

TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 subpart C, section 15.225

FOR:

Better Place Ltd.

Wall Mount Charging Spot

Model: CSv1-Wall

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1 Applicant information

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Telephone: +972 73-777-9777
Fax: +972 3644-8699
E-mail: tal.cohen@betterplace.com
Contact name: Mr. Tal Cohen

2 Equipment under test attributes

Product name: Wall Mount Charging Spot
Model(s): CSv1-Wall
Serial number: FLS10320792
Hardware version: p2
Software release: N.A
Receipt date: 8/24/2010

3 Manufacturer information

Manufacturer name: Better Place Labs Israel Ltd.
Address: P.O.Box 11793, 13 Ha'amal St., Afek Industrial Park, Rosh Ha'ayin 48092, Israel
Telephone: +972 73-777-9777
Fax: +972 3644-8699
E-Mail: tal.cohen@betterplace.com
Contact name: Mr. Tal Cohen

4 Test details

Project ID: 21149
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 8/24/2010
Test completed: 11/18/2010
Test specification(s): FCC CFR 47 part 15 subpart C, section 15.225

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	Pass
Section 15.215(c), Occupied bandwidth	Pass
Section 15.203, Antenna requirements	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
Tested by:	Mrs. E. Pitt, test engineer	November 18, 2010	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	November 21, 2010	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	November 22, 2010	

6 EUT description

6.1 General information

The EUT is a Wall Mount Charging Spot that includes a transmitter operating at 13.56 MHz. The EUT is designated for locations which require underground infrastructure. Typical locations can include outdoor parking lots, streets and etc. The EUT is powered from 240 VAC/60 Hz, wye-connection.

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length	Indoor / outdoor
Power	AC power IN	EUT	AC mains	1	Unshielded	10 m	Outdoor
Power	AC power OUT	EUT	Load	2	Unshielded	2.4 m	Outdoor
Signal	RS-485	EUT	Modem	1	Unshielded	10 m	Outdoor

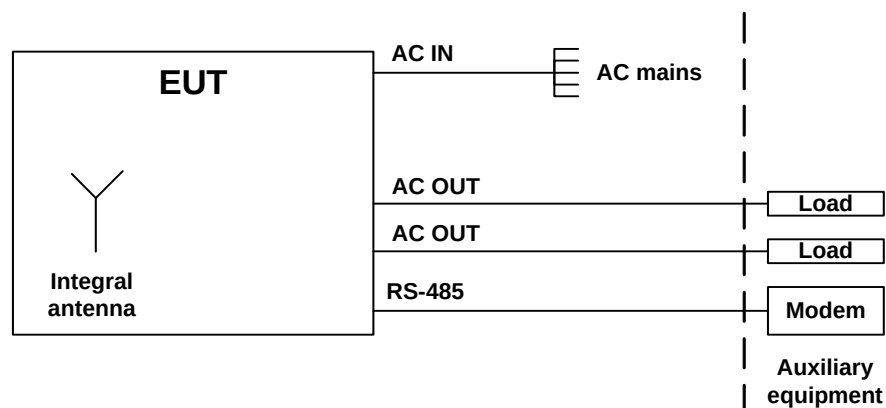
6.3 Auxiliary equipment

Description	Manufacturer	Model number	Serial number
Modem	Artila	Matrix 504	A474900083
Source	Frequency, MHz		
Clock	50		
Tx	13.56		
Data	99		

6.4 Changes made in the EUT

No changes were implemented in the EUT.

6.5 Test configuration



6.6 Transmitter characteristics

Type of equipment					
V	Stand-alone (Equipment with or without its own control provisions)				
	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)				
Intended use		Condition of use			
	fixed	Always at a distance more than 2 m from all people			
V	mobile	Always at a distance more than 20 cm from all people			
	portable	May operate at a distance closer than 20 cm to human body			
Assigned frequency range		13.110-14.010 MHz			
Operating frequency		13.56 MHz			
Is transmitter output power variable?		V	No		
			Yes	continuous variable	
				stepped variable with stepsize dB	
				minimum RF power dBm	
				maximum RF power dBm	
Antenna connection					
unique coupling		standard connector		V	integral
				V	with temporary RF connector without temporary RF connector
Antenna/s technical characteristics					
Type		Manufacturer		Model number	
Loop		Better Place		SW-ANT	
Type of modulation		AM			
Maximum transmitter duty cycle in normal use		20%			
Transmitter duty cycle supplied for test		100%			
Transmitter power source					
	Battery	Nominal rated voltage		Battery type	
		Minimum rated voltage			
		Maximum rated voltage			
	DC	Nominal rated voltage			
V	AC mains	Nominal rated voltage	240 VAC	Frequency	60 Hz

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:	10/3/2010		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 35 %	Power Supply: 240 VAC
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

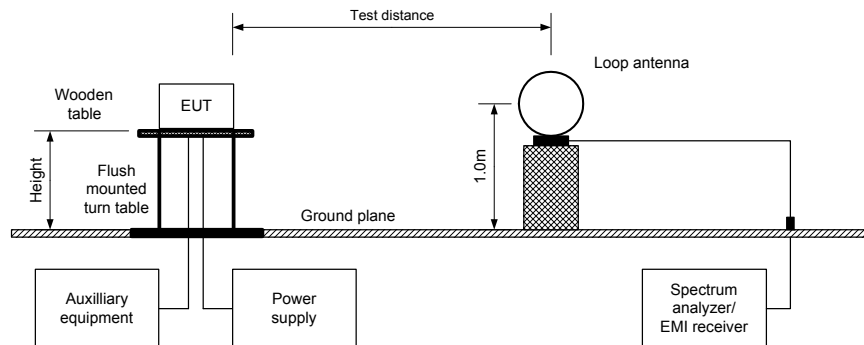
7.1.2.1 The EUT was set up as shown in Figure 7.1.1 energized and the performance check was conducted.

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:	10/3/2010		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 35 %	Power Supply: 240 VAC
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	Verdict:	PASS
Date:	10/3/2010		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 35 %	Power Supply: 240 VAC
Remarks:			

Table 7.1.2 In band radiated emission test results

TEST DISTANCE: 3 m
EUT POSITION: Typical (Vertical)
MODULATION: AM
MODULATING SIGNAL: ID code
TRANSMITTER OUTPUT POWER: Maximum
INVESTIGATED FREQUENCY RANGE: 13.110 – 14.010 MHz
RESOLUTION BANDWIDTH: 9.0 kHz
VIDEO BANDWIDTH: 30.0 kHz

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*				
Unom								
13.56	80.18	80	124	-40	V	90	Pass	
115%Unom								
13.56	80.22	80	124	-40	V	90		
85%Unom								
13.56	80.20	80	124	-40	V	90		

*- Margin = Measured emission - specification limit.

**-. EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

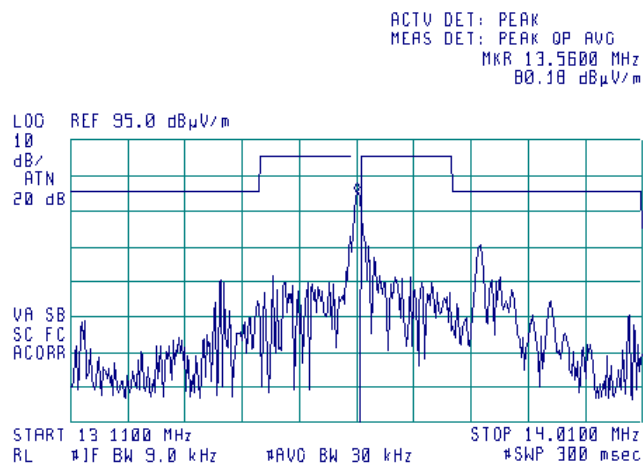
HL 0415	HL 0446	HL 0812	HL 1425				
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Full description is given in Appendix A.

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:	10/3/2010		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 35 %	Power Supply: 240 VAC
Remarks:			

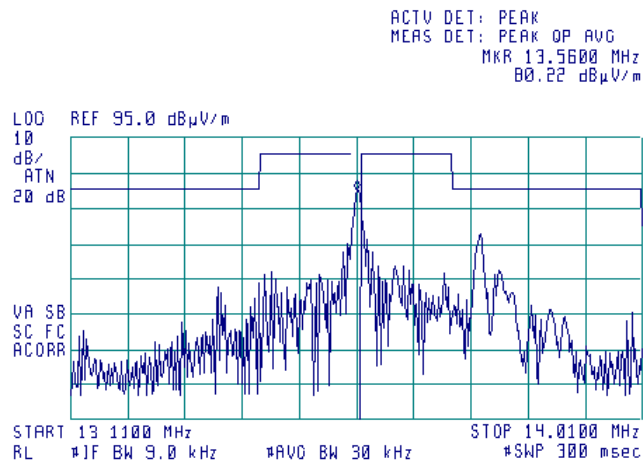
Plot 7.1.1 Fundamental emission test result

TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTOR: Peak hold
INPUT VOLTAGE: Unom



Plot 7.1.2 Fundamental emission test result

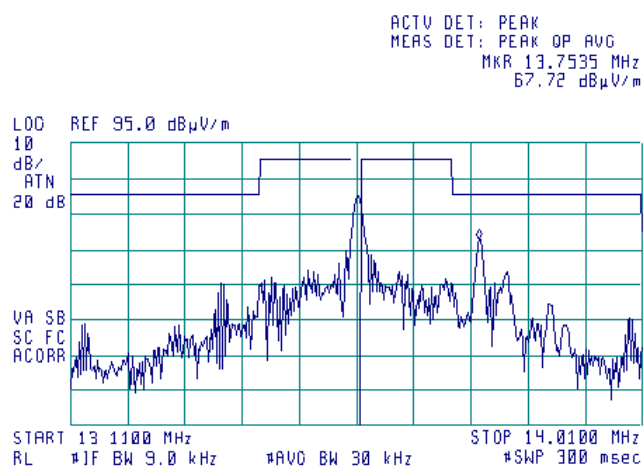
TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTOR: Peak hold
INPUT VOLTAGE: 115%Unom



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:	10/3/2010		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 35 %	Power Supply: 240 VAC
Remarks:			

Plot 7.1.3 Fundamental emission test result

TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTOR: Peak hold
INPUT VOLTAGE: 85%Unom



F=13.7535 MHz – ambient noise

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:	9/29/2010		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
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:

$$\text{Lim}_{S2} = \text{Lim}_{S1} + 40 \log (S_1/S_2),$$

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:	9/29/2010		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
Remarks:			

Figure 7.2.1 Radiated emissions below 30 MHz test set up

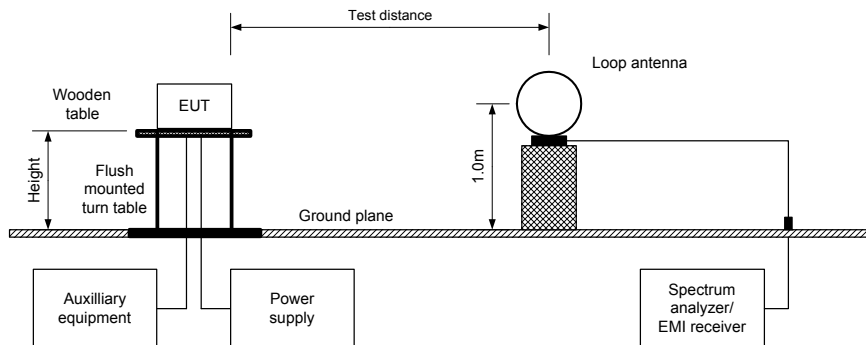
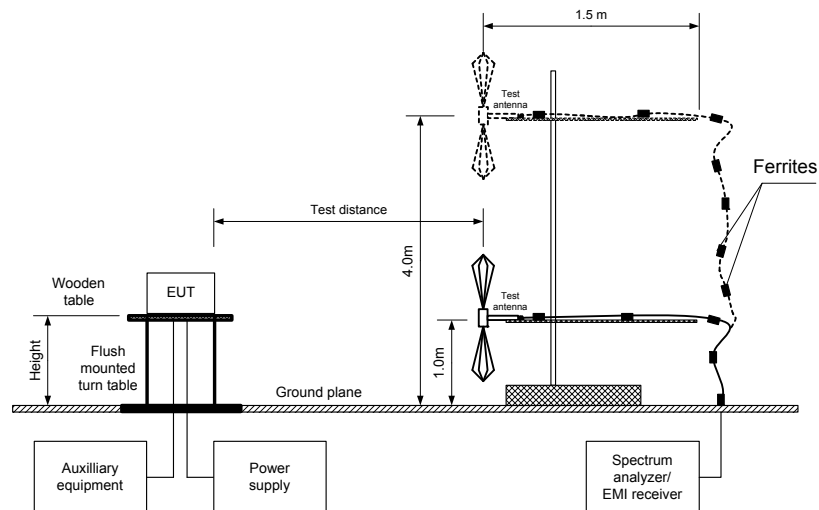


Figure 7.2.2 Radiated emissions above 30 MHz test set up



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:	9/29/2010		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
Remarks:			

Table 7.2.2 Out of band radiated emissions test results

TEST DISTANCE: 3 m
EUT POSITION: Typical (Vertical)
MODULATION: AM
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)
Biconical (30 MHz – 200 MHz)
Log periodic (200 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*				
27.120000	40.8	36.9	69.5	-32.6	V	1.0	0	Pass
30.002400	34.8	29.2	40.0	-10.8	V	2.5	90	
200.007000	41.9	39.6	43.5	-3.9	V	1.50	0	
495.372800	43.7	40.6	46.0	-5.4	V	1.40	0	
555.954700	46.1	43.8	46.0	-2.2	V	1.00	180	
797.015000	43.6	37.0	46.0	-9.0	H	1.00	0	
891.671060	42.3	39.2	46.0	-6.8	H	1.10	20	

*- Margin = Measured emission - specification limit.

**-. EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

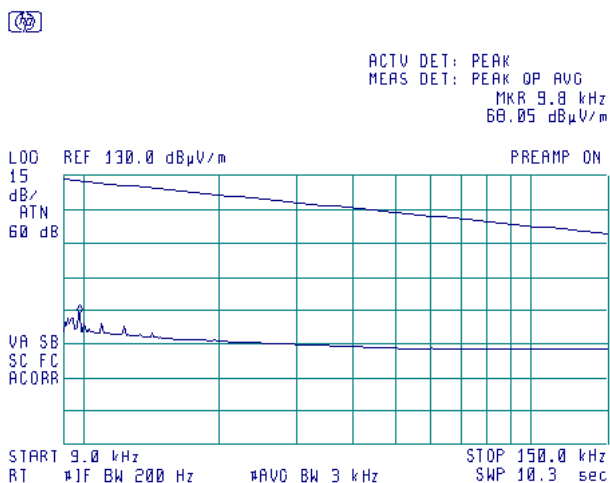
HL 0034	HL 0446	HL 0651	HL 0812	HL 1425			
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Full description is given in Appendix A.

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:	9/29/2010		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
Remarks:			

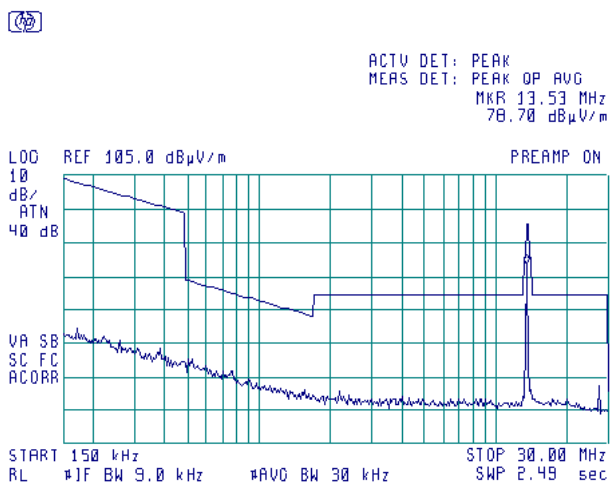
Plot 7.2.1 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
DETECTOR: Peak hold



Plot 7.2.2 Radiated emission measurements from 0.15 to 30 MHz

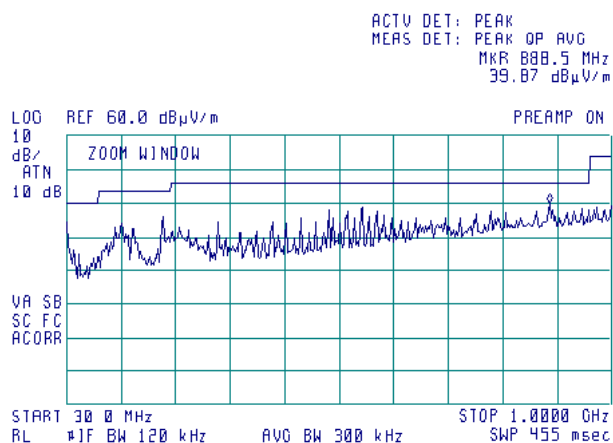
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
DETECTOR: Peak hold



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:	9/29/2010		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
Remarks:			

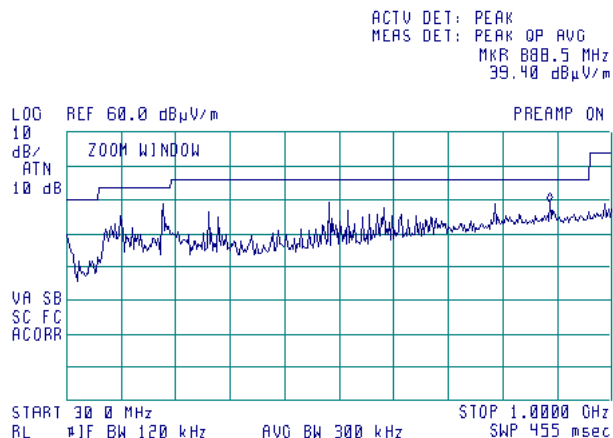
Plot 7.2.3 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: 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: 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	Verdict: PASS
Date:		10/4/2010	
Temperature: 25 °C	Air Pressure: hPa	Relative Humidity: 36 %	Power Supply: 240 VAC
Remarks:			

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.

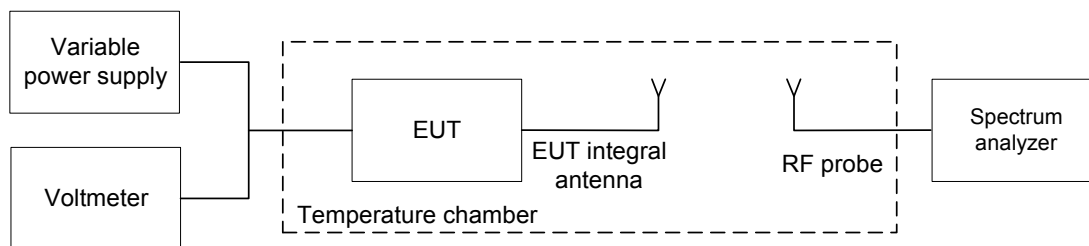
Table 7.3.1 Frequency stability limits

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	Verdict:	PASS
Date:	10/4/2010		
Temperature: 25 °C	Air Pressure: hPa	Relative Humidity: 36 %	Power Supply: 240 VAC
Remarks:			

Table 7.3.2 Frequency stability test results

OPERATING FREQUENCY: 13.560 MHz
 NOMINAL POWER VOLTAGE: 240 VAC
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 1 kHz
 VIDEO BANDWIDTH: 1 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	240	13.55983	13.55983	13.55983	13.55983	0	90	1356	-1266	Pass
+20	276	13.55992	13.55992	13.55992	13.55992	0	0		-1356	
+20	240	13.55992	13.55992	13.55992	13.55992	0	0		-1356	
+20	204	13.55992	13.55992	13.55992	13.55992	0	0		-1356	
+50	240	13.5600	13.5600	13.5600	13.5600	80	0		-1276	

* - Reference frequency

Reference numbers of test equipment used

HL 0493	HL 1424						
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Full description is given in Appendix A.

Test specification:		Section 15.207(a), Conducted emission	
Test procedure:		ANSI C63.4, Section 13.1.3	
Test mode:		Compliance	Verdict: PASS
Date:		11/18/2010	
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
Remarks:			

7.4 Conducted emissions

7.4.1 General

This test was performed to measure the common mode conducted emissions at the EUT power port. The specification test limits are given in Table 7.4.1.

Table 7.4.1 Limits for conducted emissions

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

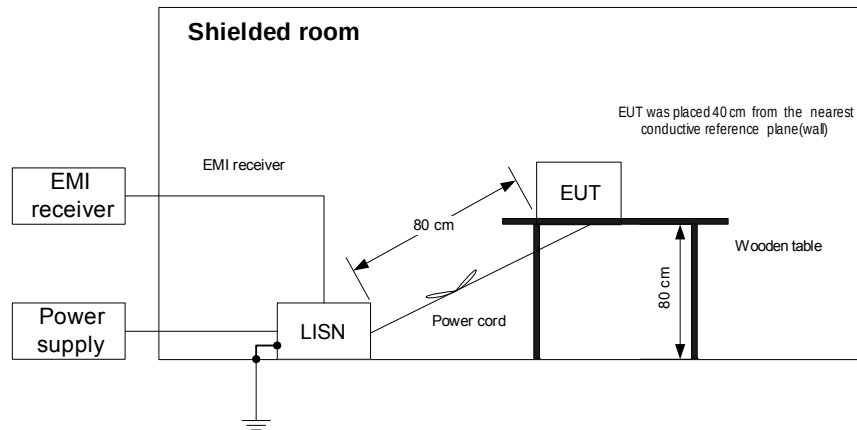
* - The limit decreases linearly with the logarithm of frequency.

7.4.2 Test procedure

- 7.4.2.1 The EUT was set up as shown in Figure 7.4.1 and the associated photographs, energized and the EUT performance was checked.
- 7.4.2.2 The measurements were performed at the EUT power terminals with the LISN connected to the EMI receiver in the frequency range referred to in Table 7.4.2. The unused coaxial connector of the LISN was terminated with 50 Ohm.
- 7.4.2.3 The position of the EUT cables was varied to find the highest emission.
- 7.4.2.4 The worst test results with respect to the limits were recorded in Table 7.4.2 and shown in the associated plots.

Test specification:		Section 15.207(a), Conducted emission	
Test procedure:		ANSI C63.4, Section 13.1.3	
Test mode:		Compliance	Verdict: PASS
Date:		11/18/2010	
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
Remarks:			

Figure 7.4.1 Setup for conducted emission measurements, table-top EUT



Test specification:		Section 15.207(a), Conducted emission	
Test procedure:		ANSI C63.4, Section 13.1.3	
Test mode:		Compliance	Verdict: PASS
Date:		11/18/2010	
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
Remarks:			

Table 7.4.2 Conducted emission test results

LINE: AC mains
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

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*		
0.185	68.71	61.39	64.29	-2.90	54.29	34.10	-20.19	L1	Pass
0.208	68.57	61.07	63.34	-2.27	53.34	31.32	-22.02		
0.248	68.23	60.31	61.86	-1.55	51.86	31.82	-20.04		
0.256	67.96	60.11	61.61	-1.50	51.61	30.25	-21.36		
0.307	65.16	57.18	60.06	-2.88	50.06	30.80	-19.26		
2.373	47.18	46.01	56.00	-9.99	45.52	46.00	-0.48		
0.184	68.69	61.50	64.32	-2.82	33.30	54.32	-21.02	L2	Pass
0.244	68.07	60.46	61.98	-1.52	31.65	51.98	-20.33		
0.309	64.57	57.10	60.01	-2.91	28.70	50.01	-21.31		
0.369	59.67	52.32	58.57	-6.25	25.18	48.57	-23.39		
0.457	54.76	46.93	56.80	-9.87	20.26	46.80	-26.54		
2.373	48.75	46.15	56.00	-9.85	45.89	46.00	-0.11		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

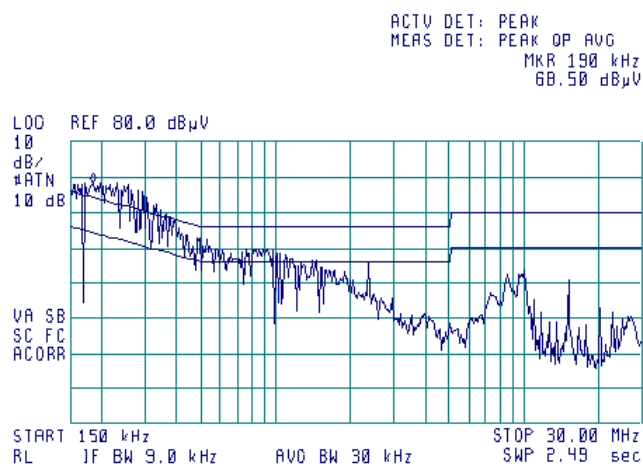
HL 0543	HL 1425	HL 1513	HL 2364	HL 2383	HL 2417	HL 2666	HL 2888
HL 3612	HL 3655						

Full description is given in Appendix A.

Test specification:		Section 15.207(a), Conducted emission	
Test procedure:		ANSI C63.4, Section 13.1.3	
Test mode:		Compliance	Verdict: PASS
Date:		11/18/2010	
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
Remarks:			

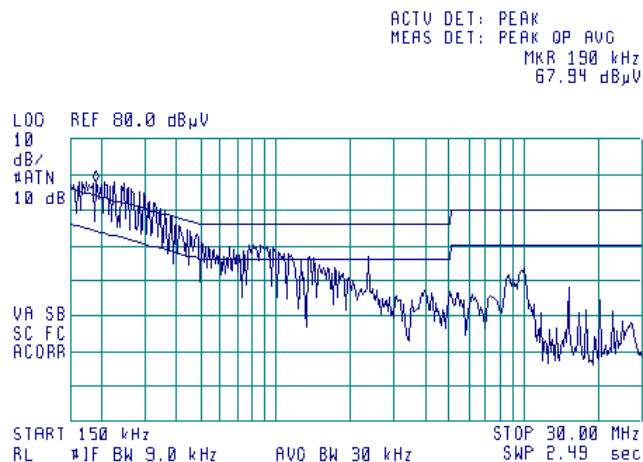
Plot 7.4.1 Conducted emission measurements

LINE: L1
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.4.2 Conducted emission measurements

LINE: L2
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:		Section 15.215(c), Occupied bandwidth	
Test procedure:		ANSI C63.4, Section 13.1.7	
Test mode:		Compliance	Verdict: PASS
Date:		10/3/2010	
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 240 VAC
Remarks:			

7.5 Occupied bandwidth test

7.5.1 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 7.5.1.

Table 7.5.1 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.

7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

7.5.2.2 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.

7.5.2.3 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 7.5.2 and the associated plots.

7.5.2.4 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 7.5.1 Occupied bandwidth test setup



Test specification:		Section 15.215(c), Occupied bandwidth	
Test procedure:		ANSI C63.4, Section 13.1.7	
Test mode:		Compliance	Verdict: PASS
Date:		10/3/2010	
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 240 VAC
Remarks:			

Table 7.5.2 Occupied bandwidth test results

ASSIGNED FREQUENCY BAND: 13.11 – 14.01 MHz
DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 1 kHz
VIDEO BANDWIDTH: 3 kHz
MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
MODULATION: Enable
MODULATING SIGNAL: Enable

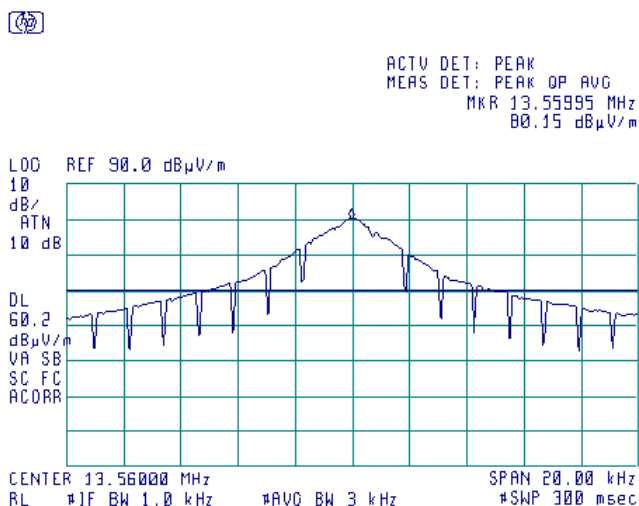
Band edge	Cross point frequency, MHz	Frequency drift, kHz		Modulation band edge, MHz	Assigned band edge, MHz	Verdict
		Negative	Positive			
Low	13.5550	0.09	NA	13.55491	13.553	Pass
High	13.5648	NA	0.08	13.56488	13.567	Pass

Reference numbers of test equipment used

HL 1425	HL 446	HL 812	HL 415					
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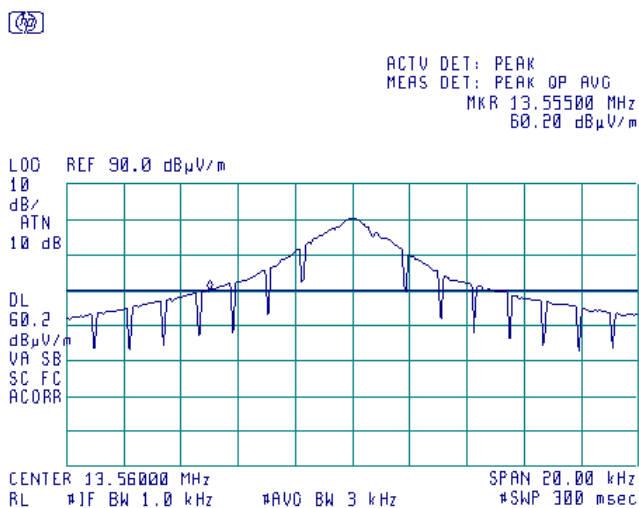
Full description is given in Appendix A.

Plot 7.5.1 Occupied bandwidth test result

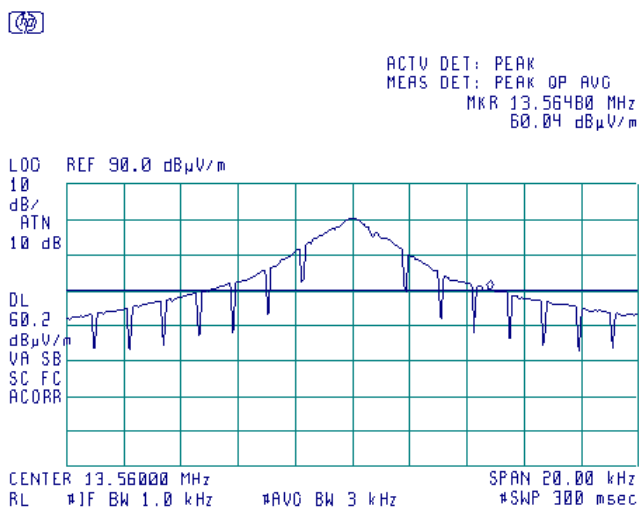


Test specification:		Section 15.215(c), Occupied bandwidth	
Test procedure:		ANSI C63.4, Section 13.1.7	
Test mode:		Compliance	Verdict: PASS
Date:		10/3/2010	
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 240 VAC
Remarks:			

Plot 7.5.2 Occupied bandwidth test result, low band edge



Plot 7.5.3 Occupied bandwidth test result, high band edge



Test specification:		Section 15.203, Antenna requirement	
Test procedure:		Visual inspection / supplier declaration	
Test mode:		Compliance	Verdict: PASS
Date:		11/17/2010	
Temperature: 24.3 °C	Air Pressure: 1014 hPa	Relative Humidity: 42 %	Power Supply: 240 VAC
Remarks:			

7.6 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 7.6.1.

Table 7.6.1 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	

8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./Check	Due Cal./Check
0034	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1988	11-Jun-10	11-Jun-11
0415	Cable, Coax, RF, RG-214	Hermon Laboratories	CC-3	056	01-Dec-09	01-Dec-10
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-10	29-Jun-11
0493	Temperature Chamber -45...175 deg C	Thermotron	S-1.2 Mini-Max	14016	13-May-10	13-May-11
0543	Analyzer Power Universal	Voltech	PM3000A	AI 18/0991	17-Sep-10	17-Sep-11
0651	Antenna, Biconical, 30 - 200 MHz	Hermon Laboratories	AB-200	124	12-Jan-10	12-Jan-11
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	Hermon Laboratories	C214-11	148	02-Dec-09	02-Dec-10
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	31-Aug-10	31-Aug-11
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A002 22, 3705A002 04	24-Aug-10	24-Aug-11
1513	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1513	01-Sep-10	01-Sep-11
2364	SmartWave Switching Amplifier	Elgar	SW5250A E-4	0317A005 96	03-Mar-10	03-Mar-11
2383	Transformer, Isolation, 230/230, 1.8 kVA	Taiyo Yuden, Inc.	LGY1.8-21	EJ0180	24-May-10	24-May-11
2417	Power source connection panel (for HL 2364)	Hermon Laboratories	PCP-1	2417	06-Jul-10	06-Jul-11
2666	Compliance Test System	California Instruments	PACS-3	72342	26-Jan-09	26-Jan-11
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	07-Jul-10	07-Jul-11
3612	Cable RF, 17.5 m, N type-N type	Teldor	RG-214/U	NA	02-Dec-09	02-Dec-10
3655	Ferrite Clamp	Luthi	FTC 101	4855	21-Jan-10	21-Jan-11

9 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.

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) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. 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) and approved by Israel Ministry of environmental protection, radiation hazards department (Permit number 1158). The FCC Designation Number is US1003.

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Person for contact: Mr. Alex Usoskin, CEO.

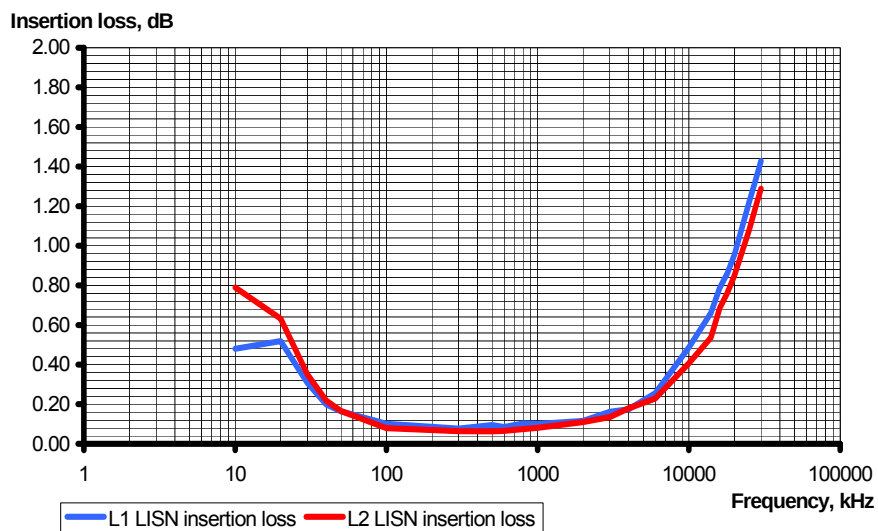
11 APPENDIX D Specification references

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.

12 APPENDIX E Test equipment correction factors

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
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
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.1988, HL 0034

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
200	12.6	625	20.4
225	12.2	650	20.9
250	13.4	675	22.0
275	14.3	700	22.2
300	15.2	725	22.7
325	15.7	750	22.5
350	15.9	775	22.7
375	16.4	800	22.8
400	17.0	825	23.2
425	17.4	850	23.5
450	17.9	875	23.9
475	18.6	900	24.0
500	19.1	925	24.0
525	19.3	950	24.2
550	19.6	975	24.7
575	19.8	1000	25.1
600	20.0		

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
Biconical antenna
HL, model LPA 200/1000
Ser.No.124, HL 0651

Frequency MHz	Antenna Factor dB(1/m)
30	14.0
35	11.9
40	10.9
45	10.3
50	10.1
60	9.7
70	7.9
80	7.1
90	9.1
100	11.1
120	15.3
140	13.1
160	14.8
180	16.0
200	17.4

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).

Cable loss
Cable Coaxial, RG-58/RG-214, s/n 056, HL 0415
+ Cable Coaxial, RG-214, 11.5m, s/n 148, HL 0812

No.	Frequency, MHz	Cable loss, dB	Measured uncertainty, dB
1	20	0.73	±0.12
2	30	0.91	
3	50	1.2	
4	80	1.56	
5	100	1.76	
6	200	2.59	
7	300	3.26	
8	400	3.93	
9	500	4.42	
10	600	4.92	
11	700	5.36	
12	800	5.88	
13	900	6.41	
14	1000	6.71	
15	1500	8.63	
16	2000	10.39	

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

Frequency, MHz	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

13 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
EMC	electromagnetic compatibility
EUT	equipment under test
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
kV	kilovolt
L	length
LISN	line impedance stabilization network
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
s	second
VA	volt-ampere
W	width

END OF DOCUMENT