Intentional Radiator Test Report

Test Standards:
FCC Part 15.247 (Subpart C – Intentional Radiators)
Industry Canada RSS-210, Issue 8

Prepared For:
NWave Techologies, Ltd
1201 International Pkwy. Suite 200
Richardson, Texas 75081 USA

Equipment Under Test:

Product Name :
Smart Radio Module

Model Name :
NWRM1000

Application Purpose : Original

Prepared by:

EMCE Engineering, Inc.
44366 S. Grimmer Blvd.
Fremont, CA 94538
USA

Revision History

Rev.	Issue Date	Description
0	11/03/14	Initial Issue

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1.0 CUSTOMER INFORMATION

Test Laboratory:	EMCE Engineering 44366 S. Grimmer Blvd. Fremont, CA 94538 USA Tel: 510-490-4307, Fax: 510-490-3441 bob@universalcompliance.com
	FCC registration number : 743299
	Test Site : FCC : US5291, IC : 3324A
Applicant Name :	NWave Techologies, Ltd 1201 International Pkwy. Suite 200 Richardson, Texas 75081 USA Tel: +1-214-908-9313
	Contact Person: Yury Birchenko
Application Purpose :	Original
EUT Description	Smart Radio Module
Product Name	Smart Radio Module
Model Name :	NWRM1000
Applied Standards :	FCC Title 47 CFR Part 15 Subpart C (15.247) IC RSS-210, Issue 8:2010(Annex 8)/RSS-GEN, Issue 5:2012
FCC ID :	2ADCZ-NWRM1000
IC :	12418A-NWRM1000
RF Operating Frequency (ies)	915.875 – 917.100 MHz
Modulation	ASK
Emission Designator	-
Report Number	4082-1
Receipt of EUT :	09/15/14
Date of Testing :	09/15/14 – 10/30/14
Date of Report :	11/03/14

The tests listed in this report have been completed to demonstrate compliance to the standards mentioned in the above table.

Contents approved:

Name: Bob Cole
Title: President

2.0 EUT AND ACCESSORY INFORMATION

EUT Information

Product Specification	Description
Model Name	NWRM1000
Type of Modulation	FHSS
Number of Channels	50
Operating Frequency Range	915.875 – 917.1 MHz
Type of Equipment	Portable
Extreme Operating Temperature Range	-20 C – 55 C
Extreme Operating Voltage Range	N/A – Battery Powered
Type of Antenna	Integral
Antenna Gain (dBi)	1.3
Transmitter Method of Frequency Generation	Synthesized
Transmitter Aggregate Data Rate	>250kbps
Transmitter Duty Type	Intermittant
Continuous Operation for Testing Purposes?	Yes

EUT and accessories

The table below lists all EUTs and accessories used in the tests. Later in this report, only numbers in the last column are used to refer to the devices in each test.

	Product Name	Model Name	S/N	Number
EUT	Smart Radio Module	NWRM1000	N/A	E0001

Software

The computers were equipped with test software provided by the customer. The software was used to control the EUT in the tests.

Number of Frequencies to be examined (CFR 47, 15.31(m)):

50 total, 3 frequencies examined (915.875, 916.5, 917.1 MHz).

3.0 MODIFICATIONS

There were no modifications.

4.0 SUMMARY OF TEST RESULTS

CFR 47, 15.247:2007 Section #	RSS 210 Issue 8 Section #	Description	Results
15.203		Antenna Requirement	PASSED
15.247 (b)(2)	RSS-210 (A8.4(1))	Tx Conducted Output Power of The Fundamental	PASSED
15.247 (d)	RSS-210 (A8.5)	Conducted Spurious Emissions of The Fundamental(-20dBc)	PASSED
15.247d: 15.209(a)/15.205	RSS-210 (A8.5) RSS-GEN 7.2.2	Radiated Spurious Emissions of the Fundamental – Includes Restricted Band Harmonics	PASSED
15.247 (d)/15.209	RSS-210 (A8.5) RSS-GEN 7.2.2	TX Band-Edge	PASSED
15.247 (a)(1)	RSS 210 (A8.1(c))	20dB Bandwidth	PASSED
15.247 (a)(1)	RSS 210 (A8.1(b))	Channel Separation	PASSED
15.247 (a)(1)(i)	RSS 210 (A8.1(c))	Number of Hopping Frequencies	PASSED
15.247 (1)(i)	RSS 210 (8.1(c))	Time of Occupancy(Dwell Time)	PASSED
	RSS GEN, Clause 4.6.1	99% Occupied Bandwidth	-
15.207 (a)	RSS Gen 7.2.4	TX AC Power Conducted Emissions	N/A
15.247g	RSS 210 (A8.1)	Hopping Capability	PASSED
15.247h	RSS 210 (A8.1)	Hopping Coordination Requirement	PASSED
15.247i	RSS Gen (5.5)	RF Exposure Requirement	PASSED

PASS The EUT passed that particular test.
FAIL The EUT failed that particular test.
N/A Not Applicable due to product type.

5.0 STANDARDS AND MEASUREMENT METHODS

The tests were performed in guidance of CFR 47 section 15.247, FCC Public Notice DA 00-705 (March 30, 2000), FCC Report & Order 97-114 (April 10, 1997), Industry Canada RSS-210 Issue 8, and ANSI C63.4 (2009). Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under “Test method”. For the test equipment, see device list in the end of this test.

Selection of operation mode for tests

Before tests, all operation modes and modulation patterns were tried. The worst case was selected for each test and those results reported.

6.0 TEST SETUPS

To fulfill all requirements for the testing, total of two different test setups were used. One EUT was used, unmodified for radiated tests.

SMA connector added in place of internal antenna for Antenna Conducted measurements.

Setup A (Antenna Conducted measurements)

Operational description

ANTENNA CONDUCTED EMISSIONS MEASUREMENTS

The EUT was connected to the Laptop Computer through the serial port (COM1), the antenna bypassed and the SMA Cable connected to the Spectrum Analyzer. This setup was used for the *PEAK POWER OUTPUT, 20 dB BW, BAND-EDGE COMPLIANCE, and RESTRICTED BAND* measurements.

Block Diagram

The solid lines are coaxial cables and the dashed lines are either EUT insertion to the test board or control cables between test setup devices. The measurement results were adjusted with the attenuation of the coaxial cable.

Setup B (Radiated measurements)

Operational description

RADIATED EMISSIONS MEASUREMENTS

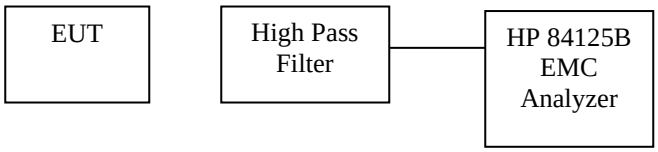
This setup was used in radiated emissions measurements.

The EUT was tested in 3 orthogonal orientations.

Worst case data is presented.

THIS SETUP USED FOR RADIATED SPURIOUS EMISSIONS:

Block diagram



Note: The high –pass filter is used for the Radiated Spurious emissions above 2.4835 GHz. A pass-thru connector is used for Radiated Spurious emissions measurements from 30 MHz – 2.4 GHz.

The solid lines are coaxial cables and the dashed lines are either EUT insertion to the test board or control cables between test setup devices.

7.0 TEST RESULTS

CFR 47, 15.247:2007 Section #	RSS 210 Issue 8 Section #	Description	Results
15.203		Antenna Requirement	PASSED

Antenna Requirement

An intentional radiator shall be designed such that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna requirement must meet one of the following:

- Antenna must be permanently attached to the device.
- Antenna must use unique type of connector to attach to the device.
- Device must be professionally installed. Installer shall be responsible for insuring that the correct antenna is installed with the device.

Antenna is a printed trace, integral to the PCB.

Antenna - Gain = 1.300 dBi
Type = Trace Antenna

CFR 47, 15.247:2007 Section #	RSS 210 Issue 8 Section #	Description	Results
15.205	RSS 210 (A8.5)	Radiated Spurious Emissions of the Fundamental – Includes Restricted Band Harmonics	PASSED

Radiated Emissions – Restricted Bands

Requirement(s): CFR47, 15.247(d), 15.209, RSS210(2.2, A8.5)

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Restricted Band Measurements were taken, using a Peak detector, over the frequency band of 30 - 1000 MHz, and using an Average Detector over the bands of 1000 – 10000 MHz, in both horizontal and vertical polarizations. All measurements were repeated with the EUT operating at 915.875, 916.5, 917.1 MHz. Worst case data is presented in this report.

Restricted Band Spurious Radiated Emissions 30 MHz – 18 GHz

Test Location: EMCE Engineering •44366 S. Grimmer Blvd • Fremont, CA 94538 •

Customer: **NWave**
Specification: **EN55022B 928 MHz - 10 GHz PK**
Work Order #: **4069** Date: 9/22/2014
Test Type: **Radiated Scan** Time: 12:13:20
Equipment: **Remote Control** Sequence#: 1
Manufacturer: NWave Technologies, Ltd Tested By: Bob Cole
Model: NWRM1000
S/N:

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8593EM	3497A5703	05/17/2014	05/17/2016	609
HP 84125B Preamps	2542A11087	05/17/2014	05/17/2015	001
EMCO 3115 Horn	9065-5057	05/20/2014	05/20/2015	608
EMITest Measurement Software	v4.01 Build 195	05/01/2014	05/01/2017	610

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

All Peak Measurements meet Average Limits
DBPSK 100 bps
SparkIt Configuration

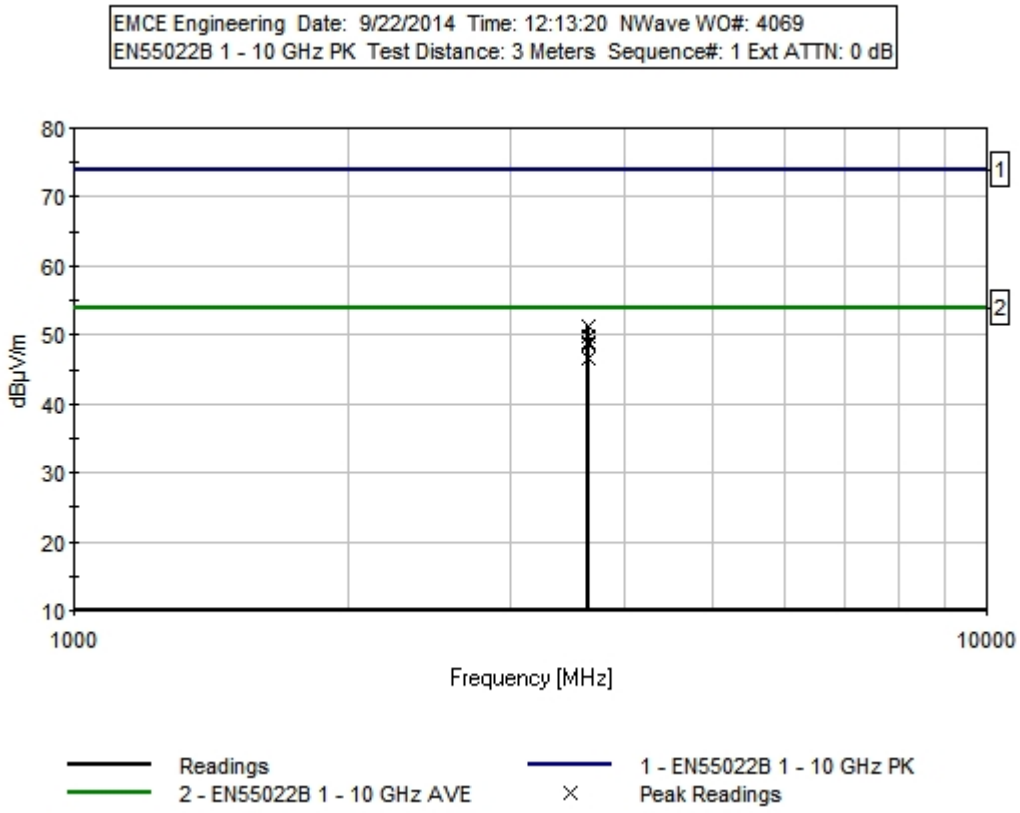
Transducer Legend:

T1=84125 RF Amps T2=25' LMR #001
T3=A.H. SAS-200/571 Horn

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	3663.502M	72.4	+54.8	+2.0	+31.7		+0.0 9	51.3	74.0 915.875 MHZ Xmit	-22.7	Vert 185
2	3663.564M	70.9	+54.8	+2.0	+31.7		+0.0 2	49.8	74.0 916.5 MHz Xmit	-24.2	Horiz 210
3	3668.400M	70.9	+54.8	+2.0	+31.7		+0.0 357	49.8	74.0 917.1 MHz Xmit	-24.2	Horiz 158
4	3666.000M	70.0	+54.8	+2.0	+31.7		+0.0 181	48.9	74.0 916.5 MHZ Xmit	-25.1	Vert 204
5	3668.400M	69.7	+54.8	+2.0	+31.7		+0.0 180	48.6	74.0 917.1 MHz Xmit	-25.4	Horiz 188
6	3663.500M	67.8	+54.8	+2.0	+31.7		+0.0 7	46.7	74.0 915.875 MHZ Xmit	-27.3	Horiz 215


EMCE Engineering Date: 9/22/2014 Time: 12:13:20 NWave WO#: 4069
EN55022B 1 - 10 GHz PK Test Distance: 3 Meters Sequence#: 1 Ext ATTN: 0 dB
80
70
60
50
40
30
20
10
dBµV/m
1000
10000
Frequency [MHz]
1
2
Readings
2 - EN55022B 1 - 10 GHz AVE
1 - EN55022B 1 - 10 GHz PK
Peak Readings

Test Location: EMCE Engineering •44366 S. Grimmer Blvd • Fremont, CA 94538 •

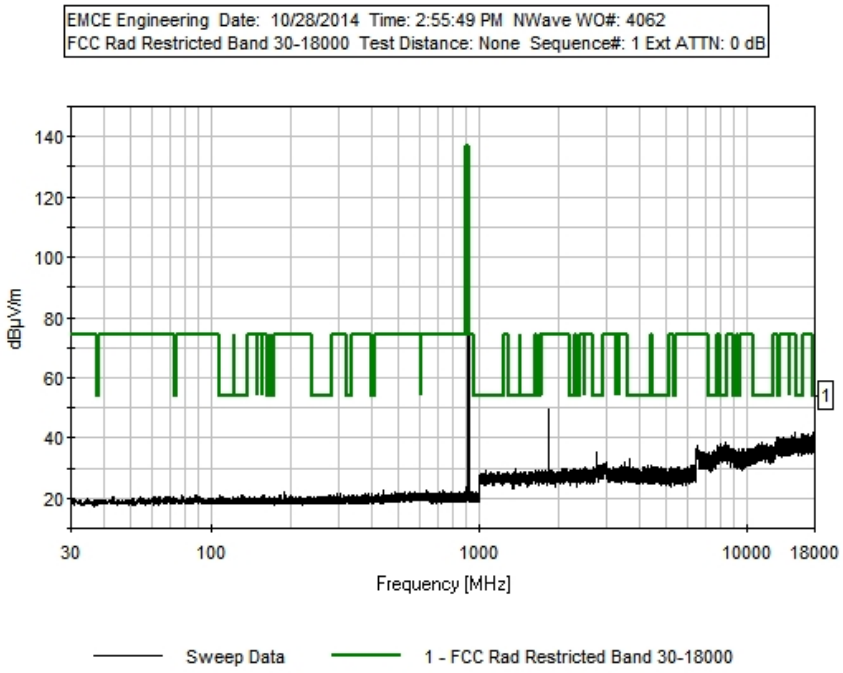
Customer: **NWave**
Specification: **FCC Rad Restricted Band 30-18000**
Work Order #: **4062** Date: 10/28/2014
Test Type: **Radiated Scan** Time: 2:55:49 PM
Equipment: **UNB Radio Module** Sequence#: 1
Manufacturer: NWAVE Tested By: Bob Cole
Model: NWRM1000
S/N:

Transducer Legend:

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: None

#	Freq MHz	Rdng dBµV	dB	dB	dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	2749.363M	45.1					-10.0	35.1	54.0	-18.9	None
2	7690.685M	45.0					-10.0	35.0	54.0	-19.0	None
3	3664.645M	43.0					-10.0	33.0	54.0	-21.0	None
4	3771.913M	40.5					-10.0	30.5	54.0	-23.5	None



CFR 47, 15.247:2007 Section #	RSS 210 Issue 8 Section #	Description	Results
15.207 (a)	RSS Gen 7.2.2	TX AC Power Conducted Emissions	N/A

TX AC Power Conducted Emissions

Requirement(s): CFR47, 15.207a, RSS Gen 7.2.2

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 µH/50 ohms line impedance stabilization network (LISN). 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. The lower limit applies at the boundary between the frequency ranges.

CFR47, 15.207c waives the requirement for battery powered devices:

Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

CLASS B LIMIT

Frequency Band (MHz)	EN 55022 B Limit (dBµV/m)	Detector
0.15 – 0.5	66 to 56	QP
0.5 – 5.0	56	QP
5.0 – 30.0	60	QP

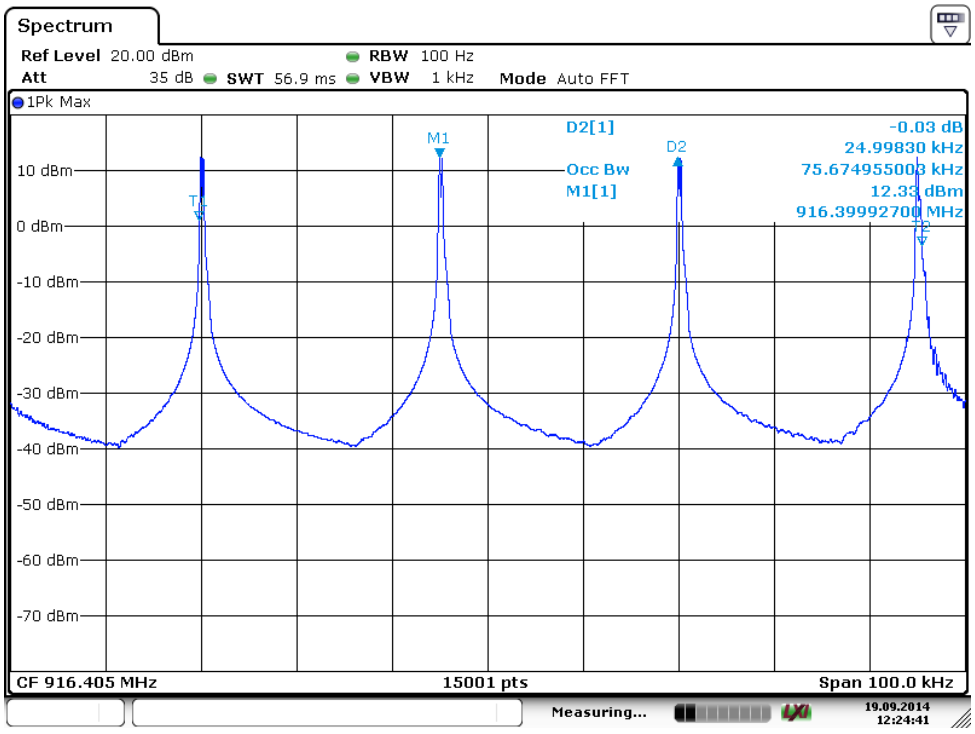
Not Applicable – Battery Powered EUT

CFR 47, 15.247:2007 Section #	RSS 210 Issue 8 Section #	Description	Results
15.247 (a)(1)	RSS 210 (A8.1b)	Channel Separation	PASSED

Channel Separation

For frequency hopping systems operating in the 902-928 MHz band: 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.

Frequency Band (MHz)	15.247 (a)(1)(i) Limit	Measured	Results
915.875 – 917.100	>=25 kHz	25 kHz	PASSED



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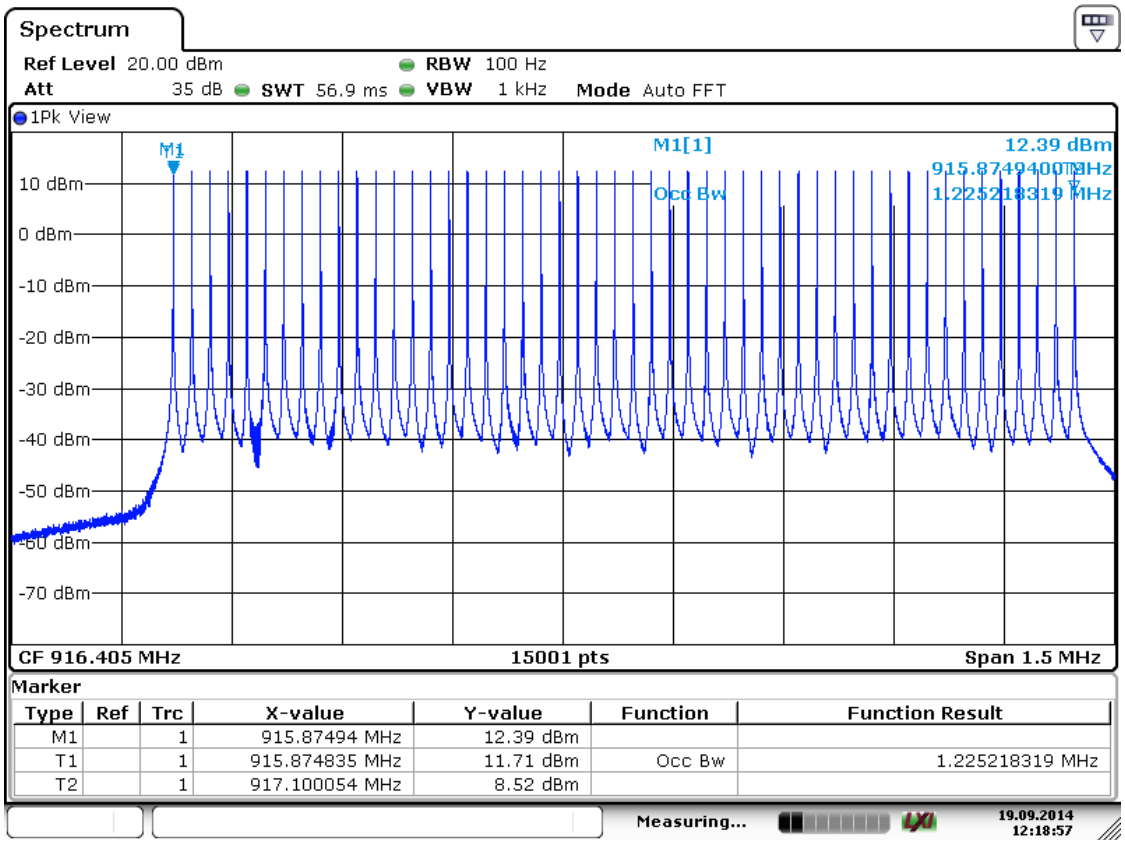
CFR 47, 15.247:2007 Section #	RSS 210 Issue 8 Section #	Description	Results
15.247 (a)(1)	RSS 210 (A8.1(c))	Number of Hopping Frequencies	PASSED

Number of Hopping Frequencies

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.

Frequency Band (MHz)	15.247 (a)(1)(i) Minimum	Measured	Results
915.875 – 917.100	50	50	PASSED



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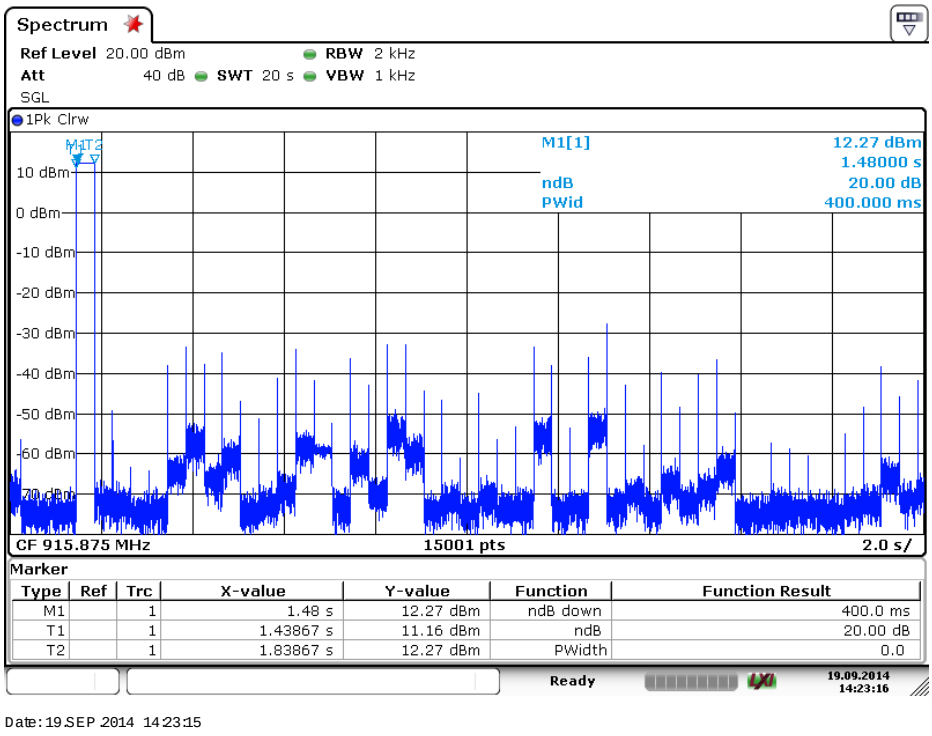
CFR 47, 15.247:2007 Section #	RSS 210 Issue 8 Section #	Description	Results
15.247 (1)(i)	RSS 210 (8.1(c))	Time of Occupancy(Dwell Time)	PASSED

Time of Occupancy(Dwell Time)

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.

Frequency Band (MHz)	15.247 (a)(1)(i) (ms)	Measured (ms)	Results
915.875	400	400	PASSED
916.500	400	400	PASSED
917.100	400	400	PASSED

Dwell Time – 915.875 MHz



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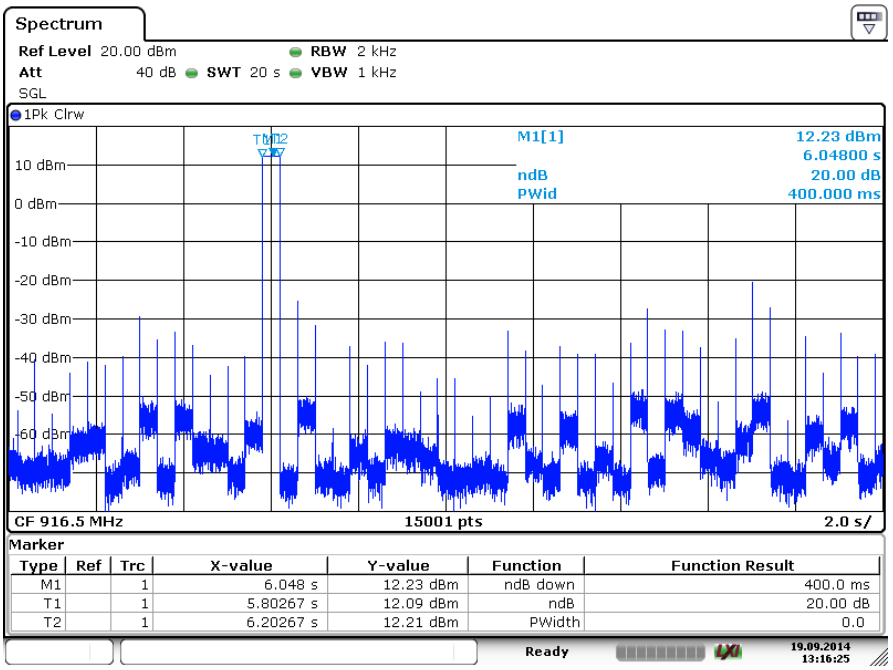
Dwell Time – 916.500 MHz



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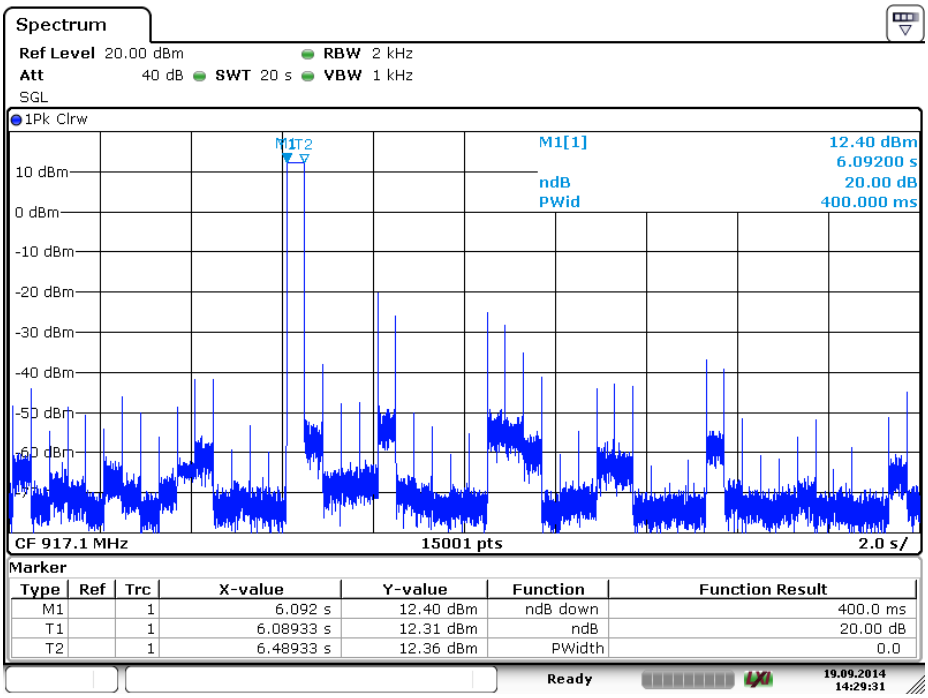
Dwell Time – 917.100 MHz



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CFR 47, 15.247:2007 Section #	RSS 210 Issue 8 Section #	Description	Results
	RSS-GEN 4.6.1	99% Occupied Bandwidth	-

99% Occupied Band Width

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power. This is also known as the *99% emission bandwidth*. For transmitters in which there are multiple carriers, contiguous or non-contiguous in frequency, the occupied bandwidth is to be the sum of the occupied bandwidths of the individual carriers

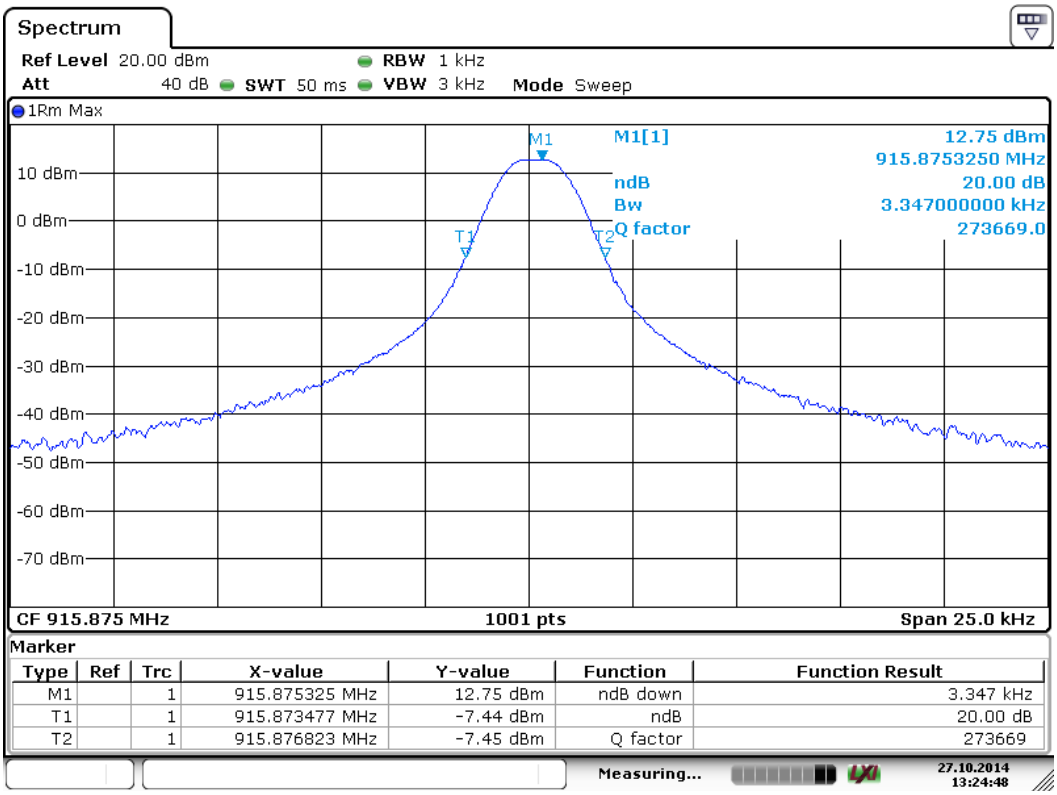
CFR 47, 15.247:200 Section #	RSS 210 Issue 8 Section #	Description	Results
15.247 (a)(1)	RSS 210 (A8.2)	20dB Bandwidth	PASSED

20 dB Band Width

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.**

Frequency Band (MHz)	15.247 (a)(1)(i) <(kHz)	Measured (kHz)	Results
915.875	500	3.347	PASSED
916.500	500	3.272	PASSED
917.100	500	3.332	PASSED

915.875 MHz BW



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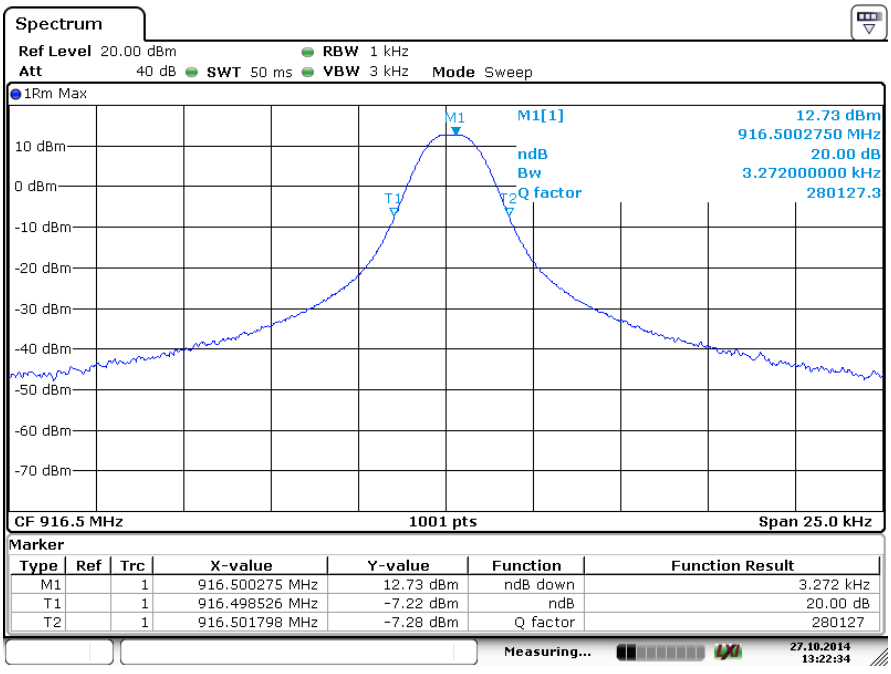
916.5 MHz BW



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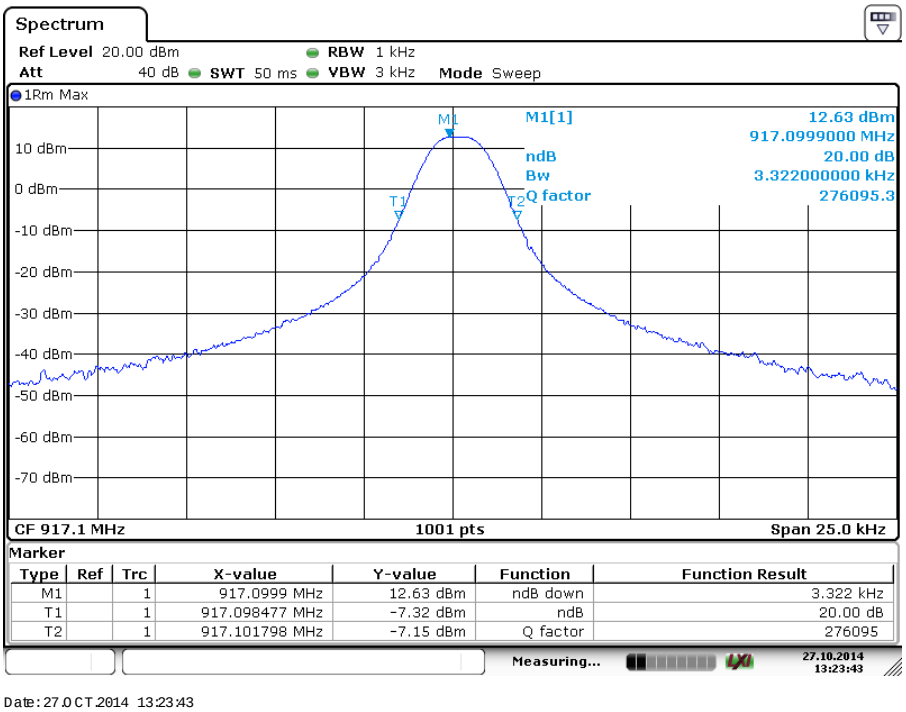
917.1 MHz BW



CFR 47, 15.247:200 Section #	RSS 210 Issue 8 Section #	Description	Results
15.247 (b)	RSS 210 (A8.4(2))	TX Conducted Peak Output Power	PASSED

TX Conducted Peak Output Power

Requirement(s): CFR47, 15.247(b)(2), RSS210(A8.4)

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

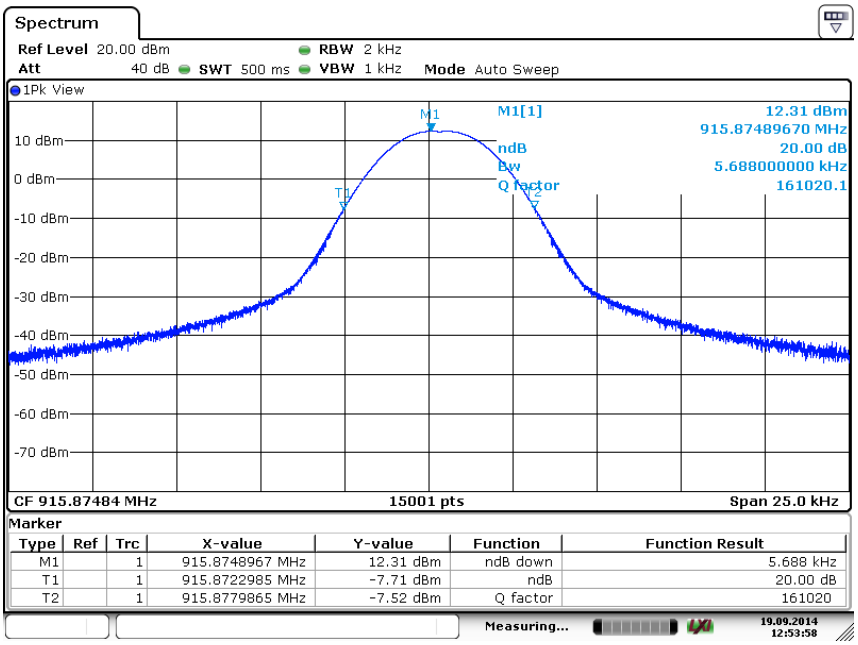
(2) **For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels**; and, 0.25 watts for systems employing

less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Frequency Band (MHz)	15.247 (a)(1)(i) (<mW)	Measured (mW)	Results
915.875	1000	17.02	PASSED
916.500	1000	16.83	PASSED
917.100	1000	16.67	PASSED

- Conducted Emissions Measurement Uncertainty: The uncertainty of the measurement with a confidence factor of approx. 95% (normal distribution) with a coverage factor of 2, in the range of 30 MHz – 26.2 GHz, is +/- 1.62 dB

Peak Output Power – 915.875 MHz



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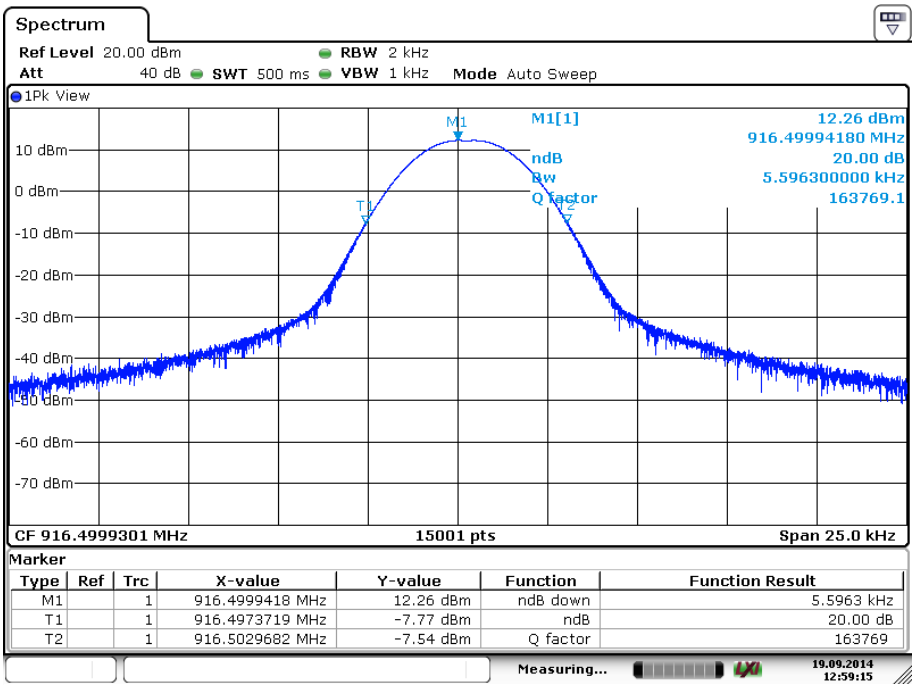
Peak Output Power – 916.5 MHz



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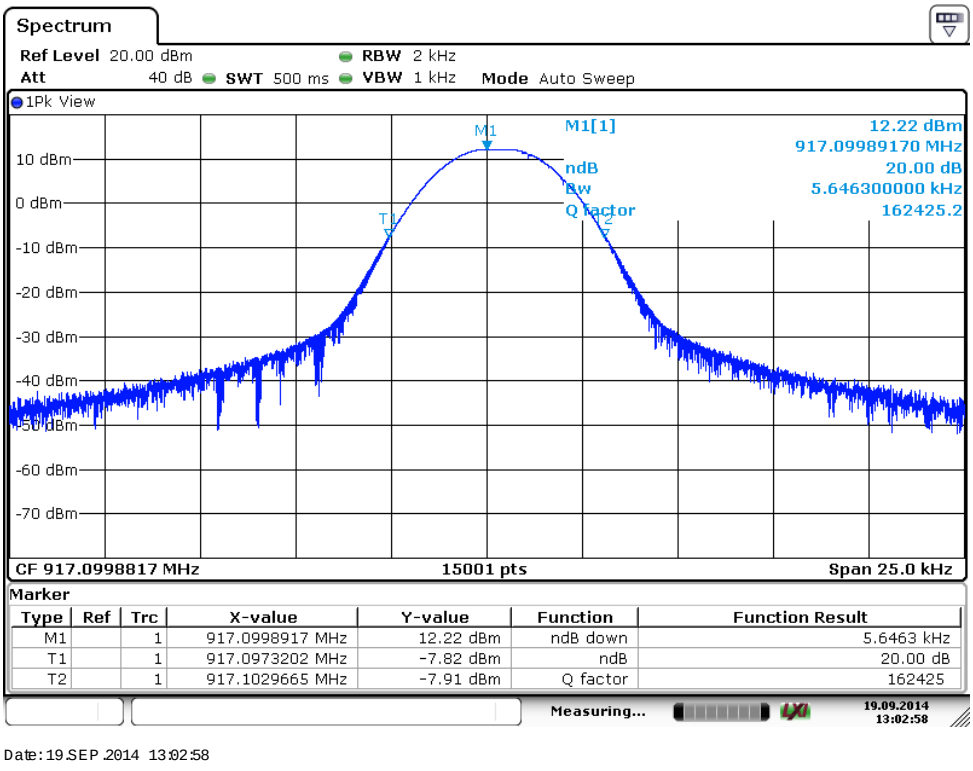
Peak Output Power – 917.1 MHz



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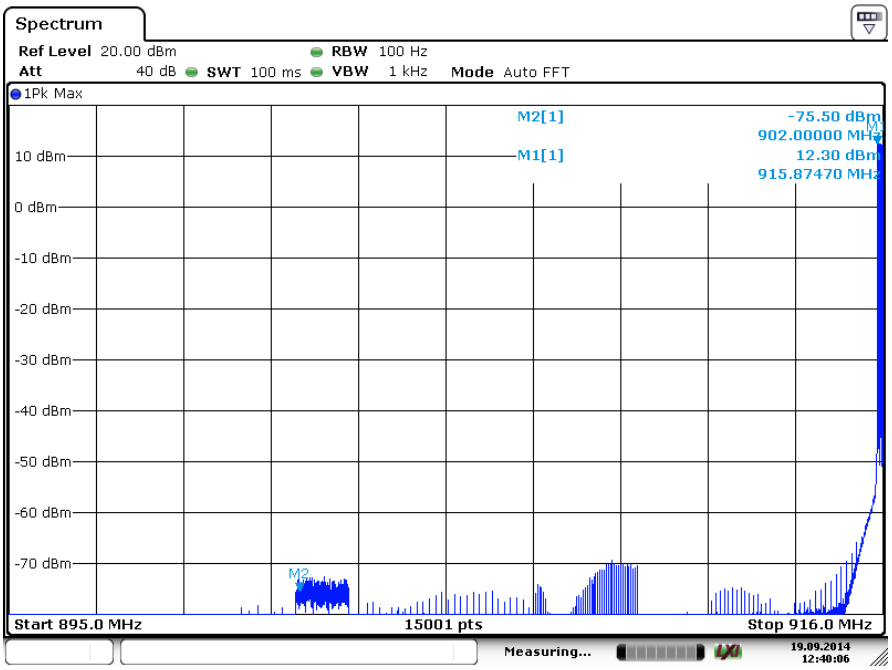
CFR 47, 15.247:2007 Section #	RSS 210 Issue 8 Section #	Description	Results
15.247 (c)	RSS 210 (A8.5)	Band-Edge Compliance of RF Emissions	PASSED

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

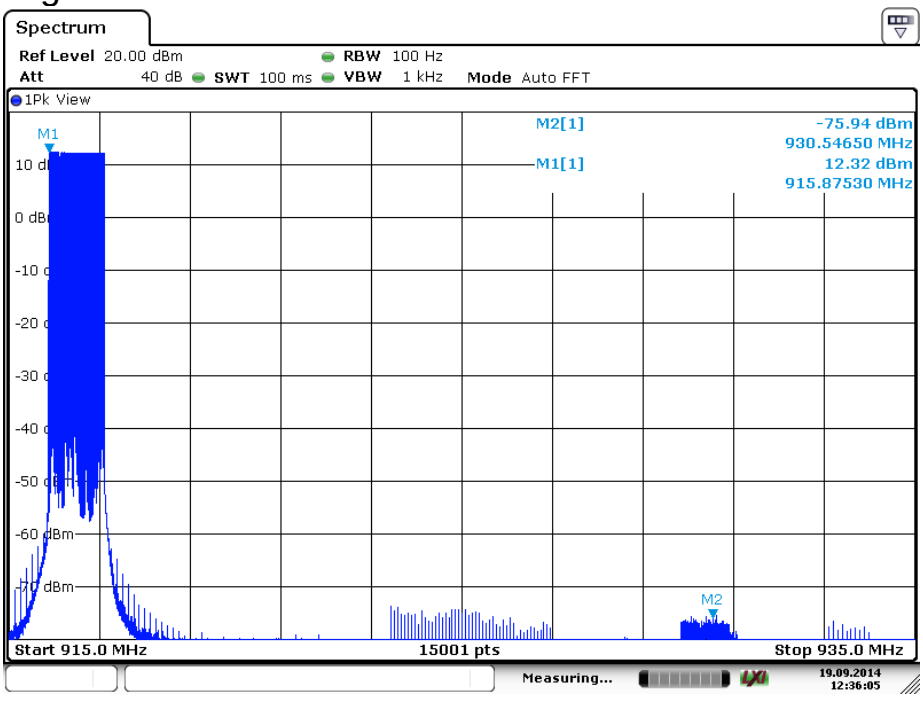
Frequency Band (MHz)	15.247 (a)(1)(i) (<dBm)	Measured (mW)	Results
902	-7.64	-75.50	PASSED
928	-7.64	-75.94	PASSED

902 MHz Bandedge



Date: 19.SEP.2014 12:40:06

928 MHz Bandedge



Date: 19.SEP.2014 12:36:05

CFR 47, 15.247:200 Section #	RSS 210 Issue 8 Section #	Description	Results
15.247g	RSS 210 (A8.1)	Hopping Capability	PASSED

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

Hopping sequence is generated by pre-programmed pseudorandom table function as outlined below.

Hopping step #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Channel #	21	42	29	7	33	30	9	14	35	26	17	2	43	50	41	15	31	39	22	40	23	3	5	20	16

Hopping step #	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Channel #	25	13	11	28	6	45	48	12	1	24	32	18	34	36	4	37	47	44	46	27	10	38	19	8	49

As can be seen from the table above, each of 50 25KHz channels is used just one time over 50 hops.

The receiver has an input processing band of 2 MHz which allows simultaneous reception of all 50 25KHz channels with occupy 1.25 MHz.

Transmitter and the receiver are designed to comply with all of the regulations in section §15.247. Regardless the data pattern and rate the transmitter is presented with, hopping is carried out according to hopping table specified above with equal use of all 50 channels and "listed before talk" check on each hop. Data that could not be sent immediately is buffered and sent when required channels become available or error is return upon the buffer overflow.

CFR 47, 15.247:200 Section #	RSS 210 Issue 8 Section #	Description	Results
15.247h	RSS 210 (A8.1)	Hopping Coordination Requirement	PASSED

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

"Listen before talk" method is used on each hopping step. If the channel is occupied, the transmitter waits 35 ms and makes another check (listen). If the channel is busy 2 times in a row, next channel is chosen from the table. No other coordination between transmitters is implemented.

CFR 47, 15.247:200 Section #	RSS 210 Issue 8 Section #	Description	Results
15.247i	RSS Gen (5.5)	RF Exposure Requirement	PASSED

According to §1.1310 and §2.1091 RF exposure is calculated.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	$*900/f^2$	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	$*180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

Prediction of MPE limit at a given distance:

$S = PG/4\pi R^2$
S = Power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

RESULTS

Max Peak output Power at antenna input terminal (dBm)	12.31
Max Peak output Power at antenna input terminal (mW)	17.02
Prediction distance (cm)	20.00000
Prediction frequency (MHz)	2441.00000
Antenna Gain(typical) (dBi)	1.300
Power density at prediction frequency (mW/cm^2)	0.004568
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2)	1.00000

8.0 TEST EQUIPMENT

Antenna Conducted Measurements:

Equipment	Type	Manufacturer	Calibration Due Date
EMI Analyzer System	84125B	Hewlett-Packard	5/17/15
Spectrum Analyzer	8566B	Hewlett-Packard	5/2/15
Pre-Amp	83051A	Hewlett-Packard	5/17/15
Pre-Amp	83017A	Hewlett-Packard	5/17/15
Pre-Amp	8744D	Hewlett-Packard	5/2/15
High Pass Filter	9701	CMT	5/17/15
Horn Antenna	SAS 200/571	AH Systems	12/5/14
Cable	0.25 meters	Murata	5/10/15

Spurious RF radiated emissions:

Equipment	Type	Manufacturer	Calibration Due Date
EMI Analyzer System	84125B	Hewlett-Packard	5/17/15
Spectrum Analyzer	8566B	Hewlett-Packard	8/10/15
Pre-Amp	83051A	Hewlett-Packard	5/17/15
Pre-Amp	83017A	Hewlett-Packard	5/17/15
Pre-Amp	8744D	Hewlett-Packard	5/2/15
High Pass Filter	9701	CMT	5/17/15
Horn Antenna	SAS 200/571	AH Systems	12/5/14
Cable	N – N (30 Meters)	EMCE	5/10/15