HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC 47 CFR PART 15 subpart C, section 15.249 and subpart B

FOR:

Essence Security International Ltd.

Wireless Control Panel

Model: EverGuard

Model number: ES7000EG
FCC ID:YXG-ES7000EG

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.

Table of contents

1 Applicant information

Client name:	Essence Security International Ltd.
Address:	12 Abba Edan avenue, Ackerstein Tower Bldg. D, P.O.Box 2073, Herzliya 46120, Israel
Telephone:	+972 7324 47718
Fax:	+972 7329 03064
E-mail:	eitanch@essencesecurity.com
Contact name:	Mr. Eitan Chalfon

2 Equipment under test attributes

Product name:	Wireless control panel
Product type:	Transceiver
Model:	EverGuard
Model number:	ES7000EG
Hardware version:	4b
Software release:	14_2_101_3_3
Receipt date	11/22/2011

3 Manufacturer information

Manufacturer name:	Essence Security International Ltd.
Address:	12 Abba Edan avenue, Ackerstein Tower Bldg. D, P.O.Box 2073, Herzliya 46120, Israel
Telephone:	+972 7324 47718
Fax:	+972 7329 03064
E-Mail:	eitanch@essencesecurity.com
Contact name:	Mr. Eitan Chalfon

4 Test details

Project ID:	22706
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	11/22/2011
Test completed:	11/23/2011
Test specification(s):	FCC 47 CFR Part 15, subpart C, §15.249; subpart B §§15.107, 15.109

5 Tests summary

Test	Status
Transmitter characteristics	
Section 15.249(a)(d), Field strength of emissions	Pass
Section 15.249(d), Band edge emissions	Pass
Section 15.207(a), Conducted emission	Pass
Section 15.203, Antenna requirement	Pass
Section 15.215(c), Occupied bandwidth	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Pass
Section 15.109, Radiated emission	Pass

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. S. Samokha, test engineer	November 23, 2011	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	December 7, 2011	
Approved by:	Mr. M. Nikishin, EMC and radio group manager	December 27, 2011	

6 EUT description

6.1 General information

The EUT, ES7000EG, is a two-way, wireless control panel. This device receives Radio Frequency (RF) signals from a full array of sensors and detectors, remote access devices and interface devices, such as a keyfob and keypad. It also transmits bi-directional RF signals to these units providing supervision, re-configuration, control and more.

The EUT comprises a GSM module manufactured by Motorola, approved by FCC for modular approval, FCC ID:IHDT56HQ1.

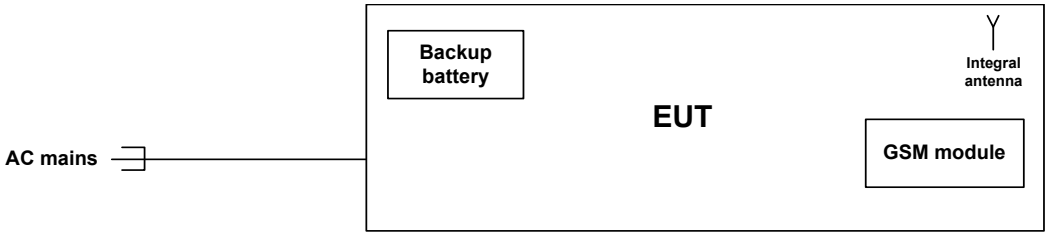
6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length
Power	AC power	EUT	AC mains	1	Unshielded	1.5 m

6.3 Changes made in EUT

No changes were performed in the EUT.

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
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 ranges	902 – 928 MHz
Operating frequencies	916. 5 MHz
Maximum field strength of carrier	86.9 dBµV/m at 3 m distance

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
Integral	Essence Security	Built-in wire antenna	NA

Transmitter aggregate data rate/s	38.4 kbps
Type of modulation	2FSK
Modulating test signal (baseband)	PRBS

Transmitter power source					
	Battery	**Nominal rated voltage**		Battery type	Lithium
	DC	**Nominal rated voltage**			
X	AC mains	**Nominal rated voltage**	120 AC	Frequency	

Common power source for transmitter and receiver	X yes	no

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

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

7.1 Field strength of emissions

7.1.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.1.1, Table 7.1.2 and Table 7.1.3.

Table 7.1.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)		
	Peak	Average	Quasi-Peak
902 – 928	NA	NA	94

Table 7.1.2 Harmonics limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
902 – 928	74.0	54.0

Table 7.1.3 Radiated spurious emissions limits (other than harmonics)

Frequency, MHz	Field strength at 3 m, dB(μV/m)*			
	Peak	Quasi Peak	Average	Attenuation below carrier
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	50 dBc (whichever is the less stringent)
0.090 – 0.110	NA	108.5 – 106.8**	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**	
0.490 – 1.705	NA	73.8 – 63.0**	NA	
1.705 – 30.0*		69.5		
30 – 88		40.0		
88 – 216		43.5		
216 – 960		46.0		
960 - 1000		54.0		
Above 1000	74.0	NA	54.0	

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

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

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

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

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

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

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

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

7.1.2.2 The measurements were performed in typical position.

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

7.1.2.4 The worst test results (the lowest margins) were recorded in the associated tables and shown in the associated plots.

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

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

7.1.3.2 The measurements were performed in typical position.

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

7.1.3.4 The worst test results (the lowest margins) were recorded in the associated tables and shown in the associated plots

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

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

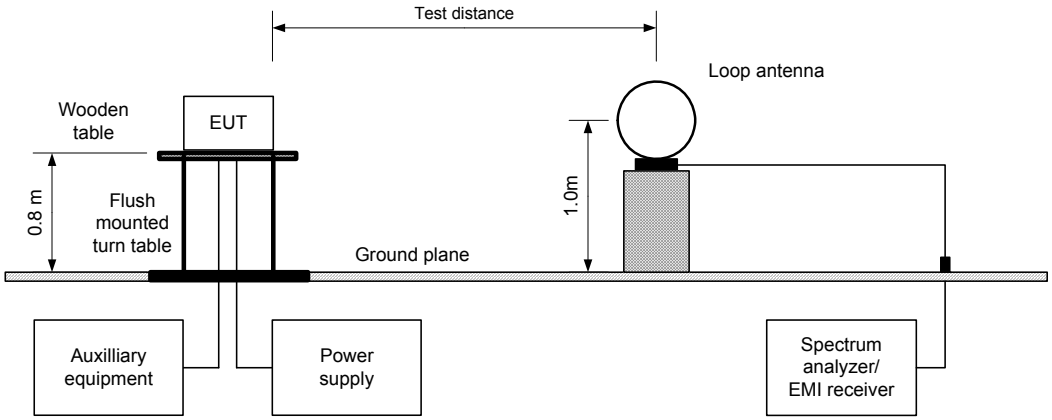
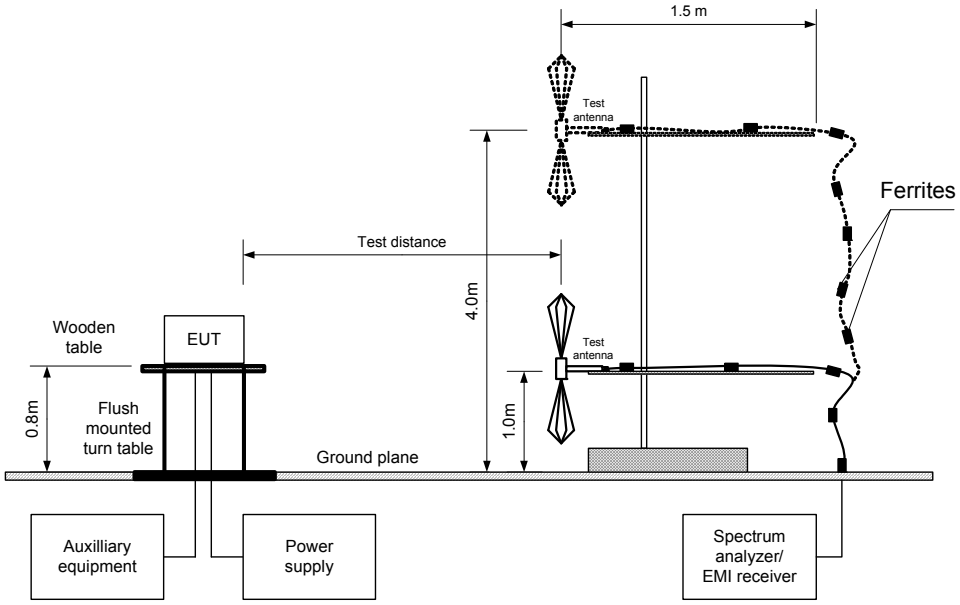


Figure 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

Table 7.1.4 Field strength of fundamental emission and spurious emissions

ASSIGNED FREQUENCY RANGE:	902.0 - 928.0 MHz
TEST DISTANCE:	3 m
EUT POSITION:	Vertical (Typical)
MODULATION:	2FSK
MODULATING SIGNAL:	ID code
BIT RAFE:	38.4 kbps
DUTY CYCLE:	100%
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 9500 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1.0 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)

Fundamental emission

Frequency, MHz	Antenna		Azimuth, degrees*	Peak emission, dB(μV/m)	Quasi-peak			Verdict
	Pol.	Height, m			Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
916.5	Vert	1.0	0	86.9	86.8	94.0	-7.2	Pass
916.5	Hor	1.8	29	86.6	86.5	94.0	-7.5	Pass

Spurious emissions

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength			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**	
5499.025	Vert	1.0	315	50.38	74.0	-23.62	45.75	54.0	-8.25	Pass

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

Test specification:	**Section 15.249(a)(d), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	**Air Pressure:** 1023 hPa	**Relative Humidity:** 45 %	**Power Supply:** 120VAC
Remarks:			

Table 7.1.5 Field strength of spurious emissions below 1 GHz

ASSIGNED FREQUENCY RANGE:	902.0 - 928.0 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
TEST DISTANCE:	3 m
MODULATION:	2FSK
MODULATING SIGNAL:	ID code
BIT RATE:	38.4 kbps
DUTY CYCLE:	100%
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
RESOLUTION BANDWIDTH:	120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	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*				
42.87500	34.8	29.5	40.0	-10.50	Vert	1.0	337	Pass
196.61075	32.2	30.7	43.5	-12.80	Hor	1.3	0	
258.04450	33.2	28.9	46.0	-17.10	Hor	1.0	0	
294.91200	34.2	32.1	46.0	-13.90	Vert	1.5	299	

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

Reference numbers of test equipment used

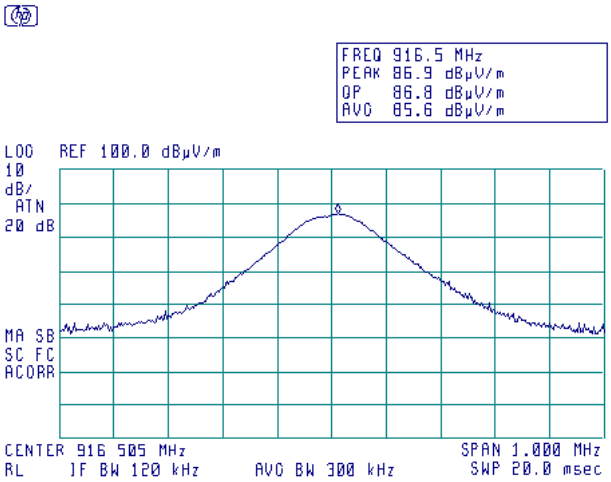
HL 0446	HL 0521	HL 0604	HL 2432	HL 2871	HL 2882	HL 2909	HL 3531
HL 3533	HL 3623	HL 4114					

Full description is given in Appendix A.

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

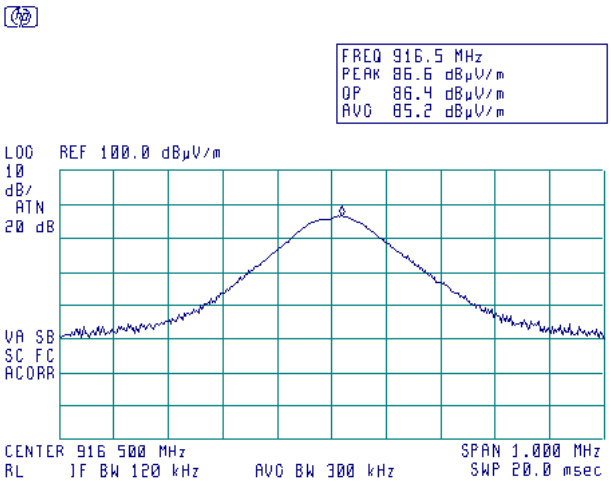
Plot 7.1.1 Radiated emission measurements at the fundamental frequency

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



Plot 7.1.2 Radiated emission measurements at the fundamental frequency

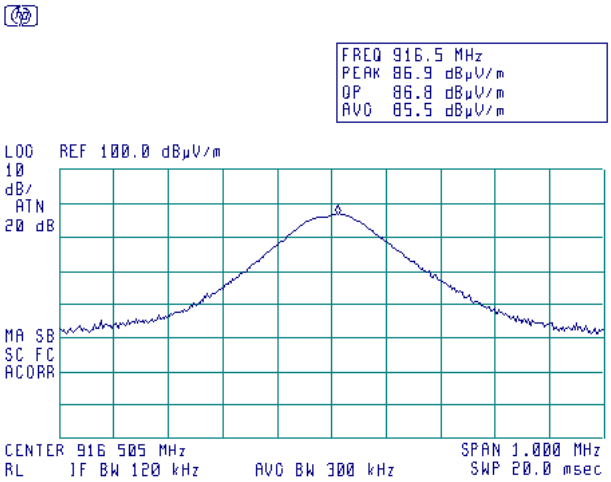
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: Unom



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

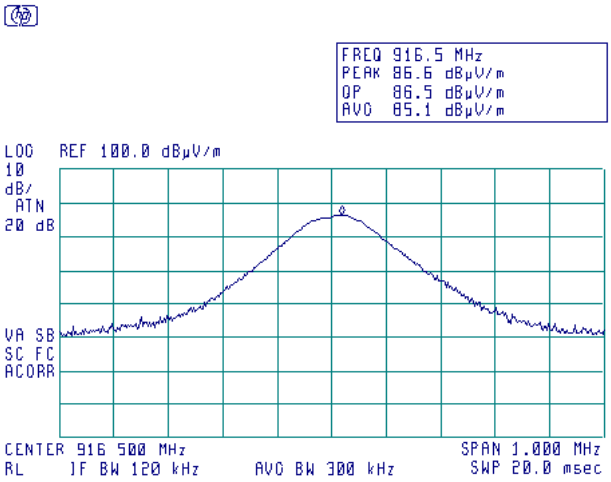
Plot 7.1.3 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: 115%Unom



Plot 7.1.4 Radiated emission measurements at the fundamental frequency

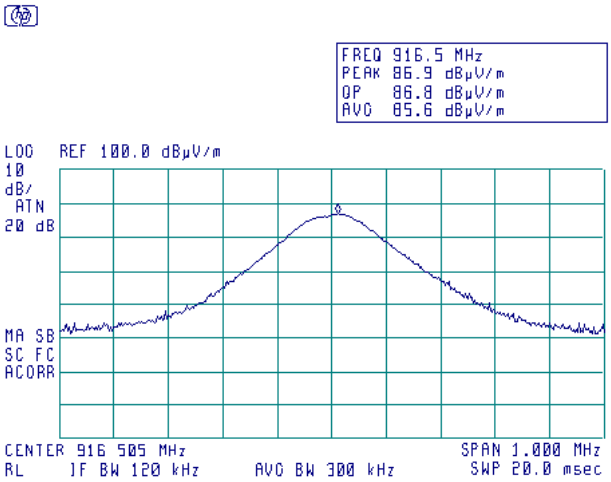
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: 115%Unom



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

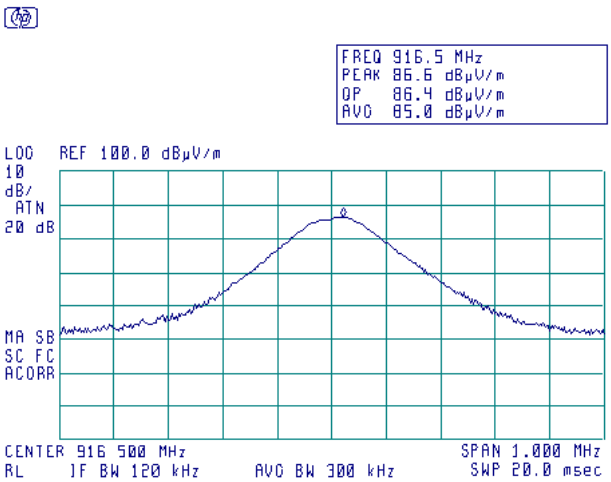
Plot 7.1.5 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: 85%Unom



Plot 7.1.6 Radiated emission measurements at the fundamental frequency

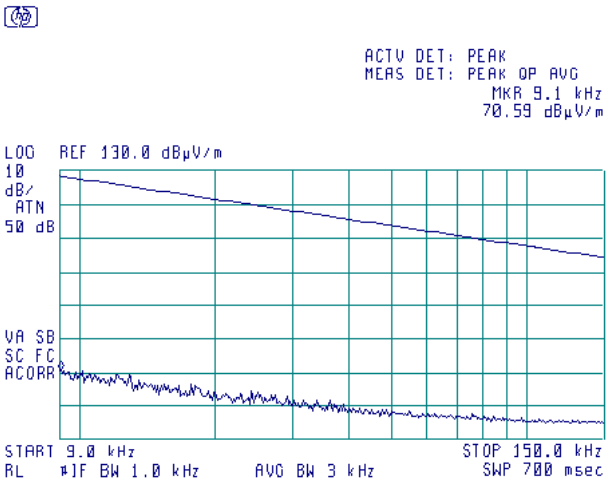
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: 85%Unom



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

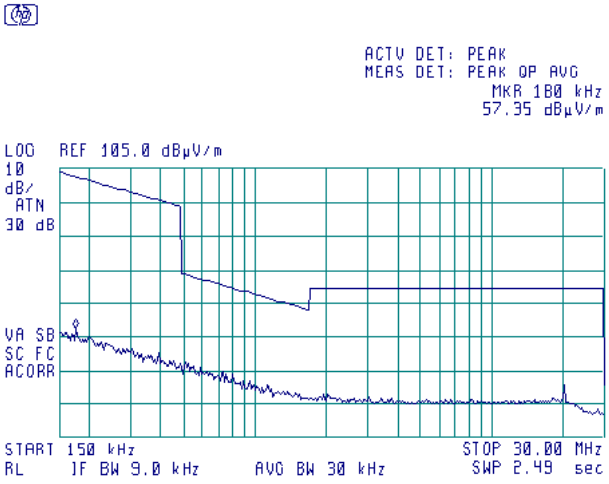
Plot 7.1.7 Radiated emission measurements from 9 to 150 kHz

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



Plot 7.1.8 Radiated emission measurements from 0.15 to 30 MHz

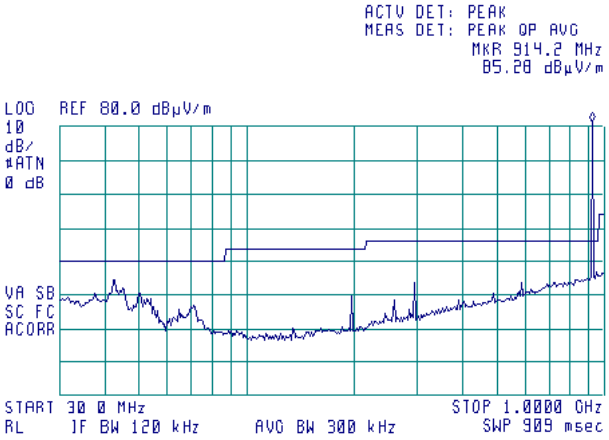
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

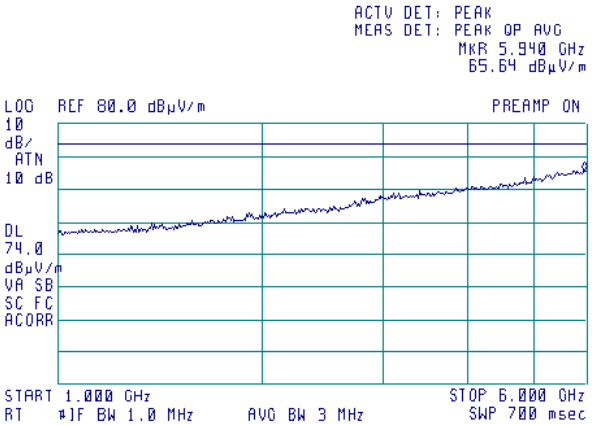
Plot 7.1.9 Radiated emission measurements from 30 to 1000 MHz

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

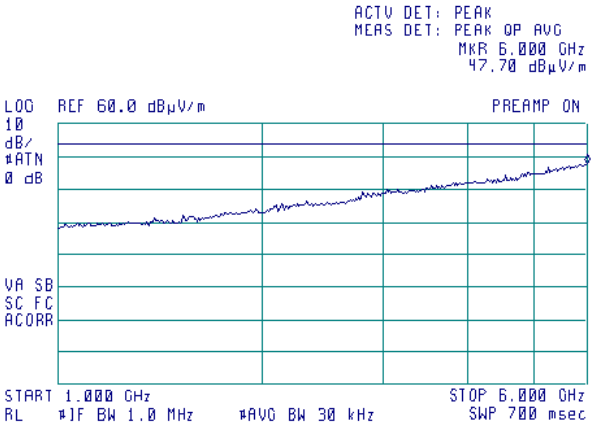


Plot 7.1.10 Radiated emission measurements from 1.0 to 6.0 GHz

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



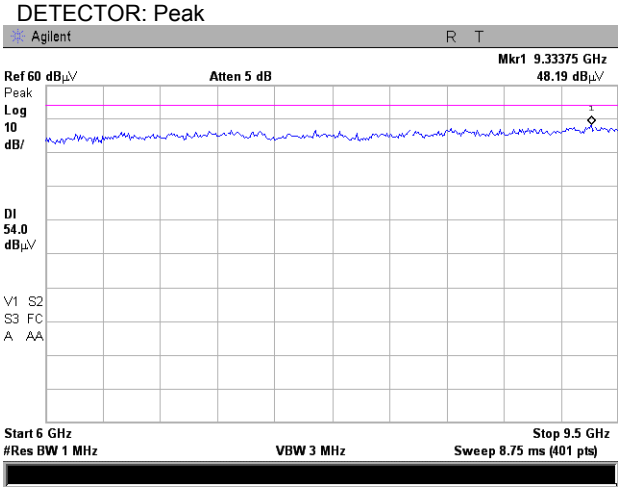
DETECTOR: Average



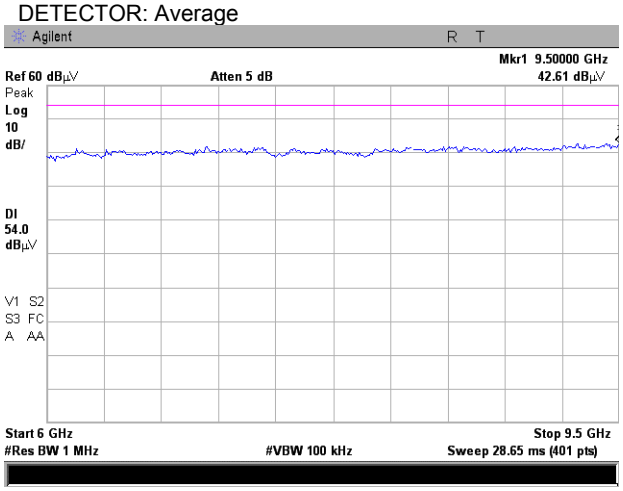
Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

Plot 7.1.11 Radiated emission measurements from 6.0 to 9.5 GHz

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



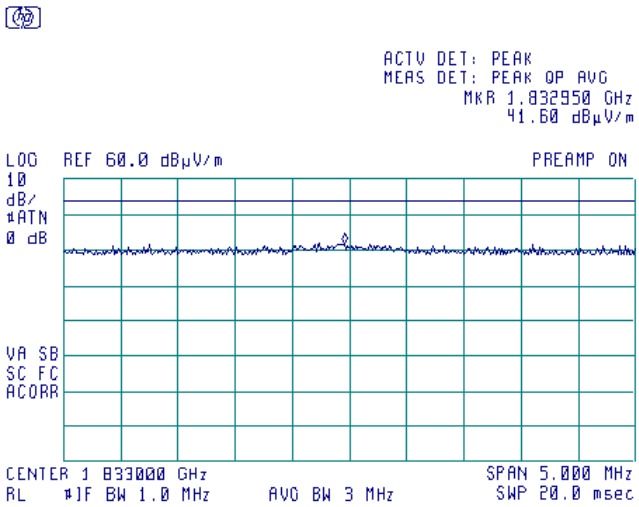
DETECTOR: Average



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

Plot 7.1.12 Radiated emission measurements at the second harmonic frequency

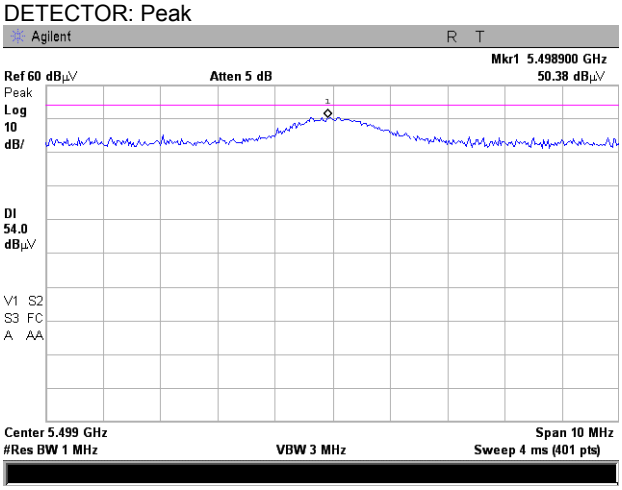
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Vertical)



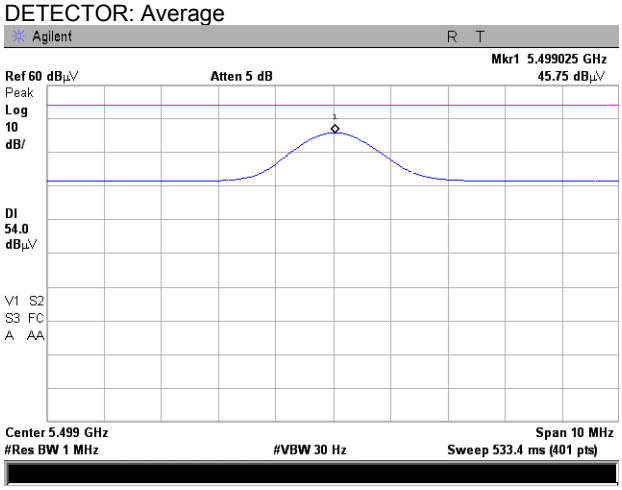
Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011 - 11/23/2011		
Temperature: 23.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

Plot 7.1.13 Radiated emission measurements at the sixth harmonic frequency

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

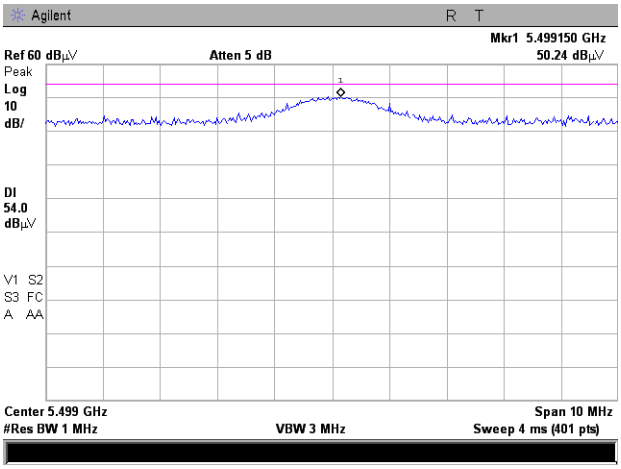


DETECTOR: Average

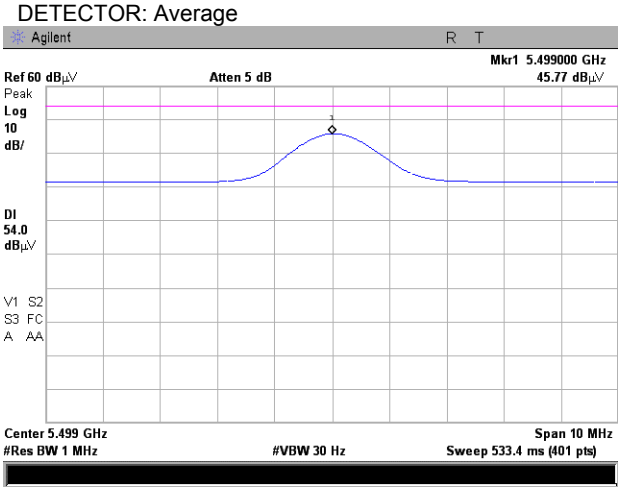


Plot 7.1.14 Radiated emission measurements at the sixth harmonic frequency

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



DETECTOR: Average



Test specification:	Section 15.249(d), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011		
Temperature: 22.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

7.2 Band edge emission

7.2.1 General

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

Table 7.2.1 Band edge emission limits

Frequency band, MHz	Field strength limit at 3 m, dBµV/m		Attenuation below carrier, dBc
	Peak	Average	
902.0 – 928.0	74.0	54.0	50

7.2.2 Test procedure

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

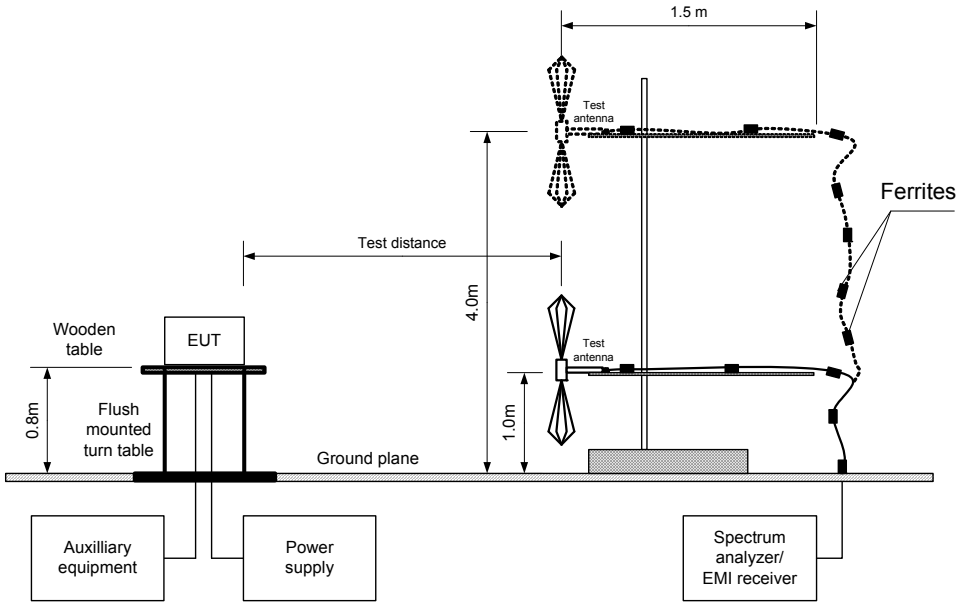
7.2.2.2 The spectrum analyzer frequency span was set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

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

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

Test specification:	Section 15.249(d), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011		
Temperature: 22.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

Figure 7.2.1 Band edge emission measurement set up



Test specification:	**Section 15.249(d), Band edge emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	11/22/2011		
Temperature: 22.1 ºC	**Air Pressure:** 1023 hPa	**Relative Humidity:** 45 %	**Power Supply:** 120VAC
Remarks:			

Table 7.2.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902.0 – 928.0 MHz
DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 120 kHz
VIDEO BANDWIDTH: 300 kHz
MODULATION: 2FSK
MODULATING SIGNAL: ID code
BIT RATE: 38.4 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Modulation envelope		Band edge limit, MHz	Margin, MHz**	Verdict
Edge	Frequency, MHz*			
Low	916.163	902.0	-14.16	Pass
High	916.838	928.0	11.16	Pass

* - Measured frequency beyond which the emission dropped below the general field strength limit
** - Margin = Band edge limit – Band edge frequency

Reference numbers of test equipment used

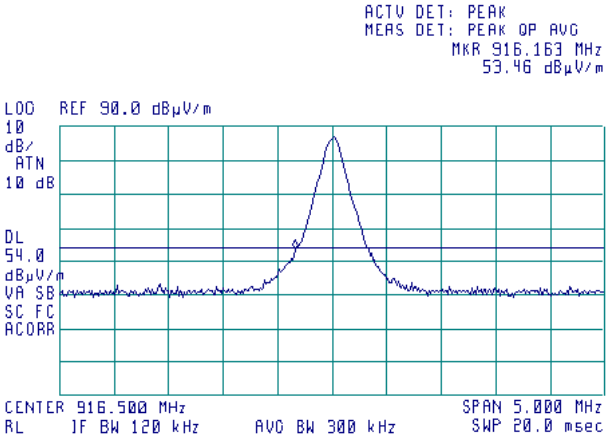
HL 0521	HL 0604	HL 2871	HL 3623				

Full description is given in Appendix A.

Test specification:	Section 15.249(d), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011		
Temperature: 22.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

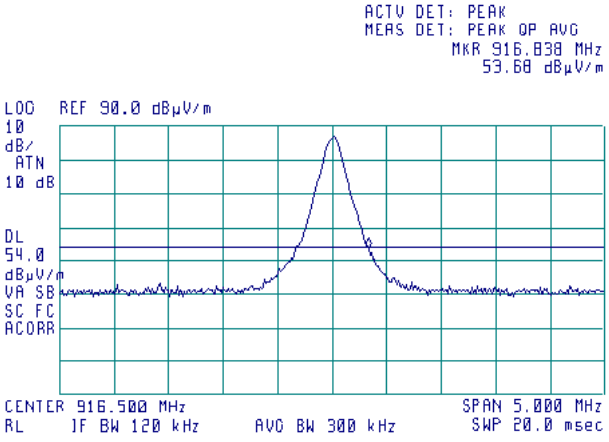
Plot 7.2.1 Low band edge emission test result

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



Plot 7.2.2 High band edge emission test result

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



Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/23/2011		
Temperature: 22.8 ºC	Air Pressure: 1023 hPa	Relative Humidity: 44 %	Power Supply: 120VAC
Remarks:			

7.3 Conducted emissions

7.3.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Limits for conducted emissions

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.

7.3.2 Test procedure

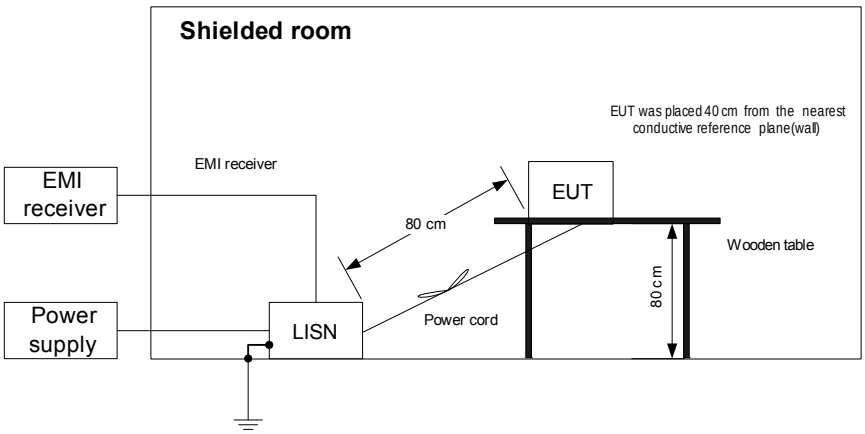
7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

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

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

7.3.2.4 The worst test results (the lowest margins) were recorded in Table 7.3.2 and shown in the associated plots.

Figure 7.3.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**Section 15.207(a), Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	11/23/2011		
Temperature: 22.8 ºC	**Air Pressure:** 1023 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120VAC
Remarks:			

Table 7.3.2 Conducted emission test results

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

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.204235	54.82	50.76	63.49	-12.73	47.47	53.49	-6.02	L1	Pass
0.552650	47.35	46.05	56.00	-9.95	35.73	46.00	-10.27		
0.995875	46.56	44.62	56.00	-11.38	28.23	46.00	-17.77		
1.403275	47.67	45.87	56.00	-10.13	32.99	46.00	-13.01		
2.246575	50.88	46.51	56.00	-9.49	33.19	46.00	-12.81		
2.597500	52.74	49.73	56.00	-6.27	37.36	46.00	-8.64		
0.203800	55.10	54.35	63.51	-9.16	51.02	53.51	-2.49	L2	Pass
0.978350	47.97	46.45	56.00	-9.55	28.10	46.00	-17.90		
1.255000	47.93	46.08	56.00	-9.92	31.37	46.00	-14.63		
1.653375	48.15	46.32	56.00	-9.68	33.04	46.00	-12.96		
2.159000	50.57	47.30	56.00	-8.70	32.52	46.00	-13.48		
2.517140	54.10	51.32	56.00	-4.68	37.74	46.00	-8.26		

*- Margin = Measured emission – specification limit.

Reference numbers of test equipment used

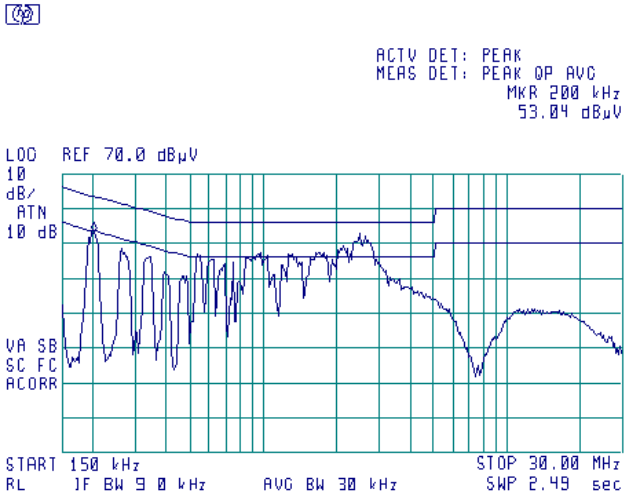
HL 0447	HL 0787	HL 1425	HL 1513	HL 3612			

Full description is given in Appendix A.

Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/23/2011		
Temperature: 22.8 ºC	Air Pressure: 1023 hPa	Relative Humidity: 44 %	Power Supply: 120VAC
Remarks:			

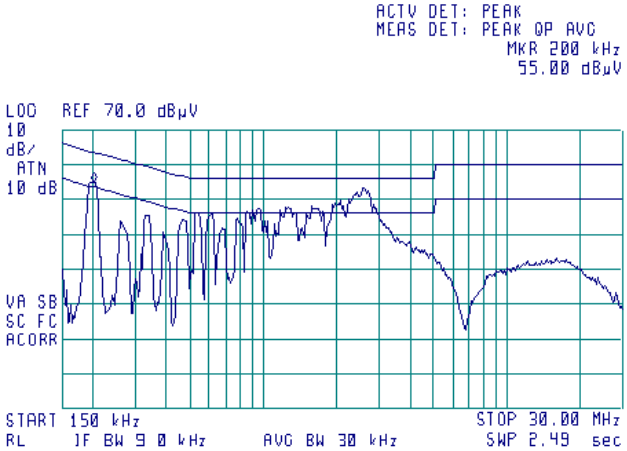
Plot 7.3.1 Conducted emission measurements

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



Plot 7.3.2 Conducted emission measurements

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



Test specification:	Section 15.203, Antenna requirement		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/23/2011		
Temperature: 22.8 ºC	Air Pressure: 1023 hPa	Relative Humidity: 44 %	Power Supply: 120VAC
Remarks:			

7.4 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.4.1.

Table 7.4.1 Antenna requirements

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

Photograph 7.4.1 Antenna assembly

Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011		
Temperature: 22.1 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120BAC
Remarks:			

7.5 Occupied bandwidth test

7.5.1 General

This test was performed to verify that the 20 dB bandwidth of the emissions was contained within the standard specified frequency band according to FCC §15.215 requirements. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc
902 – 928	**20.0**
2400 – 2483.5	
5725 – 5875	
24000 – 24250	

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

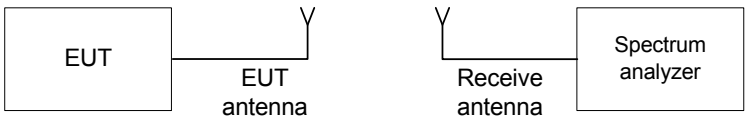
7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

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

7.5.2.3 The peak of emission was measured. The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.5.2 and the associated plot.

Figure 7.5.1 Occupied bandwidth test setup



Test specification:	**Section 15.215(c), Occupied bandwidth**		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	11/22/2011		
Temperature: 22.1 ºC	**Air Pressure:** 1023 hPa	**Relative Humidity:** 45 %	**Power Supply:** 120BAC
Remarks:			

Table 7.5.2 Occupied bandwidth test results

ASSIGNED FREQUENCY BAND	902.0 – 928.0 MHz
DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	10 kHz
VIDEO BANDWIDTH:	30 kHz
MODULATION ENVELOPE REFERENCE POINTS:	20 dBc
MODULATION:	2FSK
MODULATING SIGNAL:	Enable

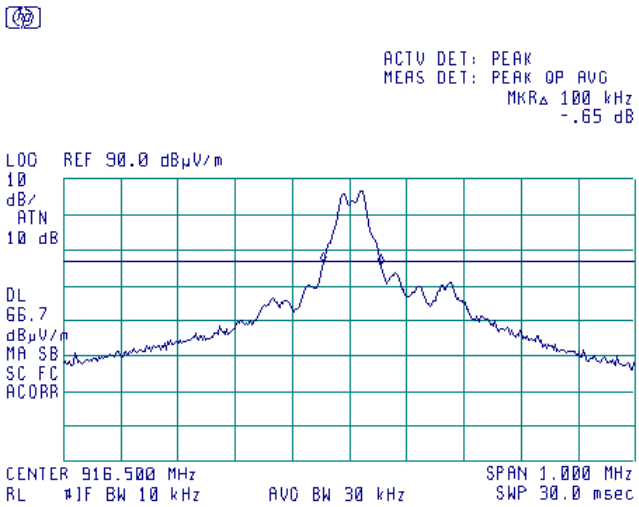
Frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
916.5	100.0	NA	NA	Pass

Reference numbers of test equipment used

HL 0521	HL 0604	HL 2871	HL 3623					

Full description is given in Appendix A.

Plot 7.5.1 Occupied bandwidth test result



Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/23/2011		
Temperature: 22.8 ºC	Air Pressure: 1023 hPa	Relative Humidity: 44 %	Power Supply: 120VAC
Remarks:			

8 Emission tests according to 47CFR part 15 subpart B requirements

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits are given in Table 8.1.1.

Table 8.1.1 Limits for conducted emissions

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

20 The limit decreases linearly with the logarithm of frequency.

8.1.2 Test procedure

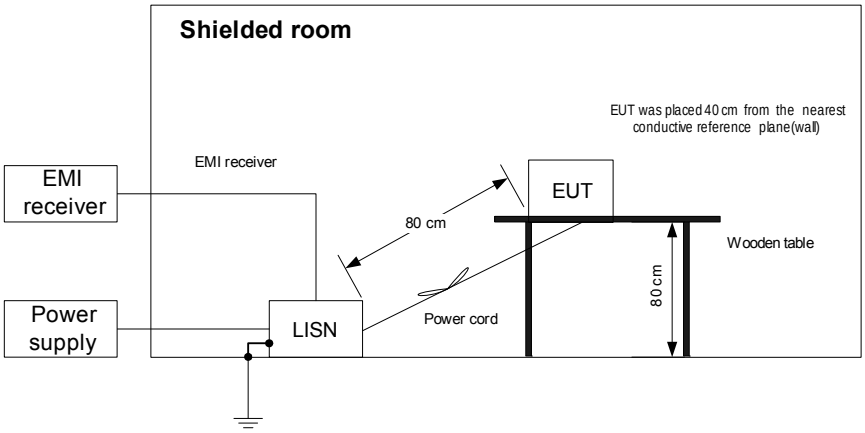
8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

8.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 8.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

8.1.2.4 The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

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



Test specification:	**Section 15.107, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	11/23/2011		
Temperature: 22.8 ºC	**Air Pressure:** 1023 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120VAC
Remarks:			

Table 8.1.2 Conducted emission test results

LINE: AC mains
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz – 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.203475	54.75	53.33	63.52	-10.19	45.66	53.52	-7.86	L1	Pass
0.281250	51.53	50.10	60.84	-10.74	43.73	50.84	-7.11		
0.882810	48.26	46.07	56.00	-9.93	31.30	46.00	-14.70		
1.024735	46.19	43.64	56.00	-12.36	29.13	46.00	-16.87		
2.030500	48.42	45.76	56.00	-10.24	30.82	46.00	-15.18		
2.721475	52.45	47.38	56.00	-8.62	31.69	46.00	-14.31		
0.203650	54.27	53.31	63.51	-10.20	45.60	53.51	-7.91	L2	Pass
0.284225	51.12	49.67	60.75	-11.08	41.85	50.75	-8.90		
0.880700	48.14	46.20	56.00	-9.80	28.99	46.00	-17.01		
1.422250	47.46	45.06	56.00	-10.94	31.17	46.00	-14.83		
2.100125	48.16	45.60	56.00	-10.40	30.79	46.00	-15.21		
2.711875	50.14	45.75	56.00	-10.25	35.08	46.00	-10.92		

*- Margin = Measured emission – specification limit.

Reference numbers of test equipment used

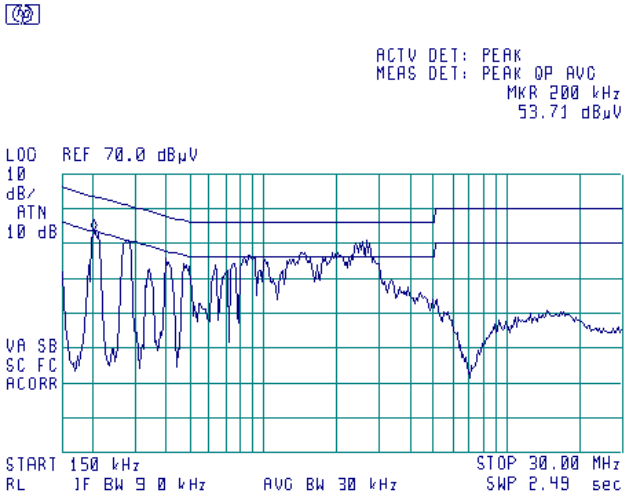
HL 0447	HL 0787	HL 1425	HL 1513	HL 3612			

Full description is given in Appendix A.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/23/2011		
Temperature: 22.8 ºC	Air Pressure: 1023 hPa	Relative Humidity: 44 %	Power Supply: 120VAC
Remarks:			

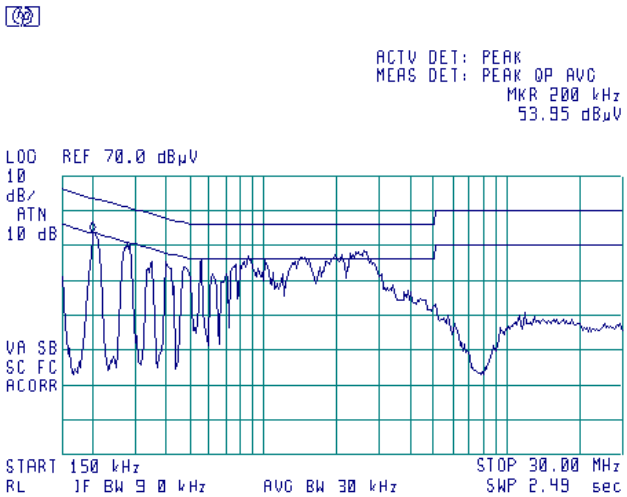
Plot 8.1.1 Conducted emission measurements

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



Plot 8.1.2 Conducted emission measurements

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



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011		
Temperature: 22.3 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

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

Table 8.2.1 Radiated emission test limits

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

8.2.2 Test procedure for measurements in semi-anechoic chamber

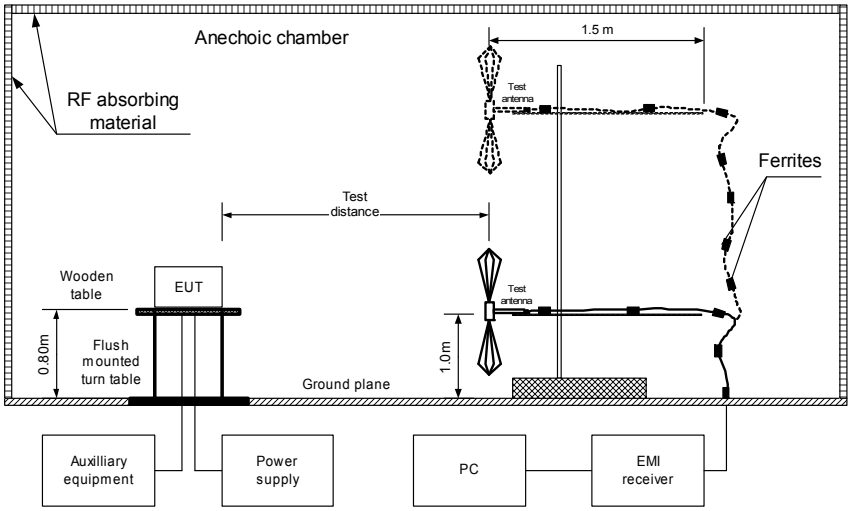
8.2.2.1 The EUT was set up as shown in Figure 8.2.1, energized and the performance check was conducted.

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 360^0, 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.

8.2.2.3 The worst test results (the lowest margins) were recorded in Table 8.2.2 and shown in the associated plots.

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011		
Temperature: 22.3 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

Figure 8.2.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	11/22/2011		
Temperature: 22.3 ºC	**Air Pressure:** 1023 hPa	**Relative Humidity:** 45 %	**Power Supply:** 120VAC
Remarks:			

Table 8.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / QUASI-PEAK
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*				
36.0081	37.1	32.0	40.0	-13.90	Vert	1.1	249	Pass
42.0052	34.5	30.1	40.0	-8.00	Vert	1.0	303	
156.0000	29.7	26.4	43.5	-9.90	Hor	1.0	345	
182.0015	39.1	37.8	43.5	-17.10	Vert	1.0	128	
196.6000	29.3	28.2	43.5	-5.70	Hor	1.0	0	
393.2040	33.0	31.5	46.0	-15.30	Hor	1.7	35	
468.0000	30.5	27.4	46.0	-14.50	Hor	1.0	345	

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 5000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	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

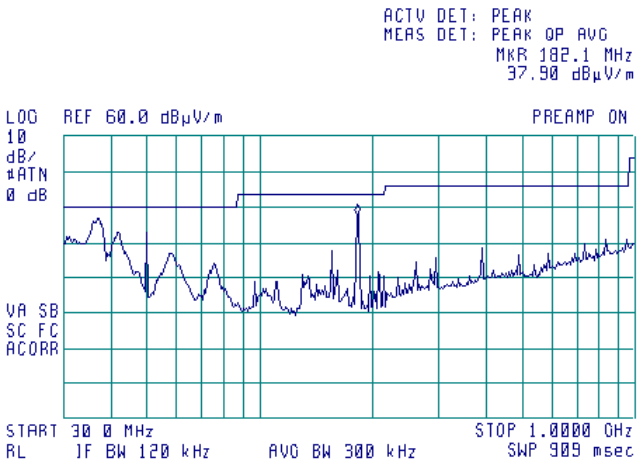
HL 0521	HL 0604	HL 2432	HL 2871	HL 3623			

Full description is given in Appendix A.

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011		
Temperature: 22.3 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

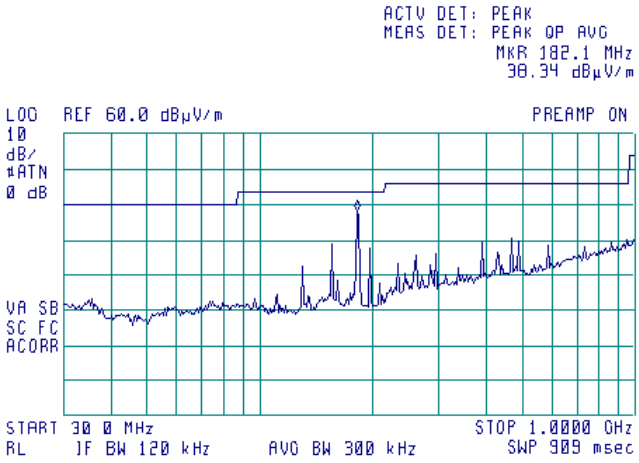
Plot 8.2.1 Radiated emission measurements in 30 – 1000 MHz range, vertical antenna polarization

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



Plot 8.2.2 Radiated emission measurements in 30 – 1000 MHz range, horizontal antenna polarization

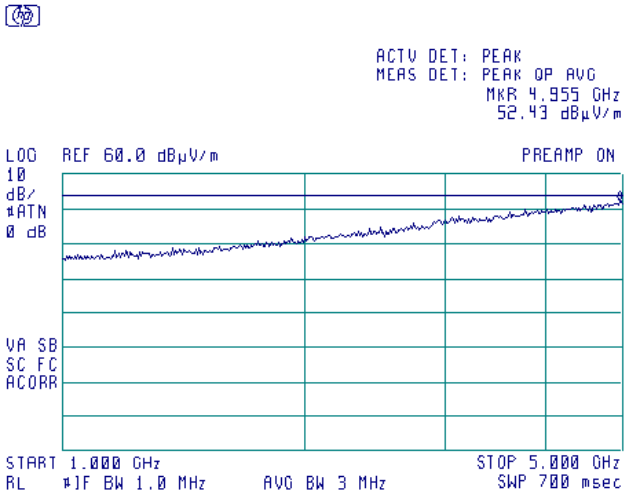
TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/22/2011		
Temperature: 22.3 ºC	Air Pressure: 1023 hPa	Relative Humidity: 45 %	Power Supply: 120VAC
Remarks:			

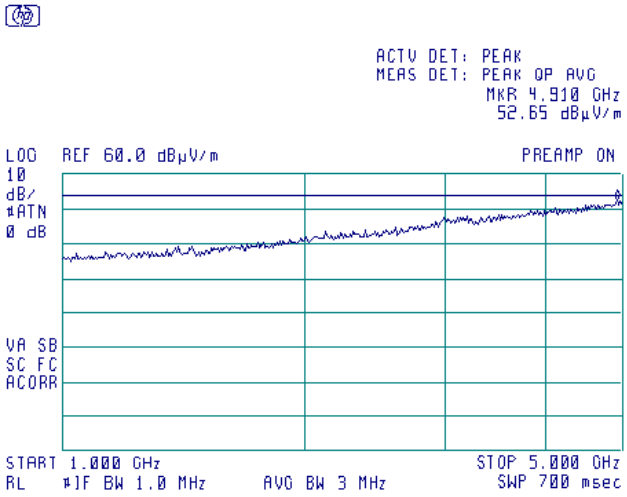
Plot 8.2.3 Radiated emission measurements from 1.0 to 5.0 GHz, vertical antenna polarization

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



Plot 8.2.4 Radiated emission measurements from 1.0 to 5.0 GHz, horizontal antenna polarization

TEST SITE: Semi 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./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz – 30 MHz	EMCO	6502	2857	03-Jul-11	03-Jul-12
0447	LISN, 16/2, 300V RMS, 50 Ohm/50 uH + 5 Ohm, STD CISPR 16-1	Hermon Laboratories	LISN 16 – 1	066	26-Oct-11	26-Oct-12
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	29-Aug-11	29-Sep-12
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 – 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-12
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard	11947A	3107A018 77	18-Oct-11	18-Oct-12
1425	EMI Receiver, 9 kHz – 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A002 22, 3705A002 04	24-Aug-11	24-Aug-12
1513	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1513	01-Sep-11	01-Sep-12
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	25-Nov-11	25-Nov-12
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA – SMA	Huber-Suhner	198-8155-00	2871	20-Sep-11	20-Sep-12
2882	Cable, 18 GHz N-type, M-F, 3 m	Bird Electronic Corp.	TC-MNFN-3.0	211539 001	25-Jul-11	25-Jul-12
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	08-May-11	08-May-12
3531	Amplifier, low noise, 2 to 8 GHz	Quinstar Technology	QLJ-02084040 -J0	111590020 02	23-Dec-10	23-Dec-11
3533	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040 -J0	111590010 01	23-Dec-10	23-Dec-11
3612	Cable RF, 17.5 m, N type-N type	Teldor	RG-214/U	NA	01-Dec-11	01-Dec-12
3623	Cable RF, 6.0 m, N type-N type, DC-6.5 GHz	Belden	MIL C-17	NA	30-Dec-10	30-Dec-11
4114	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz	ETS Lindgren	3117	00123515	08-Feb-11	08-Feb-12

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 %

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.
Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.
In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

11 APPENDIX C Test laboratory 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), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. 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). The FCC Designation Number is US1003.

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Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

47CFR part 15: 2010	Radio Frequency Devices.
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

13 APPENDIX E Test equipment correction factors

Correction factor
Line impedance stabilization network
Model LISN 16 - 1
Hermon Laboratories, HL 0447

Frequency, kHz	Correction factor, dB
10	4.9
15	2.86
20	1.83
25	1.25
30	0.91
35	0.69
40	0.53
50	0.35
60	0.25
70	0.18
80	0.14
90	0.11
100	0.09
125	0.06
150	0.04

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

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

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

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

Antenna factor
Biconilog antenna EMCO Model 3141
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(μV) to convert it into field intensity in dB(μV/m).

Antenna factor
Double-ridged guide horn antenna
Model 3115, serial number: 00027177, HL 2432

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

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

Antenna factor HL 4114

Gain and Antenna Factors for Double Ridged Horn Antenna
Manufactured by: ETS-Lindgren
Model: 3117 Serial Number: 00123515
3 Meter Calibration Polarization: Horizontal

Frequency (MHz)	Antenna Factor (dB/m)	Gain	Gain(dBi)
1000	28.4	1.5	1.8
1250	28.2	2.5	3.9
1500	27.4	4.3	6.4
1750	31.6	2.2	3.5
2000	30.9	3.4	5.3
2250	30.7	4.6	6.6
2500	33.4	3.0	4.7
2750	31.8	5.3	7.2
3000	32.6	5.2	7.1
3250	33.1	5.4	7.3
3500	32.8	6.8	8.3
3750	33.3	6.9	8.4
4000	33.4	7.7	8.9
4250	33.4	8.6	9.3
4500	33.9	8.6	9.3
4750	34.2	9.1	9.6
5000	34.1	10.3	10.1
5250	34.4	10.5	10.2
5500	34.5	11.2	10.5
5750	34.7	11.7	10.7
6000	35.2	11.5	10.6
6250	35.5	11.6	10.6
6500	35.5	12.4	10.9
6750	35.6	13.3	11.2
7000	35.7	14.0	11.5
7250	35.6	15.2	11.8
7500	35.7	15.8	12.0
7750	35.8	16.5	12.2
8000	35.8	17.6	12.4
8250	35.8	18.8	12.7
8500	35.8	19.9	13.0
8750	36.0	20.0	13.0
9000	36.2	20.5	13.1
9250	36.3	20.9	13.2
9500	36.6	20.9	13.2
9750	36.8	20.7	13.2
10000	37.1	20.3	13.1
10250	37.5	19.7	13.0
10500	37.5	20.4	13.1
10750	37.8	20.2	13.0

Specification compliance testing factor (1.0 meter spacing) to be added to receiver meter reading in dBV to convert to field intensity in dBV/meter. Calibration per ANSI C63.5 **Calibration Date: 02/08/2011** (mm dd yyyy)

Antenna factor HL 4114, continued

Gain and Antenna Factors for Double Ridged Horn Antenna
Manufactured by: ETS-Lindgren
Model: 3117 Serial Number: 00123515
3 Meter Calibration Polarization: Horizontal

Frequency (MHz)	Antenna Factor (dB/m)	Gain	Gain(dBi)
11000	37.7	21.6	13.4
11250	37.9	21.6	13.4
11500	38.1	21.5	13.3
11750	38.7	19.6	12.9
12000	38.7	20.5	13.1
12250	38.9	20.5	13.1
12500	38.9	21.3	13.3
12750	39.1	20.9	13.2
13000	39.1	22.0	13.4
13250	39.2	22.0	13.4
13500	38.8	25.5	14.1
13750	38.7	27.0	14.3
14000	38.8	26.9	14.3
14250	39.3	24.9	14.0
14500	39.9	22.8	13.6
14750	40.0	22.8	13.6
15000	39.7	25.0	14.0
15250	40.0	24.5	13.9
15500	40.1	24.7	13.9
15750	40.5	23.2	13.7
16000	40.8	22.3	13.5
16250	40.9	22.6	13.5
16500	41.8	18.9	12.8
16750	41.9	19.1	12.8
17000	42.1	18.9	12.8
17250	41.4	22.5	13.5
17500	41.2	24.4	13.9
17750	41.0	26.3	14.2
18000	40.9	27.4	14.4

Specification compliance testing factor (1.0 meter spacing) to be added to receiver meter reading in dBV to convert to field intensity in dBV/meter. Calibration per ANSI C63.5 **Calibration Date: 02/08/2011** (mm dd yyyy)

Cable loss
Cable coaxial, Huber-Suhner, 18 GHz, 6.4 m, SMA - SMA, model 198-8155-00, HL 2871

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.12	5750	2.34	12000	3.55
30	0.14	6000	2.39	12250	3.61
100	0.27	6250	2.46	12500	3.67
250	0.45	6500	2.52	12750	3.74
500	0.63	6750	2.58	13000	3.79
750	0.76	7000	2.64	13250	3.82
1000	0.89	7250	2.68	13500	3.83
1250	1.01	7500	2.73	13750	3.83
1500	1.12	7750	2.78	14000	3.88
1750	1.23	8000	2.83	14250	3.93
2000	1.32	8250	2.88	14500	3.96
2250	1.41	8500	2.94	14750	4.01
2500	1.49	8750	2.97	15000	4.00
2750	1.58	9000	3.02	15250	4.01
3000	1.66	9250	3.07	15500	4.00
3250	1.73	9500	3.13	15750	4.13
3500	1.80	9750	3.18	16000	4.22
3750	1.87	10000	3.21	16250	4.29
4000	1.93	10250	3.26	16500	4.29
4250	2.01	10500	3.30	16750	4.32
4500	2.06	10750	3.36	17000	4.37
4750	2.12	11000	3.39	17250	4.45
5000	2.17	11250	3.44	17500	4.49
5250	2.24	11500	3.48	17750	4.53
5500	2.29	11750	3.52	18000	4.55

Cable loss
Cable coaxial, Bird, 18 GHz, N-type, M-F, model TC-MNFN-3.0, S/N 211539 001
HL 2882

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.08	5750	1.78	12000	2.57
30	0.12	6000	1.84	12250	2.62
100	0.22	6250	1.87	12500	2.66
250	0.35	6500	1.92	12750	2.68
500	0.49	6750	1.96	13000	2.67
750	0.60	7000	2.01	13250	2.75
1000	0.68	7250	2.08	13500	2.77
1250	0.78	7500	2.12	13750	2.90
1500	0.85	7750	2.19	14000	3.00
1750	0.92	8000	2.22	14250	3.12
2000	0.98	8250	2.28	14500	2.98
2250	1.06	8500	2.29	14750	3.03
2500	1.11	8750	2.27	15000	2.99
2750	1.19	9000	2.28	15250	2.99
3000	1.25	9250	2.26	15500	2.98
3250	1.30	9500	2.29	15750	2.98
3500	1.34	9750	2.33	16000	2.99
3750	1.40	10000	2.34	16250	3.05
4000	1.45	10250	2.41	16500	3.11
4250	1.51	10500	2.46	16750	3.18
4500	1.54	10750	2.48	17000	3.23
4750	1.59	11000	2.48	17250	3.21
5000	1.63	11250	2.52	17500	3.22
5250	1.68	11500	2.53	17750	3.22
5500	1.72	11750	2.56	18000	3.25

Cable loss
Cable coaxial, RG-214/U, N type-N type, 17 m
Teldor, HL 3612

Frequency, MHz	Cable loss, dB
0.1	0.05
0.5	0.07
1	0.10
3	0.22
5	0.29
10	0.39
30	0.68
50	0.90
100	1.27
150	1.58
200	1.80
250	2.12
300	2.36
350	2.60
400	2.82
450	2.99
500	3.23
550	3.40
600	3.56
650	3.71
700	3.90
750	4.04
800	4.23
850	4.39
900	4.55
950	4.65
1000	4.79

Cable loss
Cable coaxial, MIL C-17, N type-N type, 6 m
Belden, HL 3623

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	2600	4.38	5400	7.76
30	0.25	2700	4.53	5500	7.79
50	0.33	2800	4.64	5600	7.88
100	0.49	2900	4.79	5700	7.93
200	0.76	3000	4.93	5800	8.05
300	0.97	3100	5.02	5900	8.03
400	1.18	3200	5.18	6000	8.07
500	1.38	3300	5.27	6100	8.14
600	1.54	3400	5.41	6200	8.21
700	1.71	3500	5.57	6300	8.28
800	1.88	3600	5.65	6400	8.35
900	2.04	3700	5.82	6500	8.43
1000	2.19	3800	5.89		
1100	2.38	3900	6.02		
1200	2.61	4000	6.15		
1300	2.63	4100	6.26		
1400	2.79	4200	6.37		
1500	2.90	4300	6.52		
1600	3.08	4400	6.63		
1700	3.21	4500	6.74		
1800	3.31	4600	6.86		
1900	3.47	4700	6.98		
2000	3.59	4800	7.09		
2100	3.74	4900	7.17		
2200	3.86	5000	7.30		
2300	3.98	5100	7.41		
2400	4.12	5200	7.59		
2500	4.24	5300	7.71		

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
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
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
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
WB	wideband

END OF DOCUMENT