

TEST REPORT

ACCORDING TO: FCC 47CFR part 15: 2009, subpart B, Class B

FOR:

Aplica Technologies Ltd.

RF Dongle 2.4 GHz

Model number: 500-09908A

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1 Applicant information

Client name: Aplica Technologies Ltd.
Address: P.O.Box 7291, Petach-Tikva 49170, Israel
Telephone: +972 3924 9393
Fax: +972 3924 9394
E-mail: arik@aplicatech.com
Contact name: Mr. Arik Israel

2 Equipment under test attributes

Product name: RF Dongle 2.4 GHz
Product type: Transceiver operating in 2401 – 2480 MHz range
Model: 500-09908A
Serial number: 15
Hardware version: AD6024
Receipt date: 2/11/2010

3 Manufacturer information

Manufacturer name: Aplica Technologies Ltd.
Address: P.O.Box 7291, Petach-Tikva 49170, Israel
Telephone: +972 3924 9393
Fax: +972 3924 9394
E-mail: arik@aplicatech.com
Contact name: Mr. Arik Israel

4 Test details

Project ID: 20521
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 10/4/2010
Test completed: 10/13/2010
Test specification: FCC 47CFR part 15: 2009, subpart B, Class B

5 Tests summary

Test	Status
FCC 47 CFR part 15, subpart B	
Section 15.107 Class B, AC power lines conducted emissions	Pass
Section 15.109 Class B, Radiated emissions	Pass
Section 15.111, Spurious emissions at RF antenna connector	Not required
Section 15.115 (b(2)), Conducted emissions at RF output terminals of TV interface	Not required

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:	Mr. S. Samokha, test engineer	October 13, 2010	
Reviewed by:	Ms. N. Averin, certification engineer	March 10, 2011	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	March 13, 2011	

6 EUT description

6.1 General information

The EUT, RF dongle, is a small PCB with a transceiver operating in 2.4 – 2.48 GHz ISM band and a USB connector. It is packaged just like a USB memory stick, and has the same embedded antenna as the modular unit. The EUT operates by connecting it to a PC and is powered from 5 VDC obtained from the PC.

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length	Indoor / outdoor
Power and signal	USB	EUT	Laptop	1	NA*	NA*	Indoor
Power	AC power	AC/DC adapter	AC mains	1	Unshielded	2.5 m	Indoor
Power	DC power	Laptop	AC/DC adapter	1	Unshielded	2.5 m	Indoor
Signal	RS-232	Laptop	RF Sensor Module	1	Unshielded	2.8 m	Indoor

* Temporary connection via USB cable was used for testing purposes during the tests.

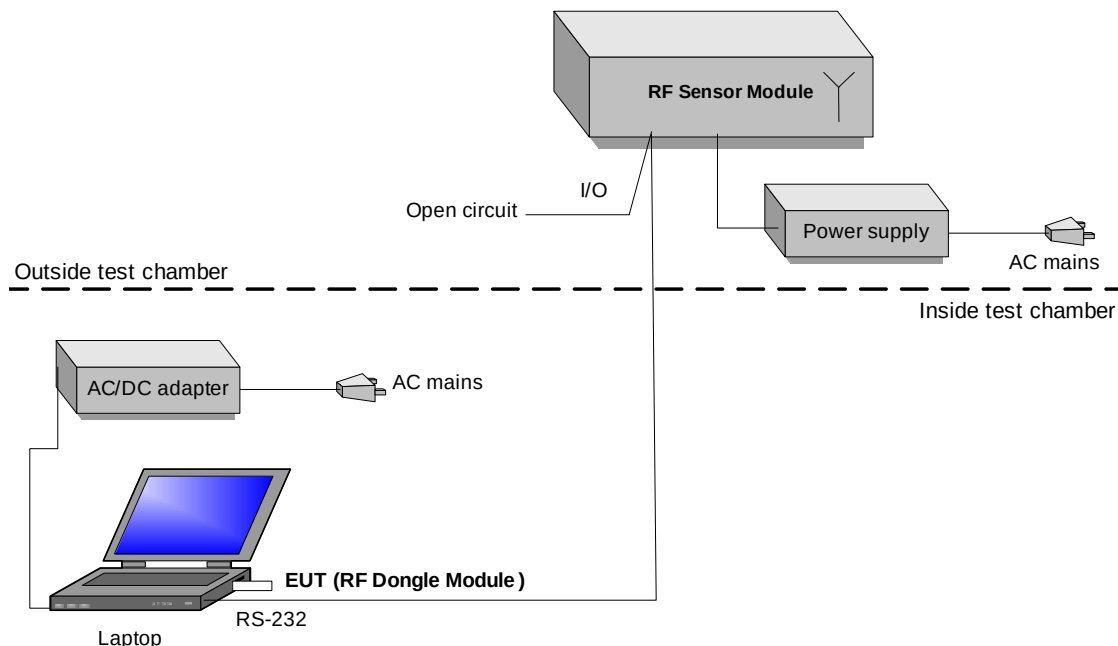
6.3 Auxiliary equipment

Description	Manufacturer	Model number	Serial number
Laptop	Dell	Latitude D-630	5ZYVB3J
AC/DC adapter	Dell	HA65NS1-00	7AR-C155
Power supply	CUS Listed	MS-10US09-A-2	NA
RF Sensor Module	Aplica Technologies	500-09898A	2

6.4 Operating frequencies

Source	Frequency, MHz					
Tx/Rx	2401	2441	2480	NA	NA	NA

6.5 Test configuration



Note Temporary connection of the EUT via USB cable was used for testing purposes during the tests.

Test specification:	Section 15.107 Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 11.5		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 24.3 °C	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

7 Emissions tests according to FCC 47CFR part 15 subpart B requirements

7.1 Conducted emissions

7.1.1 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 7.1.1.

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 the associated photograph, energized and the EUT performance was checked.

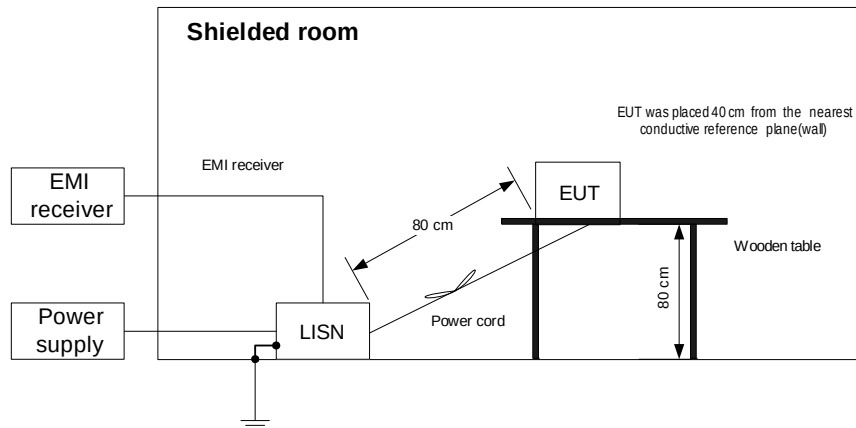
7.1.2.2 The measurements were performed at the EUT power terminals with the LISN connected to the EMI receiver in the frequency range referred to in Table 7.1.2. The unused coaxial connector of the LISN was terminated with 50 Ohm.

7.1.2.3 The position of the EUT cables was varied to find the highest emission.

7.1.2.4 The worst test results with respect to the limits were recorded in Table 7.1.2 and shown in the associated plots.

Test specification:	Section 15.107 Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 11.5		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 24.3 °C	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

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



Photograph 7.1.1 Setup for conducted emission measurements



Test specification:	Section 15.107 Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 11.5		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 24.3 °C	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

Table 7.1.2 Conducted emission test results

LINE: AC mains input of laptop AC/DC adapter
 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
 NOTE: Laptop

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*		
0.176750	54.04	52.24	64.70	-12.46	41.04	54.70	-13.66	L1	Pass
0.236625	46.73	44.89	62.25	-17.36	32.85	52.25	-19.40		
0.295000	40.84	38.19	60.42	-22.23	26.71	50.42	-23.71		
0.471738	39.33	35.86	56.53	-20.67	28.83	46.53	-17.70		
4.964475	38.31	33.62	56.00	-22.38	22.99	46.00	-23.01		
5.083100	39.61	34.12	60.00	-25.88	24.38	50.00	-25.62		
0.177500	53.60	52.11	64.66	-12.55	41.07	54.66	-13.59	L2	Pass
0.235588	47.49	44.73	62.29	-17.56	32.04	52.29	-20.25		
0.295000	41.11	38.62	60.42	-21.80	26.06	50.42	-24.36		
0.474340	39.51	35.96	56.48	-20.52	28.43	46.48	-18.05		
4.843250	38.39	34.84	56.00	-21.16	25.15	46.00	-20.85		
5.492500	38.52	33.70	60.00	-26.30	23.44	50.00	-26.56		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

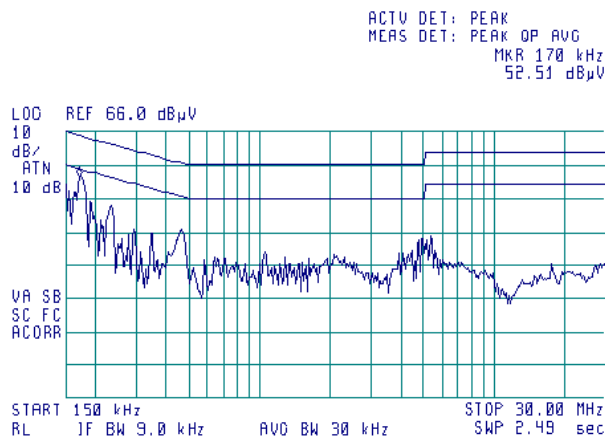
HL 0447	HL 0672	HL 0787	HL 1513	HL 2888	HL 3612		
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Full description is given in Appendix A.

Test specification:	Section 15.107 Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 11.5		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 24.3 °C	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

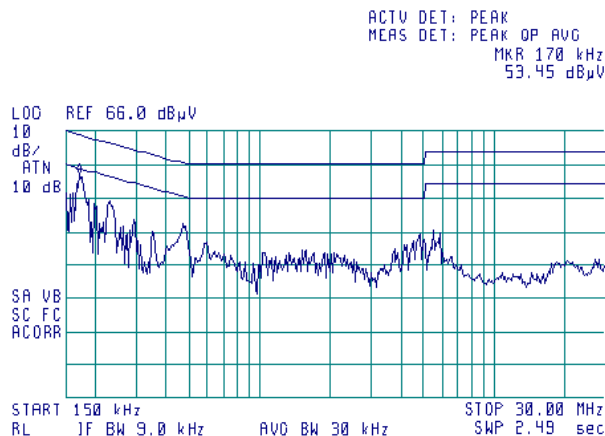
Plot 7.1.1 Conducted emission measurements, AC mains input of laptop AC/DC adapter

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



Plot 7.1.2 Conducted emission measurements, AC mains input of laptop AC/DC adapter

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





Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 23.2 °C	Air Pressure: 1015 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

7.2 Radiated emission measurements

7.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. The specification test limits are given in Table 7.2.1.

Table 7.2.1 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 a test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $\text{Lim}_{S_2} = \text{Lim}_{S_1} + 20 \log(S_1/S_2)$, where S_1 and S_2 – the standard defined and the test distance respectively in meters.

7.2.2 Test procedure

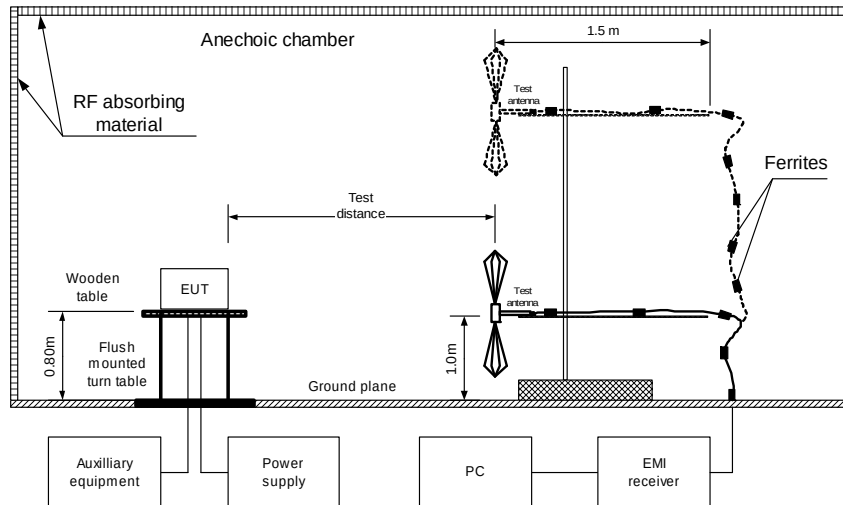
- 7.2.2.1** The EUT was set up as shown in Figure 7.2.1 and the associated photograph, energized and the EUT performance was checked.
- 7.2.2.2** The preliminary measurements were performed in the anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.
- 7.2.2.3** The EUT was set up as shown in Figure 7.2.2 and the associated photographs, energized and the EUT performance was checked.
- 7.2.2.4** The final measurements were performed at the open area test site at 10 m test distance with the antenna connected to the EMI receiver. The EUT wires and cables were arranged to produce the highest emission as it was found during the preliminary measurements. The frequencies, produced the highest emissions with respect to the limits during the preliminary test were investigated. To find the highest emission the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. At frequencies, where the high ambient noise was encountered, the final measurements were taken at 3 m distance.
- 7.2.2.5** The worst test results with respect to the limits were recorded in Table 7.2.2 and shown in the associated plots.



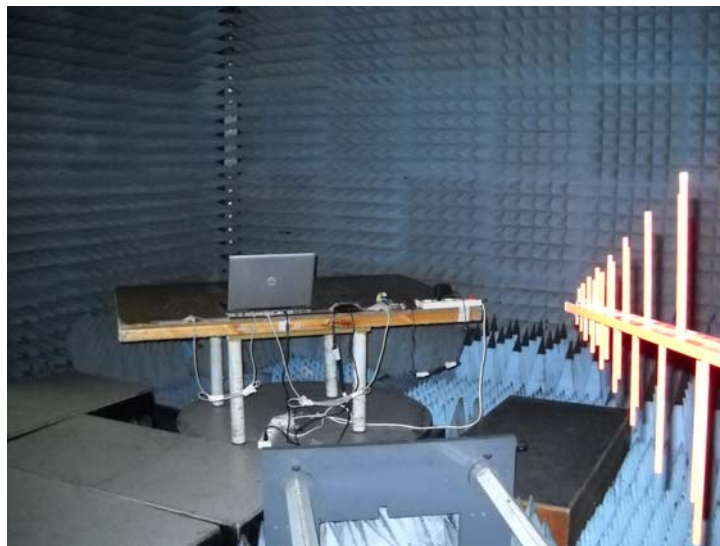
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Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 23.2 °C	Air Pressure: 1015 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

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



Photograph 7.2.1 Setup for radiated emission measurements in anechoic chamber







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Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 23.2 °C	Air Pressure: 1015 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Photograph 7.2.2 Setup for radiated emission measurements at OATS, general view



Photograph 7.2.3 Setup for radiated emission measurements at OATS, EUT cabling





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Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 23.2 °C	Air Pressure: 1015 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP
 FREQUENCY RANGE: 30 MHz – 1000 MHz
 DETECTORS USED: PEAK / QUASI-PEAK
 RESOLUTION BANDWIDTH: 120 kHz
 TEST SITE: OATS
 TEST DISTANCE: 10 m

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*				
72.747000	34.36	22.88	29.50	-6.62	Vertical	1.0	270	Pass
250.010000	33.14	29.56	35.50	-5.94	Vertical	1.0	45	

TEST SITE: OATS
 TEST DISTANCE: 3 m

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*				
204.821200	31.97	25.71	43.50	-17.79	Vertical	1.0	180	Pass

TEST SITE: SEMI ANECHOIC CHAMBER
 TEST DISTANCE: 3 m

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*				
99.900000	44.98	35.56	43.50	-7.94	Vertical	1.0	90	Pass
109.339200	39.77	32.35	43.50	-11.15	Vertical	1.5	53	

FREQUENCY RANGE: 1000 MHz – 12500 MHz
 DETECTORS USED: PEAK / AVERAGE
 RESOLUTION BANDWIDTH: 1000 kHz
 TEST SITE: ANECHOIC CHAMBER
 TEST DISTANCE: 3 m

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*				
No emissions were found.										Pass

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

HL 0032	HL 0465	HL 0521	HL 0604	HL 0784	HL 1431	HL 2109	HL 2432
HL 2697	HL 2882	HL 2909	HL 3390	HL 3884			

Full description is given in Appendix A.



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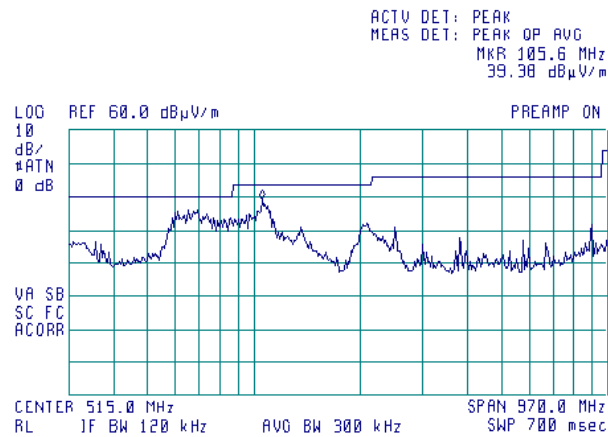
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Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 23.2 °C	Air Pressure: 1015 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

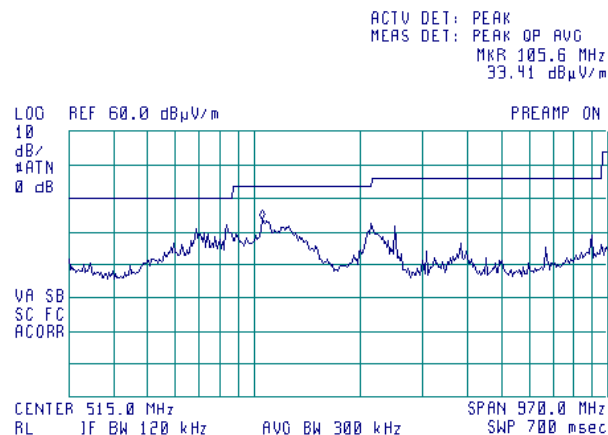
Plot 7.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



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

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m





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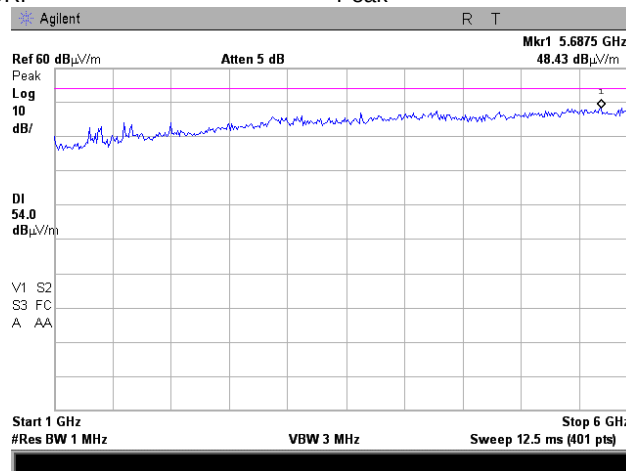
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Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 23.2 °C	Air Pressure: 1015 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

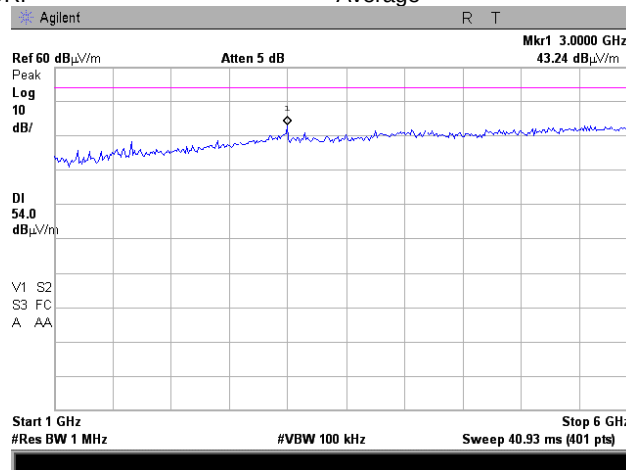
Plot 7.2.3 Radiated emission measurements in 1000 – 6000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.2.4 Radiated emission measurements in 1000 – 6000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Average





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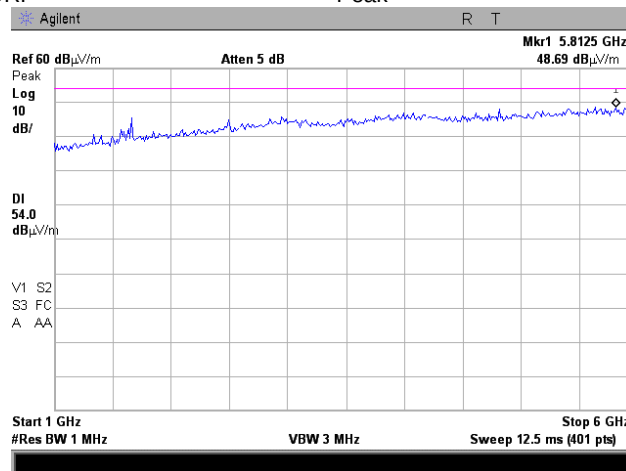
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Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 23.2 °C	Air Pressure: 1015 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

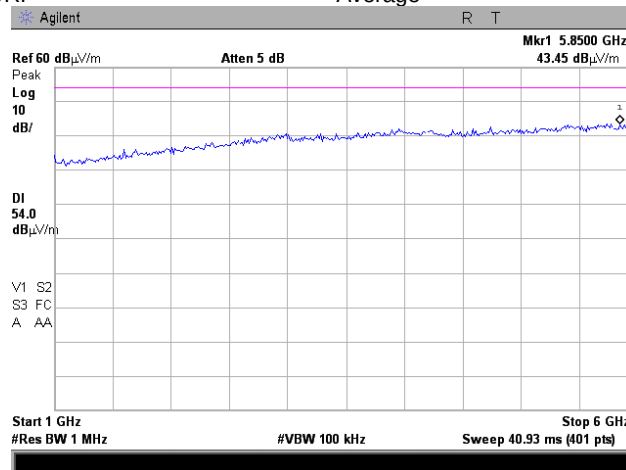
Plot 7.2.5 Radiated emission measurements in 1000 – 6000 MHz range, horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.2.6 Radiated emission measurements in 1000 – 6000 MHz range, horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Average





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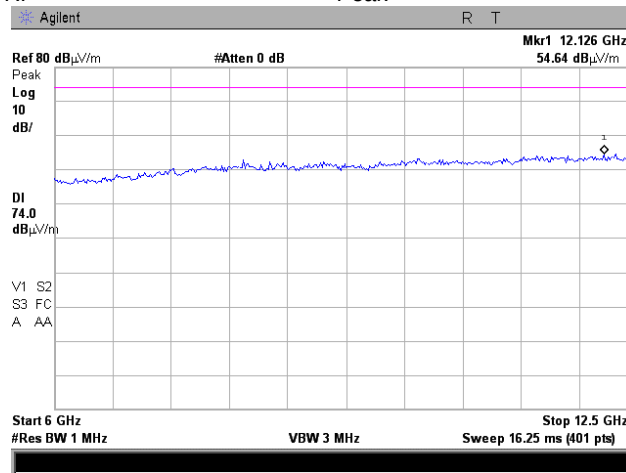
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Date of Issue: 3/13/2011

Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 23.2 °C	Air Pressure: 1015 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

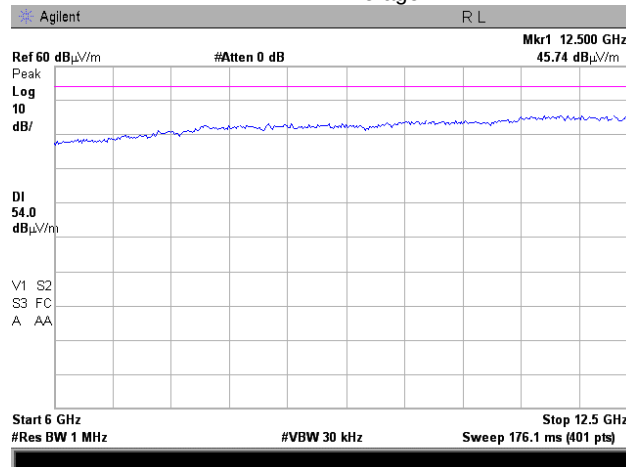
Plot 7.2.7 Radiated emission measurements in 6000 – 12500 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.2.8 Radiated emission measurements in 6000 – 12500 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Average





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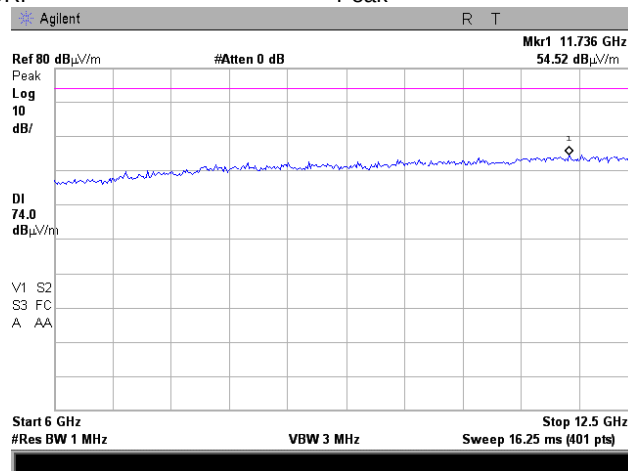
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Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date:	10/13/2010		
Temperature: 23.2 °C	Air Pressure: 1015 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

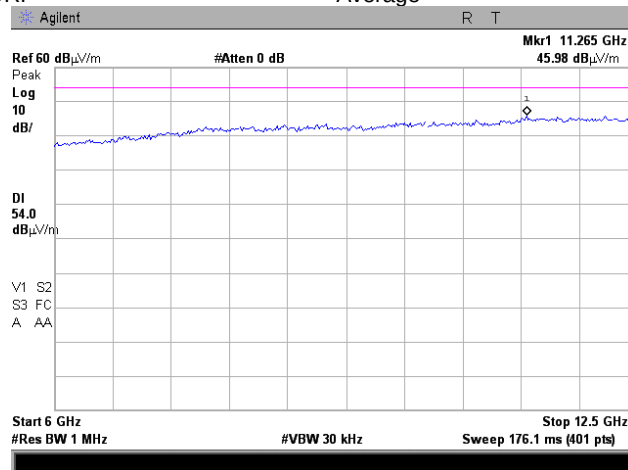
Plot 7.2.9 Radiated emission measurements in 6000 – 12500 MHz range, horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.2.10 Radiated emission measurements in 6000 – 12500 MHz range, horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Average



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./Check	Due Cal./Check
0032	Antenna, Biconical, 20 - 200 MHz	Electro-Metrics	BIA 25/30	3577	17-Jan-11	17-Jan-12
0447	LISN, 16/2, 300V RMS, 50 Ohm/50 uH + 5 Ohm, STD CISPR 16-1	Hermon Laboratories	LISN 16 - 1	066	26-Oct-10	26-Oct-11
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	Hermon Laboratories	AC - 1	023	16-Sep-10	16-Sep-11
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A00319 3448A00253	25-Aug-10	25-Aug-11
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-12
0672	Shielded Room 4,6(L) x 4,2(W) x 2,4(H) m	Hermon Laboratories	SR - 3	027	10-Nov-10	10-Nov-11
0784	Antenna X-WING BILOG, 20 MHz - 2 GHz	Schaffner-Chase EMC	CBL6140 A	1120	11-Jan-11	11-Jan-12
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard	11947A	3107A018 77	18-Oct-10	18-Oct-11
1431	Receiver RF Section, 9 kHz-2.9 GHz, part of HL1430 system	Agilent Technologies	85422E	308070026 2	25-Nov-10	25-Nov-11
1513	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1513	01-Sep-10	01-Sep-11
2109	Anechoic Chamber 6(L) x 5.5(W) x 2.95(H) m	Hermon Laboratories	AC-2	2109	10-Nov-10	10-Nov-11
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	11-Jun-10	11-Jun-11
2697	Antenna, 30 MHz - 3.0 GHz	Sunol Sciences	JB3	A022805	11-Jan-11	11-Jan-12
2882	Cable, 18 GHz N-type, M-F, 3 m	Bird Electronic Corp.	TC-MNFN-3.0	211539 001	03-Oct-10	03-Oct-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
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	07-May-10	07-May-11
3390	Microwave Cable Assembly, 26.5 GHz, 1.0 m, N type/N type	Suhner Sucoflex	104EA	3390	07-Feb-11	07-Feb-12
3612	Cable RF, 17.5 m, N type-N type	Teldor	RG-214/U	NA	01-Dec-10	01-Dec-11
3884	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type(f) in, N-type(m) out.	Agilent Technologies	87405C	MY470104 18	13-Jan-11	13-Jan-12

9 APPENDIX B 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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10 APPENDIX C Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AVRG	average (detector)
BB	broad band
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
DC	direct current
EMC	electromagnetic compatibility
EMI	electromagnetic interference
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
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
s	second
V	volt
W	width

11 APPENDIX D Test equipment correction factors

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

Voltage division factor (insertion loss)

No.	Parameter	Applied, kHz	Measured (L1), dB	Measured (L2), dB	Uncertainty, dB
1	Voltage division factor (insertion loss)	150	0.11	0.14	±0.22
2		170	0.10	0.14	±0.22
3		200	0.09	0.13	±0.22
4		250	0.08	0.13	±0.22
5		300	0.08	0.12	±0.22
6		350	0.07	0.12	±0.22
7		400	0.07	0.11	±0.22
8		500	0.07	0.12	±0.22
9		600	0.07	0.12	±0.22
10		700	0.07	0.12	±0.22
11		800	0.07	0.12	±0.22
12		900	0.07	0.12	±0.22
13		1000	0.07	0.12	±0.22
14		1200	0.08	0.12	±0.22
15		1500	0.08	0.12	±0.22
16		2000	0.08	0.13	±0.22
17		2500	0.08	0.14	±0.22
18		3000	0.09	0.14	±0.22
19		4000	0.09	0.15	±0.22
20		5000	0.10	0.16	±0.22
21		7000	0.12	0.18	±0.22
22		10000	0.14	0.20	±0.22
23		15000	0.19	0.25	±0.22
24		20000	0.25	0.30	±0.22
25		30000	0.43	0.47	±0.22

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

Antenna calibration
Sunol Sciences Inc., model JB3, serial number A022805

Frequency, MHz	Antenna factor, dB(1/m)
30	22.7
35	18.4
40	14.5
45	10.9
50	8.3
60	7.9
70	9.0
80	9.3
90	9.7
100	11.2
120	14.4
140	13.7
160	13.8
180	11.8
200	12.8
250	12.3
300	13.4
400	16.0
500	17.7
600	18.1
700	20.7
800	21.1
900	22.2
1000	23.1
1100	24.2
1200	25.1
1300	25.1
1400	25.8
1500	26.3
1600	27.6
1700	28.1
1800	27.9
1900	28.1
2000	28.3
2500	31.9
3000	34.0

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to obtain field strength in dB(μ V/m).

Biconical antenna factor

Electro-Metrics, model BIA-25/30, serial number 3577

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
20	15.1	115	16.7
25	14.6	120	14.1
30	13.7	125	13.1
35	11.8	130	13.0
40	11.4	135	12.9
45	11.7	140	12.7
50	11.4	145	12.5
55	10.5	150	14.3
60	10.3	155	14.8
65	8.9	160	14.7
70	7.6	165	15.1
75	7.3	170	15.6
80	7.3	175	16.5
85	7.8	180	16.7
90	9.4	185	17.3
95	10.6	190	17.9
100	11.8	195	17.6
105	12.5	200	17.9
110	13.7		

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, serial number 1011

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

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).

Biconilog antenna factor
Schaffner Chase EMC, model CBL 6140A, serial number 1120

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
20	12.1	600	19.1
22	8.8	620	19.8
24	5.5	640	20.6
26	3.0	660	20.7
28	2.8	680	20.9
30	3.9	700	21.0
40	8.4	720	21.4
50	9.3	740	21.7
60	9.7	760	21.6
70	9.3	780	21.6
80	7.5	800	21.9
90	6.8	820	22.2
100	7.6	840	22.6
110	6.6	860	22.7
120	6.9	880	22.7
140	7.6	900	22.9
160	11.6	920	23.2
170	8.3	940	23.7
190	9.2	960	24.3
200	9.9	980	24.6
220	10.5	1000	24.4
240	11.2	1.060	24.3
260	12.9	1.120	24.8
280	12.1	1.180	25.3
300	12.9	1.240	26.1
320	13.2	1.300	26.9
340	13.9	1.360	27.6
360	15.2	1.420	26.8
380	15.3	1.480	26.9
400	15.7	1.520	28.1
420	16.6	1.560	28.1
440	16.8	1.640	28.2
460	17.6	1.700	28.6
480	18.3	1.760	30.0
500	18.0	1.840	31.3
520	18.0	1.900	31.8
540	18.7	1.960	31.6
560	19.2	2.000	32.0
580	19.0		

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
Double-ridged waveguide horn antenna
EMC Test Systems, model 3115, serial number: 00027177

Frequency, MHz	Antenna factor. dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.8
2500.0	28.9
3000.0	30.7
3500.0	31.8
4000.0	33.0
4500.0	32.8
5000.0	34.2
5500.0	34.9
6000.0	35.2
6500.0	35.4
7000.0	36.3
7500.0	37.3
8000.0	37.5
8500.0	38.0
9000.0	38.3
9500.0	38.3
10000.0	38.7
10500.0	38.7
11000.0	38.9
11500.0	39.5
12000.0	39.5
12500.0	39.4
13000.0	40.5
13500.0	40.8
14000.0	41.5
14500.0	41.3
15000.0	40.2
15500.0	38.7
16000.0	38.5
16500.0	39.8
17000.0	41.9
17500.0	45.8
18000.0	49.1

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).

12 APPENDIX E Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions at mains port with LISN and HP 8542E or HP 8546A receiver	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

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.

13 APPENDIX F Specification references

FCC 47CFR part 15: 2009 subpart B	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.
CISPR 16-1-1: 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus

END OF DOCUMENT