HERMON LABORATORIES

839.01
Electrical

Hermon Laboratories Ltd.
Harakevet Industrial Zone, Binyamina 30500,
Israel
Tel. +972-4-6288001
Fax. +972-4-6288277
E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO: FCC CFR47 part 24, RSS-133 issue 5

FOR:

Visonic Ltd.

Wireless Alarm Control System

Model: PowerMax Pro with GSM modem

Table of contents

1 Applicant information

Client name:	Visonic Ltd.
Address:	24 Habarzel street, Tel Aviv 61920, Israel
Telephone:	+972 3645 6714
Fax:	+972 3645 6788
E-mail:	aelshtein@visonic.com
Contact name:	Mr. Arik Elshtein

2 Equipment under test attributes

Product name:	Wireless Alarm Control System
Product type:	Transceiver
Model(s):	PowerMax Pro with GSM modem
Receipt date	10/5/2009

3 Manufacturer information

Manufacturer name:	Visonic Ltd.
Address:	24 Habarzel street, Tel Aviv 61920, Israel
Telephone:	+972 3645 6714
Fax:	+972 3645 6788
E-Mail:	aelshtein@visonic.com
Contact name:	Mr. Arik Elshtein

4 Test details

Project ID:	20004
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	10/5/2009
Test completed:	10/19/2009
Test specification(s):	FCC 47 CFR part 24:2008; RSS-133 issue 5:2009

5 Tests summary

Test	Status
Transmitter characteristics	
Section 24.232/RSS-133/SRSP-510, RF power output	Pass
Section 2.1091/RSS-102, RF exposure	Provided in Exhibit to Application for certification
Section 24.238(b), Occupied bandwidth	Pass
Section 24.238//RSS-133, Radiated spurious emissions	Pass
Section 24.235/RSS-133, Frequency stability	Not required, provided in Applications for modular approval FCC ID:RI7GE864 IC:5131A-GE864

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

	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer	October 19, 2009	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	November 8, 2009	
Approved by:	Mr. M. Nikishin, EMC and radio group manager	December 2, 2009	

HERMON LABORATORIES

6 EUT description

6.1 General information

The EUT, PowermaxPro, is the controlling center of a wireless intrusion/burglar alarm system. The PowermaxPro gets (is triggered by) alarms from various intrusion sensors via an RF link (315 MHz) and reports these intrusions locally and to remote control centers.

The PowermaxPro has several states of alertness, such as "armed away", "armed home" and "disarmed", the reactions to each state differs and is explained in the manuals. Those various states are achieved in three ways, via the on board/ integrated keypad, via the RFID proximity sensor (125 kHz) and via the RF transmitter type MCT 234.

The PowermaxPro local reporting is via its LCD display as well as various tones and internal sounder and prerecorded vocal alerts. The remote reporting of an intrusion is via an analogue telephone line or alternatively via GSM modem through the cellular network to a central monitoring station. The GSM module, GE864-QUAD, manufactured by Telit Communications S.p.A., operates in 824 – 849 MHz and 1850 – 1910 MHz frequency bands and has its own modular approval, FCC ID:RI7GE864 and IC:5131A-GE864.

The EUT may be powered from AC mains via internal PS or via external AC/DC adapter and is equipped with a rechargeable backup battery pack.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Power(option1)	AC mains	EUT	AC mains	Terminal block	1	Unshielded	2 m	Indoor
Power(option2)	AC mains	EUT	AC/DC adapter	Terminal block	1	Unshielded	2 m	Indoor
Ethernet	Ethernet	EUT	Laptop	RJ-45	1	Unshielded	10 m	Indoor
Telecom	Line	EUT	Line simulator	Terminal block	1	Unshielded	3 m**	Outdoor
Signal	Set	EUT	Telephone set	Terminal block	1	Unshielded	3 m	Indoor
Signal	Zone 29, 30	EUT	Termination	Terminal block	2	Unshielded	3 m**	Indoor
Signal	V+	EUT	Open circuit	Terminal block	1	Unshielded	3 m**	Indoor
Signal	12+	EUT	Open circuit	Terminal block	1	Unshielded	3 m**	Indoor
Signal	-HOLD	EUT	Open circuit	Terminal block	1	Unshielded	3 m**	Indoor
Signal	EXT Siren	EUT	Open circuit	Terminal block	1	Unshielded	3 m**	Indoor
Signal	INT Siren	EUT	Open circuit	Terminal block	1	Unshielded	3 m**	Indoor
Signal	PGM	EUT	Open circuit	Terminal block	1	Unshielded	3 m**	Indoor

* May be up to 12 m.
** May be longer than 30 m.

6.3 Auxiliary equipment

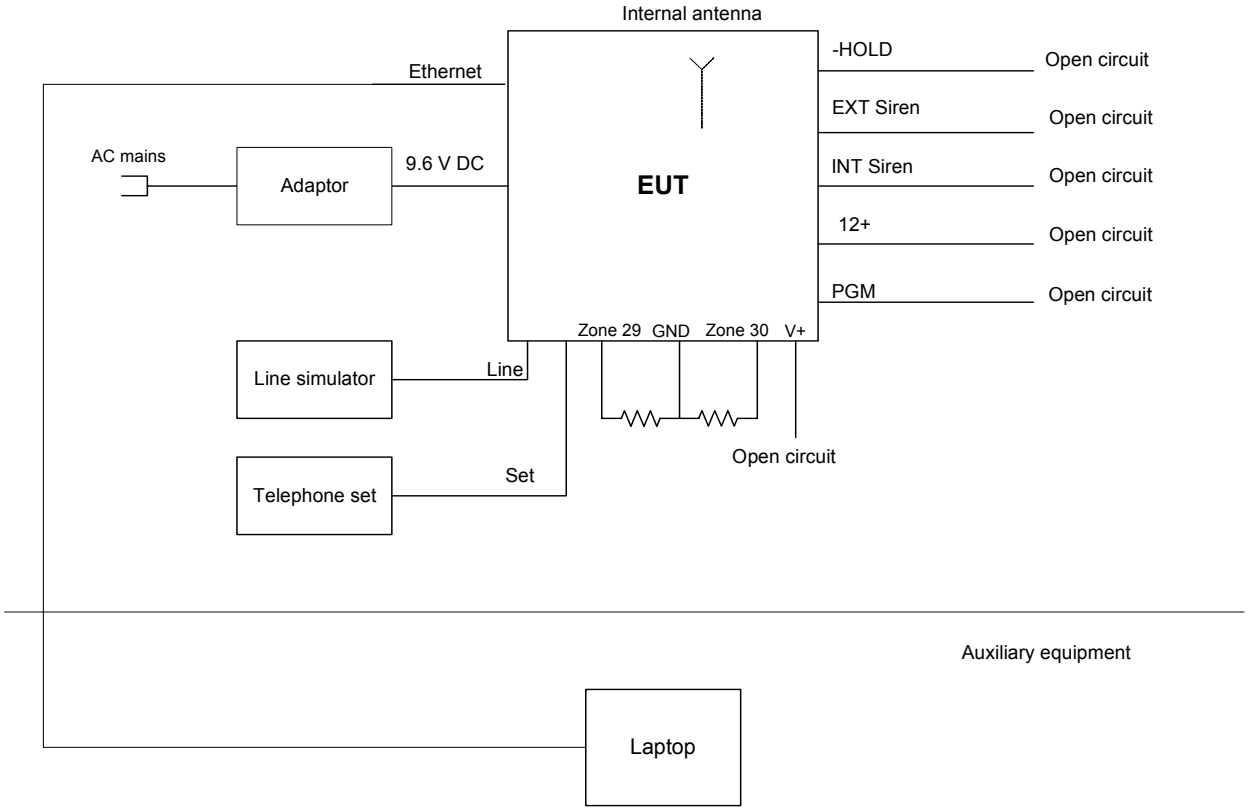
Description	Manufacturer	Model number	Serial number
Line simulator	Hermon Labs	LS-01	1856
Laptop	DELL	D600	45-453-022-116
Telephone set	Typical		

6.4 Operating frequencies

Source	Frequency, MHz			
Clock	4.19	16.0	18.43	25
Tx	315	NA	NA	NA
Rx	315	NA	NA	NA
Tx/Rx	0.125	NA	NA	NA

HERMON LABORATORIES

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**
X	fixed	Always at a distance more than 2 m from all people
	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	1850 – 1910 MHz
Operating frequency range	1850.2 – 1909.8 MHz
RF channel spacing	200 kHz
Maximum rated output power (EIRP)	27.5 dBm

Is transmitter output power variable?	X	No			
		Yes		continuous variable	
			X	stepped variable with stepsize	
				minimum RF power	
				maximum RF power	

Antenna connection					
unique coupling	standard connector	X	integral	with temporary RF connector	
				without temporary RF connector	

Transmitter 99% power bandwidth	200 kHz
Transmitter aggregate data rate/s	270 kbps
Transmitter aggregate symbol (baud) rate/s	NA
Type of modulation	GMSK

Transmitter power source					
X	AC	**Nominal rated voltage**	120 V	Frequency	60 Hz
X	Battery (backup)	**Nominal rated voltage**	9.6 V		
		Nominal modem supply voltage	3.8 VDC		

Common power source for transmitter and receiver	X	yes	no

Test specification:	Section 24.232/RSS-133/SRSP-510, Peak output power		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

7 Transmitter tests according to 47CFR part 24 and RSS-133 requirements

7.1 Peak output power

7.1.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 8.1.1.

Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	Peak output power		Equivalent field strength limit @ 3m, dB(μV/m)*
	W	dBm	
1850 - 1910	2.0	33.0	128.23

*- Equivalent field strength limit was calculated from the peak output power as follows: E=sqrt(30×P×G)/r, where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

7.1.2 Test procedure for field strength measurements

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

7.1.2.2 The EUT was adjusted to produce maximum available to end user RF output power.

7.1.2.3 The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.1.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.1.2 and the associated plots.

7.1.3 Test procedure for substitution power measurements

7.1.3.1 The test equipment was set up as shown in Figure 7.1.2 and energized.

7.1.3.2 RF signal generator was set to the EUT carrier frequency and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.1.3.3 The test antenna height was swept to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

7.1.3.4 The maximum peak output power was calculated as a sum of signal generator output power in dBm and substitution antenna gain in dBi reduced by cable loss in dB.

7.1.3.5 The above procedure was performed in both horizontal and vertical polarizations of the substitution antenna.

7.1.3.6 The worst test results (the lowest margins) were recorded in Table 7.1.3.

Test specification:	Section 24.232/RSS-133/SRSP-510, Peak output power		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

Figure 7.1.1 Setup for carrier field strength measurements

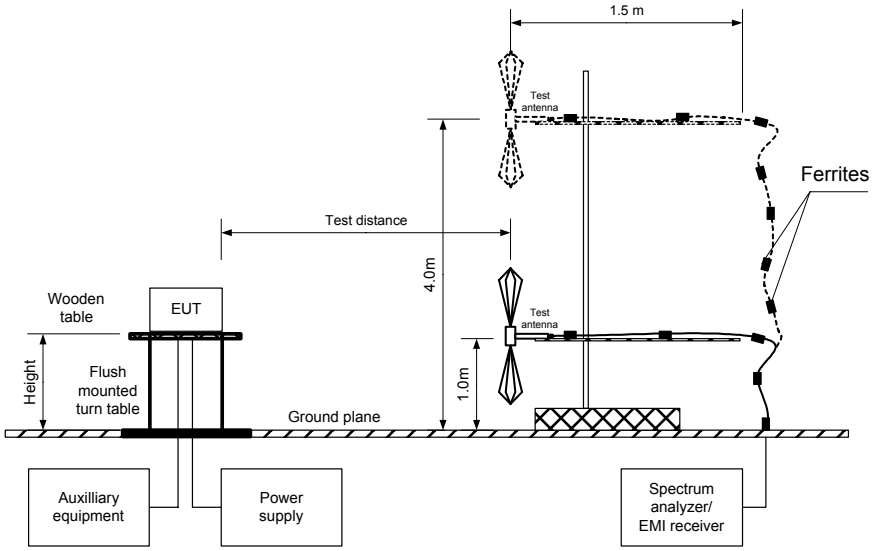
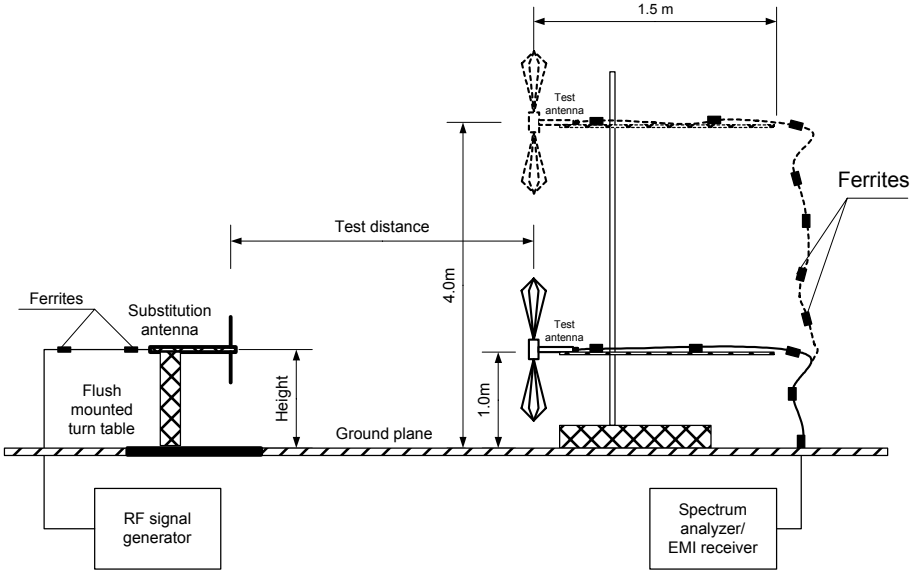


Figure 7.1.2 Setup for substitution peak output power measurements



Test specification:	**Section 24.232/RSS-133/SRSP-510, Peak output power**		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 33 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.1.2 Field strength measurement of peak output power

ASSIGNED FREQUENCY: 1850 – 1910 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
DETECTOR USED: Peak
TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)
MODULATION: GMSK
BIT RATE: 270 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 3 MHz

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees
1850.2	122.5	128.23	-5.73	H	1.62	104
1850.20	115.0	128.23	-13.23	V	1.16	237
1871.80	120.97	128.23	-7.26	H	1.28	124
1871.80	112.00	128.23	-16.23	V	1.91	126
1909.80	121.35	128.23	-6.88	H	1.68	123
1909.80	117.82	128.23	-10.41	V	1.25	122

*- Margin = Field strength – calculated field strength limit.
**- EUT front panel refer to 0 degrees position of turntable.

Table 7.1.3 Substitution measurement of peak output power

ASSIGNED FREQUENCY RANGE: 1850 – 1910 MHz
TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 3 MHz
SUBSTITUTION ANTENNA TYPE: Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	RF generator output, dBm	Antenna gain, dBi	Cable loss, dB	Peak output power, EIRP, dBm	Limit, dBm	Margin, dB*	Verdict
1850.20	122.5	H	20.90	9.38	2.78	27.50	33.00	-5.50	Pass
1871.80	120.97	H	19.30	8.79	2.78	25.31	33.00	-7.69	Pass
1909.80	121.35	H	19.60	8.26	2.82	25.04	33.00	-7.96	Pass

*- Margin = Peak output power – specification limit.

Reference numbers of test equipment used

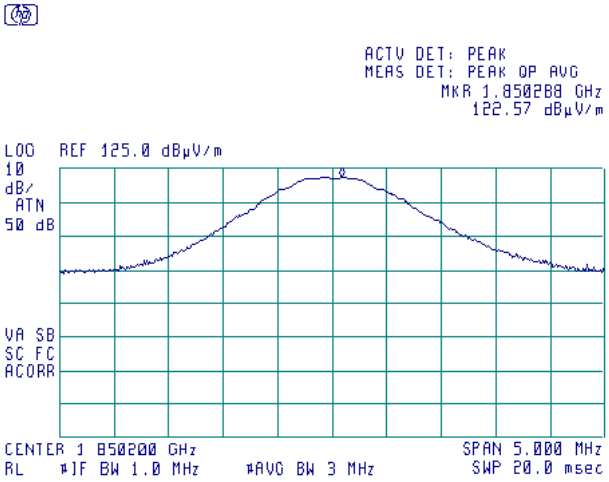
HL 0446	HL 0569	HL 0604	HL 0768	HL 1984	HL 2432	HL 3121	HL 3123
HL 3531	HL 3534	HL 3535	HL 3616				

Full description is given in Appendix A.

Test specification:	Section 24.232/RSS-133/SRSP-510, Peak output power		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

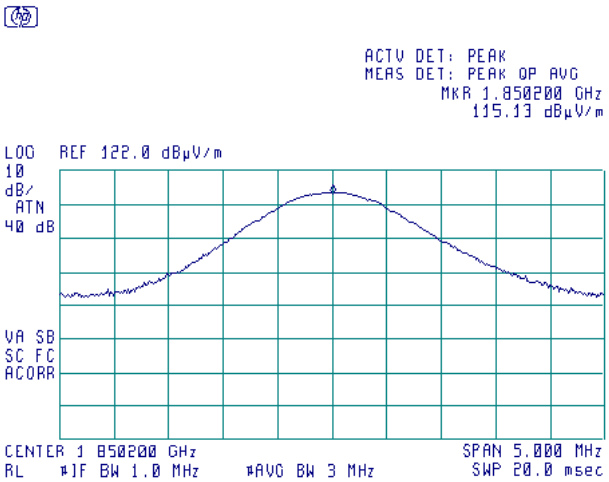
Plot 7.1.1 Field strength of carrier at low frequency

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



Plot 7.1.2 Field strength of carrier at low frequency

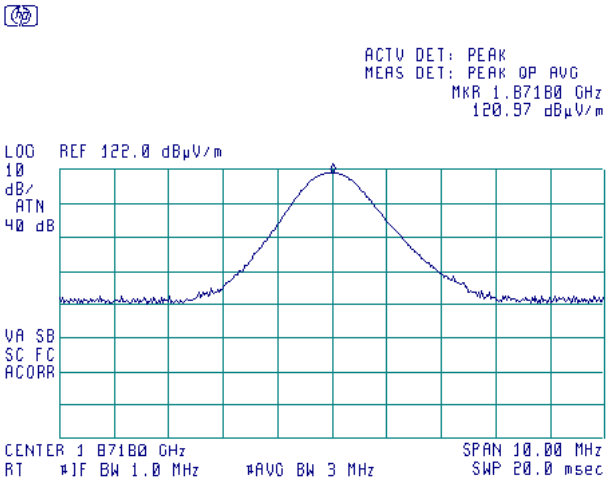
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Test specification:	Section 24.232/RSS-133/SRSP-510, Peak output power		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

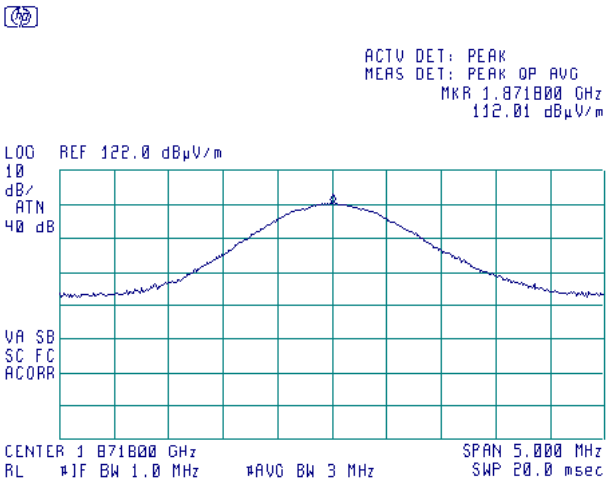
Plot 7.1.3 Field strength of carrier at mid frequency

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



Plot 7.1.4 Field strength of carrier at mid frequency

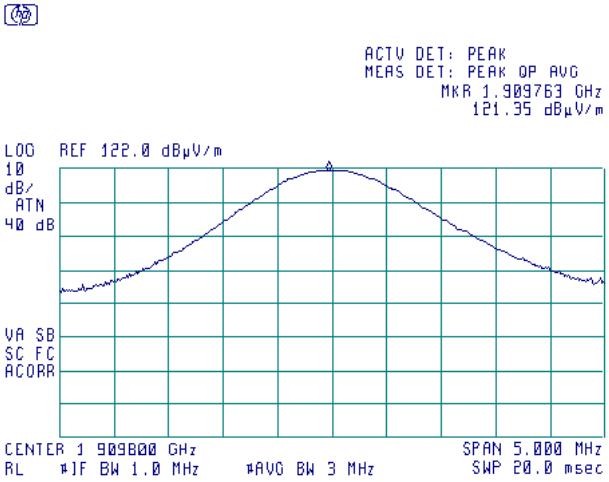
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Test specification:	Section 24.232/RSS-133/SRSP-510, Peak output power		
Test procedure:	FCC part 24, Section 24.232		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

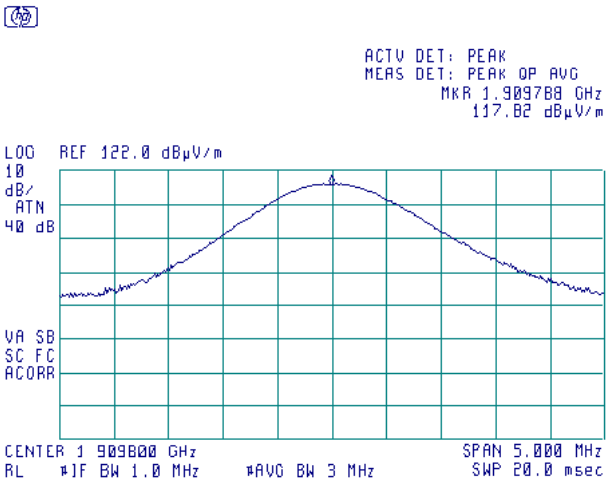
Plot 7.1.5 Field strength of carrier at high frequency

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



Plot 7.1.6 Field strength of carrier at high frequency

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



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

7.2 Radiated spurious emission measurements

7.2.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier dBc	EIRP of spurious dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10th harmonic*	43+10logP**	-13	82.25

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier
** - P is transmitter output power in Watts
*** - Equivalent field strength limit was calculated from maximum allowed EIRP of spurious as follows: E=sqrt(30×P×1.64)/r, where P is EIRP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.
7.2.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.
7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.2 and shown in the associated plots.

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

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.
7.2.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.
7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.2.2 and shown in the associated plots.

7.2.4 Test procedure for substitution EIRP measurements of spurious

7.2.4.1 The test equipment was set up as shown in Figure 7.2.3 and energized.
7.2.4.2 RF signal generator was set to the frequency of investigated spurious emission and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.
7.2.4.3 The test antenna height was swept from 1 to 4 m to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.
7.2.4.4 The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.
7.2.4.5 The EIRP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBi reduced by cable loss in dB.
7.2.4.6 The above procedure was repeated at the rest of investigated frequencies.
7.2.4.7 The worst test results (the lowest margins) were recorded in Table 7.2.3 and shown in the associated plots.

Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

Figure 7.2.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

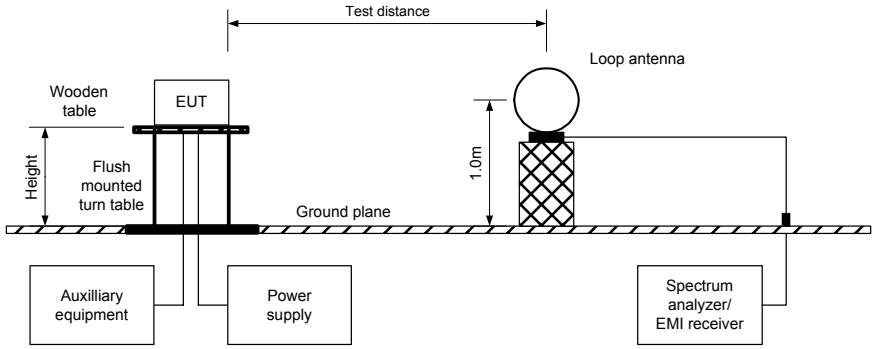
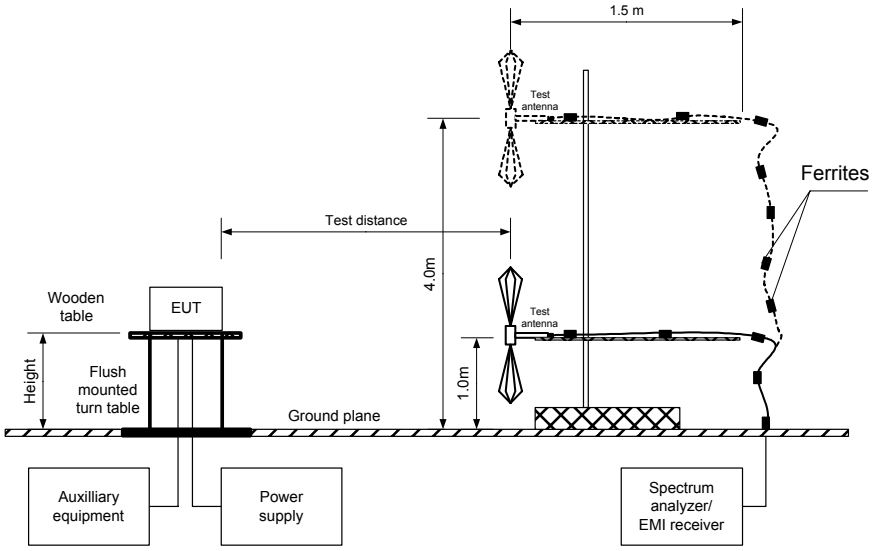
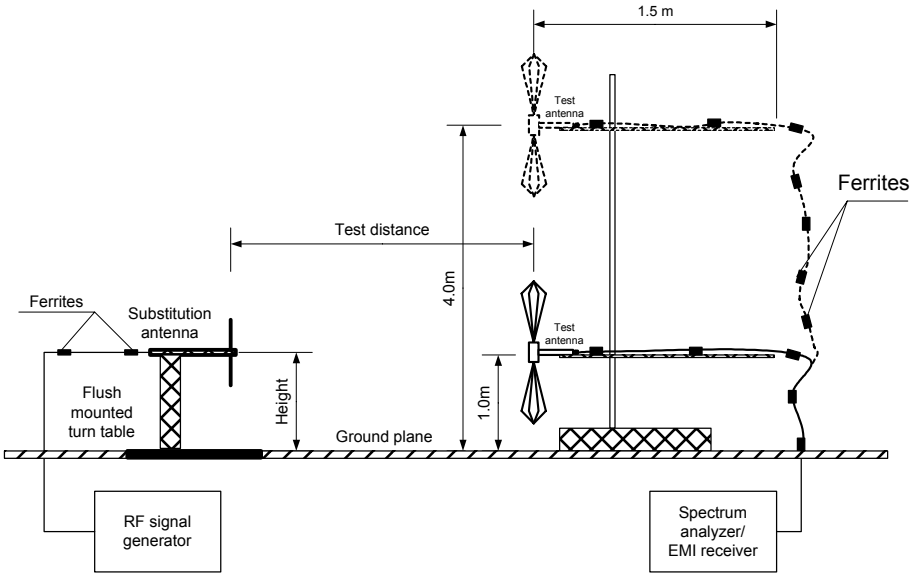


Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

Figure 7.2.3 Setup for substitution EIRP measurements of spurious



Test specification:	**Section 24.238/RSS-133, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 33 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.2.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 1850 – 1910 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 20000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Log periodic (200 MHz – 1000 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Low carrier frequency 1850.2 MHz							
1849.00	66.20+10.46***	82.25	-5.59	300	H	1.59	116
1849.98	76.00	82.25	-6.25	3****	H	1.59	116
Mid carrier frequency 1871.8 MHz							
No spurious emissions were found							
High carrier frequency 1909.8 MHz							
1910.02	76.62	82.25	-5.63	3****	H	1.68	123
1911.00	70.68+10.46***	82.25	-1.11	300	H	1.68	123

*- Margin = Field strength of spurious – calculated field strength limit.
**- EUT front panel refers to 0 degrees position of turntable.
*** - BB Correction factor 20 Log (1000/300)=10.46 dB
**** - RBW is at least 1% of the OBW=285 kHz, i.e RBW=3 kHz.

Table 7.2.3 Substitution EIRP of spurious test results

ASSIGNED FREQUENCY RANGE: 1850 – 1910 MHz
TRANSMITTER CARRIER POWER: Maximum
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
SUBSTITUTION ANTENNA TYPE: Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBi	Cable loss, dB	EIRP, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency 1850.2 MHz											
1849.00	76.66	1000	H	-24.80	9.38	2.78	-18.20	45.70	38.13	7.57	PASS
1849.98	76.00	3	H	-25.50	9.38	2.78	-18.85	46.35	38.13	8.22	PASS
High carrier frequency 1909.8 MHz											
1910.02	76.62	3	H	-25.00	8.26	2.82	-19.56	44.60	35.89	8.71	PASS
1911.00	81.14	1000	H	-20.60	8.26	2.82	-15.16	40.20	35.89	4.30	PASS

*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

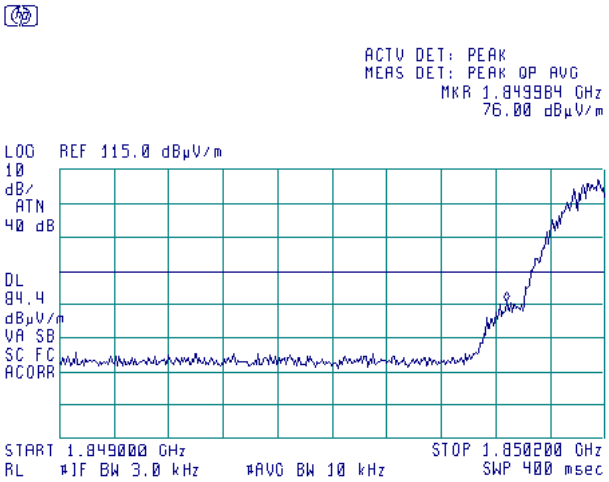
HL 0446	HL 0569	HL 0604	HL 0768	HL 1984	HL 2432	HL 3121	HL 3123
HL 3531	HL 3534	HL 3535	HL 3616				

Full description is given in Appendix A.

Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

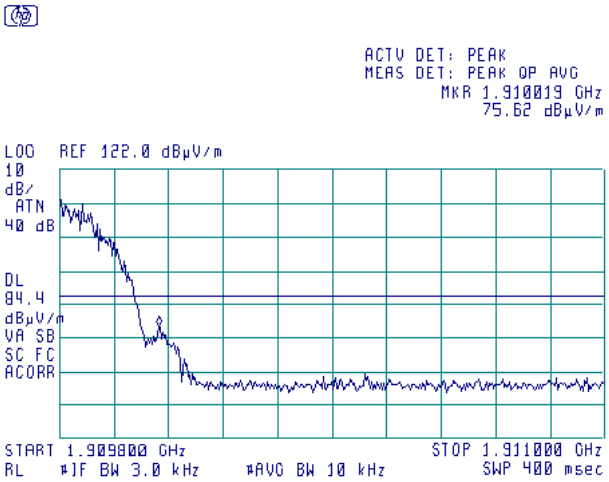
Plot 7.2.1 Low band edge emission test result

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Plot 7.2.2 High band edge emission test result

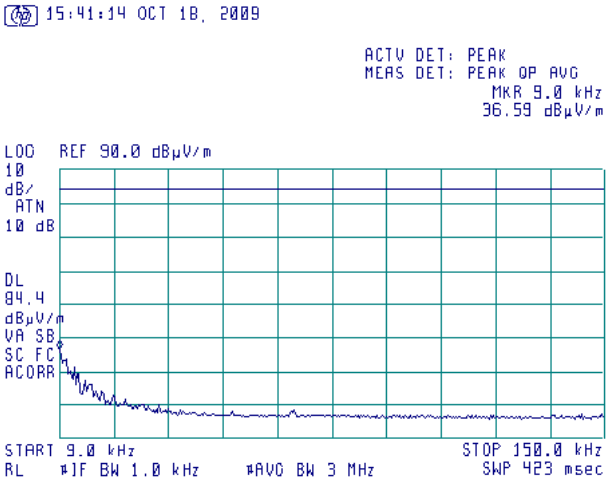
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

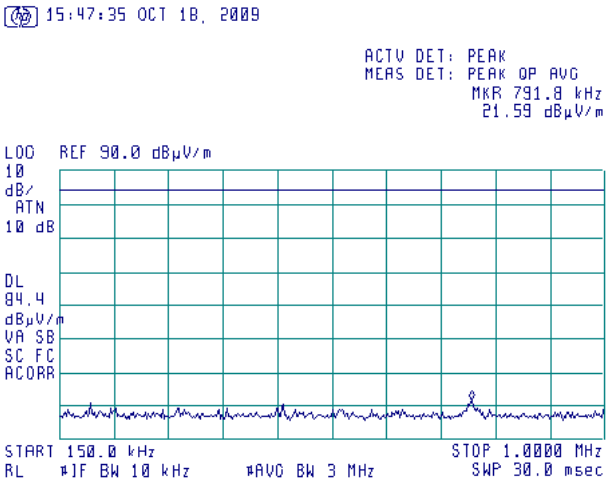
Plot 7.2.3 Radiated emission measurements in 9 - 150 kHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low, Mid, High
TEST DISTANCE: 3 m



Plot 7.2.4 Radiated emission measurements in 0.15 - 1 MHz range

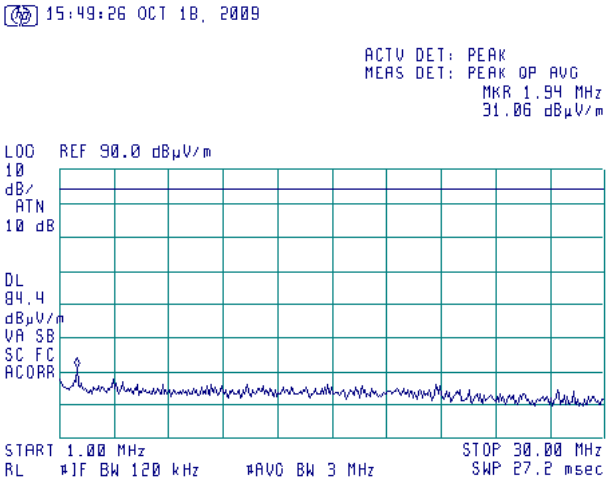
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low, Mid, High
TEST DISTANCE: 3 m



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

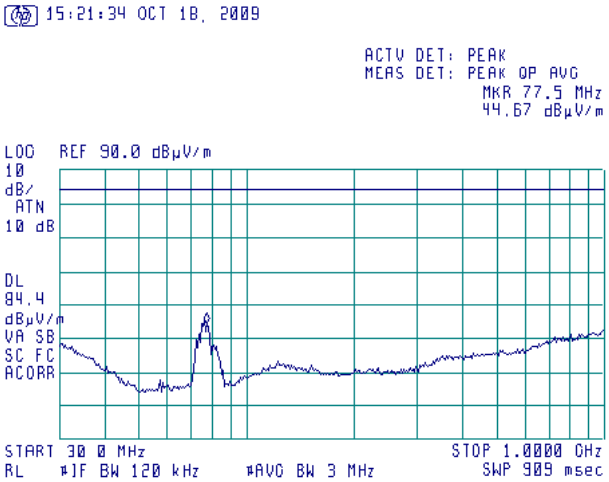
Plot 7.2.5 Radiated emission measurements in 1 - 30 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low, Mid, High
TEST DISTANCE:	3 m



Plot 7.2.6 Radiated emission measurements in 30 - 1000 MHz range

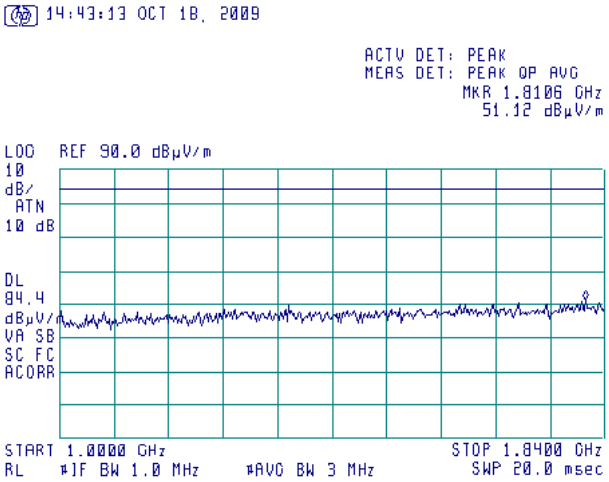
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low, Mid, High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

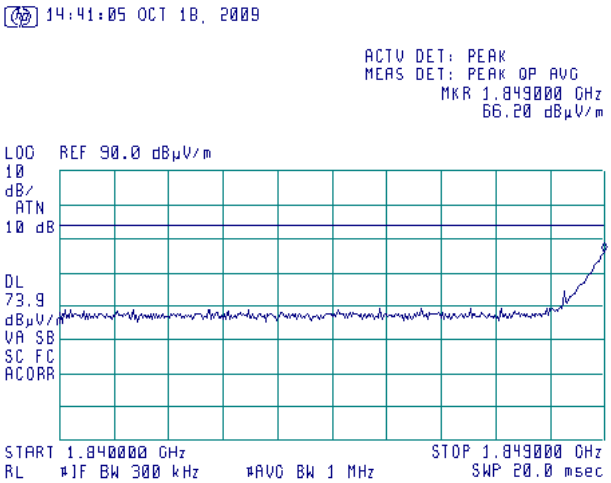
Plot 7.2.7 Radiated emission measurements in 1000 – 1840 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.2.8 Radiated emission measurements in 1840-1849 MHz range

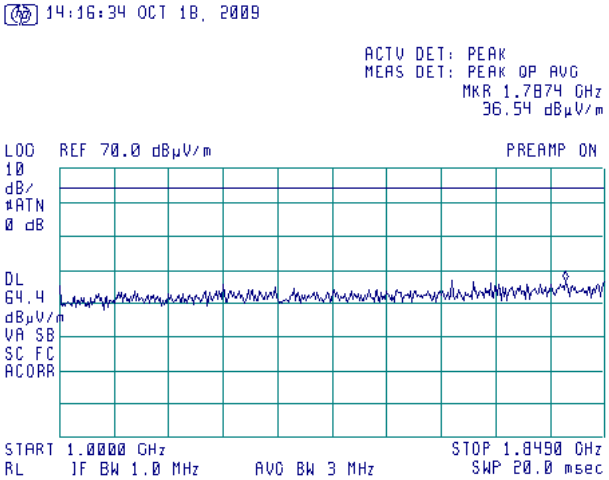
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m
BB Correction factor	10.45 dB



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

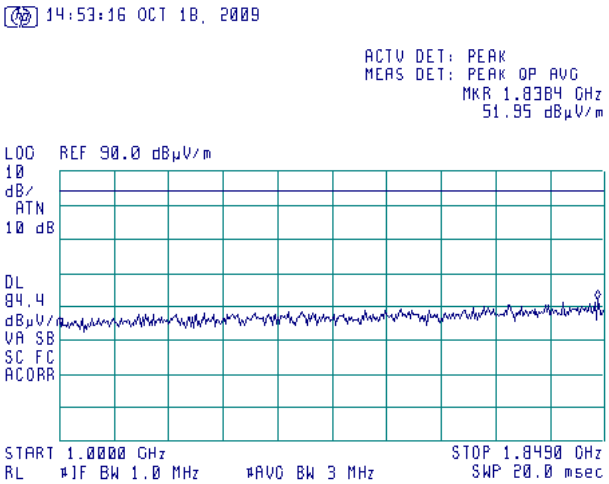
Plot 7.2.9 Radiated emission measurements in 1000-1849 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m
EXTERNAL ATTENUATION:	20 dB



Plot 7.2.10 Radiated emission measurements in 1000-1849 MHz range

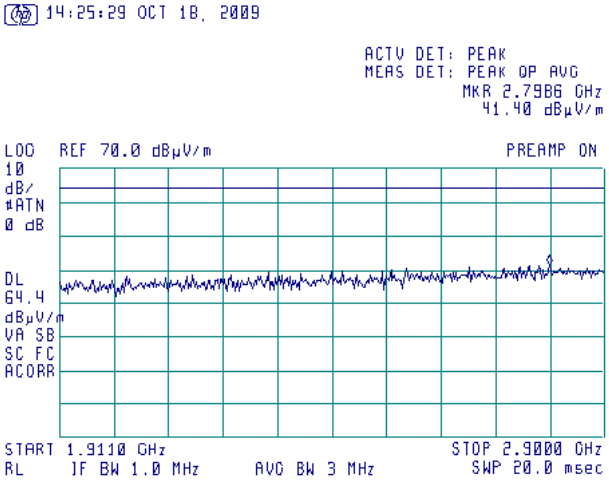
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m
EXTERNAL ATTENUATION:	20 dB



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

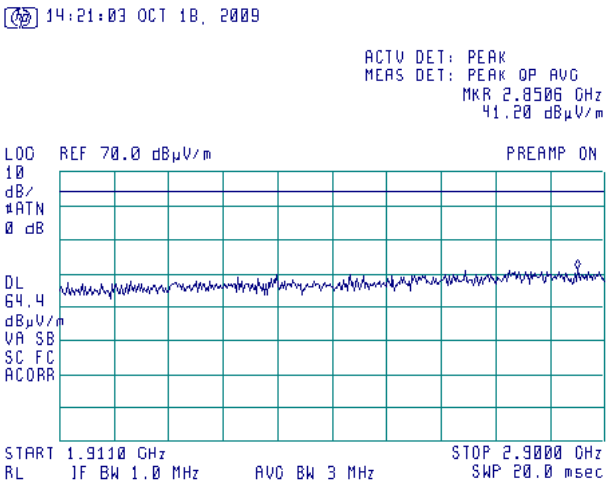
Plot 7.2.11 Radiated emission measurements in 1911 - 2900 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m
EXTERNAL ATTENUATION:	20 dB



Plot 7.2.12 Radiated emission measurements in 1911 - 2900 MHz range

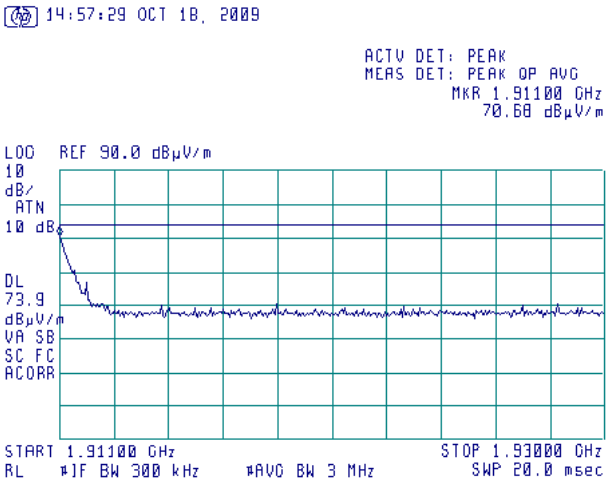
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m
EXTERNAL ATTENUATION:	20 dB



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

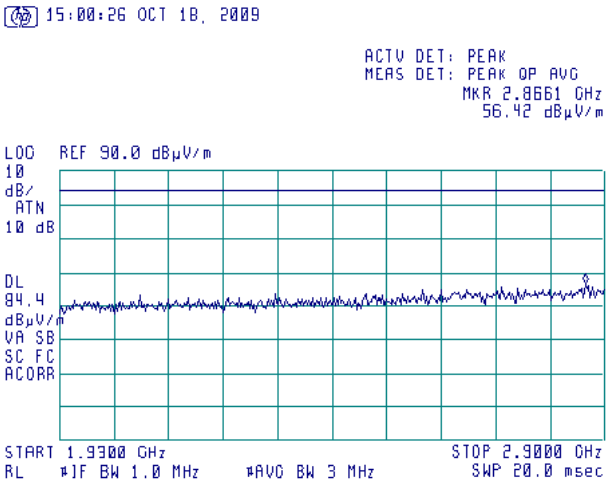
Plot 7.2.13 Radiated emission measurements in 1911 - 1930 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m
BB Correction factor	10.4575 dB



Plot 7.2.14 Radiated emission measurements in 1930 –2900 MHz range

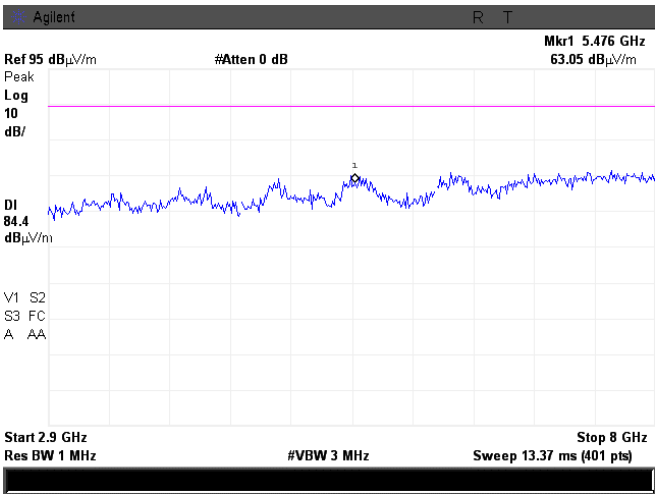
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

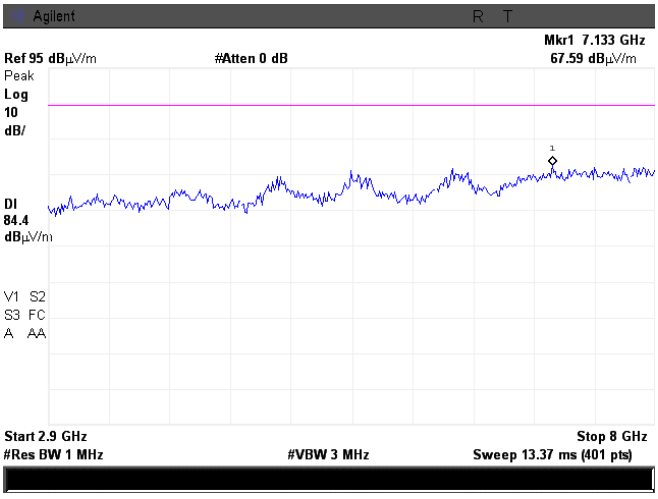
Plot 7.2.15 Radiated emission measurements in 2900 –8000 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.2.16 Radiated emission measurements in 2900 –8000 MHz range

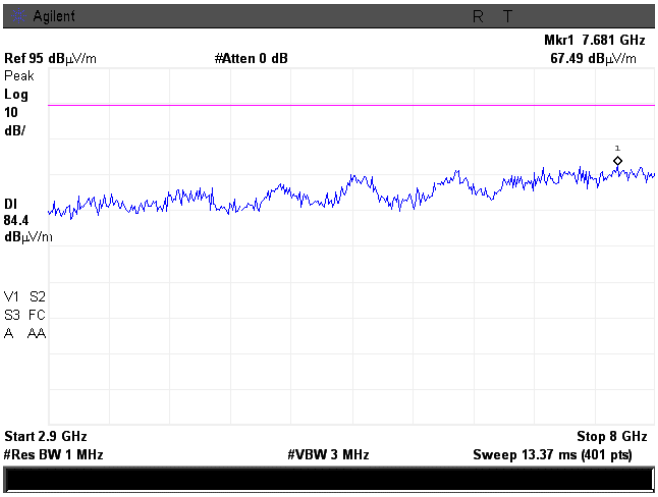
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

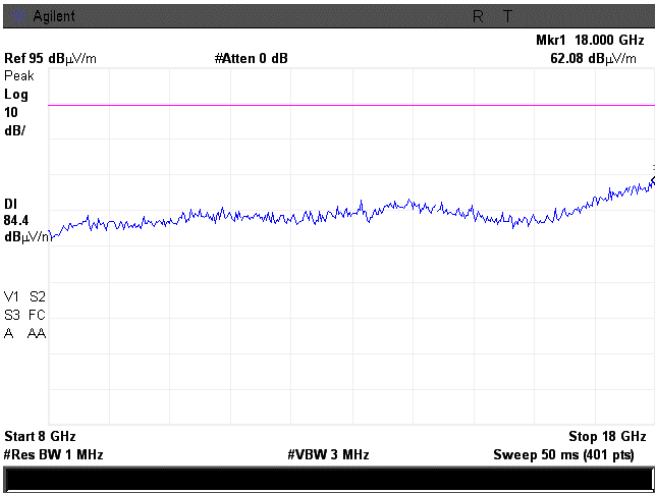
Plot 7.2.17 Radiated emission measurements in 2900 –8000 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.2.18 Radiated emission measurements in 8-18 GHz range

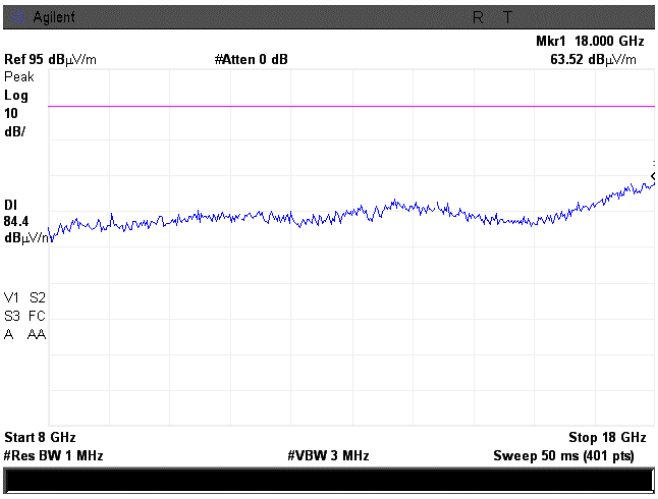
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

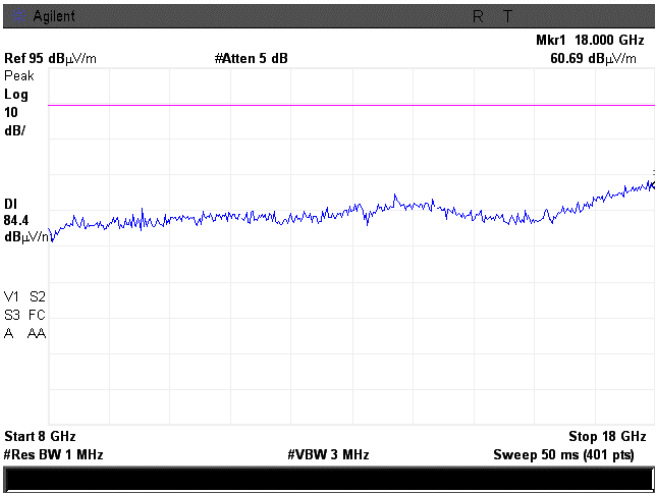
Plot 7.2.19 Radiated emission measurements in 8-18 GHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.2.20 Radiated emission measurements in 8-18 GHz range

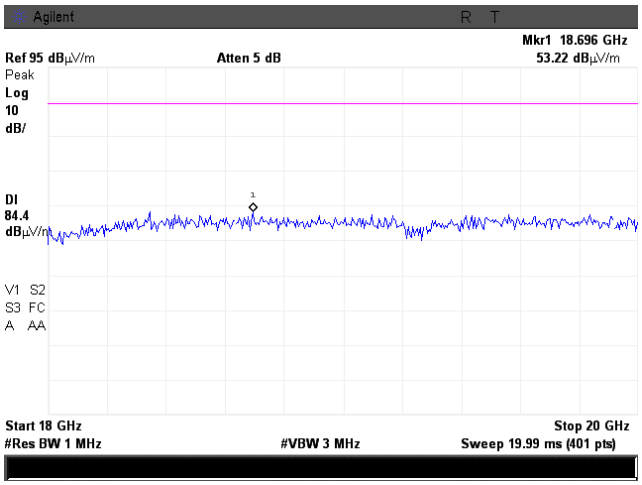
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

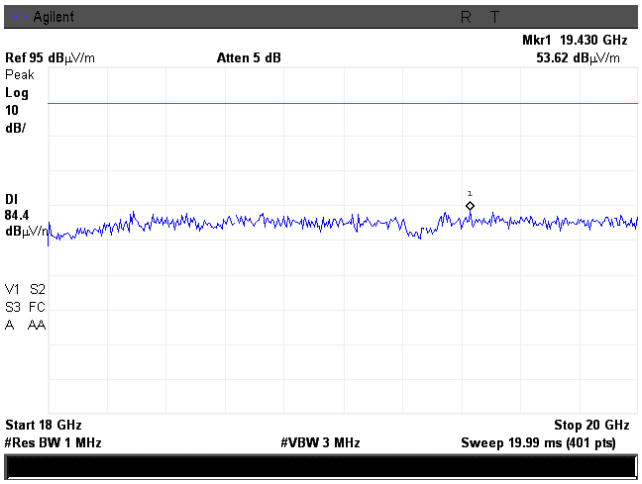
Plot 7.2.21 Radiated emission measurements in 18 - 20 GHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.2.22 Radiated emission measurements in 18 - 20 GHz range

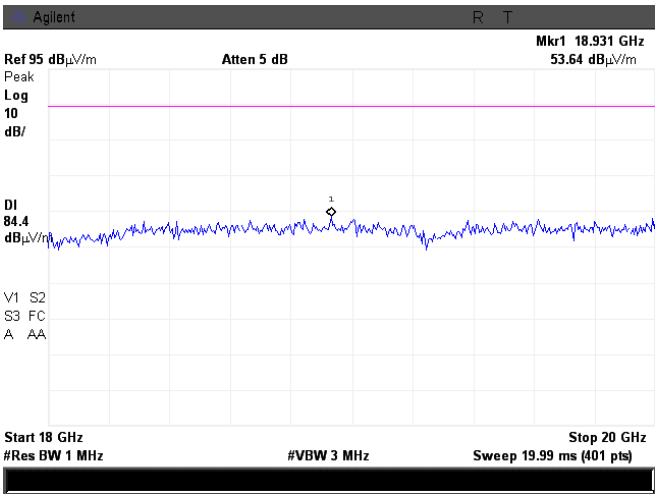
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 24.238/RSS-133, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.23 Radiated emission measurements in 18 - 20 GHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	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

Table 7.3.1 Occupied bandwidth limits

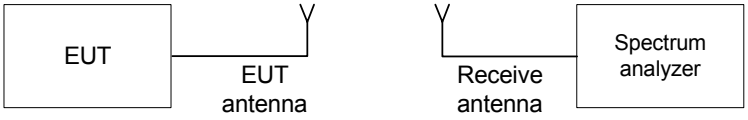
Assigned frequency, MHz	Modulation envelope reference points*, dBc
1850 – 1910	26

* - Modulation envelope reference points are provided in terms of attenuation below the unmodulated 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 the unmodulated carrier and the reference peak power level was measured.
7.3.2.3 The EUT was set to transmit the normally modulated carrier.
7.3.2.4 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and the results provided in Table 7.3.2 and the associated plots.

Figure 7.3.1 Occupied bandwidth test setup



Test specification:	**Section 24.238(b), Occupied bandwidth**		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 33 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	3 kHz
VIDEO BANDWIDTH:	10 kHz
MODULATION ENVELOPE REFERENCE POINTS:	26 dBc
MODULATION:	GMSK
BIT RATE:	270 kbps

Carrier frequency, MHz	Occupied bandwidth, kHz
1850.2	291.3
1909.8	275.0

Reference numbers of test equipment used

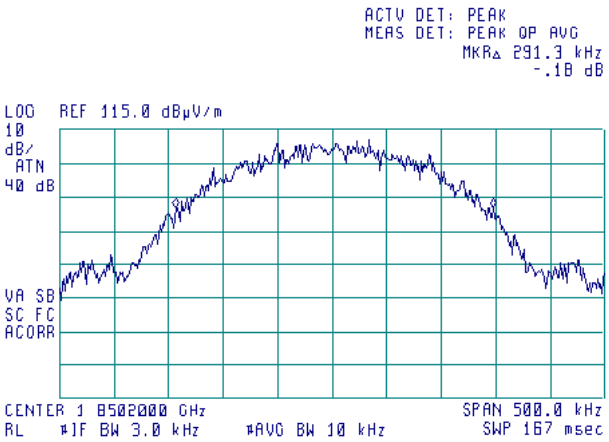
HL 0415	HL 0521	HL 0583	HL 0812	HL 1430	HL 2432	HL 3121	HL 3122
HL 3616	HL 3634						

Full description is given in Appendix A.

Test specification:	Section 24.238(b), Occupied bandwidth		
Test procedure:	FCC part 24, Section 24.238		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/19/2009 1:16:04 PM		
Temperature: 26 ºC	Air Pressure: 1010 hPa	Relative Humidity: 33 %	Power Supply: 120 VAC
Remarks:			

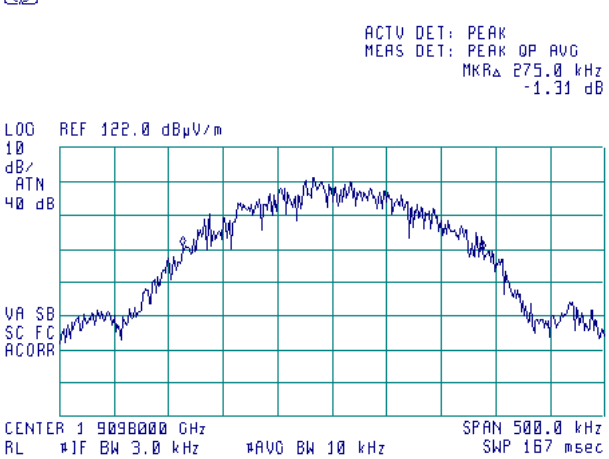
Plot 7.3.1 Occupied bandwidth test result at low frequency

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



Plot 7.3.2 Occupied bandwidth test result at high frequency

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



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0415	Cable, Coax, RF, RG-214	Hermon Laboratories	CC-3	056	02-Dec-08	02-Dec-09
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-09	29-Jun-10
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Aug-09	27-Aug-10
0569	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1953	25-Sep-08	25-Sep-10
0583	Antenna, Log Periodic, 200 - 1000 MHz	Hermon Laboratories	LP 200/1000	035	03-Feb-08	03-Feb-10
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-09	11-Jan-10
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	23-Dec-08	23-Dec-11
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	Hermon Laboratories	C214-11	148	02-Dec-08	02-Dec-09
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A002 62,3705A0 0217	31-Aug-09	31-Aug-10
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	24-Aug-09	24-Aug-10
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	24-Aug-09	24-Aug-10
3121	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	3121	07-Dec-08	07-Dec-09
3122	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	3122	01-Jan-09	01-Jan-10
3123	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	3123	01-Jan-09	01-Jan-10
3531	Amplifier, low noise, 2 to 8 GHz	Quinstar Technology	QLJ-02084040 -J0	111590020 02	07-Dec-08	07-Dec-09
3534	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040 -J0	111590010 02	07-Dec-08	07-Dec-09
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537 -J0	111590030 01	07-Dec-08	07-Dec-09
3616	Cable RF, 6.5 m, N type-N type, DC-6.5 GHz	Suhner Switzerland	Rg 214/U	NA	07-Dec-08	07-Dec-09
3634	Cable RF, 5.5 m, N type-N type, DC-6.5 GHz	Alpha Wire	RG 214/U	NA	17-Dec-08	17-Dec-09

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
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
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency stability	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)

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.

10 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 and IC 2186A-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), 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).

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

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

FCC 47CFR part 24: 2008	Private land mobile radio services
FCC 47CFR part 1: 2008	Practice and procedure
FCC 47CFR part 2: 2008	Frequency allocations and radio treaty matters; general rules and regulations
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.
ANSI/TIA/EIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
RSS-133 issue 5 February 2009	2 GHz Personal Communications Services
SRSP-510 issue 4 February 2008	Technical Requirements for Personal Communications Services in the Bands 1850-1915 MHz and 1930-1995 MHz

12 APPENDIX E Test equipment correction factors

Antenna Factor
Active Loop Antenna
EMC Test Systems, model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic Antenna Factor, dB(S/m)	Electric Antenna Factor, dB(1/m)
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.7
0.750	-41.9	9.6
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.1
4.000	-41.4	10.1
5.000	-41.5	10.0
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

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

Antenna factor
Standard gain horn antenna
Quinstar Technology
Model QWH
Ser.No.110, HL 0768

Frequency min, GHz	Frequency max, GHz	Antenna factor, dB(1/m)
18.000	26.500	32.01
26.500	40.000	35.48
40.000	60.000	39.03
60.000	90.000	42.55
90.000	140.000	46.23
140.000	220.000	50.11

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 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(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).

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
Microwave Cable Assembly, 18 GHz, 6.4 m, SMA – SMA, Huber-Suhner, model 198-9155-00
HL 3121

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.08	3600	2.10	7400	3.08	11200	3.85	15100	4.58
30	0.18	3700	2.14	7500	3.11	11300	3.85	15200	4.60
50	0.26	3800	2.18	7600	3.14	11400	3.86	15300	4.63
100	0.34	3900	2.19	7700	3.16	11500	3.86	15400	4.65
200	0.47	4000	2.25	7800	3.18	11600	3.87	15500	4.71
300	0.59	4100	2.25	7900	3.20	11700	3.85	15600	4.70
400	0.66	4200	2.28	8000	3.22	11800	3.96	15700	4.69
500	0.75	4300	2.35	8100	3.26	11900	3.92	15800	4.71
600	0.83	4400	2.35	8200	3.27	12000	3.92	15900	4.74
700	0.90	4500	2.38	8300	3.29	12100	3.94	16000	4.69
800	0.96	4600	2.43	8400	3.30	12200	3.94	16100	4.72
900	1.02	4700	2.43	8500	3.31	12300	3.99	16200	4.71
1000	1.07	4800	2.45	8600	3.33	12400	4.02	16300	4.74
1100	1.12	4900	2.48	8700	3.35	12500	4.10	16400	4.74
1200	1.15	5000	2.55	8800	3.36	12600	4.09	16500	4.75
1300	1.22	5100	2.54	8900	3.38	12700	4.15	16600	4.78
1400	1.28	5200	2.56	9000	3.40	12800	4.15	16700	4.86
1500	1.29	5300	2.58	9100	3.41	12900	4.08	16800	4.84
1600	1.36	5400	2.61	9200	3.45	13000	4.21	16900	4.83
1700	1.40	5500	2.64	9300	3.48	13100	4.19	17000	4.86
1800	1.45	5600	2.69	9400	3.52	13200	4.29	17100	4.83
1900	1.51	5700	2.67	9500	3.54	13300	4.24	17200	4.90
2000	1.50	5800	2.71	9600	3.59	13400	4.26	17300	4.91
2100	1.56	5900	2.73	9700	3.59	13500	4.26	17400	4.94
2200	1.59	6000	2.75	9800	3.62	13600	4.29	17500	4.93
2300	1.63	6100	2.81	9900	3.70	13700	4.35	17600	4.93
2400	1.73	6200	2.80	10000	3.70	13800	4.31	17700	5.00
2500	1.73	6300	2.82	10100	3.72	13900	4.29	17800	5.01
2600	1.78	6400	2.85	10200	3.73	14000	4.32	17900	5.00
2700	1.84	6500	2.87	10300	3.75	14100	4.33	18000	5.00
2800	1.84	6600	2.90	10400	3.76	14200	4.34		
2900	1.91	6700	2.91	10500	3.77	14300	4.36		
3000	1.91	6800	2.94	10600	3.79	14400	4.38		
3100	1.97	6900	2.96	10700	3.80	14600	4.42		
3200	1.98	7000	2.98	10800	3.81	14700	4.42		
3300	2.04	7100	3.01	10900	3.81	14800	4.55		
3400	2.04	7200	3.02	11000	3.83	14900	4.55		
3500	2.10	7300	3.04	11100	3.84	15000	4.55		

Cable loss
Microwave Cable Assembly, 18 GHz, 6.4 m, SMA – SMA, Huber-Suhner, model 198-9155-00
HL 3122

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.11	3600	2.08	7400	3.07	11200	3.92	15100	4.61
30	0.17	3700	2.12	7500	3.09	11300	3.95	15200	4.58
50	0.23	3800	2.15	7600	3.14	11400	3.93	15300	4.62
100	0.32	3900	2.18	7700	3.15	11500	3.93	15400	4.62
200	0.47	4000	2.21	7800	3.19	11600	3.94	15500	4.65
300	0.58	4100	2.24	7900	3.22	11700	3.97	15600	4.66
400	0.66	4200	2.27	8000	3.20	11800	3.98	15700	4.66
500	0.74	4300	2.31	8100	3.21	11900	4.08	15800	4.72
600	0.81	4400	2.31	8200	3.24	12000	4.03	15900	4.78
700	0.88	4500	2.36	8300	3.27	12100	4.06	16000	4.89
800	0.95	4600	2.37	8400	3.32	12200	4.05	16100	4.95
900	1.00	4700	2.40	8500	3.35	12300	4.16	16200	4.92
1000	1.06	4800	2.43	8600	3.35	12400	4.18	16300	4.95
1100	1.11	4900	2.45	8700	3.33	12500	4.20	16400	5.02
1200	1.16	5000	2.50	8800	3.37	12600	4.22	16500	5.04
1300	1.21	5100	2.51	8900	3.39	12700	4.23	16600	5.06
1400	1.26	5200	2.55	9000	3.45	12800	4.28	16700	5.17
1500	1.31	5300	2.56	9100	3.46	12900	4.26	16800	5.16
1600	1.35	5400	2.59	9200	3.47	13000	4.28	16900	5.19
1700	1.39	5500	2.62	9300	3.46	13100	4.28	17000	5.23
1800	1.44	5600	2.65	9400	3.50	13200	4.28	17100	5.30
1900	1.47	5700	2.67	9500	3.50	13300	4.29	17200	5.26
2000	1.52	5800	2.71	9600	3.53	13400	4.34	17300	5.30
2100	1.55	5900	2.72	9700	3.52	13500	4.31	17400	5.30
2200	1.60	6000	2.73	9800	3.54	13600	4.35	17500	5.36
2300	1.63	6100	2.76	9900	3.56	13700	4.36	17600	5.40
2400	1.67	6200	2.78	10000	3.57	13800	4.37	17700	5.47
2500	1.70	6300	2.81	10100	3.60	13900	4.41	17800	5.56
2600	1.74	6400	2.85	10200	3.69	14000	4.42	17900	5.45
2700	1.78	6500	2.87	10300	3.69	14100	4.45	18000	5.47
2800	1.83	6600	2.87	10400	3.67	14200	4.49		
2900	1.85	6700	2.90	10500	3.70	14300	4.55		
3000	1.89	6800	2.91	10600	3.70	14400	4.62		
3100	1.92	6900	2.96	10700	3.76	14600	4.54		
3200	1.96	7000	2.99	10800	3.88	14700	4.58		
3300	1.99	7100	3.01	10900	3.88	14800	4.57		
3400	2.03	7200	3.04	11000	3.85	14900	4.65		
3500	2.06	7300	3.08	11100	3.85	15000	4.64		

Cable loss
Microwave Cable Assembly, 18 GHz, 6.4 m, SMA – SMA, Huber-Suhner, model 198-9155-00
HL 3123

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.11	3600	1.97	7400	3.12	11200	3.90	15100	4.74
30	0.17	3700	1.97	7500	3.13	11300	3.93	15200	4.70
50	0.25	3800	2.03	7600	3.16	11400	3.88	15300	4.73
100	0.32	3900	2.04	7700	3.18	11500	3.87	15400	4.78
200	0.46	4000	2.10	7800	3.20	11600	3.90	15500	4.75
300	0.58	4100	1.97	7900	3.23	11700	3.86	15600	4.76
400	0.65	4200	1.97	8000	3.25	11800	3.88	15700	4.75
500	0.74	4300	2.03	8100	3.26	11900	3.86	15800	4.78
600	0.82	4400	2.04	8200	3.28	12000	3.89	15900	4.79
700	0.89	4500	2.10	8300	3.31	12100	3.94	16000	4.73
800	0.95	4600	1.97	8400	3.31	12200	3.92	16100	4.78
900	1.01	4700	1.97	8500	3.32	12300	3.96	16200	4.84
1000	1.07	4800	2.03	8600	3.34	12400	4.01	16300	4.90
1100	1.11	4900	2.04	8700	3.35	12500	4.07	16400	4.87
1200	1.17	5000	2.10	8800	3.37	12600	4.08	16500	4.90
1300	1.22	5100	2.53	8900	3.39	12700	4.17	16600	4.98
1400	1.27	5200	2.55	9000	3.42	12800	4.26	16700	5.05
1500	1.29	5300	2.60	9100	3.43	12900	4.16	16800	5.04
1600	1.35	5400	2.61	9200	3.51	13000	4.21	16900	5.02
1700	1.40	5500	2.64	9300	3.52	13100	4.24	17000	5.09
1800	1.44	5600	2.70	9400	3.54	13200	4.27	17100	5.07
1900	1.51	5700	2.67	9500	3.63	13300	4.31	17200	5.10
2000	1.49	5800	2.71	9600	3.61	13400	4.33	17300	5.13
2100	1.55	5900	2.74	9700	3.71	13500	4.25	17400	5.23
2200	1.58	6000	2.80	9800	3.66	13600	4.27	17500	5.21
2300	1.62	6100	2.79	9900	3.77	13700	4.33	17600	5.22
2400	1.72	6200	2.81	10000	3.75	13800	4.33	17700	5.36
2500	1.76	6300	2.83	10100	3.77	13900	4.31	17800	5.35
2600	1.78	6400	2.86	10200	3.80	14000	4.30	17900	5.45
2700	1.80	6500	2.88	10300	3.79	14100	4.30	18000	5.43
2800	1.86	6600	2.90	10400	3.87	14200	4.31		
2900	1.90	6700	2.92	10500	3.83	14300	4.37		
3000	1.90	6800	2.98	10600	3.88	14400	4.35		
3100	1.97	6900	2.98	10700	3.86	14600	4.53		
3200	1.97	7000	3.00	10800	3.87	14700	4.50		
3300	2.03	7100	3.02	10900	3.90	14800	4.62		
3400	2.04	7200	3.04	11000	3.84	14900	4.65		
3500	2.10	7300	3.06	11100	3.88	15000	4.79		

Cable loss
Cable coaxial, RG-214/U, N type-N type, 6.5 m
Suhner Switzerland, HL 3616

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	1750	2.66	3550	4.44	5350	6.08
30	0.25	1800	2.72	3600	4.46	5400	6.12
50	0.32	1850	2.78	3650	4.59	5450	6.17
100	0.48	1900	2.81	3700	4.60	5500	6.25
150	0.60	1950	2.86	3750	4.72	5550	6.31
200	0.71	2000	2.94	3800	4.72	5600	6.35
250	0.81	2050	2.97	3850	4.86	5650	6.41
300	0.91	2100	3.01	3900	4.85	5700	6.50
350	1.00	2150	3.06	3950	4.99	5750	6.52
400	1.07	2200	3.11	4000	4.90	5800	6.57
450	1.14	2250	3.16	4050	5.04	5850	6.61
500	1.23	2300	3.21	4100	5.01	5900	6.71
550	1.30	2350	3.26	4150	5.10	5950	6.70
600	1.37	2400	3.31	4200	5.08	6000	6.75
650	1.44	2450	3.35	4250	5.18	6050	6.74
700	1.50	2500	3.39	4300	5.14	6100	6.84
750	1.58	2550	3.46	4350	5.22	6150	6.87
800	1.64	2600	3.48	4400	5.21	6200	6.93
850	1.69	2650	3.55	4450	5.29	6250	6.96
900	1.77	2700	3.59	4500	5.31	6300	7.02
950	1.79	2750	3.66	4550	5.39	6350	7.04
1000	1.87	2800	3.68	4600	5.41	6400	7.10
1050	1.92	2850	3.75	4650	5.49	6450	7.11
1100	1.98	2900	3.79	4700	5.52	6500	7.19
1150	2.05	2950	3.86	4750	5.60		
1200	2.09	3000	3.89	4800	5.64		
1250	2.15	3050	3.94	4850	5.73		
1300	2.21	3100	3.98	4900	5.70		
1350	2.27	3150	4.03	4950	5.73		
1400	2.33	3200	4.06	5000	5.75		
1450	2.38	3250	4.12	5050	5.83		
1500	2.44	3300	4.14	5100	5.82		
1550	2.48	3350	4.22	5150	5.91		
1600	2.52	3400	4.24	5200	5.92		
1650	2.56	3450	4.31	5250	5.98		
1700	2.62	3500	4.35	5300	6.01		

Cable loss
Cable coaxial, RG-214/U, N type-N type, 5.5 m
Alpha Wire, HL 3634

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.05	1750	2.12	3550	3.43	5350	4.66
30	0.18	1800	2.16	3600	3.50	5400	4.70
50	0.24	1850	2.17	3650	3.53	5450	4.76
100	0.36	1900	2.23	3700	3.55	5500	4.80
150	0.47	1950	2.25	3750	3.57	5550	4.86
200	0.55	2000	2.33	3800	3.63	5600	4.87
250	0.64	2050	2.34	3850	3.67	5650	4.91
300	0.70	2100	2.41	3900	3.73	5700	4.97
350	0.77	2150	2.44	3950	3.73	5750	5.02
400	0.83	2200	2.49	4000	3.78	5800	5.07
450	0.91	2250	2.52	4050	3.79	5850	5.07
500	0.95	2300	2.55	4100	3.90	5900	5.15
550	1.02	2350	2.56	4150	3.88	5950	5.20
600	1.08	2400	2.60	4200	3.88	6000	5.25
650	1.15	2450	2.68	4250	3.98	6050	5.26
700	1.19	2500	2.67	4300	4.00	6100	5.30
750	1.25	2550	2.73	4350	4.02	6150	5.37
800	1.31	2600	2.74	4400	4.03	6200	5.40
850	1.35	2650	2.77	4450	4.06	6250	5.45
900	1.39	2700	2.84	4500	4.14	6300	5.47
950	1.45	2750	2.85	4550	4.16	6350	5.50
1000	1.49	2800	2.89	4600	4.17	6400	5.57
1050	1.56	2850	2.91	4650	4.19	6450	5.62
1100	1.57	2900	2.99	4700	4.21	6500	5.61
1150	1.64	2950	3.00	4750	4.26		
1200	1.66	3000	3.03	4800	4.29		
1250	1.71	3050	3.06	4850	4.30		
1300	1.73	3100	3.14	4900	4.33		
1350	1.80	3150	3.20	4950	4.36		
1400	1.81	3200	3.20	5000	4.45		
1450	1.87	3250	3.22	5050	4.44		
1500	1.94	3300	3.24	5100	4.49		
1550	1.96	3350	3.33	5150	4.53		
1600	1.97	3400	3.35	5200	4.62		
1650	2.03	3450	3.38	5250	4.63		
1700	2.05	3500	3.39	5300	4.64		

13 APPENDIX F Abbreviations and acronyms

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

END OF DOCUMENT