

TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 Subpart C, section 15.231 and
RSS-210, Issue 6, Annex 1; ICES-003 Issue 4:2004

FOR:

Visonic Ltd.
Wireless Keypad
Model:MKP-150

This report is in conformity with ISO/ IEC 17025. The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.
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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: Wireless Keypad
Product type: Transciever
Model(s): MKP-150
Serial number: W6117-1
Receipt date 2/3/2005

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: 16289
Location: Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started: 2/3/2005
Test completed: 8/10/2005
Test specification(s): FCC Part 15, subpart C, §15.231; subpart B, §15.109;
RSS-210 Issue 6:2005, Annex 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 A1.1.1, Periodic operation requirements	Pass
FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions	Pass
FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth	Pass
FCC Part 15, Section 207 / RSS-Gen, Section 7.2.2, Conducted emission	Pass
FCC Part 15, Section 203 / RSS-Gen, Section 7.1.4, Antenna requirements	Pass
Unintentional emissions	
FCC Part 15, Section 107 / RSS-Gen, Section 7.2.2, Conducted emission at AC power port	Pass
FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3.2, Radiated emission	Pass
FCC Part 15, Section 111 / RSS-Gen, Section 6(b), Section 7.2.3.1, Conducted emission at receiver antenna port	Not required

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.

The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mr. B. Efros, test engineer	February 22, 2005	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	August 14, 2005	
Approved by:	Mr. M. Nikishin, EMC group leader	August 18, 2005	

6 EUT description

6.1 General information

The EUT is a wireless keypad, which operates using two-way encrypted coded transmission at 315 MHz and provides aural and visual indications. The EUT utilizes a spatial antenna. The MKP-150 may be operated either by AC power supply or by battery. If AC power is used, the device operates continuously and the system status is constantly updated. If powered by batteries, the keypad enters sleep mode 15 sec after the last key press. The keypad immediately becomes operational again upon pressing of any key.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Power	AC	EUT	mains	Terminal block	1	Unshielded	2.5	indoor

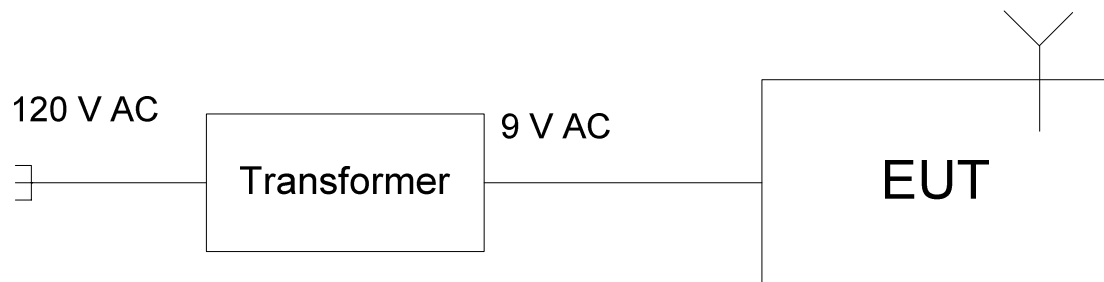
6.3 Operating frequencies

Source	Frequency, MHz
Transmitter	315

6.4 Changes made in the EUT

No changes were implemented.

6.5 Test configuration





6.6 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				
X	mobile	Always at a distance more than 20 cm from all people				
	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			NA	
		Effective radiated power (for equipment with no RF connector)			-16.7 dBm	
Is transmitter output power variable?		X	No			
			Yes	continuous variable		
				stepped variable with stepsize		
				minimum RF power		
				maximum RF power		
Antenna connection						
unique coupling		standard connector		X	integral	
				X	with temporary RF connector	
					without temporary RF connector	
Antenna/s technical characteristics						
Type	Manufacturer		Model number		Gain	
Spatial	Visonic Ltd.		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	6 VDC	Battery type	Lithium	
	DC	Nominal rated voltage	VDC			
X	AC mains	Nominal rated voltage	120 VAC/9 VAC	Frequency	60 Hz	



Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/14/2005 2:53:15 PM		
Temperature: 22°C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
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;
- 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.

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 Plot 7.1.2.

Figure 7.1.1 Setup for transmitter shut down test



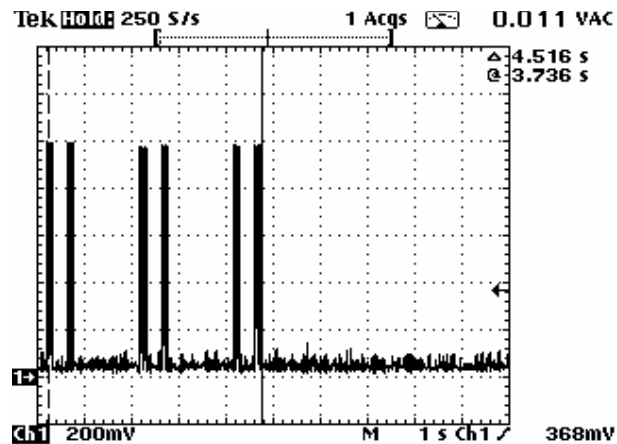


Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/14/2005 2:53:15 PM		
Temperature: 22°C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
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	Supplier declaration	Comply
Total duration of polling or supervision transmission shall not exceed 1 second	NA	NA
Polling or supervision transmission rate shall not exceed one per hour	Supplier declaration	Comply

Plot 7.1.1 Transmitter shut down test result





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:	6/14/2005 2:53:15 PM		
Temperature: 22°C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.2 Polling / supervision transmission duration

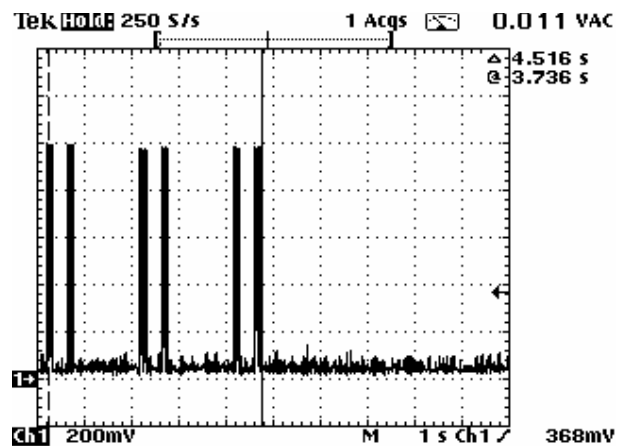


Table 7.1.2 Total duration of polling / supervision transmissions

Duration, ms	Repetition period, ms	Maximum number of transmissions within 1 hour	Total duration within 1 hour, ms
772	NA	1	772

Reference numbers of test equipment used

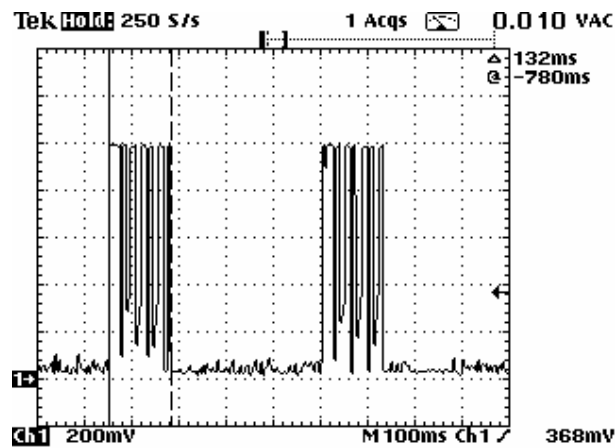
HL 1562							
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Full description is given in Appendix A.

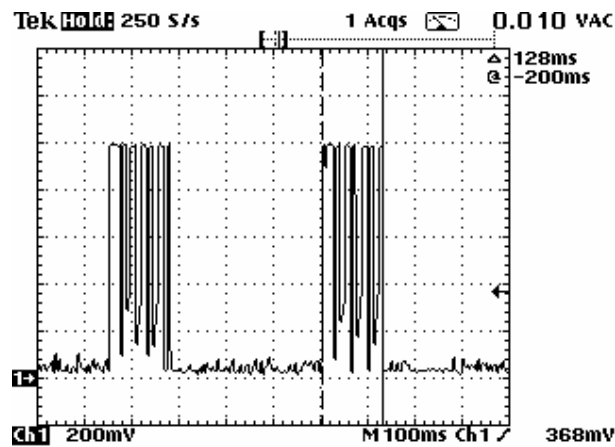


Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/14/2005 2:53:15 PM		
Temperature: 22°C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.3 First burst of pulse train duration



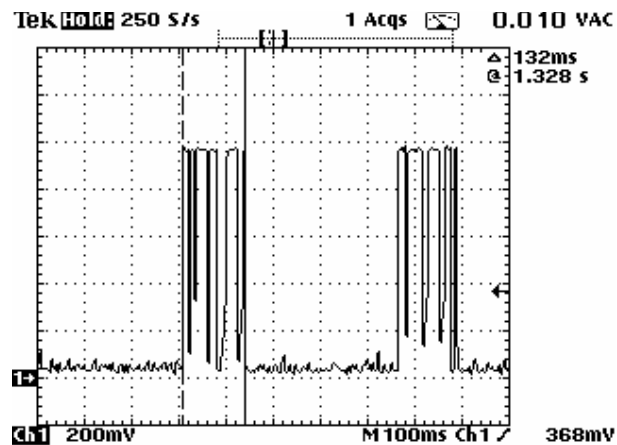
Plot 7.1.4 Second burst of pulse train duration



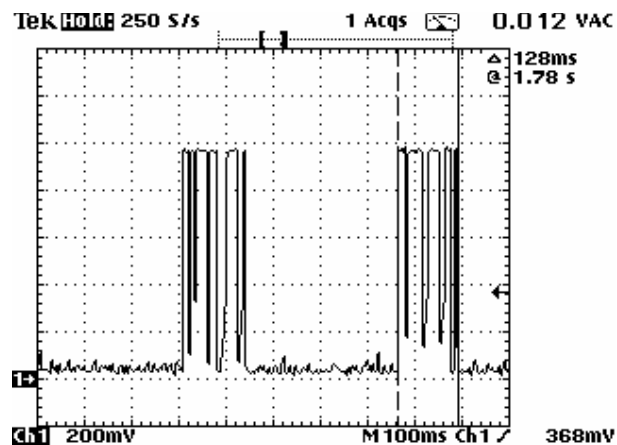


Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/14/2005 2:53:15 PM		
Temperature: 22°C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.5 Third burst of pulse train duration



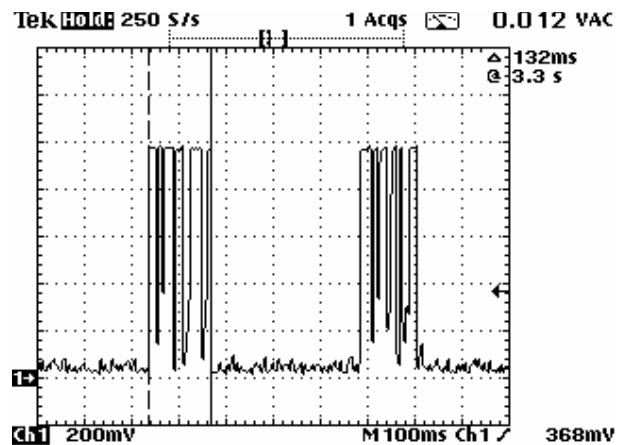
Plot 7.1.6 Fourth burst of pulse train duration



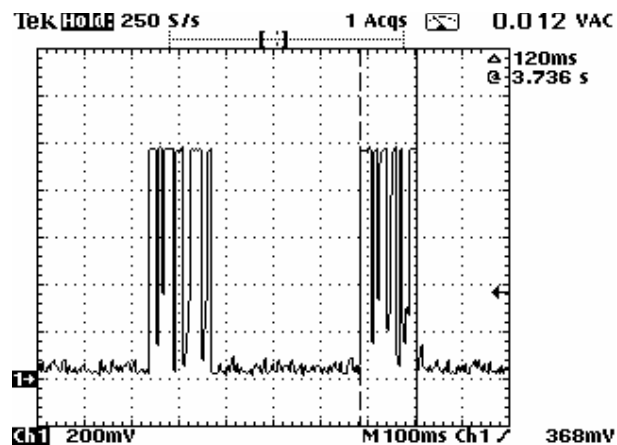


Test specification:	FCC Part 15, Section 231(a) / RSS-210, Section 6.1.1(a), Periodic operation requirements		
Test procedure:	Supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/14/2005 2:53:15 PM		
Temperature: 22°C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.7 Fifth burst of pulse train duration



Plot 7.1.8 Sixth burst of pulse train duration





Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
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
315.00	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:

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

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

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

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

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

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

where F is the carrier frequency in MHz.

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

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

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



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
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 measurements were performed in three EUT orthogonal positions.

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

7.2.2.4 The worst test results (the lowest margins) were found in the EUT vertical (Y) position, 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 measurements were performed in three EUT orthogonal positions.

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

7.2.3.4 The worst test results (the lowest margins) were found in the EUT vertical (Y) position, 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:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

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

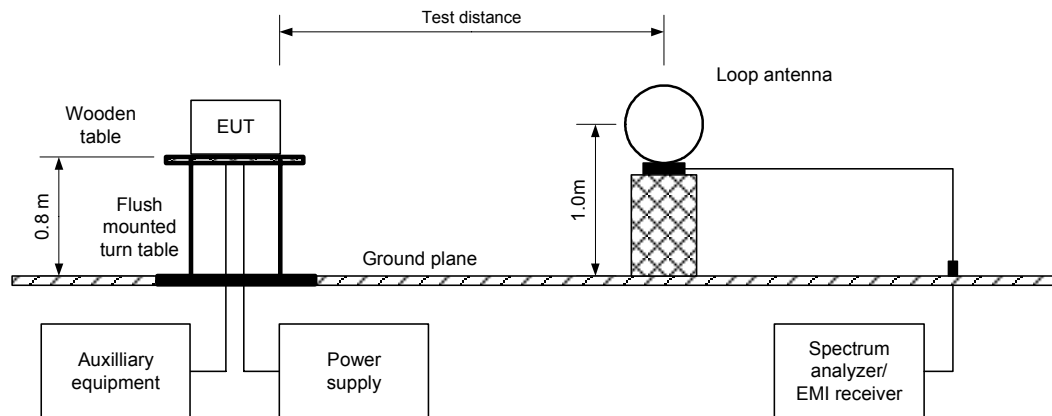
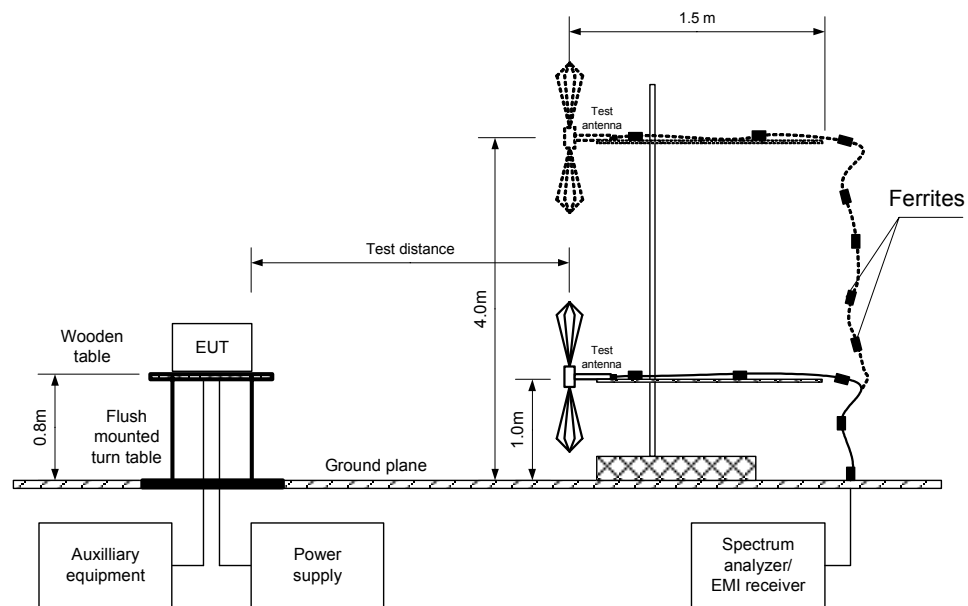


Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz





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:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
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: Vertical
 MODULATION: ASK
 MODULATING SIGNAL: ID code
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 - 3500 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 1.0 MHz (above 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (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											
314.91	H	1.2	187	78.53	95.62	-17.12	-3.02	75.51	75.62	-0.11	Pass
Spurious emissions											
629.84	V	1.1	255	39.00	75.62	-36.62	-3.02	35.98	55.62	-19.64	Pass
629.84	H	1.5	140	32.70	75.62	-42.92	-3.02	29.68	55.62	-25.94	
944.75	V	1.2	35	34.30	75.62	-41.32	-3.02	31.28	55.62	-24.34	
944.76	H	1.0	239	33.55	75.62	-42.07	-3.02	30.53	55.62	-25.09	

*- 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	Period, ms	Duration, ms	Period, ms		
2.07	2.47	37.44	NA	132.6	-3.02
0.70	1.08	15.60	NA		
0.70	1.06	76.64	NA		

*- Average factor was calculated as follows

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

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

Reference numbers of test equipment used

HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604	HL 0813
HL 1004	HL 1424	HL 1430	HL 1552	HL 1942	HL 1947	HL 1984	HL 2009
HL 2259							

Full description is given in Appendix A.



Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
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)
 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.

Reference numbers of test equipment used

HL 0446	HL 0465	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604	HL 1424
HL 1430	HL 1942						

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:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
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

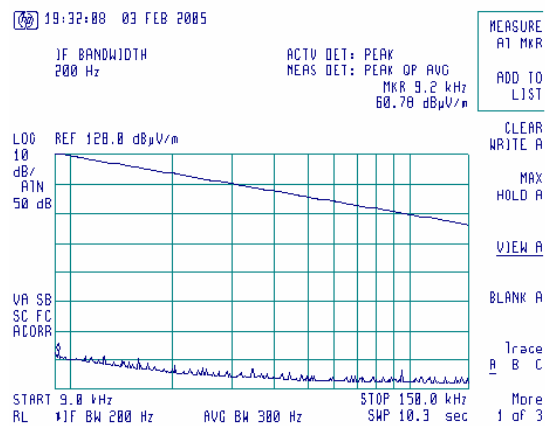
MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.291 - 8.294	16.80425 - 16.80475	399.9 - 410	3260 - 3267	10.6 - 12.7
2.1735 - 2.1905	8.362 - 8.366	25.5 - 25.67	608 - 614	3332 - 3339	13.25 - 13.4
3.020 - 3.026	8.37625 - 8.38675	37.5 - 38.25	960 - 1427	3345.8 - 3358	14.47 - 14.5
4.125 - 4.128	8.41425 - 8.41475	73 - 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



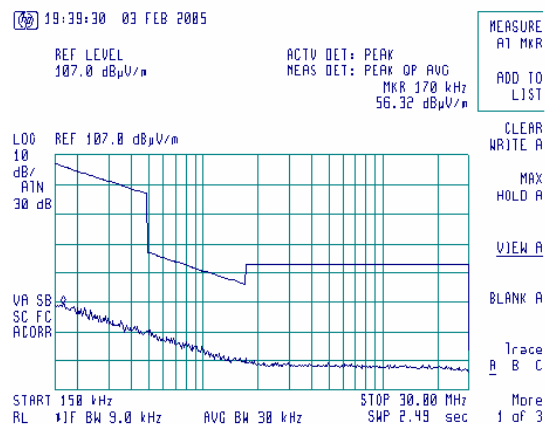
Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.1 Radiated emission measurements from 9 to 150 kHz

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

**Plot 7.2.2 Radiated emission measurements from 0.15 to 30 MHz**

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

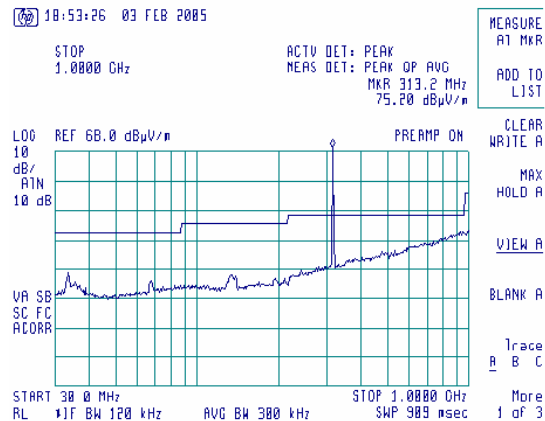




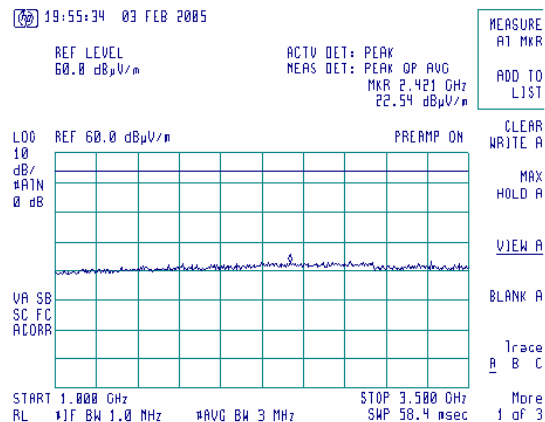
Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
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 and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)

**Plot 7.2.4 Radiated emission measurements from 1000 to 3500 MHz**

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

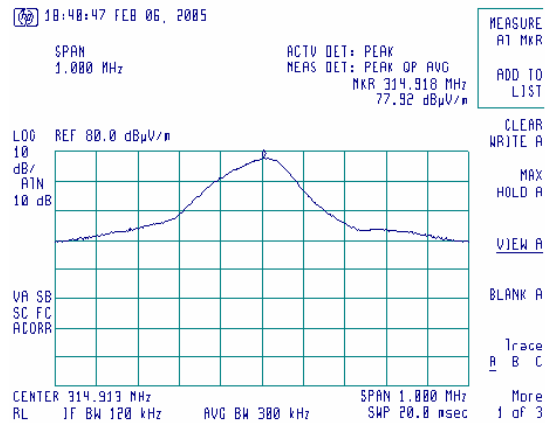




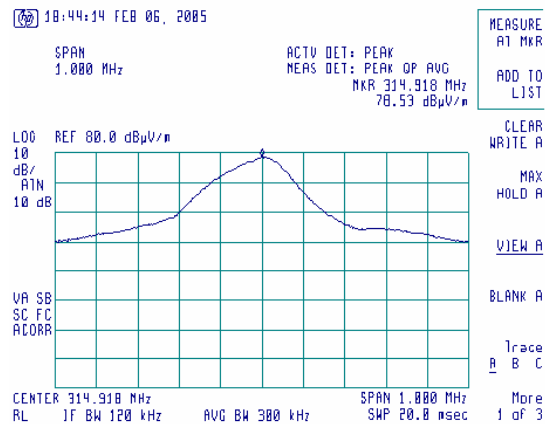
Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.5 Radiated emission measurements at the fundamental frequency

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

**Plot 7.2.6 Radiated emission measurements at the fundamental frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Y (vertical)

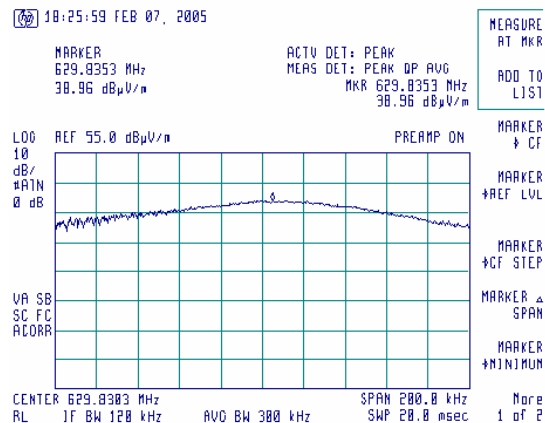




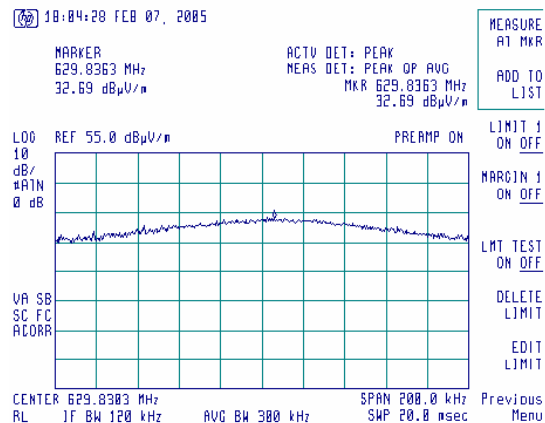
Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.7 Radiated emission measurements at the second harmonic frequency

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

**Plot 7.2.8 Radiated emission measurements at the second harmonic frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Y (vertical)

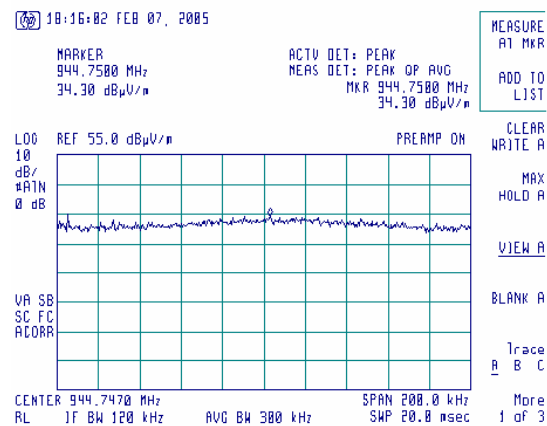




Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

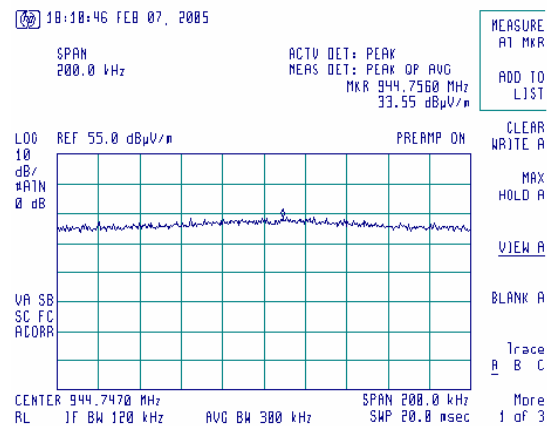
Plot 7.2.9 Radiated emission measurements at the third harmonic frequency

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



Plot 7.2.10 Radiated emission measurements at the third harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Y (vertical)

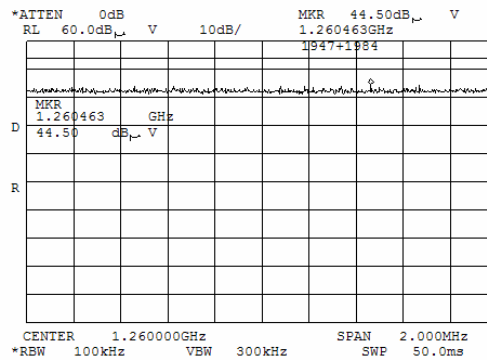




Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

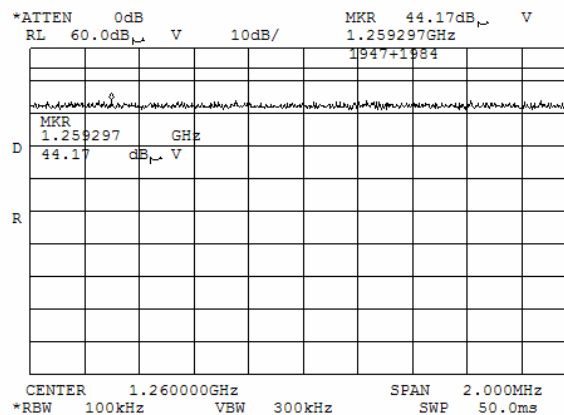
Plot 7.2.11 Radiated emission measurements at the forth harmonic frequency

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



Plot 7.2.12 Radiated emission measurements at the forth harmonic frequency

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



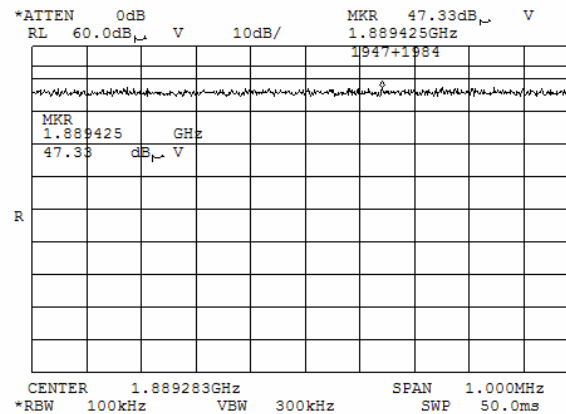




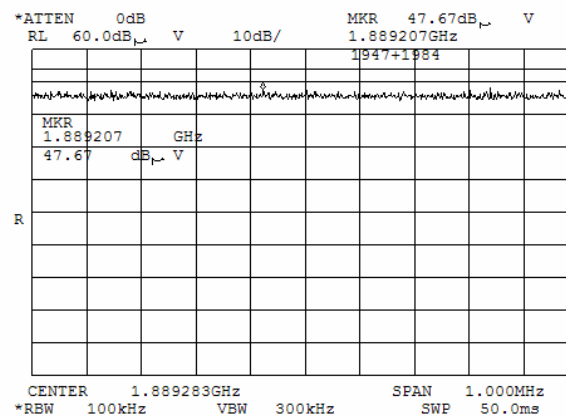
Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.15 Radiated emission measurements at the sixth harmonic frequency

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

**Plot 7.2.16 Radiated emission measurements at the sixth harmonic frequency**

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

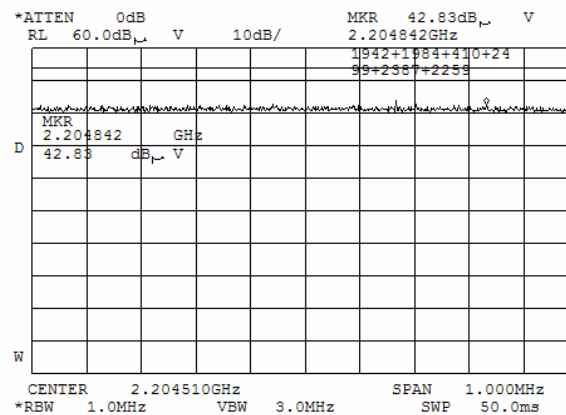




Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

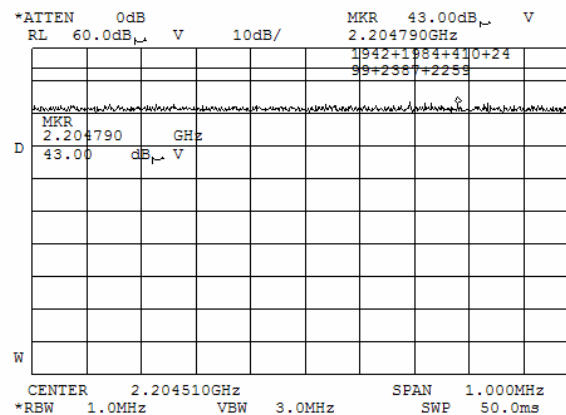
Plot 7.2.17 Radiated emission measurements at the seventh harmonic frequency

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



Plot 7.2.18 Radiated emission measurements at the seventh harmonic frequency

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

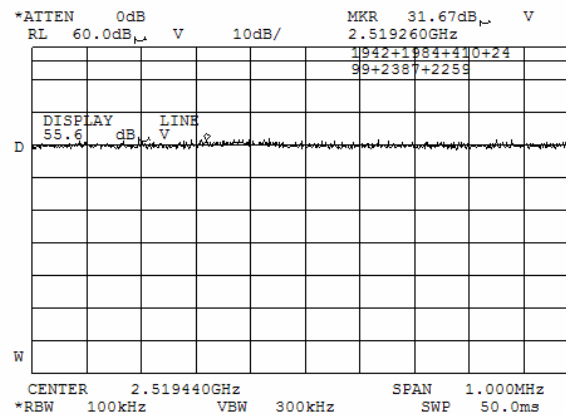




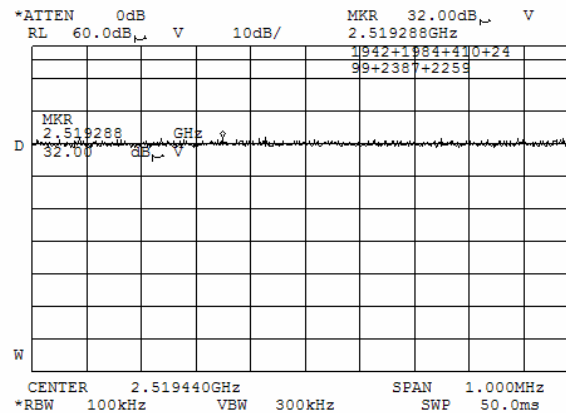
Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.19 Radiated emission measurements at the eighth harmonic frequency

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

**Plot 7.2.20 Radiated emission measurements at the eighth harmonic frequency**

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

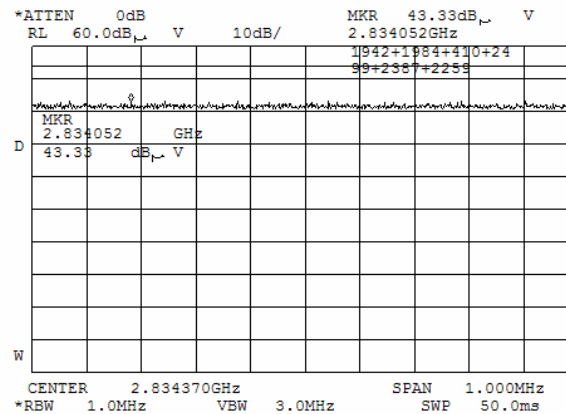




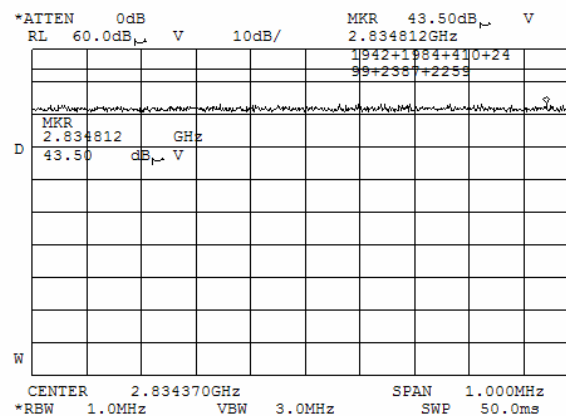
Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.21 Radiated emission measurements at the ninth harmonic frequency

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

**Plot 7.2.22 Radiated emission measurements at the ninth harmonic frequency**

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

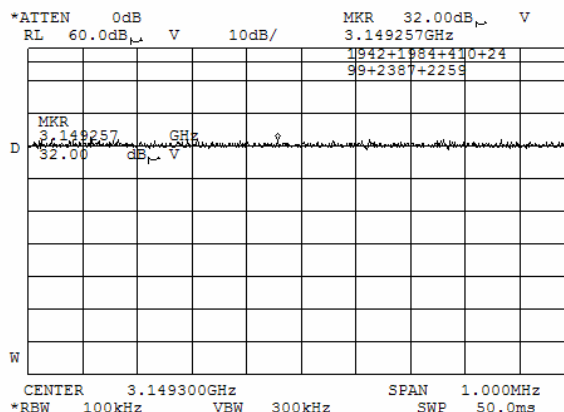




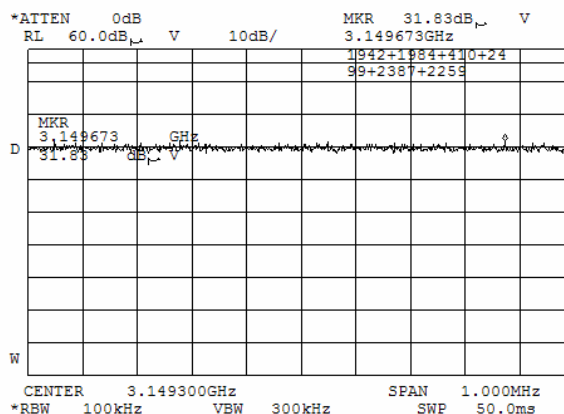
Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.23 Radiated emission measurements at the tenth harmonic frequency

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

**Plot 7.2.24 Radiated emission measurements at the tenth harmonic frequency**

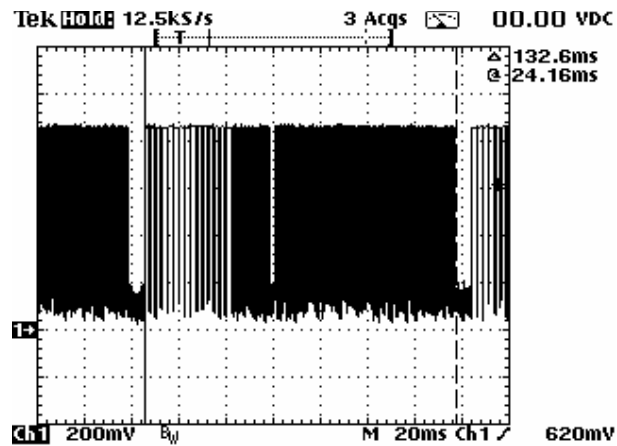
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



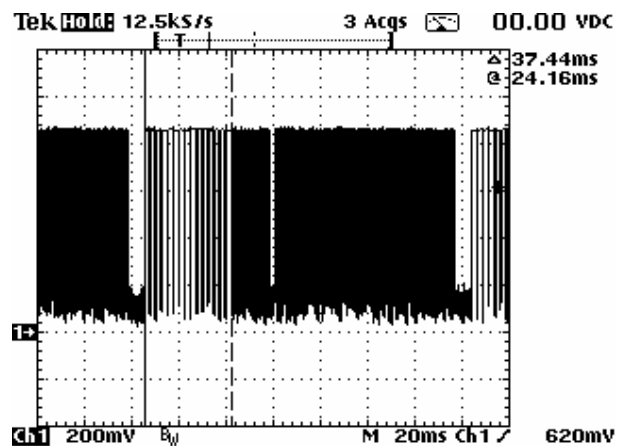


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.25 Transmission train duration



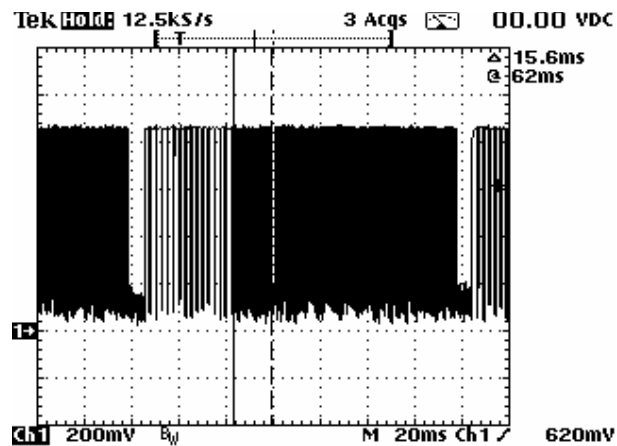
Plot 7.2.26 Transmission burst duration, start bits



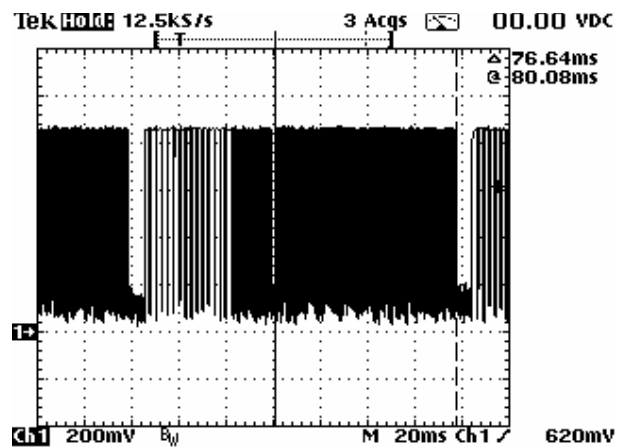


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.27 Transmission burst duration, preamble



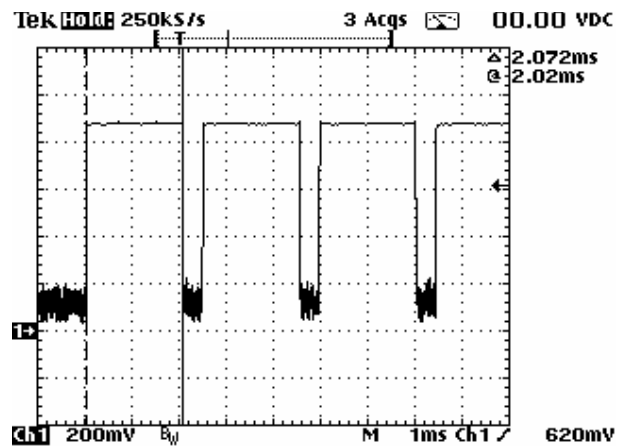
Plot 7.2.28 Transmission burst duration, message



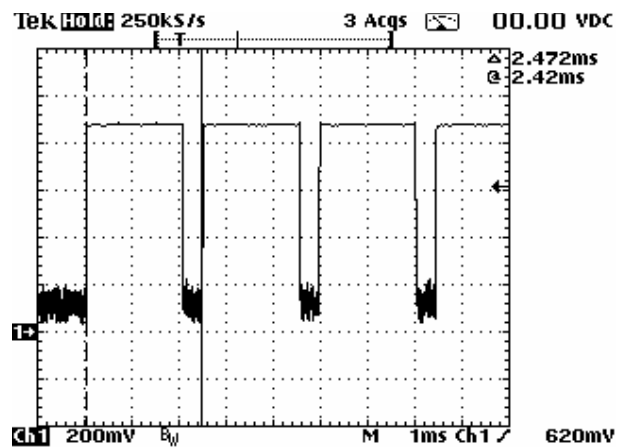


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.29 Transmission pulse duration, start bits



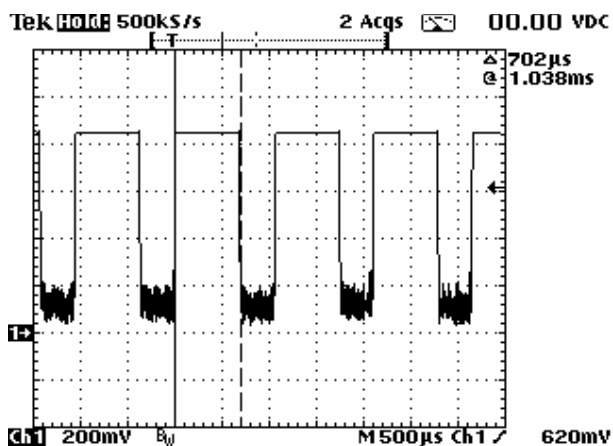
Plot 7.2.30 Transmission pulse period, start bits



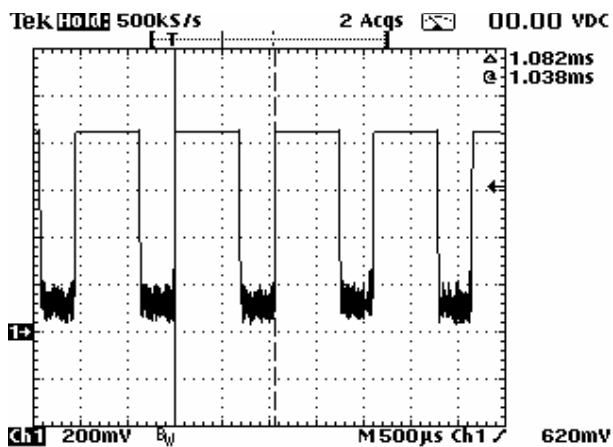


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.31 Transmission pulse duration, preamble



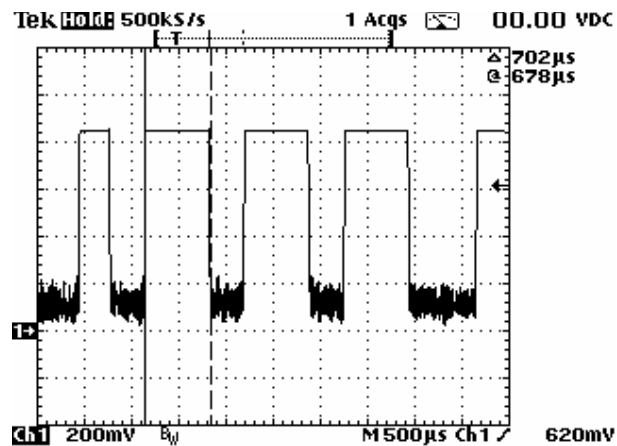
Plot 7.2.32 Transmission pulse period, preamble



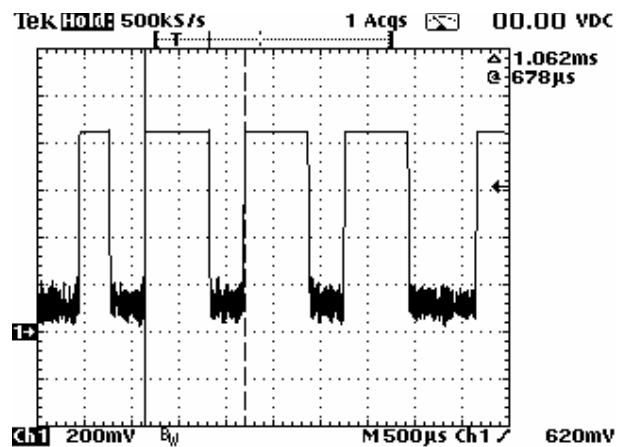


Test specification:	FCC Part 15, Section 231(b) / RSS-210, Section 6.1.1(b), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/21/2005 5:23:19 PM		
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.33 Transmission burst duration, message



Plot 7.2.34 Transmission burst period, message





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:		Verdict: PASS	
Date & Time:			
2/7/2005 4:39:50 PM			
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
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

*- 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: 2/7/2005 4:39:50 PM			
Temperature: 21 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 10 kHz
VIDEO BANDWIDTH: 300 kHz
MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
MODULATION: ASK
MODULATING SIGNAL: ID code

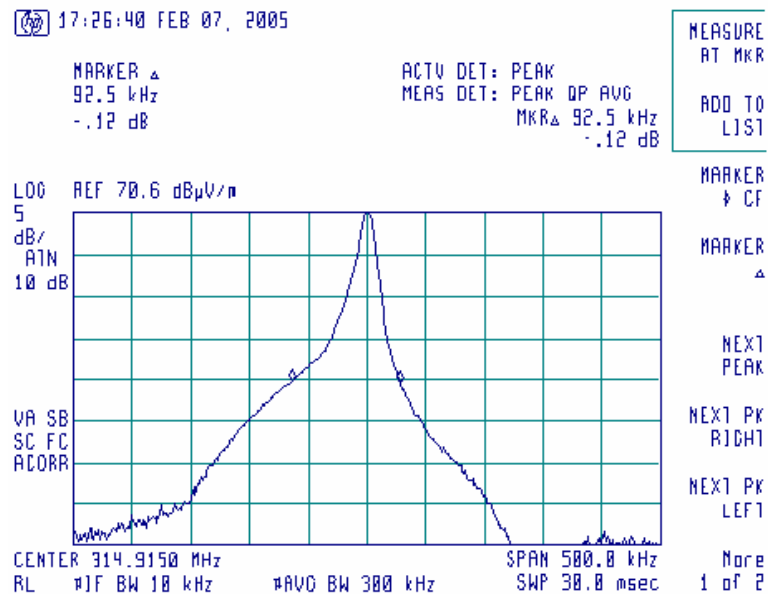
Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
314.9	92.5	0.25	787.3	694.8	Pass

Reference numbers of test equipment used

HL 0034	HL 0415	HL 0812	HL 1430					
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Full description is given in Appendix A.

Plot 7.3.1 Occupied bandwidth test result





Test specification: FCC Part 15, Section 207 / RSS-210, Section 6.6, Conducted emission			
Test procedure: ANSI C63.4, Section 13.1.3 / RSS-212, Section 5.0			
Test mode: Compliance	Verdict: PASS		
Date & Time: 2/8/2005 12:54:47 PM			
Temperature: 21°C °C	Air Pressure: 1011 hPa	Relative Humidity: 41% %	Power Supply: 120 VAC
Remarks:			

7.4 Conducted emissions

7.4.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits according to FCC Part 15, Section 15.207 are given in Table 7.4.1 and according to RSS-210, Section 6.6 - in Table 7.4.2. The worst test results (the lowest margins) were recorded in Table 7.4.3, Table 7.4.4 and shown in the associated plots.

Table 7.4.1 Limits for conducted emissions according to FCC Part 15, Section 15.207

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

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

Table 7.4.2 Limits for conducted emissions according to RSS-210, Section 6.6

Frequency, MHz	Class A limit, dB(μV)	Class B limit, dB(μV)
	QP	QP
0.45 – 1.705	60	48
1.705 – 30.0	69.5	

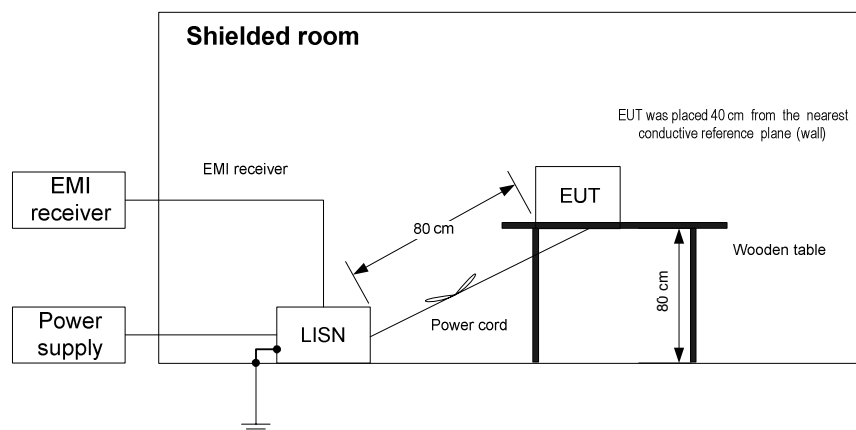
7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.

7.4.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer while unused coaxial connector of the LISN was terminated with 50 Ohm.

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

Figure 7.4.1 Setup for conducted emission measurements, table-top equipment





Test specification:		FCC Part 15, Section 207 / RSS-210, Section 6.6, Conducted emission			
Test procedure:		ANSI C63.4, Section 13.1.3 / RSS-212, Section 5.0			
Test mode:		Compliance		Verdict: PASS	
Date & Time:		2/8/2005 12:54:47 PM			
Temperature: 21°C °C		Air Pressure: 1011 hPa		Relative Humidity: 41% %	
Remarks:		Power Supply: 120 VAC			

Table 7.4.3 Conducted emission test results according to FCC Part 15, Section 15.207

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

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
23.26	19.2	18.1	60.0	-41.9	17.8	50.0	-32.2	L1	Pass
23.26	22.0	21.1	60.0	-38.9	20.8	50.0	--29.2	L2	Pass

*- Margin = Measured emission - specification limit.

Table 7.4.4 Conducted emission test results according to RSS-210, Section 6.6

LINE: AC mains
 EUT OPERATING MODE: Transmit
 EUT SET UP: TABLE-TOP
 TEST SITE: SHIELDED ROOM
 FREQUENCY RANGE: 450 kHz - 30 MHz
 RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
23.26	19.2	18.1	48.0	-29.9	L1	Pass
23.26	22.0	21.1	48.0	-26.9	L2	Pass

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0163	HL 0466	HL 0787	HL 1430	HL 1502	HL 1510		
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Full description is given in Appendix A.

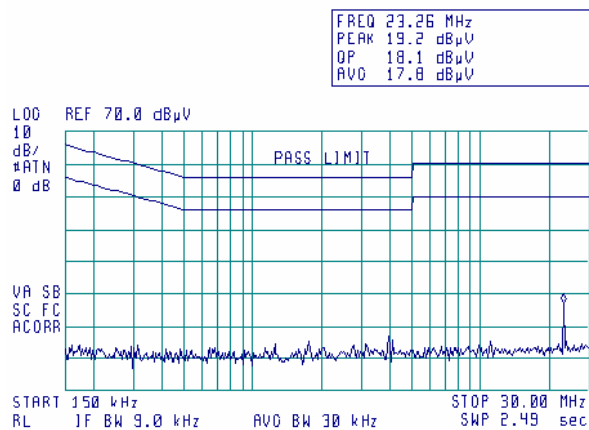


Test specification:		FCC Part 15, Section 207 / RSS-210, Section 6.6, Conducted emission	
Test procedure:		ANSI C63.4, Section 13.1.3 / RSS-212, Section 5.0	
Test mode:	Compliance	Verdict: PASS	
Date & Time:	2/8/2005 12:54:47 PM		
Temperature: 21°C °C	Air Pressure: 1011 hPa	Relative Humidity: 41% %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.1 Conducted emission measurements according to FCC Part 15, Section 15.207

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

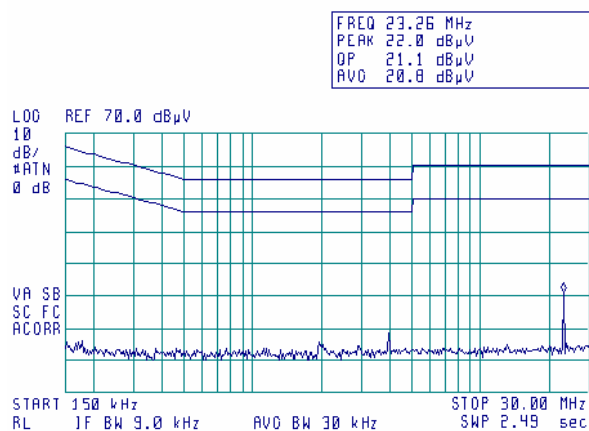
13:35:12 FEB 08, 2005



Plot 7.4.2 Conducted emission measurements according to FCC Part 15, Section 15.207

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

13:48:13 FEB 08, 2005



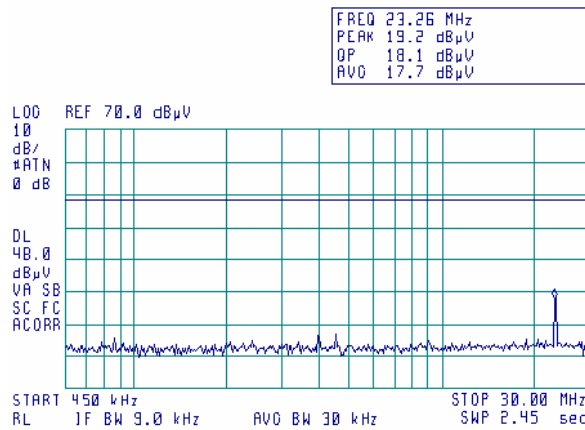


Test specification:		FCC Part 15, Section 207 / RSS-210, Section 6.6, Conducted emission	
Test procedure:		ANSI C63.4, Section 13.1.3 / RSS-212, Section 5.0	
Test mode:	Compliance	Verdict: PASS	
Date & Time:	2/8/2005 12:54:47 PM		
Temperature: 21°C °C	Air Pressure: 1011 hPa	Relative Humidity: 41% %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.3 Conducted emission measurements according to RSS-210, Section 6.6

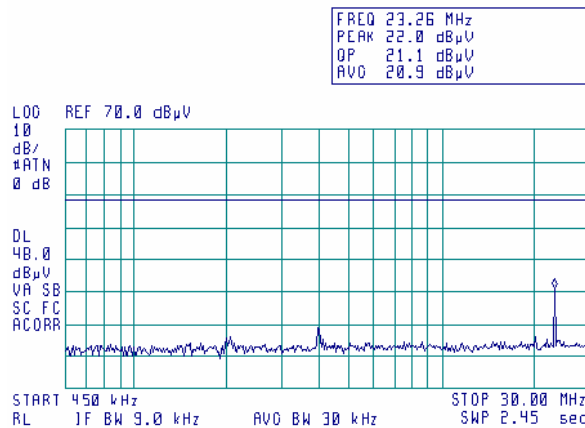
LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK
DETECTOR: PEAK

13:39:57 FEB 08, 2005

**Plot 7.4.4 Conducted emission measurements according to RSS-210, Section 6.6**

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

13:44:53 FEB 08, 2005





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:		8/14/2005 11:26:49 AM	
Temperature: °C	Air Pressure: hPa	Relative Humidity: %	Power Supply: 120 VAC
Remarks:			

7.5 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 7.5.1.

Table 7.5.1 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	



Test specification:	FCC Part 15, Section 107 / RSS-210, Section 7.4 / ICES-003, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3 / RSS-212, Section 5.0 / CISPR 22		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/8/2005 2:16:47 PM		
Temperature: 21°C °C	Air Pressure: 1011 hPa	Relative Humidity: 41% %	Power Supply: 120 VAC
Remarks:			

8 Unintentional emissions

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits according to FCC Part 15, Section 15.107 and ICES-003 are given in Table 8.1.1 and according to RSS-210, Section 6.6 - in Table 8.1.2. The worst test results (the lowest margins) were recorded in Table 8.1.3, Table 8.1.4 and shown in the associated plots.

Table 8.1.1 Limits for conducted emissions according to FCC Part 15, Section 15.107 and ICES-003, Section 5

Frequency, MHz	Class B limit, dB(μV)		Class A limit, dB(μV)	
	QP	AVRG	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*	79	66
0.5 - 5.0	56	46	73	60
5.0 - 30	60	50	73	60

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

Table 8.1.2 Limits for conducted emissions according to RSS-210, Section 7.4

Frequency, MHz	Class A limit, dB(μV)	Class B limit, dB(μV)
	QP	QP
0.45 – 1.705	60	48
1.705 – 30.0	69.5	

8.1.2 Test procedure

8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

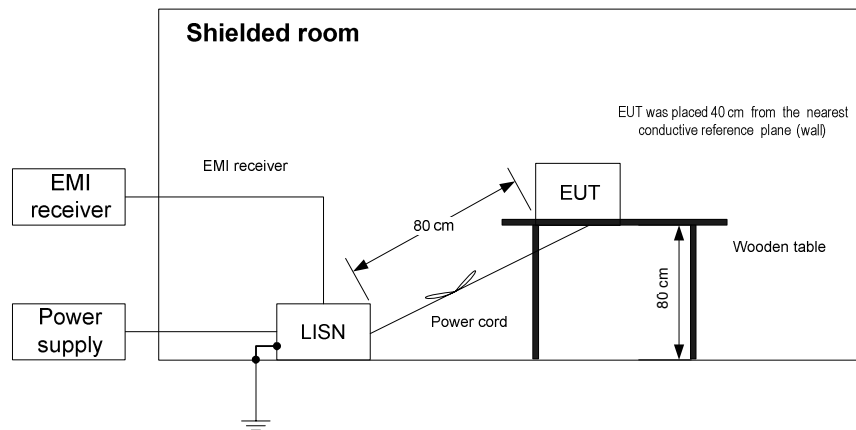
8.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer while unused coaxial connector of the LISN was terminated with 50 Ohm.

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



Test specification:	FCC Part 15, Section 107 / RSS-210, Section 7.4 / ICES-003, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3 / RSS-212, Section 5.0 / CISPR 22		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/8/2005 2:16:47 PM		
Temperature: 21°C °C	Air Pressure: 1011 hPa	Relative Humidity: 41% %	Power Supply: 120 VAC
Remarks:			

Figure 8.1.1 Setup for conducted emission measurements, table-top equipment





Test specification:	FCC Part 15, Section 107 / RSS-210, Section 7.4 / ICES-003, Conducted emission at AC power port			
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3 / RSS-212, Section 5.0 / CISPR 22			
Test mode:	Compliance	Verdict:		PASS
Date & Time:	2/8/2005 2:16:47 PM			
Temperature: 21°C °C	Air Pressure: 1011 hPa	Relative Humidity: 41% %	Power Supply: 120 VAC	
Remarks:				

Table 8.1.3 Conducted emission test results according to FCC Part 15, Section 15.107 and ICES-003, Section 5

LINE: AC mains
 EUT OPERATING MODE: Stand-by and receive
 EUT SET UP: TABLE-TOP
 TEST SITE: SHIELDED ROOM
 FREQUENCY RANGE: 150 kHz - 30 MHz
 RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
23.26	21.3	20.4	60.0	-39.6	20.2	50.0	-29.8	L1	Pass
23.26	23.9	23.4	60.0	-36.6	23.2	50.0	-26.8	L2	Pass

*- Margin = Measured emission - specification limit.

Table 8.1.4 Conducted emission test results according to RSS-210, Section 7.4

LINE: AC mains
 EUT OPERATING MODE: Receive
 EUT SET UP: TABLE-TOP
 TEST SITE: SHIELDED ROOM
 FREQUENCY RANGE: 450 kHz - 30 MHz
 RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
23.26	21.3	20.5	48.0	-27.5	L1	Pass
23.26	24.0	23.4	48.0	-24.6	L2	Pass

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0163	HL 0466	HL 0787	HL 1430	HL 1502	HL 1510		
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Full description is given in Appendix A.

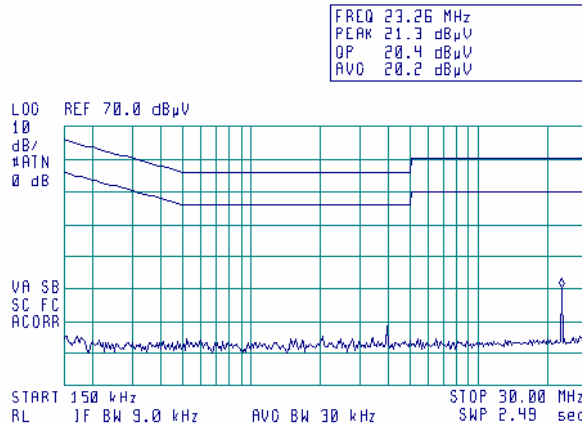


Test specification:	FCC Part 15, Section 107 / RSS-210, Section 7.4 / ICES-003, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3 / RSS-212, Section 5.0 / CISPR 22		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/8/2005 2:16:47 PM		
Temperature: 21°C °C	Air Pressure: 1011 hPa	Relative Humidity: 41% %	Power Supply: 120 VAC
Remarks:			

Plot 8.1.1 Conducted emission measurements according to FCC Part 15, Section 15.107 and ICES-003, Section 5

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

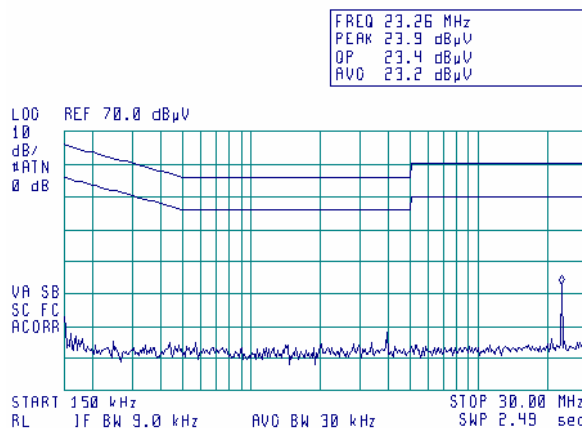
15:10:12 FEB 08, 2005



Plot 8.1.2 Conducted emission measurements according to FCC Part 15, Section 15.107 and ICES-003, Section 5

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

15:02:00 FEB 08, 2005



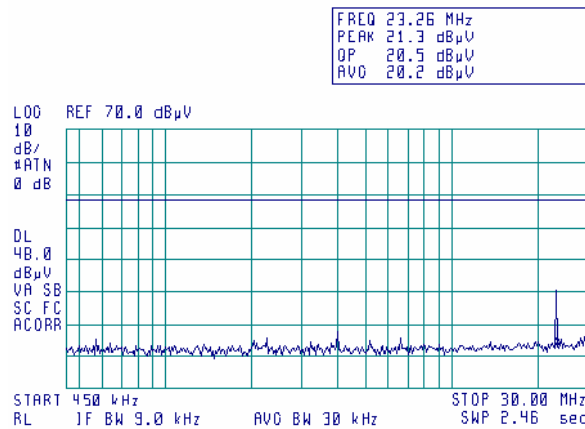


Test specification:	FCC Part 15, Section 107 / RSS-210, Section 7.4 / ICES-003, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3 / RSS-212, Section 5.0 / CISPR 22		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/8/2005 2:16:47 PM		
Temperature: 21°C °C	Air Pressure: 1011 hPa	Relative Humidity: 41% %	Power Supply: 120 VAC
Remarks:			

Plot 8.1.3 Conducted emission measurements according to RSS-210, Section 7.4

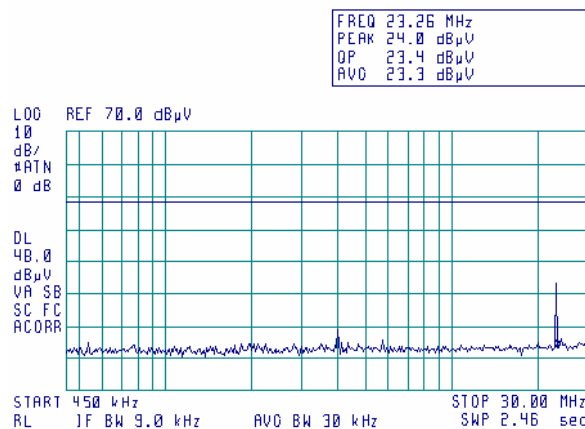
LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Receive
LIMIT: QUASI-PEAK
DETECTOR: PEAK

15:08:18 FEB 08, 2005

**Plot 8.1.4 Conducted emission measurements according to RSS-210, Section 7.4**

LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Receive
LIMIT: QUASI-PEAK
DETECTOR: PEAK

15:06:12 FEB 08, 2005





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:	2/22/2005 9:41:37 AM		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits according to FCC Part 15, Section 15.109 are given in Table 8.2.1, according to ICES-003, Section 5 -in Table 8.2.2 and according to RSS-210, Section 7.3 - in Table 8.2.3.

Table 8.2.1 Radiated emission limits according to FCC Part 15, Section 15.109

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
960 - 5 th harmonic**	43.5*	54.0	49.5	60.0*

Table 8.2.2 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: $\text{Lim}_{S_2} = \text{Lim}_{S_1} + 20 \log(S_1/S_2)$, where S_1 and S_2 – standard defined and test distance respectively in meters.

Table 8.2.3 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 - 3 rd harmonic**	60.0

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

8.2.2 Test procedure for measurements in semi-anechoic chamber

8.2.2.1 The EUT was set up as shown in Figure 8.2.1, energized and the performance check was conducted.

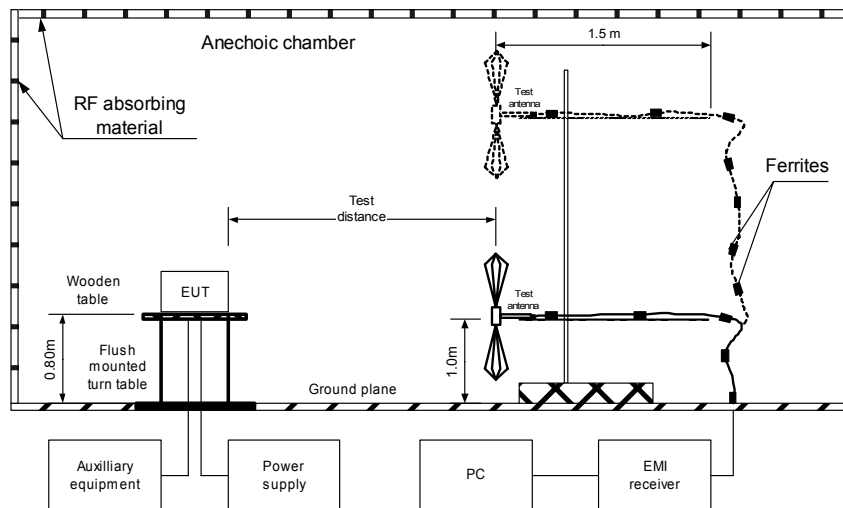
8.2.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position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

8.2.2.3 The worst test results (the lowest margins) were 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:		Verdict: PASS	
Compliance			
Date & Time:		2/22/2005 9:41:37 AM	
Temperature: 23 °C		Air Pressure: 1015 hPa	Relative Humidity: 43 %
		Power Supply: 120 VAC	
Remarks:			

Figure 8.2.1 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:	2/22/2005 9:41:37 AM		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Table 8.2.4 Radiated emission test results according to FCC Part 15, Section 15.109

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Stand-by and Receive
TEST SITE: 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 emissions were found								Pass

TEST SITE: ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 1000 MHz – 2000 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 emissions were found								Pass

Table 8.2.5 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: ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz		Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
Peak emission, dB(μV/m)	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.



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:	2/22/2005 9:41:37 AM		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Table 8.2.6 Radiated emission test results according to RSS-210, Section 7.3

EUT SET UP: TABLE-TOP
EUT OPERATING MODE: Receive
TEST SITE: 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 emissions were found								Pass

TEST SITE: ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 1000 MHz – 2000 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 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 0566	HL 0569	HL 0592	HL 0593	HL 0594	HL 1425	HL 1553
HL 1566	HL 1947	HL 1984	HL 2109				

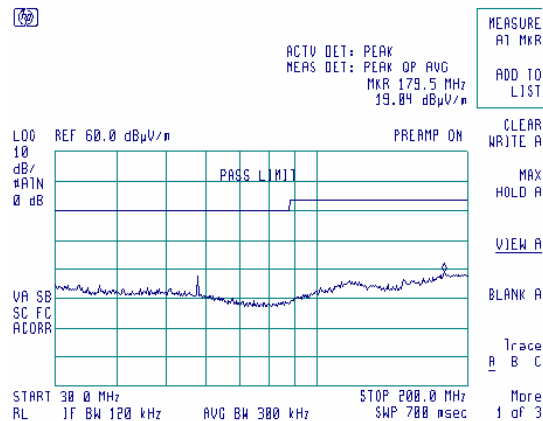
Full description is given in Appendix A.



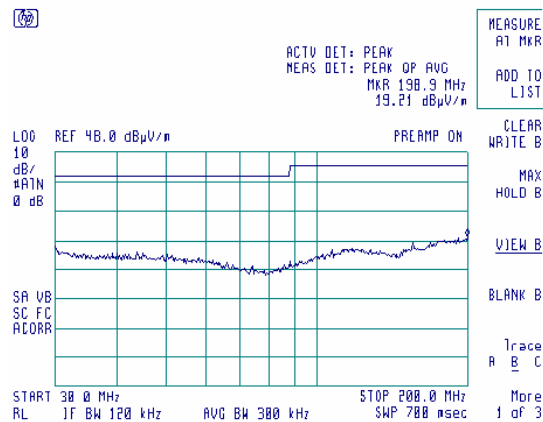
Test specification:	FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	Verdict: PASS	
Date & Time:	2/22/2005 9:41:37 AM		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 8.2.1 Radiated emission measurements in 30- 200 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by

**Plot 8.2.2 Radiated emission measurements in 30- 200 MHz range, horizontal antenna polarization**

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by

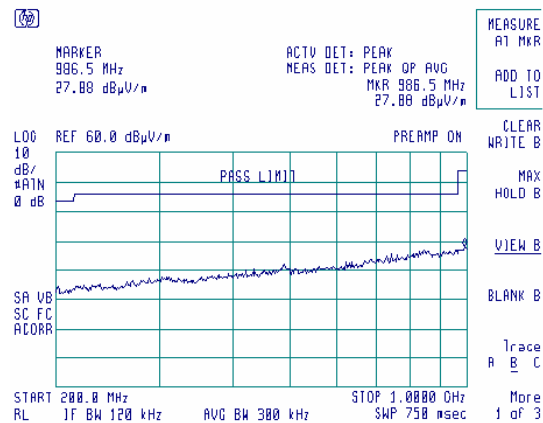




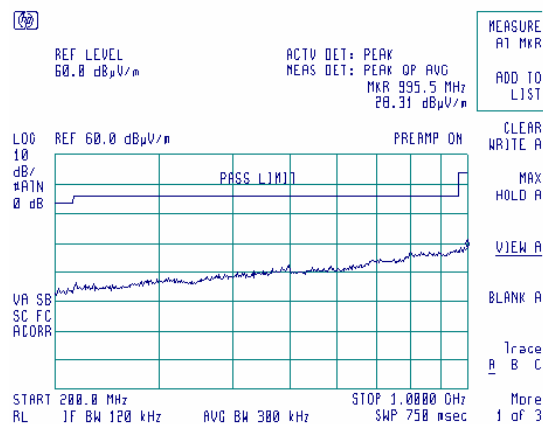
Test specification:	FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/22/2005 9:41:37 AM		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 8.2.3 Radiated emission measurements in 200- 1000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by

**Plot 8.2.4 Radiated emission measurements in 200- 1000 MHz range, horizontal antenna polarization**

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by

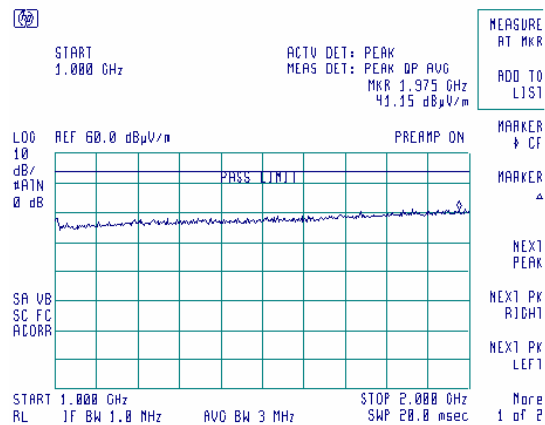




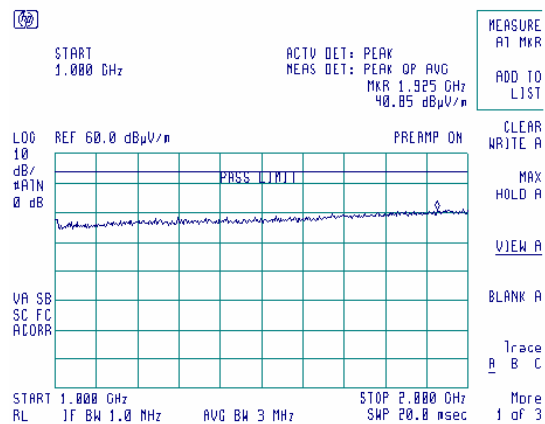
Test specification:	FCC Part 15, Section 109 / RSS-210, Section 7.3 / ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-212, Section 3.0 / CISPR 22		
Test mode:	Compliance	Verdict: PASS	
Date & Time:	2/22/2005 9:41:37 AM		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 8.2.5 Radiated emission measurements above 1000 MHz, vertical antenna polarization

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by

**Plot 8.2.6 Radiated emission measurements above 1000 MHz, horizontal antenna polarization**

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by



**9 APPENDIX A Test equipment and ancillaries used for tests**

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0034	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1988	12-Jan-05	12-Jan-06
0163	LISN FCC/VDE/MIL-STD	Electro-Metrics	ANS 25/2	1314	01-Oct-04	01-Oct-05
0415	Cable, Coax, RF, RG-214	HL	CC-3	056	02-Dec-04	02-Dec-05
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-04	28-Jun-05
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	HL	AC - 1	023	10-Oct-04	10-Oct-05
0466	Shielded Room 3(L) x 3(W) x 2.4(H) m	HL	SR - 1	024	28-Jun-04	28-Jun-07
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	26-Sep-04	26-Sep-05
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	18-May-05	18-May-06
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	03-Feb-05	03-Feb-06
0594	Turn Table FOR ANECHOIC CHAMBER flush mount d=1.2 m Pneumatic	HL	TT- WDC1	102	27-Jan-05	27-Jan-06
0604	Antenna BiconiLog Log-Periodic/T Bow- TIE 26 - 2000 MHz	EMCO	3141	9611-1011	27-Jan-05	27-Jan-06
0787	Transient Limiter	Hewlett Packard	11947A	3107A018 77	27-Jan-05	27-Jan-06
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	HL	C214-11	148	27-Jan-05	27-Jan-06
0813	Cable Coax, RG-214, 12 m, N-type connectors	HL	C214-12	149	27-Jan-05	27-Jan-06
1004	Cable Coaxial , ANDREW PSWJ4 , 6m	HL	ANDREW -6	163	27-Jan-05	27-Jan-06
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies (HP)	8564EC	3946A002 19	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
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies (HP)	8542E	3807A002 62,3705A0 0217	27-Jan-05	27-Jan-06
1502	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1502	12-Feb-05	12-Feb-06
1510	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1510	27-Jan-05	27-Jan-06
1552	Cable RF, 8 m	Alpha Wire	RG-214	1552	27-Jan-05	27-Jan-06
1553	Cable RF, 3.5 m	Alpha Wire	RG-214	1553	27-Jan-05	27-Jan-06
1562	Oscilloscope 100 MHz, DMM	Tektronix	THS720A	B039444	27-Jan-05	27-Jan-06
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	27-Jan-05	27-Jan-06
1942	Cable 18GHz, 4 m, blue	Rhophase Microwave Limited	SPS- 1803A- 4000-NPS	T4658	27-Jan-05	27-Jan-06



HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	27-Jan-05	27-Jan-06
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	22-Mar-05	22-Mar-06
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	27-Jan-05	27-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
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	12-Dec-04	12-Dec-05

**10 APPENDIX B Measurement uncertainties****Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements**

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
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.



11 APPENDIX C Test facility description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

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Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

47CFR part 15: 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: 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.
RSS-210 Issue 6: 2005	Low Power Licence- Exempt Radiocommunication Devices (All frequency bands), Category I Equipment
RSS-Gen Issue 1:2005	General Requirements and Information for the Certification of Radiocommunication Equipment
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



13 APPENDIX E Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	decibel referred to one microampere
dB Ω	decibel referred to one Ohm
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
ITE	information technology equipment
k	kilo
kHz	kilohertz
LISN	line impedance stabilization network
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
PCB	printed circuit board
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere
WB	wideband

14 APPENDIX F Test equipment correction factors

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

Frequency, MHz	Correction factor, dB	Frequency, MHz	Correction factor, dB
0.01	4.7	3	0.1
0.02	2.1	4	0.1
0.03	1.1	6	0.1
0.04	0.7	10	0.1
0.05	0.5	12	0.1
0.1	0.2	16	0.1
0.2	0.1	18	0.1
0.4	0.1	20	0.1
0.6	0.1	25	0.1
0.8	0.1	28	0.1
1	0.1	30	0.1
2	0.1		

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

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

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

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



Antenna factor
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.1988, HL 0034

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

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



Antenna factor
Biconical antenna
Electro-Metrics, model BIA-25/30
Ser.No.3566, HL 0566

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
30	14.7	120	16.8
35	12.9	125	15.5
40	12.6	130	15.5
45	12.8	135	15.1
50	12.6	140	14.8
55	11.8	145	15.1
60	11.7	150	16.9
65	10.4	155	17.2
70	9.2	160	17.3
75	9.1	165	17.8
80	9.1	170	18.3
85	9.5	175	19.0
90	11.2	180	19.5
95	12.6	185	20.0
100	13.7	190	20.4
105	14.2	195	20.5
110	15.3	200	20.6
115	17.1		

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

Antenna factor
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.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(μ V) to convert it into field intensity in dB(μ V/m).



Antenna factor
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604

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

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



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

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

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



Cable loss
Cable Coaxial, RG-58/RG-214, s/n 056, HL 0415
+ Cable Coaxial, RG-214, 11.5m, s/n 148, HL 0812

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



Cable loss
Cable RG-214, HL 0813

No.	Frequency, MHz	Cable loss, dB
1	10	0.15
2	20	0.40
3	30	0.51
4	40	0.61
5	50	0.68
6	60	0.76
7	70	0.80
8	80	0.92
9	90	0.96
10	100	0.99
11	200	1.60
12	300	1.85
13	400	2.25
14	500	2.43
15	600	2.80
16	700	3.14
17	800	3.34
18	900	3.75
19	1000	4.05
20	1200	4.41
21	1400	4.81
22	1600	5.18
23	1800	5.58
24	2000	6.09
25	2500	7.27
26	2900	8.01



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		± 0.17
19	3600	3.62		
20	3900	3.84		
21	4200	3.92		
22	4500	4.07		
23	4800	4.36		
24	5100	4.62		
25	5400	4.78		
26	5700	5.16		
27	6000	5.67		
28	6500	5.99		



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

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

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

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



Cable loss
RF cable 8 m, model RG-214-8m, HL 1552

No.	Frequency, MHz	Cable loss, dB	Measurement uncertainty, dB	Notes
1	0.010	0.01	±0.05	
2	0.1	0.01		
3	1	0.03		
4	10	0.12		
5	20	0.23		
6	30	0.30		
7	40	0.32		
8	50	0.34		
9	60	0.39		
10	70	0.43		
11	80	0.48		
12	90	0.50		
13	100	0.55		
14	200	0.78		
15	300	1.04		
16	400	1.16		
17	500	1.33		
18	600	1.51		
19	700	1.65		
20	800	1.77		
21	900	1.92		
22	1000	2.04		
23	1200	2.26		
24	1400	2.49		
25	1600	2.74		
26	1800	2.94		
27	2000	3.18		
28	2500	3.65		
29	2900	4.08		



Cable loss
RF cable 3.5 m, Alpha Wire, model RG-214, S/N 149, HL 1553

No.	Frequency, MHz	Cable loss, dB	Measurement uncertainty, dB
1	1	0.01	±0.05
2	10	0.07	
3	30	0.12	
4	50	0.22	
5	100	0.26	
6	200	0.40	
7	300	0.52	
8	400	0.60	
9	500	0.70	
10	600	0.77	
11	700	0.84	
12	800	1.00	
13	900	1.00	
14	1000	1.05	
15	2000	1.70	



Cable loss
Cable RF, 2m, model: Sucoflex 104PE, S/N 13094/4PE, HL 1566

No.	Frequency, MHz	Cable loss, dB	Tolerance, dB	Measurement uncertainty, dB
1	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	4500	1.63		
15	5000	1.66	≤ 5.0	± 0.17
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	≤ 5.0	± 0.26
30	12500	3.20		
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 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		