Company: Silver Spring Networks

Test of: LNIC

To: FCC CFR 47 Part 15 Subpart C 15.247 (FHSS)

Report No.: SSNT136-U2 Rev A

COMPLETE TEST REPORT

TEST REPORT

FROM

Test of: Silver Spring Networks LNIC

to

To: FCC CFR 47 Part 15 Subpart C 15.247 (FHSS)

Test Report Serial No.: SSNT136-U2 Rev A

This report supersedes: NONE

Applicant:	Silver Spring Networks 230 W Tasman Drive San Jose, CA 95134 USA
Product Function:	Modular radio device, will communicate over 900 MHz.
Issue Date:	2nd May 2017

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
575 Boulder Court
Pleasanton California 94566
USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

ACCREDITED
TESTING CERT #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2005. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

ilac-MRA A2LA

Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 4th day of February 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2017

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

1.2. RECOGNITION

MiCOM Labs, Inc has widely recognized wireless testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA countries. MiCOM Labs test reports are accepted globally.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2 4143A-3
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

EU MRA – European Union Mutual Recognition Agreement.
NB – Notified Body
APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. Recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.

Phase I - recognition for product testing
Phase II – recognition for both product testing and certification

1.3. PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-02.pdf

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Requirements for bodies certifying products, processes and services*. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 4th day of February 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2017

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.

United States of America – Telecommunication Certification Body (TCB)
Industry Canada – Certification Body, CAB Identifier – US0159
Europe – Notified Body (NB), NB Identifier - 2280
Japan – Recognized Certification Body (RCB), RCB Identifier - 210

2. DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	25th April 2017	Draft for client review.
Rev A	2nd May 2017	Initial release.
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In the above table the latest report revision will replace all earlier versions.

3. TEST RESULT CERTIFICATE

Manufacturer:	Silver Spring Networks 230 W Tasman Drive San Jose, CA 95134 USA	**Tested By:**	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Model:	LNIC	**Telephone:**	+1 925 462 0304
Type Of Equipment:	Modular Plug-in radio device, will communicate over 900 MHz	**Fax:**	+1 925 462 0306
S/N's:	0917600463		
Test Date(s):	06 - 07 April 2017	**Website:**	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC CFR 47 Part 15 Subpart C 15.247 (FHSS)	**EQUIPMENT COMPLIES**

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.

2. Details of test methods used have been recorded and kept on file by the laboratory.

3. Test results apply only to the item(s) tested.

A2LA ACCREDITED
TESTING CERT #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.

4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	FCC 47 CFR Part 15.247	2016	Radio Frequency Devices; Subpart C – Intentional Radiators
II	FCC 47 CFR Part 15, Subpart B	2016	Title 47: Telecommunication PART 15—RADIO FREQUENCY DEVICES, SubPart B; Unintentional Radiators
III	A2LA	June 2015	R105 - Requirement's When Making Reference to A2LA Accreditation Status
IV	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
V	ANSI C63.4	2014	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
VI	CISPR 32	2012	Electromagnetic compatibility of multimedia equipment - Emission requirements
VII	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
VIII	FCC Public Notice DA 00-705	March 2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
IX	ICES-003	Issue 6 Jan 2016	Spectrum Management and Telecommunications; Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement.
X	M 3003	Edition 3 Nov.2012	Expression of Uncertainty and Confidence in Measurements
XI	RSS-247 Issue 2	Feb 2017	Digital Transmission Systems (DTSs), Frequency Hopping System (FHSs) and Licence-Exempt Local Area Network (LE-LEN) Devices
XII	RSS-Gen Issue 4	November 2014	General Requirements and Information for the Certification of Radiocommunication Equipment
XIII	FCC 47 CFR Part 2.1033	2016	FCC requirements and rules regarding photographs and test setup diagrams.

4.2. Test and Uncertainty Procedure

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the Silver Spring Networks LNIC to FCC CFR 47 Part 15 Subpart C 15.247 (FHSS). Radio Frequency Devices; Subpart C – Intentional Radiators
Applicant:	Silver Spring Networks 230 W Tasman Drive San Jose, CA 95134 USA
Manufacturer:	Silver Spring Networks
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	SSNT136-U2
Date EUT received:	06 April 2017
Standard(s) applied:	FCC CFR 47 Part 15 Subpart C 15.247 (FHSS)
Dates of test (from - to):	06 - 07 April 2017
No of Units Tested:	1
Product Family Name:	LNIC
Model(s):	LNIC
Location for use:	Indoor/Outdoor
Declared Frequency Range(s):	902 - 928 MHz;
Type of Modulation:	2FSK
EUT Modes of Operation:	2FSK;
Declared Nominal Output Power:	902 - 928 MHz: 23 dBm
Transmit/Receive Operation:	Transceiver - Half Duplex
Rated Input Voltage and Current:	3Vdc Battery
Operating Temperature Range:	Declared Range -40°C to +85°C
ITU Emission Designator:	108KF1D
Equipment Dimensions:	15 X 6.5 X 4.24 cm
Weight:	10.4 oz
Hardware Rev:	1.0
Software Rev:	m1.0

5.2. Scope Of Test Program

Silver Spring Networks LNIC

The scope of the test program was to test the Silver Spring Networks, LNIC configurations in the frequency ranges 902 - 928 MHz; for compliance against the following specification:

FCC CFR 47 Part 15 Subpart C 15.247 (FHSS)
Radio Frequency Devices; Subpart C – Intentional Radiators

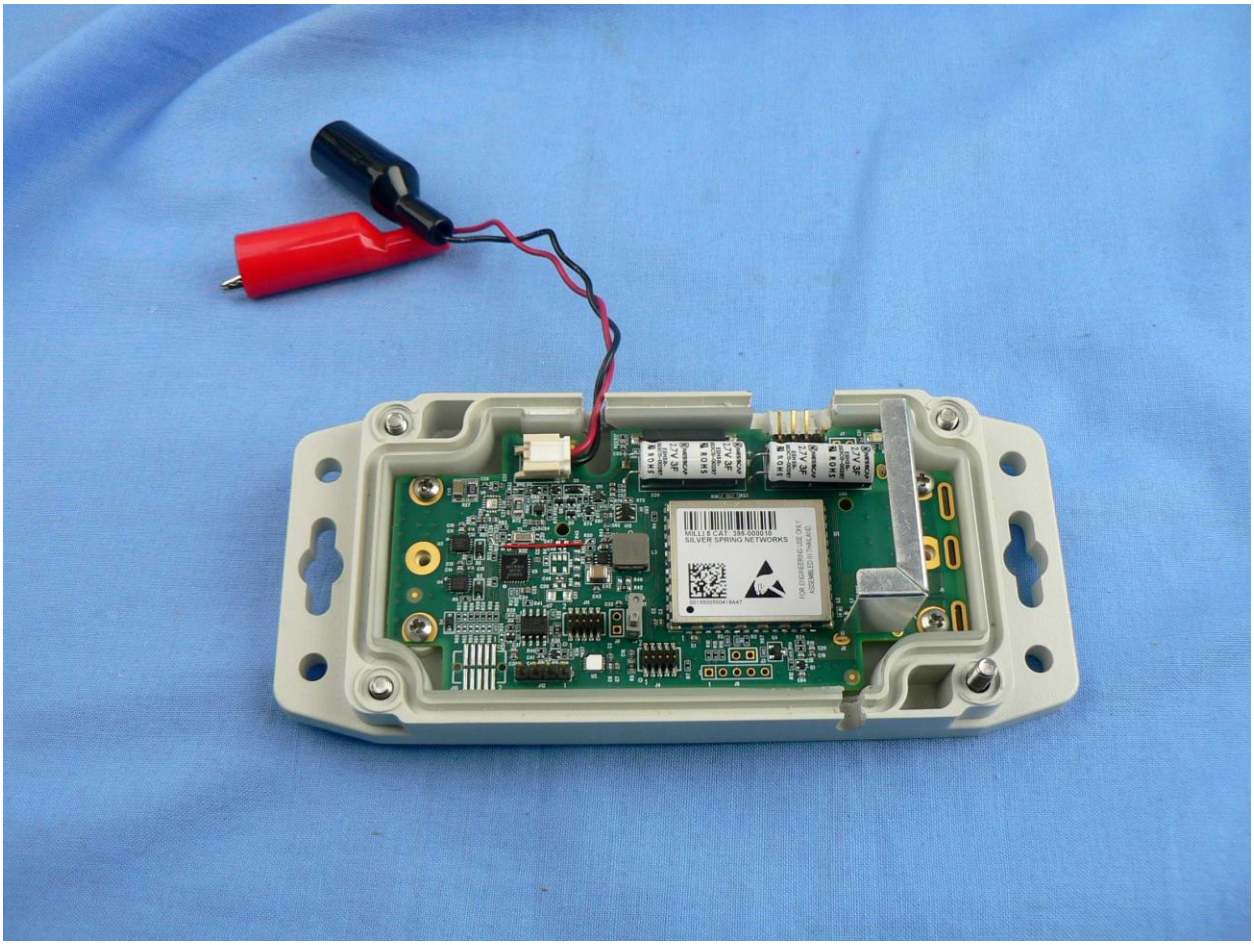
Note:
The Silver Spring Networks LNIC incorporates the Milli 5 RF module to communicate within the SSNI mesh canopy to track asset locations and report sensor data and alerts.

The Milli 5 RF module was previously tested by MiCOM Labs in September 2016. The scope of this test program is to perform Conducted RF spot check measurements of the RF Module, along with Radiated Emission measurements of the L-NIC module to demonstrate compliance.

The following product description was supplied by the manufacturer

LNIC incorporates the Milli 5 module to communicate within the SSNI mesh canopy to track asset locations and report sensor data and alerts including shock, tilt, temperature, and humidity.

Silver Spring Networks LNIC



5.3. Equipment Model(s) and Serial Number(s)

Type	Description	Manufacturer	Model	Serial no.
EUT	Radio Module -Network Interface Card (NIC)	Silver Spring Networks	LNIC	0917600463
Support Equipment	Laptop	Lenovo	--	--

5.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
integral	Tai Sheng Chen	420-0319-00	Dipole	0.0	-	360	-	902 - 928

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth
X-Pol - Cross Polarization

5.5. Cabling and I/O Ports

Port Type	Port Description	Qty	Screened (Yes/ No)
Serial	Console – Maintenance Terminal	1	NO
dc Input	3.3 Vdc Jack	1	NO

5.6. Test Configurations

Results for the following configurations are provided in this report:

Operational Mode(s) (802.11a/b/g/n/ac)	Data Rate with Highest Power MBit/s	Channel Frequency (MHz)		
		Low	Mid	High
902 - 928 MHz				
2FSK	50	902.2	915.2	927.8

5.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:
1. NONE

5.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:
1. NONE

6. TEST SUMMARY

List of Measurements

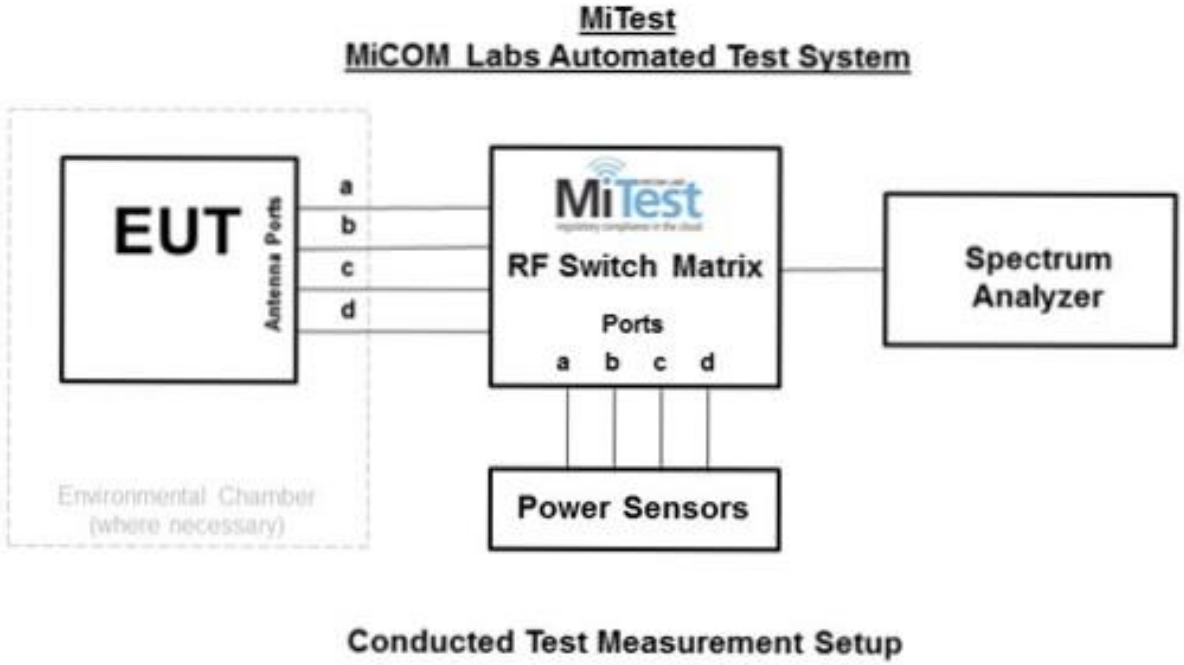
Test Header	Result	Data Link
20 dB & 99% Bandwidth	Complies	View Data
Frequency Hopping Tests	Complies	-
Number of Hopping Channels	Complies	View Data
Channel Separation	Complies	View Data
Dwell Time and Channel Occupancy	Complies	View Data
Output Power	Complies	View Data
Emissions	Complies	-
(1) Conducted Emissions	Complies	-
(i) Conducted Unwanted Spurious Emissions	Complies	View Data
(ii) Conducted Band-Edge Emissions	Complies	View Data
(2) Radiated Emissions	Complies	-
(i) TX Spurious & Restricted Band Emissions	Complies	View Data
(3) Digital Emissions (0.03 - 1 GHz)	Complies	View Data

7. TEST EQUIPMENT CONFIGURATION(S)

7.1. Conducted

Conducted RF Emission Test Set-up(s)

The following tests were performed using the conducted test set-up shown in the diagram below.
1. 20 dB & 99% Bandwidth
2. Number of Channels
3. Channel Spacing
4. Dwell Time & Channel Occupancy
5. Peak Output Power
6. Power Spectral Density
7. Conducted Spurious Emissions
8. Conducted Spurious Band-Edge Emissions



Conducted Test Measurement Setup

A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

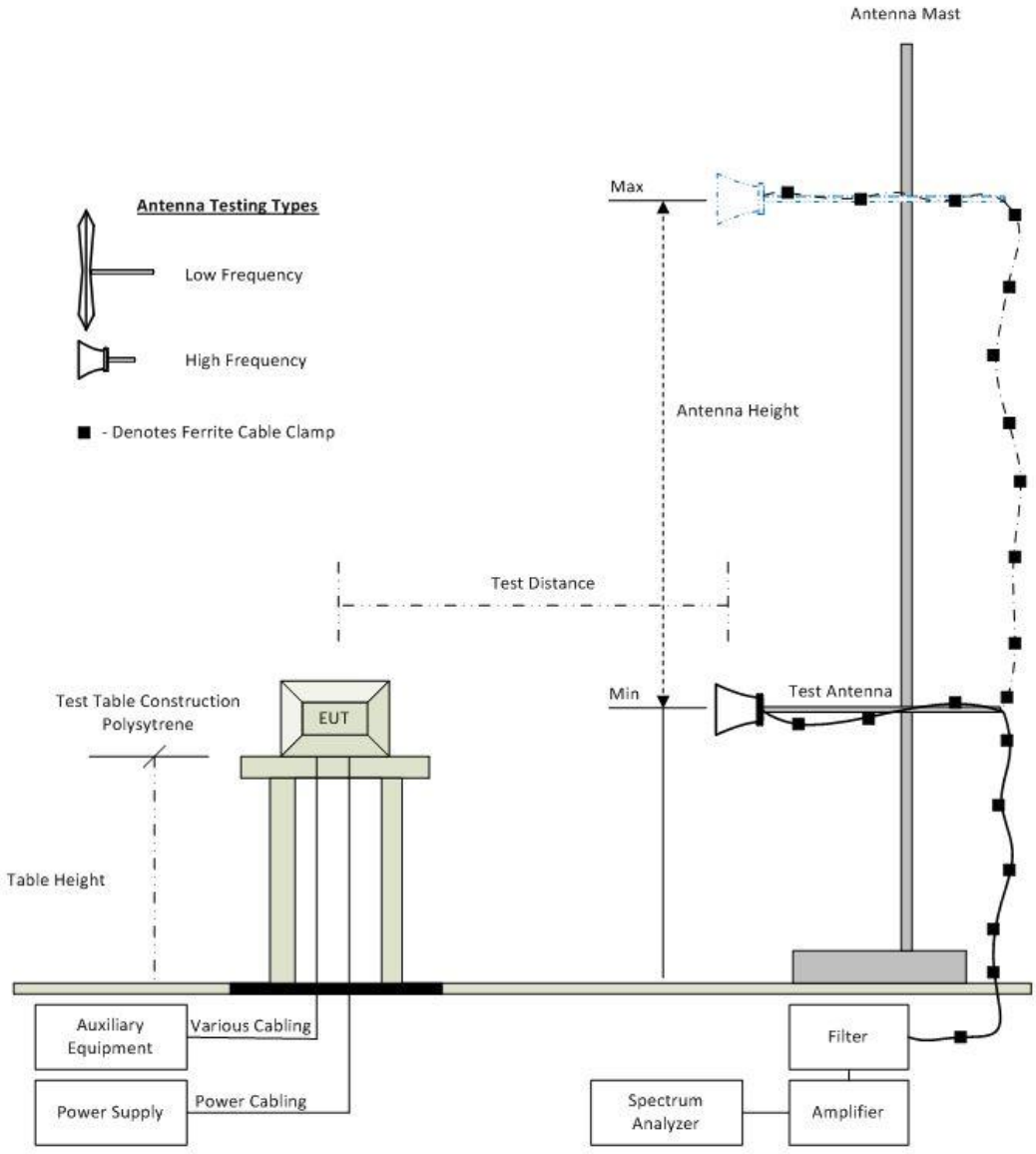
Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
#3 SA	MiTest Box to SA	Fairview Microwave	SCA1814-0101-72	#3 SA	2 Jun 2017
#3P1	EUT to MiTest box port 1	Fairview Microwave	SCA1814-0101-72	#3P1	2 Jun 2017
#3P2	EUT to MiTest box port 2	Fairview Microwave	SCA1814-0101-72	#3P2	2 Jun 2017
#3P3	EUT to MiTest box port 3	Fairview Microwave	SCA1814-0101-72	#3P3	2 Jun 2017
#3P4	EUT to MiTest box port 4	Fairview Microwave	SCA1812-0101-72	#3P4	2 Jun 2017
158	Barometer/Thermometer	Control Company	4196	E2846	30 Nov 2017
249	Resistance Thermometer	Thermotronics	GR2105-02	9340 #2	23 Oct 2017
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	2 May 2017
361	Desktop for RF#1, Labview Software installed	Dell	Vostro 220	WS RF#1	Not Required
378	Rohde & Schwarz 40 GHz Receiver with Generator	Rhode & Schwarz	ESIB40	100107/040	4 Aug 2017
390	USB Power Head 50MHz - 24GHz -60 to +20dBm	Agilent	U2002A	MY50000103	17 Oct 2017
398	MiTest RF Conducted Test Software	MiCOM	MiTest ATS	Version 4.1	Not Required
405	DC Power Supply 0-60V	Agilent	6654A	MY4001826	Cal when used
408	USB to GPIB interface	National Instruments	GPIB-USB HS	14C0DE9	Not Required
435	USB Wideband Power Sensor	Boonton	55006	8730	31 Jul 2017
436	USB Wideband Power Sensor	Boonton	55006	8731	14 Sep 2017
441	USB Wideband Power Sensor	Boonton	55006	9179	25 Sep 2017
443	4x4 RF Switch Box	MiCOM Labs	MiTest 4X4 RF Switch Box	MIC003	2 Jun 2017
445	PoE Injector	D-Link	DPE-101GL	QTAH1E2000625	Not Required
461	Spectrum Analyzer	Agilent	E4440A	MY46185537	13 Aug 2017
75	Environmental Chamber	Thermatron	SE-300-2-2	27946	24 Nov 2017

7.2. Radiated Emissions

The following tests were performed using the radiated test set-up shown in the diagram below.

1).. Radiated Spurious and Band-Edge Emissions;
2) Digital Emissions

Radiated Emission Measurement Setup Pictorial Representation



Radiated Emission Test Setup

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	30 Nov 2017
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	2 May 2017
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	15 Aug 2017
341	900MHz Notch Filter	EWT	EWT-14-0199	H1	16 Aug 2017
346	1.6 TO 10GHz High Pass Filter	EWT	EWT-57-0112	H1	16 Aug 2017
373	26III RMS Multimeter	Fluke	Fluke 26 series III	76080720	26 Oct 2017
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	9 Jun 2017
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	10 Jul 2017
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	9 Jun 2017
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
414	DC Power Supply 0-60V	HP	6274	1029A01285	Cal when used
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
447	MiTest Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	31 May 2017
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	31 May 2017
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	31 May 2017
480	Cable - Bulkhead to Amp	SRC Haverhill	157-157-3050360	480	2 Jun 2017
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-151-3050787	481	2 Jun 2017
482	Cable - Amp to Antenna	SRC Haverhill	157-157-3051574	482	2 Jun 2017
87	Uninterruptible Power Supply	Falcon Electric	ED2000-1/2LC	F3471 02/01	Cal when used

8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by MiTest. MiTest is an automated test system developed by MiCOM Labs. MiTest is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.

The MiCOM Labs "MiTest" Automated Test System" (Patent Pending)

9. TEST RESULTS

9.1. 20 dB & 99% Bandwidth

Conducted Test Conditions for 20 dB and 99% Bandwidth			
Standard:	FCC CFR 47:15.247 & RSS 247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	20 dB and 99 % Bandwidth	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(2) & 5.1	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for 20 dB and 99% Bandwidth Measurement
The bandwidth at 20 dB and 99 % was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

Testing was performed under ambient conditions at nominal voltage

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits for 20 dB and 99% Bandwidth

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Equipment Configuration for 20 dB & 99% Bandwidth			
Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Measured 20 dB Bandwidth (KHz) Port(s)				20 dB Bandwidth (KHz)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	KHz	KHz
902.2	107	--	--	--	107	107	≤500.0	-393
915.2	108	--	--	--	108	108	≤500.0	-392
927.8	107	--	--	--	107	107	≤500.0	-393

Test Frequency	Measured 99% Bandwidth (KHz) Port(s)				Maximum 99% Bandwidth (KHz)		
MHz	a	b	c	d			
902.2	107	--	--	--	107		
915.2	111	--	--	--	111		
927.8	110	--	--	--	110		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

9.2. Frequency Hopping Tests

Conducted Test Conditions for Frequency Hopping Measurements			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Frequency Hopping Tests	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(1)(i)/(ii)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References, FCC Public Notice DA 00-705		

Test Procedure for Frequency Hopping Measurements

These tests cover the following measurements:

i) channel separation
ii) channel occupancy
iii) dwell time
iv) number of hopping frequencies

Frequency hopping testing was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency or hopping mode.

Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits for Frequency Hopping Measurements

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

9.2.1. Number of Hopping Channels

Equipment Configuration for Hopping Sequence			
Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Modulation	Frequency Range (MHz)	Number of Hopping Channels	Limit	Total Number of Hops	Results
			No of Hopping Channels		
2FSK	900.00 – 916.00	70.0	--	70.0	--
2FSK	916.00 – 928.00	58.0	--	58.0	--
2FSK	902.00 – 928.00	**Total No. of Hopping Channels:**	≥50	128.0	Pass

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

9.2.2. Channel Separation

Equipment Configuration for Channel Spacing

Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Center Frequency	Packet Type	Chan Separation	Limit (20 dB Occ. BW)	Result
MHz		MHz	MHz	
915.4 & 925.6	2FSK	0.200	> 0.100	Pass

Traceability to Industry Recognized Test Methodologies	
Measurement Uncertainty:	±2.81 dB (Spectrum/Amplitude), ±0.86 ppm (Frequency)

Note: click the links in the above matrix to view the graphical image (plot).

9.2.3. Dwell Time & Channel Occupancy

Equipment Configuration for Dwell Time & Channel Occupancy			
Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

		Test Measurement Results			
Center Frequency	**Variant Type**	**Dwell Time (Single Channel)**	**Channel Occupancy**	**Channel Occupancy Limit**	**Result**
MHz		**ms**	**ms**	**ms**	
915.6	2FSK	24.0	48.0	400.00	Pass

Traceability to Industry Recognized Test Methodologies	
Measurement Uncertainty:	±2.81 dB (Spectrum/Amplitude), ±0.86 ppm (Frequency)

9.3. Output Power

Conducted Test Conditions for Fundamental Emission Output Power			
Standard:	FCC CFR 47:15.247 & RSS 247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Output Power	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (b) & (c) & 5.4 (1)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Fundamental Emission Output Power Measurement
In the case of average power measurements an average power sensor was utilized.

For peak power measurements the spectrum analyzer built-in power function was used to integrate peak power over the 20 dB bandwidth.

Testing was performed under ambient conditions at nominal voltage..

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.
Supporting Information
Calculated Power = A + G + Y+ 10 log (1/x) dBm

A = Total Power [10*Log10 ($10^{a/10}$ + $10^{b/10}$ + $10^{c/10}$ + $10^{d/10}$)]
G = Antenna Gain
Y = Beamforming Gain
x = Duty Cycle (average power measurements only)

Limits for Fundamental Emission Output Power
(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following for non-frequency hopping systems:

(3) For systems using digital modulation in the 902-928 MHz and 2400-2483.5 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.
(1) Fixed point-to-point operation:
(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(1)(i) and (c)(1)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.

Equipment Configuration for Peak Output Power

Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB

Test Measurement Results

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s)	Limit	Margin
MHz	a	b	c	d	dBm	dBm	dBm
902.2	23.73	--	--	--	23.73	30.00	-6.27
915.2	23.61	--	--	--	23.61	30.00	-6.39
927.8	23.77	--	--	--	23.77	30.00	-6.23

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

10. Emissions

10.1. Conducted Emissions

Conducted Test Conditions for Transmitter Conducted Spurious and Band-Edge Emissions			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Transmitter Conducted Spurious and Band-Edge Emissions	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (d)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Transmitter Conducted Spurious and Band-Edge Emissions Measurement

Transmitter Conducted Spurious and Band-Edge emissions were measured at a limit of 30 dBc (average detector) or 20 dBc (peak detector) below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Measurements were made while EUT was operating in transmit mode of operation at the appropriate centre frequency closest to the band-edge. Emissions were maximized during the measurement and limits derived from the peak spectral power and drawn on each plot.

Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. Testing was performed under ambient conditions at nominal voltage only.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits Transmitter Conducted Spurious and Band-Edge Emissions

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

10.1.1. Conducted Unwanted Spurious Emissions

Equipment Configuration for Transmitter Conducted Spurious Emissions			
Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	None		

Test Measurement Results

Test Frequency	Frequency Range	Transmitter Conducted Spurious Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	SE	Limit	SE	Limit	SE	Limit	SE	Limit
902.2	30.0 - 26000.0	-40.53	3.24	--	--	--	--	--	--
915.2	30.0 - 26000.0	-36.52	3.39	--	--	--	--	--	--
927.8	30.0 - 26000.0	-35.56	3.46	--	--	--	--	--	--

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

10.1.2. Conducted Band-Edge Emissions

Conducted Low Band-Edge Emissions

Equipment Configuration for Conducted Low Band-Edge Emissions - Peak			
Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	None		

Test Measurement Results

Channel Frequency:	902.2 MHz						
Band-Edge Frequency:	902 MHz						
Test Frequency Range:	880.0 – 904.0 MHz						
Temp C		**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
		M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
20	**3.3**	-5.93	3.4	902.02	--	--	-0.02

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Conducted High Band-Edge Emissions

Equipment Configuration for Conducted High Band-Edge Emissions - Peak

Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	None		

Test Measurement Results

Channel Frequency:	927.8 MHz
Band-Edge Frequency:	928.0 MHz
Test Frequency Range:	927.0 – 935.0 MHz

Temp C		Band-Edge Markers and Limit			Revised Limit		Margin
		M3 Amplitude (dBm)	Plot Limit (dBm)	M2 Frequency (MHz)		M1 Amplitude (dBm)	Plot Limit (dBm)
20	**3.3**	-1.033	1.310	927.97	--	--	--

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Conducted Low Band-Edge Emissions Hopping

Equipment Configuration for Conducted Low Band-Edge Emissions - Peak			
Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	None		

Test Measurement Results

Channel Frequency:	902.2 MHz						
Band-Edge Frequency:	902 MHz						
Test Frequency Range:	880.0 – 904.0 MHz						
Temp C		**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
		M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
20	**3.3**	-3.6	4.6	902.98	--	--	-0.98

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

Conducted High Band-Edge Emissions Hopping

Equipment Configuration for Conducted High Band-Edge Emissions - Peak			
Variant:	FHSS	**Duty Cycle (%):**	99
Data Rate:	50 kbps	**Antenna Gain (dBi):**	Not Applicable
Modulation:	2FSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	None		

Test Measurement Results

Channel Frequency:	927.8 MHz						
Band-Edge Frequency:	928.0 MHz						
Test Frequency Range:	927.0 – 935.0 MHz						
Temp C		**Band-Edge Markers and Limit**			**Revised Limit**		**Margin**
		M3 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**		**M1 Amplitude (dBm)**	**Plot Limit (dBm)**
20	**3.3**	-2.3	5.00	927.0	--	--	-0.50

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the links in the above matrix to view the graphical image (plot).

10.2. Radiated Emissions

Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions (Restricted Bands)			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	20.0 - 24.5
Test Heading:	Radiated Spurious and Band-Edge Emissions	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.205, 15.209	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Radiated Spurious and Band-Edge Emissions (Restricted Bands)

Radiated emissions for restricted bands above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned. Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.

Test configuration and setup for Radiated Spurious and Band-Edge Measurement were per the Radiated Test Set-up specified in this document.

Limits for Restricted Bands
Peak emission: 74 dBuV/m
Average emission: 54 dBuV/m

Field Strength Calculation
The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.
FS = R + AF + CORR - FO

where:
FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

Example:
Given receiver input reading of 51.5 dBmV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength (FS) of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBmV/m

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are as follows:
Level (dBmV/m) = 20 * Log (level (mV/m))

40 dBmV/m = 100 mV/m
48 dBmV/m = 250 mV/m
Restricted Bands of Operation (15.205)

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Frequency Band			
MHz	**MHz**	**MHz**	**GHz**
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to §15.213.

(4) Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of subparts D or F of this part.

(7) Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in §15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in §15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of §15.245 shall not exceed the limits specified in §15.245(b).

10.2.1. TX Spurious & Restricted Band Emissions

Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	**Variant:**	2FSK
Antenna Gain (dBi):	0.00	**Modulation:**	2FSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	902.20	**Data Rate:**	50.00 KBit/s
Power Setting:	Max	**Tested By:**	JMH

Test Measurement Results

1000.00 - 10000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	1804.44	65.59	2.45	-13.63	54.41	Peak (NRB)	Horizontal	200	0	--	--	Pass
#2	2706.67	57.57	2.86	-11.38	49.05	Max Peak	Horizontal	198	110	74.0	-25.0	Pass
#3	2706.67	54.04	2.86	-11.38	45.52	Max Avg	Horizontal	198	110	54.0	-8.5	Pass
#4	6315.47	53.67	3.93	-8.34	49.26	Peak (NRB)	Horizontal	151	0	--	--	Pass
#5	7217.80	55.07	4.31	-7.35	52.03	Peak (NRB)	Horizontal	200	74	--	--	Pass

Test Notes: LNIC powered by 3V DC

Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	**Variant:**	2FSK
Antenna Gain (dBi):	0.00	**Modulation:**	2FSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	915.20	**Data Rate:**	50.00 KBit/s
Power Setting:	Max	**Tested By:**	JMH

Test Measurement Results

1000.00 - 10000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	1830.41	61.77	2.45	-13.53	50.69	Peak (NRB)	Horizontal	100	0	--	--	Pass
#2	2745.59	58.59	2.84	-11.35	50.08	Max Peak	Horizontal	187	97	74.0	-23.9	Pass
#3	2745.59	55.58	2.84	-11.35	47.07	Max Avg	Horizontal	187	97	54.0	-6.9	Pass
#4	6406.25	54.52	3.97	-8.03	50.46	Peak (NRB)	Horizontal	151	91	--	--	Pass
#5	7321.75	58.10	4.26	-7.26	55.10	Max Peak	Horizontal	194	96	74.0	-18.9	Pass
#6	7321.75	53.60	4.26	-7.26	50.60	Max Avg	Horizontal	194	96	54.0	-3.4	Pass

Test Notes: LNIC powered by 3V DC

Equipment Configuration for TX Spurious & Restricted Band Emissions

Antenna:	Integral	**Variant:**	2FSK
Antenna Gain (dBi):	0.00	**Modulation:**	2FSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	927.80	**Data Rate:**	50.00 KBit/s
Power Setting:	Max	**Tested By:**	JMH

Test Measurement Results

1000.00 - 10000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	1855.67	66.93	2.49	-13.41	56.01	Peak (NRB)	Horizontal	151	0	--	--	Pass
#2	2783.42	58.86	2.85	-11.33	50.38	Max Peak	Horizontal	179	108	74.0	-23.6	Pass
#3	2783.42	55.93	2.85	-11.33	47.45	Max Avg	Horizontal	179	108	54.0	-6.6	Pass
#4	6494.35	53.78	4.02	-7.92	49.88	Peak (NRB)	Horizontal	200	37	--	--	Pass
#5	7422.32	54.24	4.34	-7.14	51.44	Max Peak	Horizontal	188	306	74.0	-22.6	Pass
#6	7422.32	48.93	4.34	-7.14	46.13	Max Avg	Horizontal	188	306	54.0	-7.9	Pass

Test Notes: LNIC powered by 3V DC

10.2.2. Radiated Emissions (0.03 - 1 GHz)

Radiated Test Conditions for Radiated Digital Emissions (0.03 – 1 GHz)			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	20.0 - 24.5
Test Heading:	Digital Emissions	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.209	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Radiated Digital Emissions (0.03 – 1 GHz)

Testing 30M-1 GHz was performed in a 3-meter anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed.

Test configuration and setup for Radiated Spurious and Band-Edge Measurement were per the Radiated Test Set-up specified in this document.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

FS = R + AF + CORR

where:
FS = Field Strength
R = Measured Receiver Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain

For example:
Given a Receiver input reading of 51.5dBmV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3dBmV/m

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are done as:

Level (dBmV/m) = 20 * Log (level (mV/m))

40 dBmV/m = 100mV/m
48 dBmV/m = 250mV/m

Limits for Radiated Digital Emissions (0.03 – 1 GHz)

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength		Measurement Distance (m)
	µV/m (microvolts/meter)	dBµV/m (dB microvolts/meter)	
0.009-0.490	2400/F(kHz)	--	300
0.490-1.705	24000/F(kHz)	--	30
1.705-30.0	30	29.5	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46.0	3
Above 960	500	54.0	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241. (b) In the emission table above, the tighter limit applies at the band edges. (c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. (d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. (e) The provisions in §§15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part. (f) In accordance with §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in §15.109 that are applicable to the incorporated digital device. (g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

Equipment Configuration for Radiated - Radiated Digital Emissions

Antenna:	Integral	**Variant:**	2FSK
Antenna Gain (dBi):	0.00	**Modulation:**	2FSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	902.20	**Data Rate:**	50.00 KBit/s
Power Setting:	Max	**Tested By:**	JMH

Test Measurement Results

30.00 - 1000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	902.18	45.83	6.34	-7.79	44.38	Fundamental	Vertical	100	0	--	--	
Test Notes: LNIC on 80 cm table powered by 3V DC. TX on 902.2												

Equipment Configuration for Radiated Digital Emissions

Antenna:	Integral	**Variant:**	2FSK
Antenna Gain (dBi):	0.00	**Modulation:**	2FSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	915.20	**Data Rate:**	50.00 KBit/s
Power Setting:	Max	**Tested By:**	JMH

Test Measurement Results

30.00 - 1000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	915.18	38.23	6.39	-7.75	36.87	Fundamental	Vertical	100	0	--	--	
Test Notes: LNIC on 80 cm table powered by 3V DC. TX on 915.2												

Equipment Configuration for Radiated Digital Emissions

Antenna:	Integral	**Variant:**	2FSK
Antenna Gain (dBi):	0.00	**Modulation:**	2FSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99
Channel Frequency (MHz):	927.80	**Data Rate:**	50.00 KBit/s
Power Setting:	Max	**Tested By:**	JMH

Test Measurement Results

30.00 - 10000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
#1	927.82	53.16	6.43	-7.44	52.15	Fundamental	Vertical	100	0	--	--	
Test Notes: LNIC on 80 cm table powered by 3V DC. TX on 927.8												

APPENDIX A - GRAPHICAL IMAGES

A.1. 20 dB & 99% Bandwidth

20 dB & 99% BANDWIDTH

Variant: FHSS, Channel: 902.20 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc

Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 902.152 MHz : -0.549 dBm M2 : 902.231 MHz : 20.668 dBm Delta1 : 107 KHz : 3.817 dB T1 : 902.152 MHz : -0.549 dBm T2 : 902.260 MHz : 3.269 dBm OBW : 107 KHz	Channel Frequency: 902.20 MHz

back to matrix

20 dB & 99% BANDWIDTH

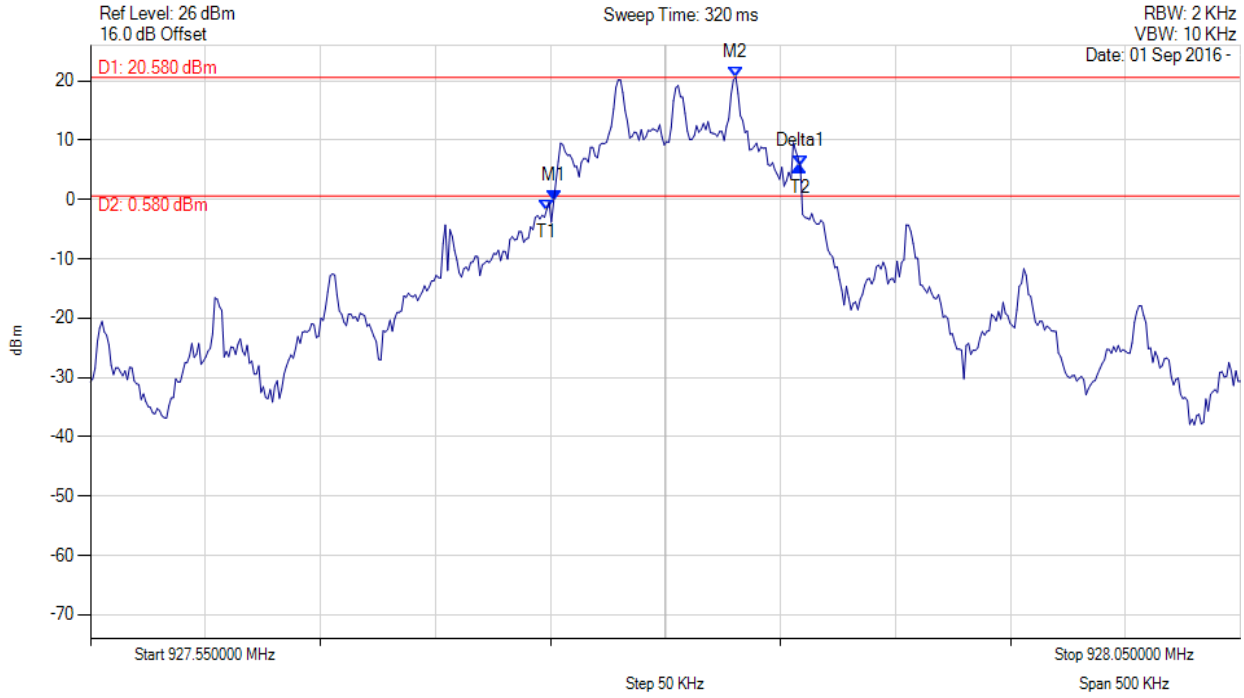
Variant: FHSS, Channel: 915.20 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc

Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 915.153 MHz : 0.865 dBm M2 : 915.231 MHz : 20.334 dBm Delta1 : 108 KHz : -0.958 dB T1 : 915.149 MHz : -2.025 dBm T2 : 915.261 MHz : -0.093 dBm OBW : 111 KHz	Channel Frequency: 915.20 MHz

back to matrix

20 dB & 99% BANDWIDTH

Variant: FHSS, Channel: 927.80 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc

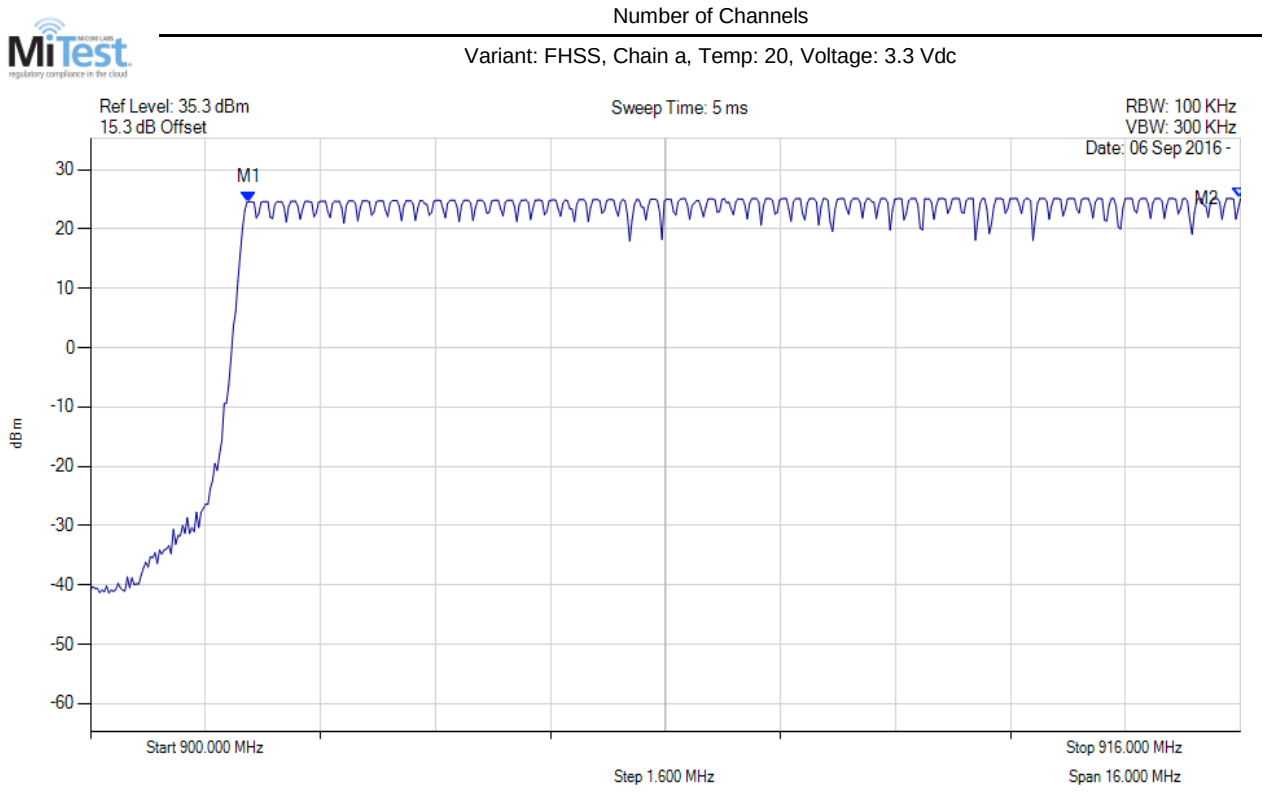


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 927.751 MHz : -0.298 dBm M2 : 927.831 MHz : 20.637 dBm Delta1 : 107 KHz : 5.939 dB T1 : 927.748 MHz : -1.816 dBm T2 : 927.859 MHz : 5.640 dBm OBW : 110 KHz	Channel Frequency: 927.80 MHz

back to matrix

A.2. Frequency Hopping Tests

A.2.1. Number of Hopping Channels

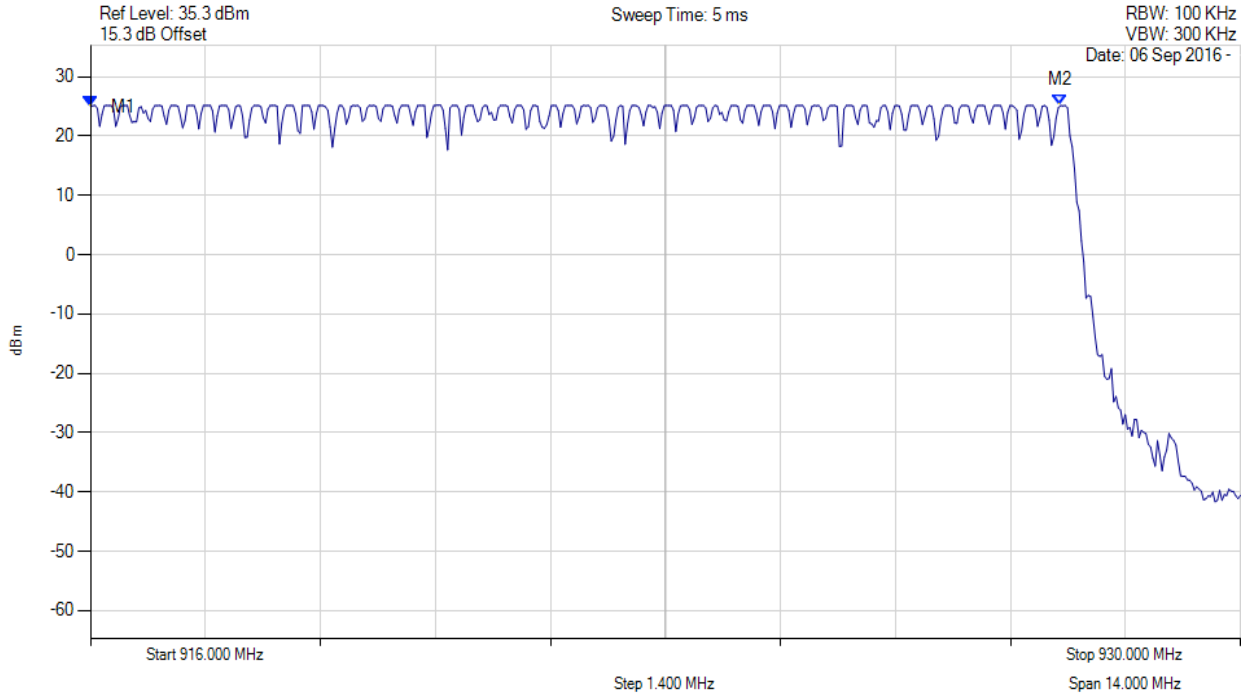


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = MAX HOLD	M1 : 902.200 MHz : 24.615 dBm M2 : 916.000 MHz : 25.125 dBm	Channel Frequency: 0 Hz

back to matrix

Number of Channels

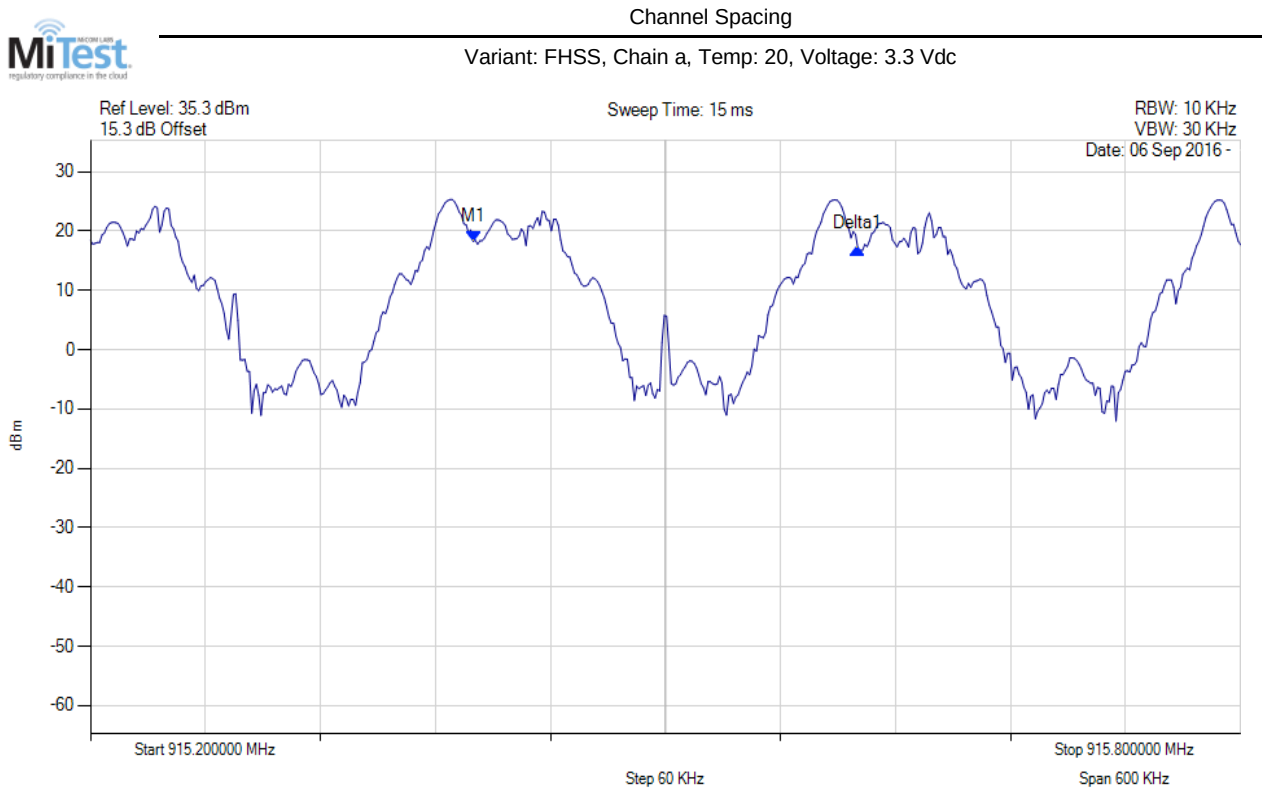
Variant: FHSS, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = MAX HOLD	M1 : 916.000 MHz : 25.028 dBm M2 : 927.800 MHz : 25.146 dBm	Channel Frequency: FHSS 902-928 MHz

back to matrix

A.2.2. Channel Separation



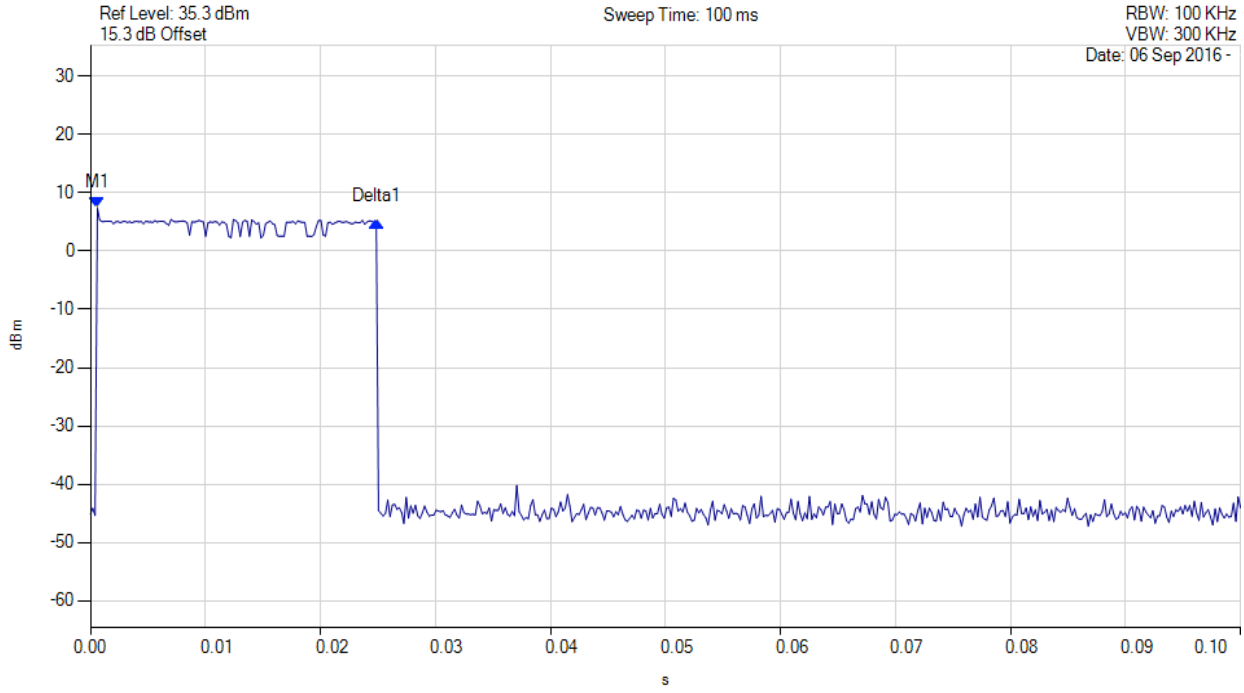
Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = MAX HOLD	M1 : 915.400 MHz : 18.296 dBm Delta1 : 200 KHz : -1.269 dB	Channel Frequency: 915.4 MHz

back to matrix

A.2.3. Dwell Time and Occupancy

Dwell Time

Variant: FHSS, Channel: 915.60 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc

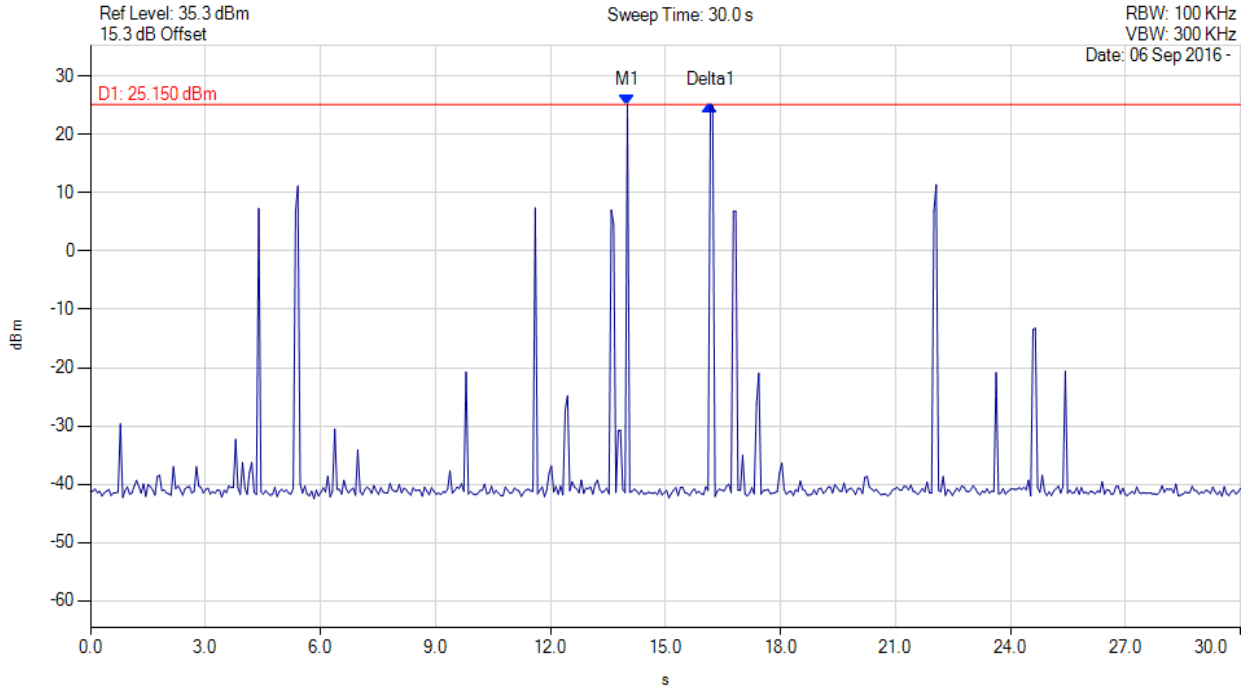


Analyzer Setup	Marker:Time:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = CLR/WRITE	M1(915.60 MHz) : 0.000 s : 7.415 dBm Delta1(915.60 MHz) : 0.024 s : -2.264 dB	Channel Frequency: 915.60 MHz

back to matrix

Channel Occupancy

Variant: FHSS, Channel: 915.60 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Time:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = CLR/WRITE	M1(915.60 MHz) : 14.008 s : 25.137 dBm Delta1(915.60 MHz) : 2.164 s : 0.012 dB	Channel Frequency: 915.60 MHz

back to matrix

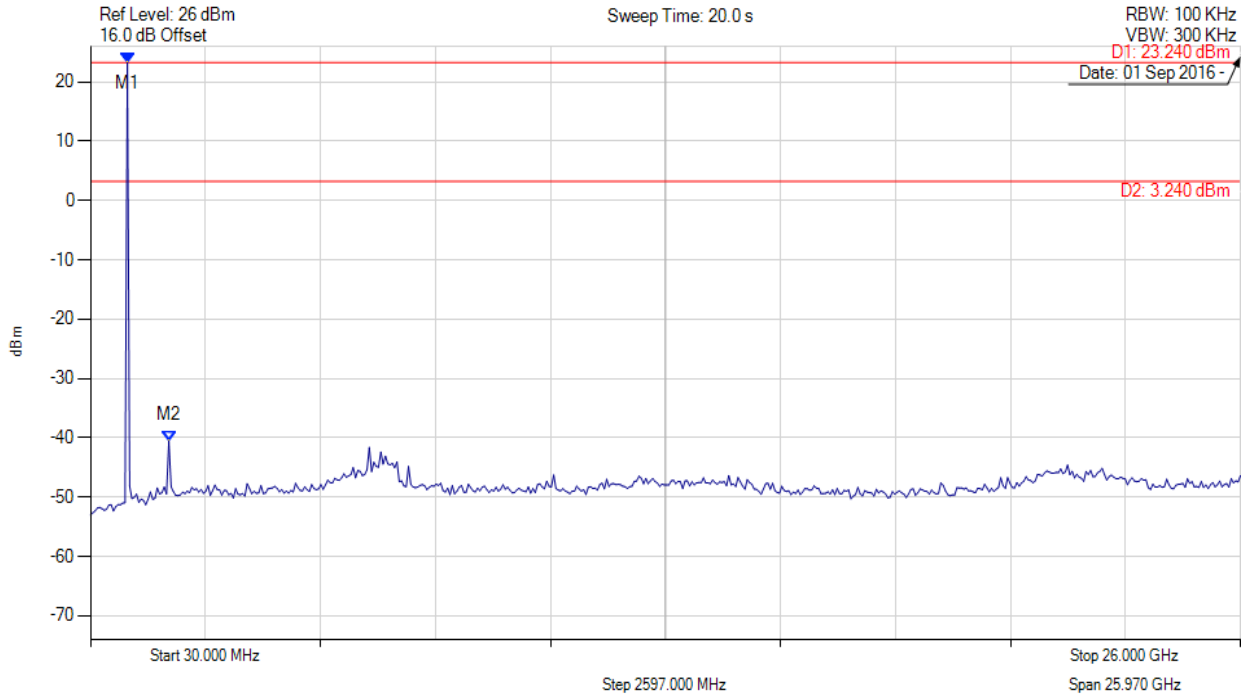
A.3. Emissions

A.3.1. Conducted Emissions

A.3.1.1. Conducted Unwanted Spurious Emissions

CONDUCTED SPURIOUS EMISSIONS

Variant: FHSS, Channel: 902.20 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc

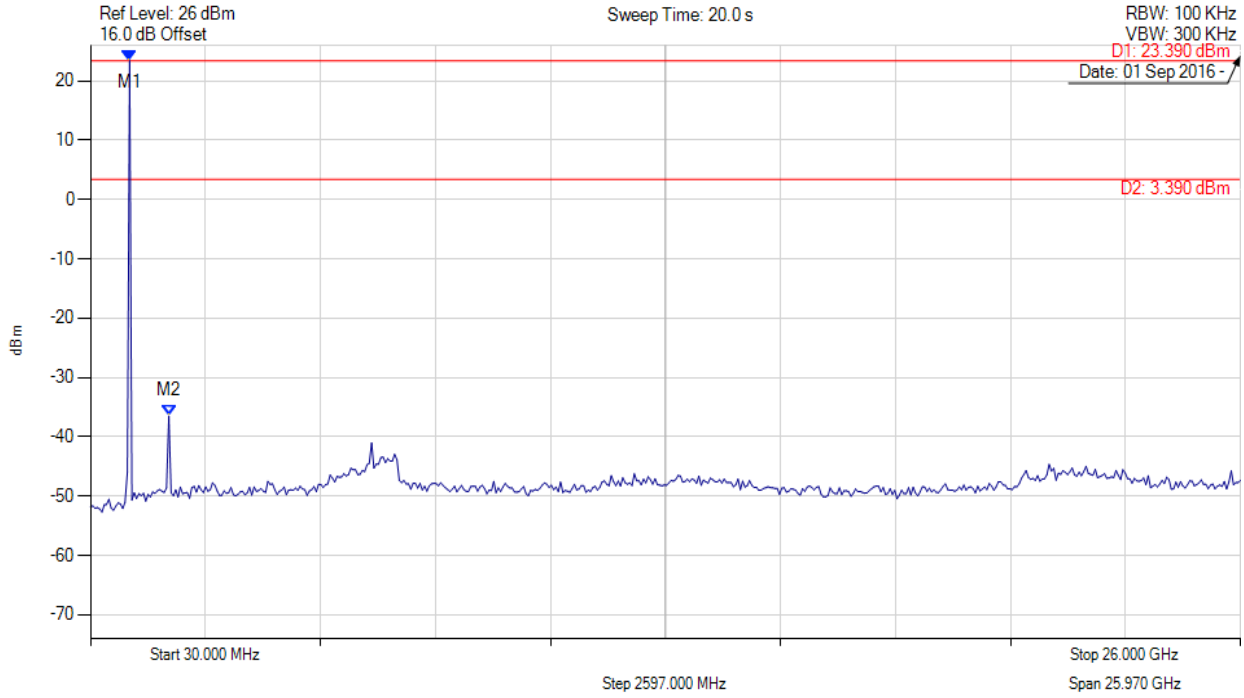


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 862.705 MHz : 23.240 dBm M2 : 1799.499 MHz : -40.530 dBm	Channel Frequency: 902.20 MHz

back to matrix

CONDUCTED SPURIOUS EMISSIONS

Variant: FHSS, Channel: 915.20 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc

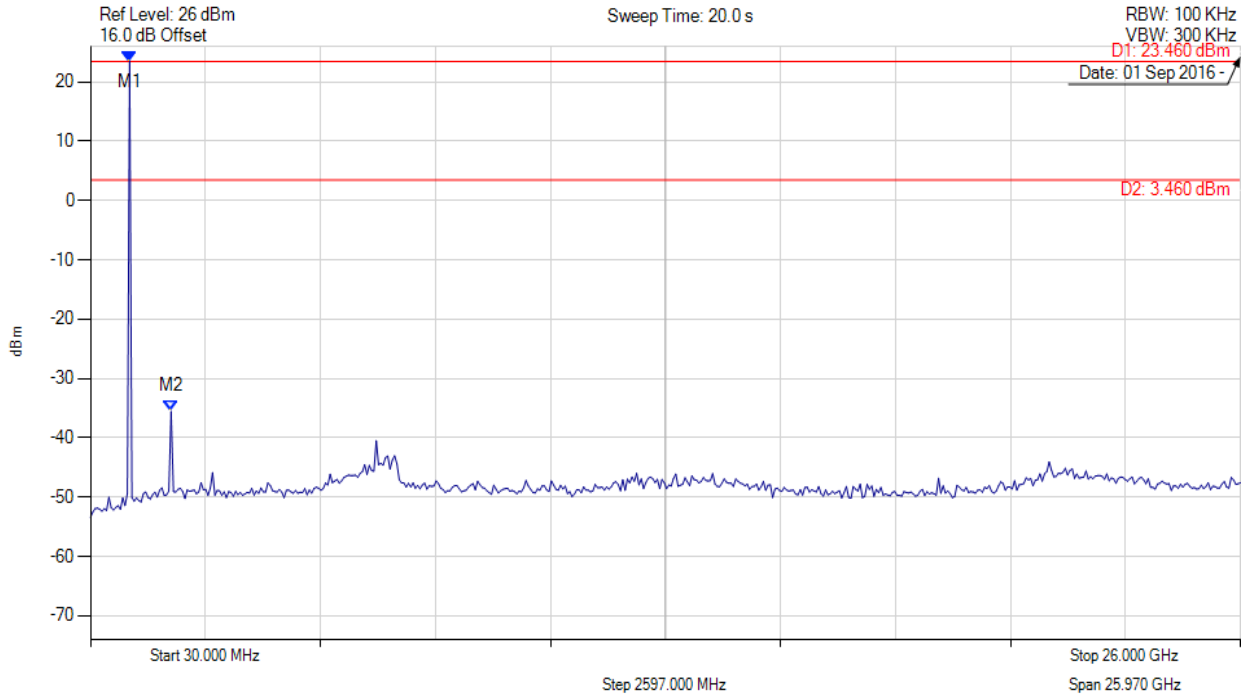


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 914.749 MHz : 23.389 dBm M2 : 1799.499 MHz : -36.515 dBm	Channel Frequency: 915.20 MHz

back to matrix

CONDUCTED SPURIOUS EMISSIONS

Variant: FHSS, Channel: 927.80 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = CLR/WRITE	M1 : 914.749 MHz : 23.462 dBm M2 : 1851.543 MHz : -35.564 dBm	Channel Frequency: 927.80 MHz

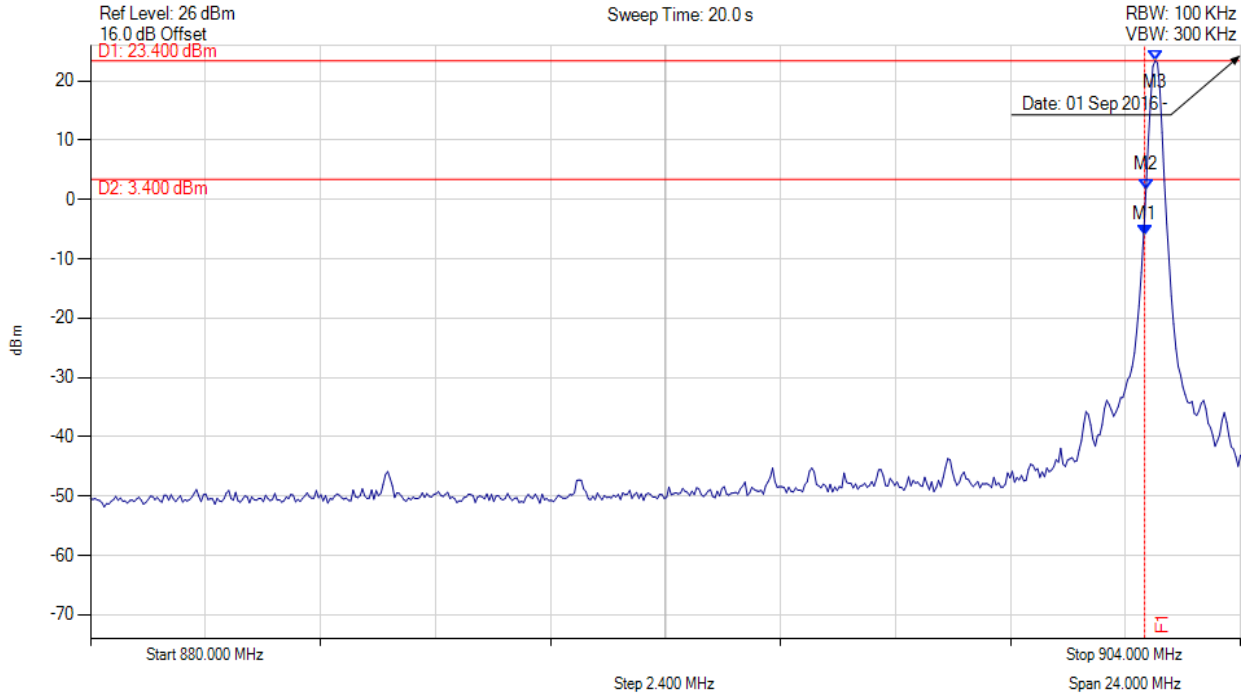
back to matrix

A.3.1.2. Conducted Band-Edge Emissions

Conducted Low Band-Edge Emissions

CONDUCTED LOW BAND-EDGE EMISSIONS

Variant: FHSS, Channel: 902.20 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc



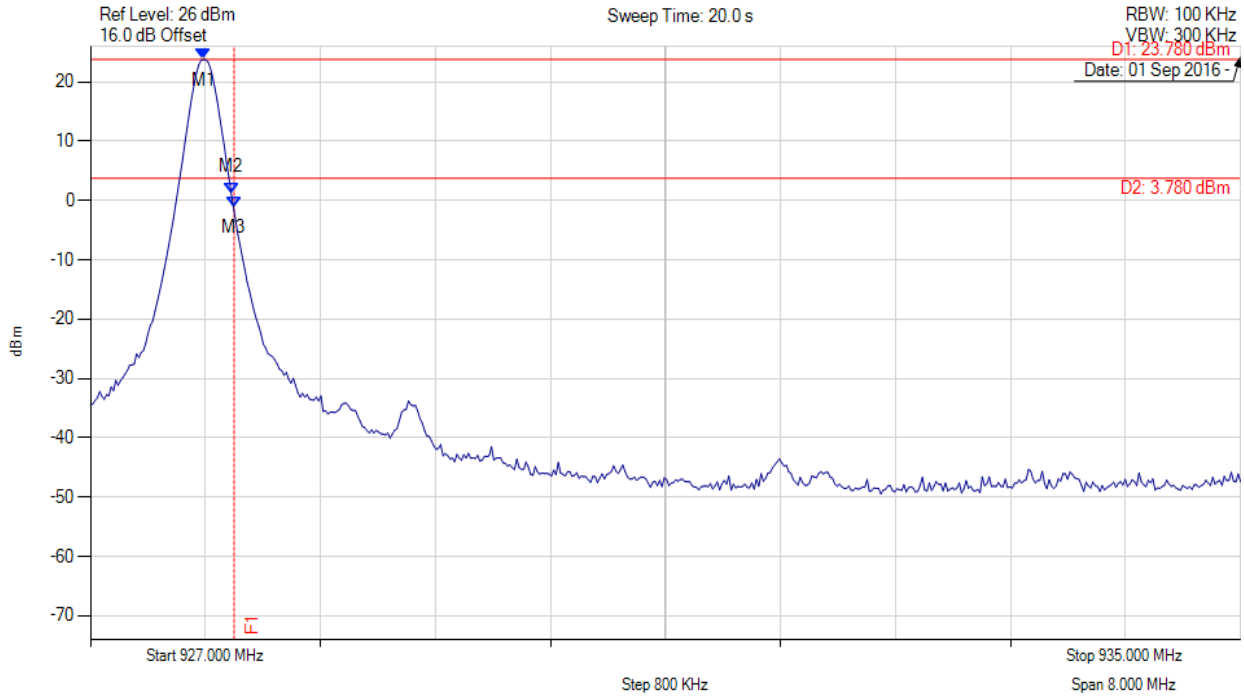
Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 902.000 MHz : -5.934 dBm M2 : 902.028 MHz : 1.640 dBm M3 : 902.220 MHz : 23.397 dBm	Channel Frequency: 902.20 MHz

back to matrix

Conducted High Band-Edge Emissions

CONDUCTED HIGH BAND-EDGE EMISSIONS

Variant: FHSS, Channel: 927.80 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc

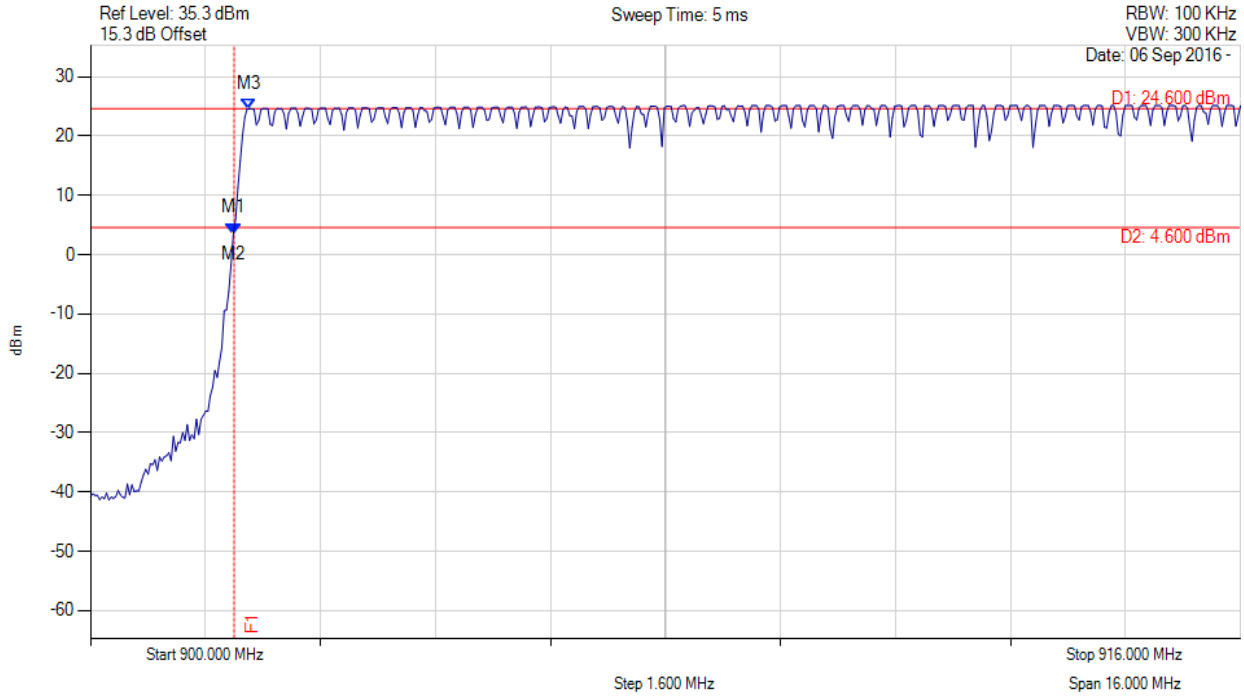


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = CLR/WRITE	M1 : 927.786 MHz : 23.781 dBm M2 : 927.978 MHz : 1.310 dBm M3 : 928.000 MHz : -1.033 dBm	Channel Frequency: 927.80 MHz

back to matrix

CONDUCTED LOW BAND-EDGE EMISSIONS HOPPING

Variant: FHSS, Channel: 902.2 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc

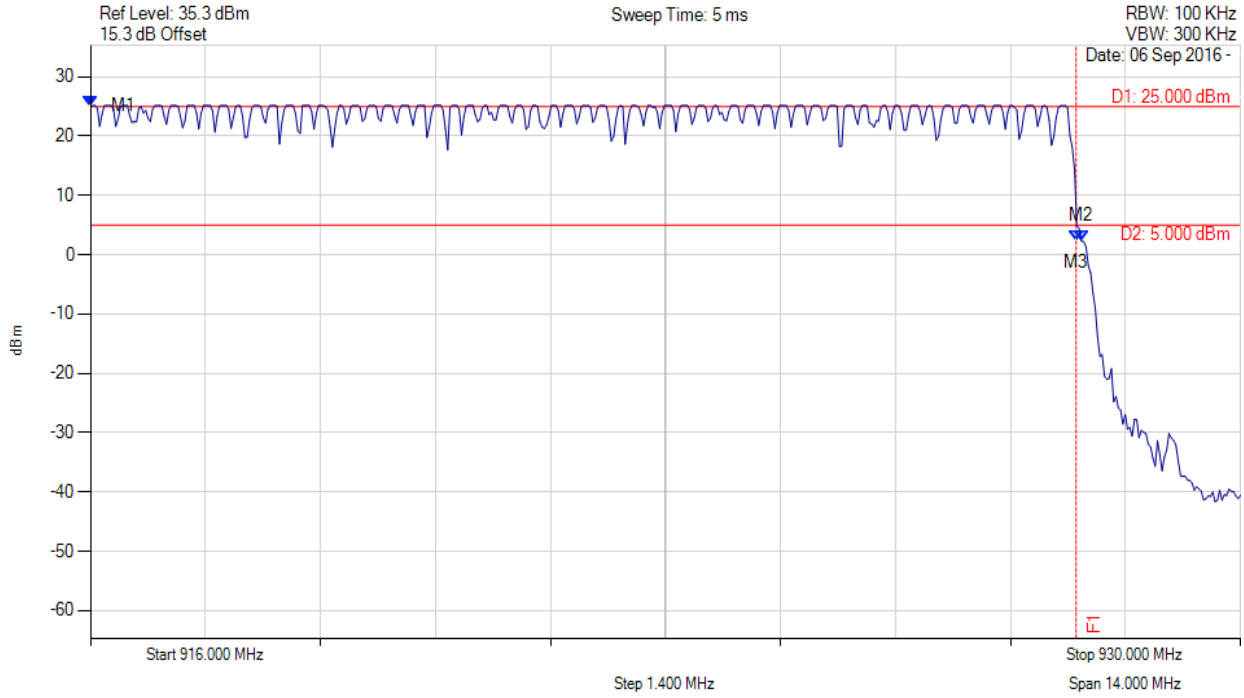


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = MAX HOLD	M1 : 902.000 MHz : 3.600 dBm M2 : 902.988 MHz : 3.600 dBm M3 : 902.200 MHz : 24.615 dBm	Channel Frequency: 0 Hz

back to matrix

CONDUCTED HIGH BAND-EDGE EMISSIONS HOPPING

Variant: FHSS, Channel: 927.80 MHz, Chain a, Temp: 20, Voltage: 3.3 Vdc

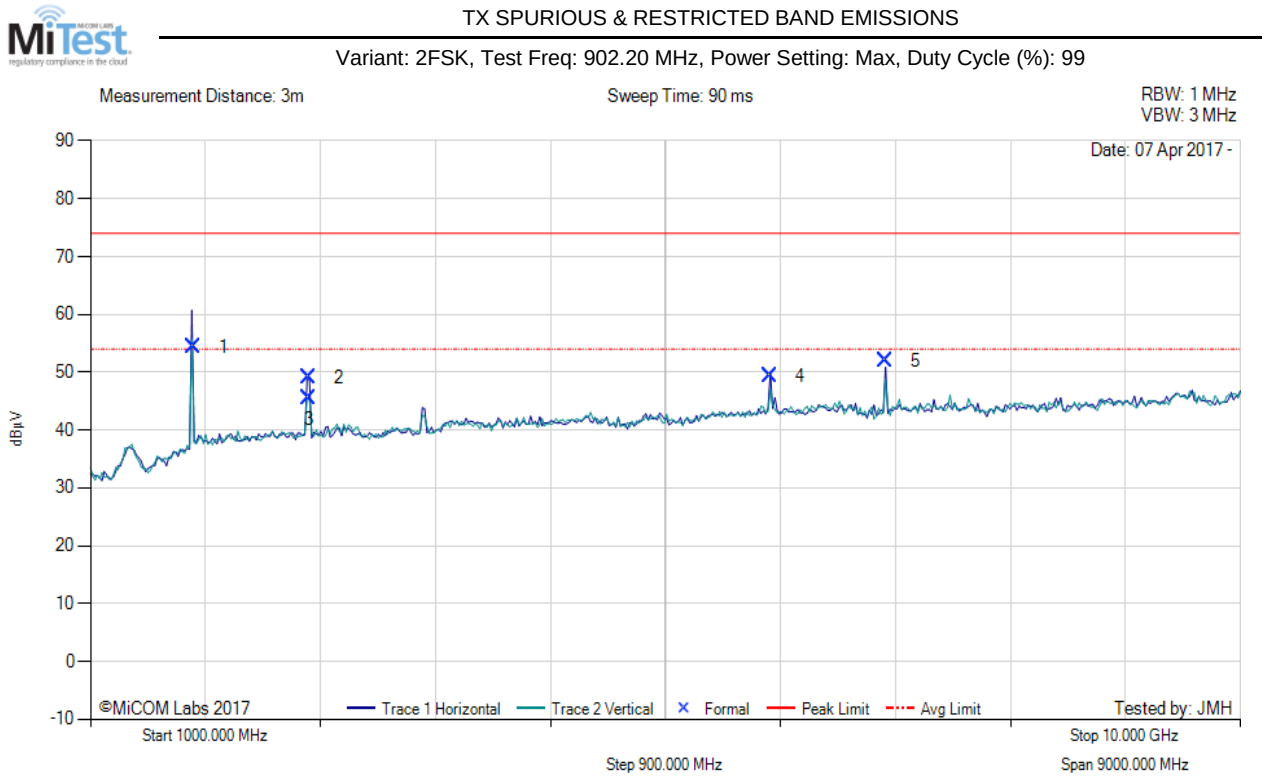


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = MAX HOLD	M1 : 916.000 MHz : 25.070 dBm M2 : 927.064 MHz : 2.300 dBm M3 : 928.000 MHz : 2.300 dBm	Channel Frequency: 0 Hz

back to matrix

A.3.2. Radiated Emissions

A.3.2.3. TX Spurious & Restricted Band Emissions



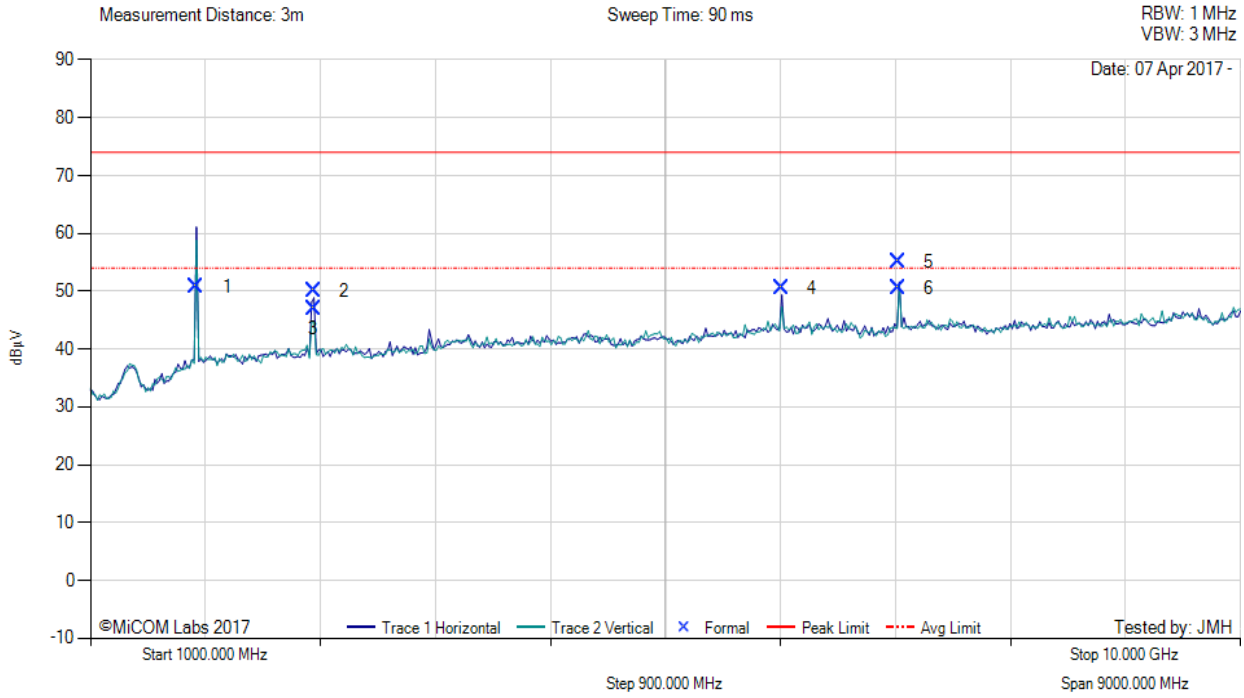
1000.00 - 10000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	1804.44	65.59	2.45	-13.63	54.41	Peak (NRB)	Horizontal	200	0	--	--	Pass
2	2706.67	57.57	2.86	-11.38	49.05	Max Peak	Horizontal	198	110	74.0	-25.0	Pass
3	2706.67	54.04	2.86	-11.38	45.52	Max Avg	Horizontal	198	110	54.0	-8.5	Pass
4	6315.47	53.67	3.93	-8.34	49.26	Peak (NRB)	Horizontal	151	0	--	--	Pass
5	7217.80	55.07	4.31	-7.35	52.03	Peak (NRB)	Horizontal	200	74	--	--	Pass

Test Notes: LNIC powered by 3V DC

back to matrix

TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: 2FSK, Test Freq: 915.20 MHz, Power Setting: Max, Duty Cycle (%): 99



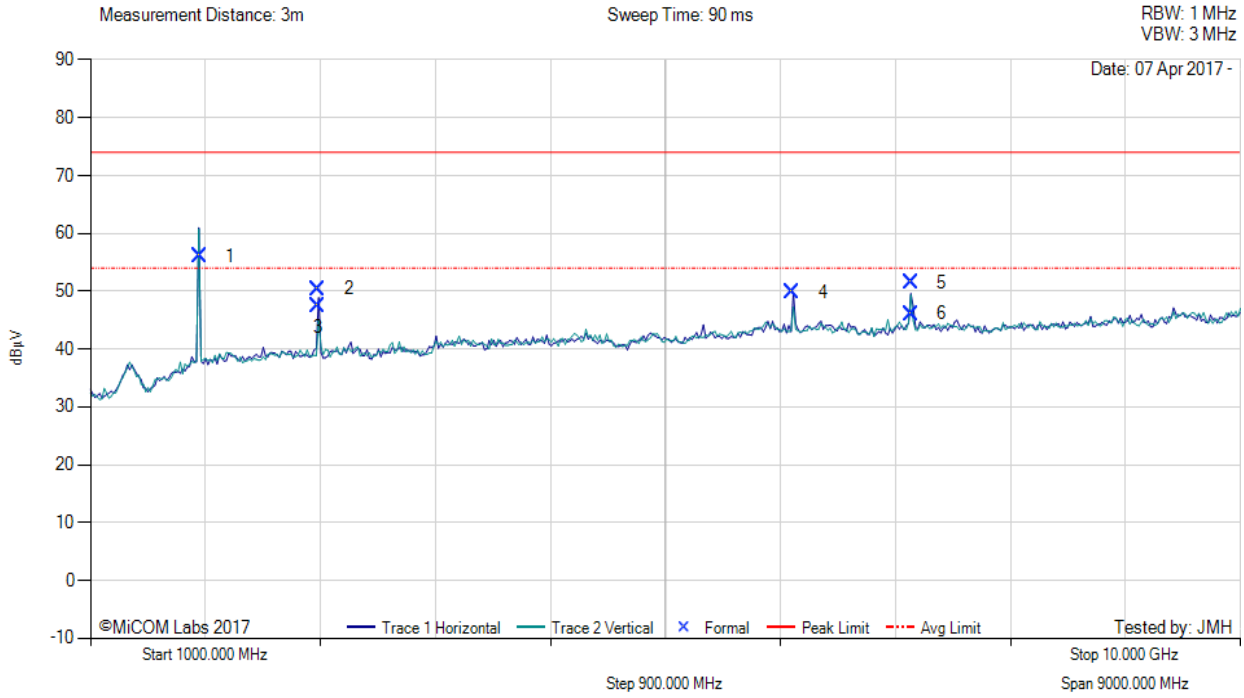
1000.00 - 10000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	1830.41	61.77	2.45	-13.53	50.69	Peak (NRB)	Horizontal	100	0	--	--	Pass
2	2745.59	58.59	2.84	-11.35	50.08	Max Peak	Horizontal	187	97	74.0	-23.9	Pass
3	2745.59	55.58	2.84	-11.35	47.07	Max Avg	Horizontal	187	97	54.0	-6.9	Pass
4	6406.25	54.52	3.97	-8.03	50.46	Peak (NRB)	Horizontal	151	91	--	--	Pass
5	7321.75	58.10	4.26	-7.26	55.10	Max Peak	Horizontal	194	96	74.0	-18.9	Pass
6	7321.75	53.60	4.26	-7.26	50.60	Max Avg	Horizontal	194	96	54.0	-3.4	Pass

Test Notes: LNIC powered by 3V DC

back to matrix

TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: 2FSK, Test Freq: 927.80 MHz, Power Setting: Max, Duty Cycle (%): 99

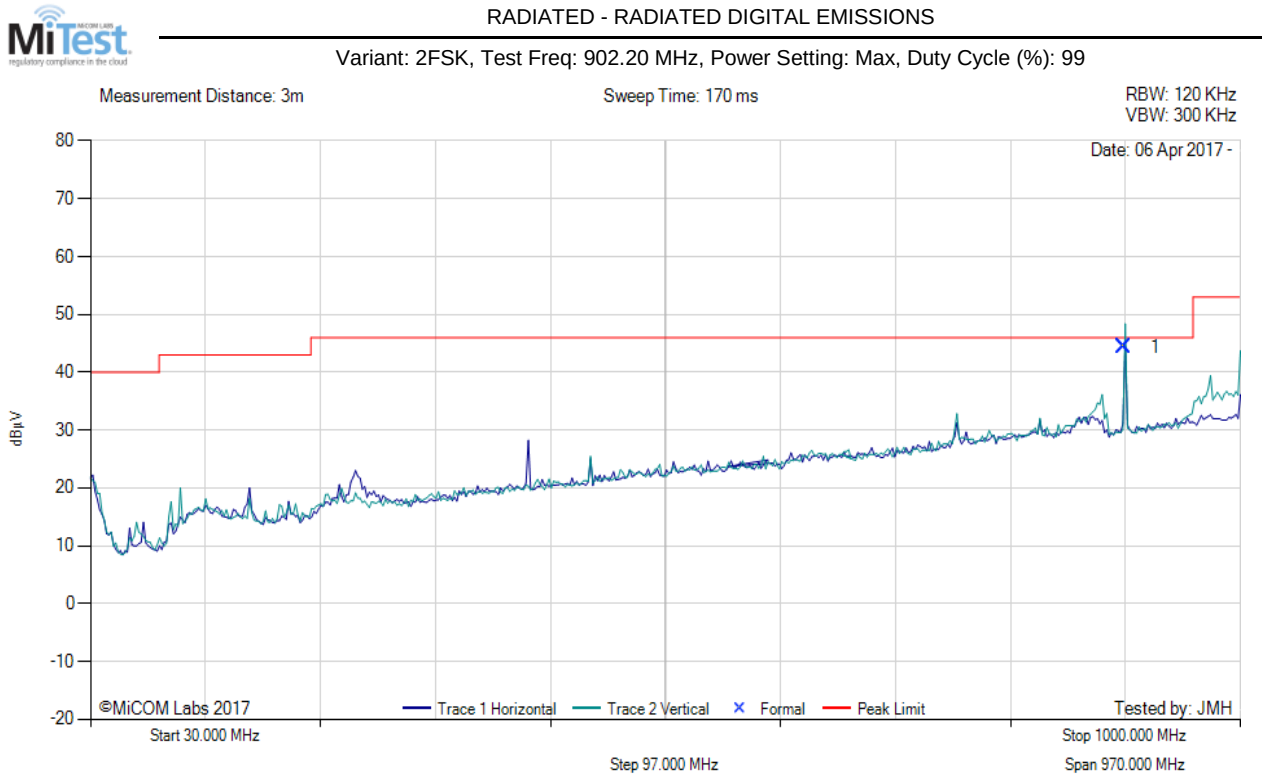


1000.00 - 10000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	1855.67	66.93	2.49	-13.41	56.01	Peak (NRB)	Horizontal	151	0	--	--	Pass
2	2783.42	58.86	2.85	-11.33	50.38	Max Peak	Horizontal	179	108	74.0	-23.6	Pass
3	2783.42	55.93	2.85	-11.33	47.45	Max Avg	Horizontal	179	108	54.0	-6.6	Pass
4	6494.35	53.78	4.02	-7.92	49.88	Peak (NRB)	Horizontal	200	37	--	--	Pass
5	7422.32	54.24	4.34	-7.14	51.44	Max Peak	Horizontal	188	306	74.0	-22.6	Pass
6	7422.32	48.93	4.34	-7.14	46.13	Max Avg	Horizontal	188	306	54.0	-7.9	Pass

Test Notes: LNIC powered by 3V DC

back to matrix

A.3.3. Radiated Emissions (0.03 - 1 GHz)



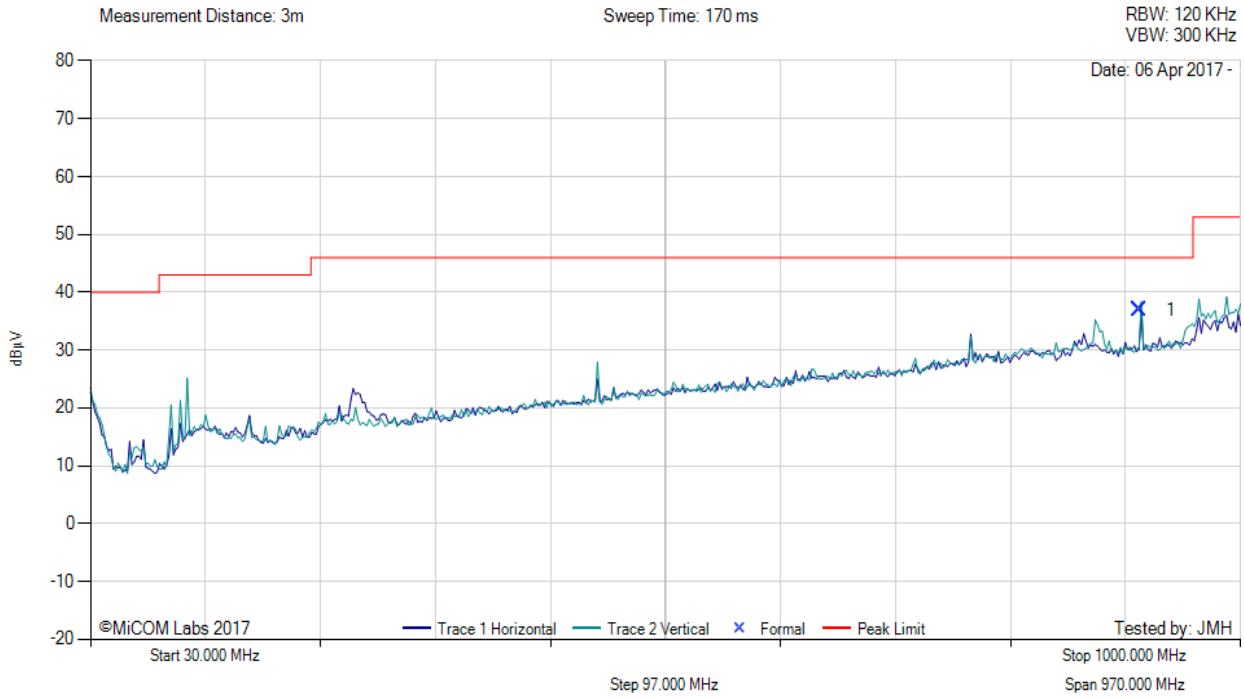
30.00 - 1000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	902.18	45.83	6.34	-7.79	44.38	Fundamental	Vertical	100	0	--	--	

Test Notes: LNIC on 80 cm table powered by 3V DC. TX on 902.2

back to matrix

RADIATED DIGITAL EMISSIONS

Variant: 2FSK, Test Freq: 915.20 MHz, Power Setting: Max, Duty Cycle (%): 99



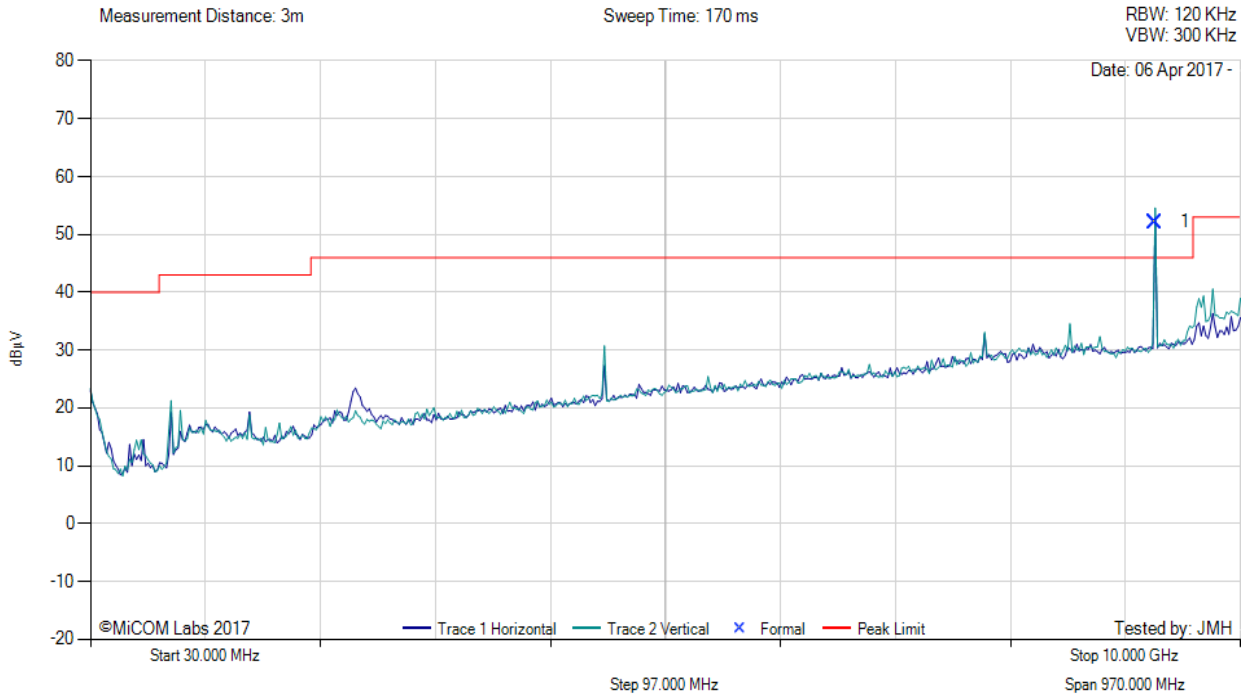
30.00 - 1000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	915.18	38.23	6.39	-7.75	36.87	Fundamental	Vertical	100	0	--	--	

Test Notes: LNIC on 80 cm table powered by 3V DC. TX on 915.2

back to matrix

RADIATED DIGITAL EMISSIONS

Variant: 2FSK, Test Freq: 927.80 MHz, Power Setting: Max, Duty Cycle (%): 99



30.00 - 10000.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	927.82	53.16	6.43	-7.44	52.15	Fundamental	Vertical	100	0	--	--	

Test Notes: LNIC on 80 cm table powered by 3V DC. TX on 927.8

back to matrix

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