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DATE: 21 March 2016

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

FCC/IC Radio Test Report

for

Visonic Ltd.

Equipment under test:

Glass Break Detector

GB-502 PG2 (915-0:016)

Tested by: _____
I. Siboni

Approved by: _____
D. Shidlowsky

Measurement/Technical Report for

Visonic Ltd.

Glass Break Detector

GB-502 PG2 (915-0:016)

FCC ID: WP3GB502PG2

IC: 1467C-GB502GP2

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

Equipment type:	FCC: Frequency Hopping Spread Spectrum –DSS IC: Spread Spectrum/Digital Device (902-928 MHz)
Limits used:	FCC: 47CFR15 Section 15.247 IC: RSS-247, Issue 1, May 2015 RSS Gen Issue 4, November 2014

Measurement procedures used are FCC Public Notice DA-00-705 and ANSI C63.10: 2013.

Application for Certification
prepared by:
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Israel
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Applicant for this device:
(different from "prepared by")
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1. General Information

1.1 *Administrative Information*

Manufacturer:	Visonic Ltd.
Manufacturer's Address:	Habarzel 24 Tel Aviv Israel 69710 Tel: +972-3-645-6789 Fax: +972-3-645-6788
Manufacturer's Representative:	Zuri Rubin
Equipment Under Test (E.U.T):	Glass Break Detector
Product Marketing Name (PMN):	GB-502 PG2 (915-0:016)
Equipment Serial No.:	Not designated
Hardware Version	90-207522
Software Version	V0.76
Date of Receipt of E.U.T:	August 04, 2015
Start of Test:	August 04, 2015, March 20, 2016*
End of Test:	December 22, 2015, March 20, 2016*
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C RSS-247, Issue 1, May 2015 RSS Gen Issue 4, November 2014

*Additional Band-edge testing in continuous transmission mode was performed on March 20, 2016.

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-245.
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 GB-502 PG2 is a wireless PowerG Two-way acoustic glass-break detector designed to detect the breaking of framed glass mounted in an outside wall. This detector is wall/ceiling mountable and suitable for most types of window/door glass: plate, tempered, laminated, wired, coated and sealed insulating glass.

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*

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 tested in 2 different modes: continuous transmission and hopping mode with an internal antenna at the maximum power at 2 different channels Low and High (912.75MHz and 919.106MHz), in GFSK 50Kbps Data Rate modulation.

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*

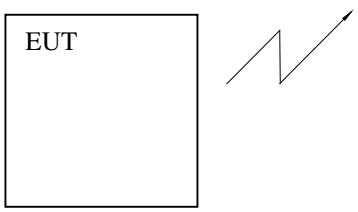


Figure 1. Configuration of Tested System

3. Radiated Measurement Test Set-Up Photos

Figure 2. Radiated Emission Test – Ceiling Mounted

Figure 3. Radiated Emission Test – Ceiling Mounted

Figure 4. Radiated Emission Test – Ceiling Mounted

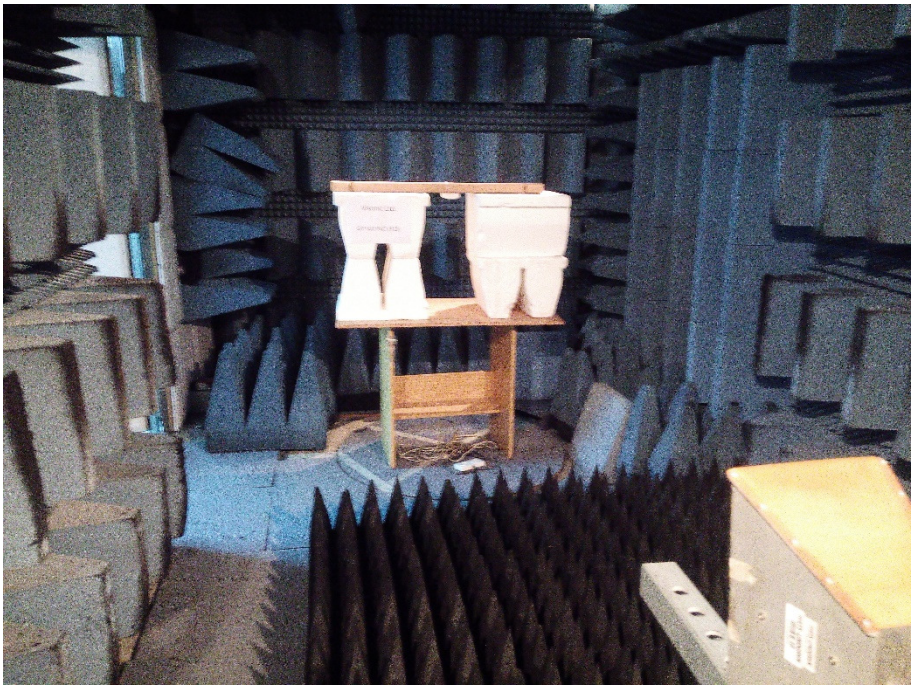


Figure 5. Radiated Emission Test – Ceiling Mounted

Figure 6. Radiated Emission Test – Wall Mounted

Figure 7. Radiated Emission Test – Wall Mounted

4. 20dB Minimum Bandwidth

4.1 *Test Specification*

F.C.C. Part 15, Subpart C: 15.247(a)(1)(i)
RSS 247 Issue 1, Clause 5.1

4.2 *Test Procedure*

An RF sniffer was placed next to the E.U.T. in order to detect the transmitted signal.
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 (912.750 MHz) and High (919.106 MHz) channels

4.3 *Test Results*

Operation Frequency (MHz)	Bandwidth Reading (kHz)	Specification (kHz)
912.750	103.8	<250
919.106	105.8	<250

Figure 8 — 20 dB Minimum Bandwidth Test Results Table

JUDGEMENT: Passed

For additional information see *Figure 9 to Figure 10.*

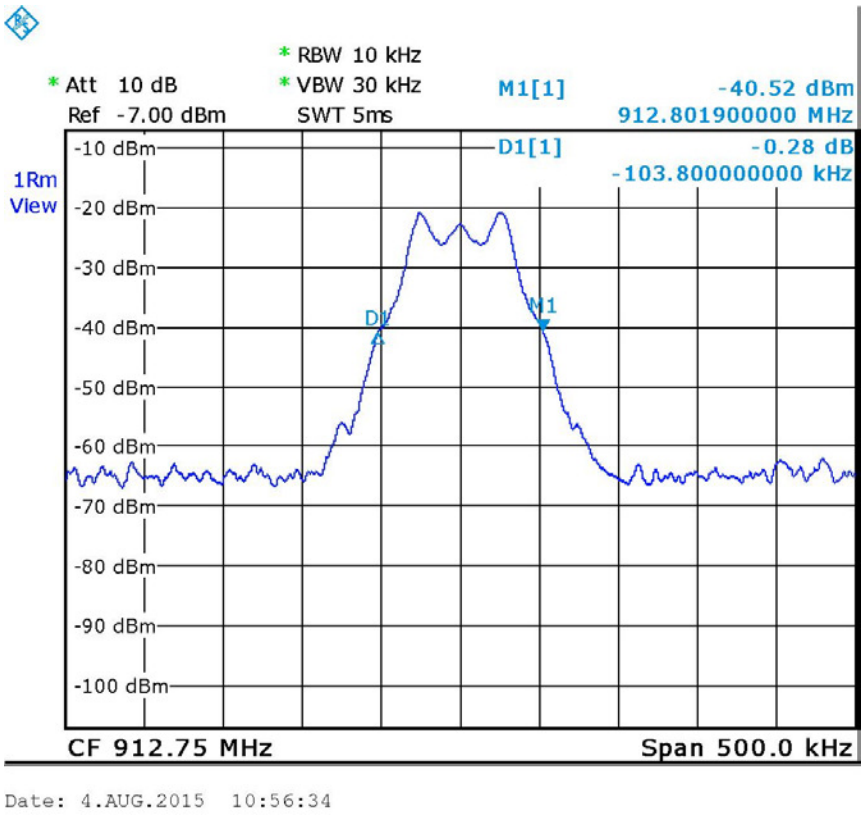


Figure 9. — 912.75 MHz

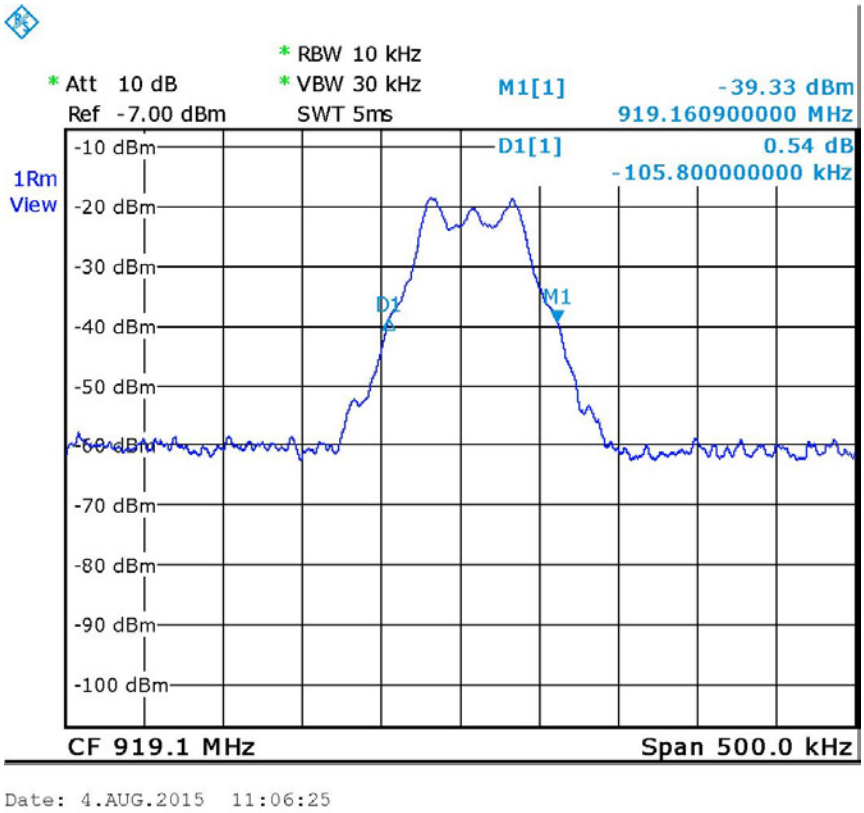


Figure 10. — 919.106 MHz

4.4 *Test Equipment Used, 20 dB Minimum Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	January 31, 2016

Figure 11 Test Equipment Used

5. 26dB Minimum Bandwidth

5.1 *Test Specification*

F.C.C. Part 15, Subpart C: 15.247(a)(1)(i)
RSS GEN 2014, Section 6.6

5.2 *Test Procedure*

An RF sniffer was placed next to the E.U.T. in order to detect the transmitted signal.
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 (912.750 MHz) and High (919.106 MHz) channels

5.3 *Test Results*

Operation Frequency (MHz)	Bandwidth Reading (kHz)
912.750	116.8
919.106	118.8

Figure 12 — 26 dB Minimum Bandwidth Test Results

JUDGEMENT: Passed

For additional information see *Figure 13* to *Figure 14.*

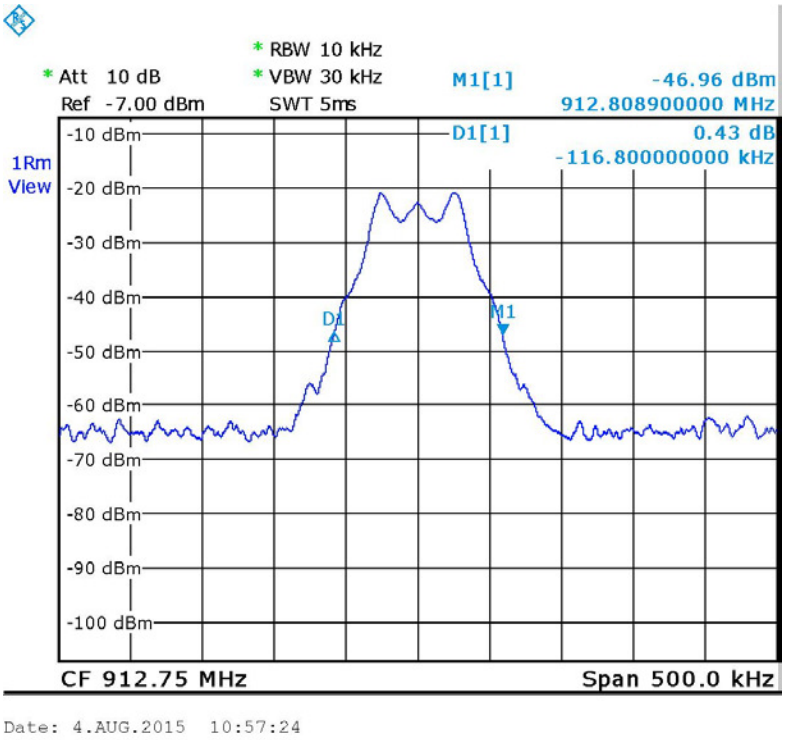


Figure 13. — 912.75 MHz

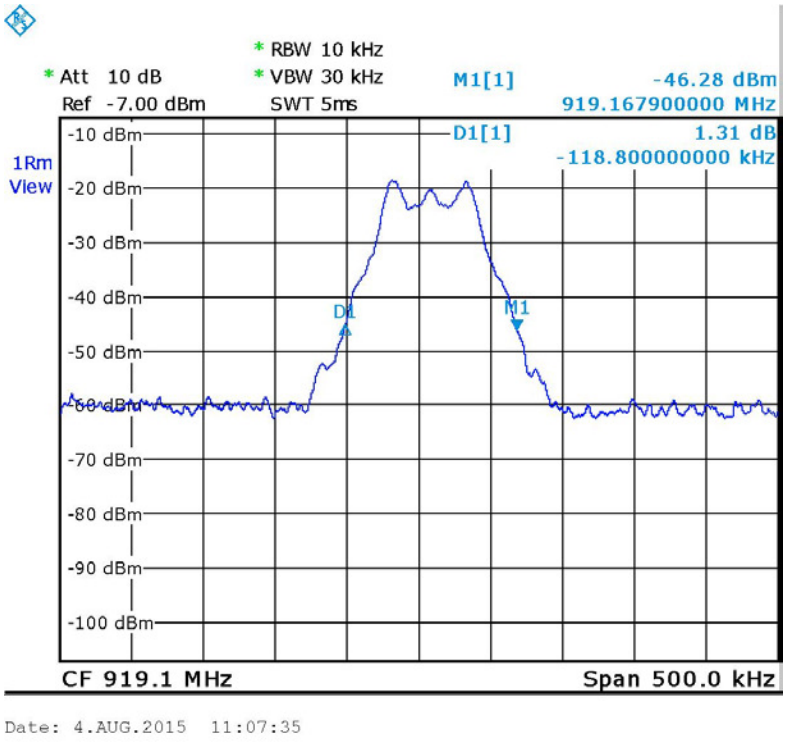


Figure 14. — 919.106 MHz

5.4 *Test Equipment Used, 26 dB Minimum Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	January 31, 2016

Figure 15 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)

RSS 247, Issue 1, Clause 5.1

6.2 *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: 30 kHz
Detector Function: Peak
Trace: Maximum Hold

6.3 *Test Results*

Number of Hopping Frequencies	Specification
50	>=50

Figure 16 Number of Hopping Frequencies Test Results Table

JUDGEMENT: Passed

For additional information see *Figure 17* to *Figure 23*.

Number of Hopping Frequencies

E.U.T Description	Glass Break Detector
Type	GB-502 PG2 (915-0:016)
Serial Number:	Not designated

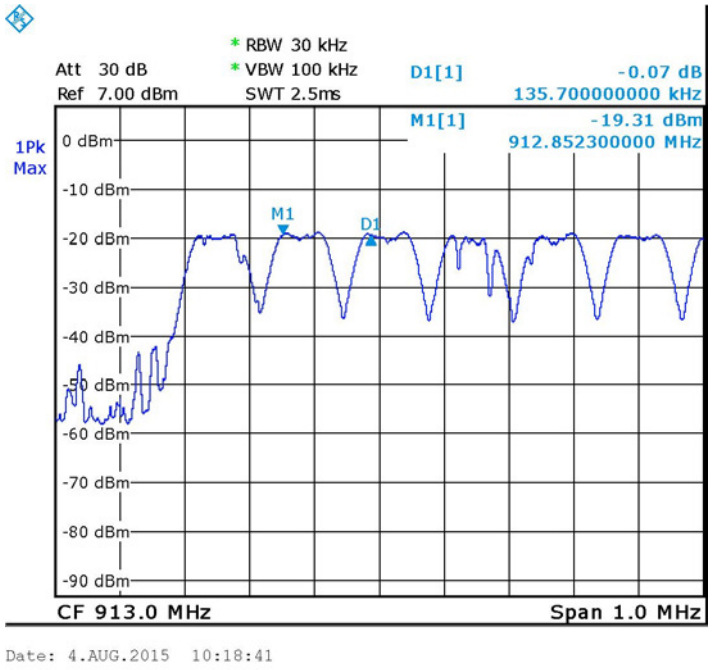


Figure 17. Number of Channels

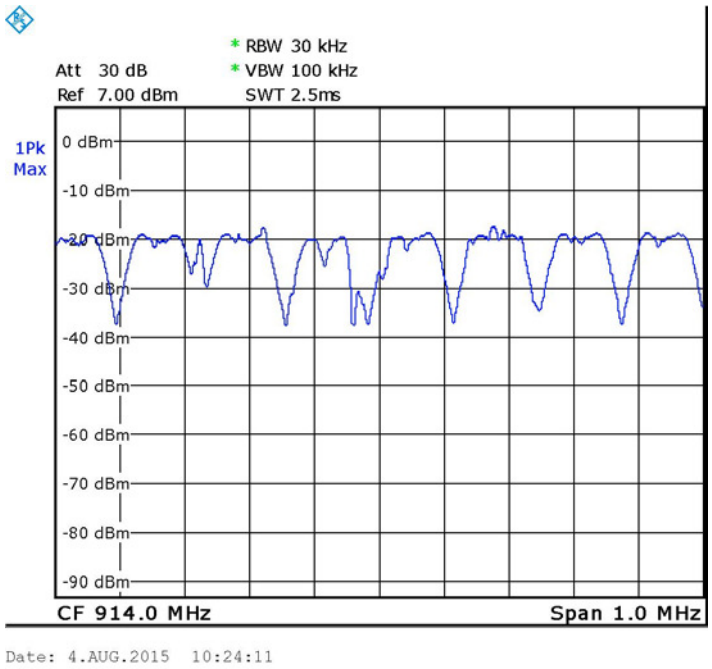
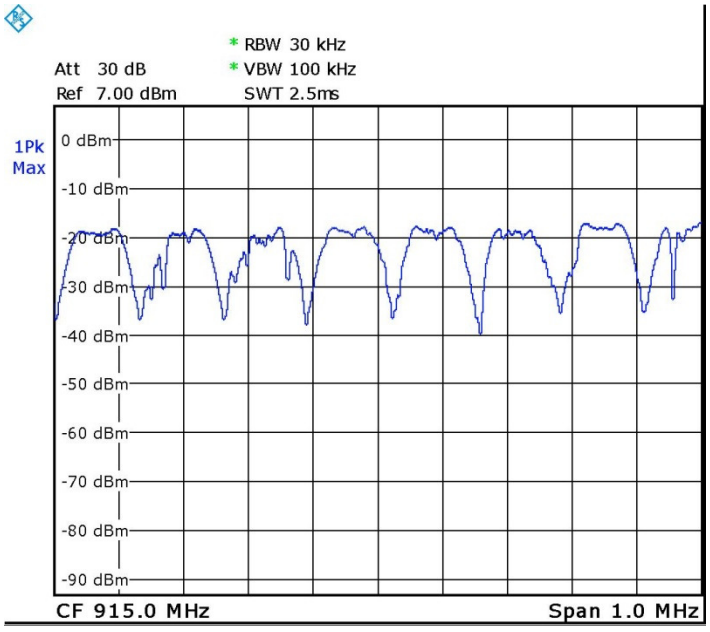


Figure 18. Number of Channels

Number of Hopping Frequencies

E.U.T Description	Glass Break Detector
Type	GB-502 PG2 (915-0:016)
Serial Number:	Not designated

Figure 19. Number of Channels



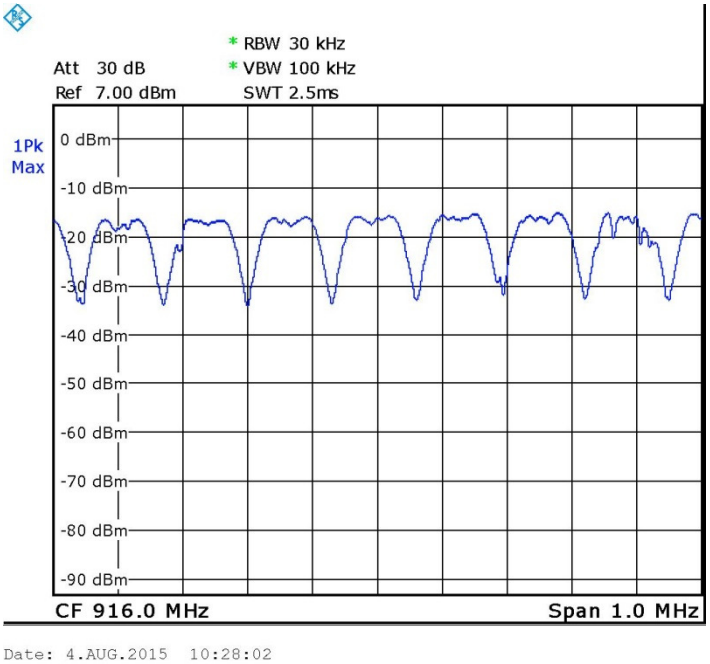
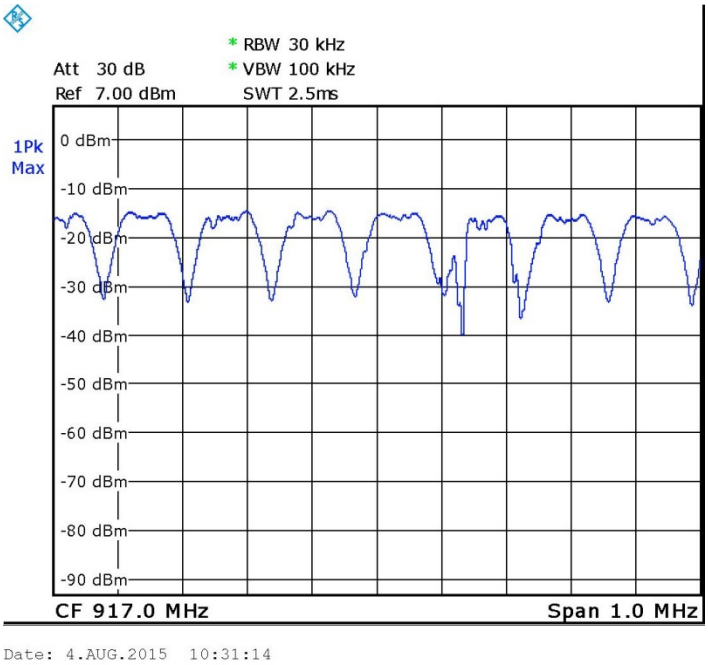


Figure 20. Number of Channels

Number of Hopping Frequencies

E.U.T Description	Glass Break Detector
Type	GB-502 PG2 (915-0:016)
Serial Number:	Not designated

Figure 21. Number of Channels



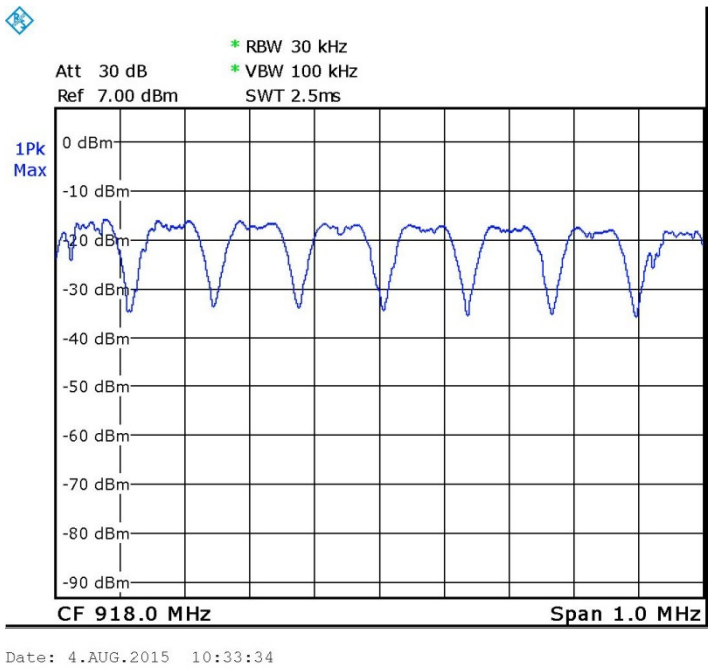


Figure 22. Number of Channels

Number of Hopping Frequencies

E.U.T Description	Glass Break Detector
Type	GB-502 PG2 (915-0:016)
Serial Number:	Not designated

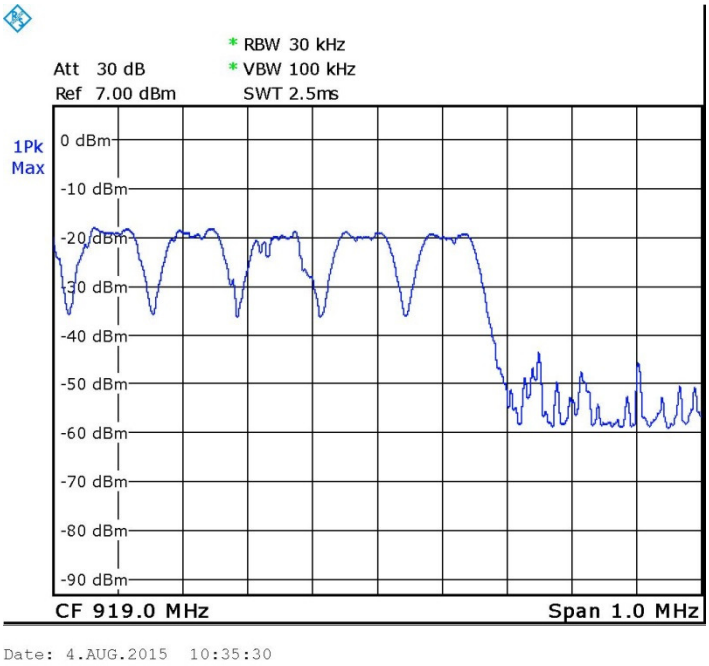


Figure 23. Number of Channels

6.4 *Test Equipment Used, Number of Hopping Frequencies*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	January 31, 2016

Figure 24 Test Equipment Used

7. Channel Frequency Separation

7.1 *Test Specification*

FCC Part 15, Subpart C, 15.247(a) (1)
RSS 247, Issue 1, May 2015, Clause 5.1

7.2 *Test Procedure*

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

RBW: 30 kHz
VBW: 30 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)
135.7	>100	35.7

Figure 25 Channel Frequency Separation Test Results Table

JUDGEMENT: Passed by 35.7 kHz

For additional information see *Figure 26*.

Channel Frequency Separation

E.U.T Description	Glass Break Detector
Type	GB-502 PG2 (915-0:016)
Serial Number:	Not designated

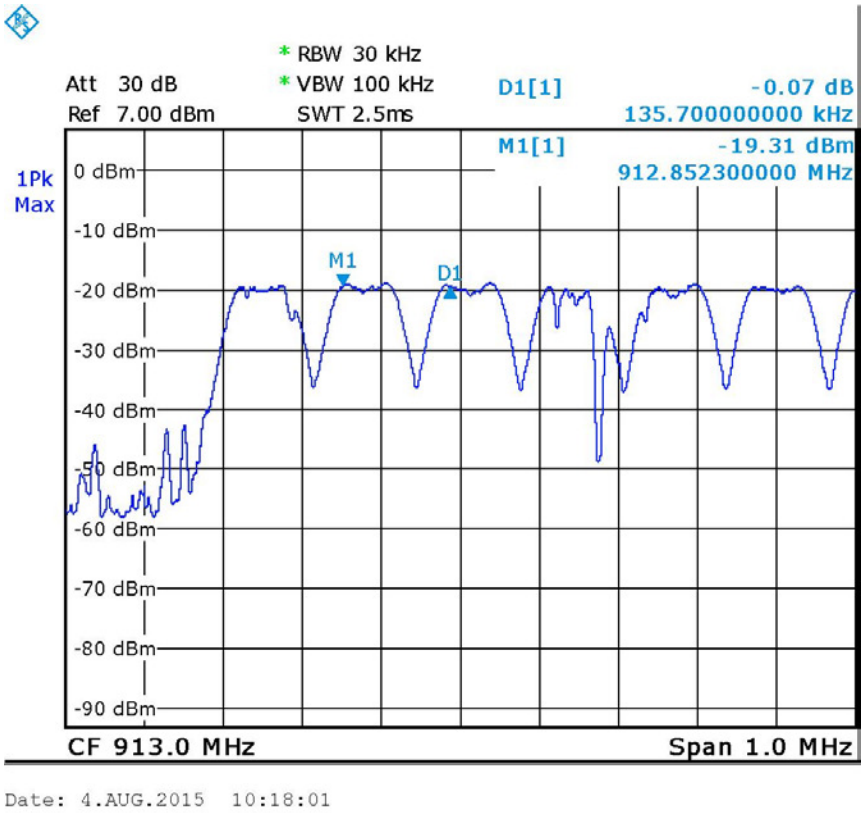


Figure 26. Channel Frequency Separation

7.4 *Test Equipment Used, Channel Frequency Separation Test*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	January 31, 2016

Figure 27 Test Equipment Used

8. Radiated Maximum Power Output

8.1 *Test Specification*

F.C.C. Part 15, Subpart C: 15.247(b)(2)
RSS 247, Issue 1, Clause 5.4

8.2 *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 (912.750 MHz) and High (919.106 MHz) channels with modulation.

8.3 *Test Results for Ceiling Mounted*

Frequency	Pol	E	Results	Results	Limit	Margin
(MHz)		(dbµV/m)	(dBm)	(W)	(W)	(W)
912.750	V	111.17	15.97	0.040	1.0	-0.960
912.750	H	101.14	5.94	0.004	1.0	-0.996
919.106	V	102.37	7.17	0.005	1.0	-0.995
919.106	H	108.57	13.37	0.022	1.0	-0.978

Figure 28 Radiated Power Output Test Results Table - Ceiling Mounted

JUDGEMENT: Passed by 0.960W

For additional information see *Figure 30* to *Figure 33.*

8.4 *Test Results for Wall Mounted*

Frequency	Pol	E	Results	Results	Limit	Margin
(MHz)		(dbµV/m)	(dBm)	(W)	(W)	(W)
912.750	V	98.2	3.0	0.002	1.0	-0.998
912.750	H	110.6	15.4	0.035	1.0	-0.965
919.106	V	97.7	2.5	0.002	1.0	-0.998
919.106	H	110.5	15.3	0.034	1.0	-0.966

Figure 29 Radiated Power Output Test Results Table- Wall Mounted

JUDGEMENT: Passed by 0.965W

For additional information see *Figure 34* to *Figure 37.*

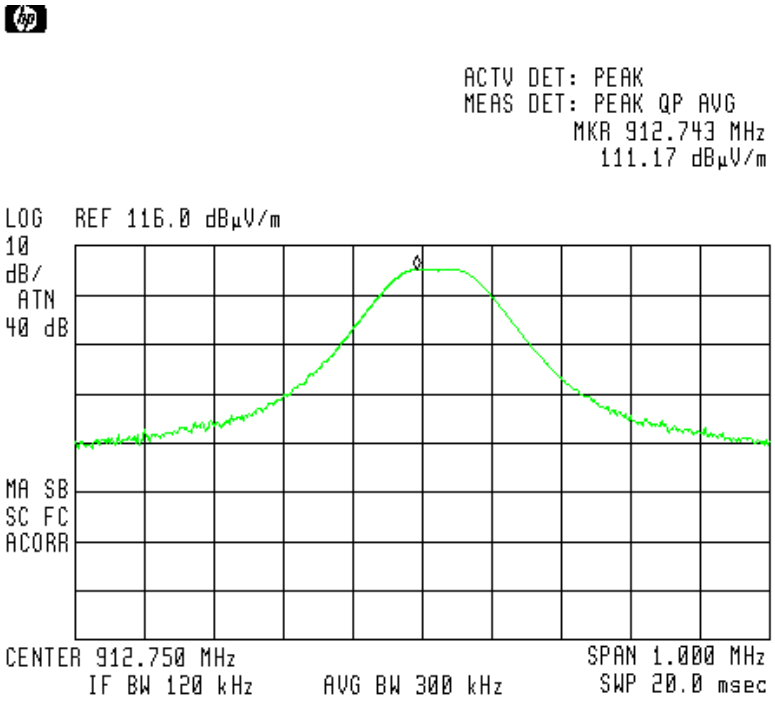


Figure 30 — 912.75 MHz-Horizontal – Ceiling Mounted

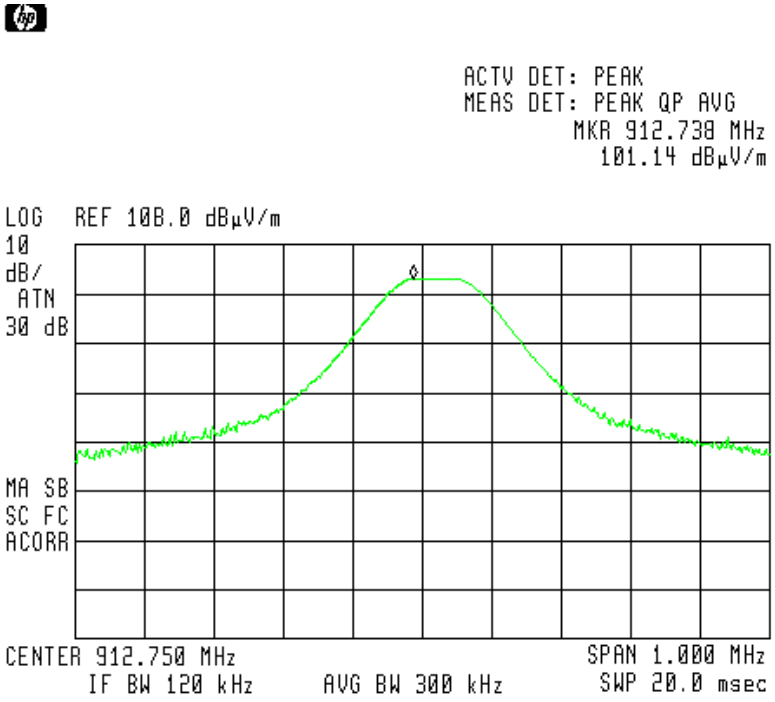


Figure 31 — 912.75 MHz-Vertical – Ceiling Mounted

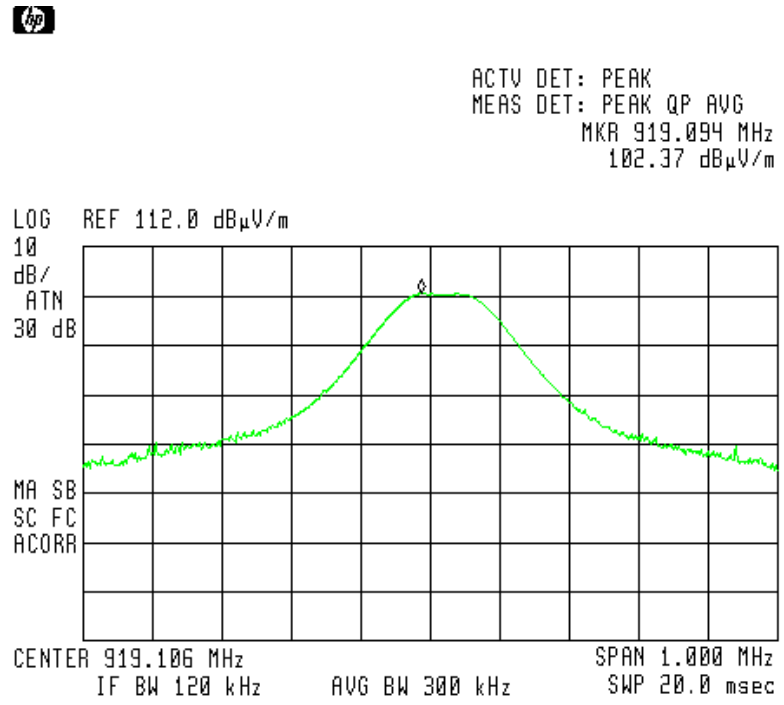


Figure 32 — 919.106 MHz Vertical – Ceiling Mounted

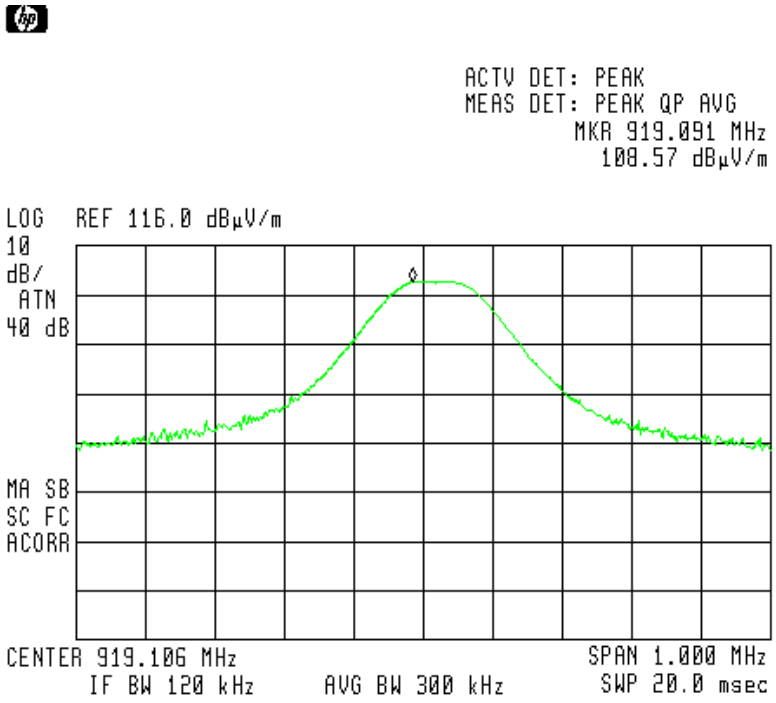


Figure 33 — 919.106 MHz Horizontal – Ceiling Mounted

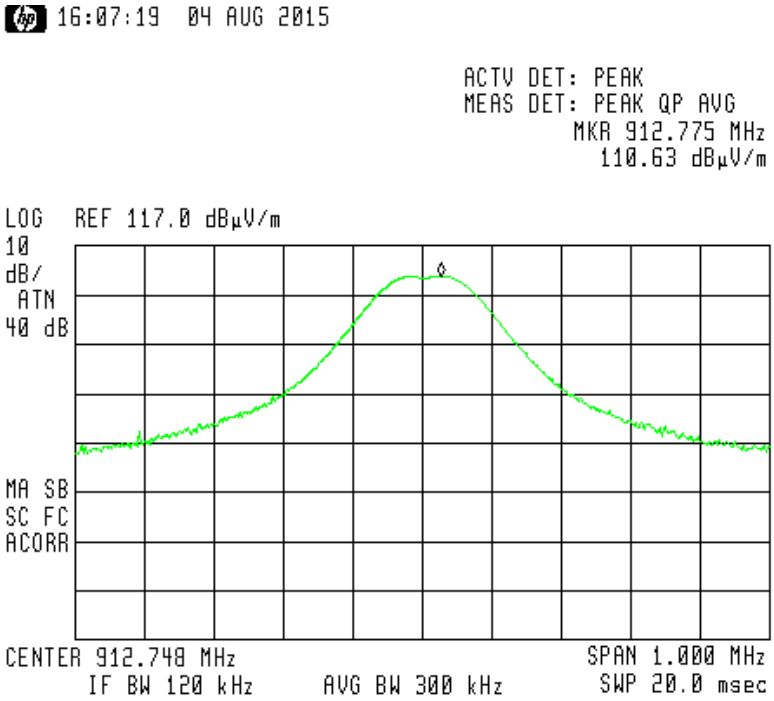


Figure 34 — 912.75 MHz-Horizontal – Wall Mounted

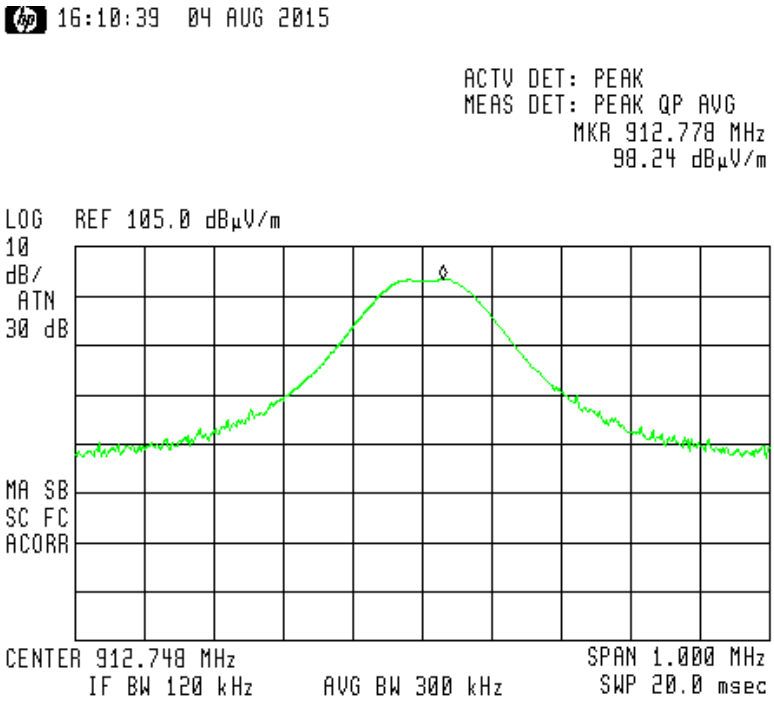


Figure 35 — 912.75 MHz-Vertical – Wall Mounted

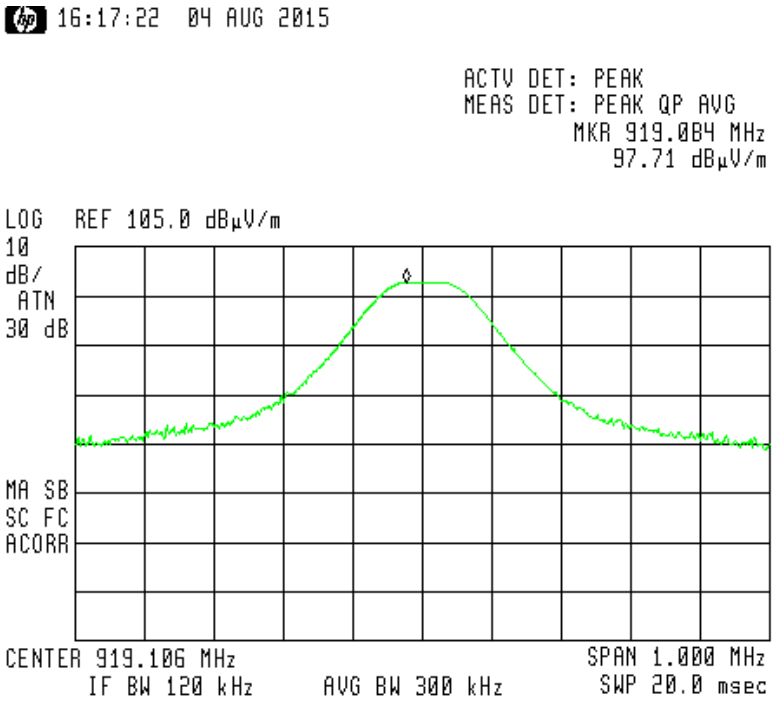


Figure 36 — 919.106 MHz Vertical – Wall Mounted

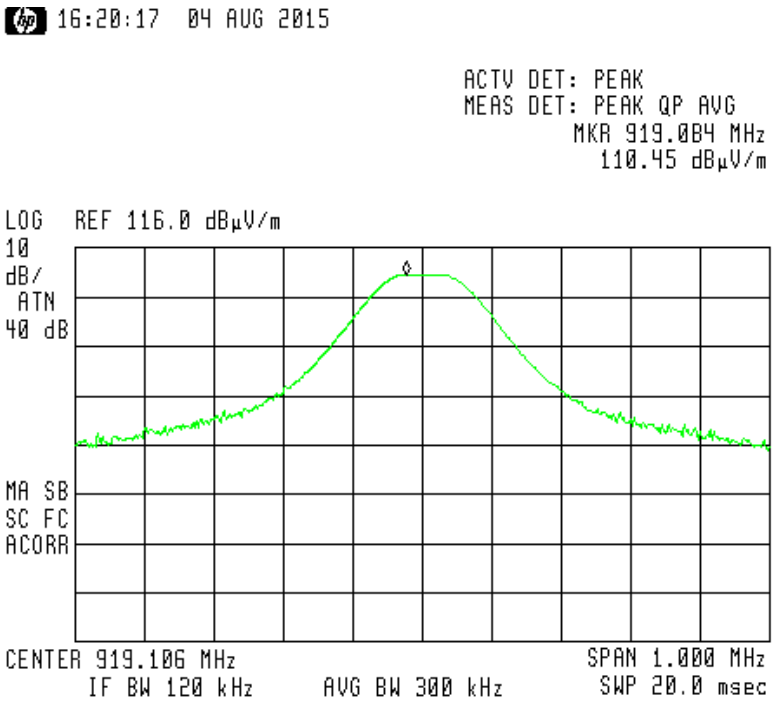


Figure 37 — 919.106 MHz Horizontal – Wall Mounted

8.5 *Test Equipment Used, Radiated Maximum Power Output*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	HP	8542E	3906A00276	March 11, 2015	March 31, 2016
RF Filter Section	HP	85420E	3705A00248	March 11, 2015	March 31, 2016
Antenna Log Periodic	EMCO	3146	9505-4081	December 28, 2014	December 28, 2015
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 38 Test Equipment Used

9. Dwell Time on Each Channel

9.1 *Test Specification*

FCC Part 15, Section 15.247(a)(1)(i)
RSS GEN Issue 3, 7.2.5 (Table 5)

9.2 *Test Procedure*

The E.U.T. was tested in radiated mode using the substitution antenna. The spectrum analyzer was set to 30 kHz VBW.

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*

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

JUDGEMENT: Passed

Additional information of the results is given in *Figure 39 to Figure 40.*

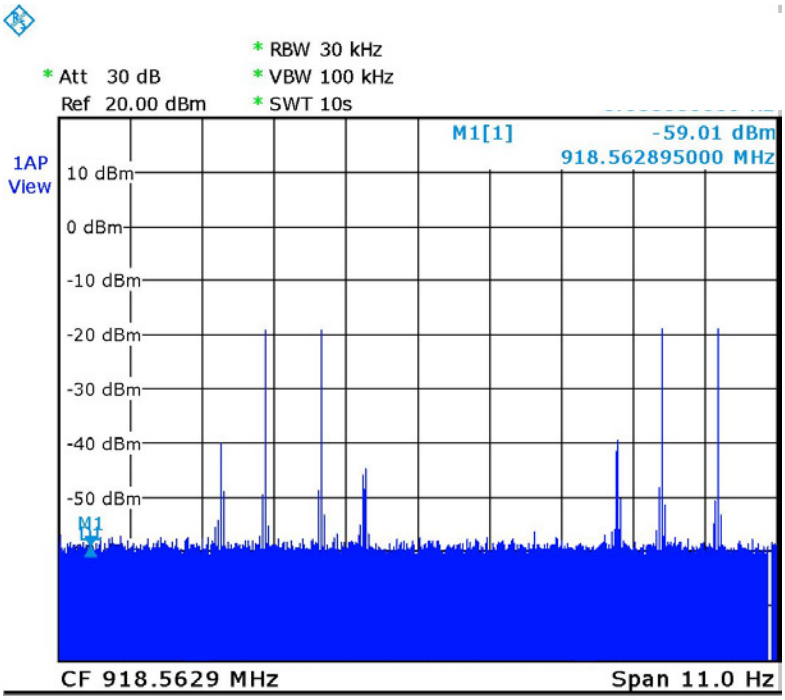


Figure 39 — Transmission within 10 sec

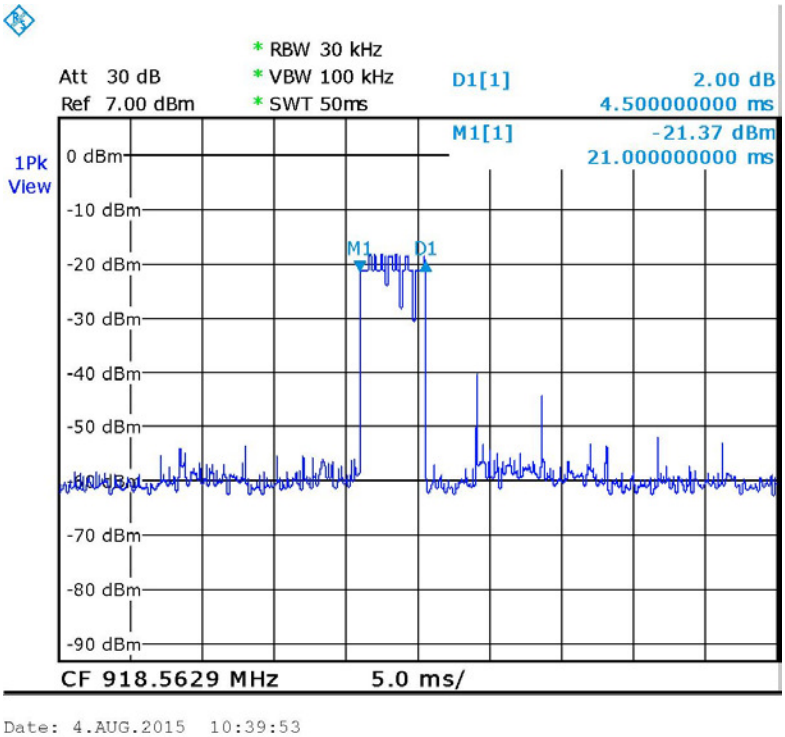


Figure 40 — Burst duration

(Burst duration=4.5msec*7=31.6msec<400msec)

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

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	January 31, 2016

Figure 41 Test Equipment Used

10. Band Edge

10.1 *Test Specification*

FCC Part 15, Section 15.247(d)

RSS 247 Issue 1, Clause 5.1

10.2 *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 120 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.

10.3 *Test Results for Ceiling Mounted- Hopping Mode*

Operation Frequency (MHz)	**Band Edge Frequency** (MHz)	**Spectrum Level** (dBuV/m)	**Specification** (dBuV/m)
Low	902.0	73.99	92.2
High	928.0	73.75	92.2

Figure 42 Band Edge Test Results Table Ceiling - Hopping Mode

JUDGEMENT: Passed

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

10.4 *Test Results for Ceiling Mounted - Continuous Mode*

Operation Frequency (MHz)	**Band Edge Frequency** (MHz)	**Spectrum Level** (dBuV/m)	**Specification** (dBuV/m)
Low	902.0	68.9	92.2
High	928.0	69.3	92.2

Figure 43 Band Edge Test Results Table Ceiling Continuous Mode

JUDGEMENT: Passed

For additional information see *Figure 48* and *Figure 49.*

10.5 *Test Results for Wall Mounted - Hopping Mode*

Operation Frequency (MHz)	**Band Edge Frequency** (MHz)	**Spectrum Level** (dBuV/m)	**Specification** (dBuV/m)
Low	902.0	73.4	90.4
High	928.0	74.3	90.4

Figure 44 Band Edge Test Results Table – Wall Mounted – Hopping Mode

JUDGEMENT: Passed

For additional information see *Figure 50* and *Figure 51.*

10.6 *Test Results for Wall Mounted – Continuous Mode*

Operation Frequency (MHz)	**Band Edge Frequency** (MHz)	**Spectrum Level** (dBuV/m)	**Specification** (dBuV/m)
Low	902.0	68.4	90.4
High	928.0	68.6	90.4

Figure 45 Band Edge Test Results Table – Wall Mounted – Continuous Mode

JUDGEMENT: Passed

For additional information see *Figure 52* and *Figure 53.*

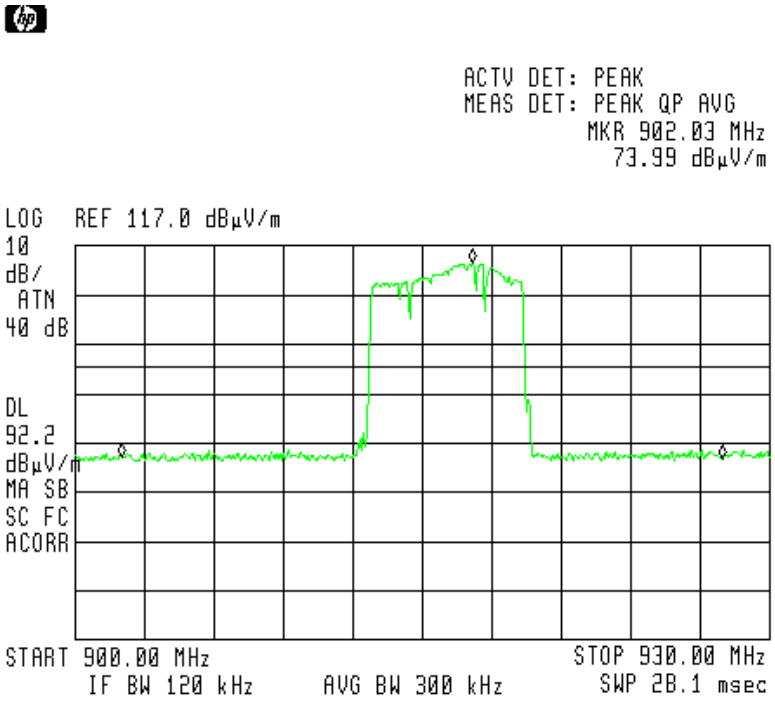


Figure 46 — 902.0 MHz Horizontal – Ceiling Mounted Hopping Mode

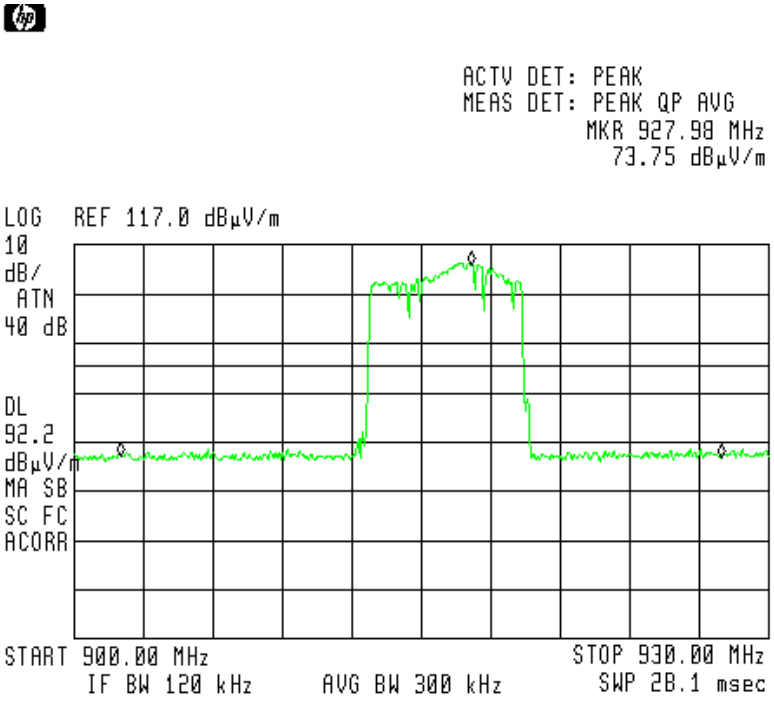


Figure 47 — 928.0 MHz Horizontal – Ceiling Mounted Hopping Mode

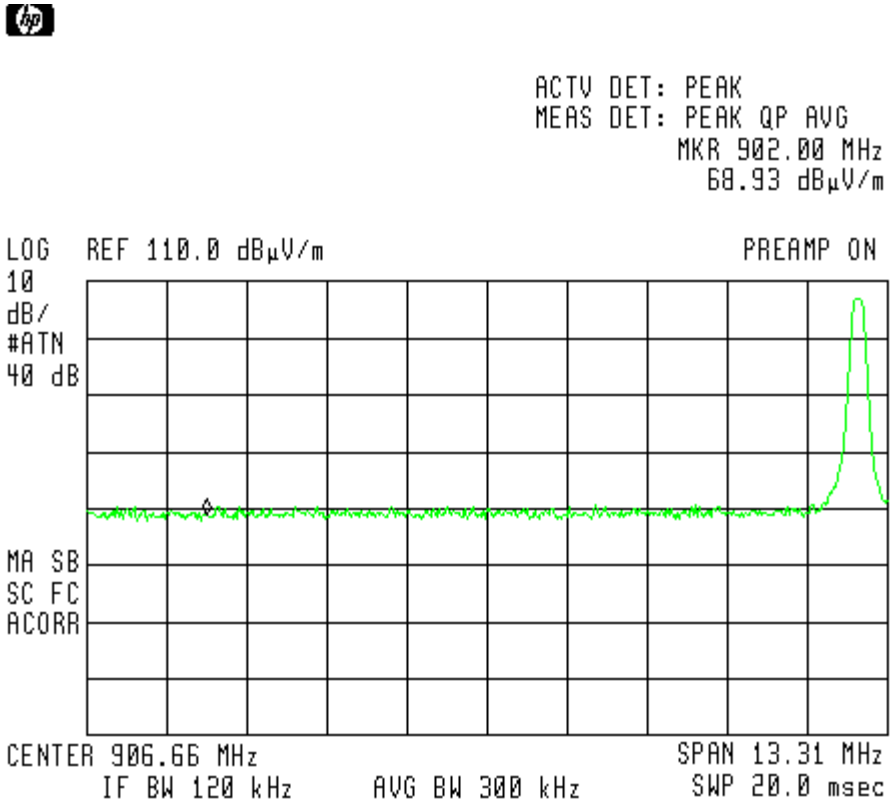


Figure 48 — 902.0 MHz Horizontal – Ceiling Mounted – Continuous Mode

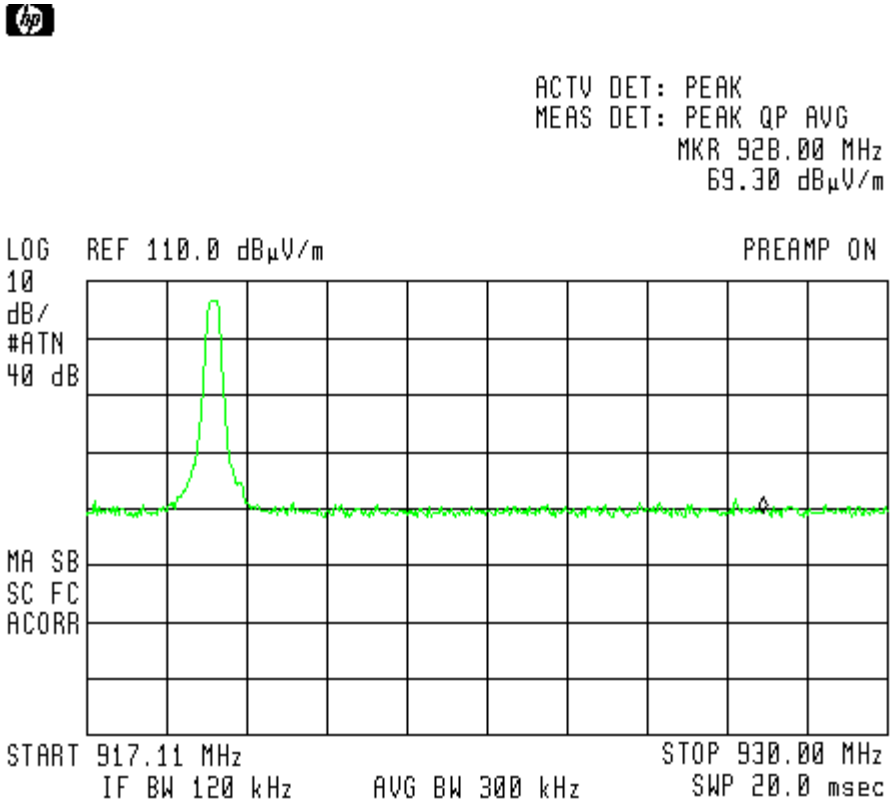


Figure 49 — 928.0 MHz Horizontal – Ceiling Mounted – Continuous Mode

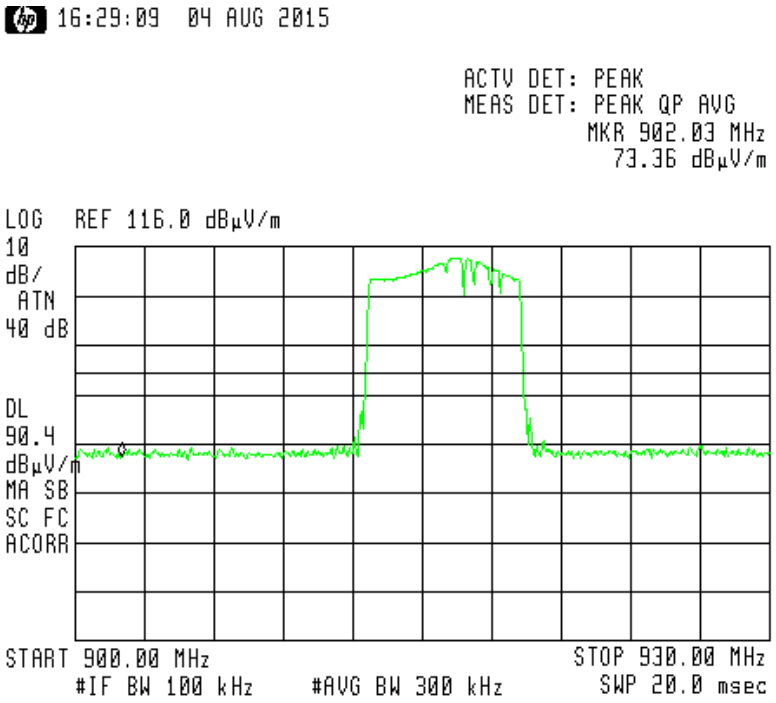


Figure 50 — 902.0 MHz Horizontal – Wall Mounted –Hopping Mode

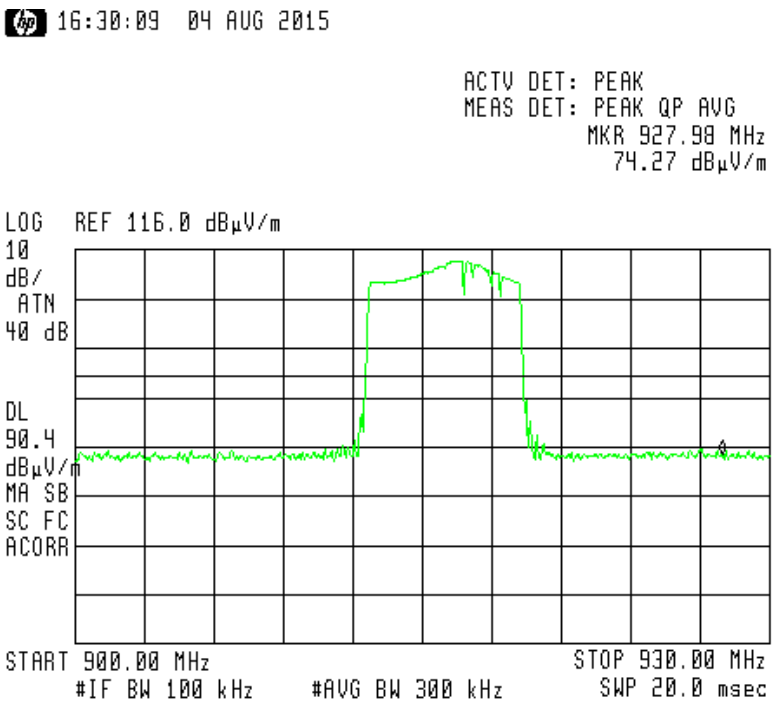


Figure 51 — 928.0 MHz Horizontal – Wall Mounted –Hopping Mode

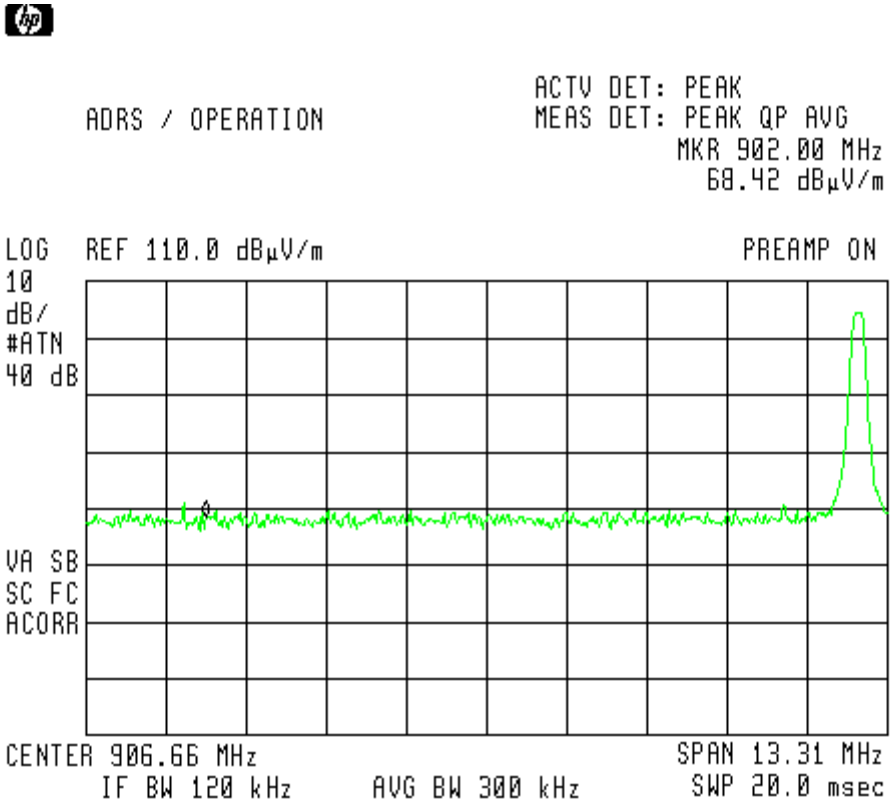


Figure 52 — 902.0 MHz Horizontal – Wall Mounted – Continuous Mode

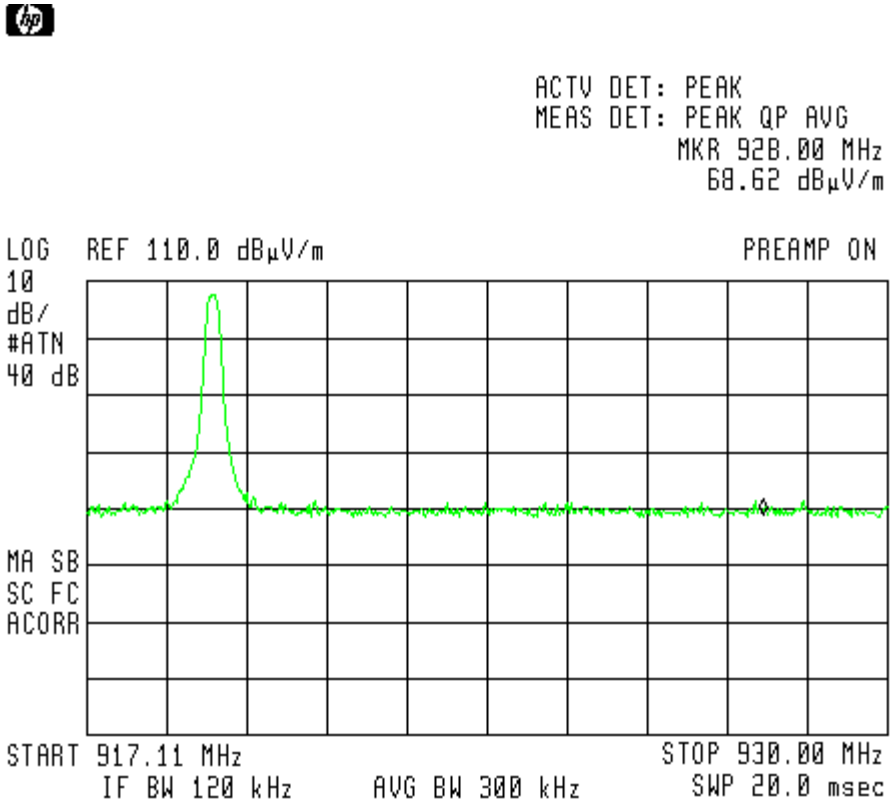


Figure 53 — 928.0 MHz Horizontal – Wall Mounted – Continuous Mode

10.7 *Test Equipment Used, Band Edge Spectrum*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	HP	8542E	3906A00276	March 11, 2015	March 31, 2016
RF Filter Section	HP	85420E	3705A00248	March 11, 2015	March 31, 2016
Antenna Log Periodic	EMCO	3146	9505-4081	December 28, 2014	December 28, 2016*
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

* The next calibration due date has been extended from December 28, 2015 to December 28, 2016.

Figure 54 Test Equipment Used

11. Emissions in Non-Restricted Frequency Bands

11.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(d)
FCC, Part 15, Subpart C, Section 209
RSS GEN Issue 4: 2014, Clause 8.9

11.2 *Test Procedure*

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

For 0.009MHz-1000MHz 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 0.009 MHz-1000 MHz was scanned.

RBW was set to 100 kHz.

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

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

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

For 1000MHz-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.

RBW was set to 100 kHz.

In the frequency range 30-7000MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.
In the frequency range 7000MHz-10000 MHz, a spectrum analyzer including a low noise amplifier was used.

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

For all final evaluations the distance was 3 meters.

The E.U.T. was operated at the frequencies of 912.75 and 919.106 MHz. These frequencies were measured using a peak detector.

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.

11.1 *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 [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.

11.2 *Test Results*

JUDGEMENT: Passed

All detected emissions were greater than 20dBc below the fundamental level.

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

11.3 *Test Instrumentation Used, Emission in Non Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	March 3, 2016
EMI Receiver	HP	8542E	3906A00276	March 11, 2015	March 31, 2016
RF Filter Section	HP	85420E	3705A00248	March 19, 2015	March 31, 2016
Biconical Antenna	EMCO	3104	2606	December 28, 2014	December 28, 2015
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	November 4, 2016
Log Periodic Antenna	EMCO	3146	9505-4081	December 28, 2014	December 28, 2015
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Low Noise Amplifier	Narda	DBS-0411N313	13	March 1, 2015	March 1, 2016
Low Noise Amplifier	Sophia Wireless	LNA28-B	232	March 1, 2015	March 1, 2016
Spectrum Analyzer	HP	8593EM	3536A00120ADI	February 24, 2015	February 28, 2016
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	March 1, 2016
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 55 Test Equipment Used

12. Emissions in Restricted Frequency Bands

12.1 *Test Specification*

FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)
RSS GEN Issue 4: 2014, Clauses 8.9; 8.10
RSS -247, Issue 1, Clause 5.5

12.2 *Test Procedure*

For 0.009MHz-1000M 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 0.009 MHz-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-30MHz, the center of the loop antenna height was one meter above the ground.

In the frequency range of 30MHz-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 1000M-10000M 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 2.

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.

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.

In the frequency range 30-7000MHz, 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.

For all final evaluations, the distance was 3 meters.
The E.U.T. was tested in 2 operating frequencies:
912.75 MHz and 919.106 MHz.

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.

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.

Figure 56 Table of Limits

12.3 *Test Results for Ceiling Mounted*

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C and RSS GEN Issue 4: 2014, Clause 8.9 specification.

For the operation frequency 912.75 MHz, the margin between the emission level and the specification limit is 1.75dB in the worst case at the frequency of 2738.2 MHz, vertical polarization.

For the operation frequency 919.106 MHz, the margin between the emission level and the specification limit is 2.12dB in the worst case at the frequency of 2757.3 MHz, horizontal polarization.

For additional information see *Figure 57* and *Figure 58.*

12.4 *Test Results for Wall Mounted*

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C and RSS GEN Issue 4: 2014, Clause 8.9 specification.

For the operation frequency 912.75 MHz, the margin between the emission level and the specification limit is 6dB in the worst case at the frequency of 2738.2 MHz, vertical and horizontal polarization.

For the operation frequency 919.106 MHz, the margin between the emission level and the specification limit is 3.0dB in the worst case at the frequency of 1838.2 MHz, horizontal polarization.

For additional information see *Figure 59* and *Figure 60.*

Radiated Emission

E.U.T Description	Glass Break Detector
Type	GB-502 PG2 (915-0:016)
Serial Number:	Not designated
	Ceiling Mounted

Specification: FCC, Part 15, Subpart C
RSS GEN Issue 4: 2014, Clause 8.9

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 (dBµV/m)	Peak Specification (dB µV/m)	Peak Margin (dB)
912.750	1825.5	H	52.38	74.0	-21.62
912.750	1825.5	V	53.76	74.0	-20.24
912.750	2738.2	H	55.58	74.0	-18.42
912.750	2738.2	V	56.01	74.0	-17.99
919.106	1838.2	H	50.33	74.0	-23.67
919.106	1838.2	V	51.15	74.0	-22.85
919.106	2757.3	H	56.57	74.0	-17.43
919.106	2757.3	V	55.66	74.0	-18.34

Figure 57. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak – Ceiling Mounted

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	Glass Break Detector
Type	GB-502 PG2 (915-0:016)
Serial Number:	Not designated
	Ceiling Mounted

Specification: FCC, Part 15, Subpart C
RSS GEN Issue 4: 2014, Clause 8.9

Antenna Polarization: Horizontal/Vertical
Frequency range: 30 MHz to 10.0 GHz
Test Distance: 3 meters
Detector: Peak

Operation Frequency	Freq.	Polarity	Average Result	Average Specification	Average Margin
(MHz)	(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
912.750	1825.5	H	48.16	54.0	-5.84
912.750	1825.5	V	51.27	54.0	-2.73
912.750	2738.2	H	51.15	54.0	-2.85
912.750	2738.2	V	52.25	54.0	-1.75
919.106	1838.2	H	46.07	54.0	-7.93
919.106	1838.2	V	46.89	54.0	-7.11
919.106	2757.3	H	51.88	54.0	-2.12
919.106	2757.3	V	51.36	54.0	-2.64

Figure 58. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average – Ceiling Mounted

Radiated Emission

E.U.T Description	Glass Break Detector
Type	GB-502 PG2 (915-0:016)
Serial Number:	Not designated
	Wall Mounted

Specification: FCC, Part 15, Subpart C
RSS GEN Issue 4: 2014, Clause 8.9

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 (dBµV/m)	Peak Specification (dB µV/m)	Peak Margin (dB)
912.750	1825.5	H	49.8	74.0	-24.2
912.750	1825.5	V	50.2	74.0	-23.8
912.750	2738.2	H	54.2	74.0	-19.8
912.750	2738.2	V	55.0	74.0	-19.0
919.106	1838.2	H	59.9	74.0	-14.1
919.106	1838.2	V	50.9	74.0	-23.1
919.106	2757.3	H	55.1	74.0	-18.9
919.106	2757.3	V	55.4	74.0	-18.6

Figure 59. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak – Wall Mounted

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	Glass Break Detector
Type	GB-502 PG2 (915-0:016)
Serial Number:	Not designated
	Wall Mounted

Specification: FCC, Part 15, Subpart C
RSS GEN Issue 4: 2014, Clause 8.9

Antenna Polarization: Horizontal/Vertical
Frequency range: 30 MHz to 10.0 GHz
Test Distance: 3 meters
Detector: Peak

Operation Frequency	Freq.	Polarity	Average Result	Average Specification	Average Margin
(MHz)	(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
912.750	1825.5	H	42.7	54.0	-11.3
912.750	1825.5	V	42.3	54.0	-11.7
912.750	2738.2	H	48.0	54.0	-6.0
912.750	2738.2	V	48.0	54.0	-6.0
919.106	1838.2	H	51.0	54.0	-3.0
919.106	1838.2	V	43.5	54.0	-10.5
919.106	2757.3	H	48.1	54.0	-5.9
919.106	2757.3	V	48.5	54.0	-5.1

Figure 60. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average – Wall Mounted

12.5 *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:

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

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

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

No external pre-amplifiers are used.

12.6 *Test Equipment Used, Spurious Radiated Emission Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	March 3, 2016
EMI Receiver	HP	8542E	3906A00276	March 11, 2015	March 31, 2016
RF Filter Section	HP	85420E	3705A00248	March 19, 2015	March 31, 2016
Biconical Antenna	EMCO	3104	2606	December 28, 2014	December 28, 2015
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	November 4, 2016
Log Periodic Antenna	EMCO	3146	9505-4081	December 28, 2014	December 28, 2015
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Low Noise Amplifier	Narda	DBS-0411N313	13	March 1, 2015	March 1, 2016
Low Noise Amplifier	Sophia Wireless	LNA28-B	232	March 1, 2015	March 1, 2016
Spectrum Analyzer	HP	8593EM	3536A00120ADI	February 24, 2015	February 28, 2016
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	March 1, 2016
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 61 Test Equipment Used

13. Antenna Gain/Information

The antenna gain is -4.0dBi.

14. R.F Exposure/Safety

The EUT is a glass break detector. The typical placement of the E.U.T. is either wall or ceiling mounted. The typical distance between the E.U.T. and the user is 20cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on 47CFR1 Section1.1310 and RSS 102, Issue 5, Section 2.5.1 Requirements

a. FCC Limit at 912.75 MHz is: $\frac{f}{1500}=0.608\frac{mW}{cm^2}$

IC Limit at 912.75 MHz is: $7\frac{mW}{cm^2}$

Using Table 1 of 47CFR1 Section 1.1310 and Section 2.5.1 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:

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

P_t = Calculated Transmitted Power (includes G_t) 111.17 dBuV/m =15.97 dBm =39.5 mW

G_t = Antenna Gain -4.0 dBi

R = Distance From Transmitter= 20 cm

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

$$S_p=\frac{39.5}{4\pi(20)^2}=0.008\frac{mW}{cm^2}$$

d. This value is below the FCC/IC limits.

15. APPENDIX A - CORRECTION FACTORS

15.1 *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

15.2 *Correction factors for Log Periodic Antenna Model EMCO 3146 Serial 9505-4081*

CALIBRATION DATA

Frequency, MHz	Antenna factor, dB/m [1]
200	11.55
250	11.60
300	14.43
400	15.38
500	17.98
600	18.78
700	21.17
800	21.16
900	22.67
1000	24.09

[1] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.

15.3 *Correction factors for Biconical Antenna Model EMCO 3104 Serial 2606*

CALIBRATION DATA

Frequency, MHz	Near free space antenna factor, dB/m	Geometry specific correction factor, dB	Free space antenna factor, dB/m [1)]
30	12.97	0.13	12.84
35	12.34	0.09	12.25
40	12.03	0.06	11.97
45	11.42	0.02	11.40
50	11.91	0.03	11.88
60	11.92	0.37	11.55
70	9.60	0.25	9.35
80	6.99	-0.45	7.44
90	10.87	-0.34	11.21
100	11.51	-0.06	11.57
120	13.30	0.20	13.10
140	12.56	-0.01	12.57
160	14.49	-0.12	14.61
180	16.53	0.05	16.48
200	15.30	0.15	15.15

[1)] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.

15.4 *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

15.5 *Correction factors for Double-Ridged Waveguide Horn*

Model: 3115, S/N 29845
10 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (dB/m)
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