HERMON LABORATORIES

839.01
Electrical

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TEST REPORT

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

FOR:

Picowave Technologies Ltd.

Wireless mouse (remote control)

Model: KeyV

Table of contents

1 Applicant information

Client name:	Picowave Technologies Ltd.
Address:	10 Hacarcom street, Binyamina 30500, Israel
Telephone:	+972 4618 0293
Fax:	+972 77 718 0293
E-mail:	shimon@picowave.co.il
Contact name:	Mr. Shimon Ben-David

2 Equipment under test attributes

Product name:	Wireless mouse (remote control)
Product type:	Transmitter
Model(s):	KeyV
Serial number:	RMT0001
Hardware version:	RevA
Receipt date	6/28/2010

3 Manufacturer information

Manufacturer name:	Picowave Technologies Ltd.
Address:	10 Hacarcom street, Binyamina 30500, Israel
Telephone:	+972 4618 0293
Fax:	+972 77 718 0293
E-Mail:	shimon@picowave.co.il
Contact name:	Mr. Shimon Ben-David

4 Test details

Project ID:	20816
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	6/28/2010
Test completed:	7/08/2010
Test specification(s):	FCC 47 CFR Part 15, subpart C, §15.249

5 Tests summary

Test	Status
Transmitter characteristics	
Section 15.249(a)(d), Field strength of emissions	Pass
Section 15.249(d), Band edge emissions	Pass
Section 15.207(a), Conducted emission	Pass
Section 15.203, Antenna requirement	Pass
Section 15.215(c), Occupied bandwidth	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer	July 6, 2010	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	July 7, 2010	
Approved by:	Mr. M. Nikishin, EMC and radio group manager	July 20, 2010	

6 EUT description

6.1 General information

The EUT is a wireless handheld mouse (remote control), powered by 3.7 V battery. The battery can be charged via PC USB port.

6.2 Support and test equipment

Description	Manufacturer	Model number	Serial number
Laptop	DELL	Inspiron 6400	JUJREM000016A
AC/DC adaptor	IBM	08K-8206	11S08K8206Z1ZAPX57K2rg

6.3 Changes made in EUT

No changes were performed in the EUT.

6.4 Transmitter characteristics

Type of equipment	
V	Stand-alone (Equipment with or without its own control provisions)
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)
	Plug-in card (Equipment intended for a variety of host systems)

Intended use		**Condition of use**
	Fixed	Always at a distance more than 2 m from all people
	mobile	Always at a distance more than 20 cm from all people
V	portable	May operate at a distance closer than 20 cm to human body

Assigned frequency range	2400 – 2483.5 MHz
Operating frequency range	2433 – 2465 MHz
RF channel spacing	1 MHz
Maximum field strength of carrier	105.64 dBµV/m at 3 m distance

Is transmitter output power variable?	**V**	No		
		Yes		continuous variable
				stepped variable with stepsize dB
			minimum RF power	dBm
			maximum RF power	dBm

Antenna connection			
unique coupling	standard connector	**V** Integral	with temporary RF connector
			V without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Integral	Picowave Technologies	NA	NA

Transmitter aggregate data rate/s	1 Mbps					
Type of modulation	GFSK					
Maximum transmitter duty cycle in normal use	%					

Transmitter power source					
		Nominal rated voltage		Battery type	
V	DC	**Nominal rated voltage**	3.7 V		
	AC mains	**Nominal rated voltage**		Frequency	Hz

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

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

7.1 Field strength of emissions

7.1.1 General

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

Table 7.1.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(µV/m)		
	Peak	Average	Quasi-Peak
2400 – 2483.5	114.0	94.0	NA

Table 7.1.2 Harmonics limits

Fundamental frequency, MHz	Field strength at 3 m, dB(µV/m)	
	Peak	Average
2400 – 2483.5	74.0	54.0

Table 7.1.3 Radiated spurious emissions limits (other than harmonics)

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

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

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

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

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

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

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

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

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

7.1.2.2 The measurements were performed in three EUT orthogonal positions.

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

7.1.2.4 The worst test results (the lowest margins) found in the EUT 3 orthogonal positions were recorded in the associated tables and shown in the associated plots.

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

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

7.1.3.2 The measurements were performed in three EUT orthogonal positions.

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

7.1.3.4 The worst test results (the lowest margins) found in the EUT 3 orthogonal positions were recorded in the associated tables and shown in the associated plots.

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

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

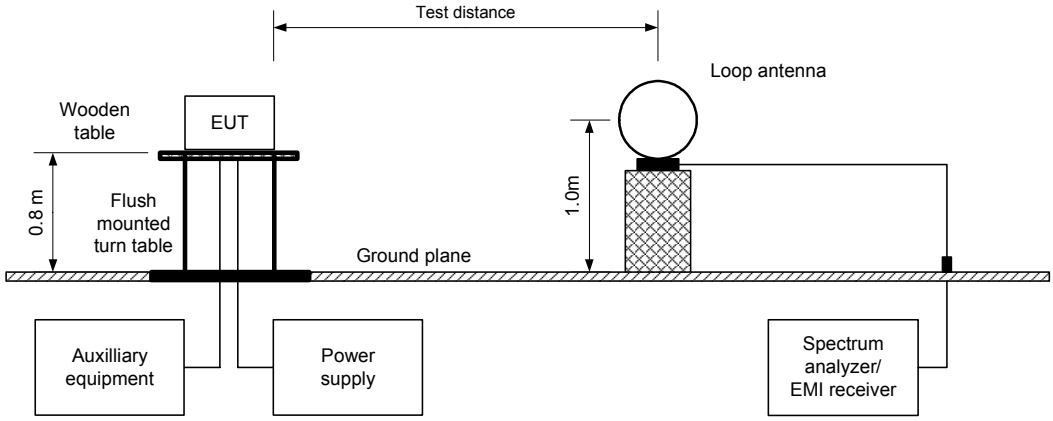
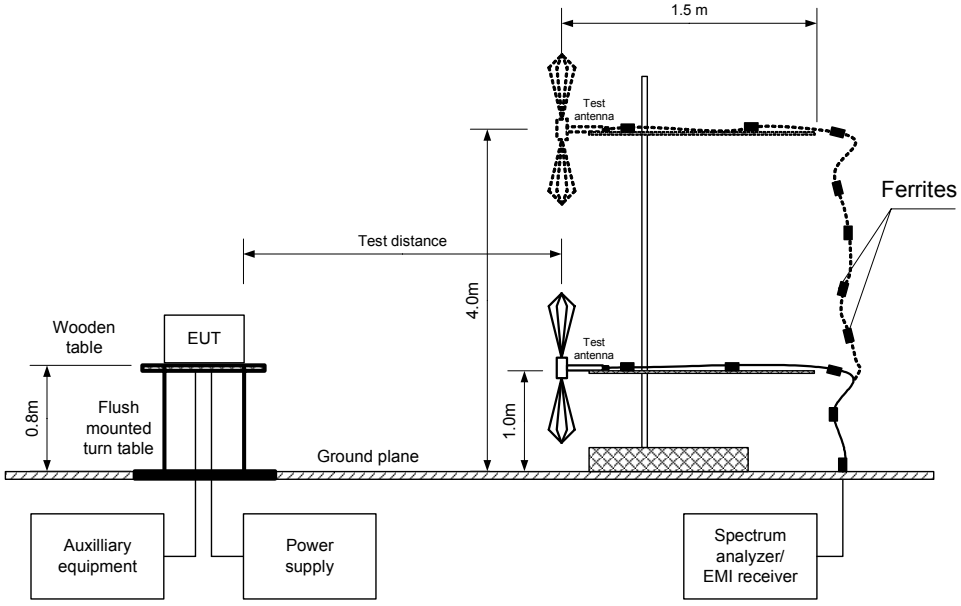


Figure 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 15.249(a)(d), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	7/1/2010		
Temperature: 25 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 47 %	**Power Supply:** 3.7 VDC
Remarks:			

Table 7.1.4 Field strength of fundamental emission and spurious emissions

TEST DISTANCE:	3 m
EUT POSITION:	3 orthogonal X / Y / Z
MODULATION:	GFSK
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 26500 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz) 1.0 MHz (above 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
Fundamental emission* **											
2433	H	1.3	172	103.41	114	-10.59	-24.88	78.53	94	-15.47	Pass
2449	H	1.4	167	105.64	114	-8.36	-24.88	80.76	94	-13.24	
2465	H	1.4	173	104.97	114	-9.03	-24.88	80.09	94	-13.91	
Spurious emissions											
4865.74	H	1.3	168	58.40	74	-15.60	-24.88	33.52	54	-20.48	Pass
4898.01	H	1.4	170	61.22	74	-12.78	-24.88	36.34	54	-17.66	
4930.01	H	1.4	178	57.41	74	-16.59	-24.88	32.53	54	-21.47	
9731.25	H	1.2	166	50.96	74	-23.04	-24.88	26.08	54	-27.92	
9795.84	H	1.2	161	51.10	74	-22.90	-24.88	26.22	54	-27.78	
9860.03	H	1.2	170	51.73	74	-22.27	-24.88	26.85	54	-27.15	

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = dB below (negative if above) specification limit.
*** Max value was obtained in Y-axis orthogonal position.

Table 7.1.5 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Pulse number during 100 msec	Duration, ms	Period, ms		
1.9	3	NA	NA	NA	-24.88

*- Average factor was calculated as follows

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

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

Average factor=20 log (1.9 x 3 /100) =-24.88 dB

Reference numbers of test equipment used

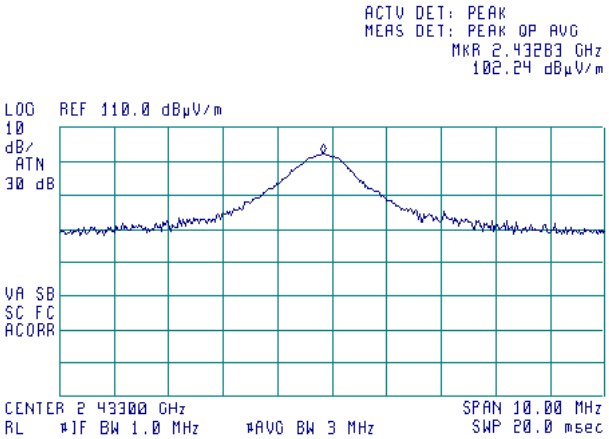
HL 0446	HL 0521	HL 0604	HL 0768	HL 1430	HL 2432	HL 2780	HL 2871
HL 2883	HL 3119	HL 3616	HL 3883				

Full description is given in Appendix A.

Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

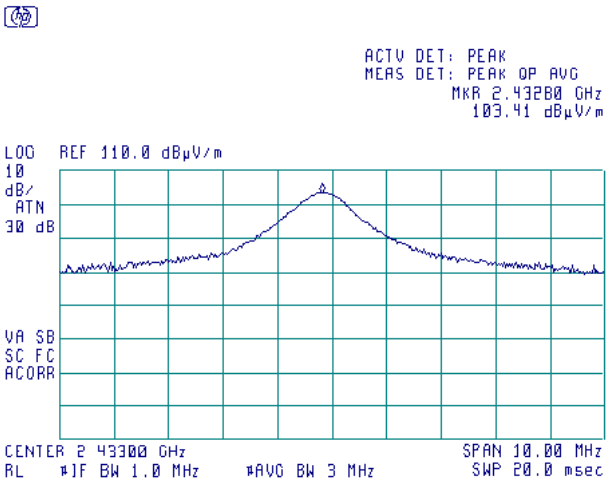
Plot 7.1.1 Radiated emission measurements at the fundamental frequency

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	3 orthogonal (**X**/ Y/ Z)
FREQUENCY	2433 MHz



Plot 7.1.2 Radiated emission measurements at the fundamental frequency

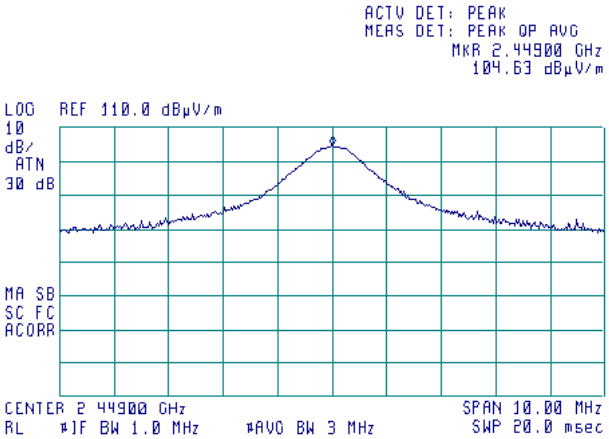
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	3 orthogonal (X/ **Y**/ Z)
FREQUENCY	2433 MHz



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

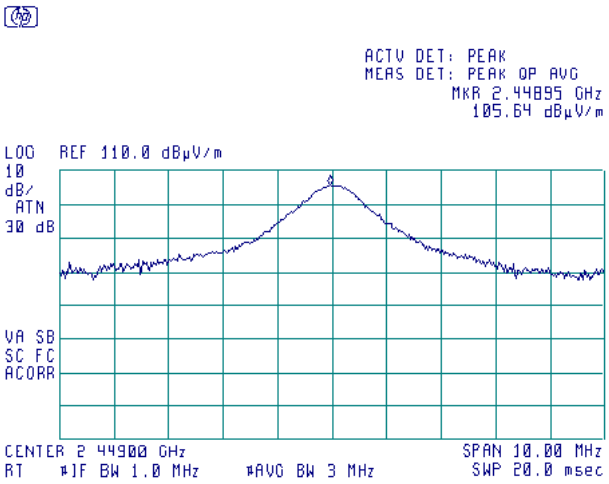
Plot 7.1.3 Radiated emission measurements at the fundamental frequency

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	3 orthogonal (**X**/ Y/ Z)
FREQUENCY	2449 MHz



Plot 7.1.4 Radiated emission measurements at the fundamental frequency

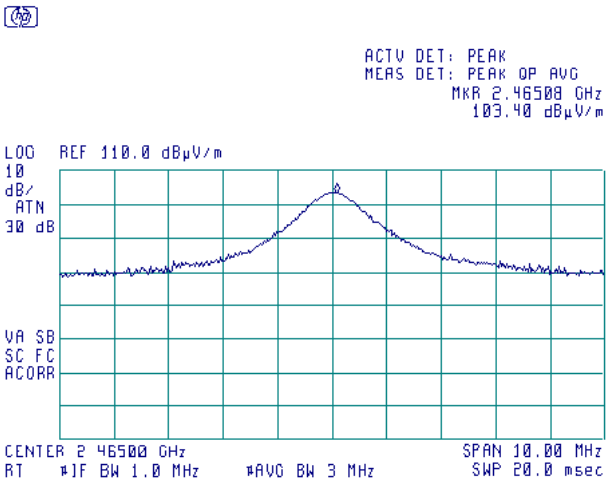
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	3 orthogonal (X/ **Y**/ Z)
FREQUENCY	2449 MHz



Test specification:	**Section 15.249(a)(d), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	7/1/2010		
Temperature: 25 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 47 %	**Power Supply:** 3.7 VDC
Remarks:			

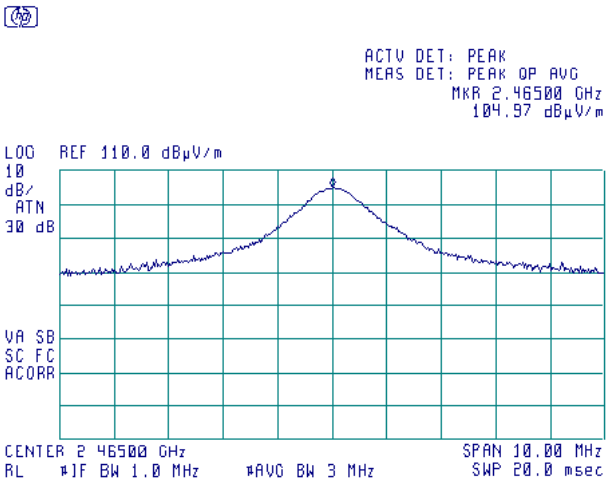
Plot 7.1.5 Radiated emission measurements at the fundamental frequency

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	3 orthogonal (**X**/ Y/ Z)
FREQUENCY	2465 MHz



Plot 7.1.6 Radiated emission measurements at the fundamental frequency

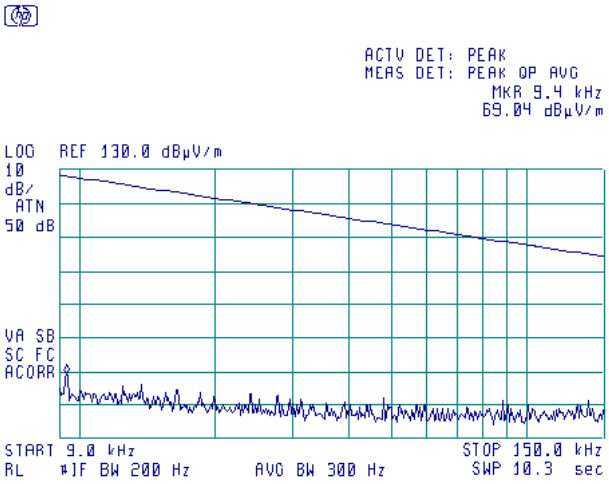
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	3 orthogonal (X/ **Y**/ Z)
FREQUENCY	2465 MHz



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

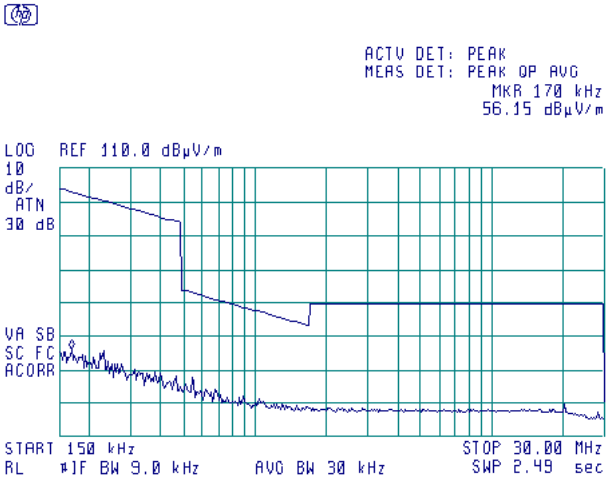
Plot 7.1.7 Radiated emission measurements from 9 to 150 kHz

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



Plot 7.1.8 Radiated emission measurements from 0.15 to 30 MHz

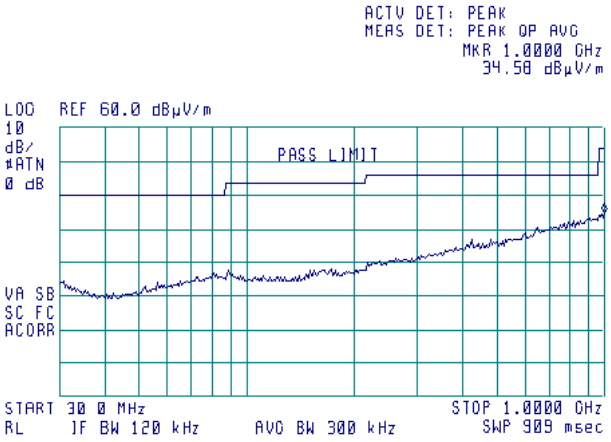
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X/ Y/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

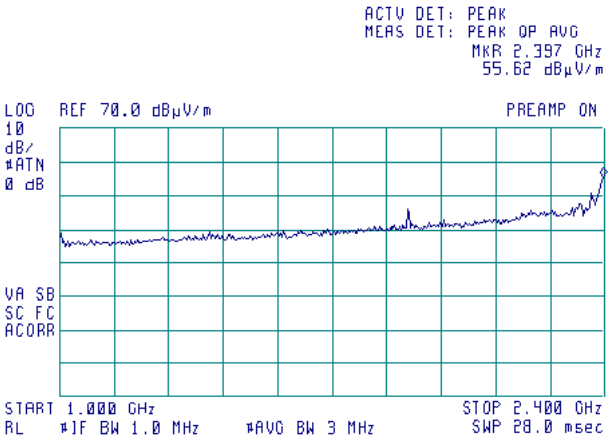
Plot 7.1.9 Radiated emission measurements from 30 to 1000 MHz

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



Plot 7.1.10 Radiated emission measurements from 1.0 to 2.4 GHz at low frequency

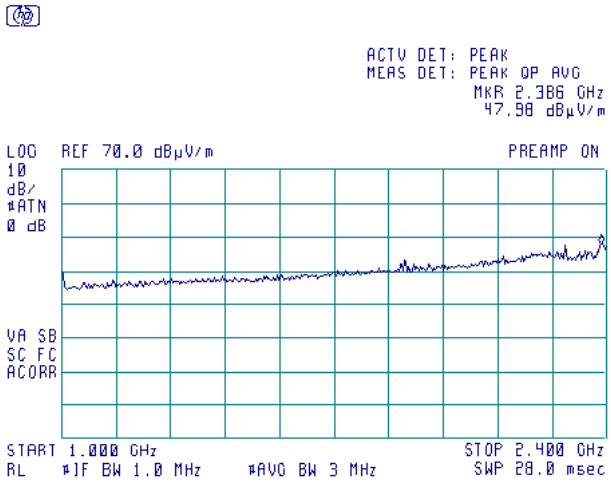
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

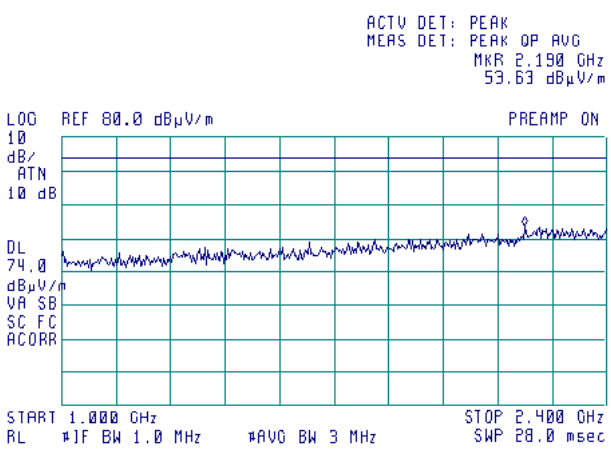
Plot 7.1.11 Radiated emission measurements from 1.0 to 2.4 GHz at mid frequency

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



Plot 7.1.12 Radiated emission measurements from 1.0 to 2.4 GHz at high frequency

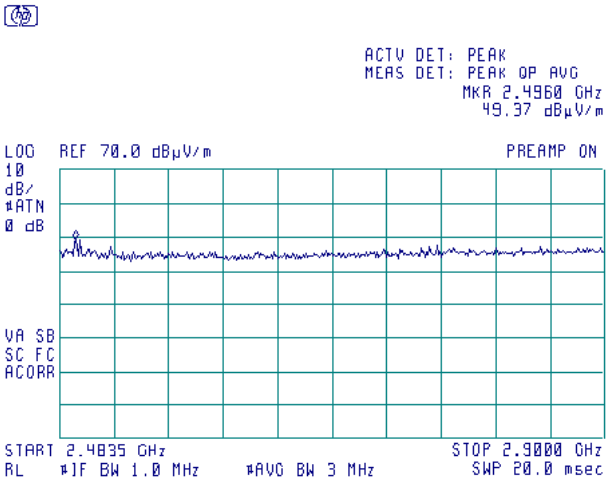
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

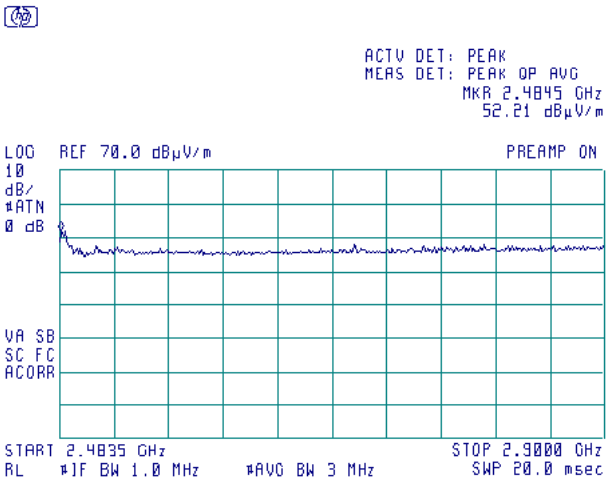
Plot 7.1.13 Radiated emission measurements from 2.483 to 2.9 GHz at low frequency

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



Plot 7.1.14 Radiated emission measurements from 2.483 to 2.9 GHz at mid frequency

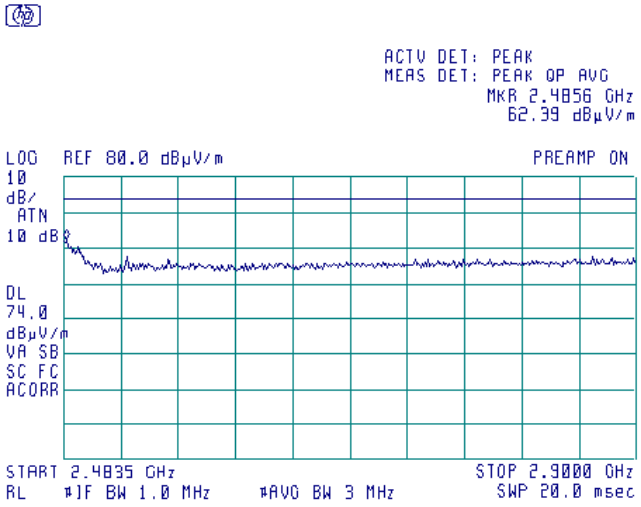
TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

Plot 7.1.15 Radiated emission measurements from 2.483 to 2.9 GHz at high frequency

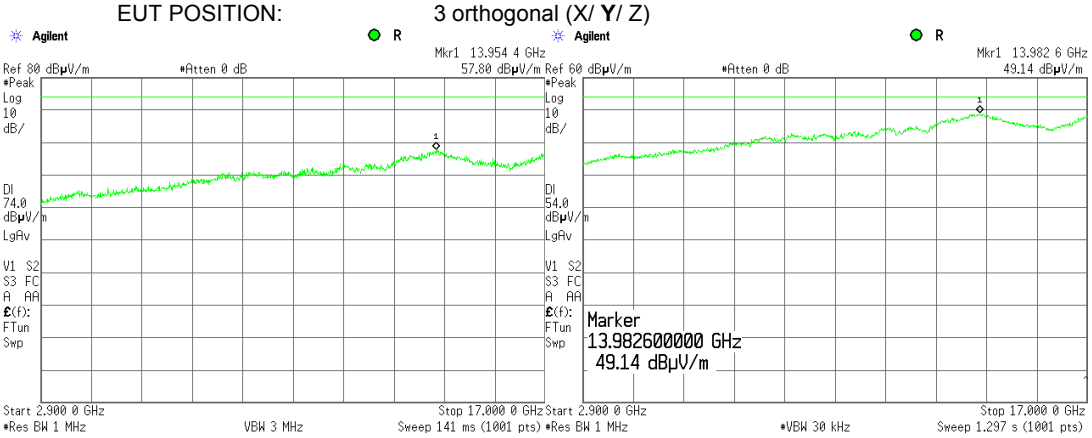
TEST SITE:	Semi Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	3 orthogonal (X/ Y/ Z)



Test specification:	**Section 15.249(a)(d), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	7/1/2010		
Temperature: 25 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 47 %	**Power Supply:** 3.7 VDC
Remarks:			

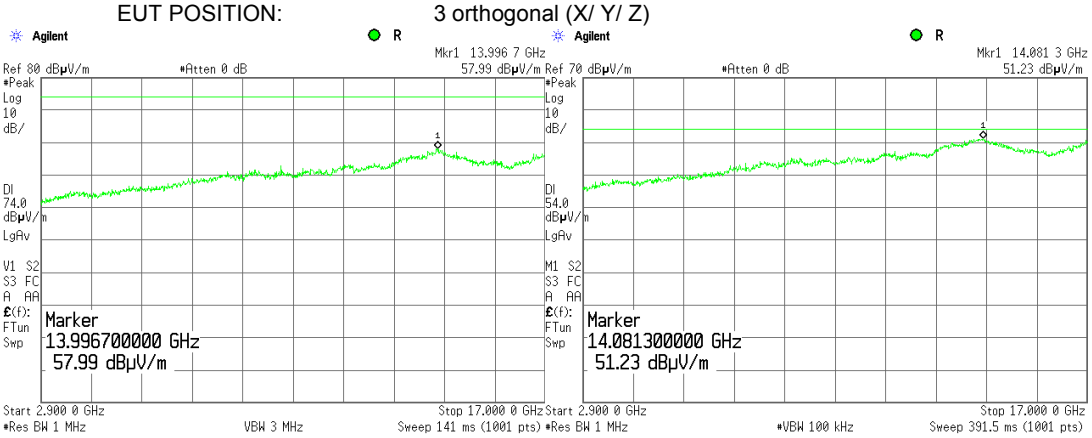
Plot 7.1.16 Radiated emission measurements from 2.9 to 17.0 GHz at low frequency

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



Plot 7.1.17 Radiated emission measurements from 2.9 to 17.0 GHz at mid frequency

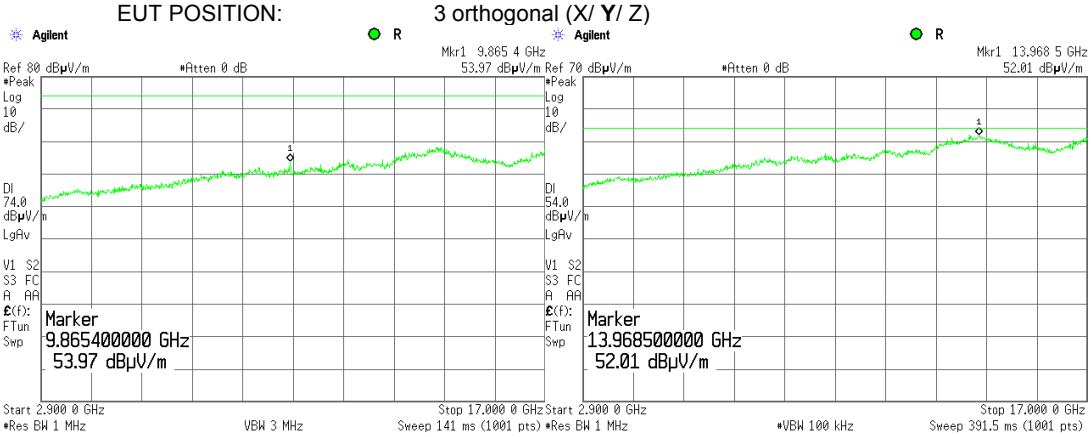
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



Test specification:	**Section 15.249(a)(d), Field strength of emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	7/1/2010		
Temperature: 25 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 47 %	**Power Supply:** 3.7 VDC
Remarks:			

Plot 7.1.18 Radiated emission measurements from 2.9 to 17.0 GHz at high frequency

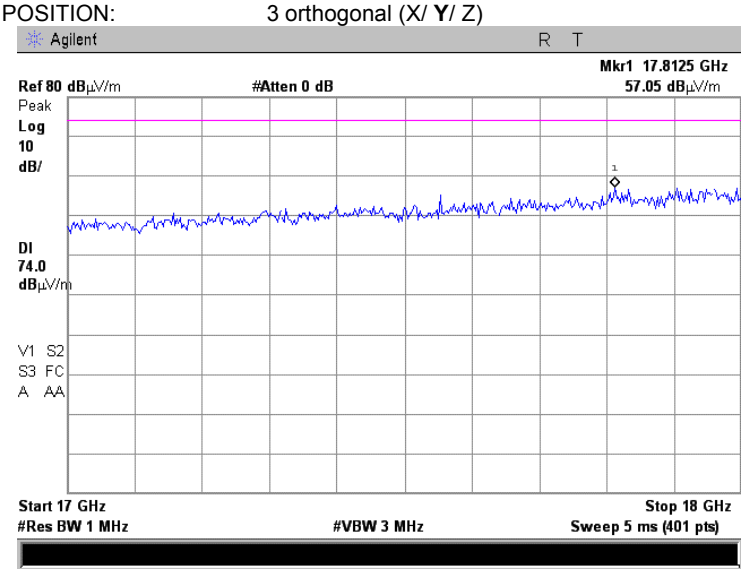
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ **Y**/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

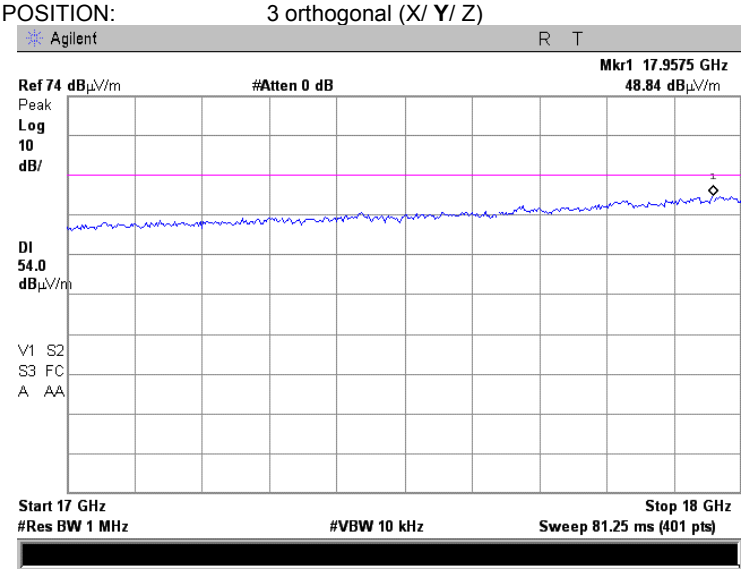
Plot 7.1.19 Radiated emission measurements from 17.0 to 18.0 GHz at low frequency, VBW=3 MHz

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



Plot 7.1.20 Radiated emission measurements from 17.0 to 18.0 GHz at low frequency, VBW=10 kHz

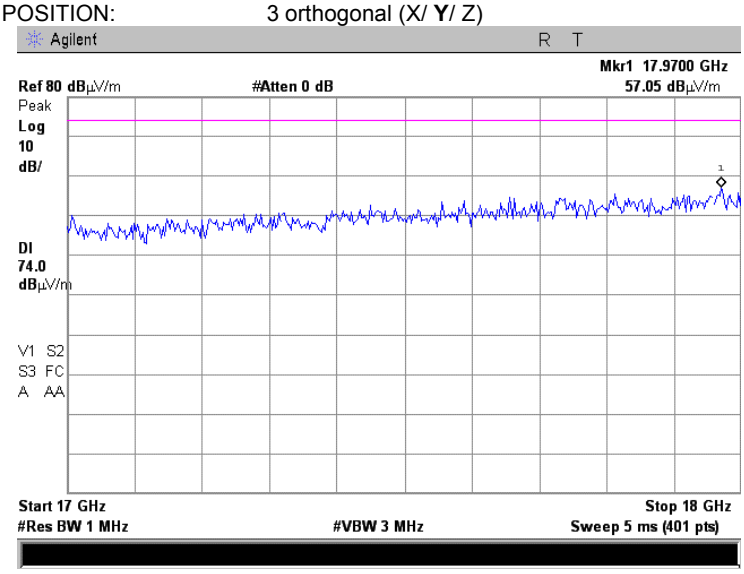
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ **Y**/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

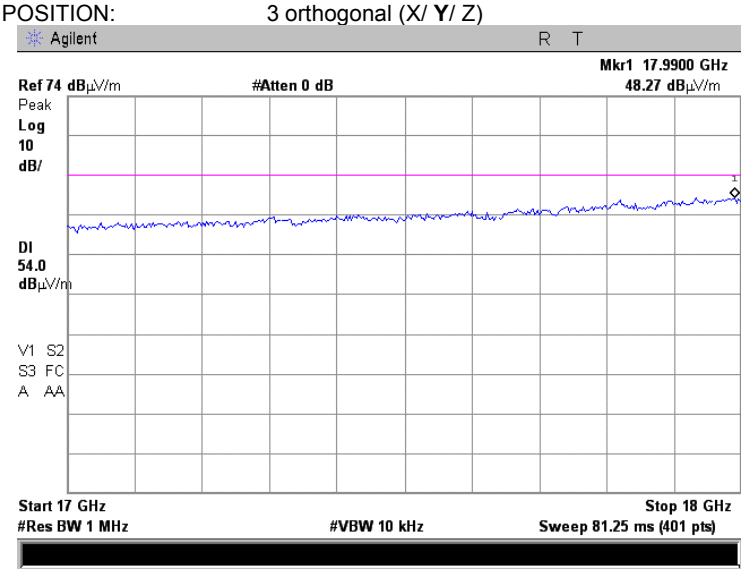
Plot 7.1.21 Radiated emission measurements from 17.0 to 18.0 GHz at mid frequency, VBW=3 MHz

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



Plot 7.1.22 Radiated emission measurements from 17.0 to 18.0 GHz at mid frequency, VBW=10 kHz

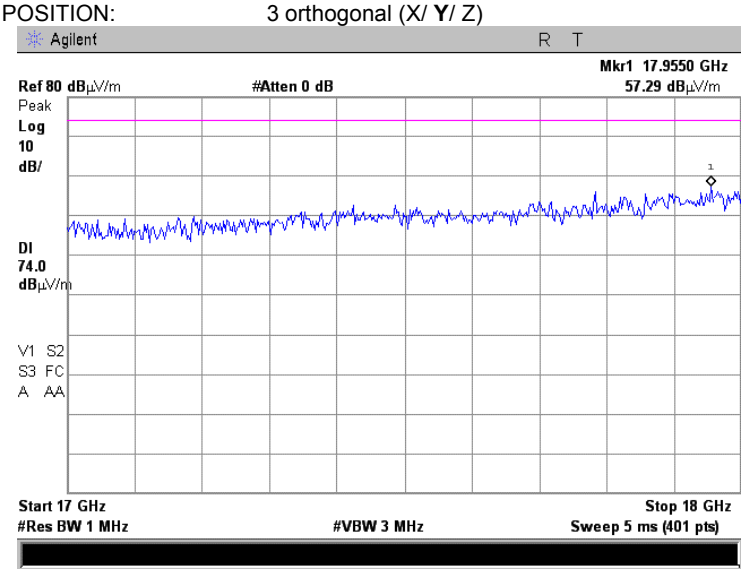
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ **Y**/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

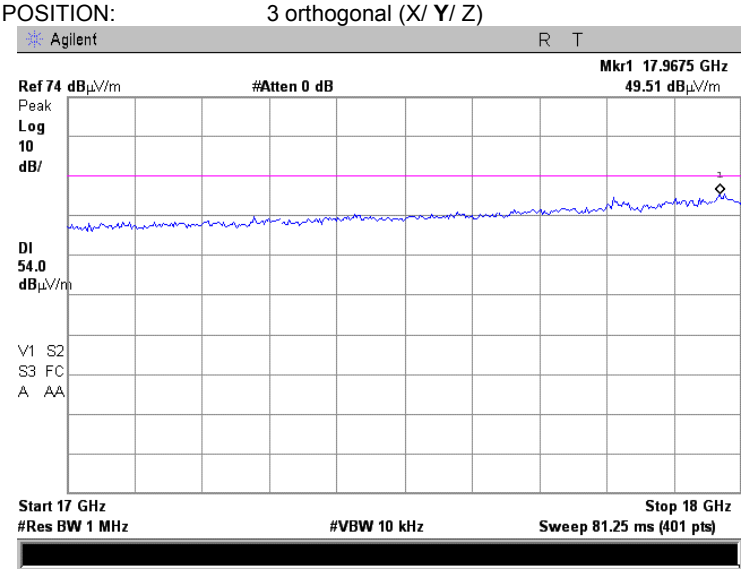
Plot 7.1.23 Radiated emission measurements from 17.0 to 18.0 GHz at high frequency, VBW=3 MHz

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



Plot 7.1.24 Radiated emission measurements from 17.0 to 18.0 GHz at high frequency, VBW=10 kHz

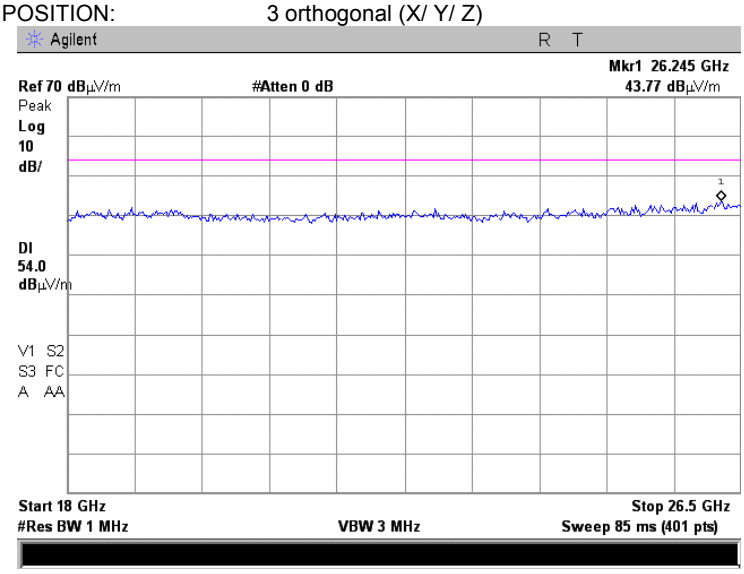
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ **Y**/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

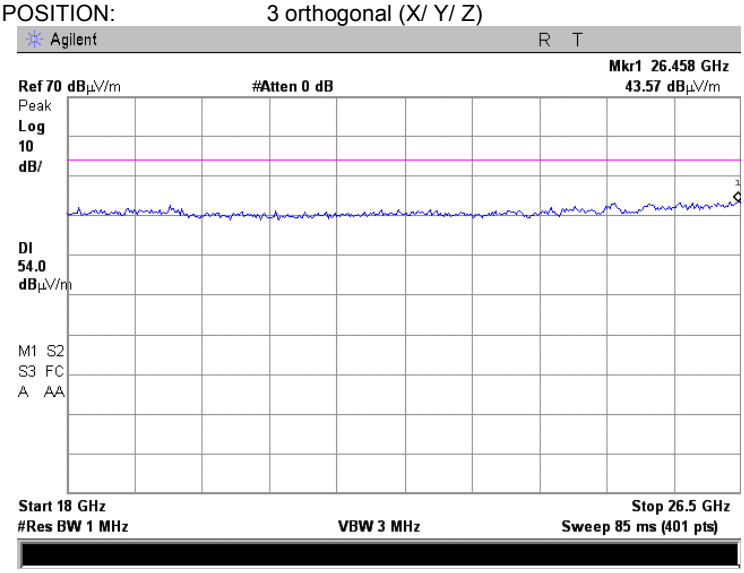
Plot 7.1.25 Radiated emission measurements from 18.0 to 26.5 GHz at low frequency

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



Plot 7.1.26 Radiated emission measurements from 18.0 to 26.5 GHz at mid frequency

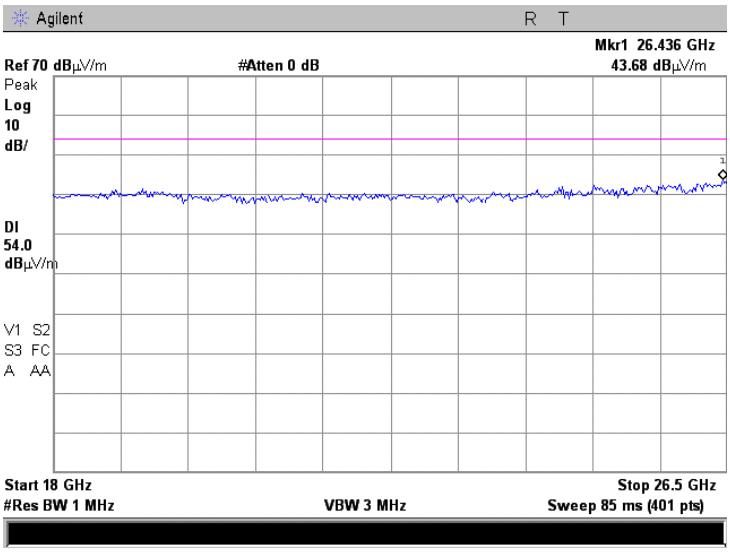
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

Plot 7.1.27 Radiated emission measurements from 18.0 to 26.5 GHz at high frequency

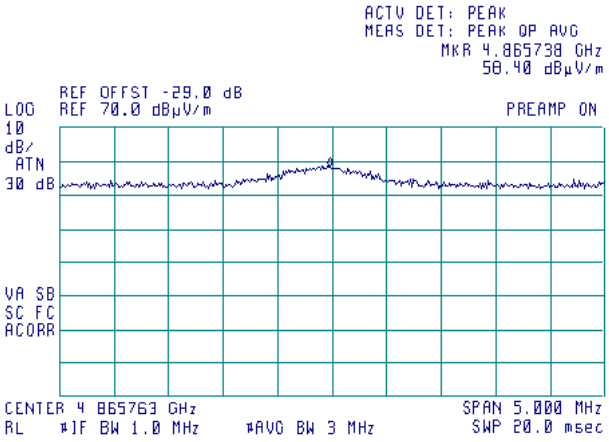
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

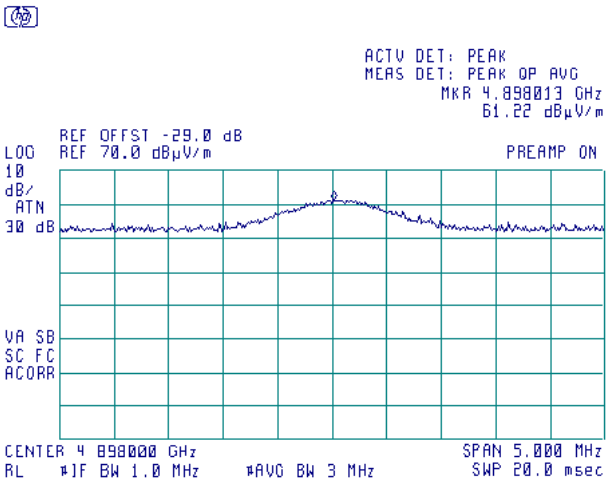
Plot 7.1.28 Radiated emission measurements at the second harmonic frequency

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ **Y**/ Z)
FREQUENCY: 2433 MHz



Plot 7.1.29 Radiated emission measurements at the second harmonic frequency

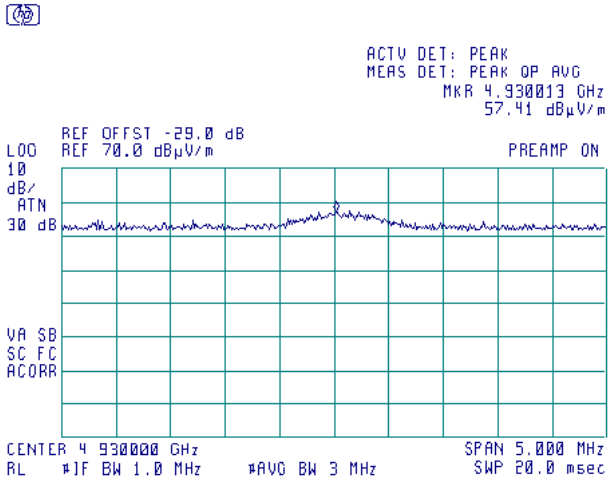
TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)
FREQUENCY: 2449 MHz



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

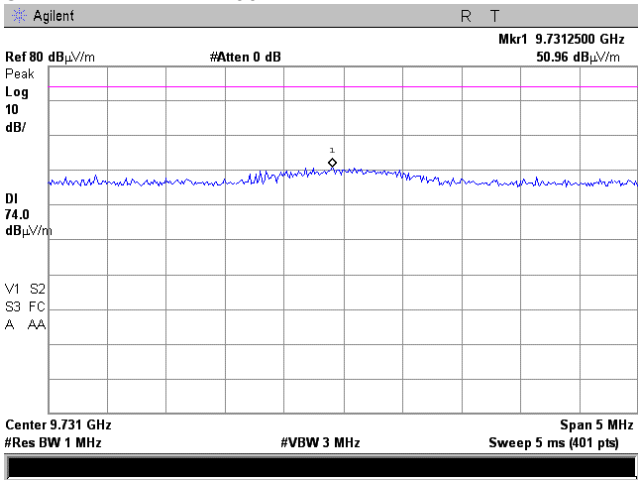
Plot 7.1.30 Radiated emission measurements at the second harmonic frequency

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ **Y**/ Z)
FREQUENCY: 2465 MHz



Plot 7.1.31 Radiated emission measurements at the fourth harmonic frequency

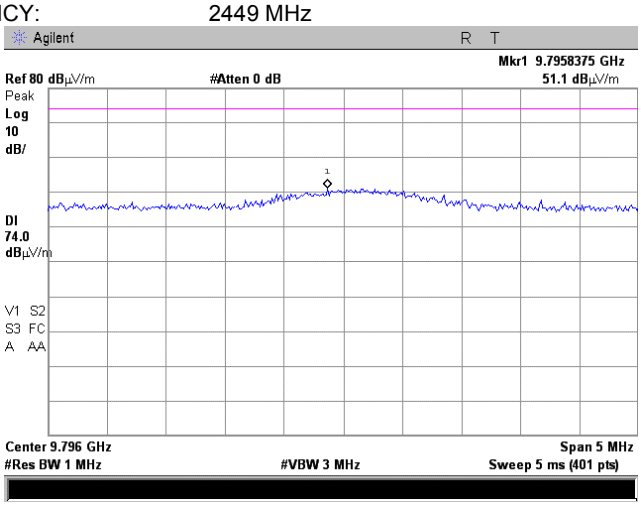
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)
FREQUENCY: 2433 MHz



Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

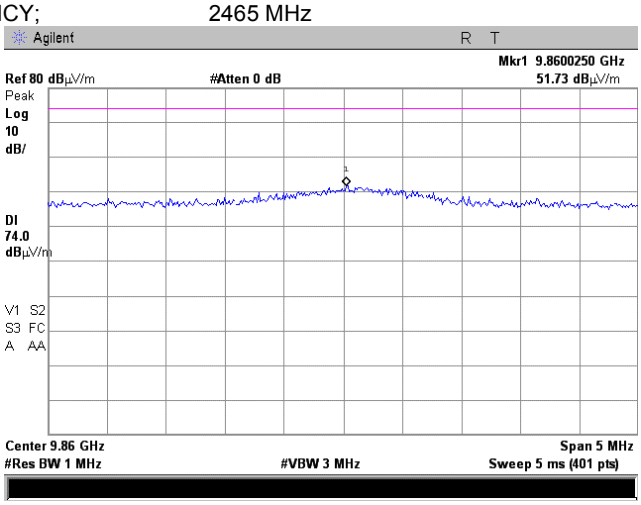
Plot 7.1.32 Radiated emission measurements at the fourth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)
FREQUENCY: 2449 MHz



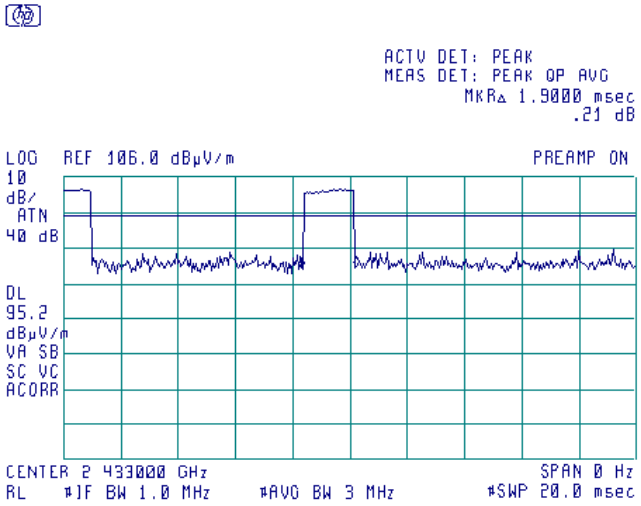
Plot 7.1.33 Radiated emission measurements at the fourth harmonic frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)
FREQUENCY; 2465 MHz

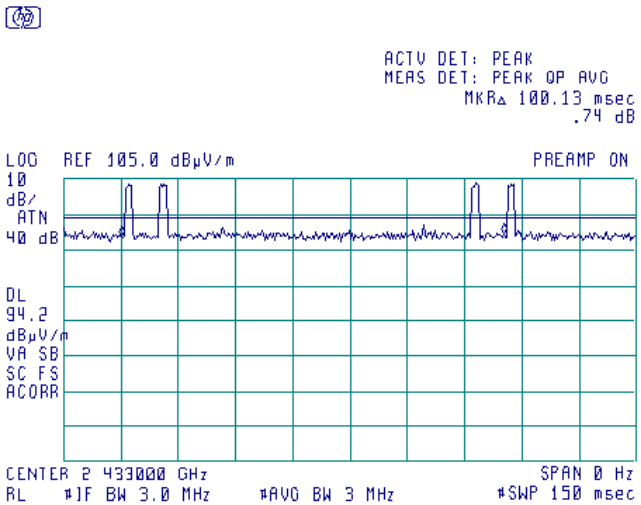


Test specification:	Section 15.249(a)(d), Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 25 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

Plot 7.1.34 Transmission pulse duration



Plot 7.1.35 Number of transmission pulses in 100 ms



Average factor=20 log (1.9 x 3 /100) =-24.88 dB

Test specification:	Section 15.249(d), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

7.2 Band edge emission

7.2.1 General

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

Table 7.2.1 Band edge emission limits

Frequency band, MHz	Field strength limit at 3 m, dBµV/m		Attenuation below carrier, dBc
	Peak	Average	
2400.0 – 2483.5	74.0	54.0	50

7.2.2 Test procedure

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

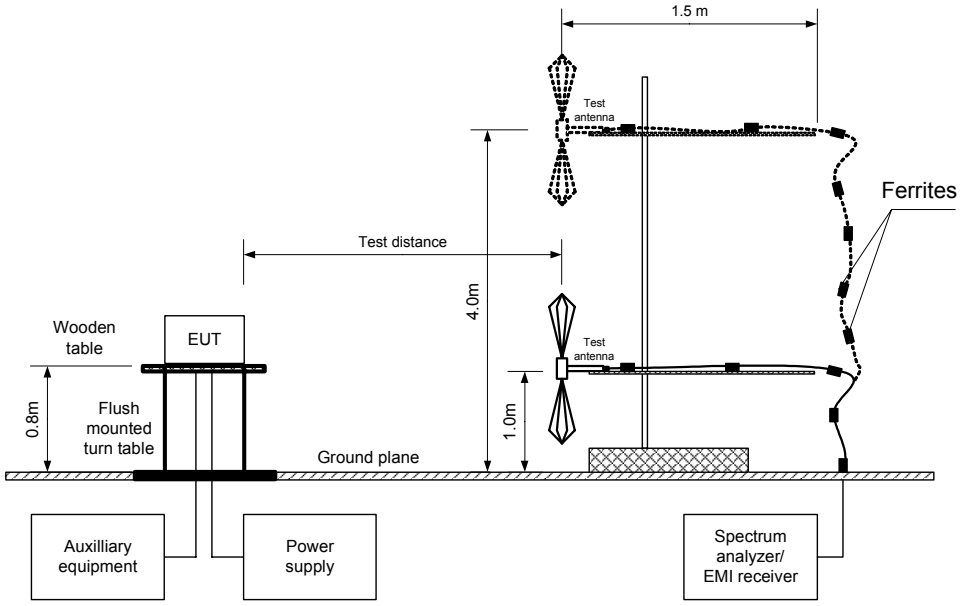
7.2.2.2 The spectrum analyzer frequency span was set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

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

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

Test specification:	Section 15.249(d), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

Figure 7.2.1 Band edge emission measurement set up



Test specification:	**Section 15.249(d), Band edge emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	7/1/2010		
Temperature: 24 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 47 %	**Power Supply:** 3.7 VDC
Remarks:			

Table 7.2.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 2400.0 – 2483.5 MHz
DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 3 MHz
MODULATION: GFSK
BIT RATE: 1 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Freq., MHz	Antenna		Azimuth, degrees	Peak field strength			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	
2400.0	H	1.3	172	56.78	74	-17.22	-24.88	31.90	54	-22.10	Pass
2483.5	H	1.4	167	64.22	74	-9.78	-24.88	39.34	54	-14.66	

The test shows compliance with 15.249(d) requirements.

Reference numbers of test equipment used

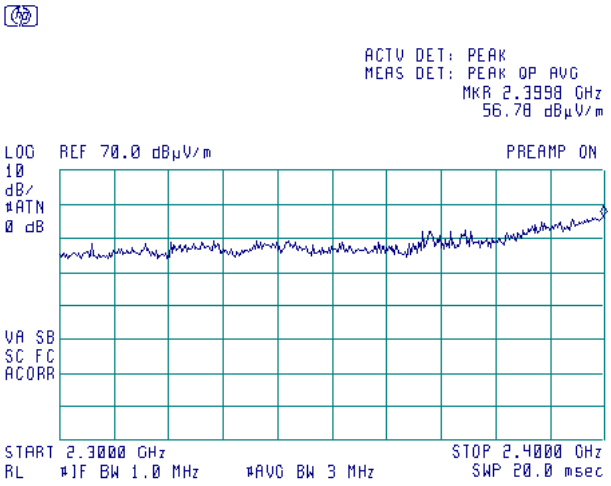
HL 0521	HL 2432	HL 3119					

Full description is given in Appendix A.

Test specification:	Section 15.249(d), Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	7/1/2010		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 3.7 VDC
Remarks:			

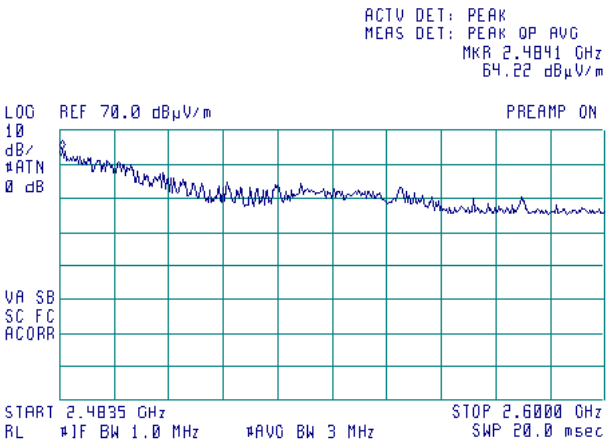
Plot 7.2.1 Low band edge emission test result

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: X/**Y**/Z



Plot 7.2.2 High band edge emission test result

TEST SITE: Semi Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: X/**Y**/Z



Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	7/4/2010		
Temperature: 27.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 53 %	Power Supply: 120 VAC
Remarks:			

7.3 Conducted emissions

7.3.1 General

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

Table 7.3.1 Limits for conducted emissions

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

* The limit decreases linearly with the logarithm of frequency.

7.3.2 Test procedure

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

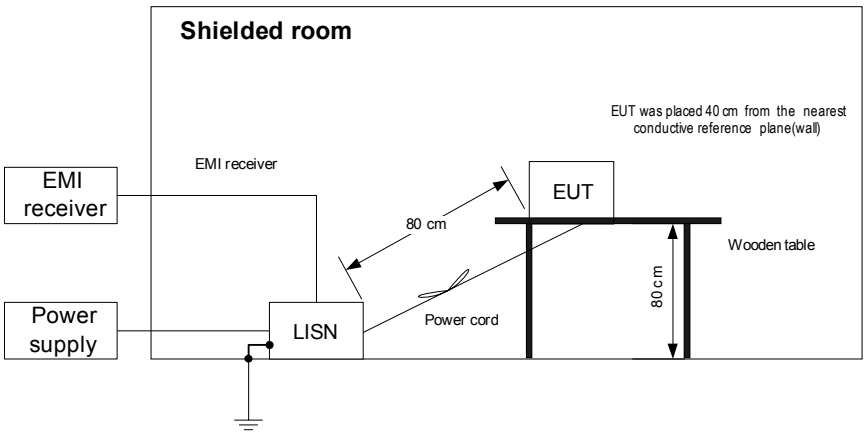
7.3.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.3.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

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

Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	7/4/2010		
Temperature: 27.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 53 %	Power Supply: 120 VAC
Remarks:			

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



Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	7/4/2010		
Temperature: 27.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 53 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.2 Conducted emission test results

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

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.161697	55.60	53.40	65.43	-12.03	39.68	55.43	-15.75	L1	Pass
0.175868	52.16	45.56	64.74	-19.18	22.17	54.74	-32.57		
0.215991	48.06	44.98	63.04	-18.06	30.71	53.04	-22.33		
3.812062	38.79	32.08	56.00	-23.92	19.80	46.00	-26.20		
0.164074	52.35	50.35	65.31	-14.96	37.26	55.31	-18.05	L2	Pass
0.219235	45.90	43.45	62.91	-19.46	30.17	52.91	-22.74		
0.328371	37.64	34.33	59.54	-25.21	24.29	49.54	-25.25		
3.644816	35.86	28.14	56.00	-27.86	16.50	46.00	-29.50		

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

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.164246	53.14	50.01	65.31	-15.30	36.05	55.31	-19.26	L1	Pass
0.218580	46.91	43.28	62.94	-19.66	27.46	52.94	-25.48		
0.328650	39.49	35.27	59.53	-24.26	20.39	49.53	-29.14		
3.742550	37.73	30.93	56.00	-25.07	18.36	46.00	-27.64		
0.163316	51.86	47.44	65.35	-17.91	32.68	55.35	-22.67	L2	Pass
0.220056	46.10	42.26	62.88	-20.62	28.44	52.88	-24.44		
0.274950	40.69	36.14	61.03	-24.89	22.38	51.03	-28.65		
3.826967	36.47	30.36	56.00	-25.64	17.82	46.00	-28.18		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

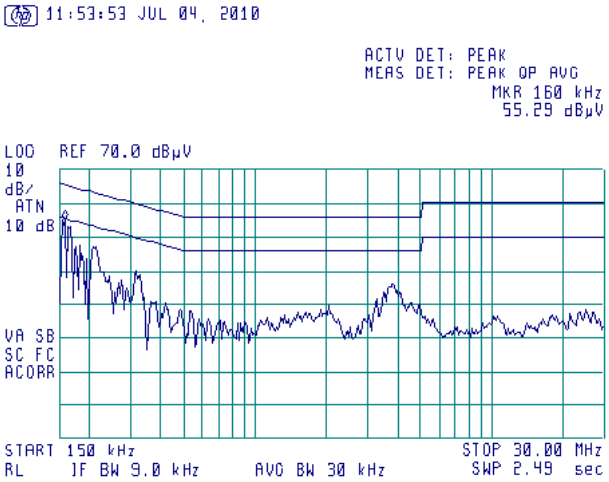
HL 0787	HL 1205	HL 1425	HL 1513	HL 2888	HL 3612		

Full description is given in Appendix A.

Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	7/4/2010		
Temperature: 27.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 53 %	Power Supply: 120 VAC
Remarks:			

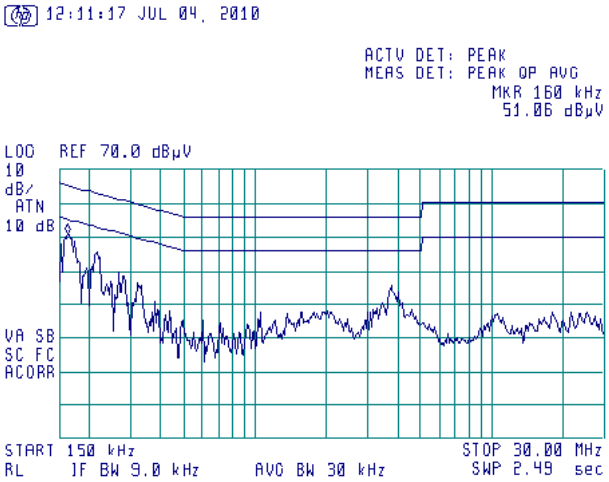
Plot 7.3.1 Conducted emission measurements

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



Plot 7.3.2 Conducted emission measurements

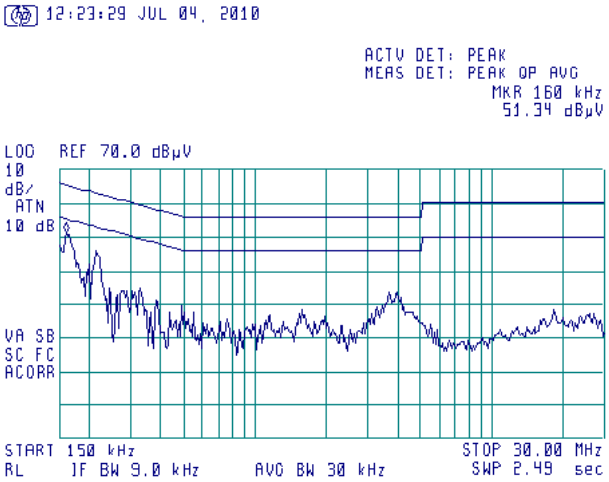
LINE: L2
EUT OPERATING MODE: Transmit during charging
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	7/4/2010		
Temperature: 27.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 53 %	Power Supply: 120 VAC
Remarks:			

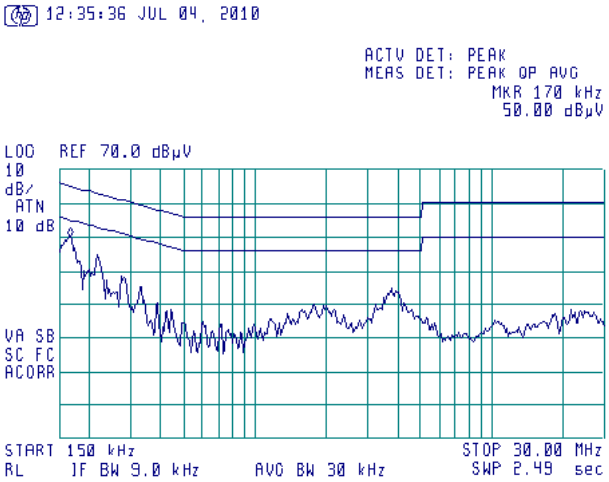
Plot 7.3.3 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Charging, tansmit OFF
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.3.4 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Charging, tansmit OFF
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/4/2010		
Temperature: 24.7 ºC	Air Pressure: 1006 hPa	Relative Humidity: 49 %	Power Supply: 3.7 VDC
Remarks:			

7.4 Occupied bandwidth test

7.4.1 General

This test was performed to verify that the 20 dB bandwidth of the emissions was contained within the standard specified frequency band according to FCC §15.215 requirements. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Occupied bandwidth limits

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

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

7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.

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

7.4.2.3 The peak of emission was measured. The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.4.2 and associated plot.

7.4.2.4 The obtained modulation bandwidth was verified to be within the allowed frequency range.

Figure 7.4.1 Occupied bandwidth test setup

Test specification:	**Section 15.215(c), Occupied bandwidth**		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	7/4/2010		
Temperature: 24.7 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 49 %	**Power Supply:** 3.7 VDC
Remarks:			

Table 7.4.2 Occupied bandwidth test results

ASSIGNED FREQUENCY BAND	2400-2483.5 MHz
DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	10 kHz
VIDEO BANDWIDTH:	30 kHz
MODULATION ENVELOPE REFERENCE POINTS:	20 dBc
MODULATION:	GFSK
MODULATING SIGNAL:	enable

Fundamental frequency MHz	Band edge	Frequency drift, kHz		Cross point frequency, MHz	Assigned band edge, MHz	Verdict
		Negative	Positive			
2433	Low	NA	NA	2432.46	2400.0	Pass
	High	NA	NA	2433.21	2483.5	Pass
2449	Low	NA	NA	2448.62	2400.0	Pass
	High	NA	NA	2449.41	2483.5	Pass
2465	Low	NA	NA	2464.63	2400.0	Pass
	High	NA	NA	2465.42	2483.5	Pass

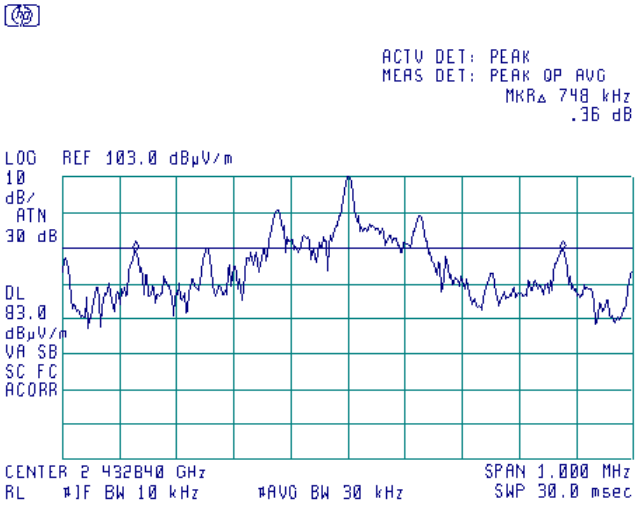
Reference numbers of test equipment used

HL 0521	HL 2432	HL 3119						

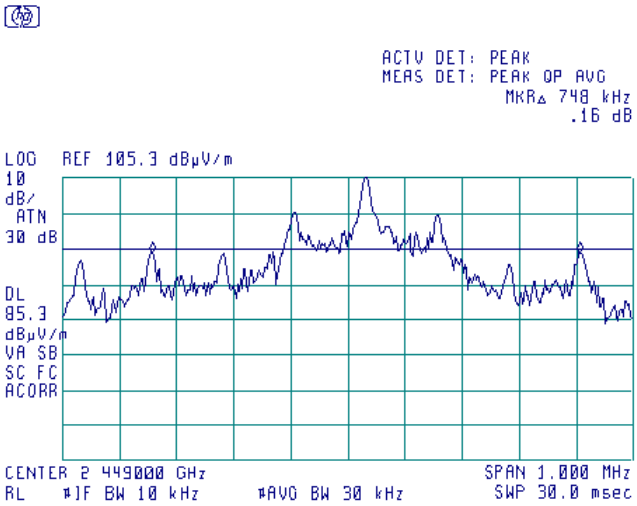
Full description is given in Appendix A.

Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/4/2010		
Temperature: 24.7 ºC	Air Pressure: 1006 hPa	Relative Humidity: 49 %	Power Supply: 3.7 VDC
Remarks:			

Plot 7.4.1 Occupied bandwidth test result at Fmin

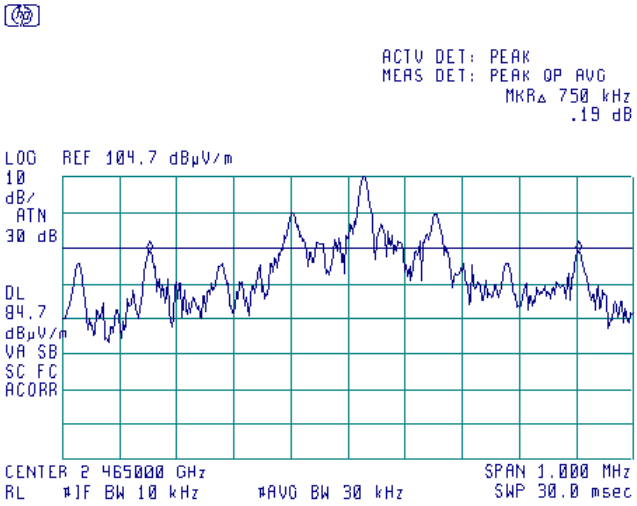


Plot 7.4.2 Occupied bandwidth test result at Fmid



Test specification:	**Section 15.215(c), Occupied bandwidth**		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	7/4/2010		
Temperature: 24.7 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 49 %	**Power Supply:** 3.7 VDC
Remarks:			

Plot 7.4.3 Occupied bandwidth test result at Fmax



Test specification:	**Section 15.203, Antenna requirement**		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	**Verdict:**	PASS
Date:	7/4/2010		
Temperature: 24.3 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 42 %	**Power Supply:** 3.7 VDC
Remarks:			

7.5 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.5.1.

Table 7.5.1 Antenna requirements

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

8 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	27-Aug-09	27-Aug-10
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-10	11-Jan-11
0768	Antenna Standard Gain Horn,18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	23-Dec-08	23-Dec-11
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard	11947A	3107A018 77	18-Oct-09	18-Oct-10
1205	One phase voltage regulator, 2kVA, 0-250V	Hermon Laboratories	TDGC-2	109	03-Aug-09	03-Aug-10
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A002 22, 3705A002 04	28-Aug-09	28-Aug-10
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A002 62,3705A0 0217	31-Aug-09	31-Aug-10
1513	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1513	01-Sep-09	01-Sep-10
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	11-Jun-10	11-Jun-11
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	15-Sep-09	15-Sep-10
2883	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539 003	01-Dec-09	01-Dec-10
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	07-Jul-10	07-Jul-11
3119	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539004	29-Nov-09	29-Nov-10
3612	Cable RF, 17.5 m, N type-N type	Teldor	RG-214/U	NA	02-Dec-09	02-Dec-10
3616	Cable RF, 6.5 m, N type-N type, DC-6.5 GHz	Suhner Switzerland	Rg 214/U	NA	27-May-10	27-May-11
3883	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type(f) in, N-type(m) out.	Agilent Technologies	87405C	MY470104 06	13-Jan-10	13-Jan-11

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

10 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.
Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, 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).

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Person for contact: Mr. Alex Usoskin, CEO.

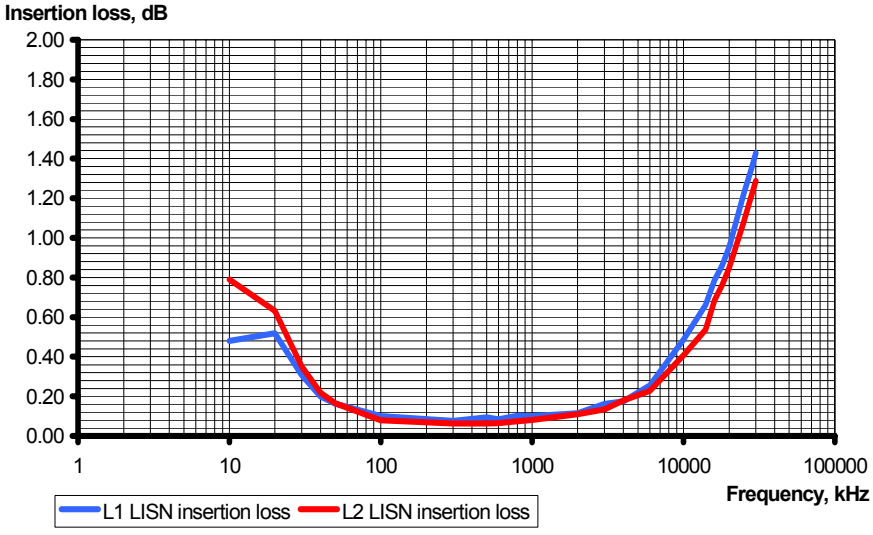
11 APPENDIX D Specification references

47CFR part 15: 2009	Radio Frequency Devices.
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

12 APPENDIX E Test equipment correction factors

Correction factor
Line impedance stabilization network
Model NNB-2/16Z, Rolf Heine, HL 2888

Frequency, kHz	Insertion loss,dB		Measurement Uncertainty, dB
	L1	N	
10	0.48	0.79	±0.6
20	0.52	0.63	
30	0.31	0.35	
40	0.20	0.22	
50	0.16	0.17	
100	0.10	0.08	
300	0.08	0.06	
500	0.10	0.06	
600	0.09	0.07	
800	0.10	0.07	
1000	0.10	0.08	
2000	0.12	0.11	
3000	0.16	0.14	
4000	0.17	0.18	
6000	0.26	0.23	
10000	0.49	0.41	
14000	0.66	0.54	
16000	0.79	0.69	
18000	0.86	0.76	
20000	0.96	0.85	
25000	1.22	1.08	
28000	1.35	1.21	
30000	1.43	1.29	



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

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

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

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

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

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

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

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

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

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

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

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

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

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

Cable loss
Cable coaxial, 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		

13 APPENDIX F Abbreviations and acronyms

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

END OF DOCUMENT