

# TEST REPORT

ACCORDING TO: FCC part 15, subpart B, RSS-Gen Issue 2:2007 and  
ICES-003 Issue 4:2004

FOR:

**Telematics Wireless Ltd.**  
**Roadside mini reader**  
**Model: FP310RAM-X**

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.



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## 1 Applicant information

**Client name:** Telematics Wireless Ltd.  
**Address:** 26 Hamelaha street, POB 1911, Holon, 58117, Israel  
**Telephone:** +972 3557 5706  
**Fax:** +972 3557 5703  
**E-mail:** itsikk@tlmw.com  
**Contact name:** Mr. Itsik Kanner

## 2 Equipment under test attributes

**Product name:** Roadside mini reader  
**Product type:** Transceiver  
**Model(s):** FP310RAM-X  
**Serial number:** FCC0001  
**Hardware version:** B  
**Software release:** 4.01  
**Receipt date:** 3/22/2010

## 3 Manufacturer information

**Manufacturer name:** Telematics Wireless Ltd.  
**Address:** 26 Hamelaha street, POB 1911, Holon, 58117, Israel  
**Telephone:** +972 3557 5706  
**Fax:** +972 3557 5703  
**E-Mail:** itsikk@tlmw.com  
**Contact name:** Mr. Itsik Kanner

## 4 Test details

**Project ID:** 20641  
**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel  
**Test started:** 3/22/2010  
**Test completed:** 3/29/2010  
**Test specification(s):** FCC part 15, subpart B, §§15.107, 15.109, 15.111;  
RSS-Gen Issue 2:2007; ICES-003 Class B



## 5 Tests summary

Test	Status
<b>Unintentional emissions</b>	
FCC part 15 Section 15.107 / ICES-003 Section 5.3, Class B Conducted emission at AC power port	Pass
FCC part 15 Section 15.109 / RSS-137 Section 6.6 / ICES-003 Section 5.5, Class B Radiated emission	Pass
FCC part 15 Section 15.111/ RSS-Gen Section 7.2.3.1, Conducted emission at receiver antenna port	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.  
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
<b>Tested by:</b>	Mr. E. Plotnichenko, test engineer	March 29, 2010	
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	April 11, 2010	
<b>Approved by:</b>	Mr. M. Nikishin, EMC and radio group manager	April 12, 2010	



## 6 EUT description

### 6.1 General information

The EUT is a roadside reader of a vehicle identification system, operating at 915 MHz and utilizing an external antenna. The modulation is ASK. Data bit rate is 500 kbps.

### 6.2 Ports and lines

Port type	Port description	Conn. from	Conn. to	Qty.	Cable type	Cable length, m	Indoor / outdoor
Power	DC power	DC power supply	EUT	1	Unshielded	1.5	Indoor
Power	AC power	AC mains	DC power supply	1	Unshielded	1.5	Indoor
RF	Antenna	EUT	50 Ohm termination	1	Coax	1	Outdoor
Control	RS-232	EUT	Laptop	1	Shielded	1.5	Indoor
Signal	IO	EUT	Open circuit	1	Unshielded	1	Indoor
Power	AC power	AC mains	AC/DC adaptor	1	Unshielded	0.8	Indoor
Power	DC power	AC/DC adaptor	Laptop	1	Unshielded	2	Indoor
Telecom	Ethernet	Laptop	Open circuit	1	Unshielded	2	Indoor
Signal	USB	Laptop	Open circuit	1	Unshielded	2	Indoor
Signal	Audio	Laptop	Microphone	1	Unshielded	2	Indoor

### 6.3 Support and test equipment

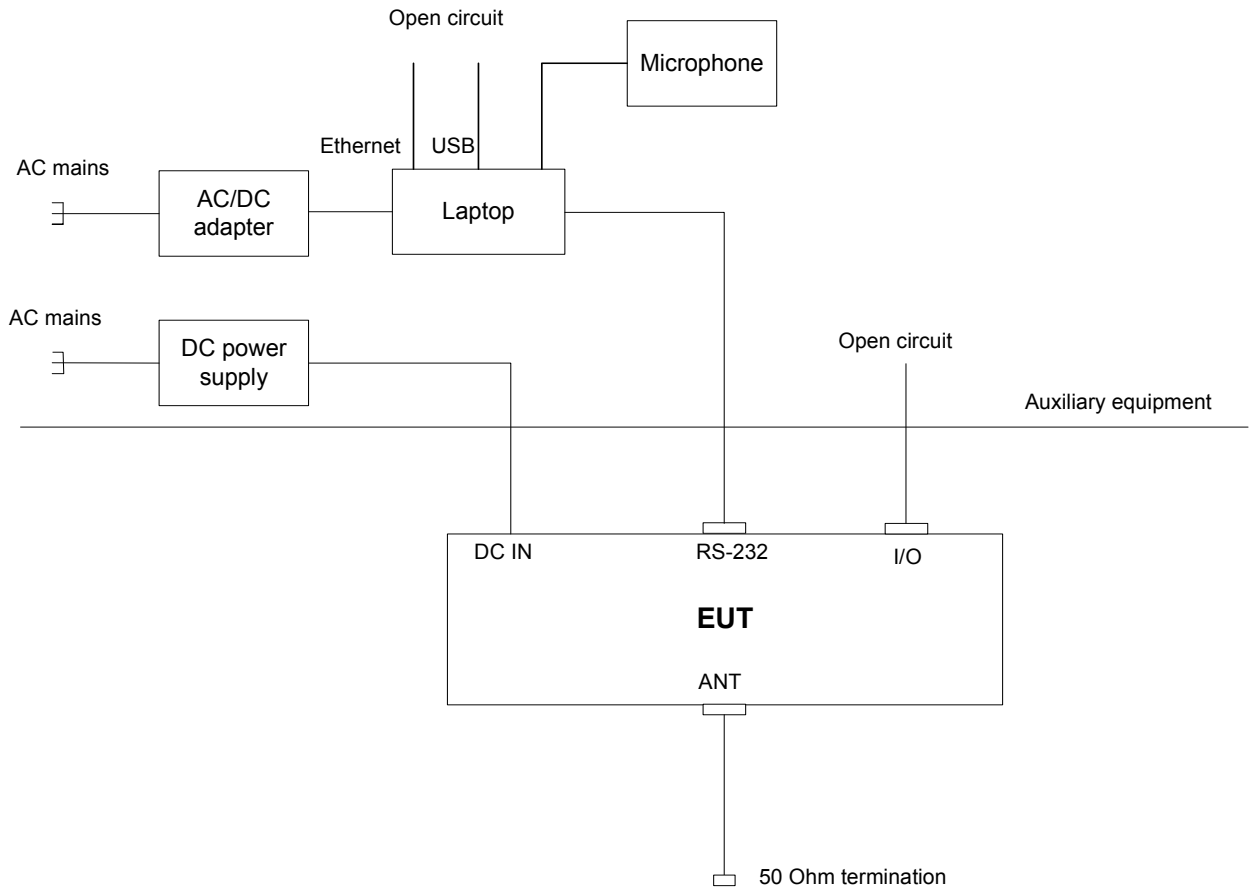
Description	Manufacturer	Model number	Serial number
Antenna	OR ANTENNA	OR-900-930-8	033
Laptop	Dell	Latitude D650	HX8VV2J
DC power supply	Horizon Electronics	SR 60-25	72-7138
AC/DC adapter	Dell	90W-AC	CN-0DF2667161571F0161

### 6.4 Changes made in the EUT

No changes were implemented.



## 6.5 Test configuration





<b>Test specification:</b>	<b>FCC section 15.107/ ICES-003 section 5.3 Class B, Conducted emission at AC power port</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.5 and 12.1.3		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2010 1:23:50 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

## 7 Emissions tests

### 7.1 Conducted emissions

#### 7.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Limits for conducted emissions

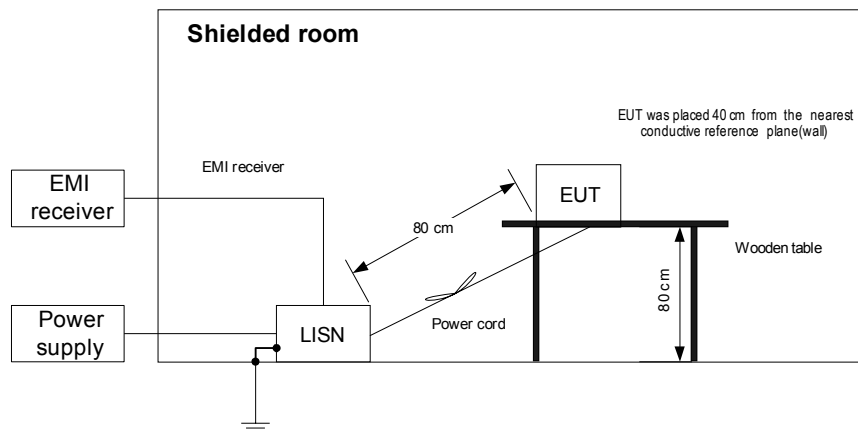
Frequency, MHz	Class B limit, dB(μV)		Class A limit, dB(μV)	
	QP	AVRG	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*	79	66
0.5 - 5.0	56	46	73	60
5.0 - 30	60	50	73	60

\* The limit decreases linearly with the logarithm of frequency.

#### 7.1.2 Test procedure

- 7.1.2.1 The EUT was set up as shown in Figure 7.1.1 and associated photographs, energized and the performance check was conducted.
- 7.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.
- 7.1.2.3 The position of the device cables was varied to determine maximum emission level.
- 7.1.2.4 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

Figure 7.1.1 Setup for conducted emission measurements, table-top equipment





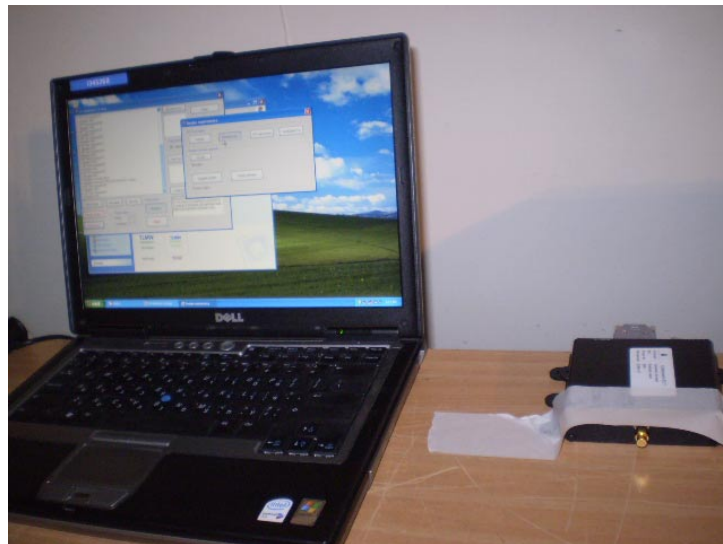
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<b>Test specification:</b>	FCC section 15.107/ ICES-003 section 5.3 Class B, Conducted emission at AC power port		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.5 and 12.1.3		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	3/24/2010 1:23:50 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Photograph 7.1.1 Setup for conducted emission measurements



Photograph 7.1.2 Setup for conducted emission measurements







<b>Test specification:</b>	FCC section 15.107/ ICES-003 section 5.3 Class B, Conducted emission at AC power port		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.5 and 12.1.3		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	3/24/2010 1:23:50 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Table 7.1.2 Conducted emission test results

LIMIT: Class B  
EUT OPERATING MODE: Receive  
EUT SET UP: TABLE-TOP  
TEST SITE: SHIELDED ROOM  
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE  
FREQUENCY RANGE: 150 kHz - 30 MHz  
RESOLUTION BANDWIDTH: 9 kHz

LINE: AC mains input of EUT power supply

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.201125	27.98	26.57	63.61	-37.04	15.25	53.61	-38.36	L1	Pass
0.400205	30.49	27.51	57.87	-30.36	14.34	47.87	-33.53		
9.126255	41.29	38.72	60.00	-21.28	34.44	50.00	-15.56		
0.201367	29.30	28.08	63.60	-35.52	18.59	53.60	-35.01	L2	Pass
0.400660	31.12	29.20	57.86	-28.66	15.99	47.86	-31.87		
9.076490	39.67	35.46	60.00	-24.54	27.60	50.00	-22.40		

LINE: AC mains input of laptop power adapter

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.151550	58.02	53.81	65.92	-12.11	41.05	55.92	-14.87	L1	Pass
0.214650	50.77	46.11	63.09	-16.98	38.27	53.09	-14.82		
0.286925	45.72	41.06	60.67	-19.61	31.80	50.67	-18.87		
0.388038	44.20	40.26	58.12	-17.86	32.29	48.12	-15.83		
0.639605	45.68	40.85	56.00	-15.15	36.52	46.00	-9.48		
0.802070	42.56	36.83	56.00	-19.17	27.99	46.00	-18.01		
0.150000	52.91	48.26	66.00	-17.74	38.61	56.00	-17.39	L2	Pass
0.197535	51.71	46.22	63.75	-17.53	36.81	53.75	-16.94		
0.268760	49.83	48.60	61.22	-12.62	43.82	51.22	-7.40		
0.300745	48.68	44.75	60.25	-15.50	36.14	50.25	-14.11		
0.439298	43.16	39.27	57.13	-17.86	29.60	47.13	-17.53		
0.839455	41.51	36.45	56.00	-19.55	31.06	46.00	-14.94		

\*- Margin = Measured emission - specification limit.

#### Reference numbers of test equipment used

HL 0447	HL 0787	HL 1511	HL 1425	HL 2888	HL 3612		
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Full description is given in Appendix A.



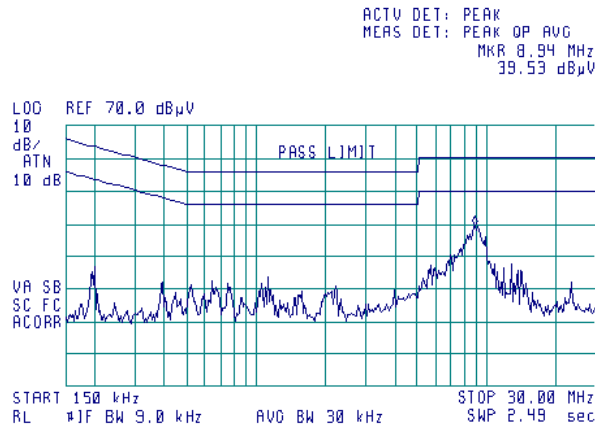
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<b>Test specification:</b>	<b>FCC section 15.107/ ICES-003 section 5.3 Class B, Conducted emission at AC power port</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.5 and 12.1.3		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2010 1:23:50 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

**Plot 7.1.1 Conducted emission measurements**

LINE: L1 of EUT power supply  
LIMIT: Class B  
EUT OPERATING MODE: Receive  
LIMIT: QUASI-PEAK, AVERAGE  
DETECTOR: PEAK

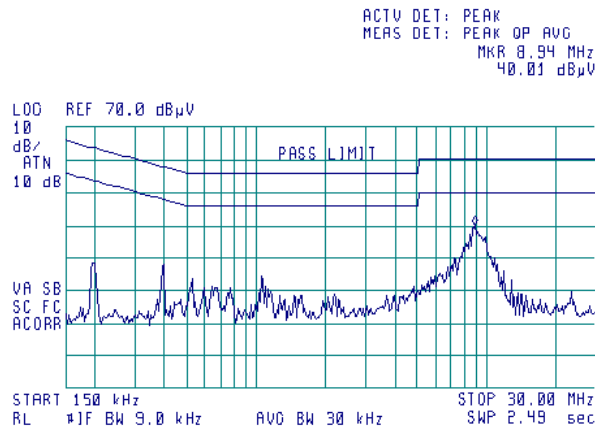
12:56:02 MAR 24, 2010



**Plot 7.1.2 Conducted emission measurements**

LINE: L2 of EUT power supply  
LIMIT: Class B  
EUT OPERATING MODE: Receive  
LIMIT: QUASI-PEAK, AVERAGE  
DETECTOR: PEAK

12:49:16 MAR 24, 2010





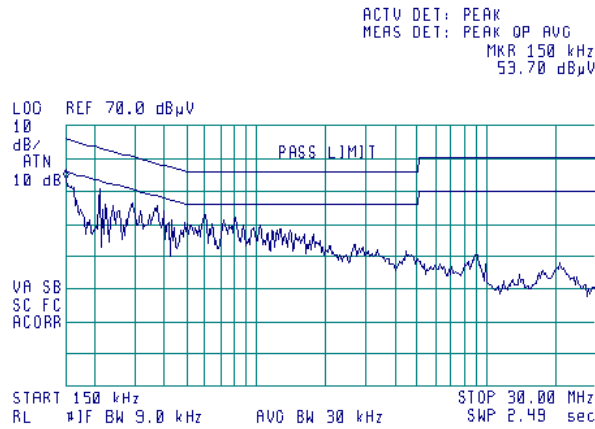
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<b>Test specification:</b>	<b>FCC section 15.107/ ICES-003 section 5.3 Class B, Conducted emission at AC power port</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.5 and 12.1.3		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2010 1:23:50 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

**Plot 7.1.3 Conducted emission measurements**

LINE: L1 of laptop AC mains  
LIMIT: Class B  
EUT OPERATING MODE: Receive  
LIMIT: QUASI-PEAK, AVERAGE  
DETECTOR: PEAK

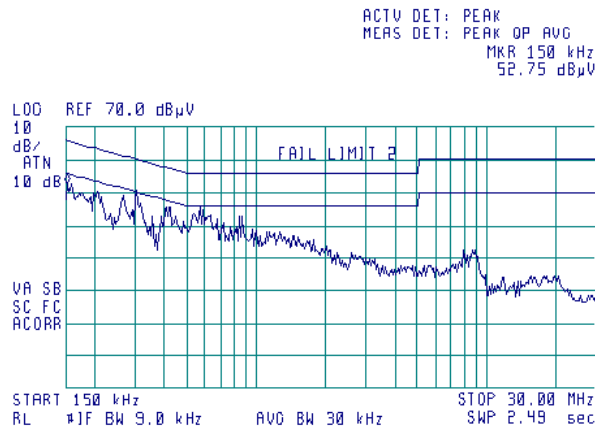
12:26:57 MAR 24, 2010



**Plot 7.1.4 Conducted emission measurements**

LINE: L2 of laptop AC mains  
LIMIT: Class B  
EUT OPERATING MODE: Receive  
LIMIT: QUASI-PEAK, AVERAGE  
DETECTOR: PEAK

12:41:45 MAR 24, 2010





<b>Test specification:</b>	FCC section 15.109/ RSS-137 section 6.6/ICES-003 Section 5.5 Class B, Radiated emission		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	3/25/2010 2:14:16 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

## 7.2 Radiated emission measurements

### 7.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 7.2.1, Table 7.2.2.

**Table 7.2.1 Radiated emission test limits according to FCC part 15 section 15.109 class B and RSS-Gen section 7.2.3.2**

Frequency, MHz	Class B limit, dB( $\mu$ V/m)	
	10 m distance	3 m distance
30 - 88	29.5*	40.0
88 - 216	33.0*	43.5
216 - 960	35.5*	46.0
Above 960	43.5*	54.0

**Table 7.2.2 Radiated disturbance test limits according to ICES-003 section 5.5**

Frequency, MHz	Class B limit, dB( $\mu$ V/m)		Class A limit, dB( $\mu$ V/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 230	30.0	40.5*	40.0	50.5*
230 - 1000	37.0	47.5*	47.0	57.5*

\* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows:  $Lim_{S_2} = Lim_{S_1} + 20 \log(S_1/S_2)$ , where  $S_1$  and  $S_2$  – standard defined and test distance respectively in meters.

### 7.2.2 Test procedure

**7.2.2.1** The EUT was set up as shown in Figure 7.2.1 and associated photographs, energized and the performance check was conducted.

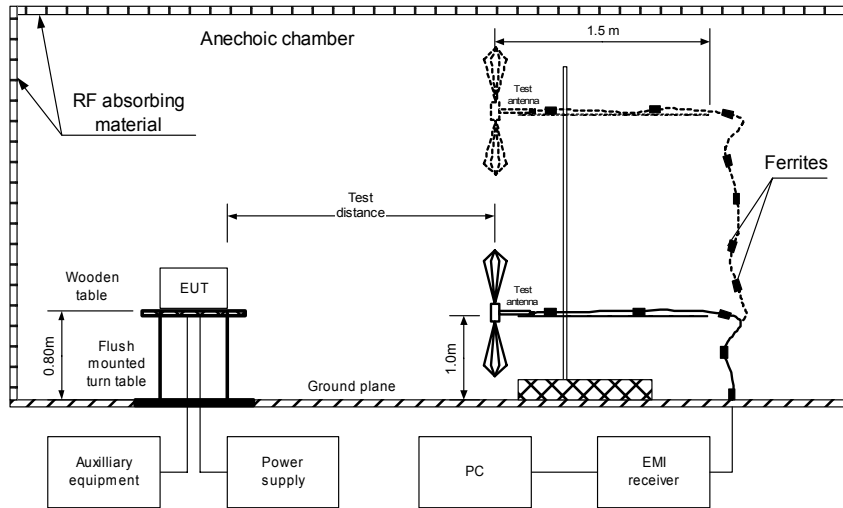
**7.2.2.2** The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

**7.2.2.3** The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.4 and shown in the associated plots.



<b>Test specification:</b>		<b>FCC section 15.109/ RSS-137 section 6.6/ICES-003 Section 5.5 Class B, Radiated emission</b>	
<b>Test procedure:</b>		ANSI C63.4, Sections 11.6 and 12.1.4	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	3/25/2010 2:14:16 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Figure 7.2.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Photograph 7.2.1 Setup for radiated emission measurements in 30-1000 MHz





<b>Test specification:</b>	FCC section 15.109/ RSS-137 section 6.6/ICES-003 Section 5.5 Class B, Radiated emission		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	3/25/2010 2:14:16 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Photograph 7.2.2 Setup for radiated emission measurements above 1000 MHz



Photograph 7.2.3 Setup for radiated emission measurements, EUT cabling





<b>Test specification:</b>	FCC section 15.109/ RSS-137 section 6.6/ICES-003 Section 5.5 Class B, Radiated emission		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	3/25/2010 2:14:16 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Table 7.2.3 Radiated emission test results according to FCC part 15 section 15.109 and RSS-Gen section 7.2.3.2

EUT SET UP: TABLE-TOP  
LIMIT: Class B  
EUT OPERATING MODE: Receive / Stand-by  
TEST SITE: SEMI ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
DETECTORS USED: PEAK / QUASI-PEAK  
FREQUENCY RANGE: 30 MHz – 1000 MHz  
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
99.78	36.4	34.1	43.5	-9.4	Vertical	1.0	180	Pass
112.00	32.1	26.9	43.5	-16.6	Vertical	1.0	0	
166.60	40.3	38.5	43.5	-5.0	Horizontal	2.1	135	
365.80	42.4	39.8	46.0	-6.2	Vertical	1.0	180	
500.00	37.2	33.7	46.0	-12.3	Vertical	1.0	0	
665.16	46.9	43.3	46.0	-2.7	Vertical	1.0	0	
999.99	37.9	35.0	54.0	-19.0	Vertical	1.0	200	

TEST SITE: SEMI ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
DETECTORS USED: PEAK / AVERAGE  
FREQUENCY RANGE: 1000 MHz – 4600 MHz  
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
1300.00	48.5	74.0	-26.5	30.3	54.0	-23.7	Vertical	1.0	180	Pass

\*- Margin = Measured emission - specification limit.  
\*\*- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0521	HL 0604	HL 1984	HL 2871	HL 3615		
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Full description is given in Appendix A.



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<b>Test specification:</b>	FCC section 15.109/ RSS-137 section 6.6/ICES-003 Section 5.5 Class B, Radiated emission		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	3/25/2010 2:14:16 PM		
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Table 7.2.4 Radiated disturbance test results according to ICES-003 section 5.5

EUT SET UP: TABLE-TOP  
 TEST SITE: SEMI ANECHOIC CHAMBER  
 TEST DISTANCE: 3 m  
 DETECTORS USED: PEAK / QUASI-PEAK  
 FREQUENCY RANGE: 30 MHz – 1000 MHz  
 RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
99.78	36.4	34.1	40.5	-6.4	Vertical	1.0	180	Pass
112.00	32.1	26.9	40.5	-13.6	Vertical	1.0	0	
166.60	40.3	38.5	40.5	-2.0	Horizontal	2.1	135	
365.80	42.4	39.8	47.5	-7.7	Vertical	1.0	180	
500.00	37.2	33.7	47.5	-13.8	Vertical	1.0	0	
665.16	46.9	43.3	47.5	-4.2	Vertical	1.0	0	
999.99	37.9	35.0	47.5	-12.5	Vertical	1.0	200	

\*- Margin = Measured emission - specification limit.  
 \*\*- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0521	HL 0604	HL 1984	HL 2871	HL 3615			
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Full description is given in Appendix A.



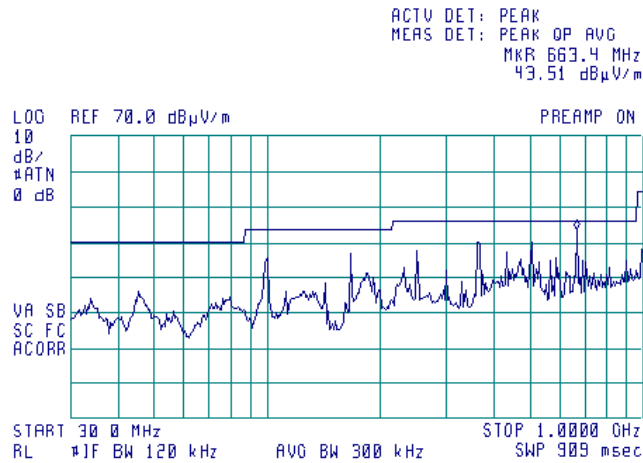


<b>Test specification:</b> FCC section 15.109/ RSS-137 section 6.6/ICES-003 Section 5.5 Class B, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Sections 11.6 and 12.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 3/25/2010 2:14:16 PM			
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber  
LIMIT: FCC part 15 subpart B Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by

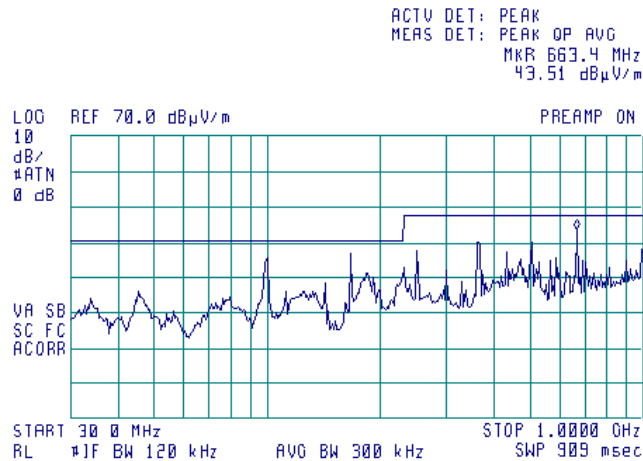
19:29:23 MAR 22, 2010



Plot 7.2.2 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber  
LIMIT: ICES-003 section 5.5 Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by

19:27:39 MAR 22, 2010





HERMON LABORATORIES

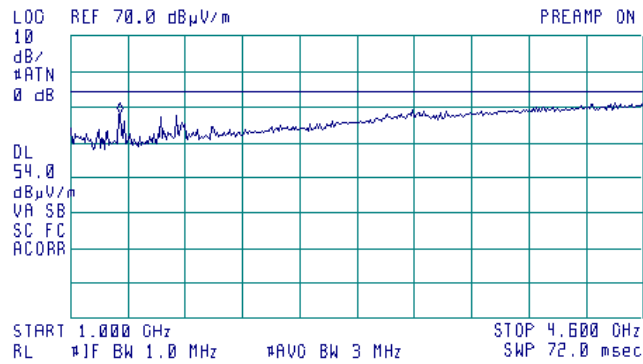
<b>Test specification:</b> FCC section 15.109/ RSS-137 section 6.6/ICES-003 Section 5.5 Class B, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Sections 11.6 and 12.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 3/25/2010 2:14:16 PM			
<b>Temperature:</b> 24.4 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

**Plot 7.2.3 Radiated emission measurements above 1000 MHz, vertical and horizontal antenna polarization**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by

08:49:05 MAR 23, 2010

ACTV DET: PEAK  
MEAS DET: PEAK OP AVG  
MKR 1.307 GHz  
40.00 dBμV/m





<b>Test specification:</b>	<b>Section 15.111/ RSS-Gen, Section 7.2.3.1, Conducted emission at receiver antenna port</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 12.1.5		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/22/2010 4:32:47 PM		
<b>Temperature:</b> 23.3 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 31 %	<b>Power Supply:</b> 12VDC
<b>Remarks:</b>			

### 7.3 Spurious emissions at RF antenna connector

#### 7.3.1 General

This test was performed to measure spurious emissions at RF antenna connector of receiver operated within 30 to 960 MHz band or a citizens band (CB) receiver which was tested for compliance with radiated emission limits with the antenna port connected to resistive termination.

Specification test limits according to FCC Part 15, Section 15.111 are given in Table 7.3.1 and according to RSS-Gen, Section 7.2.3.1 in Table 7.3.2.

**Table 7.3.1 Spurious emission limits according to FCC Part 15, Section 15.111**

Frequency, MHz	EUT type	Power of spurious	
		nW	dBm
25 MHz – 5 <sup>th</sup> harmonic*	Citizens band (CB) receiver	2.0	-57.0
30 MHz – 2 <sup>nd</sup> harmonic**	Superheterodyne receiver		
<b>30 MHz – 5<sup>th</sup> harmonic*</b>	<b>Other receiver operates within 30 – 960 MHz</b>		

\* - harmonic of the highest frequency the EUT generates, uses, operates or tunes to.

\*\* - harmonic of the highest local oscillator frequency.

**Table 7.3.2 Spurious emission limits according to RSS-Gen, Section 7.2.3.1**

Frequency, MHz	EUT type	Power of spurious	
		nW	dBm
30 MHz – 1000 MHz	Receiver operates within 30 – 960 MHz	2.0	-57.0
1000 MHz - 3 <sup>rd</sup> harmonic*		5.0	-53.0

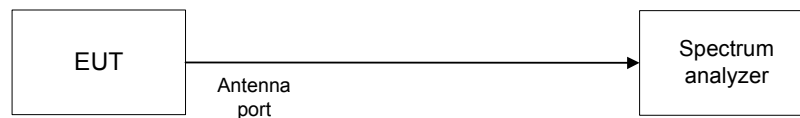
\* - harmonic of the highest frequency the EUT generates, uses, operates or tunes to (without exceeding 40 GHz).

#### 7.3.2 Test procedure

**7.3.2.1** The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

**7.3.2.2** The spurious emission was measured with spectrum analyzer as provided in Table 7.3.3 and the associated plots.

**Figure 7.3.1 Spurious emission test setup**





<b>Test specification:</b>	<b>Section 15.111/ RSS-Gen, Section 7.2.3.1, Conducted emission at receiver antenna port</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 12.1.5		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/22/2010 4:32:47 PM		
<b>Temperature:</b> 23.3 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 31 %	<b>Power Supply:</b> 12VDC
<b>Remarks:</b>			

**Table 7.3.3 Spurious emission test results**

INVESTIGATED FREQUENCY RANGE: 30 – 4750 MHz  
 RECEIVER OPERATING FREQUENCY: 915.0 MHz  
 EUT OPERATING MODE: Receive  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 100 kHz (below 1000 MHz)  
 1000 kHz (above 1000 MHz)  
 VIDEO BANDWIDTH: 300 kHz (below 1000 MHz)  
 3000 kHz (above 1000 MHz)

Frequency, MHz	Spurious emission, dBm	Limit, dBm	Margin, dB	Verdict
No emissions were found				Pass

**Reference numbers of test equipment used**

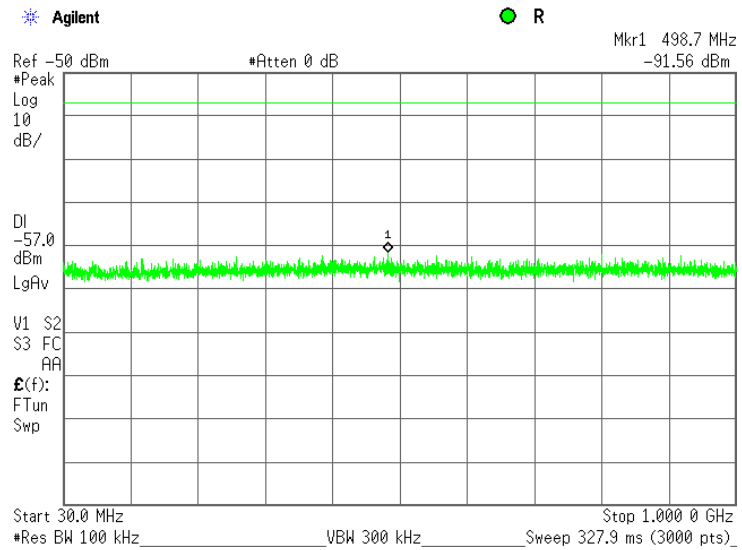
HL 3474	HL 3818						
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Full description is given in Appendix A.

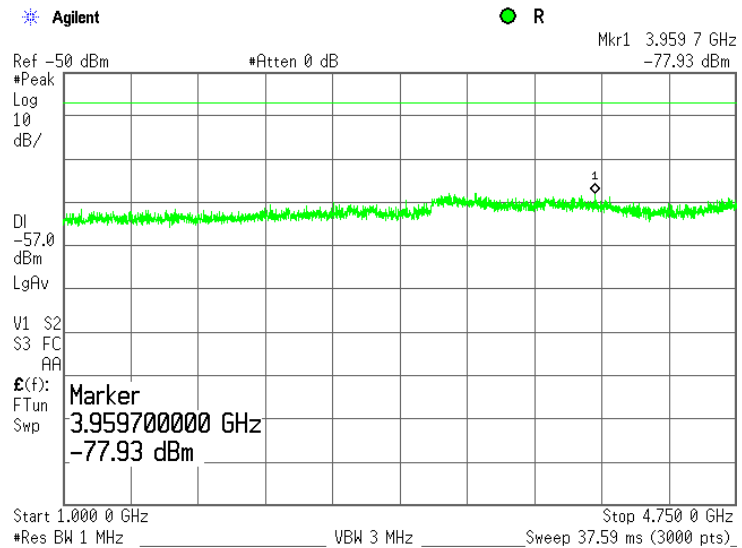


<b>Test specification:</b>	<b>Section 15.111/ RSS-Gen, Section 7.2.3.1, Conducted emission at receiver antenna port</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 12.1.5		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/22/2010 4:32:47 PM		
<b>Temperature:</b> 23.3 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 31 %	<b>Power Supply:</b> 12VDC
<b>Remarks:</b>			

Plot 7.3.1 Spurious emission test results in the 30 – 1000 MHz range



Plot 7.3.2 Spurious emission test results in the 1000 – 4750 MHz range



According to RSS-Gen Section 7.2.3.1 the limit is -53 dBm.

**8 APPENDIX A Test equipment and ancillaries used for tests**

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0447	LISN, 16/2, 300V RMS, 50 Ohm/50 uH + 5 Ohm, STD CISPR 16-1	Hermon Laboratories	LISN 16 - 1	066	05-Nov-09	05-Nov-10
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Aug-09	27-Aug-10
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-10	11-Jan-11
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard	11947A	3107A018 77	18-Oct-09	18-Oct-10
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A002 22, 3705A002 04	28-Aug-09	28-Aug-10
1511	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1511	01-Jan-10	01-Jan-11
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	29-Jan-10	29-Jan-11
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	15-Sep-09	15-Sep-10
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	06-Jul-09	06-Jul-10
3474	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 0.6 m	Gore	GORE 65475	1640102	09-May-09	09-May-10
3612	Cable RF, 17.5 m, N type-N type	Teldor	RG-214/U	NA	02-Dec-09	02-Dec-10
3615	Cable RF, 6.5 m, N type-N type, DC-6 GHz	Suhner Switzerland	RG 214/U	NA	27-May-09	27-May-10
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	25-Sep-09	25-Sep-10

## 9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
<b>Unintentional radiator tests</b>	
Conducted emissions with LISN	9 kHz to 150 kHz: $\pm 3.9$ dB 150 kHz to 30 MHz: $\pm 3.8$ dB
Radiated emissions at 3 m measuring distance Horizontal polarization	Biconilog antenna: $\pm 5.3$ dB Biconical antenna: $\pm 5.0$ dB Log periodic antenna: $\pm 5.3$ dB Double ridged horn antenna: $\pm 5.3$ dB
Vertical polarization	Biconilog antenna: $\pm 6.0$ dB Biconical antenna: $\pm 5.7$ dB Log periodic antenna: $\pm 6.0$ dB Double ridged horn antenna: $\pm 6.0$ dB

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

## 10 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.

Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

Address: P.O. Box 23, Binyamina 30500, Israel.  
Telephone: +972 4628 8001  
Fax: +972 4628 8277  
e-mail: mail@hermonlabs.com  
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

## 11 APPENDIX D Specification references

47CFR part 15: 2009	Radio Frequency Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4:2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
RSS-Gen Issue 2: 2007	General Requirements and Information for the Certification of Radiocommunication Equipment
ICES-003 Issue 4:2004	Digital Apparatus



## 12 APPENDIX E Test equipment correction factors

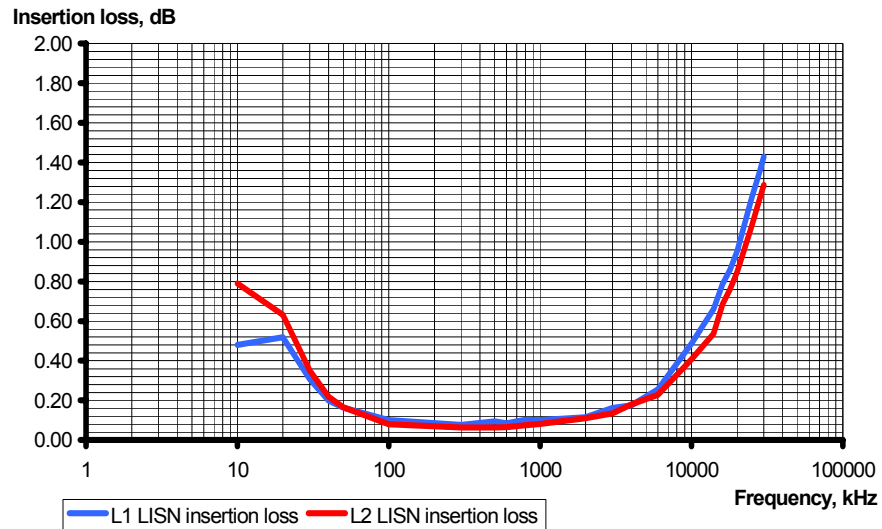
Correction factor  
Line impedance stabilization network  
Model LISN 16 - 1  
Hermon Laboratories, HL 0447

Frequency, kHz	Correction factor, dB
10	4.9
15	2.86
20	1.83
25	1.25
30	0.91
35	0.69
40	0.53
50	0.35
60	0.25
70	0.18
80	0.14
90	0.11
100	0.09
125	0.06
150	0.04

The correction factor in dB is to be added to meter readings of an interference analyzer or a spectrum analyzer.

**Correction factor**  
**Line impedance stabilization network**  
**Model NNB-2/16Z, Rolf Heine, HL 2888**

Frequency, kHz	Insertion loss, dB		Measurement Uncertainty, dB
	L1	N	
10	0.48	0.79	±0.6
20	0.52	0.63	
30	0.31	0.35	
40	0.20	0.22	
50	0.16	0.17	
100	0.10	0.08	
300	0.08	0.06	
500	0.10	0.06	
600	0.09	0.07	
800	0.10	0.07	
1000	0.10	0.08	
2000	0.12	0.11	
3000	0.16	0.14	
4000	0.17	0.18	
6000	0.26	0.23	
10000	0.49	0.41	
14000	0.66	0.54	
16000	0.79	0.69	
18000	0.86	0.76	
20000	0.96	0.85	
25000	1.22	1.08	
28000	1.35	1.21	
30000	1.43	1.29	



**Antenna factor**  
**Biconilog antenna EMCO Model 3141**  
**Ser.No.1011, HL 0604**

Frequency, MHz	Antenna Factor, dB(1/m)	Frequency, MHz	Antenna Factor, dB(1/m)
26	7.8	940	24.0
28	7.8	960	24.1
30	7.8	980	24.5
40	7.2	1000	24.9
60	7.1	1020	25.0
70	8.5	1040	25.2
80	9.4	1060	25.4
90	9.8	1080	25.6
100	9.7	1100	25.7
110	9.3	1120	26.0
120	8.8	1140	26.4
130	8.7	1160	27.0
140	9.2	1180	27.0
150	9.8	1200	26.7
160	10.2	1220	26.5
170	10.4	1240	26.5
180	10.4	1260	26.5
190	10.3	1280	26.6
200	10.6	1300	27.0
220	11.6	1320	27.8
240	12.4	1340	28.3
260	12.8	1360	28.2
280	13.7	1380	27.9
300	14.7	1400	27.9
320	15.2	1420	27.9
340	15.4	1440	27.8
360	16.1	1460	27.8
380	16.4	1480	28.0
400	16.6	1500	28.5
420	16.7	1520	28.9
440	17.0	1540	29.6
460	17.7	1560	29.8
480	18.1	1580	29.6
500	18.5	1600	29.5
520	19.1	1620	29.3
540	19.5	1640	29.2
560	19.8	1660	29.4
580	20.6	1680	29.6
600	21.3	1700	29.8
620	21.5	1720	30.3
640	21.2	1740	30.8
660	21.4	1760	31.1
680	21.9	1780	31.0
700	22.2	1800	30.9
720	22.2	1820	30.7
740	22.1	1840	30.6
760	22.3	1860	30.6
780	22.6	1880	30.6
800	22.7	1900	30.6
820	22.9	1920	30.7
840	23.1	1940	30.9
860	23.4	1960	31.2
880	23.8	1980	31.6
900	24.1	2000	32.0
920	24.1		

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

**Antenna factor  
Double-ridged wave guide horn antenna  
Model 3115, S/N 9911-5964, HL1984**

Frequency, MHz	Antenna factor, dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.6
2500.0	28.9
3000.0	31.2
3500.0	32.0
4000.0	32.5
4500.0	32.7
5000.0	33.6
5500.0	35.1
6000.0	35.4
6500.0	34.9
7000.0	36.1
7500.0	37.8
8000.0	38.0
8500.0	38.1
9000.0	39.1
9500.0	38.3
10000.0	38.6
10500.0	38.2
11000.0	38.7
11500.0	39.5
12000.0	40.0
12500.0	40.4
13000.0	40.5
13500.0	41.1
14000.0	41.6
14500.0	41.7
15000.0	38.7
15500.0	38.2
16000.0	38.8
16500.0	40.5
17000.0	42.5
17500.0	45.9
18000.0	49.4

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).

**Cable loss**  
Cable coaxial, Huber-Suhner, 18 GHz, 6.4 m, SMA - SMA, model 198-8155-00,  
HL 2871

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.12	5750	2.34	12000	3.55
30	0.14	6000	2.39	12250	3.61
100	0.27	6250	2.46	12500	3.67
250	0.45	6500	2.52	12750	3.74
500	0.63	6750	2.58	13000	3.79
750	0.76	7000	2.64	13250	3.82
1000	0.89	7250	2.68	13500	3.83
1250	1.01	7500	2.73	13750	3.83
1500	1.12	7750	2.78	14000	3.88
1750	1.23	8000	2.83	14250	3.93
2000	1.32	8250	2.88	14500	3.96
2250	1.41	8500	2.94	14750	4.01
2500	1.49	8750	2.97	15000	4.00
2750	1.58	9000	3.02	15250	4.01
3000	1.66	9250	3.07	15500	4.00
3250	1.73	9500	3.13	15750	4.13
3500	1.80	9750	3.18	16000	4.22
3750	1.87	10000	3.21	16250	4.29
4000	1.93	10250	3.26	16500	4.29
4250	2.01	10500	3.30	16750	4.32
4500	2.06	10750	3.36	17000	4.37
4750	2.12	11000	3.39	17250	4.45
5000	2.17	11250	3.44	17500	4.49
5250	2.24	11500	3.48	17750	4.53
5500	2.29	11750	3.52	18000	4.55

**Cable loss**  
**Cable coaxial, Microwave, SMA-SMA, 18 GHz, 0.6 m**  
**Gore, HL 3474**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.00	5000	0.44	10200	0.72	15500	0.84
30	0.02	5100	0.44	10300	0.68	15600	0.95
50	0.03	5200	0.44	10400	0.75	15700	0.82
100	0.03	5300	0.44	10500	0.64	15800	0.94
200	0.07	5400	0.46	10600	0.75	15900	0.91
300	0.10	5500	0.45	10700	0.80	16000	0.91
400	0.11	5600	0.46	10800	0.77	16100	0.86
500	0.12	5700	0.47	10900	0.80	16200	0.86
600	0.14	5800	0.48	11000	0.79	16300	0.86
700	0.14	5900	0.48	11100	0.70	16400	0.84
800	0.15	6000	0.49	11200	0.76	16500	0.83
900	0.18	6100	0.51	11300	0.70	16600	0.87
1000	0.17	6200	0.50	11400	0.73	16700	0.90
1100	0.18	6300	0.50	11500	0.67	16800	0.91
1200	0.21	6400	0.51	11600	0.74	16900	0.90
1300	0.20	6500	0.51	11700	0.64	17000	0.97
1400	0.21	6600	0.52	11800	0.68	17100	0.94
1500	0.22	6700	0.54	11900	0.67	17200	1.01
1600	0.23	6800	0.51	12000	0.71	17300	0.97
1700	0.23	6900	0.55	12100	0.64	17400	1.02
1800	0.24	7000	0.54	12200	0.64	17500	1.06
1900	0.25	7100	0.55	12300	0.71	17600	1.01
2000	0.27	7200	0.55	12400	0.62	17700	1.10
2100	0.26	7300	0.54	12500	0.80	17800	1.16
2200	0.28	7400	0.52	12600	0.69	17900	1.12
2300	0.28	7500	0.58	12700	0.85	18000	1.00
2400	0.28	7600	0.56	12800	0.67		
2500	0.29	7700	0.57	12900	0.84		
2600	0.30	7800	0.62	13000	0.76		
2700	0.31	7900	0.57	13100	0.85		
2800	0.32	8000	0.55	13200	0.77		
2900	0.32	8100	0.59	13300	0.82		
3000	0.32	8200	0.59	13400	0.79		
3100	0.33	8300	0.60	13500	0.82		
3200	0.33	8400	0.66	13600	0.91		
3300	0.35	8500	0.60	13700	0.81		
3400	0.35	8600	0.59	13800	0.76		
3500	0.36	8700	0.59	13900	0.75		
3600	0.36	8800	0.58	14000	0.81		
3700	0.37	8900	0.60	14100	0.77		
3800	0.38	9000	0.60	14200	0.89		
3900	0.38	9100	0.60	14300	0.92		
4000	0.38	9200	0.57	14400	0.78		
4100	0.41	9300	0.57	14600	0.85		
4200	0.40	9400	0.58	14700	0.83		
4300	0.41	9500	0.60	14800	0.95		
4400	0.42	9600	0.62	14900	0.89		
4500	0.43	9700	0.58	15000	0.96		
4600	0.42	9800	0.63	15100	0.90		
4700	0.44	9900	0.58	15200	0.96		
4800	0.43	10000	0.67	15300	0.90		
4900	0.44	10100	0.69	15400	0.95		

**Cable loss**  
Cable coaxial, RG-214/U, N type-N type, 17 m  
Teldor, HL 3612

Frequency, GHz	Cable loss, dB
0.1	0.05
0.5	0.07
1	0.10
3	0.22
5	0.29
10	0.39
30	0.68
50	0.90
100	1.27
150	1.58
200	1.80
250	2.12
300	2.36
350	2.60
400	2.82
450	2.99
500	3.23
550	3.40
600	3.56
650	3.71
700	3.90
750	4.04
800	4.23
850	4.39
900	4.55
950	4.65
1000	4.79

**Cable loss**  
Cable coaxial, RG-214/U, N type-N type, 6.5 m  
Suhner Switzerland, HL 3615

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	1750	2.47	3550	4.10	5350	5.76
30	0.24	1800	2.53	3600	4.17	5400	5.84
50	0.31	1850	2.59	3650	4.21	5450	5.88
100	0.47	1900	2.61	3700	4.23	5500	5.90
150	0.58	1950	2.66	3750	4.33	5550	5.96
200	0.68	2000	2.74	3800	4.36	5600	6.02
250	0.77	2050	2.76	3850	4.38	5650	6.02
300	0.86	2100	2.80	3900	4.46	5700	6.09
350	0.94	2150	2.84	3950	4.52	5750	6.14
400	1.01	2200	2.89	4000	4.48	5800	6.15
450	1.08	2250	2.94	4050	4.52	5850	6.22
500	1.16	2300	2.98	4100	4.64	5900	6.29
550	1.21	2350	3.03	4150	4.62	5950	6.32
600	1.28	2400	3.07	4200	4.69	6000	6.39
650	1.35	2450	3.11	4250	4.75	6050	6.40
700	1.41	2500	3.15	4300	4.79	6100	6.48
750	1.48	2550	3.21	4350	4.83	6150	6.57
800	1.54	2600	3.25	4400	4.90	6200	6.62
850	1.58	2650	3.29	4450	4.95	6250	6.68
900	1.65	2700	3.33	4500	4.98	6300	6.74
950	1.67	2750	3.39	4550	5.04	6350	6.79
1000	1.74	2800	3.45	4600	5.08	6400	6.82
1050	1.79	2850	3.48	4650	5.12	6450	6.83
1100	1.84	2900	3.51	4700	5.15	6500	6.91
1150	1.91	2950	3.58	4750	5.22		
1200	1.94	3000	3.62	4800	5.26		
1250	1.99	3050	3.65	4850	5.29		
1300	2.06	3100	3.69	4900	5.33		
1350	2.11	3150	3.75	4950	5.36		
1400	2.16	3200	3.77	5000	5.38		
1450	2.21	3250	3.80	5050	5.46		
1500	2.25	3300	3.85	5100	5.49		
1550	2.30	3350	3.90	5150	5.56		
1600	2.35	3400	3.94	5200	5.58		
1650	2.38	3450	4.00	5250	5.64		
1700	2.42	3500	4.03	5300	5.69		



### 13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB( $\mu$ V)	decibel referred to one microvolt
dB( $\mu$ V/m)	decibel referred to one microvolt per meter
dB( $\mu$ A)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
$\mu$ s	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
$\Omega$	Ohm
PCB	printed circuit board
PM	pulse modulation
ppm	part per million ( $10^{-6}$ )
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere
WB	wideband

END OF DOCUMENT