

TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 SUBPART C, section 15.245

FOR:

Rokonet Electronics Ltd.

Motion Detector

WatchOUT

Model: RK315DT0000A

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.

Table of contents

1	Applicant information.....	3
2	Equipment under test attributes	3
3	Manufacturer information	3
4	Test details.....	3
5	Tests summary.....	4
6	EUT description.....	5
6.1	General information.....	5
6.2	Ports and lines	5
6.3	Auxiliary equipment.....	5
6.4	Operating frequencies.....	5
6.5	Changes made in the EUT.....	5
6.6	Test configuration.....	5
7	Transmitter tests according to FCC 47CFR part 15 subpart C requirements.....	6
7.1	Field strength of emissions.....	6
7.2	Band edge emission.....	23
7.3	Conducted emissions.....	26
7.4	Antenna requirements.....	29
8	Emission tests according to FCC 47CFR part 15 subpart B requirements.....	30
8.1	Conducted emissions.....	30
8.2	Radiated emission measurements.....	33
9	APPENDIX A Test equipment and ancillaries used for tests.....	36
10	APPENDIX B Measurement uncertainties.....	38
11	APPENDIX C Test facility description	39
12	APPENDIX D Specification references	39
13	APPENDIX E Abbreviations and acronyms.....	40
14	APPENDIX F Test equipment correction factors.....	41

1 Applicant information

Client name: Rokonet Electronics Ltd.
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Telephone: +972 3963 7700
Fax: +972 3961 6584
E-mail: david@rokonet.co.il
Contact name: Mr. David Kartoun

2 Equipment under test attributes

Product name: Motion detector
Product type: Transmitter
Brand name: WatchOUT
Model: RK315DT0000A
Receipt date: 6/10/2005

3 Manufacturer information

Manufacturer name: Rokonet Electronics Ltd.
Address: 14 Hachoma street, Rishon Le Zion, 75655, Israel
Telephone: +972 3963 7700
Fax: +972 3961 6584
E-mail: david@rokonet.co.il
Contact name: Mr. David Kartoun




4 Test details

Project ID: 16528
Location: Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started: 6/10/2005
Test completed: 7/11/2005
Test specifications: FCC Part 15, subpart C, §15.245

5 Tests summary

Test	Status
Transmitter characteristics	
Section 15.245(b), Field strength of emissions	Pass
Section 15.245(b)(3), Band edge emissions	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 standards. 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.

	Name and Title	Date	Signature
Tested by:	Mr. A. Adelberg, test engineer	July 11, 2005	
Reviewed by:	Ms. N. Averin, certification engineer	November 1, 2005	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	November 8, 2005	

6 EUT description

6.1 General information

The EUT is a combined motion detector for outdoor use. It uses Dual Tech Technology for detecting: one technology is PIR (Passive Infra-Red) and the other is MW (microwave). The MW hardware is a MW module operated at 10.525 GHz, which includes an integral patch antenna. The MW module is a standard product of a UK company, Microwave Solutions Ltd. The EUT includes 2 PIR channels and two MW channels. Also, it has RS485 bus for communication with a central unit and active IR anti-masking channels. The EUT is fixed type of equipment powered by 12 V DC from the central unit of the alarm system. The central unit is powered from AC mains via 120 VAC / 16.5 VAC transformer.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Indoor / outdoor	Cable length
		From	To					
Power	12 VDC	EUT	Central Unit	Terminal block	1	Unshielded	Outdoor	12 m*
GND	GND	EUT					Outdoor	12 m*
Signal	Communication bus (RS 485)	EUT					Outdoor	12 m*
Signal	Alarm	EUT					Outdoor	12 m*
Signal	Test	EUT					Outdoor	12 m*
Signal	Anti-tamper	EUT					Outdoor	12 m*
Signal	Anti-mask	EUT					Outdoor	12 m*
Signal	LED enable	EUT					Outdoor	12 m*
Signal	Dust	EUT					Outdoor	12 m*
Signal	Set/Unset	EUT					Outdoor	12 m*

* May be up to 300 m.

6.3 Auxiliary equipment

Description	Manufacturer	Model number	Serial number
Central Unit	Rokonet Electronics Ltd.	RP128P000EUA	NA
120 VAC / 16.5 VAC transformer	AMSECO	XP-1640	NA

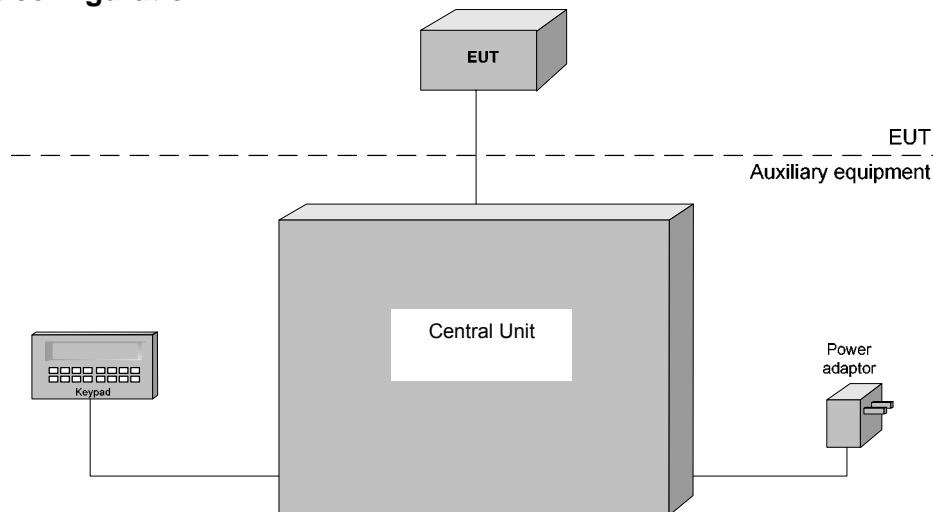
6.4 Operating frequencies

Source	Frequency, MHz				
Digital portion	0.025	16	NA	NA	NA
Transmitter	10525	NA	NA	NA	NA

6.5 Changes made in the EUT

No changes were implemented.

6.6 Test configuration



Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

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

7.1 Field strength of emissions

7.1.1 General

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

Table 7.1.1 Radiated fundamental emission limits

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

Table 7.1.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(μV/m)				
	Within restricted bands			Outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	97.5	77.5
0.090 – 0.110	NA	108.5 – 106.8**	NA		
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**		
0.490 – 1.705	NA	73.8 – 63.0**	NA		
1.705 – 30.0*		69.5**			
30 – 88		40.0			
88 – 216		43.5			
216 – 960		46.0			
960 - 1000	54.0				
1000 – 17700	74.0	NA	54.0		
Above 17700	108.0	NA	88.0		

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

$$\text{Lims}_2 = \text{Lims}_1 + 40 \log(S_1/S_2),$$

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

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

Note: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 100 GHz for intentional radiators operated above 10 GHz.

Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

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

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

7.1.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360⁰ and the measuring antenna was rotated around its vertical axis.

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

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

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

7.1.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360⁰, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

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

Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

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

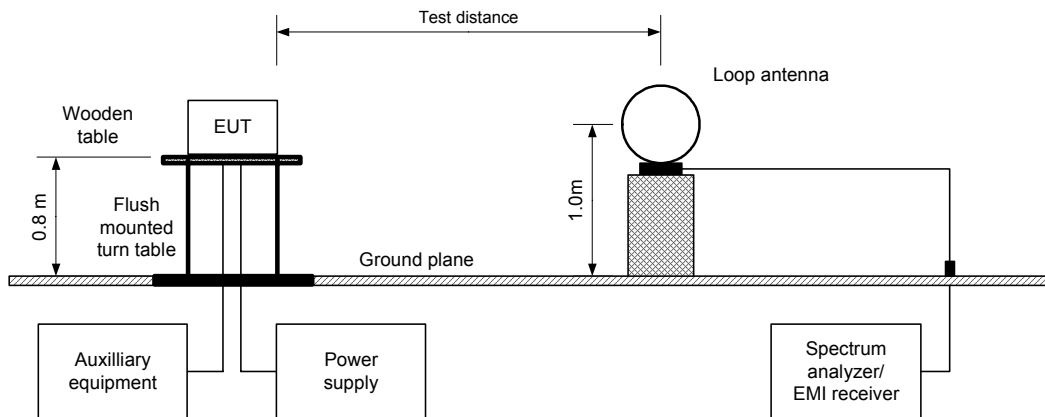
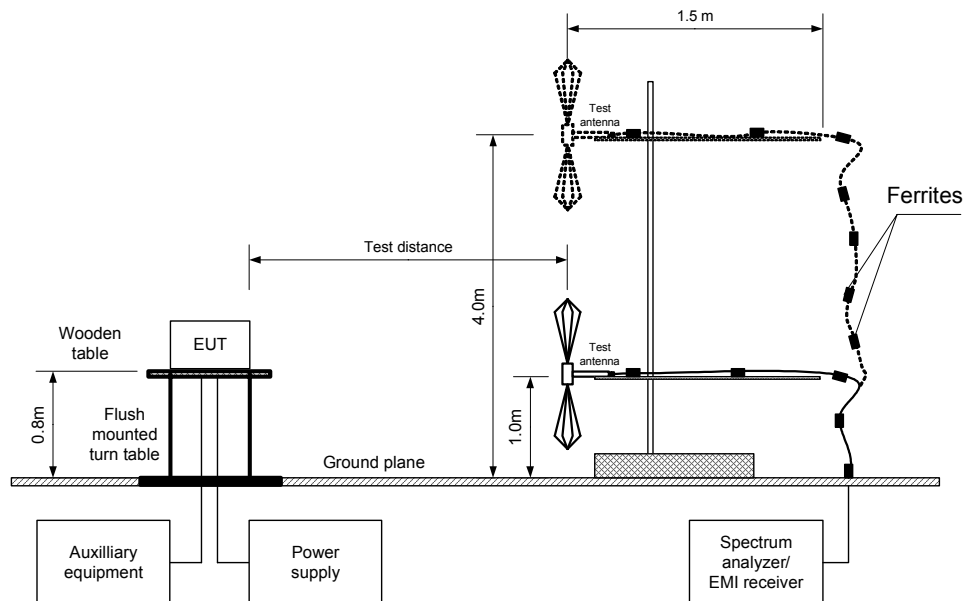


Figure 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

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

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: FSK
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 – 60000 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 (1 – 18 GHz)
 Standard gain horn (18 GHz – 60 GHz)

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											
10524.35	Hor	1.20	5.00	113.00	148.00	-35.00	-25.61	87.39	128.00	-40.61	Pass
Spurious emissions											
21044.38	Vert	1.00	0.00	61.50	97.5	-36.00	-25.61	35.89	77.5	-41.61	Pass
31573.57	Horiz	1.00	320.00	62.67	97.5	-34.83	-25.61	37.06	77.5	-40.44	Pass

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

Table 7.1.4 Average factor calculation

Transmission pulse		Average factor, dB
Duration, μs	Period, μs	
26.83	511.70	-25.61

*- Average factor was calculated as follows

for pulse train shorter than 100 ms:

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

for pulse train longer than 100 ms:

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

Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

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

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: FSK
 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*				
0.09 - 1000	No emission were found						Pass	

*- Margin = Measured emission - specification limit.

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

Table 7.1.6 Restricted bands

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2655 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 - 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 - 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	

Reference numbers of test equipment used

HL 0410	HL 0446	HL 0465	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604
HL 0768	HL 0769	HL 0770	HL 1424	HL 1927	HL 1984	HL 2009	HL 2260
HL 2399	HL 2400	HL 2432	HL 2499				

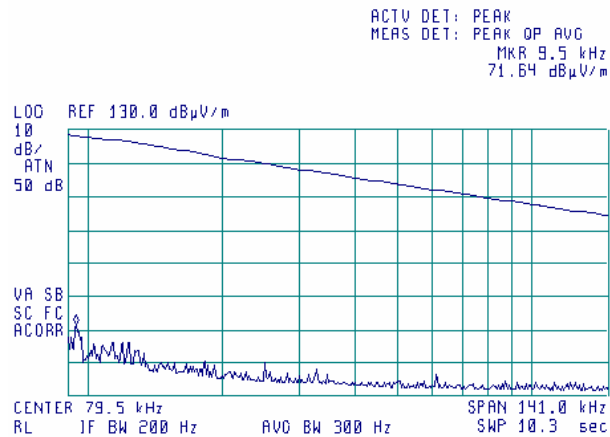
Full description is given in Appendix A.

Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.1 Radiated emission measurements from 9 to 150 kHz

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

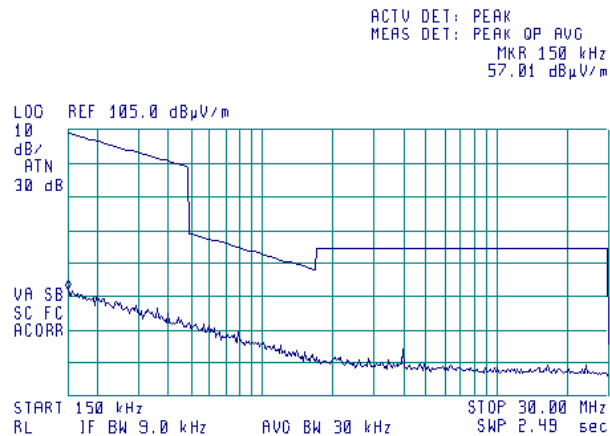
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Plot 7.1.2 Radiated emission measurements from 0.15 to 30 MHz

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

14:41:41 JUN 17, 2005

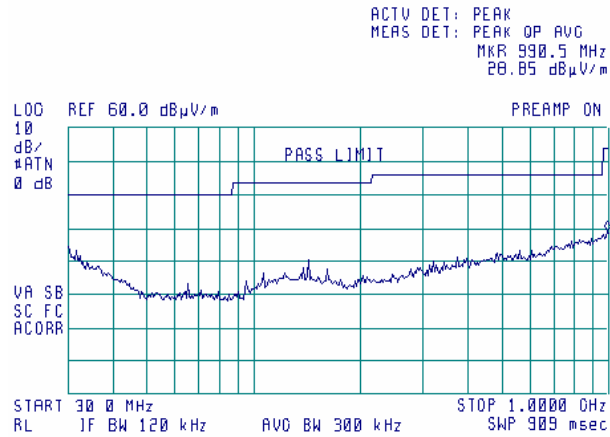


Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.3 Radiated emission measurements from 30 to 1000 MHz

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

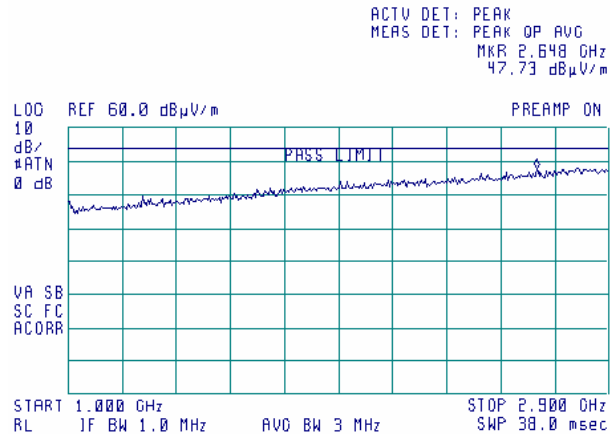
13:30:02 JUN 17, 2005



Plot 7.1.4 Radiated emission measurements from 1.0 to 2.9 GHz

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

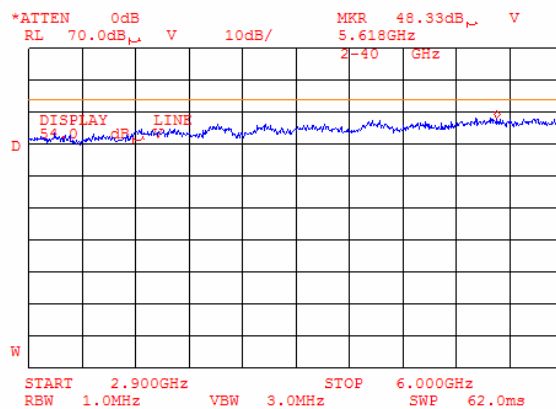
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Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

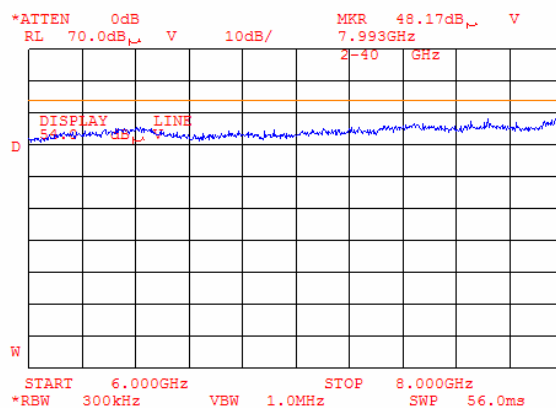
Plot 7.1.5 Radiated emission measurements from 2.9 to 6 GHz

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



Plot 7.1.6 Radiated emission measurements from 6 to 8 GHz

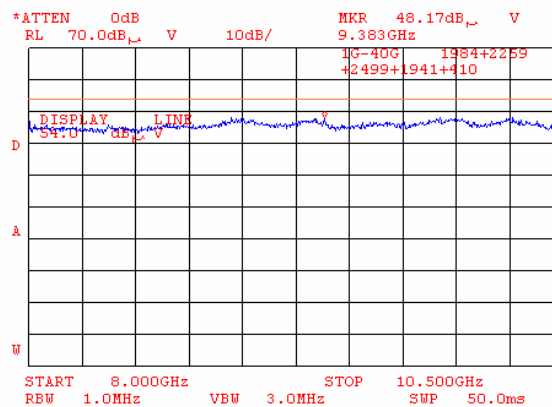
TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

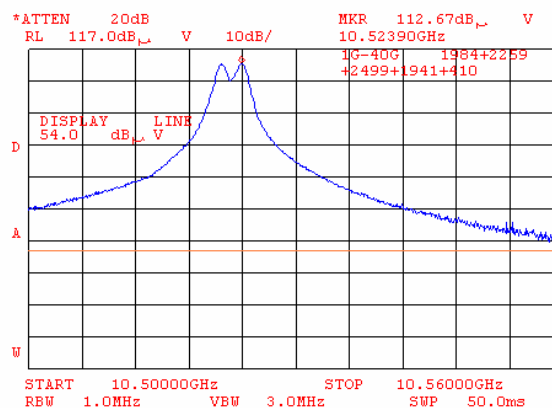
Plot 7.1.7 Radiated emission measurements from 8 to 10.5 GHz

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



Plot 7.1.8 Radiated emission measurements from 10.5 to 10.56 GHz

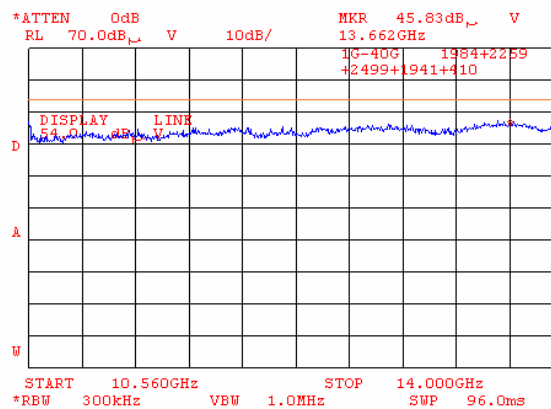
TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

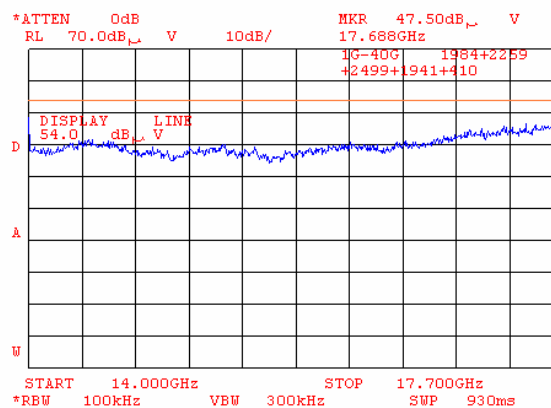
Plot 7.1.9 Radiated emission measurements from 10.56 to 14 GHz

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



Plot 7.1.10 Radiated emission measurements from 14.0 to 17.7 GHz

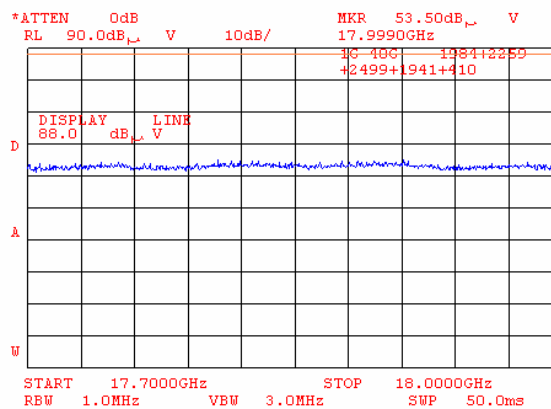
TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

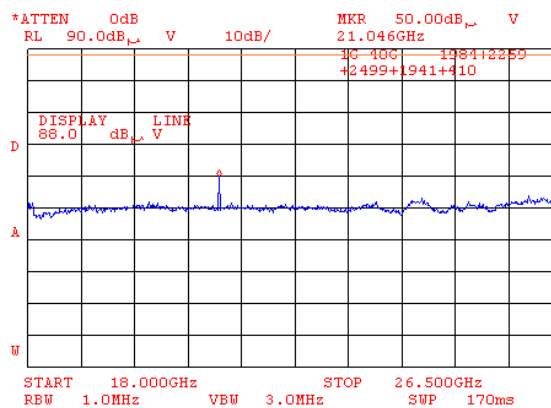
Plot 7.1.11 Radiated emission measurements from 17.7 to 18 GHz

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



Plot 7.1.12 Radiated emission measurements from 18.0 to 26.5 GHz

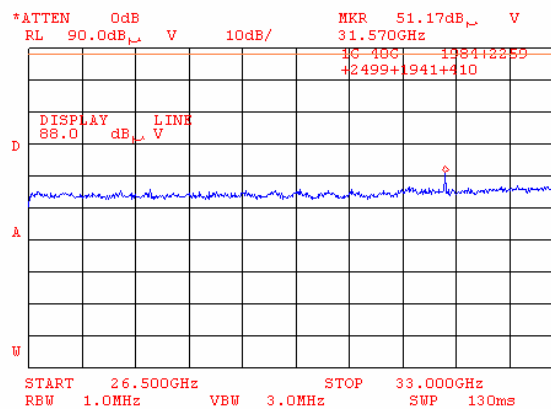
TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

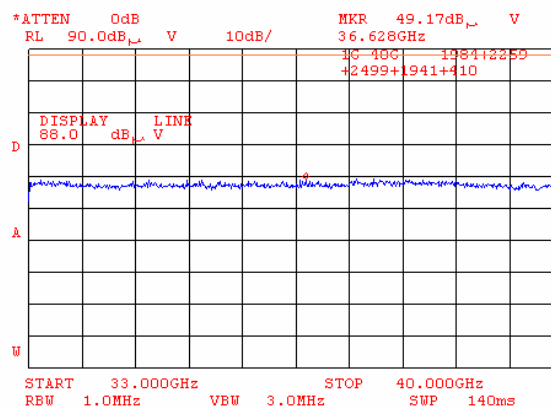
Plot 7.1.13 Radiated emission measurements from 26.5 to 33 GHz

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



Plot 7.1.14 Radiated emission measurements from 33.0 to 40.0 GHz

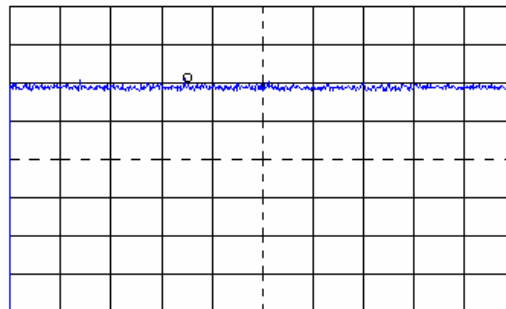
TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.15 Radiated emission measurements from 40.0 to 60.0 GHz

TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)
 MK: 46.920GHz - 59.1dBm
 F: 40.0G- 60.0GHz RL:- 40 dBm 10dB/ 10+



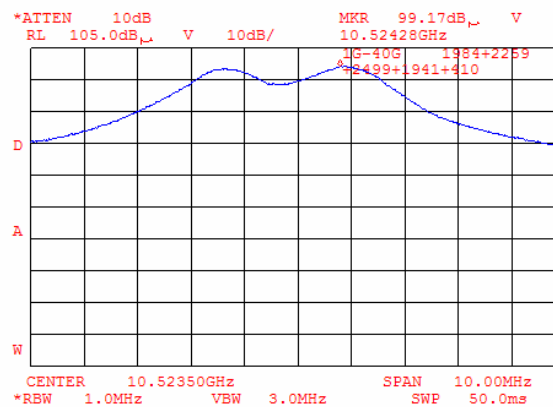
RBW: 1MHz VBW: 3MHz SWP: 100ms ATT: 0dB

Electric field strength: -59.1 dBm +107 dB + 39.03 dB(1/m)[AF] = 86.93 dBμV/m

Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

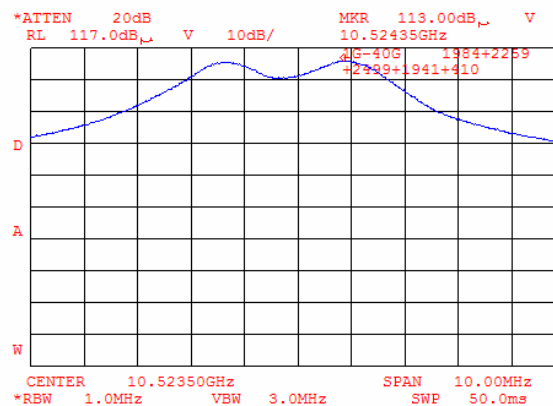
Plot 7.1.16 Radiated emission measurements at the fundamental frequency

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



Plot 7.1.17 Radiated emission measurements at the fundamental frequency

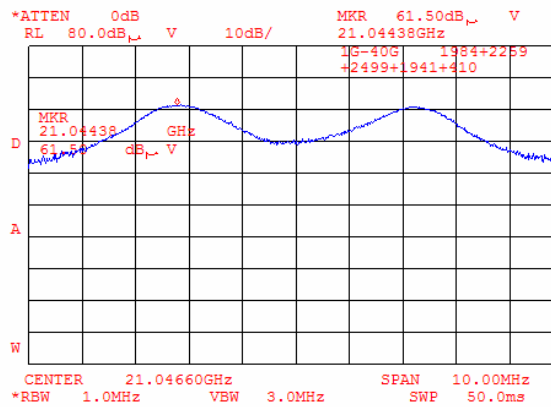
TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 EUT POSITION: Typical (Vertical)



Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

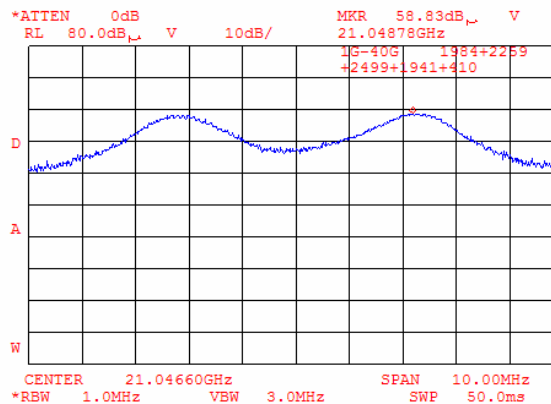
Plot 7.1.18 Radiated emission measurements at the second harmonic frequency

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



Plot 7.1.19 Radiated emission measurements at the second harmonic frequency

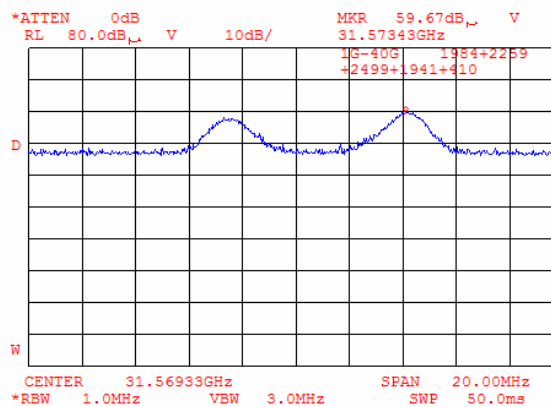
TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 EUT POSITION: Typical (Vertical)



Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

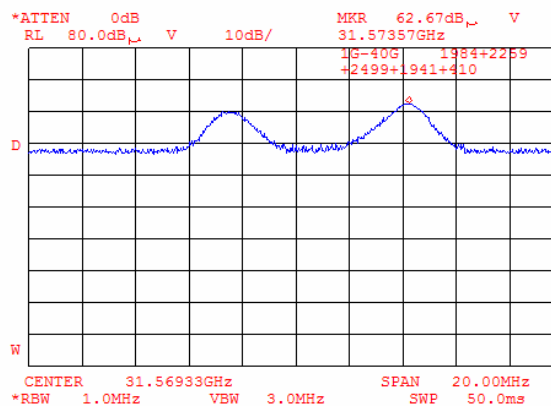
Plot 7.1.20 Radiated emission measurements at the third harmonic frequency

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



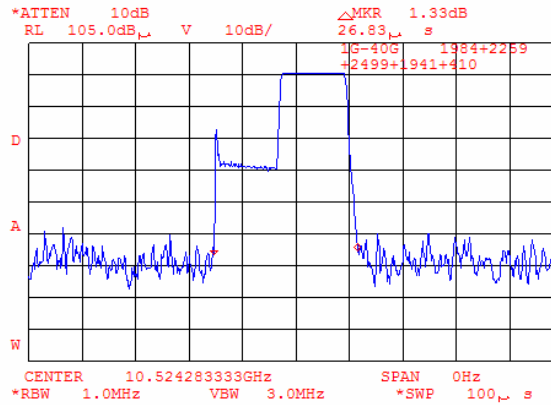
Plot 7.1.21 Radiated emission measurements at the third harmonic frequency

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

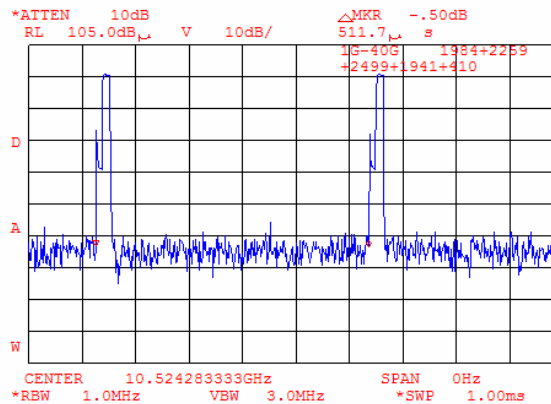


Test specification:	Section 15.245(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:16:55 PM		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.22 Transmission pulse duration



Plot 7.1.23 Transmission pulse period



Test specification:	Section 15.245(b)(3), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:18:30 PM		
Temperature: 26 °C	Air Pressure: 1010 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

7.2 Band edge emission

7.2.1 General

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

Table 7.2.1 Band edge emission limits

Frequency band, MHz	Field strength limit at 3 m, dB μ V/m		Attenuation below carrier, dBc
	Peak	Average	
10500 - 10550	97.5	77.5	50

7.2.2 Test procedure

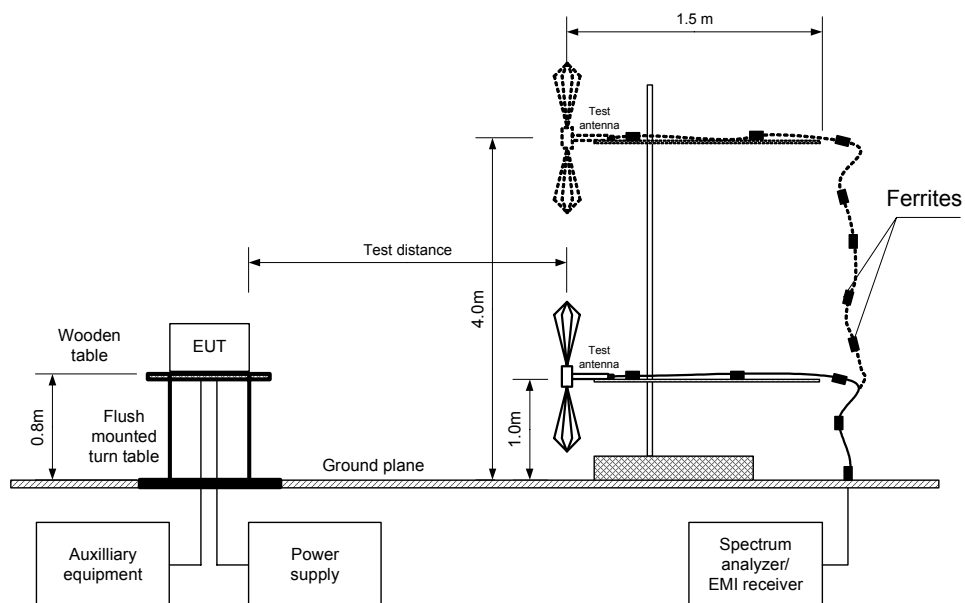
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

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

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

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

Figure 7.2.1 Band edge emission measurement set up



Test specification:	Section 15.245(b)(3), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:18:30 PM		
Temperature: 26 °C	Air Pressure: 1010 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.2 Band edge emission test results

OPERATING FREQUENCY RANGE: 10500 – 10550 MHz
DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 300 kHz
MODULATION: FSK
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
ATTENUATION BELOW CARRIER: 50 dBc

Modulation envelope		Band edge limit, MHz	Margin, kHz***	Verdict
Edge	Frequency, MHz*			
Low	10514.48	10500.00	-14480	Pass
High	10531.98	10550.00	18020	Pass

* - Measured frequency beyond which the emission dropped 50 dB below the carrier emission or below the field strength limit whichever was a less stringent

** - Margin = Band edge limit – Band edge frequency

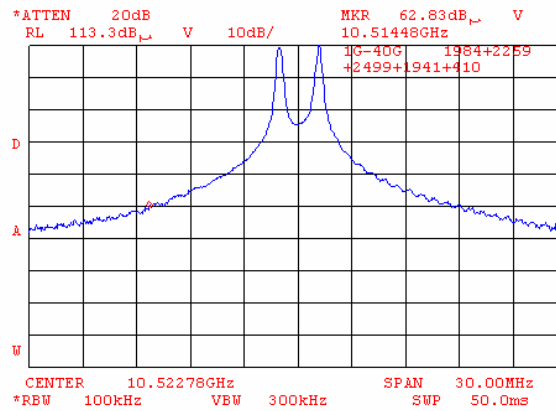
Reference numbers of test equipment used

HL 0410	HL 1424	HL 1984	HL 2259	HL 2387	HL 2399	HL 1941	HL 2499
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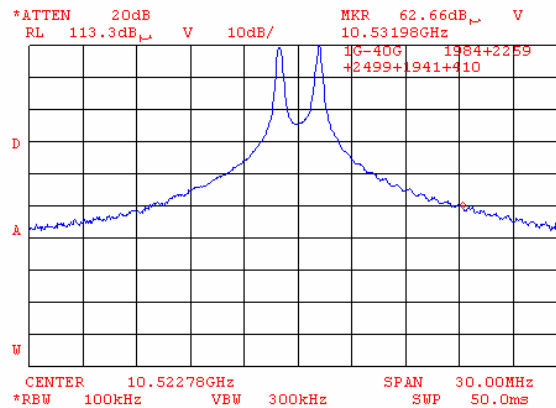
Full description is given in Appendix A.

Test specification:	Section 15.245(b)(3), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:18:30 PM		
Temperature: 26 °C	Air Pressure: 1010 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.1 Band edge emission test result, left edge



Plot 7.2.2 Band edge emission test result, right edge



Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:19:35 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

7.3 Conducted emissions

7.3.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.3.1. The worst test results (the lowest margins) were recorded in Table 7.3.2 and shown in the associated plots.

Table 7.3.1 Limits for conducted emissions

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

* The limit decreases linearly with the logarithm of frequency.

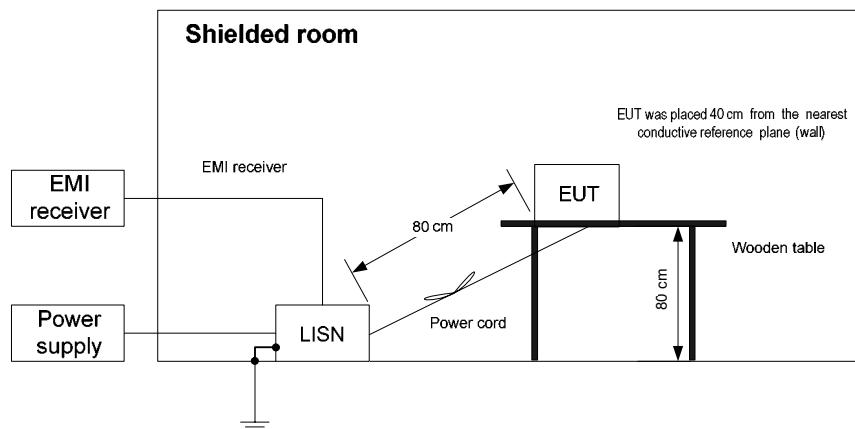
7.3.2 Test procedure

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

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

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

Figure 7.3.1 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:	7/5/2005 6:19:35 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.2 Conducted emission test results

LINE: AC mains
 EUT OPERATING MODE: Transmit
 EUT SET UP: TABLE-TOP
 TEST SITE: SHIELDED ROOM
 DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
 FREQUENCY RANGE: 150 kHz - 30 MHz
 RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
16.008986	49.55	47.15	60.00	-12.85	46.17	50.00	-3.83	L1	Pass
16.008856	51.39	48.24	60.00	-11.76	47.21	50.00	-2.79	L2	Pass

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0447	HL 0466	HL 0521	HL 0787	HL 1502	HL 1510		
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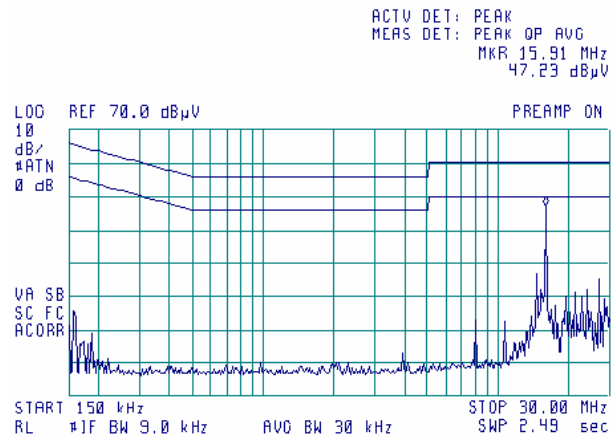
Full description is given in Appendix A.

Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:19:35 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.1 Conducted emission measurements

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

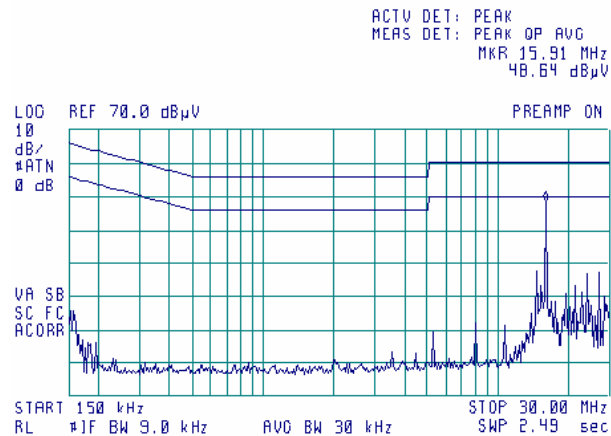
12:17:26 JUN 17, 2005



Plot 7.3.2 Conducted emission measurements

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

12:12:35 JUN 17, 2005



Test specification:	Section 15.203, Antenna requirement		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:32:29 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

7.4 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.4.1.

Table 7.4.1 Antenna requirements

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

Photograph 7.4.1 Antenna assembly



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:	7/5/2005 6:21:00 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	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.

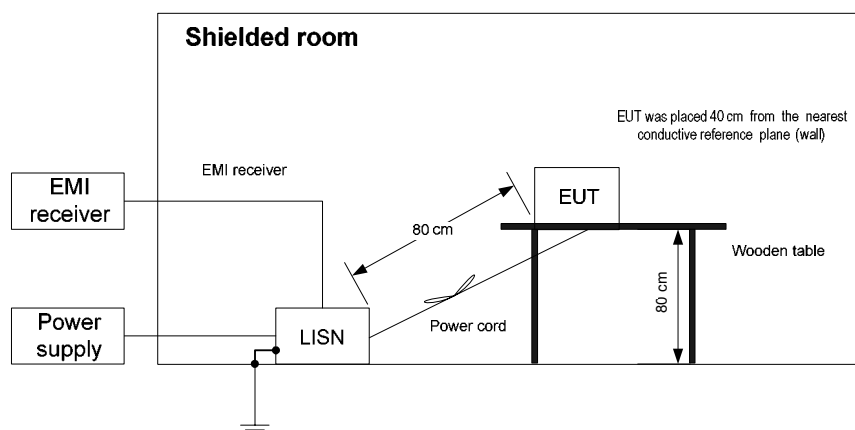
8.1.2 Test procedure

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, 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:	7/5/2005 6:21:00 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Table 8.1.2 Conducted emission test results

LINE: AC mains
LIMIT: Class B
EUT OPERATING MODE: Standby
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*		
16.008986	49.55	47.15	60.00	-12.85	46.17	50.00	-3.83	L1	Pass
16.008856	51.39	48.24	60.00	-11.76	47.21	50.00	-2.79	L2	Pass

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0447	HL 0466	HL 0521	HL 0787	HL 1502	HL 1510		
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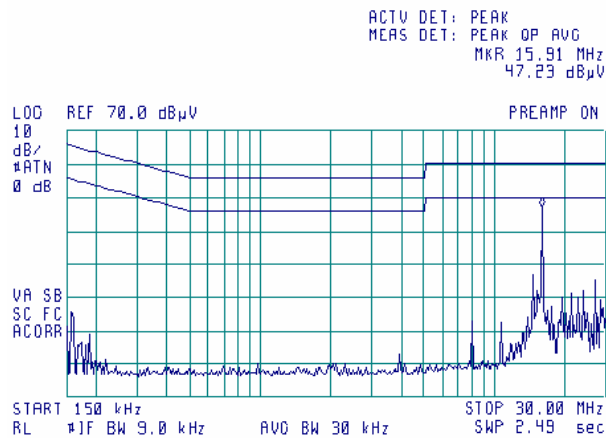
Full description is given in Appendix A.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/5/2005 6:21:00 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 8.1.1 Conducted emission measurements

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

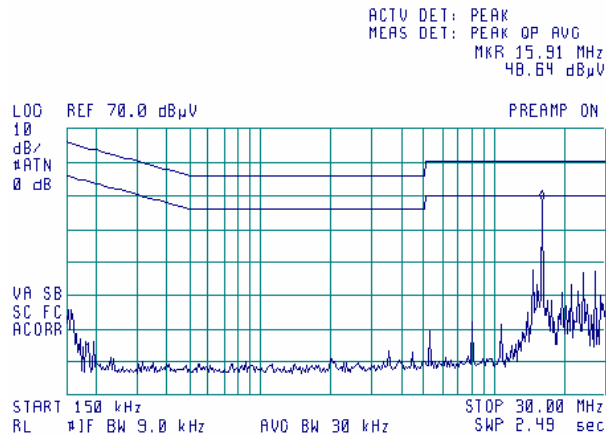
12:17:26 JUN 17, 2005



Plot 8.1.2 Conducted emission measurements

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

12:12:35 JUN 17, 2005



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:	7/5/2005 6:04:57 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

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

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.

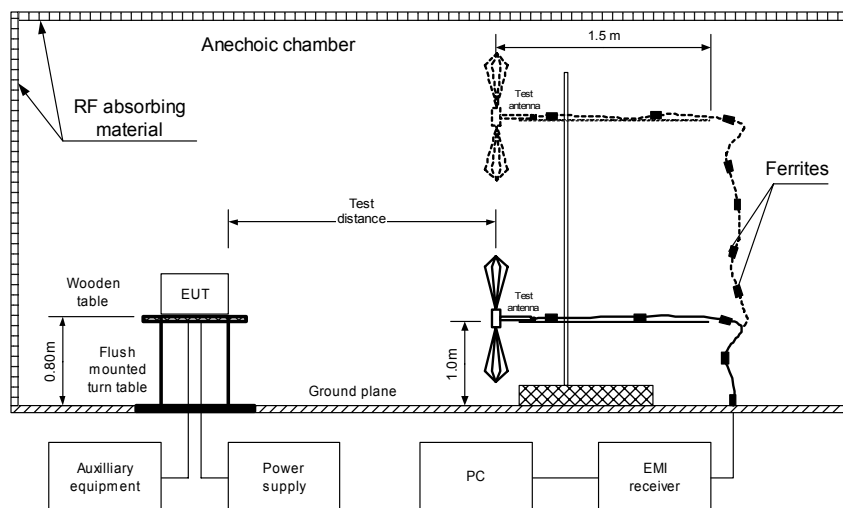
8.2.2 Test procedure for measurements in semi-anechoic chamber

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 8.2.1 and shown in the associated plots.

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:	7/5/2005 6:04:57 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Table 8.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: 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*				
No emissions were found								Pass

FREQUENCY RANGE: 1 – 2.9 GHz
DETECTORS USED: PEAK / AVERAGE
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 0592	HL 0593	HL 0594	HL 0604	HL 1984
HL 2009	HL 1947						

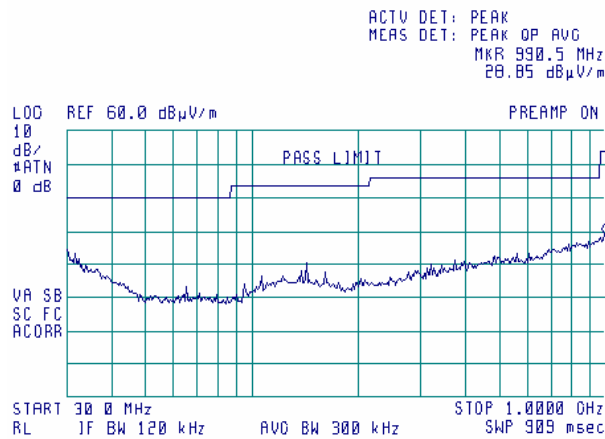
Full description is given in Appendix A.

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:	7/5/2005 6:04:57 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

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

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

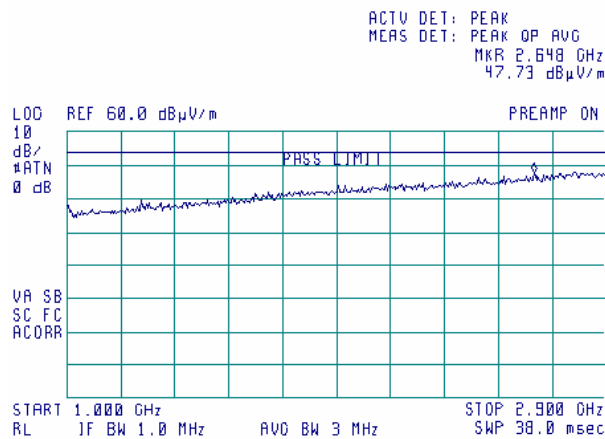
13:30:02 JUN 17, 2005



Plot 8.2.2 Radiated emission measurements in 1 - 2.9 GHz range, vertical and horizontal antenna polarization

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

13:31:41 JUN 17, 2005



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0410	Cable, Coax, Microwave, DC-18 GHz, N-N, 1 m	Gore	PFP01P01039.4	9338767	17-Oct-04	17-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	03-Nov-04	03-Nov-05
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 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	18-May-05	18-May-06
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	03-Feb-05	03-Feb-06
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
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, K-band, Gain - 25 dB	Quinstar Technology	QWH-4200-BA	110	10-Jan-05	10-Jan-06
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, Ka band, Gain 25 dB	Quinstar Technology	QWH-2800-BA	112	10-Jan-05	10-Jan-06
0770	Antenna Standard Gain Horn, 40-60 GHz WR-19, U-band Gain - 25 dB	Quinstar Technology	QWH-1900-AA	118	10-Jan-05	10-Jan-06
0787	Transient Limiter	Hewlett Packard	11947A	3107A01877	21-Nov-04	21-Nov-05
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies (HP)	8564EC	3946A00219	30-Aug-04	30-Aug-05
1502	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1502	12-Feb-05	12-Feb-06
1510	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1510	02-Dec-04	02-Dec-05
1927	Dual Voltage Battarey Charger	EMC Test Systems	NA	NA	02-Dec-04	02-Dec-05
1941	Cable 18GHz, 4 m, green	Rhophase Microwave Limited	SPS-1803A-4000-NPS	T4657	17-Oct-04	17-Oct-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	22-Mar-05	22-Mar-06

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-04	02-Dec-05
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	05-Nov-04	05-Nov-05
2260	Amplifier Low Noise 14-33 GHz	Sophia Wireless	LNA28-B	0233	05-Nov-04	05-Nov-05
2387	Filter Bandpass, 8-14 GHz	HL	FBP8-14	2387	05-Jun-05	05-Jun-06
2399	Cable 40GHz, 1.5 m, blue	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2945	24-Jun-05	24-Jun-06
2400	Cable 40GHz, 1.5 m, green	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2946	24-Jun-04	24-Jun-05
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	22-Mar-05	22-Mar-06
2499	Quadruplexer 1-12 GHz (1-2 GHz; 2-4GHz;4-8 GHz; 8-12GHz)	Electronica S.p.A. - Roma	UE 84	D/00239	10-Feb-05	10-Feb-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 %

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, QA manager.

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

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 LISN 16 – 1, Hermon Laboratories**

Frequency, MHz	Correction factor, dB
0.01	5.0
0.02	2.2
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	0.2
10	0.3
12	0.4
16	0.5
18	0.6
20	0.7
25	0.9
28	1.2
30	1.3

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, HL 0446**

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

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

Antenna factor
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
Standard gain horn antenna
Quinstar Technology, Model QWH
Ser.No.112, HL 0768, 0769, 0770

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

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

**Antenna factor
Double-ridged wave guide horn antenna
Model 3115, S/N 9911-5964, HL1984**

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

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

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

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

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

Cable loss
Cable GORE, HL 0410

No.	Frequency, GHz	Cable loss, dB
1	0.5	0.16
2	1	0.28
3	2	0.38
4	4	0.55
5	6	0.85
6	8	0.90
7	10	1.07
8	12	1.11
9	14	1.29
10	16	1.41
11	18	1.73

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

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

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

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

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

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

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		

Cable loss
Cable coaxial, 40GHz, 1.5 m, Blue, Rhophase Microwave Limited, model: KPS-1503A-1500-KPS,
HL 2399

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.07	6.5	1.57	15.50	2.50
0.05	0.10	6.7	1.60	16.00	2.51
0.1	0.16	6.9	1.55	16.50	2.58
0.2	0.26	7.1	1.65	17.00	2.65
0.3	0.33	7.3	1.65	17.50	2.73
0.5	0.38	7.5	1.70	18.00	2.74
0.7	0.41	7.7	1.71	18.50	2.67
0.9	0.58	7.9	1.73	19.00	2.67
1.1	0.64	8.1	1.79	19.50	2.74
1.3	0.70	8.3	1.81	20.00	2.69
1.5	0.75	8.5	1.84	20.50	2.80
1.7	0.79	8.7	1.85	21.00	2.82
1.9	0.83	8.9	1.90	21.50	2.87
2.1	0.88	9.1	1.95	22.00	2.87
2.3	0.93	9.3	1.93	22.50	2.92
2.5	0.97	9.5	1.98	23.50	3.04
2.7	1.01	9.7	1.96	24.00	3.05
2.9	1.04	9.9	2.03	24.50	3.03
3.1	1.08	10.1	1.99	25.00	3.11
3.3	1.14	10.30	2.02	25.50	3.10
3.5	1.17	10.50	2.02	26.00	3.17
3.7	1.21	10.70	2.02	26.50	3.11
3.9	1.24	10.90	2.08	27.00	3.16
4.1	1.26	11.10	2.02	28.00	3.19
4.3	1.26	11.30	2.09	29.00	3.19
4.5	1.29	11.50	2.05	30.00	3.30
4.7	1.34	11.70	2.11	31.00	3.31
4.9	1.34	11.90	2.11	32.00	3.35
5.1	1.40	12.10	2.12	33.00	3.46
5.3	1.43	12.40	2.17	34.00	3.45
5.5	1.45	13.00	2.29	35.00	3.49
5.7	1.47	13.50	2.31	36.00	3.54
5.9	1.40	14.00	2.43	37.00	3.62
6.1	1.53	14.50	2.43	39.00	3.69
6.3	1.55	15.00	2.46	40.00	3.75

Cable loss
Cable coaxial, 40GHz, 1.5 m, green, Rhophase Microwave Limited, model: KPS-1503A-1500-KPS,
HL 2400

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.06	6.5	1.46	15.50	2.34
0.05	0.08	6.7	1.49	16.00	2.34
0.1	0.15	6.9	1.50	16.50	2.40
0.2	0.23	7.1	1.51	17.00	2.46
0.3	0.29	7.3	1.55	17.50	2.54
0.5	0.37	7.5	1.56	18.00	2.61
0.7	0.46	7.7	1.58	18.50	2.59
0.9	0.53	7.9	1.60	19.00	2.59
1.1	0.58	8.1	1.61	19.50	2.67
1.3	0.65	8.3	1.68	20.00	2.62
1.5	0.66	8.5	1.68	20.50	2.73
1.7	0.72	8.7	1.75	21.00	2.71
1.9	0.76	8.9	1.74	21.50	2.78
2.1	0.79	9.1	1.81	22.00	2.83
2.3	0.85	9.3	1.79	22.50	2.81
2.5	0.90	9.5	1.86	23.50	2.91
2.7	0.91	9.7	1.85	24.00	2.97
2.9	0.97	9.9	1.87	24.50	2.98
3.1	0.97	10.1	1.88	25.00	2.97
3.3	1.03	10.30	1.82	25.50	3.03
3.5	1.06	10.50	1.92	26.00	3.04
3.7	1.10	10.70	1.86	26.50	3.11
3.9	1.13	10.90	1.96	27.00	2.97
4.1	1.16	11.10	1.90	28.00	3.15
4.3	1.18	11.30	1.99	29.00	3.07
4.5	1.21	11.50	1.95	30.00	3.13
4.7	1.23	11.70	2.00	31.00	3.13
4.9	1.26	11.90	2.01	32.00	3.18
5.1	1.28	12.10	1.99	33.00	3.31
5.3	1.31	12.40	2.06	34.00	3.32
5.5	1.32	13.00	2.11	35.00	3.37
5.7	1.36	13.50	2.17	36.00	3.36
5.9	1.37	14.00	2.36	37.00	3.46
6.1	1.38	14.50	2.32	39.00	3.49
6.3	1.44	15.00	2.30	40.00	3.52

Cable 18GHz, 4 m, green, model: SPS-1803A-4000-NPS, s/n T4657 (HL 1941)
Calibration data

Frequency, GHz	Insertion loss, dB
0.03	0.19
0.05	0.24
0.10	0.33
0.20	0.46
0.30	0.57
0.40	0.65
0.50	0.73
0.60	0.80
0.70	0.87
0.80	0.92
0.90	0.98
1.00	1.03
1.10	1.08
1.20	1.14
1.30	1.18
1.40	1.22
1.50	1.27
1.60	1.32
1.70	1.35
1.80	1.40
1.90	1.43
2.00	1.46
2.10	1.50
2.20	1.54
2.30	1.57
2.40	1.61
2.50	1.64
2.60	1.67
2.70	1.70
2.80	1.74
2.90	1.77
3.10	1.83
3.30	1.89
3.50	1.95
3.70	2.01
3.90	2.07
4.10	2.14
4.30	2.18
4.50	2.26
4.70	2.31
4.90	2.32
5.10	2.42
5.30	2.45
5.50	2.47
5.70	2.53
5.90	2.59

Frequency, GHz	Insertion loss, dB
6.10	2.63
6.30	2.66
6.50	2.72
6.70	2.77
6.90	2.78
7.10	2.81
7.30	2.87
7.50	2.92
7.70	2.94
7.90	3.02
8.10	3.06
8.30	3.13
8.50	3.14
8.70	3.16
8.90	3.23
9.10	3.20
9.30	3.22
9.50	3.31
9.70	3.32
9.90	3.39
10.10	3.42
10.30	3.46
10.50	3.46
10.70	3.48
10.90	3.50
11.10	3.58
11.30	3.63
11.50	3.65
11.70	3.85
11.90	3.81
12.10	3.84
12.40	3.91
13.00	3.87
13.50	3.99
14.00	4.12
14.50	4.17
15.00	4.27
15.50	4.33
16.00	4.38
16.50	4.38
17.00	4.42
17.50	4.61
18.00	4.78

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