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DATE: 09 October 2012

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

FCC Radio Test Report

for

Israel Wireless Devices

Equipment under test:

Wireless Sensor

W/SC420-915

Written by:

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Approved by:

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This report relates only to items tested.





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1. General Information

1.1 Administrative Information

Manufacturer:	Israel Wireless Devices
Manufacturer's Address:	10 Dizingof St. Netanya 42405 Israel Tel: +972-52-485-1020
Manufacturer's Representative:	Shimon Zigdon
Equipment Under Test (E.U.T):	Wireless Sensor
Equipment Model No.:	W/SC420-915
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	13.8.2012
Start of Test:	13.8.2012
End of Test:	15.8.2012
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
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. 90715.
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-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-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

The EUT is a component in a Wireless Sensor Network of Industrial Automation system. The EUT is a battery powered wireless transceiver which comprises an interface to a standard, current loop, industrial sensor. The EUT wakes-up periodically, sample an attached sensor and transmits the sampled reading to a central data collector. The EUT operates in 915MHz ISM band. The EUT modulation is GFSK, 50kbps, Frequency Hopping (spread over 50 channels) with a channel spacing of 0.13MHz

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.

1.3.3.3 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.

1.5 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*

Unit was tested in a typical wall mounted orientation, same as installation position, transmitting from internal antenna at the max power at 3 different channels. Modulated GFSK 50Kbps Data Rate.

2.2 *EUT Exercise Software*

The EUT was tested when programmed with the formal, commercially released firmware, configured to transmit periodically at maximum transmission rate.

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*

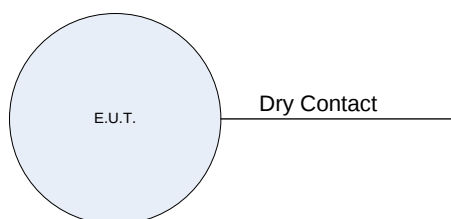


Figure 1. Configuration of Tested System

3. Radiated Measurement Test Set-up Photos



Figure 2. Radiated Emission Test



Figure 3. Radiated Emission Test



4. 20dB Minimum Bandwidth

4.1 Test Specification

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

4.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The spectrum analyzer was set to 10 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in *Figure 1*, 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

4.3 Test Results

Operation Frequency (MHz)	Bandwidth Reading (KHz)	Specification (KHz)
912.74	101.8	<250
915.98	92.4	<250
919.09	99.4	<250

Figure 4 — 20 dB Minimum Bandwidth Test Results Table

JUDGEMENT: Passed

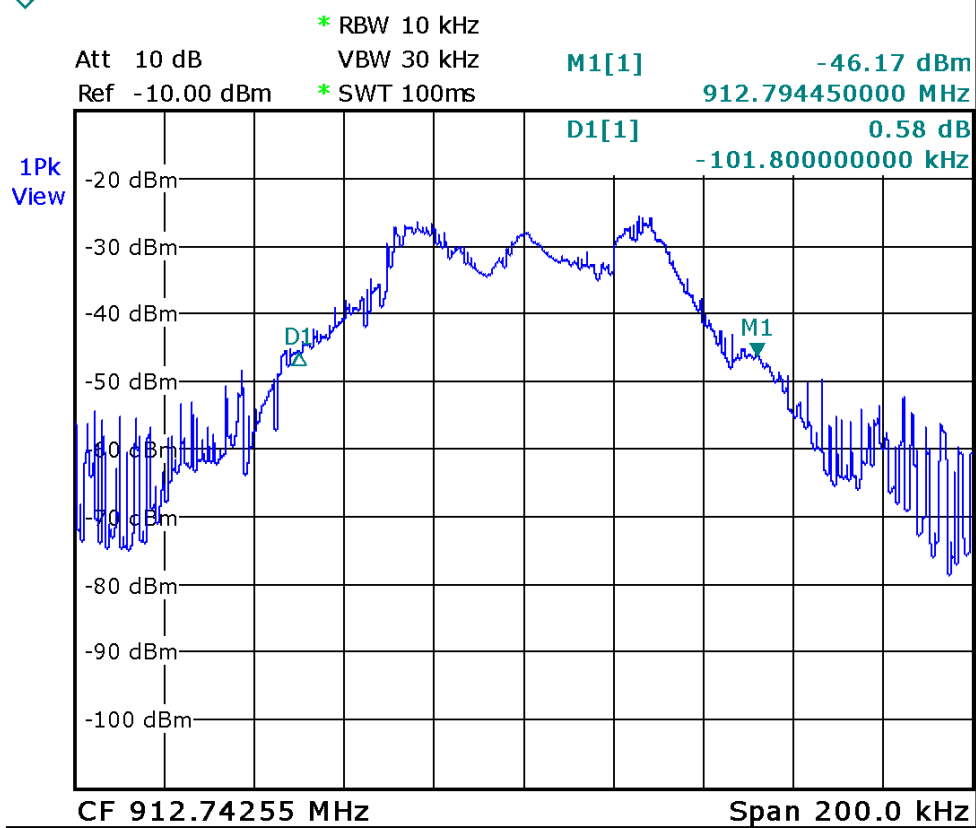
For additional information see *Figure 5 to Figure 7*.

TEST PERSONNEL:

Tester Signature: 

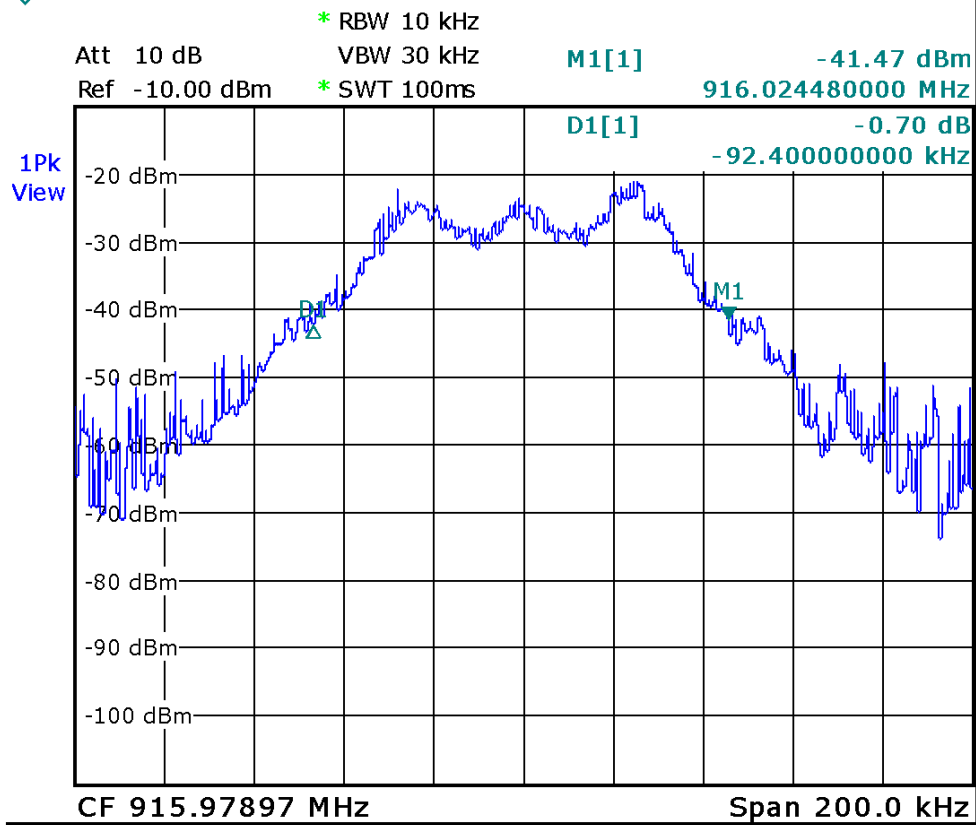
Date: 09.09.12

Typed/Printed Name: A. Sharabi



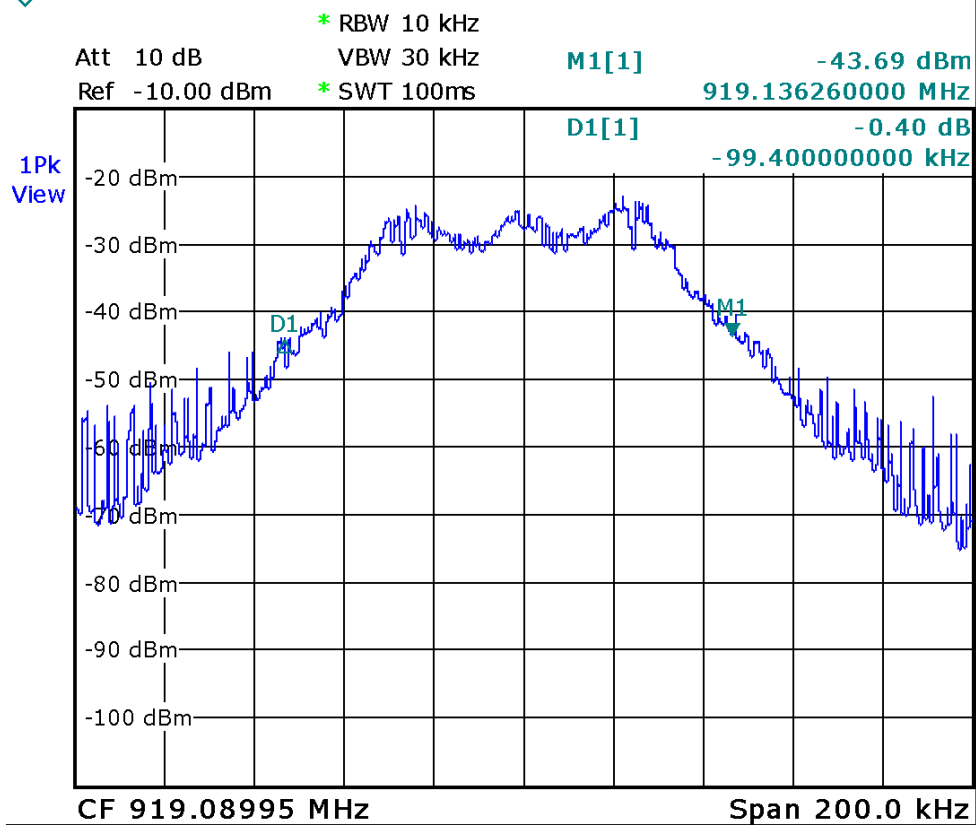
Date: 14.AUG.2012 12:29:55

Figure 5. — 912.75 MHz



Date: 14.AUG.2012 12:31:47

Figure 6. — 915.98 MHz



Date: 14.AUG.2012 12:33:38

Figure 7. — 919.08 MHz



4.4 Test Equipment Used, 20 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	October 10, 2011	1 Year
Biconilog Antenna	EMCO	3142B	1250	June 24, 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 8 Test Equipment Used

5. Number of Hopping Frequencies

5.1 Test Specification

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

5.2 Test Procedure

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

5.3 Test Results

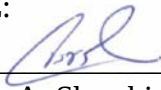
Number of Hopping Frequencies	Specification
50	≥ 50

Figure 9 Number of Hopping Frequencies Test Results Table

JUDGEMENT: Passed

For additional information see *Figure 10 to Figure 16*.

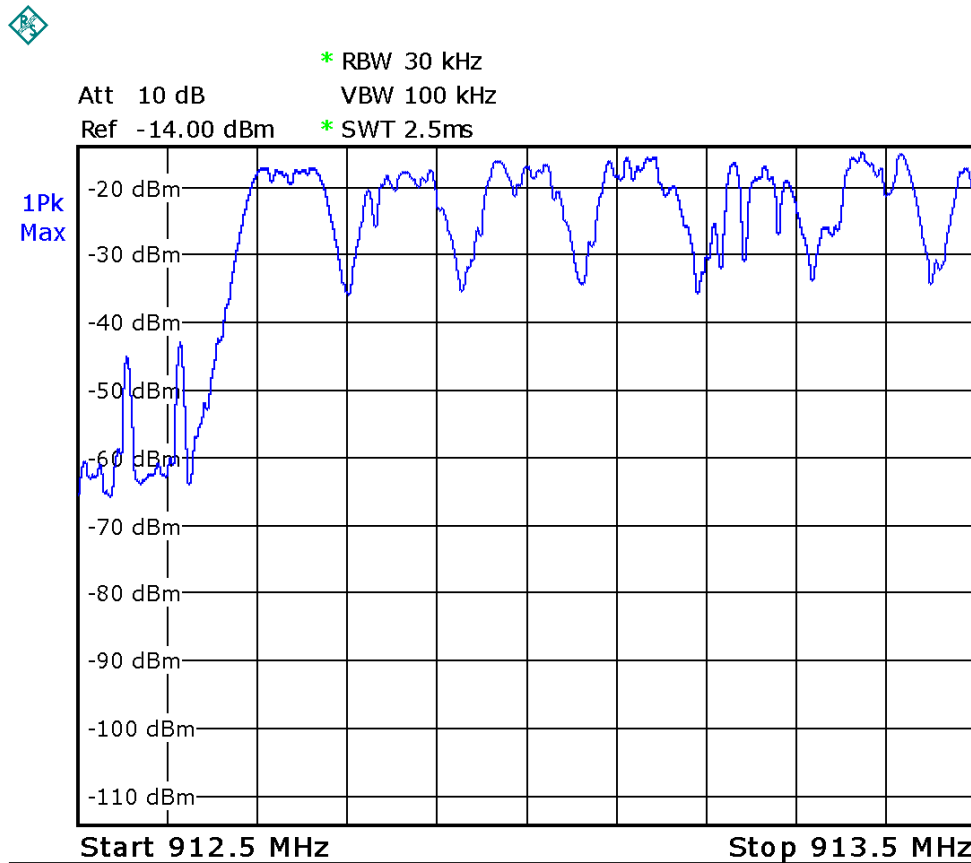
TEST PERSONNEL:

Tester Signature:  Date: 09.09.12

Typed/Printed Name: A. Sharabi

Number of Hopping Frequencies

E.U.T Description	Wireless Sensor
Type	W/SC420-915
Serial Number:	Not designated

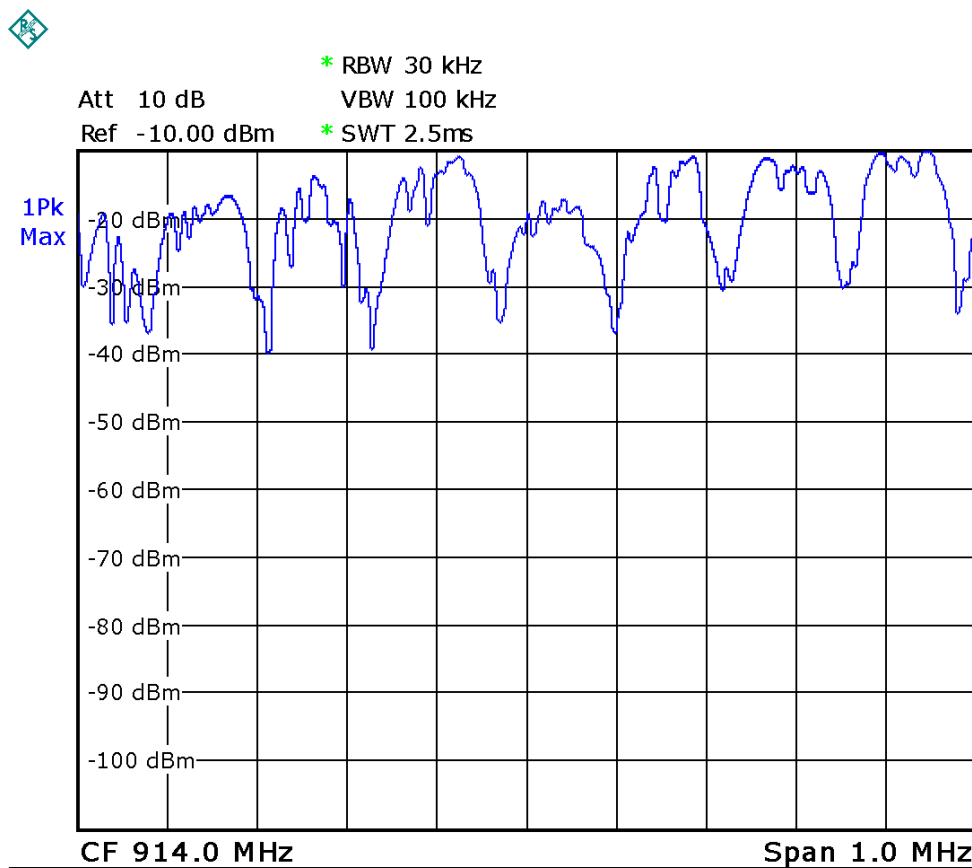


Date: 14.AUG.2012 11:11:11

Figure 10. Number of Channels

Number of Hopping Frequencies

E.U.T Description	Wireless Sensor
Type	W/SC420-915
Serial Number:	Not designated

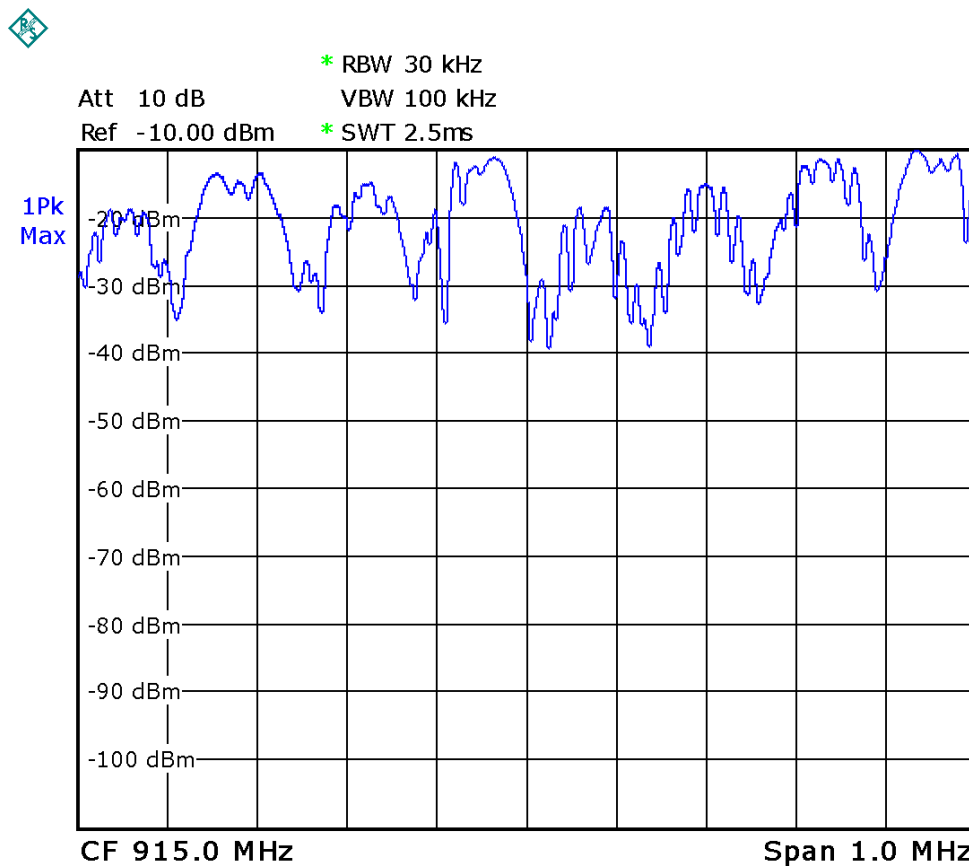


Date: 14.AUG.2012 11:31:28

Figure 11. Number Of Channels

Number of Hopping Frequencies

E.U.T Description	Wireless Sensor
Type	W/SC420-915
Serial Number:	Not designated

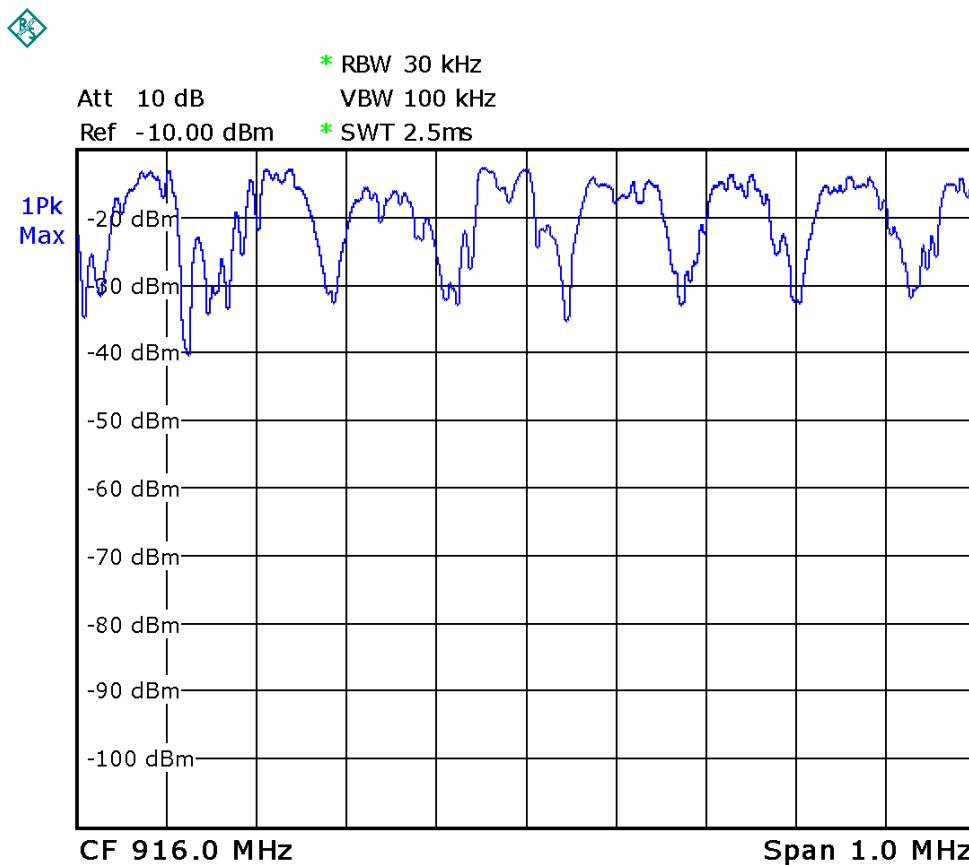


Date: 14.AUG.2012 11:34:39

Figure 12. Number Of Channels

Number of Hopping Frequencies

E.U.T Description	Wireless Sensor
Type	W/SC420-915
Serial Number:	Not designated

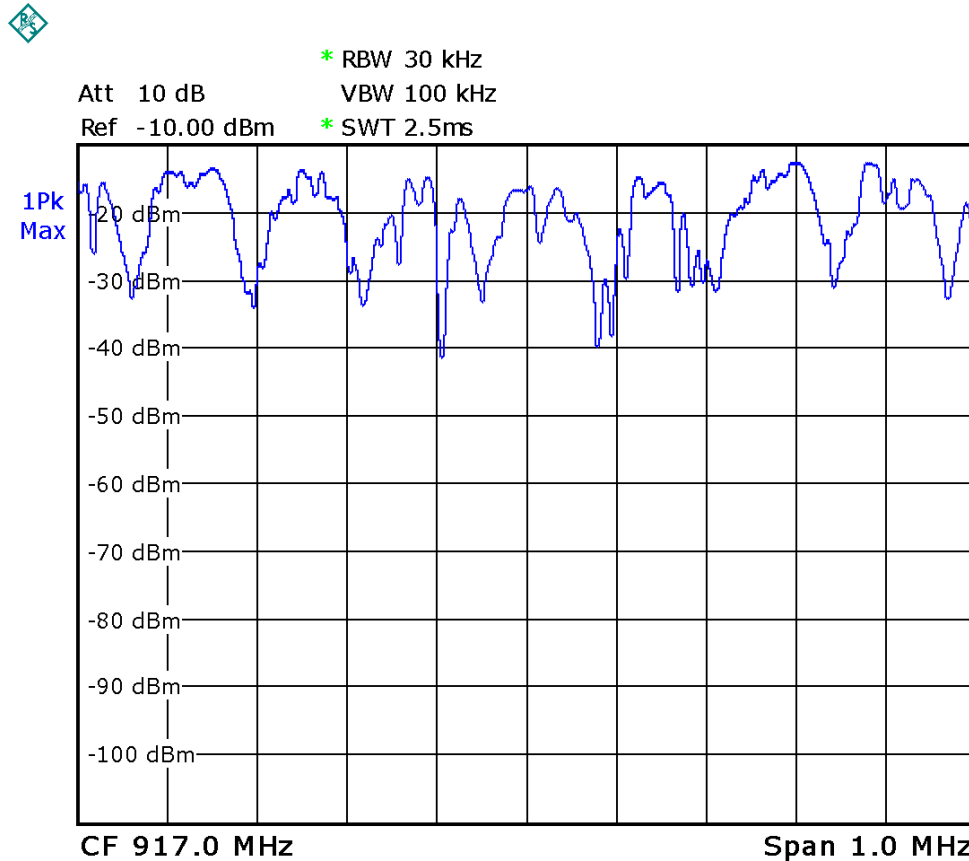


Date: 14.AUG.2012 11:58:53

Figure 13. Number Of Channels

Number of Hopping Frequencies

E.U.T Description	Wireless Sensor
Type	W/SC420-915
Serial Number:	Not designated

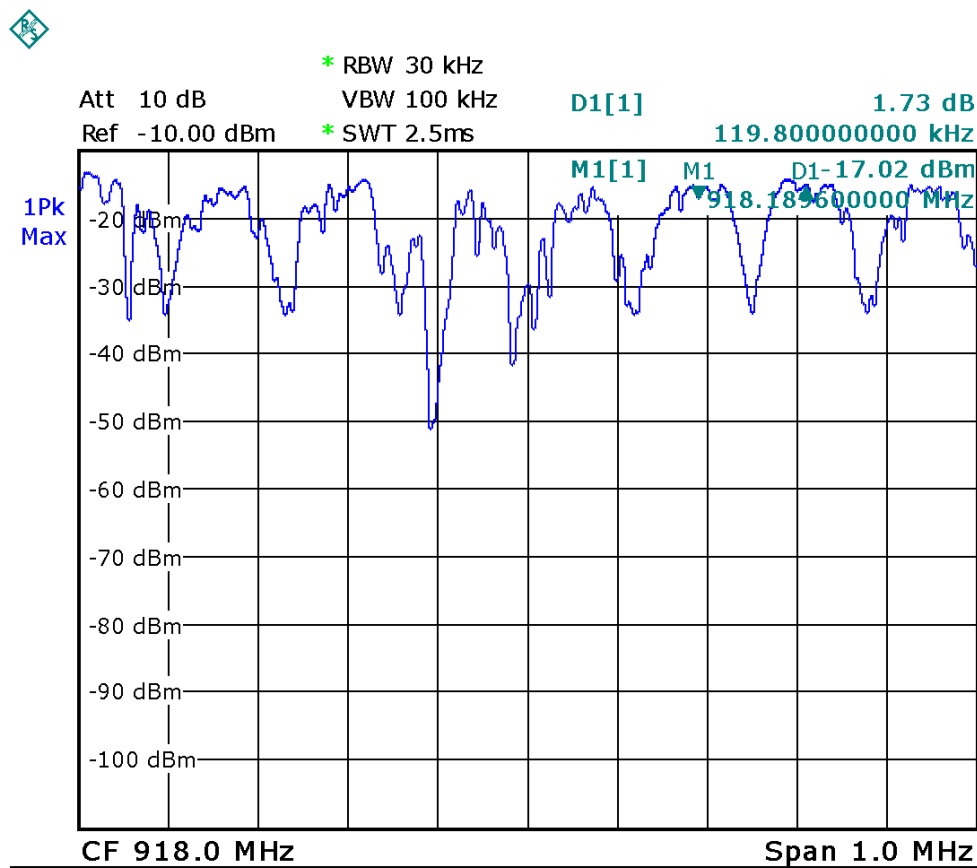


Date: 14.AUG.2012 12:04:47

Figure 14. Number Of Channels

Number of Hopping Frequencies

E.U.T Description Wireless Sensor
Type W/SC420-915
Serial Number: Not designated

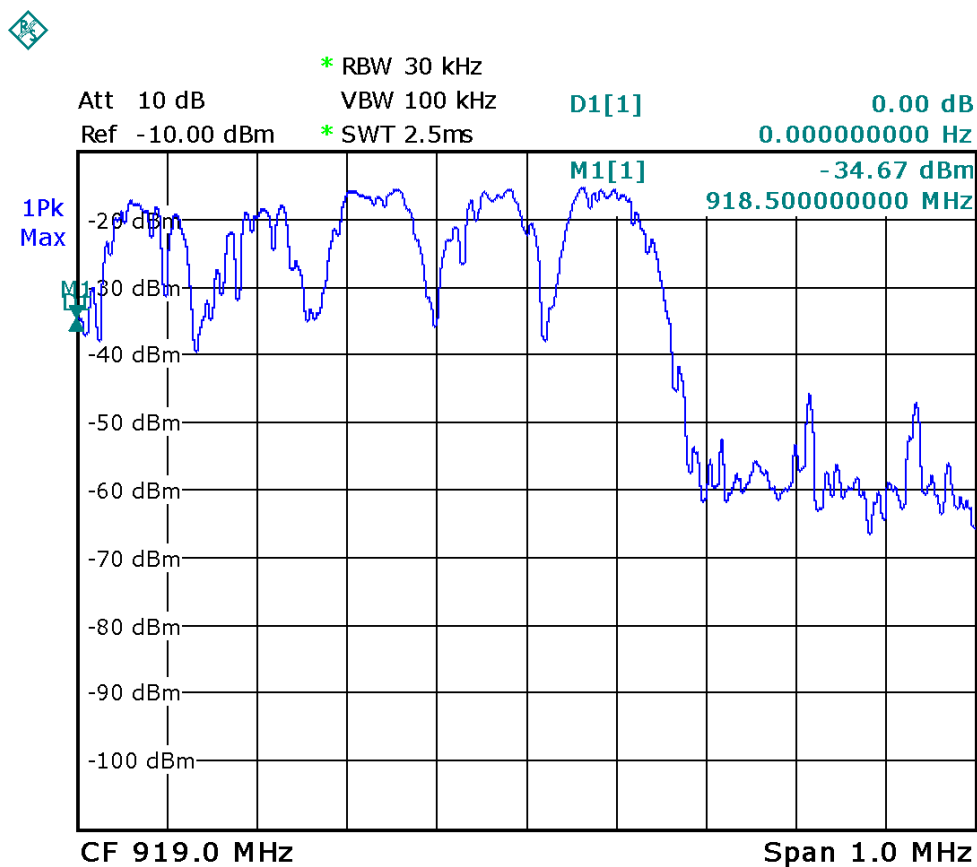


Date: 14.AUG.2012 12:11:55

Figure 15. Number Of Channels

Number of Hopping Frequencies

E.U.T Description Wireless Sensor
Type W/SC420-915
Serial Number: Not designated



Date: 14.AUG.2012 12:16:03

Figure 16. Number Of Channels



5.4 Test Equipment Used, Number of Hopping Frequencies

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	October 10, 2011	1 Year

Figure 17 Test Equipment Used



6. Channel Frequency Separation

6.1 Test Specification

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

6.2 Test procedure

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.

6.3 Test Results

Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
119.8	>100	19.8

Figure 18 Channel Frequency Separation Test Results Table

JUDGEMENT: Passed by 19.8 kHz

For additional information see *Figure 19*.

TEST PERSONNEL:

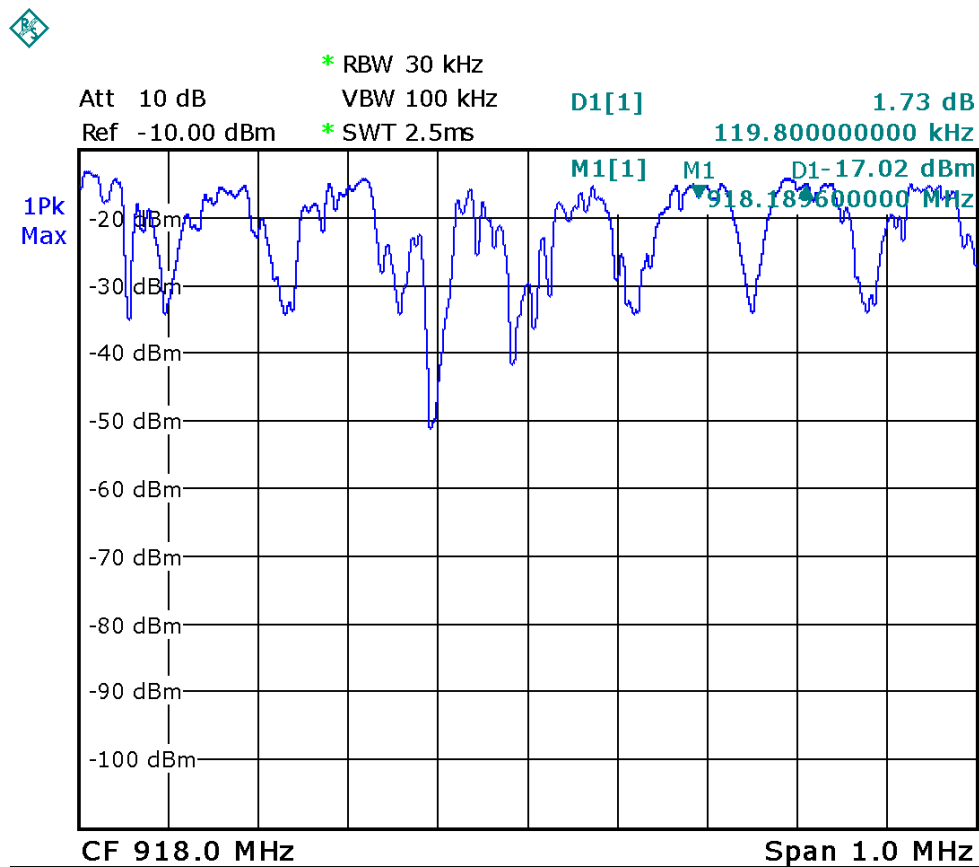
Tester Signature: 
Typed/Printed Name: A. Sharabi

Date: 09.09.12



Channel Frequency Separation

E.U.T Description Wireless Sensor
Type W/SC420-915
Serial Number: Not designated



Date: 14.AUG.2012 12:11:55

Figure 19. Channel Frequency Separation



6.4 Test Equipment Used, Channel Frequency Separation Test

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	October 10, 2011	1 Year

Figure 20 Test Equipment Used

7. Radiated Maximum Power Output

7.1 Test Specification

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

7.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The EUT was set up as shown in *Figure 1*, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization/

The worst case emission were measured vertically

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{v/m} \times d)^2}{(30 \times G)} [\text{W}]$$

The E.U.T. was tested at the Low, Mid and High channels with modulation.



7.3 Test Results

Frequency	E	E	Antenna Gain	Antenna Distance	Calculated Results	Limit	Margin
(MHz)	(db μ V/m)	(V/m)	(dBi)	(m)	(mW)	(mW)	(mW)
912.74	103.25	0.145	0	3	6.3	1000	-993.7
915.97	103.40	0.148	0	3	6.6	1000	-993.4
919.08	103.05	0.142	0	3	6.0	1000	-994.0

Figure 21 Radiated Power Output Test Results Table

JUDGEMENT: Passed by 993.4 mW

For additional information see *Figure 22 to Figure 24*.

TEST PERSONNEL:

Tester Signature: 

Date: 09.09.12

Typed/Printed Name: A. Sharabi

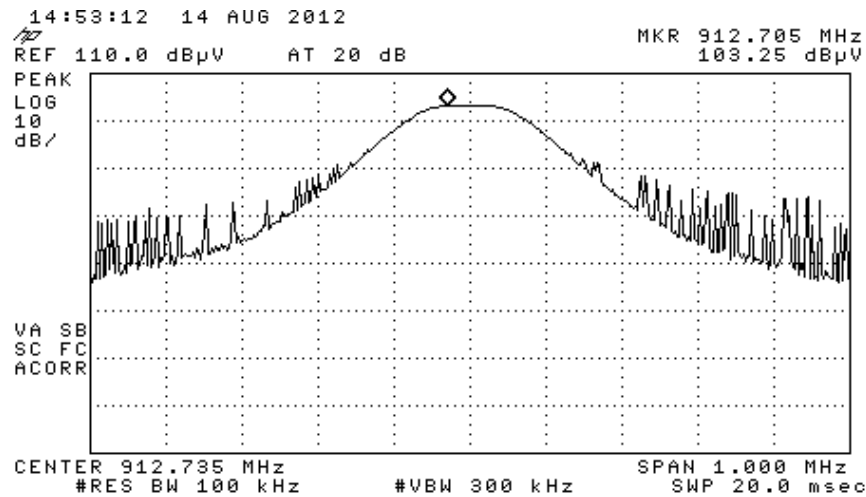


Figure 22 — 912.74 MHz - Horizontal

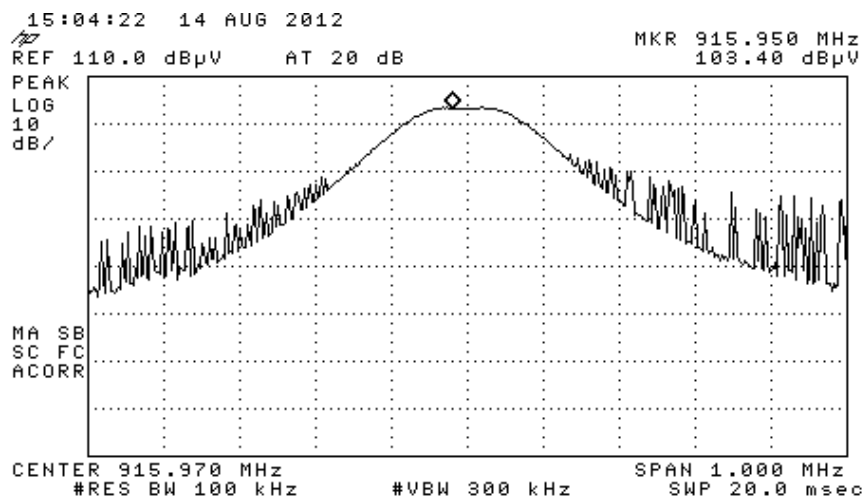


Figure 23 — 915.97 MHz - Horizontal

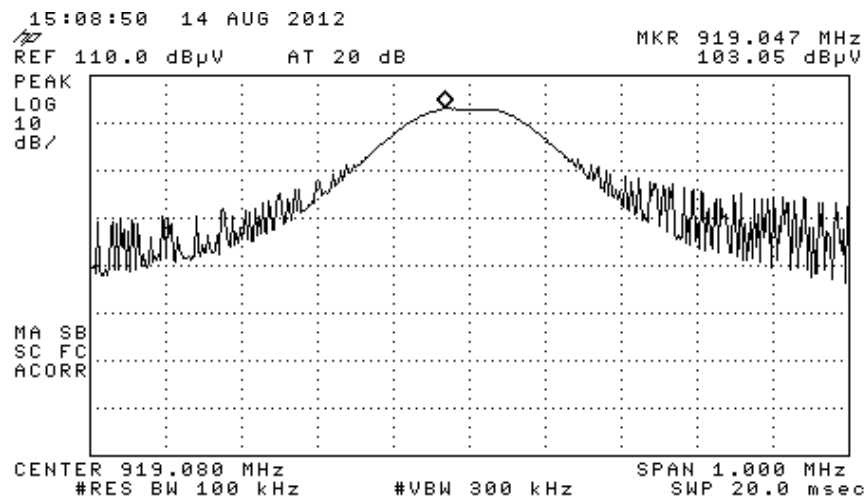


Figure 24 — 919.08 MHz - Horizontal



7.4 Test Equipment Used, Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
EMC Analyzer	HP	HP8593	3536A00120ADI	February 28, 2012	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 25 Test Equipment Used



8. Dwell Time on Each Channel

8.1 Test Specification

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

8.2 Test Procedure

The E.U.T. was tested in radiated mode using the substitution antenna. The spectrum analyzer was set to 100 kHz VBW .

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 20 seconds

8.3 Test Results

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 26 to Figure 27*.

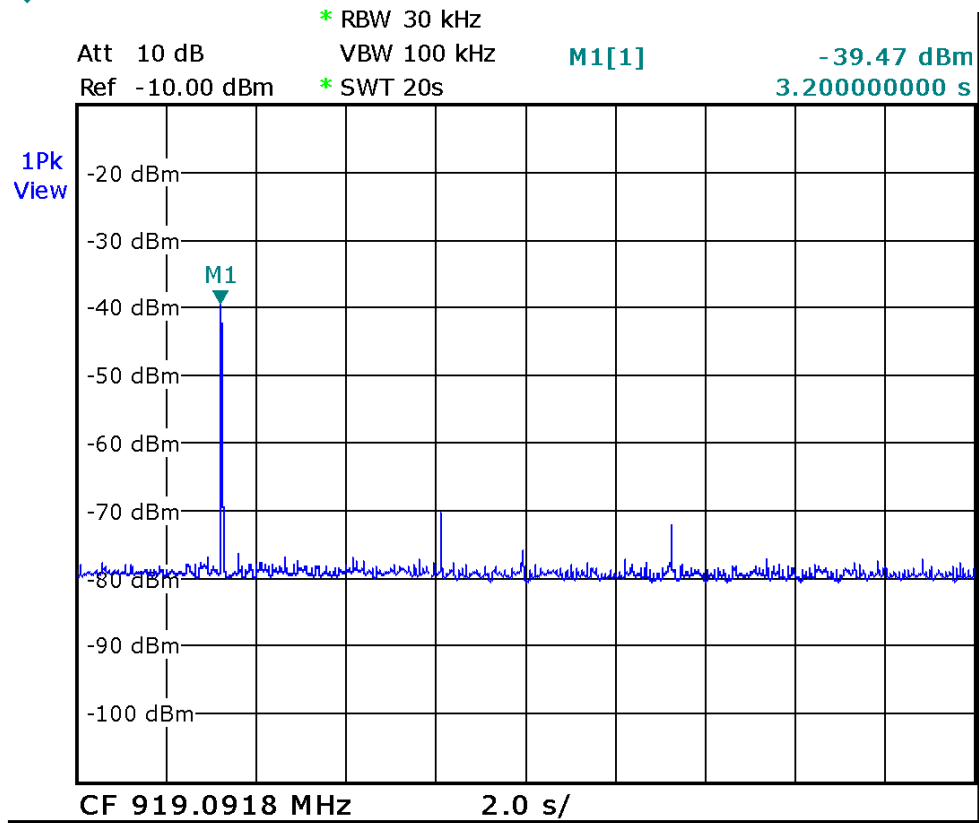
JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

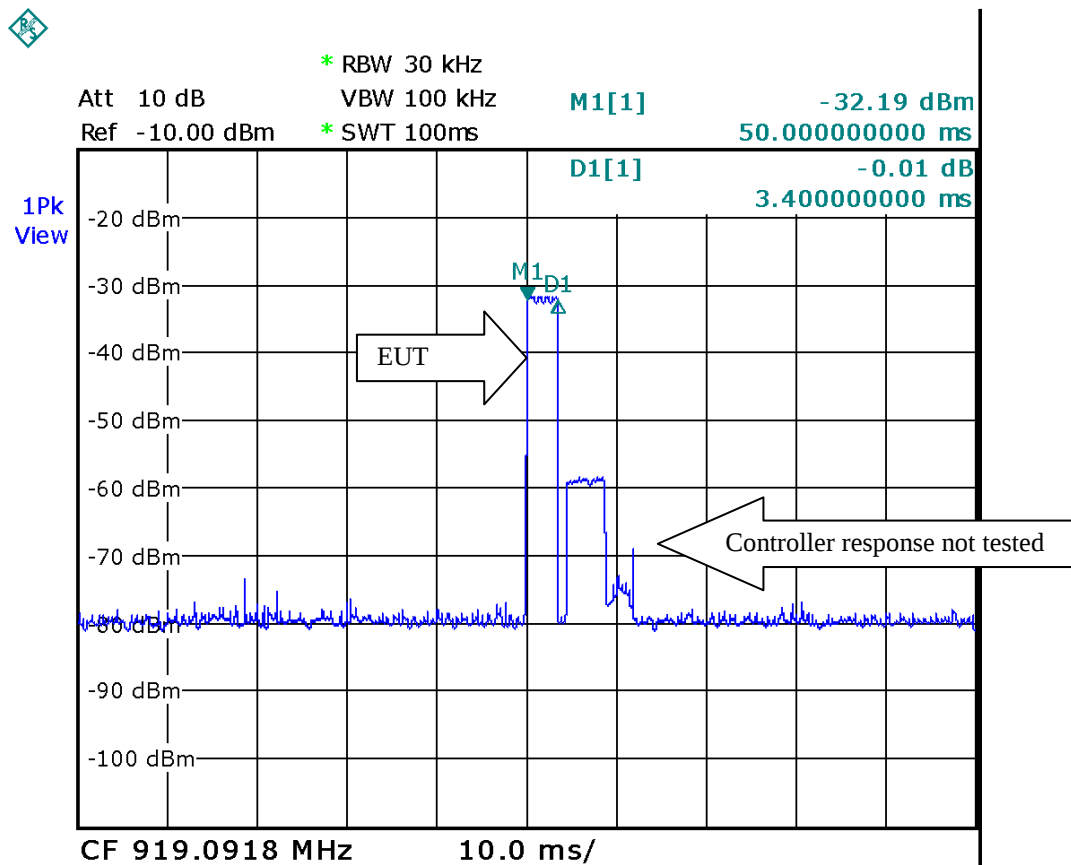
Date: 09.09.12

Typed/Printed Name: A. Sharabi



Date: 14.AUG.2012 12:21:31

Figure 26 — Transmission Within 20 sec



Date: 14.AUG.2012 12:25:40

Figure 27 — Burst duration within 20sec



8.4 Test Equipment Used, Dwell Time on Each Channel

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	October 10, 2011	1 Year

Figure 28 Test Equipment Used

9. Band Edge

[In Accordance with section 15.247(d)]

9.1 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The EUT was set up as shown in *Figure 1*, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated 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.

9.2 Test Results

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)
912.74	912.38	81.2	83.0
919.08	919.58	83.0	83.0

Figure 29 Band Edge Test results table

JUDGEMENT: Passed.

For additional information see *Figure 30 to Figure 31*.

TEST PERSONNEL:

Tester Signature: 

Date: 09.09.12

Typed/Printed Name: A. Sharabi

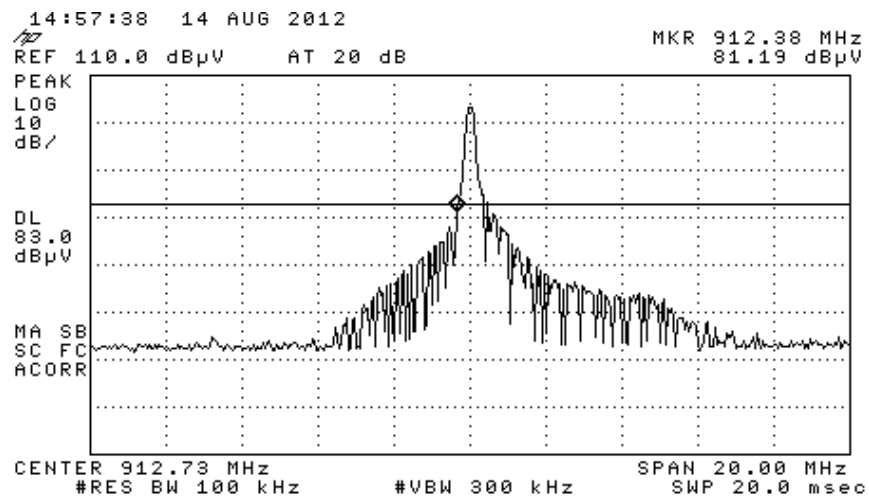


Figure 30 — 912.74 MHz

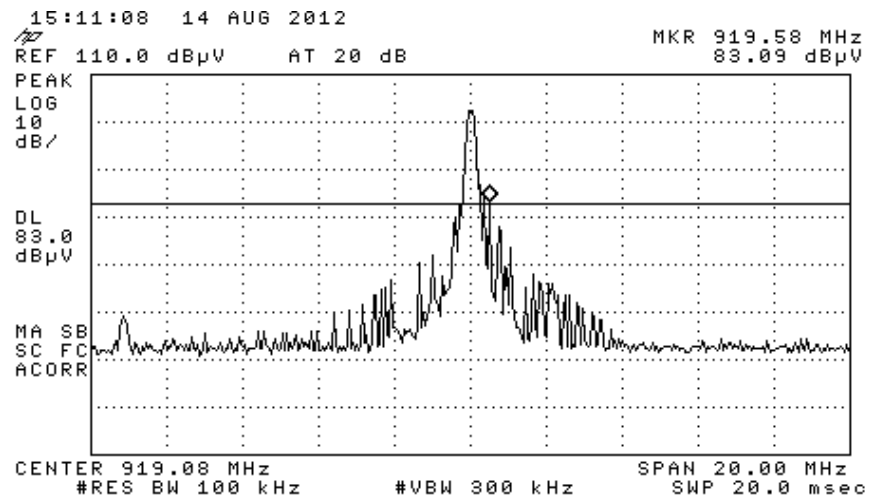


Figure 31 — 919.08 MHz



9.3 Test Equipment Used, Band Edge Spectrum.

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
EMC Analyzer	HP	HP8593	3536A00120ADI	February 28, 2012	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 32 Test Equipment Used



10. Spurious Radiated Emission, 9 kHz – 30 MHz

10.1 Test Specification

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

10.2 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 912.74, 916.00, and 919.09 MHz. These frequencies were measured using a peak detector.

10.3 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: 09.09.12

Typed/Printed Name: A. Sharabi



10.4 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.

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

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
EMC Analyzer	HP	HP8593	3536A00120ADI	February 28, 2012	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 33 Test Equipment Used



11. Spurious Radiated Emission 30 MHz – 10 GHz

11.1 Test Specification

30 MHz- 10 GHz, F.C.C., Part 15, Subpart C

11.2 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 2.9-10.0 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:
912.74 MHz; 916.0 MHz; 919.09 MHz.



11.3 Test Data

JUDGEMENT: Passed

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

For the operation frequency 912.74 MHz, the margin between the emission level and the specification limit is 13.7 in the worst case at the frequency of 1825.50 MHz, horizontal polarization.

For the operation frequency 916.0 MHz, the margin between the emission level and the specification limit is 13.9 in the worst case at the frequency of 1832.00 MHz, vertical polarization.

For the operation frequency 919.09 MHz, the margin between the emission level and the specification limit is 13.0 in the worst case at the frequency of 1838.10 MHz, vertical polarization.

TEST PERSONNEL:

Tester Signature: 

Date: 09.09.12

Typed/Printed Name: A. Sharabi



Radiated Emission

E.U.T Description Wireless Sensor
Type W/SC420-915
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 30 MHz to 10.0 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)
912.74	1825.50	H	60.3	74.0	-13.7
912.74	1825.50	V	60.0	74.0	-14.0
912.74	2738.10	H	54.5	74.0	-19.5
912.74	2738.10	V	55.4	74.0	-18.6
916.00	1832.00	H	60.0	74.0	-14.0
916.00	1832.00	V	60.1	74.0	-13.9
916.00	2748.00	H	53.4	74.0	-20.6
916.00	2748.00	V	59.1	74.0	-14.9
919.087	1838.10	H	60.2	74.0	-13.8
919.087	1838.10	V	61.0	74.0	-13.0
919.087	2757.50	H	55.5	74.0	-18.5
919.087	2757.50	V	54.8	74.0	-19.2

**Figure 34. 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 Wireless Sensor
Type W/SC420-915
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters

Frequency range: 30 MHz to 10.0 GHz
Detector: Average

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dBμV/m)	Duty Cycle Factor (dB)	Average (dBμV/m)	Average Specification (dB μV/m)	Average Margin (dB)
912.74	1825.50	H	60.3	-29.3	31.0	54.0	-23.0
912.74	1825.50	V	60.0	-29.3	30.7	54.0	-23.3
912.74	2738.10	H	54.5	-29.3	25.2	54.0	-28.8
912.74	2738.10	V	55.4	-29.3	26.1	54.0	-27.9
916.00	1832.00	H	60.0	-29.3	30.7	54.0	-23.3
916.00	1832.00	V	60.1	-29.3	30.8	54.0	-23.2
916.00	2748.00	H	53.4	-29.3	24.1	54.0	-29.9
916.00	2748.00	V	59.1	-29.3	29.8	54.0	-24.2
919.087	1838.10	H	60.2	-29.3	30.9	54.0	-23.1
919.087	1838.10	V	61.0	-29.3	31.7	54.0	-22.3
919.087	2757.50	H	55.5	-29.3	26.2	54.0	-27.8
919.087	2757.50	V	54.8	-29.3	25.5	54.0	-28.5

**Figure 35. 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.

“Peak Reading” includes correction factor.

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



11.4 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 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.



11.5 Test Equipment Used, Spurious Radiated Emission 30 MHz – 10 GHz

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Period
EMC Analyzer	HP	HP8593	3536A00120ADI	February 28, 2012	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 36 Test Equipment Used



12. Antenna Gain/Information

The antenna gain is 0dBi.

13. R.F Exposure/Safety

The typical placement of the E.U.T. is wall or ceiling mounted. The typical distance between the E.U.T. and the user is 3m.

Calculation of Maximum Permissible Exposure (MPE)

Based on 47CFR1 Section1.1307(b)(1) Requirements

(a) FCC Limit at 912.74 MHz is: $\frac{f}{1500} = 0.609 \frac{mW}{cm^2}$

FCC Limit at 916.00MHz is: $\frac{f}{1500} = 0.611 \frac{mW}{cm^2}$

FCC Limit at 919.09 MHz is: $\frac{f}{1500} = 0.613 \frac{mW}{cm^2}$

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 (includes G_t)

G_t = Antenna Gain

R = Distance From Transmitter

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

Frequency (MHz)	Pt (mW)	Antenna type	G_T (dBi)	R (cm)	S_{AV} (mW/cm ²)	Spec (mW/cm ²)
912.74	6.3	Internal	0	300	55.7×10^{-5}	0.609
916.00	6.6	Internal	0	300	58.3×10^{-5}	0.611
919.09	6.0	Internal	0	300	53.1×10^{-5}	0.613

(d) The above are below the FCC limit.



14. APPENDIX A - CORRECTION FACTORS

14.1 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



14.2 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		



14.3 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		



14.4 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