

TEST REPORT

ACCORDING TO: FCC Part 15 Subpart B, RSS-Gen issue 2:2007 and
ICES-003 Issue 4:2004

FOR:

Visonic Ltd.

Wireless alarm control system

Model:PowerMaxComplete

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.
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1 Applicant information

Client name: Visonic Ltd.
Address: 24 Habarzel street, Tel Aviv 61920, Israel
Telephone: +972 3645 6714
Fax: +972 3645 6788
E-mail: aelshtein@visonic.com
Contact name: Mr. Arik Elshtein

2 Equipment under test attributes

Product name: Wireless alarm control system
Product type: Transmitter
Model(s): PowerMaxComplete
Receipt date 5/16/2007

3 Manufacturer information

Manufacturer name: Visonic Ltd.
Address: 24 Habarzel street, Tel Aviv 61920, Israel
Telephone: +972 3645 6714
Fax: +972 3645 6788
E-Mail: aelshtein@visonic.com
Contact name: Mr. Arik Elshtein

4 Test details

Project ID: 17939
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 5/16/2007
Test completed: 3/21/2008
Test specification(s): FCC Part 15, subpart B; RSS-Gen issue 2:2007; ICES-003 issue 4:2004

5 Tests summary

Test	Status
FCC Part 15, Section 107 / RSS-Gen, Section 7.2. 2/ ICES-003, Conducted emission at AC power port	Pass
FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3.2/ICES-003, Radiated emission	Pass
FCC Part 15, Section 111 / RSS-Gen, Section 6(b), Section 7.2.3.1, Conducted emission at receiver antenna port	Not required

Testing was completed against the 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.

This test report replaces the previously issued test report identified by Doc ID:VISEMC_FCC.17939.

	Name and Title	Date	Signature
Tested by:	Mr. S. Samokha, test engineer	March 21, 2008	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	March 30, 2008	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	March 31, 2008	

6 EUT description

6.1 General information

The EUT is a wireless alarm control system operating at 315 MHz. The product includes GSM modem (FCC certified for modular approval) and proximity reader transceiver@131 kHz. The EUT transmits alarm messages to Visonic's wireless siren and receives alarm messages from various wireless detectors. The device utilizes integral antennas, separate for each radio. Once event was encountered the system also automatically reports via a public telephone network. The EUT is powered from AC mains and is equipped with a rechargeable backup battery pack.

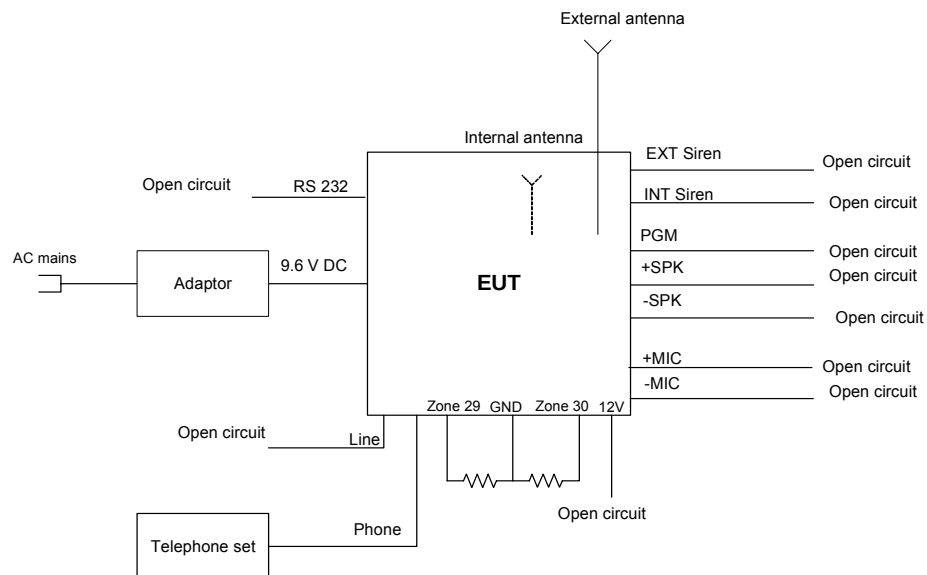
6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Power	DC power	EUT	AC/DC adaptor	Terminal block	1	Unshielded	2 m	Indoor
Power	AC mains	EUT	AC mains	Terminal block	1	Unshielded	2 m	Indoor
Signal	RS 232	EUT	Open circuit	RJ 45	1	Unshielded	2 m	Indoor
Telecom	Line	EUT	Open circuit	RJ 11	1	Unshielded	2 m	Outdoor
Signal	Set	EUT	Telephone set	RJ 11	1	Unshielded	2 m	Indoor
Signal	Zone 29, 30	EUT	Termination	Terminal block	2	Unshielded	2 m	Indoor
Signal	12V+	EUT	Open circuit	Terminal block	1	Unshielded	2 m	Indoor
Signal	MIC	EUT	Open circuit	Terminal block	1	Unshielded	2 m	Indoor
Signal	SPK	EUT	Open circuit	Terminal block	1	Unshielded	2 m	Indoor
Signal	EXT Siren	EUT	Open circuit	Terminal block	1	Unshielded	2 m	Indoor
Signal	INT Siren	EUT	Open circuit	Terminal block	1	Unshielded	2 m	Indoor
Signal	PGM	EUT	Open circuit	Terminal block	1	Unshielded	2 m	Indoor

6.3 Changes made in the EUT

No changes were implemented.

6.4 Test configuration



Test specification:	Section 15.107/RSS-Gen, Section 7.2.2/ICES-003 Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 11.5		
Test mode:	Compliance	Verdict: PASS	
Date & Time:	2/22/2008 1:24:15 PM		
Temperature: 22.8 °C	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 120VAC
Remarks:			

7 Emissions tests

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 7.1.2.

Table 7.1.1 Limits for conducted emissions according to FCC Part 15, Section 107 and ICES-003, Section 5

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.

Table 7.1.2 Limits for conducted emissions according to RSS-Gen, Section 7.2.2

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.

7.1.2 Test procedure

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

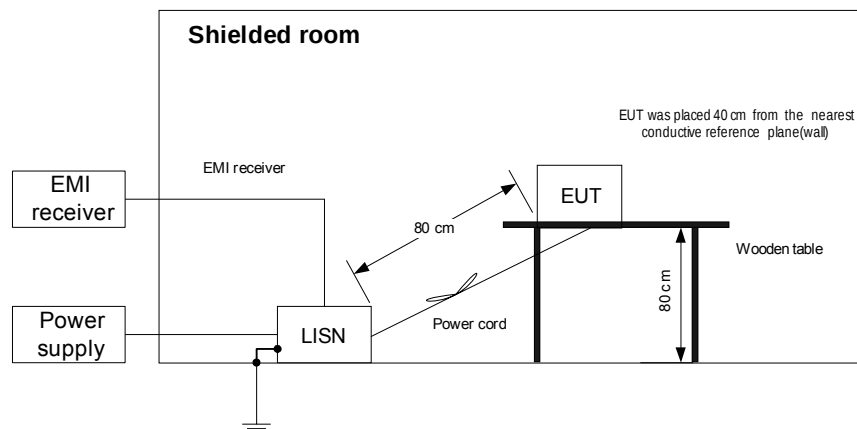
7.1.2.2 The measurements were performed at the EUT power terminals with the LISN connected to the EMI receiver in the frequency range referred to in Table 7.1.2. The unused coaxial connector of the LISN was terminated with 50 Ohm.

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/RSS-Gen, Section 7.2.2/ICES-003 Class B, AC power lines conducted emissions	
Test procedure:		ANSI C63.4, Section 11.5	
Test mode:		Verdict: PASS	
Compliance			
Date & Time:		2/22/2008 1:24:15 PM	
Temperature: 22.8 °C	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 120VAC
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/RSS-Gen, Section 7.2.2/ICES-003 Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 11.5		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/22/2008 1:24:15 PM		
Temperature: 22.8 °C	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 120VAC
Remarks:			

Table 7.1.3 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

Without rechargeable battery

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*		
0.158590	55.29	52.81	65.58	-12.77	40.33	55.58	-15.25	L1	Pass
0.166229	55.13	52.86	65.21	-12.35	42.42	55.21	-12.79		
0.196245	48.60	45.69	63.80	-18.11	27.56	53.80	-26.24		
0.365308	42.81	40.95	58.66	-17.71	33.55	48.66	-15.11		
0.530627	38.41	35.93	56.00	-20.07	28.28	46.00	-17.72		
0.162860	55.69	54.00	65.37	-11.37	42.88	55.37	-12.49	L2	Pass
0.165432	55.90	53.41	65.25	-11.84	41.41	55.25	-13.84		
0.198961	49.39	47.24	63.69	-16.45	32.86	53.69	-20.83		
0.390058	40.79	38.10	58.07	-19.97	25.66	48.07	-22.41		

*- Margin = Measured emission - specification limit.

With rechargeable battery

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*		
0.179986	53.96	51.71	64.54	-12.83	40.29	54.54	-14.25	L1	Pass
0.181262	54.24	51.63	64.48	-12.85	41.40	54.48	-13.08		
0.224167	47.22	44.12	62.72	-18.60	31.57	52.72	-21.15		
0.363842	43.64	40.72	58.69	-17.97	33.98	48.69	-14.71		
0.468429	41.66	39.19	56.59	-17.40	26.96	46.59	-19.63		
1.136518	40.45	36.00	56.00	-20.00	25.34	46.00	-20.66		
0.180247	54.45	52.20	64.52	-12.32	38.01	54.52	-16.51	L2	Pass
0.226877	46.71	44.43	62.62	-18.19	29.85	52.62	-22.77		
0.376616	43.03	40.27	58.39	-18.12	28.93	48.39	-19.46		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

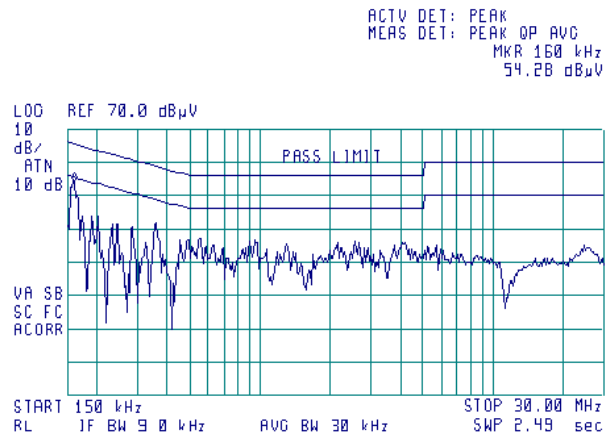
HL 0163	HL 0787	HL 1430	HL 1502	HL 1510			
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Full description is given in Appendix A.

Test specification:		Section 15.107/RSS-Gen, Section 7.2.2/ICES-003 Class B, AC power lines conducted emissions	
Test procedure:		ANSI C63.4, Section 11.5	
Test mode:		Verdict: PASS	
Compliance			
Date & Time:		2/22/2008 1:24:15 PM	
Temperature: 22.8 °C		Air Pressure: 1015 hPa	
		Relative Humidity: 38 %	
		Power Supply: 120VAC	
Remarks:			

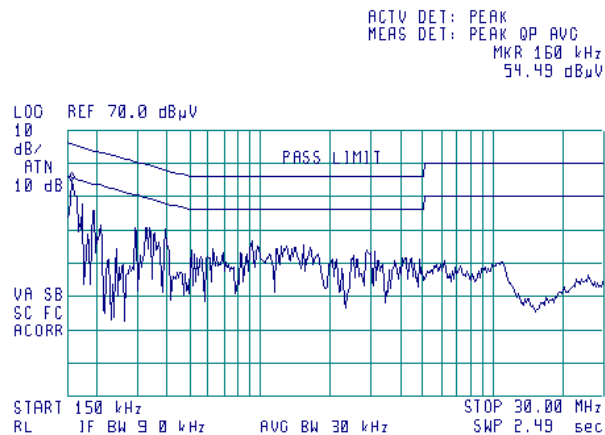
Plot 7.1.1 Conducted emission measurements

LINE: L1
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK
NOTE: Without battery



Plot 7.1.2 Conducted emission measurements

LINE: L2
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK
NOTE: Without battery

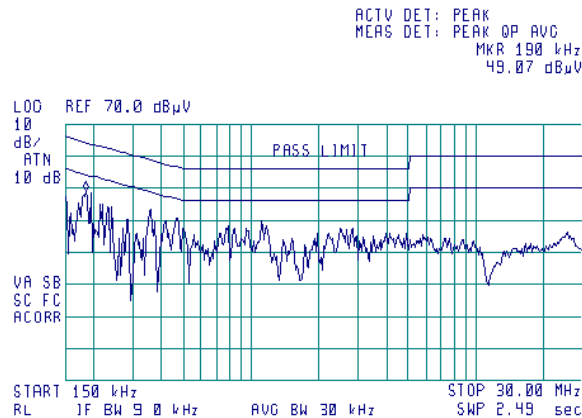




Test specification:	Section 15.107/RSS-Gen, Section 7.2.2/ICES-003 Class B, AC power lines conducted emissions		
Test procedure:	ANSI C63.4, Section 11.5		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/22/2008 1:24:15 PM		
Temperature: 22.8 °C	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 120VAC
Remarks:			

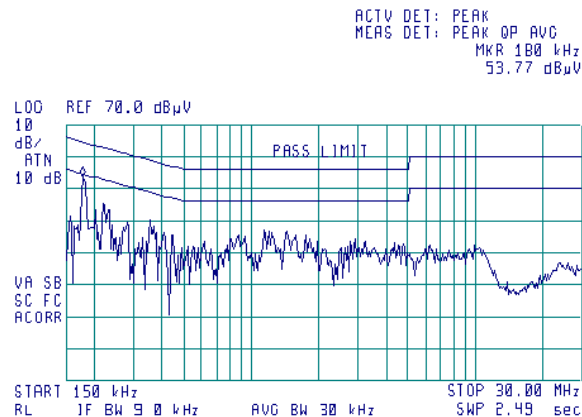
Plot 7.1.3 Conducted emission measurements

LINE: L1
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK
NOTE: With battery



Plot 7.1.4 Conducted emission measurements

LINE: L2
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK
NOTE: With battery



Test specification:	Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/28/2008 3:33:08 PM		
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	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 7.2.2, Table 7.2.3.

Table 7.2.1 Radiated emission test limits according to FCC Part 15, Section 109

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*

Table 7.2.2 Radiated emission limits according to ICES-003, Section 5

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 - 230	30	40.5*	40	50.5*
230 - 1000	37	47.5*	47	57.5*

* - 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.

Table 7.2.3 Radiated emission limits according to RSS-Gen, Section 7.2.3.2

Frequency, MHz	Field strength limit at 3 m test distance, dB(μV/m)
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
960 - 3 rd harmonic**	54.0

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



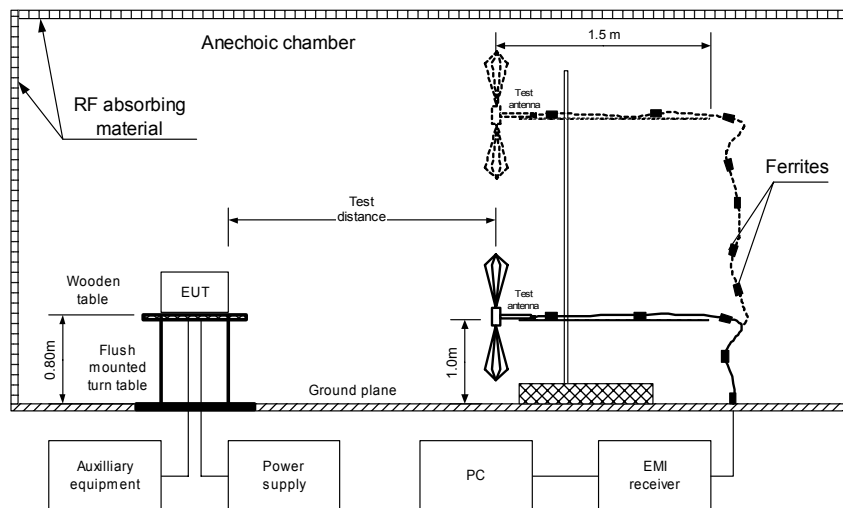
Test specification:		Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions	
Test procedure:		ANSI C63.4, Section 11.6	
Test mode:		Compliance	Verdict: PASS
Date & Time:		2/28/2008 3:33:08 PM	
Temperature: 22 °C		Air Pressure: 1011 hPa	Relative Humidity: 47 %
Remarks:		Power Supply: 120 VAC	

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 test distance given in Table 7.2.2 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.
- 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.

Test specification:	Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict: PASS	
Date & Time:	2/28/2008 3:33:08 PM		
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

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

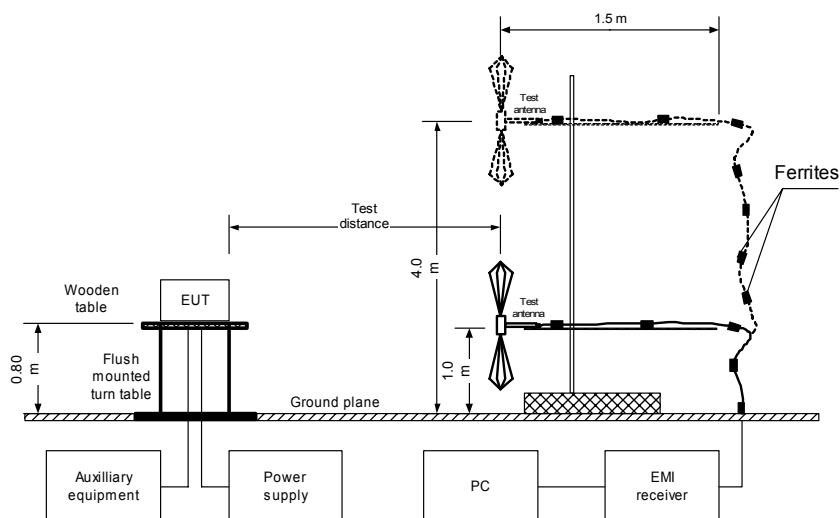


Photograph 7.2.1 Setup for preliminary radiated emission measurements



Test specification:	Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict: PASS	
Date & Time:	2/28/2008 3:33:08 PM		
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Figure 7.2.2 Setup for radiated emission measurements at OATS, table-top EUT

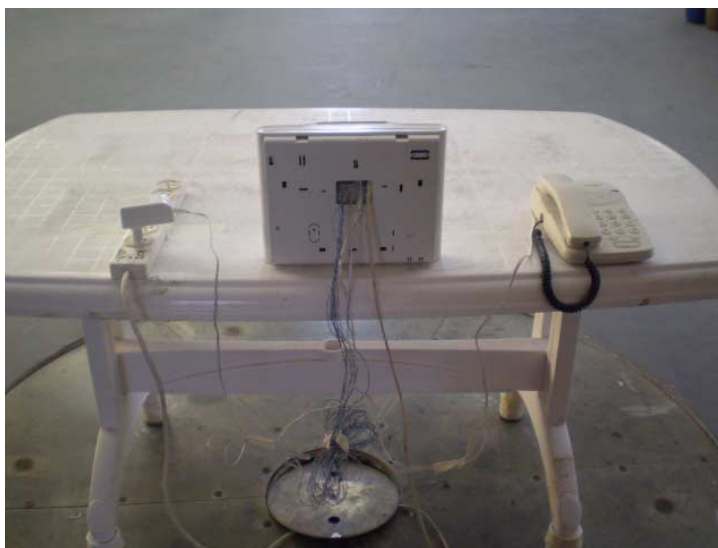


Test specification:	Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/28/2008 3:33:08 PM		
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Photograph 7.2.2 Setup for final radiated emission measurements, general view



Photograph 7.2.3 Setup for final radiated emission measurements, EUT cabling



Test specification:	Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict: PASS	
Date & Time:	2/28/2008 3:33:08 PM		
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.4 Radiated emission test results

EUT SET UP: TABLE-TOP
TEST SITE: OATS
TEST DISTANCE: 10 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*				
277.330000	26.44	18.51	35.5 (see Note)	-16.99	V	1.2	255	Pass

Note: calculated limit

EUT SET UP: TABLE-TOP
TEST SITE: OATS
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*				
30.055600	26.97	20.75	40.00	-19.25	V	1.0	0	Pass
32.003500	21.35	15.18	40.00	-24.82	H	1.0	0	
80.387400	28.89	22.42	40.00	-17.58	V	1.1	28	

TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 9500 MHz
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
5033.733	48.67	41.67	54.0	-12.33	V	1.0	0	Pass
5033.733	51.83	48.00	54.0	-6.00	H	1.0	165	

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

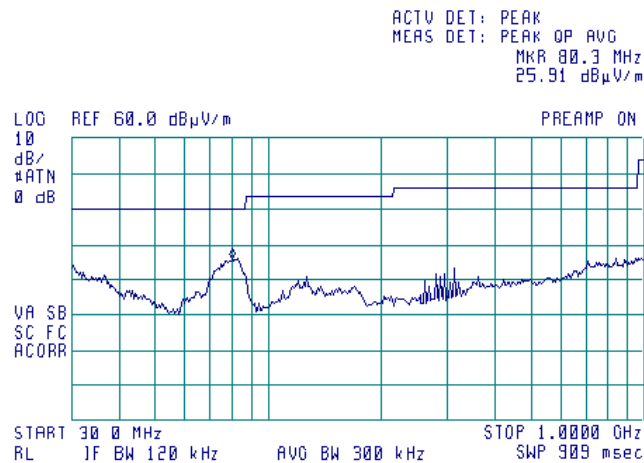
HL 0410	HL 0415	HL 0566	HL 0784	HL 0812	HL 0813	HL 1424	HL 1425
HL 1430	HL 1553	HL 1566	HL 1984	HL 2499	HL 2697	HL 2910	

Full description is given in Appendix A.

Test specification:	Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/28/2008 3:33:08 PM		
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

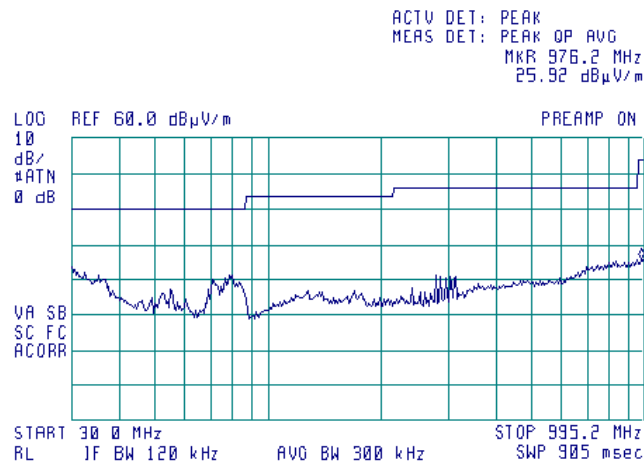
Plot 7.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



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

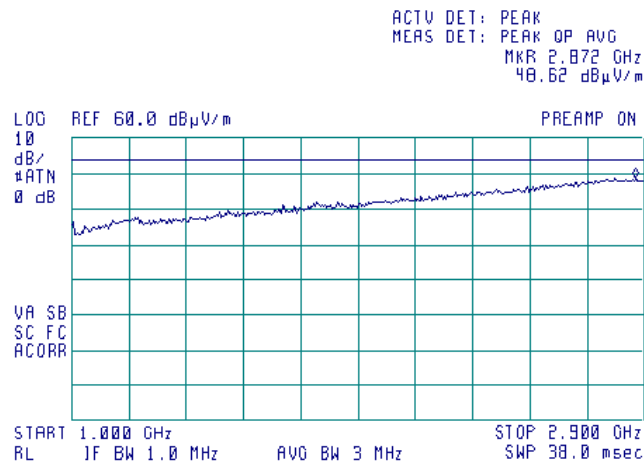
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Test specification:		Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions	
Test procedure:		ANSI C63.4, Section 11.6	
Test mode:		Compliance	Verdict: PASS
Date & Time:		2/28/2008 3:33:08 PM	
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

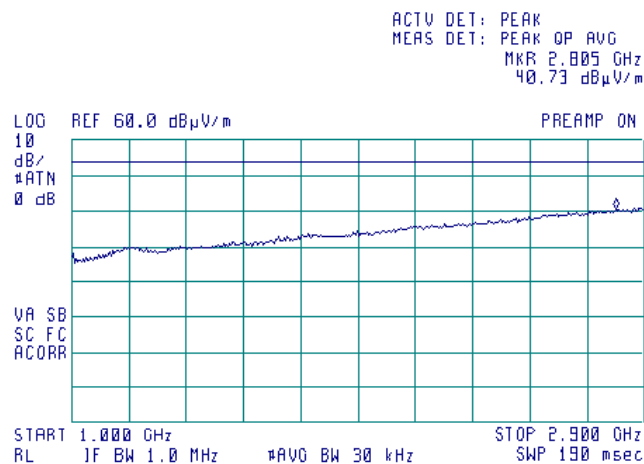
Plot 7.2.3 Radiated emission measurements in 1000 – 2900 MHz, vertical antenna polarization

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



Plot 7.2.4 Radiated emission measurements in 1000 – 2900 MHz, vertical antenna polarization

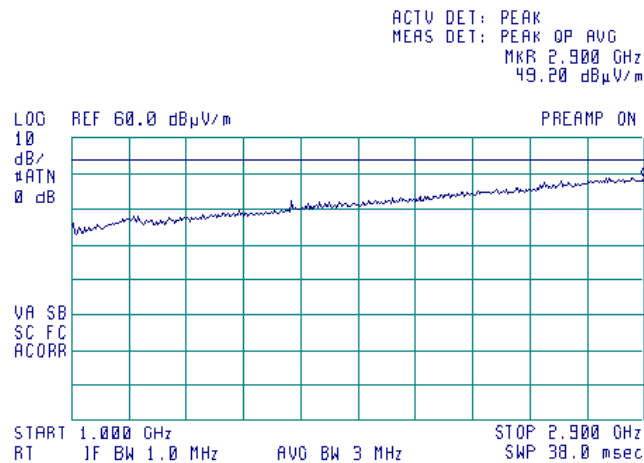
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:		Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions	
Test procedure:		ANSI C63.4, Section 11.6	
Test mode:		Verdict:	
Date & Time:		PASS	
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

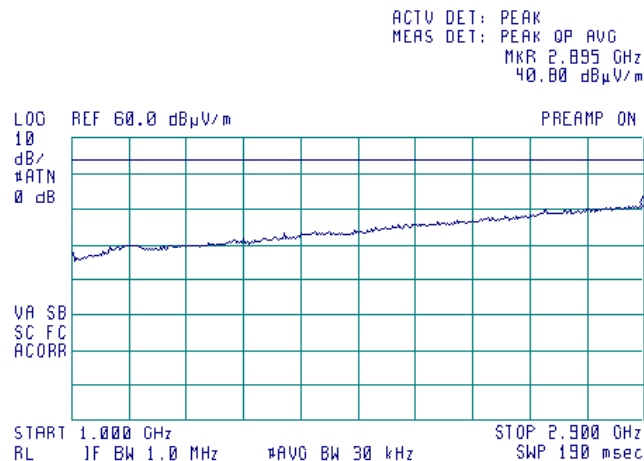
Plot 7.2.5 Radiated emission measurements in 1000 – 2900 MHz, horizontal antenna polarization

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



Plot 7.2.6 Radiated emission measurements in 1000 – 2900 MHz, horizontal antenna polarization

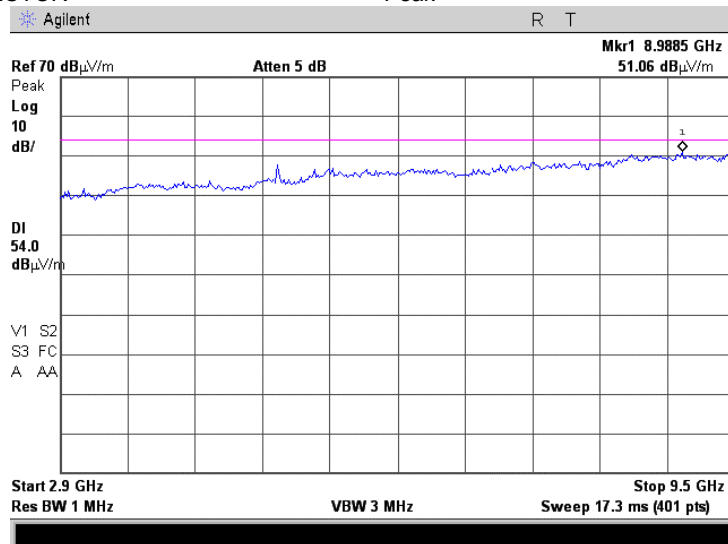
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:		Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions	
Test procedure:		ANSI C63.4, Section 11.6	
Test mode:		Compliance	Verdict: PASS
Date & Time:		2/28/2008 3:33:08 PM	
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

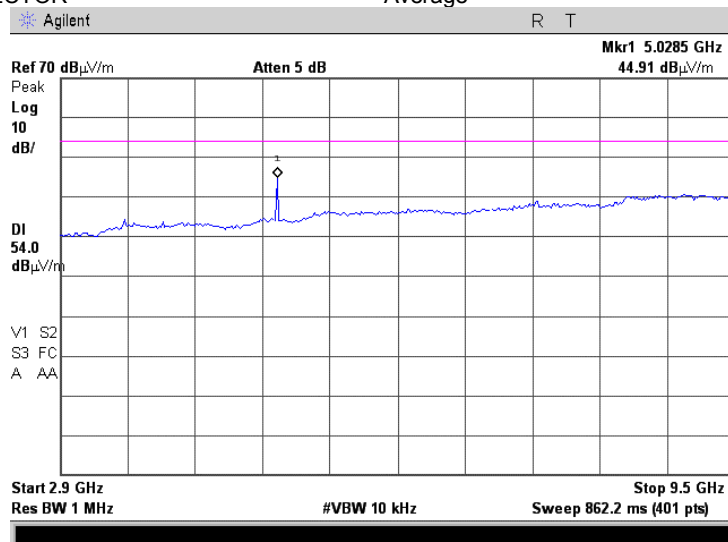
Plot 7.2.7 Radiated emission measurements in 2900 – 9500 MHz, vertical antenna polarization

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



Plot 7.2.8 Radiated emission measurements in 2900 – 9500 MHz, vertical antenna polarization

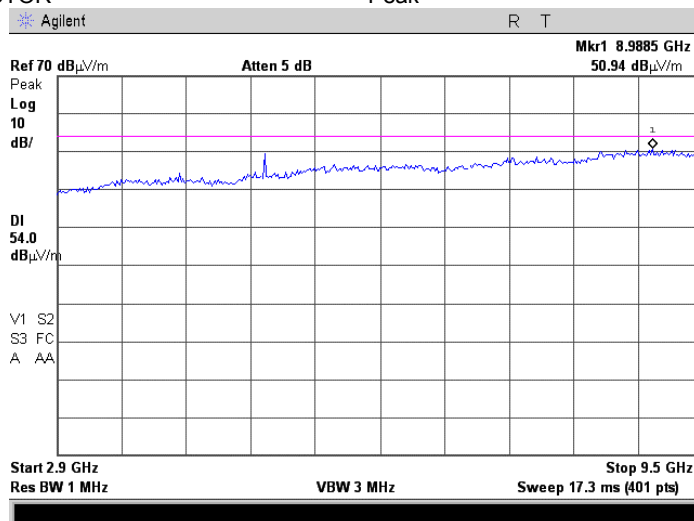
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 15.109/ RSS-Gen, Section 7.2.3 / ICES-003 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/28/2008 3:33:08 PM		
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

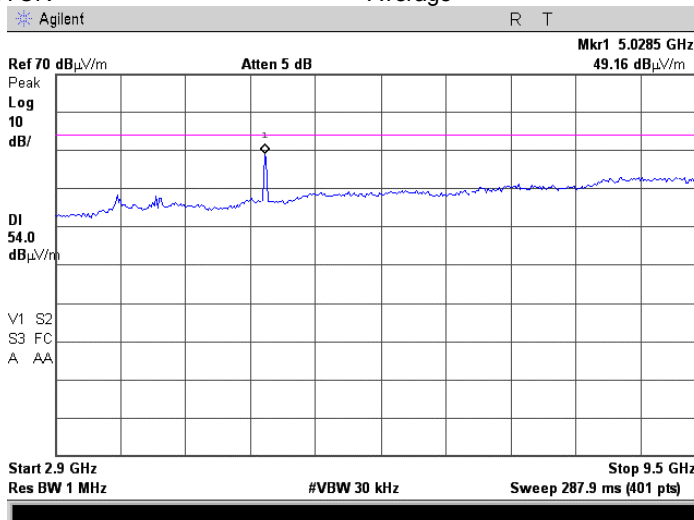
Plot 7.2.9 Radiated emission measurements in 2900 – 9500 MHz, horizontal antenna polarization

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



Plot 7.2.10 Radiated emission measurements in 2900 – 9500 MHz, 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.	Due Cal.
0163	LISN FCC/VDE/50 Ohm/50 uH + 5 Ohm, MIL-STD-461E, CISPR 16-1	Electro-Metrics	ANS 25/2	1314	20-Nov-07	20-Nov-08
0410	Cable, Coax, Microwave, DC-18 GHz, N-N, 1 m	Gore	PFP01P0 1039.4	9338767	30-Dec-07	30-Dec-08
0415	Cable, Coax, RF, RG-214	HL	CC-3	056	02-Dec-07	02-Dec-08
0566	Antenna, Biconical, 20 - 200 MHz	Electro-Metrics	BIA 25/30	3566	25-Sep-07	25-Sep-08
0784	Antenna X-WING BILOG, 20 MHz - 2 GHz	Schaffner-Chase EMC	CBL6140 A	1120	10-Jan-08	10-Jan-09
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard Co	11947A	3107A018 77	21-Nov-07	21-Nov-08
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	HL	C214-11	148	02-Dec-07	02-Dec-08
0813	Cable Coax, RG-214, 12 m, N-type connectors	HL	C214-12	149	02-Dec-07	02-Dec-08
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	28-Aug-07	28-Aug-08
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A002 22, 3705A002 04	31-Aug-07	31-Aug-08
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A002 62,3705A0 0217	31-Aug-07	31-Aug-08
1502	Cable RF, 6 m, BNC/BNC	Belden	M17/167 MIL-C-17	1502	16-Nov-07	16-Nov-08
1510	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1510	30-Dec-07	30-Dec-08
1553	Cable RF, 3.5 m	Alpha Wire	RG-214	1553	22-May-07	22-May-08
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	02-Dec-07	02-Dec-08
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	03-Mar-08	03-Mar-09
2499	Quadruplexer 1-12 GHz (1-2 GHz; 2-4GHz;4-8 GHz; 8-12GHz)	Elettronica S.p.A. - Roma	UE 84	D/00239	08-Feb-07	08-Feb-09
2697	Antenna, 30 MHz - 3.0 GHz	Sunol Sciences. Corp. Pleasanton, California USA	JB3	A022805	10-Jan-08	10-Jan-09
2910	Cable 18 GHz, 3 m, SMA-SMA	Gore	NA	989370	05-Oct-07	05-Oct-08

9 APPENDIX B 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.

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).

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11 APPENDIX D Specification references

FCC 47CFR part 15: 2007 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
RSS-Gen Issue 2:2007	General Requirements and Information for the Certification of Radiocommunication Equipment
ICES-003 Issue 4: 2004	Digital Apparatus
CAN/CSA-CEI/IEC CISPR 22: 02	Information Technology Equipment- Radio Disturbance Characteristics- Limits and Methods of measurement

12 APPENDIX E Test equipment correction factors

Correction factor
Line impedance stabilization network
Model ANS-25/2, Electro-Metrics, HL 0163

Frequency, MHz	Correction factor, dB	Frequency, MHz	Correction factor, dB
0.01	4.7	3	0.1
0.02	2.1	4	0.1
0.03	1.1	6	0.1
0.04	0.7	10	0.1
0.05	0.5	12	0.1
0.1	0.2	16	0.1
0.2	0.1	18	0.1
0.4	0.1	20	0.1
0.6	0.1	25	0.1
0.8	0.1	28	0.1
1	0.1	30	0.1
2	0.1		

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

Antenna factor
Biconical antenna
Electro-Metrics, model BIA-25/30
Ser.No.3566, HL 0566

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
30	14.7	120	16.8
35	12.9	125	15.5
40	12.6	130	15.5
45	12.8	135	15.1
50	12.6	140	14.8
55	11.8	145	15.1
60	11.7	150	16.9
65	10.4	155	17.2
70	9.2	160	17.3
75	9.1	165	17.8
80	9.1	170	18.3
85	9.5	175	19.0
90	11.2	180	19.5
95	12.6	185	20.0
100	13.7	190	20.4
105	14.2	195	20.5
110	15.3	200	20.6
115	17.1		

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).

Antenna factor
Biconilog antenna
CHASE Model CBL6140A
Serial no: 1120, HL 0784

Frequency, MHz	Antenna factor, dB
30.0	4.3
35.0	7.3
40.0	8.8
45.0	9.3
50.0	9.6
60.0	9.9
70.0	9.2
80.0	7.6
90.0	7.6
100.0	8.8
120.0	7.2
125.0	7.5
140.0	7.7
150.0	7.9
160.0	11.4
175.0	8.6
180.0	8.8
200.0	9.8
250.0	12.5
300.0	12.2
350.0	14.8
400.0	16.1
450.0	16.5
500.0	17.6
550.0	18.3
600.0	18.5
650.0	19.8
700.0	20.1
750.0	20.8
800.0	21.2
850.0	22.0
900.0	22.2
950.0	23.2
1000.0	23.8

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 wave guide horn antenna
Model 3115, S/N 9911-5964, HL1984

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

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

Antenna calibration
Sunol Sciences Inc., model JB3, serial number A022805, HL 2697

Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain
30	22.2	-22.5	0.01	620	19.7	6.3	4.27	1215	24.9	7.0	5.05	1810	28.3	7.1	5.08	2405	30.9	6.9	4.93
40	14.7	-12.5	0.06	630	19.6	6.6	4.57	1225	25.1	6.9	4.91	1820	28.6	6.8	4.74	2415	31.0	6.9	4.85
45	11.3	-8.1	0.16	635	19.7	6.5	4.48	1230	25.2	6.8	4.82	1825	28.7	6.8	4.75	2420	31.0	6.8	4.82
45	11.3	-8.1	0.16	640	19.9	6.4	4.40	1235	25.1	7.0	4.96	1830	28.7	6.8	4.76	2425	31.1	6.8	4.81
50	8.9	-4.7	0.34	645	19.9	6.5	4.45	1240	25.0	7.1	5.09	1835	28.7	6.7	4.72	2430	31.0	6.9	4.87
55	7.9	-2.8	0.52	650	19.9	6.5	4.51	1245	25.0	7.1	5.12	1840	28.8	6.7	4.69	2435	31.0	6.9	4.88
60	7.8	-2.1	0.62	655	19.9	6.6	4.60	1250	25.0	7.1	5.15	1845	28.6	6.9	4.90	2440	31.2	6.8	4.74
70	9.0	-1.9	0.64	665	19.9	6.7	4.70	1260	24.9	7.3	5.36	1855	28.5	7.0	5.07	2450	31.0	7.0	4.96
75	8.8	-1.1	0.78	670	20.0	6.7	4.71	1265	25.0	7.3	5.31	1860	28.6	7.0	5.01	2455	31.0	7.0	5.01
80	8.4	-0.2	0.97	675	20.1	6.7	4.71	1270	25.1	7.2	5.26	1865	28.5	7.1	5.17	2460	30.9	7.2	5.19
85	8.0	0.8	1.20	680	20.1	6.7	4.71	1275	25.3	7.0	5.05	1870	28.4	7.3	5.33	2465	31.1	6.9	4.95
90	8.2	1.1	1.29	685	20.1	6.8	4.79	1280	25.5	6.8	4.84	1875	28.4	7.2	5.28	2470	31.3	6.8	4.76
95	9.2	0.5	1.13	690	20.1	6.9	4.88	1285	25.4	7.0	4.97	1880	28.5	7.2	5.22	2475	31.4	6.7	4.99
100	10.6	-0.4	0.92	695	20.2	6.8	4.82	1290	25.3	7.1	5.10	1885	28.5	7.2	5.22	2480	31.3	6.8	4.79
110	12.6	-1.6	0.70	705	20.4	6.8	4.75	1300	25.2	7.3	5.33	1895	28.6	7.2	5.24	2490	31.1	7.0	4.99
115	13.3	-1.9	0.65	710	20.5	6.8	4.75	1305	25.3	7.2	5.21	1900	28.6	7.2	5.27	2495	31.2	7.0	4.99
120	13.9	-2.1	0.62	715	20.5	6.8	4.80	1310	25.5	7.1	5.09	1905	28.5	7.3	5.36	2500	30.9	7.2	5.27
125	14.2	-2.0	0.63	720	20.5	6.9	4.85	1315	25.4	7.2	5.23	1910	28.5	7.4	5.45	2505	31.1	7.1	5.15
130	14.2	-1.7	0.68	725	20.6	6.8	4.81	1320	25.3	7.3	5.38	1915	28.5	7.3	5.38	2510	31.0	7.2	5.22
135	13.8	-1.0	0.79	730	20.7	6.8	4.77	1325	25.5	7.2	5.21	1920	28.6	7.3	5.31	2515	31.0	7.2	5.26
140	13.4	-0.3	0.94	735	20.9	6.7	4.65	1330	25.6	7.0	5.06	1925	28.6	7.3	5.35	2520	31.2	7.0	5.05
150	12.9	0.8	1.21	745	21.0	6.6	4.59	1340	25.7	7.1	5.09	1935	28.5	7.4	5.54	2530	31.0	7.3	5.37
155	12.7	1.3	1.34	750	21.0	6.6	4.58	1345	25.7	7.1	5.13	1940	28.4	7.6	5.70	2535	31.2	7.0	5.06
160	12.7	1.6	1.44	755	21.0	6.4	4.74	1350	25.7	7.1	5.17	1945	28.5	7.5	5.69	2540	31.2	7.1	5.09
165	12.5	2.0	1.59	760	21.0	6.8	4.83	1355	25.8	7.0	5.06	1950	28.6	7.4	5.48	2545	31.0	7.3	5.43
170	12.2	2.6	1.83	765	21.1	6.8	4.73	1360	25.9	6.9	4.95	1955	28.6	7.5	5.57	2550	31.0	7.3	5.39
175	11.8	3.3	2.13	770	21.3	6.7	4.64	1365	26.0	6.9	4.95	1960	28.6	7.5	5.65	2555	31.1	7.2	5.30
180	11.6	3.7	2.36	775	21.3	6.7	4.68	1370	26.0	7.0	4.96	1965	28.7	7.4	5.47	2560	31.0	7.4	5.47
185	11.5	4.0	2.54	780	21.3	6.7	4.72	1375	26.0	7.0	5.01	1970	28.7	7.2	5.29	2565	31.6	6.8	5.70
190	11.6	4.2	2.61	785	21.3	6.8	4.77	1380	26.0	7.0	5.06	1975	28.9	7.2	5.22	2570	31.1	7.3	5.37
195	12.1	3.9	2.47	790	21.3	6.8	4.82	1385	26.0	7.0	4.99	1980	29.0	7.1	5.16	2575	31.5	7.0	4.96
200	13.1	3.2	2.07	795	21.4	6.8	4.79	1390	26.1	6.9	4.92	1985	29.1	7.1	5.11	2580	31.6	6.9	4.87
205	12.0	4.4	2.76	800	21.5	6.8	4.77	1395	26.2	6.9	4.94	1990	29.1	7.0	5.06	2585	31.6	6.8	4.79
210	11.0	5.6	3.66	805	21.6	6.7	4.71	1400	26.2	7.1	5.09	1995	29.1	7.1	5.08	2590	31.6	6.9	4.88
215	11.3	5.6	3.59	810	21.7	6.7	4.65	1405	26.1	7.0	5.02	2000	29.1	7.1	5.11	2595	31.5	7.0	4.97
220	11.6	5.5	3.52	815	21.7	6.7	4.72	1410	26.1	7.1	5.09	2005	29.1	7.1	5.16	2600	31.6	6.9	4.86
225	11.7	5.5	3.55	820	21.7	6.8	4.80	1415	26.2	7.0	5.02	2010	29.1	7.1	5.15	2605	31.3	7.2	5.30
230	11.9	5.5	3.57	825	21.7	6.8	4.82	1420	26.3	7.0	4.96	2015	29.2	7.1	5.13	2610	31.4	7.1	5.15
240	12.3	5.5	3.54	835	21.8	6.8	4.82	1430	26.1	7.2	5.25	2025	29.3	7.1	5.08	2620	31.6	7.0	4.97
245	12.3	5.7	3.71	840	21.9	6.8	4.80	1435	26.1	7.2	5.24	2030	29.3	7.0	5.05	2625	31.4	7.1	5.17
250	12.3	5.9	3.88	845	21.9	6.8	4.83	1440	26.2	7.2	5.24	2035	29.3	7.1	5.07	2630	31.6	7.0	5.00
260	12.7	5.8	3.83	855	22.0	6.8	4.80	1450	26.5	7.0	4.98	2045	29.2	7.2	5.23	2640	31.7	7.0	4.98
265	13.2	5.5	3.54	860	22.1	6.8	4.74	1455	26.4	7.1	5.07	2050	29.2	7.2	5.27	2645	31.7	6.9	4.93
270	13.7	5.2	3.27	865	22.0	6.9	4.92	1460	26.4	7.1	5.17	2055	29.3	7.2	5.21	2650	31.8	6.9	4.85
275	13.7	5.3	3.39	870	21.9	7.1	5.11	1465	26.4	7.2	5.19	2060	29.5	7.0	5.02	2655	31.8	6.9	4.85
280	13.7	5.4	3.50	875	21.9	7.1	5.08	1470	26.4	7.2	5.22	2065	29.4	7.1	5.08	2660	31.7	7.0	5.02
285	13.7	5.6	3.61	880	22.1	7.0	5.05	1475	26.4	7.1	5.17	2070	29.4	7.1	5.10	2665	32.0	6.7	4.71
290	13.7	5.7	3.72	885	22.1	7.0	5.08	1480	26.5	7.1	5.12	2075	29.5	7.0	5.01	2670	32.0	6.7	4.67
295	13.8	5.8	3.77	890	22.1	7.0	5.06	1485	26.5	7.1	5.14	2080	29.8	6.8	4.76	2675	31.9	6.8	4.81
300	13.9	5.8	3.81	895	22.2	7.1	5.09	1490	26.5	7.1	5.17	2085	29.7	6.9	4.89	2680	31.7	7.0	5.04
305	14.0	5.9	3.85	900	22.2	7.1	5.12	1495	26.5	7.2	5.24	2090	29.7	6.9	4.86	2685	31.9	6.8	4.83
310	14.1	5.9	3.88	905	22.3	7.1	5.08	1500	26.5	7.2	5.31	2095	29.8	6.8	4.78	2690	32.1	6.7	4.72
315	14.3	5.9	3.89	910	22.3	7.0	5.05	1505	26.5	7.2	5.27	2100	29.9	6.8	4.75	2695	32.1	6.7	4.71
320	14.4	5.9	3.90	915	22.4	7.0	4.99	1510	26.6	7.2	5.23	2105	29.8	6.8	4.81	2700	32.0	6.8	4.81
325	14.5	5.9	3.92	920	22.6	6.9	4.92	1515	26.6	7.2	5.30	2110	29.9	6.8	4.78	2705	32.0	6.8	4.80
330	14.6	5.9	3.93	925	22.7	6.9	4.85	1520	26.5	7.3	5.38	2115	29.9	6.8	4.76	2710	32.1	6.8	4.79
335	14.7	6.0	4.02	930	22.8	6.8	4.77	1525	26.6	7.3	5.37	2120	29.9	6.8	4.84	2715	32.1	6.7	4.71
340	14.7	6.2	4.12	935	22.8	6.8	4.83	1530	26.6	7.3	5.36	2125	29.9	6.9	4.89	2720	32.4	6.5	4.47
350	15.0	6.0	3.96	945	22.8	6.9	4.87	1540	26.5	7.4	5.53	2135	29.9	6.9	4.94	2730	31.9	7.0	5.05
355	15.3	5.9	3.88	950	22.9	6.9	4.85	1545	26.5	7.5	5.58	2140	29.8	7.1	5.08	2735	31.6	7.4	5.44
360	15.6	5.8	3.78	955	23.0	6.8	4.81	1550	26.5	7.5	5.63	2145	29.9	6.9	4.92	2740	31.6	7.1	5.46
365	15.5	5.9	3.89	960	23.1	6.8	4.77	1555	26.7	7.3	5.39	2150	29.9	7.0	4.98	2745	31.9	7.0	5.06
370	15.5	6.0	4.01	965	23.1	6.7	4.73	1560	26.9	7.1	5.16	2155	29.8	7.1	5.10	2750	32.0	6.9	4.94
375	15.6	6.1	4.03	970	23.2	6.7	4.69	1565	26.9	7.2	5.23	2160	29.8	7.1	5.09	2755	32.0	7.0	4.98
380	15.7	6.1	4.05	975	23.3	6.8	4.82	1570	26.9	7.2	5.30	2165	29.9	7.0	5.08	2760	32.0	7.0	5.06
385	15.7	6.2	4.15	980	23.5	6.8	4.54	1575	27.0	7.2	5.23	2170	29.9	7.1	5.07	2765	32.2	6.8	4.80
390	15.7	6.3	4.25	985	23.5	6.6	4.52	1580	27.0	7.1	5.17	2175	29.8	7.2	5.20	2770	32.3	6.8	4.73
395	15.9	6.3	4.22	990	23.6	6.5	4.50	1585	27.0	7.2	5.20	2180	29.8	7.2	5.27	2775			

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
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
dB(μ A)	decibel referred to one microampere
dB Ω	decibel referred to one Ohm
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
ITE	information technology equipment
k	kilo
kHz	kilohertz
LISN	line impedance stabilization network
LO	local oscillator
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
PCB	printed circuit board
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
VA	volt-ampere
WB	wideband