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Electrical

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TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 Subpart C, section 15.231 and RSS-210, Issue 5, section 6.1.1; ICES-003 Issue 4:2004

FOR:

Visonic Ltd.

Wrist-worn transmitter

Model:MCT-212

Report ID: VISRAD_FCC.16304.doc
Date of Issue: 3/10/2005

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1 Applicant information

Client name:	Visonic Ltd.
Address:	24 Habarzel street, Tel Aviv, Israel, 69710
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:	Wrist-worn transmitter
Model(s):	MCT-212
Serial number:	W09/05
Receipt date	2/8/2005

3 Manufacturer information

Manufacturer name:	Visonic ltd.
Address:	24 Habarzel street, Tel Aviv, Israel, 69710
Telephone:	+972 3645 6714
Fax:	+972 3645 6891
E-Mail:	aelshtein@visonic.com
Contact name:	Mr. Arick Elshtein

4 Test details

Project ID:	16304
Location:	Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test performed:	2/8/2005
Test specification(s):	FCC Part 15, subpart C, §15.231; subpart B, §15.109; RSS-210 Issue 5:2001, section 6.1.1; ICES-003 issue 4:2004
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. Michael Lerman, test engineer	February 20, 2005	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	March 10, 2005	
	Mr. M. Nikishin, EMC group leader	March 13, 2005	
Approved by:	Mr. A. Usoskin, C.E.O.	March 14, 2005	

6 EUT description

6.1 General information

Miniature waterproof transmitter, designed for home health care signaling. The EUT is powered by 3 V internal battery and utilizes an integral antenna.

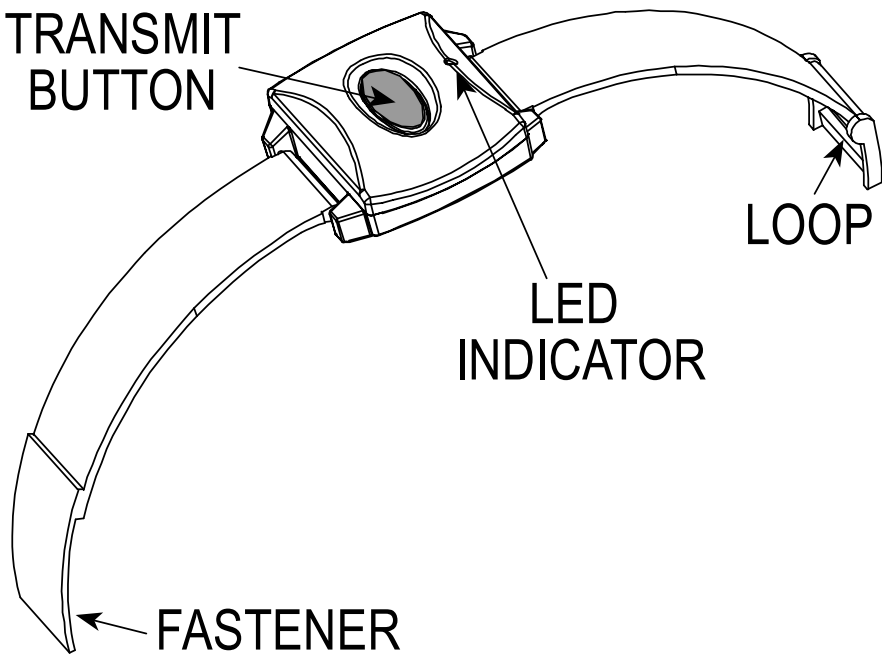
6.2 Operating frequencies

Source	Frequency, MHz
Transmitter	315

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	315 MHz
Operating frequency	315 MHz

Maximum rated output power	At transmitter 50 Ω RF output connector	dBm
	Effective radiated power (for equipment with no RF connector)	-31.7 dBm

Is transmitter output power variable?	X	No			
		Yes		continuous variable	
				stepped variable with stepsize	dB
			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

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
PCB print	Visonic	NA	NA

Type of modulation	ASK				
Modulating test signal (baseband)	ID Code				
Transmitter duty cycle supplied for test	100 %	**Tx ON time**	msec	**Period**	msec

Transmitter power source					
X	Battery	**Nominal rated voltage**	3 VDC	Battery type	Lithium

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:	2/18/2005 12:58:52 PM		
Temperature: 22 ºC	Air Pressure: 1015 hPa	Relative Humidity: 34 %	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

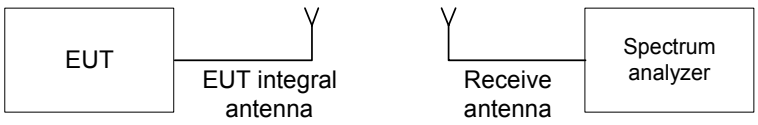
7.1.2.1 The EUT was set up as shown in Figure 7.1.1.

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 Plot 7.1.1.

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:	2/18/2005 12:58:52 PM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 34 %	**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	NA	NA
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	NA	NA

Plot 7.1.1 Transmitter shut down test result

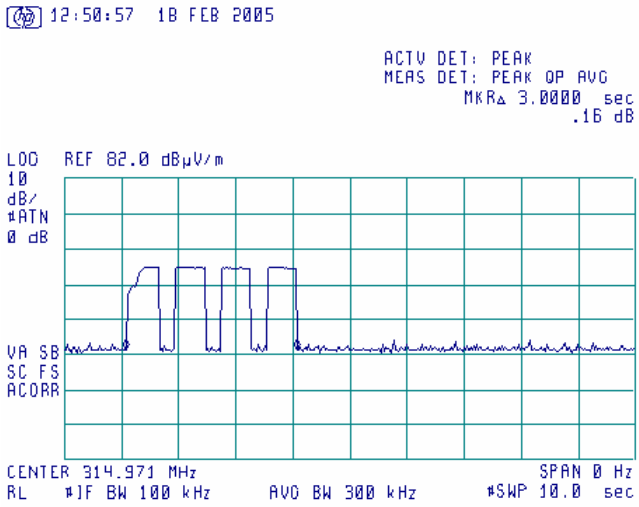


Table 7.1.2 Total duration of polling / supervision transmissions

Duration, ms	Repetition period, ms	Maximum number of transmissions within 1 hour, ms	Total duration within 1 hour, ms
No supervision signals			

Reference numbers of test equipment used

HL 1425							

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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**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
315	95.62	75.62

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	75.62	55.62
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:

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

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.

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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**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 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 worst test results (the lowest margins) 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 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 worst test results (the lowest margins) 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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

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

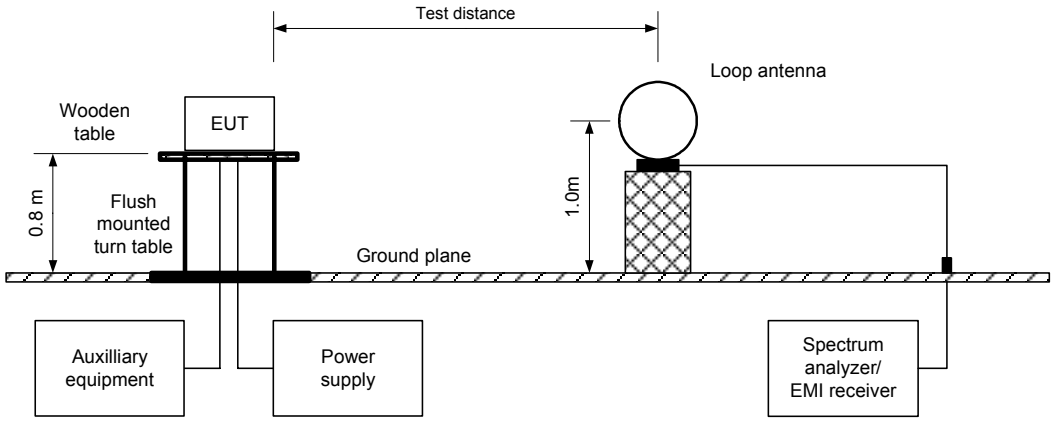
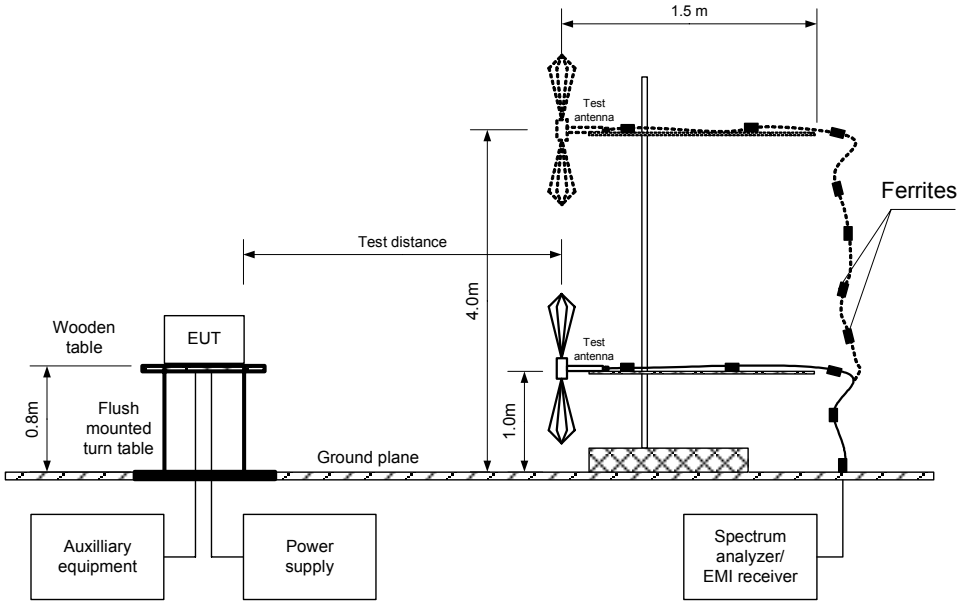


Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz



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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**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:	3 orthogonal (X / Y / Z)
MODULATION:	ASK
MODULATING SIGNAL:	ID code
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 - 4000 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) 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											
314.975	V	1	271	49.26	95.62	-46.36	-4.59	44.67	75.62	-30.95	Pass
314.975	H	1	145	63.46	95.62	-32.16	-4.59	58.87	75.62	-16.75	Pass
Spurious emissions											
629.9	H	1.1	123	28.68	75.62	-46.94	-4.59	24.09	55.62	-31.53	Pass

The recorded test results were obtained throughout measurements in the EUT "Z" orthogonal position

*- 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		Transmission train duration, ms	Average factor, dB
Duration, ms	Number of pulses	Duration, ms	Number of bursts		
0.8	36	45.64	2	292	-4.59

*- Average factor was calculated as follows

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

Reference numbers of test equipment used

HL 0465	HL 0521	HL 0566	HL 0569	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 1556	HL 1562	HL 1826	HL 1849	HL 1850	HL 1942	HL 1984
HL 2009	HL 2109	HL 2432					

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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**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:	ASK
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) 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 spurious were found								

*- 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 0566	HL 0569	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 1556	HL 1562	HL 1826	HL 1849	HL 1850	HL 1942	HL 1984
HL 2009	HL 2109	HL 2432					

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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

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	

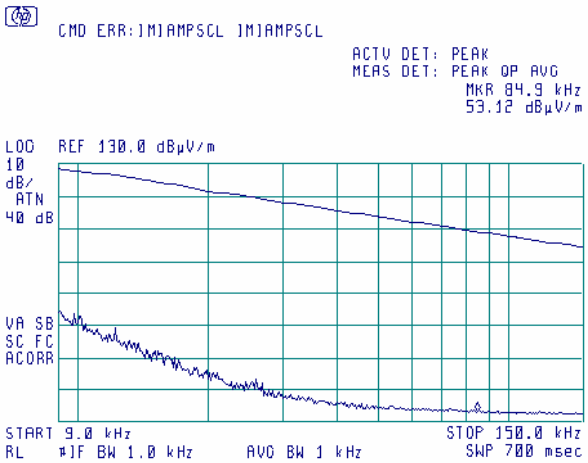
Table 7.2.7 Restricted bands according to RSS-210, Section 6.3

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.291 - 8.294	16.80425 - 16.80475	399.9 - 410	3260 - 3267	10.6 - 12.7
2.1735 - 2.1905	8.362 - 8.366	25.5 - 25.67	608 - 614	3332 - 3339	13.25 - 13.4
3.020 - 3.026	8.37625 - 8.38675	37.5 - 38.25	960 - 1427	3345.8 - 3358	14.47 - 14.5
4.125 - 4.128	8.41425 - 8.41475	73 - 74.6	1435 - 1626.5	3600 - 4400	15.35 - 16.2
4.17725 - 4.17775	12.290 - 12.293	74.8 - 75.2	1645.5 - 1646.5	4500 - 5150	17.7 - 21.4
4.20725 - 4.20775	12.51975 - 12.52025	108 - 138	1660 - 1710	5350 – 5460	22.01 - 23.12
5.677 - 5.683	12.57675 - 12.57725	156.52475 - 156.52525	1718.8 - 1722.2	7250 - 7750	23.6 - 24
6.215 - 6.218	13.36 - 13.41	156.7 - 156.9	2200 - 2300	8025 - 8500	31.2 - 31.8
6.26775 - 6.26825	16.420 - 16.423	240 - 285	2310 - 2390	9000 - 9200	36.43 - 36.5
6.31175 - 6.31225	16.69475 - 16.69525	322 - 335.4	2655 - 2900	9300 - 9500	Above 38.6

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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

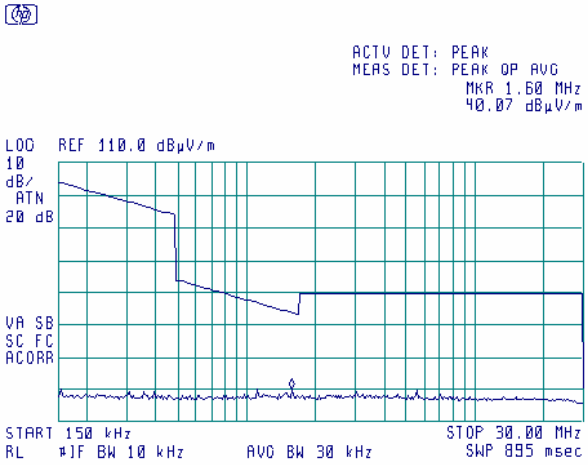
Plot 7.2.1 Radiated emission measurements from 9 to 150 kHz

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



Plot 7.2.2 Radiated emission measurements from 0.15 to 30 MHz

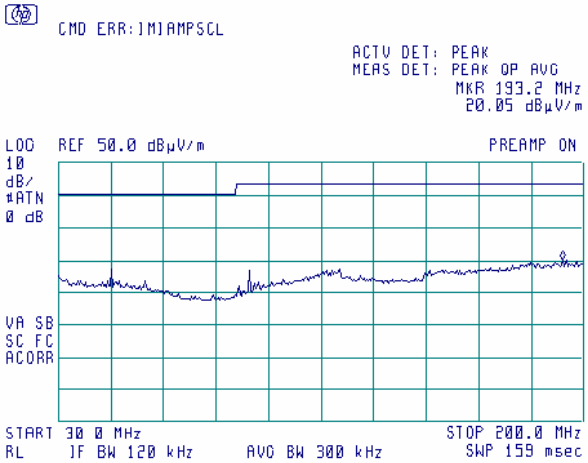
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X/ Y/ Z)



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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

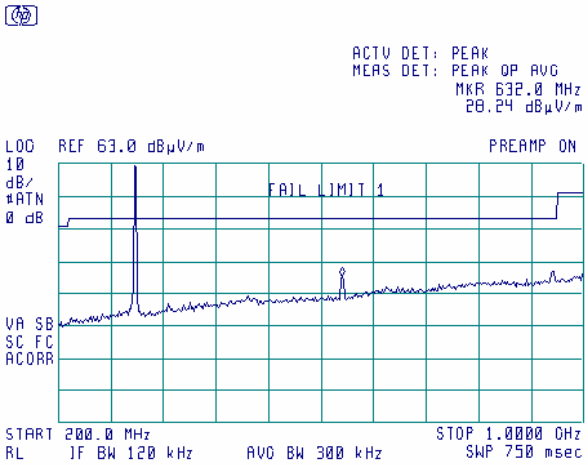
Plot 7.2.3 Radiated emission measurements from 30 to 200 MHz

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



Plot 7.2.4 Radiated emission measurements from 200 to 1000 MHz

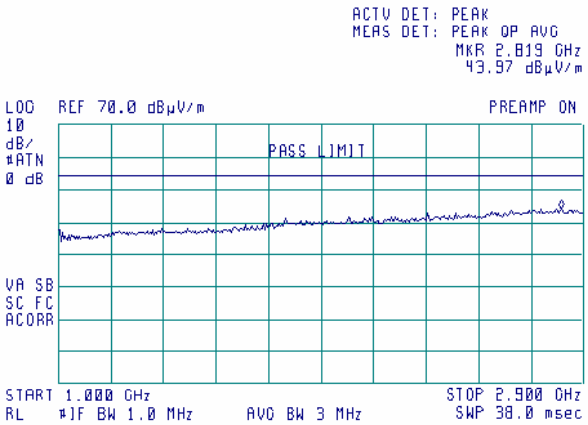
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	Air Pressure: 1014 hPa	Relative Humidity: 43 %	Power Supply: 3 VDC
Remarks:			

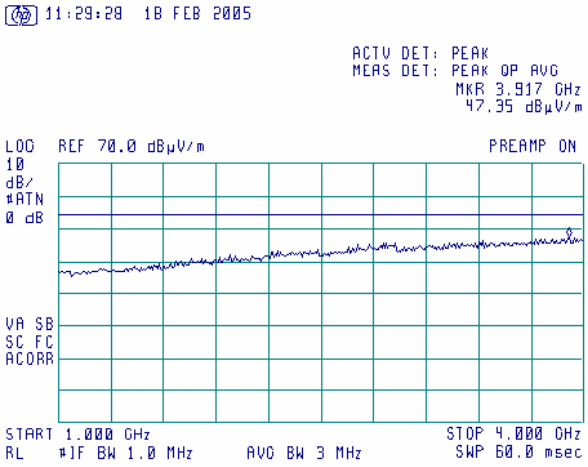
Plot 7.2.5 Radiated emission measurements from 1000 to 2900 MHz

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



Plot 7.2.6 Radiated emission measurements from 2900 to 4000 MHz

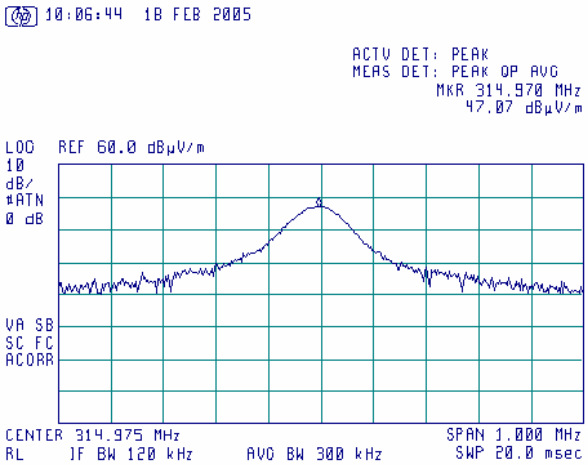
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

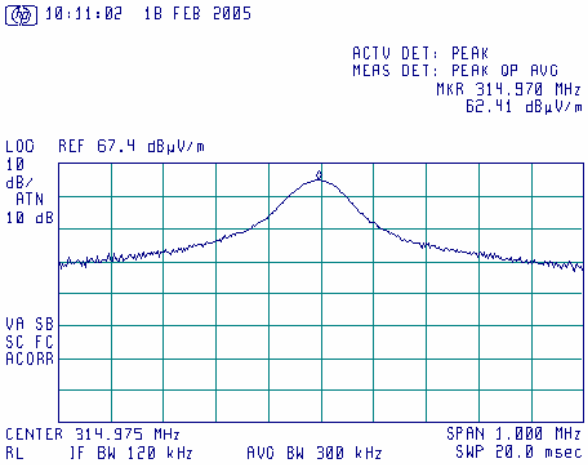
Plot 7.2.7 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Z



Plot 7.2.8 Radiated emission measurements at the fundamental frequency

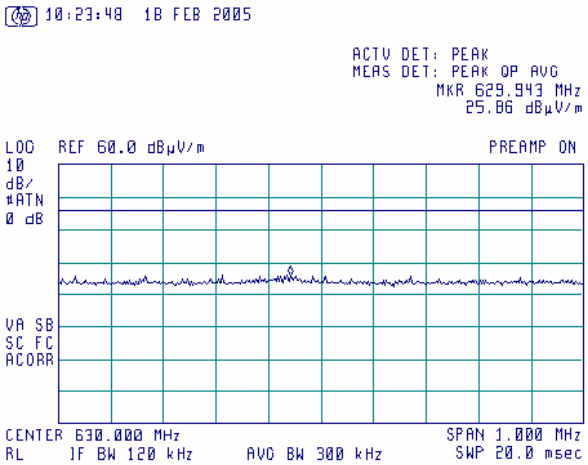
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Z



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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

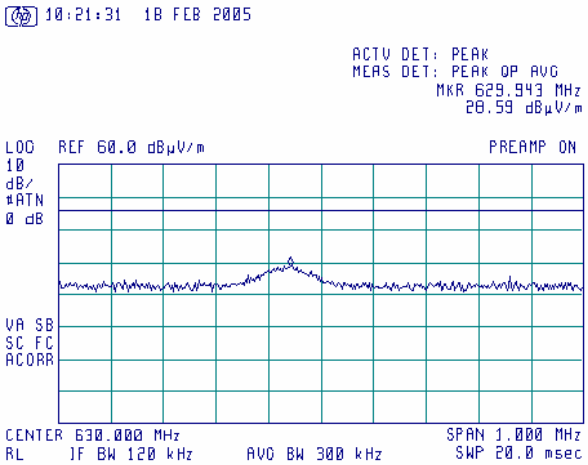
Plot 7.2.9 Radiated emission measurements at the second harmonic frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Z



Plot 7.2.10 Radiated emission measurements at the second harmonic frequency

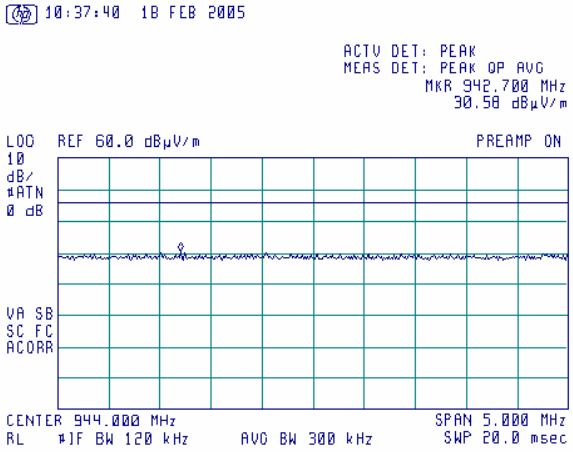
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Z



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:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

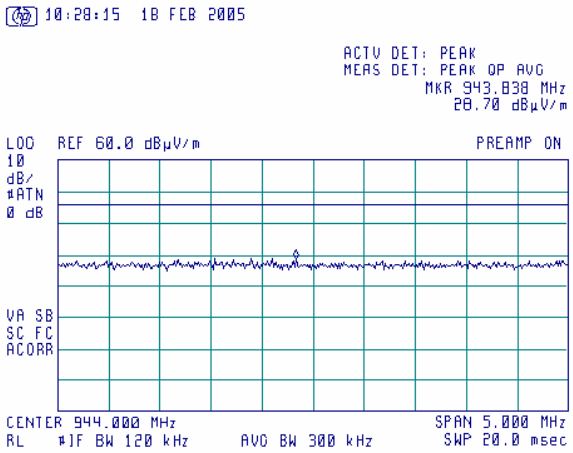
Plot 7.2.11 Radiated emission measurements at the third harmonic frequency

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



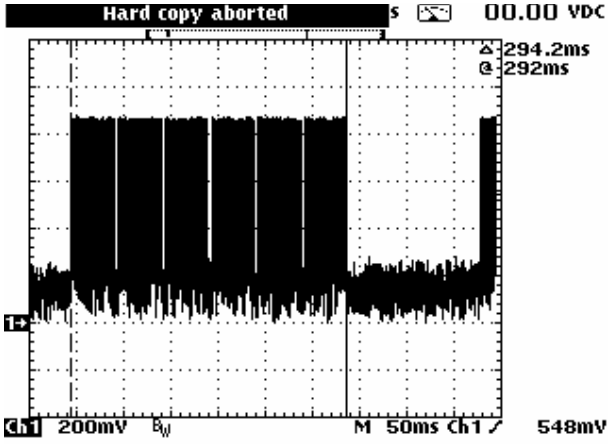
Plot 7.2.12 Radiated emission measurements at the third harmonic frequency

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

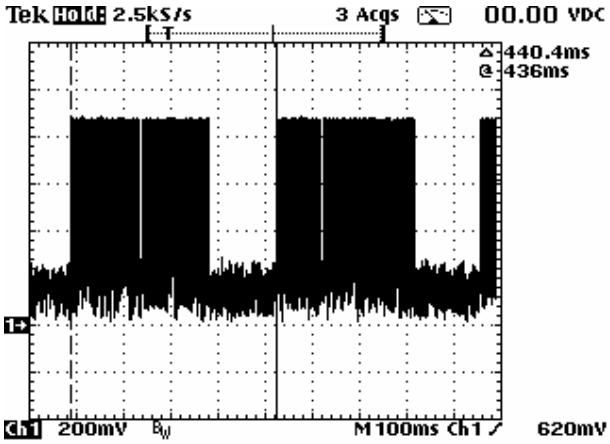


Test specification:	**FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

Plot 7.2.13 Transmission train duration

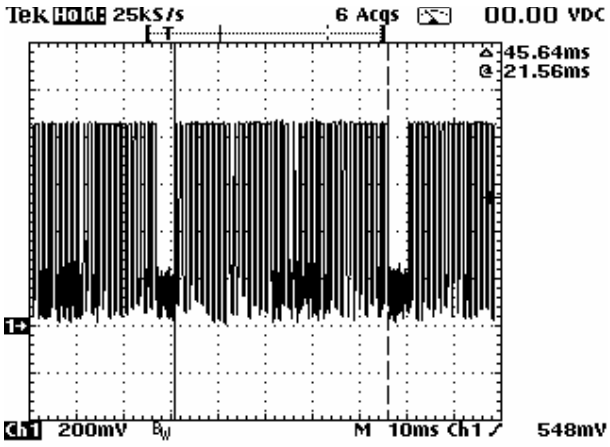


Plot 7.2.14 Transmission train period

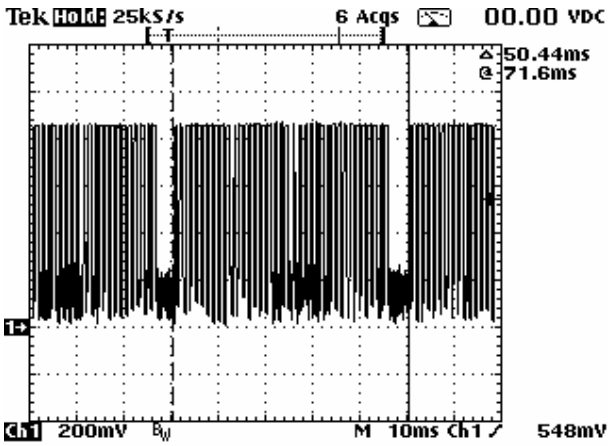


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	Air Pressure: 1014 hPa	Relative Humidity: 43 %	Power Supply: 3 VDC
Remarks:			

Plot 7.2.15 Transmission burst duration

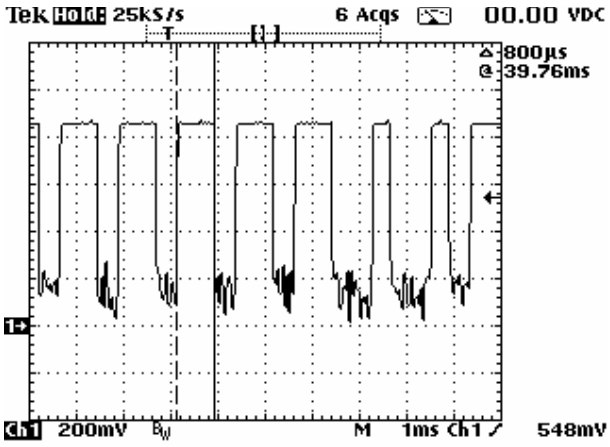


Plot 7.2.16 Transmission burst period

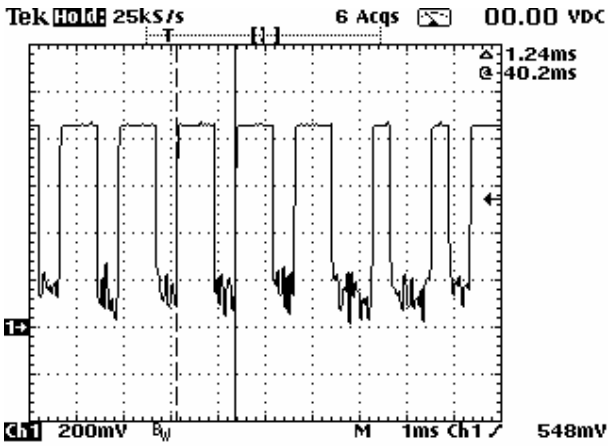


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	Air Pressure: 1014 hPa	Relative Humidity: 43 %	Power Supply: 3 VDC
Remarks:			

Plot 7.2.17 Transmission pulse bit "0" duration

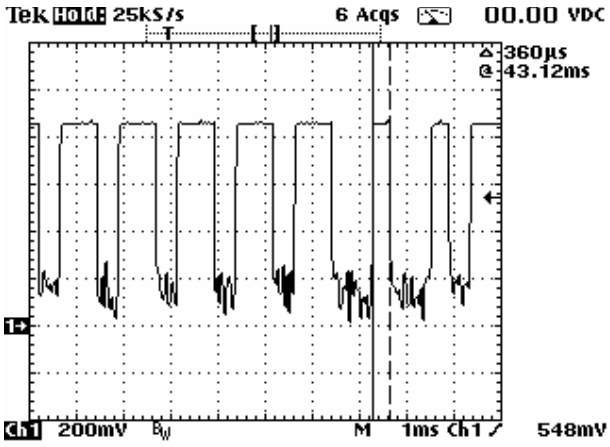


Plot 7.2.18 Transmission pulse bit "0" period

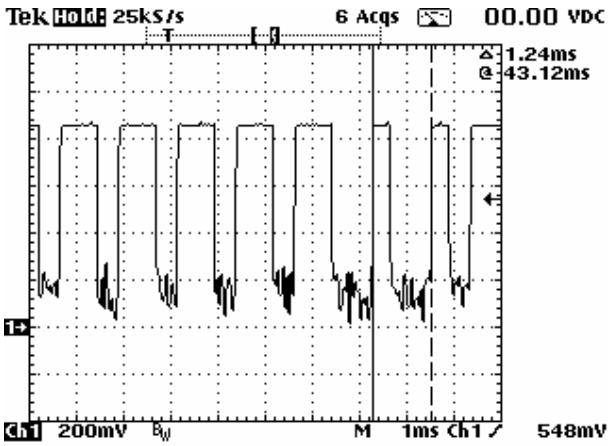


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/18/2005 11:56:47 AM		
Temperature: 22 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

Plot 7.2.19 Transmission pulse bit "1" duration



Plot 7.2.20 Transmission pulse bit "1" period



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:	2/18/2005 12:48:41 PM		
Temperature: 22 ºC	Air Pressure: 1015 hPa	Relative Humidity: 34 %	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 plots.

Table 7.3.1 Occupied bandwidth limits

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

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

7.3.2 Test procedure

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

7.3.2.2 The EUT was set to transmit modulated carrier.

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

Figure 7.3.1 Occupied bandwidth test setup

Test specification:	**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:	2/18/2005 12:48:41 PM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 34 %	**Power Supply:** 3 VDC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	1 kHz
VIDEO BANDWIDTH:	3 kHz
MODULATION ENVELOPE REFERENCE POINTS:	20 dBc
MODULATION:	ASK
MODULATING SIGNAL:	ID code

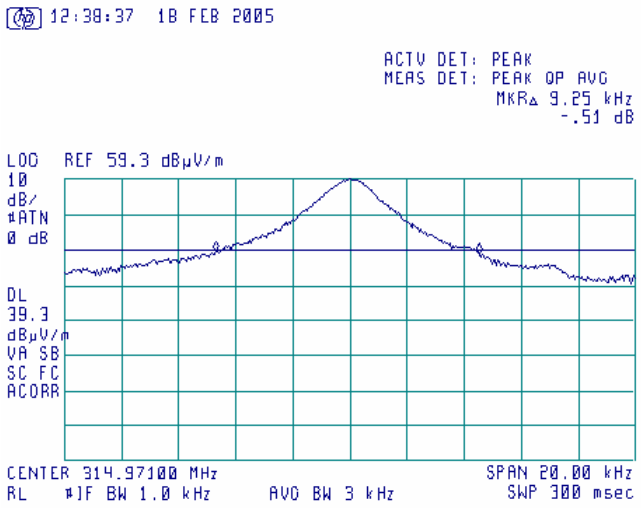
Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
315	9.25	0.25	787.5	778.25	Pass

Reference numbers of test equipment used

HL 1425								

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:	2/20/2005 11:39:12 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3 VDC
Remarks:			

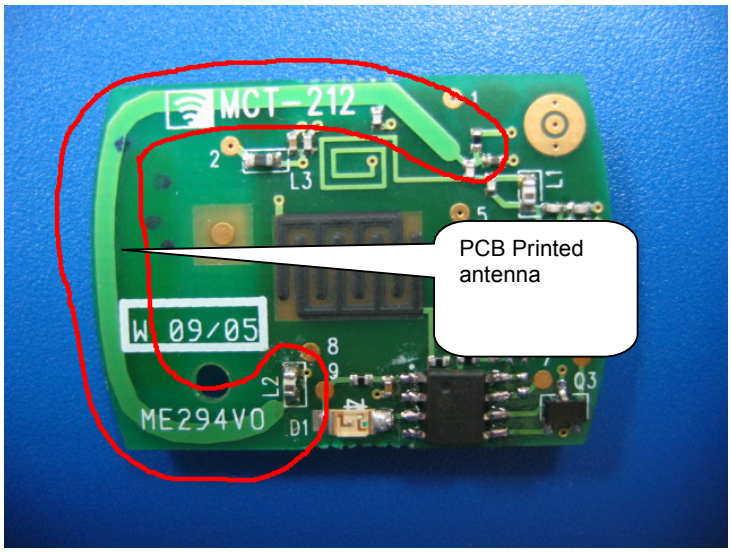
7.4 Antenna requirements

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 / RSS-210, Section 7.3 / ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/18/2005 12:02:02 PM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 34 %	**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 according to FCC Part 15, Section 109 are given in Table 7.5.1, according to ICES-003, Section 5 in Table 7.5.2 and according to RSS-210, Section 7.3 in Table 7.5.3.

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 - 5th harmonic**	43.5*	54.0	49.5	60.0*

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	40.5*	40	50.5*
230 - 1000	37	47.5*	47	57.5*

* - 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.

Table 7.5.3 Radiated emission limits according to RSS-210, Section 7.3

Frequency, MHz	Field strength limit at 3 m test distance, dB(μV/m)
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
960 - 1610	54.0
1610 - 3rd harmonic**	60.0

** - harmonic of the highest frequency the EUT generates, uses, operates or tunes to.

7.5.2 Test procedure for measurements in semi-anechoic chamber

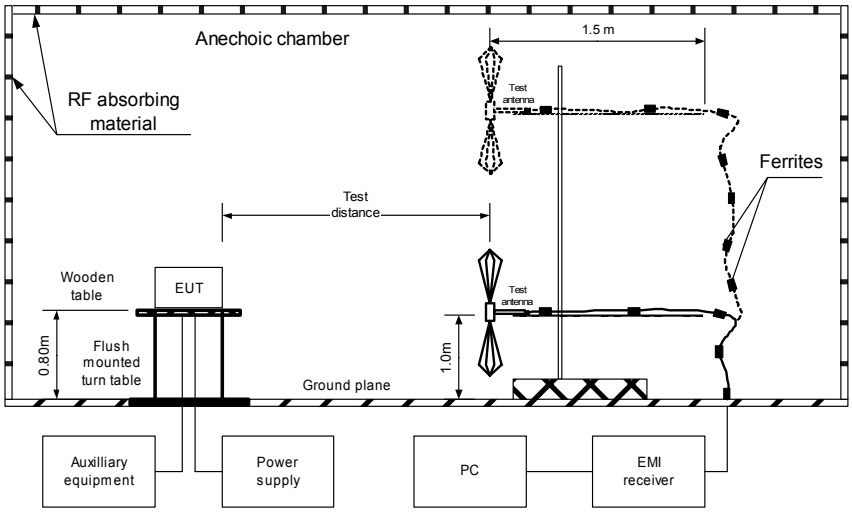
7.5.2.1 The EUT was set up as shown in Figure 7.5.1 and associated photograph/s, energized and the performance check was conducted.

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 and the EUT cables position was varied.

7.5.2.3 The worst test results (the lowest margins) were provided in the associated tables and plots.

Test specification:	**FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/18/2005 12:02:02 PM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 34 %	**Power Supply:** 3 VDC
Remarks:			

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



Test specification:	**FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/18/2005 12:02:02 PM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 34 %	**Power Supply:** 3 VDC
Remarks:			

Table 7.5.4 Radiated emission test results according to FCC Part 15, Section 109

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Stand-by
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*				
No spurious were found								

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
FREQUENCY RANGE: 1000 MHz – 2900 MHz
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 spurious were found								

Table 7.5.5 Radiated emission test results according to ICES-003, Section 5

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Stand-by
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*				
No spurious were found								

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

Test specification:	**FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/18/2005 12:02:02 PM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 34 %	**Power Supply:** 3 VDC
Remarks:			

Table 7.5.6 Radiated emission test results according to RSS-210, Section 7.3

EUT SET UP: TABLE-TOP
EUT OPERATING MODE: Stand by
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*				
No spurious were found								

TEST SITE: Semi-anechoic chamber
TEST DISTANCE: 3 m
FREQUENCY RANGE: 1000 MHz – 2900 MHz
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 spurious were found								

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

Reference numbers of test equipment used

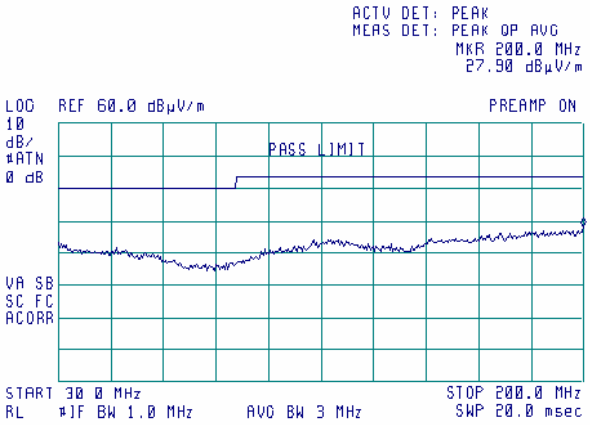
HL 0465	HL 0521	HL 0566	HL 0569	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 1556	HL 1562	HL 1942	HL 1984	HL 2009	HL 2432	

Full description is given in Appendix A.

Test specification:	**FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/18/2005 12:02:02 PM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 34 %	**Power Supply:** 3 VDC
Remarks:			

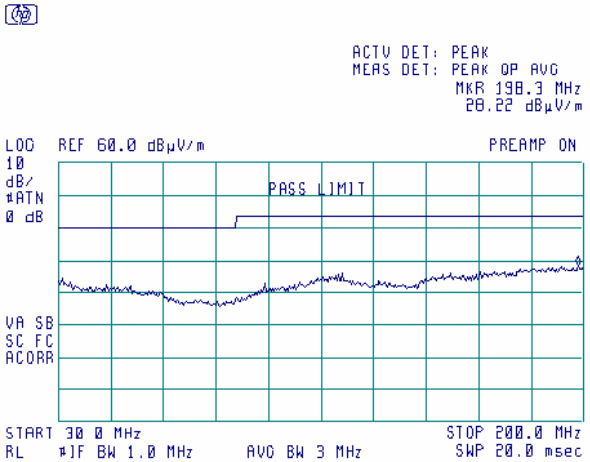
Plot 7.5.1 Radiated emission measurements in 30- 200 MHz range, vertical antenna polarization

TEST SITE: Semi-anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



Plot 7.5.2 Radiated emission measurements in 30- 200 MHz range, horizontal antenna polarization

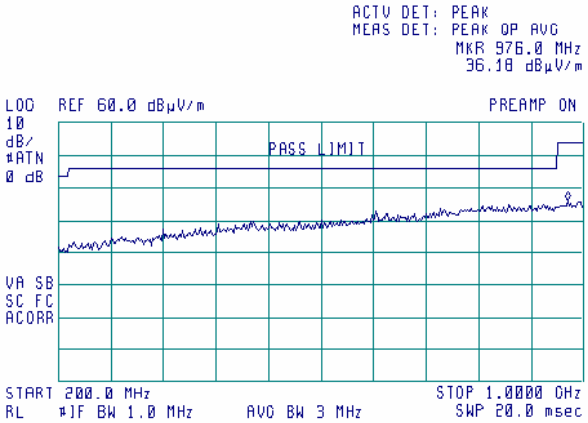
TEST SITE: Semi-anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



Test specification:	**FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/18/2005 12:02:02 PM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 34 %	**Power Supply:** 3 VDC
Remarks:			

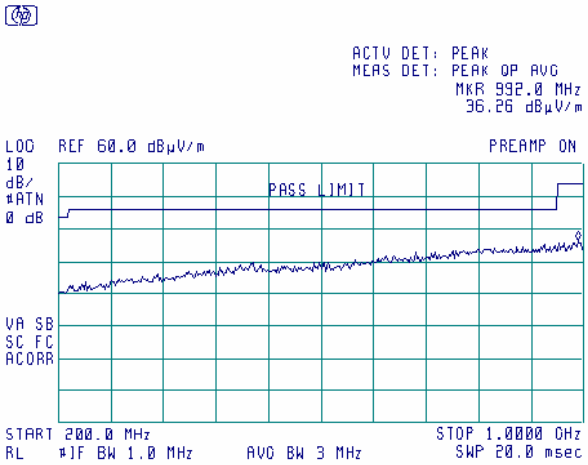
Plot 7.5.3 Radiated emission measurements in 200- 1000 MHz range, vertical antenna polarization

TEST SITE: Semi-anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



Plot 7.5.4 Radiated emission measurements in 200- 1000 MHz range, horizontal antenna polarization

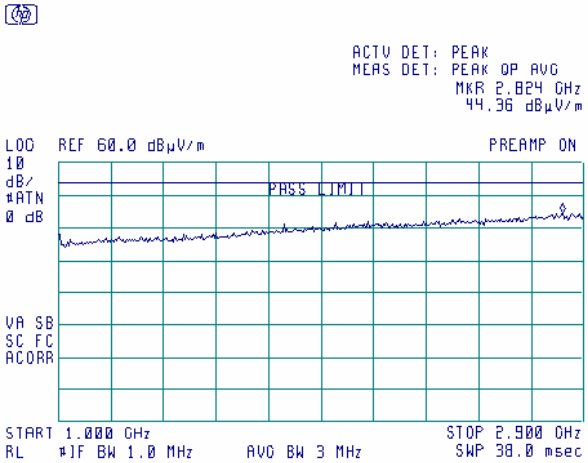
TEST SITE: Semi-anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



Test specification:	**FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/18/2005 12:02:02 PM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 34 %	**Power Supply:** 3 VDC
Remarks:			

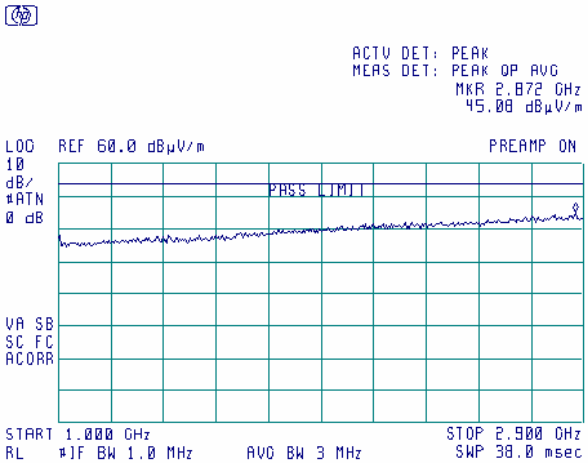
Plot 7.5.5 Radiated emission measurements in 1000- 2900 MHz range, vertical antenna polarization

TEST SITE: Semi-anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



Plot 7.5.6 Radiated emission measurements in 1000- 2900 MHz range, horizontal antenna polarization

TEST SITE: Semi-anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	HL	AC - 1	023	10-Oct-04	10-Oct-05
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	11-Nov-04	11-Nov-05
0566	Antenna, Biconical, 20 - 200 MHz	Electro-Metrics	BIA 25/30	3566	10-Jan-05	10-Jan-06
0569	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1953	12-Jan-05	12-Jan-06
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-04	02-Dec-05
0592	Position Controller	HL	L2-SR3000 (HL CRL-3)	100	02-Dec-04	02-Dec-05
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	03-Feb-05	03-Feb-06
0594	Turn Table FOR ANECHOIC CHAMBER flush mount d=1.2 m Pneumatic	HL	TT-WDC1	102	27-Jan-05	27-Jan-06
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz	EMCO	3141	9611-1011	27-Jan-05	27-Jan-06
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies (HP)	8542E	3710A002 22, 3705A002 04	27-Jan-05	27-Jan-06
1556	Cable RF, 0.5 m	Telequis	MIL-C-17F-RG 058 CU	1556	23-Sep-04	23-Sep-05
1562	Oscilloscope 100 MHz, DMM	Tektronix	THS720A	B039444	23-Sep-04	23-Sep-05
1826	Antenna mast and Turntable position controller (Small Anechoic chamber)	Sh. I. Machines	CRL-4	1	20-Sep-04	20-Sep-05
1849	Antenna mast with polarity control (Small Anechoic chamber)	Sh. I. Machines	AM-F4	1849	18-Jan-05	18-Jan-06
1850	Turntable	Sh. I. Machines	TT-M-3	1850	18-Jan-05	18-Jan-06
1942	Cable 18GHz, 4 m, blue	Rhophase Microwave Limited	SPS-1803A-4000-NPS	T4658	18-Jan-05	18-Jan-06
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	18-Jan-05	18-Jan-06
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	18-Jan-05	18-Jan-06
2109	Anechoic Chamber 6(L) x 5.5(W) x 2.95(H) m	HL	AC-2	2109	12-Dec-04	12-Dec-05
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	12-Dec-04	12-Dec-05

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
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.

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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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
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

Biconical antenna factor

Electro-Metrics, model BIA-25/30, serial number 3566, HL 0566

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(µV) to convert it into field intensity in dB(µV/m).

Log periodic antenna factor

Electro-Metrics, model LPA-25/30, serial number 1953, HL 0569

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(µV) to convert it into field intensity in dB(µV/m).

Antenna factor

Biconilog antenna EMCO, model 3141, serial number 1011, HL 0604

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
EMC Test Systems (EMCO), model 3115

Frequency, MHz	Antenna factor (s/n 9911-5964), dB(1/m), HL 1984	Antenna factor (s/n 00027177), dB(1/m), HL 2432
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(μV) to convert it into field intensity in dB(μV/m).

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

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

Cable loss
Cable 18 GHz, 4 m, blue, model: SPS-1803A-4000-NPS, S/N 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 loss
RF cable 8 m, model RG-214, HL 2009

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