

# TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247 (FHSS) and subpart B

FOR:

**Visonic Ltd.**

**Indoor Siren**

**Model: SR-720 PG2**

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## 1 Applicant information

**Client name:** Visonic Ltd.  
**Address:** Habarzel street 24, Tel Aviv 69710, Israel  
**Telephone:** +972 3645 6789  
**Fax:** +972 3645 6788  
**E-mail:** aelshtein@visonic.com  
**Contact name:** Mr. Arick Elshtein

## 2 Equipment under test attributes

**Product name:** Indoor Siren  
**Product type:** Transceiver  
**Model(s):** SR-720 PG2  
**Hardware version:** 90-203850 revision PCB-B  
**Software release:** JS-701796, version 2.08  
**Receipt date** 2/15/2011

## 3 Manufacturer information

**Manufacturer name:** Visonic Ltd.  
**Address:** Habarzel street 24, Tel Aviv 69710, Israel  
**Telephone:** +972 3645 6789  
**Fax:** +972 3645 6788  
**E-Mail:** aelshtein@visonic.com  
**Contact name:** Mr. Arick Elshtein




## 4 Test details

**Project ID:** 21726  
**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel  
**Test started:** 2/15/2011  
**Test completed:** 2/23/2011  
**Test specification(s):** FCC 47CFR part 15, subpart C, §15.247 (FHSS); subpart B, §15.109

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
Section 15.247(a)1, The 20 dB bandwidth	Pass
Section 15.247(a)1, Frequency separation	Pass
Section 15.247(a)1, Number of hopping frequencies	Pass
Section 15.247(a)1, Average time of occupancy	Pass
Section 15.247(b), Peak output power	Pass
Section 15.247(d), Emissions at band edges	Pass
Section 15.247(d), Radiated spurious emissions	Pass
Section 15.203, Antenna requirements	Pass
Section 15.207(a), Conducted emission	Not required
Section 15.247(i), RF exposure	Pass, the exhibit to the application of certification is provided
<b>Unintentional emissions</b>	
Section 15.107, Conducted emission at AC power port	Not required
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.

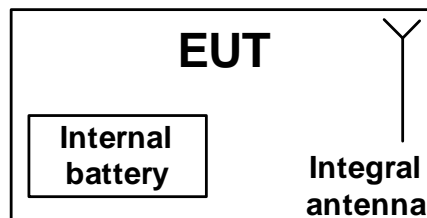
	Name and Title	Date	Signature
<b>Tested by:</b>	Mrs. E. Pitt, test engineer	February 23, 2011	
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	April 3, 2011	
<b>Approved by:</b>	Mr. M. Nikishin, EMC and radio group manager	May 6, 2011	

## 6 EUT description

### 6.1 General information

The EUT, SR-720 PG2, is a siren of PM Complete PCG2 Power Code II (PCG2) Wireless Alarm Control System .

### 6.2 Test configuration



### 6.3 Changes made in the EUT

No changes were implemented in the EUT.

## 6.4 Transmitter characteristics

<b>Type of equipment</b>						
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)					
<b>Intended use</b>		<b>Condition of use</b>				
	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				
<b>Assigned frequency ranges</b>		902 – 928 MHz				
<b>Operating frequencies</b>		912.750 – 919.106 MHz				
<b>Maximum rated output power</b>		At transmitter 50 $\Omega$ RF output connector			dBm	
		Peak output power			10 dBm	
<b>Is transmitter output power variable?</b>		X	No			
		Yes	continuous variable			
			stepped variable with stepsize			dB
			minimum RF power			dBm
			maximum RF power			dBm
<b>Antenna connection</b>						
unique coupling		standard connector		X	integral	with temporary RF connector
						X without temporary RF connector
<b>Antenna/s technical characteristics</b>						
Type	Manufacturer		Model number		Gain	
Integral	Visonic		Built-in wire antenna		2 dBi	
<b>Transmitter aggregate data rate/s</b>		50 kbps				
<b>Type of modulation</b>		GFSK				
<b>Modulating test signal (baseband)</b>		PRBS				
<b>Maximum transmitter duty cycle in normal use</b>		0.1%				
<b>Transmitter power source</b>						
X	Battery	<b>Nominal rated voltage</b>	3.6 VDC	<b>Battery type</b>	Lithium	
	DC	<b>Nominal rated voltage</b>	VDC			
	AC mains	<b>Nominal rated voltage</b>	VAC	<b>Frequency</b>		
<b>Common power source for transmitter and receiver</b>				X	yes	no
<b>Spread spectrum technique used</b>		X	Frequency hopping (FHSS)			
			Digital transmission system (DTS)			
			Hybrid			
<b>Spread spectrum parameters for transmitters tested per FCC 15.247 only</b>						
<b>FHSS</b>	Total number of hops		50			
	Bandwidth per hop		100 kHz			
	Max. separation of hops		131 kHz			

<b>Test specification:</b>		<b>Section 15.247(a)1, 20 dB bandwidth</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

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

### 7.1 20 dB bandwidth

#### 7.1.1 General

This test was performed to measure 20 dB bandwidth of the transmitter hopping channel. Specification test limits are given in Table 7.1.1.

Table 7.1.1 The 20 dB bandwidth limits

Assigned frequency, MHz	Maximum bandwidth, kHz	Modulation envelope reference points*, dBc
902.0 – 928.0	500	20
2400.0 – 2483.5	NA	
5725.0 – 5850.0	1000	

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

#### 7.1.2 Test procedure

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 set to transmit modulated carrier at maximum data rate.

7.1.2.3 The transmitter bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

7.1.2.4 The test was repeated for each data rate and each modulation format.

Figure 7.1.1 The 20 dB bandwidth test setup



<b>Test specification:</b>		<b>Section 15.247(a)1, 20 dB bandwidth</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Table 7.1.2 The 20 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 902-928 MHz  
DETECTOR USED: Peak  
SWEEP TIME: Auto  
RESOLUTION BANDWIDTH:  $\geq 1\%$  of the 20 dB bandwidth  
VIDEO BANDWIDTH:  $\geq$  RBW  
MODULATION ENVELOPE REFERENCE POINTS: 20.0 dBc  
MODULATING SIGNAL: PRBS  
FREQUENCY HOPPING: Disabled

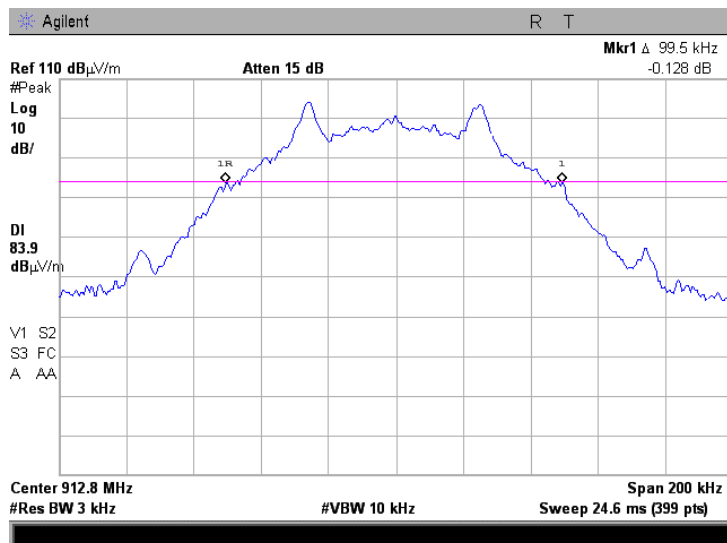
Carrier frequency, MHz	Type of modulation	Data rate, kbps	Symbol rate, Msymbols/s	20 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
912.750	GFSK	50	NA	99.5	500	-400.5	Pass
915.863				98.5	500	-401.5	Pass
919.106				100.0	500	-400.0	Pass

Reference numbers of test equipment used

HL 2780	HL 569	HL 3901						
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Full description is given in Appendix A.

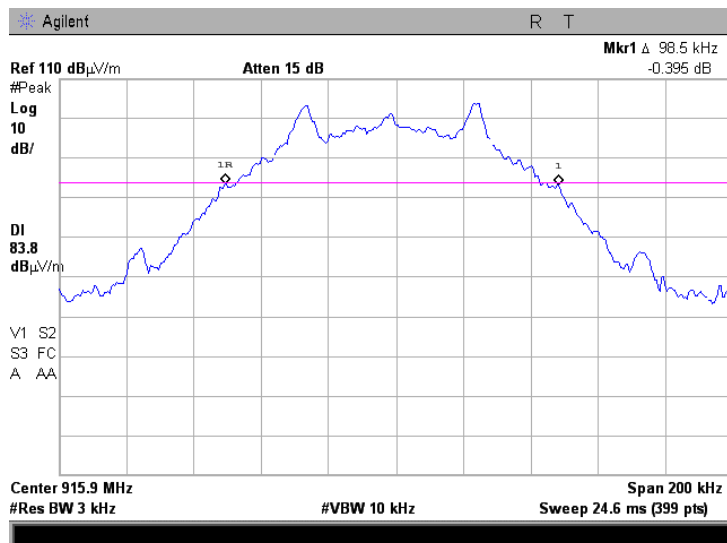
Plot 7.1.1 The 20 dB bandwidth test result at low frequency



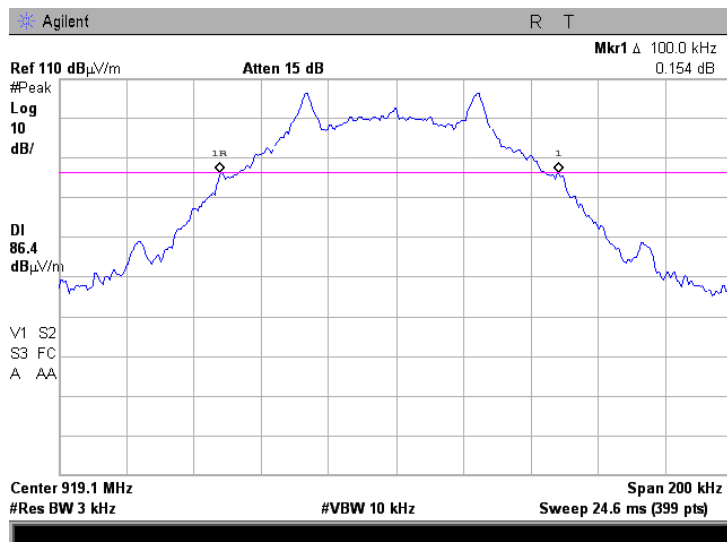


<b>Test specification:</b>	<b>Section 15.247(a)1, 20 dB bandwidth</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.1.2 The 20 dB bandwidth test result at mid frequency



Plot 7.1.3 The 20 dB bandwidth test result at high frequency



<b>Test specification:</b>	<b>Section 15.247(a)1, Frequency separation</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 59 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 7.2 Carrier frequency separation

### 7.2.1 General

This test was performed to measure frequency separation between the peaks of adjacent channels. Specification test limits are given in Table 7.2.1.

**Table 7.2.1 Carrier frequency separation limits**

Assigned frequency range, MHz	Carrier frequency separation
902.0 – 928.0	25 kHz or 20 dB bandwidth of the hopping channel, whichever is greater
2400.0 – 2483.5	
5725.0 – 5850.0	

### 7.2.2 Test procedure

- 7.2.2.1** The EUT was set up as shown in Figure 7.2.1, energized with frequency hopping function enabled and its proper operation was checked.
- 7.2.2.2** The spectrum analyzer span was set to capture the carrier frequency and both of adjacent channels, the lower and the higher. The resolution bandwidth was set wider than 1 % of the frequency span.
- 7.2.2.3** The spectrum analyzer was set in max hold mode and allowed trace to stabilize.
- 7.2.2.4** The frequency separation between the peaks of adjacent channels was measured as provided in Table 7.2.2 and the associated plots.

**Figure 7.2.1 Carrier frequency separation test setup**



<b>Test specification:</b>		<b>Section 15.247(a)1, Frequency separation</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/22/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 59 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**Table 7.2.2 Carrier frequency separation test results**

ASSIGNED FREQUENCY: 902-928MHz  
 MODULATION: GFSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 50kbps  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH:  $\geq 1\%$  of the span  
 VIDEO BANDWIDTH:  $\geq$  RBW  
 FREQUENCY HOPPING: Enabled  
 20 dB BANDWIDTH: 100 kHz

Carrier frequency separation, kHz	Limit, kHz	Margin*	Verdict
131	100	-31	Pass

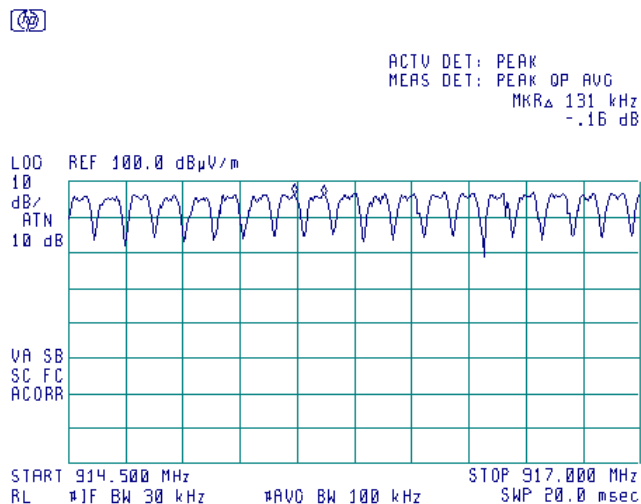
\* - Margin = Carrier frequency separation – specification limit.

**Reference numbers of test equipment used**

HL 2909	HL 1984	HL 3616					
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Full description is given in Appendix A.

**Plot 7.2.1 Carrier frequency separation**



<b>Test specification:</b>		<b>Section 15.247(a)1, Number of hopping frequencies</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/22/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 59 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 7.3 Number of hopping frequencies

### 7.3.1 General

This test was performed to calculate the number of hopping frequencies used by the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Minimum number of hopping frequencies

Assigned frequency range, MHz	Number of hopping frequencies
902.0 – 928.0	50 (if the 20 dB bandwidth is less than 250 kHz) 25 (if the 20 dB bandwidth is 250 kHz or greater)
2400.0 – 2483.5	15
5725.0 – 5850.0	75

### 7.3.2 Test procedure

- 7.3.2.1** The EUT was set up as shown in Figure 7.3.1, energized with frequency hopping function enabled and its proper operation was checked.
- 7.3.2.2** Initially the spectrum analyzer span was set equal to frequency band of operation and the resolution bandwidth was set wider than 1 % of the frequency span. If the separate hopping channels were not clearly resolved the frequency band of operation was broken to sections and the resolution bandwidth was set wider than 1 % of the frequency span of each section.
- 7.3.2.3** The spectrum analyzer was set in max hold mode and allowed trace to stabilize.
- 7.3.2.4** The number of frequency hopping channels was calculated as provided in Table 7.3.2 and associated plots.

Figure 7.3.1 Hopping frequencies test setup



<b>Test specification:</b>	<b>Section 15.247(a)1, Number of hopping frequencies</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date:</b>	2/22/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 59 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**Table 7.3.2 Hopping frequencies test results**

ASSIGNED FREQUENCY: 902-928 MHz  
 MODULATION: GFSK  
 BIT RATE: 50 kbps  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH:  $\geq 1\%$  of the span  
 VIDEO BANDWIDTH:  $\geq$  RBW  
 FREQUENCY HOPPING: Enabled

Number of hopping frequencies	Minimum number of hopping frequencies	Margin*	Verdict
50	50	0	PASS

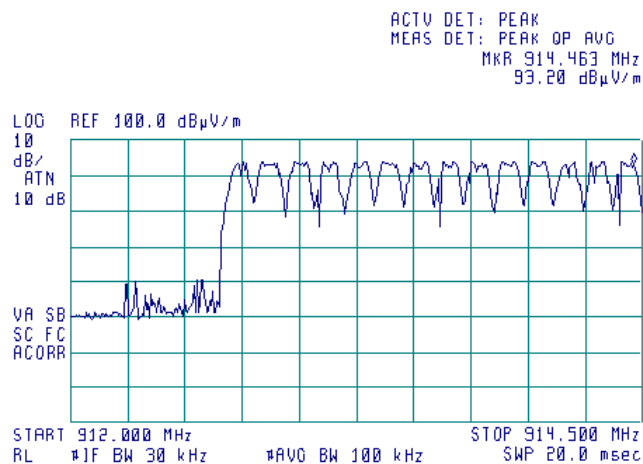
\* - Margin = Number of hopping frequencies – Minimum number of hopping frequencies.

**Reference numbers of test equipment used**

HL 1431	HL 2883	HL 3386	HL 1984				
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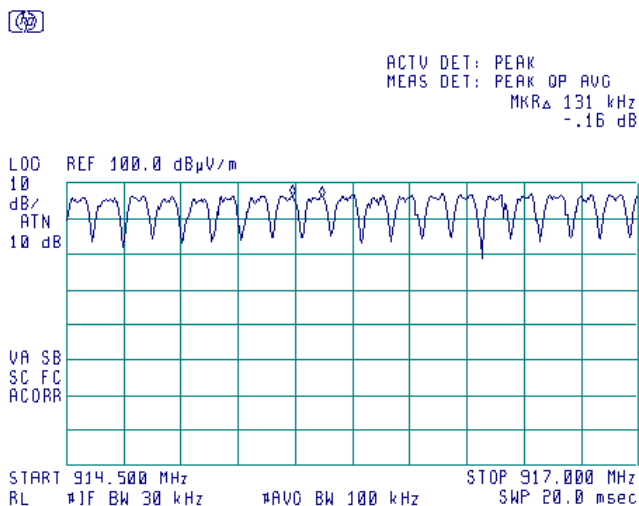
Full description is given in Appendix A.

**Plot 7.3.1 Number of hopping frequencies in the frequency range 912 –914.5 MHz (fourteen)**

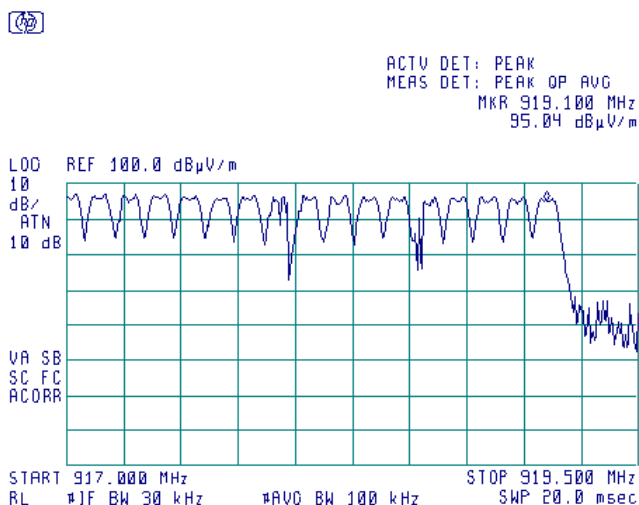


<b>Test specification:</b>	<b>Section 15.247(a)1, Number of hopping frequencies</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 59 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**Plot 7.3.2 Number of hopping frequencies in the frequency range 914.5 –917.0 MHz (nineteen)**



**Plot 7.3.3 Number of hopping frequencies in the frequency range 917 –919.5 MHz (seventeen)**



<b>Test specification:</b>	<b>Section 15.247(a)1, Average time of occupancy</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 59 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 7.4 Average time of occupancy

### 7.4.1 General

This test was performed to calculate the average time of occupancy (dwell time) on any frequency channel of the EUT. Specification test limits are given in Table 7.4.1.

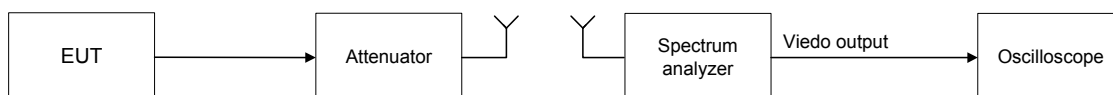
Table 7.4.1 Average time of occupancy limits

Assigned frequency range, MHz	Maximum average time of occupancy, s	Investigated period, s	Number of hopping frequencies
902.0 – 928.0	0.4	20.0	≥ 50
902.0 – 928.0	0.4	10.0	< 50
2400.0 – 2483.5	0.4	0.4 × N	N (≥ 15)
5725.0 – 5850.0	0.4	30.0	≥ 75

### 7.4.2 Test procedure

- 7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized with frequency hopping function enabled and its proper operation was checked.
- 7.4.2.2 The spectrum analyzer span was set to zero centered on a hopping channel.
- 7.4.2.3 The single transmission duration and period were measured with oscilloscope.
- 7.4.2.4 The average time of occupancy was calculated as the single transmission time multiplied by the investigated period and divided by the single transmission period.
- 7.4.2.5 The test was repeated at each data rate and modulation type as provided in Table 7.4.2 and the associated plots.

Figure 7.4.1 Average time of occupancy test setup



<b>Test specification:</b>		<b>Section 15.247(a)1, Average time of occupancy</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/22/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 59 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Table 7.4.2 Average time of occupancy test results

ASSIGNED FREQUENCY RANGE: 902-928 MHz  
 MODULATION: GFSK  
 MODULATING SIGNAL: PRBS  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 3 MHz  
 VIDEO BANDWIDTH: 3 MHz  
 NUMBER OF HOPPING FREQUENCIES: 50  
 INVESTIGATED PERIOD: 20 s  
 FREQUENCY HOPPING: Enabled

Carrier frequency MHz	Single transmission duration, ms	Single transmission period, s	Average time of occupancy*, s	Bit rate, kbps	Limit, s	Margin, s**	Verdict
915.863	4	2	0.04	50	0.4	-0.36	Pass

\* - Average time of occupancy = (Single transmission duration × Investigated period) / (Single transmission period × number of hopping channels).

\*\* - Margin = Average time of occupancy – specification limit.

**Reference numbers of test equipment used**

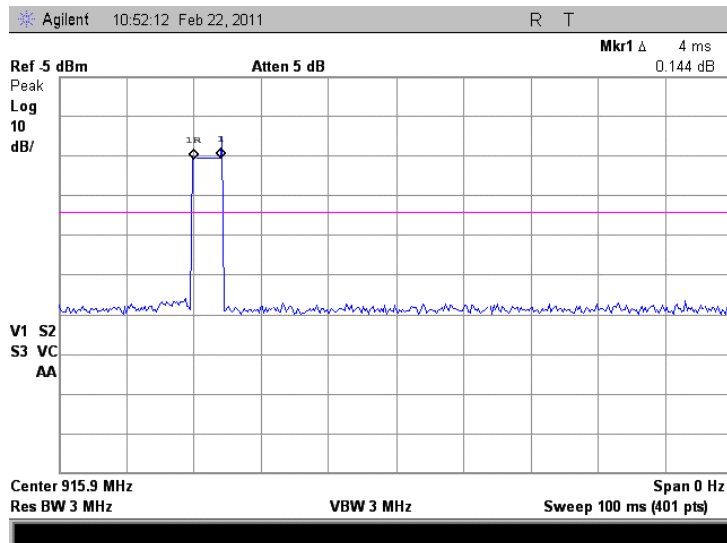
HL 1984	HL 2909	HL 3616					
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Full description is given in Appendix A.

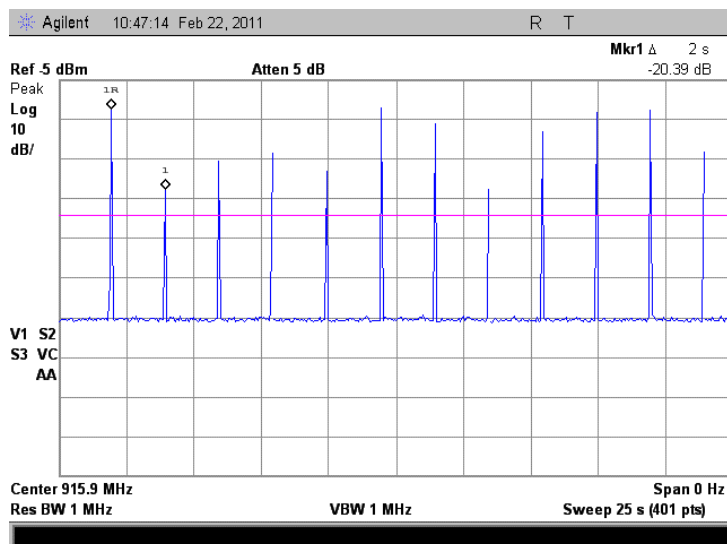


<b>Test specification:</b>	<b>Section 15.247(a)1, Average time of occupancy</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 59 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.4.1 Single transmission duration



Plot 7.4.2 Single transmission period



<b>Test specification:</b>	<b>Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 7.5 Peak output power

### 7.5.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.5.1.

**Table 7.5.1 Peak output power limits**

Assigned frequency range MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	1	30	131.2	6.0*
2400.0 – 2483.5	0.125 (<75 hopping channels)	21.0(<75 hopping channels)	122.2 (<75 hopping channels)	
	1.0 (≥75 hopping channels)	30.0 (≥75 hopping channels)	131.2 (≥75 hopping channels)	
5725.0 – 5850.0	1.0	30.0	131.2	

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

\*\* - The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

- by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
- without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
- by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

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

**7.5.2.3** The frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

**7.5.2.4** The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.5.2 and associated plots.

**7.5.2.5** The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

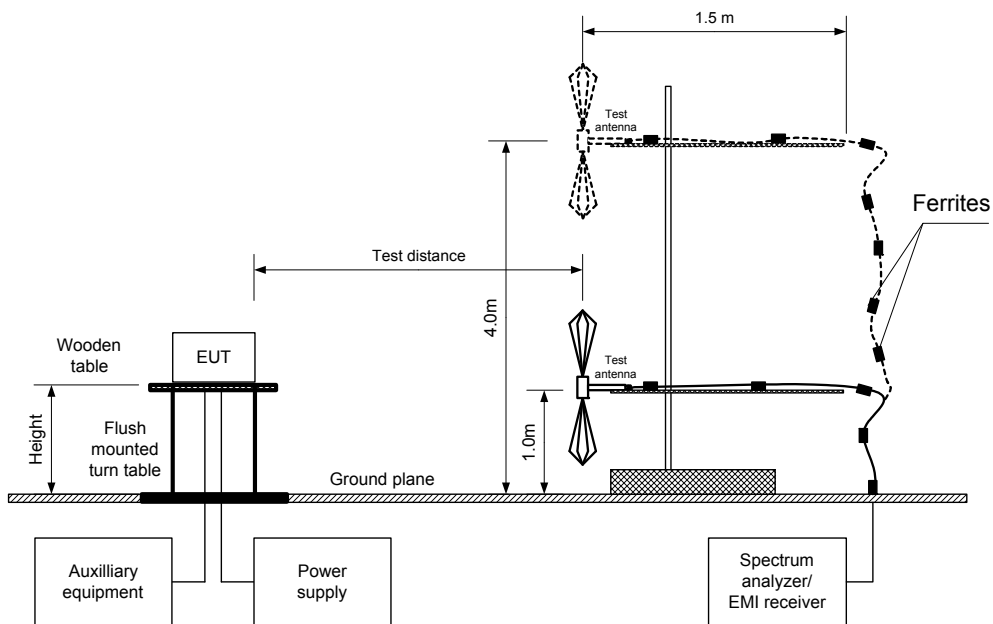
The above equation was converted in logarithmic units for 3 m test distance:

$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

**7.5.2.6** The worst test results (the lowest margins) were recorded in Table 7.5.1.

<b>Test specification:</b>		<b>Section 15.247(b), Peak output power</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Figure 7.5.1 Setup for carrier field strength measurements



<b>Test specification:</b>		<b>Section 15.247(b), Peak output power</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Table 7.5.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: OATS  
 EUT HEIGHT: 0.8 m  
 DETECTOR USED: Peak  
 TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)  
 MODULATION: GFSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 50 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 EUT 20 dB BANDWIDTH: 100 kHz  
 RESOLUTION BANDWIDTH: 120 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 FREQUENCY HOPPING: Disabled  
 NUMBER OF FREQUENCY HOPPING CHANNELS: 50

Frequency, MHz	Field strength dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin dB***	Verdict
912.750	104.9	H	1.4	0	2	7.7	30	-22.3	Pass
915.863	104.7	H	1.4	0	2	7.5	30	-22.5	Pass
919.106	107.2	H	1.4	0	2	10.0	30	-20.0	Pass

\*- EUT front panel refer to 0 degrees position of turntable.

\*\* - Peak output power was calculated from the field strength of carrier as follows:  $P = (E \times d)^2 / (30 \times G)$ , where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi - 95.2 dB*

\*\*\* - Margin = Peak output power – specification limit.

Note: Maximum peak output power was obtained at Unom (115%Unom, 85%Unom) input power voltage.

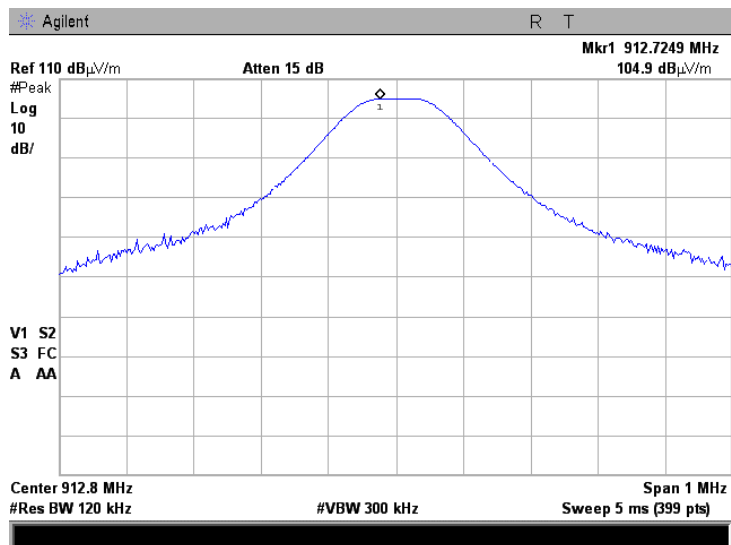
#### Reference numbers of test equipment used

HL 0569	HL 2780	HL 3901				
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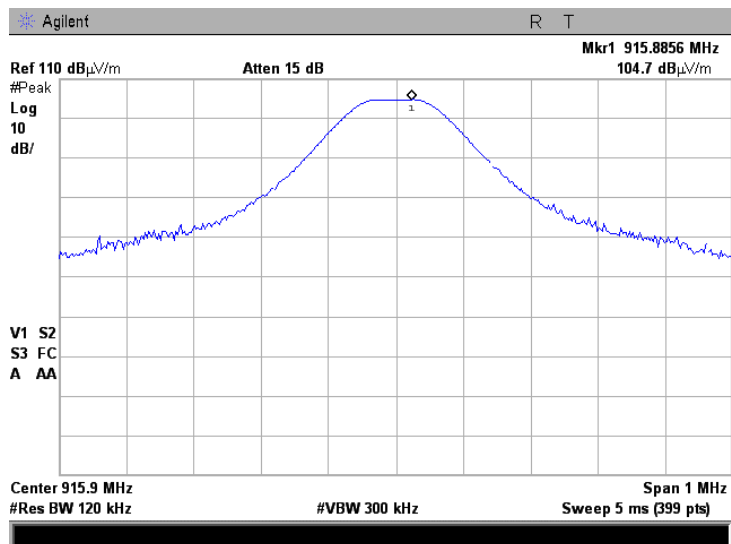
Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.5.1 Field strength of carrier at low frequency

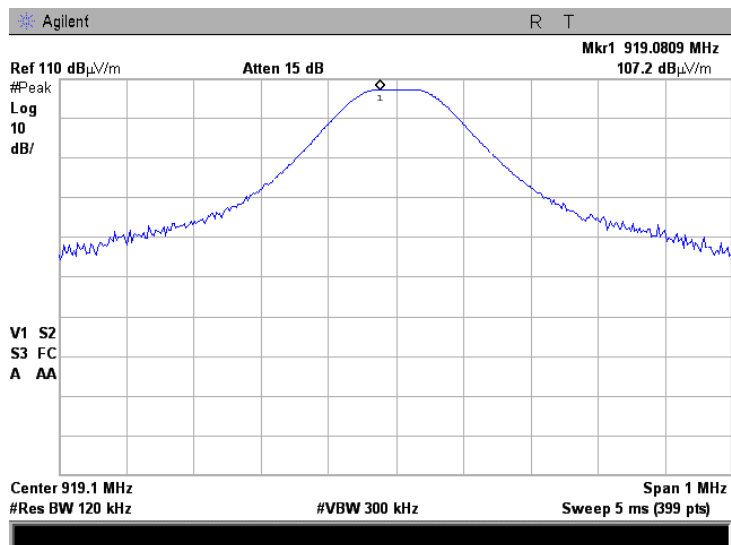


Plot 7.5.2 Field strength of carrier at mid frequency



<b>Test specification:</b>	<b>Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.5.3 Field strength of carrier at high frequency



<b>Test specification:</b>	<b>Section 15.247(d), Emissions at band edges</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 7.6 Band edge radiated emissions

### 7.6.1 General

This test was performed to measure emissions, radiated from the EUT at the assigned frequency band edges. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Band edge emission limits

Assigned frequency, MHz	Attenuation below carrier*, dBc	Field strength at 3 m within restricted bands, dB(μV/m)	
		Peak	Average
902.0 – 928.0	20.0	74.0	54.0
2400.0 – 2483.5			
5725.0 – 5850.0			

\* - Band edge emission limit is provided in terms of attenuation below the peak of modulated carrier measured with the same resolution bandwidth.

### 7.6.2 Test procedure

- 7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized normally modulated at the maximum data rate with its hopping function disabled and its proper operation was checked.
- 7.6.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- 7.6.2.3 The spectrum analyzer span was set to capture the carrier frequency and associated modulation products. The resolution bandwidth was set wider than 1 % of the frequency span.
- 7.6.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- 7.6.2.5 The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.6.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- 7.6.2.6 The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.
- 7.6.2.7 The above procedure was repeated with the frequency hopping function enabled.

Figure 7.6.1 Band edge emission test setup



<b>Test specification:</b>		<b>Section 15.247(d), Emissions at band edges</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**Table 7.6.2 Band edge emission test results**

ASSIGNED FREQUENCY RANGE: 902-928 MHz  
DETECTOR USED: Peak  
MODULATION: GFSK  
MODULATING SIGNAL: PRBS  
BIT RATE: 50 kbps  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
RESOLUTION BANDWIDTH:  $\geq 1\%$  of the span  
VIDEO BANDWIDTH:  $\geq$  RBW

Frequency, MHz	Band edge emission, dBuV/m	Emission at carrier, dBuV/m	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Frequency hopping disabled						
912.750	48.79	104.9	-56.11	20.0	-36.11	Pass
919.106	48.17	107.2	-59.03		-39.03	
Frequency hopping enabled						
912.750	45.23	104.9	-59.67	20.0	-39.67	Pass
919.106	49.09	107.2	-58.11		-38.11	

\*- Margin = Attenuation below carrier – specification limit.

**Reference numbers of test equipment used**

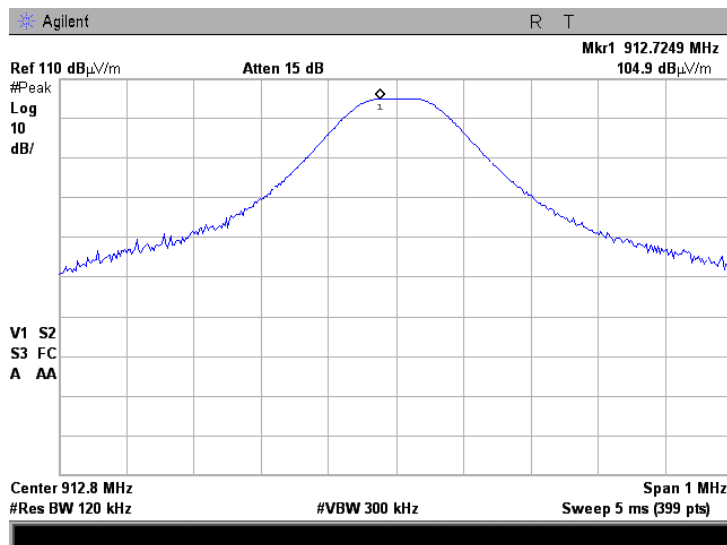
HL 0569	HL 2780	HL 3901					
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Full description is given in Appendix A.

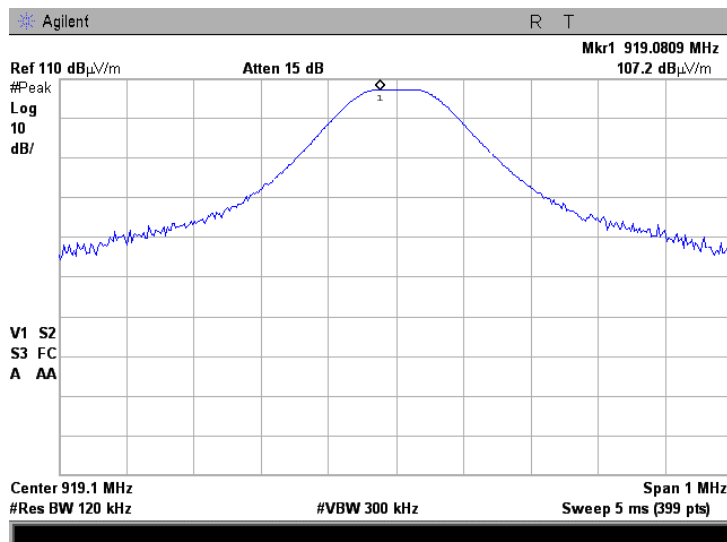


<b>Test specification:</b>		<b>Section 15.247(d), Emissions at band edges</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.6.1 The highest emission level within the assigned band at low carrier frequency

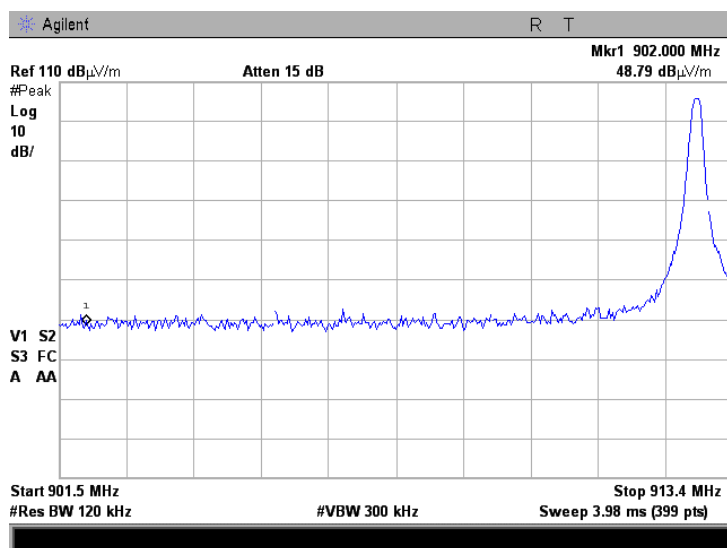


Plot 7.6.2 The highest emission level within the assigned band at high carrier frequency

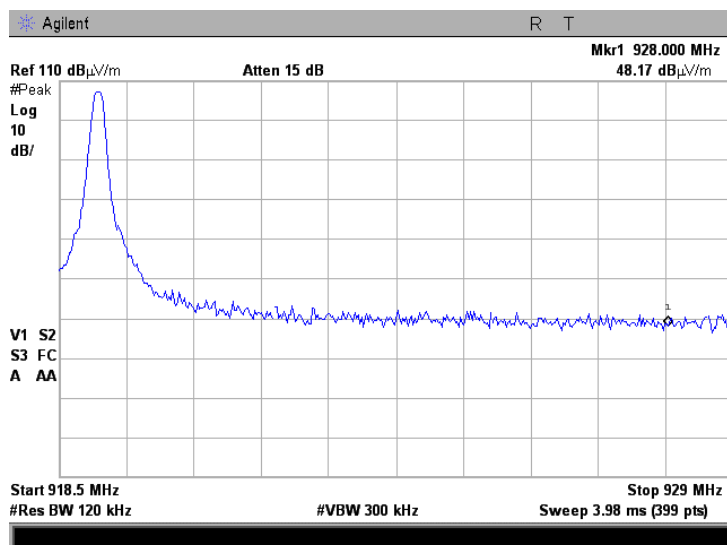


<b>Test specification:</b>		<b>Section 15.247(d), Emissions at band edges</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.6.3 The highest band edge emission at low carrier frequency with hopping function disabled

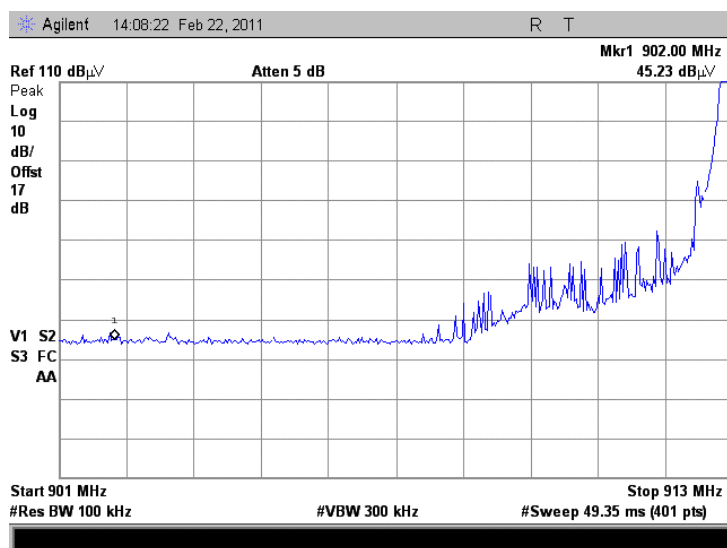


Plot 7.6.4 The highest band edge emission at high carrier frequency with hopping function disabled

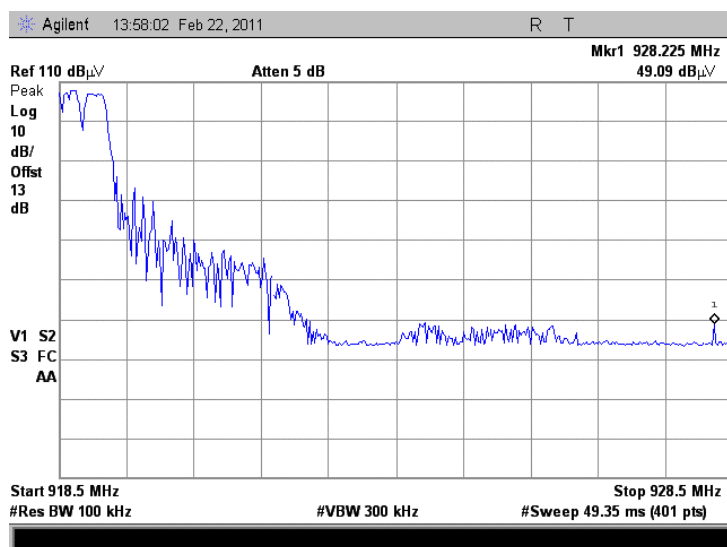


<b>Test specification:</b>		<b>Section 15.247(d), Emissions at band edges</b>	
<b>Test procedure:</b>		Public notice DA 00-705	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.6.5 The highest band edge emission at low carrier frequency with hopping function enabled



Plot 7.6.6 The highest band edge emission at high carrier frequency with hopping function enabled



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 7.7 Field strength of spurious emissions

### 7.7.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)***			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***
	Peak	Quasi Peak	Average	
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	20.0
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		
1000 – 10 <sup>th</sup> harmonic	74.0	NA	54.0	

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

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

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

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

\*\*\* - The field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

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

**7.7.2.1** The EUT was set up as shown in Figure 7.7.1, energized and the performance check was conducted.

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

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

### 7.7.3 Test procedure for spurious emission field strength measurements above 30 MHz

**7.7.3.1** The EUT was set up as shown in Figure 7.7.2, energized and the performance check was conducted.

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

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

<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Figure 7.7.1 Setup for spurious emission field strength measurements below 30 MHz

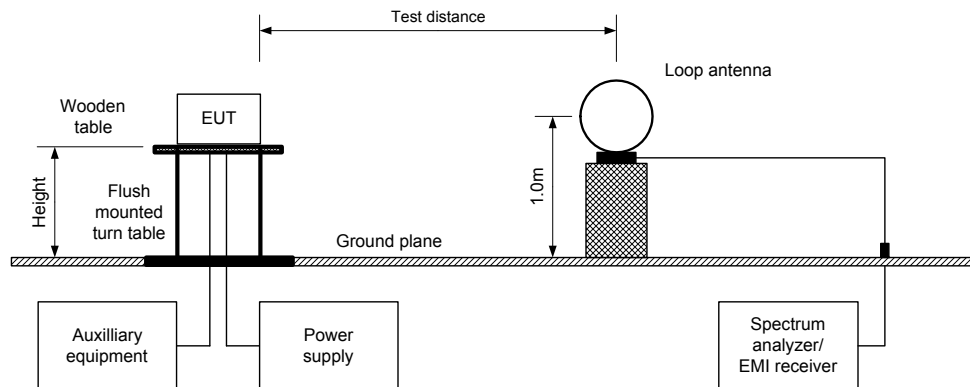
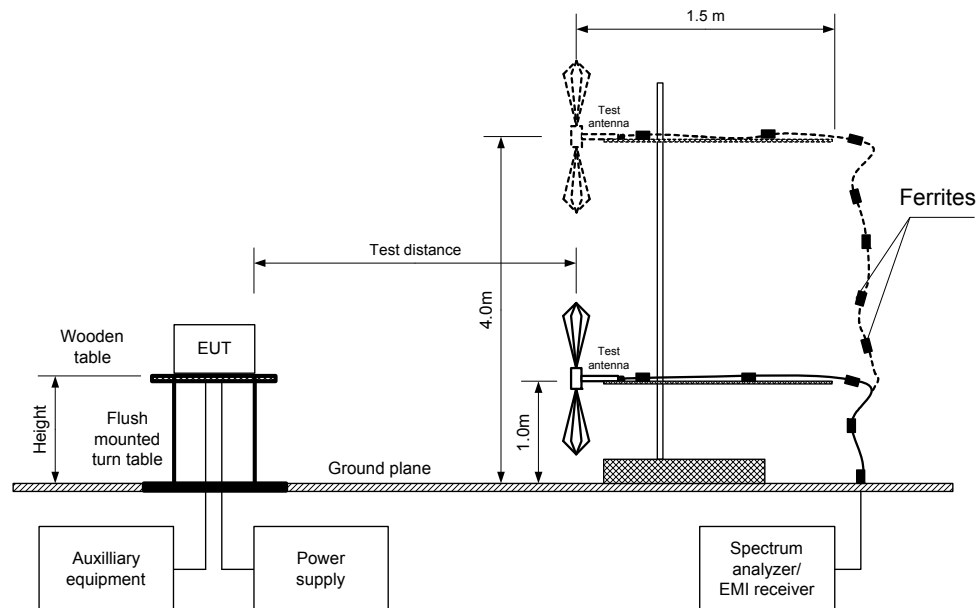


Figure 7.7.2 Setup for spurious emission field strength measurements above 30 MHz



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**Table 7.7.2 Field strength of emissions outside restricted bands**

ASSIGNED FREQUENCY RANGE: 902-928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 - 9300 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 50 kbps  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconical (30 MHz – 200 MHz)  
 Log periodic (200 MHz – 1000 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)  
 Disabled

FREQUENCY HOPPING:

Frequency MHz	Field strength of spurious, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(μV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
Low carrier frequency									
1825.550	49.35	H	2.00	23	104.9	-55.55	20.0	-35.55	Pass
5476.354	48.47	H	1.8	0		-56.43		-36.43	
Mid carrier frequency									
1831.781	48.23	H	1.84	83	104.7	-56.47	20.0	-36.47	Pass
5495.305	51.77	V	2.00	10		-53.13		-33.13	
High carrier frequency									
1838.155	49.11	H	1.96	25	107.2	-58.09	20.0	-58.09	Pass
5514.802	51.07	V	1.90	10		-56.13		-56.13	

\*- EUT front panel refers to 0 degrees position of turntable.

\*\*- Margin = Attenuation below carrier – specification limit.

Test specification:	Section 15.247(d), Radiated spurious emissions			
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4			
Test mode:	Compliance	Verdict:		PASS
Date:	2/15/2011 - 2/20/2011			
Temperature: 22 °C	Air Pressure: 1008 hPa	Relative Humidity: 60 %	Power Supply: Battery	
Remarks:				

**Table 7.7.3 Field strength of spurious emissions above 1 GHz within restricted bands**

ASSIGNED FREQUENCY RANGE: 902-928 MHz  
 INVESTIGATED FREQUENCY RANGE: 1000 - 9300 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 50 kbps  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1000 kHz  
 TEST ANTENNA TYPE: Double ridged guide  
 FREQUENCY HOPPING: Disabled

Frequency MHz	Antenna		Azimuth degrees	Peak field strength(VBW=3 MHz)			Average field strength(VBW=10 Hz)				Verdict
	Polarization	Height m		Measured dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured dB(μV/m)	Calculated dB(μV/m)	Limit, dB(μV/m)	Margin dB***	
Low carrier frequency											
2738.265	V	1.1	0	47.39	74.00	-26.61	44.40	16.40	54.00	-37.60	Pass
3648.839	V	1.3	180	44.49	74.00	-29.51	40.21	12.21	54.00	-41.79	
7301.975	V	1.8	10	49.50	74.00	-24.50	44.64	16.64	54.00	-37.36	
8214.712	V	1.5	0	44.56	74.00	-29.44	35.85	7.85	54.00	-46.15	
9127.550	V	1.8	10	52.37	74.00	-21.63	48.93	20.93	54.00	-33.07	
Mid carrier frequency											
2747.602	V	1.1	0	47.77	74.00	-26.23	45.74	17.74	54.00	-36.26	Pass
7326.952	V	1.9	10	52.87	74.00	-21.13	50.24	22.24	54.00	-31.76	
8242.793	V	1.2	10	46.18	74.00	-27.82	40.22	12.22	54.00	-41.78	
9158.643	V	1.8	10	55.73	74.00	-18.27	52.80	24.80	54.00	-29.20	
High carrier frequency											
2757.318	V	1.4	0	47.26	74.00	-26.74	45.09	17.09	54.00	-36.91	Pass
7352.798	V	1.5	10	51.71	74.00	-22.29	46.79	18.79	54.00	-35.21	
8271.941	V	1.4	10	46.41	74.00	-27.59	38.67	10.67	54.00	-43.33	
9191.035	V	1.9	10	54.40	74.00	-19.60	50.94	22.94	54.00	-31.06	

\*- EUT front panel refers to 0 degrees position of turntable.

\*\*- Margin = Measured field strength - specification limit.

\*\*\*- Margin = Calculated field strength - specification limit,

where Calculated field strength = Measured field strength + average factor.

**Table 7.7.4 Average factor calculation**

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
4	2000	NA	NA	NA	-28

\*- Average factor was calculated as follows

for pulse train shorter than 100 ms:

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

for pulse train longer than 100 ms:

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

<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**Table 7.7.5 Field strength of spurious emissions below 1 GHz within restricted bands**

ASSIGNED FREQUENCY RANGE: 902-928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 50 kbps  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)  
 9.0 kHz (150 kHz – 30 MHz)  
 120 kHz (30 MHz – 1000 MHz)  
 VIDEO BANDWIDTH: > Resolution bandwidth  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconical (30 MHz – 200 MHz)  
 Log periodic (200 MHz – 1000 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 FREQUENCY HOPPING: Disabled

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

\*- Margin = Measured emission - specification limit.

\*\* - EUT front panel refer to 0 degrees position of turntable.

**Table 7.7.6 Restricted bands**

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

**Reference numbers of test equipment used**

HL 0446	HL 0521	HL 0569	HL 0604	HL 1984	HL 2780	HL 2871	HL 3341
HL 3342	HL 3533	HL 3623	HL 3883	HL 3901	HL 3902		

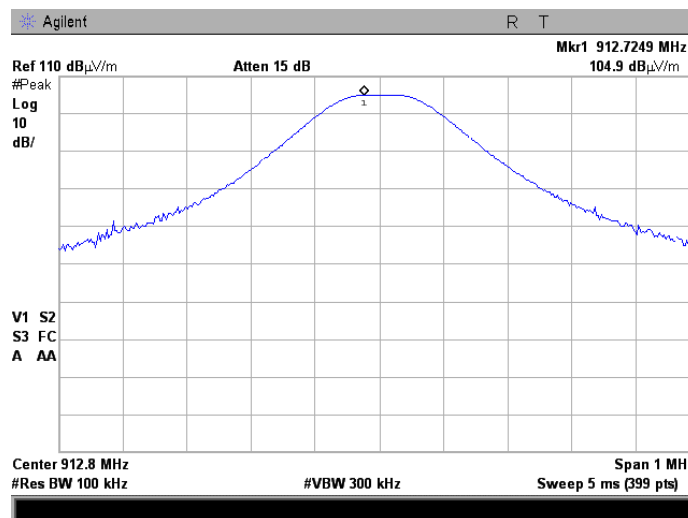
Full description is given in Appendix A.



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

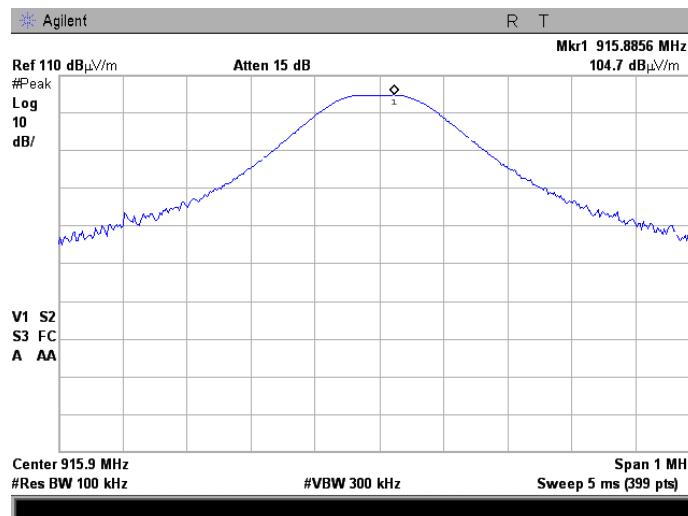
#### Plot 7.7.1 Radiated emission measurements at the low carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



#### Plot 7.7.2 Radiated emission measurements at the mid carrier frequency

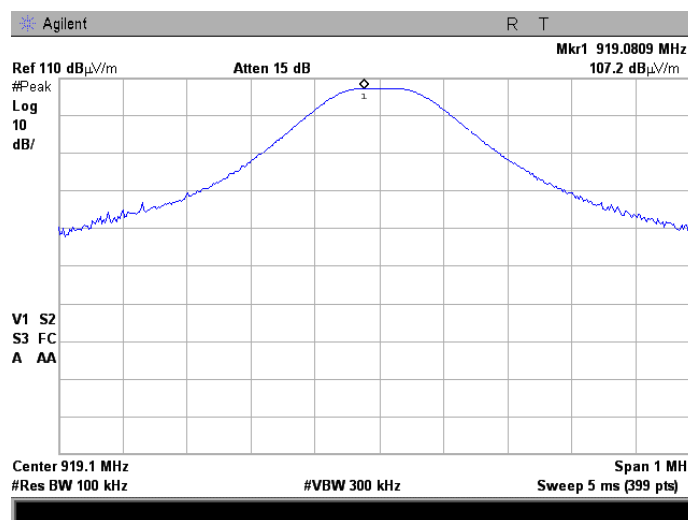
TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

### Plot 7.7.3 Radiated emission measurements at the high carrier frequency

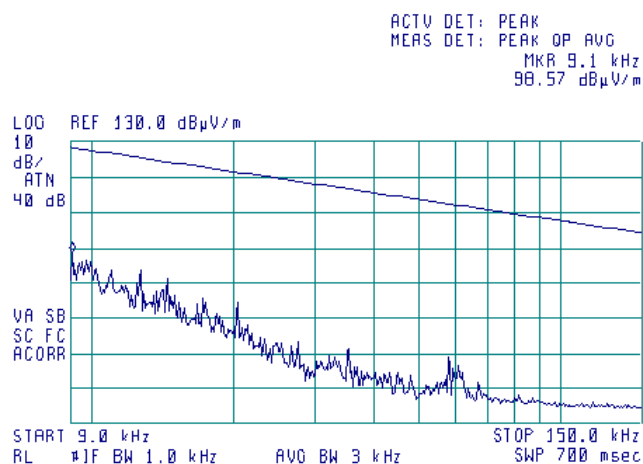
TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

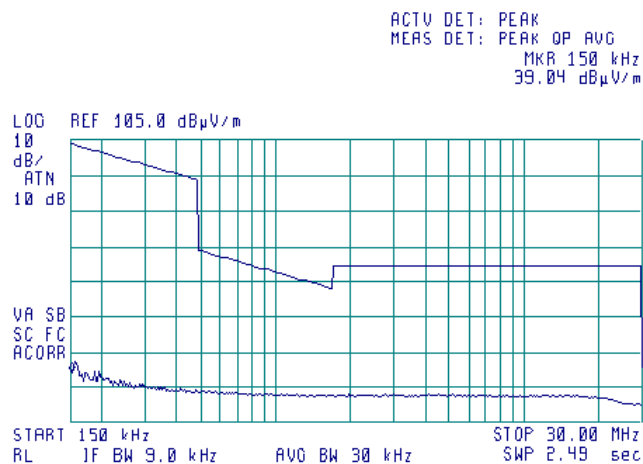
**Plot 7.7.4 Radiated emission measurements from 9 to 150 kHz at the low,mid,high carrier frequency**

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



**Plot 7.7.5 Radiated emission measurements from 0.15 to 30 MHz at the low,mid,high carrier frequency**

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



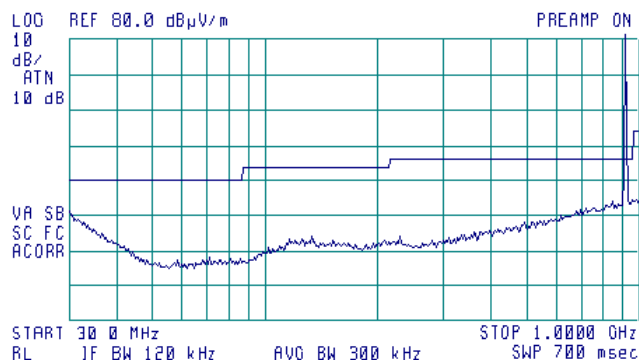
<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**Plot 7.7.6 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency**

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG

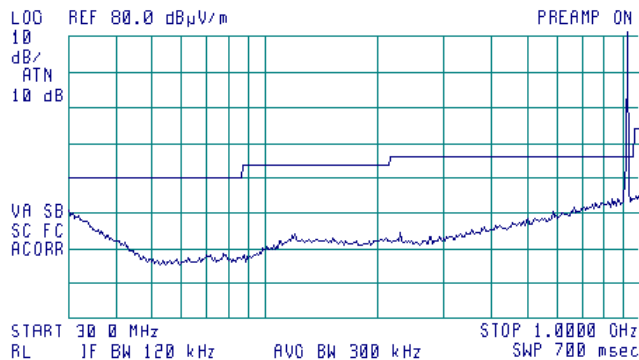


**Plot 7.7.7 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency**

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



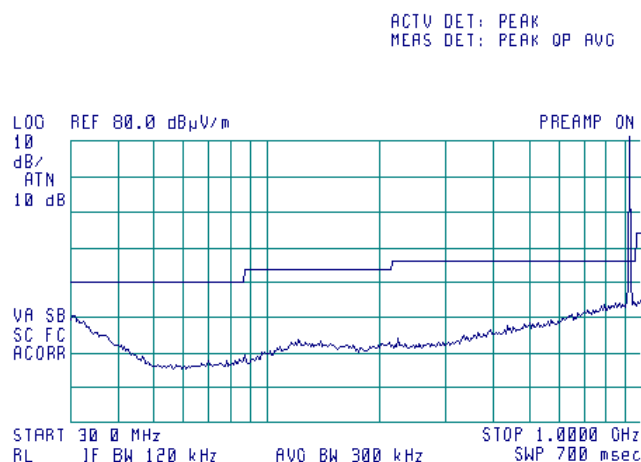
ACTV DET: PEAK  
MEAS DET: PEAK QP AVG



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

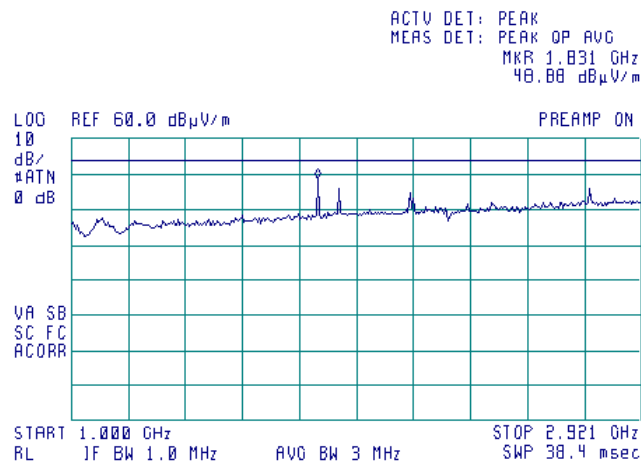
**Plot 7.7.8 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency**

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



**Plot 7.7.9 Radiated emission measurements from 1000 to 2900 MHz at the low carrier frequency**

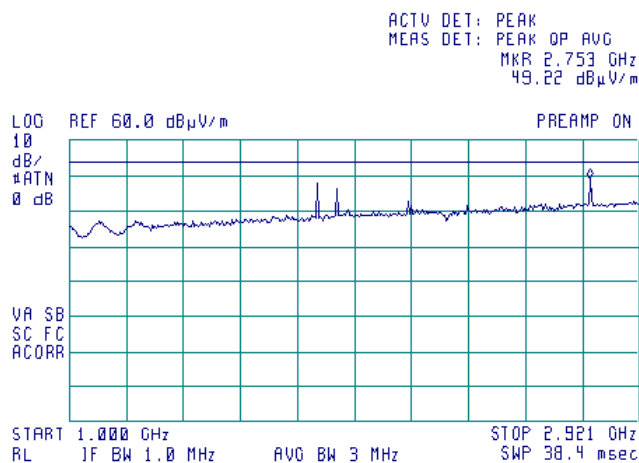
TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

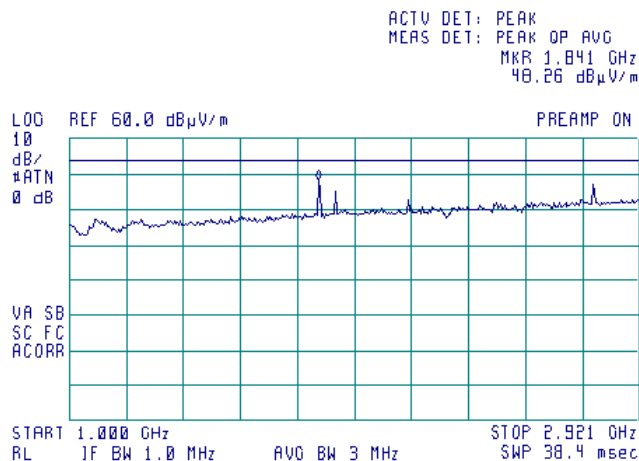
**Plot 7.7.10 Radiated emission measurements from 1000 to 2900 MHz at the mid carrier frequency**

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



**Plot 7.7.11 Radiated emission measurements from 1000 to 2900 MHz at the high carrier frequency**

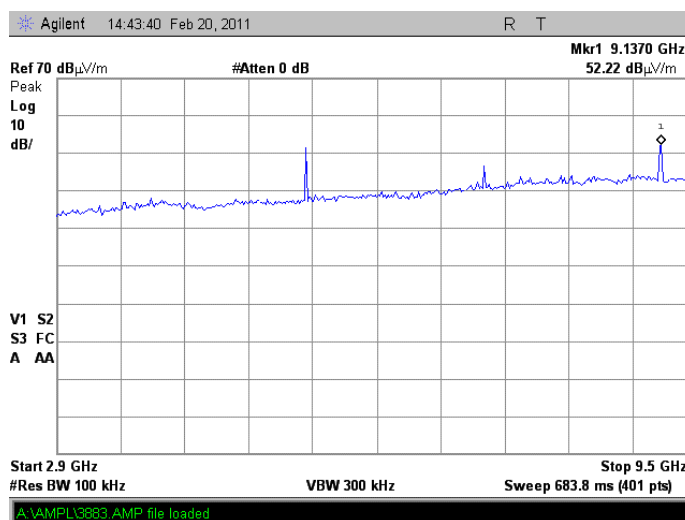
TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

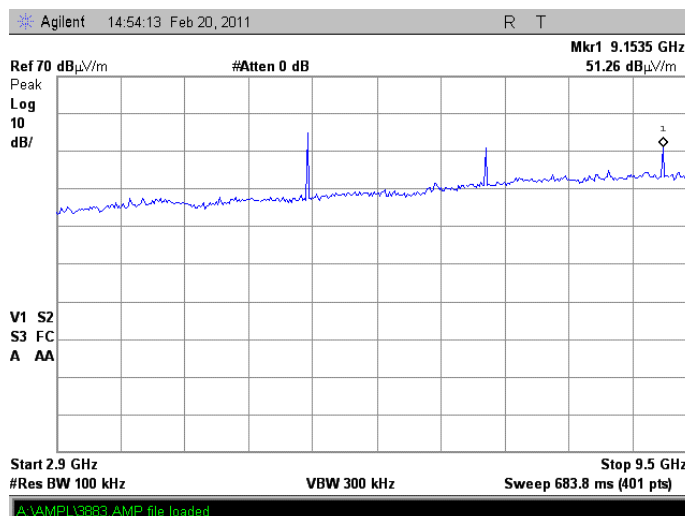
**Plot 7.7.12 Radiated emission measurements from 2900 to 9300 MHz at the low carrier frequency**

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



**Plot 7.7.13 Radiated emission measurements from 2900 to 9300 MHz at the mid carrier frequency**

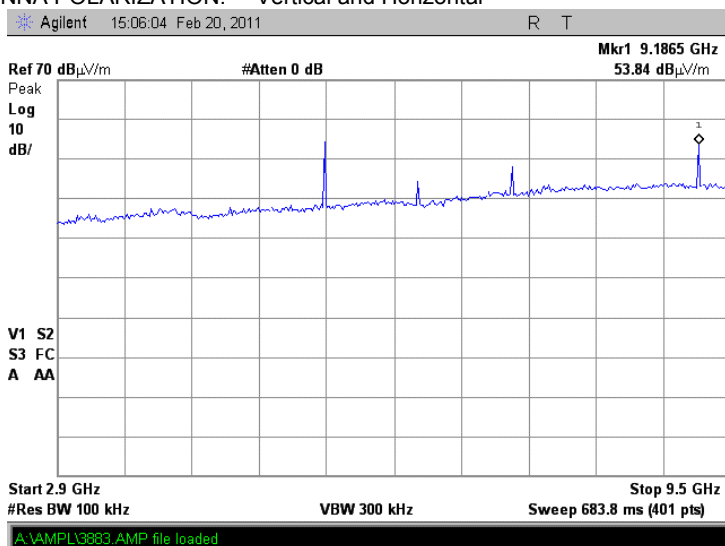
TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



<b>Test specification:</b>		<b>Section 15.247(d), Radiated spurious emissions</b>	
<b>Test procedure:</b>		Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/15/2011 - 2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.7.14 Radiated emission measurements from 2900 to 9300 MHz at the high carrier frequency

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal

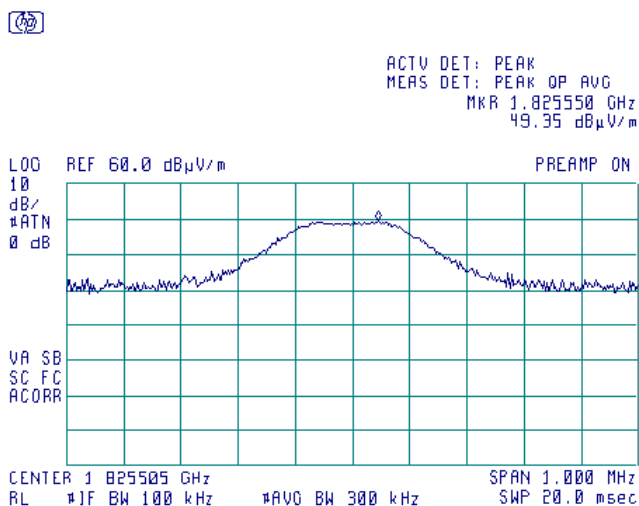




<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

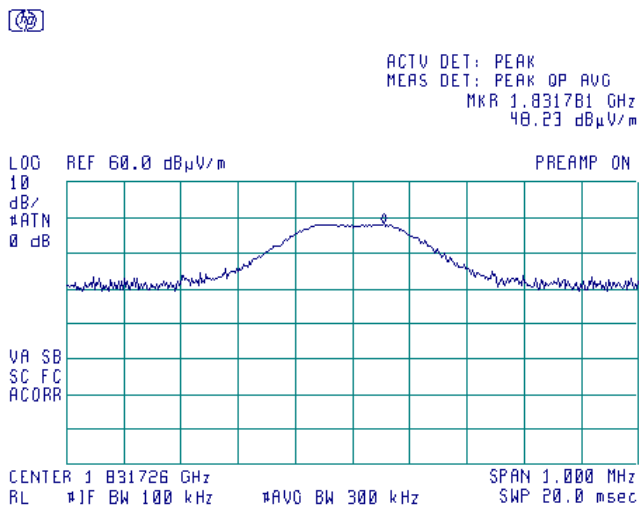
**Plot 7.7.15 Radiated emission measurements at the second harmonic of low carrier frequency**

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



**Plot 7.7.16 Radiated emission measurements at the second harmonic of mid carrier frequency**

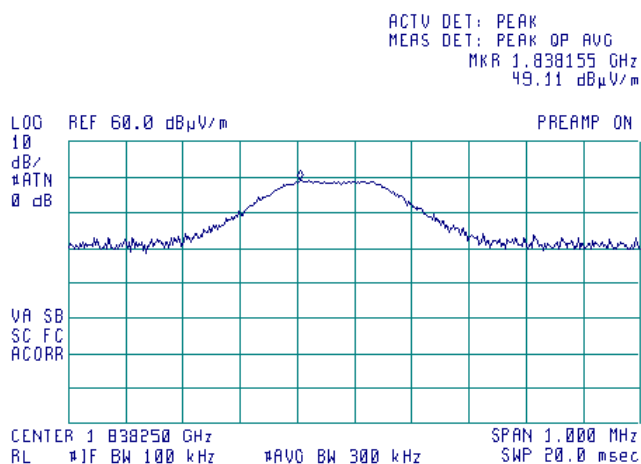
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

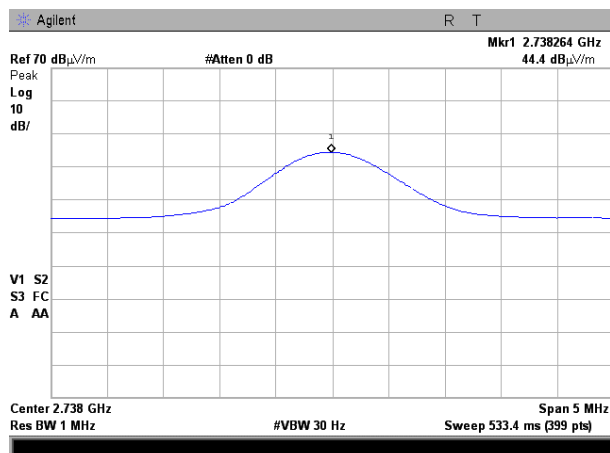
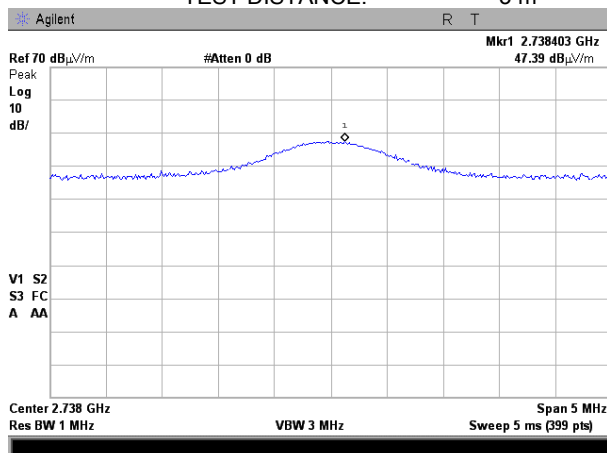
Plot 7.7.17 Radiated emission measurements at the second harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



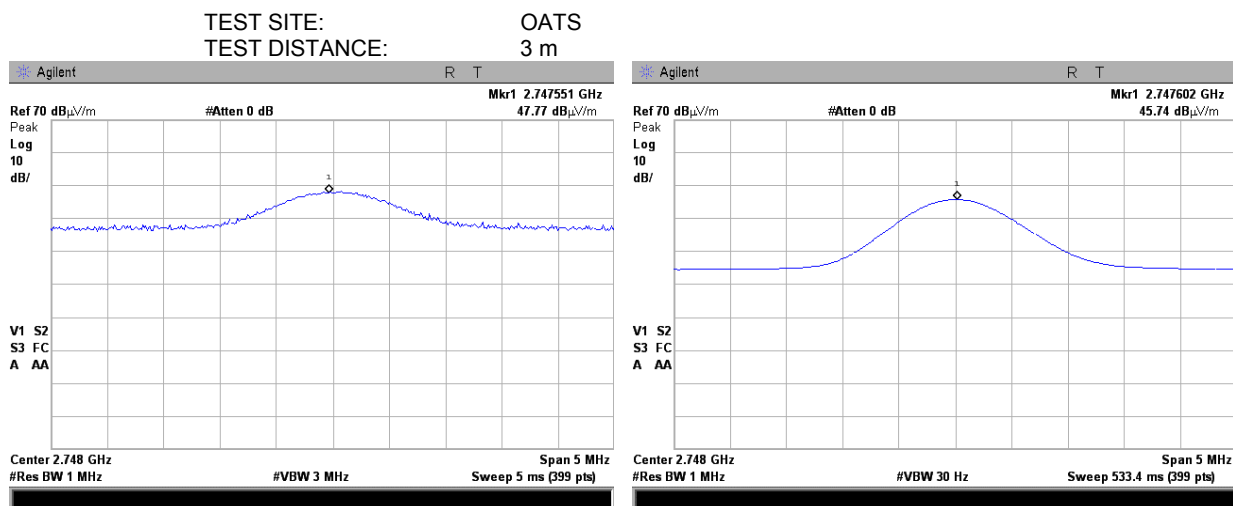
Plot 7.7.18 Radiated emission measurements at the third harmonic of low carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m

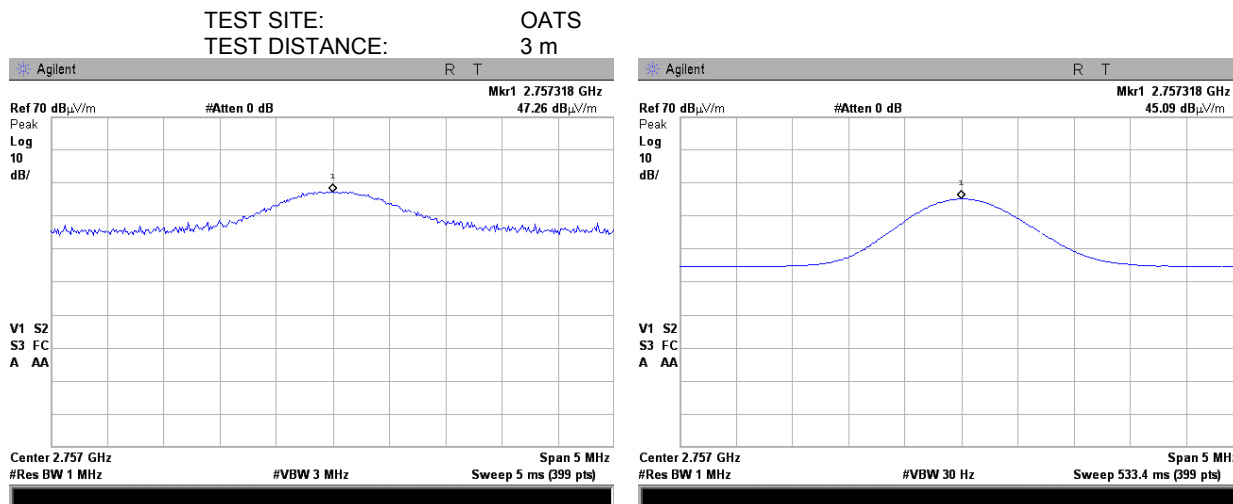


<b>Test specification:</b>		<b>Section 15.247(d), Radiated spurious emissions</b>	
<b>Test procedure:</b>		Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/15/2011 - 2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.7.19 Radiated emission measurements at the third harmonic of mid carrier frequency

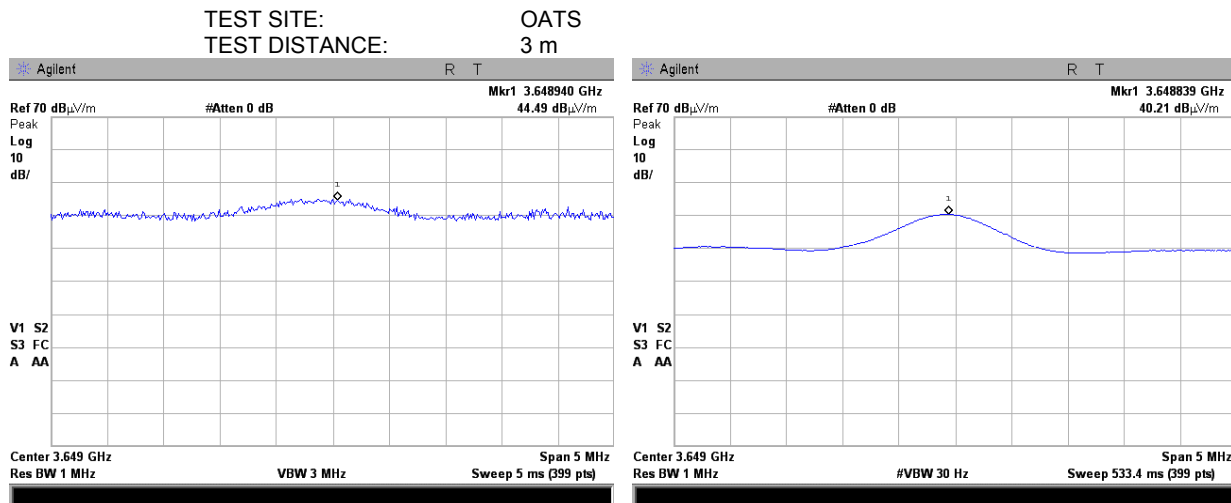


Plot 7.7.20 Radiated emission measurements at the third harmonic of high carrier frequency

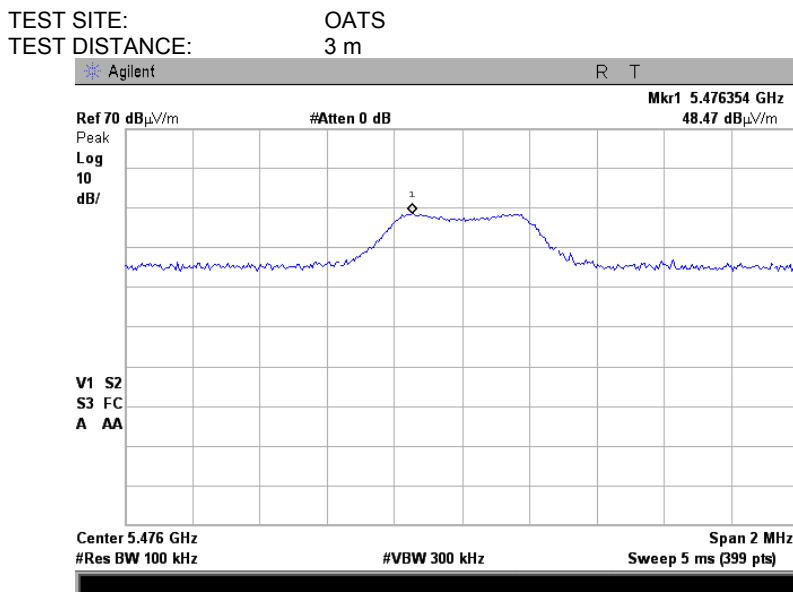


<b>Test specification:</b>		<b>Section 15.247(d), Radiated spurious emissions</b>	
<b>Test procedure:</b>		Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/15/2011 - 2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**Plot 7.7.21 Radiated emission measurements at the fourth harmonic of low carrier frequency**



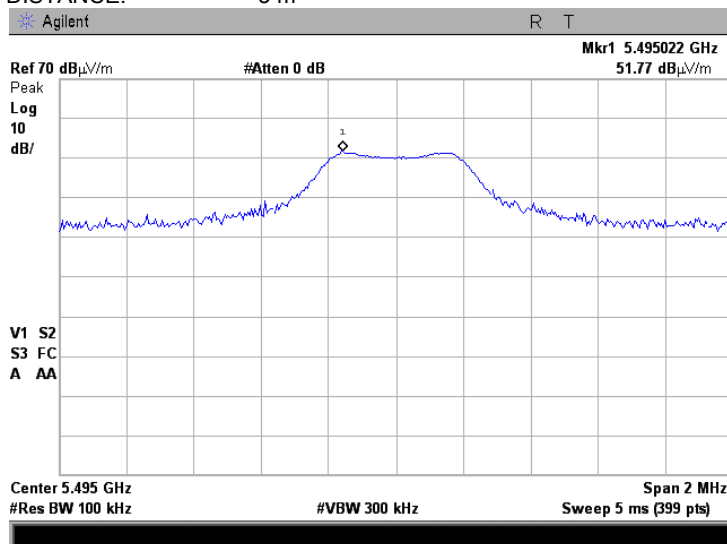
**Plot 7.7.22 Radiated emission measurements at the sixth harmonic of low carrier frequency**



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

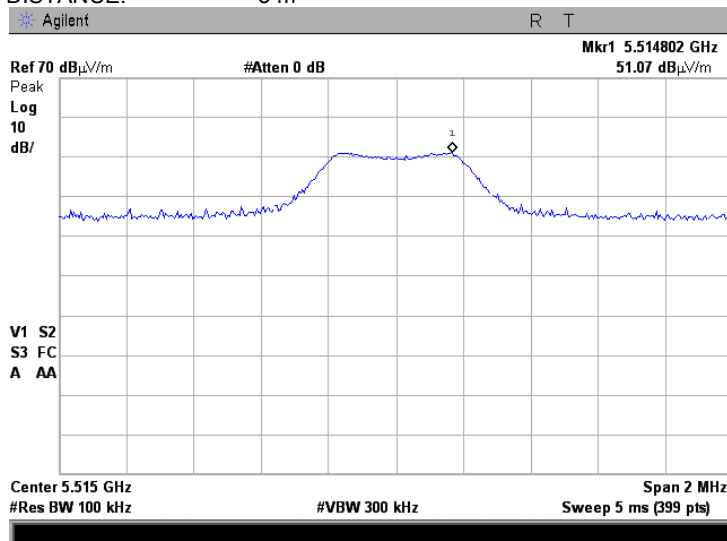
Plot 7.7.23 Radiated emission measurements at the sixth harmonic of mid carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m



Plot 7.7.24 Radiated emission measurements at the sixth harmonic of high carrier frequency

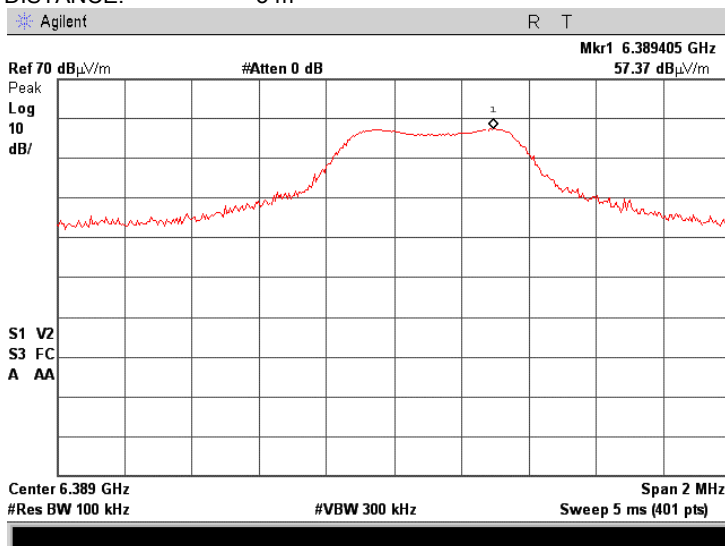
TEST SITE: OATS  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

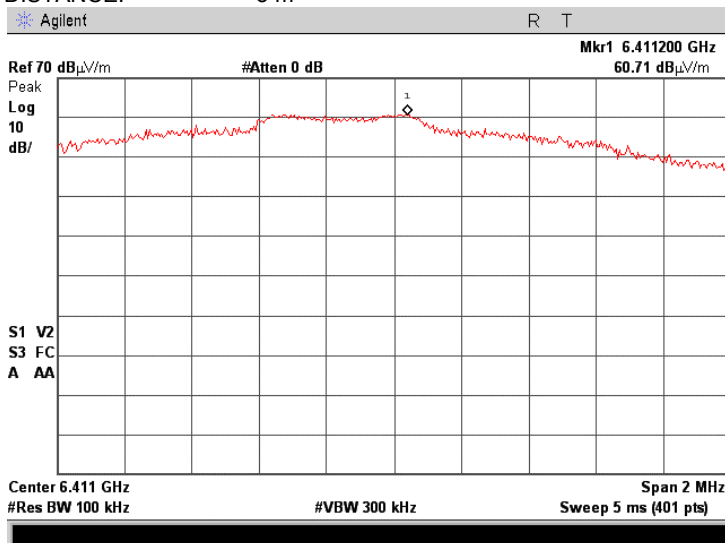
Plot 7.7.25 Radiated emission measurements at the seventh harmonic of low carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m



Plot 7.7.26 Radiated emission measurements at the seventh harmonic of mid carrier frequency

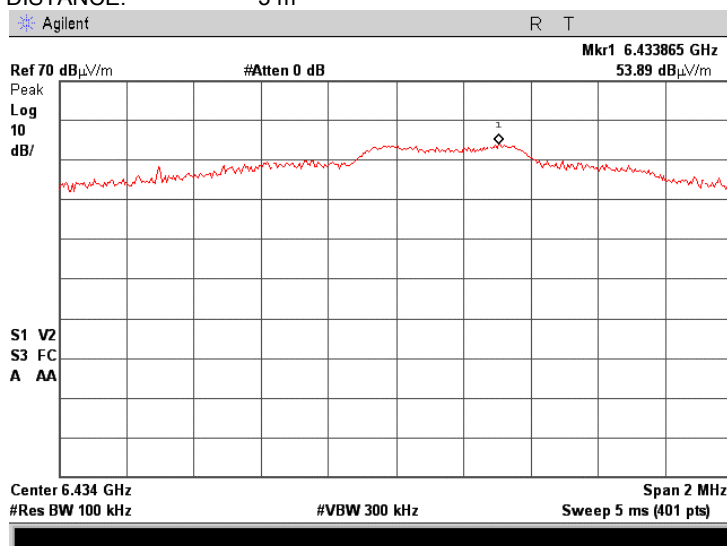
TEST SITE: OATS  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

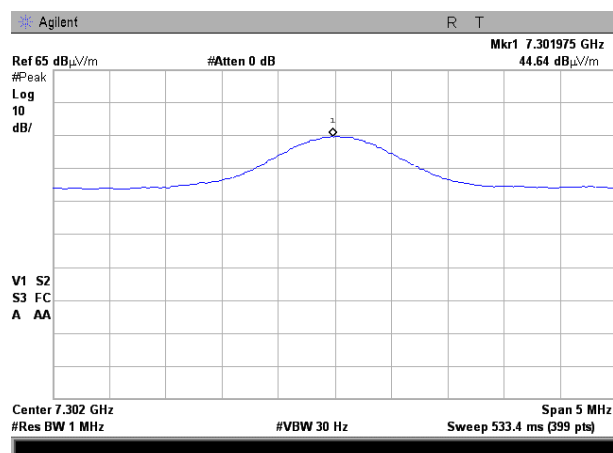
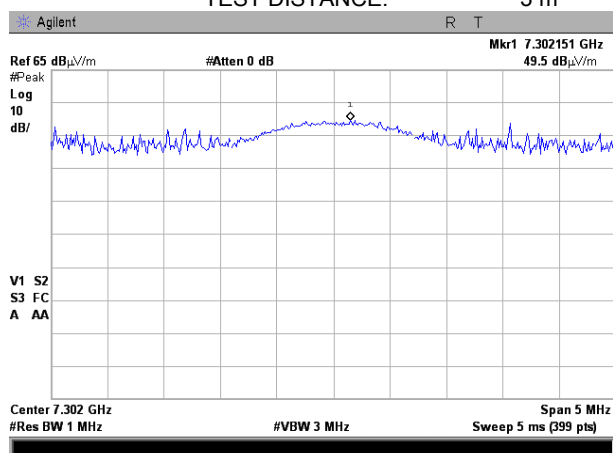
Plot 7.7.27 Radiated emission measurements at the seventh harmonic of high carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m



Plot 7.7.28 Radiated emission measurements at the eighth harmonic of low carrier frequency

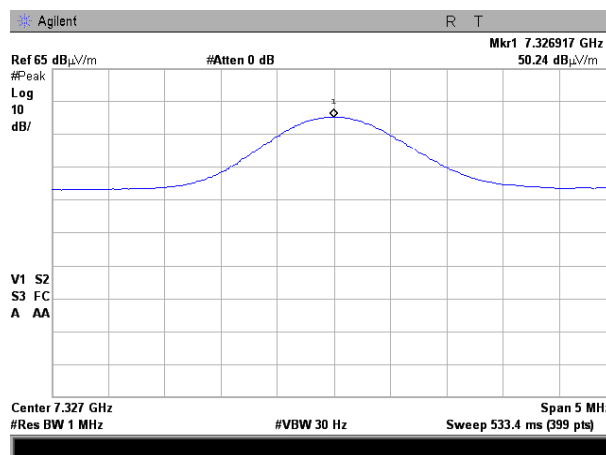
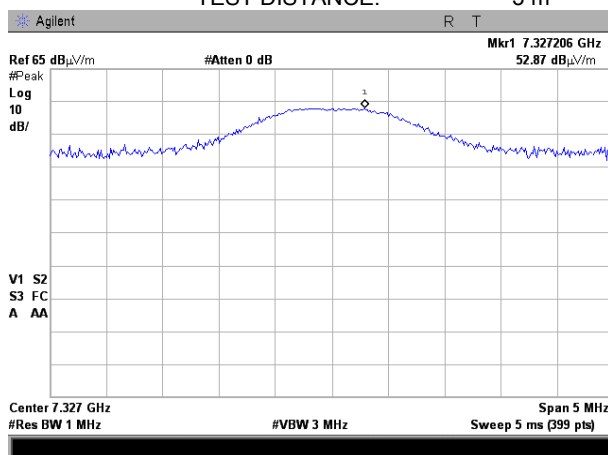
TEST SITE: OATS  
TEST DISTANCE: 3 m



<b>Test specification:</b>		<b>Section 15.247(d), Radiated spurious emissions</b>	
<b>Test procedure:</b>		Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/15/2011 - 2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

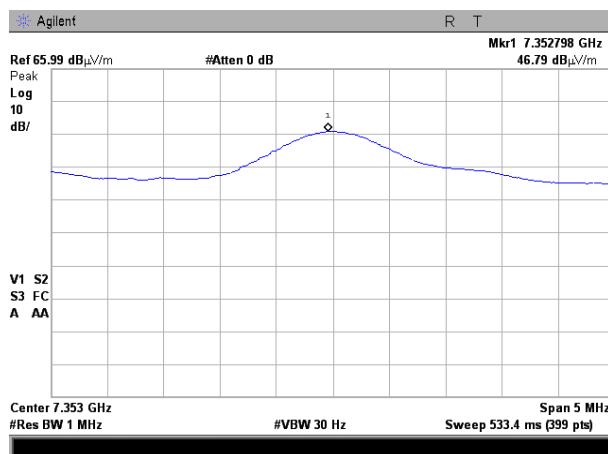
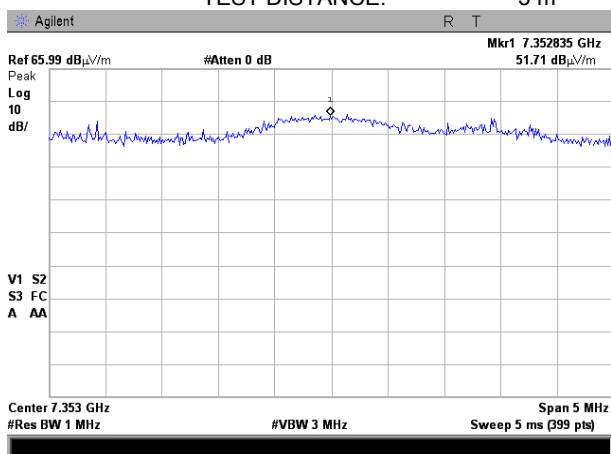
Plot 7.7.29 Radiated emission measurements at the eighth harmonic of mid carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m



Plot 7.7.30 Radiated emission measurements at the eighth harmonic of high carrier frequency

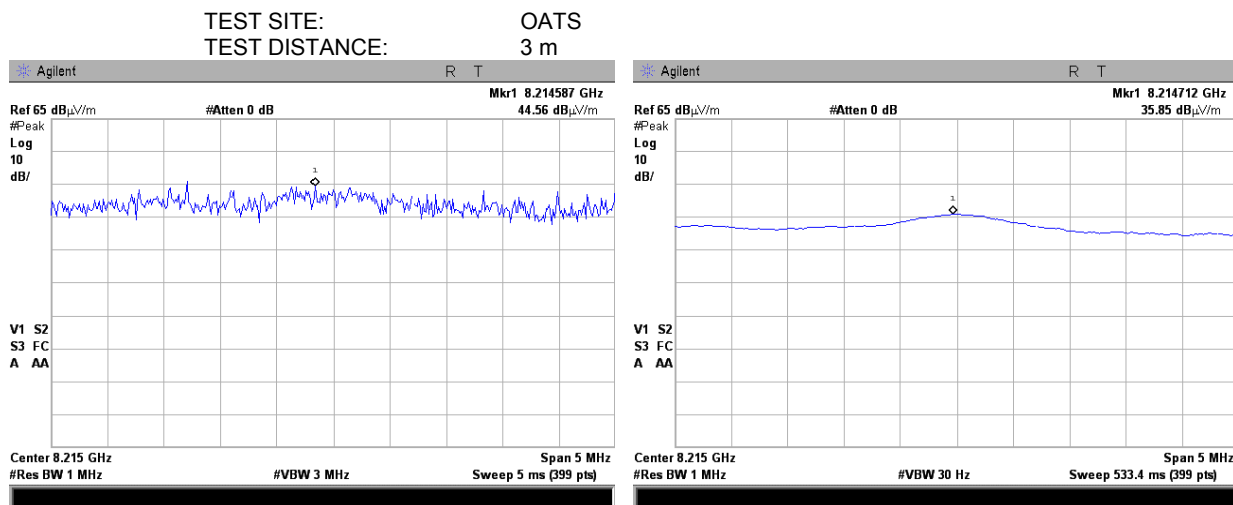
TEST SITE: OATS  
TEST DISTANCE: 3 m



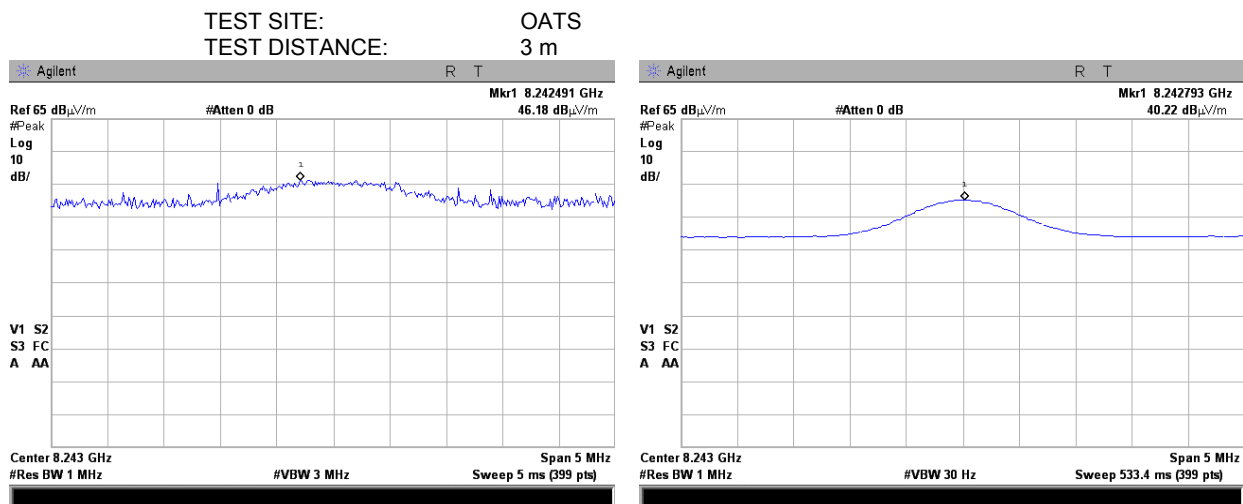


<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.7.31 Radiated emission measurements at the ninth harmonic of low carrier frequency



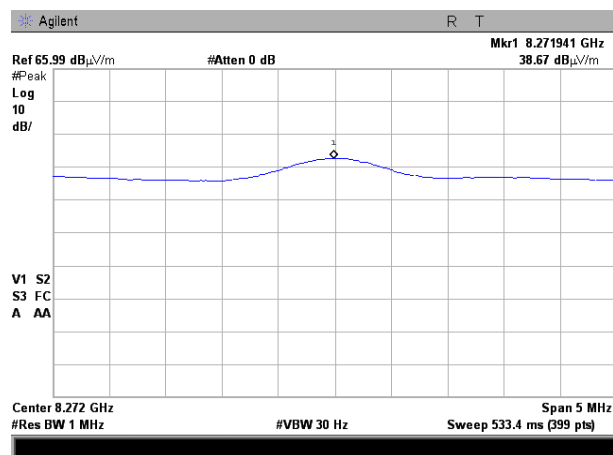
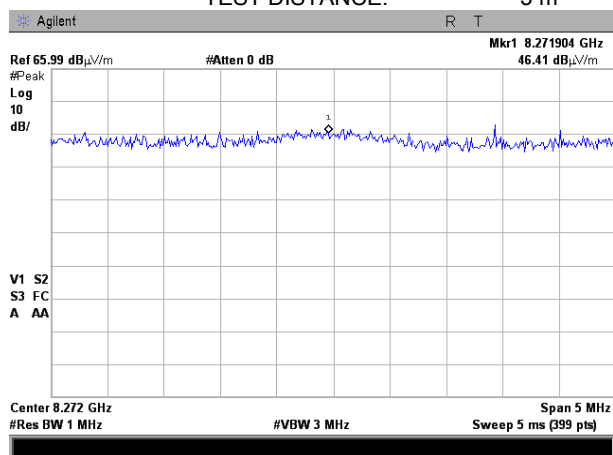
Plot 7.7.32 Radiated emission measurements at the ninth harmonic of mid carrier frequency



<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

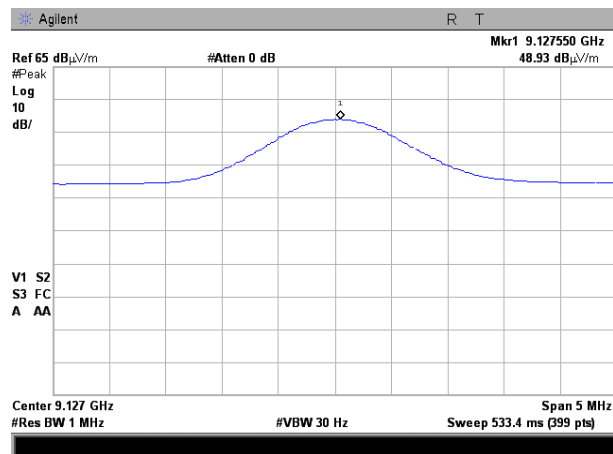
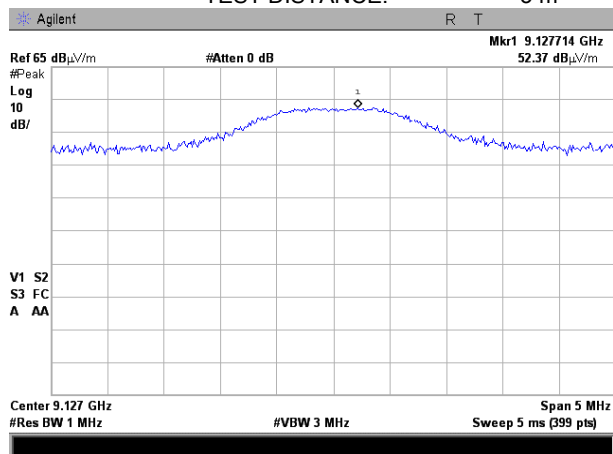
Plot 7.7.33 Radiated emission measurements at the ninth harmonic of high carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m



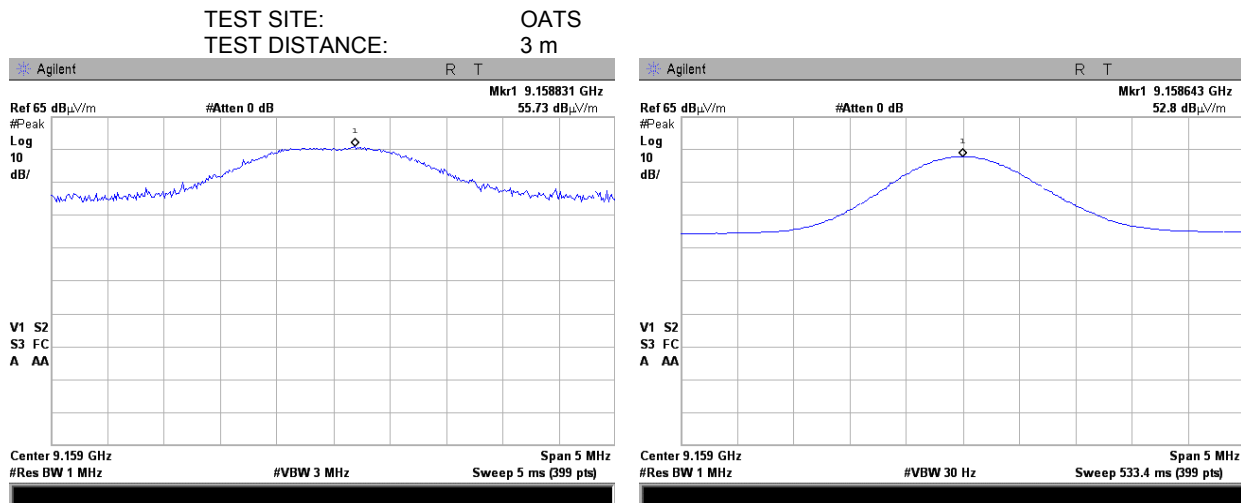
Plot 7.7.34 Radiated emission measurements at the tenth harmonic of low carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m

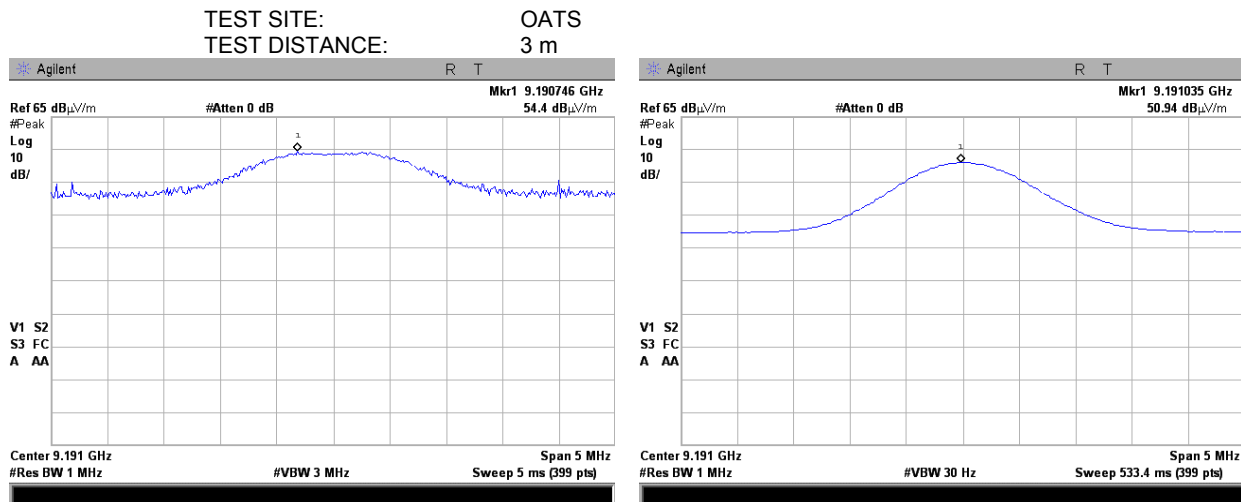


<b>Test specification:</b>		<b>Section 15.247(d), Radiated spurious emissions</b>	
<b>Test procedure:</b>		Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/15/2011 - 2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.7.35 Radiated emission measurements at the tenth harmonic of mid carrier frequency

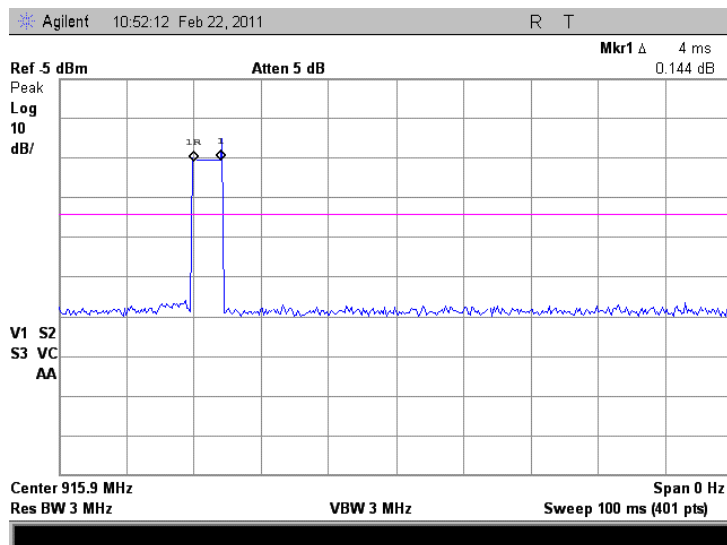


Plot 7.7.36 Radiated emission measurements at the tenth harmonic of high carrier frequency

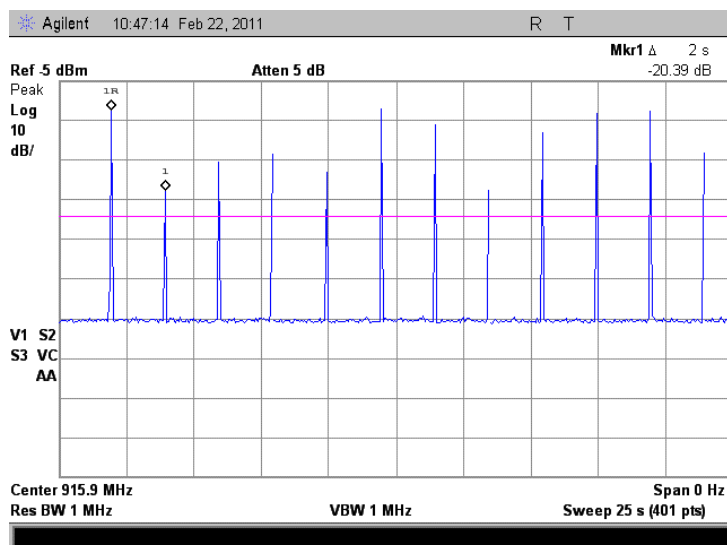


<b>Test specification:</b>	<b>Section 15.247(d), Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/15/2011 - 2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 60 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.7.37 Transmission pulse duration



Plot 7.7.38 Transmission pulse period



<b>Test specification:</b>	<b>Section 15.203, Antenna requirements</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> hPa	<b>Relative Humidity:</b> 59 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 7.8 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 7.8.1.

**Table 7.8.1 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	

<b>Test specification:</b>		<b>Section 15.109, Radiated emission</b>	
<b>Test procedure:</b>		ANSI C63.4, Sections 11.6 and 12.1.4	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 53 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 8 Unintentional emissions

### 8.1 Radiated emission measurements

#### 8.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.1.1.

Table 8.1.1 Radiated emission test limits

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

\* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows:  $\text{Lim}_{S_2} = \text{Lim}_{S_1} + 20 \log (S_1/S_2)$ , where  $S_1$  and  $S_2$  – standard defined and test distance respectively in meters.

#### 8.1.2 Test procedure for measurements in semi-anechoic chamber

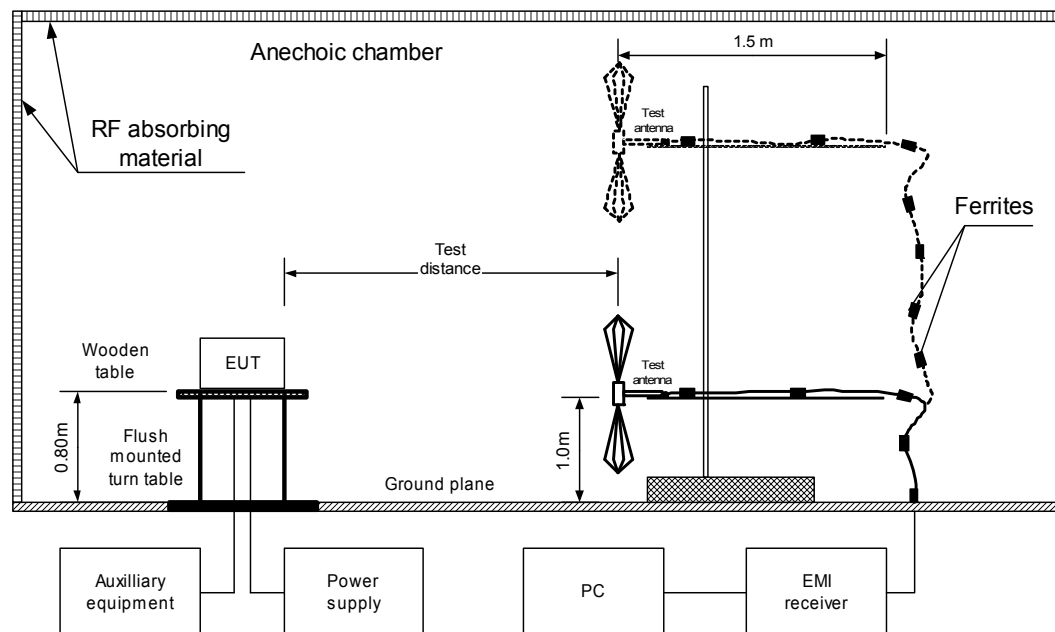
**8.1.2.1** The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

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

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

<b>Test specification:</b>		<b>Section 15.109, Radiated emission</b>	
<b>Test procedure:</b>		ANSI C63.4, Sections 11.6 and 12.1.4	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 53 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



<b>Test specification:</b>	<b>Section 15.109, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 53 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Table 8.1.2 Radiated emission test results

EUT SET UP: TABLE-TOP  
LIMIT: Class B  
EUT OPERATING MODE: Receive / Stand-by  
TEST SITE: ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
DETECTORS USED: PEAK / QUASI-PEAK  
FREQUENCY RANGE: 30 MHz – 1000 MHz  
RESOLUTION BANDWIDTH: 120 kHz

RECESSION BANDWIDTH:					120 kHz			
Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No emissions were found								Pass

TEST SITE: ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
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 1431	HL 1826	HL 1849	HL 1984	HL 2109	HL 2697	HL 2909	HL 3119
HL 3636	HL 3883						

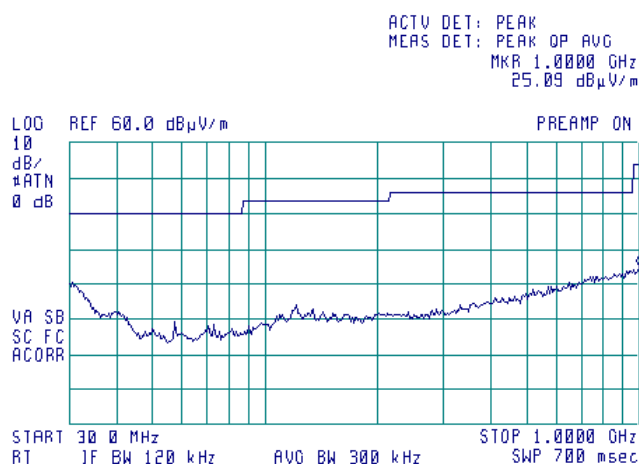
Full description is given in Appendix A.



<b>Test specification:</b>		<b>Section 15.109, Radiated emission</b>	
<b>Test procedure:</b>		ANSI C63.4, Sections 11.6 and 12.1.4	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 53 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

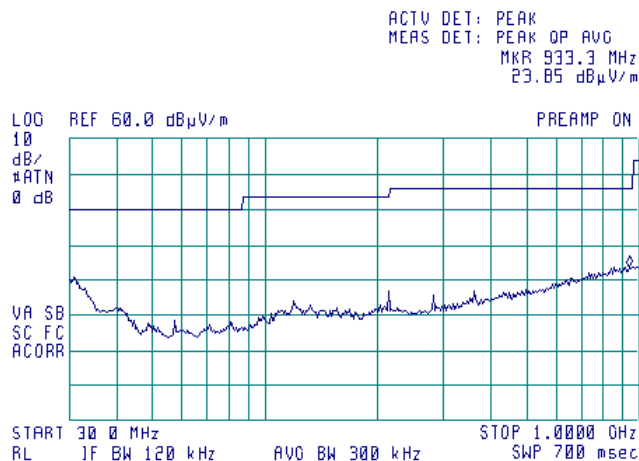
**Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization**

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



**Plot 8.1.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization**

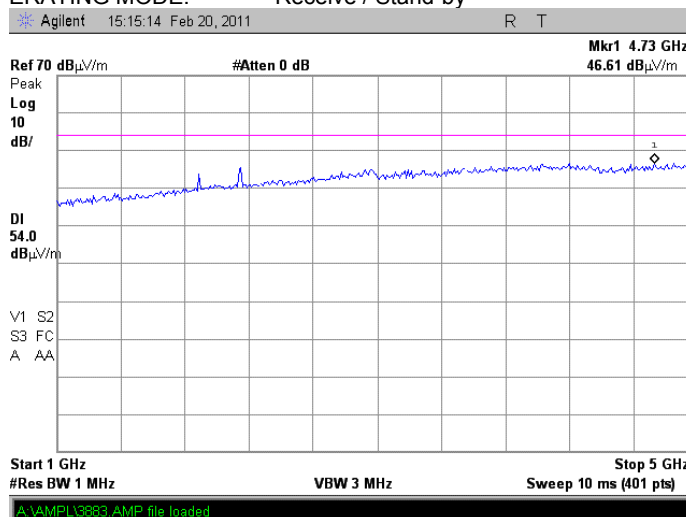
TEST SITE: Anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by



<b>Test specification:</b>		<b>Section 15.109, Radiated emission</b>	
<b>Test procedure:</b>		ANSI C63.4, Sections 11.6 and 12.1.4	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/20/2011	
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 53 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

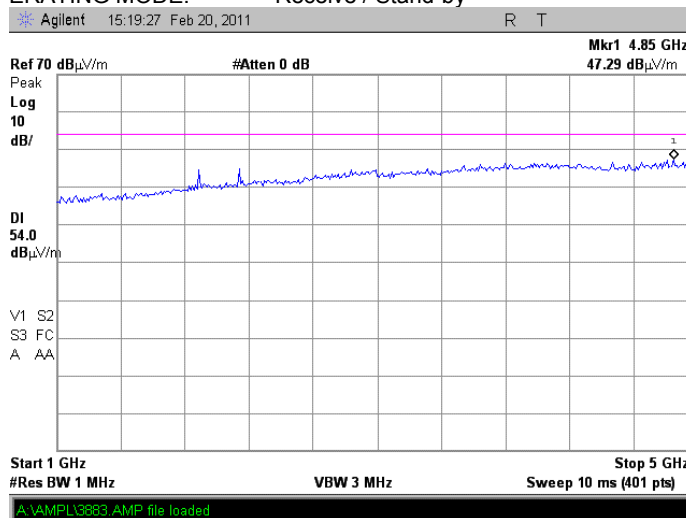
**Plot 8.1.3 Radiated emission measurements above 1000 MHz, vertical antenna polarization**

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



**Plot 8.1.4 Radiated emission measurements above 1000 MHz, horizontal antenna polarization**

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



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

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-10	29-Jun-11
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	25-Aug-10	25-Aug-11
0569	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1953	03-Sep-11	03-Sep-12
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-12
1431	Receiver RF Section, 9 kHz-2.9 GHz, part of HL1430 system	Agilent Technologies	85422E	308070026 2	25-Nov-10	25-Nov-11
1826	Antenna mast and Turntable position controller (Small Anechoic chamber)	Sh. I. Machines	CRL-4	1	11-May-10	11-May-11
1849	Antenna mast with polarity control (Small Anechoic chamber)	Sh. I. Machines	AM-F4	1849	19-Jan-11	19-Jan-12
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	11-Jun-10	11-Jun-11
2109	Anechoic Chamber 6(L) x 5.5(W) x 2.95(H) m	Hermon Laboratories	AC-2	2109	10-Nov-10	10-Nov-11
2697	Antenna, 30 MHz - 3.0 GHz	Sunol Sciences. Corp. Pleasanton, California USA	JB3	A022805	11-Jan-11	11-Jan-12
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY451024 62	07-Jul-10	07-Jul-11
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	14-Sep-10	14-Sep-11
2883	Cable, 18 GHz N-type, M-F, 3 m	Bird Electronic Corp.	TC-MNFN-3.0	211539 003	01-Dec-10	01-Dec-11
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	07-May-10	07-May-11
3119	Cable, 18 GHz N-type, M-F, 3 m	Bird Electronic Corp.	TC-MNFN-3.0	211539004	03-Oct-10	03-Oct-11
3341	High Pass Filter, 50 Ohm, 1400 to 5000 MHz	Mini-Circuits	VHF-1300+	NA	04-Oct-10	04-Oct-11
3342	High Pass Filter, 50 Ohm, 2000 to 5200 MHz	Mini-Circuits	VHF-1910+	NA	04-Oct-10	04-Oct-11
3386	Microwave Cable Assembly, 26.5 GHz, 1.0 m, N type/N type	Suhner Sucoflex	104EA	3386	30-Dec-10	30-Dec-11
3533	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040-J0	111590010 01	23-Dec-10	23-Dec-11
3616	Cable RF, 6.5 m, N type-N type, DC-6.5 GHz	Suhner Switzerland	Rg 214/U	NA	30-Dec-10	30-Dec-11
3623	Cable RF, 6.0 m, N type-N type, DC-6.5 GHz	Belden	MIL C-17	NA	27-May-10	27-May-11

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
3636	Cable RF, 3.5m, N type-N type, DC-6.5 GHz	Alpha Wire	RG 214/U	NA	30-Dec-10	30-Dec-11
3883	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type (f) in, N-type (m) out.	Agilent Technologies	87405C	MY47010406	30-Dec-10	30-Dec-11
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1225/2A	07-Feb-11	07-Feb-12
3902	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1227/2A	07-Feb-11	07-Feb-12

## 10 APPENDIX B Measurement uncertainties

### Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: $\pm 1.7$ dB 12.4 GHz to 40 GHz: $\pm 2.3$ dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: $\pm 2.6$ dB 2.9 GHz to 6.46 GHz: $\pm 3.5$ dB 6.46 GHz to 13.2 GHz: $\pm 4.3$ dB 13.2 GHz to 22.0 GHz: $\pm 5.0$ dB 22.0 GHz to 26.8 GHz: $\pm 5.5$ dB 26.8 GHz to 40.0 GHz: $\pm 4.8$ dB
Occupied bandwidth	$\pm 8.0$ %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0$ %
Radiated emissions at 3 m measuring distance Horizontal polarization  Vertical polarization	Biconilog antenna: $\pm 5.3$ dB Biconical antenna: $\pm 5.0$ dB Log periodic antenna: $\pm 5.3$ dB Double ridged horn antenna: $\pm 5.3$ dB Biconilog antenna: $\pm 6.0$ dB Biconical antenna: $\pm 5.7$ dB Log periodic antenna: $\pm 6.0$ dB Double ridged horn antenna: $\pm 6.0$ dB

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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e-mail: mail@hermonlabs.com  
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

## 12 APPENDIX D Specification references

FCC 47CFR part 15: 2010	Radio Frequency Devices
Public notice DA 00- 705: 2000	Filing and measurement guidelines for frequency hopping spread spectrum systems.
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

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( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).

Antenna factor  
Log periodic antenna  
Electro-Metrics, model LPA-25/30  
Ser.No.1953, HL 0569

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
200	15.2	625	25.2
225	15.1	650	25.8
250	16.3	675	27.2
275	17.2	700	27.6
300	19.6	725	27.6
325	18.4	750	27.6
350	19.0	775	28.0
375	20.0	800	28.2
400	20.9	825	29.4
425	21.3	850	29.9
450	22.1	875	30.0
475	22.7	900	30.4
500	23.2	925	30.6
525	23.9	950	30.8
550	24.2	975	31.6
575	24.6	1000	32.1
600	24.7		

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

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

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

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



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

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

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

Antenna calibration  
Sunol Sciences Inc., model JB3, serial number A022805, HL 2697

Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain
30	22.2	-22.5	0.01	620	19.7	6.3	4.27	1215	24.9	7.0	5.05	1810	26.3	7.1	5.08	2405	30.9	6.9	4.93
35	18.5	-17.4	0.02	625	19.7	6.5	4.42	1220	24.9	7.0	4.99	1815	28.5	6.9	4.91	2410	30.9	6.9	4.89
40	14.7	-12.5	0.06	630	19.6	6.6	4.57	1225	25.1	6.9	4.91	1820	28.6	6.8	4.74	2415	31.0	6.9	4.85
45	11.3	-8.1	0.16	635	19.7	6.5	4.48	1230	25.2	6.8	4.82	1825	28.7	6.8	4.75	2420	31.0	6.8	4.82
45	11.3	-8.1	0.16	640	19.9	6.4	4.40	1235	25.1	7.0	4.96	1830	28.7	6.8	4.76	2425	31.1	6.8	4.81
50	8.9	-4.7	0.34	645	19.9	6.5	4.45	1240	25.0	7.1	5.09	1835	28.7	6.7	4.72	2430	31.0	6.9	4.87
55	7.9	-2.8	0.52	650	19.9	6.5	4.51	1245	25.0	7.1	5.12	1840	28.8	6.7	4.69	2435	31.0	6.9	4.88
60	7.8	-2.1	0.62	655	19.9	6.5	4.60	1250	25.0	7.1	5.15	1845	28.6	6.9	4.90	2440	31.2	6.8	4.74
65	8.5	-2.0	0.63	660	19.9	6.7	4.69	1255	25.0	7.2	5.25	1850	28.4	7.1	5.12	2445	31.1	6.9	4.91
70	9.0	-1.9	0.64	665	19.9	6.7	4.70	1260	24.9	7.3	5.36	1855	28.5	7.0	5.07	2450	31.0	7.0	4.96
75	6.8	-1.1	0.78	670	20.0	6.7	4.71	1265	25.0	7.3	5.31	1860	28.6	7.0	5.01	2455	31.0	7.0	5.01
80	8.4	-0.2	0.97	675	20.1	6.7	4.71	1270	25.1	7.2	5.26	1865	28.5	7.1	5.17	2460	30.9	7.2	5.19
85	8.0	0.8	1.20	680	20.1	6.7	4.71	1275	25.3	7.0	5.05	1870	28.4	7.3	5.33	2465	31.1	6.9	4.95
90	8.2	1.1	1.29	685	20.1	6.8	4.79	1280	25.5	6.8	4.84	1875	28.4	7.2	5.28	2470	31.3	6.8	4.76
95	9.2	0.5	1.13	690	20.1	6.9	4.88	1285	25.4	7.0	4.97	1880	28.5	7.2	5.22	2475	31.4	6.7	4.69
100	10.6	-0.4	0.92	695	20.2	6.8	4.82	1290	25.3	7.1	5.10	1885	28.5	7.2	5.22	2480	31.3	6.8	4.79
110	12.6	-1.6	0.70	705	20.4	6.8	4.75	1300	25.2	7.3	5.33	1895	28.6	7.2	5.24	2490	31.1	7.0	4.99
120	13.9	-2.1	0.82	715	20.5	6.8	4.80	1310	25.5	7.1	5.09	1905	28.5	7.3	5.36	2500	30.9	7.2	5.27
125	14.2	-2.0	0.83	720	20.5	6.9	4.85	1315	25.4	7.2	5.23	1910	28.5	7.4	5.45	2505	31.1	7.1	5.15
130	14.2	-1.7	0.68	725	20.6	6.8	4.81	1320	25.3	7.3	5.36	1915	28.5	7.3	5.38	2510	31.0	7.2	5.22
140	13.4	-0.3	0.94	735	20.9	6.7	4.65	1330	25.6	7.0	5.06	1925	28.6	7.3	5.35	2520	31.2	7.0	5.05
150	12.9	0.8	1.21	745	21.0	6.6	4.59	1340	25.7	7.1	5.09	1935	28.5	7.4	5.54	2530	31.0	7.3	5.37
160	11.6	1.6	1.44	755	21.7	6.4	4.44	1350	25.8	7.2	5.17	1945	28.5	7.5	5.68	2540	31.2	7.1	5.09
165	12.5	2.0	1.59	760	21.0	6.8	4.83	1355	25.8	7.0	5.06	1950	28.6	7.4	5.48	2545	31.0	7.3	5.43
170	12.2	2.6	1.83	765	21.1	6.8	4.73	1360	25.9	6.9	4.95	1955	28.6	7.5	5.57	2550	31.0	7.3	5.39
175	11.8	3.3	2.13	770	21.3	6.7	4.64	1365	26.0	6.9	4.95	1960	28.6	7.5	5.65	2555	31.1	7.2	5.30
180	11.6	3.7	2.36	775	21.3	6.7	4.68	1370	26.0	7.0	4.96	1965	28.7	7.4	5.47	2560	31.0	7.4	5.47
185	11.5	4.0	2.54	780	21.3	6.7	4.72	1375	26.0	7.0	5.01	1970	28.7	7.3	5.29	2565	30.8	7.6	5.70
190	11.6	4.2	2.61	785	21.3	6.8	4.77	1380	26.0	7.0	5.06	1975	28.9	7.2	5.22	2570	31.1	7.3	5.37
200	13.1	3.2	2.07	795	21.4	6.8	4.79	1390	26.1	6.9	4.92	1985	29.1	7.1	5.11	2580	31.6	6.9	4.87
205	12.0	4.4	2.76	800	21.5	6.8	4.77	1395	26.2	6.9	4.94	1990	29.1	7.0	5.06	2585	31.6	6.8	4.79
210	11.0	5.6	3.66	805	21.6	6.7	4.71	1400	26.2	7.0	4.96	1995	29.1	7.1	5.09	2590	31.6	6.9	4.88
215	11.3	5.6	3.59	810	21.7	6.7	4.65	1405	26.1	7.0	5.02	2000	29.1	7.1	5.11	2595	31.5	7.0	4.87
220	11.6	5.5	3.52	815	21.7	6.7	4.72	1410	26.1	7.1	5.09	2005	29.1	7.1	5.16	2600	31.6	6.9	4.86
225	11.7	5.5	3.55	820	21.7	6.8	4.80	1415	26.2	7.0	5.02	2010	29.1	7.1	5.15	2605	31.3	7.2	5.30
230	11.9	5.5	3.57	825	21.7	6.8	4.82	1420	26.3	7.0	4.96	2015	29.2	7.1	5.13	2610	31.4	7.1	5.15
235	12.1	5.5	3.56	830	21.7	6.9	4.85	1425	26.2	7.1	5.10	2020	29.2	7.1	5.18	2615	31.7	6.9	4.88
240	12.3	5.5	3.54	835	21.8	6.8	4.82	1430	26.1	7.2	5.25	2025	29.3	7.1	5.08	2620	31.6	7.0	4.97
245	12.3	5.7	3.71	840	21.9	6.8	4.80	1435	26.1	7.2	5.24	2030	29.3	7.0	5.05	2625	31.4	7.1	5.17
250	12.3	5.9	3.88	845	21.9	6.8	4.83	1440	26.2	7.2	5.24	2035	29.3	7.1	5.07	2630	31.6	7.0	5.00
255	12.5	5.9	3.85	850	21.9	6.9	4.85	1445	26.3	7.1	5.11	2040	29.3	7.1	5.13	2635	31.8	6.8	4.82
260	12.7	5.8	3.83	855	22.0	6.8	4.80	1450	26.5	7.0	4.98	2045	29.2	7.2	5.23	2640	31.7	7.0	4.98
265	13.2	5.5	3.54	860	22.1	6.8	4.74	1455	26.4	7.1	5.07	2050	29.2	7.2	5.27	2645	31.7	6.9	4.93
270	13.7	5.2	3.27	865	22.0	6.9	4.92	1460	26.4	7.1	5.17	2055	29.3	7.2	5.21	2650	31.8	6.9	4.85
275	13.7	5.3	3.39	870	21.9	7.1	5.11	1465	26.4	7.2	5.19	2060	29.5	7.0	5.02	2655	31.8	6.9	4.85
280	13.7	5.4	3.50	875	22.0	7.1	5.08	1470	26.4	7.2	5.22	2065	29.4	7.1	5.03	2660	31.7	7.0	5.02
285	13.7	5.6	3.61	880	22.1	7.0	5.05	1475	26.5	7.1	5.17	2070	29.4	7.1	5.10	2665	32.0	6.7	4.71
290	13.7	5.7	3.72	885	22.1	7.0	5.06	1480	26.5	7.1	5.12	2075	29.5	7.0	5.01	2670	32.0	6.7	4.67
295	13.8	5.8	3.77	890	22.1	7.0	5.06	1485	26.5	7.1	5.14	2080	29.8	6.8	4.76	2675	31.9	6.8	4.81
300	13.9	5.8	3.81	895	22.2	7.1	5.09	1490	26.5	7.1	5.17	2085	29.7	6.9	4.89	2680	31.7	7.0	5.04
305	14.0	5.9	3.85	900	22.2	7.1	5.12	1495	26.5	7.2	5.24	2090	29.7	6.9	4.86	2685	31.9	6.8	4.83
310	14.1	5.9	3.88	905	22.3	7.1	5.09	1500	26.5	7.2	5.31	2095	29.8	6.8	4.78	2690	32.1	6.7	4.72
315	14.3	5.9	3.89	910	22.3	7.0	5.05	1505	26.5	7.2	5.27	2100	29.9	6.8	4.75	2695	32.1	6.7	4.71
320	14.4	5.9	3.90	915	22.4	7.0	4.99	1510	26.6	7.2	5.23	2105	29.8	6.8	4.81	2700	32.0	6.8	4.81
325	14.5	5.9	3.92	920	22.6	6.9	4.92	1515	26.6	7.2	5.28	2110	29.9	6.8	4.78	2705	32.0	6.8	4.80
330	14.6	5.9	3.93	925	22.7	6.9	4.85	1520	26.5	7.3	5.38	2115	29.9	6.8	4.76	2710	32.1	6.8	4.79
335	14.7	6.0	4.02	930	22.8	6.8	4.77	1525	26.6	7.3	5.37	2120	29.9	6.8	4.84	2715	32.1	6.7	4.71
340	14.7	6.2	4.12	935	22.8	6.8	4.83	1530	26.6	7.3	5.36	2125	29.9	6.9	4.89	2720	32.4	6.5	4.47
345	14.9	6.1	4.06	940	22.8	6.9	4.89	1535	26.6	7.4	5.44	2130	29.9	6.9	4.90	2725	32.2	6.7	4.63
350	15.1	6.0	3.99	945	22.8	6.9	4.87	1540	26.5	7.4	5.53	2135	29.8	6.9	4.94	2730	31.9	7.0	5.05
355	15.3	5.9	3.88	950	22.9	6.9	4.85	1545	26.5	7.5	5.58	2140	29.8	7.1	5.08	2735	31.6	7.4	5.44
360	15.6	5.8	3.78	955	23.0	6.8	4.81	1550	26.5	7.5	5.63	2145	29.9	6.9	4.92	2740	31.6	7.1	5.46
365	15.5	5.9	3.89	960	23.1	6.8	4.77	1555	26.7	7.3	5.39	2150	29.9	7.0	4.98	2745	31.9	7.0	5.06
370	15.5	6.0	4.01	965	23.1	6.7	4.73	1560	26.9	7.1	5.16	2155	29.8	7.1	5.10	2750	32.0	6.9	4.94
375	15.6	6.1	4.03	970	23.2	6.7	4.69	1565	26.9	7.2	5.23	2160	29.8	7.1	5.09	2755	32.0	7.0	4.98
380	15.7	6.1	4.05	975	23.3	6.6	4.62	1570	26.9	7.2	5.30	2165	29.9	7.0	5.00	2760	32.0	7.0	5.06
385	15.7	6.2	4.15	980	23.5	6.6	4.54	1575	27.0	7.2	5.23	2170	29.9	7.1	5.07	2765	32.2	6.8	4.80
390	15.7	6.3	4.25	985	23.5	6.6	4.52	1580	2										

**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 003**  
**HL 2883**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.06	5750	1.70	12000	2.46
30	0.12	6000	1.75	12250	2.48
100	0.21	6250	1.80	12500	2.52
250	0.34	6500	1.81	12750	2.50
500	0.47	6750	1.86	13000	2.54
750	0.59	7000	1.86	13250	2.48
1000	0.67	7250	1.92	13500	2.63
1250	0.76	7500	1.96	13750	2.65
1500	0.84	7750	1.98	14000	2.72
1750	0.92	8000	2.02	14250	2.67
2000	0.98	8250	2.03	14500	2.70
2250	1.05	8500	2.05	14750	2.72
2500	1.12	8750	2.11	15000	2.79
2750	1.17	9000	2.17	15250	2.80
3000	1.22	9250	2.17	15500	2.83
3250	1.27	9500	2.20	15750	2.75
3500	1.33	9750	2.19	16000	2.82
3750	1.38	10000	2.22	16250	2.85
4000	1.42	10250	2.25	16500	2.90
4250	1.46	10500	2.30	16750	2.89
4500	1.51	10750	2.28	17000	2.88
4750	1.54	11000	2.32	17250	2.85
5000	1.59	11250	2.34	17500	2.96
5250	1.62	11500	2.39	17750	3.04
5500	1.65	11750	2.42	18000	3.04

**Cable loss**  
**Cable 18 GHz, N-type, M-F, 3 m, Bird Electronic Corp., model TC-MNFN-3.0, S/N 211539004**  
**HL 3119**

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	0.06	3600	1.34	7400	2.00	11200	2.48	15100	2.90
30	0.09	3700	1.36	7500	2.01	11300	2.45	15200	2.89
50	0.11	3800	1.37	7600	2.03	11400	2.51	15300	2.91
100	0.23	3900	1.39	7700	2.05	11500	2.45	15400	2.85
200	0.30	4000	1.39	7800	2.07	11600	2.49	15500	2.83
300	0.42	4100	1.42	7900	2.06	11700	2.51	15600	2.89
400	0.39	4200	1.45	8000	2.06	11800	2.50	15700	2.85
500	0.47	4300	1.47	8100	2.09	11900	2.52	15800	2.87
600	0.49	4400	1.49	8200	2.10	12000	2.48	15900	2.91
700	0.63	4500	1.51	8300	2.11	12100	2.53	16000	2.90
800	0.62	4600	1.53	8400	2.15	12200	2.54	16100	2.94
900	0.70	4700	1.55	8500	2.15	12300	2.56	16200	2.91
1000	0.70	4800	1.54	8600	2.17	12400	2.57	16300	2.96
1100	0.77	4900	1.57	8700	2.19	12500	2.57	16400	3.01
1200	0.78	5000	1.60	8800	2.20	12600	2.55	16500	3.01
1300	0.83	5100	1.60	8900	2.21	12700	2.50	16600	2.98
1400	0.86	5200	1.62	9000	2.22	12800	2.57	16700	3.00
1500	0.85	5300	1.65	9100	2.23	12900	2.57	16800	3.01
1600	0.94	5400	1.66	9200	2.25	13000	2.55	16900	3.06
1700	0.90	5500	1.69	9300	2.24	13100	2.62	17000	3.07
1800	0.90	5600	1.70	9400	2.28	13200	2.60	17100	3.09
1900	0.95	5700	1.72	9500	2.28	13300	2.67	17200	3.10
2000	0.97	5800	1.74	9600	2.27	13400	2.66	17300	3.11
2100	1.00	5900	1.75	9700	2.30	13500	2.71	17400	3.16
2200	1.02	6000	1.77	9800	2.30	13600	2.73	17500	3.15
2300	1.05	6100	1.79	9900	2.34	13700	2.73	17600	3.21
2400	1.08	6200	1.82	10000	2.32	13800	2.85	17700	3.21
2500	1.10	6300	1.83	10100	2.31	13900	2.83	17800	3.18
2600	1.13	6400	1.83	10200	2.31	14000	2.83	17900	3.25
2700	1.15	6500	1.87	10300	2.26	14100	2.83	18000	3.14
2800	1.17	6600	1.88	10400	2.32	14200	2.84		
2900	1.21	6700	1.90	10500	2.26	14300	2.90		
3000	1.22	6800	1.93	10600	2.26	14400	2.84		
3100	1.25	6900	1.92	10700	2.31	14600	2.88		
3200	1.27	7000	1.95	10800	2.24	14700	2.85		
3300	1.29	7100	1.96	10900	2.39	14800	2.92		
3400	1.28	7200	1.99	11000	2.41	14900	2.93		
3500	1.31	7300	2.00	11100	2.46	15000	2.83		

**Cable loss**  
**Cable coaxial, Microwave Cable Assembly, 104EA, 18 GHz, 1.0 m**  
**Suhner Sucoflex, HL 3386**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.05	5750	1.01	12000	1.29
30	0.07	6000	1.02	12250	1.33
100	0.12	6250	1.02	12500	1.36
250	0.18	6500	0.95	12750	1.35
500	0.26	6750	0.96	13000	1.36
750	0.32	7000	1.01	13250	1.39
1000	0.35	7250	1.04	13500	1.37
1250	0.41	7500	1.09	13750	1.43
1500	0.45	7750	1.12	14000	1.46
1750	0.50	8000	1.13	14250	1.39
2000	0.54	8250	1.15	14500	1.36
2250	0.57	8500	1.15	14750	1.47
2500	0.61	8750	1.15	15000	1.47
2750	0.64	9000	1.16	15250	1.41
3000	0.67	9250	1.14	15500	1.52
3250	0.70	9500	1.14	15750	1.54
3500	0.71	9750	1.19	16000	1.49
3750	0.74	10000	1.20	16250	1.48
4000	0.77	10250	1.22	16500	1.52
4250	0.80	10500	1.23	16750	1.56
4500	0.84	10750	1.22	17000	1.57
4750	0.85	11000	1.21	17250	1.53
5000	0.84	11250	1.24	17500	1.55
5250	0.85	11500	1.26	17750	1.55
5500	0.92	11750	1.28	18000	1.54

**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, 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		



**Cable loss**  
**Cable coaxial, RG-214/U, N type-N type, 3.5 m**  
**Alpha Wire, HL 3636**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	-0.16	1750	1.27	3550	2.15	5350	3.00
30	0.06	1800	1.30	3600	2.20	5400	3.05
50	0.10	1850	1.32	3650	2.28	5450	3.07
100	0.27	1900	1.35	3700	2.31	5500	3.08
150	0.33	1950	1.38	3750	2.28	5550	3.11
200	0.31	2000	1.44	3800	2.27	5600	3.17
250	0.42	2050	1.47	3850	2.35	5650	3.21
300	0.42	2100	1.49	3900	2.44	5700	3.22
350	0.53	2150	1.51	3950	2.45	5750	3.24
400	0.54	2200	1.55	4000	2.40	5800	3.28
450	0.59	2250	1.57	4050	2.39	5850	3.31
500	0.63	2300	1.58	4100	2.46	5900	3.33
550	0.69	2350	1.60	4150	2.51	5950	3.37
600	0.70	2400	1.63	4200	2.54	6000	3.41
650	0.73	2450	1.65	4250	2.51	6050	3.41
700	0.78	2500	1.67	4300	2.50	6100	3.44
750	0.80	2550	1.69	4350	2.54	6150	3.49
800	0.81	2600	1.72	4400	2.61	6200	3.53
850	0.89	2650	1.75	4450	2.62	6250	3.56
900	0.89	2700	1.77	4500	2.63	6300	3.58
950	0.88	2750	1.78	4550	2.61	6350	3.61
1000	0.89	2800	1.80	4600	2.65	6400	3.64
1050	0.92	2850	1.84	4650	2.75	6450	3.68
1100	0.96	2900	1.87	4700	2.75	6500	3.69
1150	0.98	2950	1.90	4750	2.72		
1200	1.00	3000	1.90	4800	2.73		
1250	1.05	3050	1.92	4850	2.80		
1300	1.06	3100	1.96	4900	2.84		
1350	1.08	3150	2.01	4950	2.86		
1400	1.10	3200	2.01	5000	2.82		
1450	1.12	3250	2.04	5050	2.83		
1500	1.15	3300	2.04	5100	2.88		
1550	1.17	3350	2.07	5150	2.91		
1600	1.20	3400	2.13	5200	2.93		
1650	1.23	3450	2.15	5250	2.94		
1700	1.25	3500	2.16	5300	2.95		

**Cable loss**  
**Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A**  
**HL 3901**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.09	9500	4.29	21000	6.67
100	0.41	10000	4.40	22000	6.92
500	0.93	10500	4.52	23000	7.00
1000	1.33	11000	4.64	24000	7.18
1500	1.63	11500	4.76	25000	7.29
2000	1.90	12000	4.87	26000	7.55
2500	2.12	12500	4.99	27000	7.70
3000	2.33	13000	5.11	28000	7.88
3500	2.50	13500	5.20	29000	8.02
4000	2.67	14000	5.31	30000	8.15
4500	2.82	14500	5.42	31000	8.35
5000	2.99	15000	5.51	32000	8.40
5500	3.16	15500	5.58	33000	8.62
6000	3.32	16000	5.68	34000	8.73
6500	3.51	16500	5.78	35000	8.78
7000	3.65	17000	5.91	36000	8.94
7500	3.79	17500	5.99	37000	9.21
8000	3.92	18000	6.07	38000	9.37
8500	4.04	19000	6.36	39000	9.45
9000	4.18	20000	6.49	40000	9.52

**Cable loss**  
**Microwave Cable Assembly, Huber-Suhner, 40 GHz, 1.5 m, SMA-SMA, S/N 1227/2A**  
**HL 3902**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	-0.02	9500	1.84	21000	2.93
100	0.15	10000	1.86	22000	3.04
500	0.38	10500	1.93	23000	3.08
1000	0.56	11000	1.99	24000	3.18
1500	0.69	11500	2.04	25000	3.23
2000	0.82	12000	2.10	26000	3.34
2500	0.90	12500	2.15	27000	3.39
3000	0.98	13000	2.21	28000	3.49
3500	1.06	13500	2.25	29000	3.55
4000	1.11	14000	2.29	30000	3.64
4500	1.17	14500	2.34	31000	3.68
5000	1.24	15000	2.36	32000	3.77
5500	1.32	15500	2.40	33000	3.87
6000	1.40	16000	2.45	34000	3.93
6500	1.50	16500	2.48	35000	3.89
7000	1.56	17000	2.56	36000	4.00
7500	1.62	17500	2.58	37000	4.15
8000	1.68	18000	2.60	38000	4.20
8500	1.74	19000	2.80	39000	4.25
9000	1.78	20000	2.85	40000	4.32

## 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( $\mu$ V)	decibel referred to one microvolt
dB( $\mu$ V/m)	decibel referred to one microvolt per meter
dB( $\mu$ A)	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
$\mu$ s	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
$\Omega$	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