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TEST REPORT

ACCORDING TO: FCC CFR 47 part 15 subpart C, section 15.225 and
subpart B section 15.109

FOR:

On Track Innovations Ltd.
RF nozzle reader (RFID transceiver)
Model: EFP RFN900
FCC ID: JNXOTI-EFPRFN900A

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1 Applicant information

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Fax: +972 4693 8887
E-mail: h_itay@otiglobal.com
Contact name: Mr. Hemi Itay

2 Equipment under test attributes

Product name: RF nozzle reader
Product type: RFID transceiver
Model(s): EFR RFN900
Serial number: 87225222
Hardware version: 4.4.0
Software release: 0200
Receipt date: 3/25/2012

3 Manufacturer information

Manufacturer name: On Track Innovations Ltd.
Address: Z.H.R. Industrial zone, P.O. Box 32, Rosh Pina, 12000, Israel
Telephone: +972 4686 8000
Fax: +972 4693 8887
E-Mail: h_itay@otiglobal.com
Contact name: Mr. Hemi Itay

4 Test details

Project ID: 23143
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 3/25/2012
Test completed: 5/20/2012
Test specification(s): FCC CFR 47 part 15 subpart C, §15.225 and subpart B class B §15.109



5 Tests summary

Test	Status
Transmitter characteristics	
Sections 15.225(a) (b) (c), In band radiated emissions	Pass
Sections 15.225(d), Out of band radiated emissions	Pass
Section 15.225(e), Frequency stability	Pass
Section 15.207(a), Conducted emission	Not required
Section 15.215(c), Occupied bandwidth	Pass
Section 15.203, Antenna requirements	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Not required
Section 15.109, Class B, Radiated emission	Pass

	Name and Title	Date	Signature
Tested by:	Mr. Alex Chaplik, test engineer	May 20, 2012	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	May 28, 2012	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	May 29, 2012	

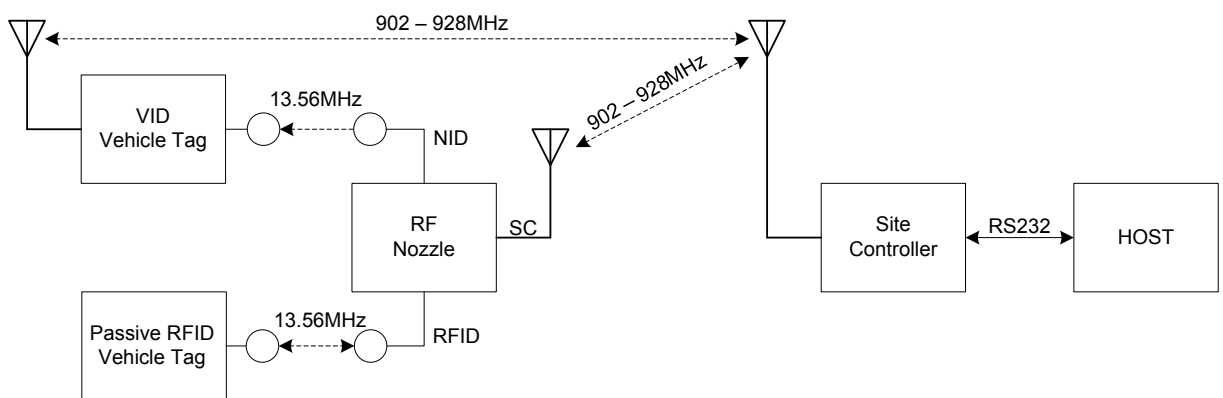
6 EUT description

6.1 General information

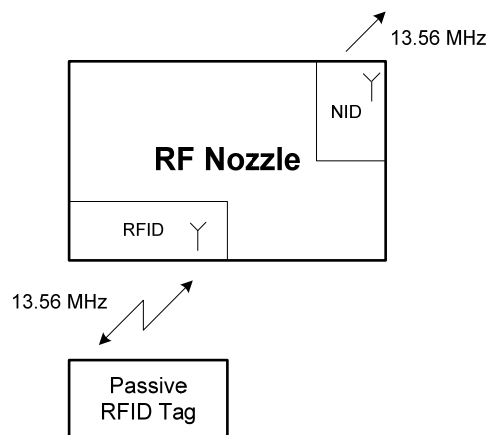
The EUT, RF Nozzle reader, is designed to serve as an interface between the refueled vehicle and the pump/station Site Controller to facilitate controlled and secured refueling. The RFN is mounted on the refueling nozzle.

The EUT is a battery powered unit, comprising three different transceivers: a RFID 13.56 MHz transceiver, a NID (Nozzle ID) 13.56 MHz transmitter and a SC (Site Controller) 902-928 MHz transceiver, all operating under the control of a local microprocessor.

The principle of the EUT operation is shown in the diagram below.



6.2 Test configuration



6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Passive RFID Tag	OTI	VPT-C1-120	01B8A123

6.4 Changes made in EUT

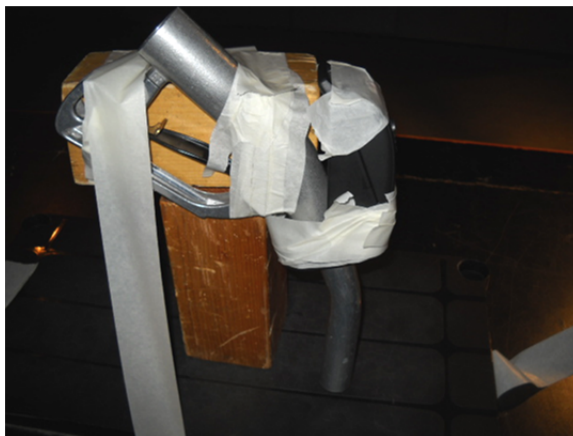
No changes were performed in the EUT.

6.5 EUT positions during testing

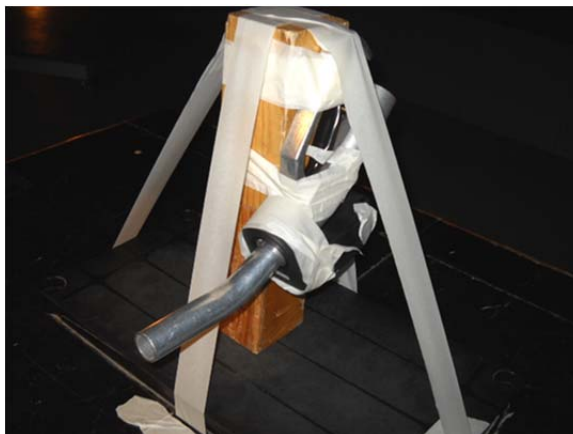
Photograph 6.5.1 EUT X-axis position



Photograph 6.5.2 EUT Y-axis position



Photograph 6.5.3 EUT Z-axis position





6.6 Transmitter characteristics of RFID transmitter

Type of equipment					
	Stand-alone (Equipment with or without its own control provisions)				
V	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
	Plug-in card (Equipment intended for a variety of host systems)				
Assigned frequency range		13.110-14.010 MHz			
Operating frequency range		13.56 MHz			
Maximum field strength		73.9 dB(μV/m) at 3 m test distance			
Is transmitter output power variable?		V		No	
				continuous variable	
				stepped variable with stepsize	
				minimum RF power	
				maximum RF power	
Antenna connection					
V	unique coupling	standard connector	Integral	with temporary RF connector	
				without temporary RF connector	
Antenna/s technical characteristics					
Type	Manufacturer		Model number		Gain
Loop	On Track Innovations		NA		NA
Transmitter aggregate data rate/s		26.48 kbps			
Type of modulation		AM			
Transmitter duty cycle supplied for test		100%			
Transmitter power source					
V	Battery	Nominal rated voltage	3.6 V	Battery type	Lithium
	DC	Nominal rated voltage			
	AC mains	Nominal rated voltage		Frequency	



Test specification:	Sections 15.225(a) (b) (c), In band radiated emissions		
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2012-5/20/2012		
Temperature: 24 °C	Air Pressure: 1004 hPa	Relative Humidity: 67 %	Power Supply: Battery
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 In band radiated emissions

7.1.1 General

This test was performed to measure field strength of fundamental emission and modulation products from the EUT within the assigned band. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Radiated emission limits

Frequency, MHz	Field strength at 30 m distance*		Field strength at 3 m distance*	
	$\mu\text{V/m}$	$\text{dB}(\mu\text{V/m})$	$\mu\text{V/m}$	$\text{dB}(\mu\text{V/m})^{**}$
13.110 – 13.410	106	40.5	10600	80.5
13.410 – 13.553	334	50.5	33400	90.5
13.553 – 13.567	15848	84.0	1584800	124.0
13.567 – 13.710	334	50.5	33400	90.5
13.710 – 14.010	106	40.5	10600	80.5

*- The limit is provided in quasi peak values.

** - The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lim}_{S_2} = \text{Lim}_{S_1} + 40 \log(S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1 energized and the performance check was conducted.

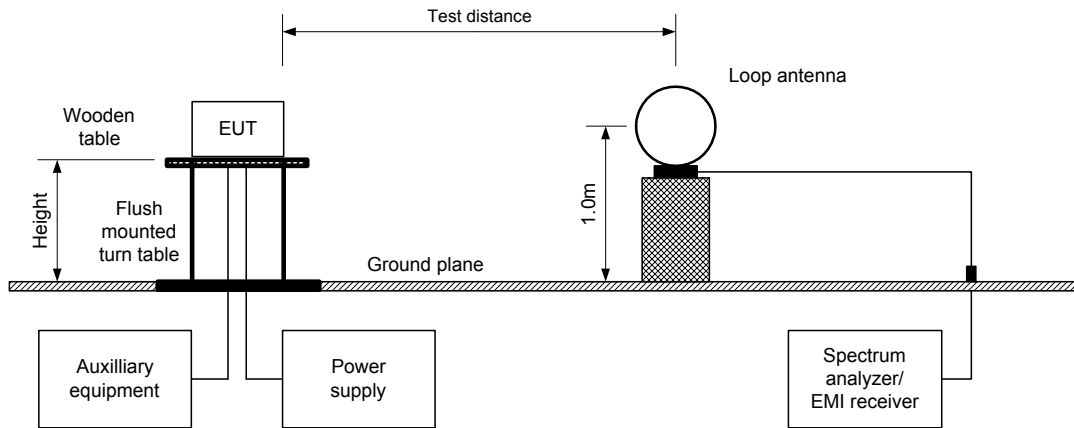
7.1.2.2 The specified frequency range was investigated with loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° , the measuring antenna was rotated around its vertical axis and the measuring antenna polarization was switched from vertical to horizontal.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.



Test specification:	Sections 15.225(a) (b) (c), In band radiated emissions		
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2012-5/20/2012		
Temperature: 24 °C	Air Pressure: 1004 hPa	Relative Humidity: 67 %	Power Supply: Battery
Remarks:			

Figure 7.1.1 Setup for in band radiated emission measurements





Test specification:		Sections 15.225(a) (b) (c), In band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:		Compliance	
Date(s):		5/2/2012-5/20/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
		Relative Humidity: 67 %	
		Power Supply: Battery	
Remarks:			

Table 7.1.2 In band radiated emission test results

TEST DISTANCE: 3 m
EUT POSITION: 3 orthogonal (X / Y / Z)
MODULATION: AM
MODULATING SIGNAL: ID code
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
INVESTIGATED FREQUENCY RANGE: 13.553 – 13.567 MHz
RESOLUTION BANDWIDTH: 9.0 kHz
VIDEO BANDWIDTH: 30.0 kHz
EUT MODE: RFID

Carrier frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Azimuth**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*			
U _{nom}							
13.56	76.7	73.9	124.0	-50.1	Vertical	280	Pass

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

Reference numbers of test equipment used

HL 0446	HL 0521	HL 2871	HL 3617			
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Full description is given in Appendix A.



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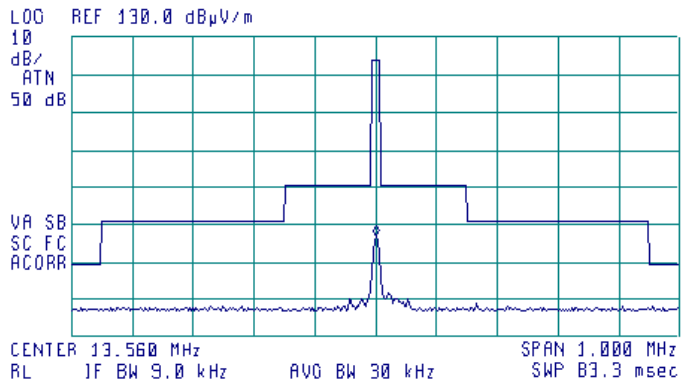
Test specification:		Sections 15.225(a) (b) (c), In band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:		Compliance	
Date(s):		5/2/2012-5/20/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 67 %	
		Power Supply: Battery	

Plot 7.1.1 Fundamental emission test result

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Peak hold
EUT POSITION: Z-axis (as worst from 3 orthogonal positions)
INPUT VOLTAGE: Unom



ACTV DET: PEAK
MEAS DET: PEAK DP AVG
MKR 13.560 MHz
76.66 dBµV/m





Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date(s): 5/2/2012-5/20/2012			
Temperature: 24 °C	Air Pressure: 1004 hPa	Relative Humidity: 67 %	Power Supply: Battery
Remarks:			

7.2 Out of band radiated emissions

7.2.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Radiated emission limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)***		
	Peak	Quasi Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**
0.090 – 0.110	NA	108.5 – 106.8**	NA
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**
0.490 – 1.705	NA	73.8 – 63.0**	NA
1.705 – 30.0*		69.5**	
30 – 88		40.0	
88 – 216		43.5	
216 – 960		46.0	
960 - 1000		54.0	

*- The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

** - The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lim}_{S_2} = \text{Lim}_{S_1} + 40 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

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

7.2.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

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

7.2.2.2 The specified frequency range was investigated with loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna was rotated around its vertical axis and the measuring antenna polarization was switched from vertical to horizontal.

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.2 and shown in the associated plots.

7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.

7.2.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ 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.

7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.2.2 and shown in the associated plots.



Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 5/2/2012-5/20/2012			
Temperature: 24 °C	Air Pressure: 1004 hPa	Relative Humidity: 67 %	Power Supply: Battery
Remarks:			

Figure 7.2.1 Radiated emissions below 30 MHz test set up

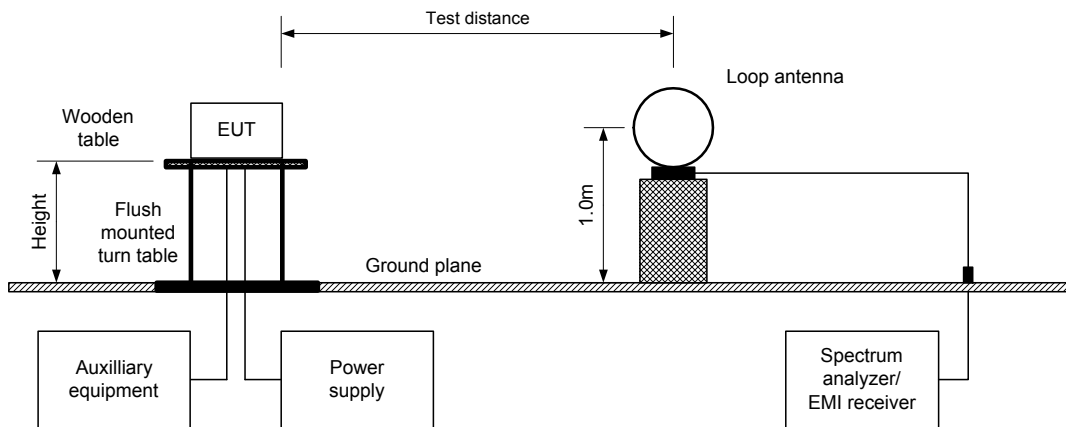
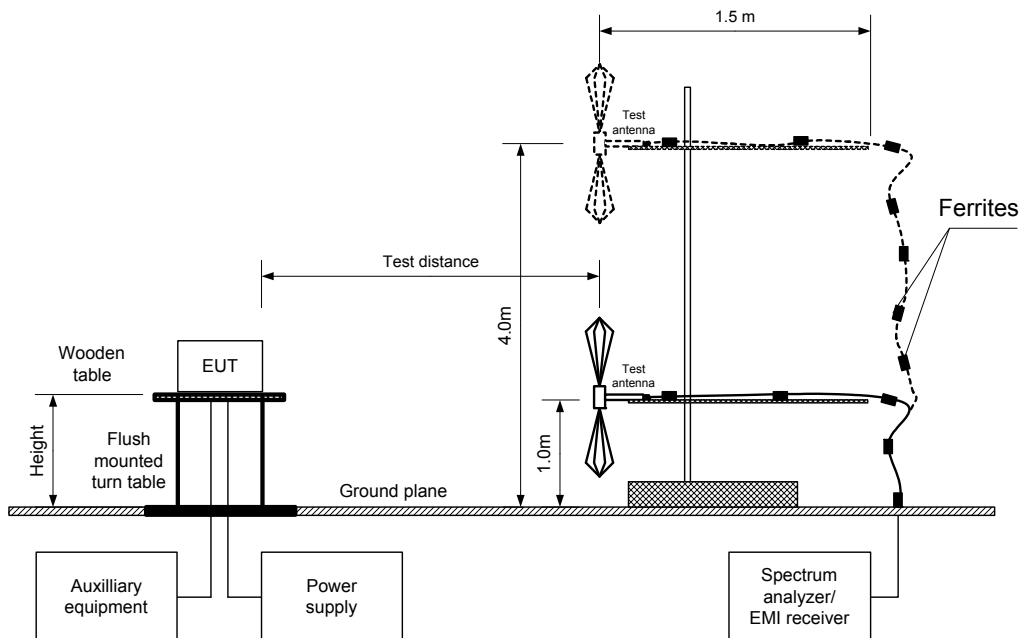


Figure 7.2.2 Radiated emissions above 30 MHz test set up





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Test specification:		Sections 15.225(d), Out of band radiated emissions	
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2012-5/20/2012		
Temperature: 24 °C	Air Pressure: 1004 hPa	Relative Humidity: 67 %	Power Supply: Battery
Remarks:			

Table 7.2.2 Out of band radiated emissions test results

TEST DISTANCE: 3 m
 EUT POSITION: 3 orthogonal (X / Y / Z)
 MODULATION: AM
 MODULATING SIGNAL: ID code
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)

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*				
40.68	24.0	22.1	40.0	-17.9	Vertical	1.1	53	Pass
279.2	28.6	25.2	46.0	-20.8	Vertical	1.2	220	
284.7	34.3	29.5	46.0	-16.5	Horizontal	1.1	70	
312.9	360.	32.7	46.0	-13.3	Vertical	1.6	226	
325.5	41.6	38.6	46.0	-7.4	Vertical	1.5	236	
474.6	39.7	37.4	46.0	-8.6	Vertical	1.1	255	

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

Reference numbers of test equipment used

HL 0446	HL 0521	HL 0604	HL 2871	HL 3617			
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Full description is given in Appendix A.

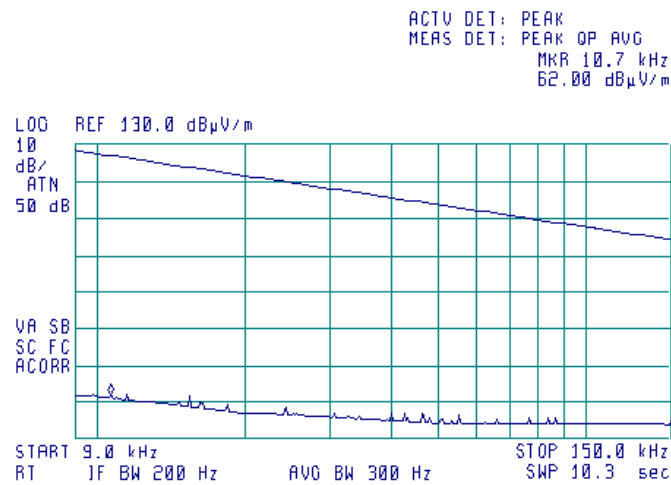


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Test specification:		Sections 15.225(d), Out of band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:		Compliance	
Date(s):		5/2/2012-5/20/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 67 %	
		Power Supply: Battery	

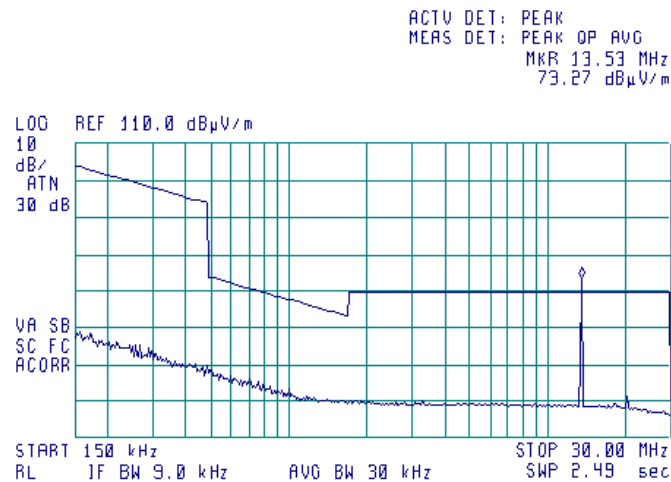
Plot 7.2.1 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.2 Radiated emission measurements from 0.15 to 30 MHz

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



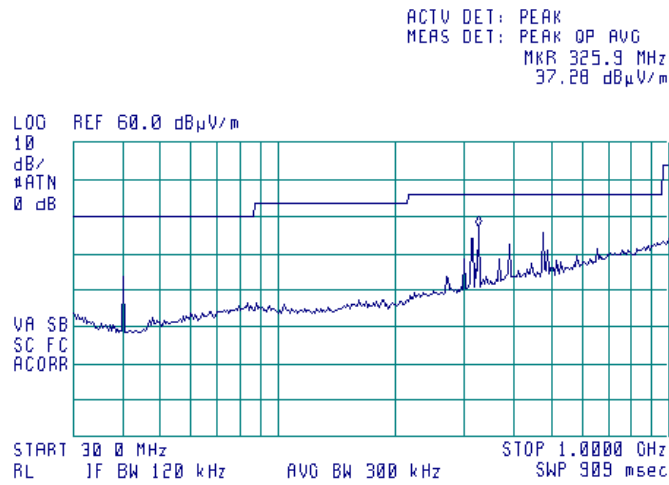


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Test specification:		Sections 15.225(d), Out of band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:		Compliance	
Date(s):		5/2/2012-5/20/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 67 %	
		Power Supply: Battery	

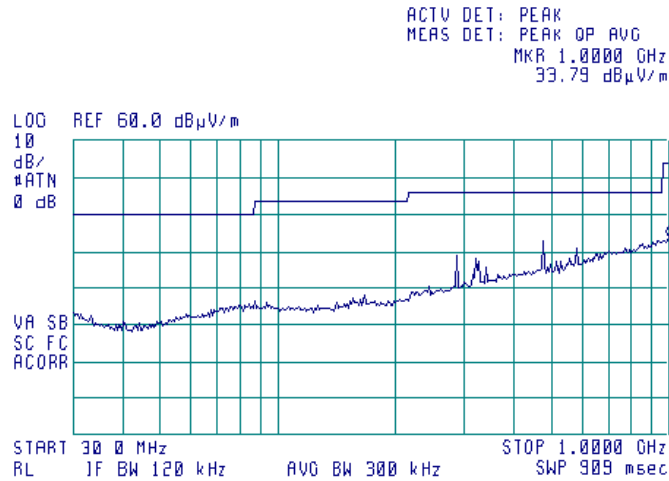
Plot 7.2.3 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.4 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold





Test specification:		Section 15.225(e), Frequency stability	
Test procedure:		ANSI C63.4, Section 13.1.6	
Test mode:		Compliance	
Date(s):		5/2/2012 - 5/7/2012	
Temperature: 23.2 °C		Air Pressure: 1011 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 42 %	
		Power Supply: Battery	

7.3 Frequency stability test

7.3.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.3.1.

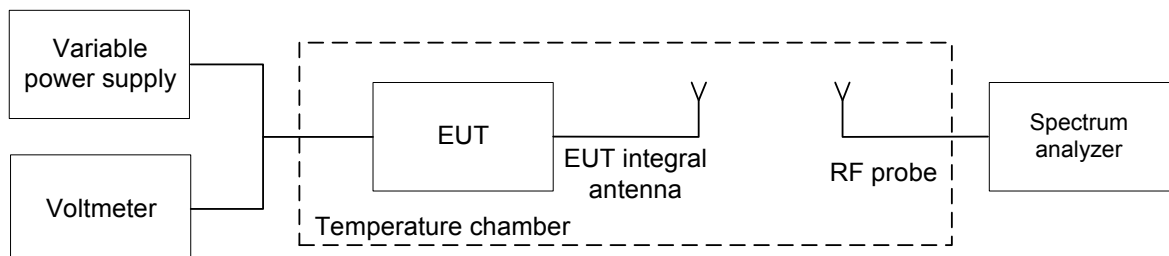
Table 7.3.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	%	Hz
13.560	± 0.01 %	1356

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 EUT power was turned off. Temperature within test chamber was set to the required one and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.3.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then after 2, 5 and 10 minutes. The EUT was powered off.
- 7.3.2.4 The above procedure was repeated at the rest of the test temperatures and voltages as provided in Table 7.3.2.
- 7.3.2.5 Frequency displacement was calculated and compared with the limit as provided in Table 7.3.2.

Figure 7.3.1 Frequency stability test setup





Test specification:		Section 15.225(e), Frequency stability	
Test procedure:		ANSI C63.4, Section 13.1.6	
Test mode:		Compliance	
Date(s):		5/2/2012 - 5/7/2012	
Temperature: 23.2 °C		Air Pressure: 1011 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 42 %	
		Power Supply: Battery	

Table 7.3.2 Frequency stability test results

OPERATING FREQUENCY: 13.560 MHz
 NOMINAL POWER VOLTAGE: 3.6 V
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 1 kHz
 VIDEO BANDWIDTH: 3 kHz
 MODULATION: Unmodulated

Temperature, °C	Voltage, V	Frequency, MHz				Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	2 nd min	5 th min	10 th min	Positive	Negative			
-20	nominal	13.559361	13.559337	13.559328	13.559242	84	-35	1356	-1272	Pass
20	nominal +15%	13.559366	13.559335	13.559299	13.559267	89	-10		-1267	
20	nominal	13.559335	13.559316	13.559303	13.559277	58	0		-1298	
20	nominal -15%	13.559331	13.559327	13.559290	13.559296	54	0		-1302	
50	nominal	13.559375	13.559334	13.559316	13.559318	98	0		-1258	

* - Reference frequency

Reference numbers of test equipment used

HL 0337	HL 1481	HL 3818					
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Full description is given in Appendix A.



Test specification:		Section 15.215(c), Occupied bandwidth	
Test procedure:		ANSI C63.4, Section 13.1.7	
Test mode:		Compliance	
Date(s):		5/2/2012-5/20/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 67 %	
		Power Supply: Battery	

7.4 Occupied bandwidth test

7.4.1 General

This test was performed to verify that the 20 dB bandwidth of the emissions was contained within the standard specified frequency band according to FCC §15.215 requirements. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc
13.110 – 13.410	20.0
13.410 – 13.553	
13.553 – 13.567	
13.567 – 13.710	
13.710 – 14.010	

*- Modulation envelope reference points provided in terms of attenuation below modulated carrier.

7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.

7.4.2.2 The spectrum analyzer sweep time and bandwidth were set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

7.4.2.3 The peak of emission was measured. The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.4.2 and associated plot.

7.4.2.4 Modulation bandwidth was calculated by adding of the negative frequency drift to the lower measured frequency and the positive frequency drift to the higher measured frequency. The obtained modulation bandwidth was verified to be within the allowed frequency range.

Figure 7.4.1 Occupied bandwidth test setup





Test specification:		Section 15.215(c), Occupied bandwidth	
Test procedure:		ANSI C63.4, Section 13.1.7	
Test mode:		Compliance	
Date(s):		5/2/2012-5/20/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
		Relative Humidity: 67 %	
		Power Supply: Battery	
Remarks:			

Table 7.4.2 Occupied bandwidth test results

ASSIGNED FREQUENCY BAND 13.11 – 14.01 MHz
DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 3 kHz
VIDEO BANDWIDTH: 10 kHz
MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
MODULATING SIGNAL: Enable

Band edge	Cross point frequency, MHz	Frequency drift, kHz		Modulation band edge, MHz	Assigned band edge, MHz	Verdict
		Negative	Positive			
Low	13.529000	0.035	NA	13.528965	13.11	Pass
High	13.600000	NA	0.098	13.600098	14.01	Pass

Reference numbers of test equipment used

HL 0446	HL 0521	HL 2871	HL 3617				
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Full description is given in Appendix A.



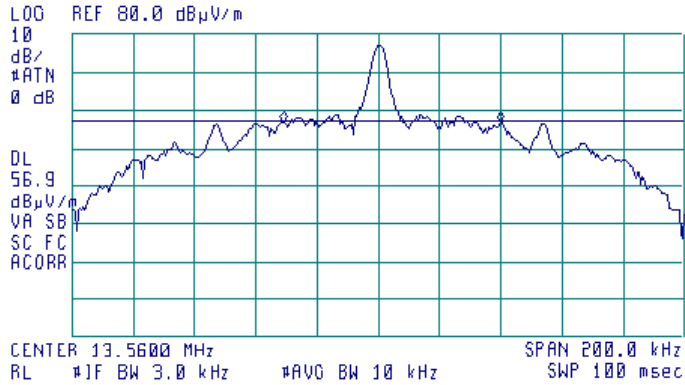
HERMON LABORATORIES

Test specification:		Section 15.215(c), Occupied bandwidth	
Test procedure:		ANSI C63.4, Section 13.1.7	
Test mode:		Compliance	
Date(s):		5/2/2012-5/20/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 67 %	
		Power Supply: Battery	

Plot 7.4.1 Occupied bandwidth test result



ACTV DET: PEAK
 MEAS DET: PEAK OP AVG
 MKRΔ 71.0 kHz
 .09 dB

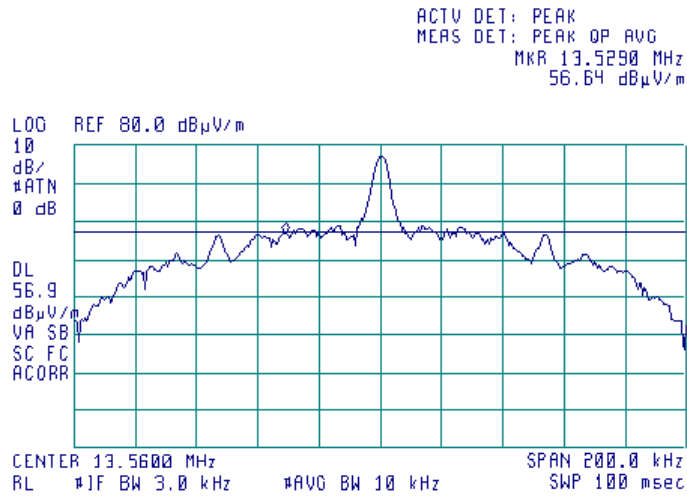




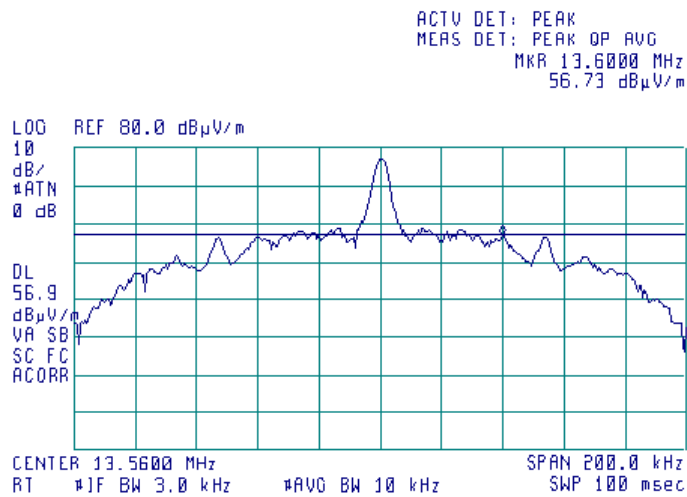
HERMON LABORATORIES

Test specification:		Section 15.215(c), Occupied bandwidth	
Test procedure:		ANSI C63.4, Section 13.1.7	
Test mode:		Compliance	
Date(s):		5/2/2012-5/20/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
Relative Humidity: 67 %		Power Supply: Battery	
Remarks:			
		Verdict: PASS	

Plot 7.4.2 Occupied bandwidth test result, low band frequency



Plot 7.4.3 Occupied bandwidth test result, high band frequency





Test specification:	Section 15.203, Antenna requirement		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2012 - 5/6/2012		
Temperature: 24 °C	Air Pressure: 1004 hPa	Relative Humidity: 67 %	Power Supply: Battery
Remarks:			

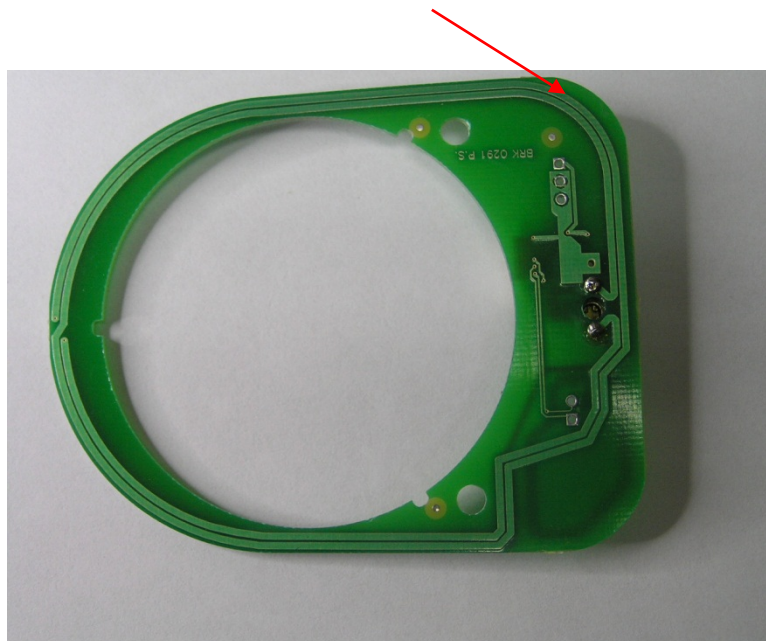
7.5 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters. The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.5.1.

Table 7.5.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	Comply
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	NA	

Photograph 7.5.1 RFID antenna assembly





Test specification:		Section 15.109, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4	
Test mode:		Compliance	
Date(s):		5/2/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 67 %	
		Power Supply: Battery	

8 Unintentional radiation test according to part 15 subpart B requirements

8.1 Radiated emission measurements

8.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.1.1.

Table 8.1.1 Radiated emission test limits

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
Above 960	43.5*	54.0	49.5	60.0*

* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log(S1/S2)$, where $S1$ and $S2$ – standard defined and test distance respectively in meters.

8.1.2 Test procedure

8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photograph/s, energized and the performance check was conducted.

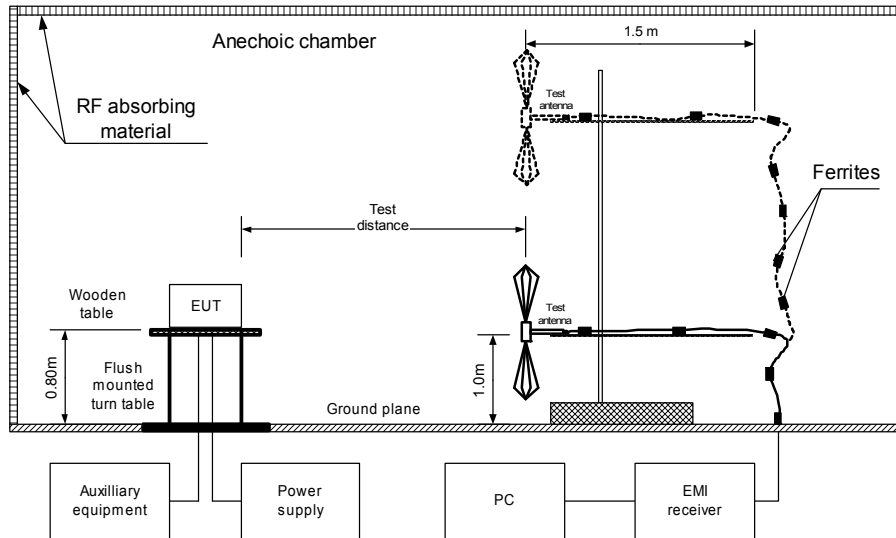
8.1.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position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

8.1.2.3 The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2012		
Temperature: 24 °C	Air Pressure: 1004 hPa	Relative Humidity: 67 %	Power Supply: Battery
Remarks:			

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Photograph 8.1.1 Setup for radiated emission measurements





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Test specification:		Section 15.109, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4	
Test mode:		Compliance	
Date(s):		5/2/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 67 %	
		Power Supply: Battery	

Table 8.1.2 Radiated emission test results

EUT SET UP: TABLE-TOP
 LIMIT: Class B
 EUT OPERATING MODE: 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*				
No emissions were found								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 2871	HL 3617				
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Full description is given in Appendix A.

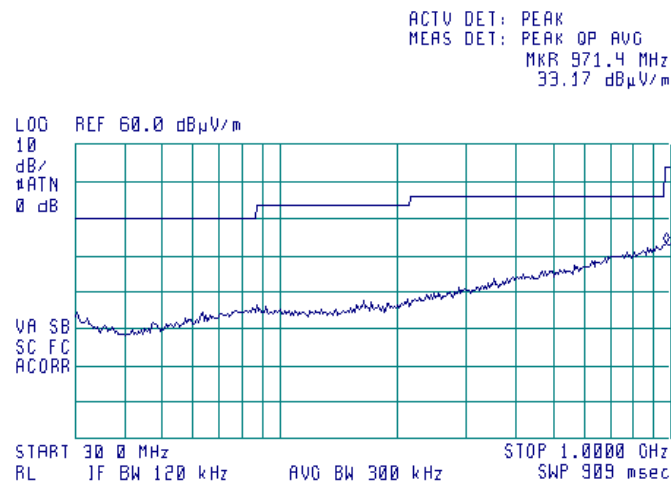


HERMON LABORATORIES

Test specification:		Section 15.109, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4	
Test mode:		Compliance	
Date(s):		5/2/2012	
Temperature: 24 °C		Air Pressure: 1004 hPa	
Relative Humidity: 67 %		Power Supply: Battery	
Remarks:			
		Verdict: PASS	

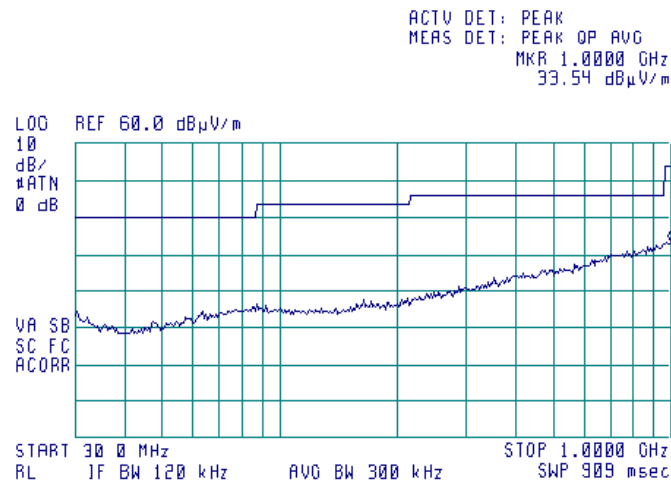
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

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



Plot 8.1.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

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



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

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0337	Probe Set, Hand held, 5 probes	Electro-Metrics	EHFP-30	238	07-Jun-11	07-Jun-12
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	03-Jul-11	03-Jul-12
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	29-Aug-11	29-Sep-12
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-13
1481	Cable, 1 m	Harbour Industries	MIL 17/60- RG142	1481	01-Sep-11	01-Sep-12
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	15-Jan-12	15-Jan-13
3617	Cable RF, 6.5 m, N type-N type, DC-6.5 GHz	Suhner Switzerland	RG 214/U	NA	19-May-11	19-May-12
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	16-Feb-12	16-Feb-13

**10 APPENDIX B Measurement uncertainties****Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements**

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 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.

11 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). The FCC Designation Number is US1003.

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Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

47CFR part 15: 2011	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.



13 APPENDIX E Test equipment correction factors

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

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



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

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ 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, RG-214/U, N type-N type, 6.5 m
Suhner Switzerland, HL 3617

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	2200	2.97	4500	5.10
50	0.33	2300	3.06	4600	5.20
100	0.48	2400	3.16	4700	5.34
200	0.71	2500	3.23	4800	5.36
300	0.89	2600	3.34	4900	5.48
400	1.04	2700	3.42	5000	5.52
500	1.19	2800	3.52	5100	5.61
600	1.32	2900	3.61	5200	5.72
700	1.44	3000	3.69	5300	5.81
800	1.56	3100	3.80	5400	5.93
900	1.68	3200	3.86	5500	6.08
1000	1.80	3300	3.98	5600	6.12
1100	1.90	3400	4.07	5700	6.25
1200	2.00	3500	4.14	5800	6.31
1300	2.11	3600	4.27	5900	6.41
1400	2.21	3700	4.36	6000	6.51
1500	2.30	3800	4.47	6100	6.62
1600	2.40	3900	4.62	6200	6.73
1700	2.49	4000	4.63	6300	6.86
1800	2.61	4100	4.76	6400	6.94
1900	2.69	4200	4.83	6500	7.06
2000	2.79	4300	4.89		
2100	2.88	4400	5.04		



14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ 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
μ s	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
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
WB	wideband

END OF DOCUMENT