



**DATE: 06 January 2015**

**I.T.L. (PRODUCT TESTING) LTD.**

**FCC Radio Test Report**

for

**Roseman Engineering Ltd.**

Equipment under test:

**WAF Unit High Power 915 MHz**

**RPC-RF-14**

Tested by:

M. Zohar

Approved by:

D. Shidlowsky

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This report relates only to items tested.





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## 1. General Information

### 1.1 Administrative Information

Manufacturer:	Roseman Engineering Ltd.
Manufacturer's Address:	Kiryat Atidim, P.O. Box 58181 Tel Aviv, 61580 Israel Tel: +972-3-573-1801 Fax: +972-3-573-1807
Manufacturer's Representative:	Haim Kashi
Equipment Under Test (E.U.T):	WAF Unit High Power 915 MHz
Equipment Model No.:	RPC-RF-14
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	September 3, 2015
Start of Test:	September 3, 2015
End of Test:	September 17, 2015
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	47CFR15 Section 15.247



## **1.2 List of Accreditations**

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T-1877, G-2245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, IC 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.



### **1.3 Product Description**

The WAF (Wireless Automated Fueling) Unit is a transmitter that in conjunction with the Vehicle Identification Box (VIB) enables to identify the vehicle automatically on the fuel island.

### **1.4 Test Methodology**

Radiated testing was performed according to the procedures in FCC Public Notice DA 00-705 and ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### **1.5 Test Facility**

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

### **1.6 Measurement Uncertainty**

#### **Conducted Emission**

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)  
0.15 – 30 MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 3.6 dB

#### **Radiated Emission**

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)  
for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.96 dB

## 2. System Test Configuration

### 2.1 Justification

The E.U.T. was evaluated when transmitting at the Low (914.8MHz), Mid (921.2MHz) and High (927.6MHz) channels in the installation position. All tests, other than spurious radiated emissions, were performed conducted.

### 2.2 EUT Exercise Software

No special exercise software was used.

### 2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

### 2.4 Equipment Modifications

No modifications were needed in order to achieve compliance.

### 2.5 Configuration of Tested System

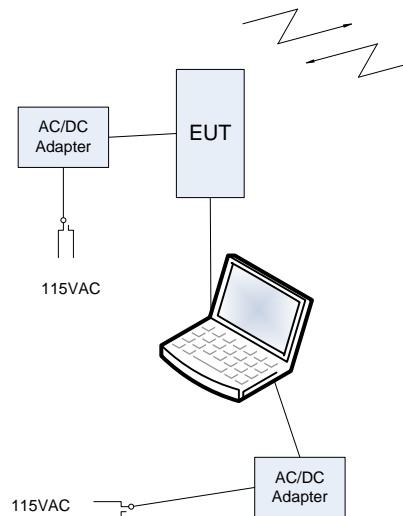


Figure 1. Configuration of Tested System – Radiated

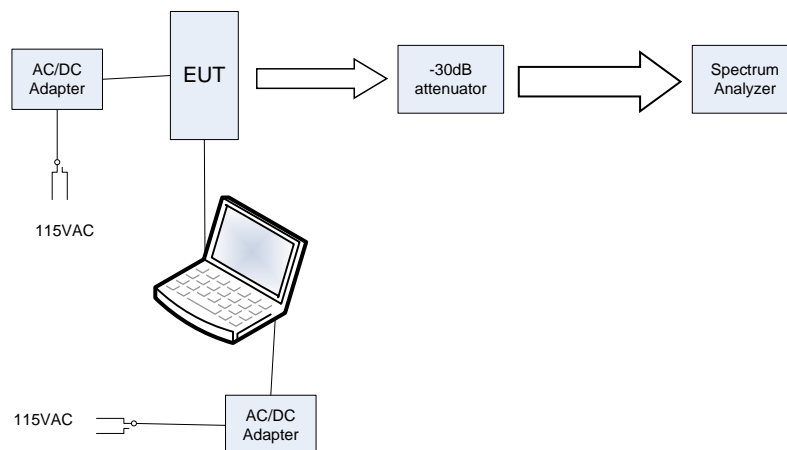


Figure 2. Configuration of Tested System - Conducted



### 3. Conducted & Radiated Measurement Test Set-Up Photos

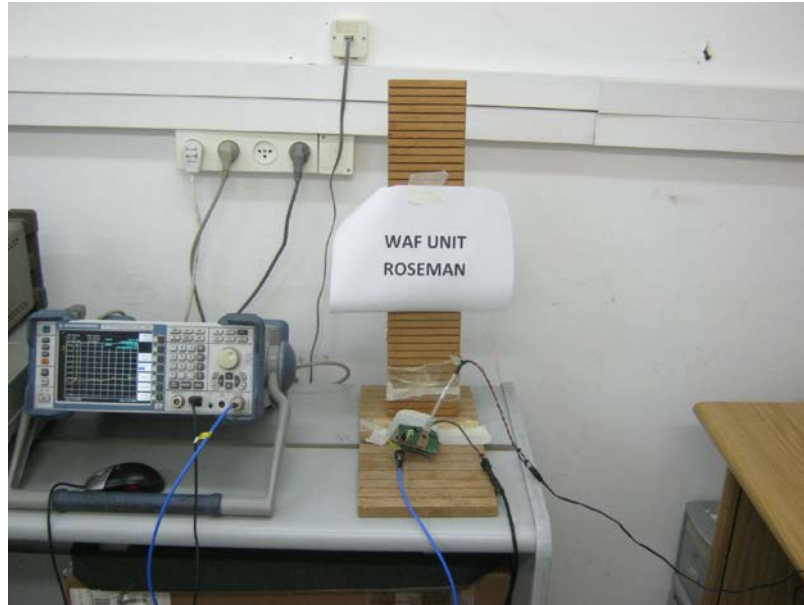


Figure 3. Conducted Emission From Antenna Ports Test



Figure 4. Conducted Emission From AC Mains



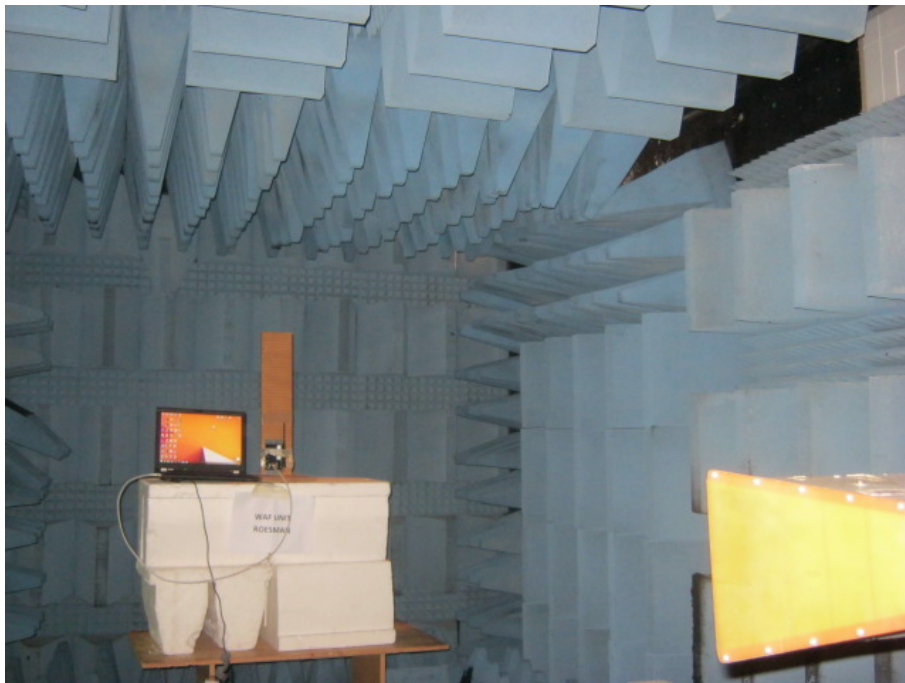
Figure 5. Radiated Emission Test



Figure 6. Radiated Emission Test



**Figure 7. Radiated Emission Test**



**Figure 8. Radiated Emission Test**



## 4. Conducted Emission From AC Mains

### 4.1 Test Specification

FCC Part 15, Subpart C, Section 15.207

### 4.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 2 of this report. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room (see Section 3), with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50  $\mu$ Hn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 4. Conducted Emission From AC Mains.*

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.





#### **4.3 Measure Data**

JUDGEMENT:                      Passed by 17.9 dB

The margin between the emission levels and the specification limit is, in the worst case, 17.9 dB for the phase line at 19.71 MHz and 19.08 dB at 19.71 MHz for the neutral line.

The EUT met the F.C.C. Part 15, Subpart C specification requirements.

The details of the highest emissions are given in *Figure 9* to *Figure 12*.



## Conducted Emission

E.U.T Description: WAF Unit High Power 915 MHz  
 Type: RPC-RF-14  
 Serial Number: Not designated

Specification: FCC Part 15, Subpart C

Lead: Phase

Detectors: Peak, Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)			
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
Trace1:	CE22BQP		
Trace2:	CE22BAP		
Trace3:	---		
2 Average	194 kHz	15.75	-38.11
1 Quasi Peak	242 kHz	16.76	-45.26
1 Quasi Peak	414 kHz	15.84	-41.72
2 Average	414 kHz	8.35	-39.21
2 Average	518 kHz	7.53	-38.46
1 Quasi Peak	538 kHz	13.23	-42.76
2 Average	962 kHz	13.50	-32.49
1 Quasi Peak	1.09 MHz	22.33	-33.67
2 Average	1.29 MHz	10.73	-35.26
1 Quasi Peak	1.634 MHz	26.19	-29.80
2 Average	2.986 MHz	10.99	-35.00
1 Quasi Peak	3.266 MHz	25.09	-30.90
1 Quasi Peak	3.69 MHz	14.77	-41.22
2 Average	3.93 MHz	9.70	-36.29
2 Average	7.922 MHz	19.04	-30.95
1 Quasi Peak	10.27 MHz	16.14	-43.85
1 Quasi Peak	16.23 MHz	31.61	-28.39
2 Average	16.23 MHz	26.44	-23.55
1 Quasi Peak	19.71 MHz	35.96	-24.03
2 Average	19.71 MHz	32.09	-17.90

Date: 17.SEP.2015 11:26:10

**Figure 9. Detectors: Peak, Quasi-peak, AVERAGE**

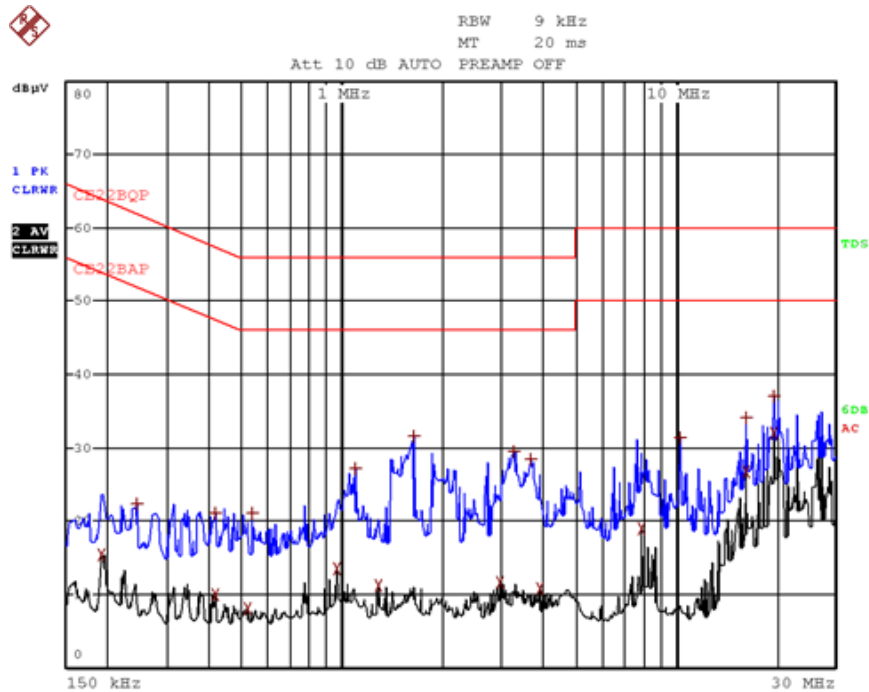
*Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*



## Conducted Emission

E.U.T Description WAF Unit High Power 915 MHz  
Type RPC-RF-14  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C  
Lead: Phase  
Detectors: Peak, Quasi-peak, Average



Date: 17.SEP.2015 11:25:09

Figure 10. Detectors: Peak, Quasi-peak, Average



## Conducted Emission

E.U.T Description    WAF Unit High Power 915 MHz  
Type                    RPC-RF-14  
Serial Number:        Not designated

Specification:    FCC Part 15, Subpart C  
Lead:                Neutral  
Detectors:        Peak, Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CE22BQP			
Trace2:	CE22BAP			
Trace3:	---			
	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	194 kHz	22.39	-41.46
2	Average	194 kHz	17.19	-36.66
2	Average	386 kHz	10.04	-38.10
1	Quasi Peak	406 kHz	14.66	-43.06
2	Average	470 kHz	8.69	-37.82
1	Quasi Peak	534 kHz	11.96	-44.03
2	Average	962 kHz	13.96	-32.03
1	Quasi Peak	1.158 MHz	18.12	-37.88
1	Quasi Peak	1.35 MHz	17.62	-38.37
2	Average	1.35 MHz	12.43	-33.56
2	Average	3.05 MHz	12.39	-33.60
1	Quasi Peak	3.522 MHz	15.71	-40.28
1	Quasi Peak	4.57 MHz	14.72	-41.27
2	Average	4.59 MHz	10.10	-35.89
2	Average	7.922 MHz	18.91	-31.09
1	Quasi Peak	10.246 MHz	24.68	-35.31
1	Quasi Peak	10.618 MHz	16.35	-43.64
2	Average	16.23 MHz	25.53	-24.47
1	Quasi Peak	19.71 MHz	34.73	-25.26
2	Average	19.71 MHz	30.91	-19.08

Date: 17.SEP.2015 11:30:59

**Figure 11. Detectors: Peak, Quasi-peak, AVERAGE**

*Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*



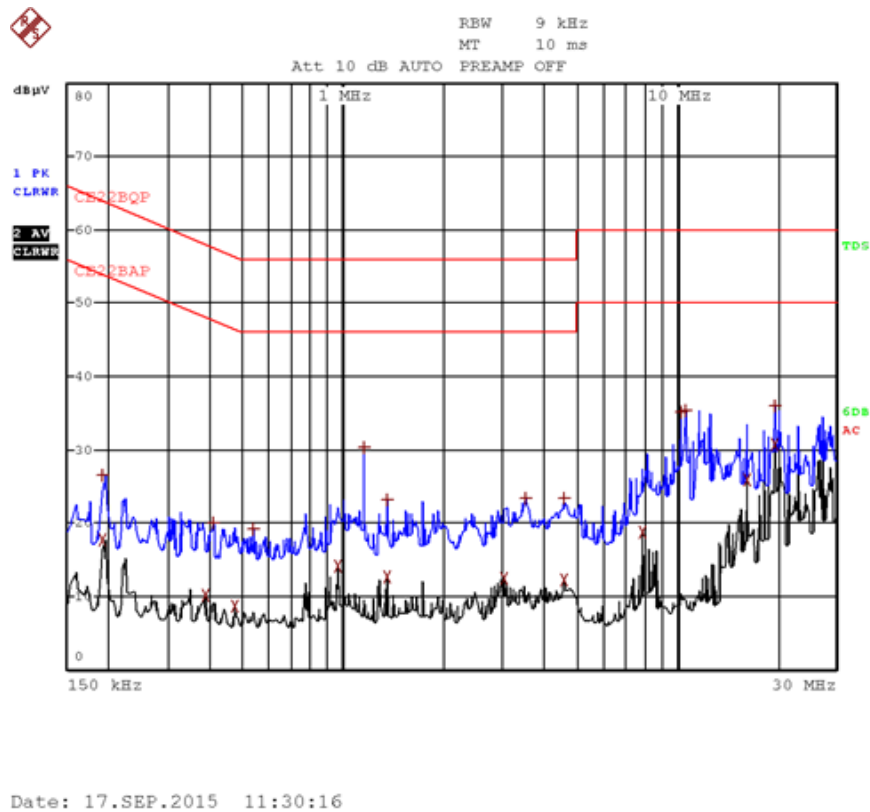
## Conducted Emission

E.U.T Description    WAF Unit High Power 915 MHz  
 Type                    RPC-RF-14  
 Serial Number:        Not designated

Specification:    FCC Part 15, Subpart C

Lead:                Neutral

Detectors:        Peak, Quasi-peak, Average



**Figure 12 Conducted Emission: NEUTRAL  
 Detectors: Peak, Quasi-peak, Average**



#### 4.4 Test Instrumentation Used, Conducted Measurement

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Period</b>
LISN	Fischer	FCC-LISN-2A	127	March 16, 2015	1 Year
Transient Limiter	HP	11947A	3107A03041	May 13, 2015	1 Year
EMI Receiver	Rohde & Schwarz	ESCI7	100724	January 4, 2015	1 Year

**Figure 13 Test Equipment Used**

## 5. 20dB Minimum Bandwidth

### 5.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(1)(i)

### 5.2 Test Procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable. The transmitter unit operated with normal modulation. The spectrum analyzer was set to 10 kHz RBW. The EUT was set up as shown in *Figure 2*, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested at Low, Mid and High channels.

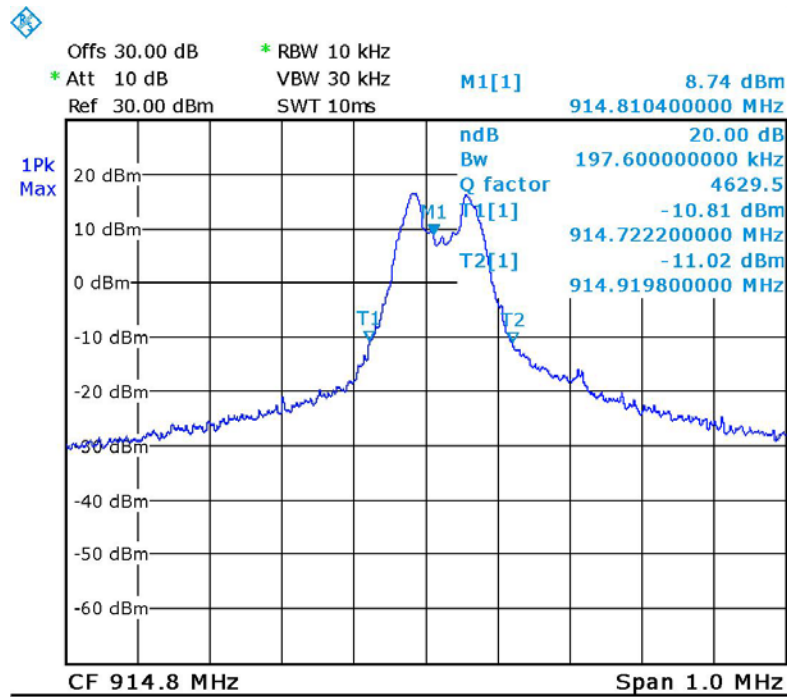
### 5.3 Test Results

Operation Frequency (MHz)	Bandwidth Reading (kHz)	Specification (kHz)
914.8	197.6	<250
921.2	181.6	<250
927.6	153.7	<250

**Figure 14 — 20 dB Minimum Bandwidth Test Results**

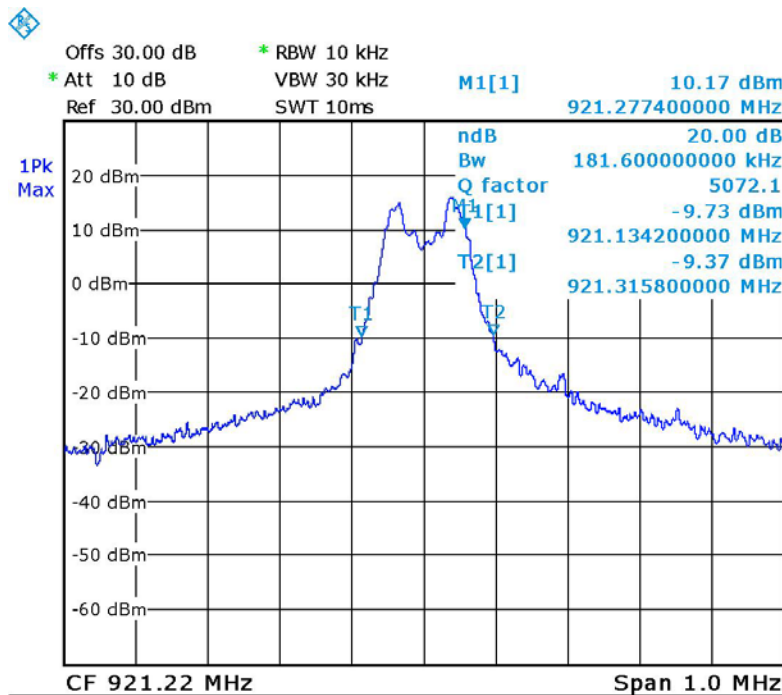
JUDGEMENT: Passed

For additional information see *Figure 15* to *Figure 17*.



Date: 3.SEP.2015 13:39:42

Figure 15. —914.8 MHz - Low



Date: 3.SEP.2015 13:47:29

Figure 16. 921.2 MHz - Mid

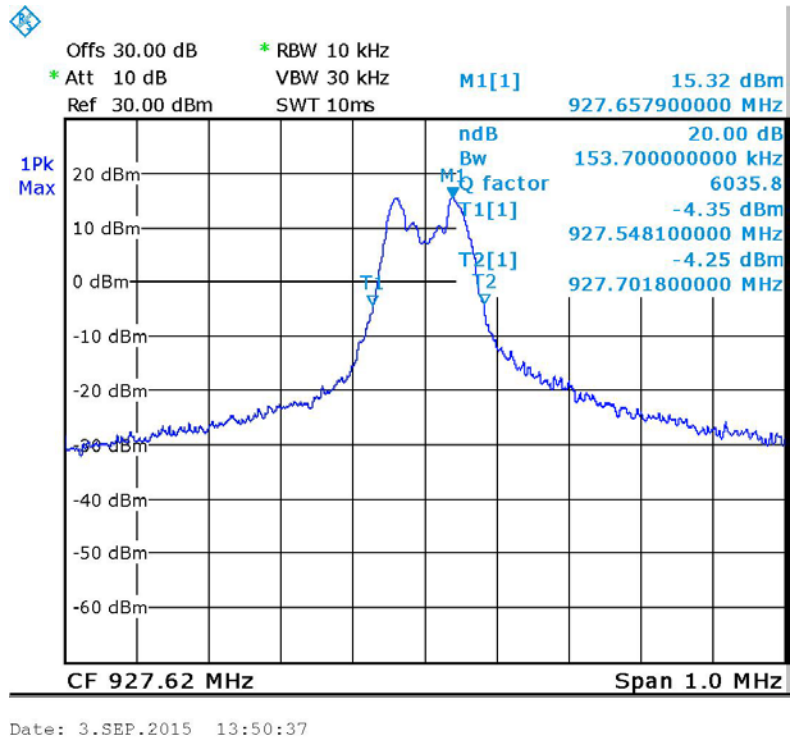


Figure 17. 927.6- High



**5.4 Test Equipment Used, 20 dB Minimum Bandwidth**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Last Calibration Date</b>	<b>Period</b>
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	1 year
-30dB Attenuator	Bird	8304-N30DB	-	June 2, 2015	1 year

**Figure 18 Test Equipment Used**



## 6. Number of Hopping Frequencies

### 6.1 Test Specification

F.C.C., Part 15, Subpart C Section 15.247(a)(1)(i)

### 6.2 Test Procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:

Band of Operation: 902-928 MHz

RBW: 30 kHz, VBW: 100 kHz

Detector Function: Peak, Trace: Maximum Hold

### 6.3 Test Results

Number of Hopping Frequencies	Specification
51	$\geq 50$

Figure 19 Number of Hopping Frequencies Test Results

JUDGEMENT: Passed

For additional information see *Figure 20* to *Figure 23*.













**6.4 Test Equipment Used, Number of Hopping Frequencies**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Last Calibration Date</b>	<b>Period</b>
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	1 year
-30dB Attenuator	Bird	8304-N30DB	-	June 2, 2015	1 year

**Figure 24 Test Equipment Used**



## 7. Channel Frequency Separation

### 7.1 Test Specification

Specification: FCC Part 15, Subpart C, 15.247(a) (1)

### 7.2 Test Procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:

RBW: 30 kHz, VBW: 100 kHz

Detector Function: Peak, Trace: Maximum Hold.

The marker delta function to determine the separation between the peaks of the adjacent channels was used.

### 7.3 Test Results

Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
253.5	>197.6	-55.9

Figure 25 Channel Frequency Separation Test Results

JUDGEMENT: Passed by 55.9 kHz

For additional information see *Figure 26*.





**7.4 Test Equipment Used, Channel Frequency Separation Test**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Last Calibration Date</b>	<b>Period</b>
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	1 year
-30dB Attenuator	Bird	8304-N30DB	-	June 2, 2015	1 year

**Figure 27 Test Equipment Used**

## 8. Peak Output Power

### 8.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(b)(2)

### 8.2 Test Procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 30.5dB)

The EMI receiver was set to 300 kHz resolution BW. The EUT was set up as shown in *Figure 2* and its proper operation was checked.

The E.U.T. was tested at the Low (914.8MHz), Mid (921.2 MHz) and High (927.6 MHz) channels with modulation.

### 8.3 Test Results

Operation Frequency (MHz)	Power (dBm)	Power (mW)	Specification (mW)	Margin (mW)
914.8	16.8	47.9	1000.0	-952.1
921.2	16.5	44.7	1000.0	-955.3
927.6	16.2	41.7	1000.0	-958.3

**Figure 28 Radiated Power Output Test Results**

JUDGEMENT: Passed by 952.1 mW

For additional information see *Figure 29* to *Figure 31*.









**8.4 Test Equipment Used, Radiated Maximum Power Output**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Last Calibration Date</b>	<b>Period</b>
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	1 year
-30dB Attenuator	Bird	8304-N30DB	-	June 2, 2015	1 year

**Figure 32 Test Equipment Used**



## 9. Dwell Time on Each Channel

### 9.1 **Test Specification**

FCC Part 15, Section 15.247(a)(1)(i)

### 9.2 **Test Procedure**

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

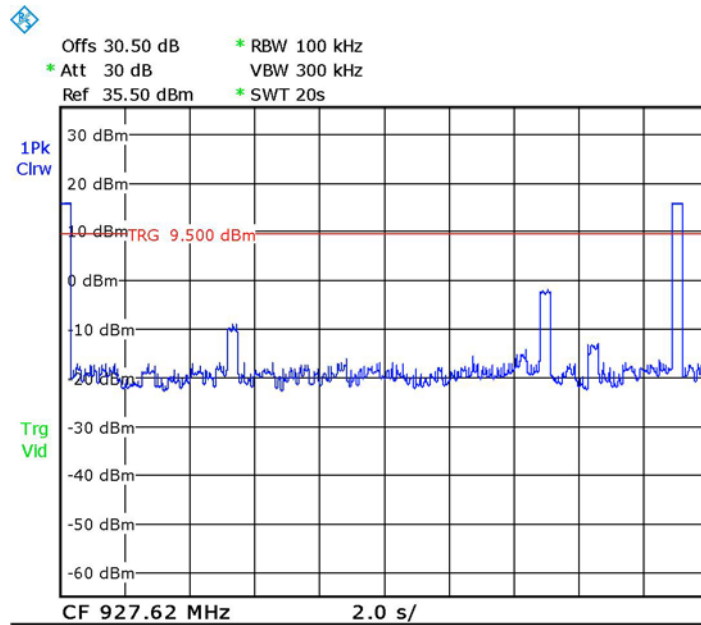
The spectrum analyzer was set to 100 kHz RBW. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 20 seconds.

### 9.3 **Test Results**

JUDGEMENT:                      Passed

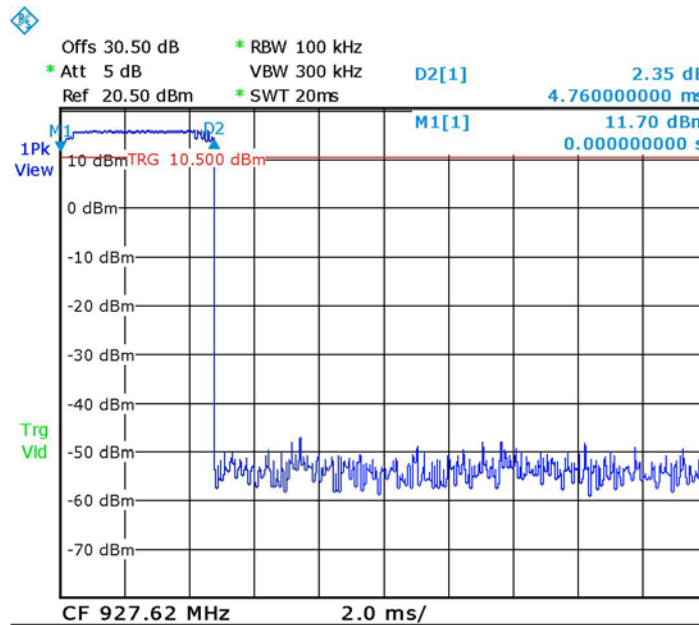
The E.U.T met the requirements of the FCC Part 15, Section 15.247(a)(1)(i).

Additional information of the results is given in *Figure 33* to *Figure 34*.



Date: 3.SEP.2015 14:48:12

Figure 33 — Number of Bursts in 20 sec=2



Date: 3.SEP.2015 14:41:44

Figure 34 — Burst Duration =4.76mS  
DWELL TIME = 4.76m \*2= 9.52msec<0.4s



**9.4 Test Equipment Used, Dwell Time on Each Channel**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Last Calibration Date</b>	<b>Period</b>
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	1 year
-30dB Attenuator	Bird	8304-N30DB	-	June 2, 2015	1 year

**Figure 35 Test Equipment Used**

## 10. Band Edge

### 10.1 Test Specification

FCC Part 15, Section 15.247(d)

### 10.2 Test Procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

The transmitter unit operated in 2 modes: hopping enabled and hopping disabled. The RBW was set to 100 kHz. The EUT was set up as shown in *Figure 2* and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum level. The display line was set to 20 dBc and the EMC analyzer was set to the band edge frequencies.

The E.U.T. was tested at the lower and the upper channels.

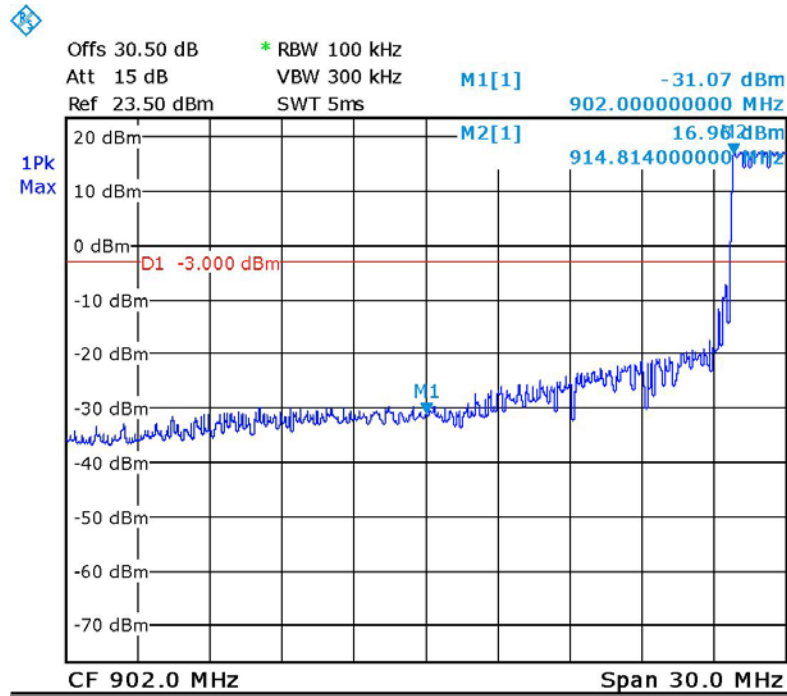
### 10.3 Test Results

Mode	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
Hopping	Low	902.0	-31.0	-3.0	-28.0
	High	928.0	-11.7	-3.8	-7.9
Non-Hopping	Low	902.0	-30.4	-3.0	-27.4
	High	928.0	-5.9	-3.7	-2.2

**Figure 36 Band Edge Test Results**

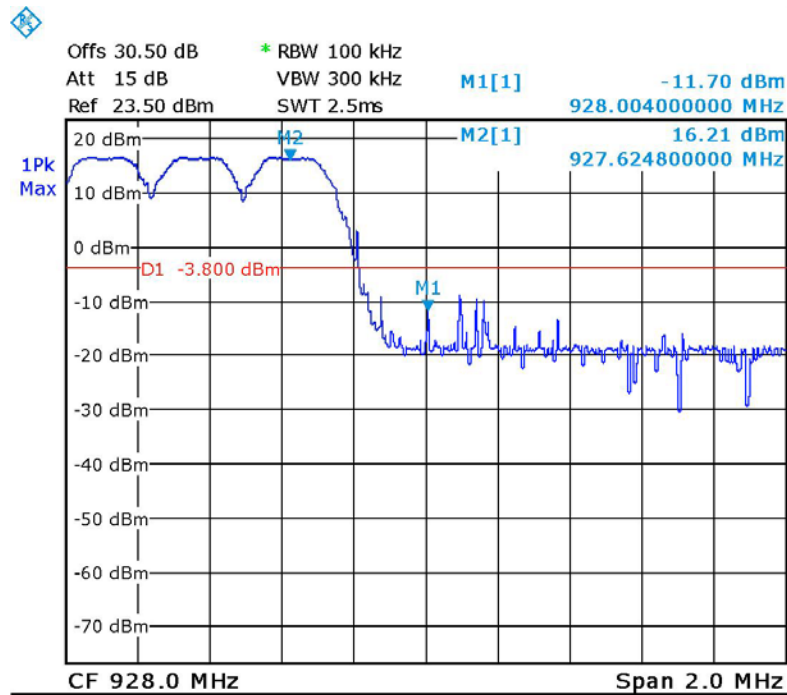
JUDGEMENT: Passed by 2.2 dB

For additional information see *Figure 37* to *Figure 40*.



Date: 7.SEP.2015 08:41:06

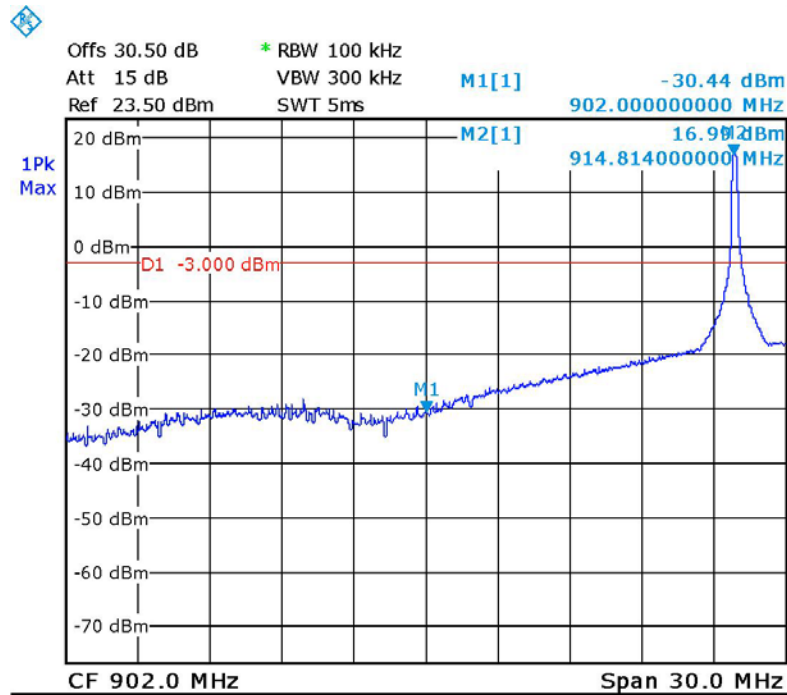
Figure 37 — Hopping - Low



Date: 7.SEP.2015 08:14:32

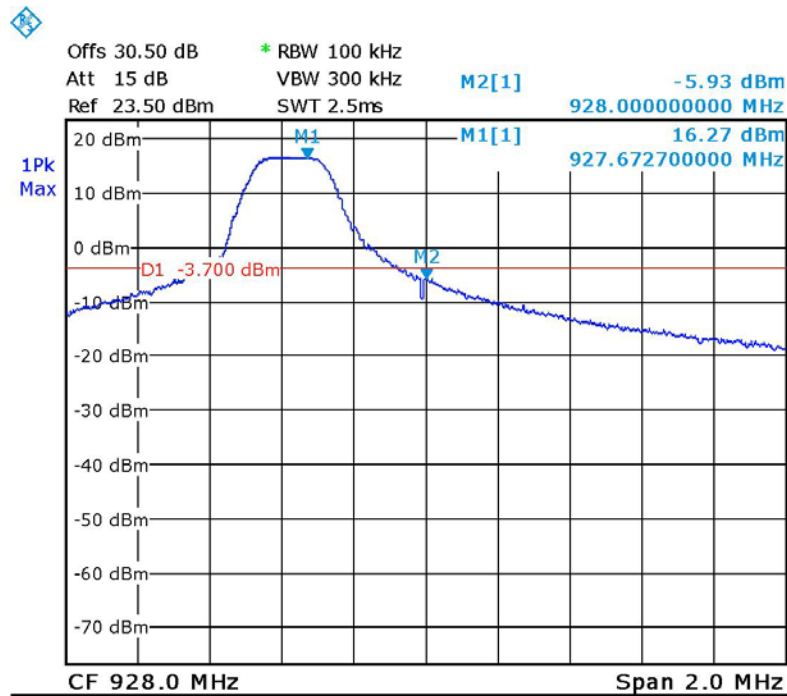
Figure 38 — Hopping - High





Date: 7.SEP.2015 08:31:20

Figure 39 — Non-Hopping - Low



Date: 7.SEP.2015 08:23:42

Figure 40 — Non-Hopping - High



#### 10.4 Test Equipment Used, Band Edge Spectrum

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Last Calibration Date</b>	<b>Period</b>
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	1 year
-30dB Attenuator	Bird	8304-N30DB	-	June 2, 2015	1 year

**Figure 41 Test Equipment Used**



## 11. Emissions in Non-Restricted Frequency Bands

### 11.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

### 11.2 Test Procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

The frequency range 1.0MHz-10000.0 MHz was scanned to find other emissions that don't fall in the restricted band

RBW was set to 100 kHz and scanning was performed to find spurious emissions within 20dBc relating to the fundamental max power.

The E.U.T. was operated at the following frequencies: Low (914.8 MHz), Mid (921.2 MHz) and High (927.6 MHz).

These frequencies were measured using a peak detector.

### 11.3 Test Results

JUDGEMENT:                      Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247 (d) specification.

For additional information see *Figure 42* to *Figure 44*.

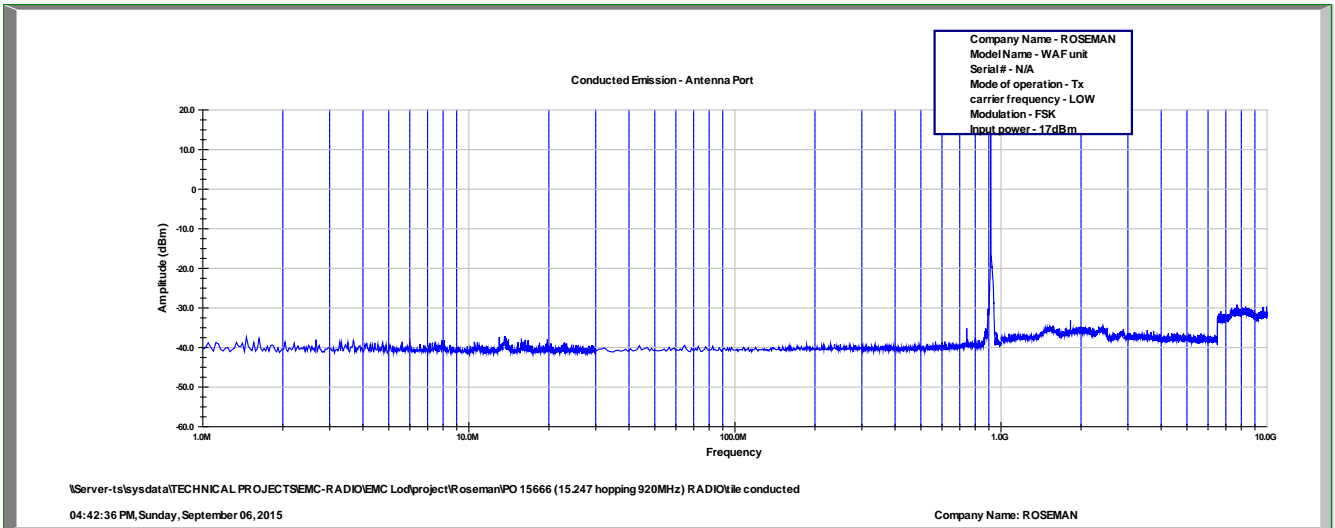


Figure 42 Conducted Spurious Emission – 914.8 MHz

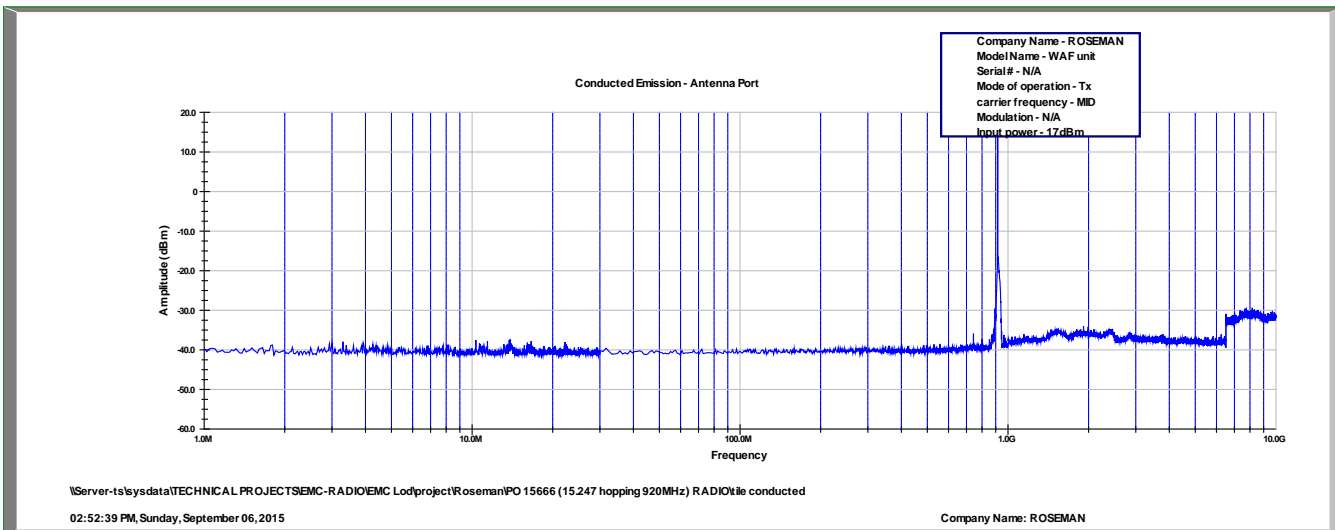


Figure 43 Conducted Spurious Emission - 921.2 MHz

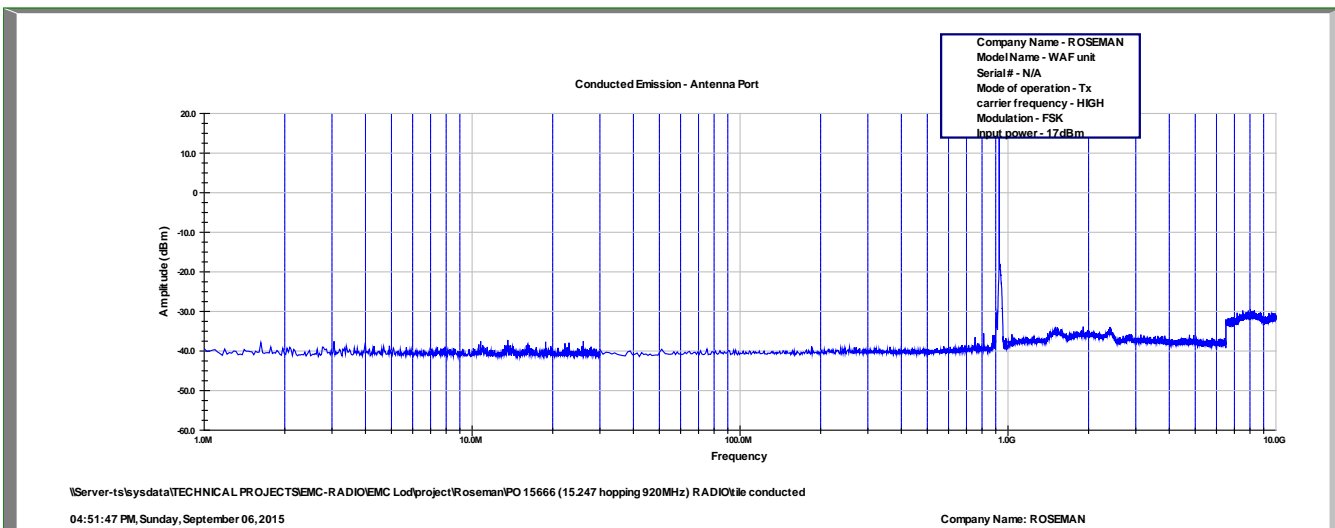


Figure 44 Conducted Spurious Emission – 927.6 MHz



**11.4 Test Equipment Used, Emissions in Non-Restricted Frequency Bands**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Last Calibration Date</b>	<b>Period</b>
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	1 year
-30dB Attenuator	Bird	8304-N30DB	-	June 2, 2015	1 year

**Figure 45 Test Equipment Used**



## 12. Emissions in Restricted Frequency Bands

### 12.1 Test Specification

FCC, Part 15, Subpart C, Sections 247(d), 15.205, 15.209

### 12.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

#### **For 9 kHz-1000.0MHz range:**

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and loop/broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 1.

The frequency range 9 kHz-1000 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements.

In the frequency range of 9 kHz – 30 MHz, the center of the loop antenna height was one meter above the ground.

In the frequency range of 30 MHz – 1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

#### **For 1000.0MHz-10000MHz range:**

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in Figure 1.

The frequency range 1000 MHz-10000 MHz was scanned.

The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

In the frequency range 1000-7000MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.

In the frequency range 7000M-10000 MHz, a spectrum analyzer including a low noise amplifier was used.

During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.



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 (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength* (dBµV/m)	Field strength* (dBµV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

\*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

The E.U.T. was at a distance of 3 meters and tested in three operating frequencies:

Low (914.8MHz), Mid (921.2MHz) and High (927.6 MHz).

### 12.3 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C 209 specification.

For additional information see *Figure 46* and *Figure 47*.



## Radiated Emission

E.U.T Description    WAF Unit High Power 915 MHz  
Type                    RPC-RF-14  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 9 kHz to 10.0 GHz  
Test Distance: 3 meters                              Detector: Peak

Operation Frequency	Freq. (GHz)	Polarity (H/V)	Peak Reading (dB $\mu$ V/m)	Peak Specification (dB $\mu$ V/m)	Peak Margin (dB)
Low	3.66	H	53.2	74.0	-20.8
	3.66	V	59.5	74.0	-14.5
Mid	3.68	H	52.3	74.0	-21.7
	3.68	V	56.8	74.0	-17.2
High	3.71	H	55.9	74.0	-18.1
	3.71	V	57.6	74.0	-16.4

**Figure 46. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain





## Radiated Emission

E.U.T Description    WAF Unit High Power 915 MHz  
Type                      RPC-RF-14  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical  
Test Distance: 3 meters

Frequency range: 9 kHz to 10.0 GHz  
Detector: Average

Operation Frequency	Freq. (GHz)	Polarity (H/V)	Average Result (dB $\mu$ V/m)	Average Specification (dB $\mu$ V/m)	Average Margin (dB)
Low	3.66	H	36.5	54.0	-17.5
	3.66	V	44.7	54.0	-9.3
Mid	3.68	H	38.2	54.0	-15.8
	3.68	V	40.8	54.0	-13.2
High	3.71	H	39.8	54.0	-14.2
	3.71	V	40.9	54.0	-13.1

**Figure 47. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Avg Reading” includes Avg factor.



#### 12.4 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{v/m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

FS:	Field Strength [dB $\mu$ v/m]
RA:	Receiver Amplitude [dB $\mu$ v]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

Example: FS = 30.7 dB $\mu$ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB $\mu$ V

No external pre-amplifiers are used.



### 12.5 Test Equipment Used, Emissions in Restricted Frequency Bands

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
EMI Receiver	R&S	ESCI7	100724	January 4, 2015	1 year
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
EMI Receiver	HP	8542E	3906A00276	March 11, 2015	1 year
RF Filter section	HP	85420E	3705A00248	March 19, 2015	1 year
Horn Antenna	ETS	3115	29845	May 19, 2015	3 years
Log Periodic Antenna	EMCO	3146	9505-4081	December 28, 2015	1 year
Biconical Log Antenna	EMCO	3142	1250	May 22, 2014	2 years
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2014	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	March 1, 2015	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	March 1, 2015	1 year
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 48 Test Equipment Used

### 13. Avg. Factor Calculation

1. Pulse period = 1 (worst scenario)
2. Pulse duration = 1 (worst scenario)
3. Burst duration = 4.76msec

$$4. \text{ Average Factor} = 20 \log \left[ \frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within 100msec} \right]$$

$$\text{Average Factor} = 20 \log \left[ 1 * \frac{4.76}{100} * 5 \right] = -12.5\text{dB}$$

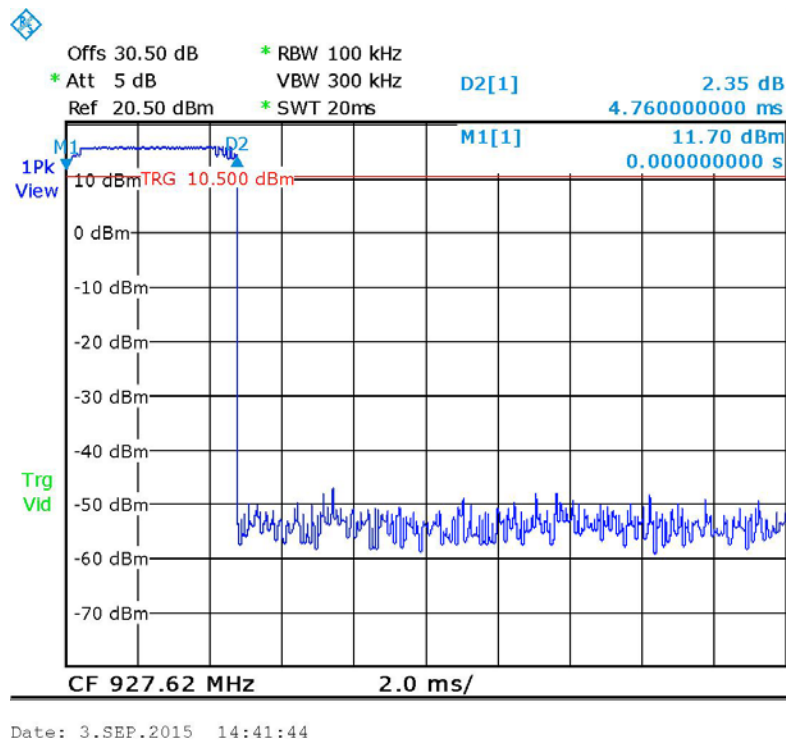
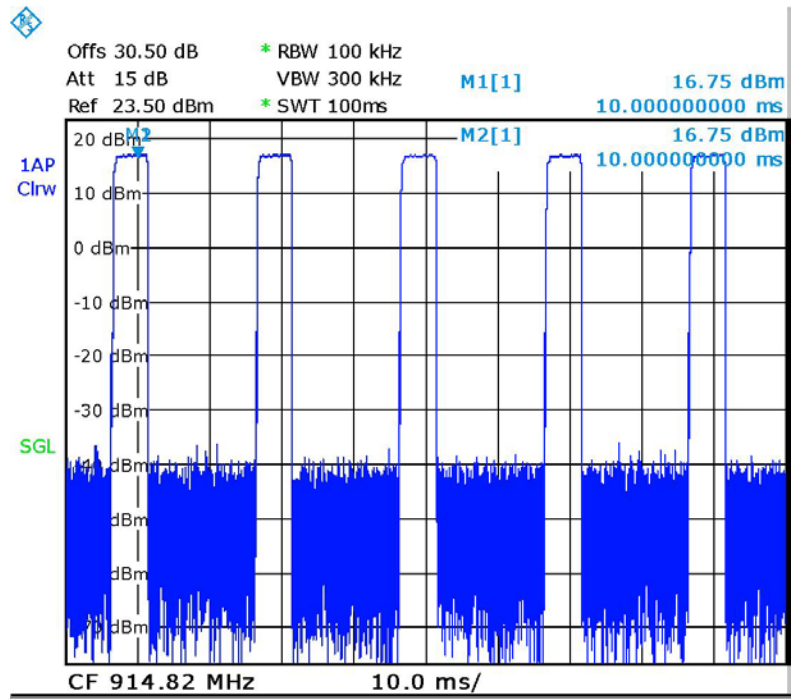


Figure 49. Burst Duration



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Figure 50. Number of Bursts in 100msec=5



**13.1 Test Equipment Used, Average Factor**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Last Calibration Date</b>	<b>Period</b>
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	1 year
-30dB Attenuator	Bird	8304-N30DB	-	June 2, 2015	1 year

**Figure 51 Test Equipment Used**



## 14. Antenna Gain/Information

The antenna gain is 2 dBi.

## 15. R.F Exposure/Safety

The typical placement of the E.U.T. is wall mounted. The typical distance between the E.U.T. and the user is 20cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on 47CFR1 Section 1.1307(b)(1) Requirements

(a) FCC Limit at 914.8 MHz is:  $\frac{f}{1500} = 0.609 \frac{mW}{cm^2}$

FCC Limit at 921.2 MHz is:  $\frac{f}{1500} = 0.614 \frac{mW}{cm^2}$

FCC Limit at 927.6 MHz is:  $\frac{f}{1500} = 0.618 \frac{mW}{cm^2}$

Using Table 1 of 47CFR1 Section 1.1310 limit for general population/uncontrolled exposures, the above levels are an average over 30 minutes.

(b) The power density produced by the E.U.T. is:

$$S = \frac{P_t G_t}{4\pi R^2}$$

$P_t$  = Calculated Transmitted Power 16.8 dBm = 47.9 mW

$G_t$  = Antenna Gain 2dBi = 1.6 numeric

$R$  = Distance From Transmitter 20 cm

(c) The peak power density produced by the E.U.T. is:

Frequency (MHz)	Pt (mW)	Antenna type	G <sub>T</sub> (dBi)	R (cm)	S <sub>AV</sub> (mW/cm <sup>2</sup> )	Spec (mW/cm <sup>2</sup> )
914.8	47.9	Internal	1.6	20	0.015247	0.609
921.2	44.7	Internal	1.6	20	0.014228	0.614
927.6	41.7	Internal	1.6	20	0.013274	0.618

(d) The above are below the FCC limit.



## 16. APPENDIX A - CORRECTION FACTORS

### 16.1 Correction factors for **CABLE**

**from EMI receiver  
to test antenna  
at 3 meter range.**

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
0.010	0.4	50.00	1.2
0.015	0.2	100.00	0.7
0.020	0.2	150.00	2.1
0.030	0.3	200.00	2.3
0.050	0.3	300.00	2.9
0.075	0.3	500.00	3.8
0.100	0.2	750.00	4.8
0.150	0.2	1000.00	5.4
0.200	0.3	1500.00	6.7
0.500	0.4	2000.00	9.0
1.00	0.4	2500.00	9.4
1.50	0.5	3000.00	9.9
2.00	0.5	3500.00	10.2
5.00	0.6	4000.00	11.2
10.00	0.8	4500.00	12.1
15.00	0.9	5000.00	13.1
20.00	0.8	5500.00	13.5
		6000.00	14.5

**NOTES:**

1. The cable type is SPUMA400 RF-11N(X2) and 39m long
2. The cable is manufactured by Huber + Suhner



**16.2 Correction factors for ACTIVE LOOP ANTENNA**

**Model 6502  
S/N 9506-2950**

<b>FREQUENCY</b>	<b>Magnetic Antenna Factor</b>	<b>Electric Antenna Factor</b>
<b>(MHz)</b>	<b>(dB)</b>	<b>(dB)</b>
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2



**16.3 Correction factors for Horn ANTENNA**

**Model: 3115**

**Antenna serial number: 29845**

**10 meter range**

<b>FREQUENCY</b>	<b>AFE</b>	<b>FREQUENCY</b>	<b>AFE</b>
<b>(MHz)</b>	<b>(dB/m)</b>	<b>(MHz)</b>	<b>(dB/m)</b>
1000	22.4	10000	36.1
2000	25.2	11000	37.0
3000	31.1	12000	41.3
4000	30.2	13000	38.1
5000	34.2	14000	41.7
6000	31.6	15000	39.0
7000	34.7	16000	38.8
8000	34.8	17000	43.2
9000	36.2	18000	43.7



16.4

**Correction factors for Log Periodic Antenna**

**Model: 3146**

**Serial number: 9505-4081**

**CALIBRATION DATA**

Frequency, MHz	Antenna factor, dB/m <sup>1)</sup>
200	11.55
250	11.80
300	14.43
400	15.38
500	17.98
600	18.78
700	21.17
800	21.16
900	22.67
1000	24.09

<sup>1)</sup> The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.



**16.5 Correction factors for Biconical log ANTENNA**

**Model: 3142**

**Antenna serial number: 1250**

**3 meter range**

<b>FREQUENCY</b>	<b>AFF</b>	<b>FREQUENCY</b>	<b>AFF</b>
<b>(MHz)</b>	<b>(dB/m)</b>	<b>(MHz)</b>	<b>(dB/m)</b>
<b>30</b>	<b>18.4</b>	<b>1100</b>	<b>25</b>
<b>40</b>	<b>13.7</b>	<b>1200</b>	<b>24.9</b>
<b>50</b>	<b>9.9</b>	<b>1300</b>	<b>26</b>
<b>60</b>	<b>8.1</b>	<b>1400</b>	<b>26.1</b>
<b>70</b>	<b>7.4</b>	<b>1500</b>	<b>27.1</b>
<b>80</b>	<b>7.2</b>	<b>1600</b>	<b>27.2</b>
<b>90</b>	<b>7.5</b>	<b>1700</b>	<b>28.3</b>
<b>100</b>	<b>8.5</b>	<b>1800</b>	<b>28.1</b>
<b>120</b>	<b>7.8</b>	<b>1900</b>	<b>28.5</b>
<b>140</b>	<b>8.5</b>	<b>2000</b>	<b>28.9</b>
<b>160</b>	<b>10.8</b>		
<b>180</b>	<b>10.4</b>		
<b>200</b>	<b>10.5</b>		
<b>250</b>	<b>12.7</b>		
<b>300</b>	<b>14.3</b>		
<b>400</b>	<b>17</b>		
<b>500</b>	<b>18.6</b>		
<b>600</b>	<b>19.6</b>		
<b>700</b>	<b>21.1</b>		
<b>800</b>	<b>21.4</b>		
<b>900</b>	<b>23.5</b>		
<b>1000</b>	<b>24.3</b>		