

TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 Subpart C, sections 15.231(a), 15.207
FCC CFR 47 PART 15 Subpart B, sections 15.107, 15.109

FOR:

Rkonet Electronics Ltd.

Wireless Repeater

Part number:

RP296EWR0USA

This report is in conformity with ISO/IEC 17025. The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.

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1 Applicant information

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Telephone: +972 3963 7777
Fax: +972 3961 6584
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Contact name: Mr. David Kartoun

2 Equipment under test attributes

Product name: Wireless Repeater
Part number: RP296EWR0USA
Receipt date: 6/22/2006

3 Manufacturer information

Manufacturer name: Risco Ltd.
Address: 32 Hacharoshet street, Ind. Zone, Kiryat Malachi, 83101, Israel
Telephone: +972 8860 0660
Fax: +972 8860 0662
E-mail: david@riscogroup.com
Contact name: Mr. David Kartoun




4 Test details

Project ID: 17207
Location: Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started: 6/22/2006
Test completed: 8/21/2006
Test specifications: FCC CFR 47 Part 15, subpart C, §§15.231(a), 15.207; subpart B, §§ 15.107, 15.109

5 Tests summary

Test	Status
Transmitter characteristics	
Section 15.231(a), Periodic operation requirements	Pass
Section 15.231(b), Field strength of emissions	Pass
Section 15.231(c), Occupied bandwidth	Pass
Section 15.207(a), Conducted emission	Pass
Section 15.203, Antenna requirement	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Pass
Section 15.109, Radiated emission	Pass
Section 15.111, 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.

	Name and Title	Date	Signature
Tested by:	Mr. P. Kagan, test engineer	August 21, 2006	
Reviewed by:	Ms. N. Averin, certification engineer	August 21, 2006	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	August 21, 2006	

6 EUT description

6.1 General information

The EUT is a repeater, which increases the range between Rokonet's transmitters and receivers by acting as a relay station. The repeater receives alarm messages from transmitters that were registered to it, recognizes them and resends these messages to a receiver. The EUT is equipped with a built-in supervised wireless transmitter and receiver by Melexis operating at 433.92 MHz. The EUT is equipped with an integral helical antenna. The EUT is powered from 10-16 VDC or AC from bus or from three 1.5V rechargeable backup batteries. 120 VAC / 16.5 VAC adapter manufactured by Honeywell, model number 1321, serial number 781410181472 was used during the testing. The EUT clocks are 13.56 MHz (transmitter crystal) and 23.5122 MHz (receiver crystal).

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Power	AC power	EUT	AC/AC adapter	DC jack	1	Unshielded	1.5 m	Indoor
Power	AC mains	AC/AC adapter	AC mains	2-pole wall outlet	1	NA	NA	Indoor

6.3 Test configuration



6.4 EUT general view





Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 3:25:09 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

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

7.1 Periodic operation requirements

7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- A manually operated transmitter shall employ switch that will automatically deactivate the transmitter within not more than 5 seconds of being released;
- A transmitter activated automatically shall cease transmission within 5 seconds after activation;
- Periodic transmissions, excluding polling or supervision transmissions, at regular predetermined intervals are not permitted;
- Polling or supervision transmissions, including data, to determine system integrity in security or safety applications shall not last longer than 2 seconds per hour.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

7.1.2 Test procedure for transmitter shut down test

7.1.2.1 The EUT was set up as shown in Figure 7.1.1.

7.1.2.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.2.3 The transmitter was activated automatically.

7.1.2.4 The transmission time was captured and shown in associated plots.

7.1.3 Test procedure for measurements of polling / supervision transmission duration

7.1.3.1 The EUT was set up as shown in Figure 7.1.1.

7.1.3.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.3.3 The transmission time was captured and shown in associated plot.

Figure 7.1.1 Setup for transmitter shut down test

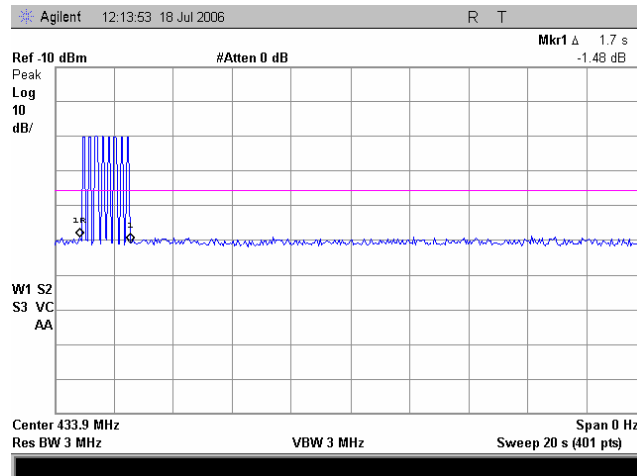


Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 3:25:09 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

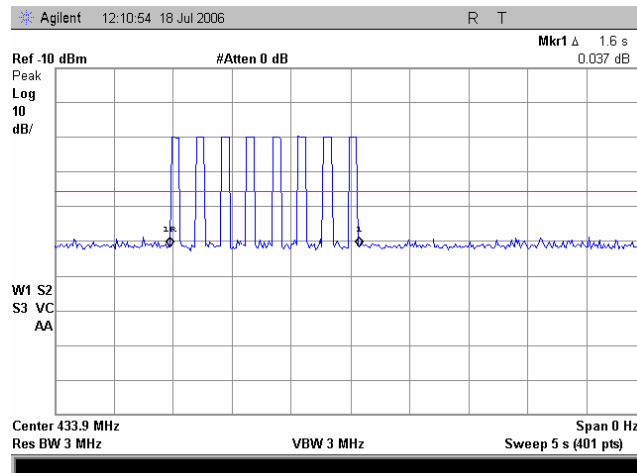
Table 7.1.1 Periodic operation requirements

Requirement	Rationale	Verdict
Continuous transmissions are not permitted	Supplier declaration	Comply
A manually operated transmitter shall be deactivated within not more than 5 seconds of switch being released	NA	NA
Transmitter activated automatically shall cease transmission within 5 seconds	Plots 7.1.1, 7.1.2	Comply
Periodic transmissions at regular predetermined intervals are not permitted	Supplier declaration	Comply
Total duration of polling or supervision transmissions shall not exceed 2 seconds per hour	Plot 7.1.6	Comply

Plot 7.1.1 Transmitter shut down test result, power up

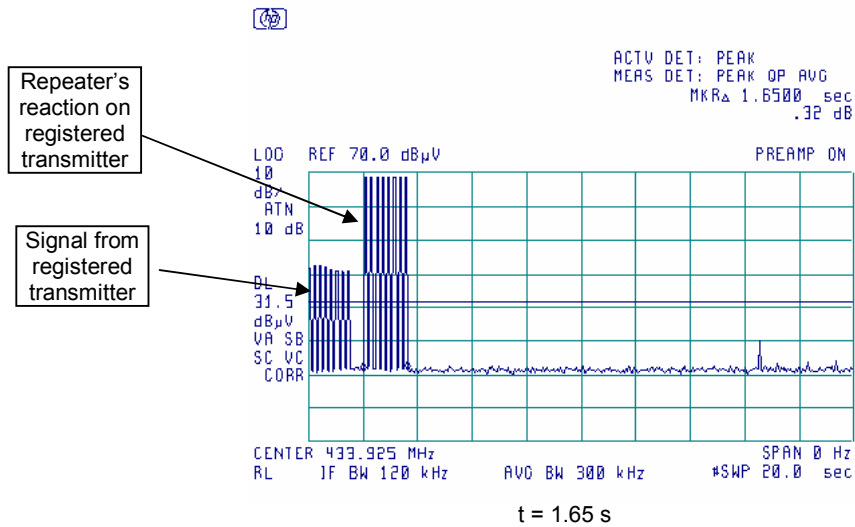


Plot 7.1.2 Transmitter shut down test result, power up

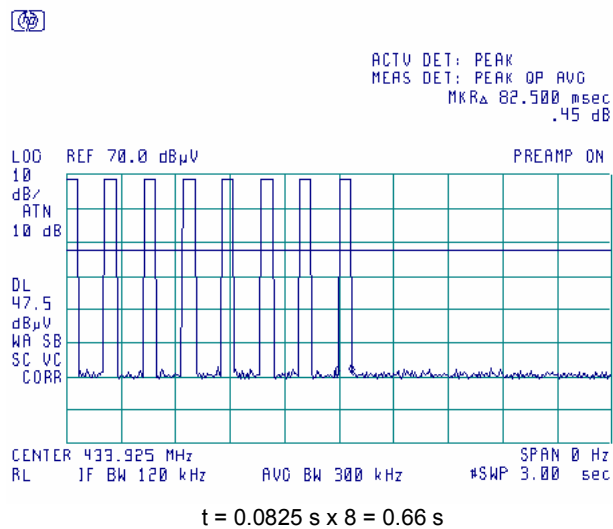


Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 3:25:09 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 7.1.3 Repeater's reaction on registered transmitter



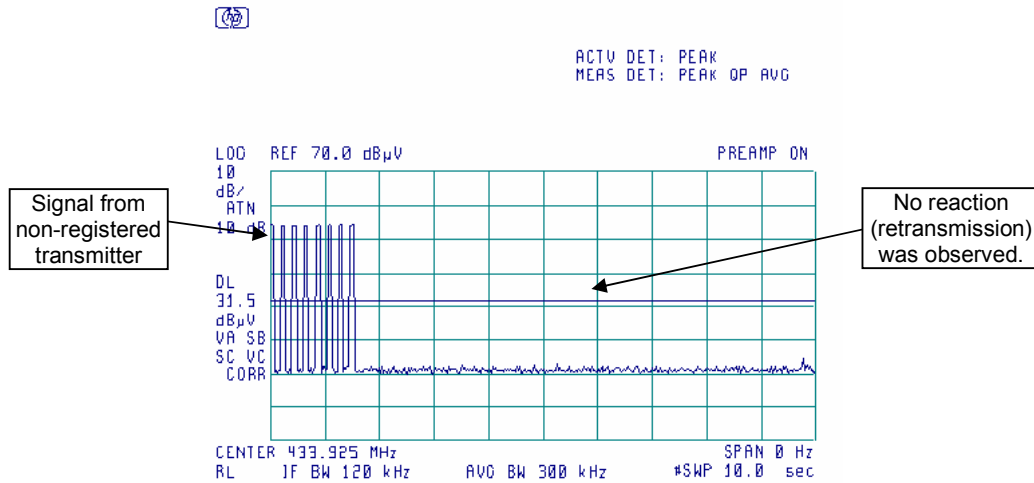
Plot 7.1.4 Repeater's reaction on registered transmitter





Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 3:25:09 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 7.1.5 Repeater's reaction on non-registered transmitter



Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 3:25:09 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 7.1.6 Polling / supervision transmission per hour

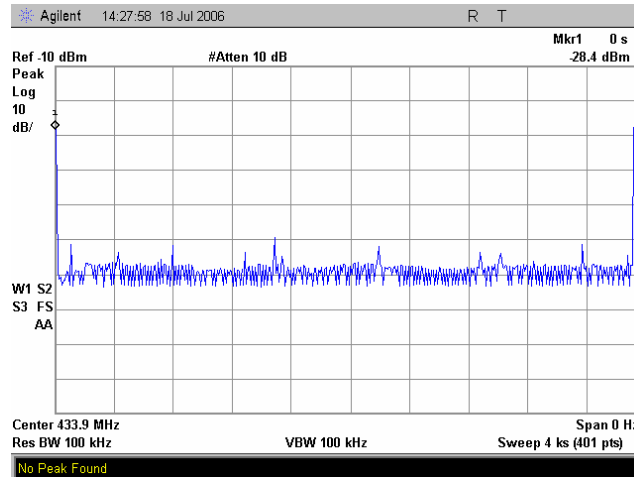


Table 7.1.2 Total duration of polling / supervision transmissions

Pulse duration, ms	Number of pulses within 1 burst	Burst duration, ms	Number of bursts within 1 transmission	Number of transmissions within 1 hour	Total duration within 1 hour, ms
1.5	21	64.5	8	1	252

Reference numbers of test equipment used

HL 1430							
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Full description is given in Appendix A.



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

7.2 Field strength of emissions

7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
433.92	100.8	80.8

Table 7.2.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(μV/m)				
	Within restricted bands			Outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	80.8	60.8
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			
Above 1000	74.0	NA	54.0		

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

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

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

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

Note 1: The fundamental emission limit in dB(μV/m) was calculated as follows:

$$\text{Lim}_{AVR} = 20 \times \log(56.81818 \times F - 6136.3636) \text{ - within 130 – 174 MHz band;}$$

$$\text{Lim}_{AVR} = 20 \times \log(41.6667 \times F - 7083.3333) \text{ - within 260 – 470 MHz band,}$$

where F is the carrier frequency in MHz.

The limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

Note 2: 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.

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

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

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

7.2.2.3 The measurements were performed in three EUT orthogonal positions. The worst test results were found in EUT position "X" as recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

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

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

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

7.2.3.3 The measurements were performed in three EUT orthogonal positions. The worst test results were found in EUT position "X" as recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz

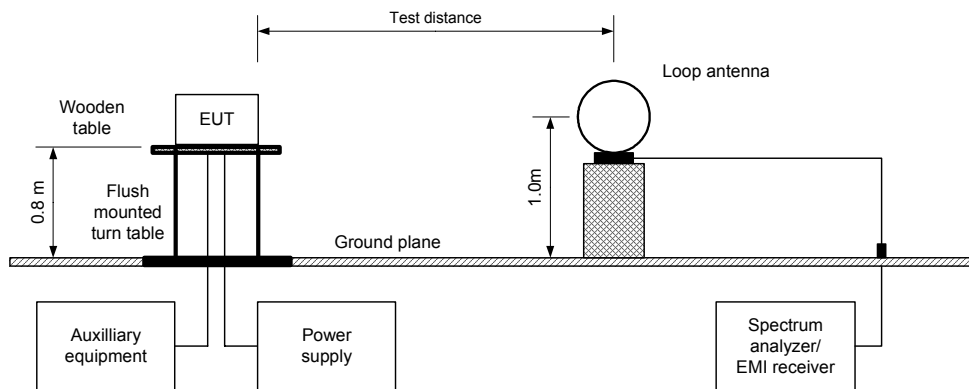
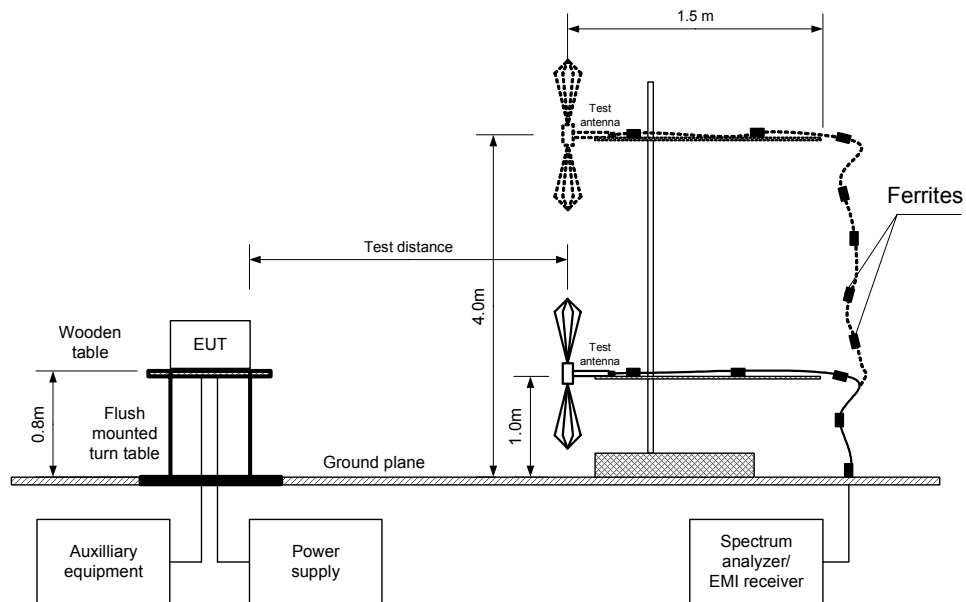


Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz





Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Table 7.2.3 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: X-axis^{Note1}
 MODULATION: OOK
 MODULATING SIGNAL: ID code
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 - 4500 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 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**		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
Fundamental emission											
433.92	H	1.2	210	89.19	100.8	-11.61	-9.83	79.36	80.8	-1.44	Pass
Spurious emissions											
60.25	V	1.2	210	30.08	80.8	-50.72	-9.83	20.25	60.8	-40.55	Pass
64.26	V	1.2	210	30.36	80.8	-50.44	-9.83	20.53	60.8	-40.27	
867.84	V	1.2	210	51.80	80.8	-29.00	-9.83	41.97	60.8	-18.83	

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

Table 7.2.4 Average factor calculation

Transmission pulse		Transmission burst duration, ms	Average factor, dB
Duration, ms	Period, ms		
1.5	3	64.5	-9.83

*- Average factor was calculated as follows for pulse train longer than 100 ms:

$$Average\ factor = 20 \times \log_{10} \left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\ ms} \times Number\ of\ bursts\ within\ 100\ ms \right)$$

$$Average\ factor = 20 \times \log_{10} \left(\frac{1.5}{3} \times \frac{64.5}{100} \times 1 = -9.83 \right)$$

Note 1: The measurements were performed in three EUT orthogonal positions. The worst test results were found in EUT position "X".

Reference numbers of test equipment used

HL 0446	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1004
HL 1424	HL 1553	HL 1566	HL 1849	HL 1850	HL 2009	HL 2109	

Full description is given in Appendix A.



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Table 7.2.5 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE: 3 m
 EUT POSITION: X-axis^{Note1}
 MODULATION: OOK
 MODULATING SIGNAL: ID code
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)

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

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

Table 7.2.6 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	

Note 1: The measurements were performed in three EUT orthogonal positions. The worst test results were found in EUT position "X".

Reference numbers of test equipment used

HL 0446	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1004
HL 1424	HL 1553	HL 1566	HL 1849	HL 1850	HL 2009	HL 2109	

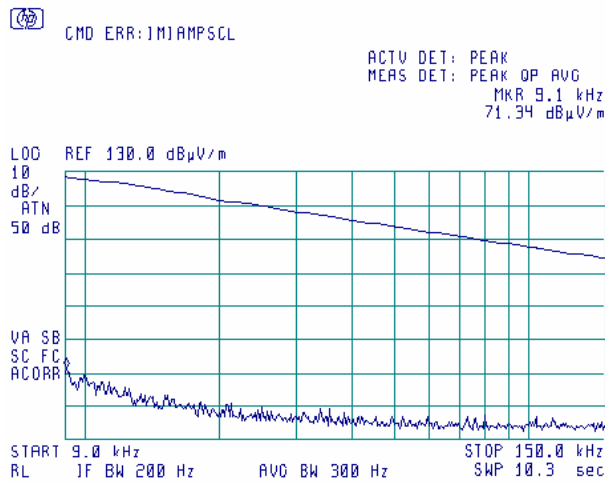
Full description is given in Appendix A.



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

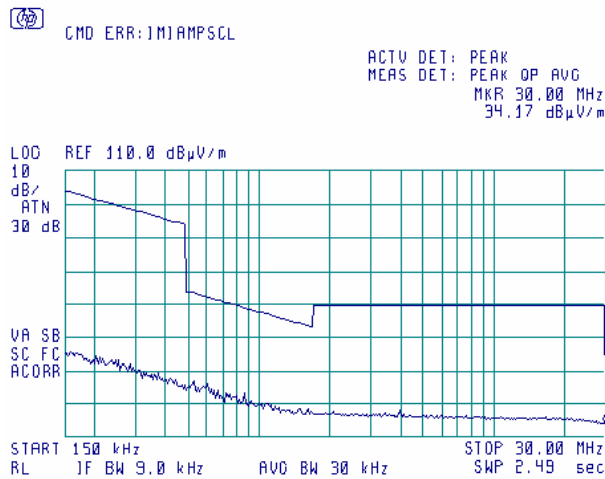
Plot 7.2.1 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 EUT POSITION: X-axis



Plot 7.2.2 Radiated emission measurements from 0.15 to 30 MHz

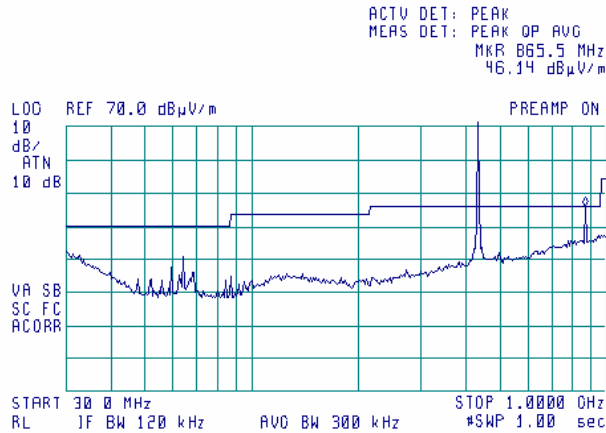
TEST SITE: Anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 EUT POSITION: X-axis



Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

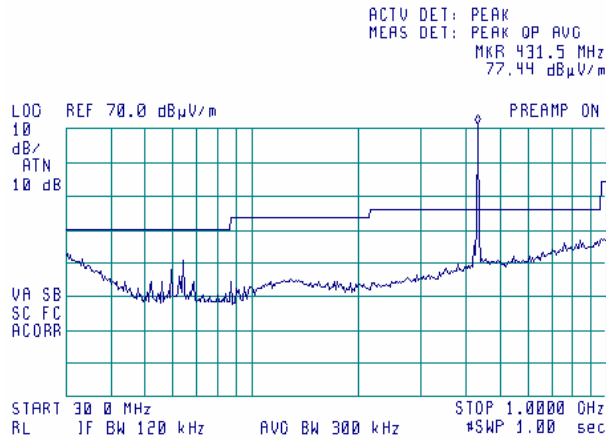
Plot 7.2.3 Radiated emission measurements from 30 to 1000 MHz

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



Plot 7.2.4 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 EUT POSITION: X-axis

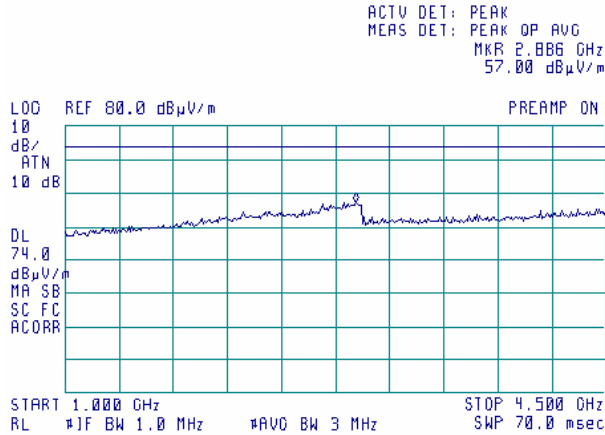


Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 7.2.5 Radiated emission measurements from 1000 to 4500 MHz

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

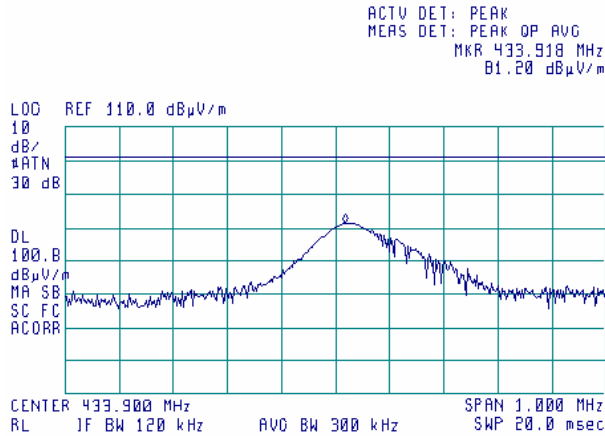
07:29:02 JUN 23, 2006



Plot 7.2.6 Radiated emission measurements at the fundamental frequency

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

11:18:57 JUN 22, 2006





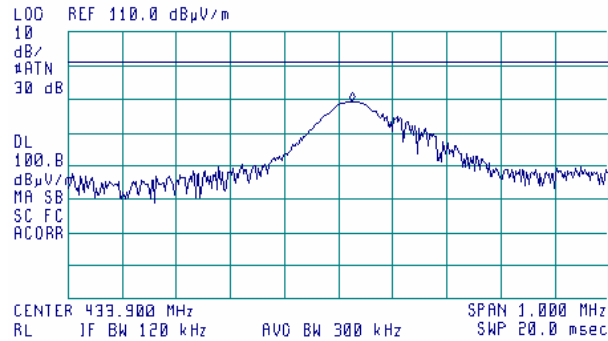
Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 7.2.7 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 EUT POSITION: X-axis

11:17:02 JUN 22, 2006

ACTV DET: PEAK
 MEAS DET: PEAK OP AVG
 MKR 433.925 MHz
 89.19 dBµV/m

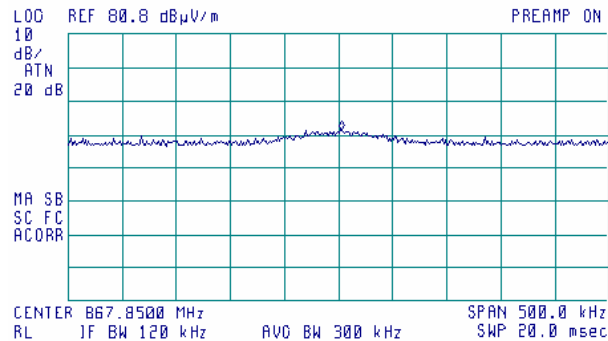


Plot 7.2.8 Radiated emission measurements at the second harmonic frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical & Horizontal
 EUT POSITION: X-axis

09:26:27 JUN 30, 2006

ACTV DET: PEAK
 MEAS DET: PEAK OP AVG
 MKR 867.8525 MHz
 51.00 dBµV/m



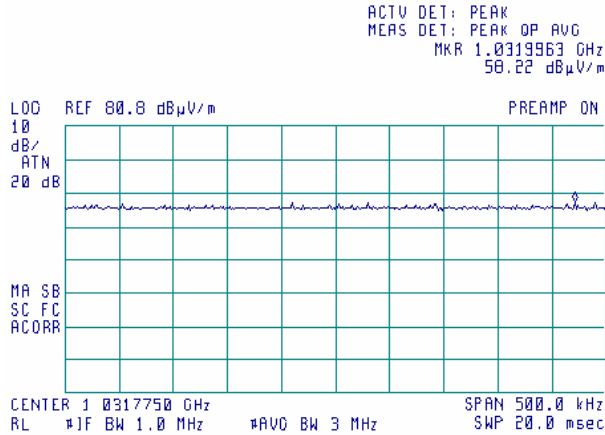


Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 7.2.9 Radiated emission measurements at the third harmonic frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical & Horizontal
 EUT POSITION: X-axis

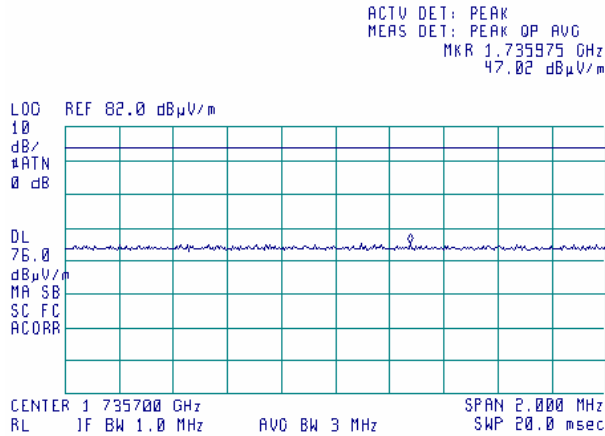
10:03:01 JUN 30, 2006



Plot 7.2.10 Radiated emission measurements at the fourth harmonic frequency

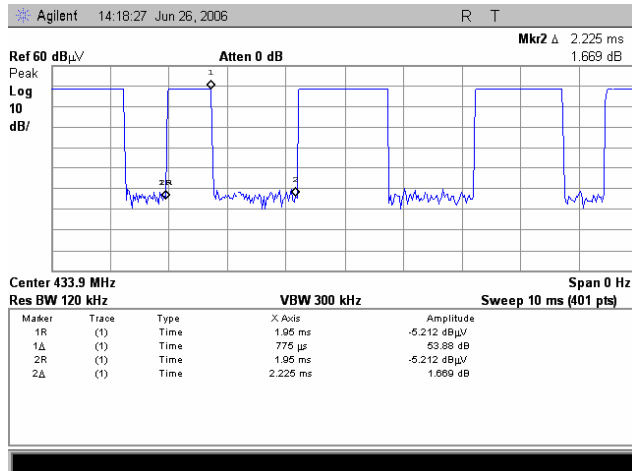
TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical & Horizontal
 EUT POSITION: X-axis

16:17:15 JUN 22, 2006

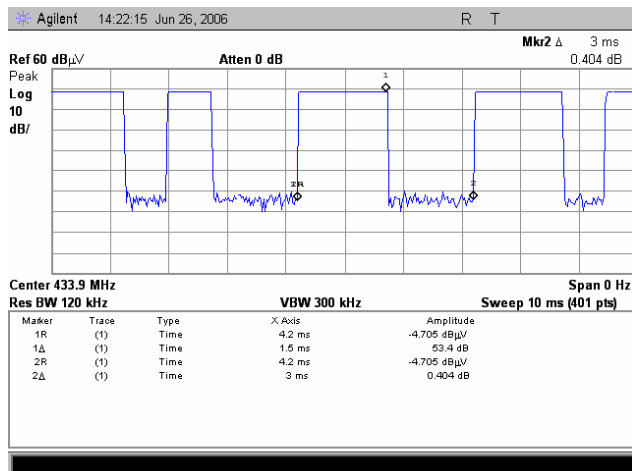


Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 7.2.11 Transmission pulse1 duration and period

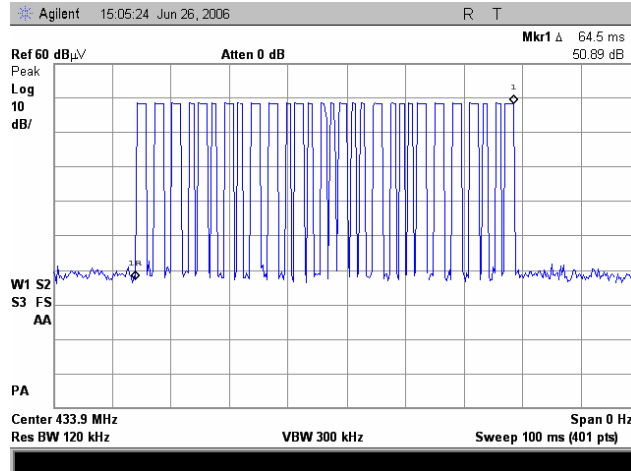


Plot 7.2.12 Transmission pulse2 duration and period

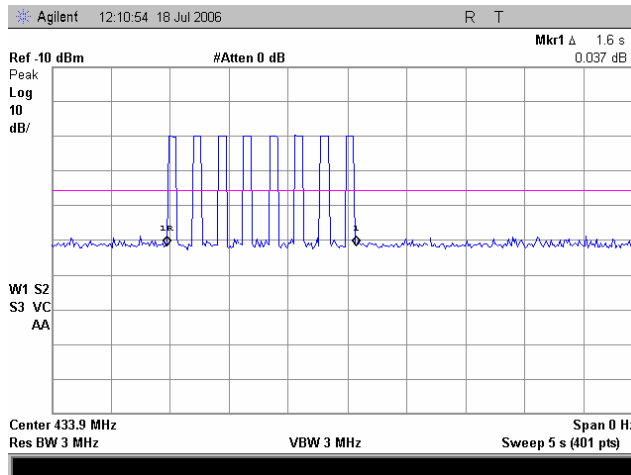


Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/18/2006 1:57:27 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 7.2.13 Transmission burst duration



Plot 7.2.14 Transmission train duration





Test specification:	Section 15.231(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/21/2006 11:57:32 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

7.3 Occupied bandwidth test

7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1. The test results are provided in Table 7.3.2 and associated plot.

Table 7.3.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, % of the carrier frequency
70 - 900	20.0	0.25
Above 900		0.50

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

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

7.3.2.2 The EUT was set to transmit modulated carrier.

7.3.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and associated plot.

Figure 7.3.1 Occupied bandwidth test setup





Test specification:	Section 15.231(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/21/2006 11:57:32 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
 RESOLUTION BANDWIDTH: 10 kHz
 VIDEO BANDWIDTH: 30 kHz
 MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
 MODULATION: OOK
 MODULATING SIGNAL: ID code

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
433.9192	70.80	0.25	1084.798	-1013.998	Pass

Reference numbers of test equipment used

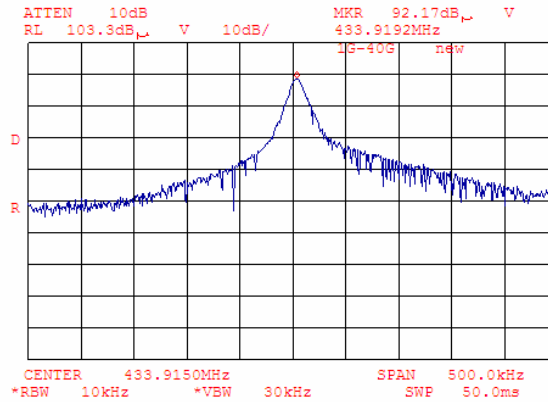
HL 0337	HL 1424						
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Full description is given in Appendix A.

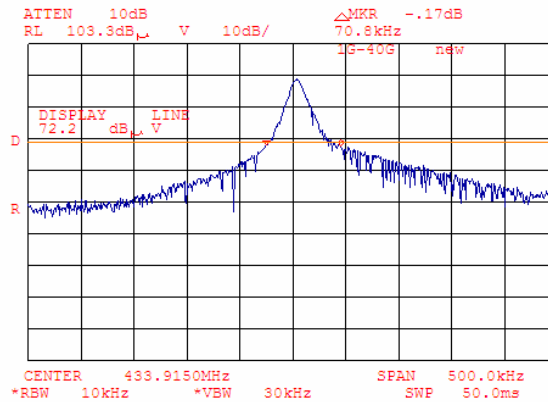


Test specification:	Section 15.231(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/21/2006 11:57:32 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 7.3.1 Occupied bandwidth test result, reference level



Plot 7.3.2 Occupied bandwidth test result





Test specification:	Section 15.207(a), Conducted emissions		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/30/2006 11:58:32 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

7.4 Conducted emissions

7.4.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.4.1. The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

Table 7.4.1 Limits for conducted emissions

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

* The limit decreases linearly with the logarithm of frequency.

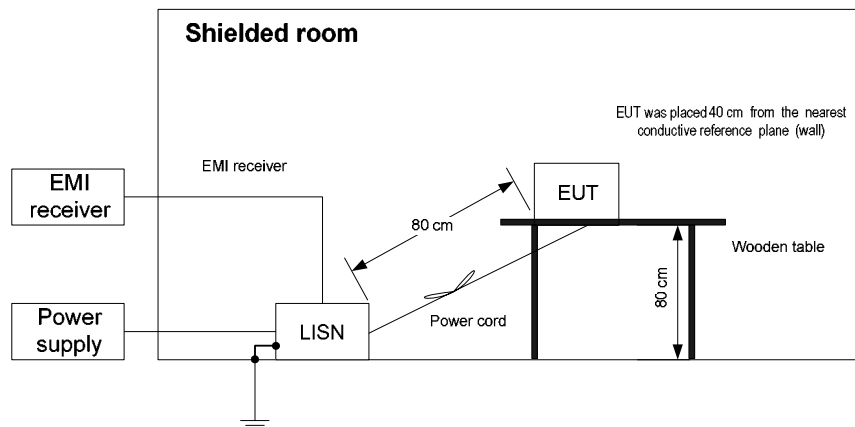
7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.

7.4.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.4.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

Figure 7.4.1 Setup for conducted emission measurements





Test specification:	Section 15.207(a), Conducted emissions		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/30/2006 11:58:32 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Table 7.4.2 Conducted emission test results

LINE: AC mains input of AC/AC adapter
 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*		
0.151600	28.62	13.45	65.92	-52.47	-12.72	55.92	-68.64	L1	Pass
0.170270	27.55	11.97	65.01	-53.04	-12.68	55.01	-67.69		
0.204156	21.74	3.65	63.49	-59.84	-14.23	53.49	-67.72		
0.227765	17.38	4.61	62.59	-57.98	-13.50	52.59	-66.09		
0.798673	13.85	11.65	56.00	-44.35	3.54	46.00	-42.46		
28.118049	22.33	21.24	60.00	-38.76	19.54	50.00	-30.46	L2	Pass
0.150011	23.78	14.95	66.00	-51.05	-10.83	56.00	-66.83		
0.154888	23.03	14.40	65.76	-51.36	-9.65	55.76	-65.41		
0.157213	22.83	15.65	65.65	-50.00	-8.08	55.65	-63.73		
0.802659	14.24	10.97	56.00	-45.03	-0.46	46.00	-46.46		
1.065122	10.57	8.15	56.00	-47.85	-1.78	46.00	-47.78		
28.117018	17.21	16.21	60.00	-43.79	14.36	50.00	-35.64		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

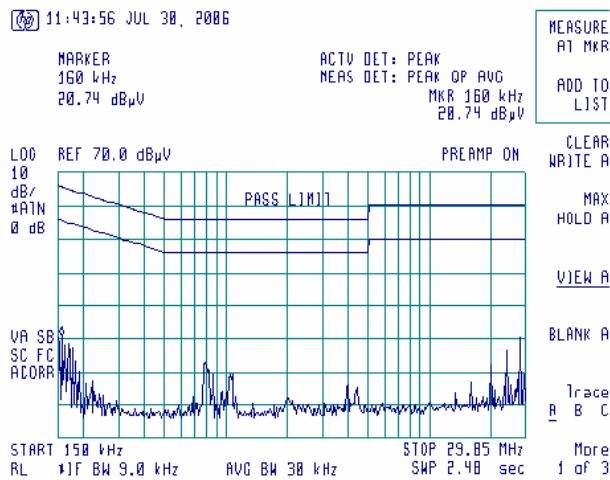
HL 0163	HL 0672	HL 0787	HL 1430	HL 1502	HL 1510		
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Full description is given in Appendix A.

Test specification:	Section 15.207(a), Conducted emissions		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/30/2006 11:58:32 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

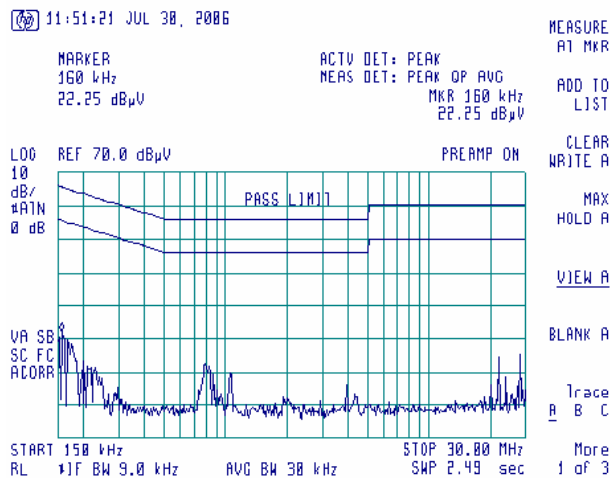
Plot 7.4.1 Conducted emission measurements

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



Plot 7.4.2 Conducted emission measurements

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





Test specification:	Section 15.203, Antenna requirement		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2006 1:45:57 PM		
Temperature: 25 °C	Air Pressure: 1011 hPa	Relative Humidity: 39 %	Power Supply: 16.5 VAC
Remarks:			

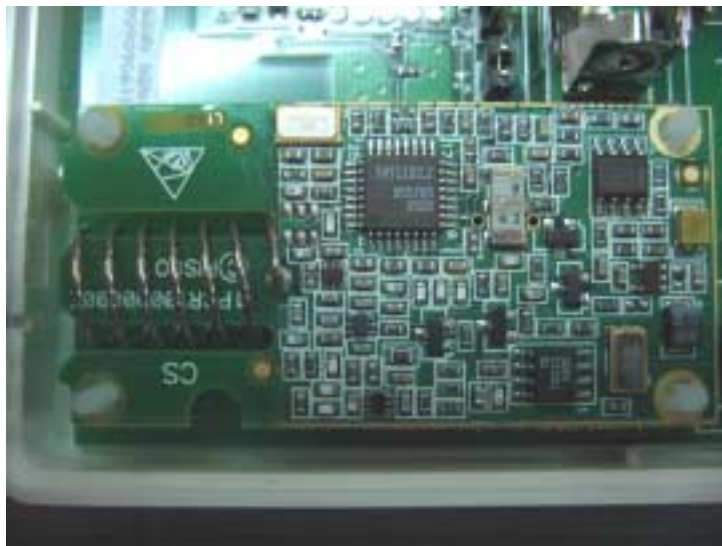
7.5 Antenna requirements

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

Table 7.5.1 Antenna requirements

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

Photograph 7.5.1 Antenna assembly



Test specification:	Section 15.107, Conducted emission at AC power port, Class B		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/27/2006 10:43:06 AM		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

8 Emission tests according to FCC 47CFR part 15 subpart B 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. The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

Table 8.1.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μ V)		Class A limit, dB(μ V)	
	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.

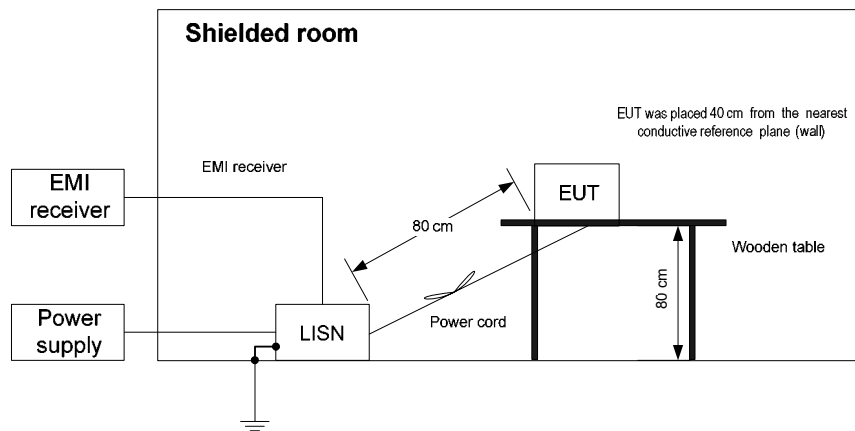
8.1.2 Test procedure

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 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.

Figure 8.1.1 Setup for conducted emission measurements



Test specification:	Section 15.107, Conducted emission at AC power port, Class B		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/27/2006 10:43:06 AM		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

Table 8.1.2 Conducted emission test results

LINE: AC mains input of AC/AC adapter
LIMIT: Class B
EUT OPERATING MODE: Charging
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*		
0.152285	24.56	16.31	65.89	-49.58	3.94	55.89	-51.95	L1	Pass
28.075118	27.08	25.69	60.00	-34.31	24.45	50.00	-25.55		
0.156935	29.88	19.89	65.66	-45.77	3.49	55.66	-52.17	L2	Pass

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

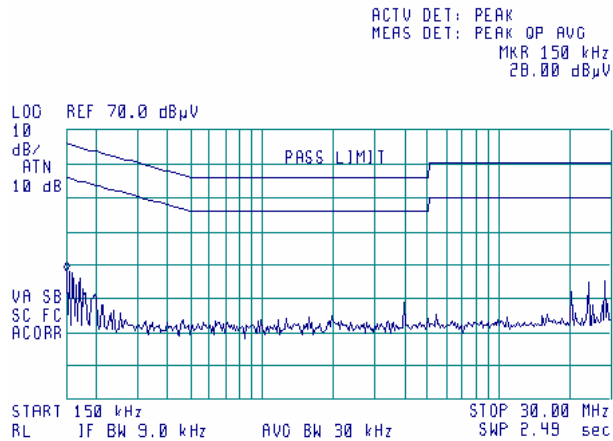
HL 0163	HL 0672	HL 0787	HL 1430	HL 1502	HL 1510		
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Full description is given in Appendix A.

Test specification:	Section 15.107, Conducted emission at AC power port, Class B		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/27/2006 10:43:06 AM		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

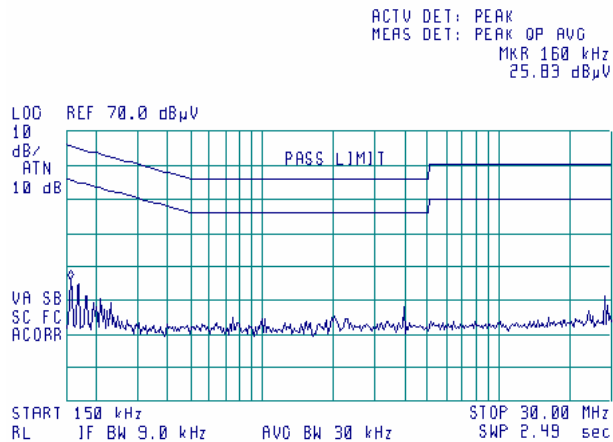
Plot 8.1.1 Conducted emission measurements

LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Charging
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 8.1.2 Conducted emission measurements

LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Charging
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 1:44:20 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 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.

Table 8.2.1 Radiated emission test limits

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

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

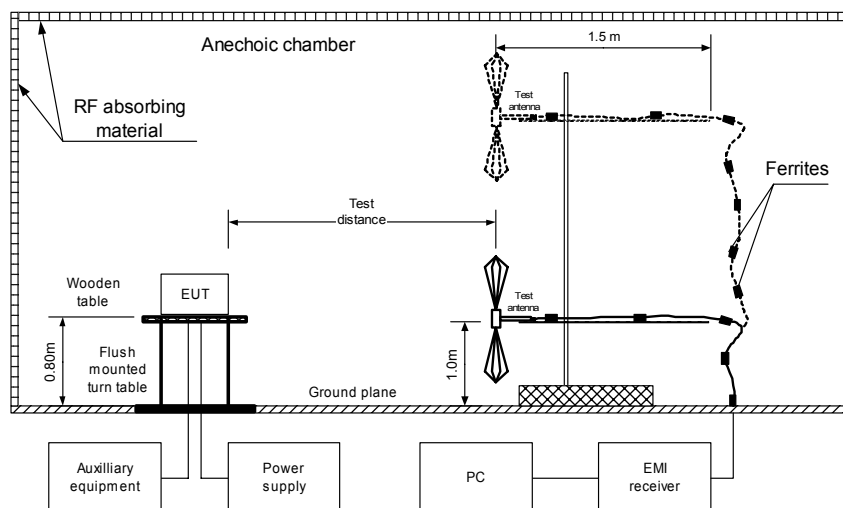
8.2.2 Test procedure

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°, 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 8.2.2 and shown in the associated plots.

Figure 8.2.1 Setup for radiated emission measurements in anechoic chamber





Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 1:44:20 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Table 8.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive / Standby
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
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*				
32.102500	28.21	27.14	40.00	-12.86	V	1	270	Pass
36.102500	30.11	29.24	40.00	-10.76	V	1	270	
40.115000	32.58	31.85	40.00	-8.15	V	1	270	
44.125500	30.92	30.07	40.00	-9.93	V	1	270	
48.136400	31.96	31.38	40.00	-8.62	V	1	270	
100.273300	24.75	23.31	43.50	-20.19	V	1	270	

FREQUENCY RANGE: 1000 MHz – 2900 MHz
DETECTOR USED: PEAK
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*				
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 0593	HL 0594	HL 0604	HL 1004	HL 1947
HL 1984	HL 2009						

Full description is given in Appendix A.

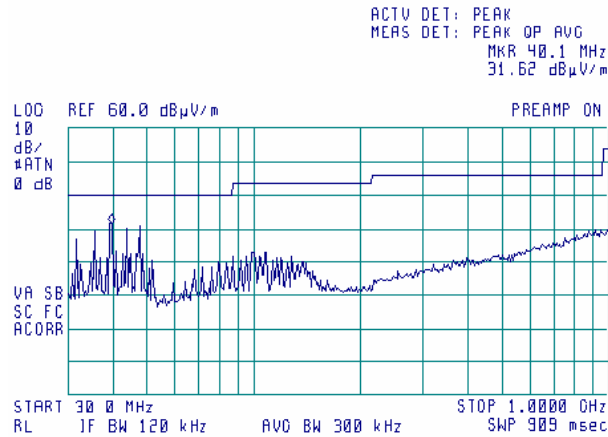


Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 1:44:20 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

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

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

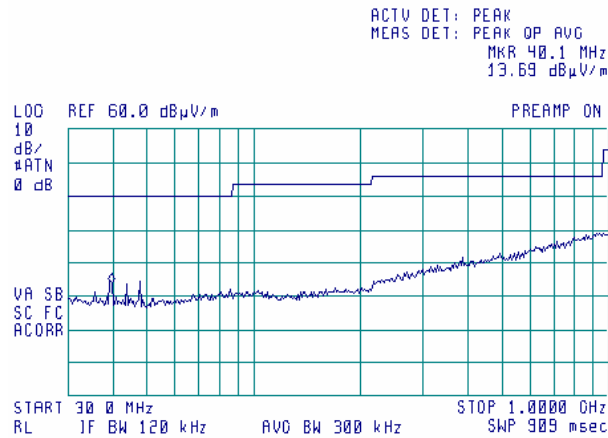
11:35:09 JUN 30, 2006



Plot 8.2.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

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

11:37:17 JUN 30, 2006

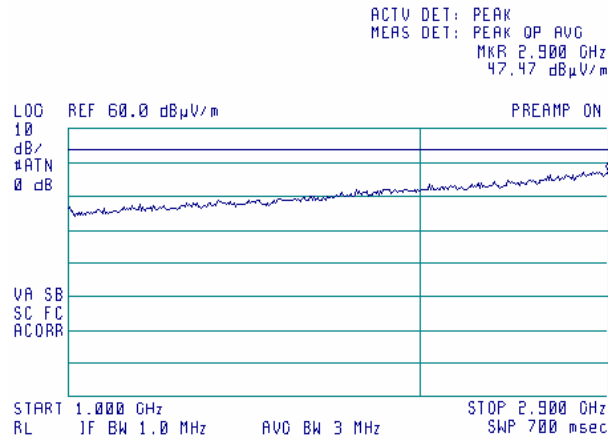




Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 1:44:20 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 16.5 VAC
Remarks:			

Plot 8.2.3 Radiated emission measurements above 1000 MHz, vertical & horizontal antenna polarization

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



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0163	LISN FCC/VDE/MIL-STD	Electro-Metrics	ANS 25/2	1314	01-Oct-05	01-Oct-06
0337	Probe Set, Hand held, 5 probes	Electro-Metrics	EHFP-30	238	08-Jun-06	08-Jun-07
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	11-Nov-05	11-Nov-06
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	26-Sep-05	26-Sep-06
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-05	02-Dec-06
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	02-Feb-06	02-Feb-07
0594	Turn Table for anechoic chamber flush mount d=1.2 m Pneumatic	HL	TT- WDC1	102	26-Jan-06	26-Jan-07
0604	Antenna BiconiLog Log-Periodic/T Bow- TIE 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-06	10-Jan-07
0672	Shielded Room 4,6(L) x 4,2(W) x 2,4(H) m	HL	SR - 3	027	11-Nov-05	11-Nov-06
0787	Transient Limiter	Hewlett Packard	11947A	3107A018 77	21-Nov-05	21-Nov-06
1004	Cable Coaxial , ANDREW PSWJ4 , 6m	HL	ANDREW -6	163	04-Dec-05	04-Dec-06
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	30-Aug-05	30-Aug-06
1430	EMI Receiver, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3807A002 62,3705A0 0217	01-Sep-05	01-Sep-06
1502	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1502	02-Dec-05	02-Dec-06
1510	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1510	02-Dec-05	02-Dec-06
1553	Cable RF, 3.5 m	Alpha Wire	RG-214	1553	02-Dec-05	02-Dec-06
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	02-Dec-05	02-Dec-06
1653	Analyzer EMC 9 kHz - 1.5 GHz	Agilent Technologies	E7401A	US394402 81	06-Feb-06	06-Feb-07
1849	Antenna mast with polarity control (Small Anechoic chamber)	Sh. I. Machines	AM-F4	1849	18-Jan-06	18-Jan-07
1850	Turntable	Sh. I. Machines	TT-M-3	1850	11-Nov-05	11-Nov-06
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS- 1803A- 6500-NPS	T4974	17-Oct-05	17-Oct-06
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	03-Mar-06	03-Mar-07
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-05	02-Dec-06
2109	Anechoic Chamber 6(L) x 5.5(W) x 2.95(H) m	HL	AC-2	2109	11-Nov-05	11-Nov-06

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of ISO/IEC 17025 (or alternately ANSI/NCSL Z540-1).

The laboratory calibrates its measurement standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements. The Hermon Labs EMC measurements uncertainty is given in the table above. Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX C 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).

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Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

FCC 47CFR part 15: 2005	Radio Frequency Devices.
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

13 APPENDIX E 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

14 APPENDIX F Test equipment correction factors

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

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

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

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

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

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

Antenna factor
Biconilog antenna EMCO, model 3141, serial number 1011

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

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

**Antenna factor
Double-ridged wave guide horn antenna
Model 3115, S/N 9911-5964**

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).

Cable loss

Cable coaxial, GORE A2P01POL118, 2.3 m, model GORE-3, serial number 176, HL 0589
+ Cable coaxial, ANDREW PSWJ4, 6 m, model: ANDREW-6, serial number 163, 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		
22	4500	4.07		
23	4800	4.36		±0.17
24	5100	4.62		
25	5400	4.78		
26	5700	5.16		
27	6000	5.67		
28	6500	5.99		

Cable 18 GHz, 6.5 m, blue, model NPS-1803A-6500-NPS, serial number T4974, HL 1947
Calibration data

Frequency, GHz	Insertion loss, dB
0.03	0.30
0.05	0.38
0.10	0.53
0.20	0.74
0.30	0.91
0.40	1.05
0.50	1.18
0.60	1.29
0.70	1.40
0.80	1.50
0.90	1.59
1.00	1.68
1.10	1.77
1.20	1.86
1.30	1.94
1.40	2.01
1.50	2.08
1.60	2.16
1.70	2.22
1.80	2.29
1.90	2.36
2.00	2.42
2.10	2.48
2.20	2.54
2.30	2.60
2.40	2.66
2.50	2.71
2.60	2.77
2.70	2.83
2.80	2.89
2.90	2.95
3.10	3.06
3.30	3.17
3.50	3.28
3.70	3.39
3.90	3.51
4.10	3.62
4.30	3.76
4.50	3.87
4.70	4.01
4.90	4.10
5.10	4.21
5.30	4.31
5.50	4.43
5.70	4.56
5.90	4.71

Frequency, GHz	Insertion loss, dB
6.10	4.87
6.30	4.95
6.50	4.94
6.70	4.88
6.90	4.87
7.10	4.83
7.30	4.85
7.50	4.86
7.70	4.91
7.90	4.96
8.10	5.03
8.30	5.08
8.50	5.13
8.70	5.21
8.90	5.22
9.10	5.34
9.30	5.35
9.50	5.52
9.70	5.51
9.90	5.66
10.10	5.70
10.30	5.78
10.50	5.79
10.70	5.82
10.90	5.86
11.10	5.94
11.30	6.06
11.50	6.21
11.70	6.44
11.90	6.61
12.10	6.76
12.40	6.68
13.00	6.66
13.50	6.81
14.00	6.90
14.50	6.90
15.00	6.97
15.50	7.17
16.00	7.28
16.50	7.27
17.00	7.38
17.50	7.68
18.00	7.92

Cable loss
RF cable 8 m, model RG-214, serial number C-56, 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		

Cable RF, 2m, model: Sucoflex 104PE, s/n 13094/4PE (HL 1566)
Calibration data

No.	Parameter	SET, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB	Notes
1	Insertion Loss	30	0.10	-	≤ 5.0	±0.12	
2		50	0.13	-			
3		100	0.20	-			
4		300	0.33	-			
5		500	0.45	-			
6		800	0.60	-			
7		1000	0.65	-			
8		1500	0.91	-			
9		2000	1.08	-			
10		2500	1.19	-			
11		3000	1.28	-			
12		3500	1.49	-			
13		4000	1.63	-			
14	Insertion Loss	4500	1.63	-	≤ 5.0	±0.17	
15		5000	1.66	-			
16		5500	1.88	-			
17		6000	1.96	-			
18		6500	1.93	-			
19		7000	2.07	-			
20		7500	2.37	-			
21		8000	2.34	-			
22		8500	2.64	-			
23		9000	2.68	-			
24		9500	2.64	-			
25		10000	2.70	-			
26		10500	2.84	-			
27		11000	2.88	-			
28		11500	3.19	-			
29		12000	3.15	-			
30	Insertion Loss	12500	3.20	-	≤ 5.0	±0.26	
31		13000	3.22	-			
32		13500	3.47	-			
33		14000	3.41	-			
34		14500	3.59	-			
35		15000	3.79	-			
36		15500	4.24	-			
37		16000	4.12	-			
38		16500	4.46	-			
39		17000	4.50	-			
40		17500	4.49	-			
41		18000	4.45	-			

Cable RF, 3.5m, model RG-214, serial number 1553 (HL 1553)

No.	Parameter	Set		Measured, dBm	Attenuation, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB
		MHz	dBm					
1	Attenuation	1	-0.12	-0.13	0.01	NA	NA	±0.12
2		10	0.00	-0.07	0.07			
3		30	-0.10	-0.22	0.12			
4		50	-0.09	-0.31	0.22			
5		100	-0.13	-0.39	0.26			
6		200	-0.08	-0.48	0.40			
7		300	-0.12	-0.64	0.52			
8		400	-0.03	-0.63	0.60			
9		500	0.19	-0.51	0.70			
10		600	0.05	-0.72	0.77			
11		700	-0.06	-0.90	0.84			
12		800	-0.01	-1.01	1.00			
13		900	0.03	-0.97	1.00			
14		1000	-0.08	-1.13	1.05			
15		2000	-0.19	-1.89	1.70			

Cable RF, 6m, model: M17/167 MIL-C-17, s/n 1502 (HL 1502)
Calibration data (0.1 – 1000 MHz)

No.	Parameter	Set, MHz	Measured, dB	Deviation	Tolerance (specification), dB	Measured uncertainty dB
1	Attenuation	0.1	0.02	NA	NA	±0.12
2		1	0.07			
3		3	0.15			
4		5	0.17			
5		10	0.26			
6		30	0.43			
7		50	0.57			
8		80	0.72			
9		100	0.81			
10		300	1.48			
11		500	2.00			
12		800	2.70			
13		1000	3.09			

Cable RF, 8m, model: M17/167 MIL-C-17, s/n 1510 (HL 1510)
Calibration data (0.1 – 1000 MHz)

No.	Parameter	Set, MHz	Measured, dB	Deviation	Tolerance (specification), dB	Measured uncertainty dB
1	Attenuation	0.1	0.05	NA	NA	±0.12
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			