



**DATE: 04 February 2015**

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

**FCC Radio Test Report**

for

**AeroScout Ltd.**

**Equipment under test:**

**LF Exciter**

**EX-5200**

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:	AeroScout Ltd.
Manufacturer's Address:	3 Pekeris St. Einstein Entrance 4 <sup>th</sup> Floor Rehovot 76702 Tel: +972-8-9369393 Fax: +972-8-9365977
Manufacturer's Representative:	Leonid Genusin
Equipment Under Test (E.U.T):	LF Exciter
Equipment Model No.:	EX-5200
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	02.02.15
Start of Test:	02.02.15
End of Test:	02.02.15
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C RSS-210, Issue 8, 2010



## **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 Number US1004.
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 4025A-1.

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 AeroScout EX5200 Exciter is a component of the AeroScout suite of enterprise visibility solutions that enables location-based applications. The EX5200 extends the AeroScout suite to provide robust and sophisticated RFID detection capabilities, using the same AeroScout tags that can also be accurately located in real time by the AeroScout system.

The EX5200 triggers AeroScout's tags as they pass through a choke point or when they are located near the Exciter and the tags in turn transmit Wi-Fi message to compatible Access Points in range. The Exciter can activate/deactivate the tags, program the tags or even cause tag reaction such as blinking. This provides instant acknowledgment that a tagged asset passed through a gate, doorway or some other well-defined area.

The detection capabilities of the EX5200, combined with the location features of the AeroScout Visibility System, make the AeroScout suite the most sophisticated enterprise visibility solution for a wide variety of industries.

### **1.4 Test Methodology**

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4: 2009, RSS, Gen Issue 4. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### **1.5 Test Facility**

Both conducted and radiated 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 US1004.

### **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

#### **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):  
± 3.44 dB



## 2. System Test Configuration

### 2.1 *Justification*

Radiated emission screening was performed in 3 orthogonal orientations. The worst case orientation was the vertical position.

The EX-5200 uses the same radio board as the EX-5500 which received FCC/IC certification under FCC ID Q3HEX5500 and IC: 5115A-EX5500.

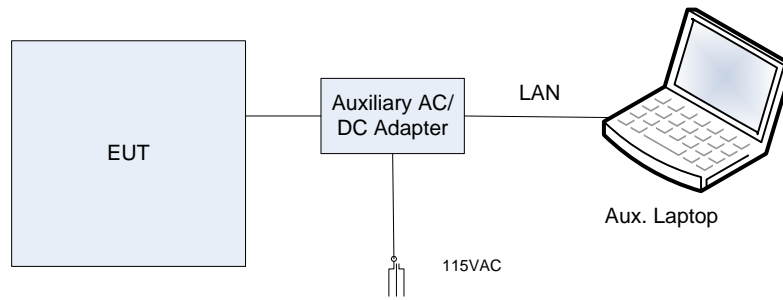
### 2.2 *Special Accessories*

No special accessories were needed to achieve compliance.

### 2.3 *Equipment Modifications*

No equipment modifications were required to achieve compliance.

## 2.4 Configuration of Tested System



**Figure 1. Configuration of Tested System**



### 3. Test Set-up Photos



Figure 2. Conducted Emission Test

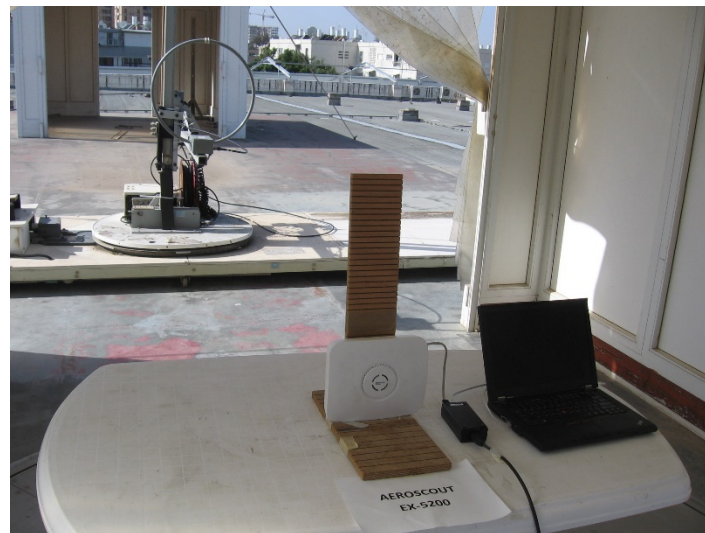


Figure 3. Radiated Emission Test



## 4. Conducted Emission From AC Mains

### 4.1 Test Specification

FCC Part 15, Subpart C, Section 207

### 4.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 4.1. 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 2.

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 0.95dB

The margin between the emission levels and the specification limit is, in the worst case, 0.95 dB for the phase line at 0.158 MHz and 1.05 dB at 0.158 MHz for the neutral line.

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

The details of the highest emission levels are given in *Figure 4* to *Figure 7*.

TEST PERSONNEL:

Tester Signature: \_\_\_\_\_

Date: 04.02.15

Typed/Printed Name: M. Zohar



## Conducted Emission

E.U.T Description      LF Exciter  
Type                      EX-5200  
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 dB $\mu$ V	DELTA LIMIT dB
Trace1:	CE22BQP			
Trace2:	CE22BAP			
Trace3:	---			
1	Quasi Peak	158 kHz	64.61	-0.95
2	Average	158 kHz	51.93	-3.63
1	Quasi Peak	210 kHz	60.78	-2.42
2	Average	210 kHz	47.65	-5.54
1	Quasi Peak	262 kHz	56.25	-5.11
2	Average	262 kHz	42.72	-8.64
1	Quasi Peak	310 kHz	50.27	-9.69
1	Quasi Peak	13.998 MHz	50.32	-9.67
1	Quasi Peak	14.126 MHz	52.61	-7.38
2	Average	14.126 MHz	41.48	-8.51
1	Quasi Peak	14.25 MHz	52.80	-7.19
2	Average	14.25 MHz	40.58	-9.41
1	Quasi Peak	14.878 MHz	49.51	-10.48
1	Quasi Peak	15.874 MHz	50.75	-9.24
2	Average	15.998 MHz	39.66	-10.33
1	Quasi Peak	16.002 MHz	50.40	-9.59
1	Quasi Peak	16.126 MHz	50.16	-9.83
2	Average	16.25 MHz	35.80	-14.19

Date: 2.FEB.2015 10:34:34

**Figure 4. 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.*

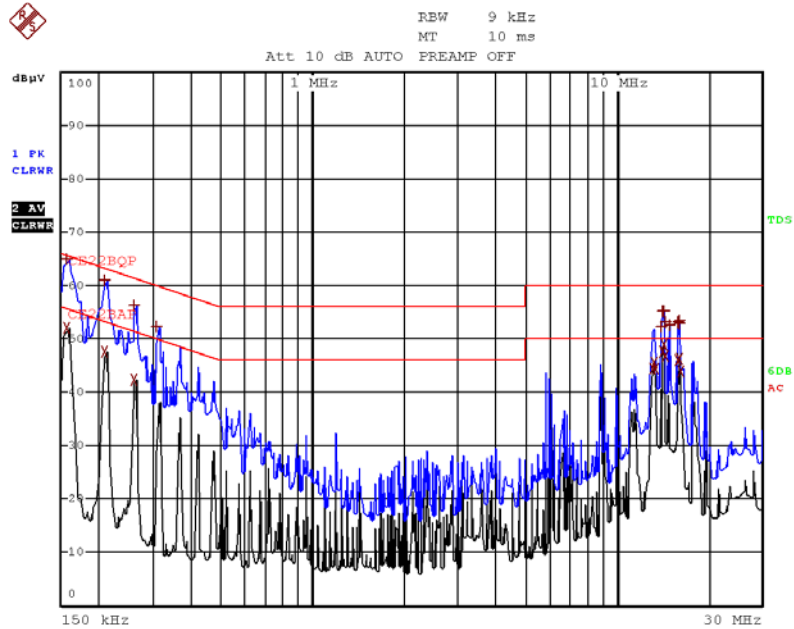
# Conducted Emission

E.U.T Description    LF Exciter  
Type                    EX-5200  
Serial Number:        Not designated

Specification:    FCC Part 15, Subpart C

Lead:                Phase

Detectors:        Peak, Quasi-peak, Average



Date: 2.FEB.2015 10:32:00

**Figure 5. Detectors: Peak, Quasi-peak, Average**

*Notes:*

1. Horizontal axis shows logarithmic frequency scale.
2. The vertical axis shows amplitude (in dB  $\mu$ V).
3. Peak detection is designated by the top of each vertical line.
4. Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.
5. Average detection is designated by the second dash mark (from the top) of each vertical line.



## Conducted Emission

E.U.T Description    LF Exciter  
Type                    EX-5200  
Serial Number:        Not designated

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

EDIT PEAK LIST (Final Measurement Results)				
TRACE		FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
Trace1:	CE22BQP			
Trace2:	CE22BAP			
Trace3:	---			
1	Quasi Peak	158 kHz	64.51	-1.05
2	Average	158 kHz	52.10	-3.46
1	Quasi Peak	210 kHz	60.67	-2.53
2	Average	210 kHz	47.75	-5.45
1	Quasi Peak	262 kHz	56.02	-5.34
2	Average	262 kHz	42.89	-8.47
1	Quasi Peak	314 kHz	51.65	-8.21
1	Quasi Peak	14.002 MHz	50.00	-9.99
1	Quasi Peak	14.126 MHz	52.29	-7.70
2	Average	14.126 MHz	40.16	-9.84
1	Quasi Peak	14.25 MHz	52.45	-7.54
1	Quasi Peak	15.374 MHz	48.00	-11.99
1	Quasi Peak	15.75 MHz	47.94	-12.05
2	Average	15.75 MHz	35.97	-14.02
1	Quasi Peak	15.874 MHz	50.25	-9.74
2	Average	15.874 MHz	38.05	-11.94
1	Quasi Peak	16.002 MHz	49.90	-10.09
2	Average	16.002 MHz	38.85	-11.14
1	Quasi Peak	16.126 MHz	49.66	-10.33

Date: 2.FEB.2015 10:43:20

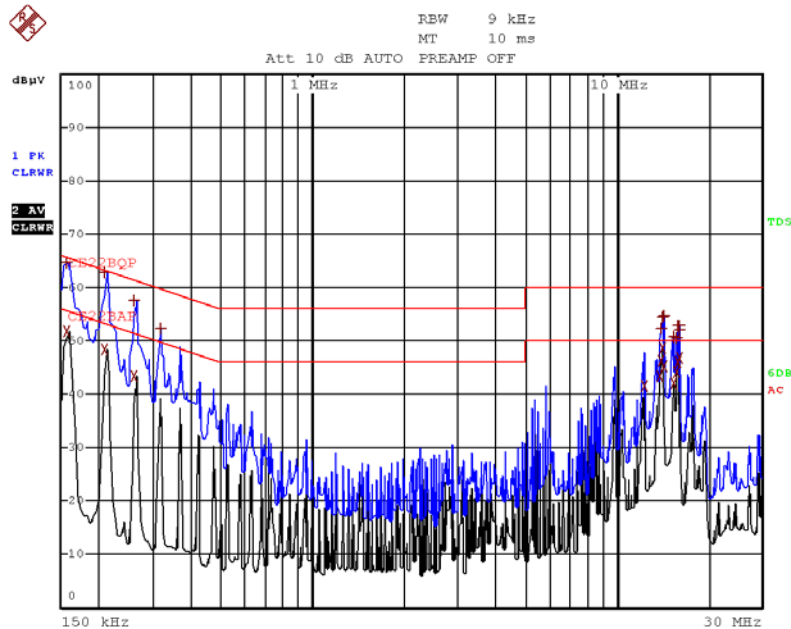
**Figure 6. Detectors: Peak, Quasi-peak, AVERAGE**

*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 LF Exciter  
Type EX-5200  
Serial Number: Not designated

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



Date: 2.FEB.2015 10:41:28

**Figure 7 Conducted Emission: NEUTRAL  
Detectors: Peak, Quasi-peak, Average**

*Notes:*

1. Horizontal axis shows logarithmic frequency scale.
2. The vertical axis shows amplitude (in dB µV).
3. Peak detection is designated by the top of each vertical line.
4. Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.
5. Average detection is designated by the second dash mark (from the top) of each vertical line.



#### 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	June 23, 2014,	1 Year
Transient Limiter	HP	11947A	3107A03041	May 13, 2014	1Year
EMI Receiver	Rohde & Schwarz	ESCI7	100724	January 4, 2015	1Year

**Figure 8 Test Equipment Used**



## 5. 26dB Minimum Bandwidth

### 5.1 Test Specification

F.C.C. Part 15, Subpart C, Part 2.1049

### 5.2 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 1 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 3, 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.

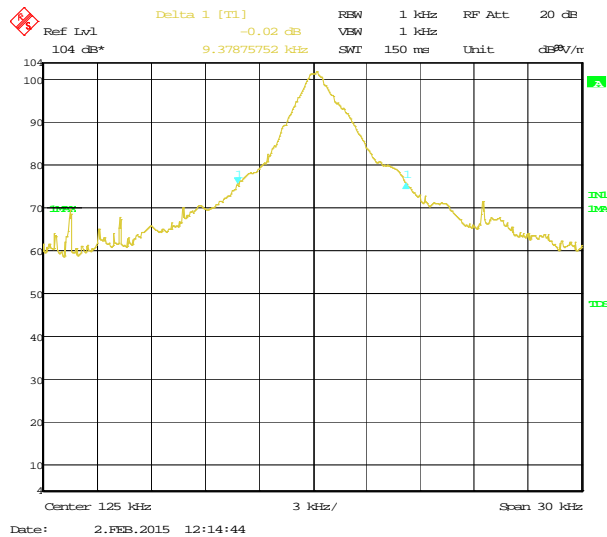


Figure 9. 26dB Bandwidth



### 5.3 Test Results

E.U.T Description: LF Exciter

Model: EX-5200

Serial Number: Not designated

Operational Frequency (kHz)	Bandwidth Reading (kHz)
125.0	9.4

Figure 10 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: \_\_\_\_\_

Date: 04.02.15

Typed/Printed Name: M. Zohar



#### 5.4 Test Equipment Used; 26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESBI7	100120	January 1, 2015	1 Year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 Year
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 11 Test Equipment Used



## 6. Field Strength of Fundamental

### 6.1 Test Specification

F.C.C., Part 15, Subpart C, 15.209

### 6.2 Test Procedure

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

The E.U.T. was placed on a non-conductive table, 0.8 meters above the O.A.T.S. ground plane.

The EMI receiver was set to the E.U.T. Fundamental Frequency (125 kHz) and Peak Detection.

The distance between the E.U.T. and test antenna was 3 meters.

The turntable and antenna were adjusted for maximum level reading on the EMI receiver. The loop antenna was in vertical axis. The antenna height (center of loop) was 1 meter.

### 6.3 Test Results

JUDGEMENT: Passed by 4.0 dB

The EUT met the FCC Part 15, Subpart C, Section 15.209 specification requirements.

The details of the highest reading given in *Figure 13*.

TEST PERSONNEL:

Tester Signature: \_\_\_\_\_

Date: 04.02.15

Typed/Printed Name: M. Zohar

Operating Frequency	Reading	AVERAGE FACTOR	AVG RESULT	Limit	Margin
(KHz)	(dB $\mu$ V/m)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
125.0	101.7	N/A	N/A	105.7	-4.0

Figure 12 Test Results – Field Strength of Fundamental



## Field Strength of Fundamental

E.U.T Description LF Exciter  
Type EX-5200  
Serial Number: Not designated

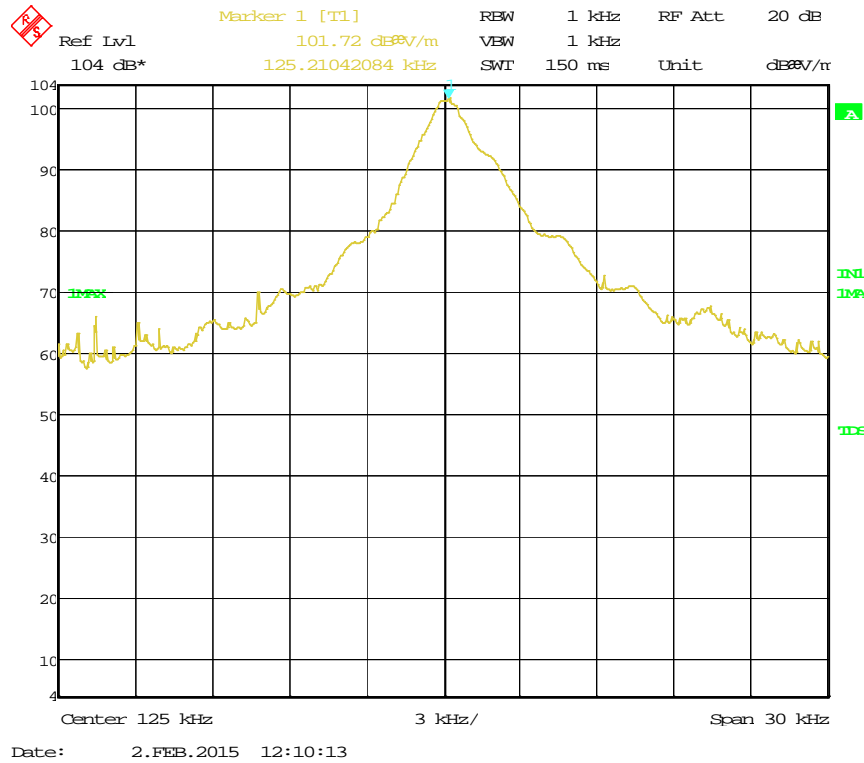


Figure 13. Field Strength of Fundamental  
Detector: Peak



#### 6.4 Test Equipment Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESBI7	100120	January 1, 2015	1 Year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 Year
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 14. Test Equipment Used



## 7. Radiated Emission, 9 kHz – 30 MHz

### 7.1 Test Specification

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

### 7.2 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 with CISPR 16 requirements.

In the frequency range 9 kHz-30MHz, the loop antenna was in 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 frequency of 125 kHz. This frequency was measured using a peak detector.

### 7.3 Test Results

Frequency (kHz)	Peak (dBuV/m)	AVG. FAC (dBuV/m)	AVG RESULT (dBuV/m)	Limit (dBuV/m)	Margin (dB)
250.0	69.3	N/A	N/A	99.6	-30.3
375.0	60.8	N/A	N/A	96.1	-35.3

JUDGEMENT: Passed

The EUT was tested and it met the requirements of the FCC Part 15, Subpart C, Section 209 specification.

TEST PERSONNEL:

Tester Signature: \_\_\_\_\_

Date: 04.02.15

Typed/Printed Name: M. Zohar



#### 7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	R&S	ESBI7	100120	January 1, 2015	1 Year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 Year
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 15. Test Equipment Used

#### 7.5 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 $\mu$ v/m]
- RA: Receiver Amplitude [dB $\mu$ v]
- AF: Receiving Antenna Correction Factor [dB/m]
- CF: Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.





## 8. APPENDIX A - CORRECTION FACTORS

### 8.1 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

Frequency (MHz)	Cable Loss (dB)
0.010	0.4
0.015	0.2
0.020	0.2
0.030	0.3
0.050	0.3
0.075	0.3
0.100	0.2
0.150	0.2
0.200	0.3
0.500	0.4
1.00	0.4
1.50	0.5
2.00	0.5
5.00	0.6
10.00	0.8
15.00	0.9
20.00	0.8

Frequency (MHz)	Cable Loss (dB)
50.00	1.2
100.00	0.7
150.00	20.1
200.00	2.3
300.00	2.9
500.00	3.8
750.00	4.8
1000.00	5.4
1500.00	6.7
2000.00	9.0
2500.00	9.4
3000.00	9.9
3500.00	10.2
4000.00	11.2
4500.00	12.1
5000.00	13.1
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



## 8.2 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

*NOTES:*

- 1. The cable type is RG-8.*
- 2. The overall length of the cable is 10 meters.*



**8.4 Correction factors for ACTIVE LOOP ANTENNA**

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

<b>FREQUENCY</b> (MHz)	<b>Magnetic Antenna Factor</b> (dB)	<b>Electric Antenna Factor</b> (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



## 9. Comparison Industry Canada Requirements With FCC

**FCC ID: Q3HEX5200**

**IC: 5115A-EX5200**

Test	FCC	IC
<input type="checkbox"/> Radiated Emission	15.209	RSS 210 Issue 8 Clause 2.5
<input type="checkbox"/> Conducted Emission	15.209	RSS 210 Issue 8 Clause 2.5