

TEST REPORT

ACCORDING TO: FCC 47CFR, Section 15.231
RSS-210, Section 6.1.1

FOR:

Visonic Ltd.
Pendant transmitter
MCT-241 MD RL
315 MHz

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	Operating frequencies	5
6.3	Changes made in the EUT	5
6.4	Test configuration	5
6.5	Transmitter characteristics	6
7	Transmitter tests according to 47CFR part 15 subpart C requirements	7
7.1	Periodic operation requirements	7
7.2	Field strength of emissions	12
7.3	Occupied bandwidth test	33
7.4	Antenna requirements	35
7.5	Radiated emission measurements	36
8	APPENDIX A Test equipment and ancillaries used for tests	40
9	APPENDIX B Measurement uncertainties	41
10	APPENDIX C Test facility description	42
11	APPENDIX D Specification references	42
12	APPENDIX E Abbreviations and acronyms	43
13	APPENDIX F Test equipment correction factors	44

1 Applicant information

Client name: Visonic Ltd.
Address: 30, Habarzel street, Tel Aviv, 69710, Israel
Telephone: +972 3645 6714
Fax: +972 3645 6891
E-mail: aelshtein@visonic.com
Contact name: Mr. Arick Elshtein

2 Equipment under test attributes

Product name: Pendant transmitter
Operating frequency: 315 MHz
Model: MCT-241 MD RL
Serial number: 2704-10
Receipt date: 10/6/2004

3 Manufacturer information

Manufacturer name: Visonic Ltd.
Address: 30, Habarzel street, Tel Aviv, 69710, Israel
Telephone: +972 3645 6714
Fax: +972 3645 6891
E-Mail: aelshtein@visonic.com
Contact name: Mr. Arick Elshtein

4 Test details

Project ID: 16101
Location: Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started: 10/6/2004
Test completed: 12/23/2004
Test specifications: FCC 47CFR, Section 15.231
RSS-210, Section 6.1.1
Test suite: FCC_15.231(a) and RSS-210_6.1.1 (5/10/2004 8:29:24 AM, modified)

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements	Pass
FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions	Pass
FCC Part 15, Section 231(c) / RSS-210, Section 6.1.1(c), Occupied bandwidth	Pass
FCC Part 15, Section 207 / RSS-210, Section 6.6, Conducted emission	Not required
FCC Part 15, Section 203 / RSS-210, Section 5.5, Antenna requirements	Pass
Unintentional emissions	
FCC Part 15, Section 107 / RSS-210, Section 7.4 / ICES-003, Conducted emission at AC power port	Not required
FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission	Pass
FCC Part 15, Section 111 / RSS-210, Section 7.2, Conducted emission at receiver antenna port	Not required

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

	Name and Title	Date	Signature
Tested by:	Mr. B. Efros, test engineer	October 20, 2004	
Reviewed by:	Mr. M. Nikishin, EMC group leader	December 23, 2004	
Approved by:	Mr. A. Usoskin, CEO	December 23, 2004	

6 EUT description

6.1 General information

The MCT-241 MD RL is a PowerCode™ miniature, microprocessor-controlled personal UHF transmitter. It is designed to transmit coded alert signal in distress or in other emergency situations. The transmitter is waterproof and suitable for wearing in a shower.

The EUT is powered from 3V Lithium battery.

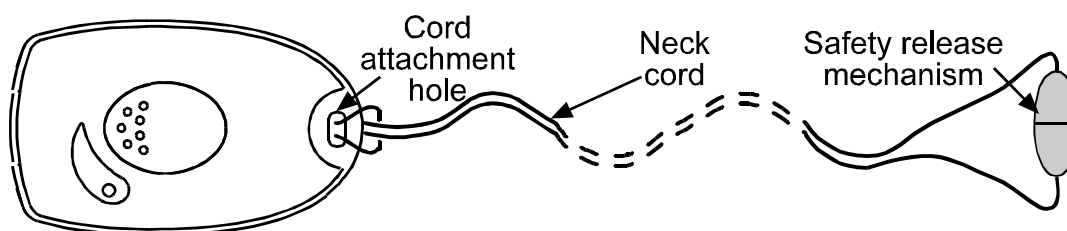
6.2 Operating frequencies

Source	Frequency, MHz					
Digital portion	4					

6.3 Changes made in the EUT

No changes were implemented.

6.4 Test configuration



6.5 Transmitter characteristics

Type of equipment								
X	Stand-alone (Equipment with or without its own control provisions)							
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)							
	Plug-in card (Equipment intended for a variety of host systems)							
Intended use		Condition of use						
	fixed	Always at a distance more than 2 m from all people						
	mobile	Always at a distance more than 20 cm from all people						
X	portable	May operate at a distance closer than 20 cm to human body						
Assigned frequency range		40.66 – 40.70 MHz and above 70 MHz						
Operating frequency		315.00 MHz						
RF channel spacing		NA						
Maximum rated output power		At transmitter 50 Ω RF output connector				NA		
		Effective radiated power (for equipment with no RF connector)				-18.75 dBm		
Is transmitter output power variable?		X	No					
			continuous variable					
			stepped variable with stepsize					
		Yes	minimum RF power				dBm	
			maximum RF power				dBm	
Antenna connection								
unique coupling		standard connector		X	integral	with temporary RF connector		
						X	without temporary RF connector	
Type of modulation				A.S.K.				
Maximum transmitter duty cycle in normal use		33.45 %		Tx ON time	1.092 s	Period	3.264 s	
Transmitter duty cycle supplied for test		100 %		Tx ON time	CW	Period	CW	
Transmitter power source								
X	Battery	Nominal rated voltage	3 VDC	Battery type	CR-2 type Lithium battery			
	DC	Nominal rated voltage	VDC					
	AC mains	Nominal rated voltage	VAC	Frequency	Hz			

Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2004 7:17:03 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

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

7.1 Periodic operation requirements

7.1.1 General

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

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- A manually operated transmitter shall employ switch that will automatically deactivate the transmitter within not more than 5 seconds of being released;
- A transmitter activated automatically shall cease transmission within 5 seconds after activation;
- Periodic transmissions, excluding polling or supervision transmissions, at regular predetermined intervals are not permitted;
- Total duration of polling or supervision transmissions, including data, to determine system integrity in security or safety applications shall not exceed 2 seconds per hour according to FCC 15.231(a) requirements;
- Periodic rate of polling or supervision transmissions, to determine system integrity in security or safety applications shall not exceed one transmission of not more than 1 second duration per hour according to RSS-210, section 6.1.1(a)(3) requirements;

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

7.1.2 Test procedure for transmitter shut down test

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

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

7.1.2.3 The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.

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

Figure 7.1.1 Setup for transmitter shut down test



Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2004 7:17:03 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Table 7.1.1 Periodic operation requirements

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

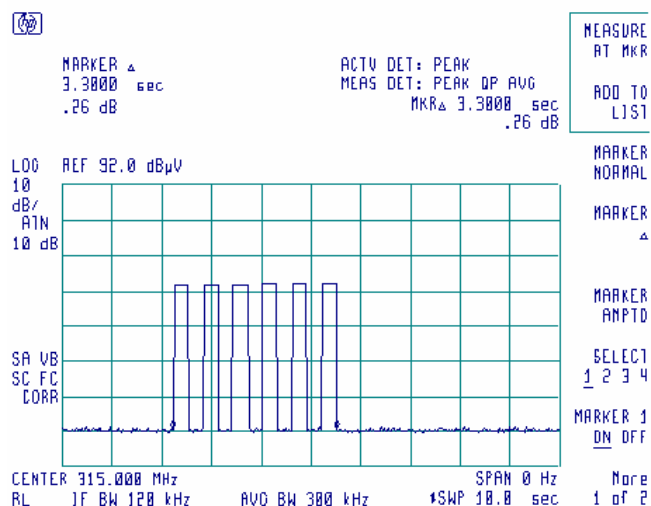
Reference numbers of test equipment used

HL 1430							
---------	--	--	--	--	--	--	--

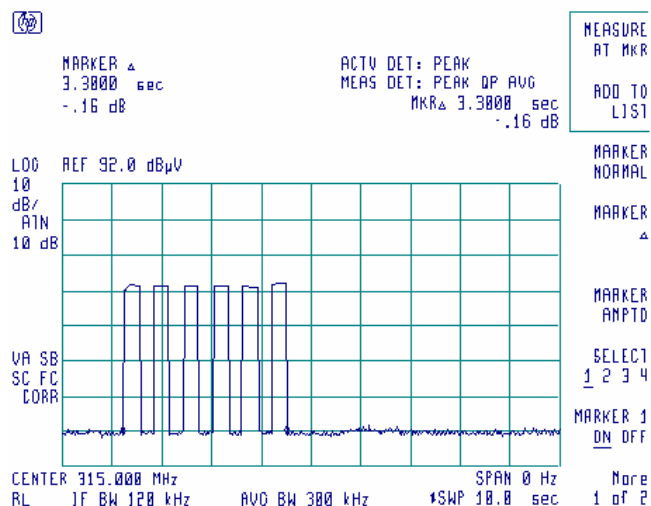
Full description is given in Appendix A.

Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2004 7:17:03 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Plot 7.1.1 Transmitter shut down test result, button control

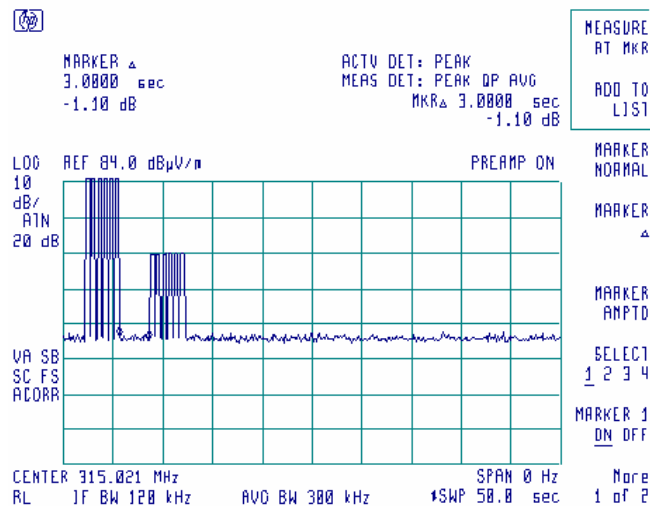


Plot 7.1.2 Transmitter shut down test result, automatic control



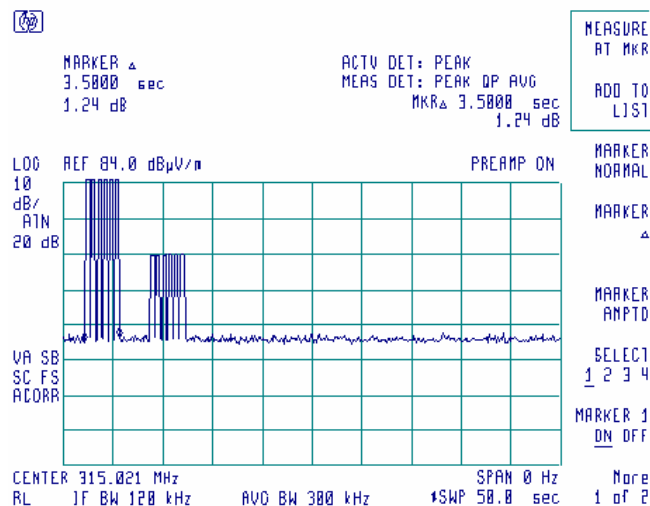
Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2004 7:17:03 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Plot 7.1.3 Transmitter shut down test result, tilt alarm and tilt restore transmissions
Pause duration



To take plots, the transmitter was turned downright and immediately returned to upright position. The first transmission is alarm and the second one is restore.

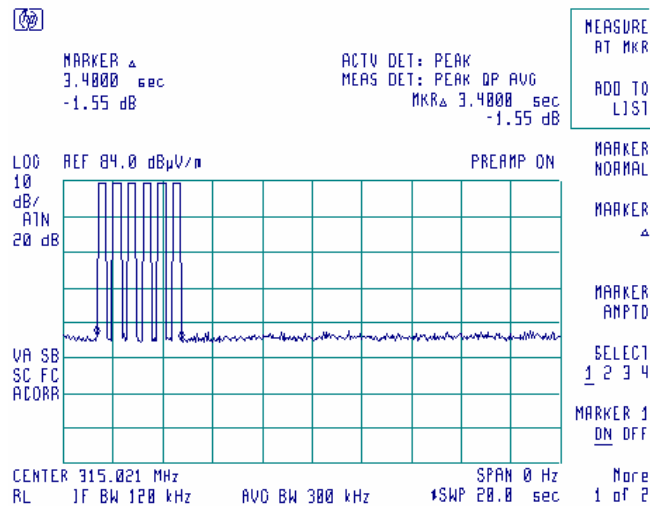
Plot 7.1.4 Transmitter shut down test result, tilt alarm and tilt restore transmissions
Transmission duration



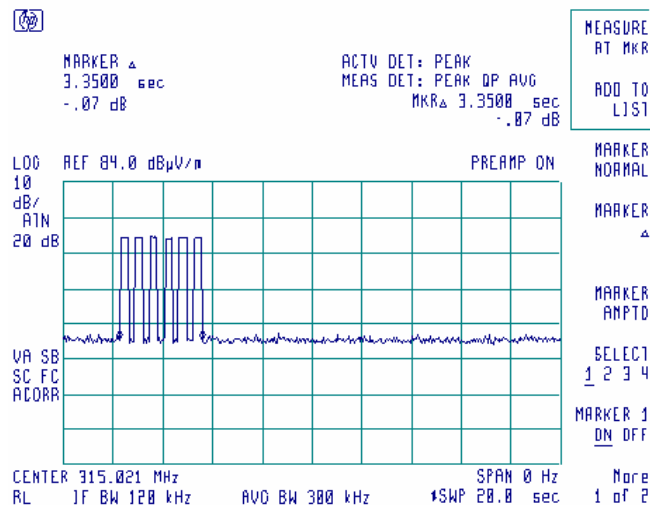
To take plots, the transmitter was turned downright and immediately returned to upright position. The first transmission is alarm and the second one is restore.

Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2004 7:17:03 PM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Plot 7.1.5 Transmitter shut down test result, tilt alarm transmission duration



Plot 7.1.6 Transmitter shut down test result, tilt restore transmission duration



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

7.2 Field strength of emissions

7.2.1 General

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

Table 7.2.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
315	95.6	75.6

Table 7.2.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(μV/m)				
	Within restricted bands			Outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.490*	NA	128.5 – 93.8**	NA	75.6	55.6
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			
Above 1000	74.0	NA	54.0		

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

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

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

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

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

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

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

where F is the carrier frequency in MHz.

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

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

Note 2: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

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 EUT performance was checked.

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

7.2.2.3 The worst test results with respect to the limits were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

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

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

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. The EUT was tested in three orthogonal positions.

7.2.3.3 The worst test results with respect to the limits were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

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

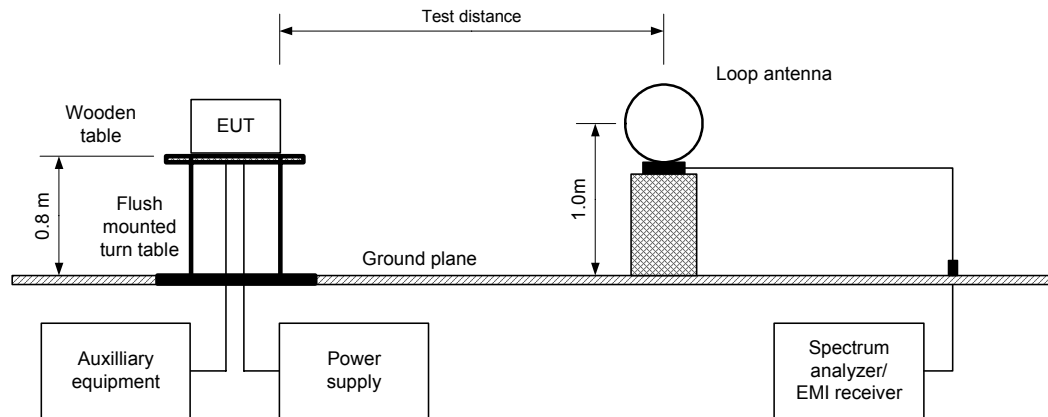
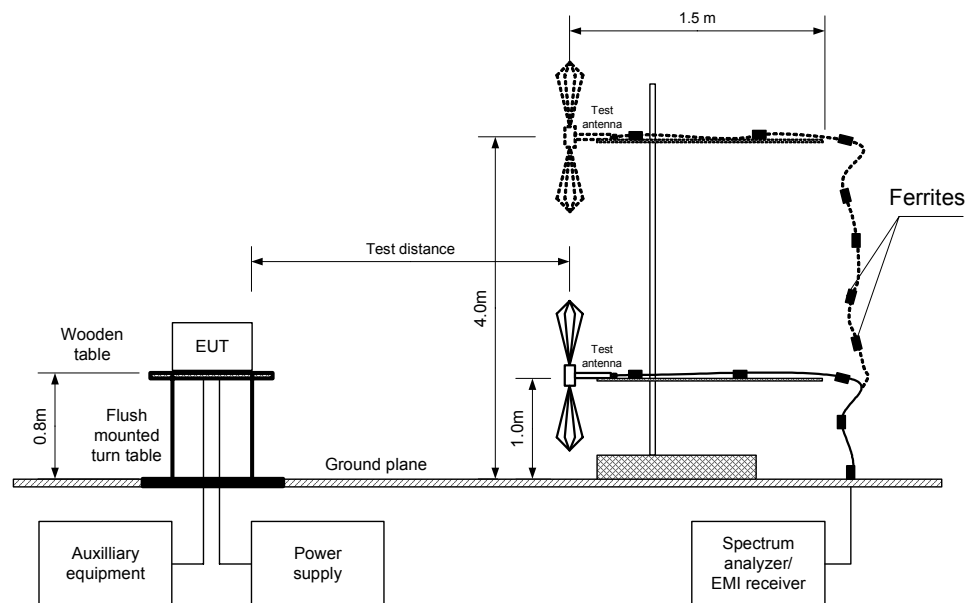


Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz

TEST DISTANCE: 3 m
EUT POSITION: Y
MODULATION: A.S.K.
MODULATING SIGNAL: ID code
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
INVESTIGATED FREQUENCY RANGE: 0.009 - 3200 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)
Biconical (30 MHz – 200 MHz)
Log periodic (200 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

Frequency, 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											
315.01	H	1.0	32	76.48	95.60	-18.82	-3.38	73.10	75.60	-2.50	Pass
Spurious emissions											
630.02	V	1.1	45	33.87	75.60	-41.73	-3.38	30.49	55.60	-25.11	Pass
945.03	V	1.2	278	42.18	75.60	-33.42	-3.38	38.80	55.60	-16.80	
1260.04	H	1.0	267	42.20	75.60	-33.4	-3.38	38.82	55.60	-16.78	
1575.05	V	1.0	273	41.72	74.00	-32.28	-3.38	38.34	54.00	-15.66	

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

** - Margin = dB below (negative if above) specification limit.

Table 7.2.4 Average factor calculation

Transmission pulse		Preamble burst duration, ms	Transmission burst duration, ms	Number of transmissions	Duty cycle %	Average factor, dB
Duration, ms	Period, ms					
0.820	1.2	44.48	286.4	6	67.7	-3.38

*- Average factor was calculated as follows:

for pulse train shorter than 100 ms:

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

for pulse train longer than 100 ms:

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

Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

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

TEST DISTANCE: 3 m
EUT POSITION: 3 orthogonal (X / Y / Z)
MODULATION: A.S.K.
MODULATING SIGNAL: ID code
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
9.0 kHz (150 kHz – 30 MHz)
120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconical (30 MHz – 200 MHz)
Log periodic (200 MHz – 1000 MHz)

Frequency, 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**	
No spurious emissions were found.											

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

**- Margin = dB below (negative if above) specification limit.

Table 7.2.6 Restricted bands according to FCC 15, Section 205

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	12.290 - 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	16.420 - 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

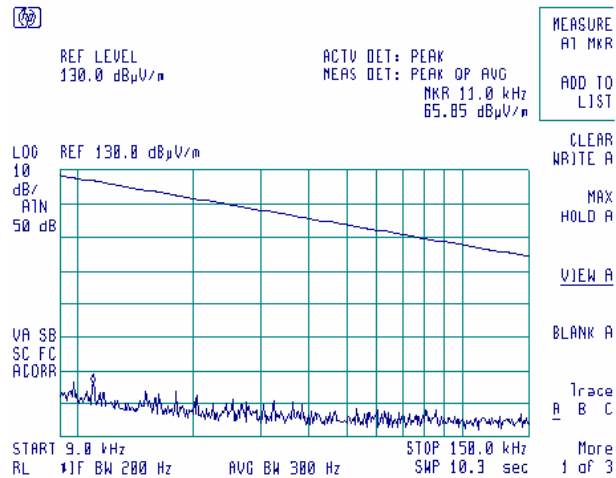
HL 0038	HL 0287	HL 0415	HL 0446	HL 0465	HL 0521	HL 0566	HL 0569
HL 0589	HL 0593	HL 0594	HL 0812	HL 1004	HL 1365	HL 1430	HL 1552
HL 1848	HL 1942	HL 1947	HL 1984	HL 2009	HL 2254	HL 2259	

Full description is given in Appendix A.

Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

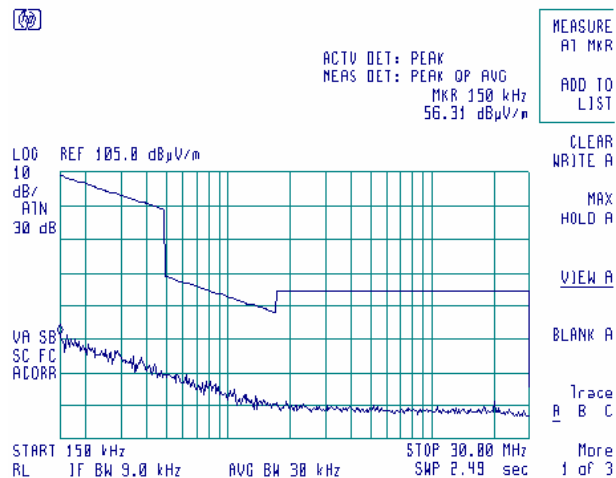
Plot 7.2.1 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.2 Radiated emission measurements from 0.15 to 30 MHz

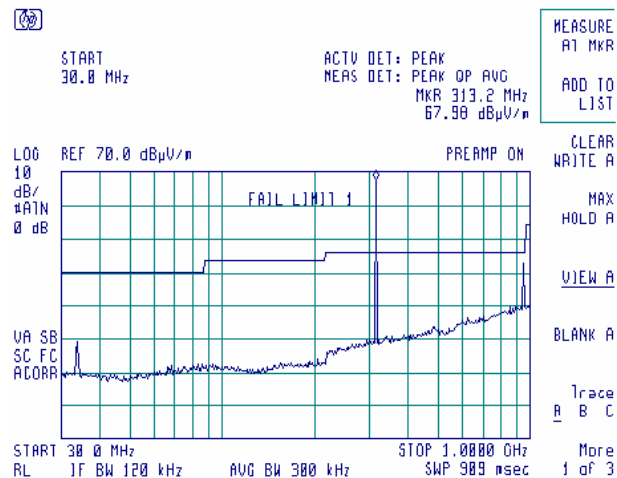
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

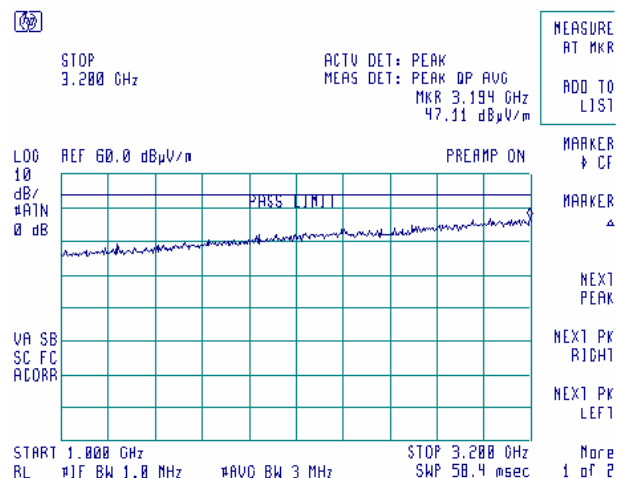
Plot 7.2.3 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.4 Radiated emission measurements from 1000 to 3200 MHz

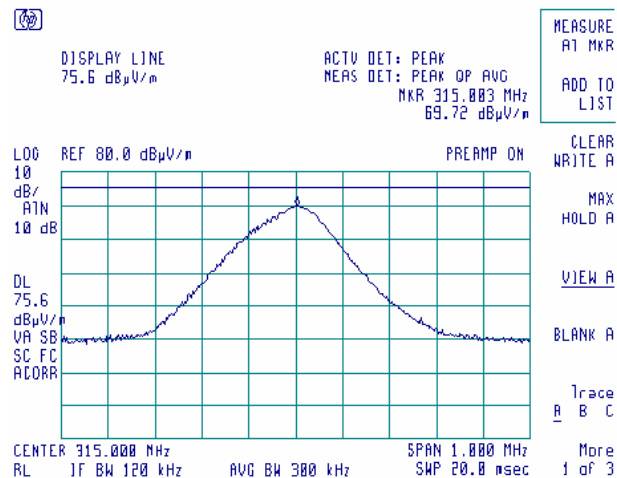
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

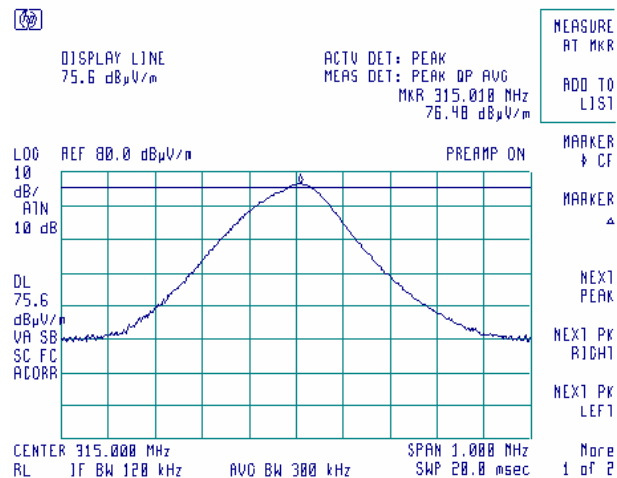
Plot 7.2.5 Field strength of fundamental measurements

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.6 Field strength of fundamental measurements

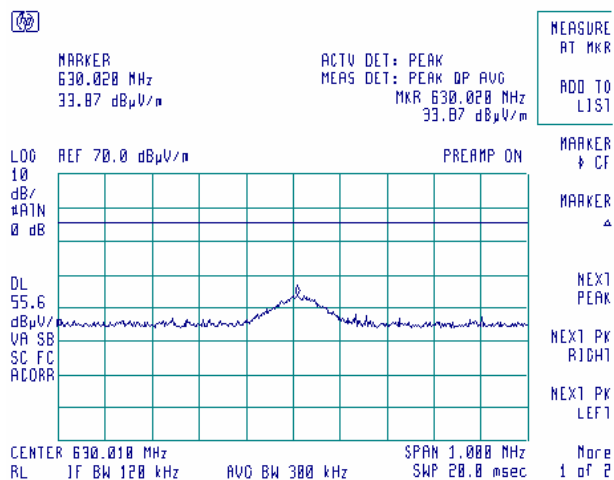
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

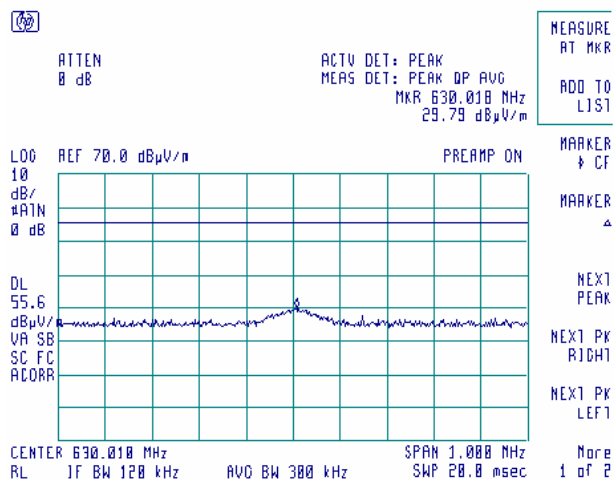
Plot 7.2.7 Radiated emission measurements, the second harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.8 Radiated emission measurements, the second harmonic

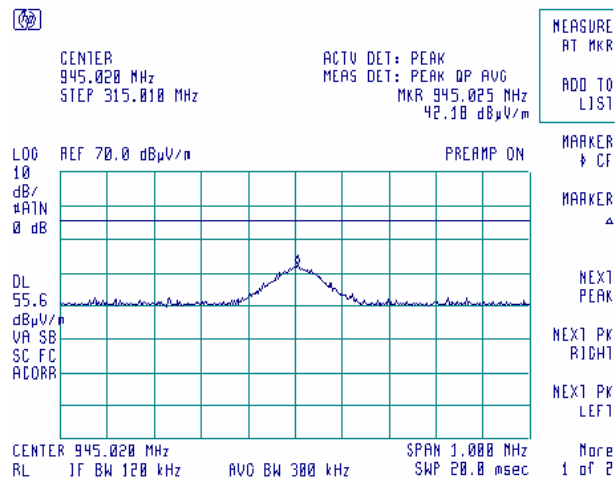
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

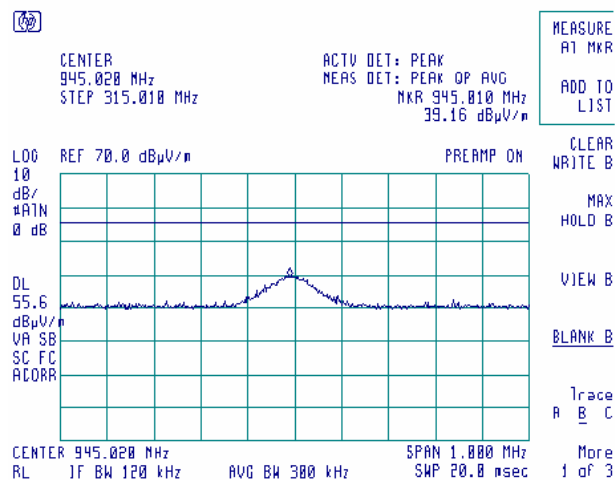
Plot 7.2.9 Radiated emission measurements, the third harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.10 Radiated emission measurements, the third harmonic

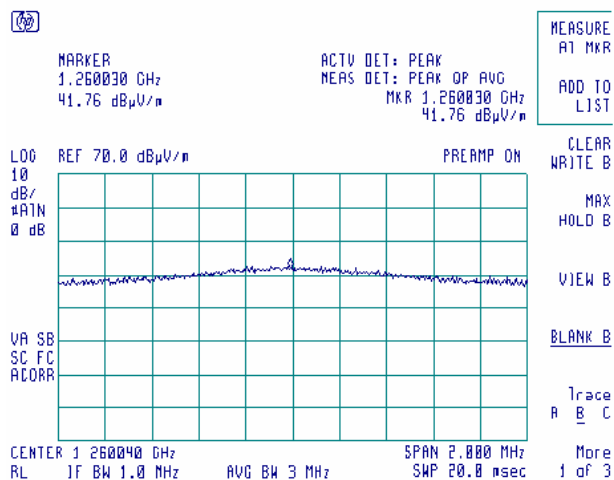
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

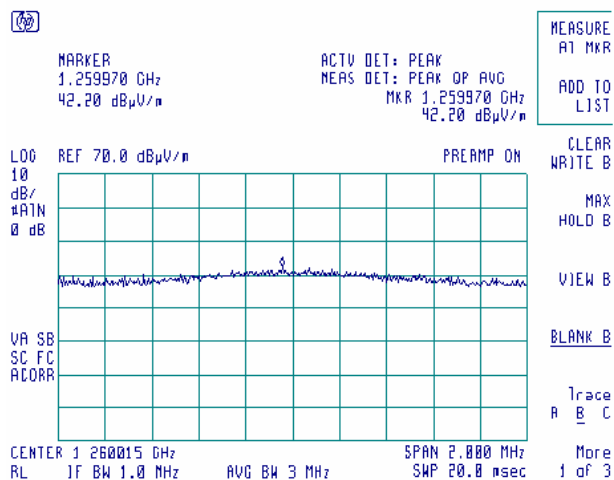
Plot 7.2.11 Radiated emission measurements, the forth harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.12 Radiated emission measurements, the forth harmonic

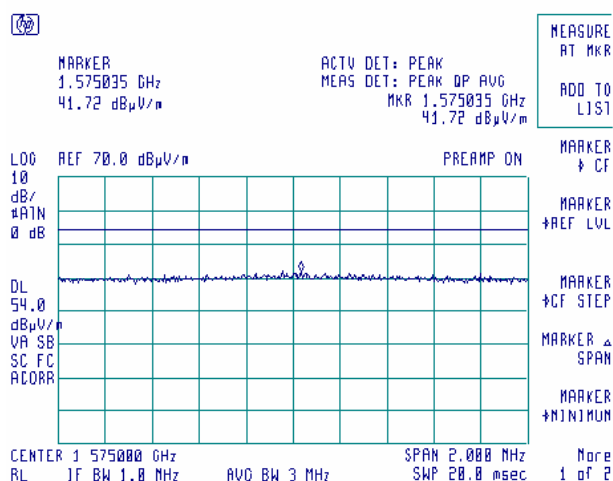
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

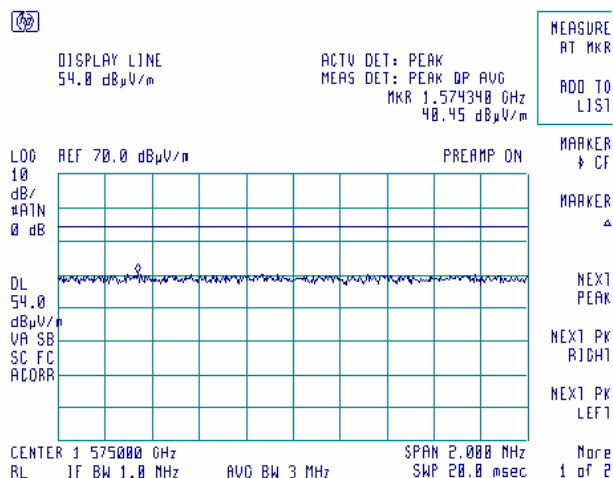
Plot 7.2.13 Radiated emission measurements, the fifth harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.14 Radiated emission measurements, the fifth harmonic

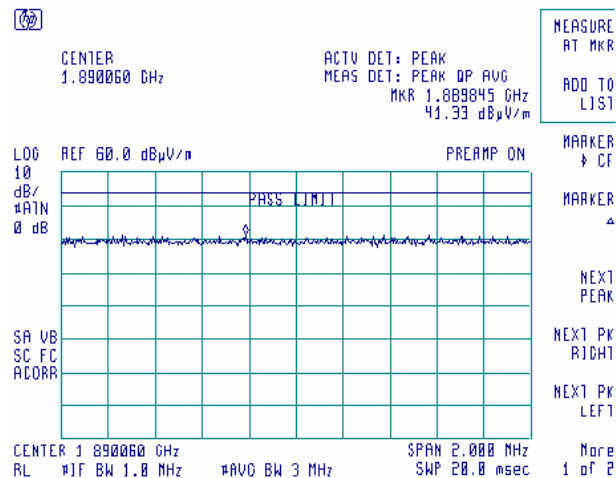
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

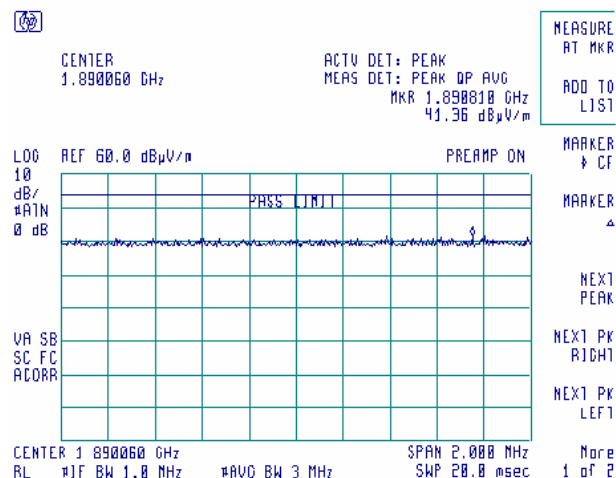
Plot 7.2.15 Radiated emission measurements, the sixth harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.16 Radiated emission measurements, the sixth harmonic

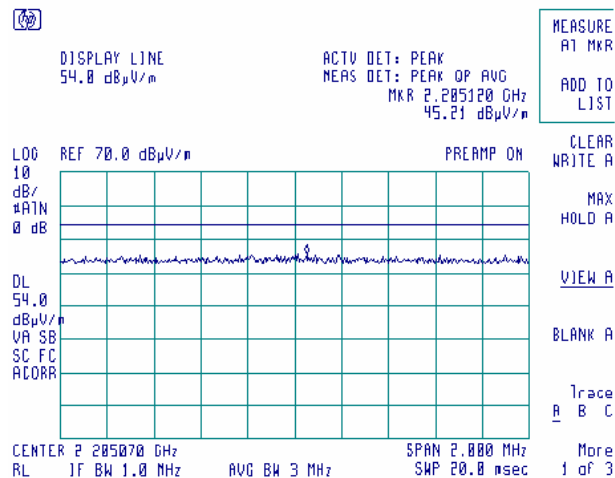
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

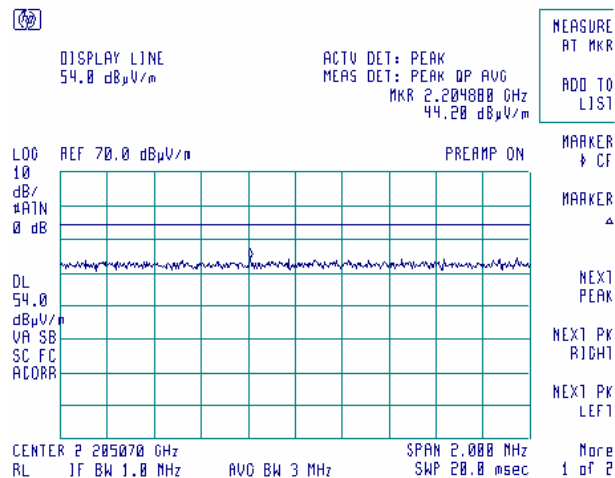
Plot 7.2.17 Radiated emission measurements, the seventh harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.18 Radiated emission measurements, the seventh harmonic

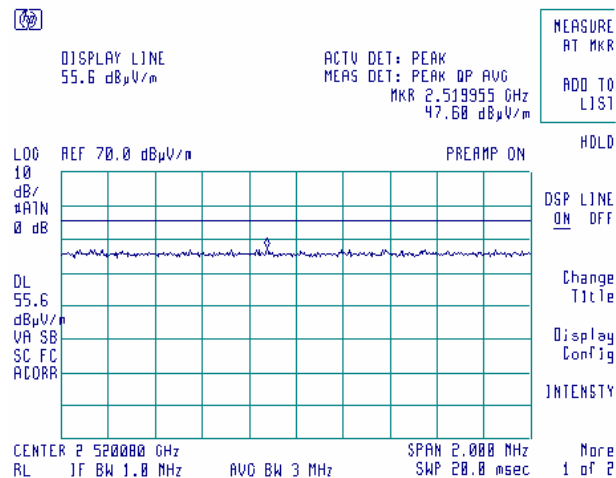
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

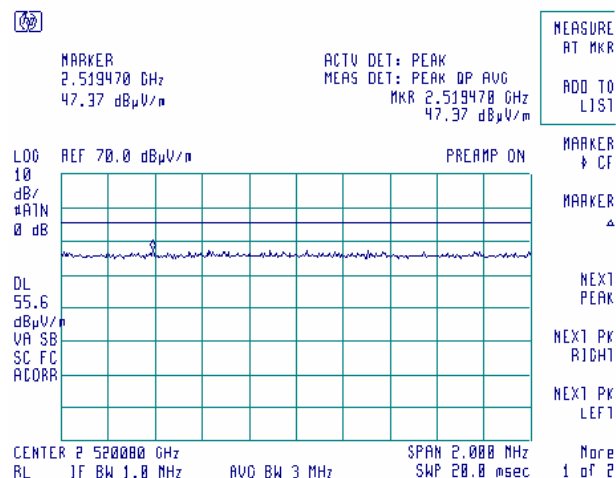
Plot 7.2.19 Radiated emission measurements, the eighth harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.20 Radiated emission measurements, the eighth harmonic

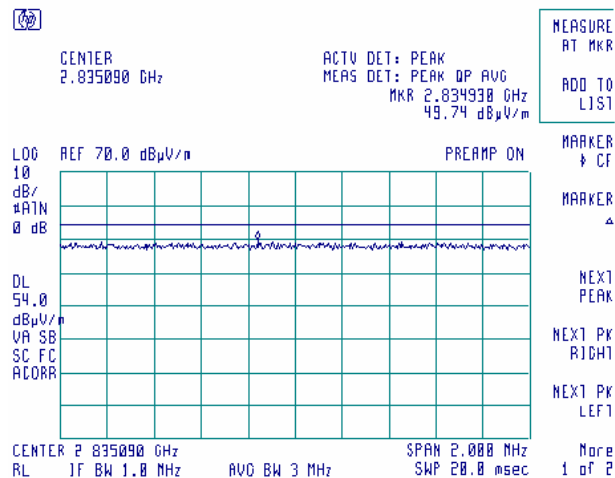
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

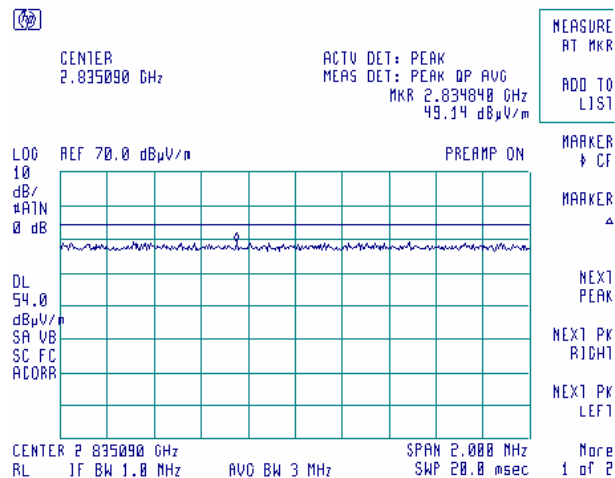
Plot 7.2.21 Radiated emission measurements, the ninth harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



Plot 7.2.22 Radiated emission measurements, the ninth harmonic

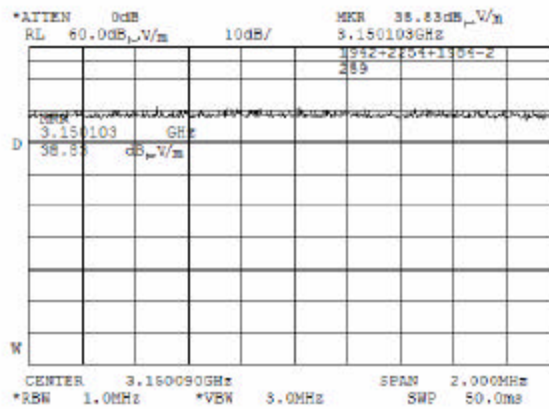
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

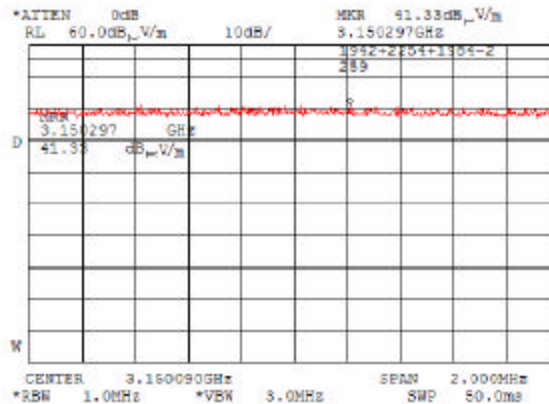
Plot 7.2.23 Radiated emission measurements, the tenth harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X / Y / Z)



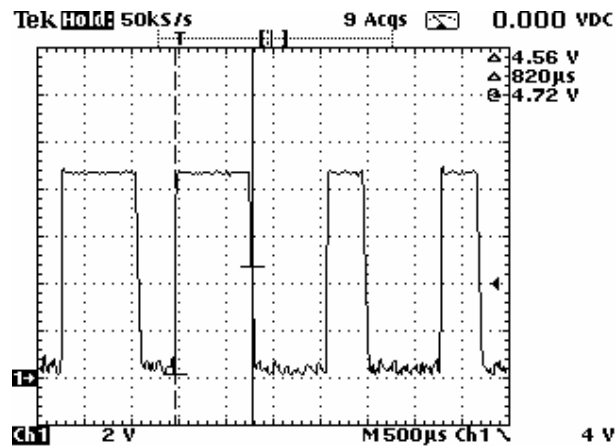
Plot 7.2.24 Radiated emission measurements, the tenth harmonic

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X / Y / Z)

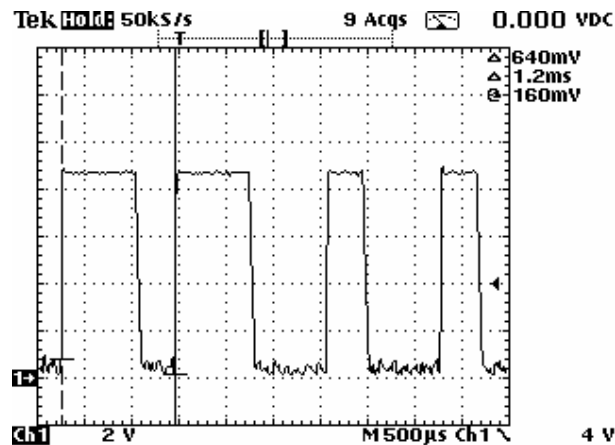


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Plot 7.2.25 Duty cycle measurements
Preamble. Transmission pulse duration, bit "1"

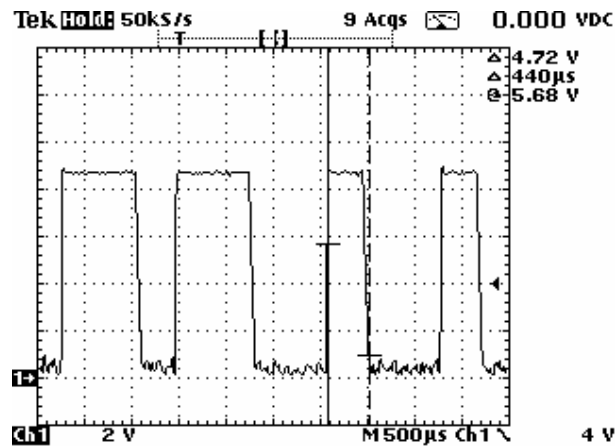


Plot 7.2.26 Duty cycle measurements
Preamble. Transmission pulse period, bit "1"

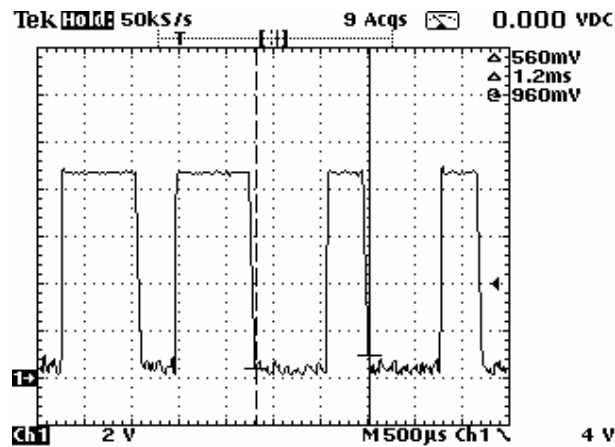


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Plot 7.2.27 Duty cycle measurements
Preamble. Transmission pulse duration, bit "0"

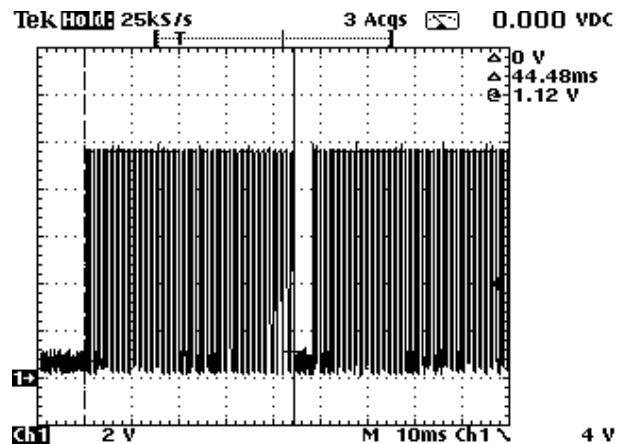


Plot 7.2.28 Duty cycle measurements
Preamble. Transmission pulse period, bit "0"

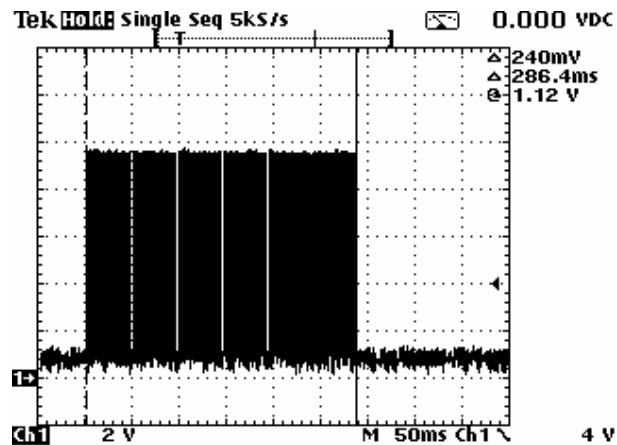


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Plot 7.2.29 Duty cycle measurements
Preamble. Transmission burst duration

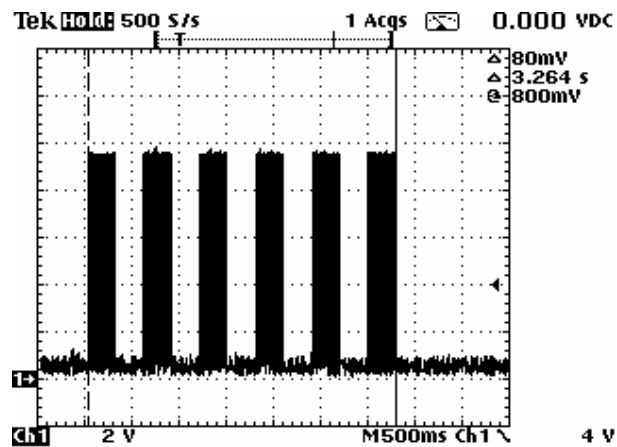


Plot 7.2.30 Duty cycle measurements
Transmission burst duration



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 11:28:14 AM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Plot 7.2.31 Duty cycle measurements
Whole transmission



Test specification:	FCC Part 15, Section 231(c) / RSS-210, Section 6.1.1(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2004 7:54:06 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

7.3 Occupied bandwidth test

7.3.1 General

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

Table 7.3.1 Occupied bandwidth limits

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

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

7.3.2 Test procedure

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

7.3.2.2 The EUT was set to transmit modulated carrier.

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

Figure 7.3.1 Occupied bandwidth test setup



Test specification:	FCC Part 15, Section 231(c) / RSS-210, Section 6.1.1(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2004 7:54:06 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 100 kHz
MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
MODULATION: A.S.K.
MODULATING SIGNAL: ID code

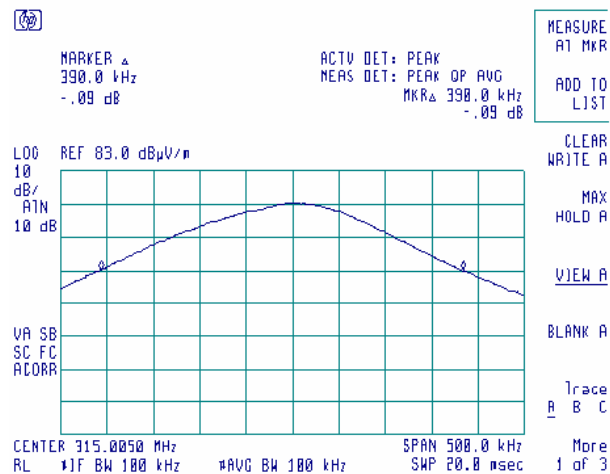
Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
315.0	390.0	0.25	787.5	397.5	Pass

Reference numbers of test equipment used

HL 0034	HL 0415	HL 0812	HL 1430					
---------	---------	---------	---------	--	--	--	--	--

Full description is given in Appendix A.

Plot 7.3.1 Occupied bandwidth test result



Test specification:	FCC Part 15, Section 203 / RSS-210, Section 5.5, Antenna requirements		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 12:02:14 PM		
Temperature: 24 °C	Air Pressure: 1012 hPa	Relative Humidity: 43 %	Power Supply: 3 VDC
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:	FCC Part 15, Section 109 / ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / CISPR 22		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 12:09:30 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

7.5 Radiated emission measurements

7.5.1 General

This test was performed to measure radiated emissions from the EUT enclosure. The specification test limits according to FCC Part 15, Section 109 are given in Table 7.5.1 and according to ICES-003, Section 5 in Table 7.5.2.

Table 7.5.1 Radiated emission limits according to FCC Part 15, Section 109

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
960 - 5 th harmonic**	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: $\text{Lim}_{S_2} = \text{Lim}_{S_1} + 20 \log(S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

Table 7.5.2 Radiated emission limits according to ICES-003, Section 5

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 230	30.0	40.5*	40.0	50.5*
230 - 1000	37.0	47.5*	47.0	57.5*

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

7.5.2 Test procedure

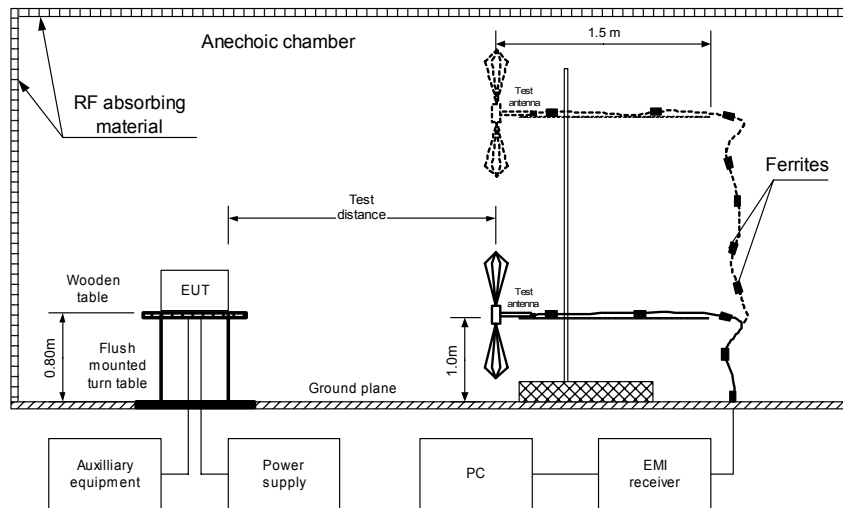
7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and the EUT performance was checked.

7.5.2.2 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. The EUT was tested in three orthogonal positions.

7.5.2.3 The worst test results with respect to the limits were provided in the associated tables and plots.

Test specification:	FCC Part 15, Section 109 / ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / CISPR 22		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 12:09:30 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Figure 7.5.1 Setup for radiated emission measurements in anechoic chamber, table-top EUT



Test specification:	FCC Part 15, Section 109 / ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / CISPR 22		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 12:09:30 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Table 7.5.3 Radiated emission test results according to FCC Part 15, Section 109

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Standby
EUT POSITION: Y
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
34.358800	20.63	17.32	40.00	-22.68	V	1	12	Pass

*- Margin = Measured emission - specification limit.

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

Table 7.5.4 Radiated emission test results according to ICES-003, Section 5

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Standby
EUT POSITION: Y
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
34.358800	20.63	17.32	40.50	-23.18	V	1	12	Pass

*- Margin = Measured emission - specification limit.

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

The radiated emission measurements above 1000 MHz were performed for the EUT in transmit mode. All emissions were found below the limit for unintentional radiated emissions.

Reference numbers of test equipment used

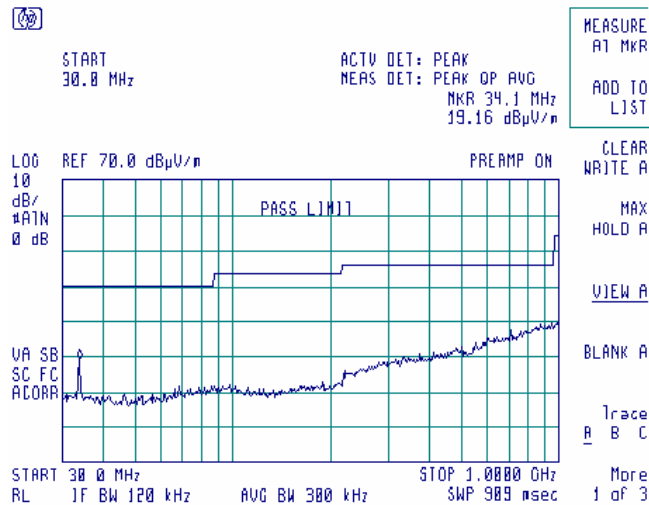
HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1004	HL 2009
---------	---------	---------	---------	---------	---------	---------	---------

Full description is given in Appendix A.

Test specification:	FCC Part 15, Section 109 / ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / CISPR 22		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/20/2004 12:09:30 PM		
Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 3 VDC
Remarks:			

Plot 7.5.1 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
EUT POSITION: 3 orthogonal (X / Y / Z)



8 APPENDIX A Test equipment and ancillaries used for tests

HL No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
0034	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1988	12-Jan-05
0038	Antenna Mast, 1-4 meter, motorized	HL	AM - 1	028	03-Feb-05
0287	Turntable, Motorized Diameter, 2 m (OATS)	HL	TMD-2	042	11-Nov-05
0415	Cable, Coax, RF, RG-214	HL	CC-3	056	02-Dec-05
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-05
0465	Anechoic Chamber 9(L) x 6,5(W) x 5,5(H) m	HL	AC - 1	023	10-Oct-05
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-2.9 GHz	Hewlett Packard	8546A	3617A00319, 3448A00253	26-Sep-05
0566	Antenna, Biconical, 20 - 200 MHz	Electro-Metrics	BIA 25/30	3566	10-Jan-05
0569	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1953	12-Jan-05
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-05
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	03-Feb-05
0594	Turn Table for anechoic chamber flush mount d=1.2 m Pneumatic	HL	TT-WDC1	102	27-Jan-05
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-05
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	HL	C214-11	148	02-Dec-05
1004	Cable Coaxial, ANDREW PSWJ4, 6m	HL	ANDREW-6	163	02-Dec-05
1365	Cable Coaxial, S-FLC 12-50, 5 m	HL	C214-5	1365	02-Dec-05
1430	EMI Receiver, 9 kHz - 2.9 GHz	Agilent Technologies (HP)	8542E	3807A00262, 3705A00217	01-Sep-05
1552	Cable RF, 8 m	Alpha Wire	RG-214	1552	02-Dec-05
1848	Antenna mast 4m/6m with polarity control (OATS)	Sh. I. Machines	AM-5	1	19-Apr-05
1942	Cable 18GHz, 4 m, blue	Rhophase Microwave Limited	SPS-1803A-4000-NPS	T4658	17-Oct-05
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	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
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-05
2254	Cable 40GHz, 0.8 m, blue	Rhophase Microwave Limited	KPS-1503A-800-KPS	W4907	24-Jun-05
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	05-Nov-05

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

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

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

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

Person for contact: Mr. Alex Usoskin, CEO.

10 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).

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

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX 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.
RSS-210 Issue 5: 2001 + Amendment: 2002 + Amendment 2: 2003 + Amendment 3: 2004	Low Power Licence- Exempt Radiocommunication Devices
RSS-212 Issue 1:1999	Test Facilities and Test Methods for Radio Equipment
ICES-003 Issue 4: 2004	Digital Apparatus
CAN/CSA-CEI/IEC CISPR 22: 02	Information Technology Equipment- Radio Disturbance Characteristics- Limits and Methods of measurement

12 APPENDIX E Abbreviations and acronyms

A	ampere
AC	alternating current
AVRG	average (detector)
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
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
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
OATS	open area test site
Ω	Ohm
PCB	printed circuit board
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

13 APPENDIX F Test equipment correction factors

Antenna Factor
Active Loop Antenna
EMC Test Systems, model 6502, serial number 2857

Frequency, MHz	Magnetic Antenna Factor, dB(S/m)	Electric Antenna Factor, dB(1/m)
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	9.7
0.750	-41.9	9.6
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.1
4.000	-41.4	10.1
5.000	-41.5	10.0
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(S/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ A/m).
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).

Biconical antenna factor

Electro-Metrics, model BIA-25/30, serial number 3566

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
20	14.1	115	15.2
25	14.5	120	14.9
30	13.8	125	13.5
35	11.9	130	13.5
40	11.5	135	13.0
45	11.7	140	12.7
50	11.4	145	12.9
55	10.6	150	14.7
60	10.4	155	15.0
65	9.0	160	15.0
70	7.8	165	15.5
75	7.6	170	15.9
80	7.5	175	16.6
85	7.9	180	17.1
90	9.5	185	17.5
95	10.9	190	17.9
100	11.9	195	18.0
105	12.4	200	18.1
110	13.5		

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

Log periodic antenna factor

Electro-Metrics, model LPA-25/30, serial number 1953

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
200	15.2	625	25.2
225	15.1	650	25.8
250	16.3	675	27.2
275	17.2	700	27.6
300	19.6	725	27.6
325	18.4	750	27.6
350	19.0	775	28.0
375	20.0	800	28.2
400	20.9	825	29.4
425	21.3	850	29.9
450	22.1	875	30.0
475	22.7	900	30.4
500	23.2	925	30.6
525	23.9	950	30.8
550	24.2	975	31.6
575	24.6	1000	32.1
600	24.7		

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).

Log periodic antenna factor

Electro-Metrics, model LPA-25/30, serial number 1988

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
200	12.6	625	20.4
225	12.2	650	20.9
250	13.4	675	22.0
275	14.3	700	22.2
300	15.2	725	22.7
325	15.7	750	22.5
350	15.9	775	22.7
375	16.4	800	22.8
400	17.0	825	23.2
425	17.4	850	23.5
450	17.9	875	23.9
475	18.6	900	24.0
500	19.1	925	24.0
525	19.3	950	24.2
550	19.6	975	24.7
575	19.8	1000	25.1
600	20.0		

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

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

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

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

Antenna factor
Double-ridged wave guide horn antenna
EMC Test Systems (EMCO), model 3115

Frequency, MHz	Antenna factor (s/n 9911-5964), dB(1/m)	Antenna factor (s/n 00027177), dB(1/m)
1000.0	24.5	24.7
1500.0	24.8	25.7
2000.0	27.6	27.8
2500.0	28.7	28.9
3000.0	30.8	30.7
3500.0	32.9	31.8
4000.0	32.7	33.0
4500.0	32.0	32.8
5000.0	33.6	34.2
5500.0	35.3	34.9
6000.0	35.7	35.2
6500.0	35.8	35.4
7000.0	36.2	36.3
7500.0	37.2	37.3
8000.0	37.2	37.5
8500.0	38.1	38.0
9000.0	38.6	38.3
9500.0	38.3	38.3
10000.0	38.4	38.7
10500.0	38.3	38.7
11000.0	38.8	38.9
11500.0	39.9	39.5
12000.0	39.6	39.5
12500.0	39.5	39.4
13000.0	40.5	40.5
13500.0	41.1	40.8
14000.0	41.5	41.5
14500.0	40.8	41.3
15000.0	39.5	40.2
15500.0	38.1	38.7
16000.0	38.1	38.5
16500.0	40.1	39.8
17000.0	42.6	41.9
17500.0	45.4	45.8
18000.0	48.7	49.1

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

Cable coaxial, RG-58/RG-214, model CC-3, serial number 056, HL 0415
+ Cable coaxial, RG-214, 11.5 m, model C214-11, serial number 148, HL 0812
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (specification), dB	Measured uncertainty dB
1	Insertion loss	20	0.73	-	NA	±0.12
2		30	0.91	-		
3		50	1.2	-		
4		80	1.56	-		
5		100	1.76	-		
6		200	2.59	-		
7		300	3.26	-		
8		400	3.93	-		
9		500	4.42	-		
10		600	4.92	-		
11		700	5.36	-		
12		800	5.88	-		
13		900	6.41	-		
14		1000	6.71	-		
15		1500	8.63	-		
16		2000	10.39	-		

Cable loss

Cable coaxial, GORE A2P01POL118, 2.3 m, model GORE-3, serial number 176, HL 0589
+ Cable coaxial, ANDREW PSWJ4, 6 m, model: ANDREW-6, serial number 163, HL 1004

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	30	0.33	≤ 6.5	±0.12
2	50	0.40		
3	100	0.57		
4	300	0.97		
5	500	1.25		
6	800	1.59		
7	1000	1.81		
8	1200	1.97		
9	1400	2.15		
10	1600	2.28		
11	1800	2.43		
12	2000	2.61		
13	2200	2.75		
14	2400	2.89		
15	2600	2.97		
16	2800	3.21	≤ 6.5	±0.12
17	3000	3.32		±0.17
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		

Cable coaxial, RG-214, 5 m, model C214-5, serial number 1365, HL 1365
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (specification), dB	Measured uncertainty dB
1	Insertion loss	1000	0.41	-	NA	±0.12
2		1200	0.44	-		
3		1400	0.48	-		
4		1600	0.52	-		
5		1800	0.55	-		
6		2000	0.58	-		
7		2200	0.61	-		
8		2400	0.64	-		±0.17
9		2600	0.67	-		
10		2800	0.7	-		
11		3000	0.73	-		
12		3300	0.79	-		
13		3600	0.84	-		
14		3900	0.94	-		
15		4200	1.22	-		

Cable loss
Cable 18 GHz, 4 m, blue, model SPS-1803A-4000-NPS, serial number T4658, HL 1942

Frequency, GHz	Cable loss, dB
0.03	0.21
0.05	0.26
0.10	0.36
0.20	0.50
0.30	0.61
0.40	0.70
0.50	0.78
0.60	0.85
0.70	0.93
0.80	0.99
0.90	1.04
1.00	1.10
1.10	1.16
1.20	1.22
1.30	1.26
1.40	1.31
1.50	1.35
1.60	1.41
1.70	1.45
1.80	1.49
1.90	1.53
2.00	1.57
2.10	1.61
2.20	1.65
2.30	1.69
2.40	1.72
2.50	1.76
2.60	1.79
2.70	1.83
2.80	1.87
2.90	1.90
3.10	1.97
3.30	2.04
3.50	2.11
3.70	2.18
3.90	2.24
4.10	2.31
4.30	2.38
4.50	2.43
4.70	2.53
4.90	2.53
5.10	2.63
5.30	2.65
5.50	2.72
5.70	2.76
5.90	2.79

Frequency, GHz	Cable loss, dB
6.10	2.88
6.30	2.90
6.50	2.97
6.70	3.02
6.90	3.04
7.10	3.07
7.30	3.12
7.50	3.13
7.70	3.19
7.90	3.24
8.10	3.30
8.30	3.36
8.50	3.45
8.70	3.41
8.90	3.45
9.10	3.42
9.30	3.55
9.50	3.48
9.70	3.58
9.90	3.61
10.10	3.66
10.30	3.68
10.50	3.70
10.70	3.70
10.90	3.75
11.10	3.78
11.30	3.86
11.50	3.98
11.70	4.10
11.90	4.12
12.10	4.09
12.40	4.13
13.00	4.23
13.50	4.35
14.00	4.40
14.50	4.44
15.00	4.57
15.50	4.66
16.00	4.64
16.50	4.66
17.00	4.75
17.50	4.85
18.00	4.93

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

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

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

Cable loss
RF cable 8 m, model RG-214, serial number C-56, HL 2009

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

Calibration data
RF cable 8 m, model RG-214, serial number 1552, HL 1552

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB
1	Insertion Loss	20	0.27	-	NA	±0.12
2		30	0.31	-		
3		50	0.40	-		
4		80	0.49	-		
5		100	0.55	-		
6		200	0.80	-		
7		300	0.99	-		
8		400	1.17	-		
9		500	1.32	-		
10		600	1.45	-		
11		700	1.60	-		
12		800	1.72	-		
13		900	1.84	-		
14		1000	2.00	-		
15		1200	2.19	-		
16		1400	2.40	-		
17		1500	2.51	-		
18		1600	2.61	-		
19		1800	2.82	-		
20		2000	3.00	-		

Cable 40 GHz, 0.8 m, blue, model KPS-1503A-800-KPS, serial number W4907 (HL 2254), insertion loss

Frequency, GHz	Insertion loss, dB	Frequency, GHz	Insertion loss, dB
0.03	0.05	10.30	1.20
0.05	0.09	10.50	1.22
0.1	0.10	10.70	1.30
0.2	0.16	10.90	1.21
0.3	0.21	11.10	1.19
0.5	0.26	11.30	1.26
0.7	0.31	11.50	1.25
0.9	0.36	11.70	1.23
1.1	0.39	11.90	1.29
1.3	0.42	12.10	1.25
1.5	0.46	12.40	1.33
1.7	0.47	13.00	1.41
1.9	0.51	13.50	1.42
2.1	0.55	14.00	1.61
2.3	0.54	14.50	1.53
2.5	0.56	15.00	1.63
2.7	0.60	15.50	1.53
2.9	0.61	16.00	1.53
3.1	0.63	16.50	1.54
3.3	0.66	17.00	1.67
3.5	0.68	17.50	1.88
3.7	0.72	18.00	1.76
3.9	0.70	18.50	2.03
4.1	0.75	19.00	1.66
4.3	0.75	19.50	1.71
4.5	0.80	20.00	1.65
4.7	0.78	20.50	1.87
4.9	0.81	21.00	1.75
5.1	0.82	21.50	1.86
5.3	0.84	22.00	1.81
5.5	0.84	22.50	2.03
5.7	0.86	23.00	1.91
5.9	0.90	23.50	1.87
6.1	0.91	24.00	1.97
6.3	0.95	24.50	1.85
6.5	0.92	25.00	2.01
6.7	0.91	25.50	2.02
6.9	0.95	26.00	2.15
7.1	0.98	26.50	2.11
7.3	1.03	27.00	2.00
7.5	0.98	28.00	2.04
7.7	1.06	29.00	1.97
7.9	1.08	30.00	1.97
8.1	1.06	31.00	2.31
8.3	1.10	32.00	2.24
8.5	1.10	33.00	2.31
8.7	1.12	34.00	2.36
8.9	1.12	35.00	2.33
9.1	1.14	36.00	2.47
9.3	1.18	37.00	2.56
9.5	1.16	38.00	2.45
9.7	1.18	39.00	2.68
9.9	1.17	40.00	2.60
10.1	1.18		