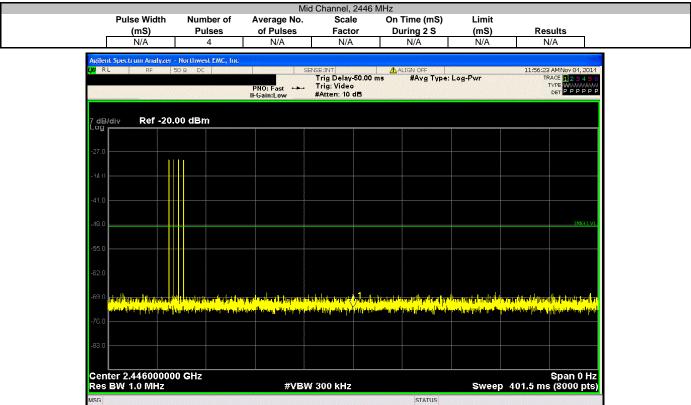
			Pulse Wi	dth Number of	
guration #	1	Signature	pryan	welles	

Pulse Width	Number of	Average No.	Scale	On Time (mS)	Limit	
(mS)	Pulses	of Pulses	Factor	During 2 S	(mS)	Results
0.24	N/A	N/A	N/A	N/A	N/A	N/A
N/A	4	N/A	N/A	N/A	N/A	N/A
N/A	7	N/A	N/A	N/A	N/A	N/A
N/A	4	N/A	N/A	N/A	N/A	N/A
N/A	3	N/A	N/A	N/A	N/A	N/A
0.24	N/A	4.5	5	5.4	400	Pass
	(mS) 0.24 N/A N/A N/A N/A	(mS) Pulses 0.24 N/A N/A 4 N/A 7 N/A 4 N/A 3	(mS) Pulses of Pulses 0.24 N/A N/A N/A 4 N/A N/A 7 N/A N/A 4 N/A N/A 3 N/A	(mS) Pulses of Pulses Factor 0.24 N/A N/A N/A N/A 4 N/A N/A N/A 7 N/A N/A N/A 4 N/A N/A N/A 3 N/A N/A	(mS) Pulses of Pulses Factor During 2 S 0.24 N/A N/A N/A N/A N/A 4 N/A N/A N/A N/A 7 N/A N/A N/A N/A 4 N/A N/A N/A N/A 3 N/A N/A N/A	(mS) Pulses of Pulses Factor During 2 S (mS) 0.24 N/A N/A N/A N/A N/A N/A 4 N/A N/A N/A N/A N/A 7 N/A N/A N/A N/A N/A 4 N/A N/A N/A N/A N/A 3 N/A N/A N/A N/A



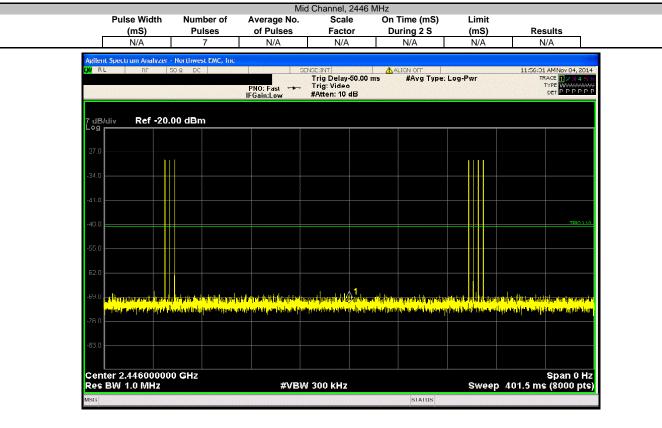
DWELL TIME

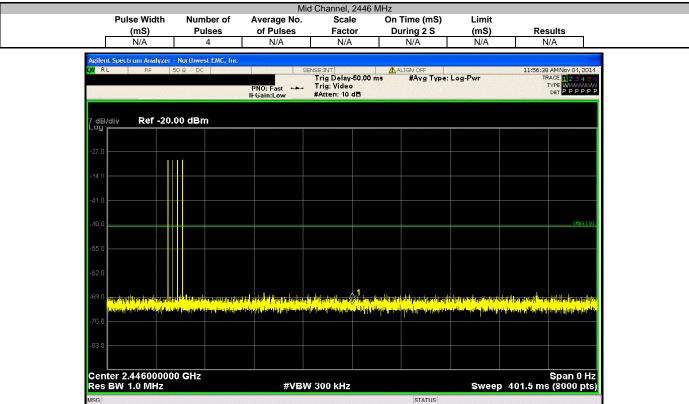






DWELL TIME







DWELL TIME

				Channel, 2446 I			
Pu	Ise Width	Number of	Average No.	Scale	On Time (mS)	Limit	
	(mS)	Pulses	of Pulses	Factor	During 2 S	(mS)	Results
	N/A	3	N/A	N/A	N/A	N/A	N/A
Agilent Spec	trum Analyzer:	- Northwest EMC, Inc					
IXI RL		50 x DC	GC	NGE:INT	ALIGN OFF		11:56:45 AMNov 04, 20:
				Trig Delay-50.00 n Trig: Video	ns #Avg Type:	Log-Pwr	
			PNO: Fast IFGain:Low	#Atten: 10 dB			
7 dB/div	Ref -20	00 dBm					
Log	KCI -2.0.	oo abiii					
-27.0							
-34.0							
-41.0							
-40.0							TRICLY
-55.0							
-62.0							
.sq n 1	141 - 1 10 - 4	Indexed and				here .	and the color of
COLO INTERNA	רי ייזקויה דראירואיקאק	n in an	and the second se	איז ייזאין איז איזעקען איז אייראי דארא איז איז איז איז איז איז איז איז איז אי	A IL CONTRACTOR AND A A A A A A A A A A A A A A A A A A	ישרא אור או איזיא אין יייגן יינן שראי געניג	
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-76.0							
-83.0							
-03.0							
Center 2	.44600000	0 GHz					Span 0 H
	1.0 MHz		#VBW	/ 300 kHz		Sweep 4	01.5 ms (8000 pt
MSG					STATUS		

Mid Channel, 2446 MHz							
	Pulse Width	Number of	Average No.	Scale	On Time (mS)	Limit	
	(mS)	Pulses	of Pulses	Factor	During 2 S	(mS)	Results
	0.24	N/A	4.5	5	5.4	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
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	3/14/2014	12
Antenna, Horn	ETS	3115	AJA	6/3/2014	24

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to its normal pseudorandom hopping sequence. The EUT was transmitting at the data rate(s) listed in the datasheet.

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



BAND EDGE COMPLIANCE - HOPPING MODE

EUT:	RE1 Radio Module			Work Order:	64SE0001					
Serial Number:	None		Date:	Date: 11/04/14						
Customer:	64seconds, Inc.		Temperature:	23.1°C						
Attendees:	None		Humidity:	27%						
Project:	None		Barometric Pres.:	1015.5						
Tested by:	Bryan Weller		Job Site:	te: MN05						
Tested by: Bryan Weller Power: Battery Job Site: MN05 TEST SPECIFICATIONS Test Method										
FCC 15.247:2014			ANSI C63.10:2009, KDB 453039							
COMMENTS										
None										
DEVIATIONS FROM TEST STANDARD										
None										
			a. PIL							
Configuration #	1	AMI	an weller							
		Signature 🖌 🧷								
				Value	Limit					
				(dBc)	≤ (dBc)	Result				
Low Channel, 2402	MHz			-30.64	-20	Pass				
High Channel, 2480	MHz		-34.95	-20	Pass					



BAND EDGE COMPLIANCE - HOPPING MODE



