Test of Digi International XBee ProS3B

To: FCC 47 CFR Part15.247 & IC RSS-210

Test Report Serial No.: DIGI41-U2 Rev A

TEST REPORT

FROM

Test of Digi International XBee ProS3B

To FCC 47 CFR Part15.247 & IC RSS-210

Test Report Serial No.: DIGI41-U2 Rev A

This report supersedes: DIGI31-U1 Rev A

Manufacturer: Digi International
355 South 520 West, Suite 180
Lindon Utah 84042
USA

Product Function: General Data and Control Radio

Copy No: pdf **Issue Date:** 27th March 2014

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
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ACCREDITED
TESTING CERT #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION & LISTINGS

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MiCOM Labs, Inc. an accredited laboratory complies with the international standard BS EN ISO/IEC 17025. 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

American Association for Laboratory Accreditation

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 28th day of February 2014.

President & CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2015

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

RECOGNITION

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA** countries. Our test reports are widely accepted for global type approvals.

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	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a 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
N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

**NB – Notified Body

PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC 17065. 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


American Association for Laboratory Accreditation

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence as a

Product Certification Body

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 quality management system.

Presented this 28th day of February 2014.

President & CEO
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2015

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)
TCB Identifier – US0159

Industry Canada – Certification Body
CAB Identifier – US0159

Europe – Notified Body
Notified Body Identifier - 2280

Japan – Recognized Certification Body (RCB)
RCB Identifier – 210

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	27th March 2014	Released as Test Report DIGI41-U2 Retest required as a result of a change in power amplifier. Both conducted and radiated testing were performed in order to prove continued compliance with the regulation. Retesting performed in order to prove compliance 20 dB & 99% Bandwidth – Section 5.1.1 Conducted Output Power – Section 5.1.4 Spurious Emissions incl. band-edge – Section 5.1.6 Radiated Emissions – Section 5.1.8
Original Test Report Released as DIGI31-U1		
Rev B	3th January 2012	Updated (DIGI31-U1) Section 5.1.1 20 dB BW with new spectrum plot Section 3.1 Technical Details to reflect name typo
Rev A	31st October 2011	Initial Release (DIGI31-U1)

1. TEST RESULT CERTIFICATE

Manufacturer:	Digi International 355 South 520 West, Suite 180 Lindon Utah 84042 USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	General Data and Control Radio	Telephone:	+1 925 462 0304
Model:	XBee ProS3B	Fax:	+1 925 462 0306
S/N:	Not Available		
Test Date(s):	15 - 22nd Sept 2011 & 11th Jan - 20th Feb 2014	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part15.247 & IC RSS-210	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,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
i.	FCC 47 CFR Part 15, Subpart C	2010	Title 47: Telecommunication PART 15—RADIO FREQUENCY DEVICES Subpart C—Intentional Radiators
ii.	RSS-210 Annex 8	2010	Radio Standards Specification 210, Issue 8, Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
iii.	FCC OET KDB 662911	4th April 2011	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
iv.	DA 00-705	2000	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" released March 30, 2000
v.	RSS-GEN	2010	Radio Standards Specification-Gen, Issue 3, General Requirements and Information for the Certification of Radiocommunication Equipment
vi.	FCC 47 CFR Part 15, Subpart B	2010	47 CFR Part 15, SubPart B; Unintentional Radiators
vii.	ICES-003	2004	Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard Digital Apparatus; Issue 4
viii.	ANSI C63.4	2009	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
ix.	CISPR 22/ EN 55022	2008 2006+A1:2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
x.	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
xi.	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
xii.	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
xiii.	A2LA	July 2012	Reference to A2LA Accreditation Status – A2LA Advertising Policy

2.2. Test and Uncertainty Procedures

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.

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

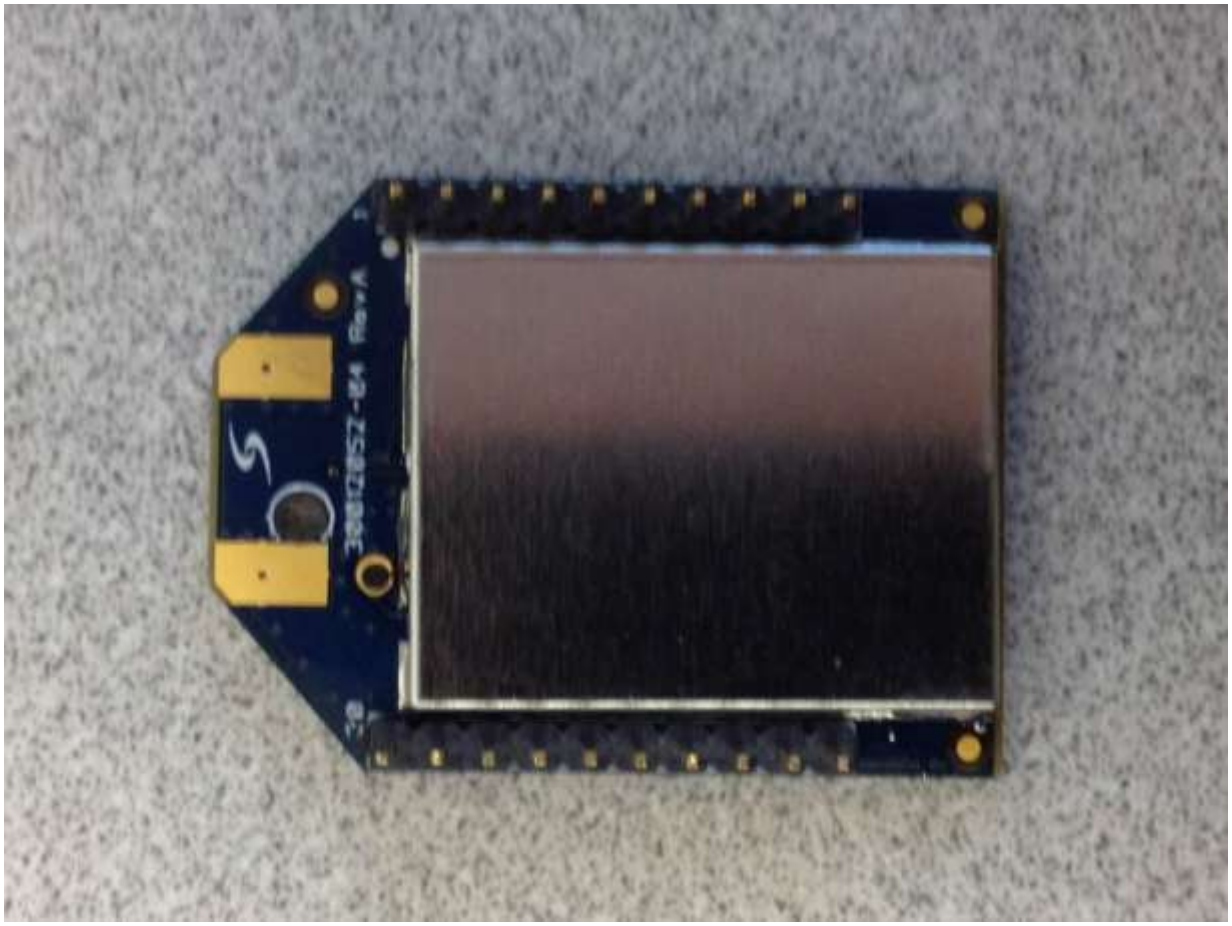
Details	Description
Purpose:	Test of the Digi International XBee ProS3B to FCC Part 15.247 and Industry Canada RSS-210 regulations for Frequency Hopping operation.
Applicant:	Digi International 355 South 520 West, Suite 180 Lindon, Utah 84042 USA
Manufacturer:	Digi International 355 South 520 West, Suite 180 Lindon Utah 84042 USA
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	DIGI41-U2 Rev A
Standard(s) applied:	FCC 47 CFR Part15.247 & IC RSS-210
Date EUT received:	1st September 2011
Dates of test (from - to):	15 - 22nd Sept 2011 & 11th Jan - 20th Feb 2014
No of Units Tested:	One
Type of Equipment:	915 MHz Frequency Hopping
Manufacturers Trade Name:	XBee 900 HP
Model:	XBee ProS3B
Location for use:	Indoor and Outdoor
Declared Frequency Range(s):	902 - 928 MHz
Type of Modulation:	FSK (10 kbps and 20 kbps), GMSK (200 kbps)
Declared Nominal Output Power:	Max: +24 dBm Min: -17 dBm
EUT Modes of Operation:	FHSS
Transmit/Receive Operation:	Transceiver Half Duplex
Rated Input Voltage and Current:	Nom: 3.3 Vdc, Min: 2.4 Vdc Max: 3.6 Vdc
Operating Temperature Range:	-40ºC to +85ºC (client declared range)
ITU Emission Designator:	10 kbps 307KF7D 20 kbps 300KF7D 200 kbps 346KF7D
Long Term Frequency Stability:	±3ppm/year
EUT Dimensions (L x W x H):	33 x 22 x 4mm or with Reverse SMA 33 x 22 x 8mm
EUT Weight :	6 grams
Primary function of equipment:	General data and control radio

3.2. Scope of Test Program

The scope of the test program was to testing on the Digi International XBee ProS3B in the frequency ranges 902 - 928 MHz against FCC 47 CFR Part 15.247 and Industry Canada RSS-210 specifications for radiated and conducted emissions for intentional radiators. The intentional radiator was tested in a simulated typical installation to demonstrate compliance with the stated standards.

Device is a frequency hopper which utilizes 64 hopping channels.

Digi International XBee Pro S3B Top



Digi International XBee Pro S3B Reverse

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	915 MHz	Digi International	XBPS3B	None Available
Support	Cable Assembly + pcb	Digi International	N/A	N/A

3.4. Antenna Details

The following is a description of the EUT antennas.

Manufacturer	Model	Type	Gain (dBi)	Frequency Band (MHz)
Digi International	A09-Y15	Yagi Directional	15.1	900 - 950
Digi International	A09-F8	Omni	8.1	900 - 950

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. RF Port (915 MHz)

3.6. Test Configurations

Test configurations

Operating Channel	Frequencies (MHz)
0	902.4
33	915.2
63	927.6

3.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

3.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

3.9. Subcontracted Testing or Third Party Data

The following tests were performed by a MiCOM Labs approved test facility;-

1. NONE

4. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247**, **Industry Canada RSS-210** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(a)(1) **A8.1**	20 dB BW	20 dB BW	Conducted	Complies	5.1.1
15.247(a)(1) **A8.1**	Transmitter Channels	Channel Spacing	Conducted	Complies	5.1.2
15.247(a)(1) **A8.1**	Transmitter Channels	Number of Channels	Conducted	Complies	5.1.3.1
		Channel Occupancy	Conducted	Complies	5.1.3.2
15.247(b)(2) **A8.4**	Output Power	Transmit Power	Conducted	Complies	5.1.4
15.247(i) **5.5**	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Conducted	Complies	5.1.5
15.247(d) **A8.5**	Conducted Spurious Emissions	Band Edge	Conducted	Complies	5.1.6
		Spurious Emissions Transmitter (1 to 10 GHz)	Conducted	Complies	
§7.2.3		Standby	Conducted	Complies	5.1.7

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247**, **Industry Canada RSS-210** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) **15.205** **15.209** **A8.5** **2.2** **2.6** **4.9**	Radiated Emissions above 1 GHz	Transmitter	Radiated	Complies	*5.1.8.1*
4.10		Receiver	Radiated	Complies	*5.1.8.2*
15.247(d) **15.205** **15.209** **A8.5** **2.2** **2.6**	Radiated Emissions below 1 GHz		Radiated	Complies	*5.1.9*
15.207 **7.2.2**	Conducted	AC Wireline Conducted Emissions	Conducted	Complies	*5.1.10*

Note 1: *Test results reported in this document relate only to the items tested*
Note 2: *The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria*
Note 3: *Section 3.7 - Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix*

5. TEST RESULTS

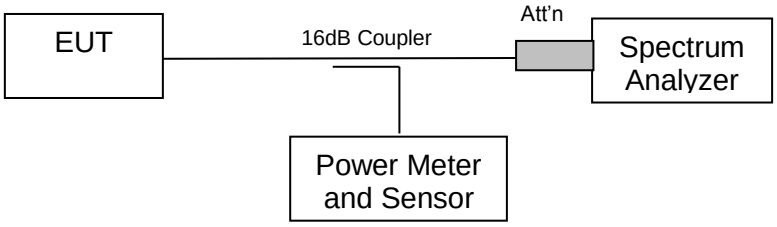
5.1. Device Characteristics

5.1.1. 20 dB Bandwidth

FCC, Part 15 Subpart C §**15.247(a)(1)**
Industry Canada RSS-210 §**A8.1**

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

Test Measurement Set up



Measurement set up for 20 dB bandwidth test

Test Results for 20 dB Bandwidth

200 Kbit/s

Equipment Configuration for 20 dB & 99% Bandwidth			
Variant:	200Kbit/s	**Duty Cycle (%):**	100
Data Rate:	200kbp/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	GMSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

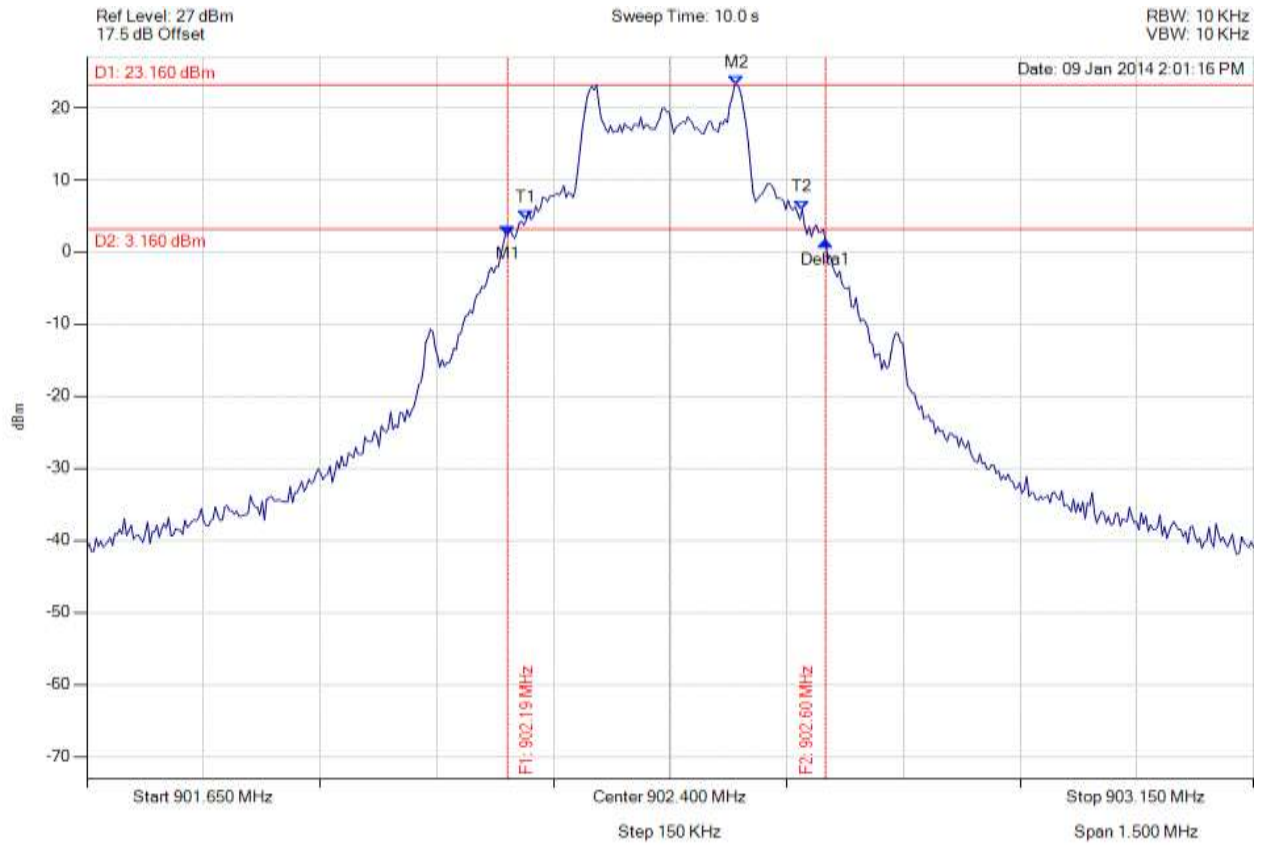
Test Frequency	Measured 20 dB Bandwidth (MHz) Port(s)				6 dB Bandwidth (MHz)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	KHz	MHz
902.4	0.409	--	--	--	0.409	0.409	≥250.0	-0.16
915.2	0.376	--	--	--	0.376	0.376	≥250.0	-0.13
927.6	0.373	--	--	--	0.373	0.373	≥250.0	-0.12

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				Maximum 99% Bandwidth (MHz)		
MHz	a	b	c	d			
902.4	0.355	--	--	--	0.355		
915.2	0.352	--	--	--	0.352		
927.6	0.352	--	--	--	0.352		

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

20 dB & 99% BANDWIDTH

Variant: GMSK 200KB, Channel: 902.40 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc

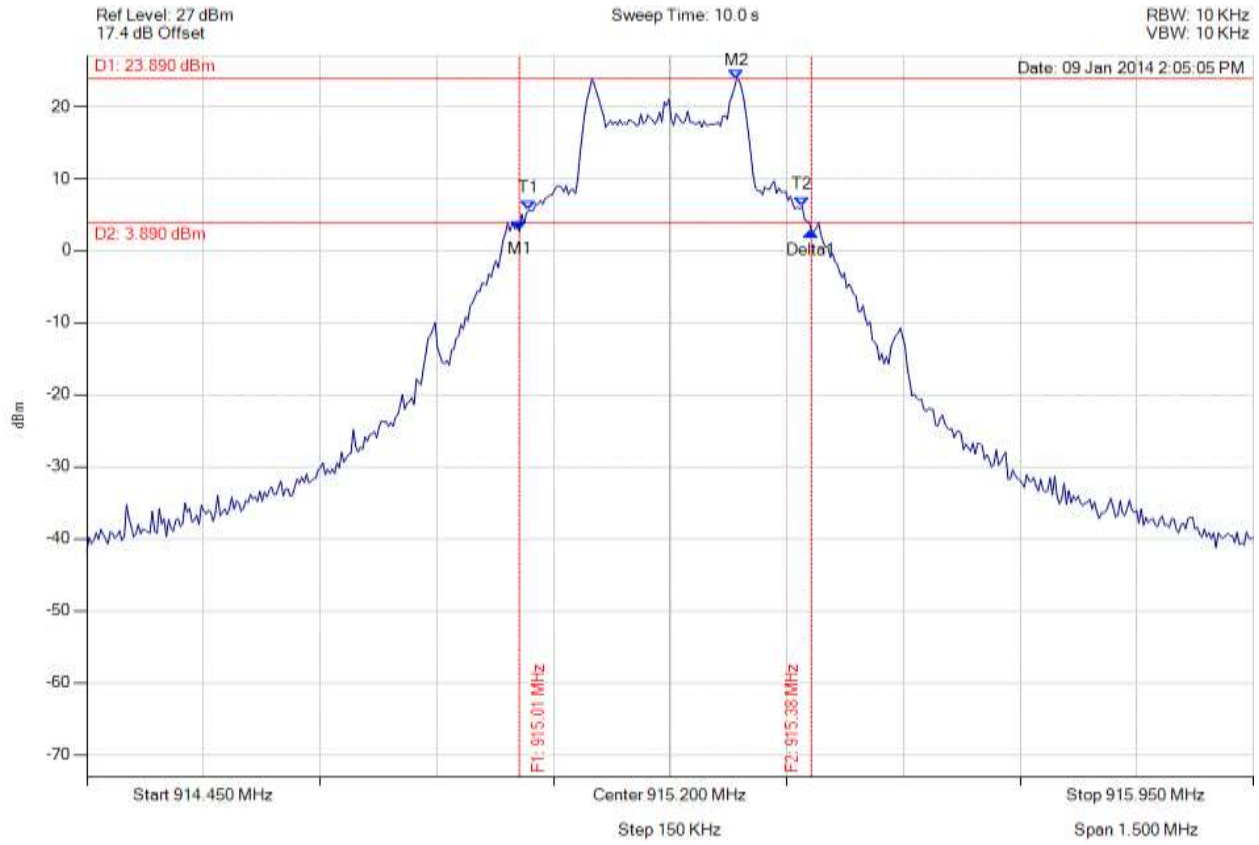


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 902.191 MHz : 2.284 dBm M2 : 902.486 MHz : 23.160 dBm Delta1 : 409 KHz : -0.818 dB T1 : 902.215 MHz : 4.466 dBm T2 : 902.570 MHz : 5.890 dBm OBW : 355 KHz	Measured 6 dB Bandwidth: 0.409 MHz Limit: ≥500.0 kHz Margin: 0.09 MHz

Back to the Matrix

20 dB & 99% BANDWIDTH

Variant: GMSK 200KB, Channel: 915.20 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc

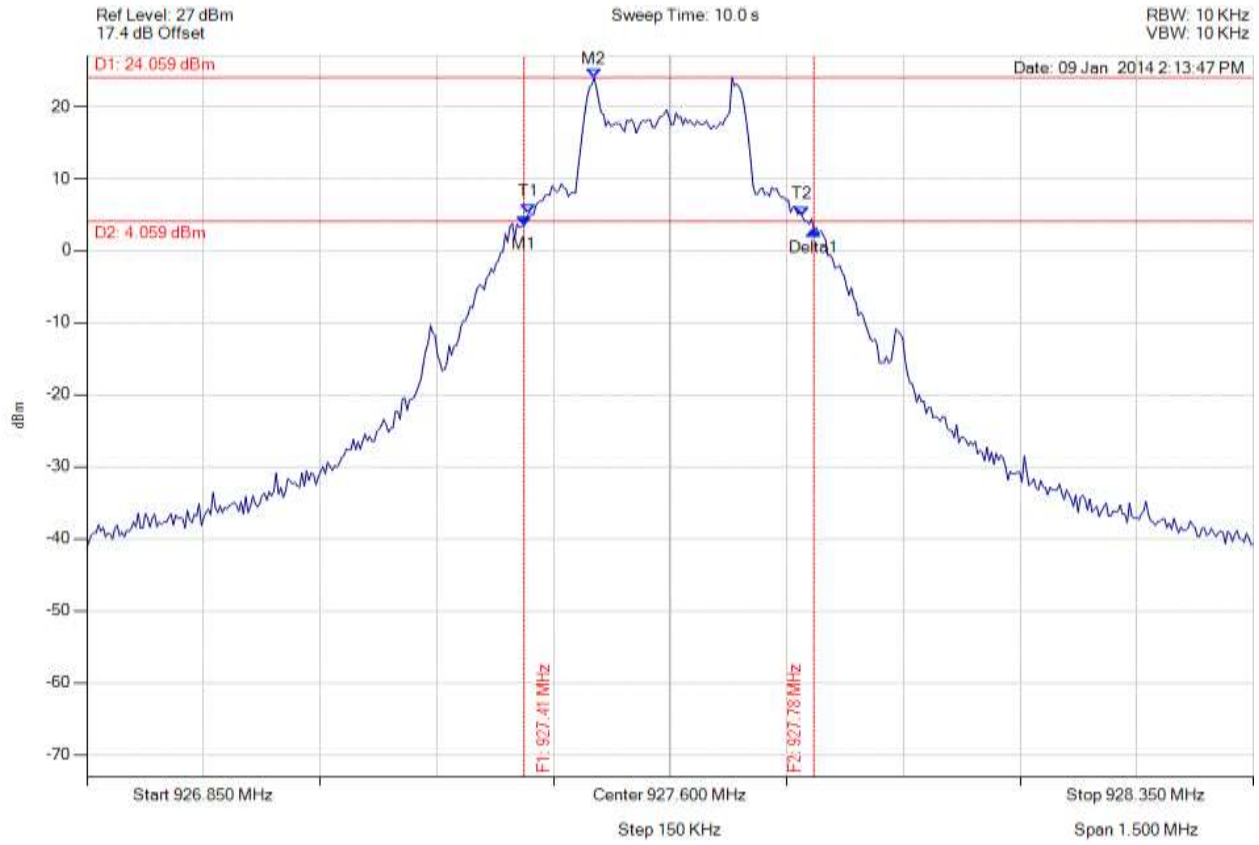


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 915.006 MHz : 2.723 dBm M2 : 915.286 MHz : 23.890 dBm Delta1 : 376 KHz : -0.073 dB T1 : 915.018 MHz : 5.574 dBm T2 : 915.370 MHz : 6.122 dBm OBW : 352 KHz	Measured 6 dB Bandwidth: 0.376 MHz Limit: ≥500.0 kHz Margin: 0.12 MHz

Back to the Matrix

20 dB & 99% BANDWIDTH

Variant: GMSK 200KB, Channel: 927.60 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 927.412 MHz : 3.435 dBm M2 : 927.502 MHz : 24.059 dBm Delta1 : 373 KHz : -0.565 dB T1 : 927.418 MHz : 5.170 dBm T2 : 927.770 MHz : 4.781 dBm OBW : 352 KHz	Measured 6 dB Bandwidth: 0.373 MHz Limit: ≥500.0 kHz Margin: 0.13 MHz

BACK TO THE MATRIX

Equipment Configuration for 20 dB & 99% Bandwidth			
Variant:	10Kbit/s	**Duty Cycle (%):**	100
Data Rate:	10kBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	FSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

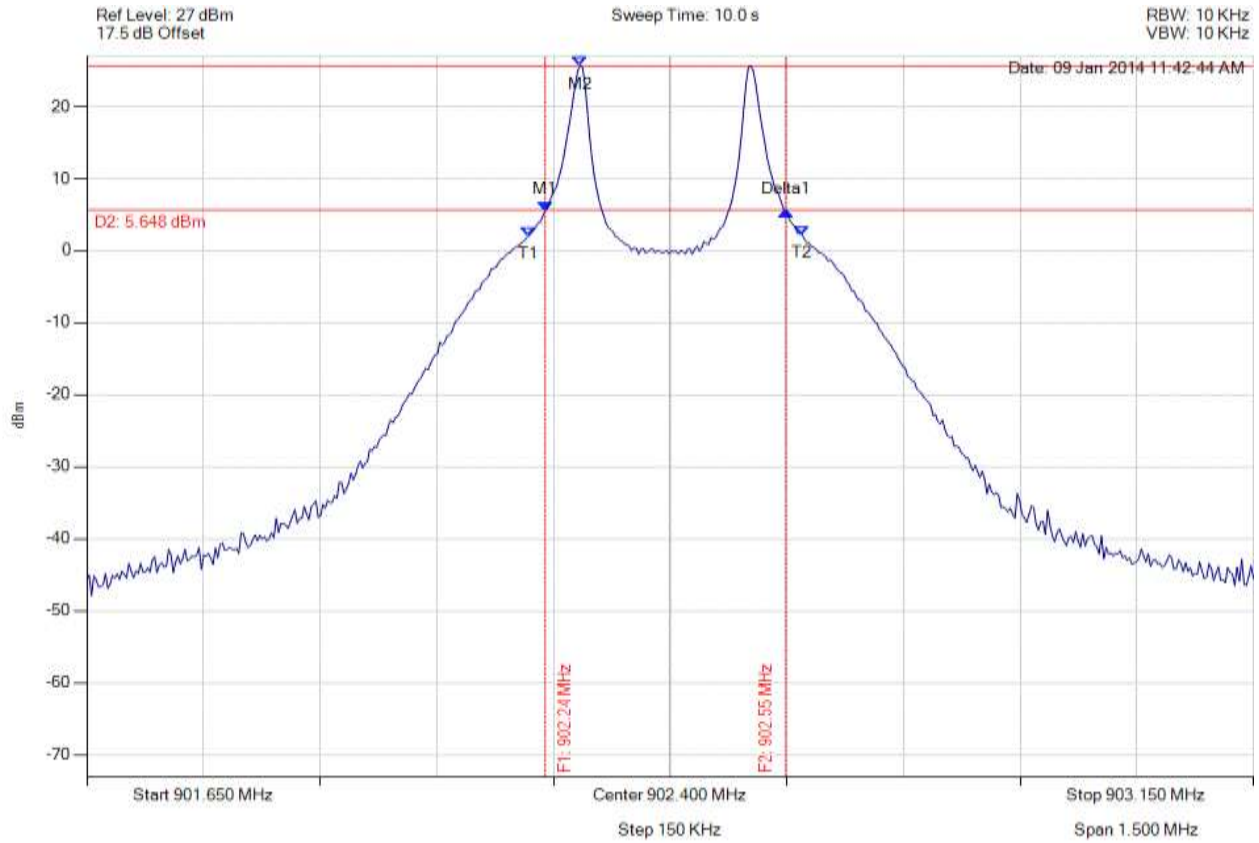
Test Frequency	Measured 20 dB Bandwidth (MHz) Port(s)				6 dB Bandwidth (MHz)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	KHz	MHz
902.4	0.310	--	--	--	0.310	0.310	≥250.0	-0.06
915.2	0.310	--	--	--	0.310	0.310	≥250.0	-0.06
927.6	0.304	--	--	--	0.304	0.304	≥250.0	-0.05

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				Maximum 99% Bandwidth (MHz)		
MHz	a	b	c	d			
902.4	0.352	--	--	--	0.352		
915.2	0.349	--	--	--	0.349		
927.6	0.349	--	--	--	0.349		

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

20 dB & 99% BANDWIDTH

Variant: FSK 10KB, Channel: 902.40 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc

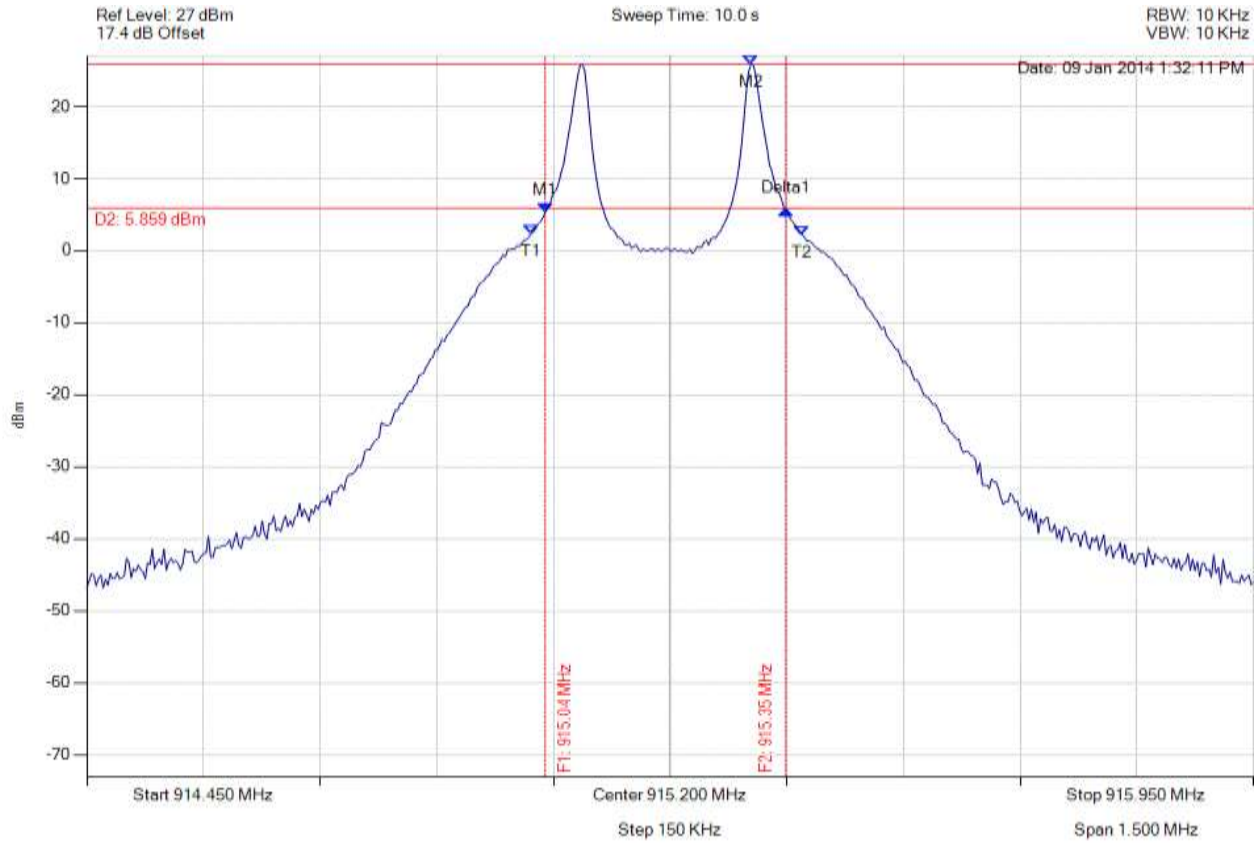


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 902.239 MHz : 5.516 dBm M2 : 902.284 MHz : 25.648 dBm Delta1 : 310 KHz : -0.061 dB T1 : 902.218 MHz : 2.024 dBm T2 : 902.570 MHz : 2.198 dBm OBW : 352 KHz	Measured 6 dB Bandwidth: 0.310 MHz Limit: ≥500.0 kHz Margin: 0.19 MHz

Back to the Matrix

20 dB & 99% BANDWIDTH

Variant: FSK 10KB, Channel: 915.20 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc

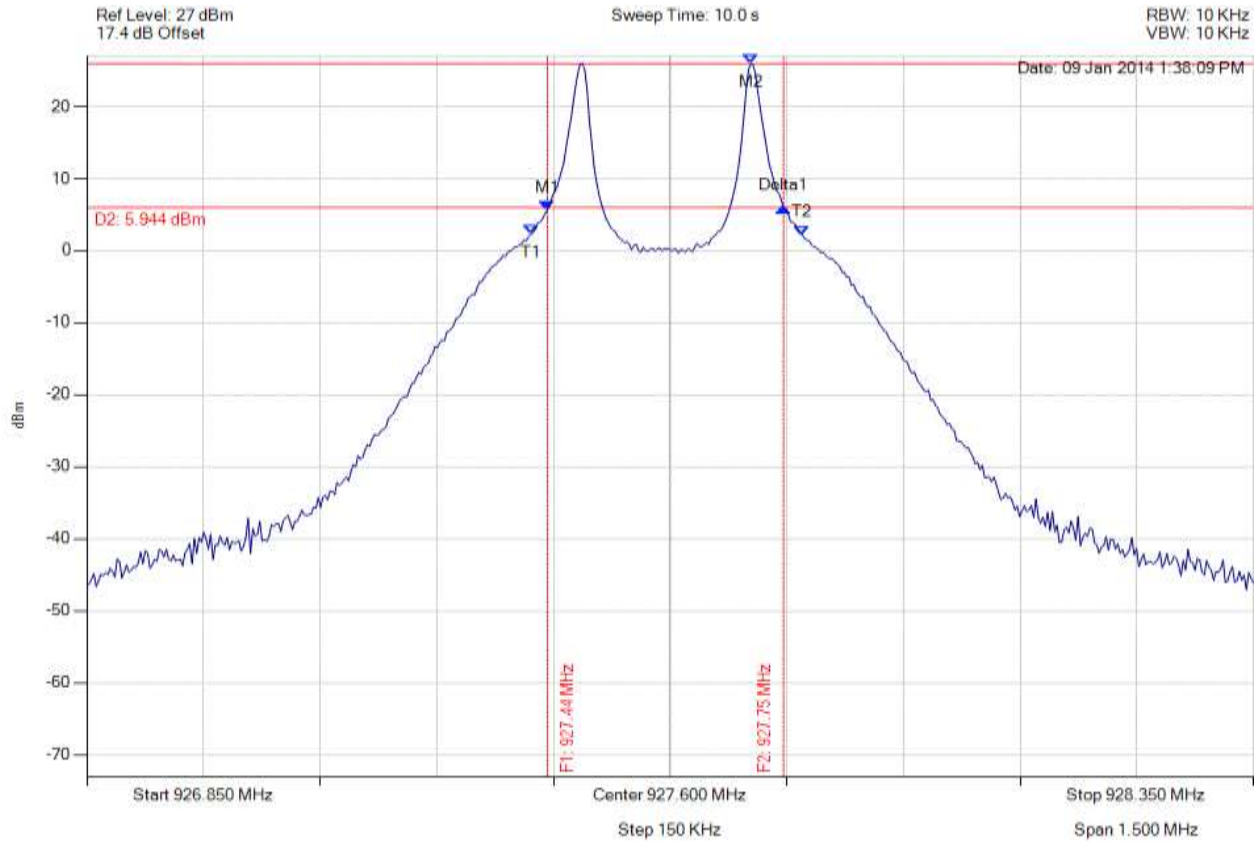


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 915.039 MHz : 5.286 dBm M2 : 915.304 MHz : 25.859 dBm Delta1 : 310 KHz : 0.358 dB T1 : 915.021 MHz : 2.379 dBm T2 : 915.370 MHz : 2.219 dBm OBW : 349 KHz	Measured 6 dB Bandwidth: 0.310 MHz Limit: ≥500.0 kHz Margin: 0.19 MHz

Back to the Matrix

20 dB & 99% BANDWIDTH

Variant: FSK 10KB, Channel: 927.60 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 927.442 MHz : 5.674 dBm M2 : 927.704 MHz : 25.944 dBm Delta1 : 304 KHz : 0.244 dB T1 : 927.421 MHz : 2.284 dBm T2 : 927.770 MHz : 2.215 dBm OBW : 349 KHz	Measured 6 dB Bandwidth: 0.304 MHz Limit: ≥500.0 kHz Margin: 0.20 MHz

BACK TO THE MATRIX

Specification

Limits

FCC §15.247 (a)(1)
Industry Canada RSS-210 §**8.1**

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.

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement uncertainty	±2.81 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

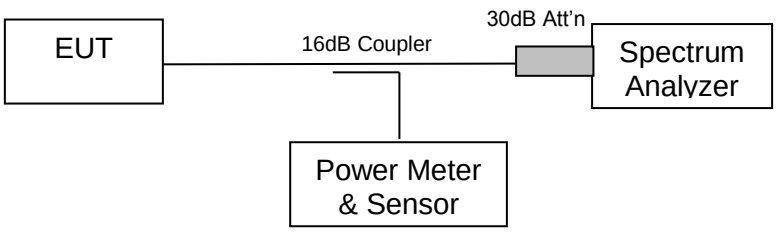
5.1.2. Transmitter Channels - Channel Spacing

FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §8.1(2)

Test Procedure

The channel spacing is measured with a spectrum analyzer connected to the antenna terminal, while the EUT is operating in transmission mode at the appropriate center frequency and modulation.

Test Measurement Set up



Measurement set up for Channel Spacing Test

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS – 10 kbps

Channel(s)	Channel Spacing (KHz)	Maximum 20 dB Bandwidth (kHz)	Specification
First two channels	400.866	312.625	Greater than maximum 20 dB Bandwidth

Channel spacing for first two channels

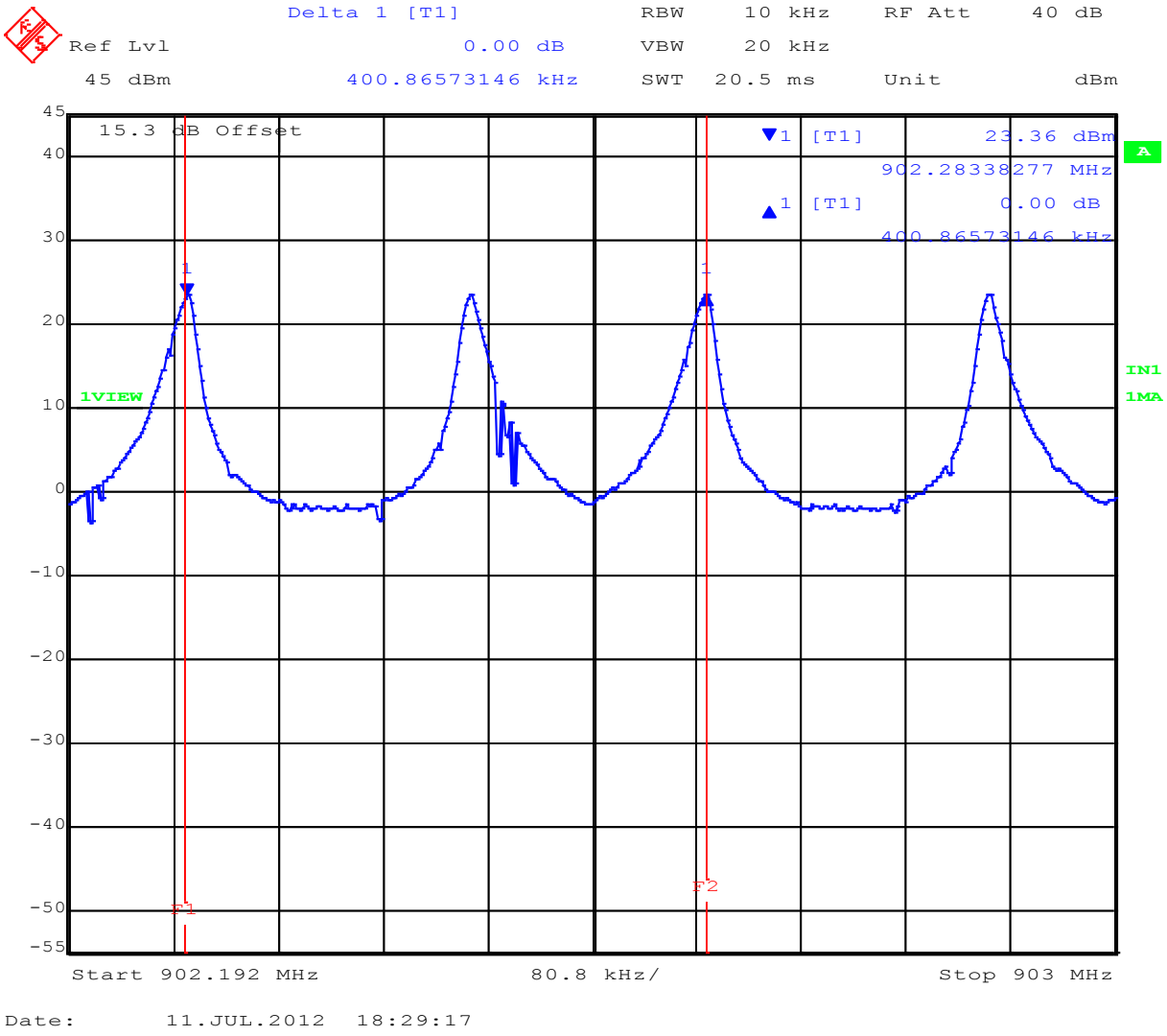


TABLE OF RESULTS - 20 kbps

Channel(s)	Channel Spacing (KHz)	Specification
25-26	300.902	Greater than maximum 20 dB Bandwidth

Maximum 20 dB bandwidth = 52.6052 kHz

Channel Spacing for CH 25 – CH 26

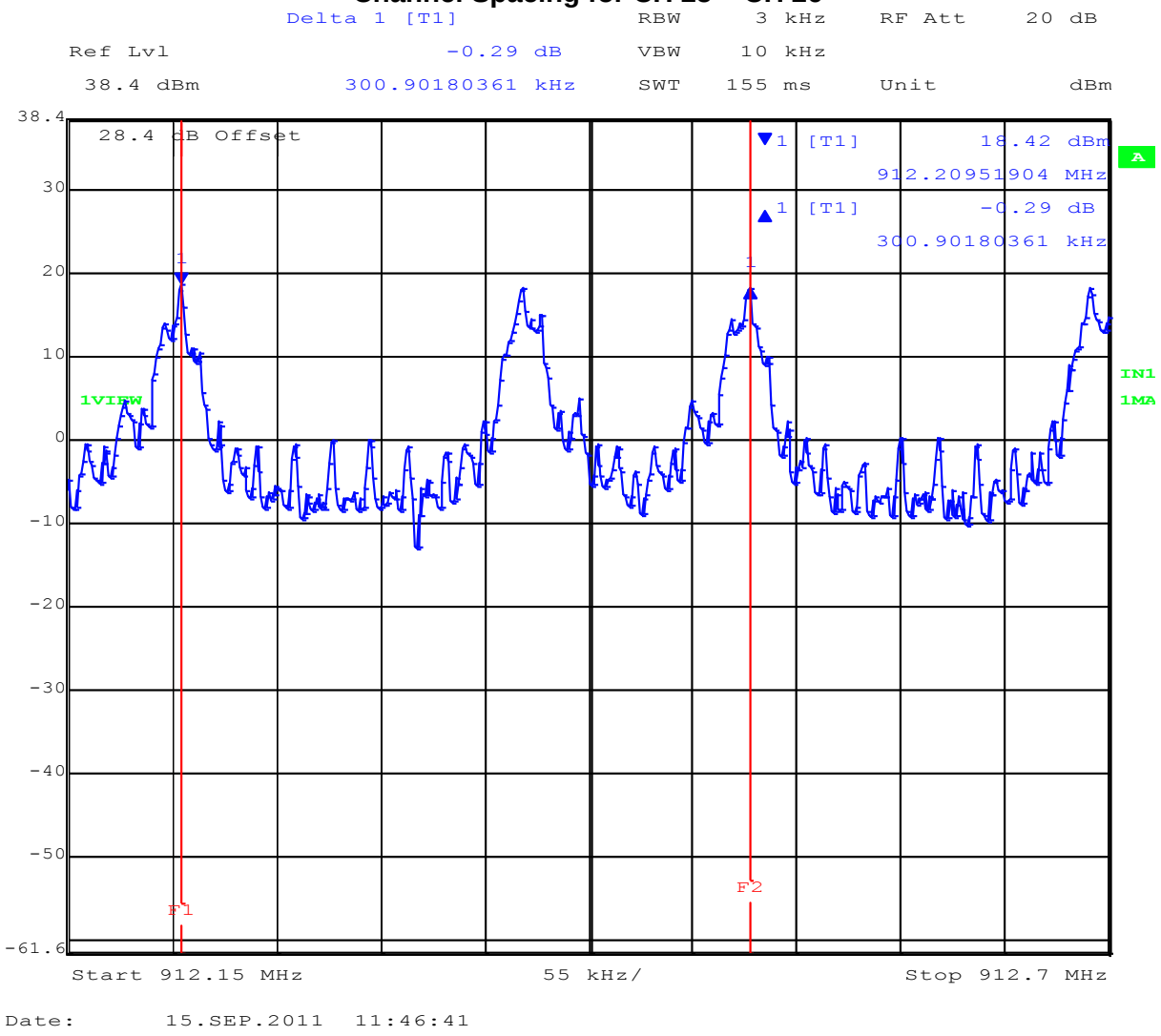
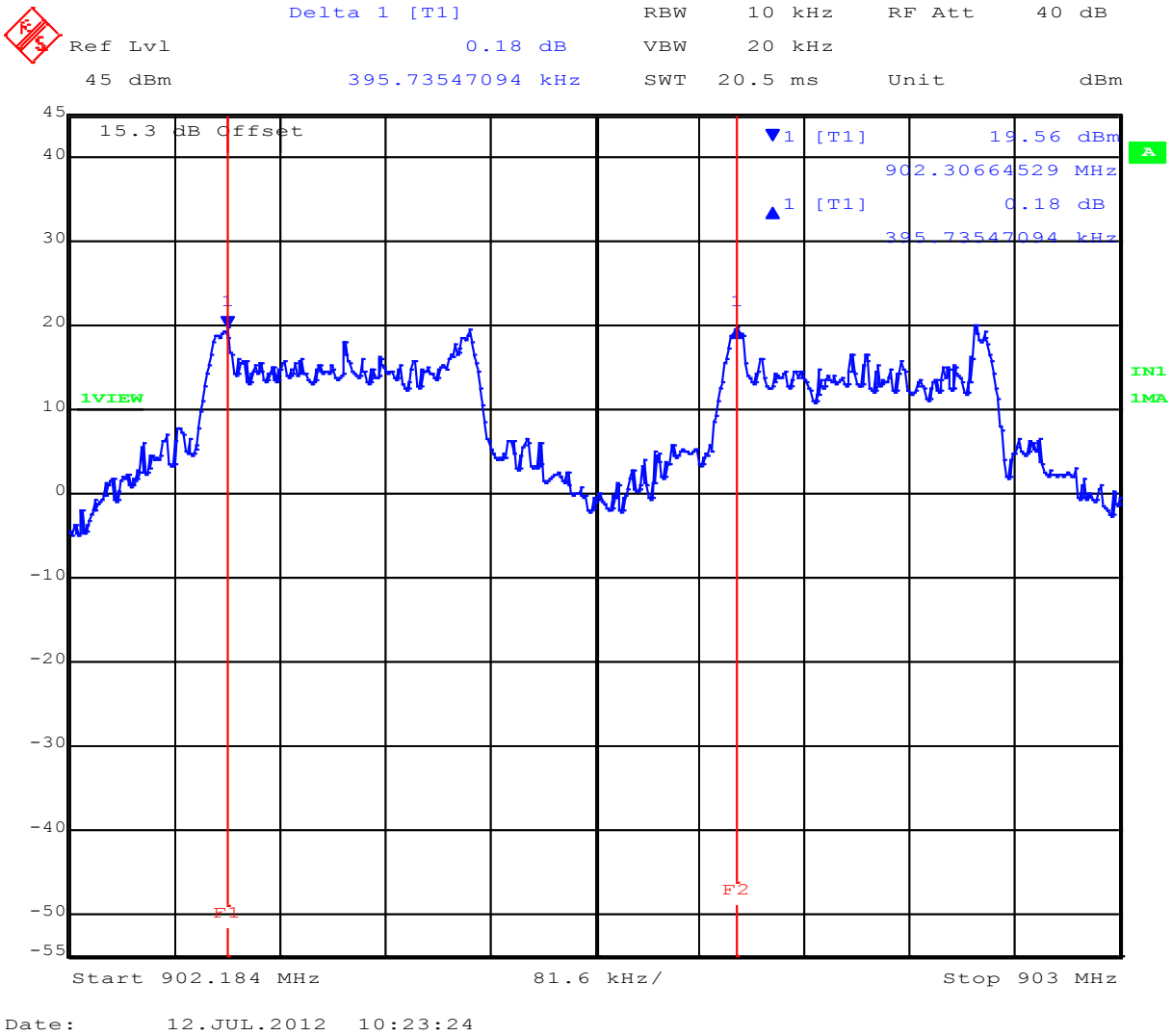


TABLE OF RESULTS – 200 kbps

Channel(s)	Channel Spacing (KHz)	Maximum 20 dB Bandwidth (kHz)	Specification
First two channels	395.735	384.770	Greater than maximum 20 dB Bandwidth

Channel spacing for first two channels



Specification for Channel Spacing

Limits

FCC §15.247 (a)(1)
Industry Canada RSS-210 §A8.1(2)

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.

Laboratory Uncertainty for Frequency Measurements

Measurement uncertainty	±0.86ppm

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-02 'Frequency Measurement"	0078, 0134, 0158, 0184, 0193, 0250, 0252 0310, 0312.

5.1.3. Transmitter Channels

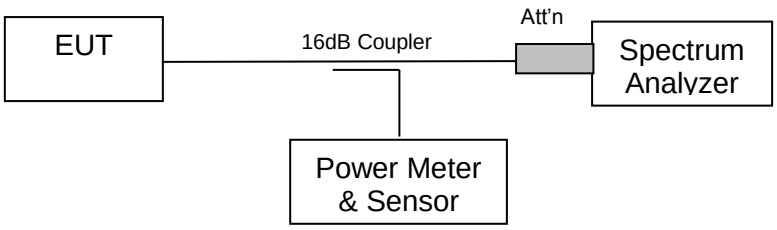
5.1.3.1. Number of Channels

FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §A8.1

Test Procedure

The number of channels and channel occupancy is measured with a spectrum analyzer connected to the antenna terminal, while the EUT is operating in transmission mode at the appropriate center frequency and modulation.

Test Measurement Set up



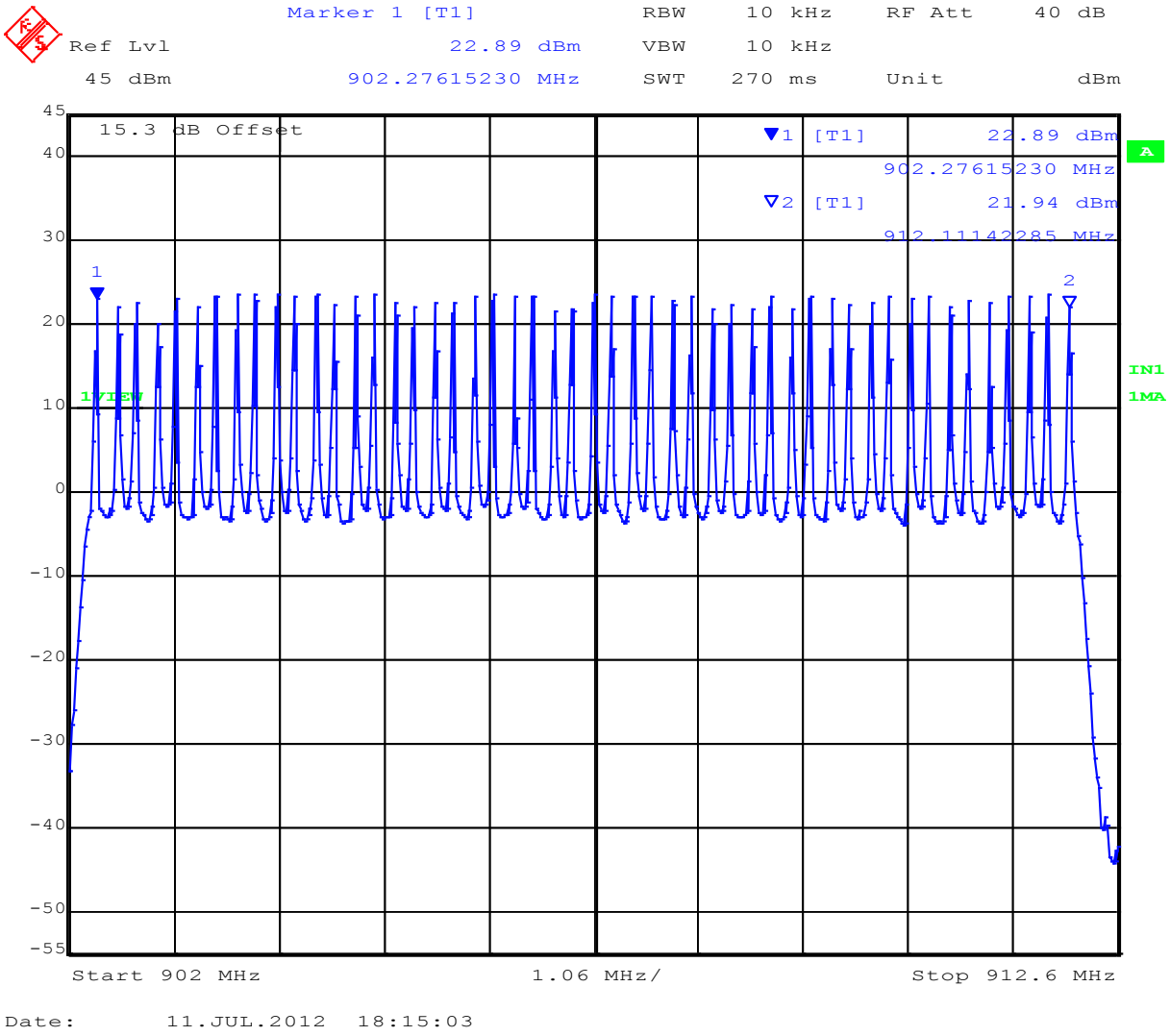
Test set up to measure the number of channels and channel occupancy

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

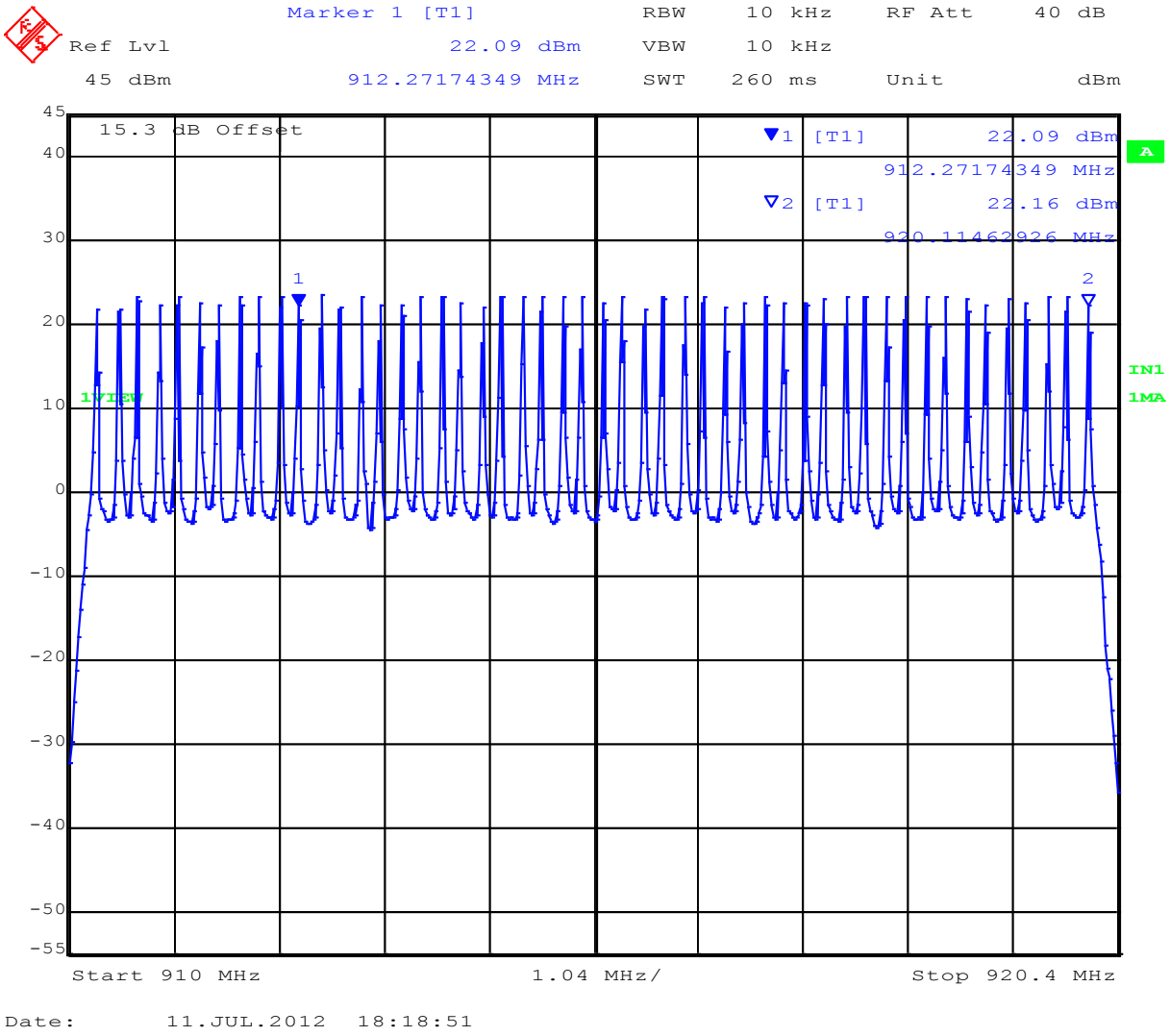
TABLE OF RESULTS – 10 kbps

Number of Channels	Specification
64	At least 25 hopping channels

10 kbps Number of Transmission Channels – Low Band



10 kbps Number of Transmission Channels – Mid Band



10 kbps Number of Transmission Channels – Upper Band

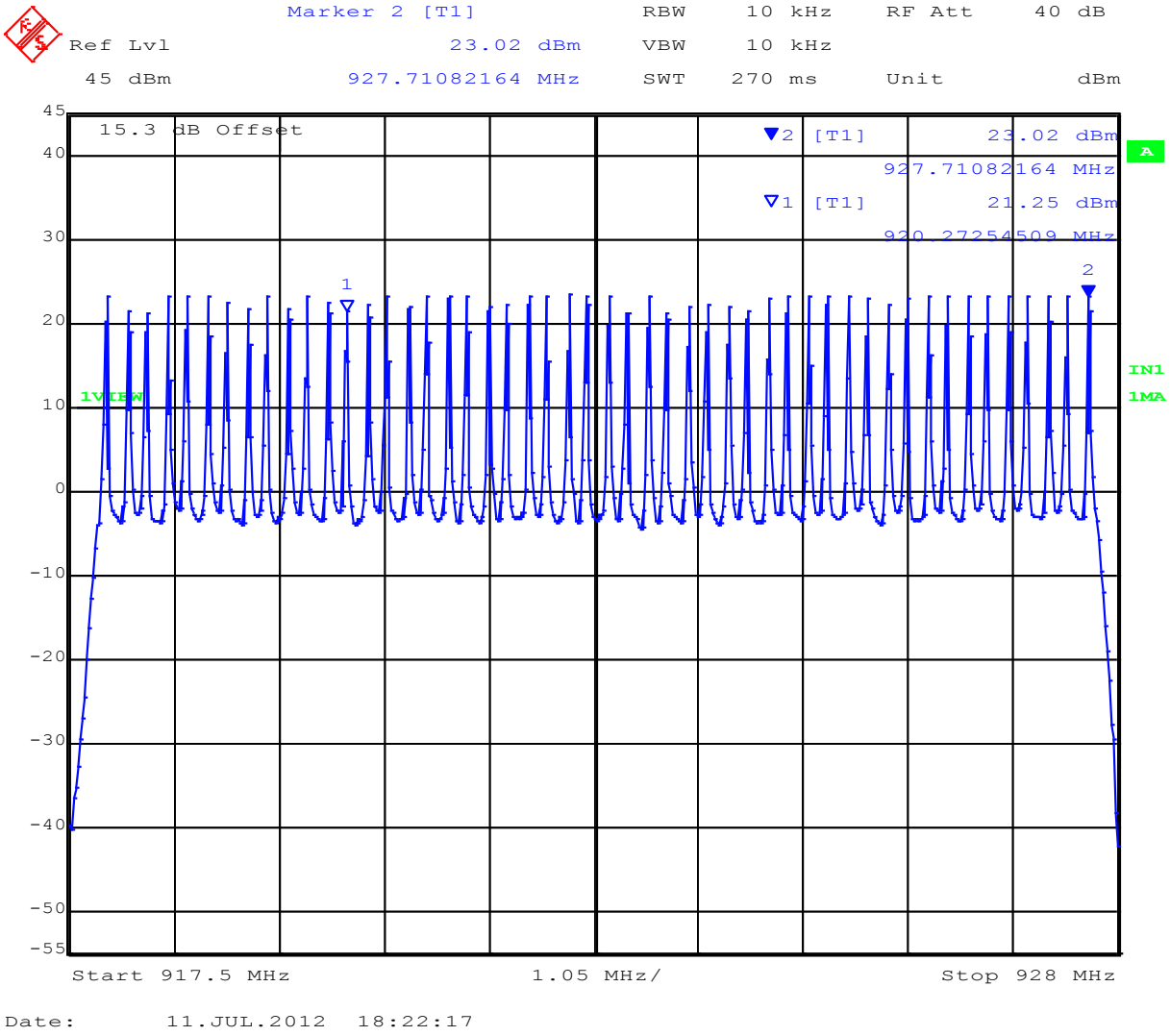
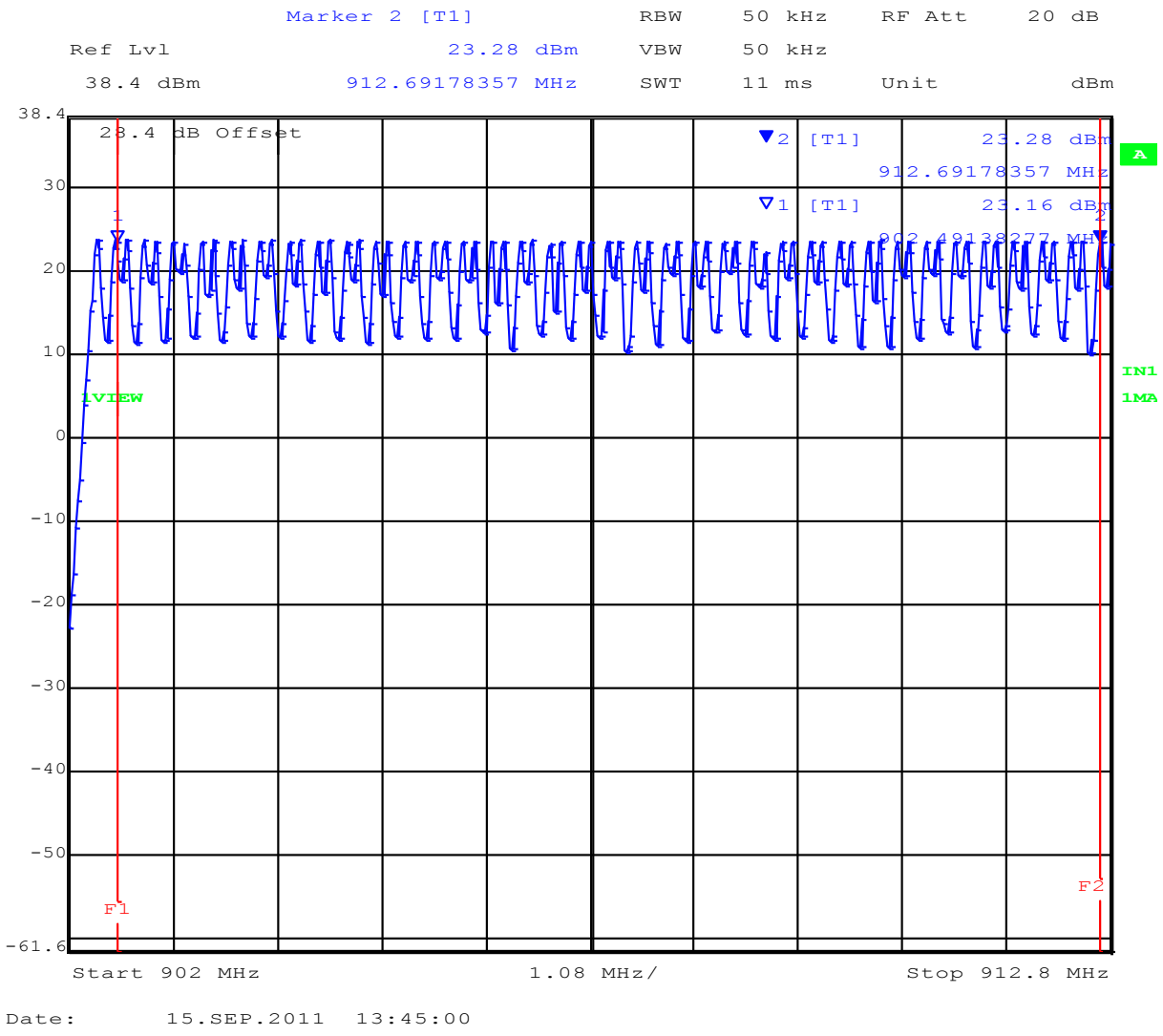


TABLE OF RESULTS – 20 kbps

Number of Channels	Specification
84	At least 25 hopping channels

20 kbps Number of Transmission Channels – Lower Band



20 kbps Number of Transmission Channels – Upper Band

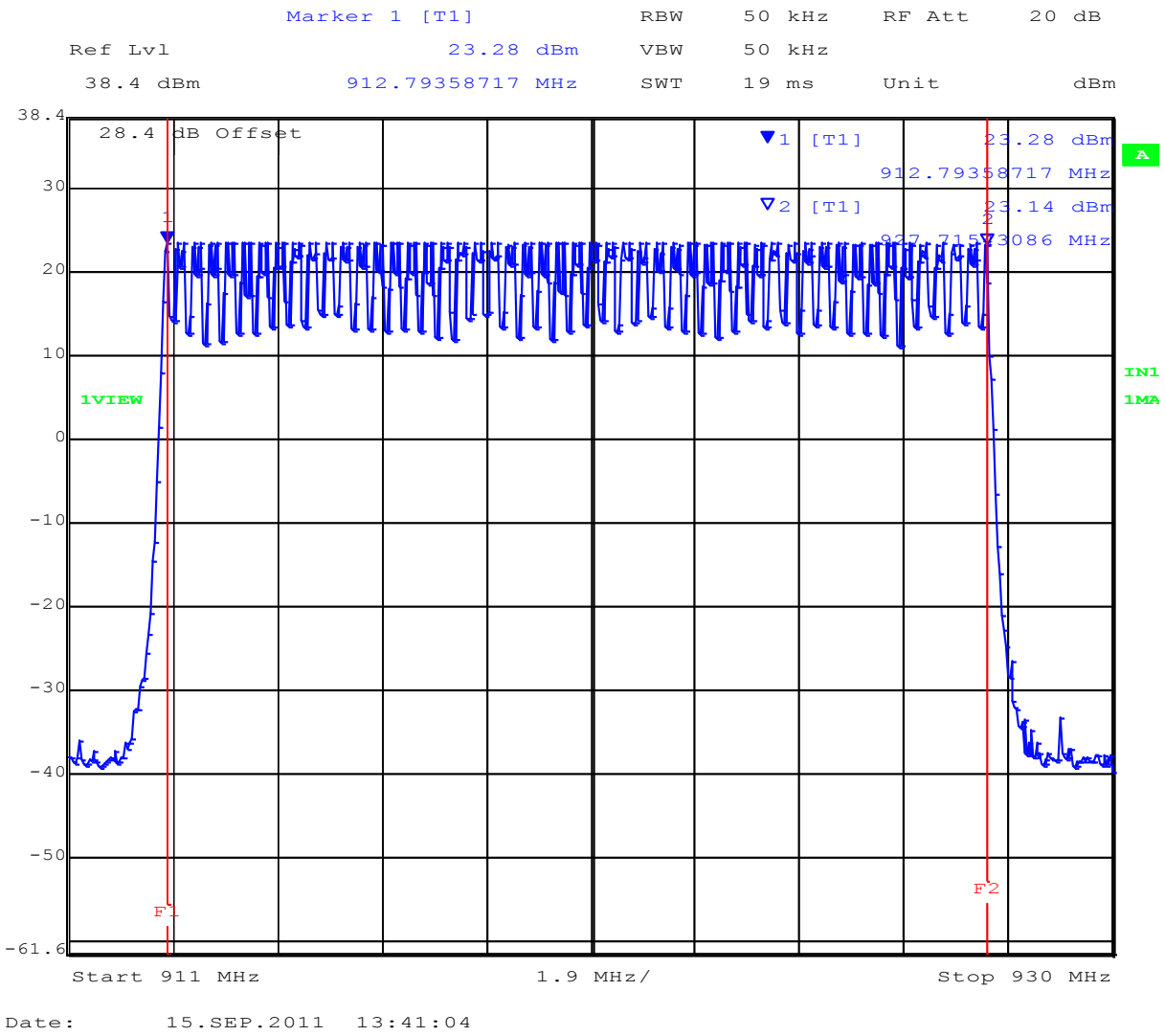
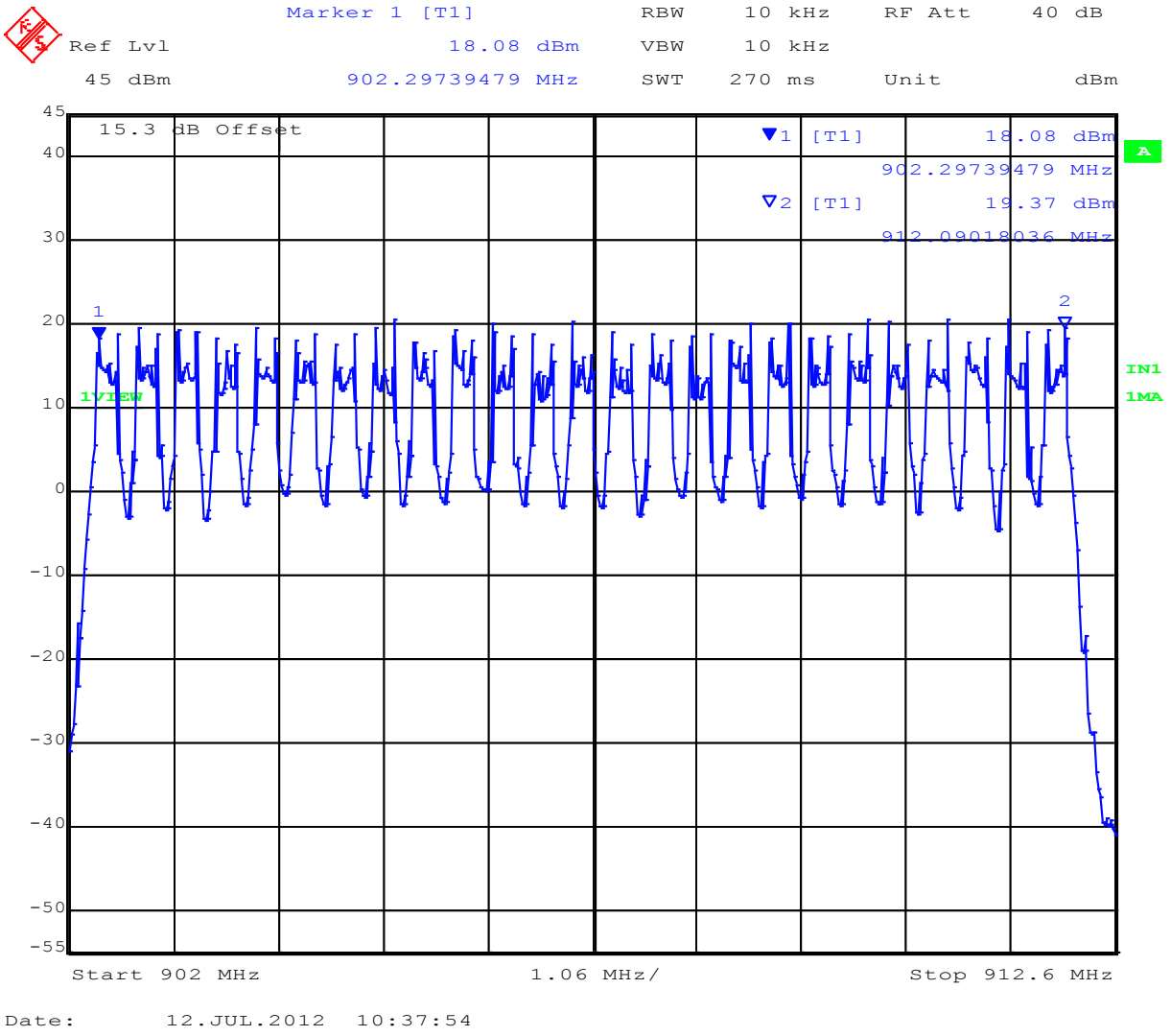


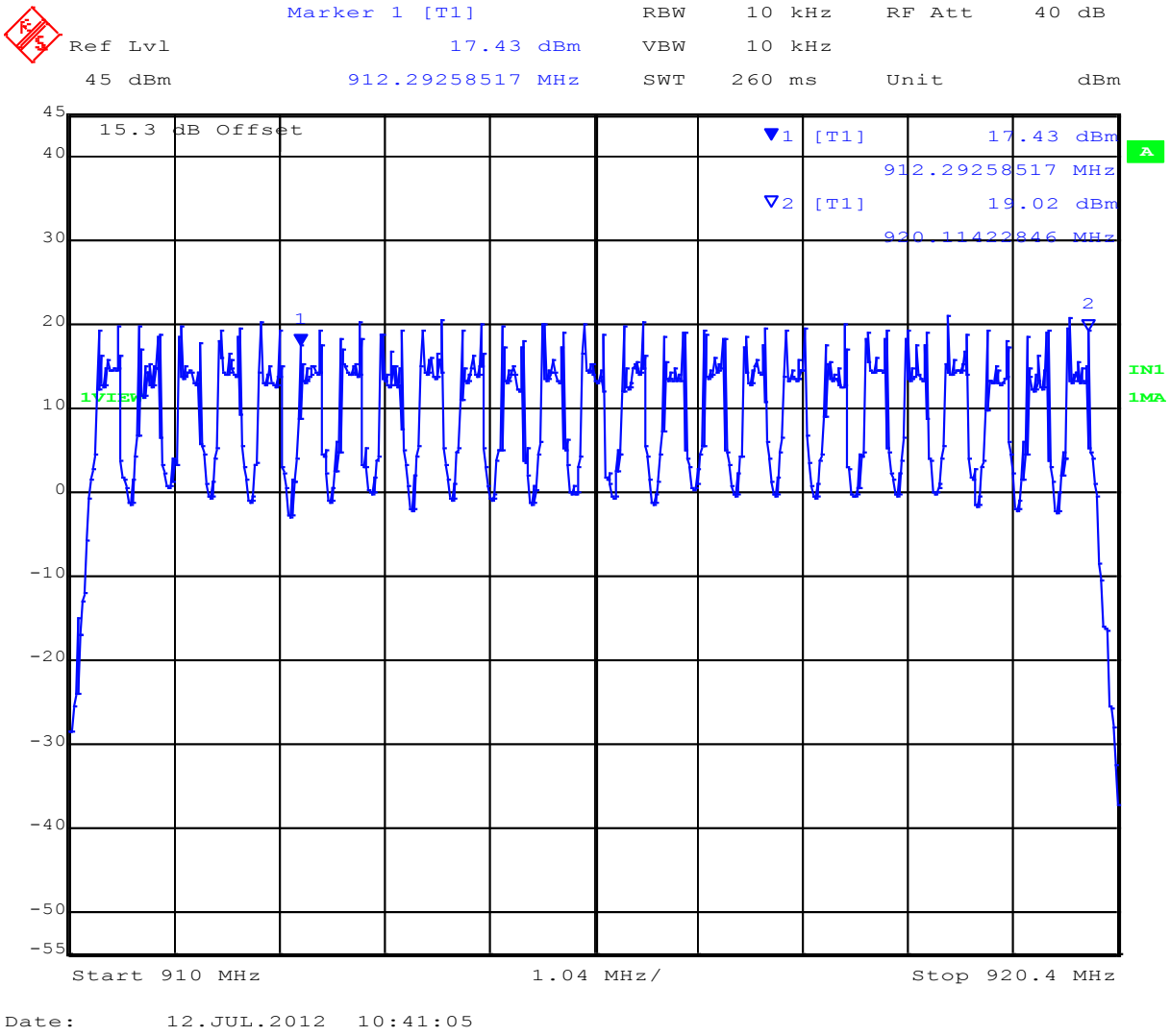
TABLE OF RESULTS – 200 kbps

Number of Channels	Specification
64	At least 25 hopping channels

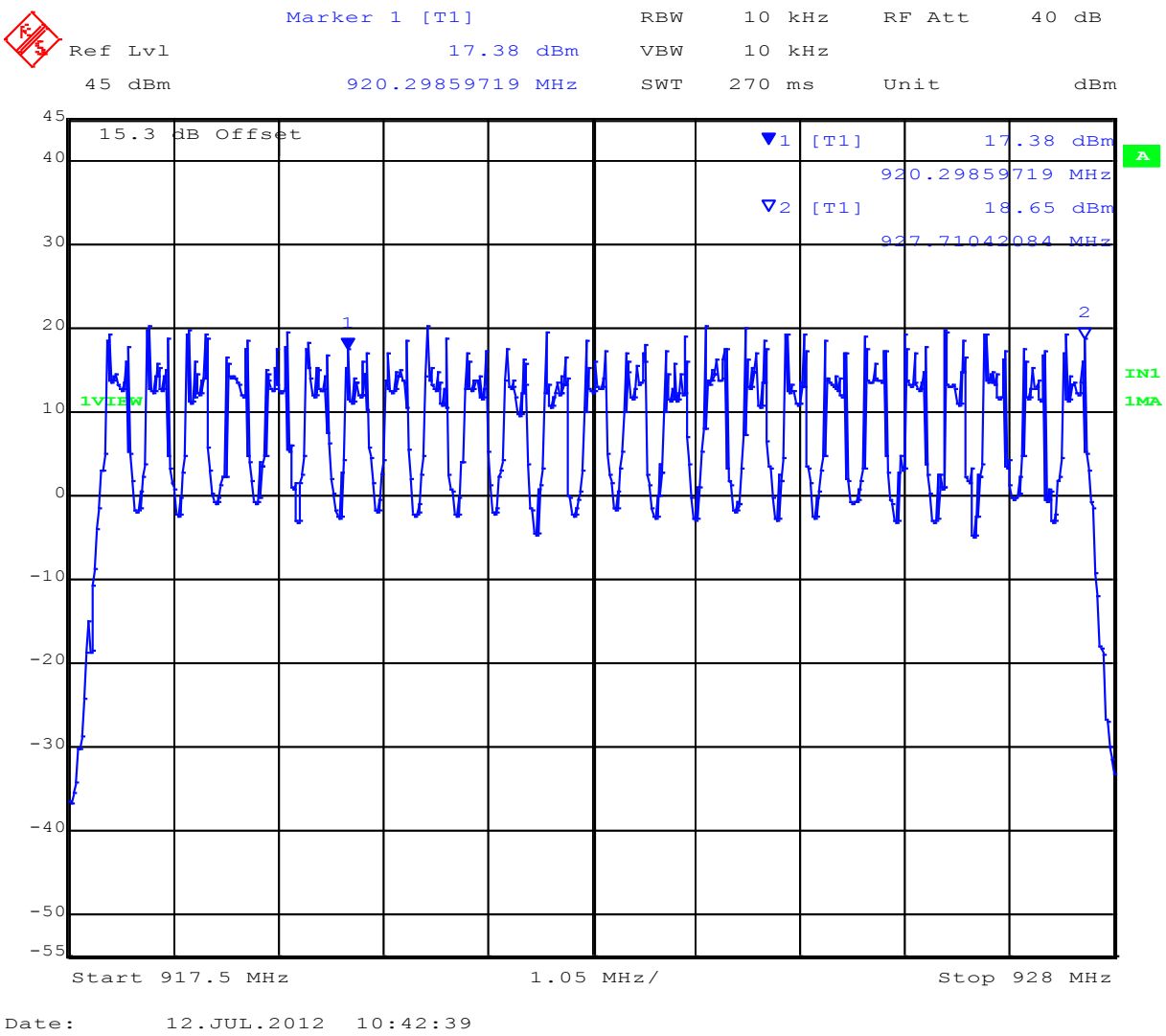
200 kbps Number of Transmission Channels – Low Band 902 – 912.6 MHz



200 kbps Number of Transmission Channels – Mid Band 910 – 920.4 MHz



200 kbps Number of Transmission Channels – Upper Band 917.5 – 928 MHz



5.1.3.2. Channel Occupancy

FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §A8.1

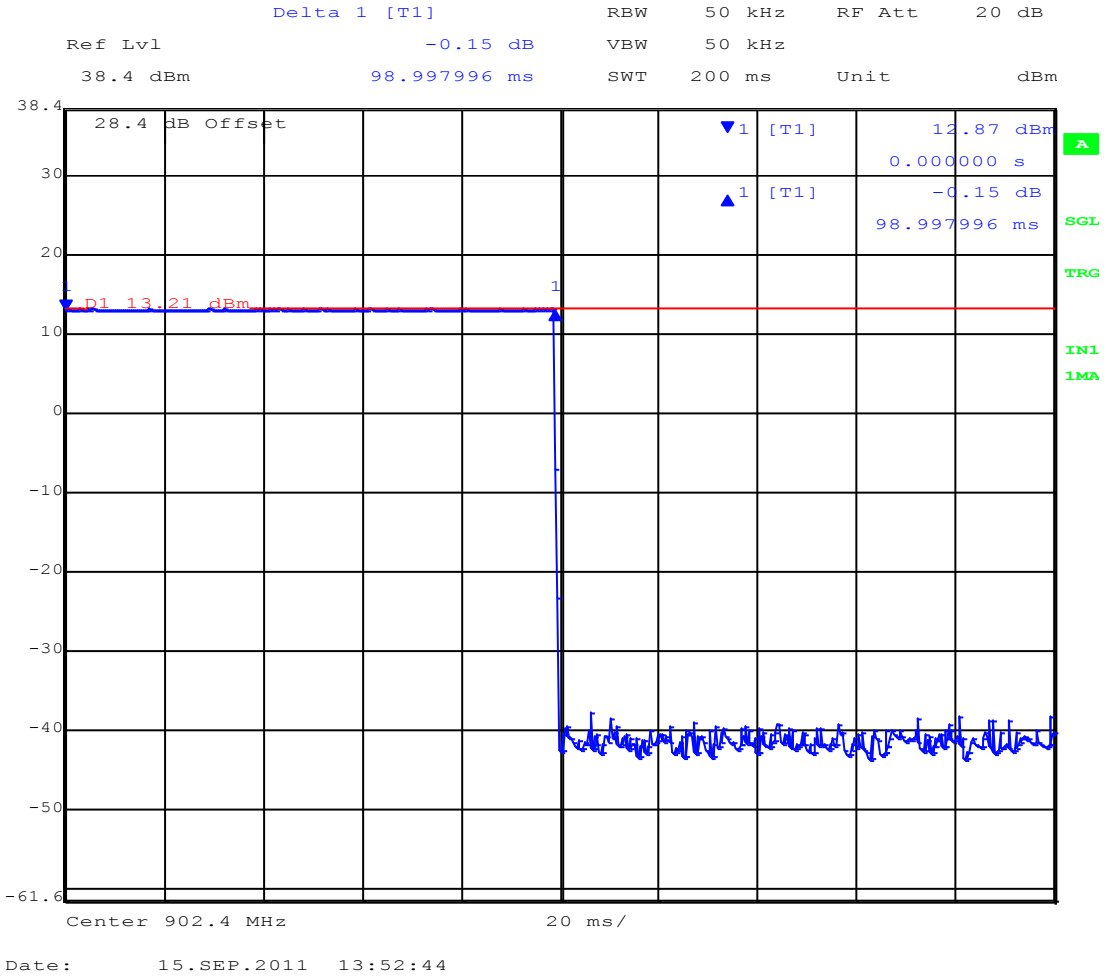
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Channel Dwell Time

TABLE OF RESULTS

Channel #	Center Frequency (MHz)	Channel Dwell Time (single channel) (mSecs)
0	**902.4**	98.997

Channel dwell time Ch 0 902.4 MHz

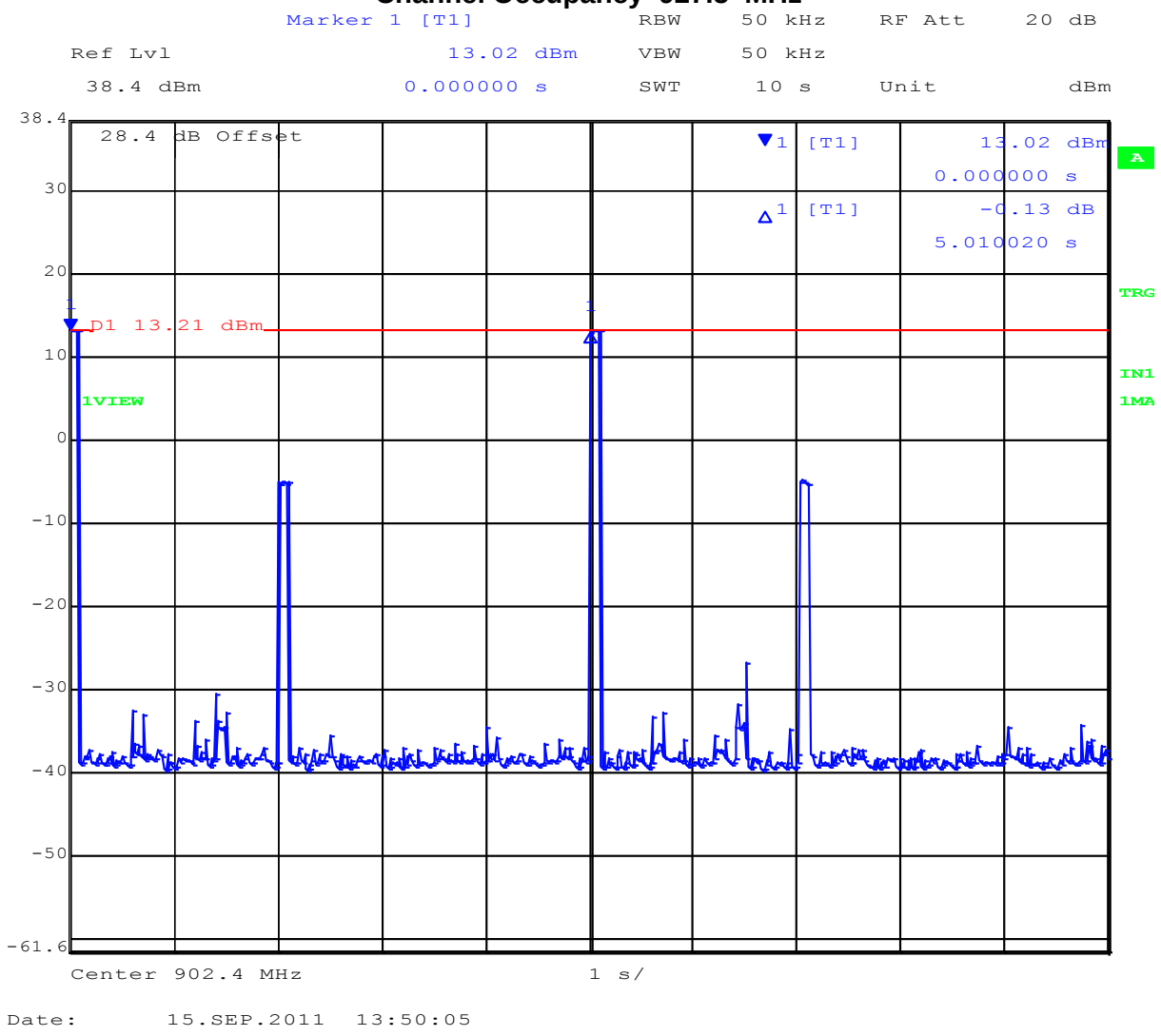


Channel Occupancy

TABLE OF RESULTS

Channel #	Center Frequency (MHz)	Channel Occupancy within 10 Second Period (Seconds)
0	902.4	5.01

Channel Occupancy 927.5 MHz



Specification for Number of Channels and Channel Occupancy

Limits

FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §A8.1

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.

Laboratory Uncertainty for Frequency Measurements

Measurement uncertainty	±0.86ppm

Traceability

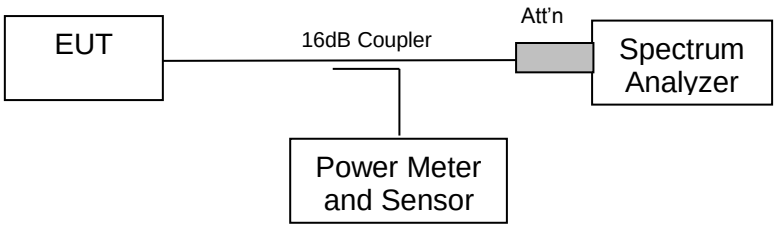
Method	Test Equipment Used
Measurements were made per work instruction WI-02 'Frequency Measurement"	0078, 0134, 0158, 0184, 0193, 0250, 0252 0310, 0312.

5.1.4. Output Power

FCC, Part 15 Subpart C §15.247(b)(2)
Industry Canada RSS-210 §A8.4

Test Procedure
The transmitter terminal of EUT was set for CW (continuous wave) operation and connected to the input of the power meter which was calibrated to measure power. The value of measured power including antenna cable loss was reported.

Test Measurement Set up



Measurement set up for Transmitter Output Power

Measurement Results for Output Power

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS

200 kBit/s

Equipment Configuration for Peak Output Power			
Variant:	200Kbit/s	**Duty Cycle (%):**	100
Data Rate:	200Kbit/s	**Antenna Gain (dBi):**	8.10
Modulation:	GMSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dBm	
902.4	24.23	--	--	--	24.23	27.90	-3.67	Max
915.2	24.56	--	--	--	24.56	27.90	-3.34	Max
927.6	24.76	--	--	--	24.76	27.90	-3.14	Max

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

10 kBit/s

Equipment Configuration for Peak Output Power			
Variant:	10Kbit/s	**Duty Cycle (%):**	100
Data Rate:	10Kbit/s	**Antenna Gain (dBi):**	8.10
Modulation:	FSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dBm	
902.4	24.11	--	--	--	24.11	27.90	-3.79	Max
915.2	24.17	--	--	--	24.17	27.90	-3.73	Max
927.6	24.22	--	--	--	24.22	27.90	-3.68	Max

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

Specification

Limits

FCC, Part 15 Subpart C §15.247 (b)(2) The maximum output power of the intentional radiator shall not exceed the following:
(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Industry Canada RSS-210 §A8.4
For frequency hopping systems operating in the 902 - 928 MHz band, the maximum peak conducted power output power is not to succeed 1.0 W if the hopset uses 50 or more hopping channels and 0.25 W if the hopset uses less than 50 hopping channels.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

5.1.5. Maximum Permissible Exposure

FCC, Part 15 Subpart C §15.247(i)
Industry Canada RSS-Gen §5.5

Calculations for Maximum Permissible Exposure Levels

Power Density = Pd (mW/cm^2) = EIRP/(4πd^2)

EIRP = P * G

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

Numeric Gain = 10 ^ (G (dBi)/10)

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm^2

Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm^2 Limit(cm)	Minimum Separation Distance (cm)
0	1	+25.99	397.2	5.62	20*
8.1	6.46	+25.99	397.2	14.29	20*
15.1	32.36	+20.90	123.03	17.8	20*

***Note:** for mobile or fixed location transmitters the minimum separation distance is 20cm, even if calculations indicate the MPE distance to be less.**

Specification

Maximum Permissible Exposure Limits

§15.247(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency levels in excess of the Commission's guidelines.

FCC §1.1310 Limit = 1mW / cm^2 from 1.310 Table 1

RSS-Gen §5.5 Before equipment certification is granted, the applicable requirements of RSS-102 shall be met.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

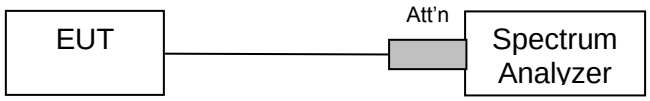
5.1.6. Conducted Spurious Emissions Transmitter

FCC, Part 15 Subpart C §15.247(d)
Industry Canada RSS-210 §A8.5

Test Procedure

Conducted emissions were measured at a limit of 20 dB below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Emissions at the band edge were measured and recorded. Measurements were made while EUT was operating in transmit mode of operation at the appropriate center frequency.

Test Measurement Set up



Band-edge measurement test configuration

Measurement Results of Conducted Spurious Emissions

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Conducted Band-Edge Results

200 KBit/s

Equipment Configuration for Conducted Low Band-Edge Emissions - Peak			
Variant:	200Kbit/s	**Duty Cycle (%):**	100
Data Rate:	200kbp/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	GMSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	902.4 MHz					
Band-Edge Frequency:	902.0 MHz					
Test Frequency Range:	890.0 - 903.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Amended Limit**		**Margin**
	M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-27.79	1.61	902.20			-0.200

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

Equipment Configuration for Conducted High Band-Edge Emissions - Peak			
Variant:	200KBits	**Duty Cycle (%):**	100
Data Rate:	200kbp/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	GMSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	927.6 MHz					
Band-Edge Frequency:	928.0 MHz					
Test Frequency Range:	927.0 - 940.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Amended Limit**		**Margin**
	M3 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-30.04	1.47	927.80			-0.200

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

Equipment Configuration for Transmitter Conducted Spurious Emissions			
Variant:	200Kbit/s	**Duty Cycle (%):**	100
Data Rate:	200kbp/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	GMSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

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
902.4	30.0 - 10000.0	-3.217	5.47	--	--	--	--	--	--
915.2	30.0 - 10000.0	-2.709	6.01	--	--	--	--	--	--
927.6	30.0 - 10000.0	-2.432	6.02	--	--	--	--	--	--

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

10 KBit/s

Equipment Configuration for Conducted Low Band-Edge Emissions - Peak			
Variant:	10Kbit/s	**Duty Cycle (%):**	100
Data Rate:	10kbp/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	FSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	902.4 MHz					
Band-Edge Frequency:	902.0 MHz					
Test Frequency Range:	890.0 - 903.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Amended Limit**		**Margin**
	M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-29.28	5.47	902.20	--	--	-0.200

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

Equipment Configuration for Conducted High Band-Edge Emissions - Peak			
Variant:	FSK 200Kbit/s	**Duty Cycle (%):**	100
Data Rate:	200kbp/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	FSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Channel Frequency:	927.6 MHz					
Band-Edge Frequency:	928.0 MHz					
Test Frequency Range:	926.0 - 940.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Amended Limit**		**Margin**
	M3 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-31.08	5.83	927.80	--	--	-0.200

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

Equipment Configuration for Transmitter Conducted Spurious Emissions			
Variant:	10Kbit/s	**Duty Cycle (%):**	100
Data Rate:	10kbp/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	FSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

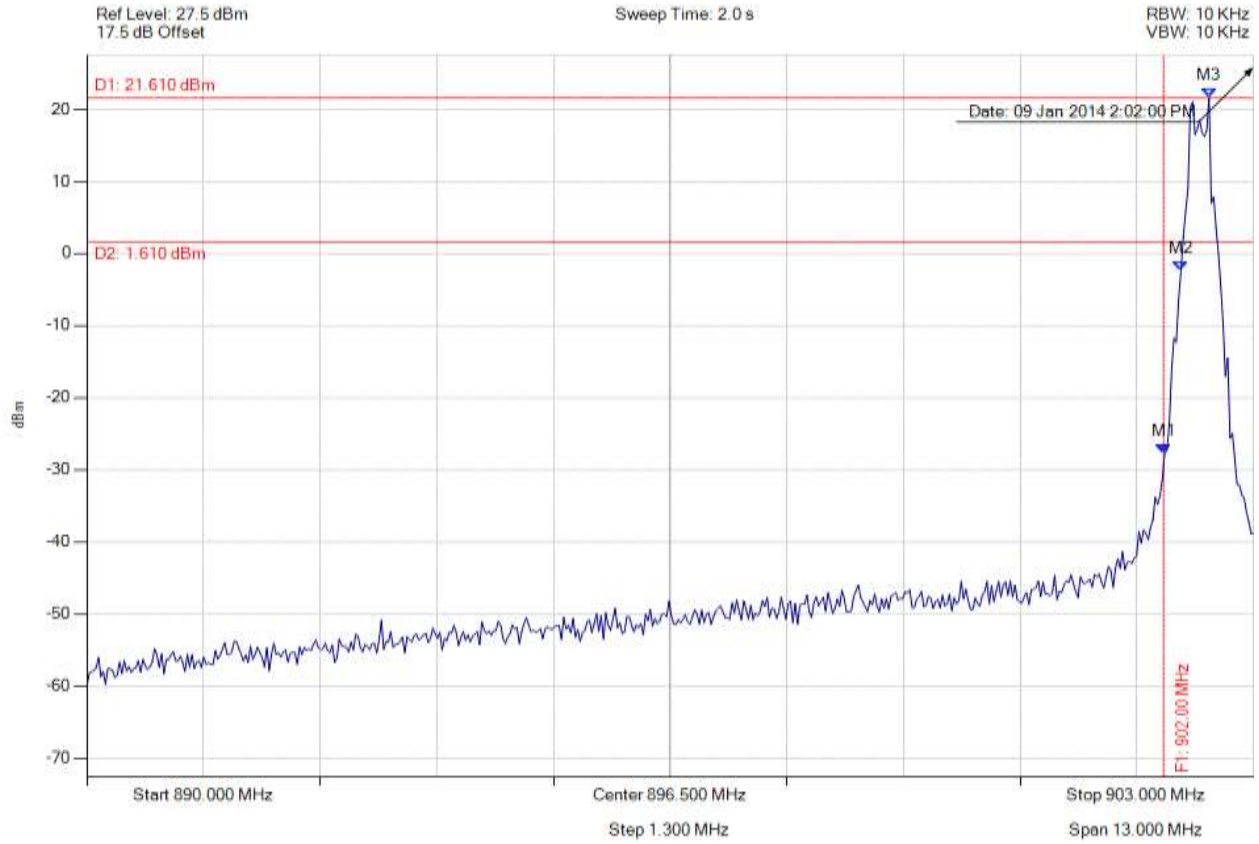
Test Measurement Results

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
902.4	30.0 - 10000.0	-3.412	5.63	--	--	--	--	--	--
915.2	30.0 - 10000.0	-2.932	5.82	--	--	--	--	--	--
927.6	30.0 - 10000.0	-2.603	5.01	--	--	--	--	--	--

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

CONDUCTED LOW BAND-EDGE EMISSION - PEAK

Variant: GMSK 200KB, Channel: 902.40 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc

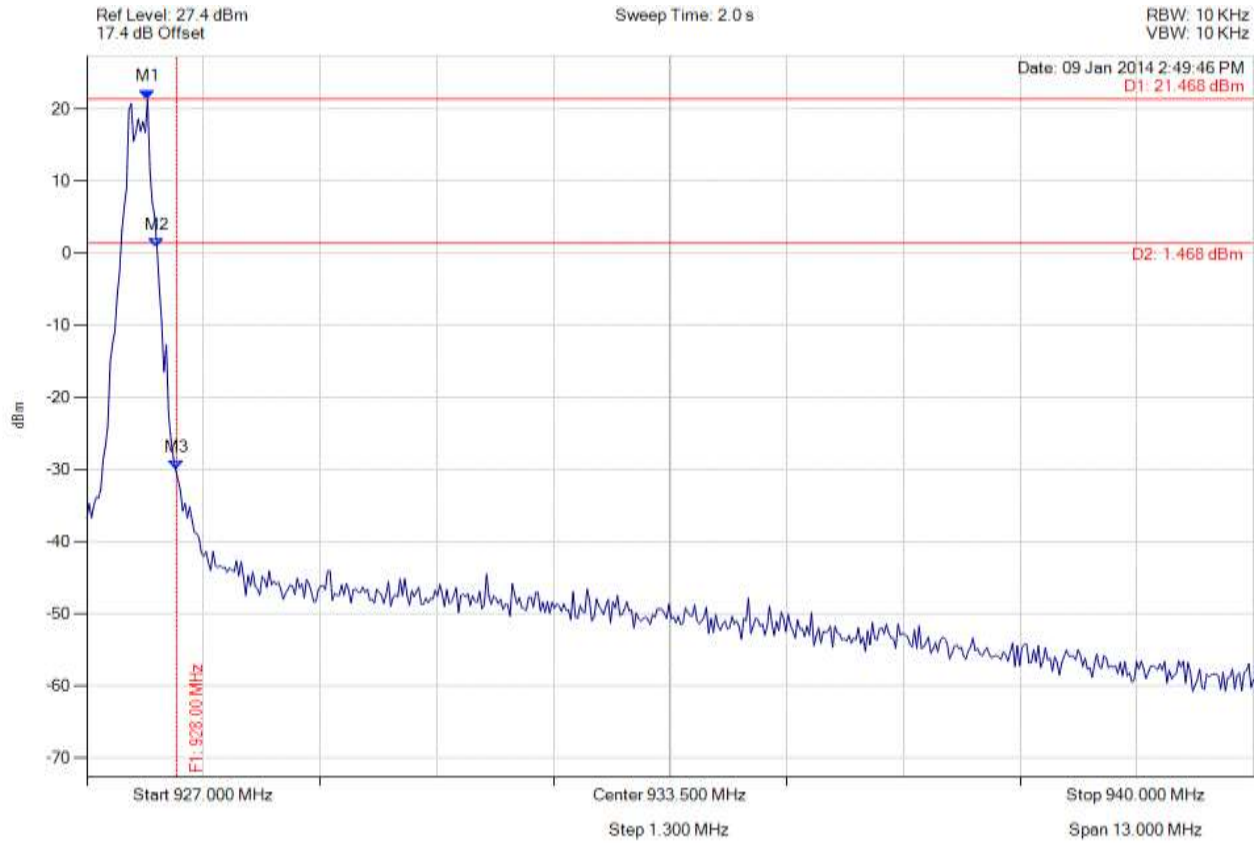


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 902.000 MHz : -27.791 dBm M2 : 902.192 MHz : -2.406 dBm M3 : 902.505 MHz : 21.610 dBm	Channel Frequency: 902.40 MHz

Back to the Matrix

CONDUCTED HIGH BAND-EDGE EMISSION - PEAK

Variant: GMSK 200KB, Channel: 927.60 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc

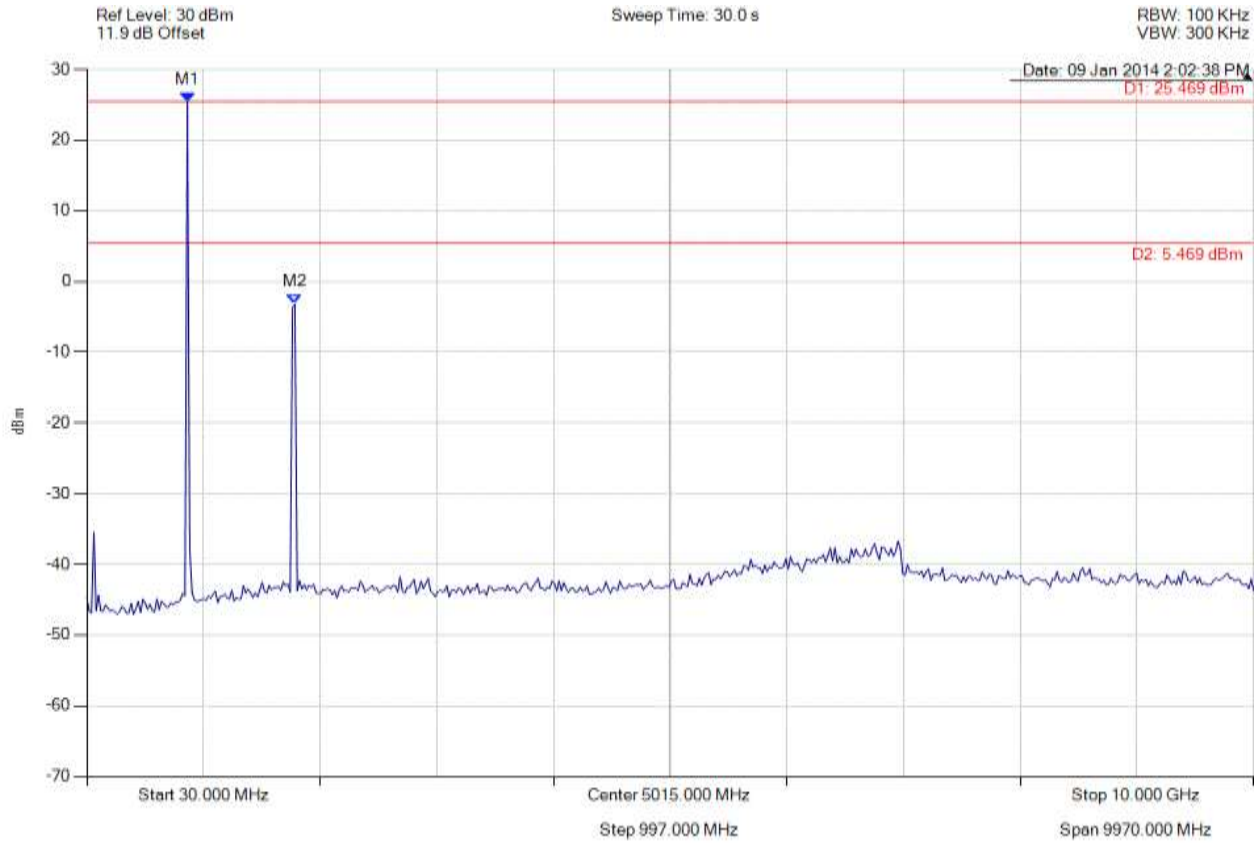


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 927.677 MHz : 21.468 dBm M2 : 927.782 MHz : 0.880 dBm M3 : 928.000 MHz : -30.037 dBm	Channel Frequency: 927.60 MHz

Back to the Matrix

CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: GMSK 200KB, Channel: 902.40 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = VIEW	M1 : 889.138 MHz : 25.469 dBm M2 : 1808.216 MHz : -3.217 dBm	Limit: 5.47 dBm Margin: -8.69 dB

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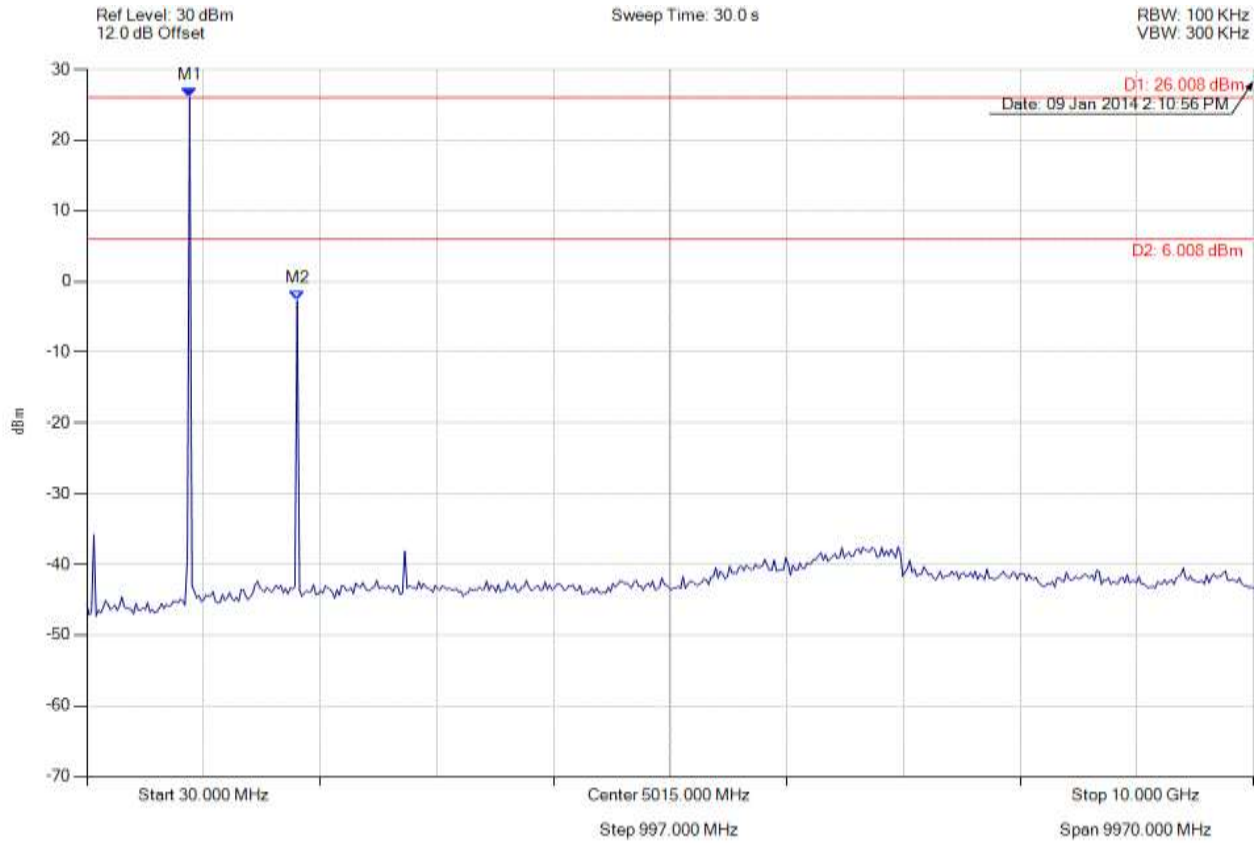
CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: GMSK 200KB, Channel: 915.20 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc

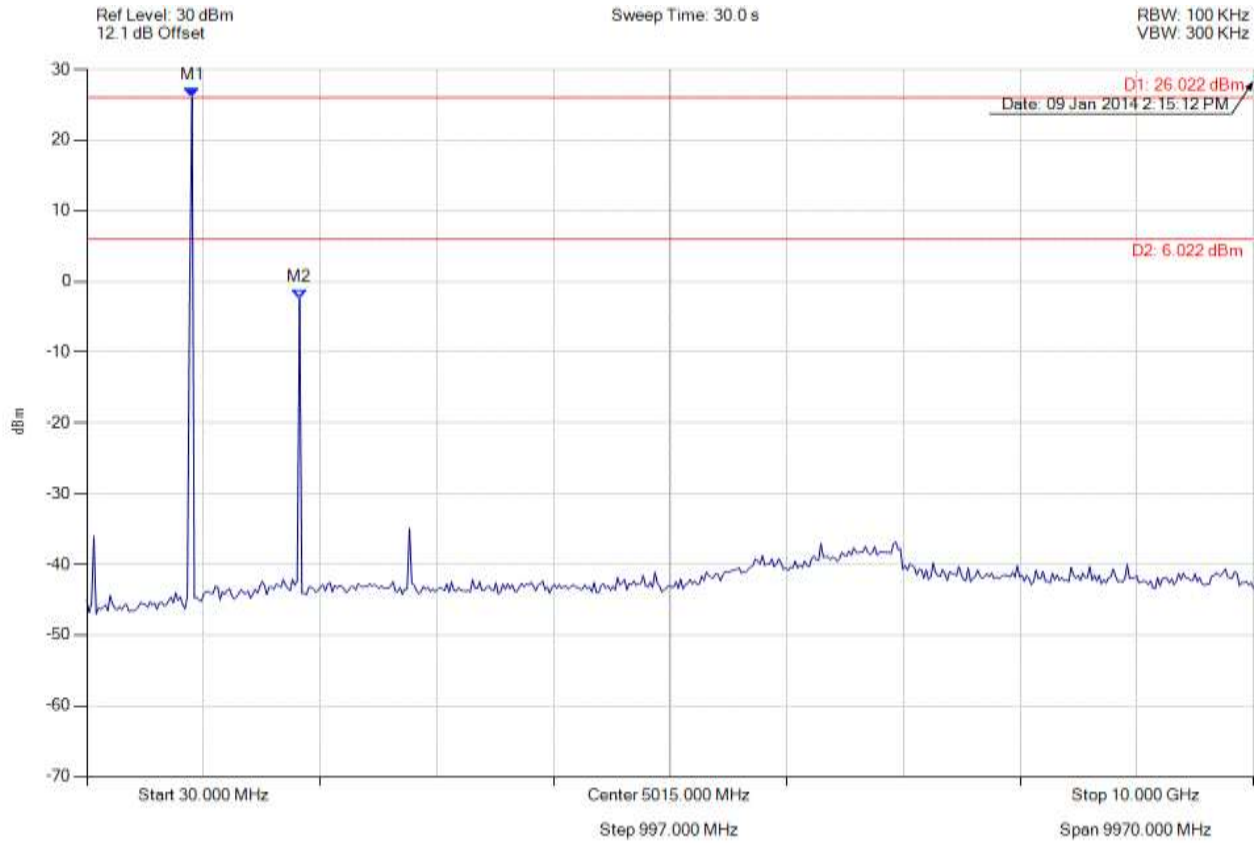


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = VIEW	M1 : 909.118 MHz : 26.008 dBm M2 : 1828.196 MHz : -2.709 dBm	Limit: 6.01 dBm Margin: -8.72 dB

Back to the Matrix

CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: GMSK 200KB, Channel: 927.60 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 30 Trace Mode = VIEW	M1 : 929.098 MHz : 26.022 dBm M2 : 1848.176 MHz : -2.432 dBm	Limit: 6.02 dBm Margin: -8.45 dB

BACK TO THE MATRIX

200 KBit/s Hopping Band-Edge

Equipment Configuration for Conducted Low Band-Edge Emissions - Peak			
Variant:	200Kbit/s HOP	**Duty Cycle (%):**	Hoping Mode
Data Rate:	200Kbit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	GMSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	Frequency hopping mode enabled		

Test Measurement Results

Channel Frequency:	902.4 MHz					
Band-Edge Frequency:	902.0 MHz					
Test Frequency Range:	890.0 - 903.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Amended Limit**		**Margin**
	M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-49.78	-19.31	902.20			-0.200

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

Equipment Configuration for Conducted High Band-Edge Emissions - Peak			
Variant:	200Kbit/s HOP	**Duty Cycle (%):**	Hoping Mode
Data Rate:	200Kbit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	GMSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	Frequency hopping mode enabled		

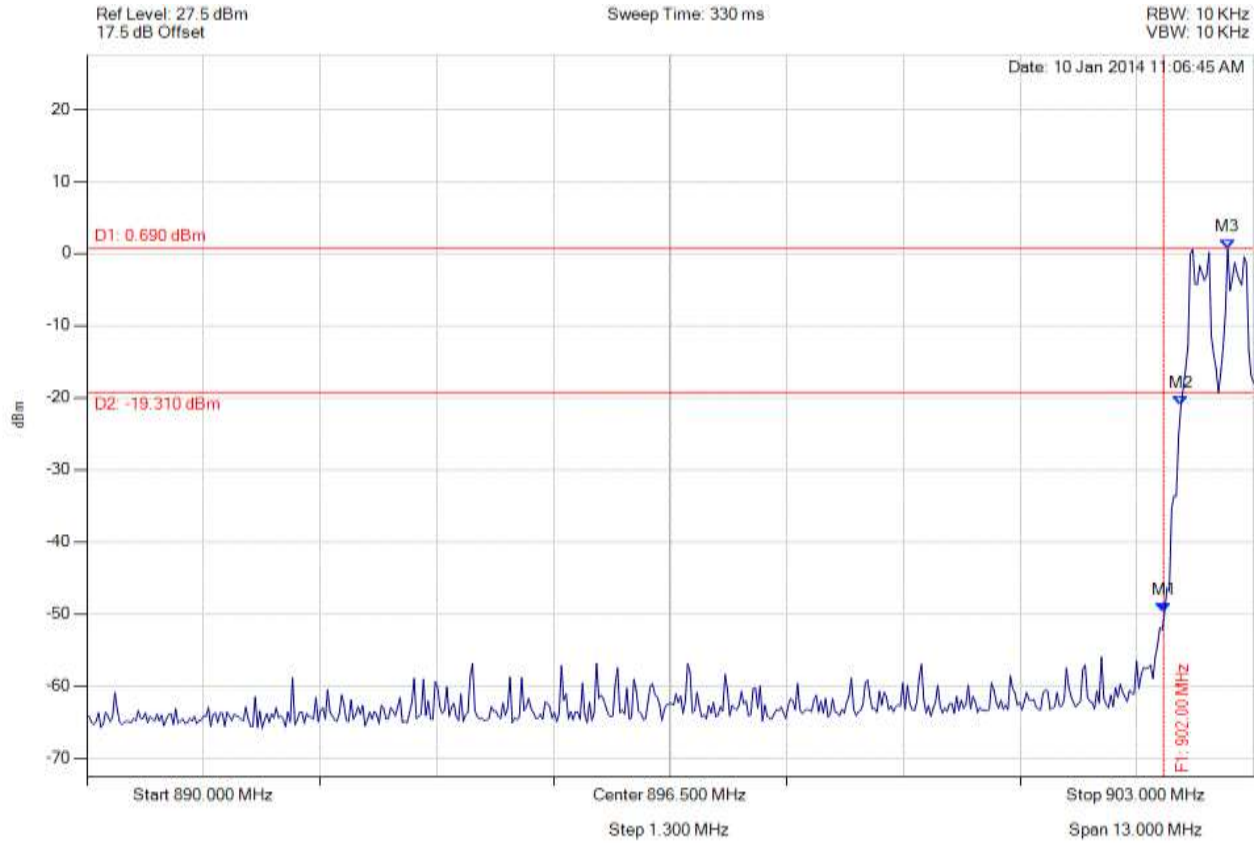
Test Measurement Results

Channel Frequency:	927.6 MHz					
Band-Edge Frequency:	928.0 MHz					
Test Frequency Range:	926.7 - 940.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Amended Limit**		**Margin**
	M3 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-50.62	-18.20	927.80			-0.200

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

CONDUCTED LOW BAND-EDGE EMISSION - PEAK

Variant: GMSK 200KB HOP, Channel: 902.40 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc

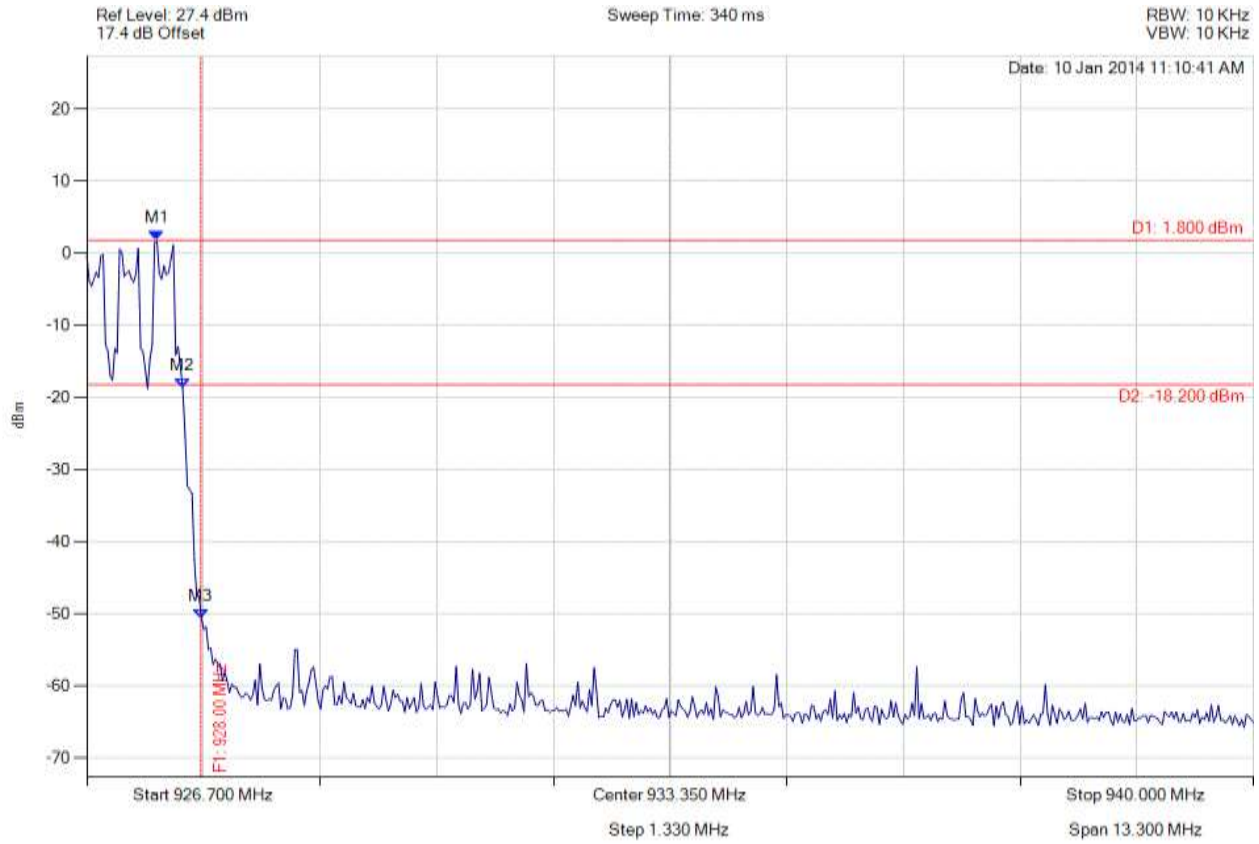


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 902.000 MHz : -49.776 dBm M2 : 902.192 MHz : -21.086 dBm M3 : 902.713 MHz : 0.693 dBm	Channel Frequency: 902.40 MHz

Back to the Matrix

CONDUCTED HIGH BAND-EDGE EMISSION - PEAK

Variant: GMSK 200KB HOP, Channel: 927.60 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 927.500 MHz : 1.797 dBm M2 : 927.793 MHz : -18.691 dBm M3 : 928.000 MHz : -50.623 dBm	Channel Frequency: 927.60 MHz

Back to the Matrix

10 KBit/s Hopping Band-Edge

Equipment Configuration for Conducted Low Band-Edge Emissions - Peak			
Variant:	10Kbit/s HOP	**Duty Cycle (%):**	Hoping Mode
Data Rate:	10 kBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	FSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	Frequency hopping mode enabled		

Test Measurement Results

Channel Frequency:	902.4 MHz					
Band-Edge Frequency:	902.0 MHz					
Test Frequency Range:	890.0 - 903.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Amended Limit**		**Margin**
	M1 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-52.27	-15.33	902.20			-0.200

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

Equipment Configuration for Conducted High Band-Edge Emissions - Peak			
Variant:	10 kBit/s HOP	**Duty Cycle (%):**	Hoping Mode
Data Rate:	10 kBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	FSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:	Frequency hopping mode enabled		

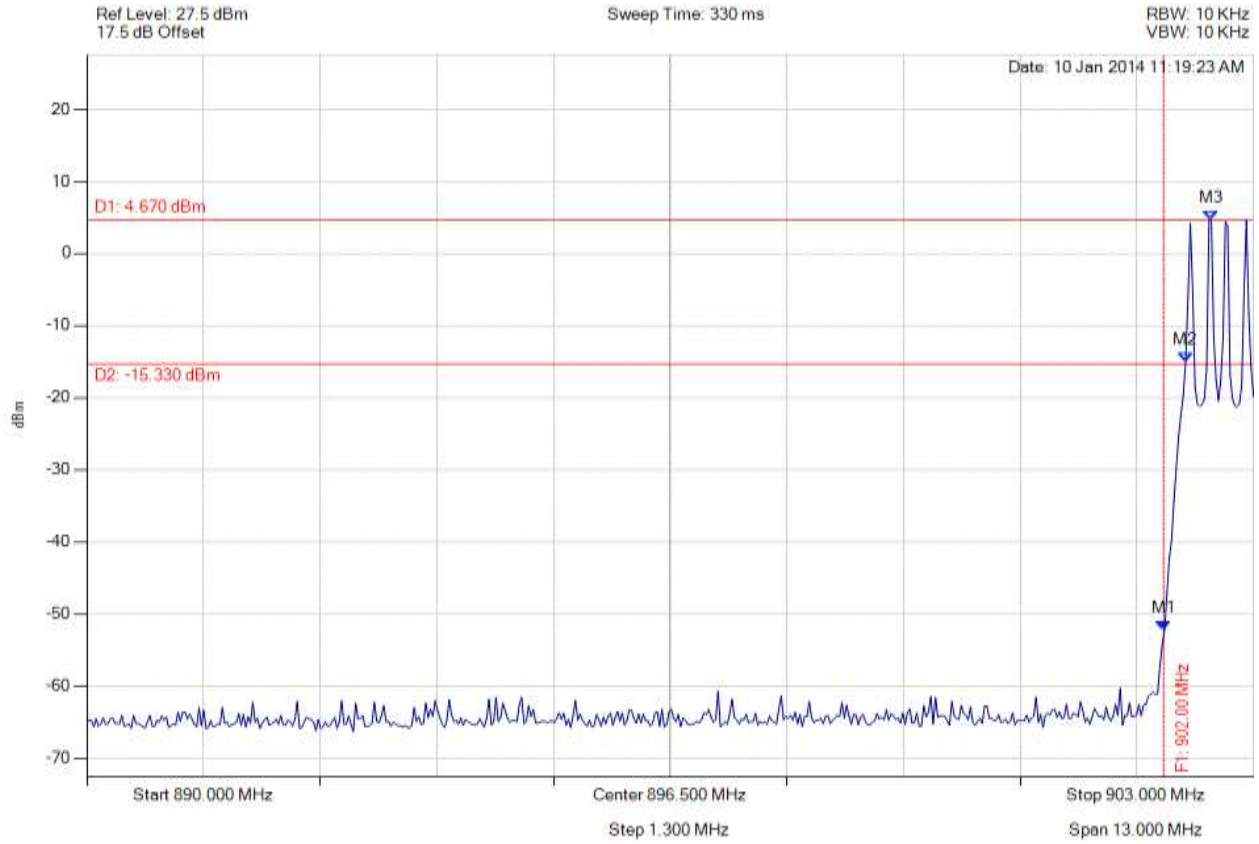
Test Measurement Results

Channel Frequency:	927.6 MHz					
Band-Edge Frequency:	928.0 MHz					
Test Frequency Range:	926.7 - 940.0 MHz					
Port(s)	**Band-Edge Markers and Limit**			**Amended Limit**		**Margin**
	M3 Amplitude (dBm)	**Plot Limit (dBm)**	**M2 Frequency (MHz)**	**Amplitude (dBm)**	**M2A Frequency (MHz)**	**(MHz)**
a	-52.34	-14.11	927.80			-0.200

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

CONDUCTED LOW BAND-EDGE EMISSION - PEAK

Variant: FSK 10KB HOP, Channel: 902.40 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc

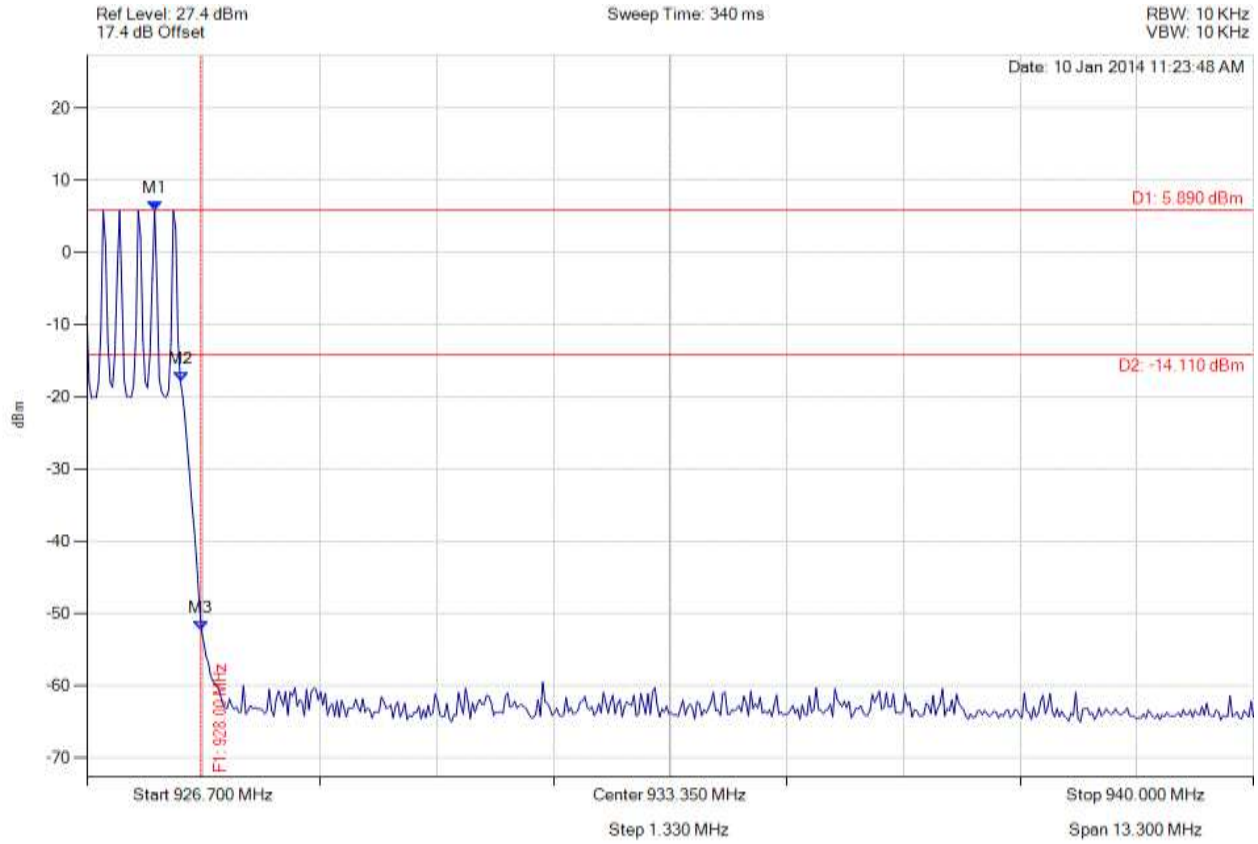


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 902.000 MHz : -52.270 dBm M2 : 902.244 MHz : -15.015 dBm M3 : 902.531 MHz : 4.673 dBm	Channel Frequency: 902.40 MHz

Back to the Matrix

CONDUCTED HIGH BAND-EDGE EMISSION - PEAK

Variant: FSK 10KB HOP, Channel: 927.60 MHz, Chain a, Temp: Ambient, Voltage: 3.3 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 927.473 MHz : 5.893 dBm M2 : 927.779 MHz : -17.741 dBm M3 : 928.000 MHz : -52.335 dBm	Channel Frequency: 927.60 MHz

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Specification

Limits Band-Edge

Lower Limit Band-edge	Upper Limit Band-edge	Limit below highest level of desired power
902 MHz	928 MHz	≥ 20 dB

FCC, Part 15 Subpart C §15.247(d)

Industry Canada RSS-210 §A.5

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.

Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty	±2.37 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0287, 0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117.

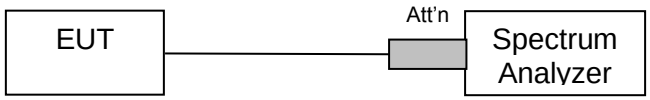
5.1.7. Conducted Receiver Spurious Emissions

Industry Canada RSS-Gen §7.2.3

Test Procedure

Conducted Stand-By emissions were measured on the device on the mid channel. The EUT was placed in Stand-By mode and emissions were measured 30 MHz – 7 GHz.

Test Measurement Set up



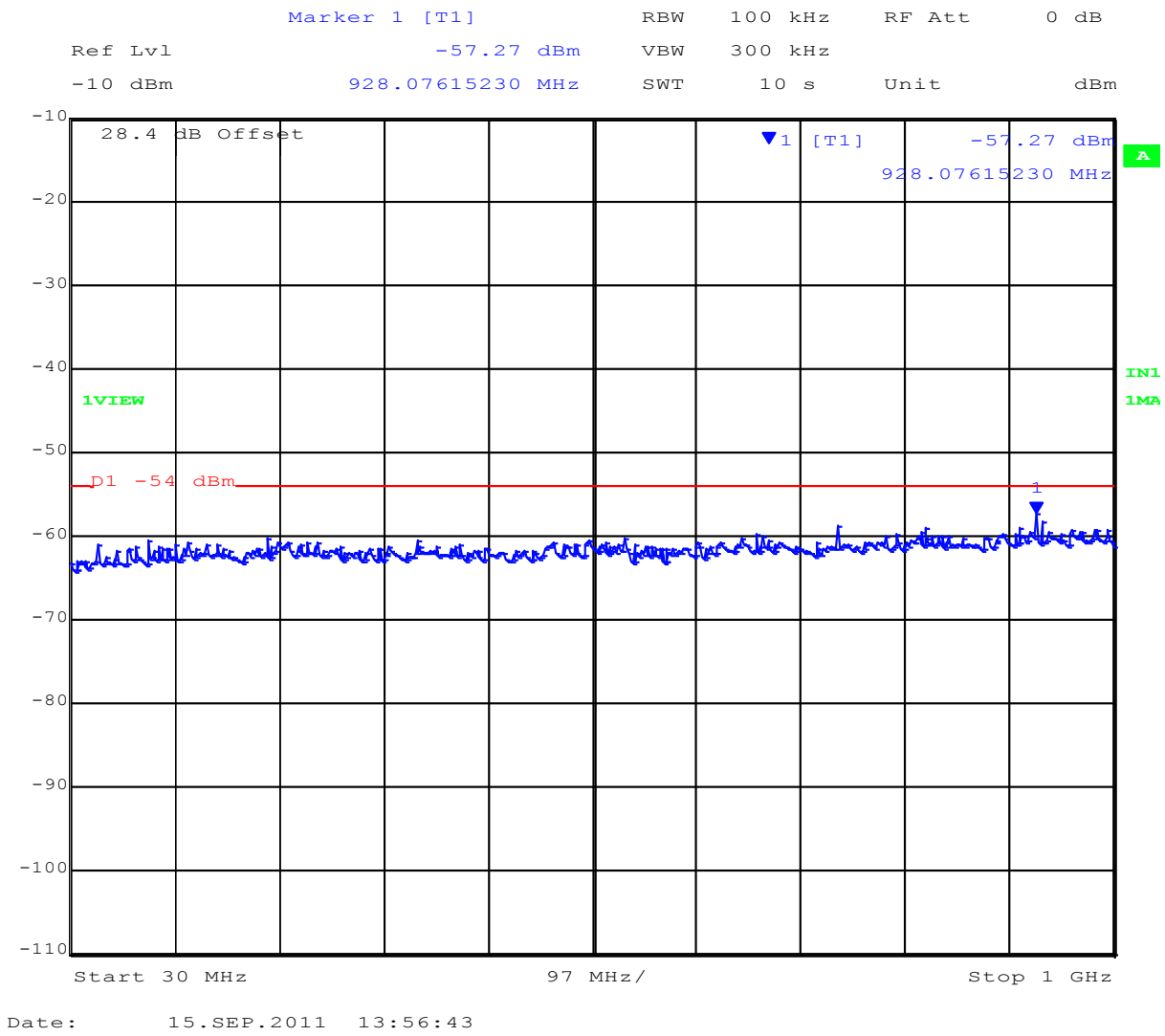
Stand-By spurious emissions test configuration

Measurement Results of Stand –By Spurious Emissions

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

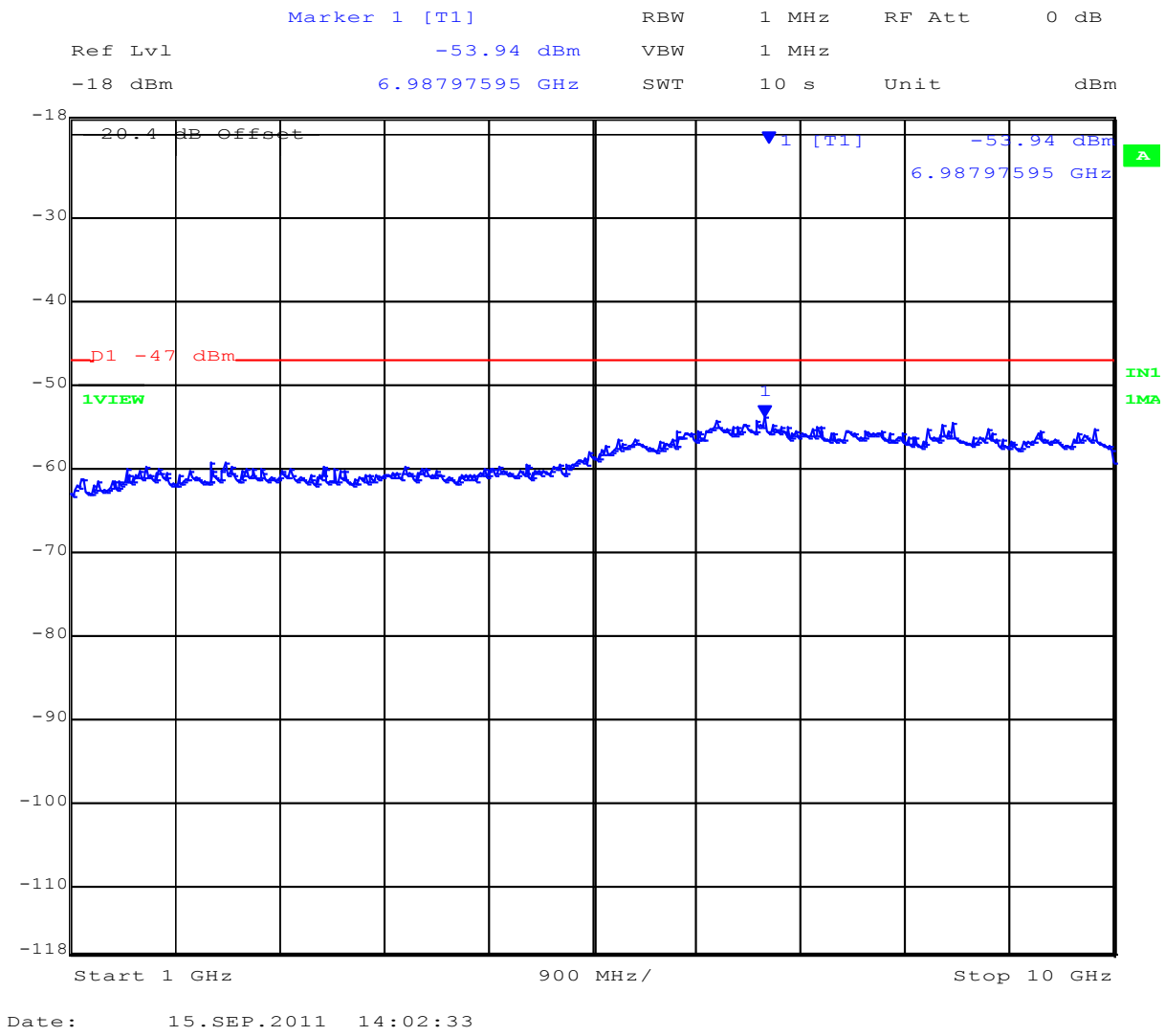
Receiver Conducted Spurious Emissions 0.03 – 10 GHz

902.4 MHz Receiver Conducted Emissions 30 MHz – 1 GHz



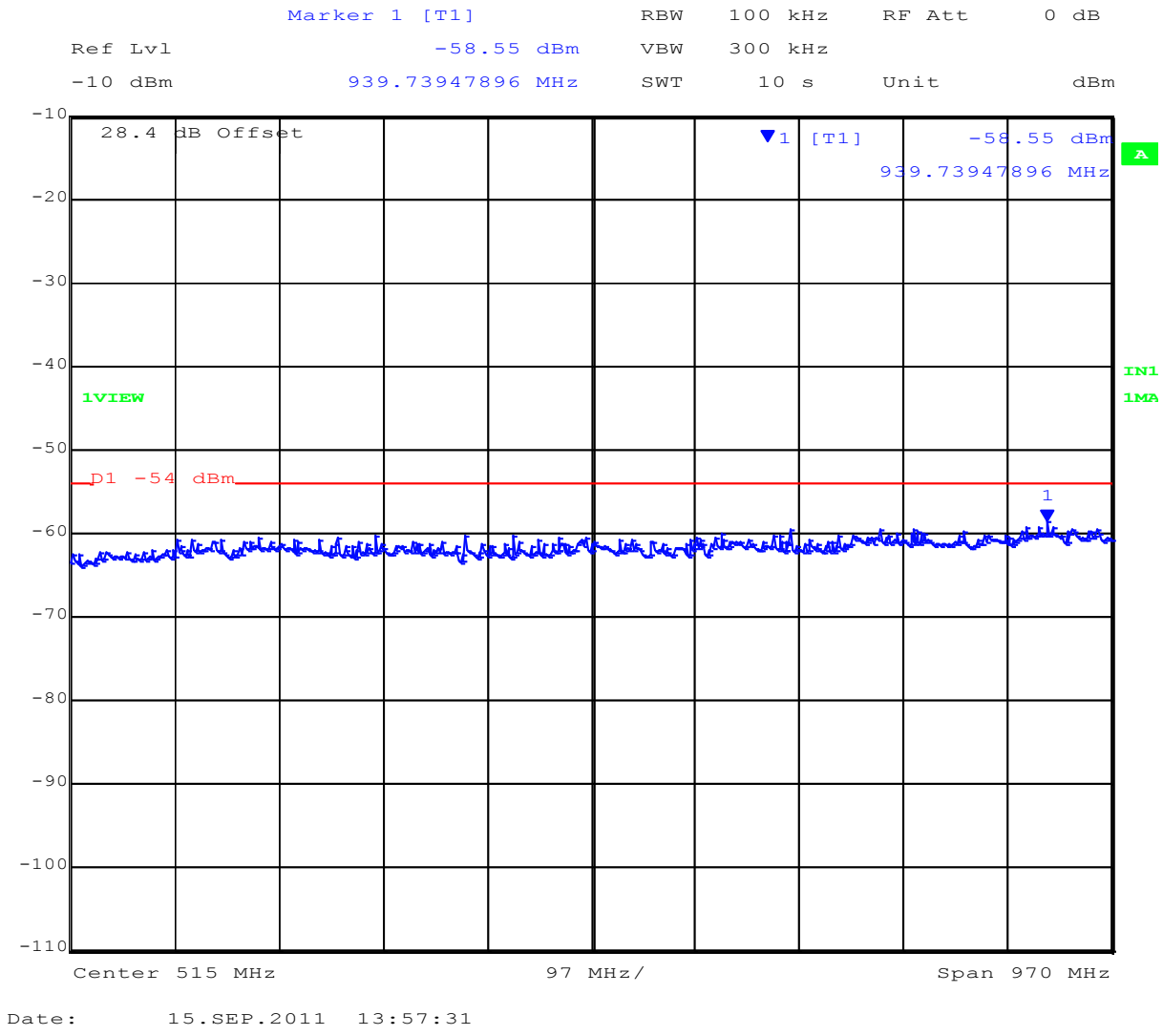
No emissions were observed breaking the limit.

902.4 MHz Receiver Conducted Emissions 1 – 10 GHz



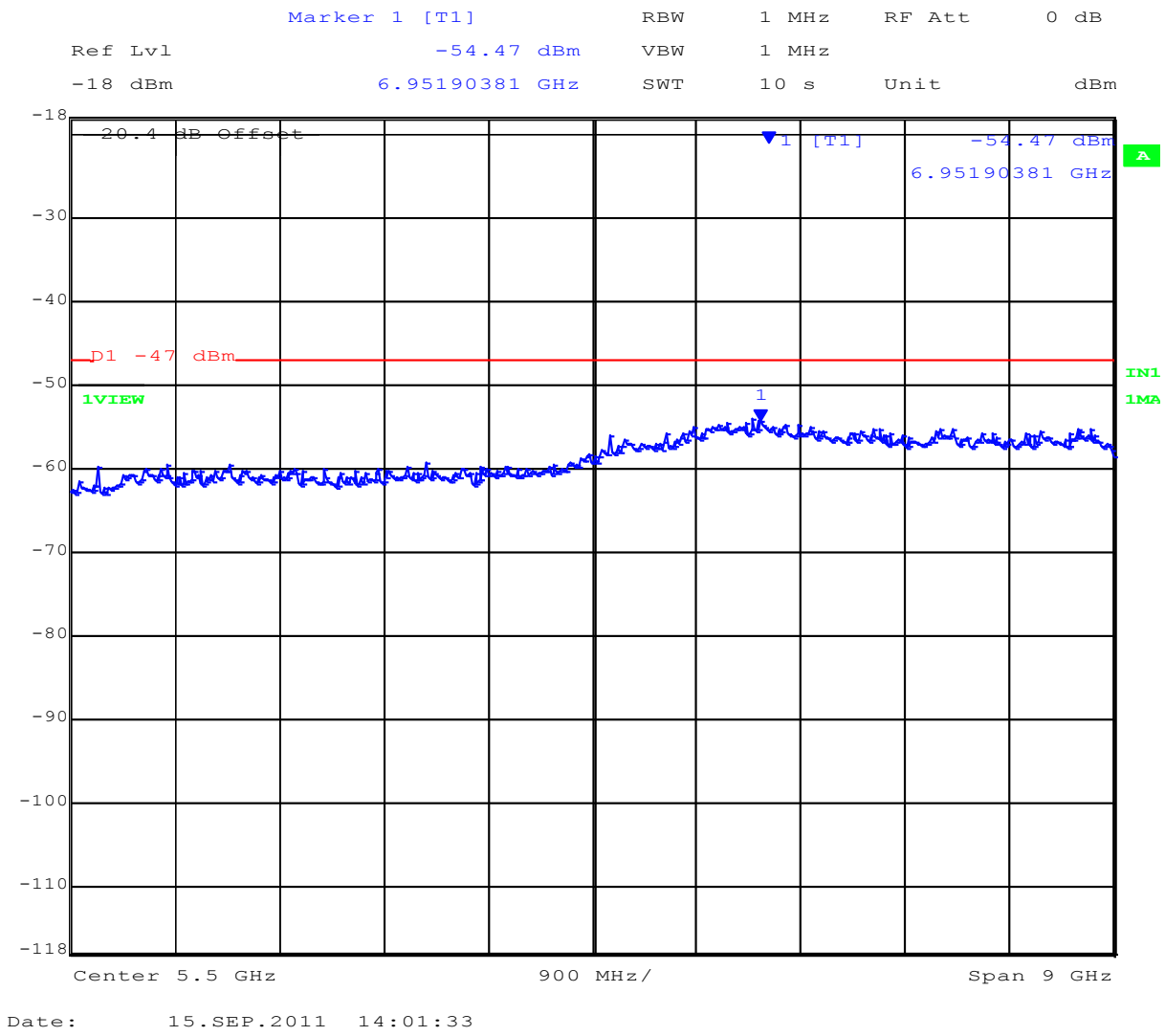
No emissions were observed breaking the limit.

915 MHz Receiver Conducted Emissions 30 MHz – 1 GHz



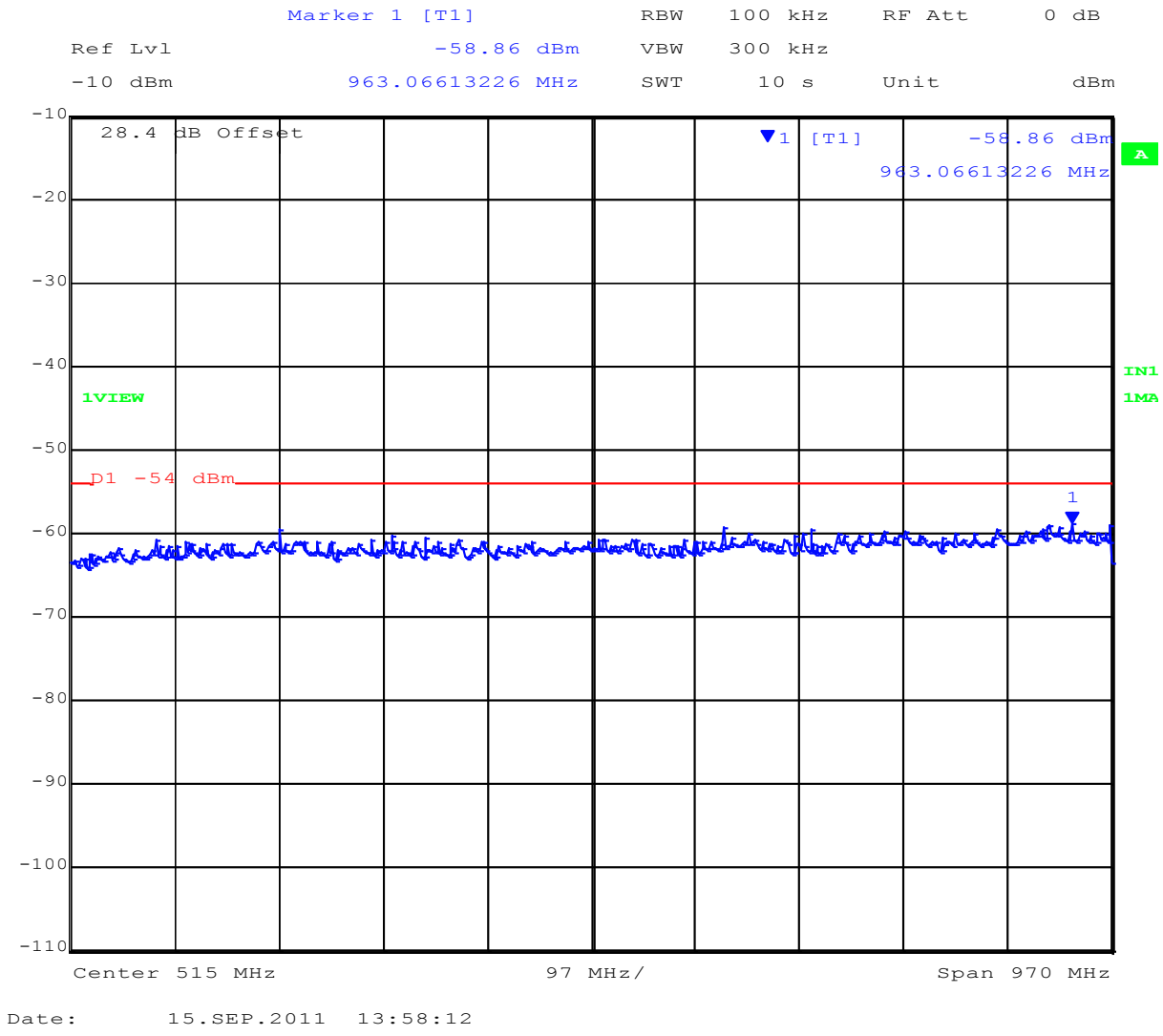
No emissions were observed breaking the limit.

915 MHz Receiver Conducted Emissions 1 – 10 GHz



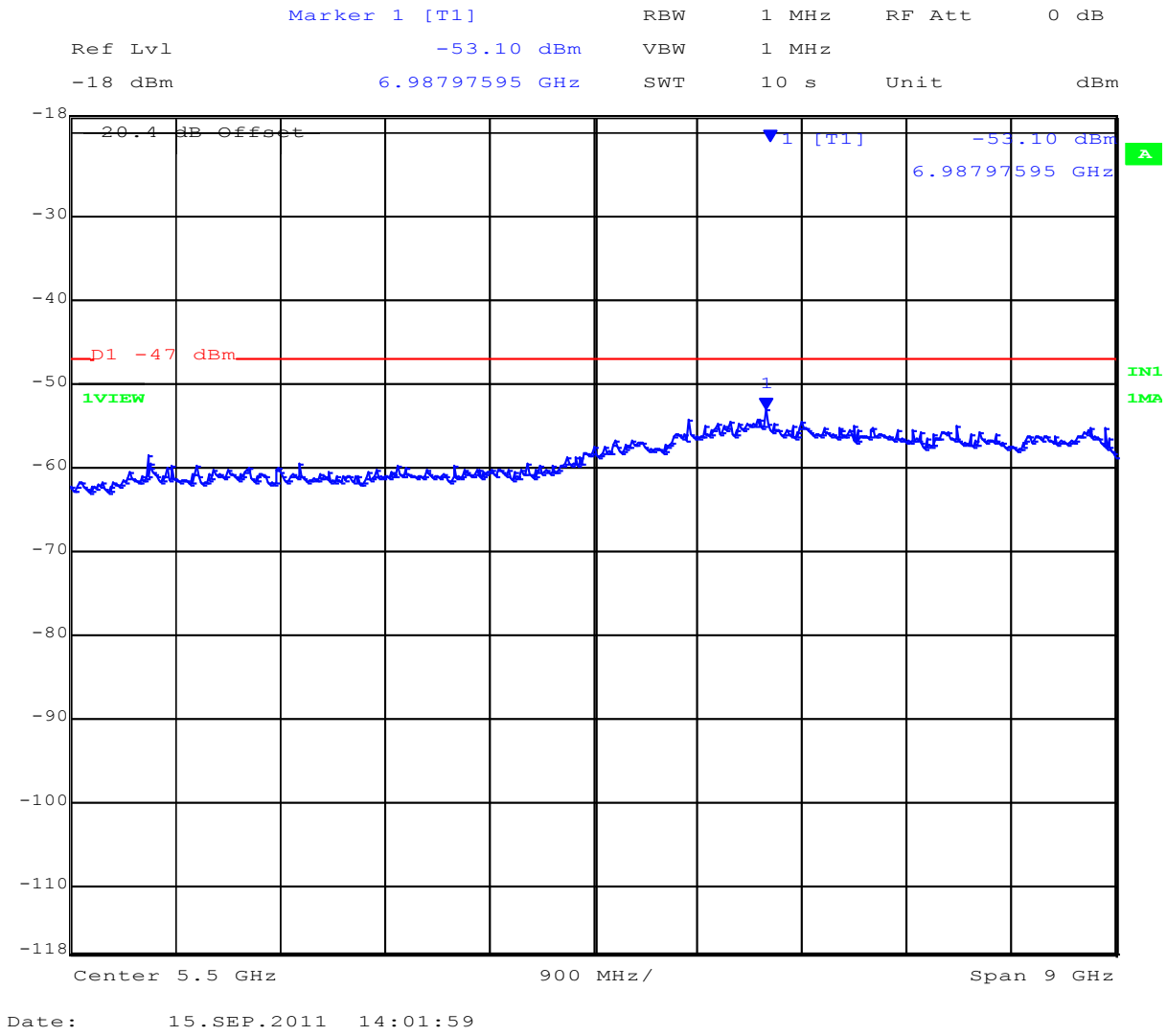
No emissions were observed breaking the limit.

927.5 MHz Receiver Conducted Emissions 30 MHz – 1 GHz



No emissions were observed breaking the limit.

927.5 MHz Receiver Conducted Emissions 1 – 10 GHz



No emissions were observed breaking the limit.

Specification
Antenna Conducted Measurement
Industry Canada RSS-Gen §7.2.3

If the device has a detachable antenna of known antenna impedance, then the antenna conducted method is permitted in lieu of a radiated measurement.
Receiver spurious emissions at any discrete frequency shall not exceed 2 nanowatts (-57 dBm) in the band 30-1000 MHz, or 5 nanowatts (-53 dBm) above 1 GHz.

Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty	±2.37 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0287, 0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117.

5.1.8. Radiated Emissions

FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209
Industry Canada RSS-210 §A8.5, §2.2, §2.6
Industry Canada RSS-Gen §4.7

Test Procedure

Radiated emissions 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.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

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

For example:
Given receiver input reading of 51.5 dBμV; 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 of the measured emission is:

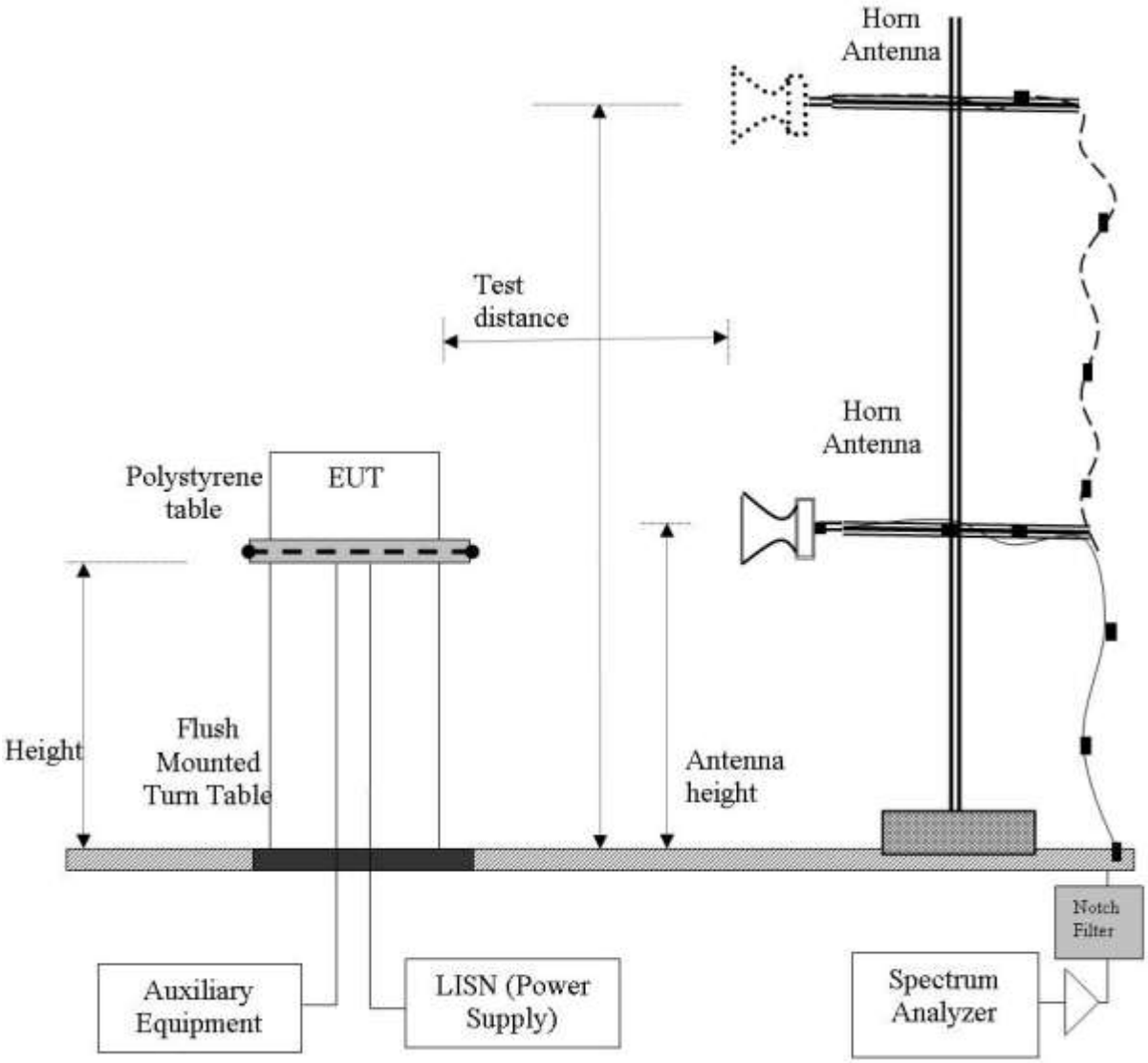
FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

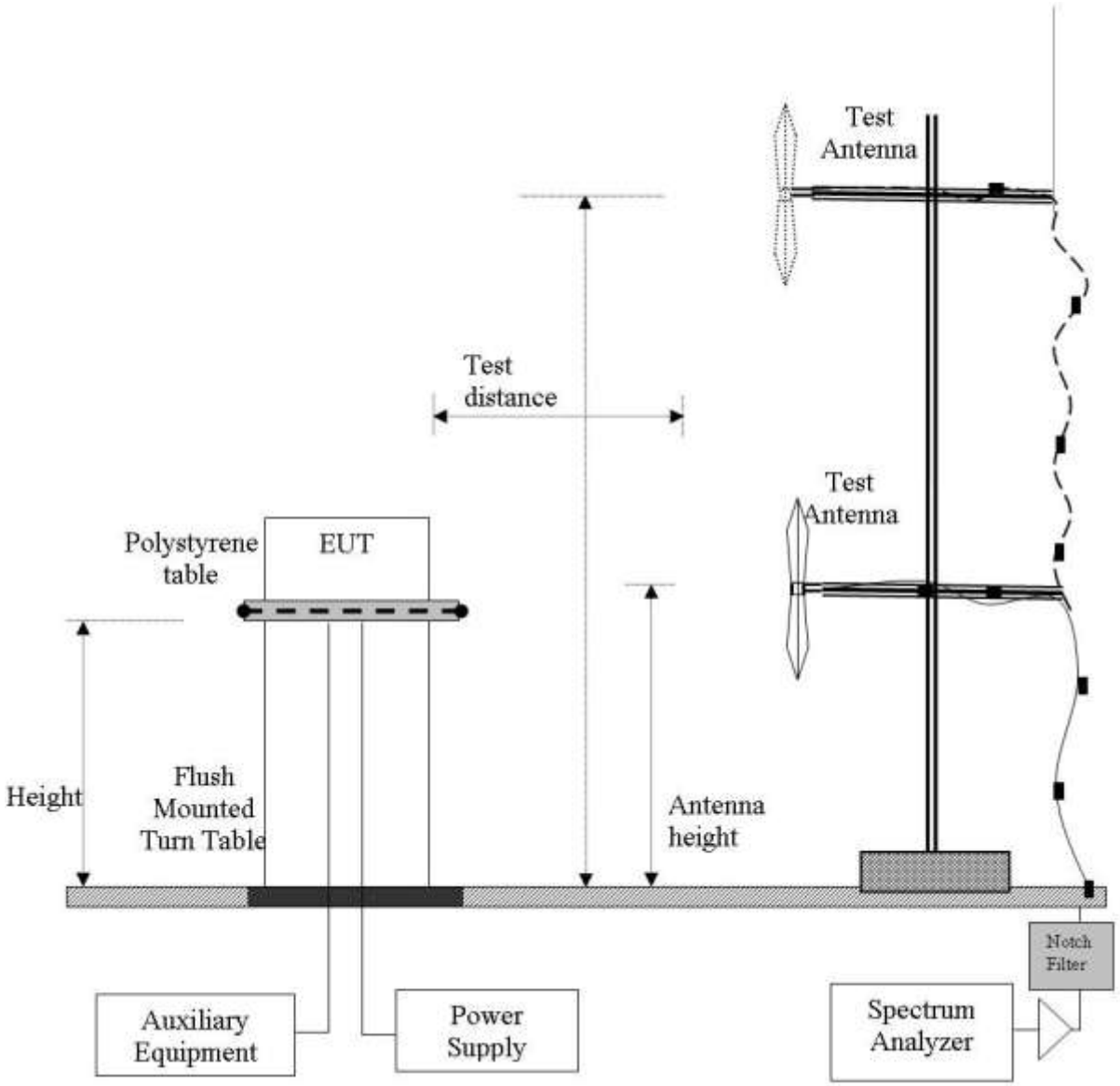
Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

Radiated Emission Measurement Setup – Above 1 GHz



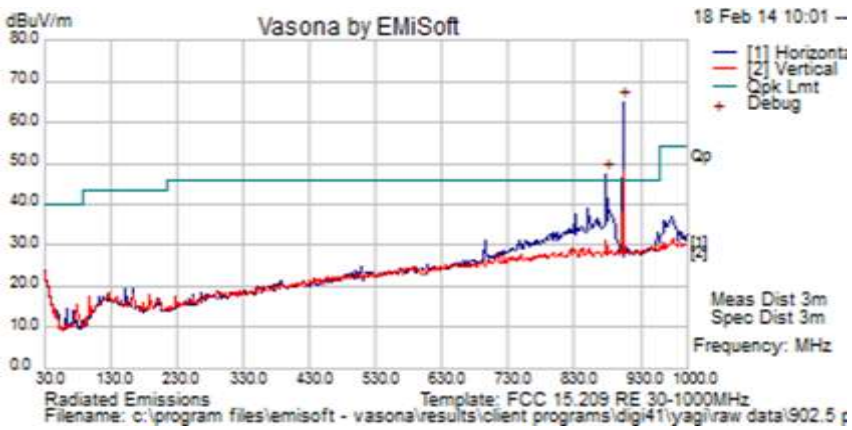
Radiated Emission Measurement Setup – Below 1 GHz



5.1.8.1. Antenna Yagi Directional - Transmitter Peak and Radiated Spurious Emissions

Radiated Peak Emissions – Yagi 15.1 dBi

Test Freq.	902.5 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;3dB attentuator at antenna port;		
Test Notes 2			

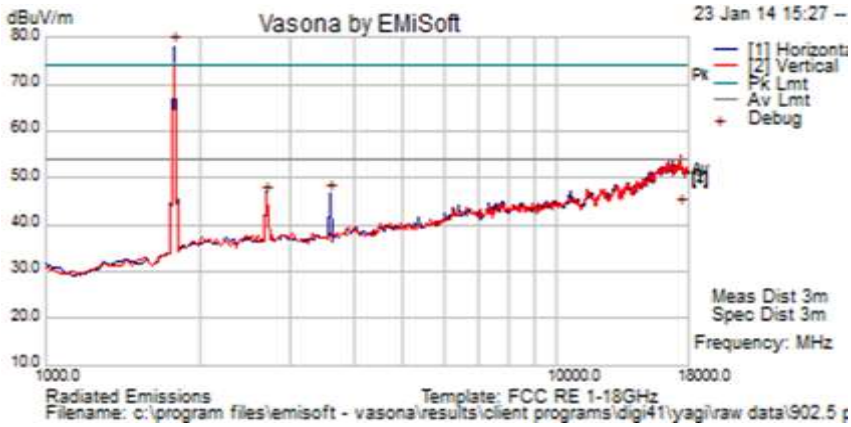


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
902.806	65.9	7.1	-7.8	65.2	Peak [Scan]	H	100					FUND
877.535	48.5	7.1	-8.1	47.4	Peak [Scan]	H	100					NRB
33.880	30.4	3.6	-12.8	21.1	Peak [Scan]	H	98	361	40	-18.9	Pass	RB
130.880	29.8	4.3	-17.4	16.7	Peak [Scan]	H	98	361	43.5	-26.8	Pass	RB
852.560	37.4	7.0	-8.3	36.1	Peak [Scan]	H	98	361	46	-9.9	Pass	RB
33.880	29.9	3.6	-12.8	20.7	Peak [Scan]	H	98	361	40	-19.3	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	902.5 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;		
Test Notes 2			

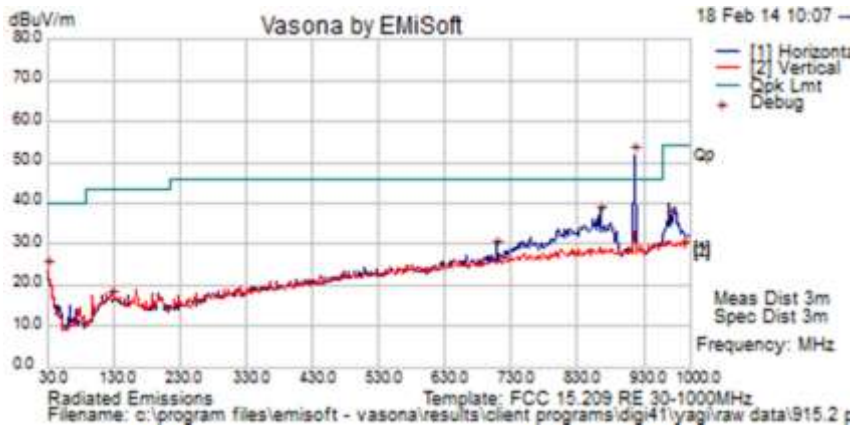


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1783.567	87.8	3.4	-12.9	78.2	Peak [Scan]	H						NRB
17352.553	30.0	12.4	1.3	43.7	Average	V	98	-1	54.0	-10.3	Pass	Noise Floor
2698.896	53.4	4.2	-11.7	45.9	Peak [Scan]	V	98	-1	54.0	-8.1	Pass	RB
3588.031	53.2	4.8	-11.5	46.5	Peak [Scan]	H						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

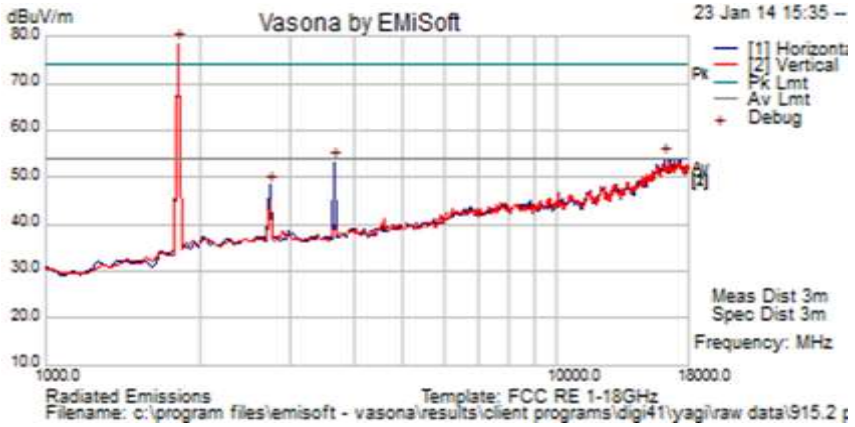
Test Freq.	915.2 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;3dB attentuator at antenna port;		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
916.413	52.1	7.2	-7.7	51.6	Peak [Scan]	H	100					FUND
864.685	38.1	7.0	-8.2	36.9	Peak [Scan]	H	98					NRB
30.000	29.9	3.5	-9.7	23.7	Peak [Scan]	H	98	361	40.0	-16.3	Pass	RB
707.545	31.9	6.5	-10.0	28.4	Peak [Scan]	H	98	361	46.0	-17.6	Pass	RB
970.415	35.6	7.3	-7.0	35.9	Peak [Scan]	H	98					NRB
127.485	29.5	4.3	-17.3	16.5	Peak [Scan]	H	98	361	43.5	-27.0	Pass	RB
Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission											
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak											

Test Freq.	915.2 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;		
Test Notes 2			

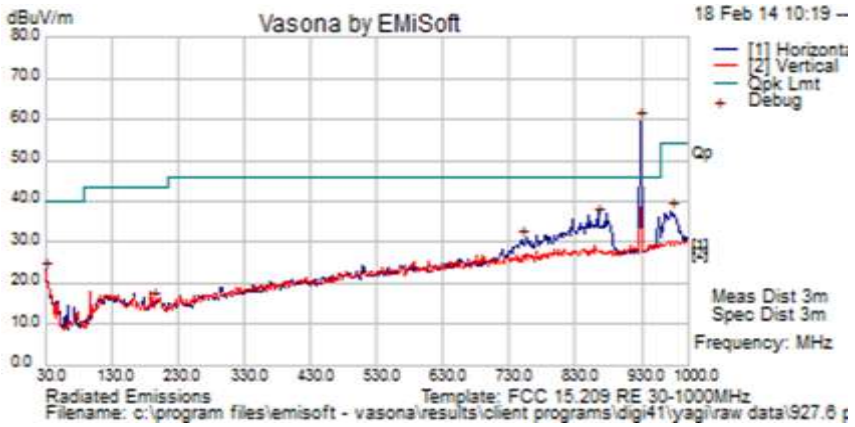


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1817.635	87.7	3.4	-12.5	78.6	Peak [Scan]	H						NRB
16194.389	30.0	12.4	1.3	43.7	Peak [Scan]	V	98	-1	54.0	-10.3	Pass	Noise Floor
3657.315	59.6	4.9	-11.3	53.2	Peak [Scan]	H						NRB
2737.475	55.8	4.2	-11.7	48.3	Peak [Scan]	H	100	0	54.0	-6.0	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	927.6 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;3dB attentuator at antenna port;		
Test Notes 2			

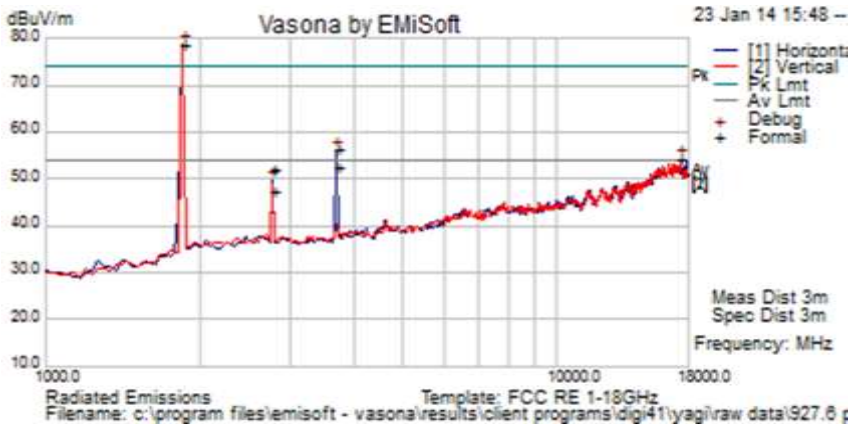


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
928.076152	59.7	7.2	-7.5	59.4	Peak [Scan]	H	100					FUND
864.685	37.1	7.0	-8.2	35.9	Peak [Scan]	H	98					NRB
750.225	33.0	6.7	-9.4	30.3	Peak [Scan]	H	98	361	46	-15.7	Pass	
976.72	36.9	7.3	-6.9	37.2	Peak [Scan]	H	98					NRB
30.97	29.5	3.5	-10.6	22.4	Peak [Scan]	H	98	361	40	-17.6	Pass	
193.93	29.8	4.6	-19.1	15.3	Peak [Scan]	H	98	361	43.5	-28.3	Pass	

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	927.6 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;		
Test Notes 2			

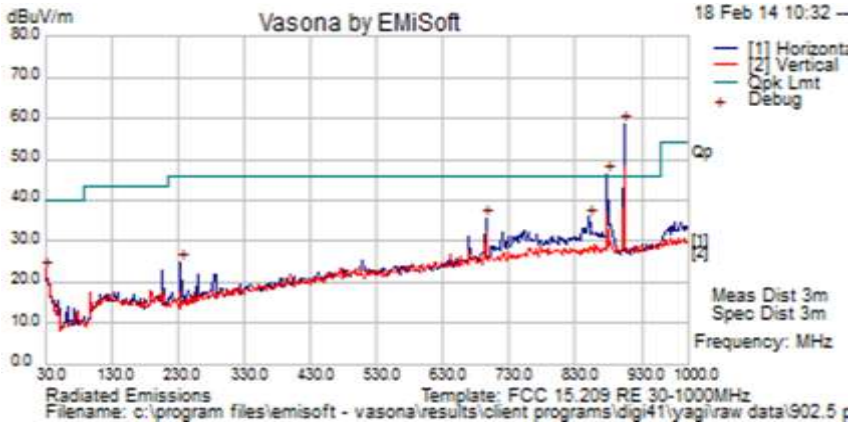


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
3710.271	62.5	4.9	-11.1	56.3	Peak Max	H	132	89	74.0	-17.7	Pass	RB
2782.515	59.5	4.2	-11.8	52.0	Peak Max	H	166	205	74.0	-22.0	Pass	RB
3710.271	58.6	4.9	-11.1	52.5	Average Max	H	132	89	54.0	-1.6	Pass	RB
2782.515	54.8	4.2	-11.8	47.3	Average Max	H	166	205	54.0	-6.7	Pass	RB
1851.703	87.8	3.4	-12.4	78.8	Peak [Scan]	H						NRB
17352.705	30.0	12.4	1.3	43.7	Peak [Scan]	V	98	-1	54.0	-10.3	Pass	Noise Floor

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	902.5 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;3dB attentuator at antenna port;		
Test Notes 2			

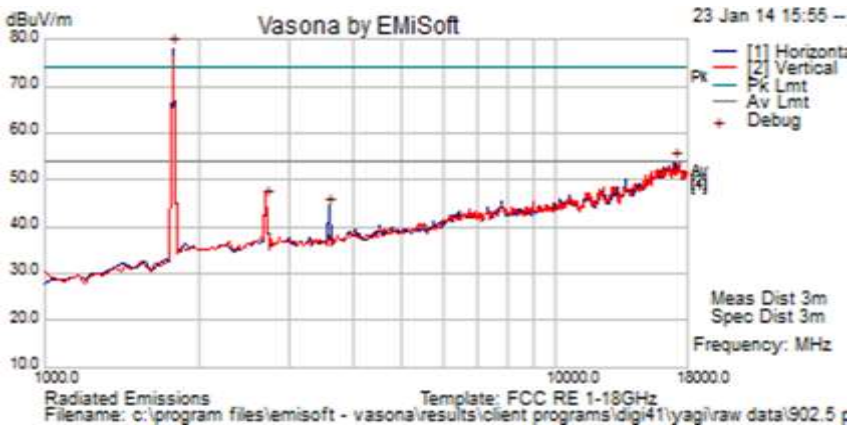


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
902.806	59.2	7.1	-7.8	58.6	Peak [Scan]	H	100					FUND
877.535	47.4	7.1	-8.1	46.4	Peak [Scan]	H	100					NRB
850.709	36.8	7.0	-8.3	35.5	Peak [Scan]	H	98					NRB
694.904	39.0	6.5	-10.3	35.3	Peak [Scan]	H	98	361	46	-10.7	Pass	RB
30.000	29.0	3.5	-9.7	22.8	Peak [Scan]	H	98	361	40	-17.2	Pass	RB
234.067	38.9	4.8	-19.2	24.5	Peak [Scan]	H	98	361	46	-21.5	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	902.5 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;		
Test Notes 2			

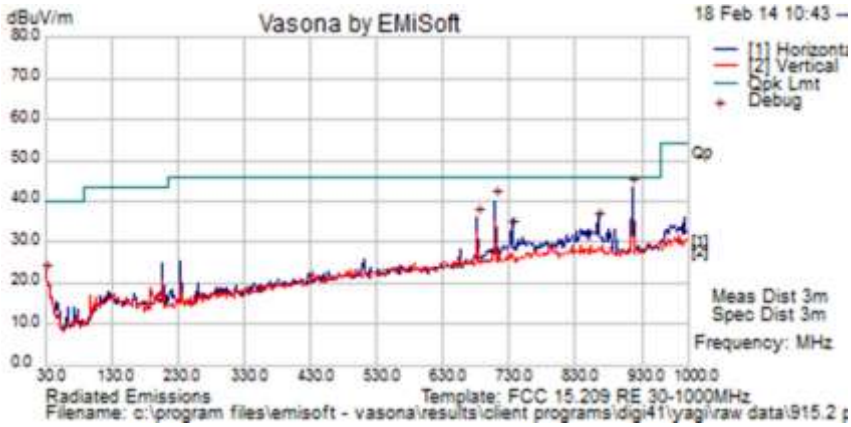


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1783.567	87.8	3.4	-12.9	78.2	Peak [Scan]	H						NRB
17012.024	41.1	12.4	0.3	53.8	Peak [Scan]	H	100	0	54.0	-0.2	Pass	Noise Floor
2708.651	53.1	4.2	-11.7	45.6	Peak [Scan]	V	98	361	54.0	-8.5	Pass	RB
3591.894	50.8	4.8	-11.5	44.1	Peak [Scan]	H	98	361	54.0	-9.9	Pass	NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	915.2 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;3dB attentuator at antenna port;		
Test Notes 2			

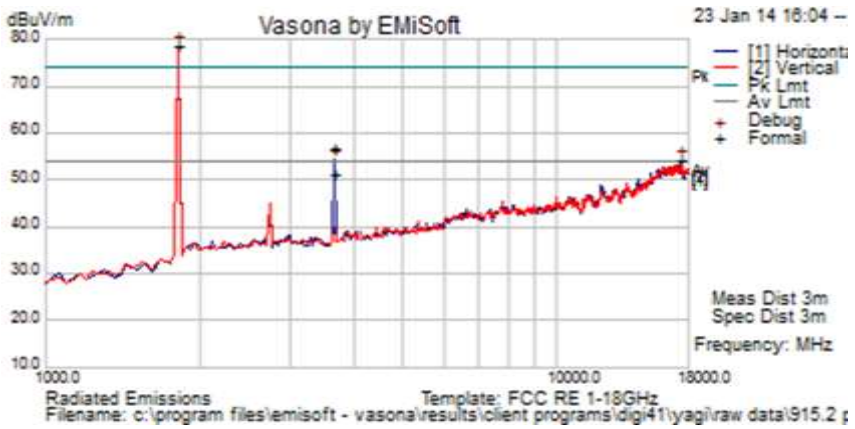


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
916.413	43.9	7.2	-7.7	43.3	Peak [Scan]	H	100					FUND
708.417	43.6	6.5	-10.0	40.1	Peak [Scan]	H	100	0	46	-5.9	Pass	RB
681.238	40.0	6.5	-10.4	36.1	Peak [Scan]	H	98	361	46	-9.9	Pass	RB
864.648	36.3	7.0	-8.2	35.1	Peak [Scan]	H	98					NRB
734.513	35.9	6.6	-9.8	32.7	Peak [Scan]	H	98	361	46	-13.3	Pass	RB
30.970	29.4	3.5	-10.6	22.3	Peak [Scan]	H	98	361	40	-17.7	Pass	BR

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	915.2 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;		
Test Notes 2			

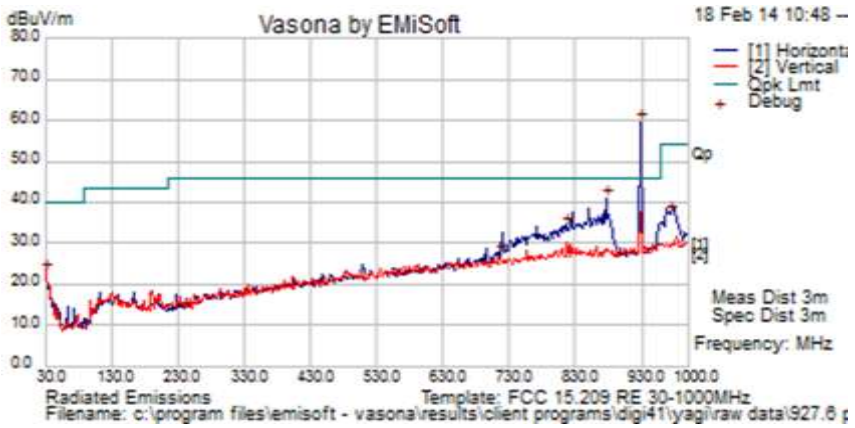


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
3660.433	63.3	4.9	-11.3	56.9	Peak Max	H	186	98	74.0	-17.1	Pass	RB
3660.433	57.8	4.9	-11.3	51.4	Average Max	H	186	98	54.0	-2.7	Pass	RB
1817.635	87.7	3.4	-12.5	78.5	Peak [Scan]	H						NRB
17352.705	41.1	12.4	0.3	53.8	Peak [Scan]	H	100	0	54.0	-0.2	Pass	Noise Floor

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	927.6 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;3dB attentuator at antenna port;		
Test Notes 2			

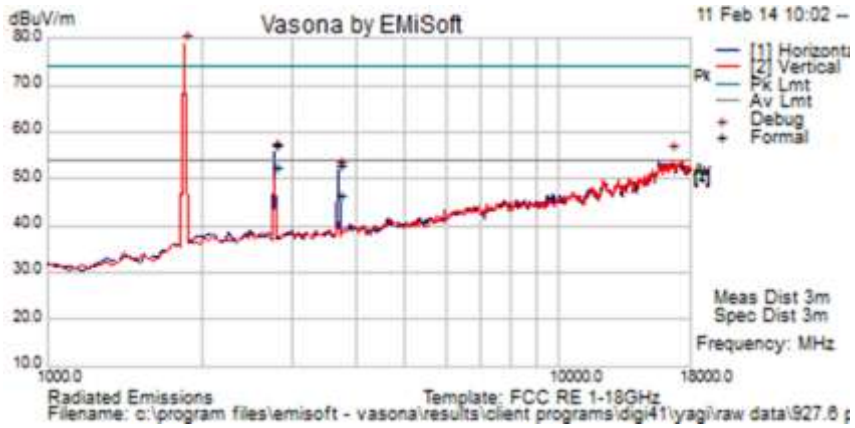


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
928.076	59.8	7.2	-7.5	59.5	Peak [Scan]	H	100					FUND
875.591	41.9	7.1	-8.1	40.9	Peak [Scan]	H	100					NRB
816.67	35.8	6.9	-8.6	34.1	Peak [Scan]	H	98	361	46.0	-11.9	Pass	
973.810	36.7	7.3	-7.0	37.0	Peak [Scan]	H	98					NRB
30.970	29.5	3.5	-10.6	22.4	Peak [Scan]	H	98	361	40	-17.6	Pass	
716.760	30.3	6.5	-9.9	26.9	Peak [Scan]	H	98	361	46	-19.1	Pass	

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	927.6 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Yagi	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb; 3dB pad at antenna port;		
Test Notes 2			



Formally measured emission peaks

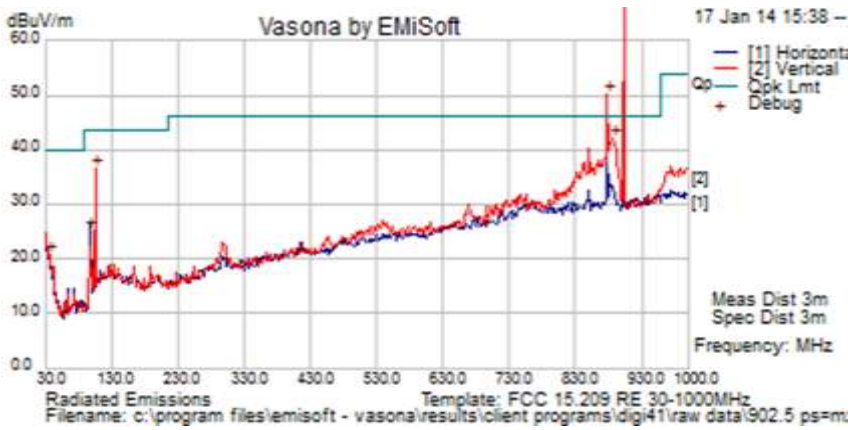
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2783.132	64.9	4.2	-11.8	57.4	Peak Max	H	101	64	74.0	-16.7	Pass	RB
3710.979	59.3	4.9	-11.1	53.1	Peak Max	H	167	96	74.0	-20.9	Pass	RB
2783.132	60.1	4.2	-11.8	52.5	Average Max	H	101	64	54.0	-1.5	Pass	RB
3710.979	52.5	4.9	-11.1	46.3	Average Max	H	167	96	54.0	-7.7	Pass	RB
1851.703	87.8	3.4	-12.4	78.8	Peak [Scan]	H						NRB
16603.206	42.7	12.0	0.6	55.3	Peak [Scan]	V	100	-1	74.0	-18.7	Pass	Noise Floor

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

5.1.8.2. Antenna Omni Directional - Transmitter Peak and Radiated Spurious Emissions

Radiated Peak Emissions – Antenna Omni Directional 8.1 dBi

Test Freq.	902.5 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;		
Test Notes 2			

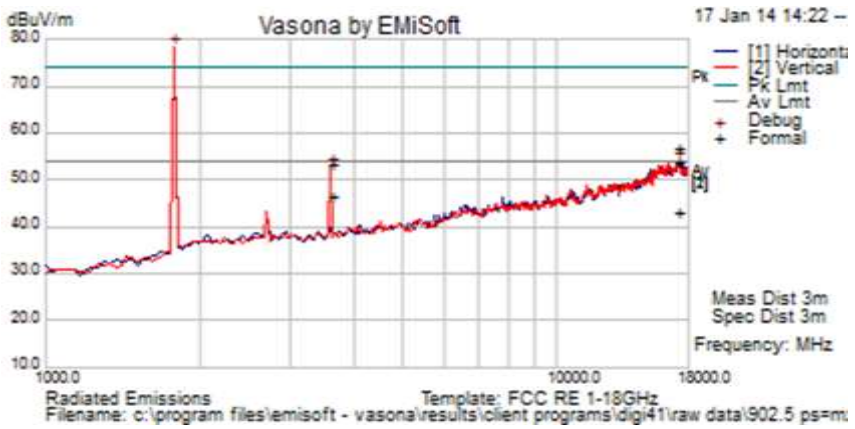


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
902.806	74.6	7.1	-7.8	73.9	Peak [Scan]	V						FUND
877.53507	51.1	7.1	-8.1	50.0	Peak [Scan]	V						NRB
887.255	43.0	7.1	-8.0	42.1	Peak [Scan]	V						NRB
97.478	43.1	4.1	-22.0	25.2	Peak [Scan]	H						NRB
105.806	52.1	4.1	-19.7	36.5	Peak [Scan]	V	98	361	43.5	-7.0	Pass	RB
37.275	32.6	3.6	-15.4	20.7	Peak [Scan]	V	98	361	40	-19.3	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	902.5 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
17182.365	43.6	12.4	0.7	56.7	Peak Max	H	180	109	74.0	-17.3	Pass	Noise Floor
3610.07	60.0	4.9	-11.5	53.4	Peak Max	V	194	233	74.0	-20.6	Pass	RB
17182.365	29.9	12.4	0.7	43.0	Average Max	H	180	109	54	-11.0	Pass	Noise Floor
3610.070	53.3	4.9	-11.5	46.7	Average Max	V	194	233	54	-7.4	Pass	RB
17182.365	40.7	12.4	0.7	53.9	Peak [Scan]	H						NRB

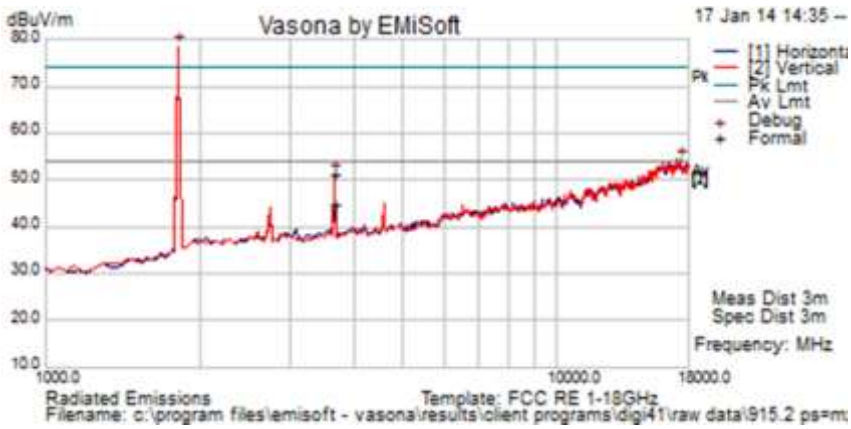
Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	915.2 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;		
Test Notes 2			

Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
106.925	53.7	4.1	-19.4	38.3	Quasi Max	V	100	326	43.5	-5.2	Pass	RB
916.413	54.1	7.2	-7.7	53.6	Peak [Scan]	V						FUND
863.927856	43.0	7.0	-8.2	41.8	Peak [Scan]	V						NRB
38.143	32.6	3.6	-15.4	20.7	Peak [Scan]	V	98	361	40	-19.3	Pass	RB
887.255	43.0	7.1	-8.0	42.1	Peak [Scan]	V						NRB
97.478	43.1	4.1	-22.0	25.2	Peak [Scan]	H						NRB
Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission											
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak											

Test Freq.	915.2 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;		
Test Notes 2			

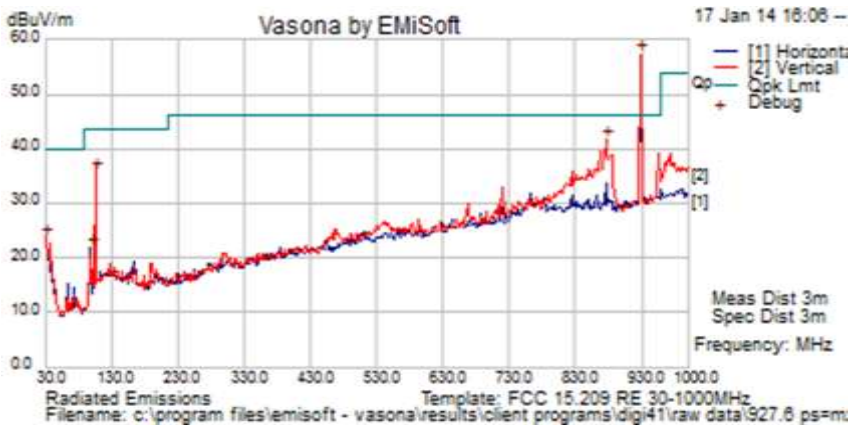


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
3661.210	57.8	4.9	-11.3	51.4	Peak Max	V	200	247	74.0	-22.6	Pass	RB
17182.365	43.6	12.4	0.7	56.7	Peak Max	H	180	109	74.0	-17.3	Pass	Noise Floor
3661.21	51.3	4.9	-11.3	44.9	Average Max	V	200	247	54.0	-9.1	Pass	RB
17182.365	29.9	12.4	0.7	43.0	Average Max	H	180	109	54	-11.0	Pass	Noise Floor
1817.635	87.8	3.4	-12.5	78.6	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	927.6 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;		
Test Notes 2			

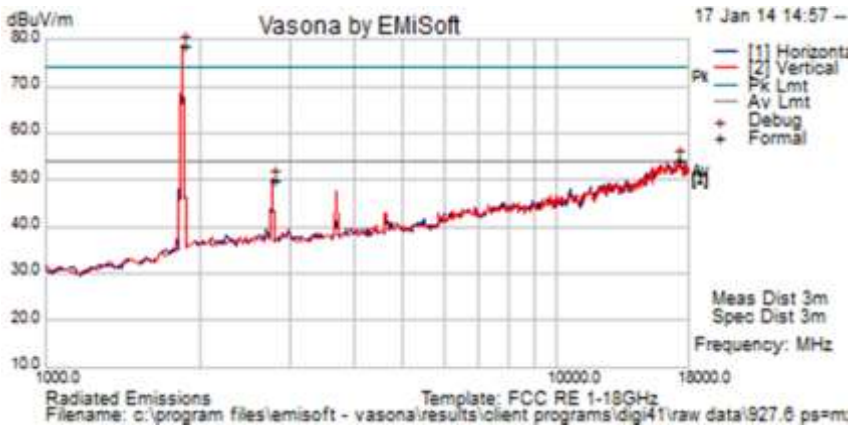


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
928.076	57.5	7.2	-7.5	57.2	Peak [Scan]	V						FUND
875.591	42.7	7.1	-8.1	41.7	Peak [Scan]	V						NRB
97.803	39.6	4.1	-21.9	21.8	Peak [Scan]	H	98	361	43.5	-21.7	Pass	RB
105.943	51.4	4.1	-19.7	35.8	Peak [Scan]	H	98	361	43.5	-7.7	Pass	RB
30.97	30.6	3.5	-10.6	23.5	Peak [Scan]	H	98	361	40	-16.5	Pass	RB
863.927856	43.0	7.0	-8.2	41.8	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	927.6 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 10 kb;		
Test Notes 2			

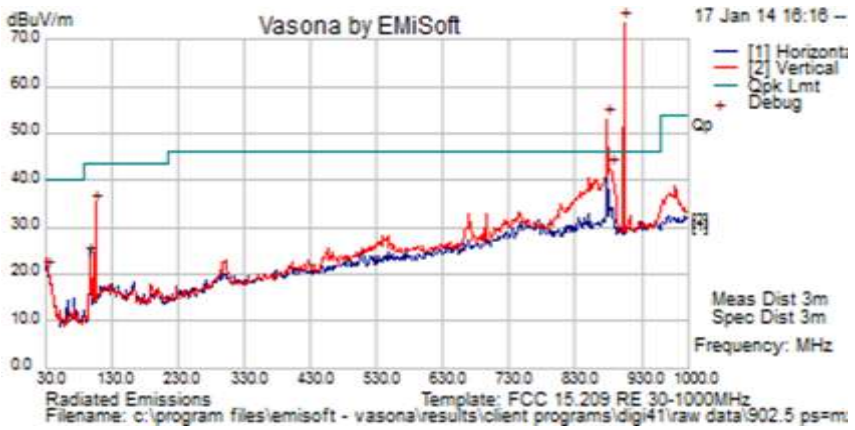


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2783.116	61.1	4.2	-11.8	53.6	Peak Max	H	101	171	74.0	-20.4	Pass	RB
17182.365	43.6	12.4	0.7	56.7	Peak Max	H	180	109	74.0	-17.3	Pass	Noise Floor
2783.116	56.1	4.2	-11.8	48.6	Average Max	H	101	171	54	-5.4	Pass	RB
17182.365	43.6	12.4	0.7	56.7	Peak Max	H	180	109	74.0	-17.3	Pass	Noise Floor
1851.70341	87.8	3.4	-12.4	78.8	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	902.5 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;		
Test Notes 2			

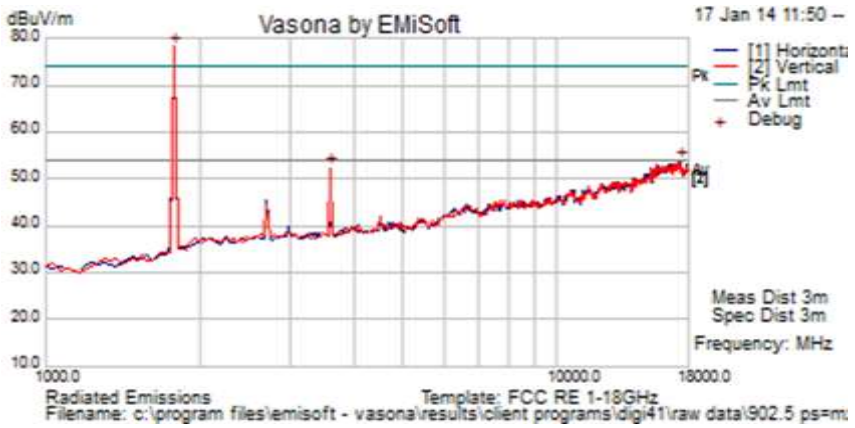


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
902.806	74.4	7.1	-7.8	73.7	Peak [Scan]	V						FUND
877.53507	54.1	7.1	-8.1	53.1	Peak [Scan]	V						NRB
883.367	43.4	7.1	-8.1	42.5	Peak [Scan]	V						NRB
97.415	41.5	4.1	-22.0	23.6	Peak [Scan]	H	98	361	43.5	-19.9	Pass	RB
105.864	50.6	4.1	-19.7	35.0	Peak [Scan]	V	98	361	43.5	-8.5	Pass	RB
33.880	29.9	3.6	-12.8	20.7	Peak [Scan]	H	98	361	40	-19.3	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	902.5 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;		
Test Notes 2			

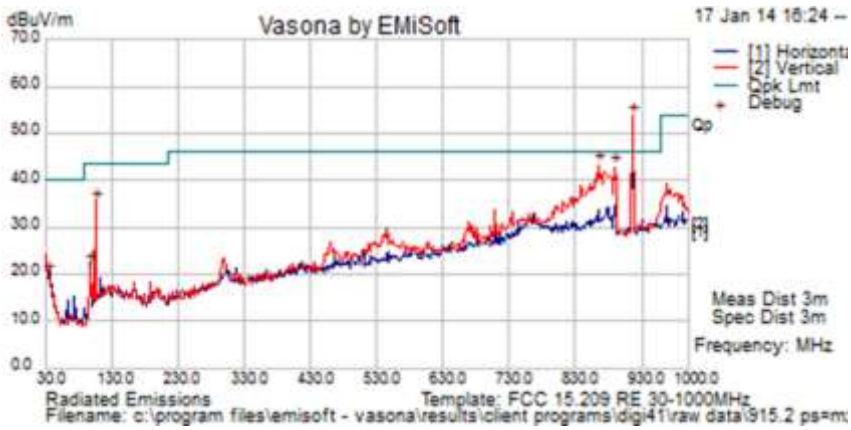


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
17386.774	42.5	12.4	1.4	56.3	Peak Max	H	154	0	74.0	-17.7	Pass	Noise Floor
3610.07	60.5	4.9	-11.5	53.9	Peak Max	V	201	238	74.0	-20.1	Pass	RB
17386.774	29.3	12.4	1.4	43.1	Average Max	H	154	0	54	-10.9	Pass	Noise Floor
3610.070	54.0	4.9	-11.5	47.4	Average Max	V	201	238	54	-6.6	Pass	RB
1783.567	87.8	3.4	-12.9	78.2	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	915.2 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;		
Test Notes 2			

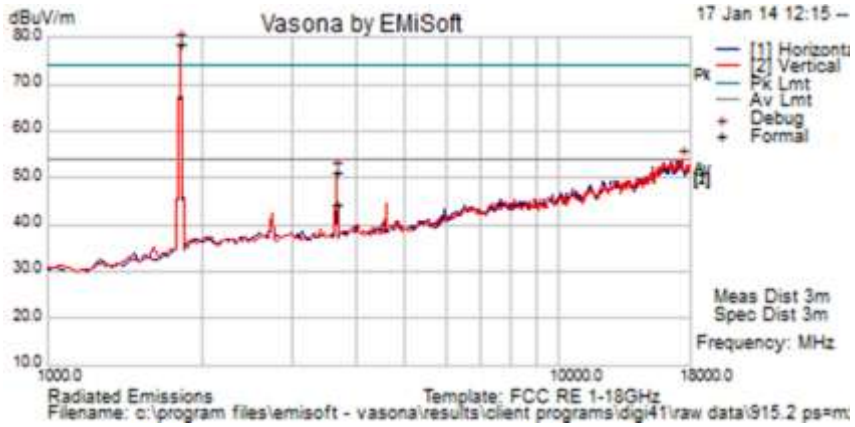


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
889.198	43.8	7.1	-8.0	42.9	Peak [Scan]	V						NRB
916.413	54.2	7.2	-7.7	53.7	Peak [Scan]	V						FUND
863.927856	44.4	7.0	-8.2	43.3	Peak [Scan]	V						NRB
33.880	29.1	3.6	-12.8	19.8	Peak [Scan]	H	98	361	40	-20.2	Pass	RB
97.673	39.8	4.1	-21.9	22.0	Peak [Scan]	H	98	361	43.5	-21.5	Pass	RB
105.766	51.0	4.1	-19.7	35.4	Peak [Scan]	H	98	361	43.5	-8.2	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	915.2 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;		
Test Notes 2			

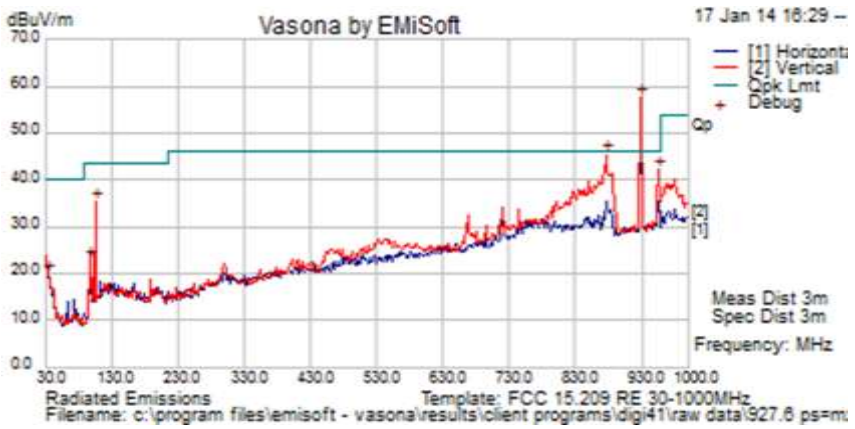


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
3660.421	57.4	4.9	-11.3	51.0	Peak Max	V	199	243	74.0	-23.0	Pass	RB
17386.774	42.5	12.4	1.4	56.3	Peak Max	H	154	0	74.0	-17.7	Pass	Noise Floor
3660.421	50.6	4.9	-11.3	44.2	Average Max	V	199	243	54.0	-9.8	Pass	RB
17386.774	29.3	12.4	1.4	43.1	Average Max	H	154	0	54	-10.9	Pass	Noise Floor
1817.635	87.7	3.4	-12.5	78.5	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	927.6 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;		
Test Notes 2			

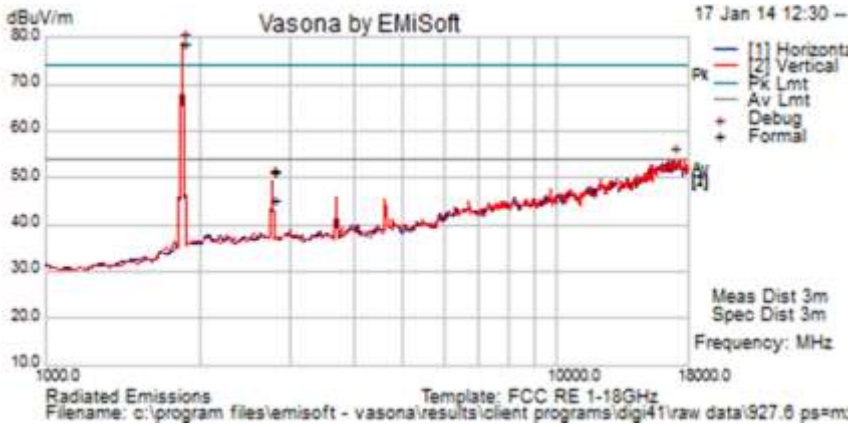


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
928.076	57.8	7.2	-7.5	57.6	Peak [Scan]	V	100	0	46.0	11.6	Fail	FUND
875.591	46.4	7.1	-8.1	45.4	Peak [Scan]	V	100	0	46.0	-0.6	Pass	NRB
955.290581	42.1	7.3	-7.1	42.3	Peak [Scan]	V	100	0	46.0	-3.7	Pass	NRB
97.211	40.6	4.1	-22.1	22.6	Peak [Scan]	H	98	361	43.5	-20.9	Pass	RB
105.764	50.6	4.1	-19.7	35.0	Peak [Scan]	H	98	361	43.5	-8.5	Pass	RB
33.880	29.1	3.6	-12.8	19.9	Peak [Scan]	H	98	361	40	-20.1	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	927.6 MHz	**Engineer**	SB
Variant	FHSS	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	Max	**Press. (mBars)**	1009
Antenna	Omni	**Duty Cycle (%)**	100
Test Notes 1	3.6VDC; 200 kb;		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2783.154	58.7	4.2	-11.8	51.2	Peak Max	H	100	177	74.0	-22.8	Pass	RB
17386.774	42.5	12.4	1.4	56.3	Peak Max	H	154	0	74.0	-17.7	Pass	Noise Floor
2783.154	52.9	4.2	-11.8	45.4	Average Max	H	100	177	54.0	-8.6	Pass	RB
17386.774	29.3	12.4	1.4	43.1	Average Max	H	154	0	54	-10.9	Pass	Noise Floor
1851.703	87.8	3.4	-12.4	78.8	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Specification

Limits

§15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

§15.205 (a) Except as shown 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 Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.109 (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 3 meters, shall not exceed the following:

§15.109 (b) Limit Matrix Class A digital device

Frequency(MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	49.5	3
88-216	150	54.0	3
216-960	200	57.0	3
Above 960	500	60.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0287, 0335, 0338, 0158, 0134, 0304, 0311, 0315, 0310, 0312, 0341

5.1.8.3. Receiver Radiated Spurious Emissions (above 1 GHz)

Industry Canada RSS-Gen §4.10, §6

Test Procedure

Radiated emissions 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.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

All Sectors of the EUT were tested simultaneously

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

For example:
Given receiver input reading of 51.5 dBμV; 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 of the measured emission is:

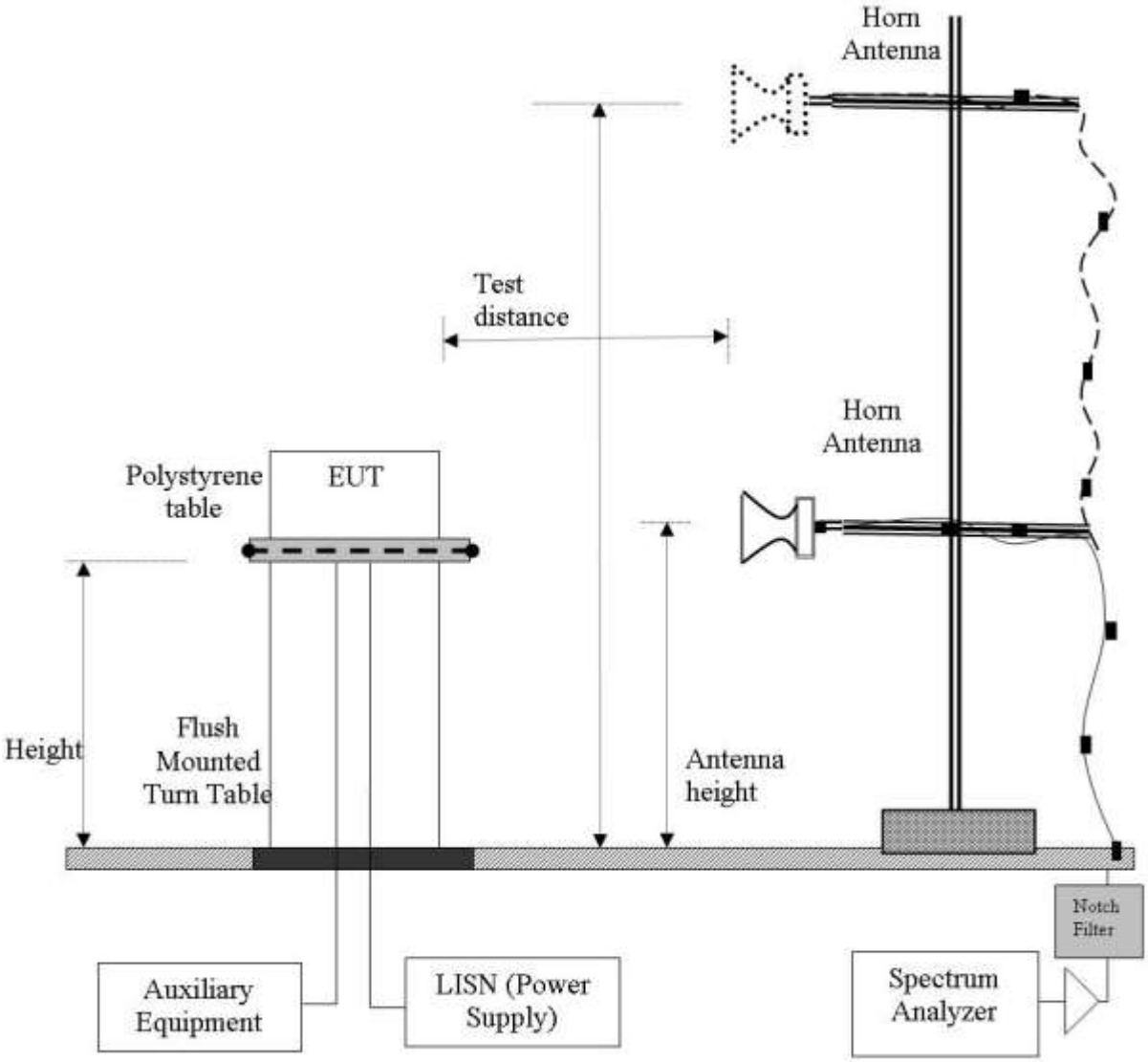
FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

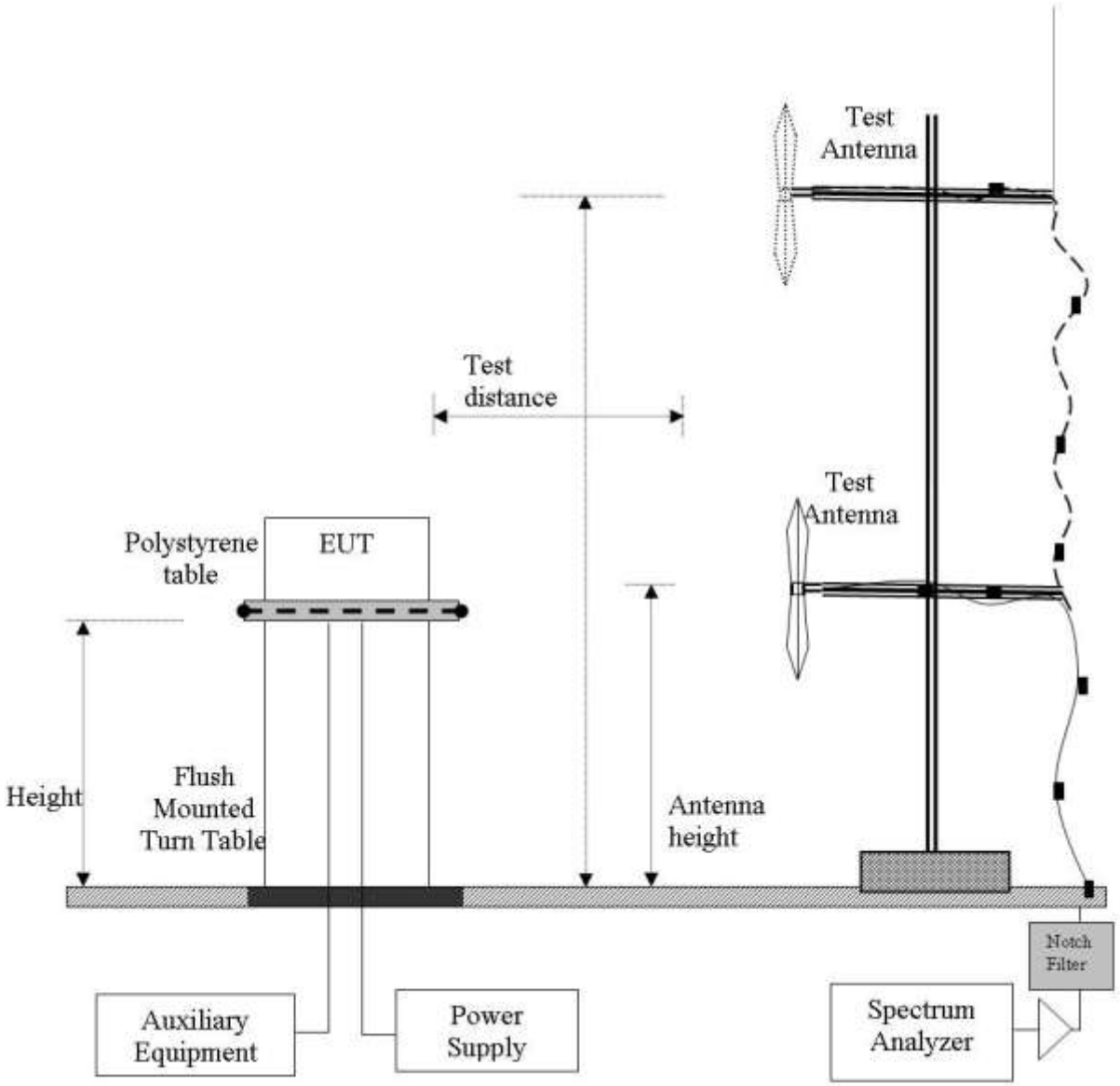
Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

Radiated Emission Measurement Setup – Above 1 GHz

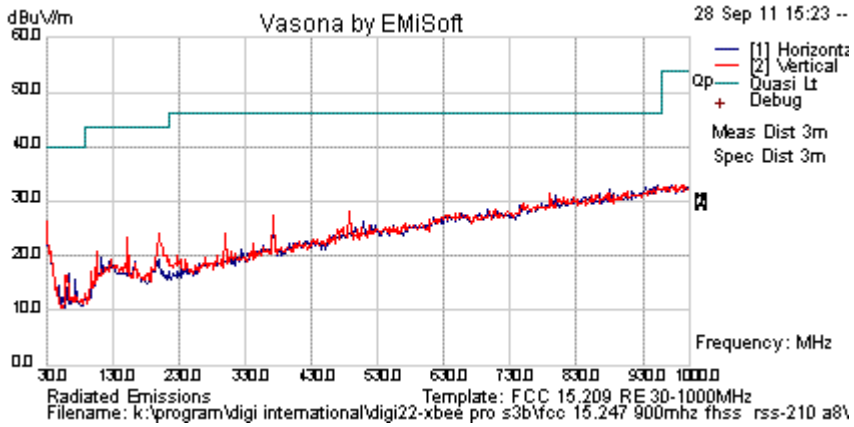


Radiated Emission Measurement Setup – Below 1 GHz



Yagi Receiver Spurious Emissions

Test Freq.	915 MHz	**Engineer**	SB
Variant	N/A	**Temp (ºC)**	28.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	30
Power Setting	Not Applicable Receiver Emissions	**Press. (mBars)**	1000
Antenna	13 Element Welded Yagi	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

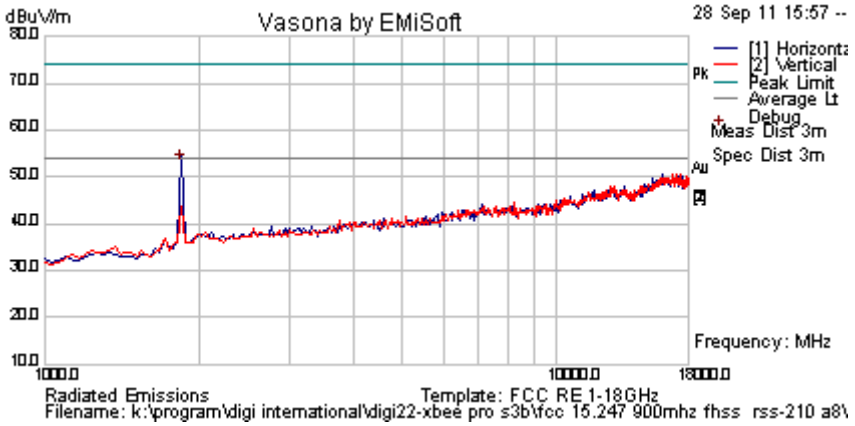


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	915 MHz	**Engineer**	SB
Variant	N/A	**Temp (ºC)**	28.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	30
Power Setting	Not Applicable Receiver Emissions	**Press. (mBars)**	1000
Antenna	13 Element Welded Yagi	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



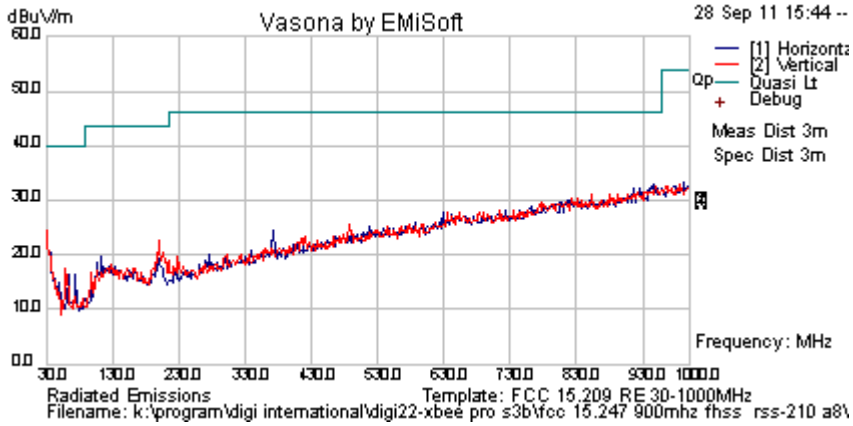
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Omni Receiver Spurious Emissions

Test Freq.	915 MHz	**Engineer**	SB
Variant	N/A	**Temp (ºC)**	28.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	30
Power Setting	Not Applicable Receiver Emissions	**Press. (mBars)**	1000
Antenna	A09-F8TM 8.1 dBi	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



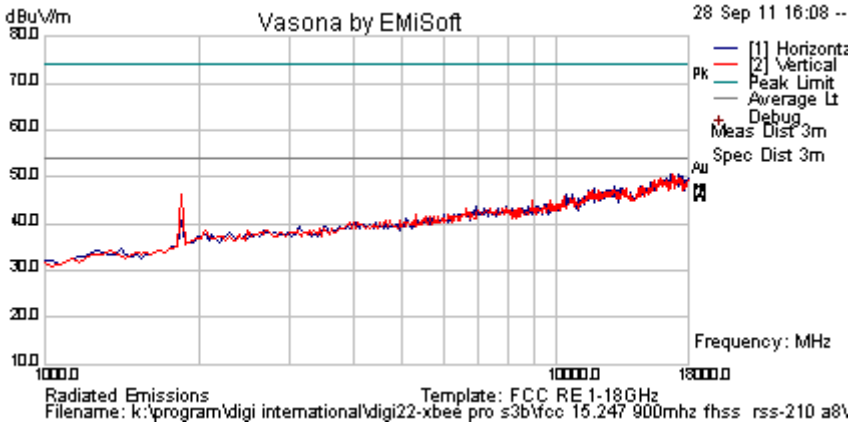
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	915 MHz	**Engineer**	SB
Variant	N/A	**Temp (ºC)**	28.5
Freq. Range	1000 MHz -18000 MHz	**Rel. Hum.(%)**	30
Power Setting	Not Applicable Receiver Emissions	**Press. (mBars)**	1000
Antenna	A09-F8TM 8.1 dBi	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

IMG



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

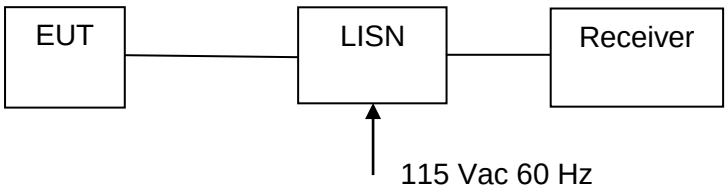
5.1.9. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

FCC, Part 15 Subpart C §15.207
Industry Canada RSS-Gen §7.2.2

ac Wireline Emissions Not Applicable as the device under test is a wireless module energized with dc power

Test Procedure
The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

Measurement Results for AC Wireline Conducted Emissions (150 kHz – 30 MHz)

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Radio Parameters:
Transmitting on Channel 26. 915.25 MHz
Transmit Power +30 dBm
Active antenna port was terminated in a 50Ω termination

Specification

Limit

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μΩ line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

RSS-Gen §7.2.2
The radio frequency voltage that is conducted back into the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The tighter limit applies at the frequency range boundaries.

§15.207 (a) and **RSS-Gen §7.2.2** Limit Matrix
The lower limit applies at the boundary between frequency ranges

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

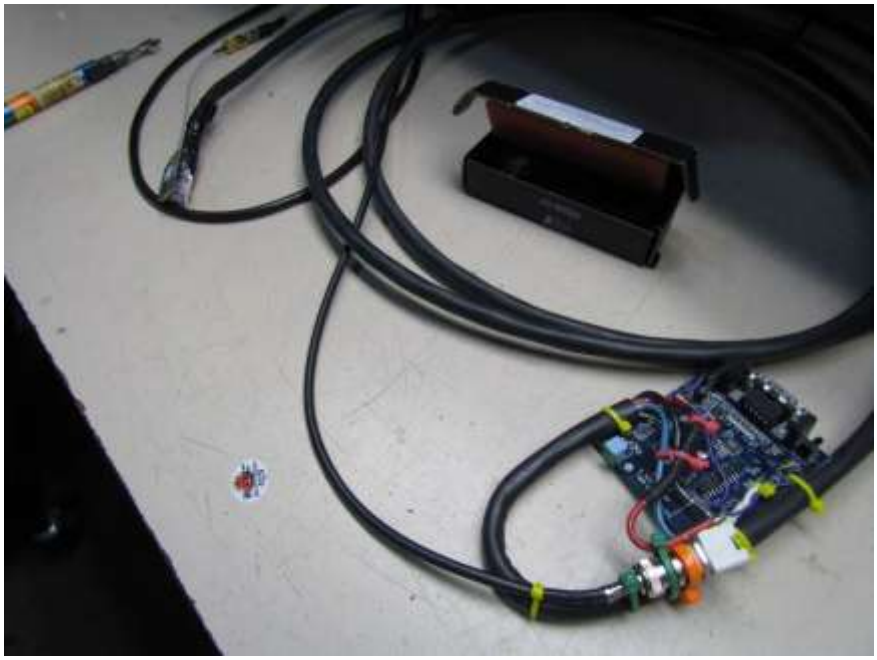
Measurement uncertainty	±2.64 dB

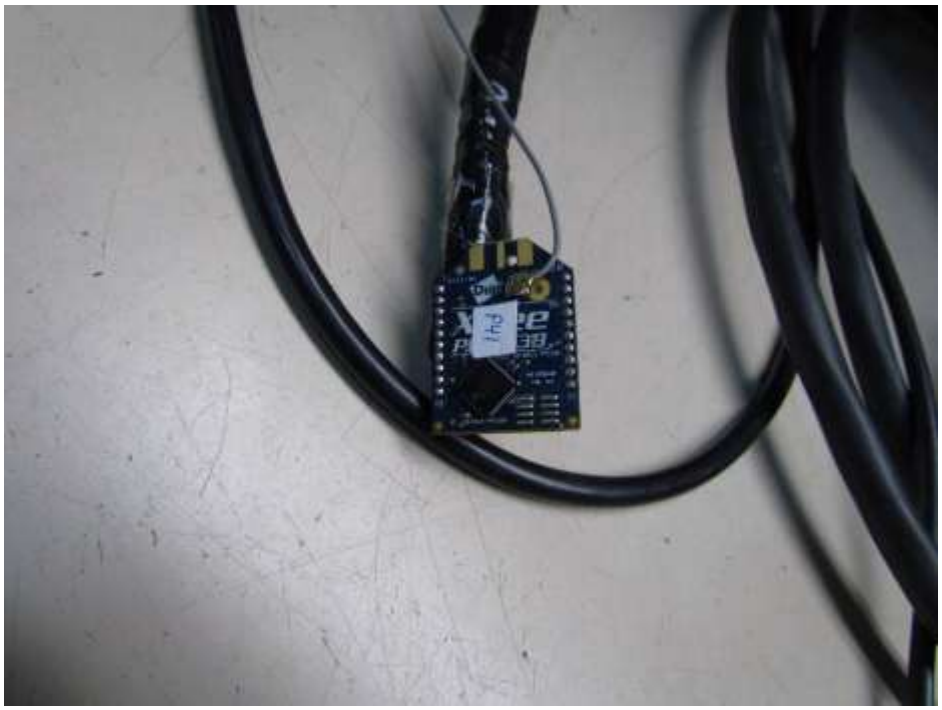
Traceability

Method	Test Equipment Used
Measurements were made per Sanmina work instruction	0190, 0193

6. PHOTOGRAPHS

6.1. General Measurement Test Set-Up





6.2. Radiated Emissions >1 GHz

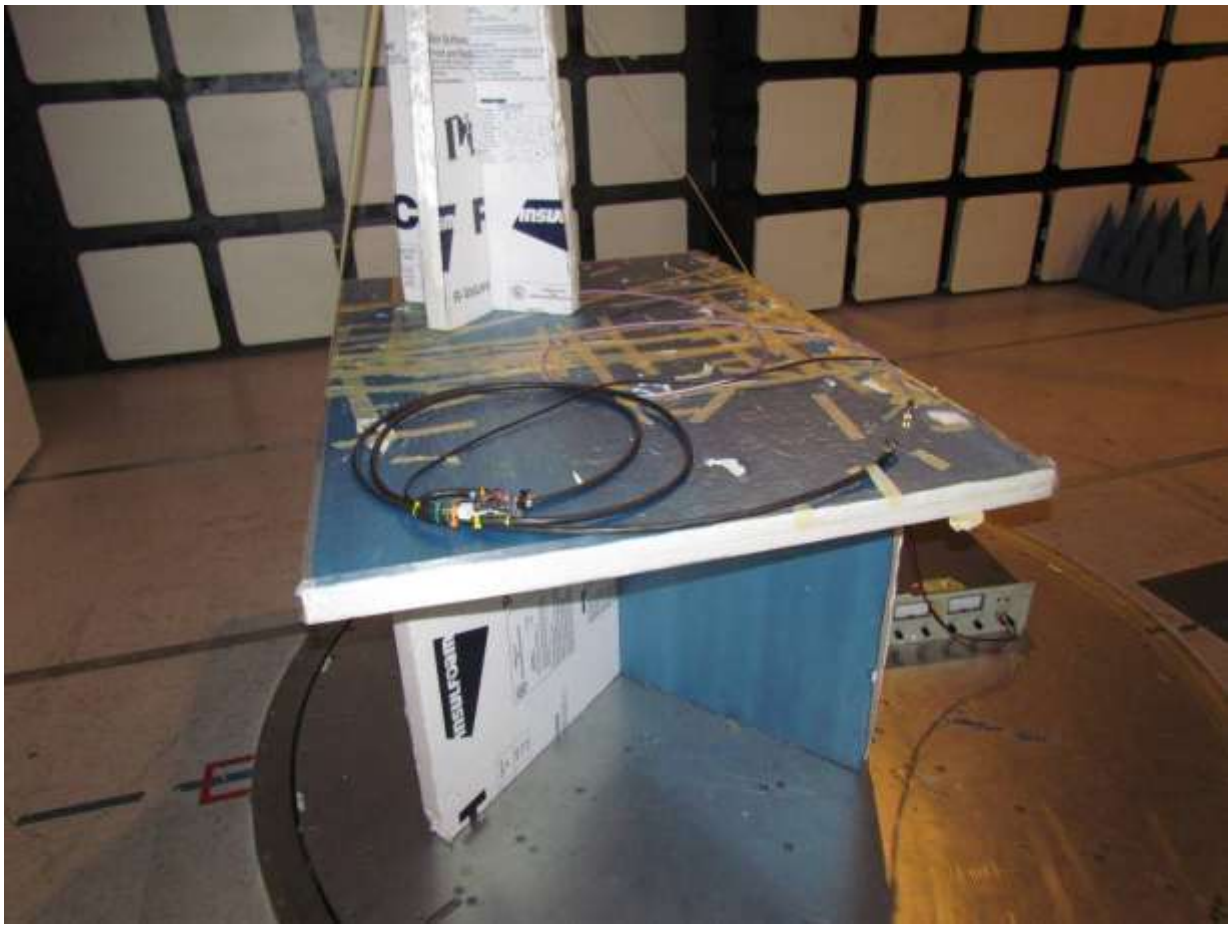
Omni Directional Antenna

Yagi Directional Antenna

6.3. Radiated Emissions <1 GHz

Omni Directional Antenna

Yagi Directional Antenna



Yagi Directional Antenna

7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0158	Barometer /Thermometer	Control Co.	4196	E2844
0184	Pulse Limiter	Rhode & Schwarz	ESH3Z2	357.8810.52
0190	LISN	Rhode & Schwarz	ESH3Z5	836679/006
0223	Power Meter	Hewlett Packard	HP EPM-442A	US37480256
0251	K-Cable	Megaphase	Sucoflex 104	Unknown
0252	K-Cable	Megaphase	Sucoflex 104	Unknown
0253	K-Cable	Megaphase	Sucoflex 104	Unknown
0256	K-Cable	Megaphase	Sucoflex 104	Unknown
0271	Amplifier	1 to 26.5 GHz	MiCOM	--
0287	EMI Receiver	Rhode & Schwarz	ESIB 40	100201
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	3140A01285
0314	30 dB N-Type Attenuator	ARRA	N944-30	1623
0335	Horn Antenna	The Electro-Mechanics Company	3117	00066580
0337	Amplifier	30 MHz – 3 GHz	MiCOM	--
0338	Antenna (30M-3GHz)	Sunol Sciences	JB3	A052907
0341	902-928 MHz Notch Filter	EWT	EWT-14-0199	H1
0363	Switch	MiCOM Labs	--	--

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