



HERMON LABORATORIES



Electrical

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TEST REPORT

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

FOR:

On Track Innovations Ltd.

Smart card reader

Brand name: SATURN

Model: SAT5000

Type: Transceiver

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 4686 8000
Fax: +972 4693 8887
E-mail: h_itay@otiglobal.com
Contact name: Mr. Hemy Itay

2 Equipment under test attributes

Product name: Smart card reader
Product type: Transceiver
Brand name: SATURN
Model(s): SAT5000
Serial number: 0567VB
Receipt date: 7/11/2004 1:40:00 PM

3 Manufacturer information

Manufacturer name: On Track Innovations Ltd.
Address: P.O.B. 32, ZHR Industrial Zone, Rosh Pina, Index 12000, Israel
Telephone: +972 4686 8000
Fax: +972 4693 8887
E-Mail: h_itay@otiglobal.com
Contact name: Mr. Hemy Itay






4 Test details

Project ID: 15932
Location: Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started: 11/1/2004
Test completed: 12/27/2005
Test specification(s): FCC Part 15, subpart C, §15.225, §15.207; subpart B, §15.107, §15.109
Test suite: FCC_15.225 (5/3/2004 5:43:04 PM, modified)

5 Tests summary

Test	Status
Transmitter characteristics	
Sections 15.225(a) (b) (c), In band radiated emissions	Pass
Sections 15.225(d), Out of band radiated emissions	Pass
Section 15.225(e), Frequency stability	Pass
Section 15.207(a), Conducted emission	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Pass
Section 15.109, Radiated emission	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mr. Michael Lerman, test engineer	December 27, 2004	
	Mr. B. Efros, test engineer	November 1, 2004	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	January 27, 2005	
	Mr. M. Nikishin, EMC group leader	January 30, 2005	
Approved by:	Mr. A. Usoskin, C.E.O.	January 31, 2005	



6 EUT description

6.1 General information

The EUT, model SAT5000, is a contactless smart card reader operating at 13.56 MHz designed for contactless payment and loyalty applications providing unsurpassed cost to performance value. It is a combined microprocessor based ISO14443 A&B proximity transceiver with on board antenna, indicator leds and buzzer in a plastic enclosure. The device is powered from mains via AC/DC adapter.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Power	12 VDC	EUT	AC/DC adapter	DC jack	1	Unshielded	1.5 m	Indoor
Power	AC mains	AC/DC adapter	AC mains	IEC 320	1	NA	NA	Indoor
Power	DC	PC	AC/DC adapter	DC jack	1	Unshielded	1.5 m	Indoor
Power	AC mains	AC/DC adapter	AC mains	Two pole	1	Unshielded	1.5 m	Indoor
RS232 configuration								
Signal	RS232	EUT	PC	D-type 9 pin	1	Shielded	1.5 m	Indoor
Signal	mouse	PC	mouse	PS/2	1	Shielded	1.5 m	Indoor
Signal	printer	PC	printer	D-type 25	1	Shielded	1.0 m	Indoor
Signal	USB	PC	termination	USB	1	Shielded	1.0 m	Indoor
USB configuration								
Signal	USB	EUT	PC	D-type 9 pin	1	Shielded	1.5 m	Indoor
Signal	mouse	PC	mouse	PS/2	1	Shielded	1.5 m	Indoor
Signal	printer	PC	printer	D-type 25	1	Shielded	1.0 m	Indoor
Signal	RS232	PC	termination	RS232	1	Shielded	1.0 m	Indoor

6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
PC (laptop)	IBM	2645	553C29X005
AC/DC adapter	NA	4824-120070-APC	NA
Mouse	Microsoft	2.2A	0124696-5
AC adapter	IBM	02K6654	241146JJ
Printer LX-810	Seiko Epson Corp.	P80SA	44B1127035
Mouse (termination)	Microsoft	2.1A	00307296

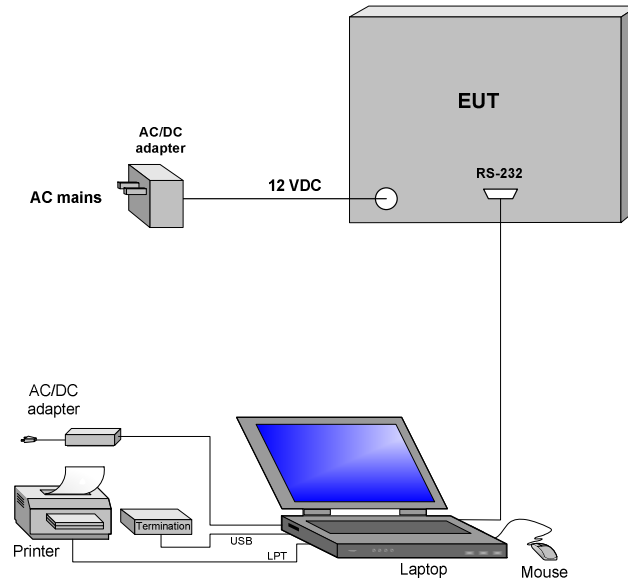
6.4 Operating frequencies

Source	Frequency, MHz	
Radio portion	13.56	
Digital clock	4	24
SAM card	5	
CPU	500	

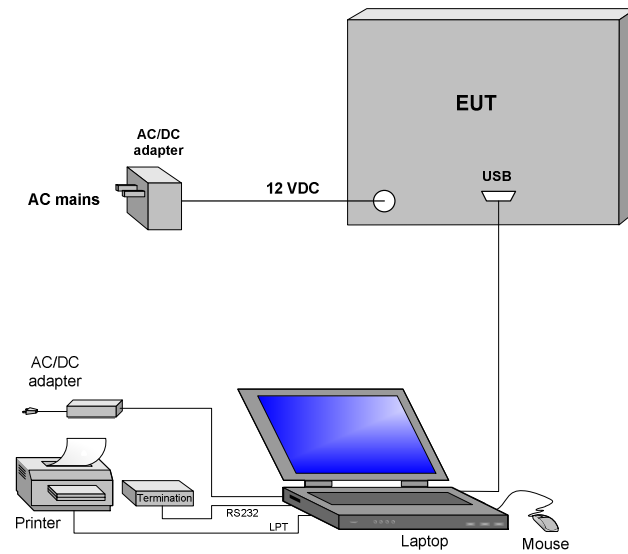


6.5 Test configuration

6.5.1 RS-232 configuration



6.5.2 USB configuration





Test specification:		Sections 15.225(a) (b) (c), In band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/24/2004 1:06:46 PM		
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:			

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

7.1 In band radiated emissions

7.1.1 General

This test was performed to measure field strength of fundamental emission and modulation products from the EUT within the assigned band. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Radiated emission limits

Frequency, MHz	Field strength at 30 m distance*		Field strength at 3 m distance*	
	μV/m	dB(μV/m)	μV/m	dB(μV/m)**
13.110 – 13.410	106	40.5	10600	80.5
13.410 – 13.553	334	50.5	33400	90.5
13.553 – 13.567	15848	84.0	1584800	124.0
13.567 – 13.710	334	50.5	33400	90.5
13.710 – 14.010	106	40.5	10600	80.5

*- The limit is provided in quasi peak values.

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

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

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

7.1.2 Test procedure

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

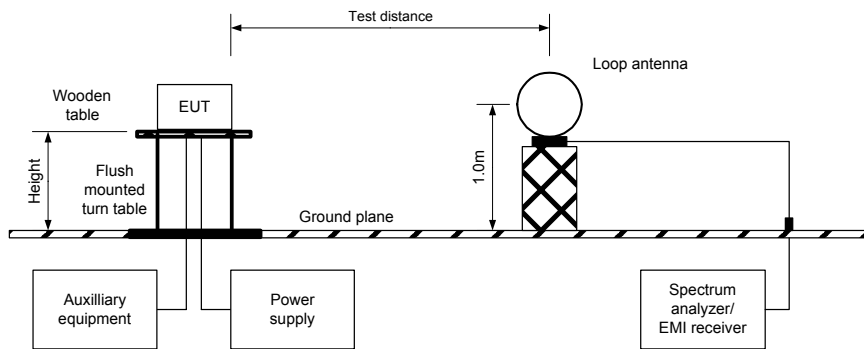
7.1.2.2 The specified frequency range was investigated with loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna was rotated around its vertical axis and the measuring antenna polarization was switched from vertical to horizontal.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.



Test specification: Sections 15.225(a) (b) (c), In band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/24/2004 1:06:46 PM			
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:			

Figure 7.1.1 Setup for in band radiated emission measurements





Test specification:	Sections 15.225(a) (b) (c), In band radiated emissions		
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/24/2004 1:06:46 PM		
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:			

Table 7.1.2 In band radiated emission test results

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

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Azimuth**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*			
USB configuration							
13.56	85.0	85.0	124.0	-39.0	Horizontal	316	Pass
13.56	87.8	87.8	124.0	-36.2	Vertical	0	
RS232 configuration							
13.56	84.9	84.8	124.0	-39.2	Horizontal	310	Pass
13.56	87.6	87.5	124.0	-36.5	Vertical	8	

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

HL 0446	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 2009	
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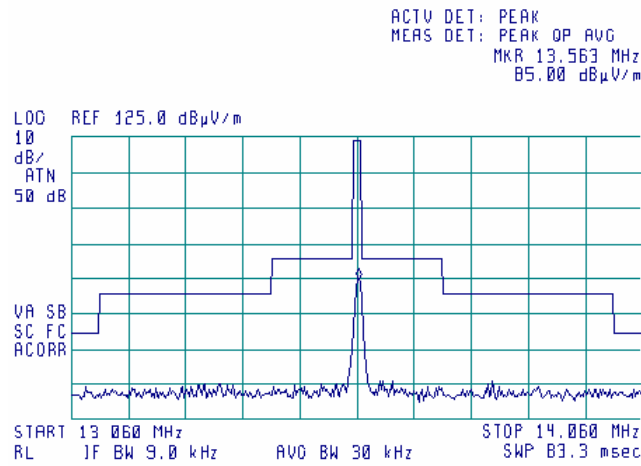
Full description is given in Appendix A.



Test specification: Sections 15.225(a) (b) (c), In band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/24/2004 1:06:46 PM			
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:			

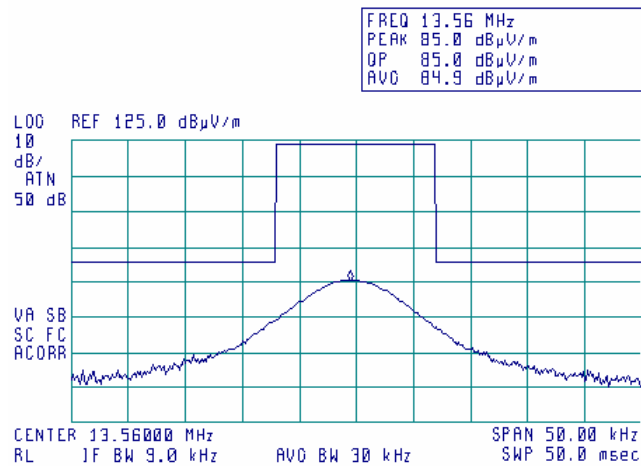
Plot 7.1.1 In band radiated emission test results, USB configuration, horizontal loop antenna polarization

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak hold



Plot 7.1.2 In band radiated emission test results, USB configuration, horizontal loop antenna polarization

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak hold

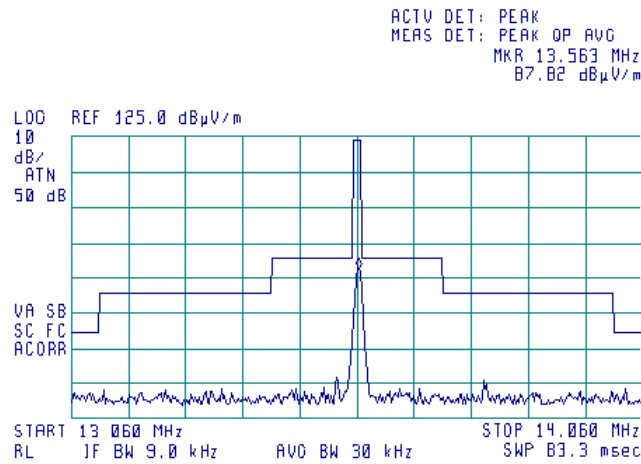




Test specification: Sections 15.225(a) (b) (c), In band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/24/2004 1:06:46 PM			
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:			

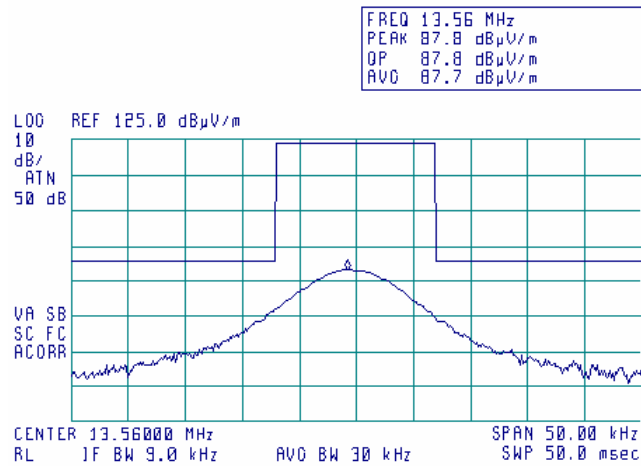
Plot 7.1.3 In band radiated emission test results, USB configuration, vertical loop antenna polarization

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak hold



Plot 7.1.4 In band radiated emission test results, USB configuration, vertical loop antenna polarization

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak hold

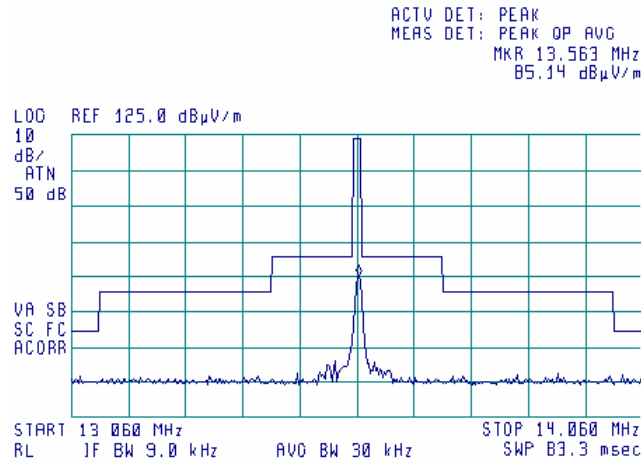




Test specification: Sections 15.225(a) (b) (c), In band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/24/2004 1:06:46 PM			
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:			

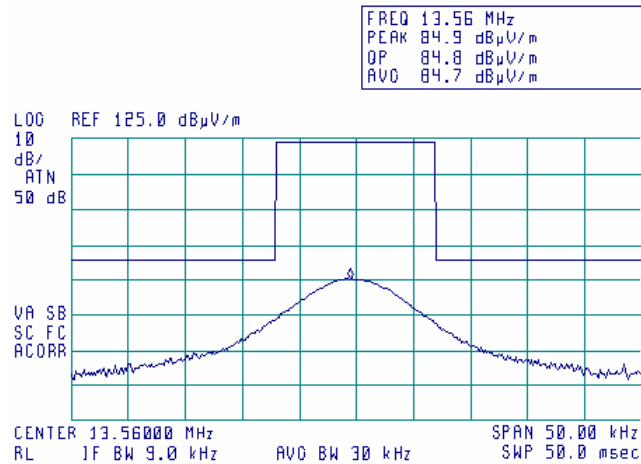
Plot 7.1.5 In band radiated emission test results, RS232 configuration, horizontal loop antenna polarization

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak hold



Plot 7.1.6 In band radiated emission test results, RS232 configuration, horizontal loop antenna polarization

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak hold

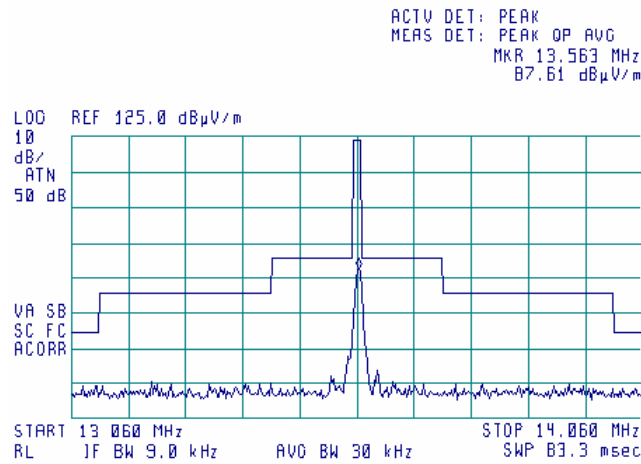




Test specification: Sections 15.225(a) (b) (c), In band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/24/2004 1:06:46 PM			
Temperature: 22 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:			

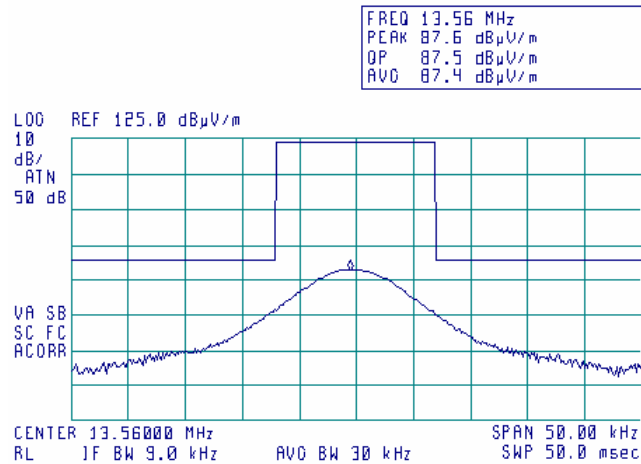
Plot 7.1.7 In band radiated emission test results, RS232 configuration, vertical loop antenna polarization

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak hold



Plot 7.1.8 In band radiated emission test results, RS232 configuration, vertical loop antenna polarization

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak hold





Test specification:	Sections 15.225(d), Out of band radiated emissions		
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:27:31 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:	USB		

7.2 Out of band radiated emissions

7.2.1 General

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

Table 7.2.1 Radiated emission limits

Frequency*, MHz	Field strength at 3 m, dB(μV/m)		
	Peak	Quasi Peak	Average
0.009 – 0.490**	NA	128.5 – 93.8***	NA
0.490 – 1.705**		73.8 – 63.0***	
1.705 – 30.0**		69.5	
30 – 88		40.0	
88 – 216		43.5	
216 – 960		46.0	
960 – 1000		54.0	
1000 – 10 th harmonic		74.0	

*- The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

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

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

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

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

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

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

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

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.2, Table 7.2.4 and shown in the associated plots.

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

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

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

7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.2.2, Table 7.2.3, Table 7.2.4, Table 7.2.5 and shown in the associated plots.



Test specification:	Sections 15.225(d), Out of band radiated emissions		
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:27:31 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:	USB		

Figure 7.2.1 Radiated emissions below 30 MHz test set up

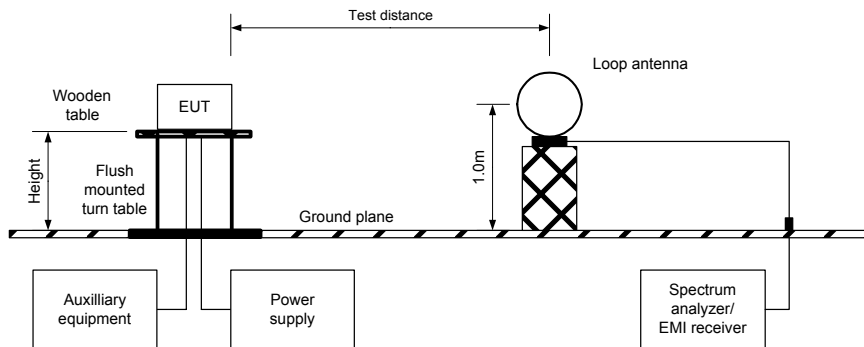
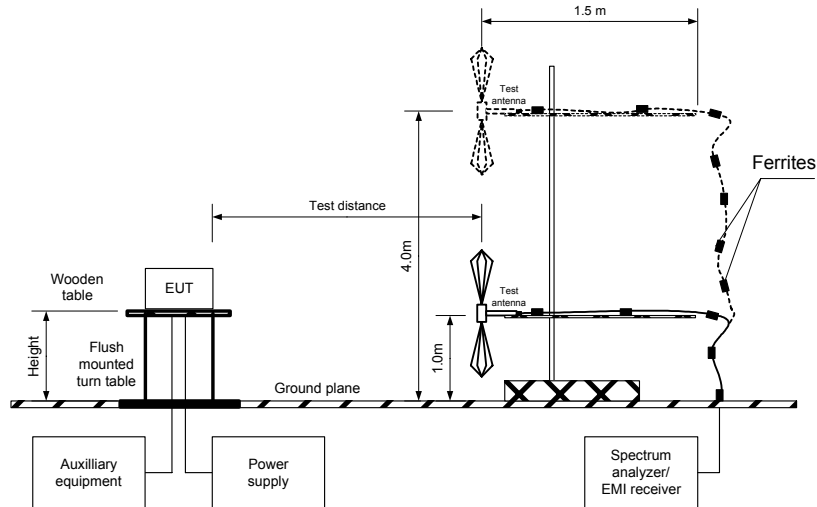


Figure 7.2.2 Radiated emissions above 30 MHz test set up





Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:27:31 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: USB			

Table 7.2.2 Out of band radiated emissions test results below 1GHz, USB configuration

TEST DISTANCE:	3 m
EUT POSITION:	Typical
MODULATION:	AM
MODULATING SIGNAL:	ID code
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 5000 MHz
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) 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*				
27.120000	41.10	37.10	69.5	-32.40	V	1	171	Pass
27.200000	42.20	38.90	69.5	-20.60	H	1	215	
35.010000	37.05	35.05	40.00	-4.95	V	1	230	
99.465000	41.17	39.32	43.50	-4.18	V	1.4	215	
178.165000	41.78	40.13	43.50	-3.37	V	1	55	
298.250000	40.41	37.65	46.00	-8.35	H	1	112	
397.670000	41.04	31.32	46.00	-14.68	H	1	35	
450.000000	40.03	27.61	46.00	-18.39	H	1	360	
497.116420	46.64	43.34	46.00	-2.66	H	1	345	

*- Margin = Measured emission - specification limit.

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

Table 7.2.3 Out of band radiated emissions test results above 1GHz, USB configuration

TEST DISTANCE:	3 m
EUT POSITION:	Typical
MODULATION:	AM
MODULATING SIGNAL:	ID code
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 5000 MHz
RESOLUTION BANDWIDTH:	1000 kHz
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Horn

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*				
1098.50766	47.32	41.24	54	-12.76	V	1.3	131	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 1947
HL 1984	HL 2009						

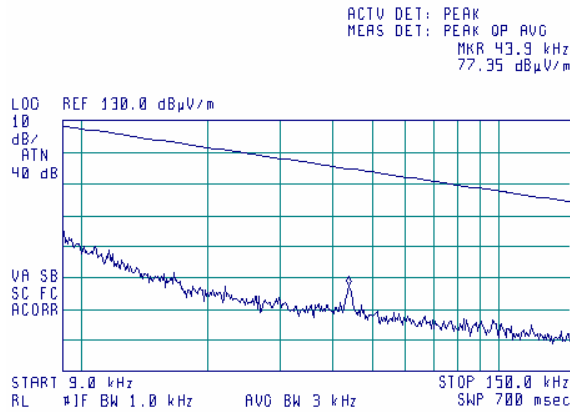
Full description is given in Appendix A.



Test specification:	Sections 15.225(d), Out of band radiated emissions		
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:27:31 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:	USB		

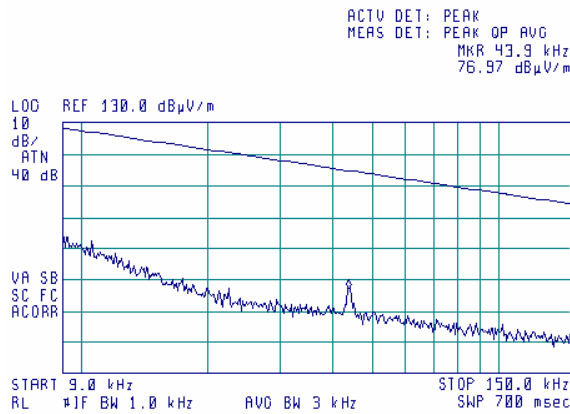
Plot 7.2.1 Radiated emission measurements from 9 to 150 kHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.2 Radiated emission measurements from 9 to 150 kHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold

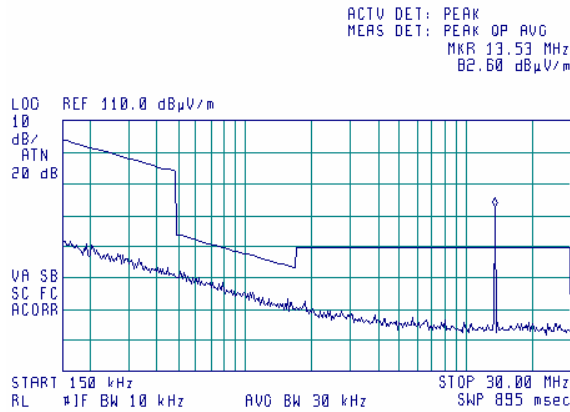




Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:27:31 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: USB			

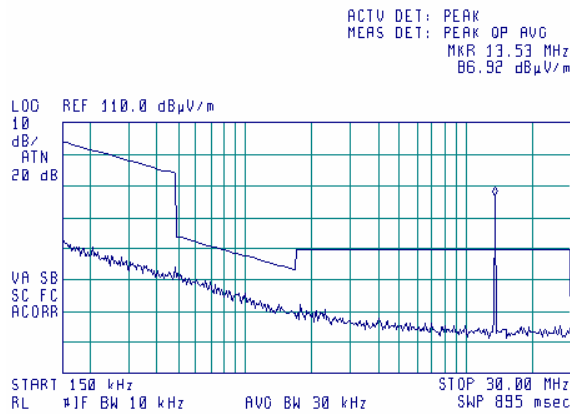
Plot 7.2.3 Radiated emission measurements from 0.15 to 30 MHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.4 Radiated emission measurements from 0.15 to 30 MHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold

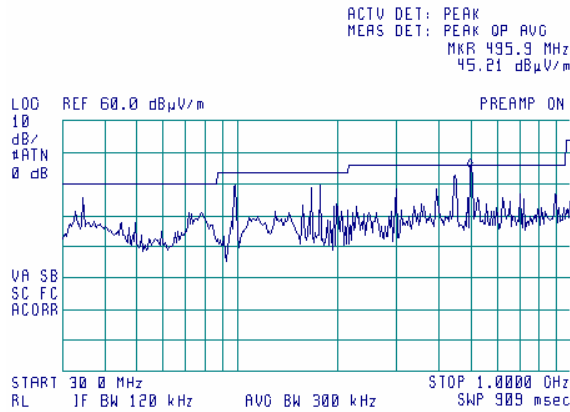




Test specification:	Sections 15.225(d), Out of band radiated emissions		
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:27:31 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:	USB		

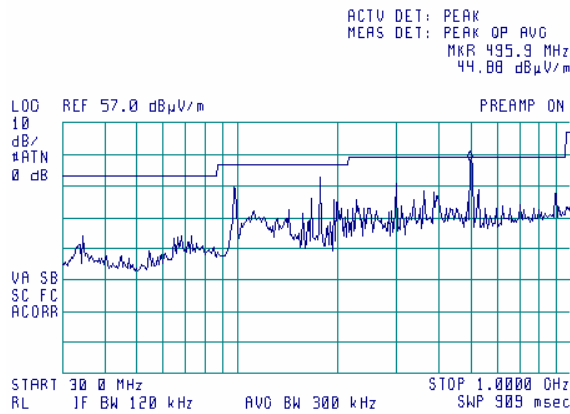
Plot 7.2.5 Radiated emission measurements from 30 to 1000 MHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.6 Radiated emission measurements from 30 to 1000 MHz, USB configuration

TEST SITE: anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold

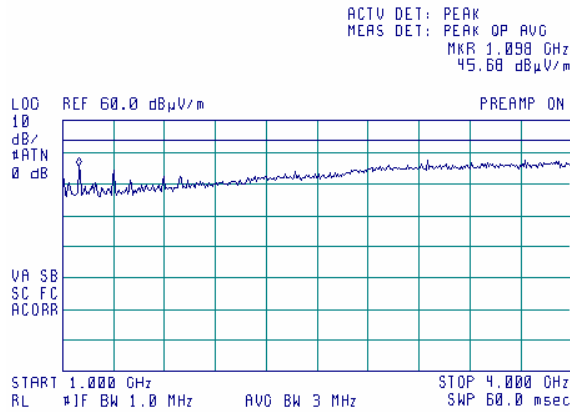




Test specification:		Sections 15.225(d), Out of band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:27:31 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: USB			

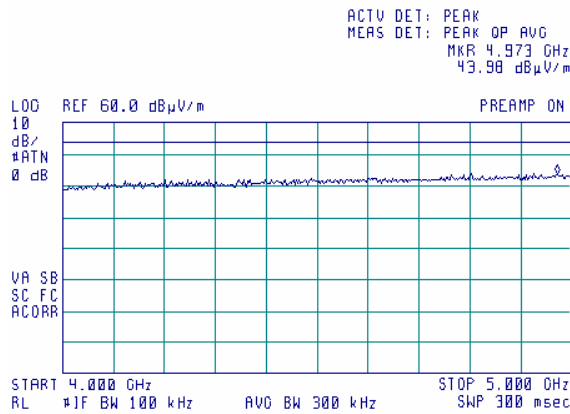
Plot 7.2.7 Radiated emission measurements from 1000 to 4000 MHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical/Horizontal
 DETECTOR: Peak hold



Plot 7.2.8 Radiated emission measurements from 4000 to 5000 MHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical/Horizontal
 DETECTOR: Peak hold

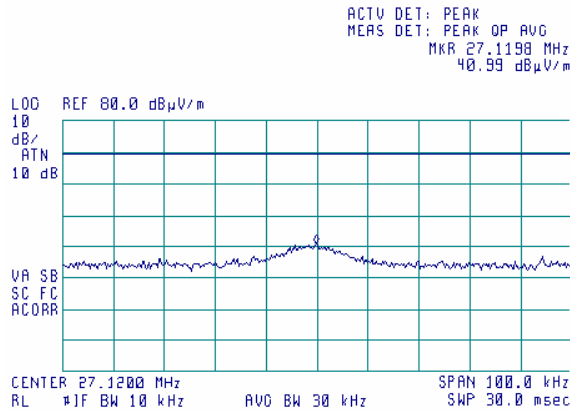




Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:27:31 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: USB			

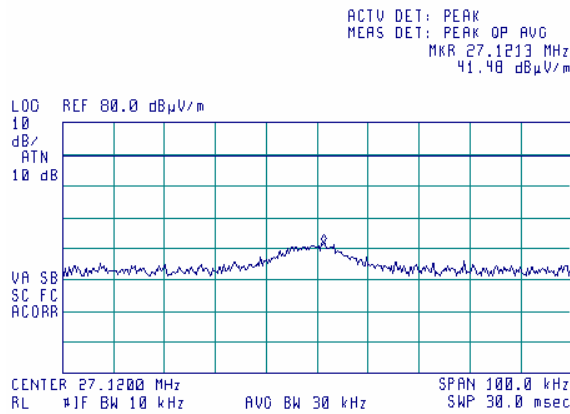
Plot 7.2.9 Radiated emission measurements, second harmonic, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.10 Radiated emission measurements, second harmonic, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold





Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:39:04 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: RS-232			

Table 7.2.4 Out of band radiated emissions test results below 1GHz, RS232 configuration

TEST DISTANCE:	3 m
EUT POSITION:	Typical
MODULATION:	AM
MODULATING SIGNAL:	ID code
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 5000 MHz
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) 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*				
27.120000	41.40	38.50	69.5	-31.00	V	1	142	Pass
27.120000	44.50	41.50	69.5	-28.00	H	1	349	
99.478550	41.74	39.02	43.50	-4.48	V	1	224	
130.450000	37.08	33.47	43.50	-10.03	V	1	362	
165.874850	40.74	36.05	43.50	-7.45	V	1	68	
178.173500	43.75	42.16	43.50	-1.34	H	2	327	
198.911050	38.25	35.91	43.50	-7.59	V	1	281	
498.400000	40.52	31.44	43.50	-12.06	V	1	227	

*- Margin = Measured emission - specification limit.

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

Table 7.2.5 Out of band radiated emissions test results above 1GHz, RS232 configuration

TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical/ Horizontal)
MODULATION:	AM
MODULATING SIGNAL:	ID code
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 5000 MHz
RESOLUTION BANDWIDTH:	1000 kHz
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Horn

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*				
1094.40966	48.50	42.60	54	-11.4	V	1.11	165	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 1947
HL 1984	HL 2009						

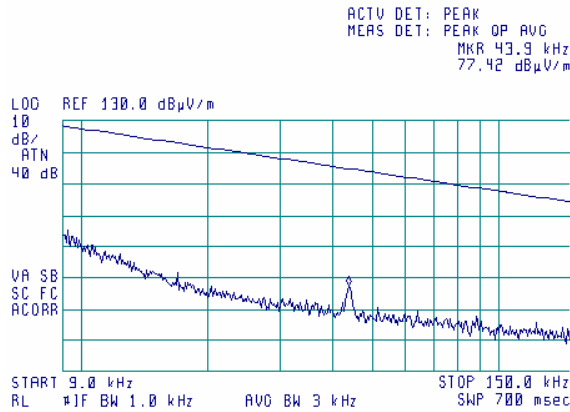
Full description is given in Appendix A.



Test specification:	Sections 15.225(d), Out of band radiated emissions		
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:39:04 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: RS-232			

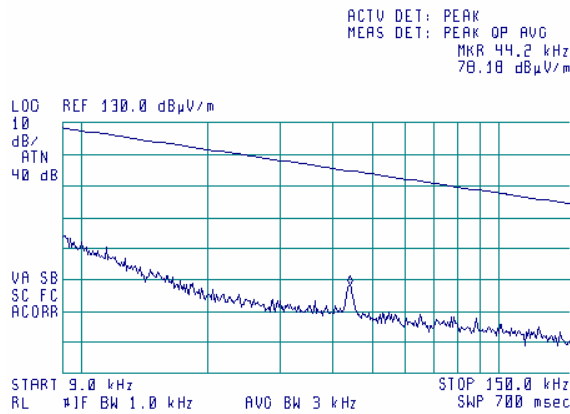
Plot 7.2.11 Radiated emission measurements from 9 to 150 kHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.12 Radiated emission measurements from 9 to 150 kHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold

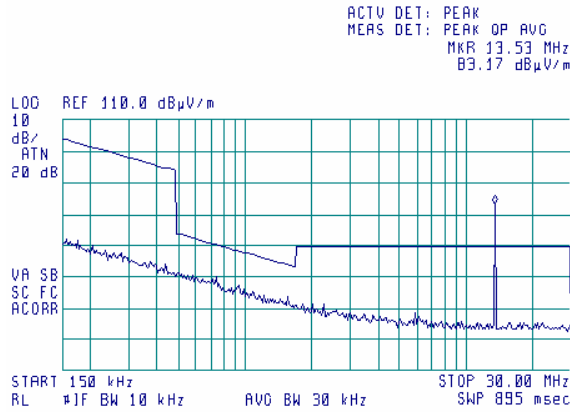




Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:39:04 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: RS-232			

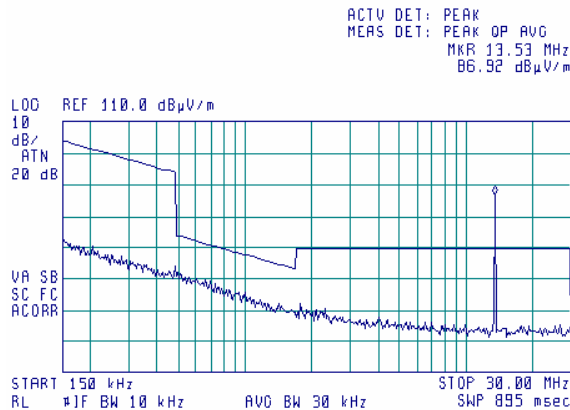
Plot 7.2.13 Radiated emission measurements from 0.15 to 30 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.14 Radiated emission measurements from 0.15 to 30 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold

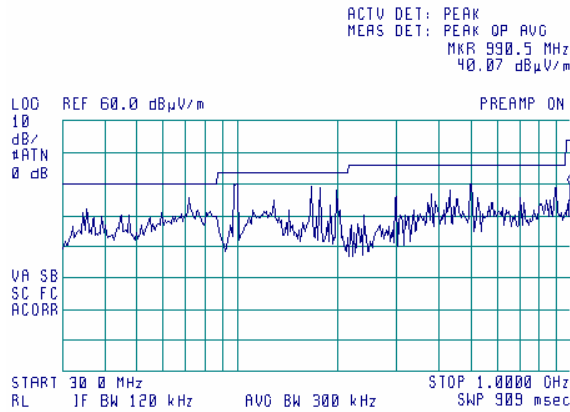




Test specification:	Sections 15.225(d), Out of band radiated emissions		
Test procedure:	ANSI C63.4, Sections 5.3 and 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:39:04 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:	RS-232		

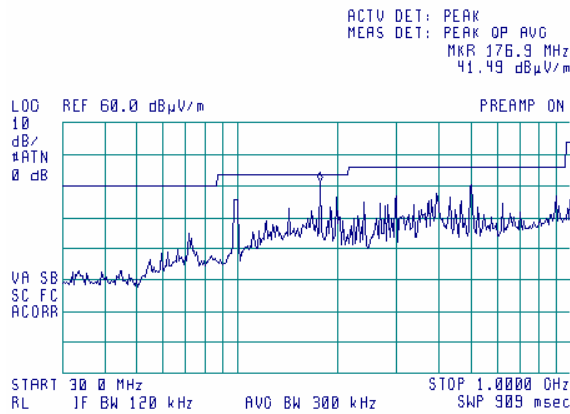
Plot 7.2.15 Radiated emission measurements from 30 to 1000 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.16 Radiated emission measurements from 30 to 1000 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold

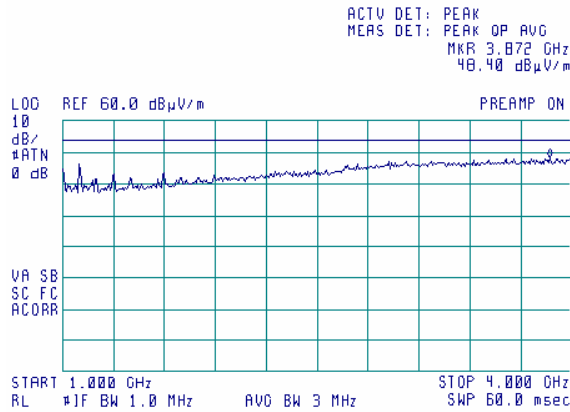




Test specification:		Sections 15.225(d), Out of band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:39:04 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: RS-232			

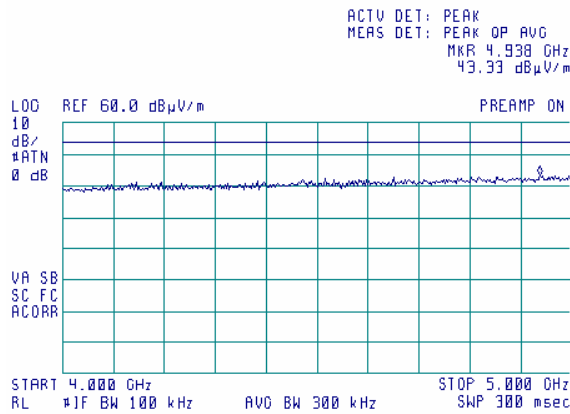
Plot 7.2.17 Radiated emission measurements from 1000 to 4000 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical/Horizontal
 DETECTOR: Peak hold



Plot 7.2.18 Radiated emission measurements from 4000 to 5000 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical/Horizontal
 DETECTOR: Peak hold

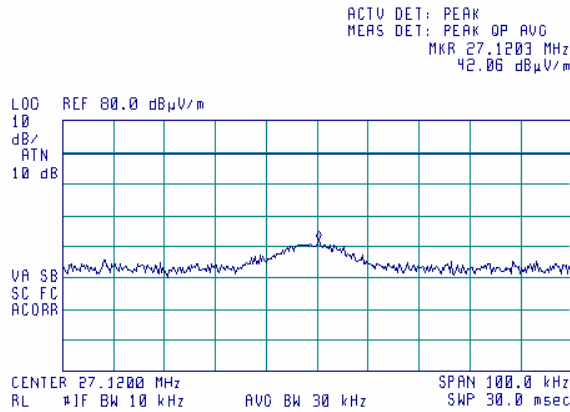




Test specification:		Sections 15.225(d), Out of band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:39:04 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: RS-232			

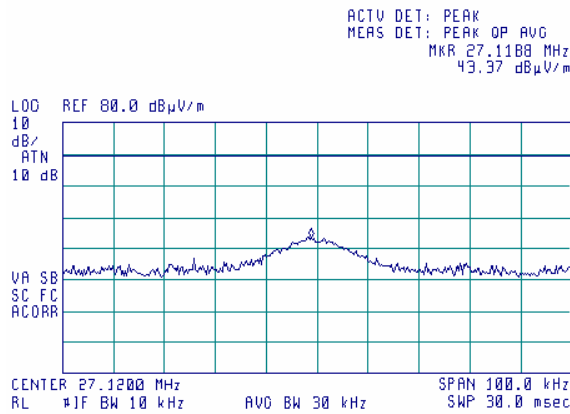
Plot 7.2.19 Radiated emission measurements, second harmonic, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 7.2.20 Radiated emission measurements, second harmonic, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold





Test specification: Section 15.225(e), Frequency stability			
Test procedure: ANSI C63.4, Section 13.1.6			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/27/2004 1:32:59 PM			
Temperature: 22°C	Air Pressure: 1013 hPa	Relative Humidity: 37%	Power Supply: 120 VAC
Remarks:			

7.3 Frequency stability test

7.3.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.3.1. The test results are provided in Table 7.3.2.

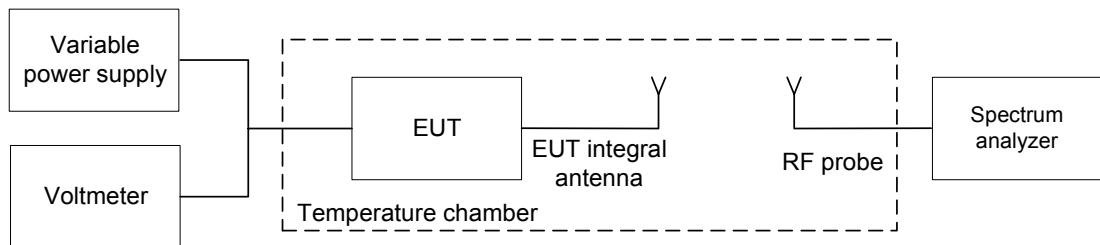
Table 7.3.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	%	Hz
13.560	± 0.01 %	1356

7.3.2 Test procedure

- 7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.
- 7.3.2.2 The EUT power was turned off. Temperature within test chamber was set to the required one and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.3.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then after 2, 5 and 10 minutes. The EUT was powered off.
- 7.3.2.4 The above procedure was repeated at the rest of the test temperatures and voltages as provided in Table 7.3.2.
- 7.3.2.5 Frequency displacement was calculated and compared with the limit as provided in Table 7.3.2.

Figure 7.3.1 Frequency stability test setup





Test specification:	Section 15.225(e), Frequency stability		
Test procedure:	ANSI C63.4, Section 13.1.6		
Test mode:	Compliance	Verdict: PASS	
Date & Time:	12/27/2004 1:32:59 PM		
Temperature: 22°C	Air Pressure: 1013 hPa	Relative Humidity: 37%	Power Supply: 120 VAC
Remarks:			

Table 7.3.2 Frequency stability test results

USB configuration

OPERATING FREQUENCY: 13.560 MHz
 NOMINAL POWER VOLTAGE: 120 VAC
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 100 Hz
 VIDEO BANDWIDTH: 300 Hz
 MODULATION: Unmodulated

Temperature, °C	Voltage, V	Frequency, MHz				Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	2 nd min	5 th min	10 th min	Positive	Negative			
-20	nominal	13.559489	13.559523	13.559533	13.559535	0	46	1356	-1310	Pass
-10	nominal	13.559523	13.559547	13.559553	13.559555	20	12		-1336	
0	nominal	13.559545	13.559566	13.559567	13.559568	33	0		-1323	
10	nominal	13.559568	13.559564	13.559559	13.559558	33	0		-1323	
20	nominal +15%	13.559564	13.559544	13.559536	13.559536	29	0		-1327	
20	nominal	13.559564	13.559542	13.559535	13.559535*	0	0		-1356	
20	nominal -15%	13.559555	13.559539	13.559532	13.559531	20	4		-1336	
30	nominal	13.559537	13.559513	13.559508	13.559506	2	29		-1327	
40	nominal	13.559505	13.559493	13.559487	13.559486	0	49		-1307	
50	nominal	13.559480	13.559478	13.559475	13.559475	0	60		-1296	

RS232 configuration

OPERATING FREQUENCY: 13.560 MHz
 NOMINAL POWER VOLTAGE: 120 VAC
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 100 Hz
 VIDEO BANDWIDTH: 300 Hz
 MODULATION: Unmodulated

Temperature, °C	Voltage, V	Frequency, MHz				Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	2 nd min	5 th min	10 th min	Positive	Negative			
-20	nominal	13.559508	13.559556	13.559568	13.559571	0	125	1356	-1231	Pass
-10	nominal	13.559576	13.559606	13.559614	13.559614	0	57		-1299	
0	nominal	13.559617	13.559631	13.559633	13.559634	0	16		-1340	
10	nominal	13.559638	13.559637	13.559637	13.559637	5	0		-1351	
20	nominal +15%	13.559638	13.559634	13.559633	13.559633	5	0		-1351	
20	nominal	13.559639	13.559633	13.559633	13.559633*	0	0		-1356	
20	nominal -15%	13.559639	13.559634	13.559633	13.559633	6	0		-1350	
30	nominal	13.559631	13.559629	13.559629	13.559629	0	4		-1352	
40	nominal	13.559630	13.559631	13.559632	13.559633	0	3		-1353	
50	nominal	13.559637	13.559640	13.559655	13.559658	25	0		-1331	

* - Reference frequency

Reference numbers of test equipment used

HL 0500	HL 1207	HL 1511	HL 2171				
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Full description is given in Appendix A.



Test specification: Section 15.207(a), Conducted emission			
Test procedure: ANSI C63.4, Section 13.1.3			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/1/2004 5:48:07 PM			
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 USB			

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, Table 7.4.3 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.

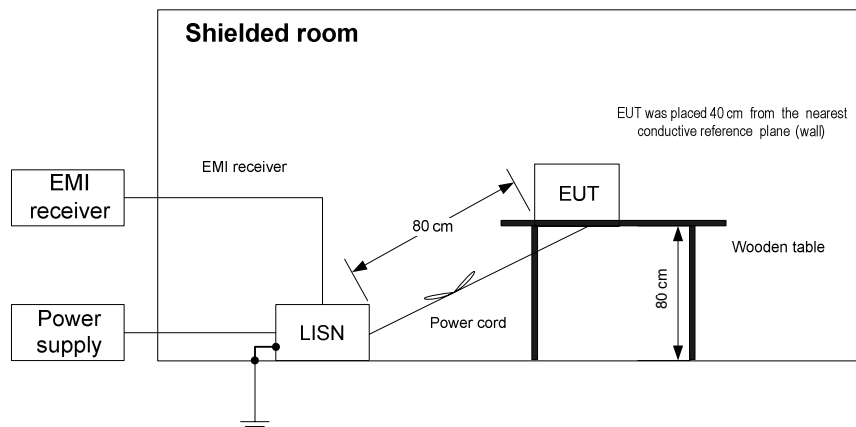
7.4.2 Test procedure

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 7.4.1. 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, table-top equipment





Test specification: Section 15.207(a), Conducted emission	
Test procedure: ANSI C63.4, Section 13.1.3	
Test mode: Compliance	Verdict: PASS
Date & Time: 11/1/2004 5:48:07 PM	
Temperature: 24 °C	Air Pressure: 1010 hPa
Relative Humidity: 43 %	
Power Supply: 120 VAC	
Remarks: SAT5000 USB	

Table 7.4.2 Conducted emission test results, USB configuration

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

LINE: SAT500 AC mains

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*		
0.150143	51.62	43.88	65.99	-22.11	13.06	55.99	-42.93	L1	Pass
0.162365	51.07	43.36	65.40	-22.04	11.62	55.40	-43.78		
0.180907	50.22	42.56	64.49	-21.93	10.78	54.49	-43.71		
0.209441	49.21	41.51	63.29	-21.78	10.43	53.29	-42.86		
0.339638	45.10	37.56	59.27	-21.71	6.96	49.27	-42.31		
13.559825	41.92	41.57	60.00	-18.43	41.51	50.00	-8.49		
0.150885	51.18	43.24	65.96	-22.72	15.02	55.96	-40.94	L2	Pass
0.155125	51.08	43.13	65.75	-22.62	17.71	55.75	-38.04		
0.160000	50.74	42.88	65.51	-22.63	12.36	55.51	-43.15		
13.559013	43.84	43.52	60.00	-16.48	43.46	50.00	-6.54		

LINE: PC AC mains

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*		
0.232047	52.09	50.05	62.42	-12.37	34.95	52.42	-17.47	L1	Pass
0.240969	51.49	50.04	62.08	-12.04	36.81	52.08	-15.27		
0.313139	49.70	46.45	59.90	-13.45	25.61	49.90	-24.29		
0.672998	46.53	43.15	56.00	-12.85	28.86	46.00	-17.14		
1.058270	42.67	39.18	56.00	-16.82	24.18	46.00	-21.82		
1.315416	44.33	39.32	56.00	-16.68	21.37	46.00	-24.63		
13.559341	42.78	40.87	60.00	-19.13	39.18	50.00	-10.82	L2	Pass
0.338217	45.69	43.67	59.30	-15.63	26.72	49.30	-22.58		
0.663357	45.46	39.91	56.00	-16.09	24.86	46.00	-21.14		
0.683736	45.95	42.65	56.00	-13.35	24.18	46.00	-21.82		
0.812405	44.09	39.74	56.00	-16.26	29.81	46.00	-16.19		
1.067654	44.11	39.11	56.00	-16.89	23.33	46.00	-22.67		
1.381775	44.49	39.12	56.00	-16.88	28.93	46.00	-17.07		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0163	HL 0447	HL 0466	HL 0521	HL 0787	HL 1004		
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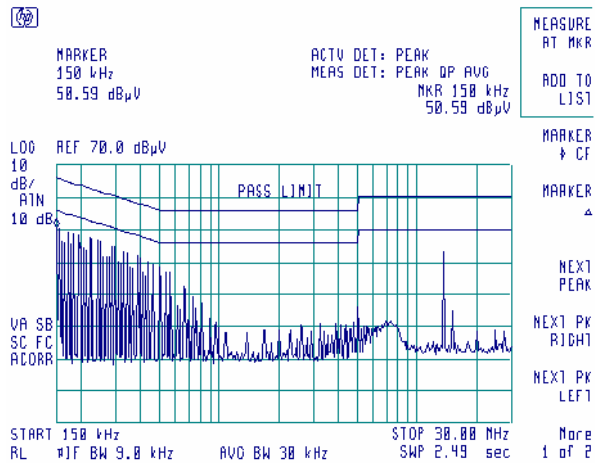
Full description is given in Appendix A.



Test specification: Section 15.207(a), Conducted emission			
Test procedure: ANSI C63.4, Section 13.1.3			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/1/2004 5:48:07 PM			
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 USB			

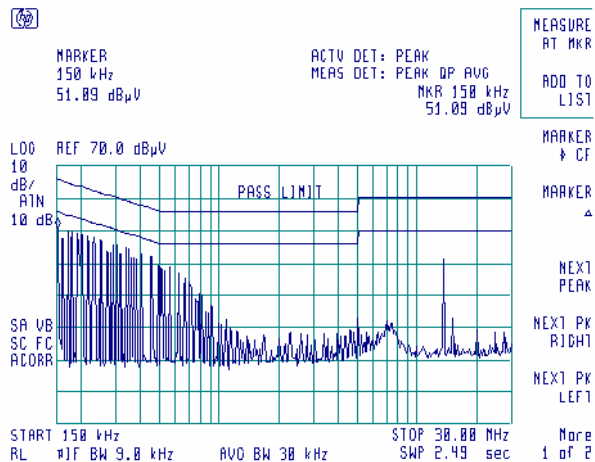
Plot 7.4.1 Conducted emission measurements, USB configuration

LINE: SAT5000, L1
 EUT OPERATING MODE: Transmit
 LIMIT: QUASI-PEAK, AVERAGE
 DETECTOR: PEAK



Plot 7.4.2 Conducted emission measurements, USB configuration

LINE: SAT5000, L2
 EUT OPERATING MODE: Transmit
 LIMIT: QUASI-PEAK, AVERAGE
 DETECTOR: PEAK

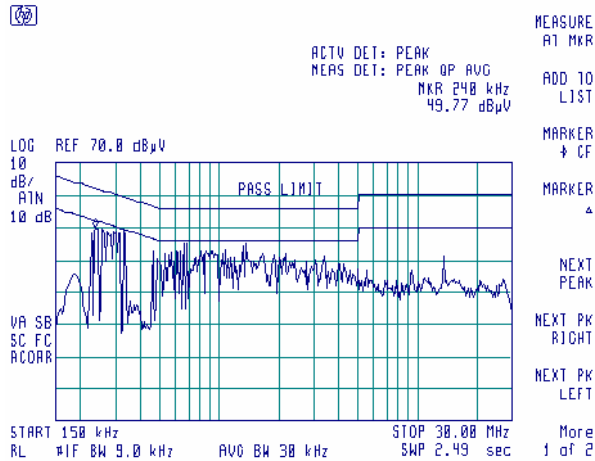




Test specification: Section 15.207(a), Conducted emission			
Test procedure: ANSI C63.4, Section 13.1.3			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/1/2004 5:48:07 PM			
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 USB			

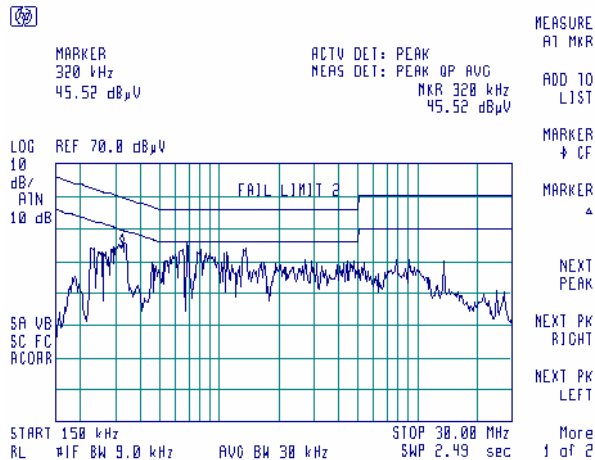
Plot 7.4.3 Conducted emission measurements, USB configuration

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



Plot 7.4.4 Conducted emission measurements, USB configuration

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





Test specification: Section 15.207(a), Conducted emission			
Test procedure: ANSI C63.4, Section 13.1.3			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/29/2004 4:11:35 PM			
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 RS232			

Table 7.4.3 Conducted emission test results, RS232 configuration

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

LINE: SAT5000 AC mains

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*		
0.156224	52.23	44.64	65.70	-21.06	15.19	55.70	-40.51	L1	Pass
0.174188	51.47	43.91	64.82	-20.91	12.26	54.82	-42.56		
0.283264	47.84	40.30	60.78	-20.48	9.41	50.78	-41.37		
0.417760	44.69	37.29	57.54	-20.25	6.84	47.54	-40.70		
0.324931	46.85	39.33	59.62	-20.29	8.54	49.62	-41.08		
0.496603	42.94	35.58	56.06	-20.48	5.41	46.06	-40.65		
0.158089	52.00	44.29	65.61	-21.32	16.60	55.61	-39.01	L2	Pass
0.170321	51.30	43.68	65.01	-21.33	12.03	55.01	-42.98		
0.198186	50.12	42.46	63.72	-21.26	10.71	53.72	-43.01		
0.270662	47.23	39.51	61.16	-21.65	8.88	51.16	-42.28		

LINE: PC AC mains

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*		
0.266341	49.77	48.24	61.29	-13.05	33.19	51.29	-18.10	L1	Pass
0.332640	48.95	46.14	59.44	-13.30	26.70	49.44	-22.74		
0.380882	49.02	46.86	58.29	-11.43	27.53	48.29	-20.76		
0.767604	46.88	43.71	56.00	-12.29	23.50	46.00	-22.50		
1.760287	44.10	39.15	56.00	-16.85	22.71	46.00	-23.29		
2.709832	41.43	34.41	56.00	-21.59	22.06	46.00	-23.94		
0.274307	44.97	39.24	61.05	-21.81	30.69	51.05	-20.36	L2	Pass
0.358330	46.43	40.88	58.83	-17.95	26.51	48.83	-22.32		
0.704522	44.88	39.32	56.00	-16.68	18.51	46.00	-27.49		
0.970083	45.71	38.96	56.00	-17.04	27.22	46.00	-18.78		
1.581678	41.97	35.77	56.00	-20.23	26.97	46.00	-19.03		
1.953308	43.04	37.44	56.00	-18.56	23.03	46.00	-22.97		
2.791610	46.72	39.11	56.00	-16.89	19.13	46.00	-26.87		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0163	HL 0447	HL 0466	HL 0521	HL 0787	HL 1004		
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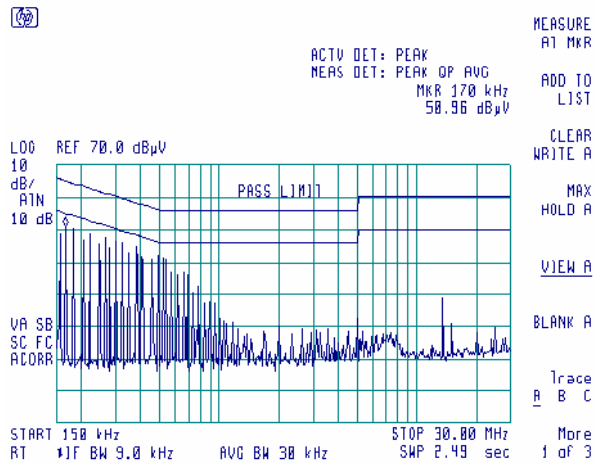
Full description is given in Appendix A.



Test specification: Section 15.207(a), Conducted emission			
Test procedure: ANSI C63.4, Section 13.1.3			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/29/2004 4:11:35 PM			
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 RS232			

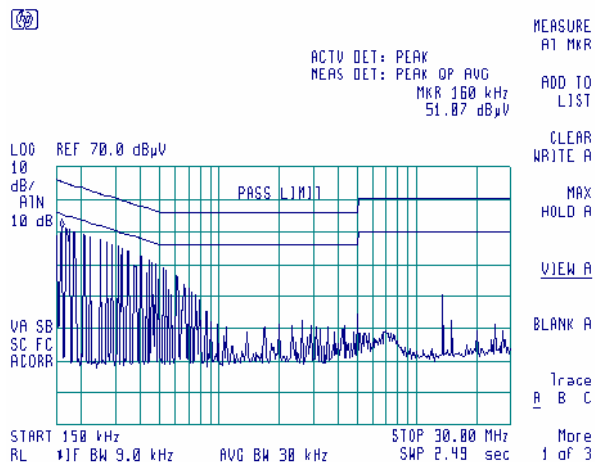
Plot 7.4.5 Conducted emission measurements, RS232 configuration

LINE: SAT5000 L1
 EUT OPERATING MODE: Transmit
 LIMIT: QUASI-PEAK, AVERAGE
 DETECTOR: PEAK



Plot 7.4.6 Conducted emission measurements, RS232 configuration

LINE: SAT5000 L2
 EUT OPERATING MODE: Transmit
 LIMIT: QUASI-PEAK, AVERAGE
 DETECTOR: PEAK

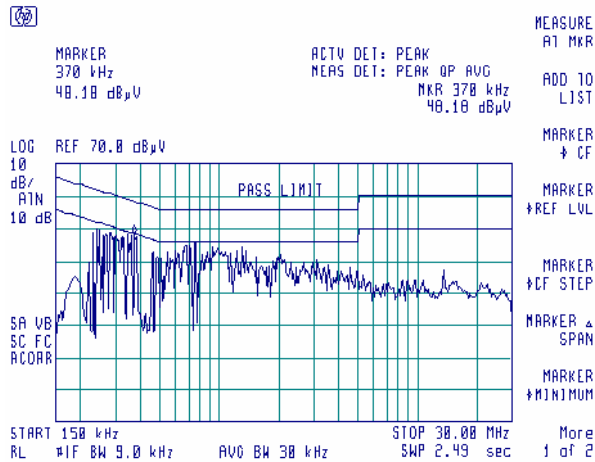




Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/29/2004 4:11:35 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 RS232			

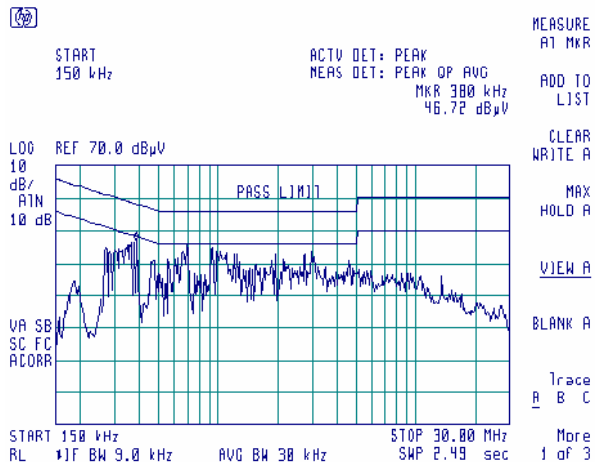
Plot 7.4.7 Conducted emission measurements, RS232 configuration

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



Plot 7.4.8 Conducted emission measurements, RS232 configuration

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





Test specification: Section 15.107, 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: 12/29/2004 4:22:16 PM			
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 USB			

8 Emission tests according to 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, Table 8.1.3 and shown in the associated plots.

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.

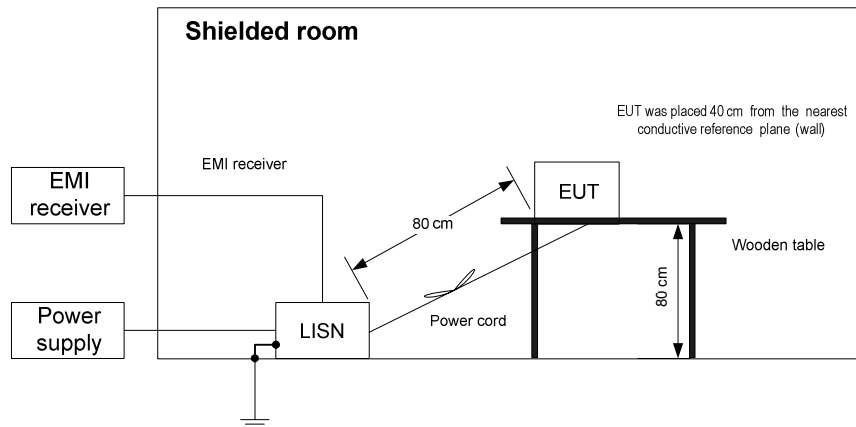
8.1.2 Test procedure

8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photographs, 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 8.1.1. 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, table-top equipment





Test specification: Section 15.107, 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: 12/29/2004 4:22:16 PM			
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 USB			

Table 8.1.2 Conducted emission test results, USB configuration

LIMIT: Class B
EUT OPERATING MODE: 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

LINE: EUT AC mains

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*		
0.156136	44.28	36.31	65.70	-29.39	8.70	55.70	-47.00	L1	Pass
0.180070	43.11	35.17	64.53	-29.36	5.11	54.53	-49.42		
0.182728	43.02	35.04	64.40	-29.36	4.90	54.40	-49.50		
0.250720	40.14	32.08	61.77	-29.69	2.99	51.77	-48.78		
0.317665	37.48	29.37	59.79	-30.42	2.29	49.79	-47.50		
0.167623	44.45	36.15	65.14	-28.99	5.83	55.14	-49.31	L2	Pass
0.215594	42.31	34.29	63.05	-28.76	4.54	53.05	-48.51		
0.306076	40.08	31.76	60.09	-28.33	3.24	50.09	-46.85		
0.358138	38.41	30.51	58.83	-28.32	2.12	48.83	-46.71		
0.441668	36.81	28.67	57.09	-28.42	1.56	47.09	-45.53		

LINE: PC AC mains

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*		
0.266341	49.77	48.24	61.29	-13.05	33.19	51.29	-18.10	L1	Pass
0.332640	48.95	46.14	59.44	-13.30	26.70	49.44	-22.74		
0.380882	49.02	46.86	58.29	-11.43	27.53	48.29	-20.76		
0.767604	46.88	43.71	56.00	-12.29	23.50	46.00	-22.50		
1.760287	44.10	39.15	56.00	-16.85	22.71	46.00	-23.29		
2.709832	41.43	34.41	56.00	-21.59	22.06	46.00	-23.94	L2	Pass
0.274307	44.97	39.24	61.05	-21.81	30.69	51.05	-20.36		
0.358330	46.43	40.88	58.83	-17.95	26.51	48.83	-22.32		
0.704522	44.88	39.32	56.00	-16.68	18.51	46.00	-27.49		
0.970083	45.71	38.96	56.00	-17.04	27.22	46.00	-18.78		
1.581678	41.97	35.77	56.00	-20.23	26.97	46.00	-19.03		
1.953308	43.04	37.44	56.00	-18.56	23.03	46.00	-22.97		
2.791610	46.72	39.11	56.00	-16.89	19.13	46.00	-26.87		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0163	HL 0447	HL 0466	HL 0521	HL 0787	HL 1004		
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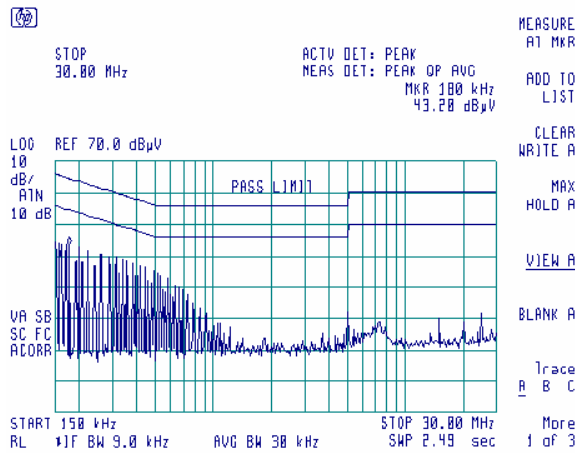
Full description is given in Appendix A.



Test specification: Section 15.107, 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: 12/29/2004 4:22:16 PM			
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 USB			

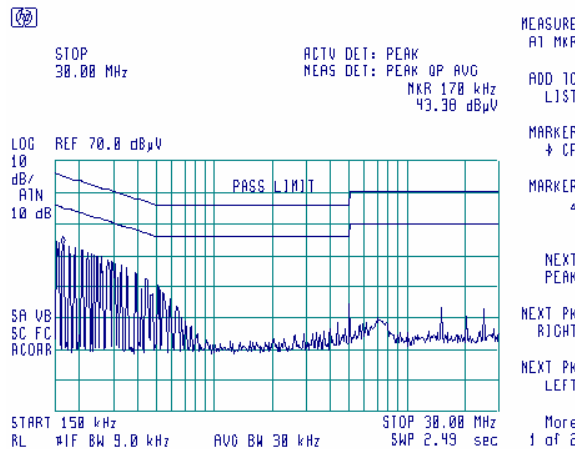
Plot 8.1.1 Conducted emission measurements, USB configuration

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



Plot 8.1.2 Conducted emission measurements, USB configuration

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

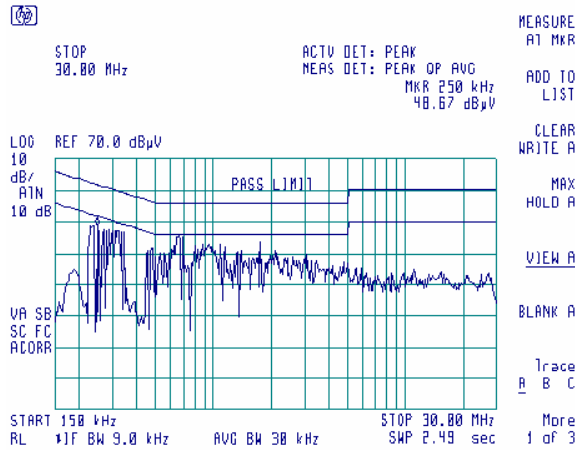




Test specification: Section 15.107, Conducted emission at AC power port			
Test procedure: ANSI C63.4, Sections 11.5 and 12.1.3			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/29/2004 4:22:16 PM			
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks: SAT5000 USB			

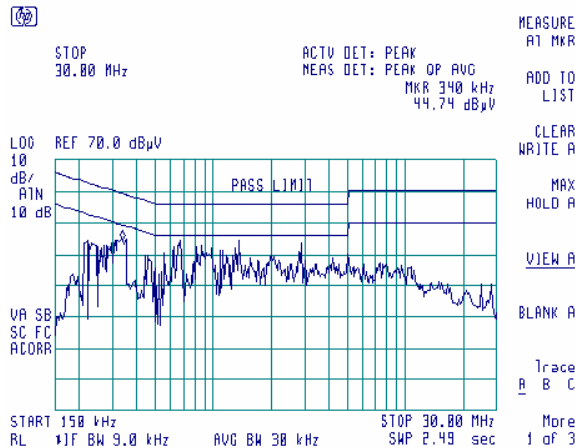
Plot 8.1.3 Conducted emission measurements, USB configuration

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



Plot 8.1.4 Conducted emission measurements, USB configuration

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





Test specification: Section 15.107, 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: 12/29/2004 4:25:16 PM	
Temperature: °C	Air Pressure: hPa
Remarks: SAT5000 RS232	

Table 8.1.3 Conducted emission test results, RS232 configuration

LIMIT: Class B
EUT OPERATING MODE: 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

LINE: EUT AC mains

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*		
0.182728	43.02	35.04	64.40	-29.36	4.90	54.40	-49.50	L1	Pass
0.250720	40.14	32.08	61.77	-29.69	2.99	51.77	-48.78		
0.317665	37.48	29.37	59.79	-30.42	2.29	49.79	-47.50		
0.382486	35.12	27.03	58.25	-31.22	1.07	48.25	-47.18		
0.215594	42.31	34.29	63.05	-28.76	4.54	53.05	-48.51		
0.306076	40.08	31.76	60.09	-28.33	3.24	50.09	-46.85	L2	Pass
0.358138	38.41	30.51	58.83	-28.32	2.12	48.83	-46.71		
0.441668	36.81	28.67	57.09	-28.42	1.56	47.09	-45.53		

LINE: PC AC mains

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*		
0.266341	49.77	48.24	61.29	-13.05	33.19	51.29	-18.10	L1	Pass
0.332640	48.95	46.14	59.44	-13.30	26.70	49.44	-22.74		
0.380882	49.02	46.86	58.29	-11.43	27.53	48.29	-20.76		
0.767604	46.88	43.71	56.00	-12.29	23.50	46.00	-22.50		
1.760287	44.10	39.15	56.00	-16.85	22.71	46.00	-23.29		
2.709832	41.43	34.41	56.00	-21.59	22.06	46.00	-23.94	L2	Pass
0.358330	46.43	40.88	58.83	-17.95	26.51	48.83	-22.32		
0.704522	44.88	39.32	56.00	-16.68	18.51	46.00	-27.49		
0.970083	45.71	38.96	56.00	-17.04	27.22	46.00	-18.78		
1.581678	41.97	35.77	56.00	-20.23	26.97	46.00	-19.03		
1.953308	43.04	37.44	56.00	-18.56	23.03	46.00	-22.97		
2.791610	46.72	39.11	56.00	-16.89	19.13	46.00	-26.87		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0163	HL 0447	HL 0466	HL 0521	HL 0787	HL 1004		
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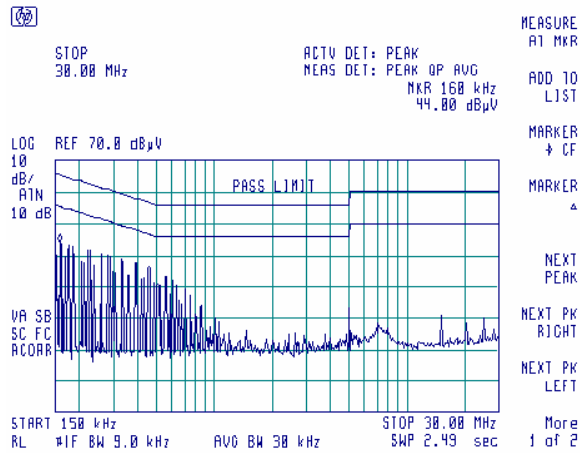
Full description is given in Appendix A.



Test specification: Section 15.107, 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: 12/29/2004 4:25:16 PM			
Temperature: °C	Air Pressure: hPa	Relative Humidity: %	Power Supply:
Remarks: SAT5000 RS232			

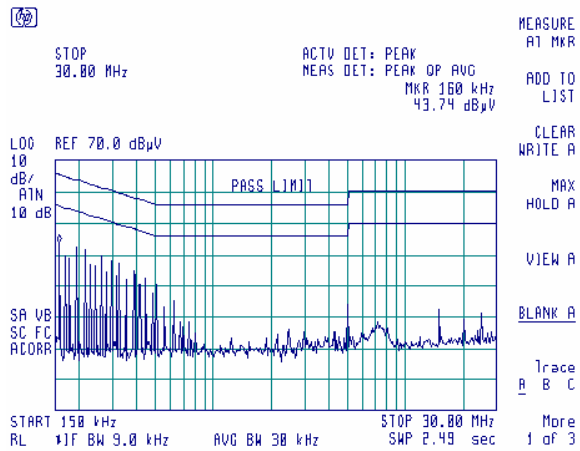
Plot 8.1.5 Conducted emission measurements, RS232 configuration

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



Plot 8.1.6 Conducted emission measurements, RS232 configuration

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

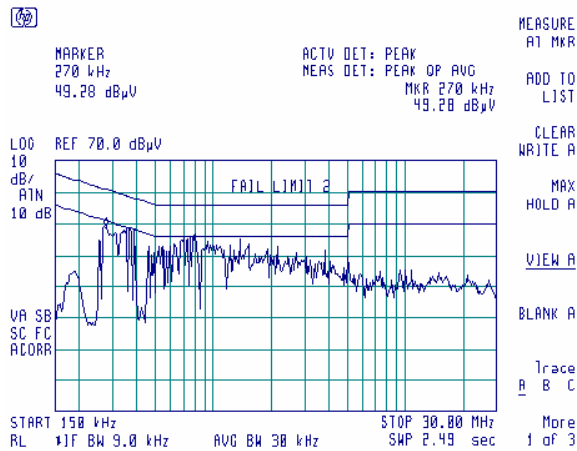




Test specification: Section 15.107, Conducted emission at AC power port			
Test procedure: ANSI C63.4, Sections 11.5 and 12.1.3			
Test mode: Compliance	Verdict: PASS		
Date & Time: 12/29/2004 4:25:16 PM			
Temperature: °C	Air Pressure: hPa	Relative Humidity: %	Power Supply:
Remarks: SAT5000 RS232			

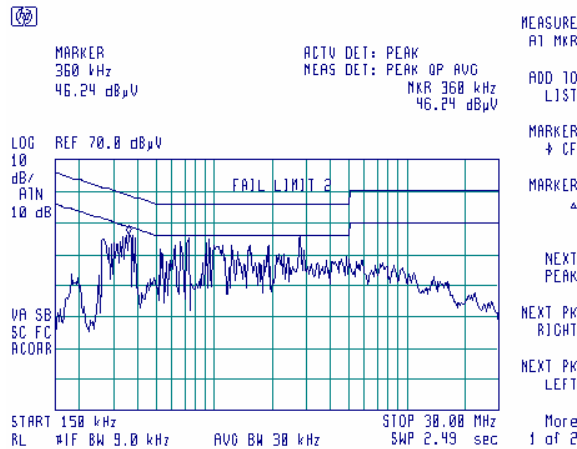
Plot 8.1.7 Conducted emission measurements, RS232 configuration

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



Plot 8.1.8 Conducted emission measurements, RS232 configuration

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





Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:31:42 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks:	USB		

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 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.

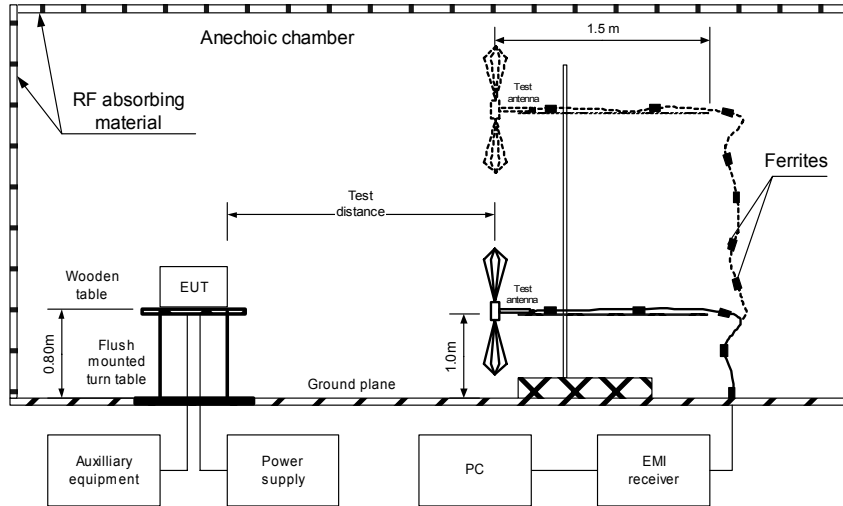
8.2.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position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

8.2.2.3 The worst test results (the lowest margins) were recorded in Table 8.2.2, Table 8.2.3 and shown in the associated plots.



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:31:42 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: USB			

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





Test specification:		Section 15.109, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 10:31:42 AM		
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: USB			

Table 8.2.2 Radiated emission test results, USB configuration

EUT SETUP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: 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
ANTENNA TYPE: Biconilog

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*				
35.010000	37.05	35.05	40.00	-4.95	V	1	230	Pass
99.465000	41.17	39.32	43.50	-4.18	V	1.4	215	
178.165000	41.78	40.13	43.50	-3.37	V	1	55	
298.250000	40.41	37.65	46.00	-8.35	H	1	112	
397.670000	41.04	31.32	46.00	-14.68	H	1	35	
450.000000	40.03	27.61	46.00	-18.39	H	1	360	
497.116420	46.64	43.34	46.00	-2.66	H	1	345	

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 5000 MHz
RESOLUTION BANDWIDTH: 1000 kHz
ANTENNA TYPE: Horn

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*				
1098.50766	47.32	41.24	54	-12.76	V	1.3	131	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 1947
HL 1984							

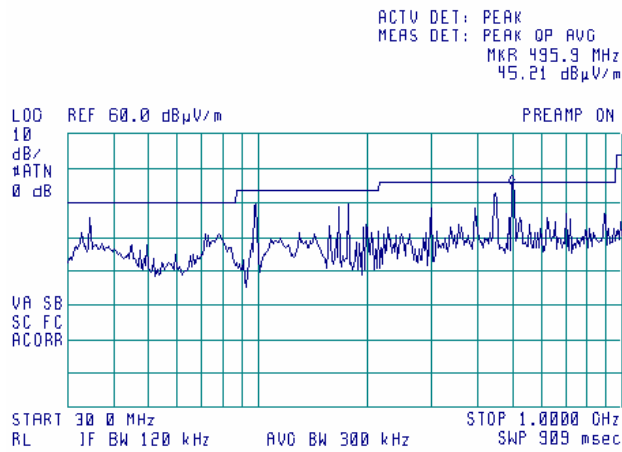
Full description is given in Appendix A.



Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:31:42 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: USB			

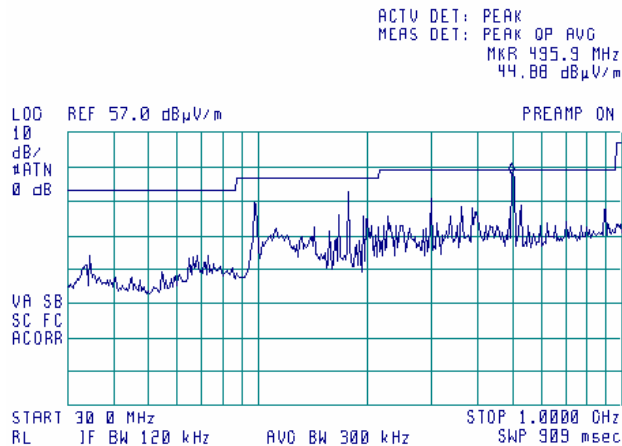
Plot 8.2.1 Radiated emission measurements from 30 to 1000 MHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 8.2.2 Radiated emission measurements from 30 to 1000 MHz, USB configuration

TEST SITE: anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold

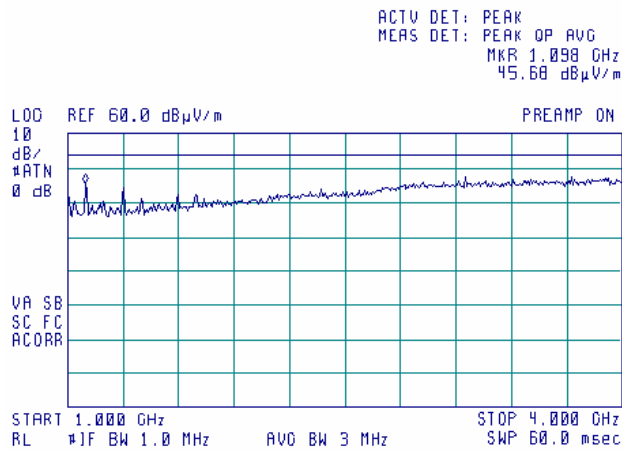




Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:31:42 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: USB			

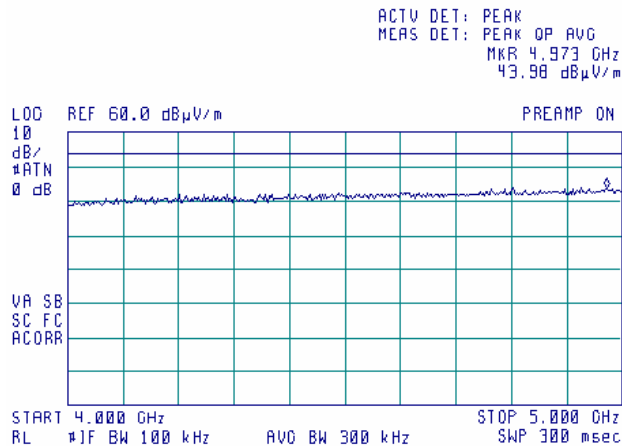
Plot 8.2.3 Radiated emission measurements from 1000 to 4000 MHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical/Horizontal
 DETECTOR: Peak hold



Plot 8.2.4 Radiated emission measurements from 4000 to 5000 MHz, USB configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical/Horizontal
 DETECTOR: Peak hold





Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:35:27 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: RS-232			

Table 8.2.3 Radiated emission test results, RS232 configuration

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: 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
ANTENNA TYPE: Biconilog

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
99.478550	41.74	39.02	43.50	-4.48	V	1	224	Pass
130.450000	37.08	33.47	43.50	-10.03	V	1	362	
165.874850	40.74	36.05	43.50	-7.45	V	1	68	
178.173500	43.75	42.16	43.50	-1.34	H	2	327	
198.911050	38.25	35.91	43.50	-7.59	V	1	281	
498.400000	40.52	31.44	43.50	-12.06	V	1	227	

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 5000 MHz
RESOLUTION BANDWIDTH: 1000 kHz
ANTENNA TYPE: Horn

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*				
1094.40966	48.50	42.60	54	-11.4	V	1.11	165	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 1947
HL 1984							

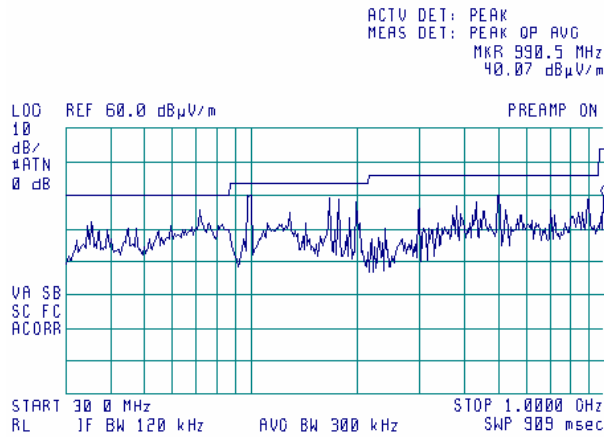
Full description is given in Appendix A.



Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:35:27 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: RS-232			

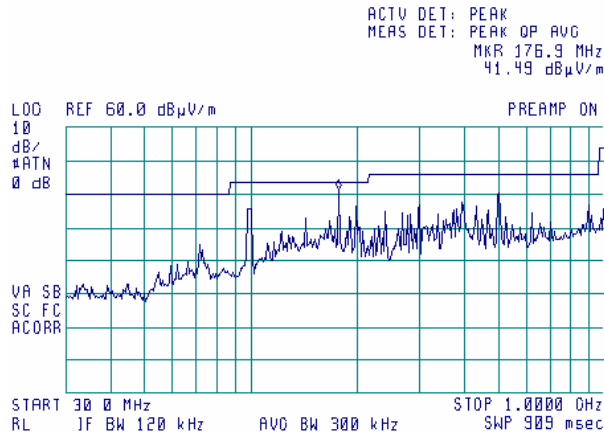
Plot 8.2.5 Radiated emission measurements from 30 to 1000 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 DETECTOR: Peak hold



Plot 8.2.6 Radiated emission measurements from 30 to 1000 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 DETECTOR: Peak hold

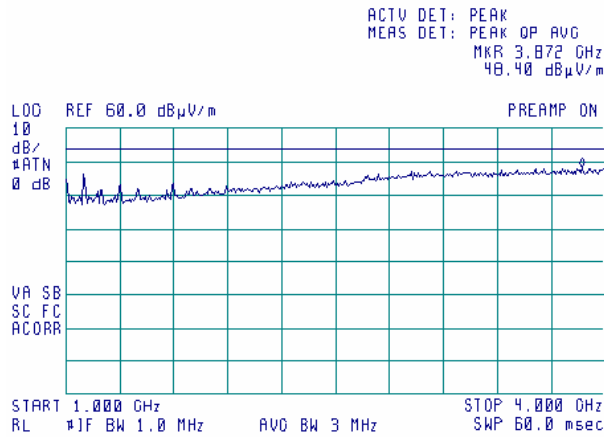




Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 11/29/2004 10:35:27 AM			
Temperature: 24 °C	Air Pressure: 1011 hPa	Relative Humidity: 30 %	Power Supply: 120 VAC
Remarks: RS-232			

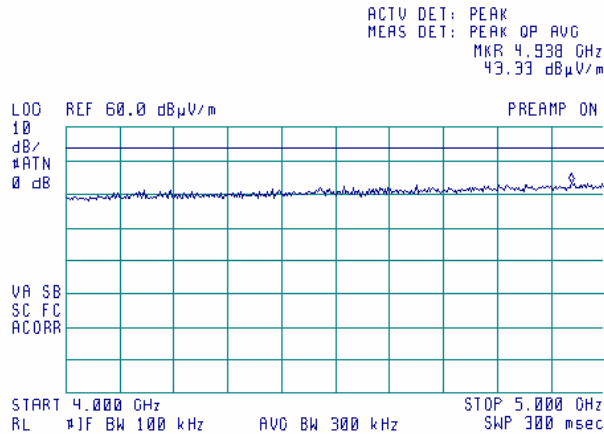
Plot 8.2.7 Radiated emission measurements from 1000 to 4000 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical/Horizontal
 DETECTOR: Peak hold



Plot 8.2.8 Radiated emission measurements from 4000 to 5000 MHz, RS232 configuration

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical/Horizontal
 DETECTOR: Peak hold



**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-04	01-Oct-05
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-04	28-Jun-05
0447	LISN, 16/2, 300V RMS	HL	LISN 16 - 1	066	03-Nov-04	03-Nov-05
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	HL	AC - 1	023	03-Nov-04	03-Nov-05
0466	Shielded Room 3(L) x 3(W) x 2.4(H) m	HL	SR - 1	024	11-Nov-04	11-Nov-05
0500	Oven temperature -42 to +150 deg C	Thermotron	S-16 Mini-Max	25-2893-05	03-Nov-04	03-Nov-05
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-2.9 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	26-Sep-04	26-Sep-05
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-04	02-Dec-05
0592	Position Controller	HL	L2-SR3000 (HL CRL-3)	100	02-Dec-04	02-Dec-05
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	02-Dec-04	02-Dec-05
0594	Turn Table FOR ANECHOIC CHAMBER flush mount d=1.2 m Pneumatic	HL	TT-WDC1	102	27-Jan-05	27-Jan-06
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz	EMCO	3141	9611-1011	27-Jan-05	27-Jan-06
0787	Transient Limiter	Hewlett Packard	11947A	3107A018 77	27-Jan-05	27-Jan-06
1004	Cable Coaxial , ANDREW PSWJ4 , 6m	HL	ANDREW -6	163	27-Jan-05	27-Jan-06
1207	One phase voltage regulator, 2kVA, 0-250V	HL	TDGC-2	1207	02-Dec-04	02-Dec-05
1511	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1511	02-Dec-04	02-Dec-05
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	17-Oct-04	17-Oct-05
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	23-Sep-04	23-Sep-05
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-04	02-Dec-05
2171	Multimeter	Fluke	177	79960418	23-Sep-04	23-Sep-05

**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

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.



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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website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

47CFR part 15: 2004	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: 2001	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 LISN 16 - 1
Hermon Laboratories**

Frequency, kHz	Correction factor, dB
10	4.9
15	2.86
20	1.83
25	1.25
30	0.91
35	0.69
40	0.53
50	0.35
60	0.25
70	0.18
80	0.14
90	0.11
100	0.09
125	0.06
150	0.04

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

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

Frequency, kHz	Correction factor, dB
10	4.9
15	2.86
20	1.83
25	1.25
30	0.91
35	0.69
40	0.53
50	0.35
60	0.25
70	0.18
80	0.14
90	0.11
100	0.09
125	0.06
150	0.04

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



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, HL1984

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

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



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		
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		
				±0.17



Cable loss
Cable 18 GHz, 6.5 m, blue, model: NPS-1803A-6500-NPS, S/N T4974, HL 1947

Frequency, GHz	Cable 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	Cable 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, 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		