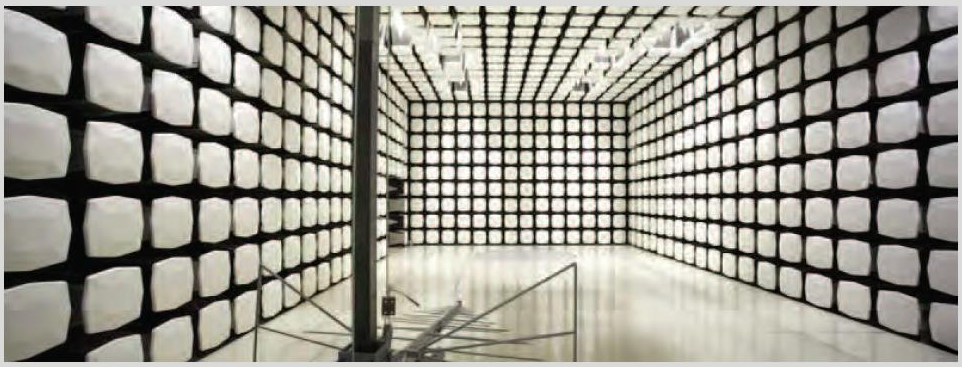
Nighthawk

NightHawk ERT Radio Module

FCC 15.247:2018

902 – 928 MHz FHSS Transceiver

Report # NIGH0001



NVLAP LAB CODE: 201049-0

CERTIFICATE OF TEST

Last Date of Test: August 21, 2018
Nighthawk
Model: NightHawk ERT Radio Module

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2018	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	AC - Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
7.5	Duty Cycle	Yes	Pass	
7.8.2	Carrier Frequency Separation	Yes	Pass	
7.8.3	Number of Hopping Frequencies	Yes	Pass	
7.8.4	Dwell Time	Yes	Pass	
7.8.5	Output Power	Yes	Pass	
7.8.6	Band Edge Compliance	Yes	Pass	
7.8.6	Band Edge Compliance - Hopping Mode	Yes	Pass	
7.8.7	Occupied Bandwidth	Yes	Pass	
7.8.8	Spurious Conducted Emissions	Yes	Pass	
11.10.2	Power Spectral Density	No	N/A	Not required for FHSS devices.

Deviations From Test Standards

None

Approved By:

Jeremiah Darden, Operations Manager

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. 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. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	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 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

Australia/New Zealand

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

Korea

MSIT / 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

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

Vietnam

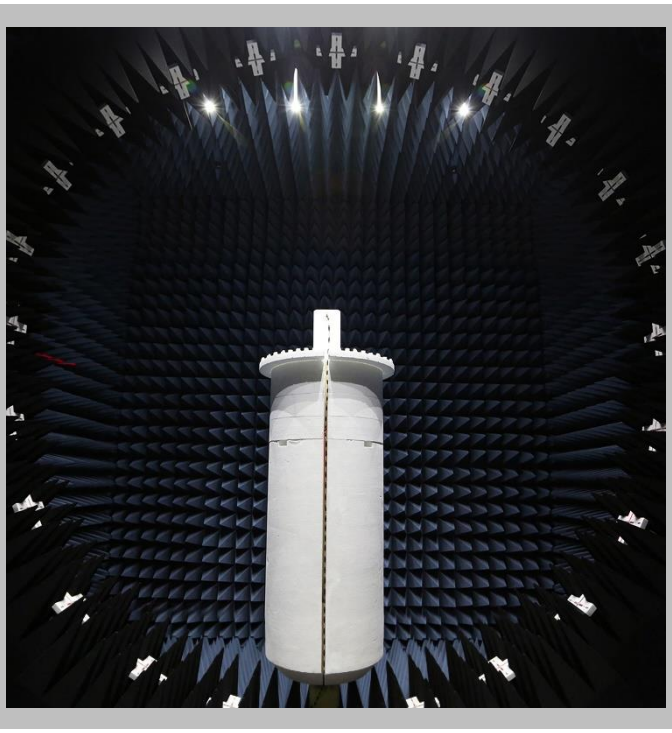
MIC – Recognized by MIC as a CAB for the acceptance of test data.

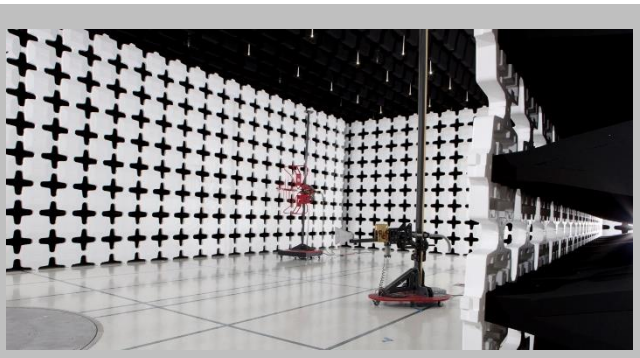
SCOPE

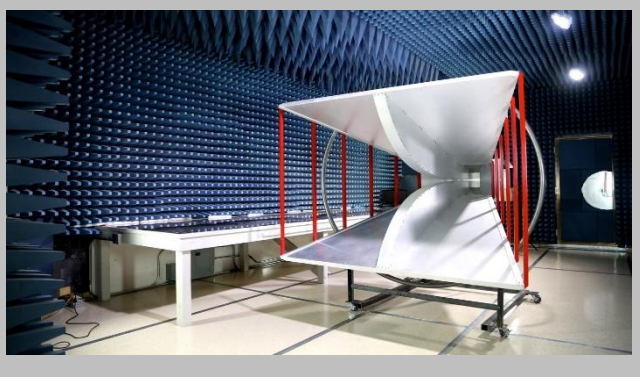
For details on the Scopes of our Accreditations, please visit:
http://portlandcustomer.element.com/ts/scope/scope.htm
http://gsi.nist.gov/global/docs/cabs/designations.html

FACILITIES

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

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.

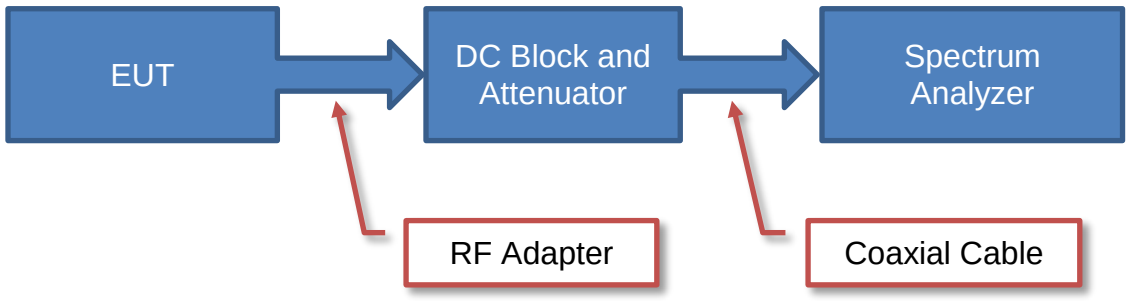
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. 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.

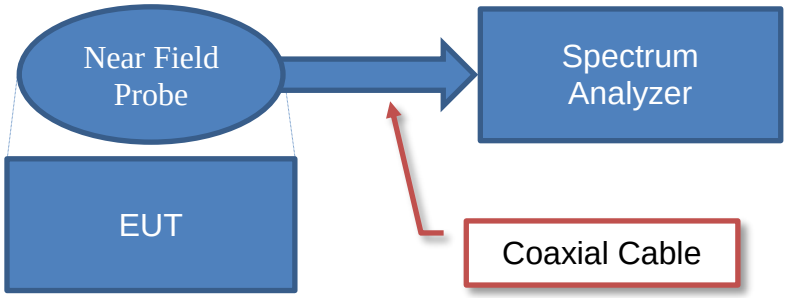
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

Test Setup Block Diagrams

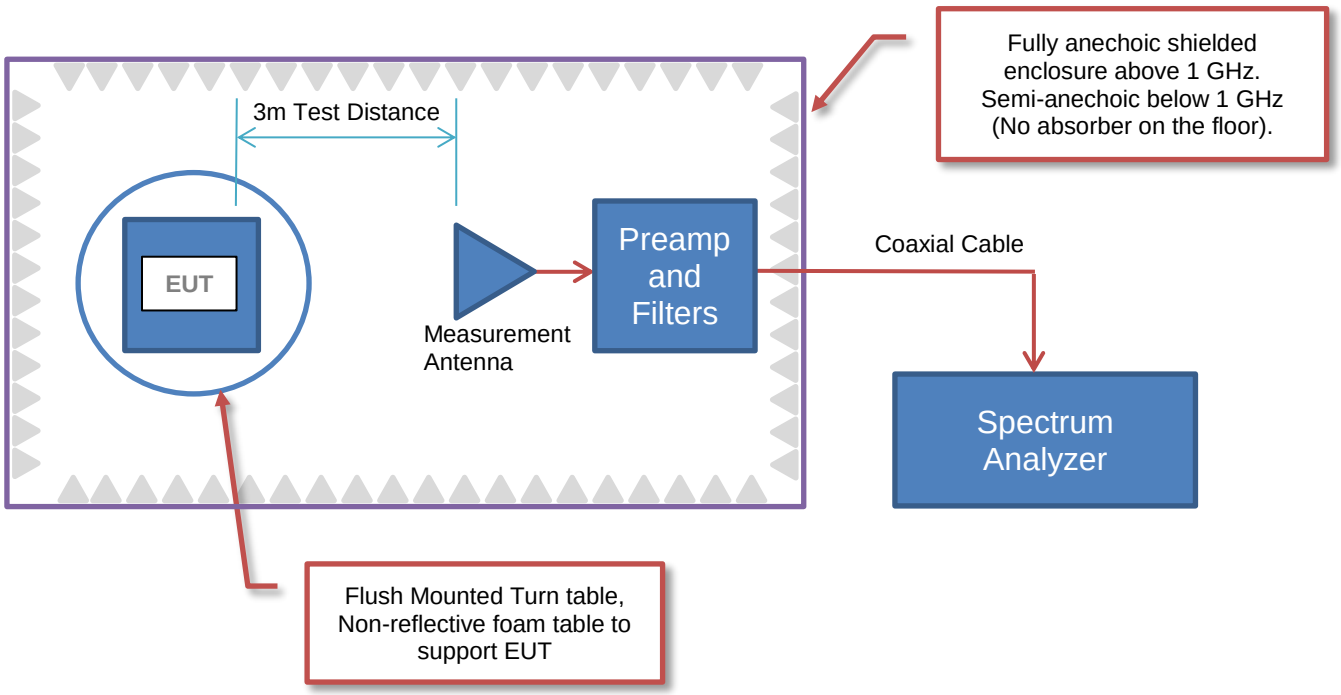
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Nighthawk
Address:	701 Canyon Drive, Suite 105
City, State, Zip:	Coppell, TX 75019
Test Requested By:	Weimin Peng
Model:	Watt Meter with 902-920 MHz Transmitter
First Date of Test:	August 20, 2018
Last Date of Test:	August 21, 2018
Receipt Date of Samples:	August 20, 2018
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Watt meter with FHSS Transceiver.

Testing Objective:
Seeking to demonstrate compliance of the FHSS radio under FCC 15.247 for operation in the 902 - 928 MHz Band.

CONFIGURATIONS

Configuration NIGH0001- 1

Software/Firmware Running during test	
Description	**Version**
NightHawk ERT Radio Module Firmware	1.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
NightHawk ERT Radio Module	NightHawk	RDCERT001	MN011414

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Cable	No	2m	No	AC Mains	EUT

Configuration NIGH0001- 2

Software/Firmware Running during test	
Description	**Version**
NightHawk ERT Radio Module Firmware	1.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
NightHawk ERT Radio Module	NightHawk	RDCERT001	MN005580

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Cable	No	2m	No	AC Mains	EUT

MODIFICATIONS

element
2018-07-17

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2018-08-20	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2018-08-21	AC – Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2018-08-21	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2018-08-21	Carrier Frequency Separation	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2018-08-21	Number of Hopping Frequencies	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2018-08-21	Dwell Time	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2018-08-21	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	2018-08-21	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
9	2018-08-21	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 Element following the test.
10	2018-08-21	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
11	2018-08-21	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

AC - POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

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. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. 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 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
LISN	Solar Electronics	9252-50-R-24-BNC	LJK	9/11/2017	9/11/2018
Cable - Conducted Cable Assembly	Northwest EMC	TXA, HHZ, TQU	TXAA	1/31/2018	1/31/2019
Power Source/Analyzer	Hewlett Packard	6841A	THC	NCR	NCR
Receiver	Rohde & Schwarz	ESCI	ARF	7/20/2018	7/20/2019

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

NIGH0001-1

MODES INVESTIGATED

Transmitting at Mid Channel 915 MHz

AC - POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

EUT:	NightHawk ERT Radio Module	Work Order:	NIGH0001
Serial Number:	MN011414	Date:	08/21/2018
Customer:	Nighthawk	Temperature:	22.2°C
Attendees:	Weimin Peng	Relative Humidity:	49.9%
Customer Project:	None	Bar. Pressure:	1024 mb
Tested By:	Marty Martin	Job Site:	TX01
Power:	110VAC/60Hz	Configuration:	NIGH0001-1

TEST SPECIFICATIONS

Specification: Equipment Class B	Method:
FCC 15.247:2018	ANSI C63.10:2013

TEST PARAMETERS

Run #:	2	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

None

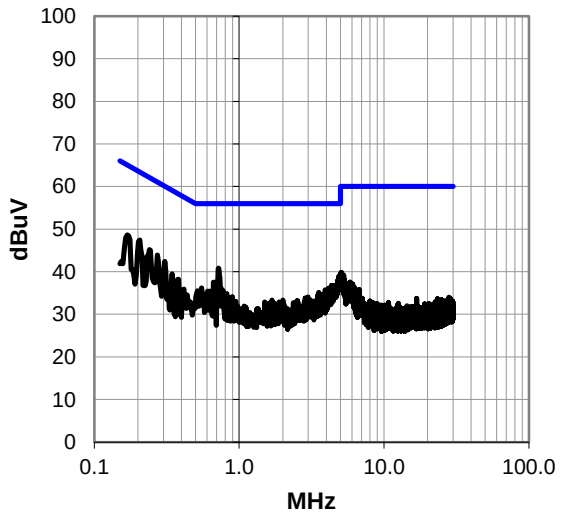
EUT OPERATING MODES

Transmitting at Mid Channel 915 MHz

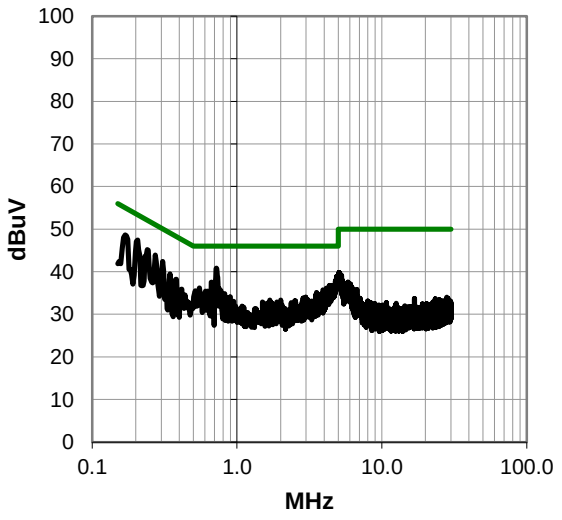
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



AC - POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

RESULTS - Run #2

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.721	20.6	20.2	40.8	56.0	-15.2
0.206	27.2	20.2	47.4	63.4	-16.0
0.169	28.5	20.1	48.6	65.0	-16.4
0.240	25.2	20.0	45.2	62.1	-16.9
0.273	23.9	20.0	43.9	61.0	-17.1
0.307	22.2	20.2	42.4	60.1	-17.7
0.665	17.2	20.3	37.5	56.0	-18.5
4.351	16.6	20.2	36.8	56.0	-19.2
4.463	16.6	20.2	36.8	56.0	-19.2
4.429	16.5	20.2	36.7	56.0	-19.3
0.344	19.4	20.1	39.5	59.1	-19.6
0.549	16.0	20.2	36.2	56.0	-19.8
4.149	15.9	20.2	36.1	56.0	-19.9
0.754	15.8	20.2	36.0	56.0	-20.0
0.378	18.1	20.1	38.2	58.3	-20.1
4.258	15.6	20.2	35.8	56.0	-20.2
5.052	19.6	20.2	39.8	60.0	-20.2
3.929	15.5	20.2	35.7	56.0	-20.3
0.516	15.3	20.2	35.5	56.0	-20.5
4.079	15.3	20.2	35.5	56.0	-20.5
0.605	15.1	20.3	35.4	56.0	-20.6
0.628	15.2	20.2	35.4	56.0	-20.6
5.190	19.1	20.2	39.3	60.0	-20.7
3.534	14.9	20.2	35.1	56.0	-20.9
0.818	14.5	20.3	34.8	56.0	-21.2
3.967	14.6	20.2	34.8	56.0	-21.2

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.721	20.6	20.2	40.8	46.0	-5.2
0.206	27.2	20.2	47.4	53.4	-6.0
0.169	28.5	20.1	48.6	55.0	-6.4
0.240	25.2	20.0	45.2	52.1	-6.9
0.273	23.9	20.0	43.9	51.0	-7.1
0.307	22.2	20.2	42.4	50.1	-7.7
0.665	17.2	20.3	37.5	46.0	-8.5
4.351	16.6	20.2	36.8	46.0	-9.2
4.463	16.6	20.2	36.8	46.0	-9.2
4.429	16.5	20.2	36.7	46.0	-9.3
0.344	19.4	20.1	39.5	49.1	-9.6
0.549	16.0	20.2	36.2	46.0	-9.8
4.149	15.9	20.2	36.1	46.0	-9.9
0.754	15.8	20.2	36.0	46.0	-10.0
0.378	18.1	20.1	38.2	48.3	-10.1
4.258	15.6	20.2	35.8	46.0	-10.2
5.052	19.6	20.2	39.8	50.0	-10.2
3.929	15.5	20.2	35.7	46.0	-10.3
0.516	15.3	20.2	35.5	46.0	-10.5
4.079	15.3	20.2	35.5	46.0	-10.5
0.605	15.1	20.3	35.4	46.0	-10.6
0.628	15.2	20.2	35.4	46.0	-10.6
5.190	19.1	20.2	39.3	50.0	-10.7
3.534	14.9	20.2	35.1	46.0	-10.9
0.818	14.5	20.3	34.8	46.0	-11.2
3.967	14.6	20.2	34.8	46.0	-11.2

CONCLUSION

Pass

Tested By

AC - POWERLINE CONDUCTED EMISSIONS

EUT:	NightHawk ERT Radio Module	Work Order:	NIGH0001
Serial Number:	MN011414	Date:	08/21/2018
Customer:	Nighthawk	Temperature:	22.2°C
Attendees:	Weimin Peng	Relative Humidity:	49.9%
Customer Project:	None	Bar. Pressure:	1024 mb
Tested By:	Marty Martin	Job Site:	TX01
Power:	110VAC/60Hz	Configuration:	NIGH0001-1

TEST SPECIFICATIONS

Specification: Equipment Class B	Method:
FCC 15.247:2018	ANSI C63.10:2013

TEST PARAMETERS

Run #:	3	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

None

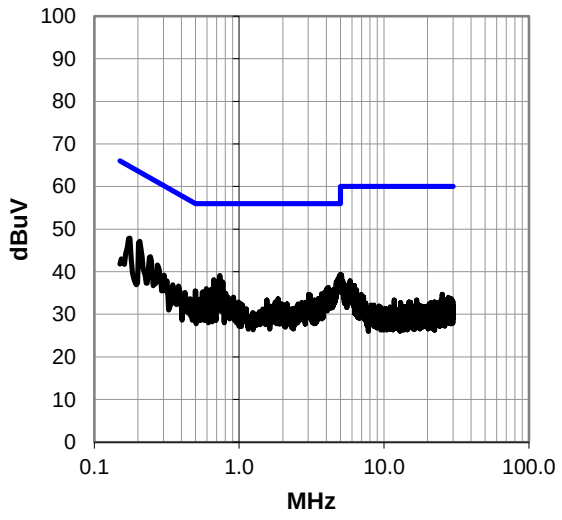
EUT OPERATING MODES

Transmitting at Mid Channel 915 MHz

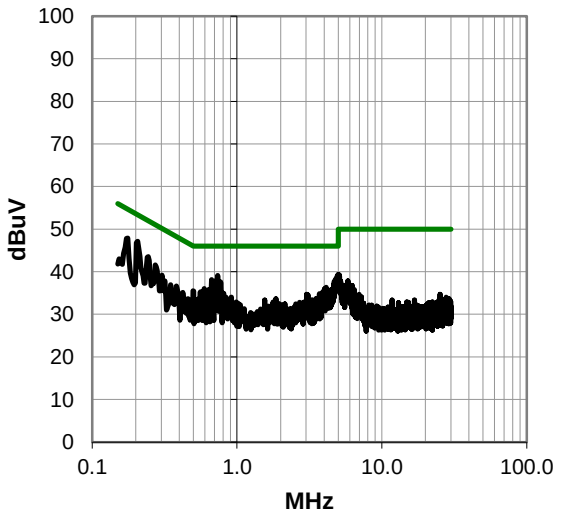
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



AC - POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

RESULTS - Run #3

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.206	26.9	20.2	47.1	63.4	-16.3
4.989	19.1	20.2	39.3	56.0	-16.7
0.176	27.7	20.2	47.9	64.7	-16.8
0.736	18.9	20.2	39.1	56.0	-16.9
0.669	17.8	20.3	38.1	56.0	-17.9
4.694	17.5	20.2	37.7	56.0	-18.3
0.769	17.4	20.2	37.6	56.0	-18.4
0.243	23.4	20.1	43.5	62.0	-18.5
0.273	21.6	20.0	41.6	61.0	-19.4
4.116	16.1	20.2	36.3	56.0	-19.7
0.594	15.7	20.3	36.0	56.0	-20.0
4.037	15.8	20.2	36.0	56.0	-20.0
0.639	15.6	20.2	35.8	56.0	-20.2
3.993	15.6	20.2	35.8	56.0	-20.2
4.448	15.5	20.2	35.7	56.0	-20.3
0.497	15.3	20.2	35.5	56.1	-20.6
0.560	15.1	20.2	35.3	56.0	-20.7
5.019	19.1	20.2	39.3	60.0	-20.7
5.078	19.0	20.2	39.2	60.0	-20.8
3.888	14.9	20.2	35.1	56.0	-20.9
4.343	14.9	20.2	35.1	56.0	-20.9
5.093	18.9	20.2	39.1	60.0	-20.9
0.303	19.0	20.2	39.2	60.2	-21.0
0.799	14.8	20.2	35.0	56.0	-21.0
3.698	14.6	20.2	34.8	56.0	-21.2
3.023	14.6	20.1	34.7	56.0	-21.3

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.206	26.9	20.2	47.1	53.4	-6.3
4.989	19.1	20.2	39.3	46.0	-6.7
0.176	27.7	20.2	47.9	54.7	-6.8
0.736	18.9	20.2	39.1	46.0	-6.9
0.669	17.8	20.3	38.1	46.0	-7.9
4.694	17.5	20.2	37.7	46.0	-8.3
0.769	17.4	20.2	37.6	46.0	-8.4
0.243	23.4	20.1	43.5	52.0	-8.5
0.273	21.6	20.0	41.6	51.0	-9.4
4.116	16.1	20.2	36.3	46.0	-9.7
0.594	15.7	20.3	36.0	46.0	-10.0
4.037	15.8	20.2	36.0	46.0	-10.0
0.639	15.6	20.2	35.8	46.0	-10.2
3.993	15.6	20.2	35.8	46.0	-10.2
4.448	15.5	20.2	35.7	46.0	-10.3
0.497	15.3	20.2	35.5	46.1	-10.6
0.560	15.1	20.2	35.3	46.0	-10.7
5.019	19.1	20.2	39.3	50.0	-10.7
5.078	19.0	20.2	39.2	50.0	-10.8
3.888	14.9	20.2	35.1	46.0	-10.9
4.343	14.9	20.2	35.1	46.0	-10.9
5.093	18.9	20.2	39.1	50.0	-10.9
0.303	19.0	20.2	39.2	50.2	-11.0
0.799	14.8	20.2	35.0	46.0	-11.0
3.698	14.6	20.2	34.8	46.0	-11.2
3.023	14.6	20.1	34.7	46.0	-11.3

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element

PSA-ESCI 2018.05.04

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 Continuously every 2 seconds at Low Channel 910 MHz and High Channel 919.8 MHz.

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

NIGH0001 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	10000 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
Cable	Northwest EMC	8-18GHz	TXD	31-May-2018	12 mo
Cable	Northwest EMC	1-8.2 GHz	TXC	31-May-2018	12 mo
Attenuator, 10dB	Weinschel Corp	4H-10	AWA	16-Mar-2018	3/16/2019
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	PAK	9-Oct-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAJ	31-May-2018	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJN	15-Sep-2016	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AJG	NCR	0 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AJF	NCR	0 mo
Cable	Northwest EMC	RE 9kHz - 1GHz	TXB	10-Oct-2017	12 mo
Antenna - Biconilog	ETS Lindgren	3143B	AYF	10-May-2018	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1551	AVK	31-May-2018	12 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	15-Mar-2018	12 mo
Attenuator, 20dB	Weinschel Corp	4H-20	AWB	16-Mar-2018	12 mo
Filter - Band Reject	WainWright Instruments	WTRCTV5-750-1000-20-70-60EEK	CUL	30-Jan-2018	12 mo
Filter High pass	Mocro-tronics	HPM50108	HGD	10-Oct-2018	12 mo

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

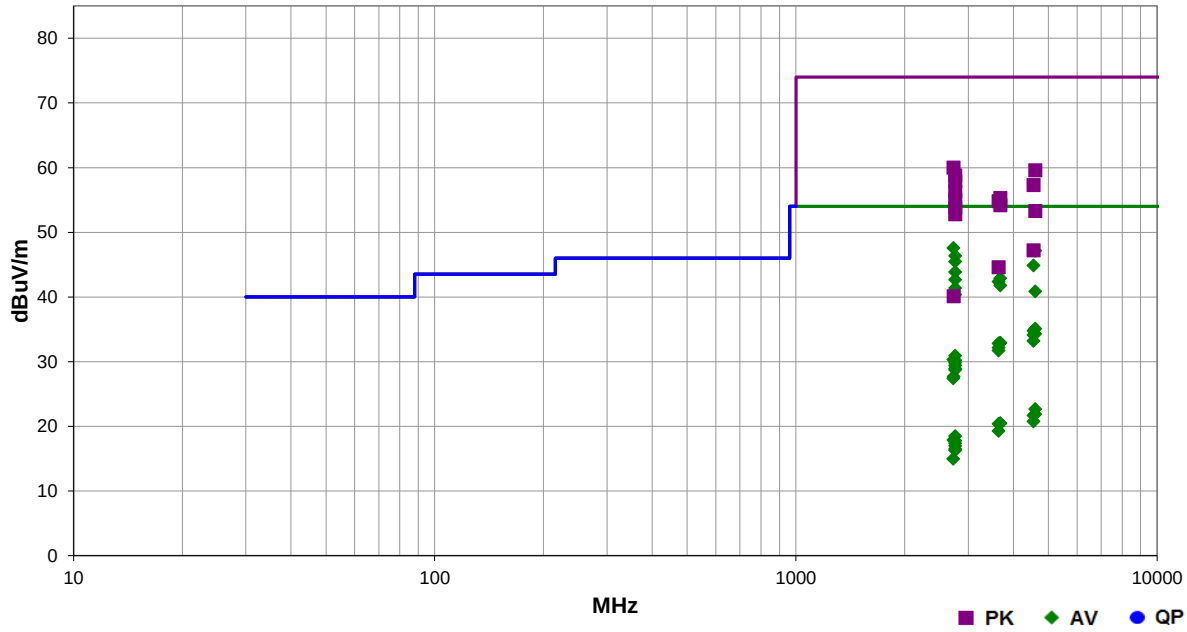
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.05.07 PSA-ESCI 2018.05.04

Work Order:	NIGH0001	**Date:**	20-Aug-2018		
Project:	None	**Temperature:**	21.9 °C		
Job Site:	TX02	**Humidity:**	49.9% RH		
Serial Number:	MN011414	**Barometric Pres.:**	1021 mbar	**Tested by:**	Marty Martin
EUT:	NightHawk ERT Radio Module				
Configuration:	1				
Customer:	Nighthawk				
Attendees:	Weimin Peng				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting Continuously every 2 seconds at Low Channel 910 MHz and High Channel 919.8 MHz.				
Deviations:	None				
Comments:	.057 duty cycle. < 98 % Transmit Upward correction = 10 * Log (0.057) = -12.44 dB. Actual duty cycle Down correction = 20 * Log (.057) = -24.88 dB. Total Duty cycle correction = -24.88 - (-12.44) = -12.44				

Test Specifications	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

Run #	26	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2729.950	61.9	-1.9	2.0	324.0	-12.4	0.0	Horz	AV	0.0	47.6	54.0	-6.4	High Ch, EUT on Side
4599.017	53.5	6.1	3.6	90.0	-12.4	0.0	Horz	AV	0.0	47.2	54.0	-6.8	High Ch, EUT on Side
2759.442	58.8	0.0	2.5	270.0	-12.4	0.0	Horz	AV	0.0	46.4	54.0	-7.6	High Ch, EUT on Side
2759.325	59.6	-1.7	4.0	180.0	-12.4	0.0	Vert	AV	0.0	45.5	54.0	-8.5	High Ch, EUT Horz
4550.100	51.4	5.9	1.5	270.0	-12.4	0.0	Horz	AV	0.0	44.9	54.0	-9.1	High Ch, EUT on Side
2759.300	58.0	-1.7	4.0	135.0	-12.4	0.0	Vert	AV	0.0	43.9	54.0	-10.1	High Ch, EUT Vert
3679.133	51.8	3.5	3.0	45.0	-12.4	0.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch, EUT on Side
2759.542	56.8	-1.7	3.0	225.0	-12.4	0.0	Horz	AV	0.0	42.7	54.0	-11.3	High Ch, EUT Horz
3639.867	51.4	3.4	1.0	225.0	-12.4	0.0	Horz	AV	0.0	42.4	54.0	-11.6	High Ch, EUT on Side
3679.317	50.7	3.5	3.0	315.0	-12.4	0.0	Vert	AV	0.0	41.8	54.0	-12.2	High Ch, EUT Horz
2759.425	53.8	0.0	4.0	360.0	-12.4	0.0	Vert	AV	0.0	41.4	54.0	-12.6	High Ch, EUT on Side
4599.042	47.2	6.1	1.0	225.0	-12.4	0.0	Vert	AV	0.0	40.9	54.0	-13.1	High Ch, EUT Horz
2759.483	54.5	-1.7	1.0	180.0	-12.4	0.0	Horz	AV	0.0	40.4	54.0	-13.6	High Ch, EUT Vert
2729.950	61.9	-1.9	2.0	324.0		0.0	Horz	PK	0.0	60.0	74.0	-14.0	High Ch, EUT on Side
4599.017	53.5	6.1	3.6	90.0		0.0	Horz	PK	0.0	59.6	74.0	-14.4	High Ch, EUT on Side
2759.442	58.8	0.0	2.5	270.0		0.0	Horz	PK	0.0	58.8	74.0	-15.2	High Ch, EUT on Side
2759.325	59.6	-1.7	4.0	180.0		0.0	Vert	PK	0.0	57.9	74.0	-16.1	High Ch, EUT Horz
4550.100	51.4	5.9	1.5	270.0		0.0	Horz	PK	0.0	57.3	74.0	-16.7	High Ch, EUT on Side

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2759.300	58.0	-1.7	4.0	135.0		0.0	Vert	PK	0.0	56.3	74.0	-17.7	High Ch, EUT Vert
3679.133	51.8	3.5	3.0	45.0		0.0	Horz	PK	0.0	55.3	74.0	-18.7	High Ch, EUT on Side
4599.133	29.0	6.1	3.6	90.0		0.0	Horz	AV	0.0	35.1	54.0	-18.9	High Ch, EUT on Side
2759.542	56.8	-1.7	3.0	225.0		0.0	Horz	PK	0.0	55.1	74.0	-18.9	High Ch, EUT Horz
3639.867	51.4	3.4	1.0	225.0		0.0	Horz	PK	0.0	54.8	74.0	-19.2	High Ch, EUT on Side
4551.367	41.3	5.9	1.5	180.0	-12.4	0.0	Vert	AV	0.0	34.8	54.0	-19.2	Low Ch, EUT Horz
4599.175	28.2	6.1	1.0	225.0		0.0	Vert	AV	0.0	34.3	54.0	-19.7	High Ch, EUT Horz
3679.317	50.7	3.5	3.0	315.0		0.0	Vert	PK	0.0	54.2	74.0	-19.8	High Ch, EUT Horz
4549.742	28.2	5.9	1.5	270.0		0.0	Horz	AV	0.0	34.1	54.0	-19.9	High Ch, EUT on Side
2759.425	53.8	0.0	4.0	360.0		0.0	Vert	PK	0.0	53.8	74.0	-20.2	High Ch, EUT on Side
4599.042	47.2	6.1	1.0	225.0		0.0	Vert	PK	0.0	53.3	74.0	-20.7	High Ch, EUT Horz
4547.517	27.3	5.9	1.5	180.0		0.0	Vert	AV	0.0	33.2	54.0	-20.8	Low Ch, EUT Horz
3679.392	29.4	3.5	3.0	45.0		0.0	Horz	AV	0.0	32.9	54.0	-21.1	High Ch, EUT on Side
3679.342	29.4	3.5	3.0	315.0		0.0	Vert	AV	0.0	32.9	54.0	-21.1	High Ch, EUT Horz
2759.483	54.5	-1.7	1.0	180.0		0.0	Horz	PK	0.0	52.8	74.0	-21.2	High Ch, EUT Vert
3640.108	29.4	3.4	1.0	225.0		0.0	Horz	AV	0.0	32.8	54.0	-21.2	High Ch, EUT on Side
3641.025	41.2	3.4	1.0	180.0	-12.4	0.0	Vert	AV	0.0	32.2	54.0	-21.8	Low Ch, EUT Horz
3639.575	28.3	3.4	1.0	180.0		0.0	Vert	AV	0.0	31.7	54.0	-22.3	Low Ch, EUT Horz
2759.575	30.9	0.0	2.5	270.0		0.0	Horz	AV	0.0	30.9	54.0	-23.1	High Ch, EUT on Side
2729.983	32.2	-1.9	2.0	324.0		0.0	Horz	AV	0.0	30.3	54.0	-23.7	High Ch, EUT on Side
2759.333	30.2	0.0	4.0	360.0		0.0	Vert	AV	0.0	30.2	54.0	-23.8	High Ch, EUT on Side
2759.325	31.5	-1.7	4.0	180.0		0.0	Vert	AV	0.0	29.8	54.0	-24.2	High Ch, EUT Horz
2759.383	31.1	-1.7	4.0	135.0		0.0	Vert	AV	0.0	29.4	54.0	-24.6	High Ch, EUT Vert
2759.308	30.6	-1.7	3.0	225.0		0.0	Horz	AV	0.0	28.9	54.0	-25.1	High Ch, EUT Horz
2759.467	30.4	-1.7	1.0	180.0		0.0	Horz	AV	0.0	28.7	54.0	-25.3	High Ch, EUT Vert
2732.133	42.0	-1.9	1.0	180.0	-12.4	0.0	Vert	AV	0.0	27.7	54.0	-26.3	Low Ch, EUT Horz
2727.575	29.3	-1.9	1.0	180.0		0.0	Vert	AV	0.0	27.4	54.0	-26.6	Low Ch, EUT Horz
4551.367	41.3	5.9	1.5	180.0		0.0	Vert	PK	0.0	47.2	74.0	-26.8	Low Ch, EUT Horz
3641.025	41.2	3.4	1.0	180.0		0.0	Vert	PK	0.0	44.6	74.0	-29.4	Low Ch, EUT Horz
4599.133	29.0	6.1	3.6	90.0	-12.4	0.0	Horz	AV	0.0	22.7	54.0	-31.3	High Ch, EUT on Side
4599.175	28.2	6.1	1.0	225.0	-12.4	0.0	Vert	AV	0.0	21.9	54.0	-32.1	High Ch, EUT Horz
4549.742	28.2	5.9	1.5	270.0	-12.4	0.0	Horz	AV	0.0	21.7	54.0	-32.3	High Ch, EUT on Side
4547.517	27.3	5.9	1.5	180.0	-12.4	0.0	Vert	AV	0.0	20.8	54.0	-33.2	Low Ch, EUT Horz
3679.392	29.4	3.5	3.0	45.0	-12.4	0.0	Horz	AV	0.0	20.5	54.0	-33.5	High Ch, EUT on Side
3679.342	29.4	3.5	3.0	315.0	-12.4	0.0	Vert	AV	0.0	20.5	54.0	-33.5	High Ch, EUT Horz
3640.108	29.4	3.4	1.0	225.0	-12.4	0.0	Horz	AV	0.0	20.4	54.0	-33.6	High Ch, EUT on Side
2732.133	42.0	-1.9	1.0	180.0		0.0	Vert	PK	0.0	40.1	74.0	-33.9	Low Ch, EUT Horz
3639.575	28.3	3.4	1.0	180.0	-12.4	0.0	Vert	AV	0.0	19.3	54.0	-34.7	Low Ch, EUT Horz
2759.575	30.9	0.0	2.5	270.0	-12.4	0.0	Horz	AV	0.0	18.5	54.0	-35.5	High Ch, EUT on Side
2729.983	32.2	-1.9	2.0	324.0	-12.4	0.0	Horz	AV	0.0	17.9	54.0	-36.1	High Ch, EUT on Side
2759.333	30.2	0.0	4.0	360.0	-12.4	0.0	Vert	AV	0.0	17.8	54.0	-36.2	High Ch, EUT on Side
2759.325	31.5	-1.7	4.0	180.0	-12.4	0.0	Vert	AV	0.0	17.4	54.0	-36.6	High Ch, EUT Horz
2759.383	31.1	-1.7	4.0	135.0	-12.4	0.0	Vert	AV	0.0	17.0	54.0	-37.0	High Ch, EUT Vert
2759.308	30.6	-1.7	3.0	225.0	-12.4	0.0	Horz	AV	0.0	16.5	54.0	-37.5	High Ch, EUT Horz
2759.467	30.4	-1.7	1.0	180.0	-12.4	0.0	Horz	AV	0.0	16.3	54.0	-37.7	High Ch, EUT Vert
2727.575	29.3	-1.9	1.0	180.0	-12.4	0.0	Vert	AV	0.0	15.0	54.0	-39.0	Low Ch, EUT Horz

DUTY CYCLE

XMit 2017.12.13

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.	Cal. Due
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-18	23-Apr-21
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-18	19-Mar-19
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18

TEST DESCRIPTION

The measurement was made in a radiated configuration of the fundamental with the carrier fully maximized for its highest radiated power. 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.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

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 may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

XMit 2017.12.13

EUT:	NightHawk ERT Radio Module			**Work Order:**	NIGH0001
Serial Number:	MN005580			**Date:**	21-Aug-18
Customer:	Nighthawk			**Temperature:**	22 °C
Attendees:	Weimin Peng			**Humidity:**	49.2% RH
Project:	None			**Barometric Pres.:**	1024 mbar
Tested by:	Marty Martin	**Power:**	110VAC/60Hz	**Job Site:**	TX09

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

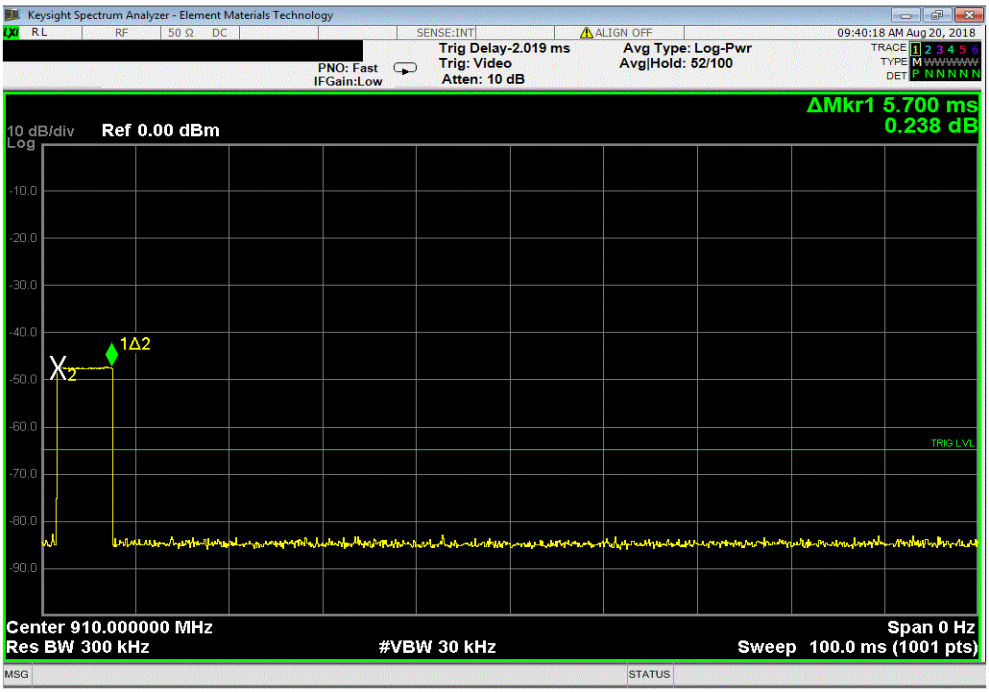
Configuration #	2	*Signature*

	Value	Limit	Result
Mid Channel 915 MHz 100 ms	0.057	N/A	N/A
Mid Channel 915 MHz 1 second	N/A	N/A	N/A
Mid Channel 915 MHz 5 seconds	N/A	N/A	N/A
Mid Channel 915 MHz 10 seconds	N/A	N/A	N/A

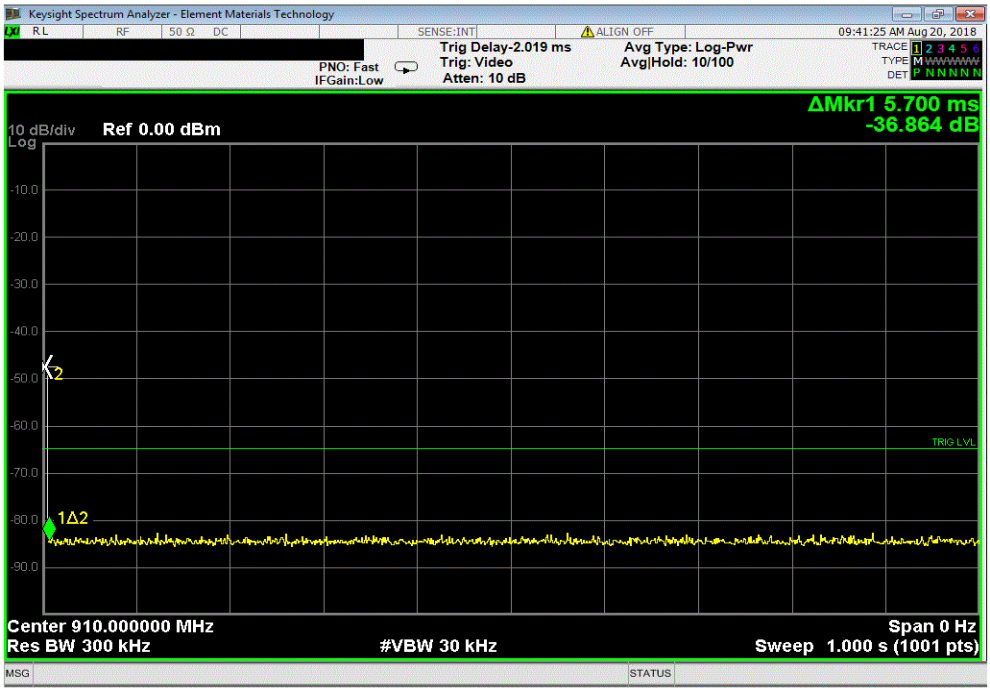
DUTY CYCLE

XMit 2017.12.13

Mid Channel 915 MHz						
				Value	Limit	Result
				0.057	N/A	N/A



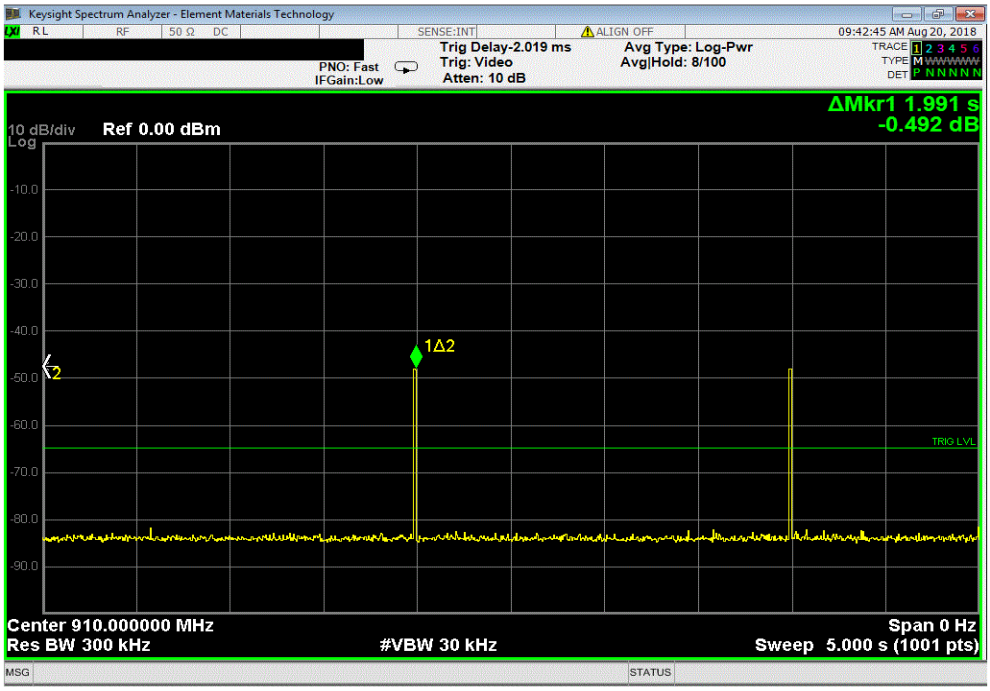
Mid Channel 915 MHz						
				Value	Limit	Result
				N/A	N/A	N/A



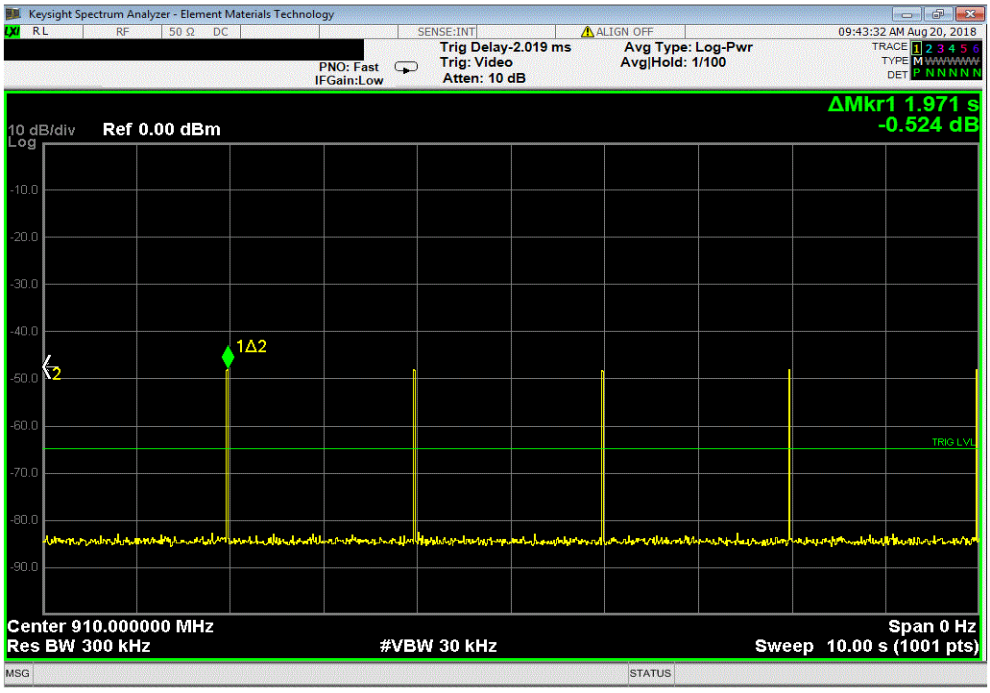
DUTY CYCLE

XMit 2017.12.13

Mid Channel 915 MHz						
				Value	Limit	Result
				N/A	N/A	N/A



Mid Channel 915 MHz						
				Value	Limit	Result
				N/A	N/A	N/A



CARRIER FREQUENCY SEPARATION

XMit 2017.12.13

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.	Cal. Due
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-18	23-Apr-21
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-18	19-Mar-19

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The channel carrier frequencies in the 902 MHz - 928 MHz 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.

CARRIER FREQUENCY SEPARATION

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**NightHawk ERT Radio Module**			**Work Order:**	**NIGH0001**
Serial Number:	**MN005580**			**Date:**	**21-Aug-18**
Customer:	**Nighthawk**			**Temperature:**	**22 °C**
Attendees:	**Weimin Peng**			**Humidity:**	**52.3% RH**
Project:	**None**			**Barometric Pres.:**	**1022 mbar**
Tested by:	**Marty Martin**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

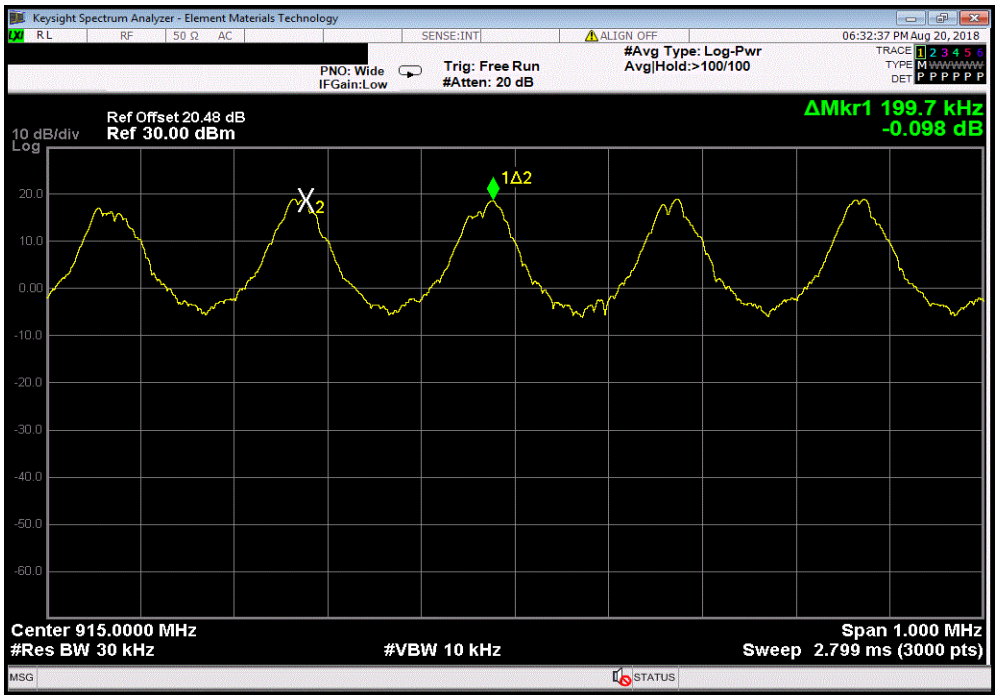
Configuration #	**2**	*Signature*

	Value	**Limit (≥)**	**Results**
Hopping Mode			
Mid Channel 915 MHz	0.2 MHz	25 kHz	Pass

CARRIER FREQUENCY SEPARATION

TbtTx 2017.12.14 XMit 2017.12.13

Hopping Mode, Mid Channel 915 MHz						
				Value	Limit (≥)	Results
				0.2 MHz	25 kHz	Pass



NUMBER OF HOPPING CHANNELS

XMit 2017.12.13

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.	Cal. Due
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-18	19-Mar-19
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-18	23-Apr-21
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18

TEST DESCRIPTION

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

NUMBER OF HOPPING CHANNELS

element

XMit 2017.12.13

EUT:	**NightHawk ERT Radio Module**			**Work Order:**	**NIGH0001**
Serial Number:	**MN005580**			**Date:**	**21-Aug-18**
Customer:	**Nighthawk**			**Temperature:**	**22.4 °C**
Attendees:	**Weimin Peng**			**Humidity:**	**49.8% RH**
Project:	**None**			**Barometric Pres.:**	**1023 mbar**
Tested by:	**Marty Martin**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

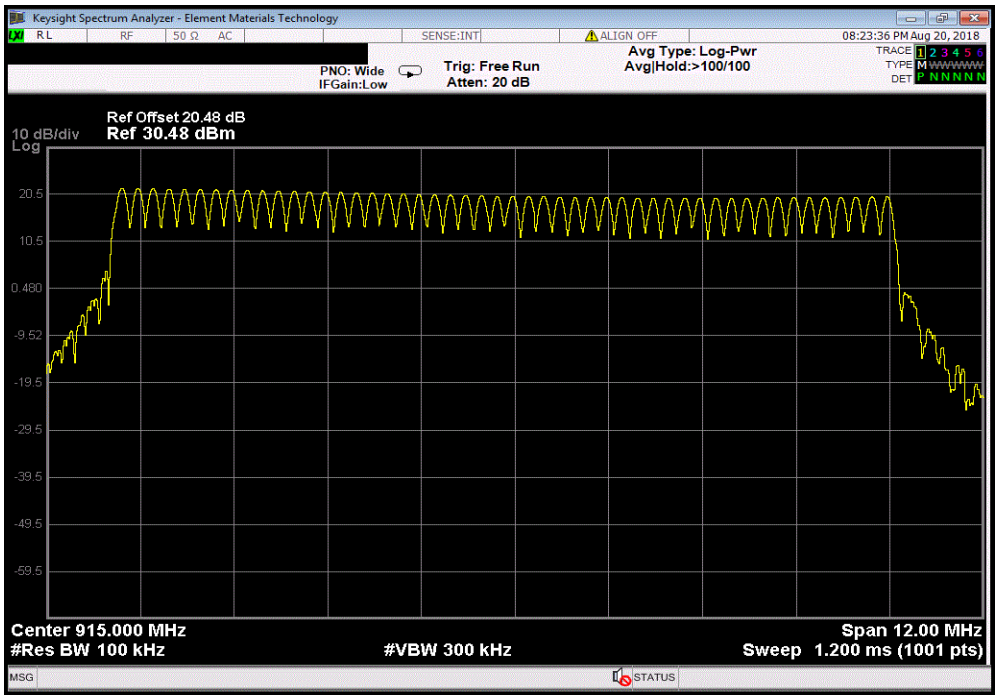
Configuration #	**2**	*Signature* Marty Martin

	Number of Channels	**Limit (> -)**	**Result**
902 MHz - 928 MHz Band			
Mid Channel 915 MHz - Hopping Mode	50	50	Pass

NUMBER OF HOPPING CHANNELS

XMit 2017.12.13

902 MHz - 928 MHz Band, Mid Channel 915 MHz - Hopping Mode						
				Number of Channels	Limit (> -)	Result
				50	50	Pass



DWELL TIME

XMit 2017.12.13

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.	Cal. Due
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-18	23-Apr-21
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-18	19-Mar-19

TEST DESCRIPTION

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

The dwell time limit is based on the Number of Hopping Channels * 400 mS. For this propriatary radio, this would be 50 Channels * 400mS = 20 Sec.

On Time During 20 Seconds = Pulse Width * Number of Pulses

DWELL TIME

element

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**NightHawk ERT Radio Module**			**Work Order:**	**NIGH0001**
Serial Number:	**MN005580**			**Date:**	**21-Aug-18**
Customer:	**Nighthawk**			**Temperature:**	**21.9 °C**
Attendees:	**Weimin Peng**			**Humidity:**	**50% RH**
Project:	**None**			**Barometric Pres.:**	**1023 mbar**
Tested by:	**Marty Martin**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

Normal user operation is 1 pulse every 30 seconds

DEVIATIONS FROM TEST STANDARD

None

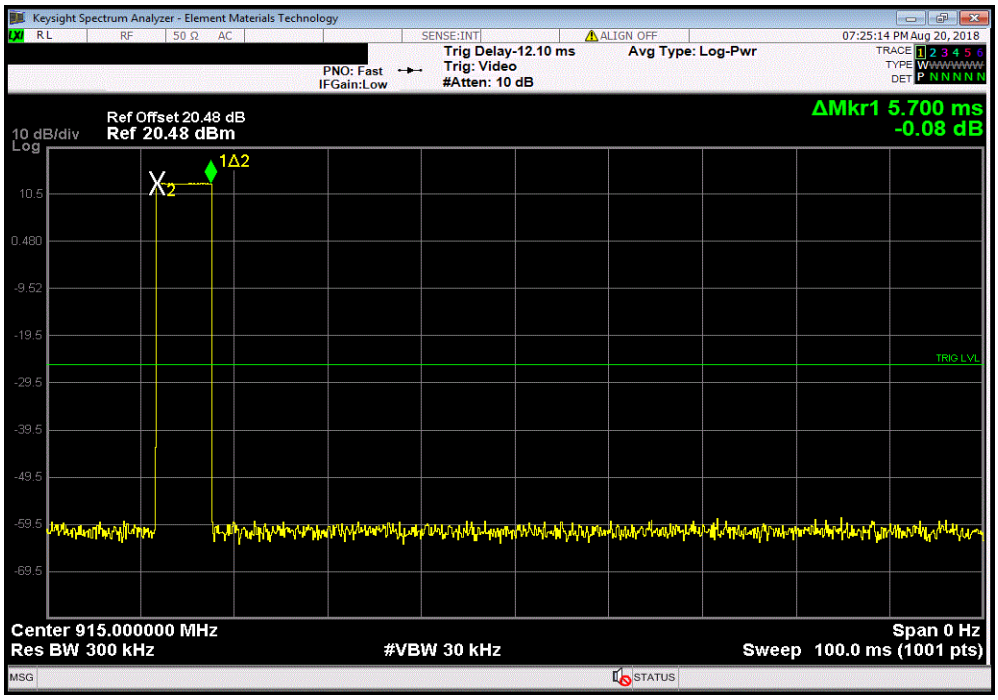
Configuration #	**2**	*Signature*

	Pulse Width (ms)	Number of Pulses	Average High Time (ms)	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
Hopping Mode							
Mid Channel 915 MHz (100mS)	5.7	1	N/A	N/A	N/A	20	N/A
Mid Channel 915 MHz (10 Second)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel 915 MHz (20 Second)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel 915 MHz (30 Second)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel 915 MHz (40 Second)	5.7	2	11.4	0.5	5.7	400	Pass

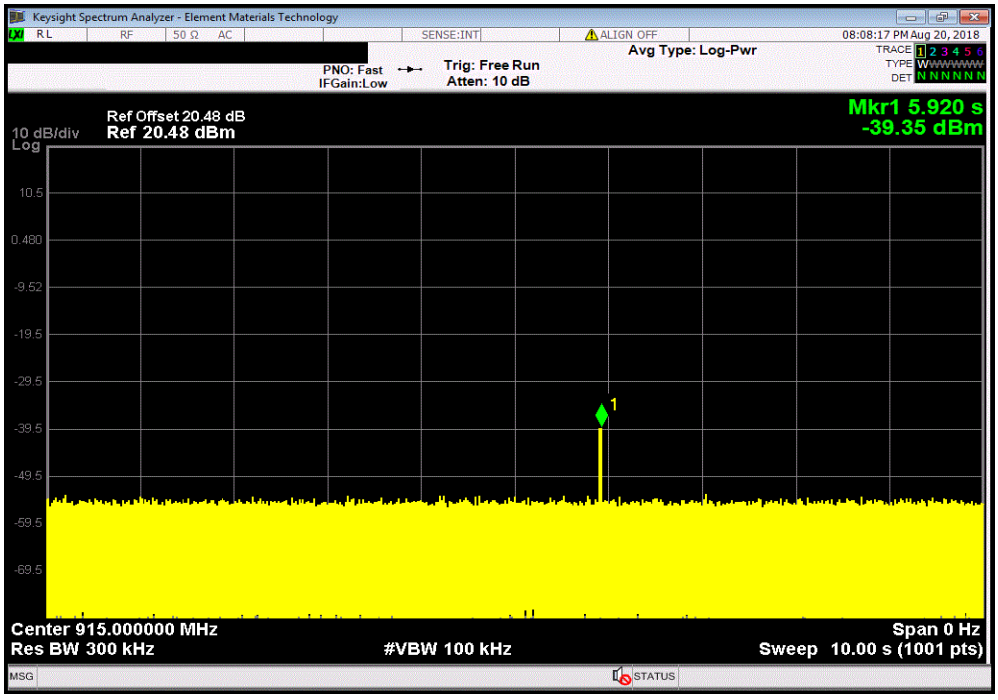
DWELL TIME

TbtTx 2017.12.14 XMit 2017.12.13

Hopping Mode, Mid Channel 915 MHz (100mS)						
Pulse Width (ms)	Number of Pulses	Average High Time (ms)	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
5.7	1	N/A	N/A	N/A	20	N/A

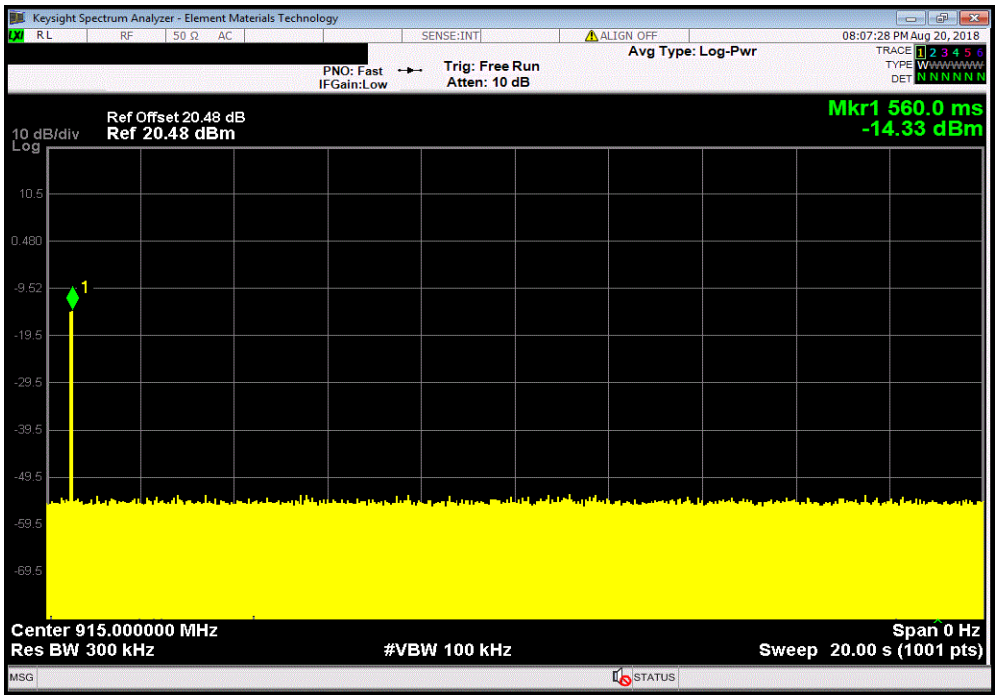


Hopping Mode, Mid Channel 915 MHz (10 second)						
Pulse Width (ms)	Number of Pulses	Average High Time (ms)	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
N/A	N/A	N/A	N/A	N/A	N/A	N/A

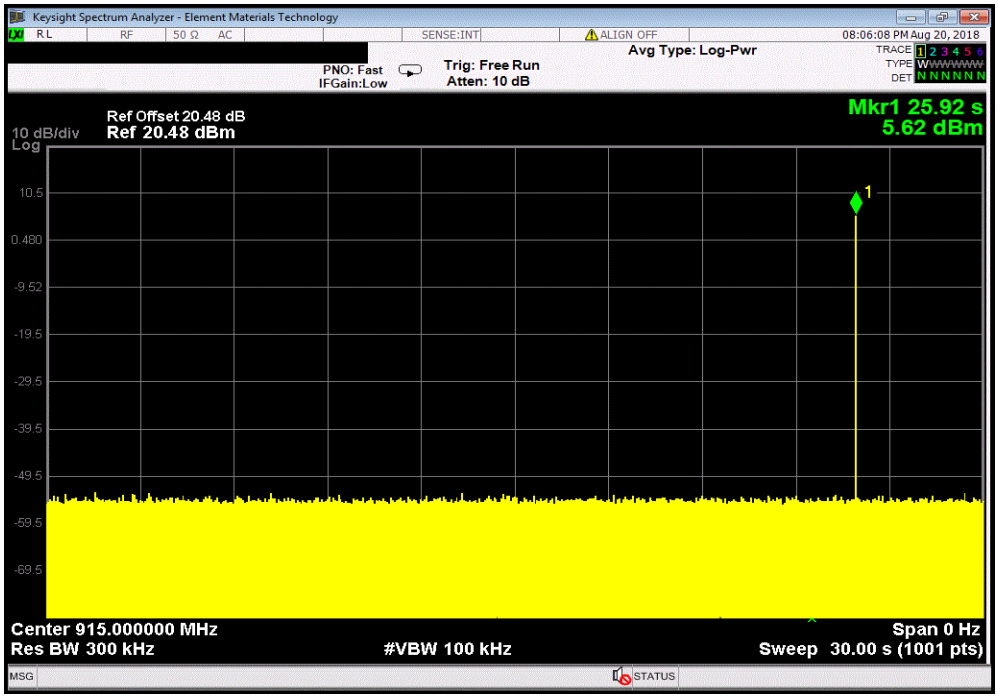


DWELL TIME

Hopping Mode, Mid Channel 915 MHz (20 Second)						
Pulse Width (ms)	Number of Pulses	Average High Time (ms)	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
N/A	N/A	N/A	N/A	N/A	N/A	N/A



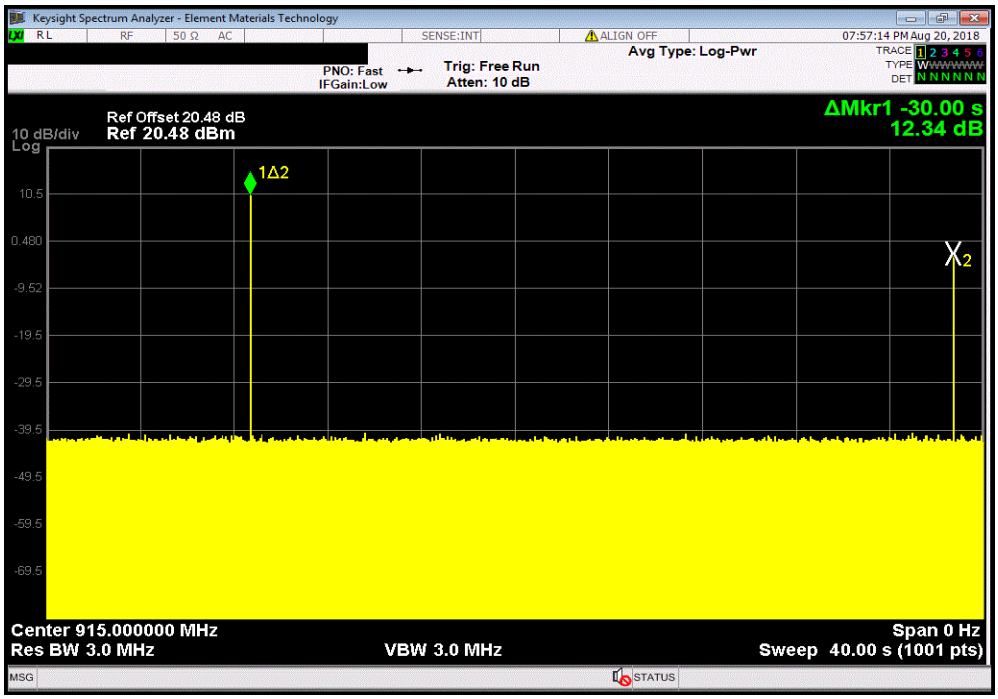
Hopping Mode, Mid Channel 915 MHz (30 Second)						
Pulse Width (ms)	Number of Pulses	Average High Time (ms)	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
N/A	N/A	N/A	N/A	N/A	N/A	N/A



DWELL TIME

TbtTx 2017.12.14 XMit 2017.12.13

Hopping Mode, Mid Channel 915 MHz (40 Second)						
Pulse Width (ms)	Number of Pulses	Average High Time (ms)	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
5.7	2	11.4	0.5	5.7	400	Pass



OUTPUT POWER

XMit 2017.12.13

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.	Cal. Due
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-18	23-Apr-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-18	19-Mar-19

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The peak output power was measured with the EUT set to low and high transmit frequencies. The EUT was transmitting in a no hop mode at the data rate(s) listed in the datasheet.

The method found in ANSI C63.10:2013 Section 7.8.5 was used for a FHSS radio.

De Facto EIRP Limit: The EUT meets the de facto EIRP limit of +36 dBm.

OUTPUT POWER

element

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**NightHawk ERT Radio Module**			**Work Order:**	**NIGH0001**
Serial Number:	**MN005580**			**Date:**	**21-Aug-18**
Customer:	**Nighthawk**			**Temperature:**	**22 °C**
Attendees:	**Weimin Peng**			**Humidity:**	**51.2% RH**
Project:	**None**			**Barometric Pres.:**	**1021 mbar**
Tested by:	**Marty Martin**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

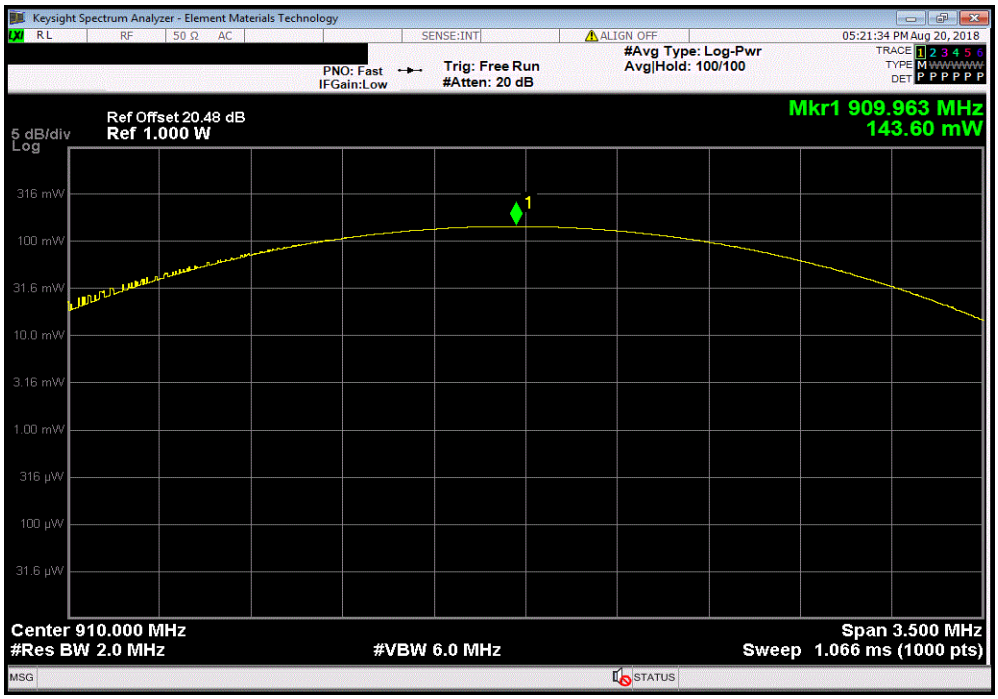
DEVIATIONS FROM TEST STANDARD

None

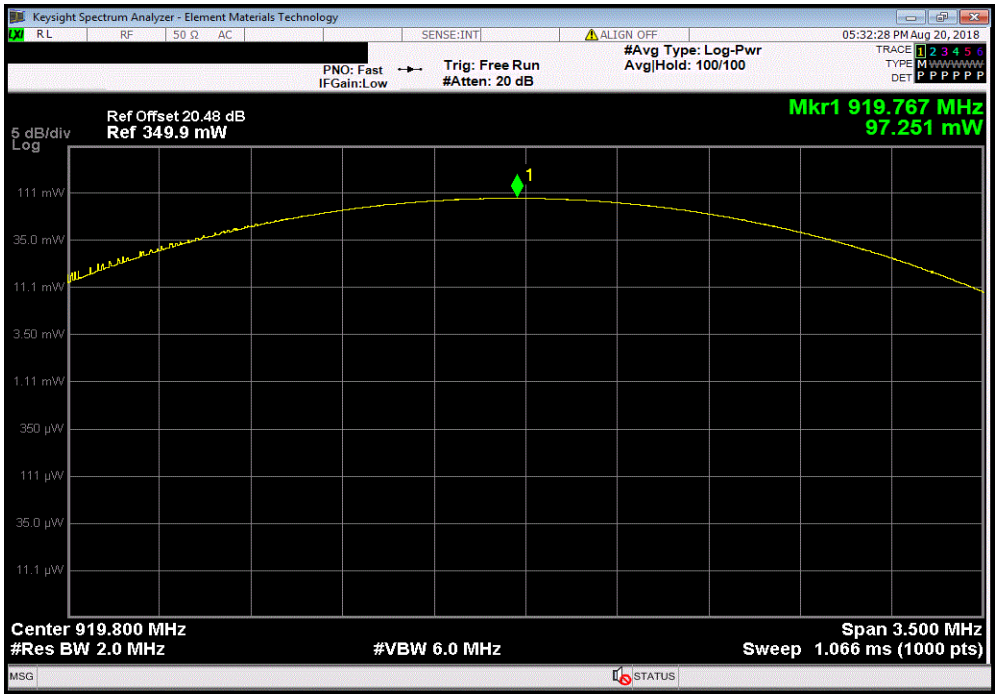
Configuration #	**2**	*Signature*

	Value	**Limit (<)**	**Result**
910 MHz - 919.8 MHz			
Low Channel 910 MHz	143.6 mW	1 W	Pass
High Channel 919.8 MHz	97.251 mW	1 W	Pass

910 MHz - 919.8 MHz, Low Channel 910 MHz						
				Value	Limit (<)	Result
				143.6 mW	1 W	Pass



910 MHz - 919.8 MHz, High Channel 919.8 MHz						
				Value	Limit (<)	Result
				97.251 mW	1 W	Pass



BAND EDGE COMPLIANCE

XMit 2017.12.13

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.	Cal. Due
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-18	23-Apr-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-18	19-Mar-19

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. 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 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 spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**NightHawk ERT Radio Module**			**Work Order:**	**NIGH0001**
Serial Number:	**MN005580**			**Date:**	**21-Aug-18**
Customer:	**Nighthawk**			**Temperature:**	**22.1 °C**
Attendees:	**Weimin Peng**			**Humidity:**	**49.8% RH**
Project:	**None**			**Barometric Pres.:**	**1021 mbar**
Tested by:	**Marty Martin**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

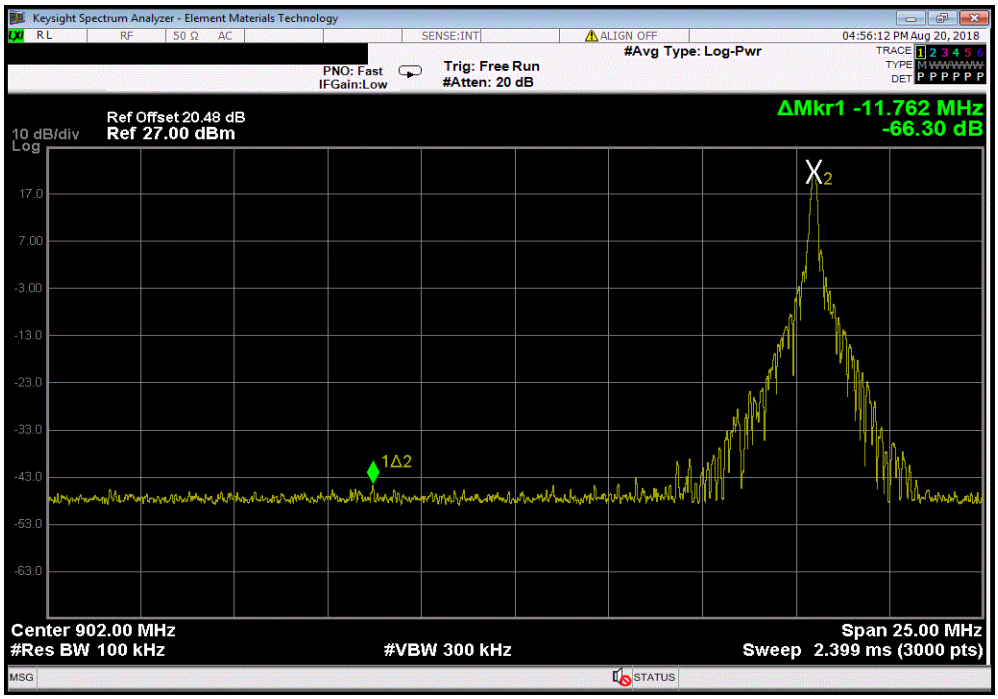
DEVIATIONS FROM TEST STANDARD

None

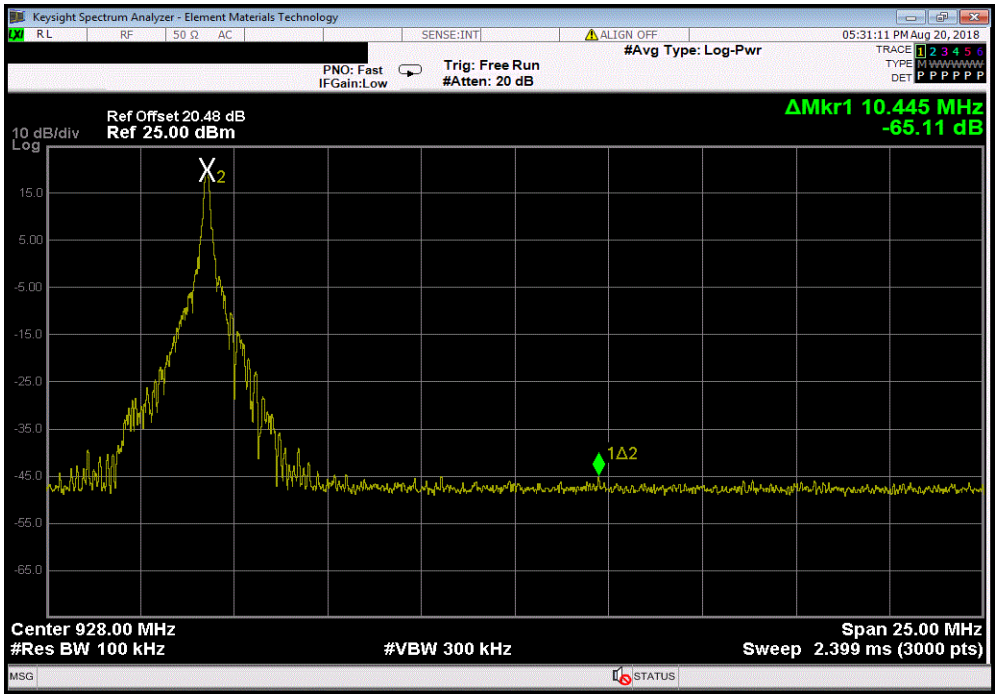
Configuration #	**2**	*Signature* Marty Martin

	Value (dBc)	**Limit ≤ (dBc)**	**Result**
910 MHz - 919.8 MHz			
Low Channel 910 MHz	-66.3	-20	Pass
High Channel 919.8 MHz	-65.11	-20	Pass

910 MHz - 919.8 MHz, Low Channel 910 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-66.3	-20	Pass



910 MHz - 919.8 MHz, High Channel 919.8 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-65.11	-20	Pass



BAND EDGE COMPLIANCE - HOPPING MODE

XMit 2017.12.13

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.	Cal. Due
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-18	23-Apr-21
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-18	19-Mar-19

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. 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 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

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**NightHawk ERT Radio Module**			**Work Order:**	**NIGH0001**
Serial Number:	**MN005580**			**Date:**	**21-Aug-18**
Customer:	**Nighthawk**			**Temperature:**	**21.9 °C**
Attendees:	**Weimin Peng**			**Humidity:**	**50.1% RH**
Project:	**None**			**Barometric Pres.:**	**1022 mbar**
Tested by:	**Marty Martin**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

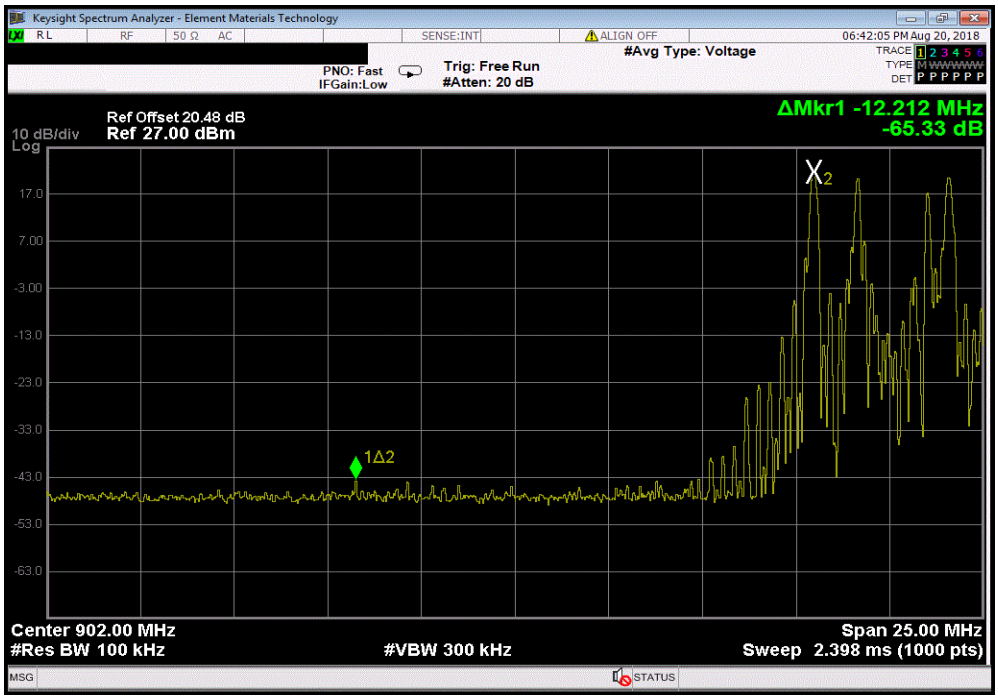
None

Configuration #	**2**	*Signature* Marty Martin

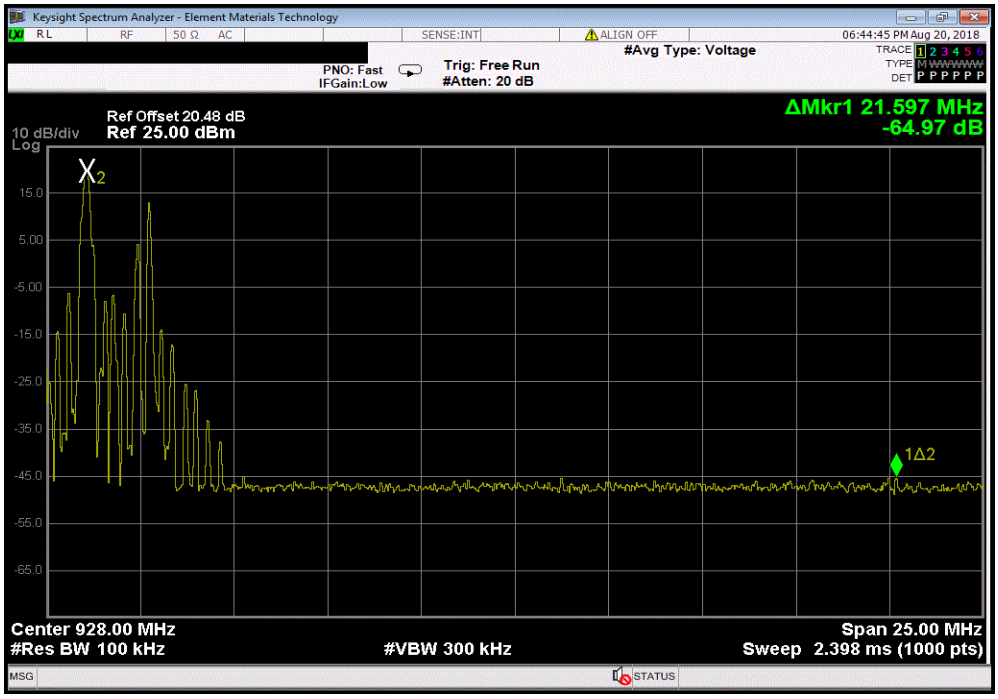
	Value (dBc)	**Limit ≤ (dBc)**	**Result**
Hopping Mode			
Low Channel 910 MHz	-65.33	-20	Pass
High Channel 919.8 MHz	-64.97	-20	Pass

BAND EDGE COMPLIANCE - HOPPING MODE

Hopping Mode, Low Channel 910 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-65.33	-20	Pass



Hopping Mode, High Channel 919.8 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-64.97	-20	Pass



OCCUPIED BANDWIDTH

XMit 2017.12.13

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.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-18	23-Apr-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-18	19-Mar-19
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18

TEST DESCRIPTION

The measurement was made using a direst connection between the RF ouput on the Eut and a spectrum analyzer. The EUT was set to the channels and modes listed in the datasheet.

The 20 dB occupied bandwidth was measured with the EUT set to low, high transmit frequencies in the band.
The EUT was transmitting in a no-hop mode.

OCCUPIED BANDWIDTH

element

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**NightHawk ERT Radio Module**			**Work Order:**	**NIGH0001**
Serial Number:	**MN005580**			**Date:**	**21-Aug-18**
Customer:	**Nighthawk**			**Temperature:**	**21.8 °C**
Attendees:	**Weimin Peng**			**Humidity:**	**50.1% RH**
Project:	**None**			**Barometric Pres.:**	**1021 mbar**
Tested by:	**Marty Martin**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

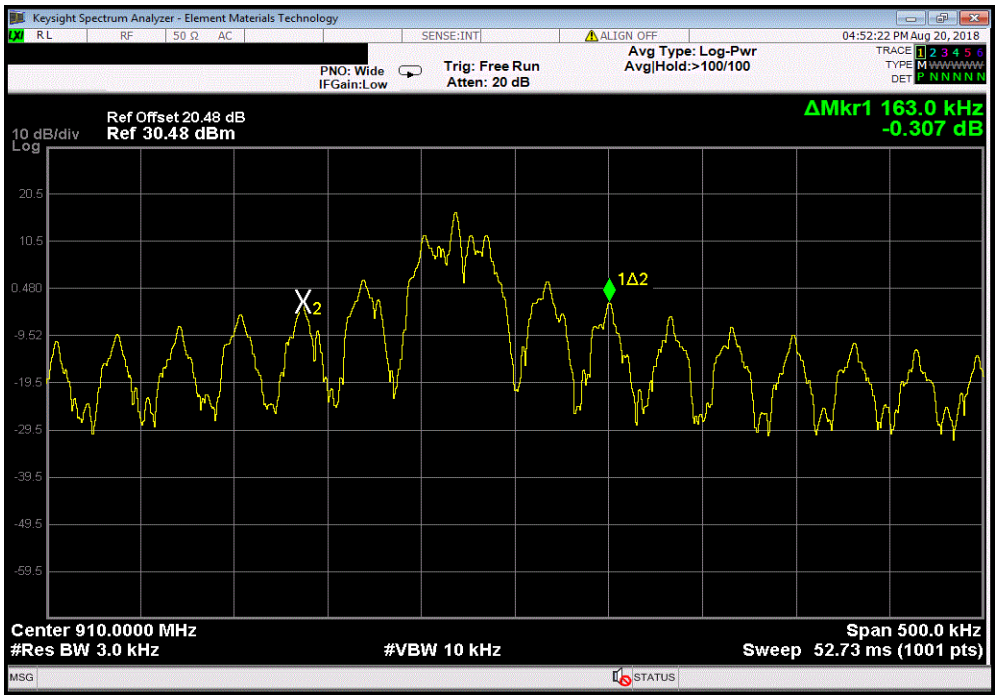
DEVIATIONS FROM TEST STANDARD

None

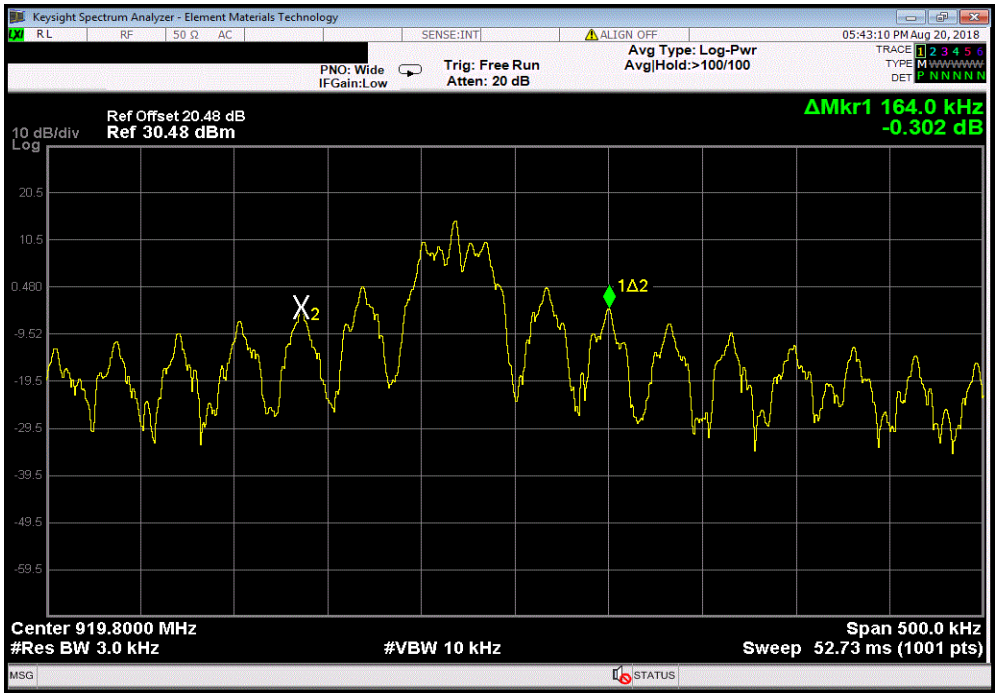
Configuration #	**2**	*Signature* Marty Martin

	Value	**Limit (≤)**	**Result**
910 MHz - 919.8 MHz			
Low Channel 910 MHz	163.0 kHz	500 kHz	Pass
High Channel 919.8 MHz	164.0 kHz	500 kHz	Pass

910 MHz - 919.8 MHz, Low Channel 910 MHz						
				Value	Limit (≤)	Result
				163.0 kHz	500 kHz	Pass



910 MHz - 919.8 MHz, High Channel 919.8 MHz						
				Value	Limit (≤)	Result
				164.0 kHz	500 kHz	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2017.12.13

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.	Cal. Due
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-18	23-Apr-21
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-18	19-Mar-19
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions were measured with the EUT set to low and high transmit frequencies For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS

element

XMit 2017.12.13

EUT:	**NightHawk ERT Radio Module**			**Work Order:**	**NIGH0001**
Serial Number:	**MN005580**			**Date:**	**21-Aug-18**
Customer:	**Nighthawk**			**Temperature:**	**22.4 °C**
Attendees:	**Weimin Peng**			**Humidity:**	**49.5% RH**
Project:	**None**			**Barometric Pres.:**	**1022 mbar**
Tested by:	**Marty Martin**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**
TEST SPECIFICATIONS		**Test Method**			
FCC 15.247:2018		ANSI C63.10:2013			

COMMENTS

EUT Transmits once every 2 seconds.

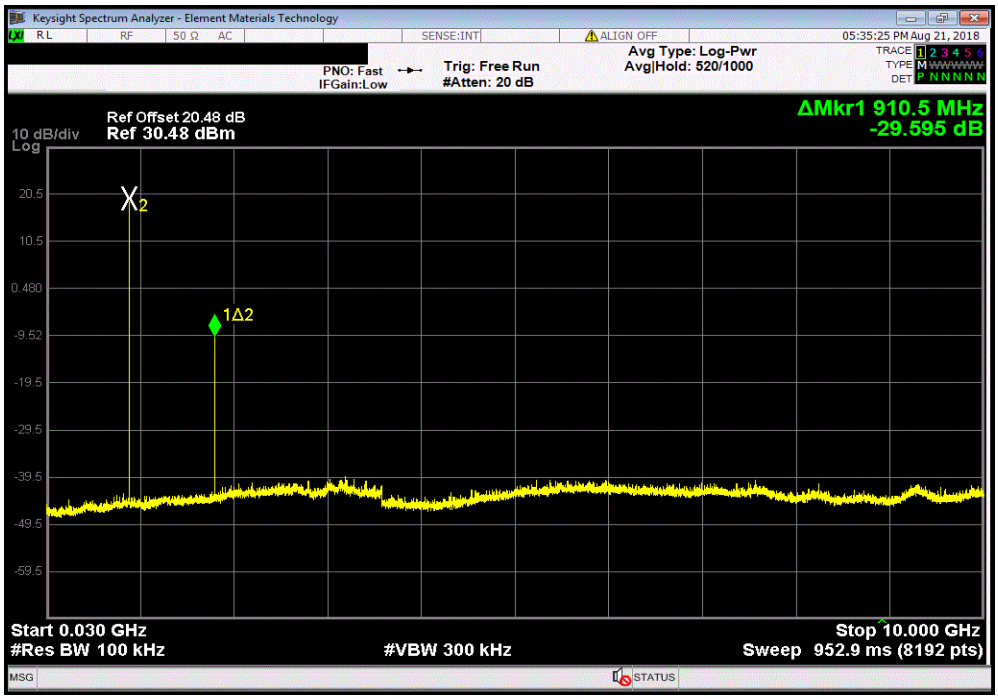
DEVIATIONS FROM TEST STANDARD

None

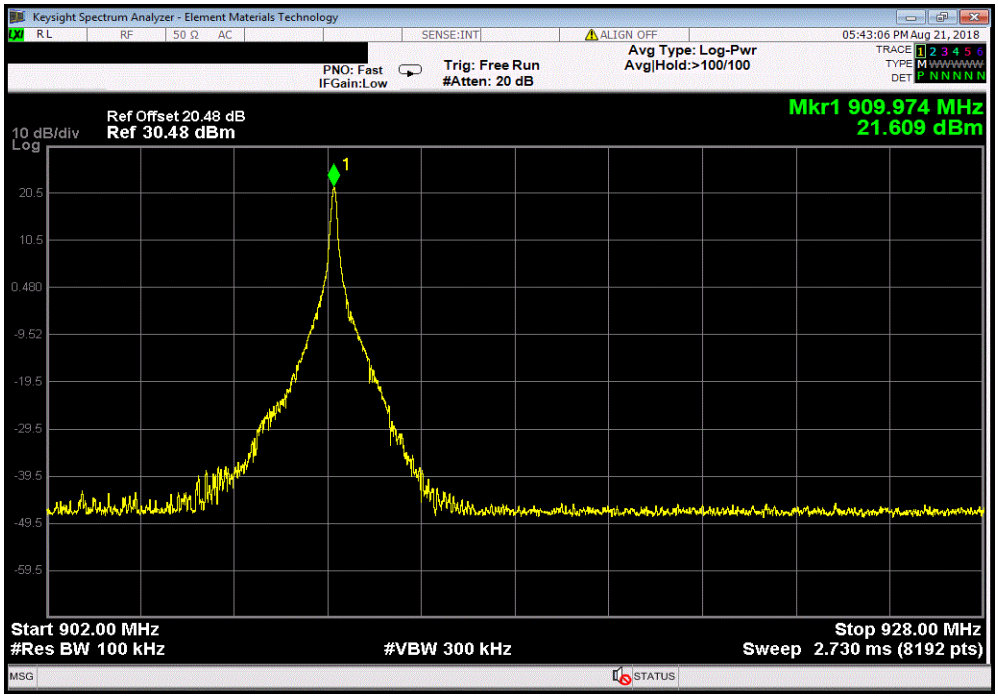
Configuration #	**2**	*Signature* Marty Martin

	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
Low Channel 910 MHz						
30 MHz - 10 GHz	.003 - 10	21.61	N/A	-29.595	-20	Pass
902 MHz - 928 MHz	.902-.928	21.61	N/A	N/A	N/A	N/A
2nd Harmonic	1.8195-1.8205	21.61	-9.98	-31.59	-20	Pass
3rd Harmonic	2.7295-2.7305	21.61	-44.09	-65.7	-20	Pass
4th Harmonic	3.6395 - 3.6405	21.61	-46.67	-68.28	-20	Pass
5th Harmonic	4.5495 - 4.5505	21.61	-48.13	-69.74	-20	Pass
6th Harmonic	5.4595 - 5.4605	21.61	-48.09	-69.7	-20	Pass
7th Harmonic	6.3695 - 6.3705	21.61	-48.34	-69.95	-20	Pass
8th Harmonic	7.2795 - 7.2805	21.61	-47.43	-69.04	-20	Pass
9th Harmonic	8.1895 - 8.1905	21.61	-47.88	-69.49	-20	Pass
10th Harmonic	9.1095 - 9.1105	21.61	-46.85	-68.46	-20	Pass
High Channel 919.8 MHz						
30 MHz - 10 GHz	.003 - 10	19.92	N/A	-26.938	-20	Pass
902 MHz - 928 MHz	.902 - .928	19.92	N/A	N/A	N/A	N/A
2nd Harmonic	1.839 - 1.840	19.92	-11.75	-31.67	-20	Pass
3rd Harmonic	2.7585 - 27595	19.92	-46.7	-66.62	-20	Pass
4th Harmonic	3.6785 - 3.6795	19.92	-48.4	-68.32	-20	Pass
5th Harmonic	4.5985 - 4.5995	19.92	-48.19	-68.11	-20	Pass
6th Harmonic	5.5185 - 5.5195	19.92	-47.56	-67.48	-20	Pass
7th Harmonic	6.4385 - 6.4395	19.92	-47.18	-67.1	-20	Pass
8th Harmonic	7.3575 - 7.3585	19.92	-47.59	-67.51	-20	Pass
9th Harmonic	8.2775 - 8.2785	19.92	-46.94	-66.86	-20	Pass
10th Harmonic	9.1975 - 9.1985	19.92	-46.64	-66.56	-20	Pass

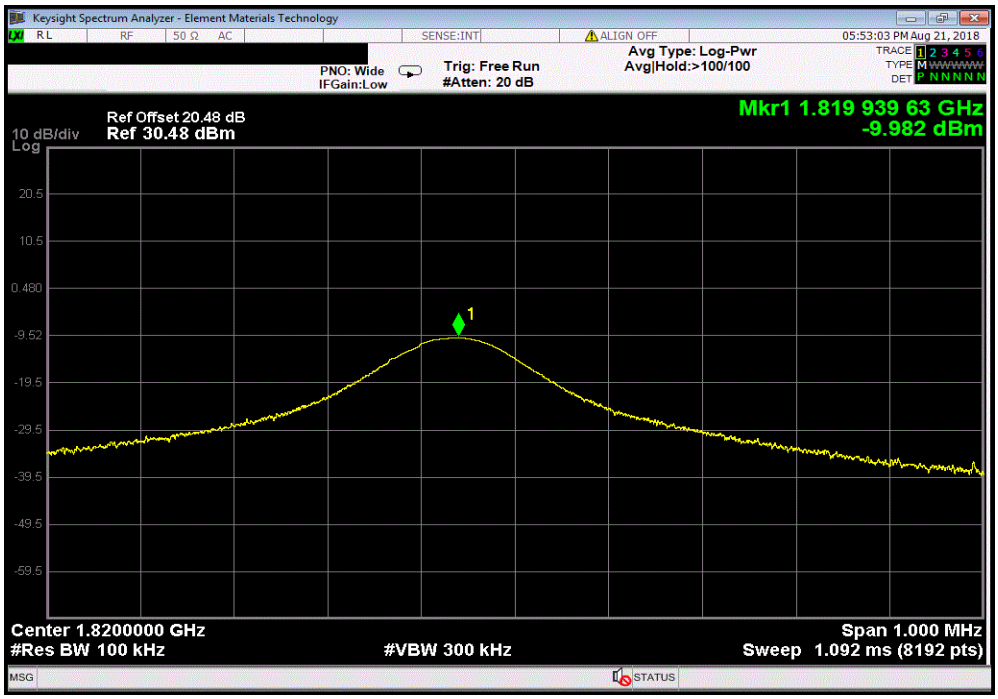
Low Channel 910 MHz, 30 MHz - 10 GHz						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	.003 - 10	21.61	N/A	-29.595	-20	Pass



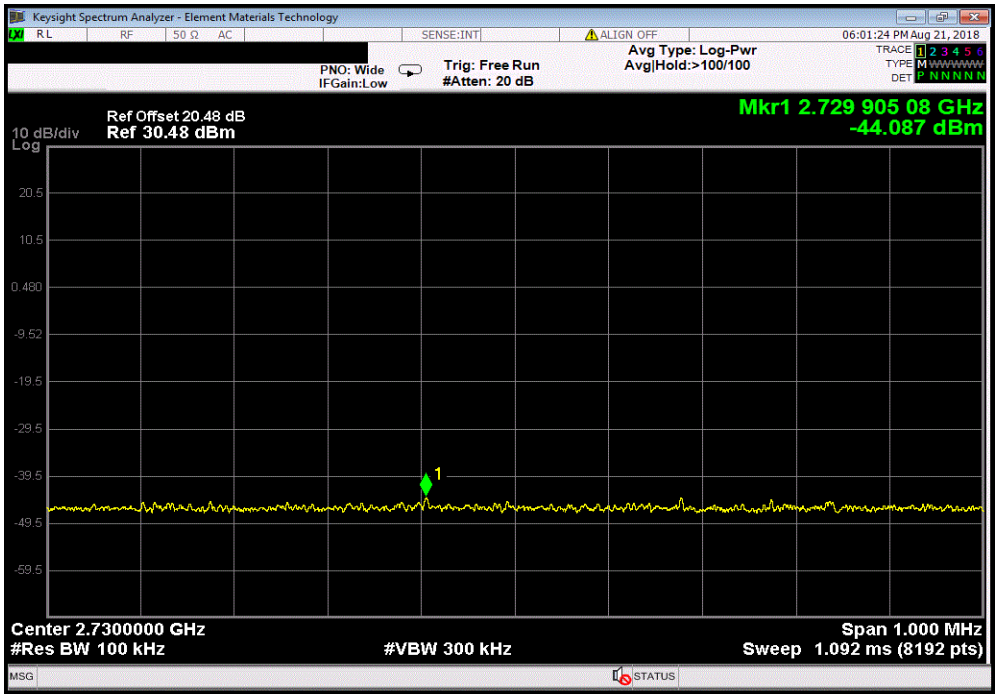
Low Channel 910 MHz, 902 MHz - 928 MHz						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	.902-.928	21.61	N/A	N/A	N/A	N/A



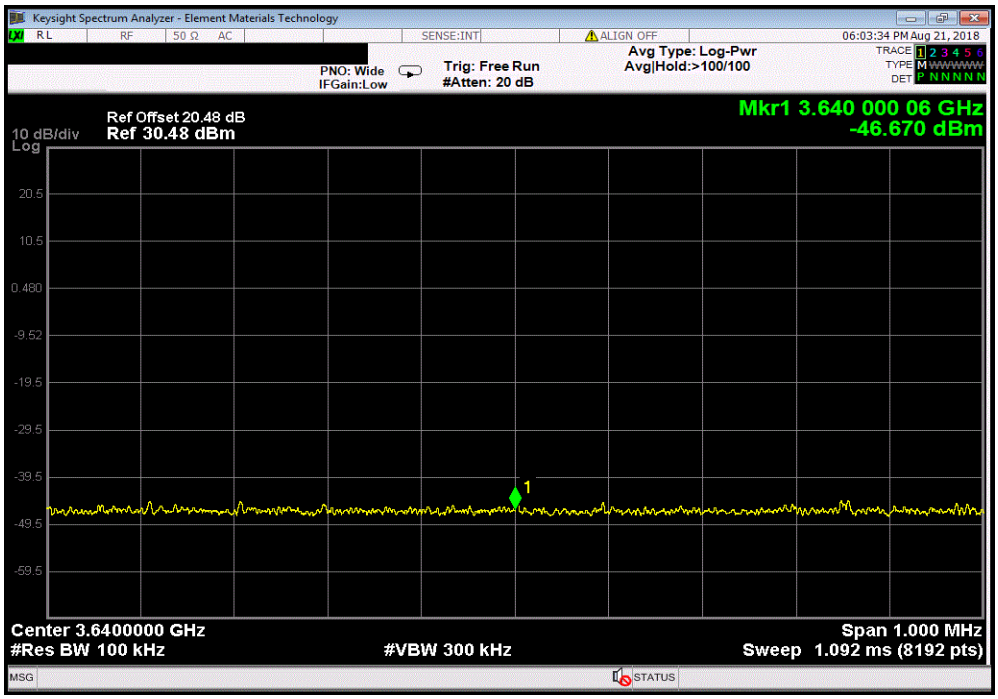
Low Channel 910 MHz, 2nd Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	1.8195-1.8205	21.61	-9.98	-31.59	-20	Pass



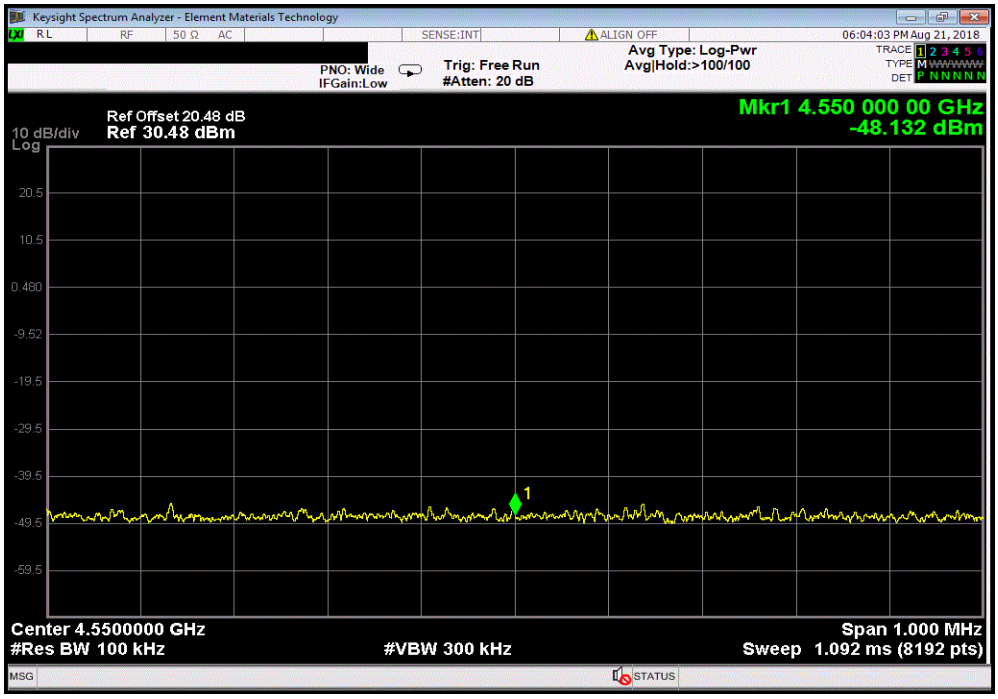
Low Channel 910 MHz, 3rd Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	2.7295-2.7305	21.61	-44.09	-65.7	-20	Pass



Low Channel 910 MHz, 4th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	3.6395 - 3.6405	21.61	-46.67	-68.28	-20	Pass



Low Channel 910 MHz, 5th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	4.5495 - 4.5505	21.61	-48.13	-69.74	-20	Pass

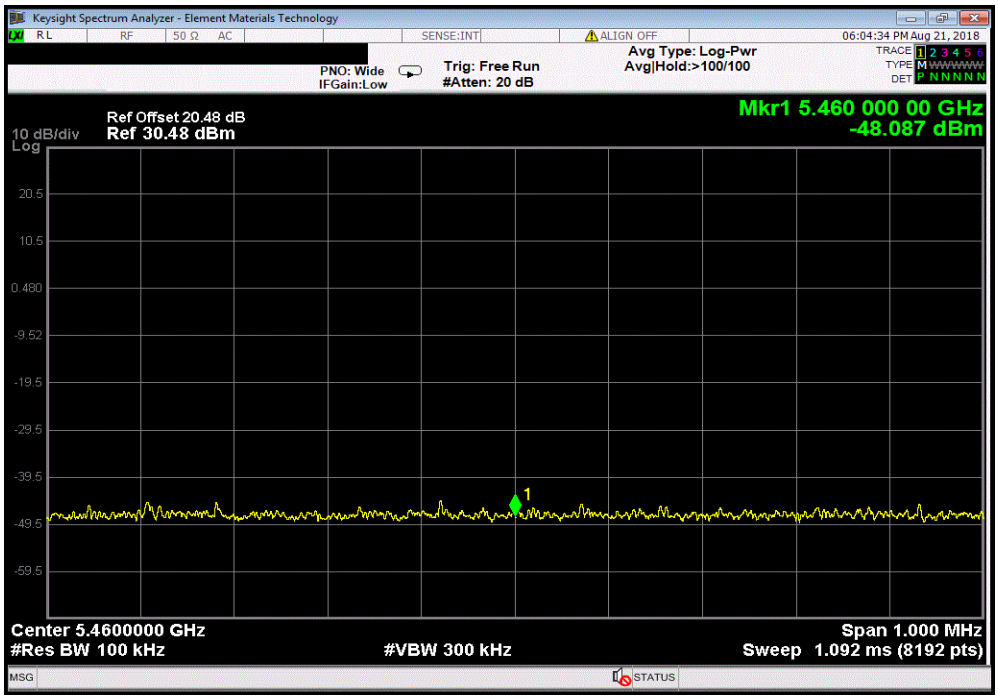


SPURIOUS CONDUCTED EMISSIONS

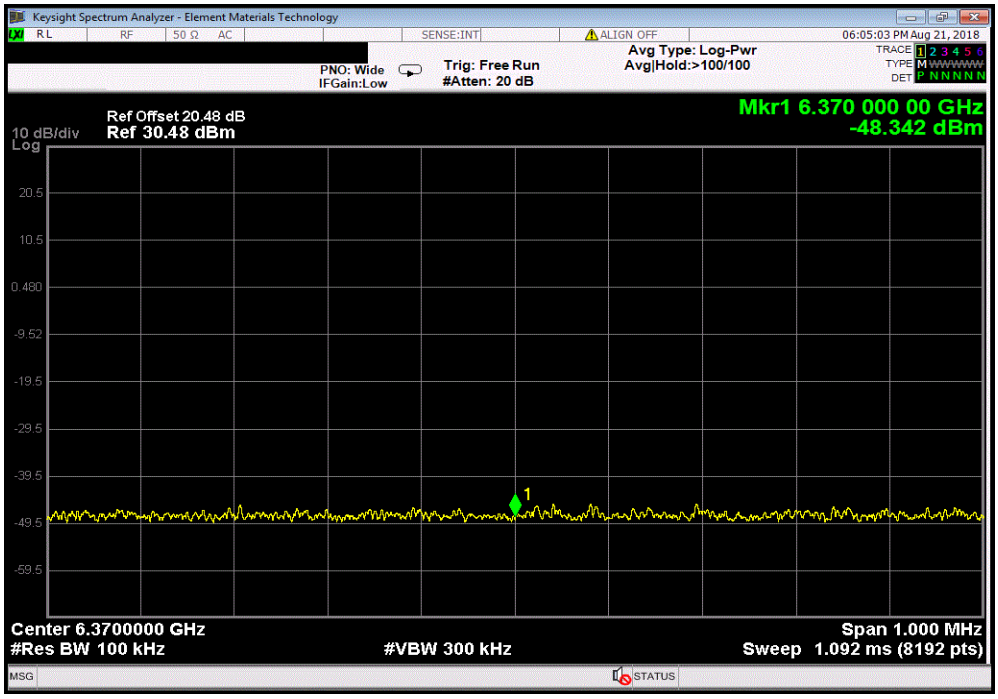
element

XMit 2017.12.13

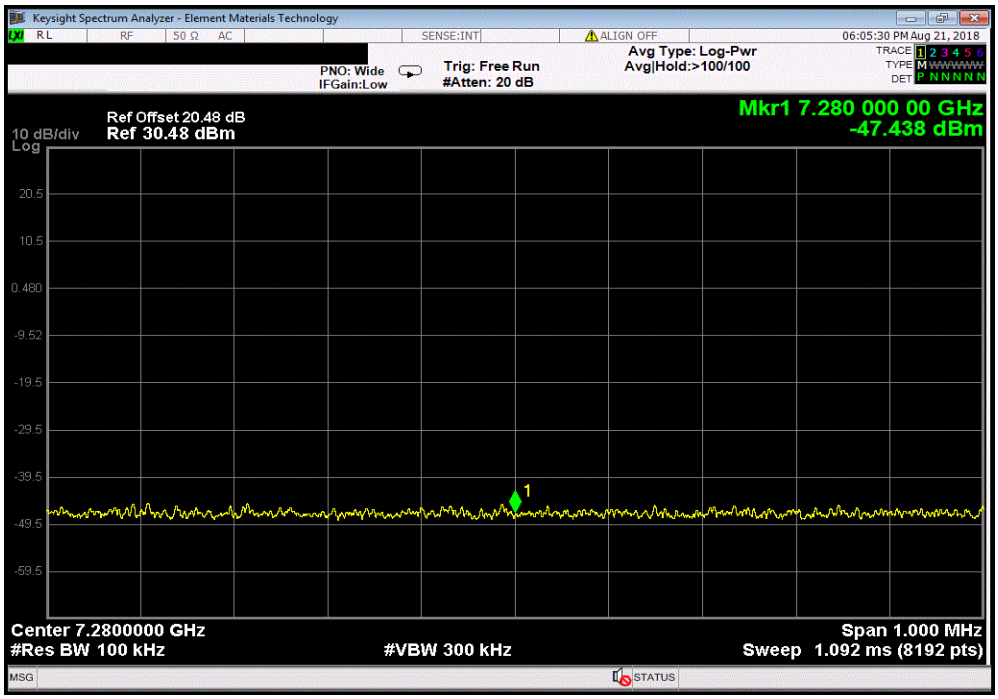
Low Channel 910 MHz, 6th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	5.4595 - 5.4605	21.61	-48.09	-69.7	-20	Pass



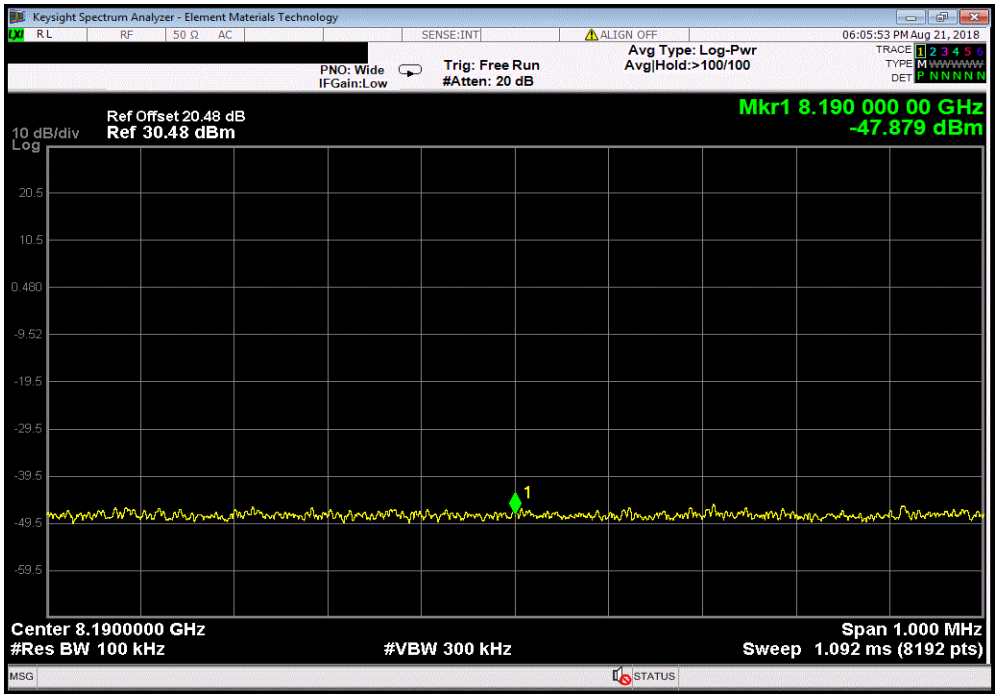
Low Channel 910 MHz, 7th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	6.3695 - 6.3705	21.61	-48.34	-69.95	-20	Pass



Low Channel 910 MHz, 8th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	7.2795 - 7.2805	21.61	-47.43	-69.04	-20	Pass



Low Channel 910 MHz, 9th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	8.1895 - 8.1905	21.61	-47.88	-69.49	-20	Pass

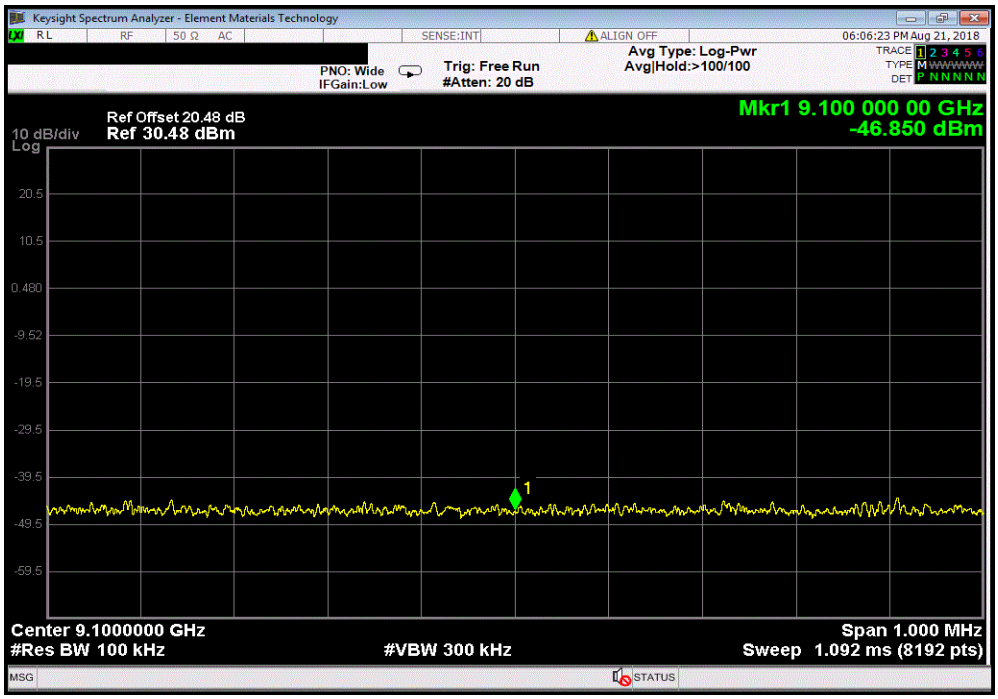


SPURIOUS CONDUCTED EMISSIONS

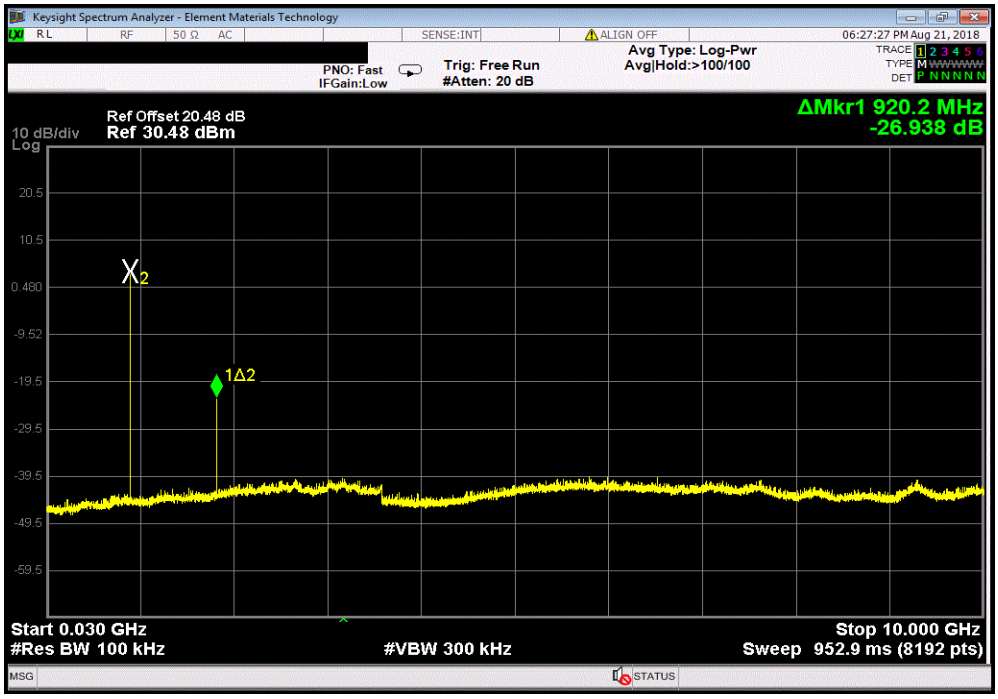
element

XMit 2017.12.13

Low Channel 910 MHz, 10th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	9.1095 - 9.1105	21.61	-46.85	-68.46	-20	Pass



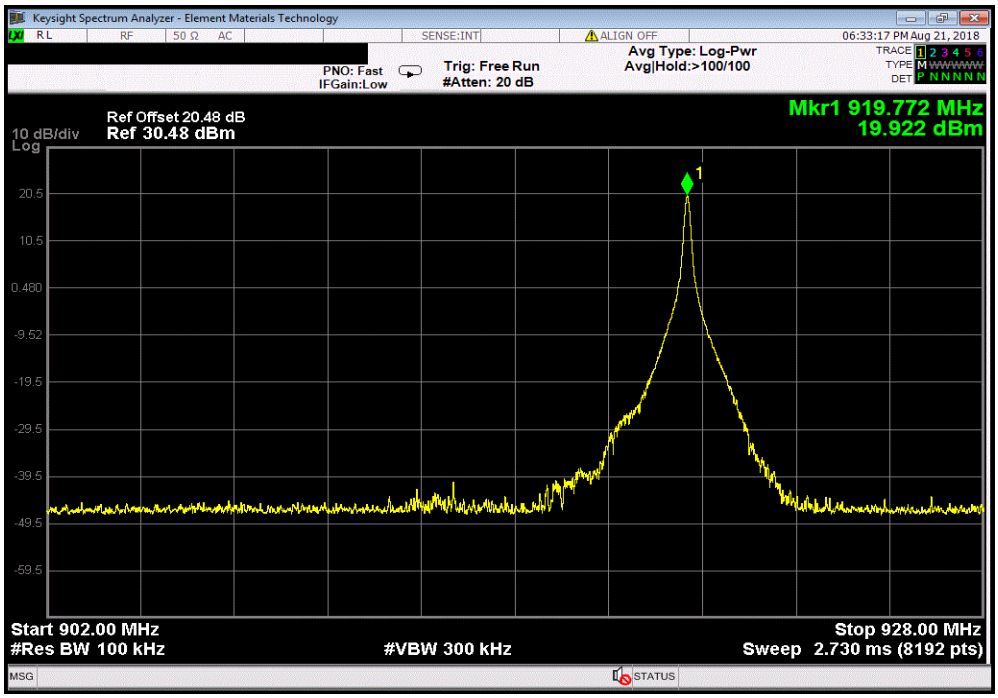
High Channel 919.8 MHz, 30 MHz - 10 GHz						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	.003 - 10	19.92	N/A	-26.938	-20	Pass



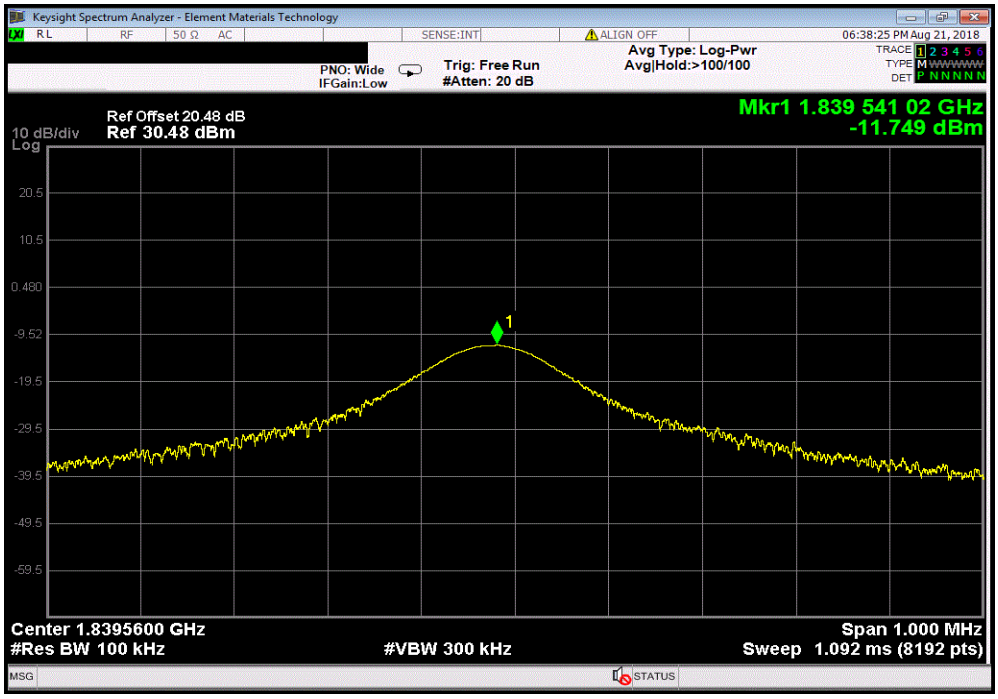
SPURIOUS CONDUCTED EMISSIONS

XMit 2017.12.13

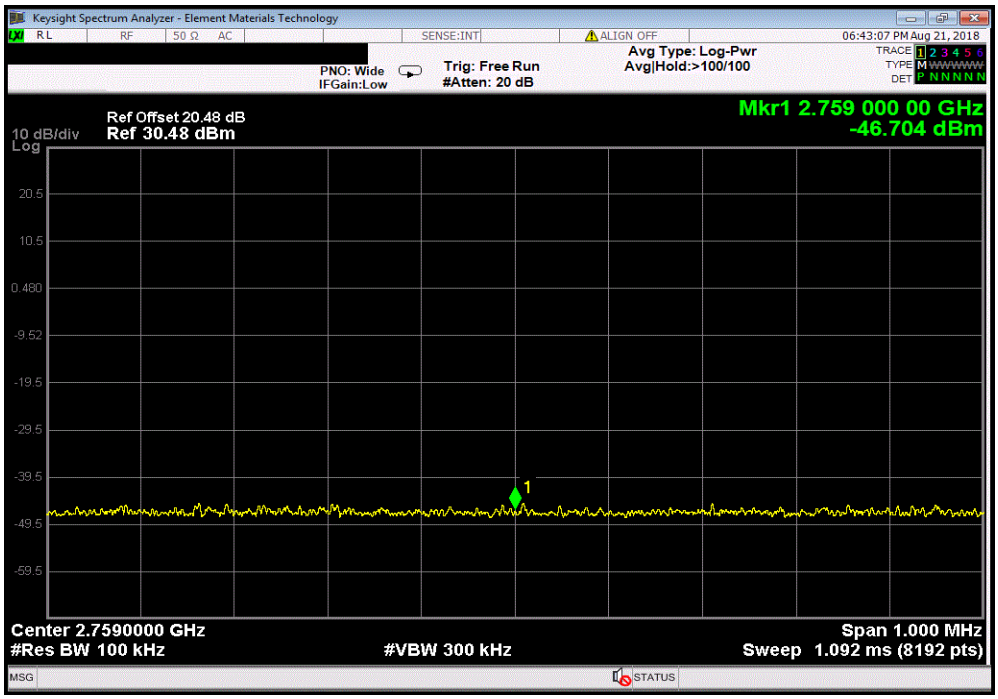
High Channel 919.8 MHz, 902 MHz - 928 MHz						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	.902 - .928	19.92	N/A	N/A	N/A	N/A



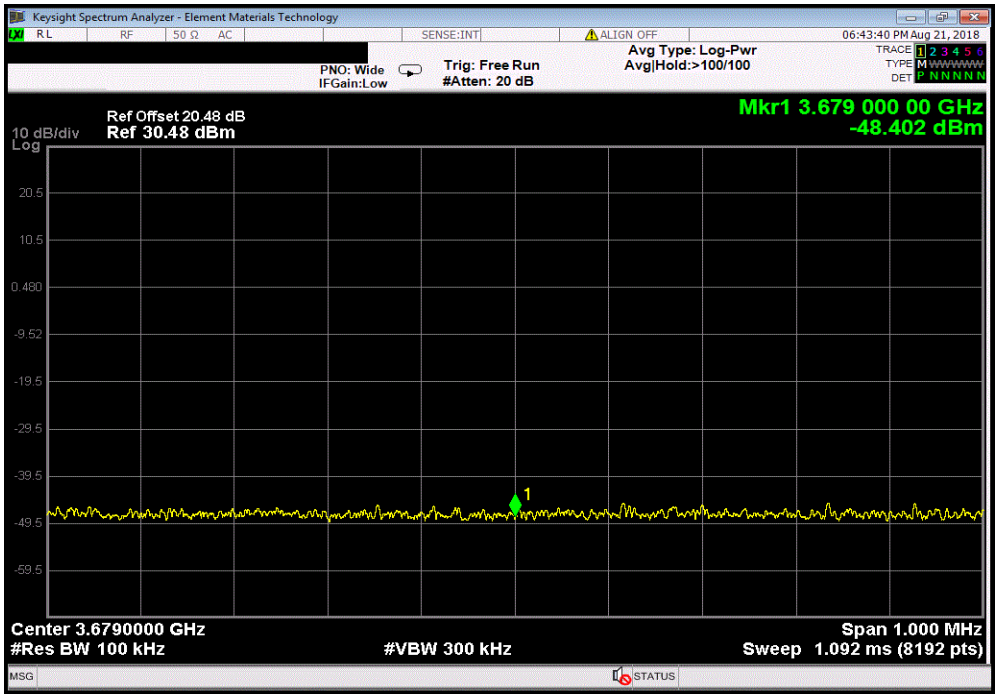
High Channel 919.8 MHz, 2nd Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	1.839 - 1.840	19.92	-11.75	-31.67	-20	Pass



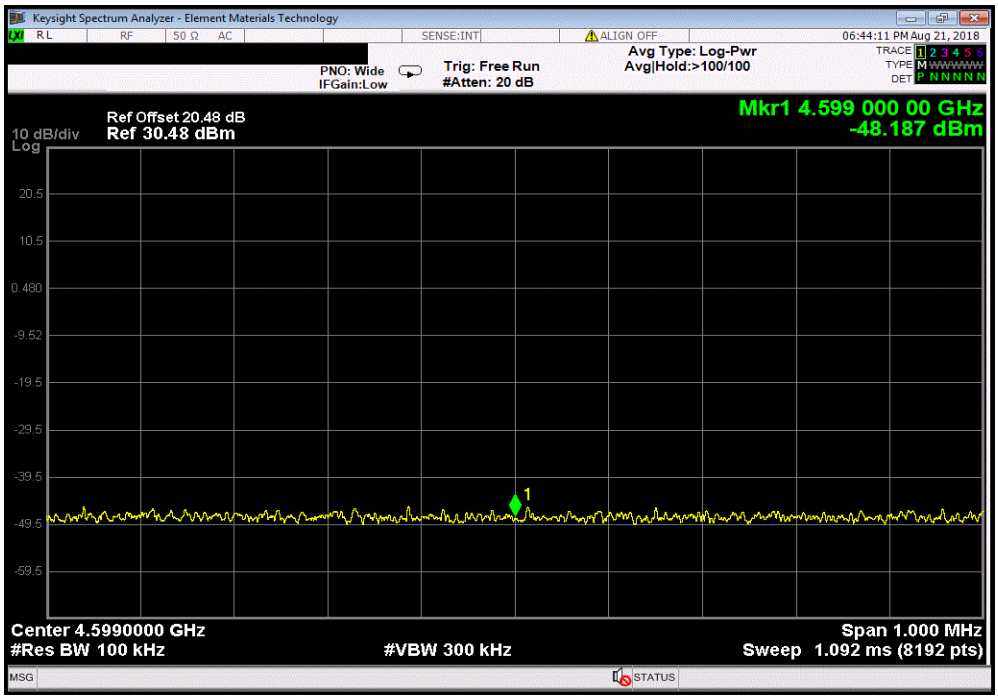
High Channel 919.8 MHz, 3rd Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	2.7585 - 27595	19.92	-46.7	-66.62	-20	Pass



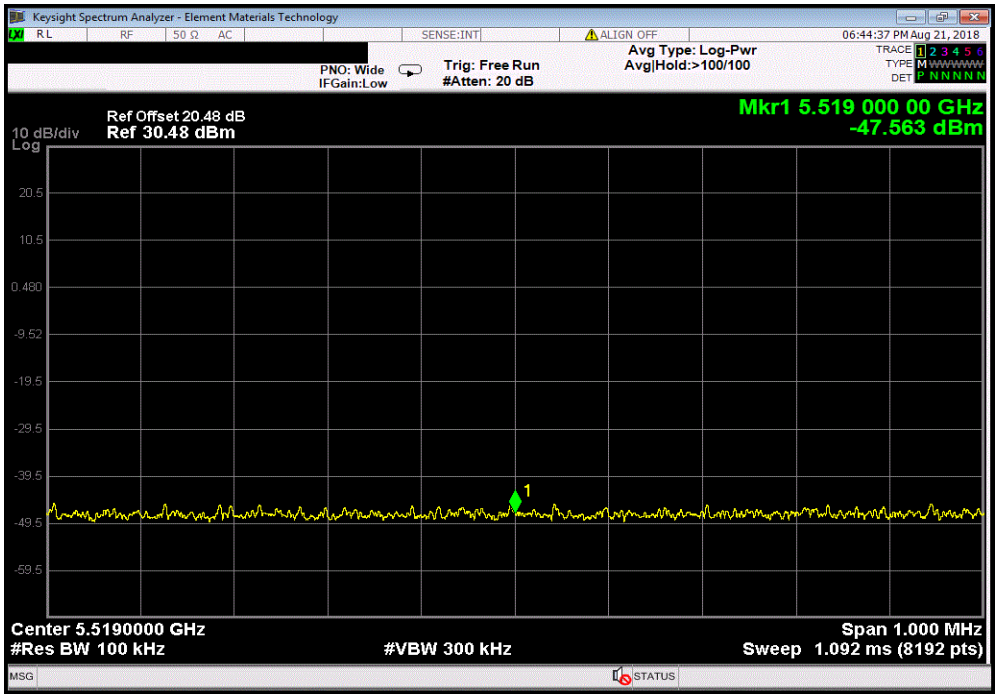
High Channel 919.8 MHz, 4th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	3.6785 - 3.6795	19.92	-48.4	-68.32	-20	Pass



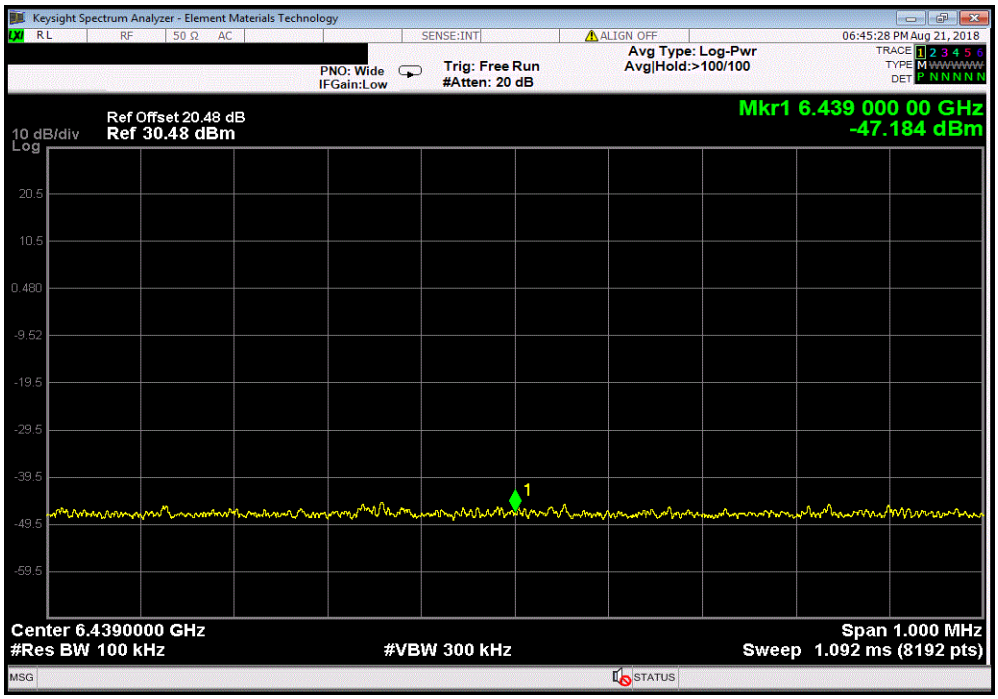
High Channel 919.8 MHz, 5th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	4.5985 - 4.5995	19.92	-48.19	-68.11	-20	Pass



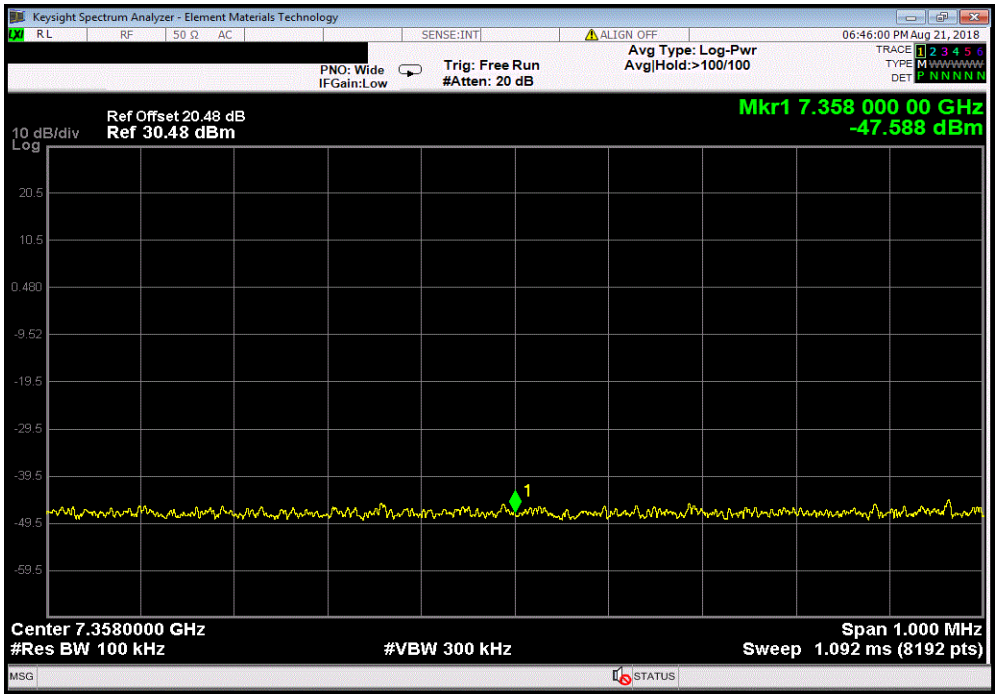
High Channel 919.8 MHz, 6th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	5.5185 - 5.5195	19.92	-47.56	-67.48	-20	Pass



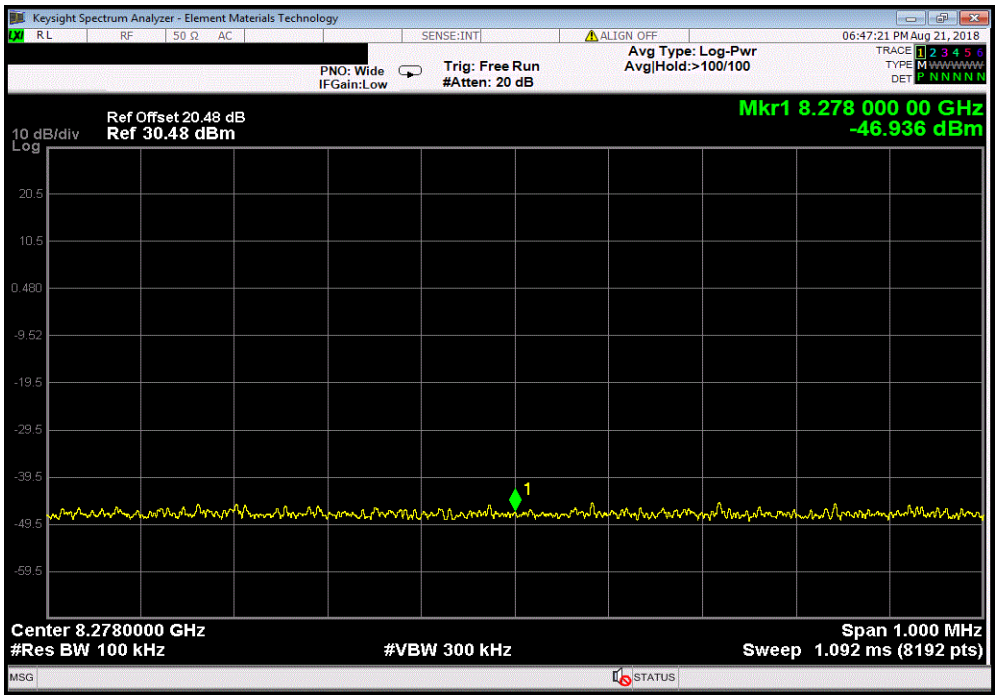
High Channel 919.8 MHz, 7th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	6.4385 - 6.4395	19.92	-47.18	-67.1	-20	Pass



High Channel 919.8 MHz, 8th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	7.3575 - 7.3585	19.92	-47.59	-67.51	-20	Pass



High Channel 919.8 MHz, 9th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	8.2775 - 8.2785	19.92	-46.94	-66.86	-20	Pass



High Channel 919.8 MHz, 10th Harmonic						
	Frequency Range (GHz)	Fundamental (dBm)	Spurious (dBm)	Max Value (dBc)	Limit <(dBc)	Result
	9.1975 - 9.1985	19.92	-46.64	-66.56	-20	Pass