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839.01
Electrical

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TEST REPORT

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

FOR:

Rokonet Electronics Ltd.

Smoke Detector

Part number: RWT30S433USA

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1 Applicant information

Client name:	Rokonet Electronics Ltd.
Address:	14 Hachoma street, Rishon Le Zion, 75655, Israel
Telephone:	+972 3963 7777
Fax:	+972 3961 6584
E-mail:	david@rokonet.co.il
Contact name:	Mr. David Kartoun

2 Equipment under test attributes

Product name:	Smoke Detector
Part number:	RWT30S433USA
Receipt date:	6/22/2006

3 Manufacturer information

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

4 Test details

Project ID:	17205
Location:	Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started:	6/22/2006
Test completed:	8/21/2006
Test specifications:	FCC CFR 47 Part 15, subpart C, §15.231(a); subpart B, §15.109

5 Tests summary

Test	Status
Transmitter characteristics	
Section 15.231(a), Periodic operation requirements	Pass
Section 15.231(b), Field strength of emissions	Pass
Section 15.231(c), Occupied bandwidth	Pass
Section 15.207(a), Conducted emission	Not required
Section 15.203, Antenna requirement	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Not required
Section 15.109, Radiated emissions, Class B	Pass
Section 15.111, Conducted emission at receiver antenna port	Not required

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

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

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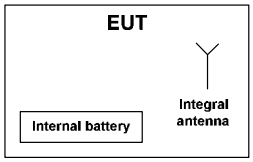
6 EUT description

6.1 General information

The EUT is a photoelectric smoke detector with a built-in supervised wireless transmitter by Melexis operating at 433.92 MHz. The transmitter is equipped with an integral helical antenna. The EUT is powered from 3 VDC. The EUT is equipped with two 3 V internal lithium batteries (in parallel). The EUT clock is 13.56 MHz.

6.2 Test configuration



6.3 EUT general view

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Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2006 9:16:02 AM		
Temperature: 24.5 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 3 VDC
Remarks:			

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

7.1 Periodic operation requirements

7.1.1 General

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

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- A manually operated transmitter shall employ switch that will automatically deactivate the transmitter within not more than 5 seconds of being released;
- A transmitter activated automatically shall cease transmission within 5 seconds after activation;
- Periodic transmissions, excluding polling or supervision transmissions, at regular predetermined intervals are not permitted;
- Polling or supervision transmissions, including data, to determine system integrity in security or safety applications shall not last longer than 2 seconds per hour.
- Transmission of set-up information for security systems may exceed the 5-s tansmission duration limits, provided such transmissions are under the control of a professional installer and do not exceed 10 seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

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

7.1.2 Test procedure for transmitter shut down test

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

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

7.1.2.3 The transmitter was activated automatically.

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

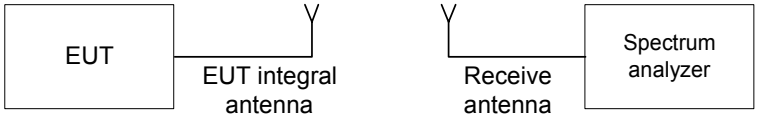
7.1.3 Test procedure for measurements of polling / supervision transmission duration

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

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

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

Figure 7.1.1 Setup for transmitter shut down test



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Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2006 9:16:02 AM		
Temperature: 24.5 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	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	NA	NA
Transmitter activated automatically shall cease transmission within 5 seconds	Plots 7.1.7, 7.1.8	Comply
Periodic transmissions at regular predetermined intervals are not permitted	Supplier declaration	Comply
Total duration of polling or supervision transmissions shall not exceed 2 seconds per hour	Plots 7.1.9 to 7.1.12	Comply
Transmission of set-up information for security systems may exceed the 5-s tansmission duration limits, provided such transmissions are under the control of a professional installer and do not exceed 10 seconds after a manually operated switch is released or a transmitter is activated automatically.	Plots 7.1.1 to 7.1.6	Comply

Table 7.1.2 Total duration of polling / supervision transmissions

Pulse duration, ms	Pulse period, ms	Burst duration, ms	Number of bursts within 1 transmission	Number of transmissions within 1 hour	Total duration within 1 hour, ms
1.55	3	59.5	8	1	245.9

Reference numbers of test equipment used

HL 0337	HL 1653	HL 2909					

Full description is given in Appendix A.

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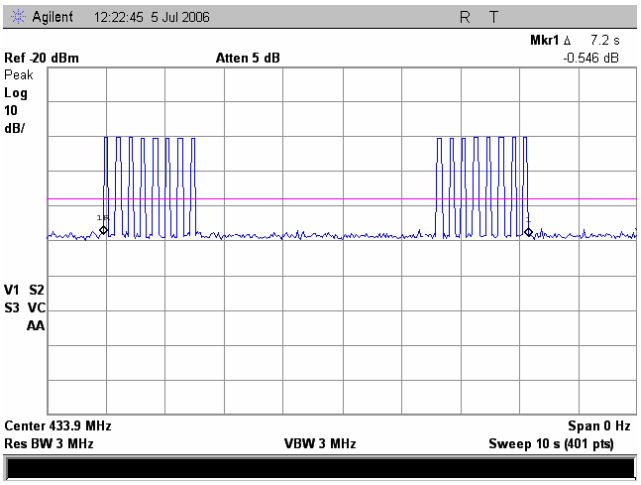
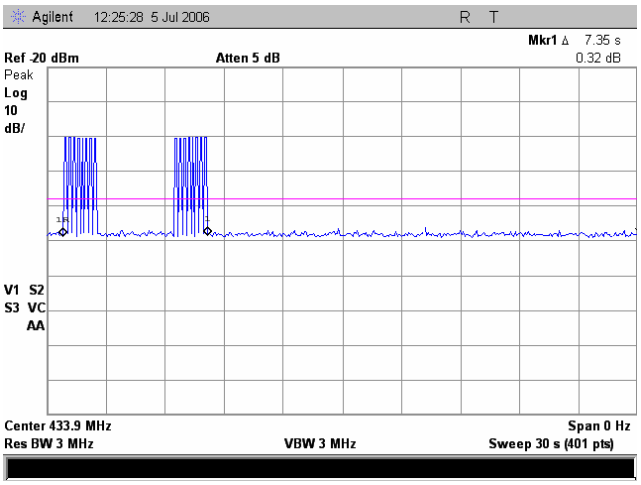
Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2006 9:16:02 AM		
Temperature: 24.5 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 3 VDC
Remarks:			

Plot 7.1.1 Transmitter shut down test result, after test button pressed
Installation / maintenance operation



Plot 7.1.2 Transmitter shut down test result, after test button pressed
Installation / maintenance operation (test mode)



Note: Test mode complies with 15.231 a(5):
1st transmission – Alarm Tx
2nd transmission – restore alarm Tx

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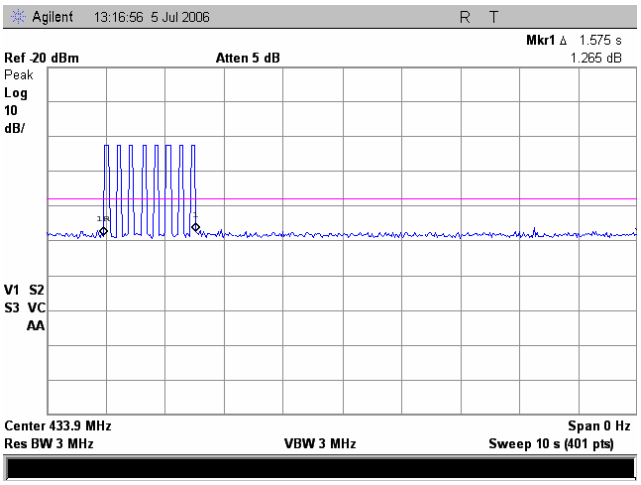
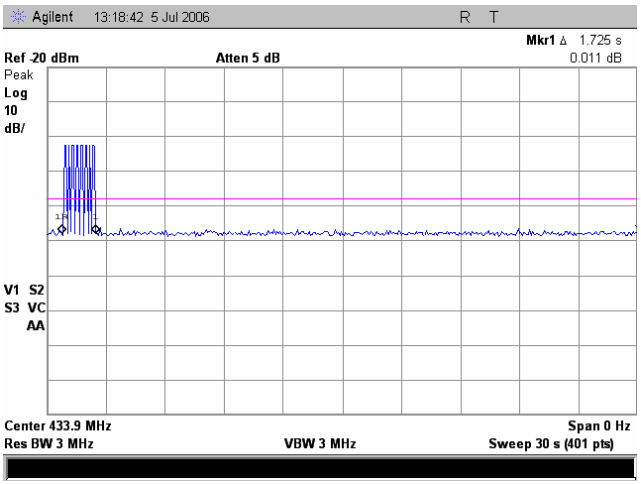
Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2006 9:16:02 AM		
Temperature: 24.5 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 3 VDC
Remarks:			

Plot 7.1.3 Transmitter shut down test result, after power up Installation / maintenance operation (test mode)



Plot 7.1.4 Transmitter shut down test result, after power up Installation / maintenance operation (test mode)



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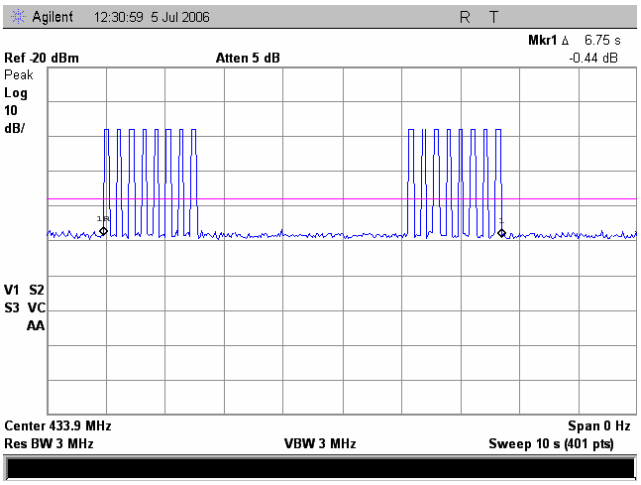
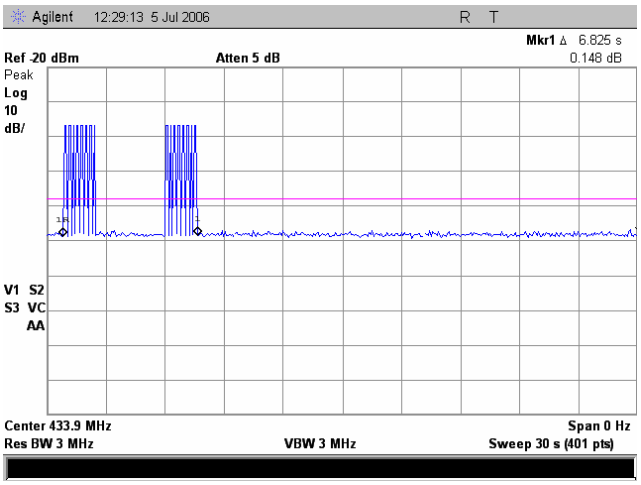
Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2006 9:16:02 AM		
Temperature: 24.5 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 3 VDC
Remarks:			

Plot 7.1.5 Transmitter shut down test result, after power up, tampered Installation / maintenance operation (test mode)



Plot 7.1.6 Transmitter shut down test result, after power up, tampered Installation / maintenance operation (test mode)



Note: Test mode complies with 15.231 a(5)
1st transmission – Write Tx (panel learns the detector)
2nd transmission – tamper Tx
During installation only with technician.

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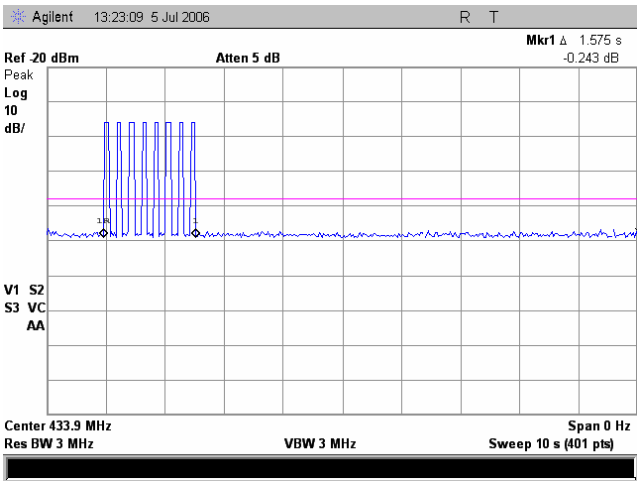
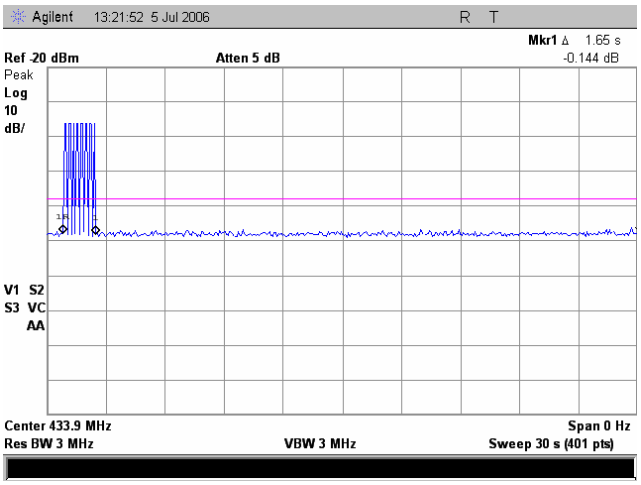
Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2006 9:16:02 AM		
Temperature: 24.5 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 3 VDC
Remarks:			

Plot 7.1.7 Transmitter shut down test result, tamper normal operation (alarm mode)



Plot 7.1.8 Transmitter shut down test result, tamper normal operation (alarm mode)



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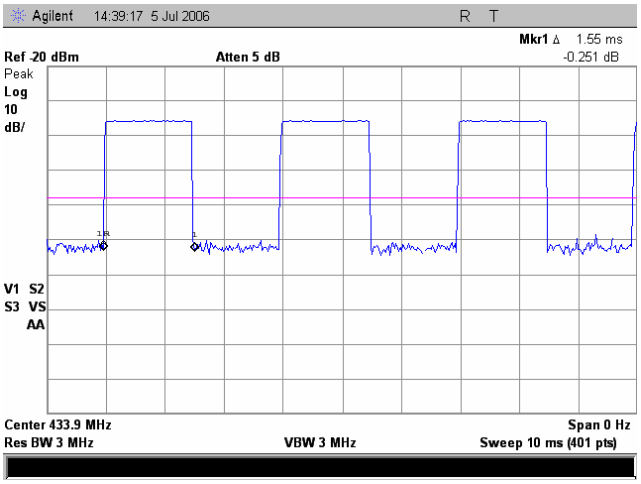
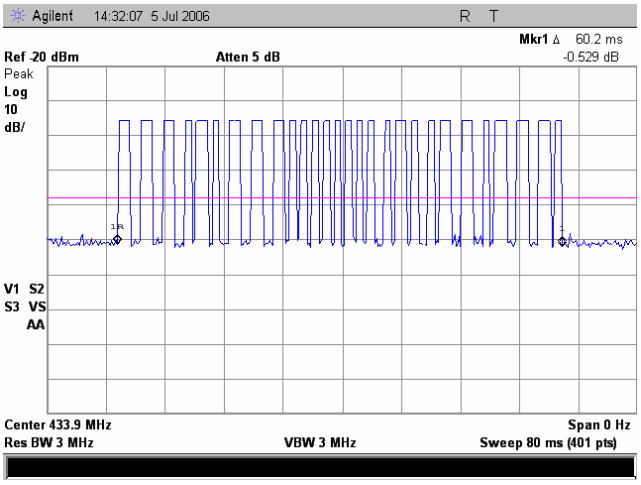
Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2006 9:16:02 AM		
Temperature: 24.5 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 3 VDC
Remarks:			

Plot 7.1.9 Polling / supervision transmission, pulse duration



Plot 7.1.10 Polling / supervision transmission, burst duration



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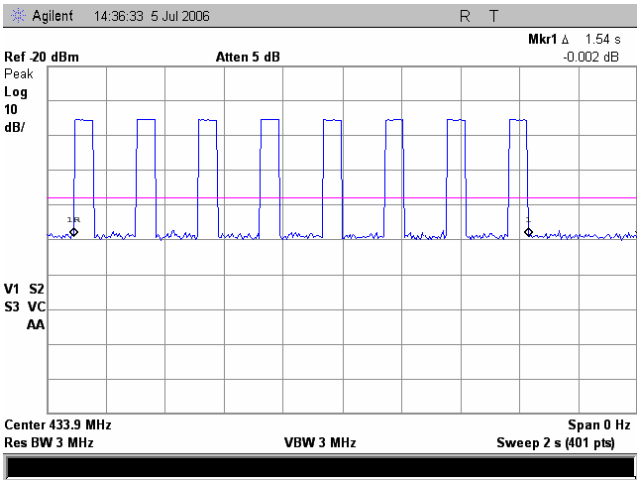
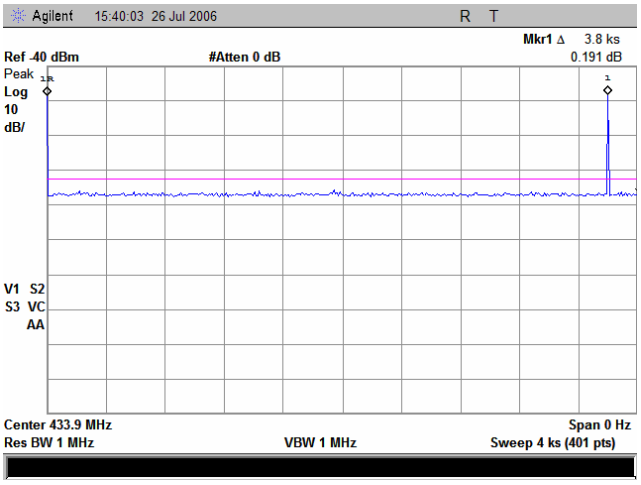
Test specification:	Section 15.231(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/26/2006 9:16:02 AM		
Temperature: 24.5 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 3 VDC
Remarks:			

Plot 7.1.11 Polling / supervision transmission, transmission duration



Plot 7.1.12 Polling / supervision transmission duration



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Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	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. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1 Radiated fundamental emission limits

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

Table 7.2.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(μV/m)				
	Within restricted bands			Outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	80.8	60.8
0.090 – 0.110	NA	108.5 – 106.8**	NA		
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**		
0.490 – 1.705	NA	73.8 – 63.0**	NA		
1.705 – 30.0*		69.5			
30 – 88		40.0			
88 – 216		43.5			
216 – 960		46.0			
960 - 1000		54.0			
Above 1000	74.0	NA	54.0		

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

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

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

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

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

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

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

where F is the carrier frequency in MHz.

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

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

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

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

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

7.2.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.

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

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

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

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

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

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Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

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

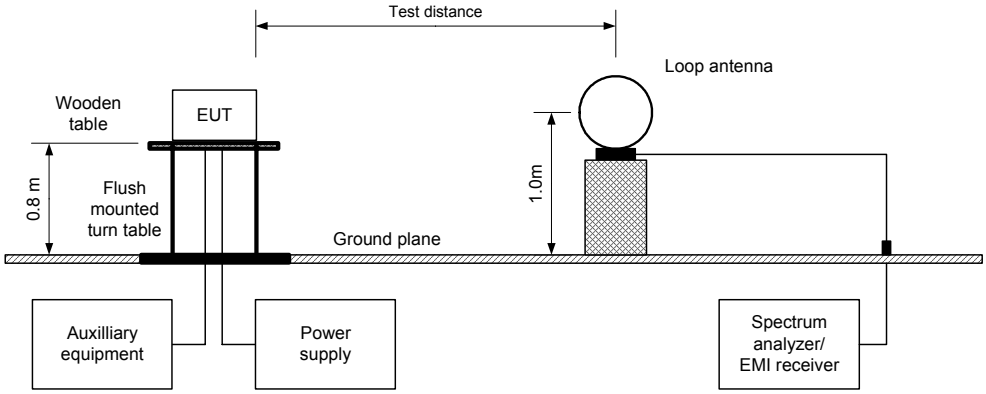
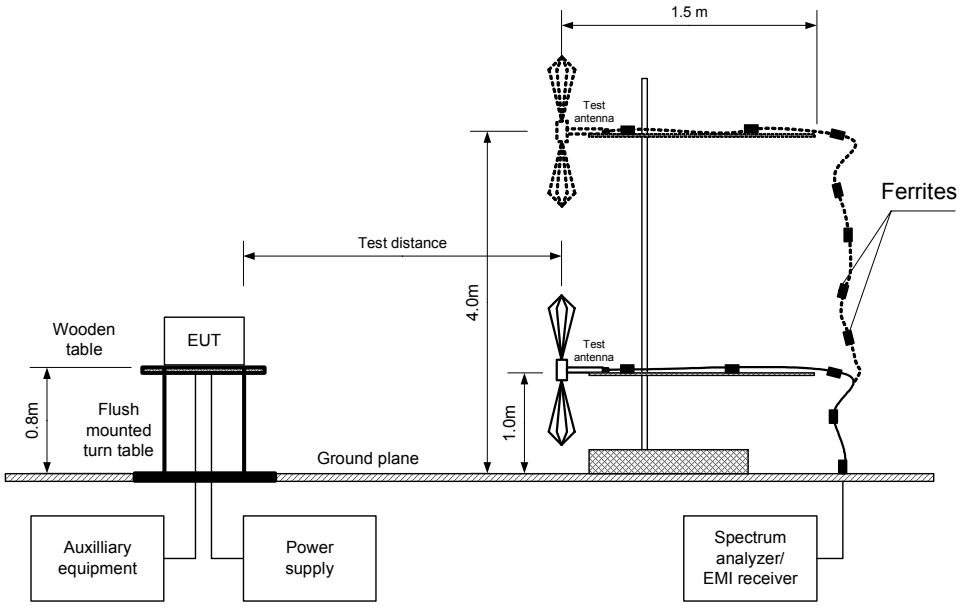


Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz



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Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	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:	X-axis[Note1]
MODULATION:	OOK
MODULATING SIGNAL:	ID code
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 4500 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz) 1.0 MHz (above 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	
Fundamental emission											
433.92	H	1.2	210	86.01	100.8	-14.79	-10.45	75.56	80.8	-5.24	Pass
Spurious emissions											
867.84	V	1.2	210	58.34	80.8	-22.46	-10.45	47.89	60.8	-12.91	Pass
420.37	V	1.2	210	34.51	80.8	-46.29	-10.45	24.06	60.8	-36.74	

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

Table 7.2.4 Average factor calculation

Transmission pulse		Transmission burst duration, ms	Average factor, dB
Duration, ms	Period, ms		
1.5	3	59.5	-10.45

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

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

$$Average\ factor = 20 \times \log_{10}\left(\frac{1.5}{3} \times \frac{59.5}{100} \times 1 = -10.45\right)$$

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

Reference numbers of test equipment used

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

Full description is given in Appendix A.

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Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	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:	X-axis[Note1]
MODULATION:	OOK
MODULATING SIGNAL:	ID code
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz)

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

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

Table 7.2.6 Restricted bands

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

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

Reference numbers of test equipment used

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

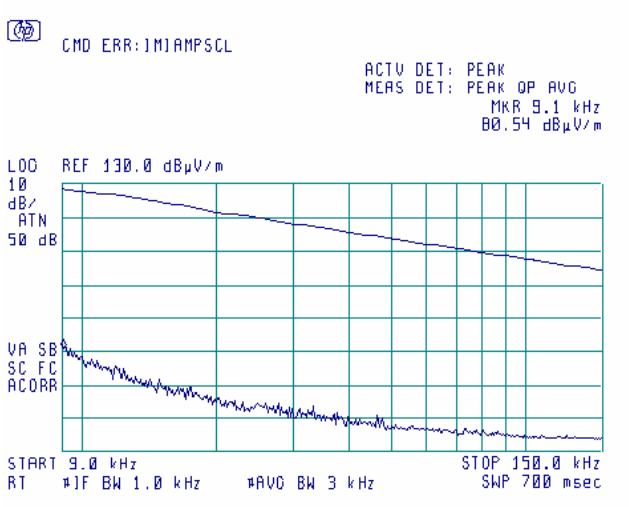
Full description is given in Appendix A.

HERMON LABORATORIES

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

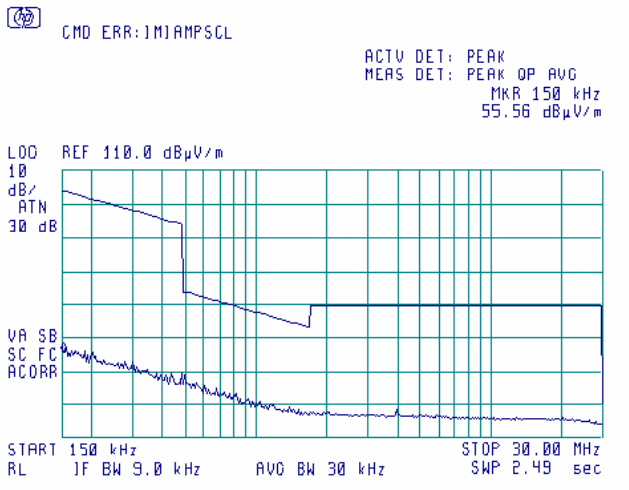
Plot 7.2.1 Radiated emission measurements from 9 to 150 kHz

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



Plot 7.2.2 Radiated emission measurements from 0.15 to 30 MHz

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

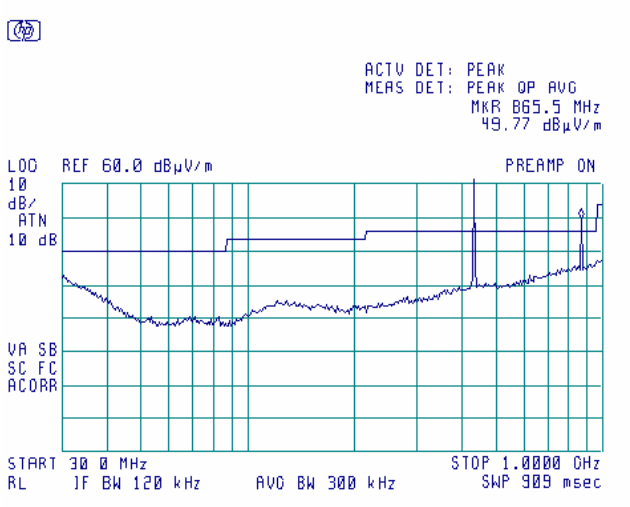


HERMON LABORATORIES

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

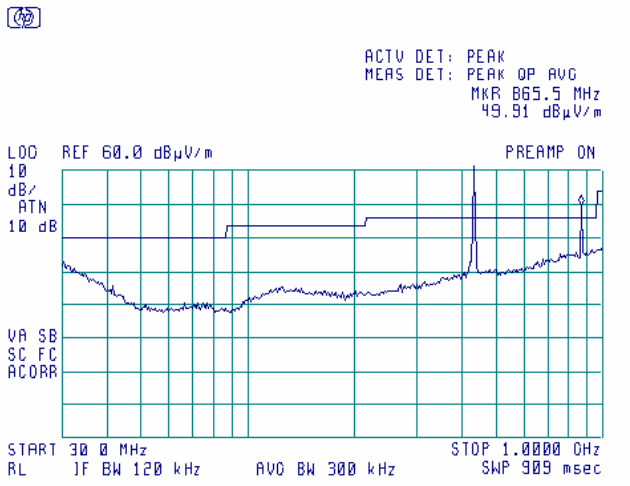
Plot 7.2.3 Radiated emission measurements from 30 to 1000 MHz

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



Plot 7.2.4 Radiated emission measurements from 30 to 1000 MHz

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

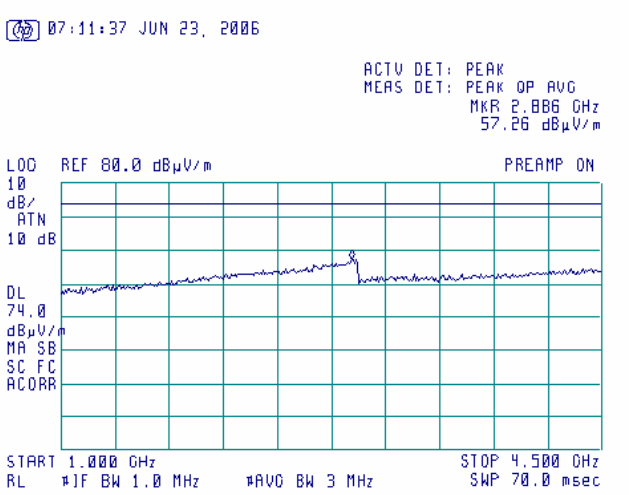


HERMON LABORATORIES

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

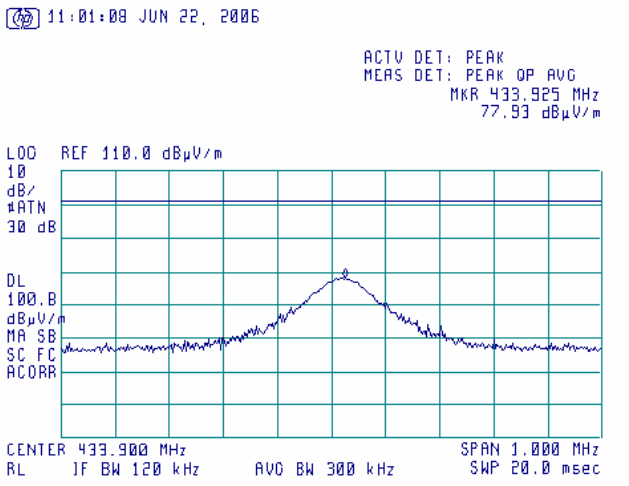
Plot 7.2.5 Radiated emission measurements from 1000 to 4500 MHz

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



Plot 7.2.6 Radiated emission measurements at the fundamental frequency

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

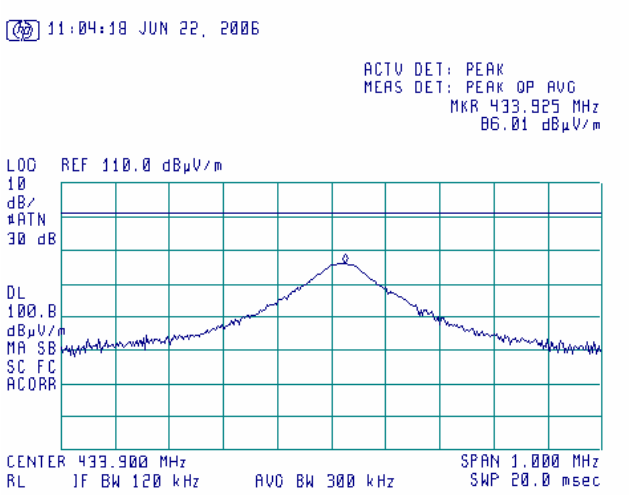


HERMON LABORATORIES

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

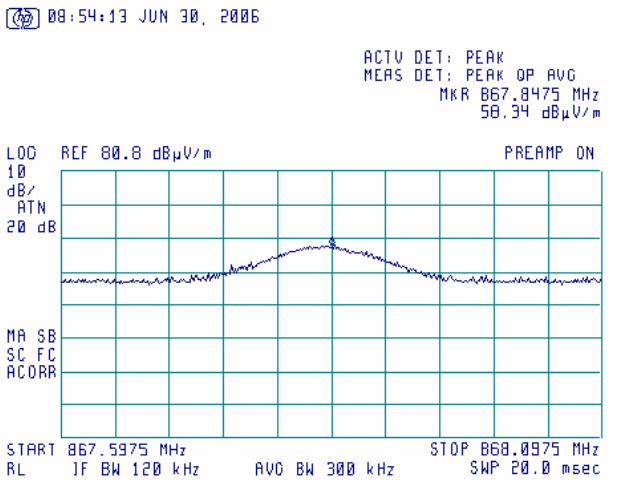
Plot 7.2.7 Radiated emission measurements at the fundamental frequency

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



Plot 7.2.8 Radiated emission measurements at the second harmonic frequency

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

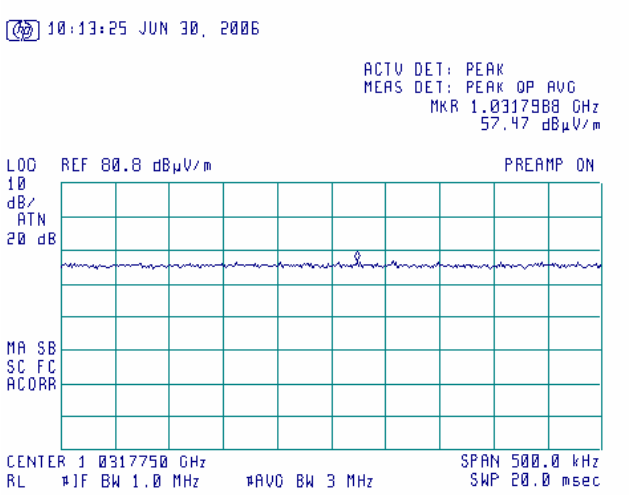


HERMON LABORATORIES

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

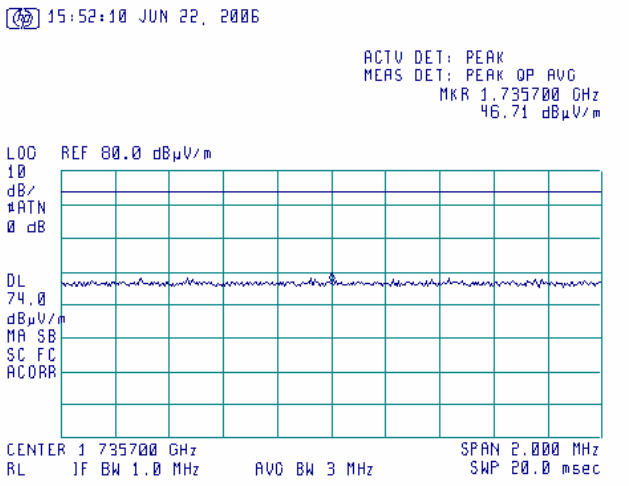
Plot 7.2.9 Radiated emission measurements at the third harmonic frequency

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



Plot 7.2.10 Radiated emission measurements at the forth harmonic frequency

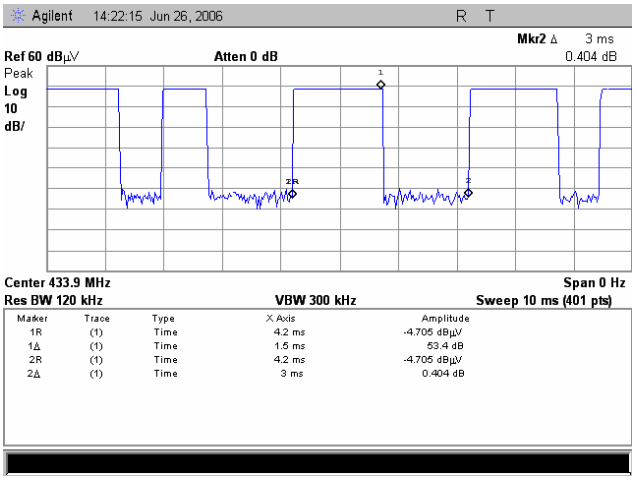
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: X-axis



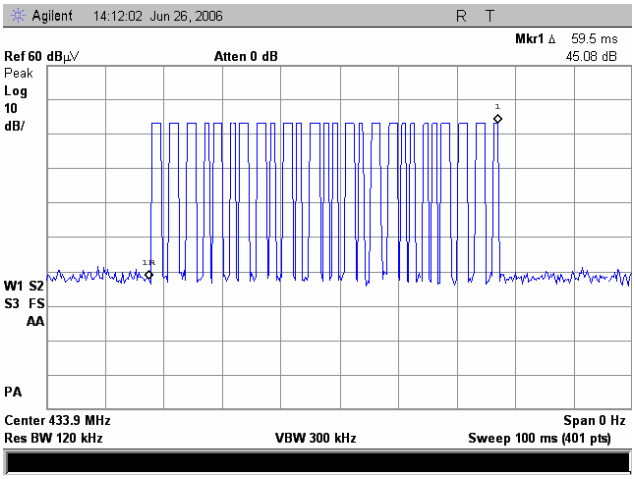
HERMON LABORATORIES

Test specification:	Section 15.231(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 11:55:04 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

Plot 7.2.11 Transmission pulse duration and period



Plot 7.2.12 Transmission burst duration



HERMON LABORATORIES

Test specification:	Section 15.231(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/21/2006 11:34:00 AM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

7.3 Occupied bandwidth test

7.3.1 General

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

Table 7.3.1 Occupied bandwidth limits

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

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

7.3.2 Test procedure

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

7.3.2.2 The EUT was set to transmit modulated carrier.

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

Figure 7.3.1 Occupied bandwidth test setup

HERMON LABORATORIES

Test specification:	Section 15.231(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/21/2006 11:34:00 AM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

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

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
433.9142	60.0	0.25	1084.7855	-1024.7855	Pass

Reference numbers of test equipment used

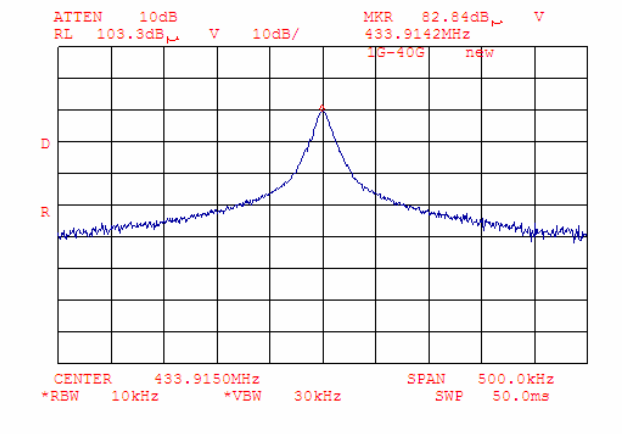
HL 0377	HL 1424							

Full description is given in Appendix A.

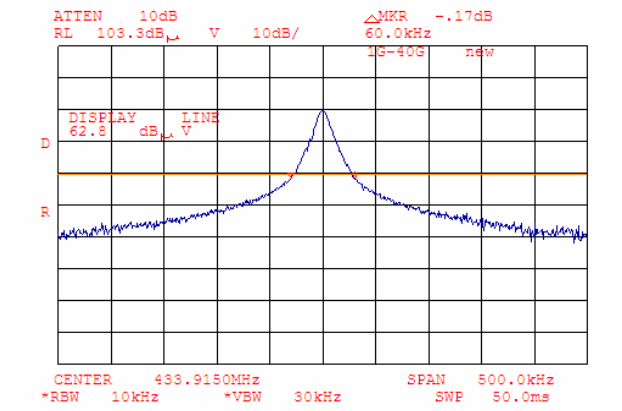
HERMON LABORATORIES

Test specification:	Section 15.231(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/21/2006 11:34:00 AM		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

Plot 7.3.1 Occupied bandwidth test result, reference level



Plot 7.3.2 Occupied bandwidth test result



HERMON LABORATORIES

Test specification:	Section 15.203, Antenna requirement		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2006 1:42:07 PM		
Temperature: 25 ºC	Air Pressure: 1011 hPa	Relative Humidity: 39 %	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

HERMON LABORATORIES

Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 1:42:58 PM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	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. Specification test limits are given in Table 7.5.1.

Table 7.5.1 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: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

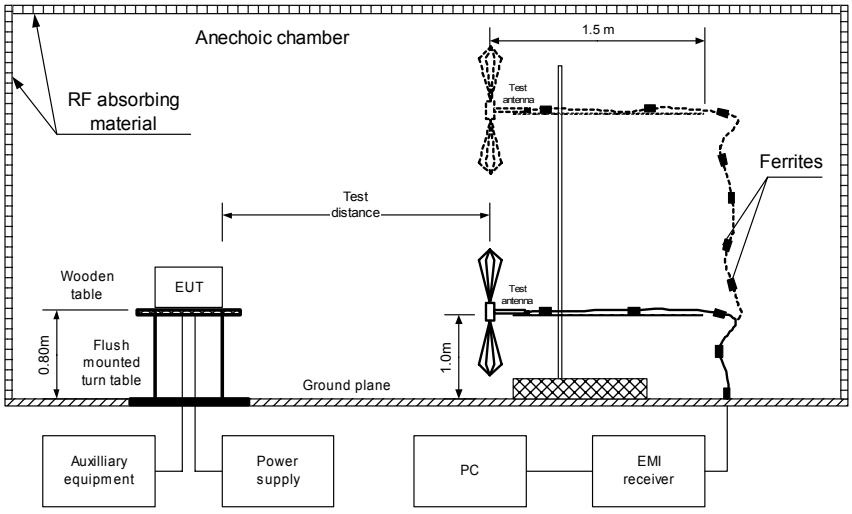
7.5.2 Test procedure

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

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 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.5.2.3 The test results were recorded in Table 7.5.2 and shown in the associated plots.

Figure 7.5.1 Setup for radiated emission measurements in anechoic chamber



HERMON LABORATORIES

Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 1:42:58 PM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

Table 7.5.2 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: 1000 MHz – 2900 MHz
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 0593	HL 0594	HL 0604	HL 1004	HL 1947
HL 1984	HL 2009						

Full description is given in Appendix A.

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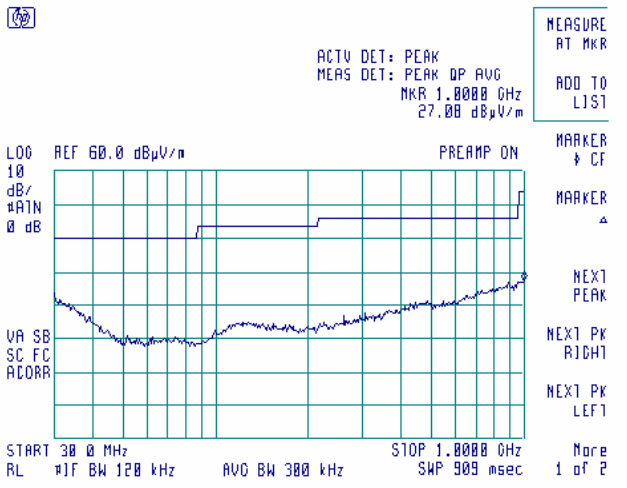
Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/30/2006 1:42:58 PM		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 40 %	Power Supply: 3 VDC
Remarks:			

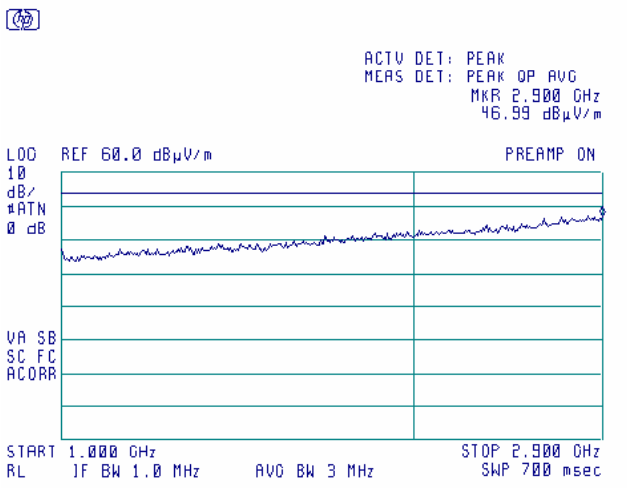
Plot 7.5.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization

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



Plot 7.5.2 Radiated emission measurements above 1000 MHz, vertical & horizontal antenna polarization

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



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0337	Probe Set, Hand held, 5 probes	Electro-Metrics	EHFP-30	238	08-Jun-06	08-Jun-07
0377	Counter, Universal, 100MHz	Hewlett Packard	5328A	1712A03035	01-Jan-06	01-Jan-07
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-06	28-Jun-07
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	HL	AC - 1	023	11-Nov-05	11-Nov-06
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A00253	26-Sep-05	26-Sep-06
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-05	02-Dec-06
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	02-Feb-06	02-Feb-07
0594	Turn Table for anechoic chamber flush mount d=1.2 m Pneumatic	HL	TT-WDC1	102	26-Jan-06	26-Jan-07
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-06	10-Jan-07
1004	Cable Coaxial , ANDREW PSWJ4 , 6m	HL	ANDREW -6	163	04-Dec-05	04-Dec-06
1424	Spectrum Analyzer, 30 Hz-40 GHz	Agilent Technologies (HP)	8564EC	3946A00219	26-Sep-05	26-Sep-06
1553	Cable RF, 3.5 m	Alpha Wire	RG-214	1553	02-Dec-05	02-Dec-06
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	02-Dec-05	02-Dec-06
1653	Analyzer EMC 9 kHz - 1.5 GHz	Agilent Technologies	E7401A	US39440281	06-Feb-06	06-Feb-07
1849	Antenna mast with polarity control (Small Anechoic chamber)	Sh. I. Machines	AM-F4	1849	18-Jan-06	18-Jan-07
1850	Turntable	Sh. I. Machines	TT-M-3	1850	11-Nov-05	11-Nov-06
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	17-Oct-05	17-Oct-06
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	03-Mar-06	03-Mar-07
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-05	02-Dec-06
2109	Anechoic Chamber 6(L) x 5.5(W) x 2.95(H) m	HL	AC-2	2109	11-Nov-05	11-Nov-06
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	10-Apr-06	10-Apr-07

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).

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Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

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

12 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(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
dBΩ	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
μs	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

13 APPENDIX F Test equipment correction factors

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

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

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

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

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

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

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

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	30	0.33	≤ 6.5	±0.12
2	50	0.40		
3	100	0.57		
4	300	0.97		
5	500	1.25		
6	800	1.59		
7	1000	1.81		
8	1200	1.97		
9	1400	2.15		
10	1600	2.28		
11	1800	2.43		
12	2000	2.61		
13	2200	2.75		
14	2400	2.89		
15	2600	2.97		
16	2800	3.21	≤ 6.5	±0.12
17	3000	3.32		
18	3300	3.47		
19	3600	3.62		
20	3900	3.84		
21	4200	3.92		±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 18 GHz, 6.5 m, blue, model NPS-1803A-6500-NPS, serial number T4974, HL 1947
Calibration data

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

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

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

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

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

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

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

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