HERMON LABORATORIES

ACCREDITED
839.01
Electrical

Hermon Laboratories Ltd.
P.O.Box 23, Binyamina 30550, Israel
Tel. +972-4-6288001
Fax. +972-4-6288277
E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 SUBPART C, section 15.245 and subpart B; RSS-210 issue 6 Annex 7 and ICES-003:2004

FOR:

Visonic Ltd.

Wireless motion detector
Model:Duet AM 10.525 GHz

Table of contents

1 Applicant information

Client name:	Visonic Ltd.
Address:	24 Habarzel st., Tel Aviv 61220, Israel
Telephone:	03-6456714
Fax:	03-6456788
E-mail:	aelshtein@visonic.com
Contact name:	Mr. Arik Elshtein

2 Equipment under test attributes

Product name:	Wireless motion detector
Product type:	Transmitter
Model(s):	Duet AM 10.525 GHz
Serial number:	4178
Receipt date	12/25/2006

3 Manufacturer information

Manufacturer name:	Visonic Ltd.
Address:	24 Habarzel st., Tel Aviv 61220, Israel
Telephone:	03-6456714
Fax:	03-6456788
E-Mail:	aelshtein@visonic.com
Contact name:	Mr. Arik Elshtein

4 Test details

Project ID:	17625
Location:	Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30550, Israel
Test started:	12/25/2006
Test completed:	2/02/2007
Test specification(s):	FCC Part 15, subpart C, §15.245 and subpart B; RSS-210, ICES-003:2004

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions	Pass
FCC Section 15.245(b)(3)/RSS-210 Annex 7, Band edge emissions	Pass
FCC Section 15.207(a)/ RSS-Gen, Section 7.2.2, Conducted emission	Pass
FCC Section 15.203/ RSS-Gen, Section 7.1.4, Antenna requirement	Pass
Unintentional emissions	
FCC Section 15.107/ICES-003, Conducted emission at AC power port	Pass
FCC Section 15.109/ RSS-Gen, Section 7.2.3.2/ICES-003, Radiated emission	Pass
FCC Section 15.111/ RSS-Gen, Section 6(b), Section 7.2.3.1, Conducted emission at receiver antenna port	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.

This test report replaces the previously issued test report identified by Doc ID:VISRAD_FCC.17625.

	Name and Title	Date	Signature
Tested by:	Mr. A. Lane, test engineer Mr. S. Samokha, test engineer	February 2, 2007	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	February 25, 2007	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	February 26, 2007	

6 EUT description

6.1 General information

The product is MW (microwave) motion detector, operated at 10.525 GHz.

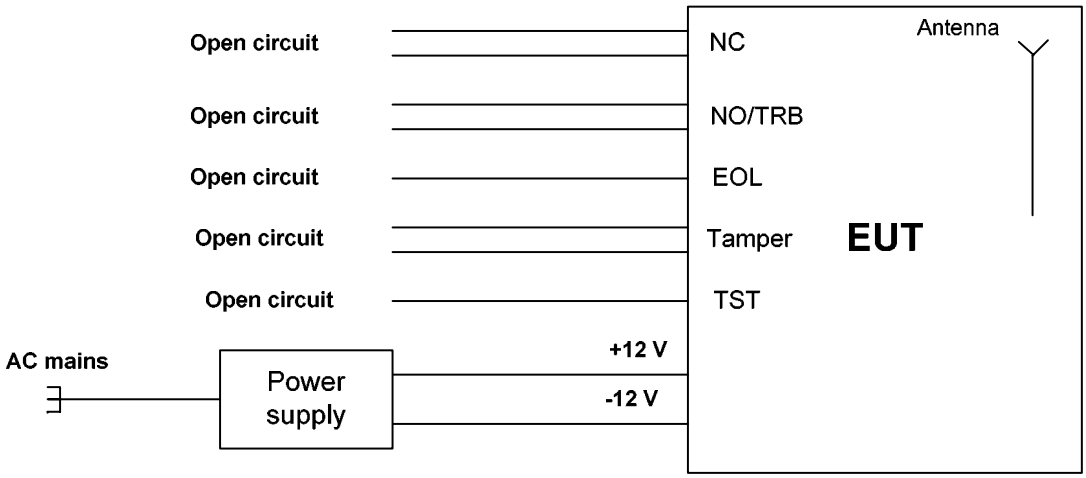
6.2 Ports and lines

Port type	Port description	Conn. from	Conn. to	Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
Power	+12-	EUT	DC power	Terminal block	2	unshielded	1.5	Indoor
Signal	Tamper	EUT	Open circuit		2	unshielded	1.5	Indoor
Control	TST	EUT	Open circuit		1	unshielded	1.5	Indoor
Signal	EOL	EUT	Open circuit		1	unshielded	1.5	Indoor
Signal	NC	EUT	Open circuit		2	unshielded	1.5	Indoor
Signal	NO/TRB	EUT	Open circuit		2	unshielded	1.5	Indoor

6.3 Changes made in EUT

No changes were implemented.

6.4 Test configuration



6.5 Transmitter characteristics

Type of equipment			
X	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**	
X	fixed	Always at a distance more than 2 m from all people	
	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		10500 - 10550 MHz	
Operating frequency		10525 MHz	
Antenna connection			
unique coupling	standard connector	X integral	with temporary RF connector
			X without temporary RF connector
Transmitter duty cycle supplied for test		6%	**Tx ON time**		**Period**	
Transmitter power source			
X	DC	**Nominal rated voltage**	12 VDC

Test specification:	FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	Air Pressure: 1009 hPa	Relative Humidity: 43 %	Power Supply: 12 VDC
Remarks:			

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

7.1 Field strength of emissions

7.1.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.1.1 and Table 7.1.2.

Table 7.1.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(µV/m)	
	Peak	Average
10500 – 10550	148.0	128.0

Table 7.1.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(µV/m)*				
	Within restricted bands			Harmonics outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	108.0	88.0
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			
1000 – 17700	74.0	NA	54.0		
Above 17700	108.0 (sensors within building) 97.5 (all other sensors)	NA	88.0 (sensors within building) 77.5 (all other sensors)		

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

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

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

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

Note: 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 but not exceeding 40 Ghz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 100 Ghz for intentional radiators operated above 10 GHz.

Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

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

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 antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.3, Table 7.1.5 and shown in the associated plots.

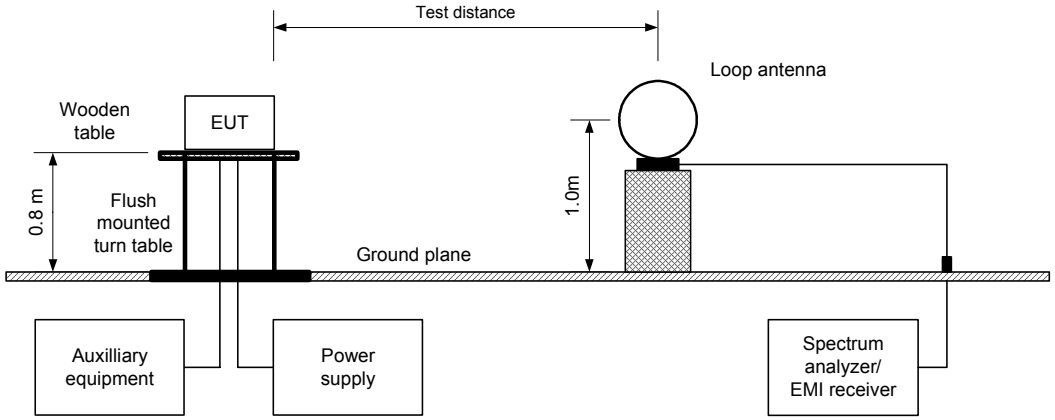
7.1.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.1.3.1 The EUT was set up as shown in Figure 7.1.2, energized and the performance check was conducted.

7.1.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

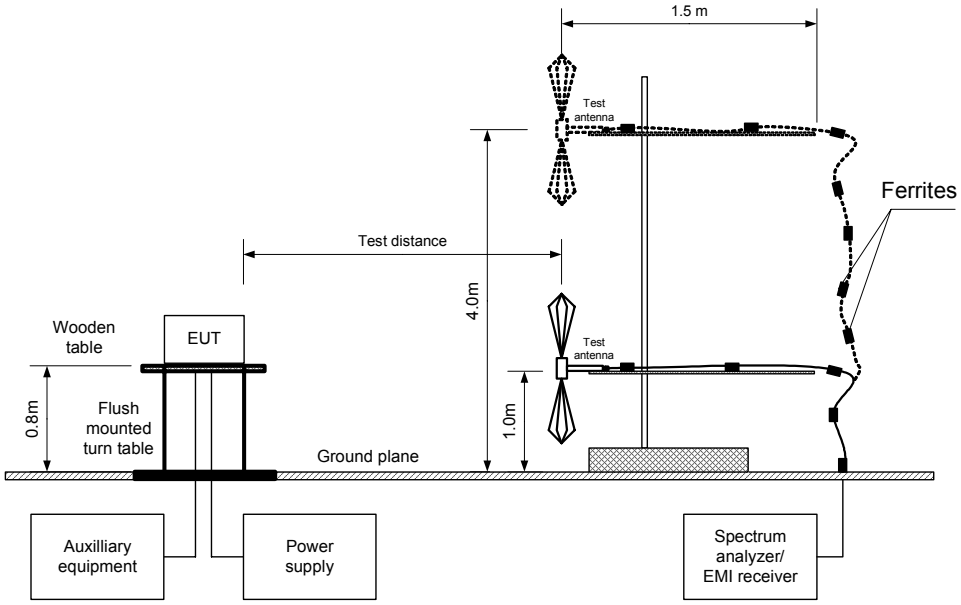
7.1.3.3 The worst test results (the lowest margins) were recorded in Table 7.1.3, Table 7.1.5 and shown in the associated plots.

Figure 7.1.1 Setup for spurious emission field strength measurements below 30 MHz



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Figure 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.1.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz

TEST DISTANCE:	3 m
EUT POSITION:	Vertical (Typical)
MODULATION:	Doppler
MODULATING SIGNAL:	NA
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 60000 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz) 1.0 MHz (above 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**		Calculated, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
Fundamental emission											
10525	V	1.1	70	91.42	148	-56.58	-24.4	67.02	128	-60.98	Pass
10525	H	1.0	56	110.7	148	-37.30	-24.4	86.30	128	-41.70	Pass
Spurious emissions											
21050.1	V	1.0	0	51.99	97.5	-45.51	-24.4	27.59	77.5	-49.91	Pass
31575.1	V	1.1	0	65.50	97.5	-32.00	-24.4	41.10	77.5	-36.40	Pass

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = dB below (negative if above) specification limit.

Table 7.1.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
0.03	0.5	26.75	29.5	NA	-24.4

*- Average factor was calculated as follows

for pulse train shorter than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{Train\ duration} \times Number\ of\ bursts\ within\ pulse\ train\right)$$

for pulse train longer than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\,ms} \times Number\ of\ bursts\ within\ 100\,ms\right)$$

Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.1.5 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	Doppler
MODULATING SIGNAL:	NA
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1 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) Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
No spurious were found								Pass

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

Table 7.1.6 Restricted bands

MHz	MHz	MHz	MHz	MHz	GHz
0.09 – 0.11	8.37625 – 8.38675	73 – 74.6	399.9 – 410	2690 – 2900	10.6 – 12.7
0.495 – 0.505	8.41425 – 8.41475	74.8 – 75.2	608 – 614	3260 – 3267	13.25 – 13.4
2.1735 – 2.1905	12.29 – 12.293	108 – 121.94	960 – 1240	3332 – 3339	14.47 – 14.5
4.125 – 4.128	12.51975 – 12.52025	123 – 138	1300 – 1427	3345.8 – 3358	15.35 – 16.2
4.17725 – 4.17775	12.57675 – 12.57725	149.9 – 150.05	1435 – 1626.5	3600 – 4400	17.7 – 21.4
4.20725 – 4.20775	13.36 – 13.41	156.52475 – 156.52525	1645.5 – 1646.5	4500 – 5150	22.01 – 23.12
6.215 – 6.218	16.42 – 16.423	156.7 – 156.9	1660 – 1710	5350 – 5460	23.6 – 24
6.26775 – 6.26825	16.69475 – 16.69525	162.0125 – 167.17	1718.8 – 1722.2	7250 – 7750	31.2 – 31.8
6.31175 – 6.31225	16.80425 – 16.80475	167.72 – 173.2	2200 – 2300	8025 – 8500	36.43 – 36.5
8.291 – 8.294	25.5 – 25.67	240 – 285	2310 – 2390	9000 – 9200	Above 38.6
8.362 – 8.366	37.5 – 38.25	322 – 335.4	2483.5 – 2500	9300 – 9500	

Reference numbers of test equipment used

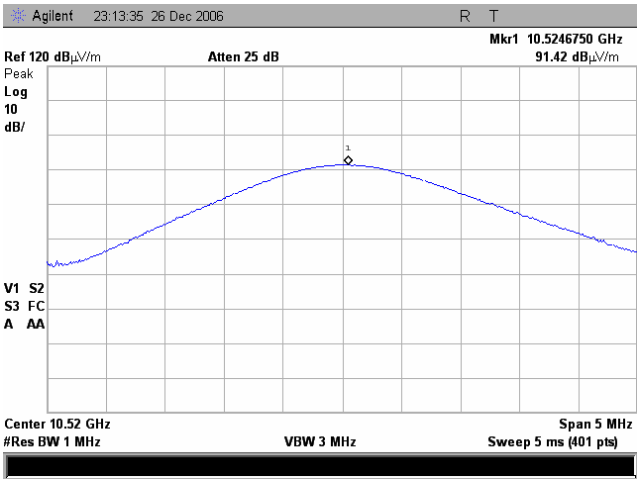
HL 0446	HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604
HL 0768	HL 0769	HL 0770	HL 2009	HL 2259	HL 2260	HL 2261	HL 2432
HL 2780	HL 2909	HL 2910					

Full description is given in Appendix A.

Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Plot 7.1.1 Radiated emission measurements at the fundamental frequency

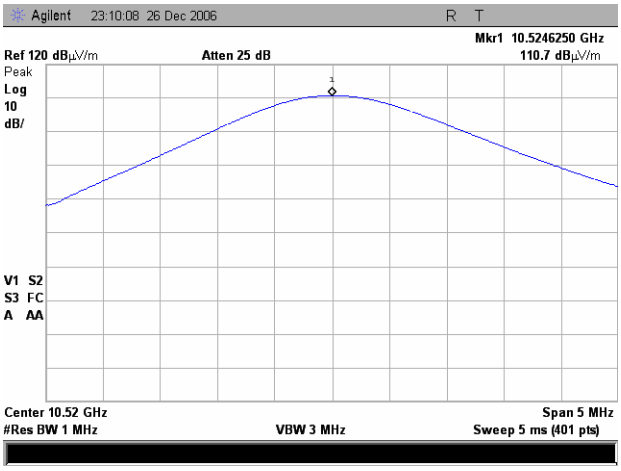
TEST SITE:	Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Vertical
DETECTOR:	Peak



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Plot 7.1.2 Radiated emission measurements at the fundamental frequency

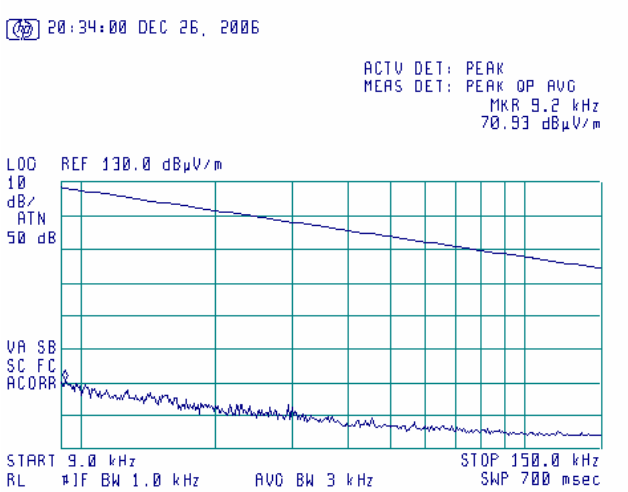
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Vertical
DETECTOR: Peak



Test specification:	FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	Air Pressure: 1009 hPa	Relative Humidity: 43 %	Power Supply: 12 VDC
Remarks:			

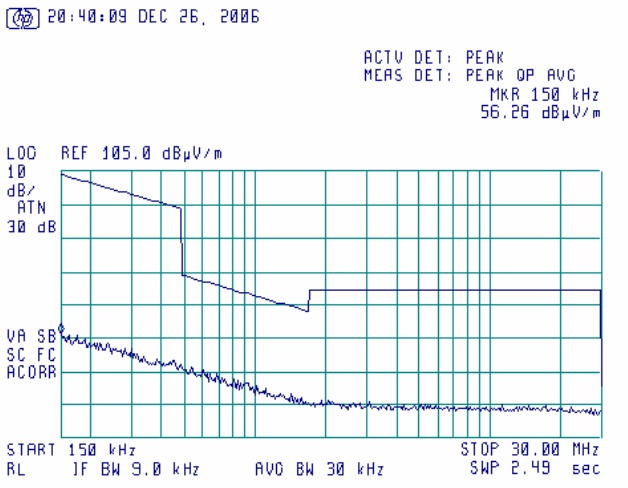
Plot 7.1.3 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Vertical



Plot 7.1.4 Radiated emission measurements from 0.15 to 30 MHz

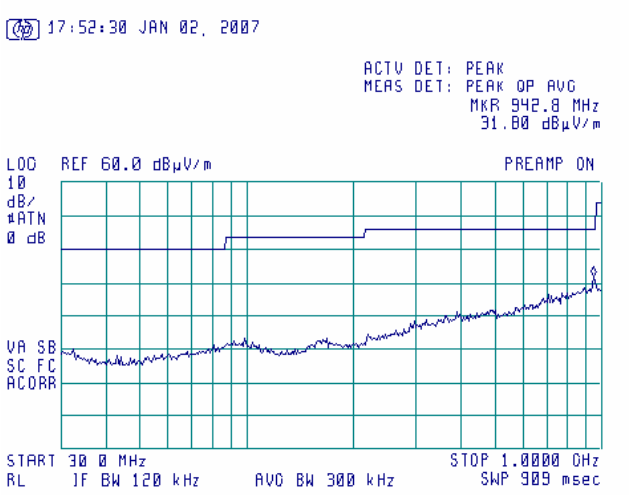
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Vertical



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

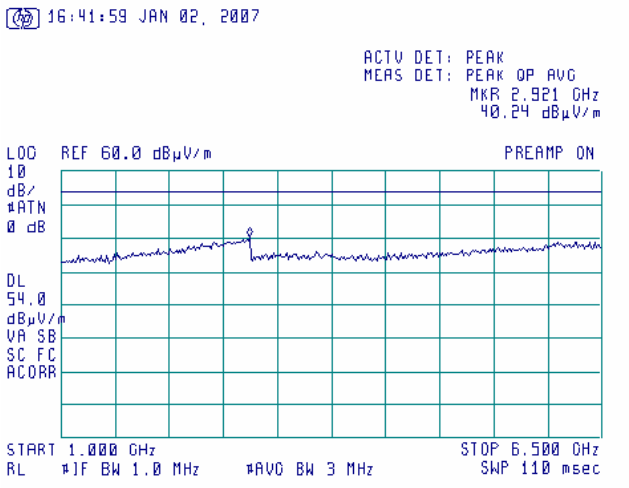
Plot 7.1.5 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical



Plot 7.1.6 Radiated emission measurements from 1.0 to 6.5 MHz

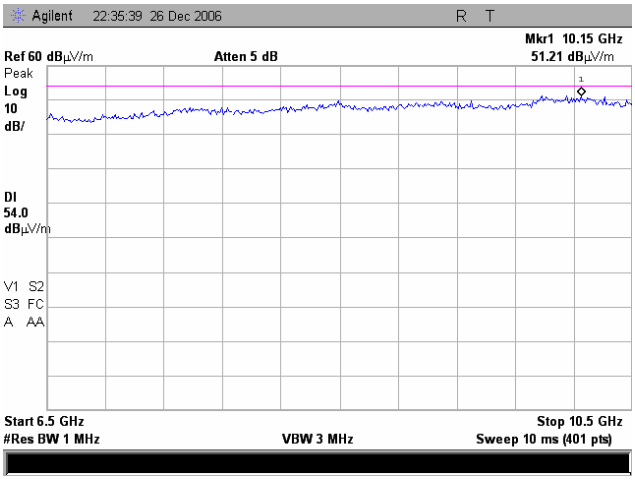
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Plot 7.1.7 Radiated emission measurements from 6.5 to 10.5 GHz

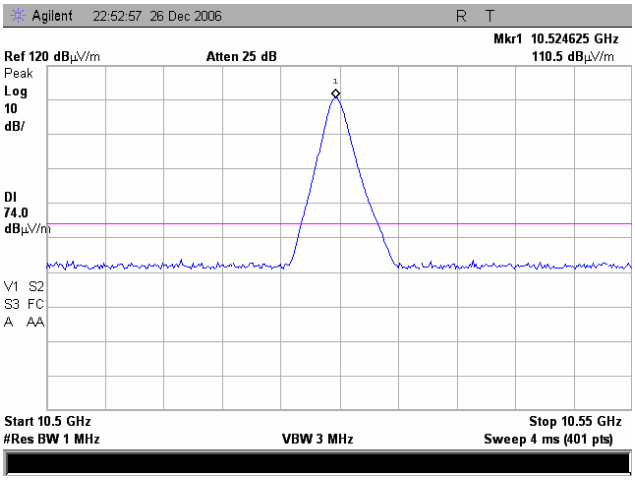
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

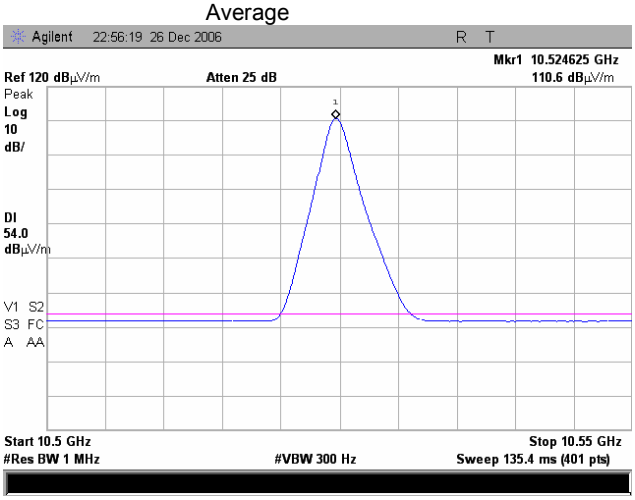
Plot 7.1.8 Radiated emission measurements from 10.5 to 10.55 GHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical
Detector Peak



Plot 7.1.9 Radiated emission measurements from 10.5 to 10.55 GHz

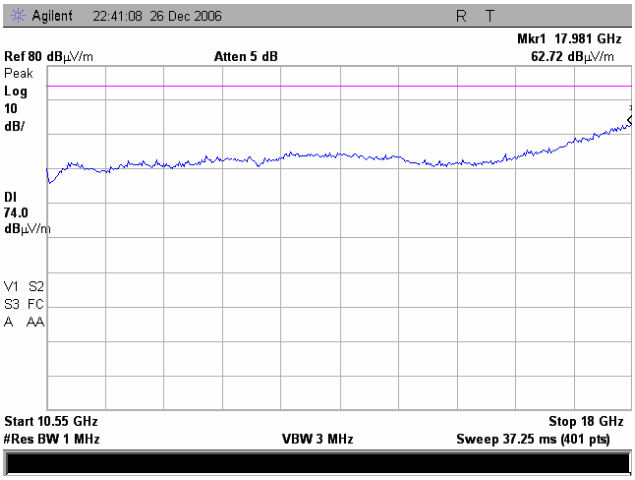
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical
Detector Average



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

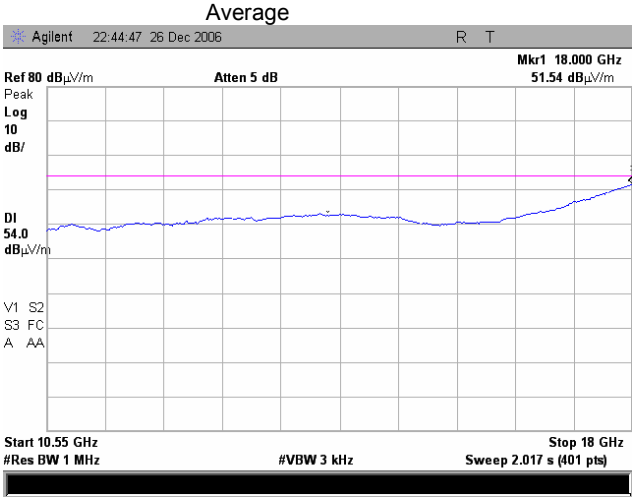
Plot 7.1.10 Radiated emission measurements from 10.55 to 18.0 GHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical
Detector Peak



Plot 7.1.11 Radiated emission measurements from 10.55 to 18.0 GHz

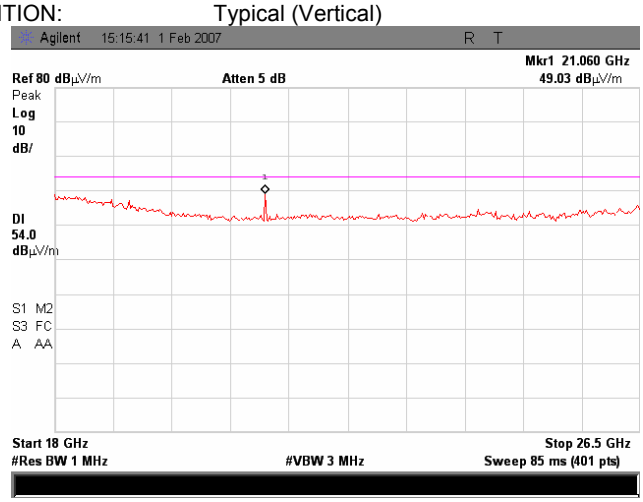
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical
Detector Average



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

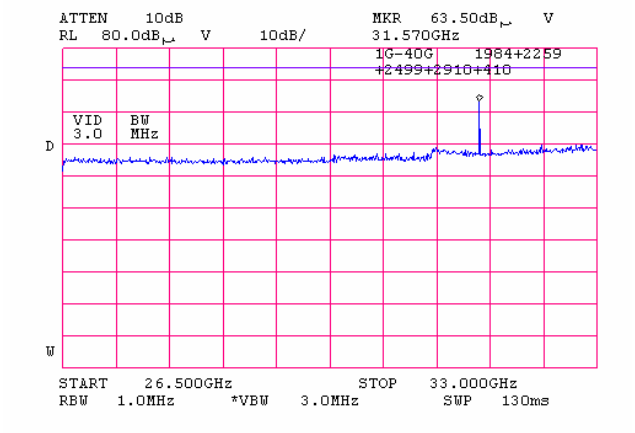
Plot 7.1.12 Radiated emission measurements from 18.0 to 26.5 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)



Plot 7.1.13 Radiated emission measurements from 26.5 to 33.0 GHz

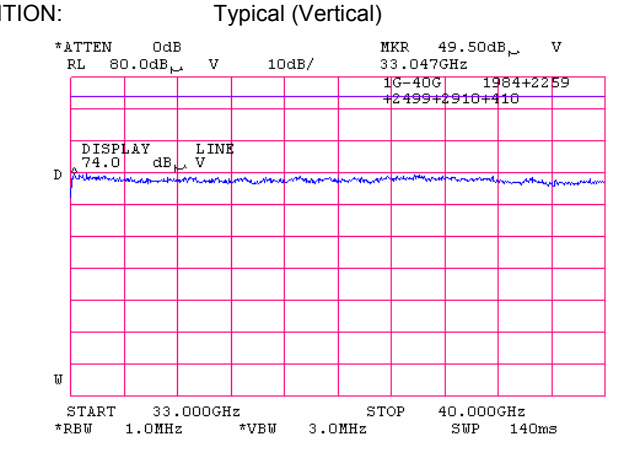
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Plot 7.1.14 Radiated emission measurements from 33.0 to 40.0 GHz

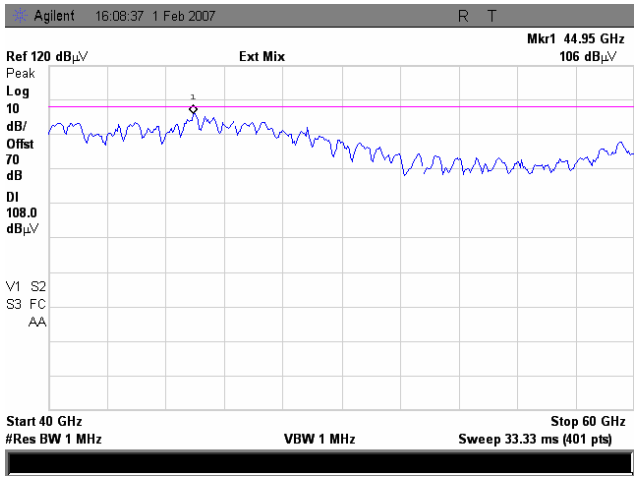
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

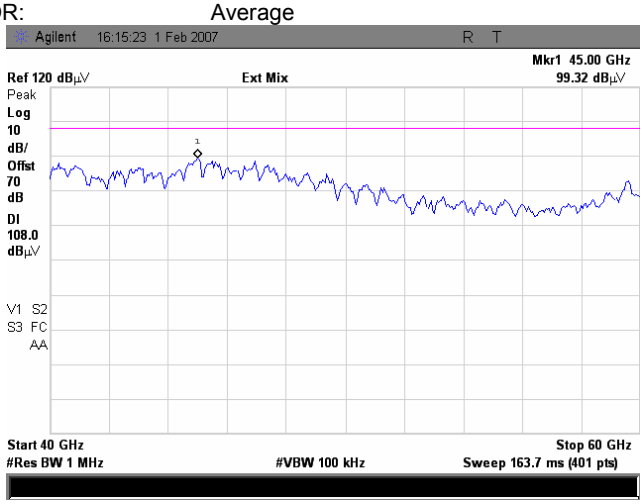
Plot 7.1.15 Radiated emission measurements from 40.0 to 60.0 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)
DETECTOR: Peak



Plot 7.1.16 Radiated emission measurements from 40.0 to 60.0 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)
DETECTOR: Average

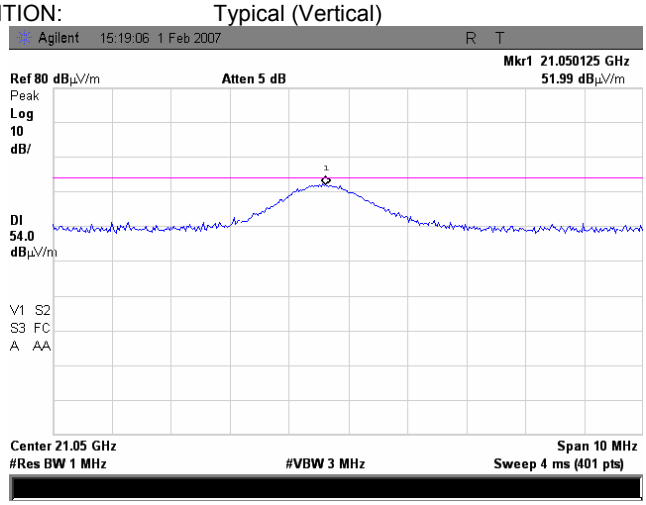


NOTE: The spectrum analyzer noise floor

Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

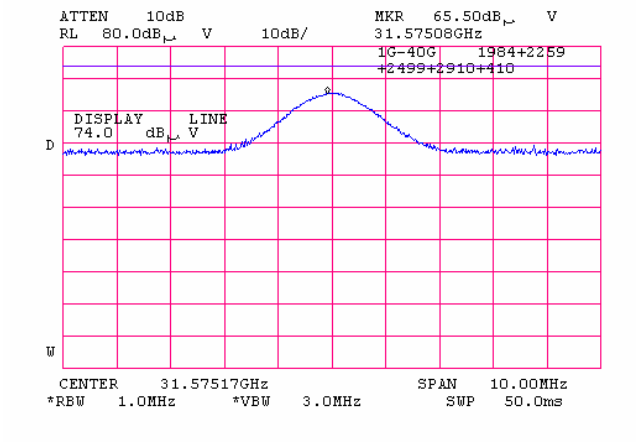
Plot 7.1.17 Radiated emission measurements at the second harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: Typical (Vertical)



Plot 7.1.18 Radiated emission measurements at the third harmonic frequency

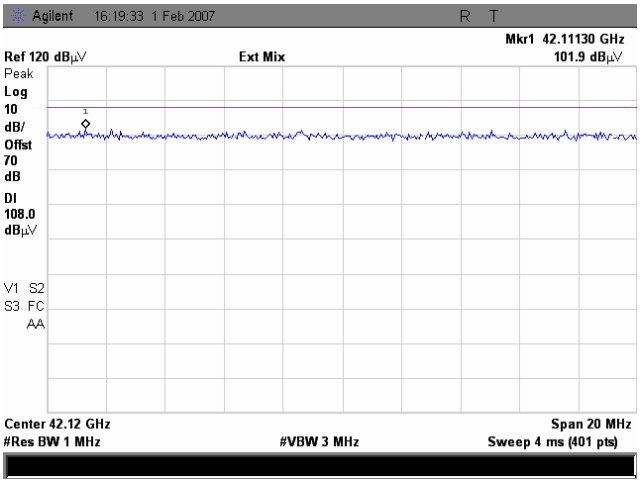
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: Typical (Vertical)



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

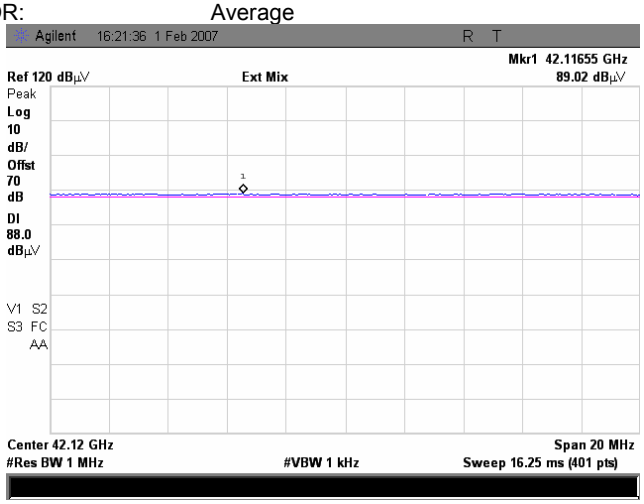
Plot 7.1.19 Radiated emission measurements at the forth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: Typical (Vertical)
DETECTOR: Peak



Plot 7.1.20 Radiated emission measurements at the forth harmonic frequency

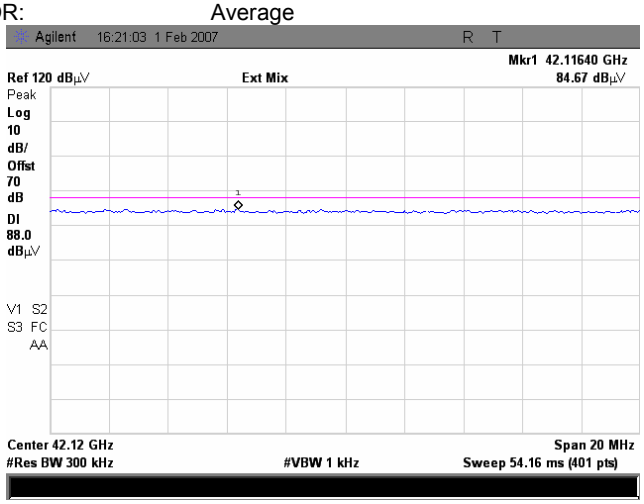
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: Typical (Vertical)
DETECTOR: Average



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Plot 7.1.21 Radiated emission measurements at the forth harmonic frequency

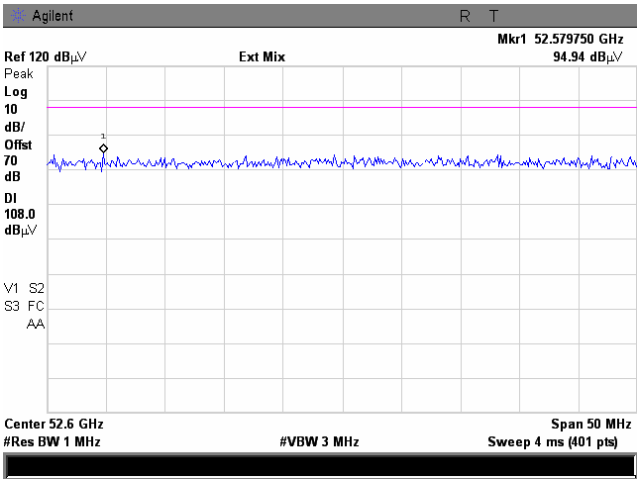
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: Typical (Vertical)
DETECTOR: Average



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

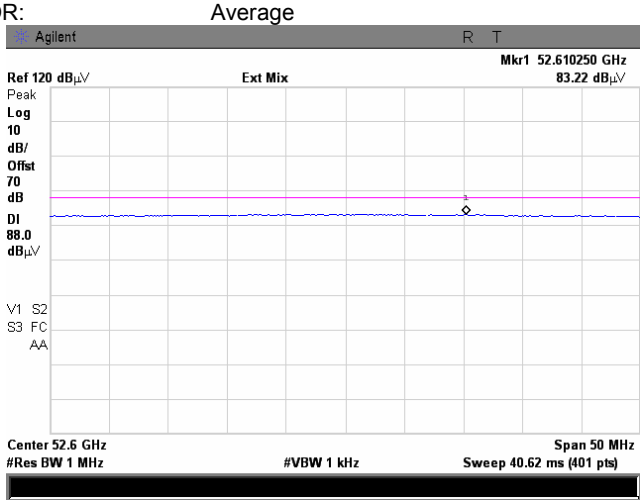
Plot 7.1.22 Radiated emission measurements at the fifth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: Typical (Vertical)
DETECTOR: Peak



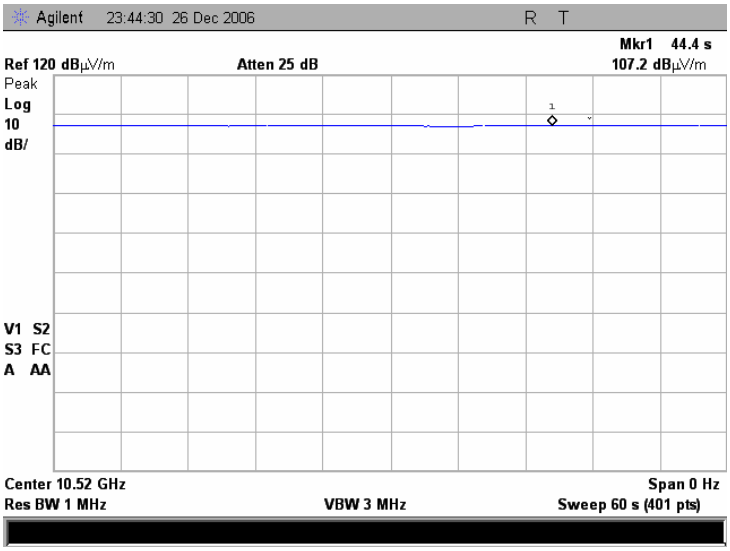
Plot 7.1.23 Radiated emission measurements at the fifth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: Typical (Vertical)
DETECTOR: Average

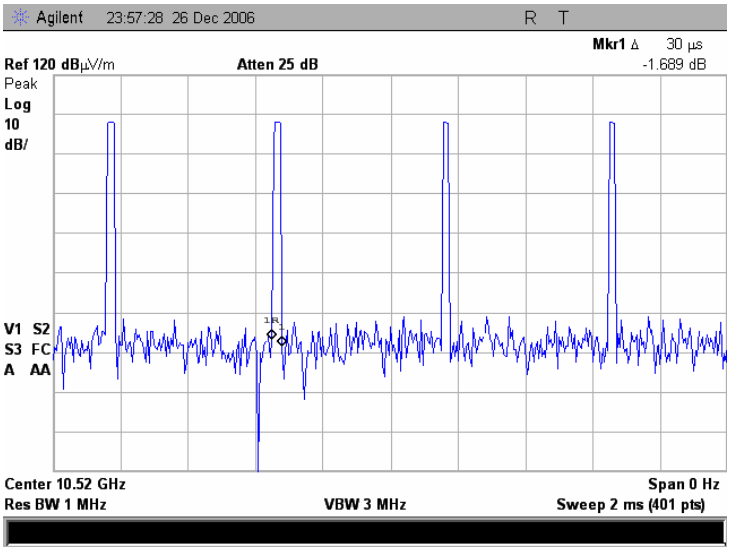


Test specification:	FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	Air Pressure: 1009 hPa	Relative Humidity: 43 %	Power Supply: 12 VDC
Remarks:			

Plot 7.1.24 Transmission duty cycle 100%

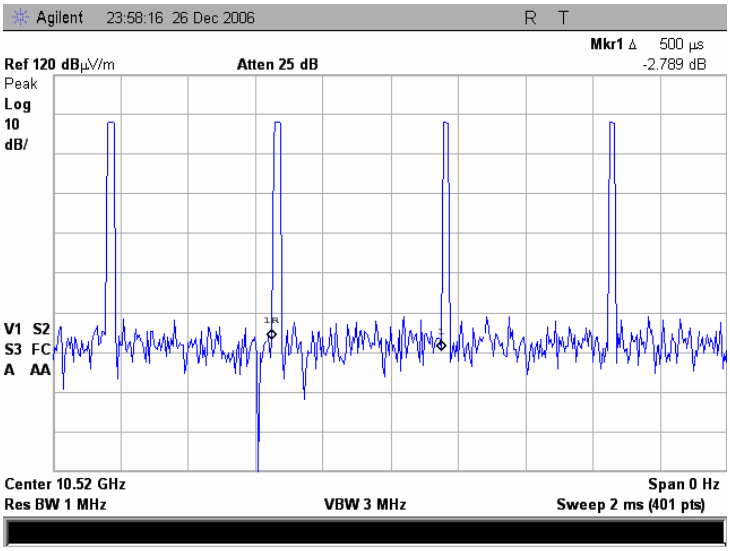


Plot 7.1.25 Transmission pulse duration

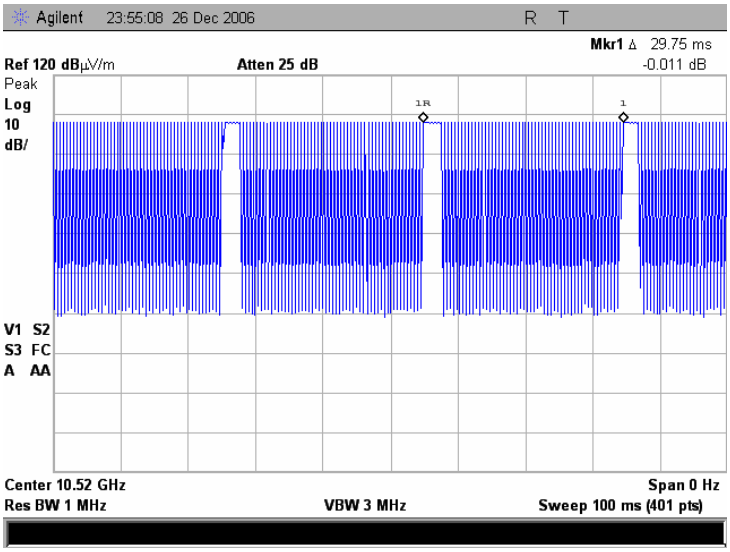


Test specification:	FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	Air Pressure: 1009 hPa	Relative Humidity: 43 %	Power Supply: 12 VDC
Remarks:			

Plot 7.1.26 Transmission pulse period

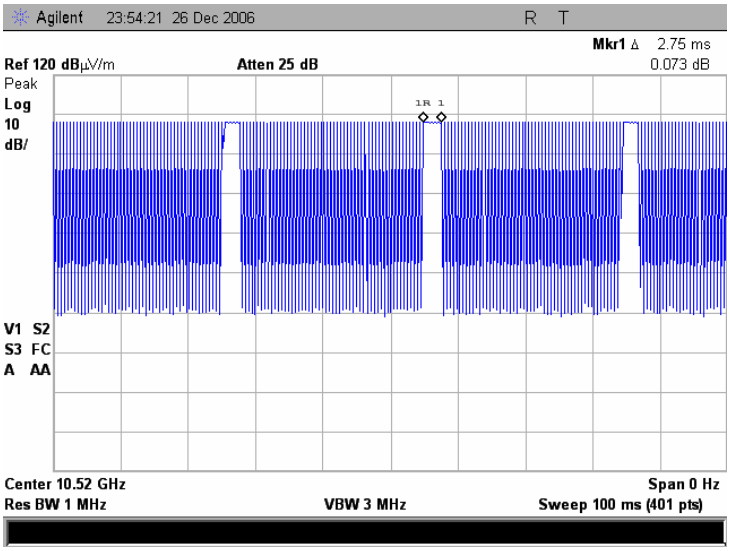


Plot 7.1.27 Transmission burst period



Test specification:	**FCC part 15, Section 15.245(b) / RSS-210 Annex 7, Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 4:30:56 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Plot 7.1.28 Long pulse transmission duration



Test specification:	FCC part 15, Section 15.245(b)(3) / RSS-210 Annex 7, Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/1/2007 2:33:55 PM		
Temperature: 20 ºC	Air Pressure: 1009 hPa	Relative Humidity: 43 %	Power Supply: 12 VDC
Remarks:			

7.2 Band edge emission

7.2.1 General

This test was performed to verify the EUT band edge emission including all associated side bands and was attenuated at least 50 dB below the unmodulated carrier level or below the general spurious emission limit. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Band edge emission limits

Frequency band, MHz	Field strength limit at 3 m, dBµV/m		Attenuation below carrier, dBc
	Peak	Average	
10500 - 10550	74.0	54.0	50

7.2.2 Test procedure

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

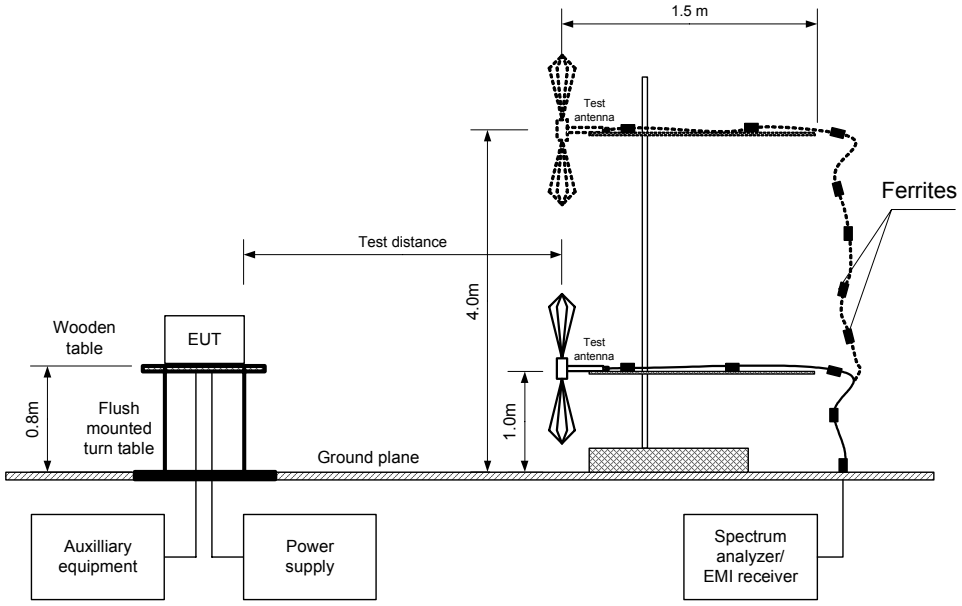
7.2.2.2 The spectrum analyzer frequency span was set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

7.2.2.3 The frequency of modulation envelope points beyond which power level drops below the band edge emission limit was measured.

7.2.2.4 The test results were recorded in Table 7.2.2 and shown in the associated plots.

Test specification:	**FCC part 15, Section 15.245(b)(3) / RSS-210 Annex 7, Band edge emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 2:33:55 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Figure 7.2.1 Band edge emission measurement set up



Test specification:	**FCC part 15, Section 15.245(b)(3) / RSS-210 Annex 7, Band edge emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 2:33:55 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.2.2 Band edge emission test results

OPERATING FREQUENCY RANGE: 10500 – 10550 MHz
DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 1000 kHz
VIDEO BANDWIDTH: 3000 kHz
MODULATION: Doppler
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	
10500	H	1.2	20	53.21	74.00	-20.79	-24.4	28.81	54.00	-25.19	Pass
10550	H	1.2	20	53.40	74.00	-20.60	-24.4	29.00	54.00	-25.00	Pass

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = dB below (negative if above) specification limit.

Table 7.2.3 Average factor calculation

Transmission pulse		Average factor, dB*
Duration, ms	Period, ms	
0.03	0.05	-24.4

*- Average factor was calculated as follows:

$$Average\ factor = 20 \times \log_{10}\left(\frac{0.03}{0.05}\right) = -24.4dB$$

Reference numbers of test equipment used

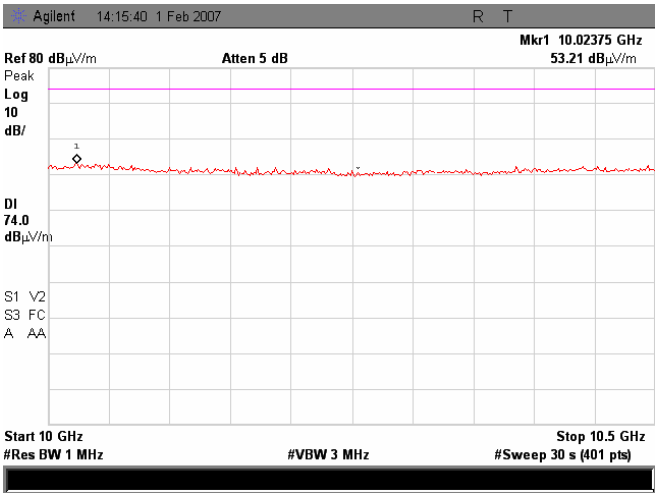
HL 2259	HL 2432	HL 2909	HL 2910				

Full description is given in Appendix A.

Test specification:	FCC part 15, Section 15.245(b)(3) / RSS-210 Annex 7, Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/1/2007 2:33:55 PM		
Temperature: 20 ºC	Air Pressure: 1009 hPa	Relative Humidity: 43 %	Power Supply: 12 VDC
Remarks:			

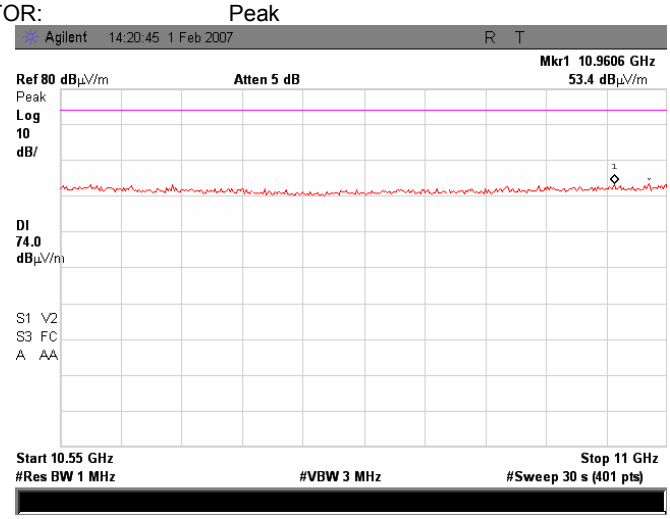
Plot 7.2.1 Band edge emission test result from 10.0 to 10.5 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)
DETECTOR: Peak



Plot 7.2.2 Band edge emission test result from 10.55 to 11.0 GHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)
DETECTOR: Peak



Test specification:	**FCC part 15, Section 15.207(a) / RSS-Gen, Section 7.2.2, Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 12:09:21 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 120 VAC
Remarks:			

7.3 Conducted emissions

7.3.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.3.1.

Table 7.3.1 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.

7.3.2 Test procedure

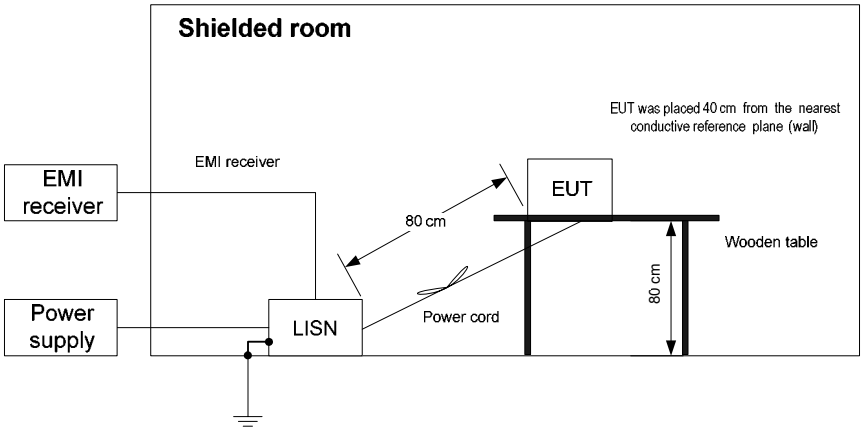
7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

7.3.2.2 The measurements were performed at power terminals of "PowerMax+" control panel with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.3.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

7.3.2.3 The position of the device cables was varied to determine maximum emission level.

7.3.2.4 The worst test results (the lowest margins) were recorded in Table 7.3.2 and shown in the associated plots.

Figure 7.3.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**FCC part 15, Section 15.207(a) / RSS-Gen, Section 7.2.2, Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 12:09:21 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.3.2 Conducted emission test results

LINE: AC mains
EUT OPERATING MODE: Transmit
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*		
0.578154	19.47	18.23	56.00	-37.77	17.74	46.00	-28.26	L1	Pass
23.689170	32.72	26.22	60.00	-33.78	25.09	50.00	-24.91		
25.997684	28.44	21.72	60.00	-38.28	19.25	50.00	-30.75		
1.733321	21.49	20.72	56.00	-35.28	18.86	46.00	-27.14	L2	Pass
23.116801	32.98	31.84	60.00	-28.16	23.90	50.00	-26.10		
24.843434	34.26	33.34	60.00	-26.66	24.62	50.00	-25.38		

*****- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

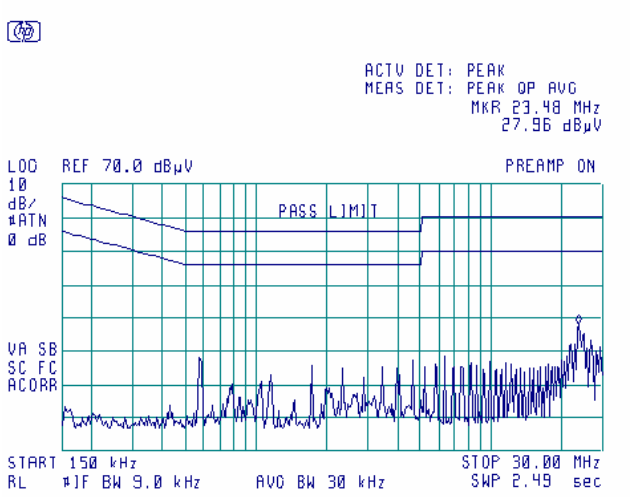
HL 0466	HL 0787	HL 1430	HL 1502	HL 1510	HL 2888		

Full description is given in Appendix A.

Test specification:	**FCC part 15, Section 15.207(a) / RSS-Gen, Section 7.2.2, Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 12:09:21 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 120 VAC
Remarks:			

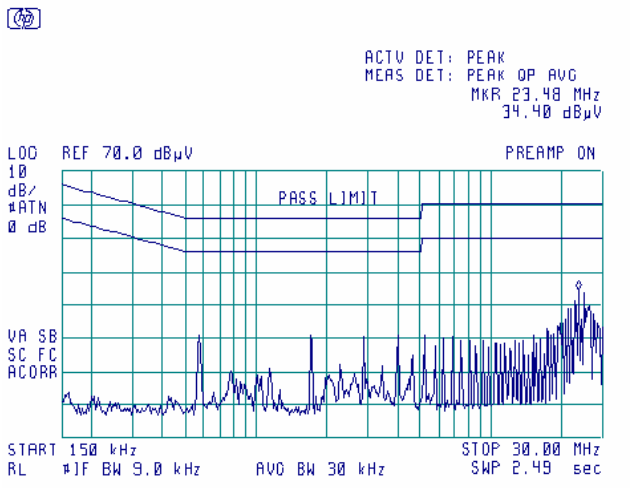
Plot 7.3.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.3.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	FCC part 15, Section 15.203/ RSS-Gen, Section 7.1.4,, Antenna requirement		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/1/2007 4:34:18 PM		
Temperature: ºC	Air Pressure: hPa	Relative Humidity: %	Power Supply:
Remarks:			

7.4 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 7.4.1.

Table 7.4.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached (integral)	Visual inspection	Comply

Test specification:	FCC part 15, Section 15.107/ ICES-003, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/1/2007 12:08:43 PM		
Temperature: 20 ºC	Air Pressure: 1009 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

8 Emission tests according to 47CFR part 15 subpart B and ICES-003 requirements

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits are given in Table 8.1.1.

Table 8.1.1 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.

8.1.2 Test procedure

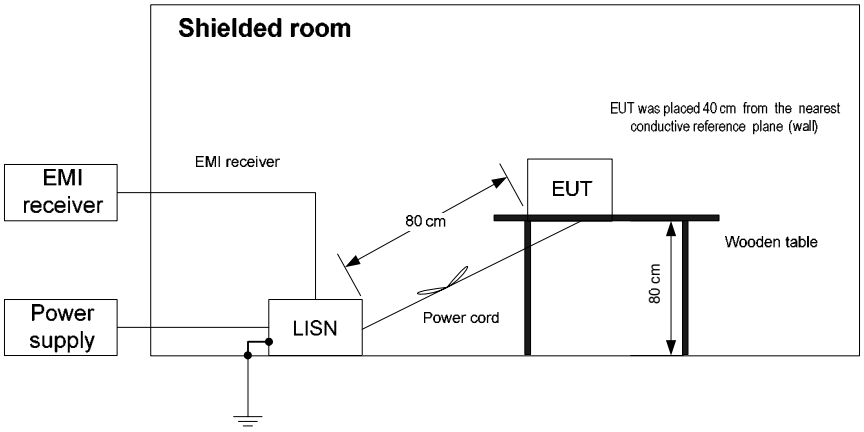
8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

8.1.2.2 The measurements were performed at power terminals of "PowerMax+" control panel with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 8.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

8.1.2.3 The position of the device cables was varied to determine maximum emission level.

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

Figure 8.1.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**FCC part 15, Section 15.107/ ICES-003, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 12:08:43 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 120 VAC
Remarks:			

Table 8.1.2 Conducted emission test results

LINE:	AC mains
LIMIT:	Class A / B
EUT OPERATING MODE:	Receive / Stand-by
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*		
0.578154	19.47	18.23	56.00	-37.77	17.74	46.00	-28.26	L1	Pass
23.689170	32.72	26.22	60.00	-33.78	25.09	50.00	-24.91		
25.997684	28.44	21.72	60.00	-38.28	19.25	50.00	-30.75		
1.733321	21.49	20.72	56.00	-35.28	18.86	46.00	-27.14	L2	Pass
23.116801	32.98	31.84	60.00	-28.16	23.90	50.00	-26.10		
24.843434	34.26	33.34	60.00	-26.66	24.62	50.00	-25.38		

*****- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

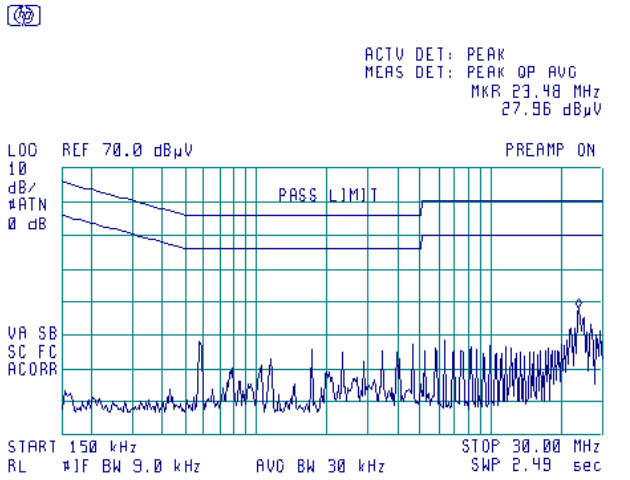
HL 0466	HL 0787	HL 1430	HL 1502	HL 1510	HL 2888		

Full description is given in Appendix A.

Test specification:	**FCC part 15, Section 15.107/ ICES-003, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/1/2007 12:08:43 PM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 120 VAC
Remarks:			

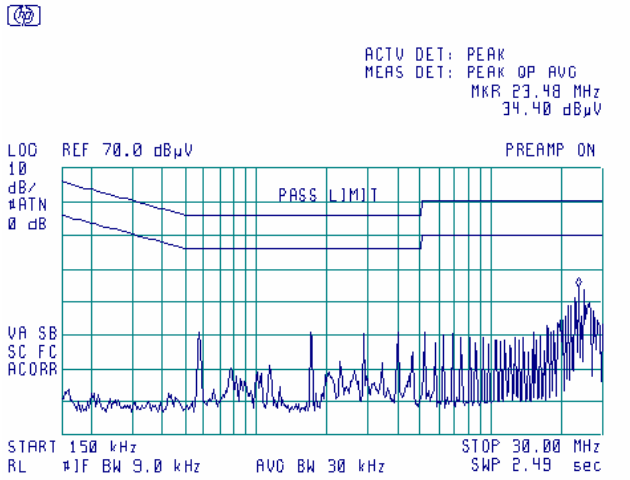
Plot 8.1.1 Conducted emission measurements

LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 8.1.2 Conducted emission measurements

LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	FCC part 15, Section 15.109/ ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	1/22/2007 11:53:51 AM		
Temperature: 20 ºC	Air Pressure: 1009 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.2.1 and Table 8.2.2.

Table 8.2.1 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*

* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

Table 8.2.2 Radiated disturbance test 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	30.0	40.5*	40.0	50.5*
230 - 1000	37.0	47.5*	47.0	57.5*

* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

8.2.2 Test procedure for measurements in semi-anechoic chamber

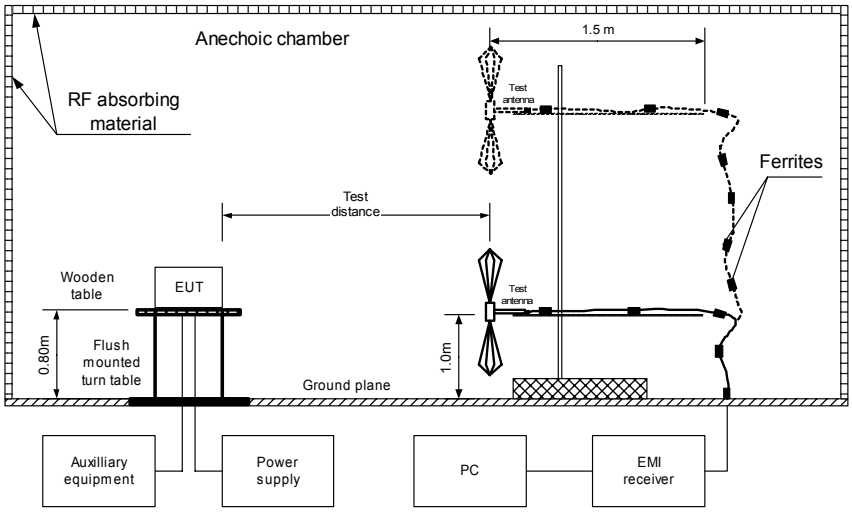
8.2.2.1 The EUT was set up as shown in Figure 8.2.1, energized and the performance check was conducted.

8.2.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

8.2.2.3 The worst test results (the lowest margins) were recorded in Table 8.2.3, Table 8.2.4 and shown in the associated plots.

Test specification:	**FCC part 15, Section 15.109/ ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/22/2007 11:53:51 AM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 120 VAC
Remarks:			

Figure 8.2.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Test specification:	**FCC part 15, Section 15.109/ ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/22/2007 11:53:51 AM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 120 VAC
Remarks:			

Table 8.2.3 Radiated emission test results

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

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
30-1000	No emissions were found							Pass

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

Reference numbers of test equipment used

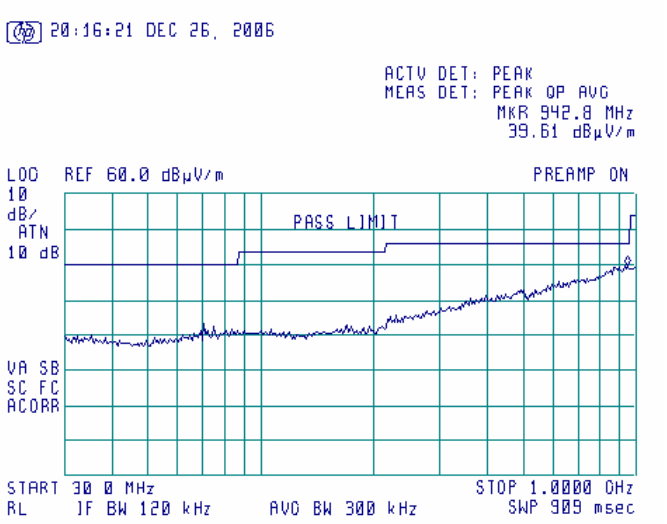
HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604	HL 2009

Full description is given in Appendix A.

Test specification:	**FCC part 15, Section 15.109/ ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/22/2007 11:53:51 AM		
Temperature: 20 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 43 %	**Power Supply:** 120 VAC
Remarks:			

Plot 8.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

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



Test specification:	**Section 5.5 Class B, Radiated disturbance measurements**		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/22/2007 11:46:14 AM		
Temperature: ºC	**Air Pressure:** hPa	**Relative Humidity:** %	**Power Supply:**
Remarks:			

Table 8.2.4 Radiated disturbance test results

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

Frequency, MHz	**Peak emission, dB(µV/m)**	**Quasi-peak**			**Antenna polarization**	**Antenna height, m**	**Turn-table position**, degrees**	**Verdict**
		Measured emission, dB(µV/m)	**Limit, dB(µV/m)**	**Margin, dB***				
30-1000	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

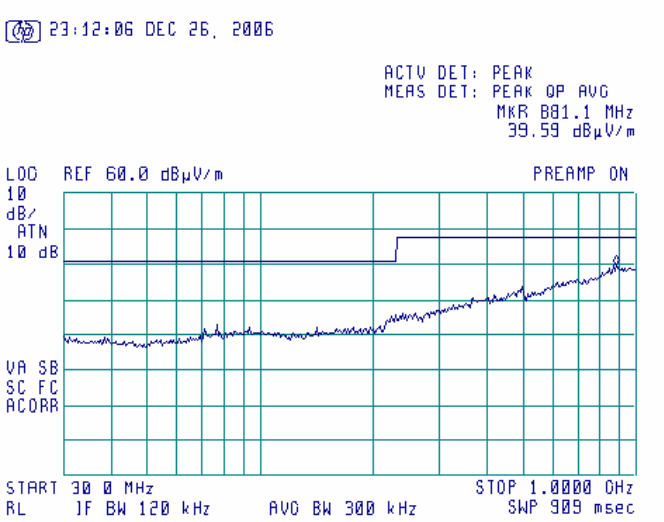
HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604	HL 2009

Full description is given in Appendix A.

Test specification:	Section 5.5 Class B, Radiated disturbance measurements		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	1/22/2007 11:46:14 AM		
Temperature: ºC	Air Pressure: hPa	Relative Humidity: %	Power Supply:
Remarks:			

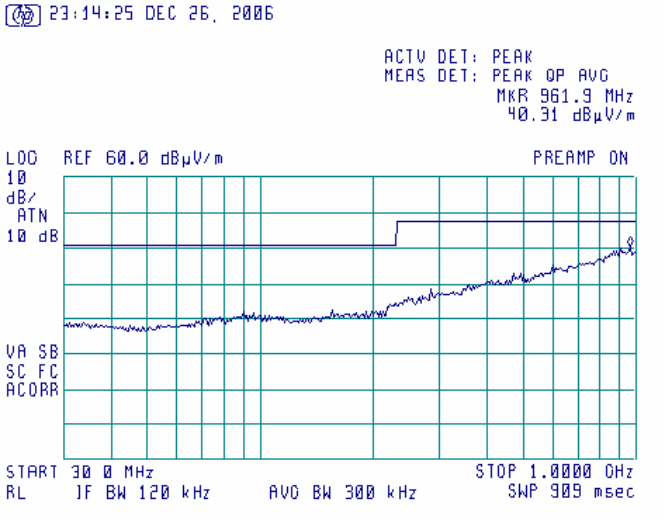
Plot 8.2.2 Radiated disturbance measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.3 Radiated disturbance measurements in 30 - 1000 MHz range, horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



HERMON LABORATORIES

9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-06	28-Jun-07
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	HL	AC - 1	023	23-Aug-05	23-Aug-08
0466	Shielded Room 3(L) x 3(W) x 2,4(H) m	HL	SR - 1	024	23-Aug-05	23-Aug-08
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	26-Sep-06	26-Sep-07
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-06	02-Dec-07
0592	Position Controller	HL	L2-SR3000 (HL CRL-3)	100	18-May-06	18-May-07
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	02-Feb-07	02-Feb-08
0594	Turn Table FOR ANECHOIC CHAMBER flush mount d=1.2 m Pneumatic	HL	TT-WDC1	102	26-Jan-07	26-Jan-08
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-07	10-Jan-08
0768	Antenna Standard Gain Horn,18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	08-Dec-06	08-Dec-08
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, 25 dB gain	Quinstar Technology	QWH-2800-BA	112	08-Dec-06	08-Dec-08
0770	Antenna Standard Gain Horn, 40-60 GHz WR-19, U-band Gain - 25 dB	Quinstar Technology	QWH-1900-AA	118	21-Jul-04	21-Jul-07
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard	11947A	3107A018 77	21-Nov-06	21-Nov-07
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A002 62,3705A0 0217	01-Sep-06	01-Sep-07
1502	Cable RF, 6 m, BNC/BNC	Belden	M17/167 MIL-C-17	1502	27-Nov-06	27-Nov-07
1510	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1510	02-Dec-06	02-Dec-07
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-06	02-Dec-07
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	05-Nov-06	05-Nov-07
2260	Amplifier Low Noise 14-33 GHz	Sophia Wireless	LNA28-B	0233	05-Nov-06	05-Nov-07
2261	Amplifier Low Noise 33-40 GHz	Sophia Wireless	LNA38-B	0234	05-Nov-06	05-Nov-07
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	03-Mar-06	03-Mar-07
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY451024 6	11-Jun-06	11-Jun-07
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	29-Mar-06	29-Mar-07

HERMON LABORATORIES

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	10-Apr-06	10-Apr-07
2910	Cable 18 GHz, 3 m, SMA-SMA	Gore	NA	989370	11-Feb-07	11-Feb-08

HERMON LABORATORIES

10 APPENDIX B Test facility 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).

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

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX C Specification references

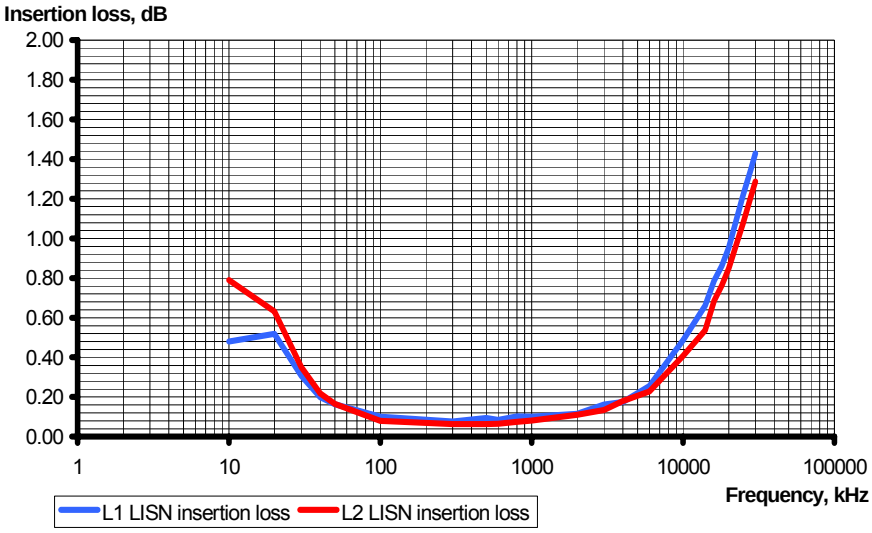
FCC 47CFR part 15: 2006	Radio Frequency Devices.
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
RSS-210 Issue 6: 2005	Low Power Licence- Exempt Radiocommunication Devices
ICES-003: 2004, Issue 4	Spectrum Management and Telecommunications Policy. Interference-Causing Equipment Standard. Digital Apparatus
CAN/CSA-CEI/IEC CISPR 22: 2002	Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement
RSS-212 Issue 1:1999	Test Facilities and Test Methods for Radio Equipment

HERMON LABORATORIES

12 APPENDIX D 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	
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	±0.6
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	



HERMON LABORATORIES

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(μV) to convert it into field intensity in dB(μV/m).

Antenna factor
Standard gain horn antenna
Quinstar Technology
Model QWH
Ser.No.110, HL 0768, 0769, 0770, 0771, 0772

Frequency min, GHz	Frequency max, GHz	Antenna factor, dB(1/m)
18.000	26.500	32.01
26.500	40.000	35.48
40.000	60.000	39.03
60.000	90.000	42.55
90.000	140.000	46.23
140.000	220.000	50.11

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

HERMON LABORATORIES

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

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

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

HERMON LABORATORIES

Antenna factor
Double-ridged guide horn antenna
Model 3115, serial number: 00027177, HL2432

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(μV) to convert it into field intensity in dB(μV/m).

HERMON LABORATORIES

Cable loss
Cable Coaxial, GORE A2P01POL118, 2.3 m, model:GORE-3, HL 0589
+ Cable Coaxial, ANDREW PSWJ4, 6m, model: ANDREW-6, HL 1004

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	30	0.33	≤ 6.5	±0.12
2	50	0.40		
3	100	0.57		
4	300	0.97		
5	500	1.25		
6	800	1.59		
7	1000	1.81		
8	1200	1.97		
9	1400	2.15		
10	1600	2.28		
11	1800	2.43		
12	2000	2.61		
13	2200	2.75		
14	2400	2.89		
15	2600	2.97		
16	2800	3.21	≤ 6.5	±0.12
17	3000	3.32		
18	3300	3.47		
19	3600	3.62		
20	3900	3.84		
21	4200	3.92		±0.17
22	4500	4.07		
23	4800	4.36		
24	5100	4.62		
25	5400	4.78		
26	5700	5.16		
27	6000	5.67		
28	6500	5.99		

HERMON LABORATORIES

Cable loss
Cable coaxial, 6 m, model: M17/167 MIL-C-17, HL 1502

Frequency, MHz	Cable loss, dB
0.1	0.02
1	0.07
3	0.15
5	0.17
10	0.26
30	0.43
50	0.57
80	0.72
100	0.81
300	1.48
500	2.00
800	2.70
1000	3.09

Cable loss
Cable M17/167 MIL-C-17, HL 1510

No.	Frequency, MHz	Cable loss, dB
1	0.1	0.05
2	1	0.09
3	3	0.16
4	5	0.18
5	10	0.27
6	30	0.44
7	50	0.58
8	80	0.69
9	100	0.82
10	300	1.48
11	500	2.01
12	800	2.65
13	1000	3.12

HERMON LABORATORIES

Cable loss
RF cable 8 m, model RG-214, HL 2009

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	1	0.10	NA	±0.12
2	10	0.14		
3	30	0.25		
4	50	0.34		
5	100	0.53		
6	300	0.99		
7	500	1.31		
8	800	1.73		
9	1000	1.98		
10	1100	2.11		
11	1200	2.21		
12	1300	2.35		
13	1400	2.46		
14	1500	2.55		
15	1600	2.68		
16	1700	2.78		
17	1800	2.88		
18	1900	2.98		
19	2000	3.09		

HERMON LABORATORIES

Cable loss
Cable coaxial, Gore, 18 GHz, 3m, SMA-SMA, S/N 989370
HL 2910

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
10	0.07	5750	2.97	12000	5.05
30	0.19	6000	2.91	12250	4.44
100	0.36	6250	3.23	12500	4.82
250	0.53	6500	3.42	12750	5.22
500	0.77	6750	3.17	13000	5.02
750	0.94	7000	3.56	13250	5.00
1000	1.10	7250	3.77	13500	5.09
1250	1.19	7500	3.48	13750	4.70
1500	1.35	7750	3.81	14000	5.03
1750	1.51	8000	3.82	14250	5.17
2000	1.57	8250	3.62	14500	4.92
2250	1.69	8500	3.95	14750	4.91
2500	1.76	8750	4.00	15000	5.03
2750	1.83	9000	3.80	15250	4.93
3000	2.02	9250	4.09	15500	5.28
3250	2.17	9500	4.12	15750	5.60
3500	2.13	9750	4.11	16000	5.16
3750	2.23	10000	4.36	16250	5.45
4000	2.40	10250	4.75	16500	5.78
4250	2.31	10500	4.61	16750	5.47
4500	2.52	10750	4.26	17000	5.21
4750	2.77	11000	4.62	17250	5.53
5000	2.82	11250	4.55	17500	5.53
5250	2.77	11500	4.59	17750	5.71
5500	3.04	11750	5.20	18000	5.77

HERMON LABORATORIES

13 APPENDIX E 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
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %

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.

HERMON LABORATORIES

14 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(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
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
μs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PM	pulse modulation
PS	power supply
pW	picowatt
RE	radiated emission
RF	radio frequency
rms	root mean square
s	second
V	volt
VA	volt-ampere
W	width