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DATE: 31 October 2012

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

FCC Radio Test Report

for

Roseman Engineering Ltd.

Equipment under test:

915 MHz Transceiver Module

RM915

Written by:

D. Shidlowsky, Documentation

Approved by:

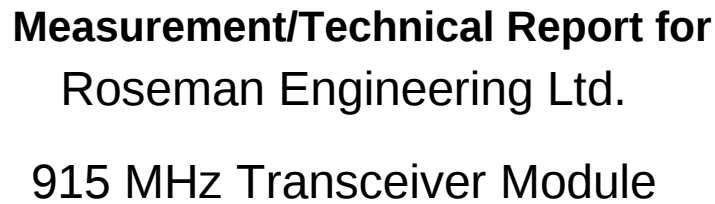
I. Siboni, Test Engineer

Approved by:

I. Raz, EMC Laboratory Manager

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This report relates only to items tested.



RM915

FCC ID: JAKRM915

This report concerns:	Original Grant:	
	Class I Change:	
	Class II Change:	X

Equipment type: Frequency Hopping Spread Spectrum

Limits used:
47CFR15 Section 15.247

Measurement procedures used are FCC Public Notice DA-00-705 and ANSI C63.4: 2003.

Application for Certification
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1. General Information

1.1 Administrative Information

Manufacturer:	Roseman Engineering Ltd.
Manufacturer's Address:	65 Weizman St. Givataim 53468 Israel Tel: +972-3-573-1801 Fax: +972-3-573-1807
Manufacturer's Representative:	Rafy Regev
Equipment Under Test (E.U.T):	915 MHz Transceiver Module
Equipment Model No.:	RM915
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	10.10.2012
Start of Test:	10.10.2012
End of Test:	10.10.2012
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod, 71100 Israel
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.), Registration No. 861911.
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-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1.
6. TUV Product Services, England, ASLLAS No. 97201.

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

See details in original application for FCC ID no. JAKRM915.

1.4 Test Methodology

Radiated testing was performed according to the procedures in FCC Public Notice DA 00-705 and ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Lod, Israel. This site is a FCC listed test laboratory (FCC Registration No. 861911, date of listing June 30, 2010).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

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*

See details in original application for FCC ID no. JAKRM915.

Spurious radiated emissions re-testing was performed due to the replacement of the dielectric filter, in the RF chain, manufactured by Murata with an alternate filter manufactured by Token.

A C2PC is being requested due to this change.

2.2 *EUT Exercise Software*

See details in original application for FCC ID no. JAKRM915.

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*

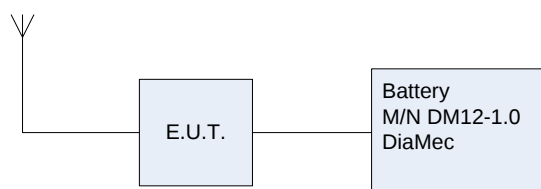


Figure 1. Configuration of Tested System

3. Test Set-up Photo



Figure 2. Radiated Emission Test



4. Spurious Radiated Emission, 9 kHz – 30 MHz

4.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

4.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

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 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 3.1.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was operated at the frequencies of 914.77, 921.13, and 927.65 MHz. These frequencies were measured using a peak detector.

4.3 Test Results

JUDGEMENT: Passed

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

The results for all three channels were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature: 

Date: 23.10.12

Typed/Printed Name: I. Siboni



4.4 Field Strength Calculation

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

$$FS = RA + AF + CF$$

FS: Field Strength [dB μ V/m]
RA: Receiver Amplitude [dB μ V]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.

4.5 Test Equipment Used, Spurious Radiated Emission 9 kHz – 30 MHz

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
EMI Receiver	Rohde & Schwarz	ESCI7	100724	30/10/2011	1 Year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2011	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Turntable Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 3 Test Equipment Used



5. Spurious Radiated Emission 30 MHz – 9.5 GHz

5.1 Test Specification

30 MHz- 9.5 GHz, F.C.C., Part 15, Subpart C

5.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

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 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 frequency range 30 MHz-10 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.

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.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

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

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.

In the frequency range 2.9-9.5 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100 Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested in three operating frequencies:
914.77, 921.13, and 927.65 MHz.



5.3 Test Results

JUDGEMENT: Passed by 4.3 dB

The signals in the band of 30 – 1000 MHz were 20 dB below the specification limit.

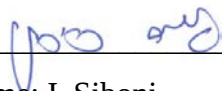
The EUT met the requirements of the F.C.C. Part 15, Subpart C, 15.247 specification.

For the operation frequency 914.77 MHz, the margin between the emission level and the specification limit is 4.3 in the worst case at the frequency of 1829.61 MHz, vertical polarization.

For the operation frequency 921.13 MHz, the margin between the emission level and the specification limit is 9.8 in the worst case at the frequency of 1842.26 MHz, vertical polarization.

For the operation frequency 927.65 MHz, the margin between the emission level and the specification limit is 13.0 in the worst case at the frequency of 1855.30 MHz, horizontal polarization.

TEST PERSONNEL:

Tester Signature: 

Date: 23.10.12

Typed/Printed Name: I. Siboni



Radiated Emission

E.U.T Description 915 MHz Transceiver Module
Type RM915
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 30 MHz to 9.5 GHz
Test Distance: 3 meters Detector: Peak

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dB μ V/m)	Peak Specification (dB μ V/m)	Peak Margin (dB)
914.77	1829.61	H	60.8	74.0	-13.2
914.77	1829.61	V	61.2	74.0	-12.8
921.13	1842.26	H	59.0	74.0	-15.0
921.13	1842.26	V	60.4	74.0	-13.6
927.65	1855.30	H	60.6	74.0	-13.4
927.65	1855.30	V	59.9	74.0	-14.1

**Figure 4. 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 915 MHz Transceiver Module
Type RM915
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 30 MHz to 9.5 GHz
Test Distance: 3 meters Detector: Average

Operation Frequency	Freq.	Polarity	Average Reading	Average Specification	Average Margin
(MHz)	(MHz)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB)
914.77	1829.61	H	47.9*	54.0	-6.1
914.77	1829.61	V	49.7*	54.0	-4.3
921.13	1842.26	H	43.8	54.0	-10.2
921.13	1842.26	V	44.2	54.0	-9.8
927.65	1855.30	H	41.0	54.0	-13.0
927.65	1855.30	V	40.9	54.0	-13.1

**Figure 5. 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.

“Average Reading” includes correction factor.

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

* Background noise



5.4 Field Strength Calculation 30 – 1000 MHz

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 $\mu\text{V/m}$]
RA:	Receiver Amplitude [dB μV]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.



5.5 Test Equipment Used, Spurious Radiated Emission 30 MHz – 9.5 GHz

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
EMI Receiver	Rohde & Schwarz	ESCI7	100724	30/10/2011	1 Year
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	30/10/2011	1 Year
RF Amplifier	HP	8447F	3113A06386	February 28, 2012	1 Year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 5, 2011	1 Year
Biconilog Antenna	EMCO	3142B	1250	September 05, 2011	1 Year
Horn Antenna	ETS	3115	6142	March 14, 2012	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Turntable Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 6 Test Equipment Used



6. APPENDIX A - CORRECTION FACTORS

6.1 Correction factors for CABLE

from EMI receiver
to test antenna
at 3 AND 10 meter range.

FREQUENCY	CORRECTION FACTOR	FREQUENCY	CORRECTION FACTOR
(MHz)	(dB)	(MHz)	(dB)
30	1.96	700	11.25
35	2.08	800	12.53
40	2.26	900	13.86
45	2.43	1000	14.86
50	2.59	1200	15.7
55	2.65	1400	17.05
60	2.86	1600	18.2
65	2.96	1800	19.4
70	3.04	2000	21.3
75	3.27		
80	3.41		
85	3.54		
90	3.68		
95	3.77		
100	3.93		
110	4.19		
120	4.41		
130	4.6		
140	4.83		
150	5.06		
160	5.35		
170	5.57		
180	5.7		
190	5.84		
200	6.02		
250	6.86		
300	7.59		
350	8.09		
400	8.7		
450	9.15		
500	9.53		
550	9.82		
600	10.24		
650	10.74		

NOTES:

1. The cable type is RG-214/U



6.2 Correction factors for Bilog ANTENNA

Model: 3142

Antenna serial number: 1250

3 meter range

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



6.3 Correction factors for Horn ANTENNA

Model: 3115

Antenna serial number: 6142

3 meter range

FREQUENCY	Antenna Factor	FREQUENCY	Antenna Factor
(MHz)	(dB/m)	(MHz)	(dB/m)
1000	23.9	10500	38.4
1500	25.4	11000	38.5
2000	27.3	11500	39.4
2500	28.5	12000	39.2
3000	30.4	12500	39.4
3500	31.6	13000	40.7
4000	33	14000	42.1
4500	32.7	15000	40.1
5000	34.1	16000	38.2
5500	34.5	17000	41.7
6000	34.9	17500	45.7
6500	35.1	18000	47.7
7000	35.9		
7500	37.5		
8000	37.6		
8500	38.3		
9000	38.5		
9500	38.1		
10000	38.6		



6.4 Correction factors for ACTIVE LOOP ANTENNA

Model 6502

S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.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