

TEST REPORT

ACCORDING TO: FCC part 27: 2003
FCC part 15: 2004 subpart B

FOR:

Vyyo Ltd.

Wireless modem

V284

710.4 – 715.6 MHz

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

Table of contents

1	Applicant information	3
2	Equipment under test attributes	3
3	Manufacturer information	3
4	Test details	3
5	Tests summary	4
6	EUT description	5
6.1	General information	5
6.2	Ports and lines	5
6.3	Support and test equipment	5
6.4	Operating frequencies	5
6.5	Changes made in the EUT	5
6.6	Test configuration	6
6.7	Transmitter characteristics	7
7	Transmitter characteristics	8
7.1	Peak output power test	8
7.2	RF exposure	11
7.3	Spurious emissions at RF antenna connector test	13
7.4	Radiated spurious emission measurements	28
7.5	Frequency stability test	40
7.6	Occupied bandwidth test	46
8	Emissions tests according to 47CFR part 15 subpart B requirements	58
8.1	Conducted emissions	58
8.2	Radiated emission measurements	61
8.3	Antenna power conducted measurements for receiver	66
9	APPENDIX A Test equipment and ancillaries used for tests	69
10	APPENDIX B Measurement uncertainties	71
11	APPENDIX C Test facility description	72
12	APPENDIX D Specification references	72
13	APPENDIX E Abbreviations and acronyms	73
14	APPENDIX F Test equipment correction factors	74

1 Applicant information

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Telephone: +972 3976 9999
Fax: +972 3976 9998
E-mail: aganor@vyyo.com
Contact name: Mr. Ganor Amiram

2 Equipment under test attributes

Product name: Wireless modem
Operating frequency range: 710.4 – 715.6 MHz
Model: V284
Serial number: 1322620
Equipment FCC code: TNB
Receipt date: 10/28/2004

3 Manufacturer information

Manufacturer name: Vyyo Ltd.
Address: Airport City, POB 197, Ben Gurion Airport, 70100, Israel
Telephone: +972 3976 9999
Fax: +972 3976 9998
E-Mail: aganor@vyyo.com
Contact name: Mr. Ganor Amiram

4 Test details

Project ID: 16109
Location: Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started: 10/28/2004
Test completed: 11/25/2004
Test specifications: FCC part 27:2003
FCC part 15: 2004 subpart B

5 Tests summary

Test	Status
Transmitter characteristics	
Section 27.50c(1)(i), Peak output power at RF antenna connector	Pass
Section 2.1091, RF radiation exposure evaluation	Pass
Section 27.53f, Spurious emissions RF antenna connector	Pass
Section 27.53f, Radiated spurious emissions	Pass
Section 27.54, Frequency stability	Pass
Section 2.1049, Occupied bandwidth	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Pass
Section 15.109, Radiated emission	Pass
Section 15.111, Antenna power conducted measurements for receiver	Pass

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

	Name and Title	Date	Signature
Tested by:	Mr. A. Adelberg, test engineer	November 25, 2004	
Reviewed by:	Ms. N. Averin, certification engineer	December 9, 2004	
	Mr. M. Nikishin, EMC group leader	December 14, 2004	
Approved by:	Mr. A. Usoskin, CEO	December 15, 2004	

6 EUT description

6.1 General information

The EUT is a broadband wireless data modem used by cable and wireless operators to deliver telephony services (T1/E1) and high-speed data connections to business and residential subscribers. The EUT operates within 710 to 716 MHz band and is powered from AC mains through a power adaptor.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Power	AC mains	Power adaptor	AC mains	2 pole	1	NA	NA	Indoor
Power	VDC	EUT	Power adaptor	DC jack	1	Unshielded	1.5 m	Indoor
Signal	Ethernet	EUT	Laptop	RJ 45	1	UTP Cat.5	1.5 m	Indoor
Signal	USB	EUT	Laptop	USB	1	Shielded	1.5 m	Indoor
Signal	Antenna	EUT	Attenuator	F-type	1	Coax 75 Ohm	12.0 m	Outdoor
Power	AC mains	Power adaptor	AC mains	3 pole	1	Unshielded	1.5 m	Indoor
Power	VDC	Laptop	Power adaptor	DC jack	1	Unshielded	1.5 m	Indoor
Signal	Mouse	Laptop	Mouse	PS2	1	Shielded	2 m	Indoor
Signal	Parallel	Laptop	Printer	D type 25	1	Shielded	5 m	Indoor

6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
E1/T1 Broadband hub	Vyvo	V3000	NA
Laptop	IBM	ThinkPad T20	55584LO
Up/Down converter	Vyvo	UDC	NA
Mouse	Microsoft	Mouse 2.1A	03306271
Printer	Epson	LX-810	44B1127035
Power adaptor for EUT	DVE	DSA-0151A	NA
Power adaptor for laptop	IBM	02K6654	12024027KK1

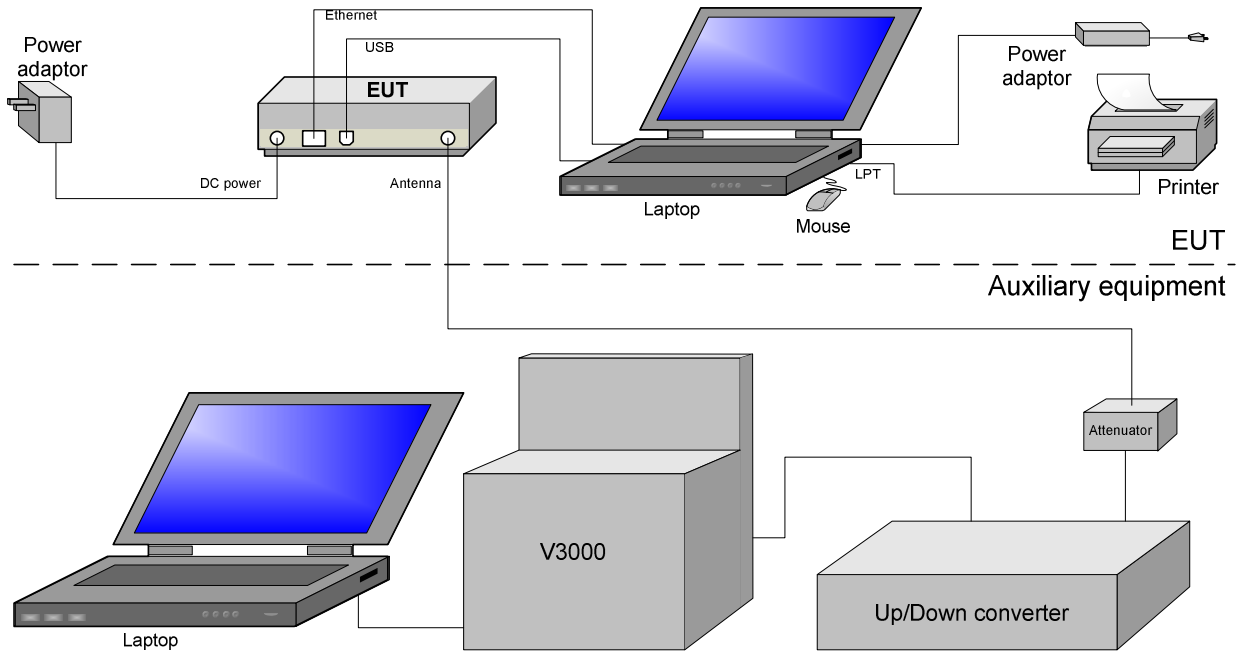
6.4 Operating frequencies

Source	Frequency, MHz		
Receiver	669.0 (LO)	44.0 (IF)	743.0-745.125 (Rx)
Transmitter	13.0 (VCTXO)	44.0 (IF)	710.4-715.6 (Tx)

6.5 Changes made in the EUT

No changes were implemented.

6.6 Test configuration





6.7 Transmitter characteristics

Type of equipment									
☒	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							
	portable	May operate at a distance closer than 20 cm to human body							
Assigned frequency range		710.0 – 716.0 MHz							
Operating frequency range		710.4 – 715.6 MHz							
Maximum rated output power		At transmitter 50 Ω RF output connector					22.3 dBm		
		Effective radiated power (for equipment with no RF connector)					NA dBm		
Is transmitter output power variable?		No							
		☒	Yes	continuous variable					
				☒	stepped variable with stepsize				0.25 dB
				minimum RF power				-11.0 dBm	
maximum RF power				+22.3 dBm					
Antenna connection									
unique coupling	☒	standard F-type connector	integral	with temporary RF connector					
				without temporary RF connector					
Antenna/s technical characteristics									
Type	Manufacturer		Model number		Gain				
Yagi	Shenglu		TDJ-700B12G13.5		13.5 dBi				
Transmitter 99% power bandwidth		400 / 800 / 1600 / 3200 kHz							
Type of multiplexing		TDMA							
Modulating test signal (baseband)		PRBS							
Maximum transmitter duty cycle in normal use		50 %							
Transmitter duty cycle supplied for test		50 %							
Transmitter power source									
	Battery	Nominal rated voltage	VDC	Battery type					
	DC	Nominal rated voltage	VDC						
☒	AC mains	Nominal rated voltage	120 VAC	Frequency	60 Hz				
Common power source for transmitter and receiver				☒	yes	no			
Emission designator		3M20D1W / 3M20G1W							
Type of modulation	Modulation states (constellation)	Payload bit rate	Symbol (baud) rate	RF channel spacing	Frequency channel				
					Low	Mid	High		
QAM	16	1.28 Mbps	0.32 Msps	400 kHz	710.4	713.0	715.6		
QPSK	4	0.64 Mbps	0.32 Msps	400 kHz	710.4	713.0	715.6		
QAM	16	2.56 Mbps	0.64 Msps	800 kHz	710.4	713.0	715.6		
QPSK	4	1.28 Mbps	0.64 Msps	800 kHz	710.4	713.0	715.6		
QAM	16	5.12 Mbps	1.28 Msps	1600 kHz	710.8	713.0	715.2		
QPSK	4	2.56 Mbps	1.28 Msps	1600 kHz	710.8	713.0	715.2		
QAM	16	10.24 Mbps	2.56 Msps	3200 kHz	711.6	713.0	714.4		
QPSK	4	5.12 Mbps	2.56 Msps	3200 kHz	711.6	713.0	714.4		



Test specification:	Section 27.50c(1)(i), Peak output power at RF antenna connector		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	11/25/2004		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

7 Transmitter characteristics

7.1 Peak output power test

7.1.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.1.1. The test results are provided in Table 7.1.2 and the associated plots.

Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	Maximum peak output power*	
	W	dBm
710.0 – 716.0	73.3	48.6

* The peak output power limit was calculated by subtracting of antenna gain in dBd from maximum allowed ERP 60 dBm (1000 W).

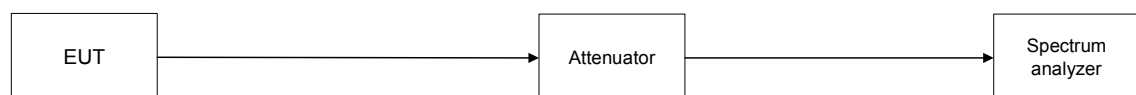
7.1.2 Test procedure

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 adjusted to produce maximum available to the end user RF output power.

7.1.2.3 The peak output power was measured with spectrum analyzer as provided in Table 7.1.2 and associated plots.

Figure 7.1.1 Peak output power test setup





Test specification:	Section 27.50c(1)(i), Peak output power at RF antenna connector		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	11/25/2004		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 710.0 – 716.0 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 5000 kHz
 VIDEO BANDWIDTH: 3000 kHz
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 BIT RATE: 0.64 Mbps (0.32 Msps)
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

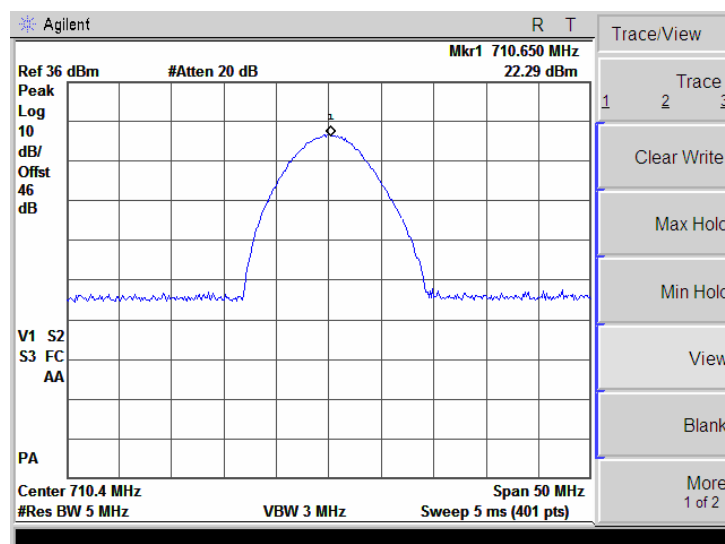
Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	Cable loss, dB	RF output power, dBm	Limit, dBm	Margin, dB	Verdict
710.4	22.3	Included		22.3	48.6	- 26.3	Pass
713.0	22.1	Included		22.1	48.6	- 26.5	Pass
715.6	22.0	Included		22.0	48.6	- 26.6	Pass

Reference numbers of test equipment used

HL 1476	HL 1651	HL 1653					
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Full description is given in Appendix A.

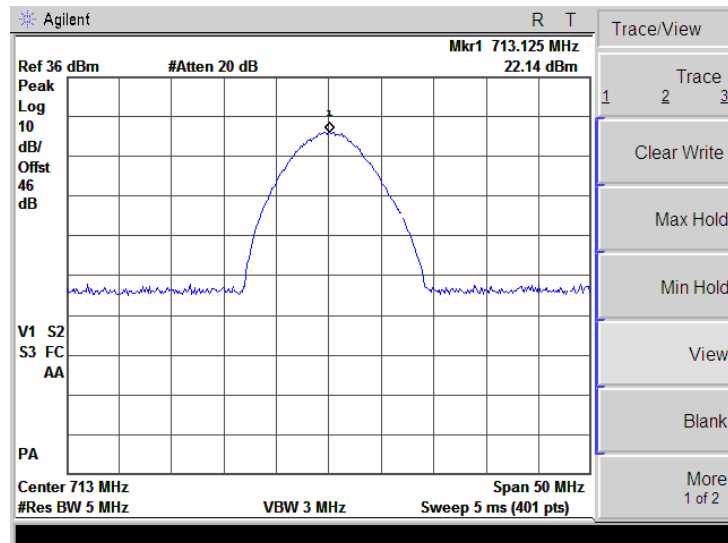
Plot 7.1.1 Peak output power test results at low frequency



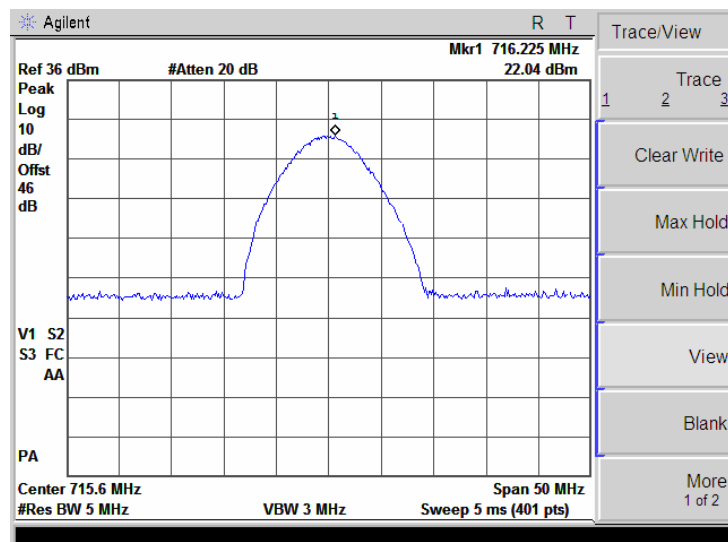


Test specification:	Section 27.50c(1)(i), Peak output power at RF antenna connector		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	11/25/2004		
Temperature: 22 °C	Air Pressure: 1012 hPa	Relative Humidity: 39 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.2 Peak output power test results at mid frequency



Plot 7.1.3 Peak output power test results at high frequency





Test specification:	Section 2.1091, RF radiation exposure evaluation		
Test procedure:	47 CFR, Section 1.1307(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

7.2 RF exposure

7.2.1 General

This test was performed to determine the minimum safe distance between the transmitter antenna and human to avoid public exposure in excess of limits for general population (uncontrolled exposure). Specification test limits are given in Table 7.2.1.

Table 7.2.1 RF exposure limits

Frequency range, MHz	Power density*		Electric field strength**, V/m
	mW/cm ²	W/m ²	
710.4	0.47	4.7	42.1
715.6	0.47	4.7	42.1

* - Power density limit within 300 - 1500 MHz was calculated according to the following equation: $S = F / 1500$, where S is power density in mW/cm² and F is frequency in MHz

** - Electric field strength limit was calculated from power density as follows: $E = \sqrt{S \times 120 \times \pi}$, where E is electric field strength in V/m and S is power density in W/m²

7.2.2 Test procedure

7.2.2.1 The EUT, connected to the antenna providing the maximum directional gain, was set up as shown in .

7.2.2.2 The E-field probe was pointed to the EUT antenna zero azimuth at a 3 m distance, the maximum field strength reading was recorded in Table 7.2.2.

7.2.2.3 The E-field probe was slowly moved toward the EUT until E-field equivalent to the maximum permitted power density was measured.

7.2.2.4 The obtained antenna to probe distance was recorded in Table 7.2.2 as a minimum separation distance.

7.2.2.5 The test was repeated at the rest of test distances according to Table 7.2.2.

Table 7.2.2 Maximum permissible exposure (MPE) measurement

Test distance, m	Field strength, V/m	Equivalent power density, mW/cm ²	Limit, mW/cm ²	Margin, mW/cm ²	Verdict
2.0	0.9	0.000215	0.47	-0.469790	Pass
1.5	1.3	0.000448	0.47	-0.469550	Pass
1.0	2.0	0.001061	0.47	-0.468940	Pass
0.5	3.5	0.003249	0.47	-0.466750	Pass
0.3	4.1	0.004459	0.47	-0.465540	Pass
0.05	10.4	0.028690	0.47	-0.441310	Pass

* - Equivalent power density was calculated from electric field strength as follows: $S = 0.1 \times E^2 / (120 \times \pi)$, where E is electric field strength in V/m and S is power density in mW/cm²

Reference numbers of test equipment used

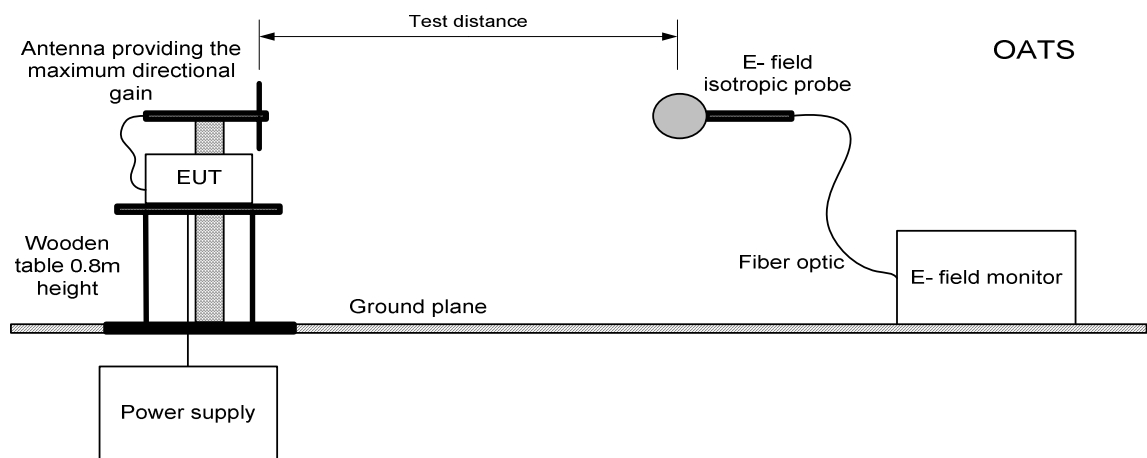
HL 0613	HL 1629						
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Full description is given in Appendix A.



Test specification:	Section 2.1091, RF radiation exposure evaluation		
Test procedure:	47 CFR, Section 1.1307(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Figure 7.2.1 Maximum permissible exposure (MPE) measurement setup





Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

7.3 Spurious emissions at RF antenna connector test

7.3.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.3.1. The test results are provided in Table 7.3.2 and associated plots.

Table 7.3.1 Spurious emission limits

Frequency, MHz*	Attenuation below carrier, dBc	Spurious emissions, dBm
0.009 – 10 th harmonic	43+10logP*	-13

* - P is transmitter output power in Watts.

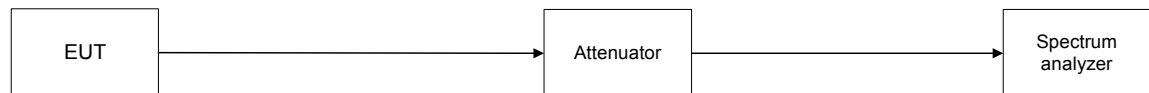
7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

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

7.3.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.3.2 and associated plots.

Figure 7.3.1 Spurious emission test setup





Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 710.0 – 716.0 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 7500 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 BIT RATE: 0.64 Mbps (0.32 Msps)
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 TRANSMITTER OUTPUT POWER: 22 dBm at low frequency
 22 dBm at high frequency

Frequency, MHz	Bit rate, Mbps	RBW, kHz	Spurious emission, dBm	Limit, dBm	Margin, dB*	Verdict
Low channel						
0.009 - 1000	More than 20 dB below limit					Pass
1420.9500	0.64	100	-37.00	-13.00	-24.00	Pass
7392.0000	0.64	1000	-23.17	-13.00	-10.17	Pass
High channel						
0.009 - 1000	More than 20 dB below limit					Pass
1431.2580	0.64	100	-37.67	-13.00	-24.67	Pass
7489.0000	0.64	1000	-23.17	-13.00	-10.17	Pass

*- Margin = Spurious emission – specification limit.

Emissions at the band edges are provided in Plots 7.3.11 to 7.3.26.

Reference numbers of test equipment used

HL 1097	HL 1424	HL 1455	HL 1488	HL 1653	HL 1942		
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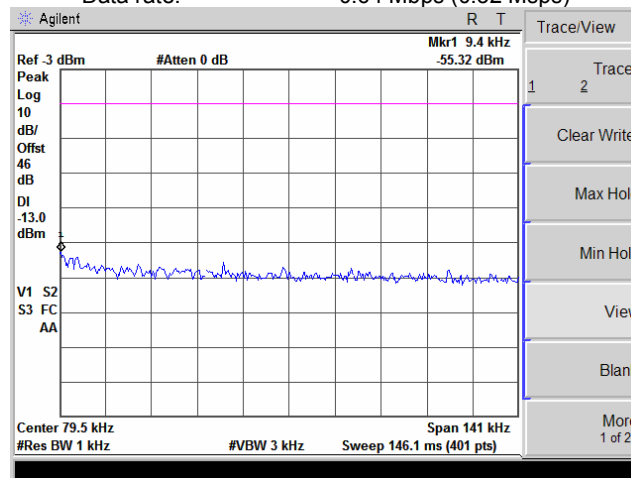
Full description is given in Appendix A.



Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

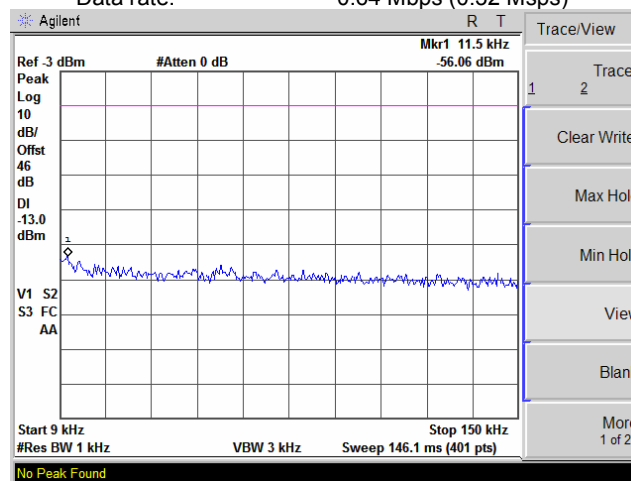
Plot 7.3.1 Spurious emission measurements at RF antenna connector, low channel

Frequency range: 9 – 150 kHz
Carrier frequency: 710.4 MHz
Modulation: QPSK
Data rate: 0.64 Mbps (0.32 Msps)



Plot 7.3.2 Spurious emission measurements at RF antenna connector, high channel

Frequency range: 9 – 150 kHz
Carrier frequency: 715.6 MHz
Modulation: QPSK
Data rate: 0.64 Mbps (0.32 Msps)

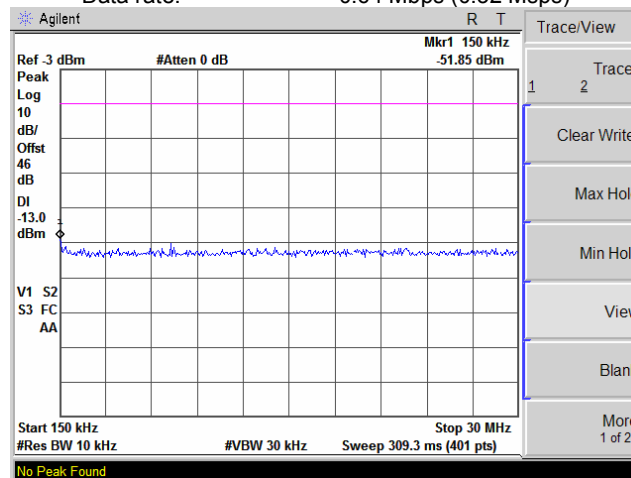




Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

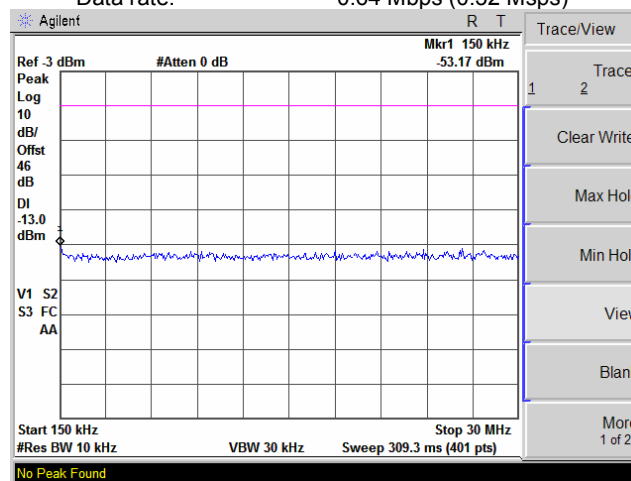
Plot 7.3.3 Spurious emission measurements at RF antenna connector, low channel

Frequency range: 150 kHz – 30 MHz
Carrier frequency: 710.4 MHz
Modulation: QPSK
Data rate: 0.64 Mbps (0.32 Msps)



Plot 7.3.4 Spurious emission measurements at RF antenna connector, high channel

Frequency range: 150 kHz – 30 MHz
Carrier frequency: 715.6 MHz
Modulation: QPSK
Data rate: 0.64 Mbps (0.32 Msps)

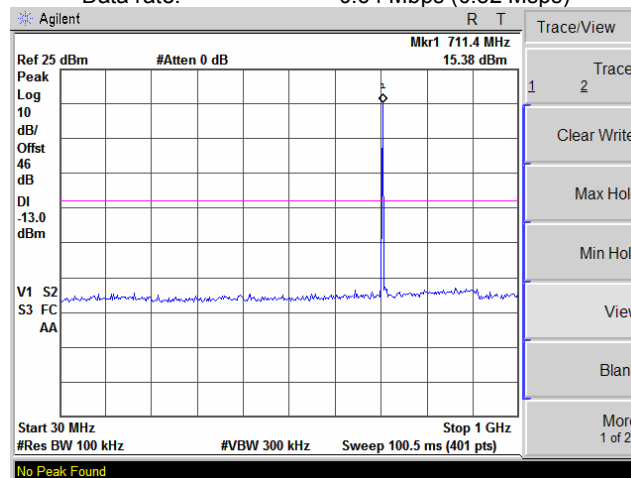




Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

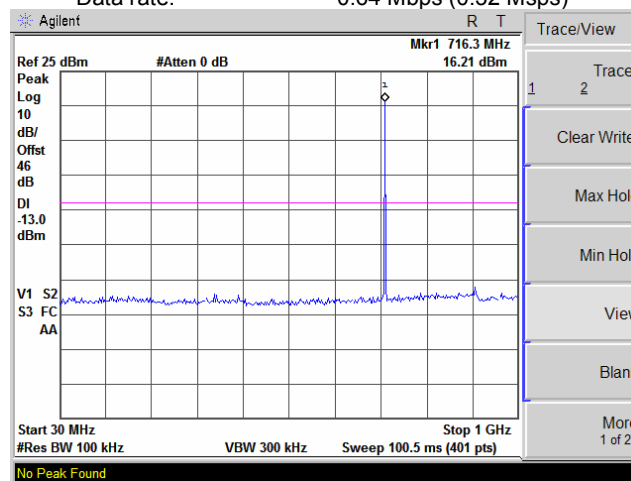
Plot 7.3.5 Spurious emission measurements at RF antenna connector, low channel

Frequency range: 30 – 1000 MHz
Carrier frequency: 710.4 MHz
Modulation: QPSK
Data rate: 0.64 Mbps (0.32 Msps)



Plot 7.3.6 Spurious emission measurements at RF antenna connector, high channel

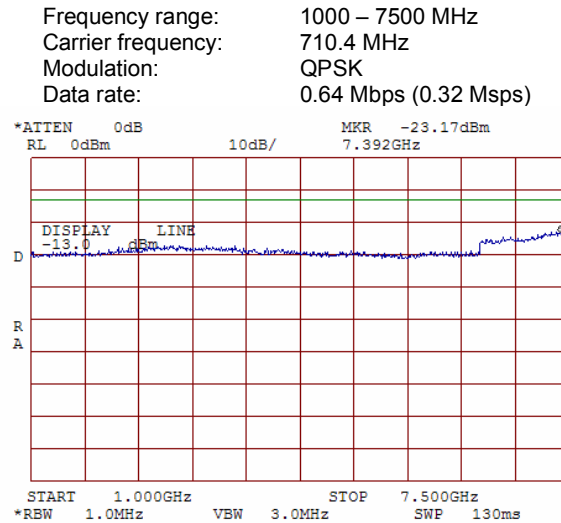
Frequency range: 30 – 1000 MHz
Carrier frequency: 715.6 MHz
Modulation: QPSK
Data rate: 0.64 Mbps (0.32 Msps)



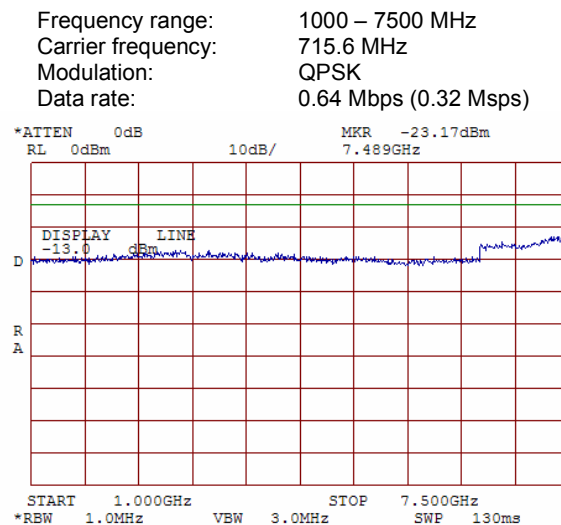


Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.7 Spurious emission measurements at RF antenna connector, low channel



Plot 7.3.8 Spurious emission measurements at RF antenna connector, high channel

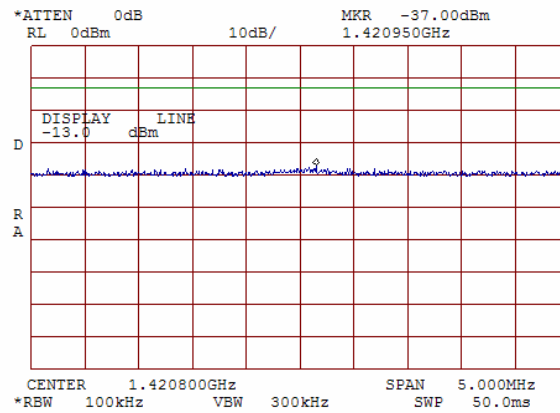




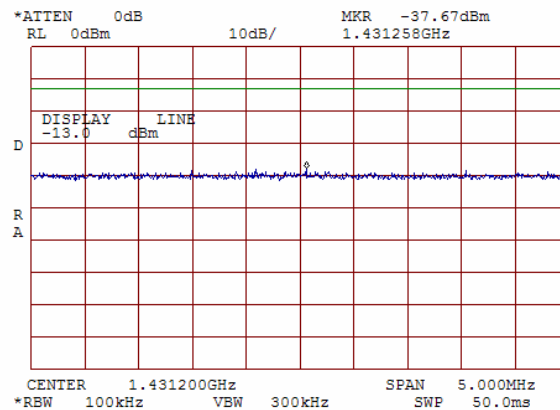
Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.9 Spurious emission measurements at RF antenna connector, the 2nd harmonic of the low channel

Carrier frequency: 710.4 MHz
Modulation: QPSK
Data rate: 0.64 Mbps (0.32 Msps)

Plot 7.3.10 Spurious emission measurements at RF antenna connector, the 2nd harmonic of the high channel

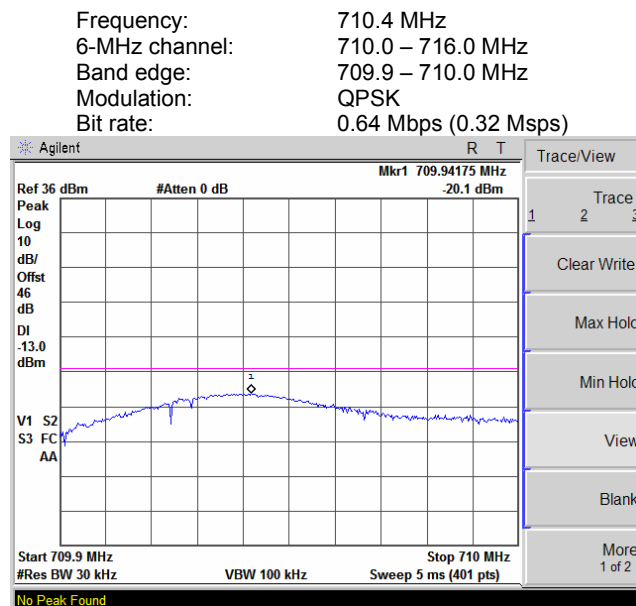
Carrier frequency: 715.6 MHz
Modulation: QPSK
Data rate: 0.64 Mbps (0.32 Msps)



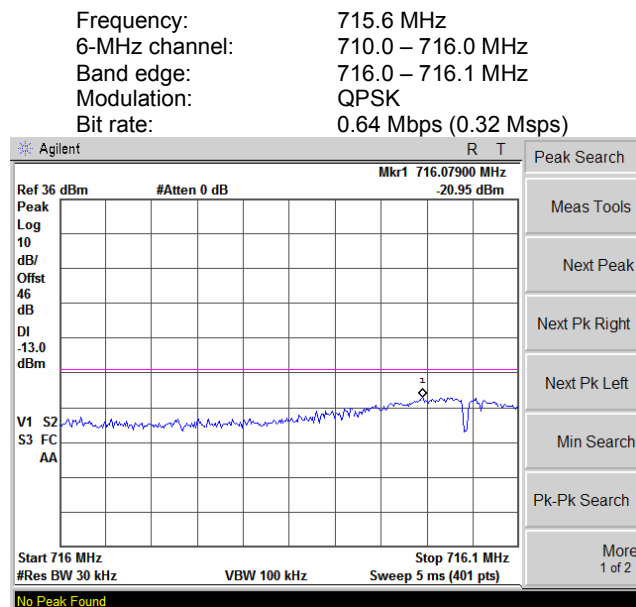


Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.11 Spurious emissions at RF antenna connector, low channel band edge measurements



Plot 7.3.12 Spurious emissions at RF antenna connector, high channel band edge measurements

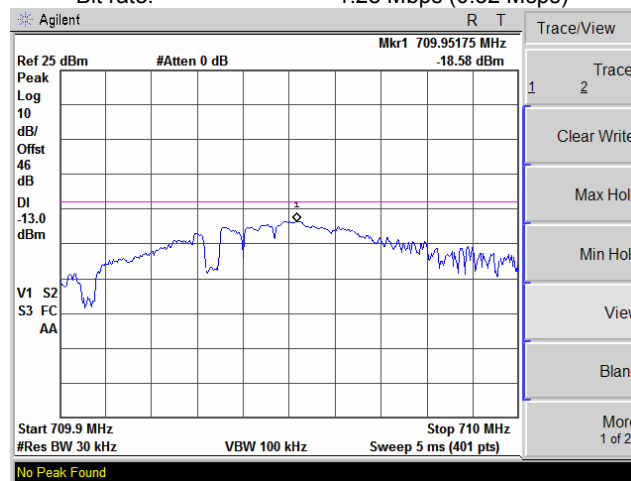




Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

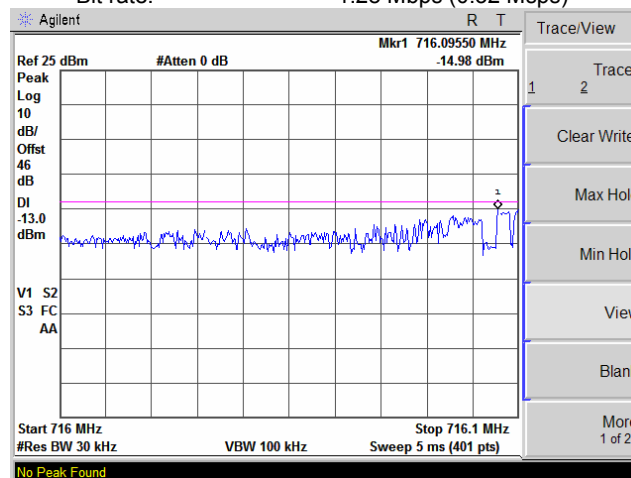
Plot 7.3.13 Spurious emissions at RF antenna connector, low channel band edge measurements

Frequency: 710.4 MHz
6-MHz channel: 710.0 – 716.0 MHz
Band edge: 709.9 – 710.0 MHz
Modulation: 16QAM
Bit rate: 1.28 Mbps (0.32 Msps)



Plot 7.3.14 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency: 715.6 MHz
6-MHz channel: 710.0 – 716.0 MHz
Band edge: 716.0 – 716.1 MHz
Modulation: 16QAM
Bit rate: 1.28 Mbps (0.32 Msps)

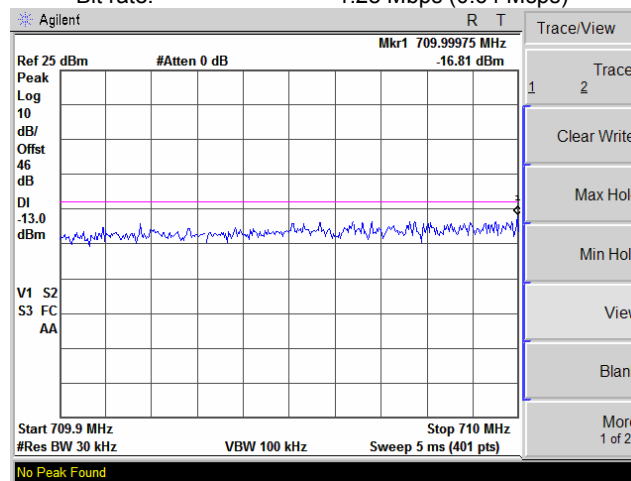




Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

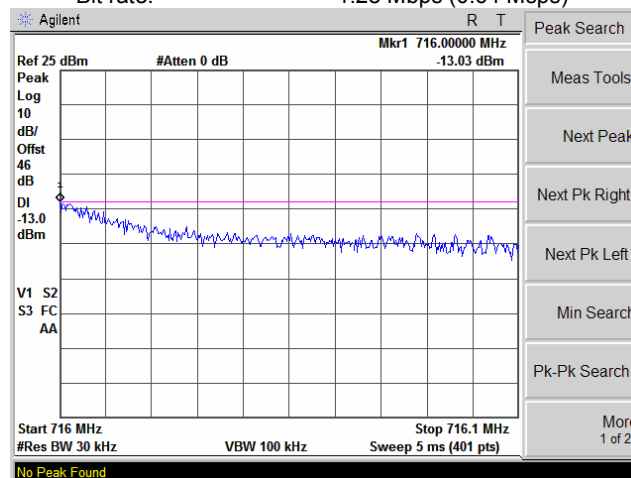
Plot 7.3.15 Spurious emissions at RF antenna connector, low channel band edge measurements

Frequency: 710.4 MHz
6-MHz channel: 710.0 – 716.0 MHz
Band edge: 709.9 – 710.0 MHz
Modulation: QPSK
Bit rate: 1.28 Mbps (0.64 Msps)



Plot 7.3.16 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency: 715.6 MHz
6-MHz channel: 710.0 – 716.0 MHz
Band edge: 716.0 – 716.1 MHz
Modulation: QPSK
Bit rate: 1.28 Mbps (0.64 Msps)

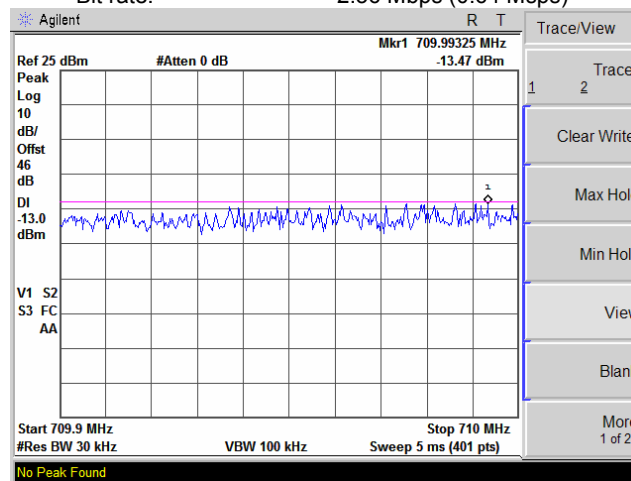




Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

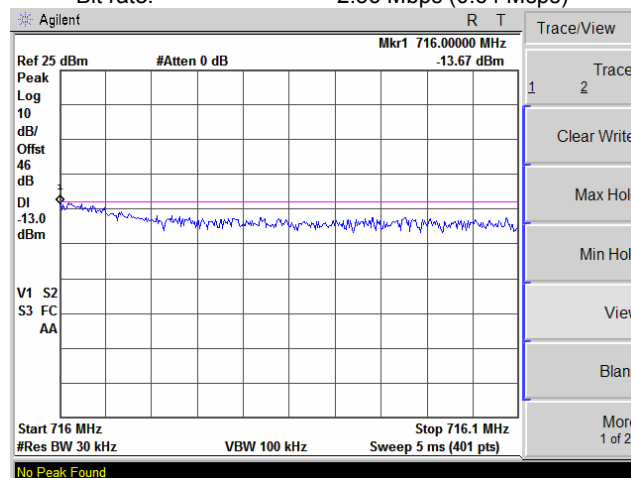
Plot 7.3.17 Spurious emissions at RF antenna connector, low channel band edge measurements

Frequency: 710.4 MHz
6-MHz channel: 710.0 – 716.0 MHz
Band edge: 709.9 – 710.0 MHz
Modulation: 16QAM
Bit rate: 2.56 Mbps (0.64 Msps)



Plot 7.3.18 Spurious emissions at RF antenna connector, high channel band edge measurements

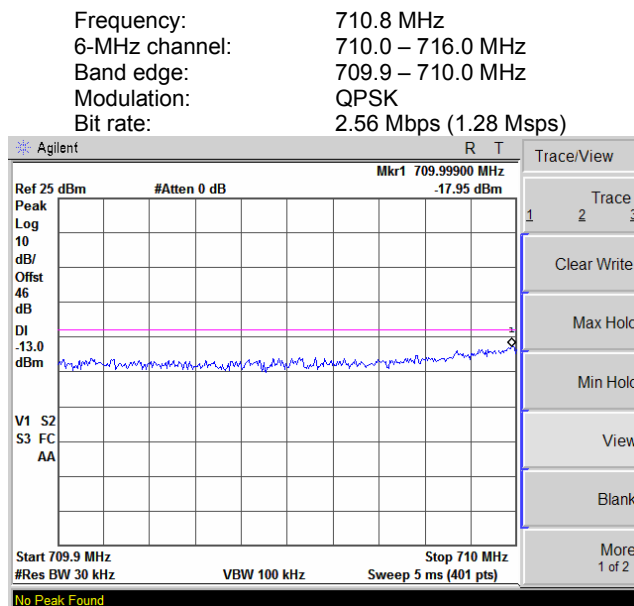
Frequency: 715.6 MHz
6-MHz channel: 710.0 – 716.0 MHz
Band edge: 716.0 – 716.1 MHz
Modulation: 16QAM
Bit rate: 2.56 Mbps (0.64 Msps)



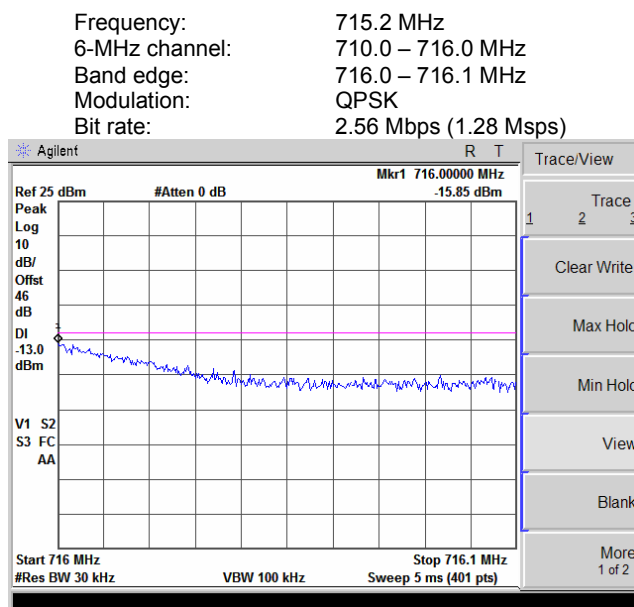


Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.19 Spurious emissions at RF antenna connector, low channel band edge measurements



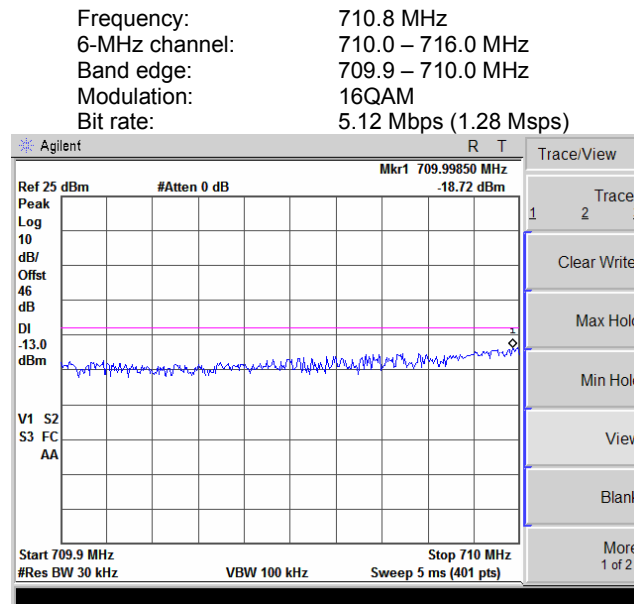
Plot 7.3.20 Spurious emissions at RF antenna connector, high channel band edge measurements



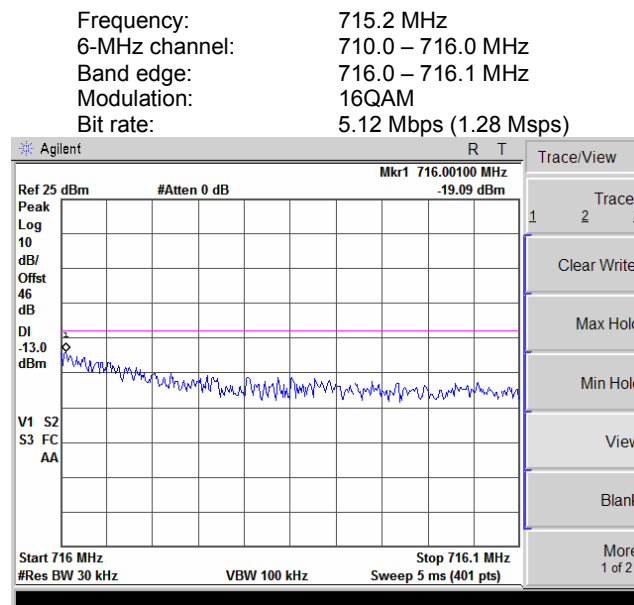


Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.21 Spurious emissions at RF antenna connector, low channel band edge measurements



Plot 7.3.22 Spurious emissions at RF antenna connector, high channel band edge measurements

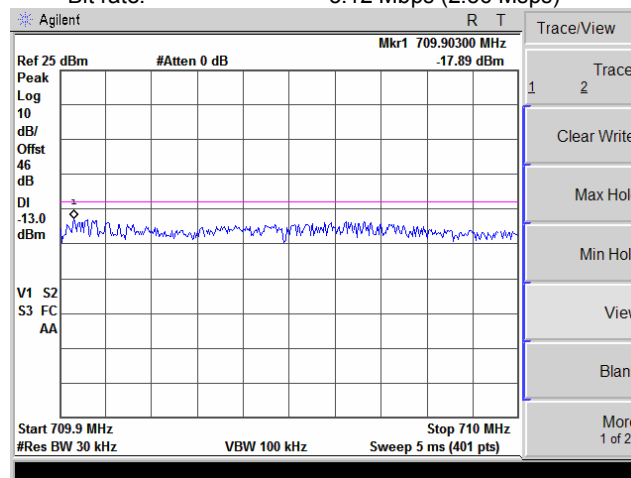




Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

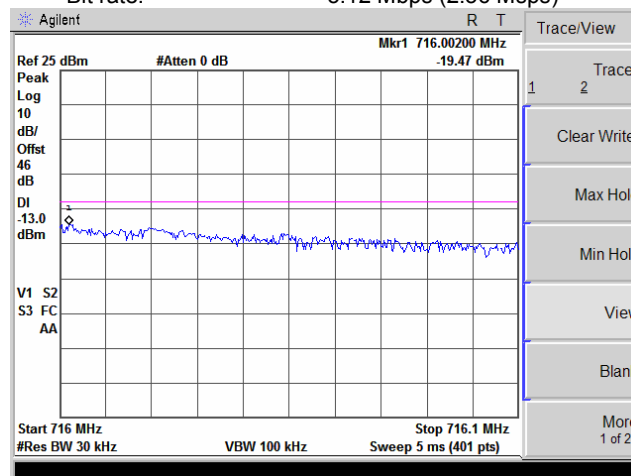
Plot 7.3.23 Spurious emissions at RF antenna connector, low channel band edge measurements

Frequency: 711.6 MHz
6-MHz channel: 710.0 – 716.0 MHz
Band edge: 709.9 – 710.0 MHz
Modulation: QPSK
Bit rate: 5.12 Mbps (2.56 Msps)



Plot 7.3.24 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency: 714.4 MHz
6-MHz channel: 710.0 – 716.0 MHz
Band edge: 716.0 – 716.1 MHz
Modulation: QPSK
Bit rate: 5.12 Mbps (2.56 Msps)

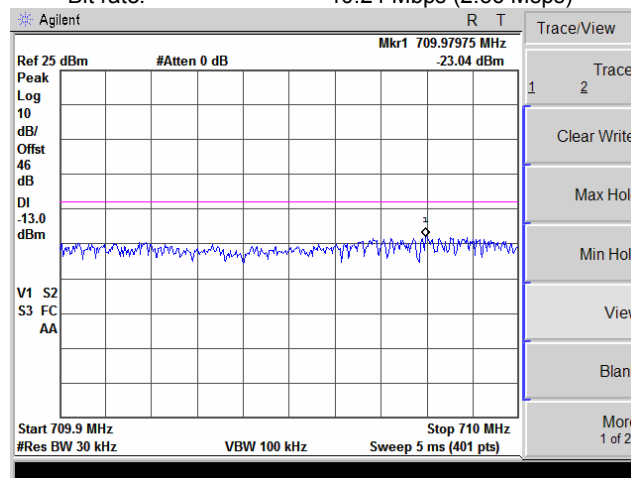




Test specification:	Section 27.53f, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

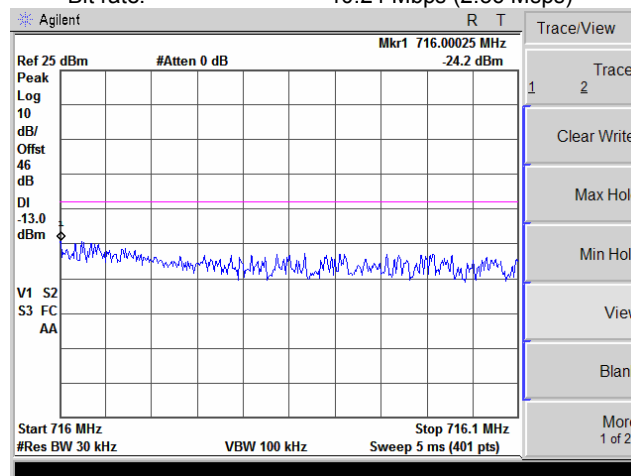
Plot 7.3.25 Spurious emissions at RF antenna connector, low channel band edge measurements

Frequency: 711.6 MHz
 6-MHz channel: 710.0 – 716.0 MHz
 Band edge: 709.9 – 710.0 MHz
 Modulation: 16QAM
 Bit rate: 10.24 Mbps (2.56 Msps)



Plot 7.3.26 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency: 714.4 MHz
 6-MHz channel: 710.0 – 716.0 MHz
 Band edge: 716.0 – 716.1 MHz
 Modulation: 16QAM
 Bit rate: 10.24 Mbps (2.56 Msps)





Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

7.4 Radiated spurious emission measurements

7.4.1 General

This test was performed to measure radiated spurious emissions from the EUT enclosure with antenna connector terminated with 50 Ohm dummy load. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Radiated spurious emission test limits

Frequency, MHz*	Attenuation below carrier, dBc	Spurious emissions, dBm	Equivalent field strength limit @ 3m, dB(μV/m)**
0.009 – 10 th harmonic	43+10logP*	-13	84.4

* - P is transmitter output power in Watts.

** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows:
 $E = \sqrt{30 \times P \times 1.64} / r$, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters.

7.4.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz range

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

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

7.4.2.3 The test results were recorded in Table 7.4.2 and shown in the associated plots.

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

7.4.3.1 The EUT was set up as shown in Figures 7.4.2, 7.4.3, energized and the EUT performance was checked.

7.4.3.2 The specified frequency range was investigated with antennas connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.4.3.3 The worst test results with respect to the limits were recorded in Table 7.4.2 and shown in the associated plots.

7.4.4 Test procedure for substitution ERP measurements of spurious

7.4.4.1 The test equipment was set up as shown in Figure 7.4.4 and energized.

7.4.4.2 RF signal generator was set to the frequency of investigated spurious emission and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.4.4.3 The test antenna height was swept from 1 to 4 m to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

7.4.4.4 The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.

7.4.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm, antenna gain in dBd and cable loss in dB.

7.4.4.6 The above procedure was repeated at the rest of investigated frequencies.

7.4.4.7 The worst test results with respect to the limits were recorded in Table 7.4.3 and shown in the associated plots.



Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Figure 7.4.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz range

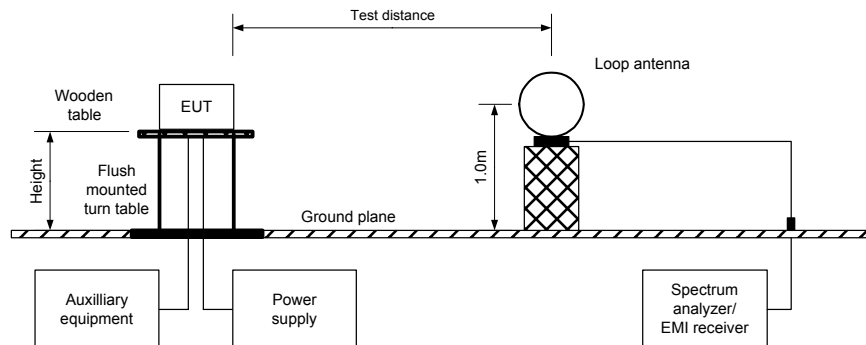
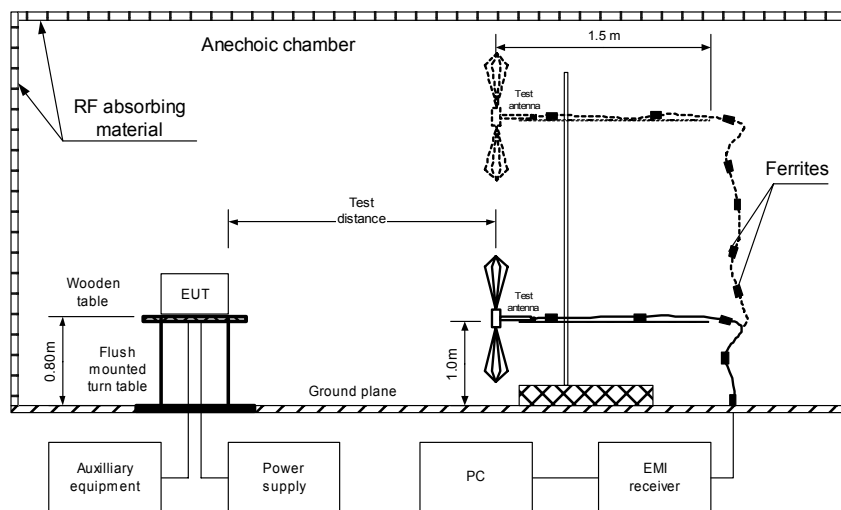


Figure 7.4.2 Setup for spurious emission field strength measurements in 30 MHz to 6.5 GHz range





Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Figure 7.4.3 Setup for spurious emission field strength measurements in 1 to 7.5 GHz range

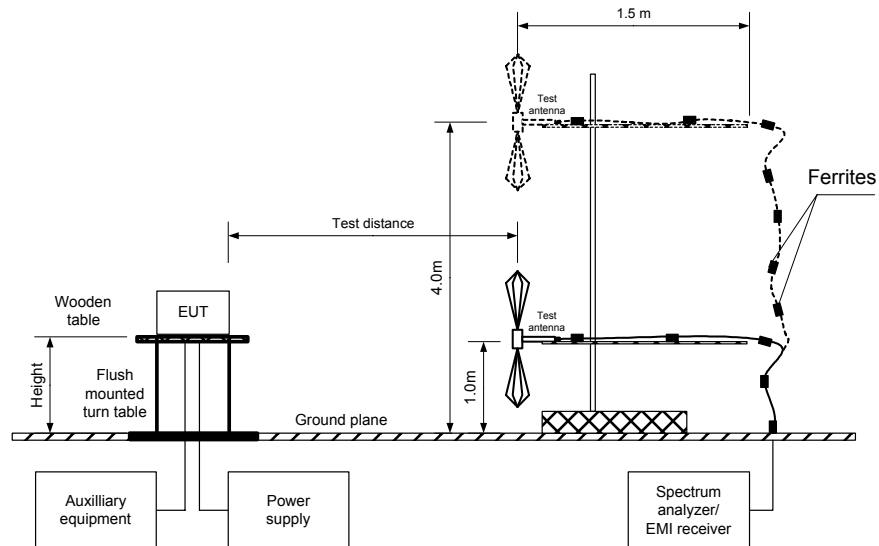
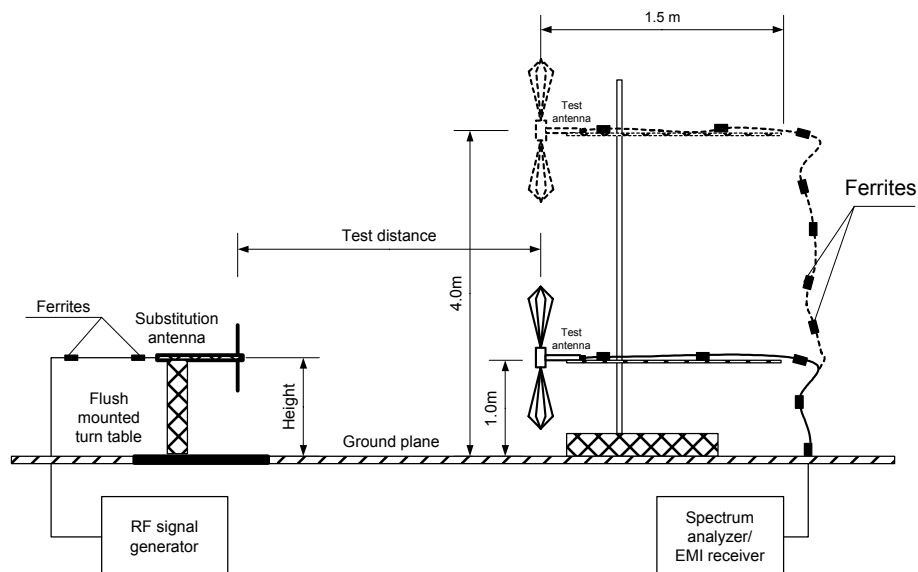


Figure 7.4.4 Setup for substitution ERP measurements of spurious





Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Table 7.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 710.0 – 716.0 MHz
 TEST DISTANCE: 3 m
 EUT HEIGHT: 0.8 m
 INVESTIGATED FREQUENCY RANGE: 0.009 – 7500 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 TRANSMITTER OUTPUT POWER: 22 dBm at low frequency
 22 dBm at high frequency

Frequency, MHz	Antenna polarization	RBW, kHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	Verdict
Low carrier frequency						
0.0485	Vertical	0.20	73.71	84.4	-10.69	Pass
0.0978	Vertical	0.20	69.59	84.4	-14.81	Pass
66.4500	Vertical	120.00	34.77	84.4	-49.63	Pass
77.2750	Vertical	120.00	30.48	84.4	-53.92	Pass
99.6875	Vertical	120.00	46.74	84.4	-37.66	Pass
132.9250	Vertical	120.00	38.88	84.4	-45.52	Pass
165.9125	Vertical	120.00	36.11	84.4	-48.29	Pass
232.7125	Vertical	120.00	30.88	84.4	-53.52	Pass
710.4200	Vertical	120.00	34.61	84.4	-49.79	Pass
1093.8729	Vertical	1000.00	47.97	84.4	-36.43	Pass
High carrier frequency						
0.0488	Vertical	0.20	76.04	84.4	-8.36	Pass
0.0978	Vertical	0.20	69.47	84.4	-14.93	Pass
33.2150	Vertical	120.00	28.30	84.4	-56.10	Pass
66.4450	Vertical	120.00	37.54	84.4	-46.86	Pass
99.4050	Horizontal	120.00	42.83	84.4	-41.57	Pass
132.7400	Vertical	120.00	39.04	84.4	-45.36	Pass
165.9875	Vertical	120.00	39.70	84.4	-44.70	Pass
259.9400	Horizontal	120.00	38.07	84.4	-46.33	Pass
389.8850	Vertical	120.00	38.47	84.4	-45.93	Pass
454.8663	Vertical	120.00	39.73	84.4	-44.67	Pass
597.5500	Vertical	120.00	38.37	84.4	-46.03	Pass
715.5550	Horizontal	120.00	48.22	84.4	-36.18	Pass
1095.4729	Vertical	1000.00	49.01	84.4	-35.39	Pass

*- Margin = Field strength of spurious – calculated field strength limit.



Test specification:	Section 27.53f, Radiated spurious emissions			
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12			
Test mode:	Compliance	Verdict:	PASS	
Date:	11/28/2004			
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC	
Remarks:				

Table 7.4.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 710.0 – 716.0 MHz
 TRANSMITTER OUTPUT POWER: 22 dBm at low frequency
 22 dBm at high frequency
 TEST SITE: OATS
 TEST DISTANCE: 3 m
 SUBSTITUTION ANTENNA HEIGHT: 0.8 m
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 SUBSTITUTION ANTENNA TYPE: Double ridged guide

Frequency, MHz	Antenna polarization	RBW, kHz	Field strength, dB(μV/m)	RF generator output, dBm	Antenna gain, dBd	Cable loss, dB	ERP result, dBm**	ERP limit, dBm	Margin, dB*	Verdict
Low carrier frequency										
1420.35	Vertical	100	56.00	-50	6.18	2.56	-46.38	-13	-33.38	Pass
2130.575	Horizontal	100	56.30	-50	6.61	3.06	-46.45	-13	-33.45	Pass
High carrier frequency										
1431.66	Vertical	100	55.20	-50	6.18	2.56	-46.38	-13	-33.38	Pass

*- Margin = Spurious emission – specification limit.

** ERP = $P_{\text{gen}} - \text{CL} + G_{\text{ant}}$, where

P_{gen} - signal generator output power in dBm

CL - cable loss in dB

G_{ant} - antenna gain in dBd

Reference numbers of test equipment used

HL 0446	HL 0465	HL 0521	HL 0589	HL 0604	HL 0661	HL 1004	HL 1200
HL 1424	HL 1942	HL 1947	HL 1984	HL 2009	HL 2400	HL 2432	

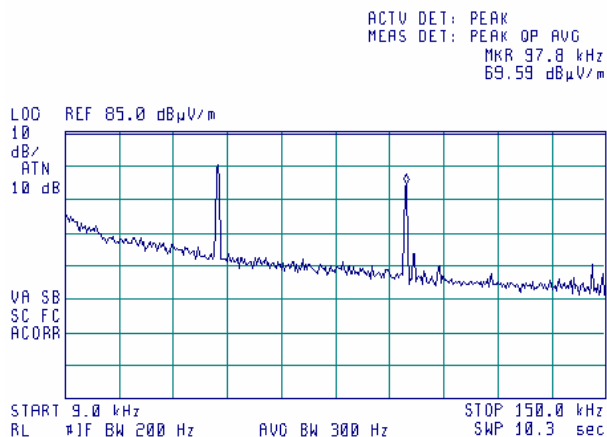
Full description is given in Appendix A.



Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

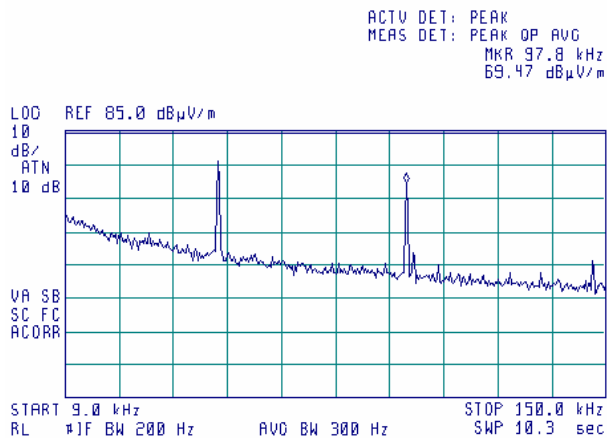
Plot 7.4.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.4.2 Radiated emission measurements in 9 - 150 kHz range

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

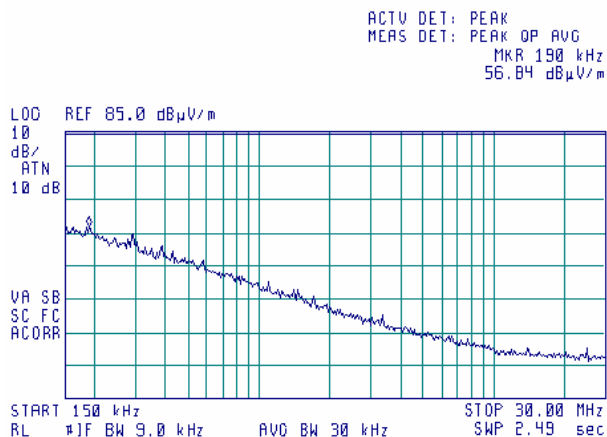




Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

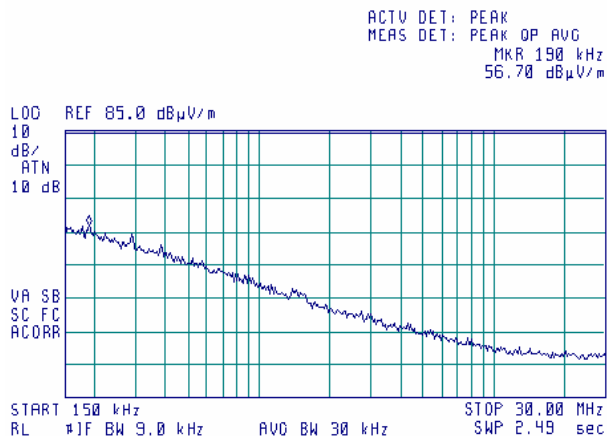
Plot 7.4.3 Radiated emission measurements in 0.15 - 30 MHz range

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



Plot 7.4.4 Radiated emission measurements in 0.15 - 30 MHz range

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

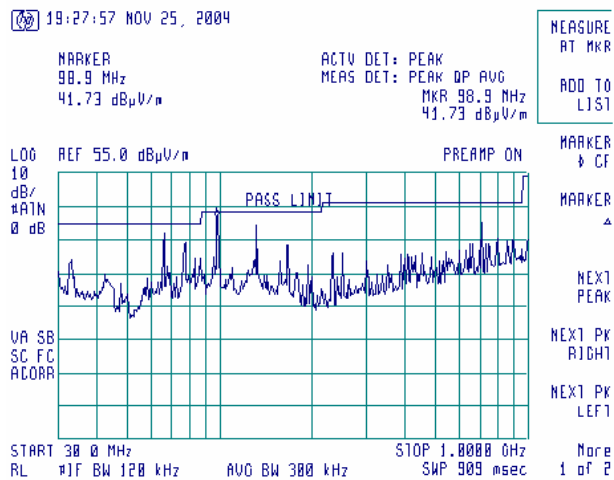




Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

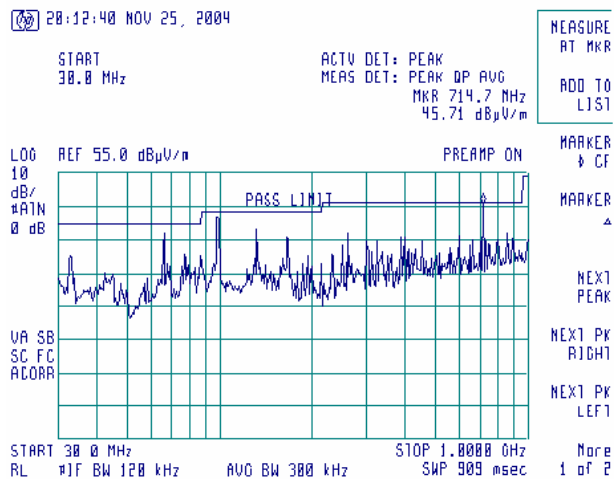
Plot 7.4.5 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.6 Radiated emission measurements in 30 - 1000 MHz range

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

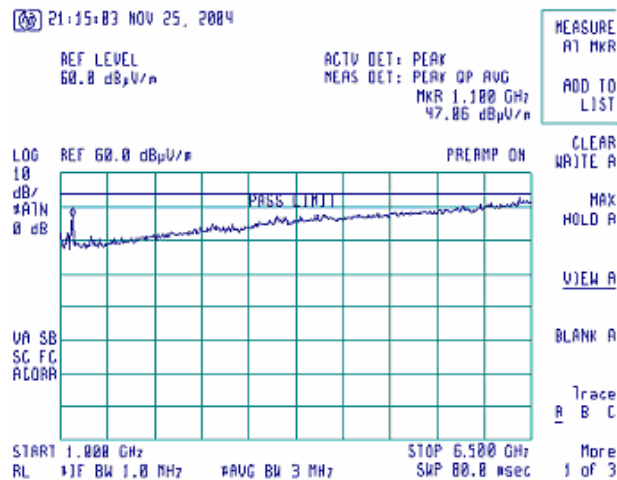




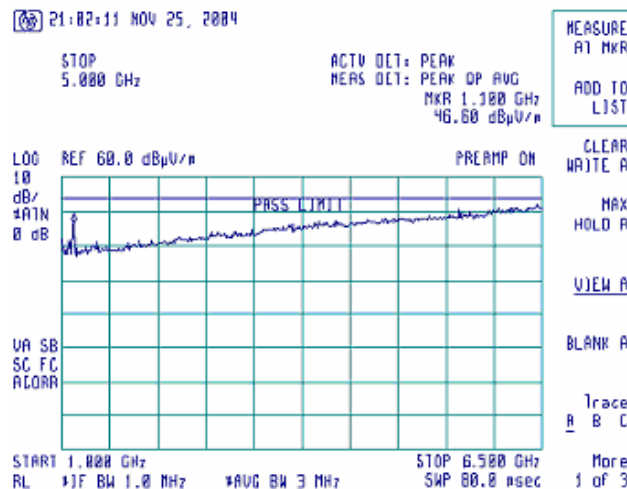
Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.7 Radiated emission measurements in 1 – 6.5 GHz range

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

**Plot 7.4.8 Radiated emission measurements in 1 – 6.5 GHz range**

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

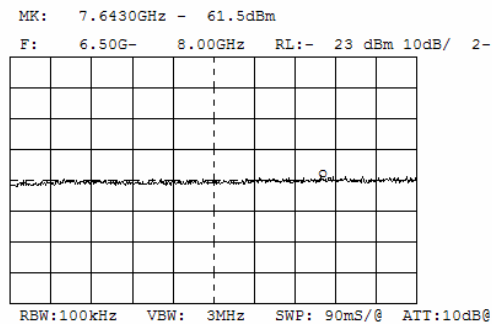




Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.9 Radiated emission measurements in 6.5 – 8 GHz range

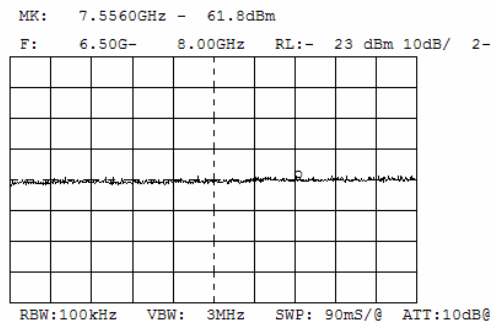
TEST SITE: OATS
 CARRIER FREQUENCY: Low
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Limit: $84.4 - (4.75 + 2.39 + 5.33 + 37.7 - 38.84) = 73.07 \text{ dB}\mu\text{V/m}$, where
 4.75 and 2.39 are cable losses, 5.33 is quadruplexer factor, 37.7 is amplifier gain, 38.84 is antenna factor.
 $73.07 \text{ dB}\mu\text{V/m} - 107 = -33.07 \text{ dBm}$

Plot 7.4.10 Radiated emission measurements in 6.5 – 8 GHz range

TEST SITE: OATS
 CARRIER FREQUENCY: High
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



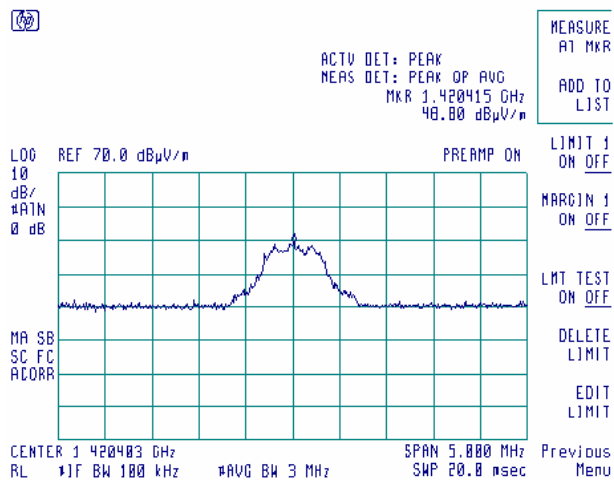
Limit: $84.4 - (4.75 + 2.39 + 5.33 + 37.7 - 38.84) = 73.07 \text{ dB}\mu\text{V/m}$, where
 4.75 and 2.39 are cable losses, 5.33 is quadruplexer factor, 37.7 is amplifier gain, 38.84 is antenna factor.
 $73.07 \text{ dB}\mu\text{V/m} - 107 = -33.07 \text{ dBm}$



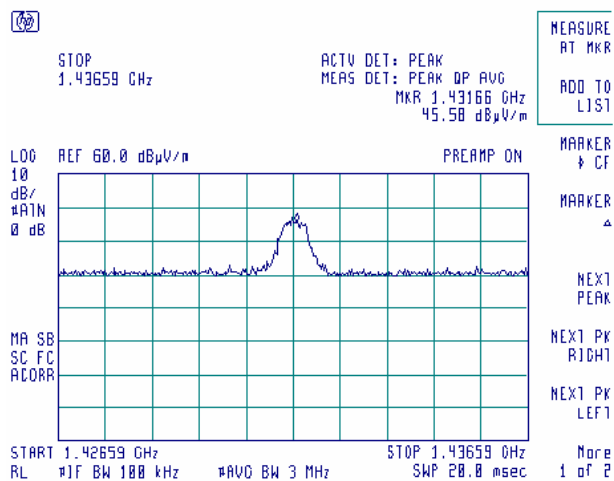
Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.11 Radiated emission measurements at the 2nd harmonic of low channel

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 710.4 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

Plot 7.4.12 Radiated emission measurements at the 2nd harmonic of high channel

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 715.6 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

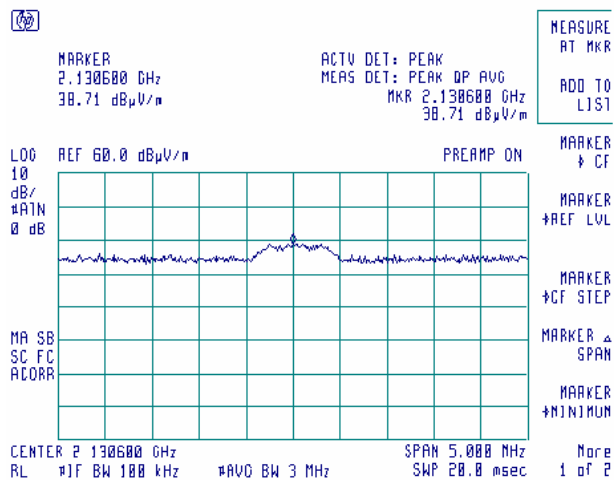




Test specification:	Section 27.53f, Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.13 Radiated emission measurements at the 3rd harmonic of low channel

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 710.4 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m





Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-A, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

7.5 Frequency stability test

7.5.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.5.1. The test results are provided in Tables 7.5.2, 7.5.3 and shown in the associated plots.

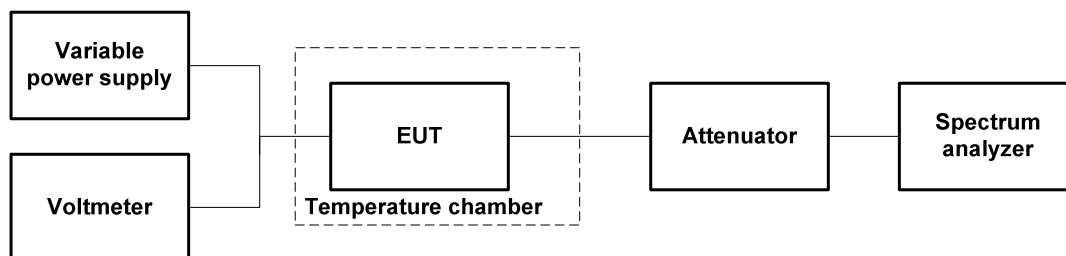
Table 7.5.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement
710.0 – 716.0	26 dBc points including frequency tolerance shall remain within the assigned band

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 power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.5.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.5.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.5.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 7.5.2.6 Frequency displacement was calculated as provided in Tables 7.5.2 and 7.5.3.

Figure 7.5.1 Frequency stability test setup





Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-A, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

Table 7.5.2 Frequency stability test results

ASSIGNED FREQUENCY RANGE: 710.0 – 716.0 MHz
 NOMINAL POWER VOLTAGE: 120 VAC (102 VAC - 138 VAC)
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 RESOLUTION BANDWIDTH: 100 Hz
 VIDEO BANDWIDTH: 100 Hz
 FREQUENCY SPAN: 10.0 kHz
 SPECTRUM ANALYZER MODE: Counter
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, Hz					Positive drift, Hz	Negative drift, Hz	Max frequency drift, Hz	Min frequency drift, Hz
		Start up	1 st min	3 rd min	5 th min	10 th min				
Low frequency										
-30	Nominal	710401092	710399922	710399831	710399710	710399645	1632	0	1632	45
-20	Nominal	710400100	NA	NA	NA	710399713	640	0		
-10	Nominal	710399524	NA	NA	NA	710400300	840	0		
0	Nominal	710400138	710400304	710400314	710400310	710400284	854	0		
10	Nominal	710400345	NA	NA	NA	710399489	885	0		
20	+15%	710399944	NA	NA	NA	710399877	484	0		
20	Nominal	710399740	NA	NA	NA	710399460*	280	NA		
20	-15%	710399757	NA	NA	NA	710399984	524	0		
30	Nominal	710399667	710399415	710399874	710400058	710400375	915	45		
40	Nominal	710400453	NA	NA	NA	710400599	1139	0		
50	Nominal	710400702	NA	NA	NA	710400580	1242	0		
High frequency										
-30	Nominal	715600017	715599854	715599759	715599684	715599625	187	205	844	339
-20	Nominal	715599832	NA	NA	NA	715599610	2	220		
-10	Nominal	715599491	NA	NA	NA	715600351	521	339		
0	Nominal	715599892	715600331	715600305	715600260	715600033	501	0		
10	Nominal	715600247	NA	NA	NA	715599652	417	178		
20	+15%	715599584	NA	NA	NA	715599874	44	246		
20	Nominal	715599608	NA	NA	NA	715599830*	NA	222		
20	-15%	715599621	NA	NA	NA	715599846	16	209		
30	Nominal	715600568	715599727	715599977	715600107	715600318	738	103		
40	Nominal	715600674	NA	NA	NA	715600588	844	0		
50	Nominal	715600403	NA	NA	NA	715600228	573	0		

* - Reference frequency

Table 7.5.3 Transmitter operating range including frequency drift

6-MHz channel, MHz	Measured 26 dBc point, MHz	Frequency drift, Hz		26 dBc point including frequency tolerance, MHz	Verdict
		Positive	Negative		
710.0 – 716.0	710.0275 – 715.98453	1632	339	710.027161 – 715.986162	Pass

Reference numbers of test equipment used

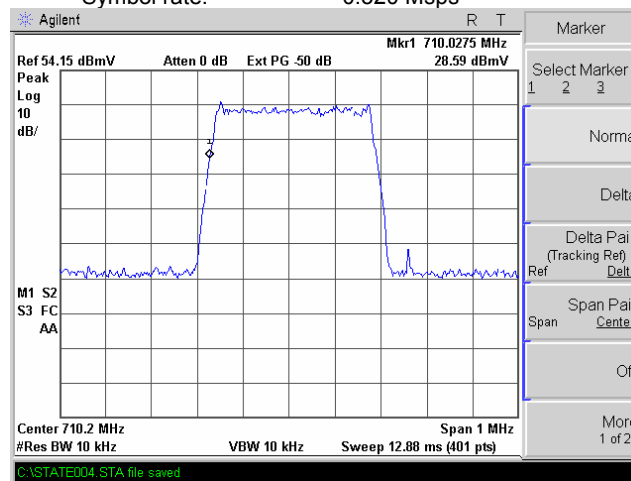
HL 0278	HL 0493	HL 1097	HL 1204	HL 1653			
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Full description is given in Appendix A.

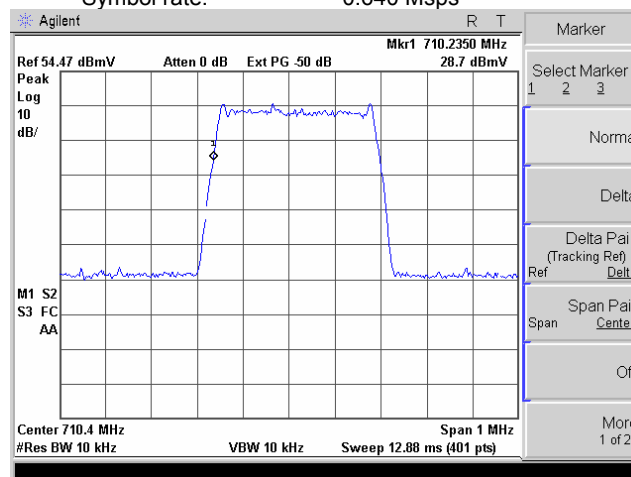


Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-A, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.1 Band edge emission at low frequency

Band edge: Left
Symbol rate: 0.320 Msps

Plot 7.5.2 Band edge emission at low frequency

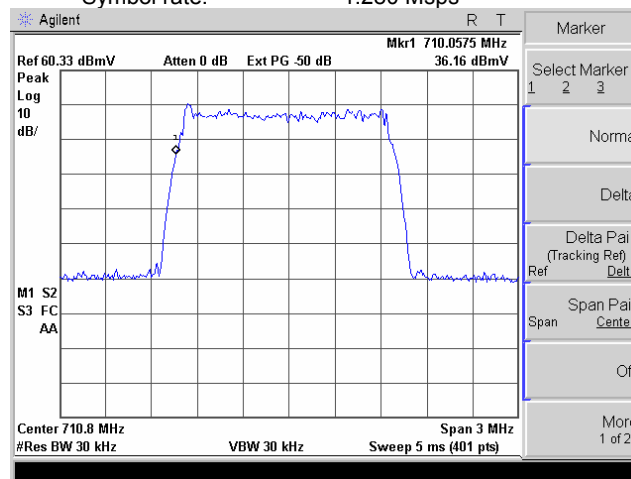
Band edge: Left
Symbol rate: 0.640 Msps



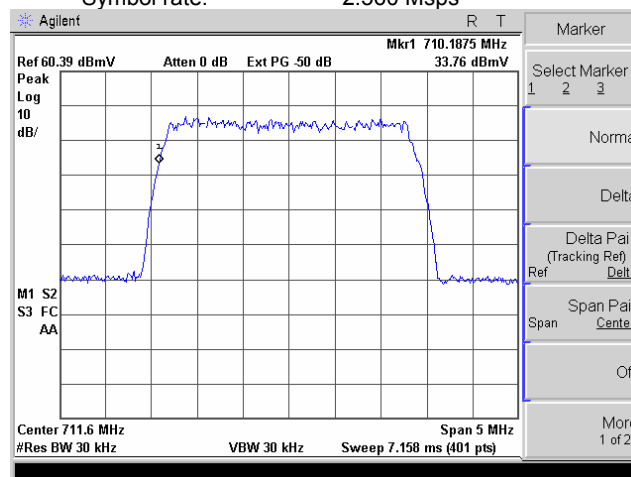
Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-A, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.3 Band edge emission at low frequency

Band edge: Left
Symbol rate: 1.280 Msps

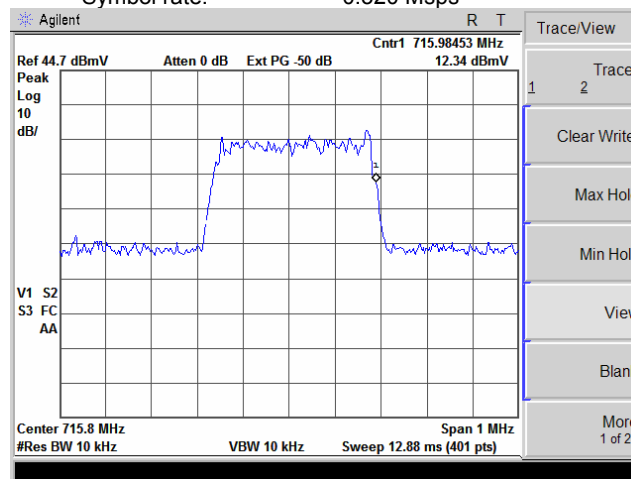
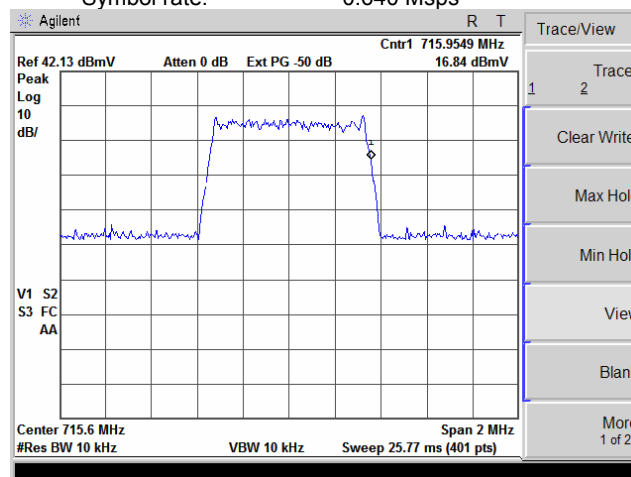
**Plot 7.5.4 Band edge emission at low frequency**

Band edge: Left
Symbol rate: 2.560 Msps



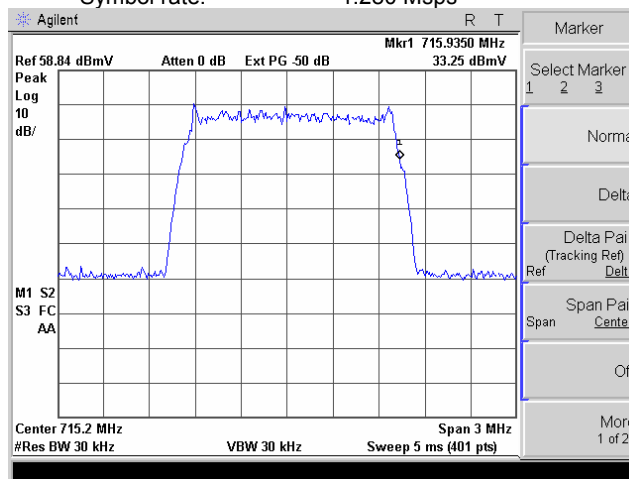
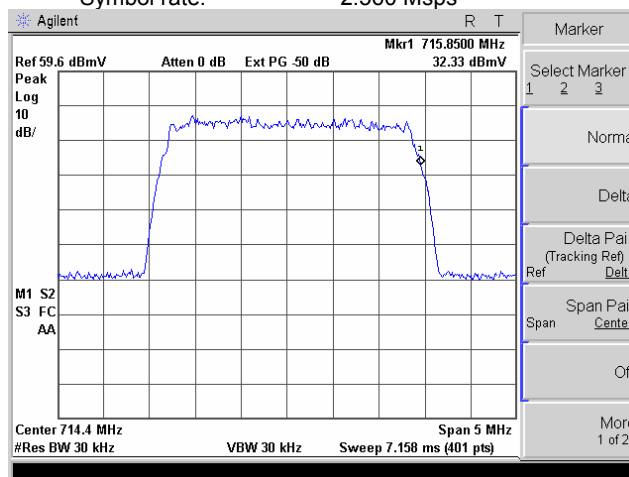


Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-A, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.5 Band edge emission at high frequencyBand edge: Right
Symbol rate: 0.320 Msps**Plot 7.5.6 Band edge emission at high frequency**Band edge: Right
Symbol rate: 0.640 Msps



Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-A, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.7 Band edge emission at high frequencyBand edge: Right
Symbol rate: 1.280 Msps**Plot 7.5.8 Band edge emission at high frequency**Band edge: Right
Symbol rate: 2.560 Msps



Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

7.6 Occupied bandwidth test

7.6.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.6.1. The test results are provided in Table 7.6.2 and associated plots.

Table 7.6.1 Occupied bandwidth limits

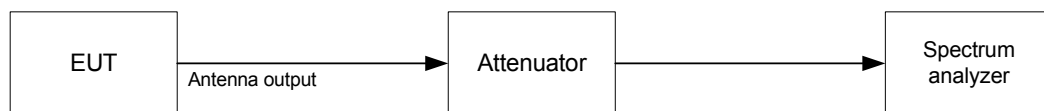
Assigned frequency, MHz	Modulation envelope reference points*, dBc
710.0 – 716.0	26

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

7.6.2 Test procedure

- 7.6.2.1** The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.
- 7.6.2.2** The EUT was set to transmit unmodulated carrier and reference peak power level was measured.
- 7.6.2.3** The EUT was set to transmit modulated carrier.
- 7.6.2.4** The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.6.2 and associated plots.

Figure 7.6.1 Occupied bandwidth test setup





Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

Table 7.6.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
 RESOLUTION BANDWIDTH: 30 kHz
 VIDEO BANDWIDTH: 30 kHz
 MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
 MODULATING SIGNAL: PRBS

Carrier frequency, MHz	Occupied bandwidth, MHz
Bit rate: 5.12 Mbps / Symbol rate: 2.56 Msps / Modulation: QPSK	
711.6	2.7240
713.0	2.8125
714.4	2.8000
Bit rate: 10.24 Mbps / Symbol rate: 2.56 Msps / Modulation: 16QAM	
713.0	2.7375
Bit rate: 5.12 Mbps / Symbol rate: 1.28 Msps / Modulation: 16QAM	
713.0	1.4250
Bit rate: 2.56 Mbps / Symbol rate: 1.28 Msps / Modulation: QPSK	
713.0	1.4500
Bit rate: 2.56 Mbps / Symbol rate: 0.64 Msps / Modulation: 16QAM	
713.0	0.7500
Bit rate: 1.28 Mbps / Symbol rate: 0.64 Msps / Modulation: QPSK	
713.0	0.7500
Bit rate: 1.28 Mbps / Symbol rate: 0.32 Msps / Modulation: 16QAM	
713.0	0.4200
Bit rate: 0.64 Mbps / Symbol rate: 0.32 Msps / Modulation: QPSK	
713.0	0.4175

The "Bit rate 5.12 Mbps / Symbol rate 2.56 Msps / Modulation: QPSK" was used for full measurements as the worst case.

Reference numbers of test equipment used

HL 0278	HL 0493	HL 1097	HL 1204	HL 1653			
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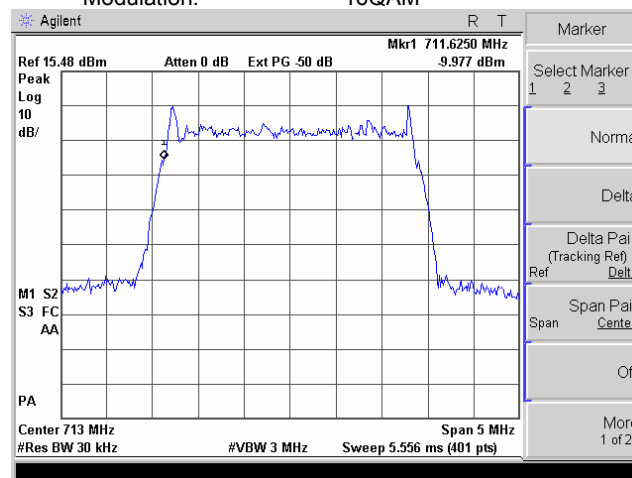
Full description is given in Appendix A.



Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

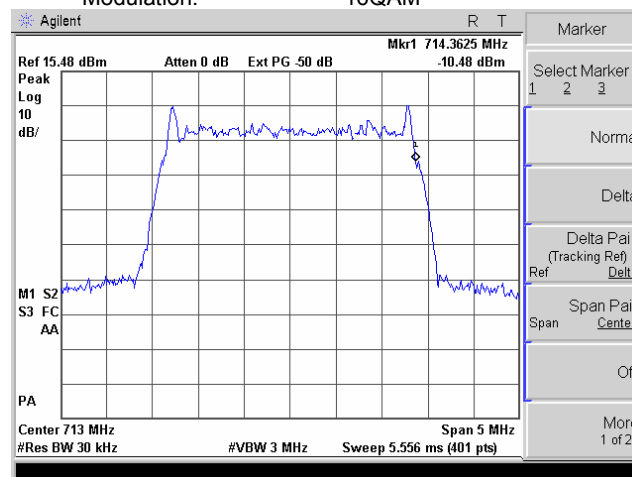
Plot 7.6.1 Occupied bandwidth test results at mid frequency

Band edge: Left
Bit rate: 10.24 Mbps
Symbol rate: 2.560 Msps
Modulation: 16QAM



Plot 7.6.2 Occupied bandwidth test results at mid frequency

Band edge: Right
Bit rate: 10.24 Mbps
Symbol rate: 2.560 Msps
Modulation: 16QAM

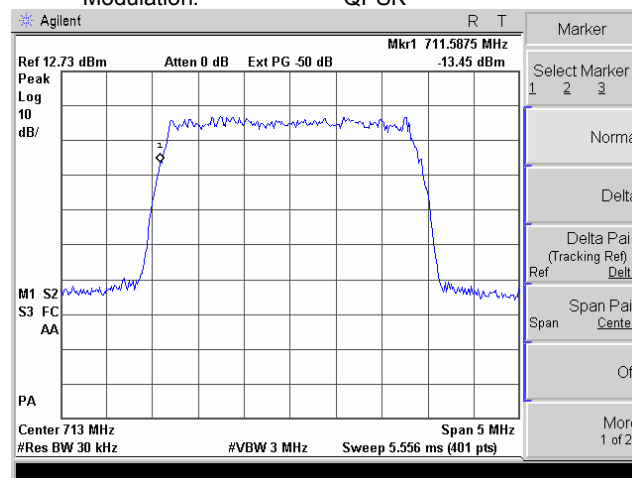




Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

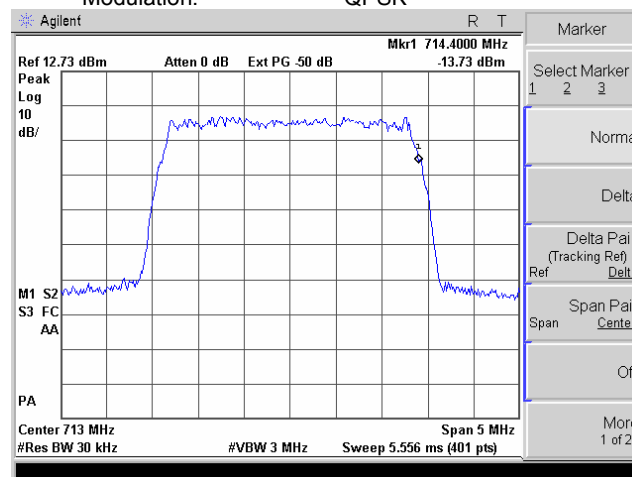
Plot 7.6.3 Occupied bandwidth test results at mid frequency

Band edge: Left
Bit rate: 5.120 Mbps
Symbol rate: 2.560 Msps
Modulation: QPSK



Plot 7.6.4 Occupied bandwidth test results at mid frequency

Band edge: Right
Bit rate: 5.120 Mbps
Symbol rate: 2.560 Msps
Modulation: QPSK

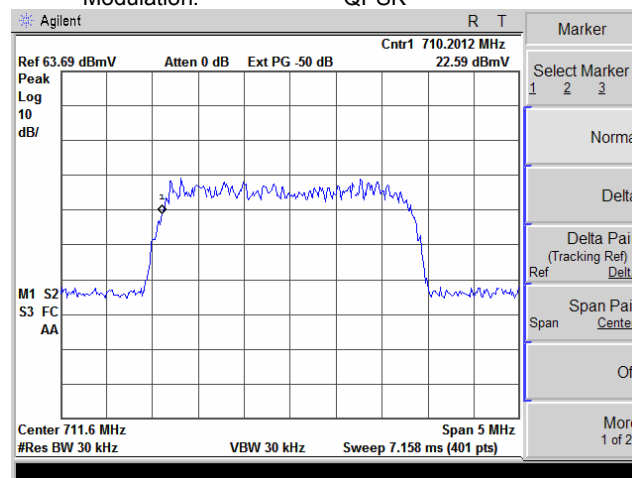




Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

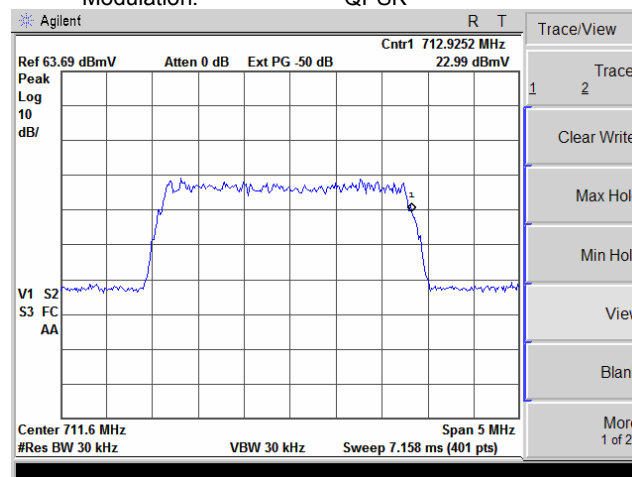
Plot 7.6.5 Occupied bandwidth test results at low frequency

Band edge: Left
Bit rate: 5.120 Mbps
Symbol rate: 2.560 Msps
Modulation: QPSK



Plot 7.6.6 Occupied bandwidth test results at low frequency

Band edge: Right
Bit rate: 5.120 Mbps
Symbol rate: 2.560 Msps
Modulation: QPSK

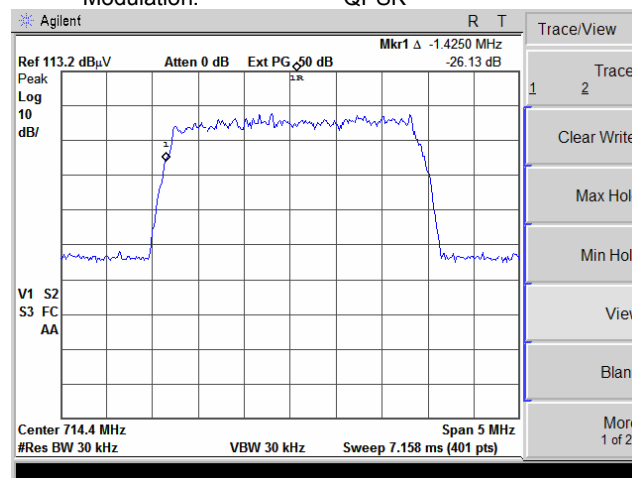




Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

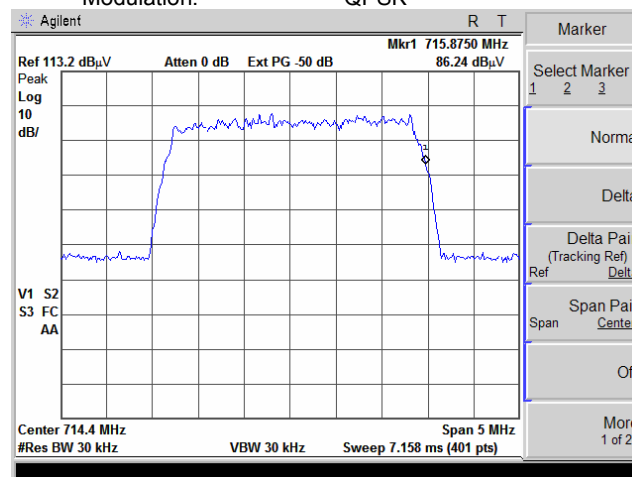
Plot 7.6.7 Occupied bandwidth test results at high frequency

Band edge: Left
Bit rate: 5.120 Mbps
Symbol rate: 2.560 Msps
Modulation: QPSK



Plot 7.6.8 Occupied bandwidth test results at high frequency

Band edge: Right
Bit rate: 5.120 Mbps
Symbol rate: 2.560 Msps
Modulation: QPSK

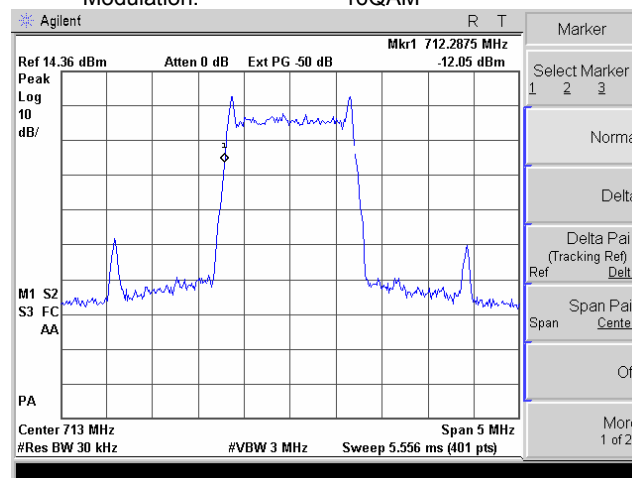




Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

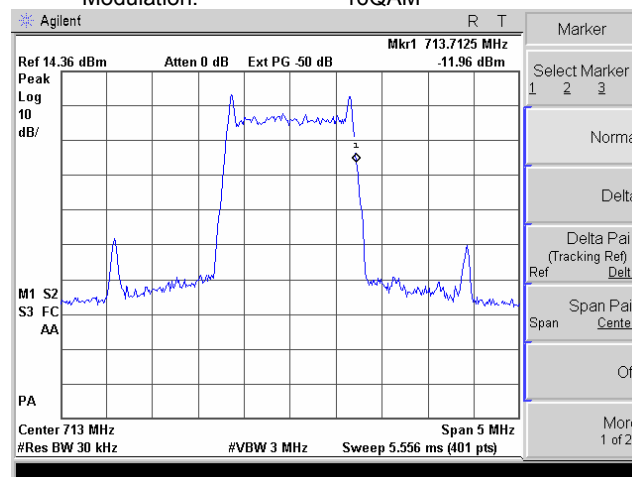
Plot 7.6.9 Occupied bandwidth test results at mid frequency

Band edge: Left
Bit rate: 5.120 Mbps
Symbol rate: 1.280 Msps
Modulation: 16QAM



Plot 7.6.10 Occupied bandwidth test results at mid frequency

Band edge: Right
Bit rate: 5.120 Mbps
Symbol rate: 1.280 Msps
Modulation: 16QAM

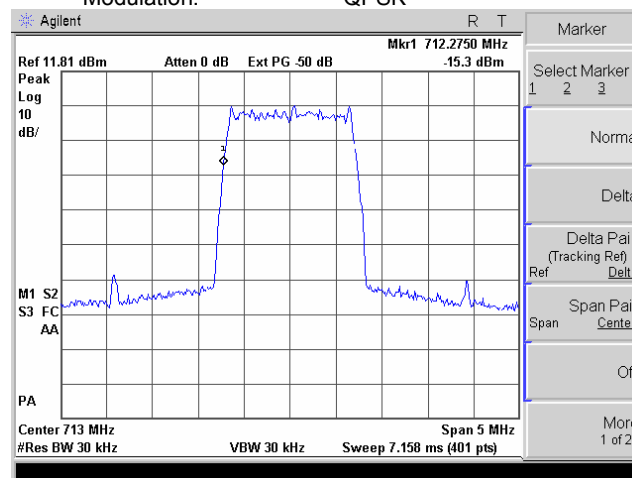




Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

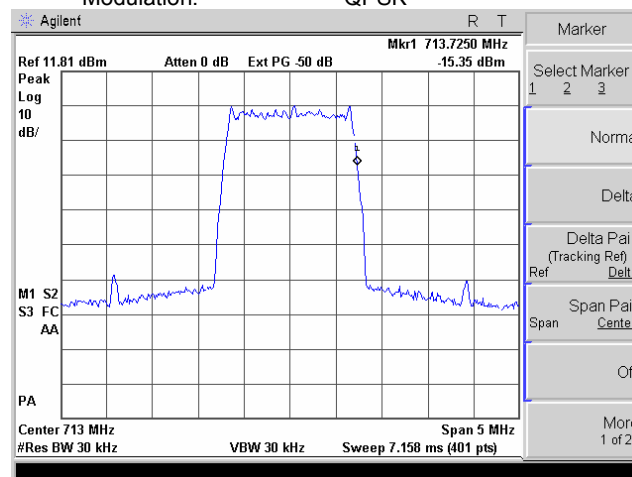
Plot 7.6.11 Occupied bandwidth test results at mid frequency

Band edge: Left
Bit rate: 2.560 Mbps
Symbol rate: 1.280 Msps
Modulation: QPSK



Plot 7.6.12 Occupied bandwidth test results at mid frequency

Band edge: Right
Bit rate: 2.560 Mbps
Symbol rate: 1.280 Msps
Modulation: QPSK

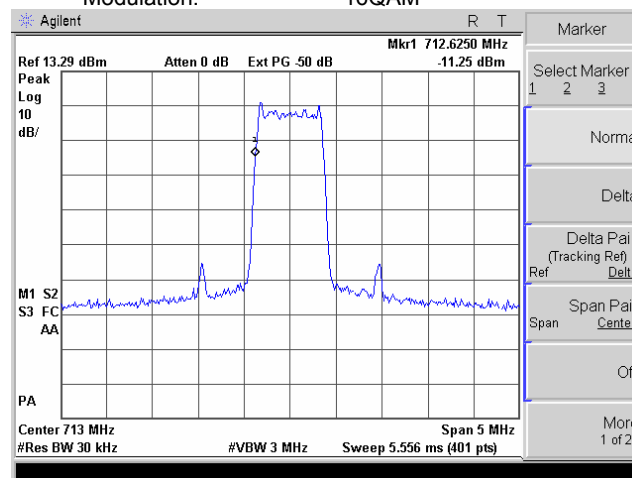




Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

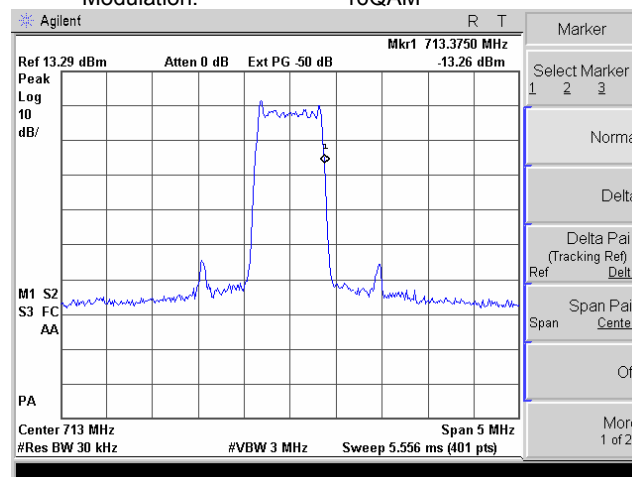
Plot 7.6.13 Occupied bandwidth test results at mid frequency

Band edge: Left
Bit rate: 2.560 Mbps
Symbol rate: 0.640 Msps
Modulation: 16QAM



Plot 7.6.14 Occupied bandwidth test results at mid frequency

Band edge: Right
Bit rate: 2.560 Mbps
Symbol rate: 0.640 Msps
Modulation: 16QAM

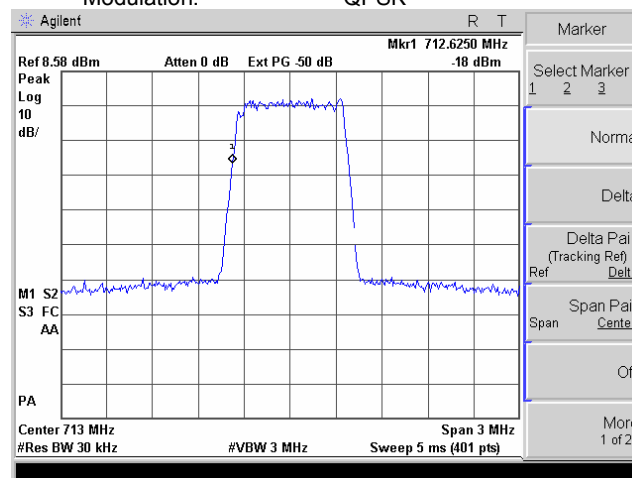




Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

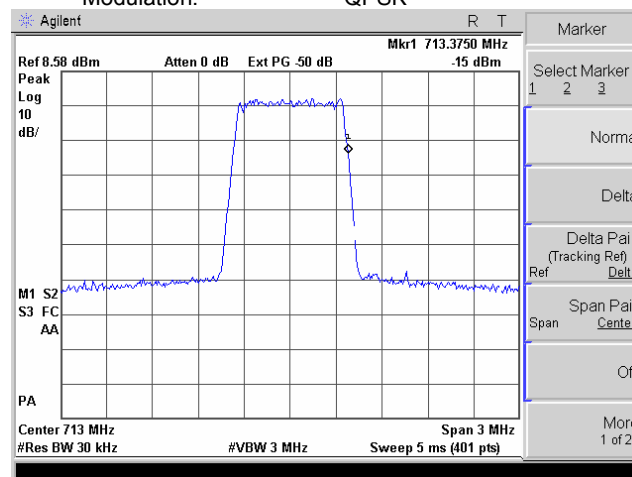
Plot 7.6.15 Occupied bandwidth test results at mid frequency

Band edge: Left
Bit rate: 1.280 Mbps
Symbol rate: 0.640 Msps
Modulation: QPSK



Plot 7.6.16 Occupied bandwidth test results at mid frequency

Band edge: Right
Bit rate: 1.280 Mbps
Symbol rate: 0.640 Msps
Modulation: QPSK

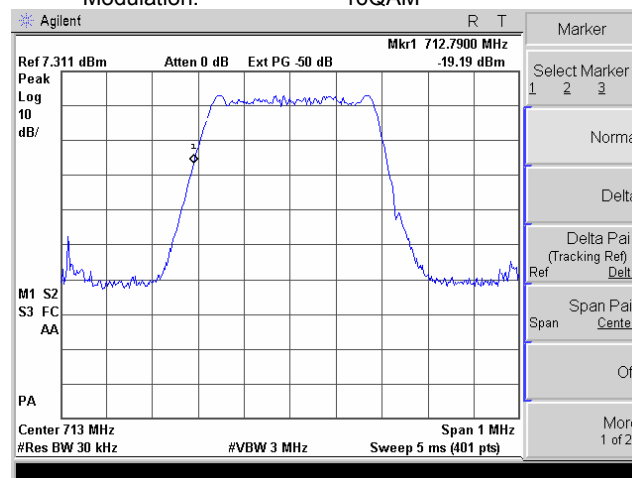




Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

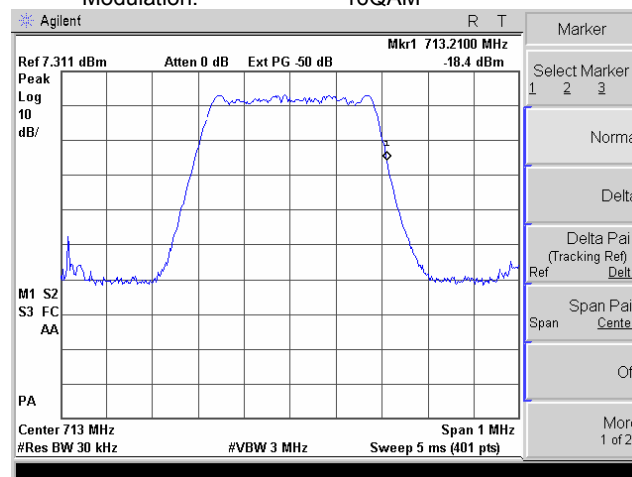
Plot 7.6.17 Occupied bandwidth test results at mid frequency

Band edge: Left
Bit rate: 1.280 Mbps
Symbol rate: 0.320 Msps
Modulation: 16QAM



Plot 7.6.18 Occupied bandwidth test results at mid frequency

Band edge: Right
Bit rate: 1.280 Mbps
Symbol rate: 0.320 Msps
Modulation: 16QAM

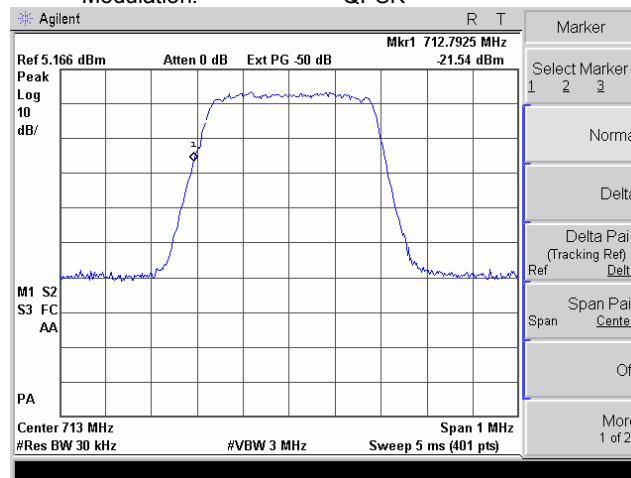




Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	11/23/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 42 %	Power Supply: 120 VAC
Remarks:			

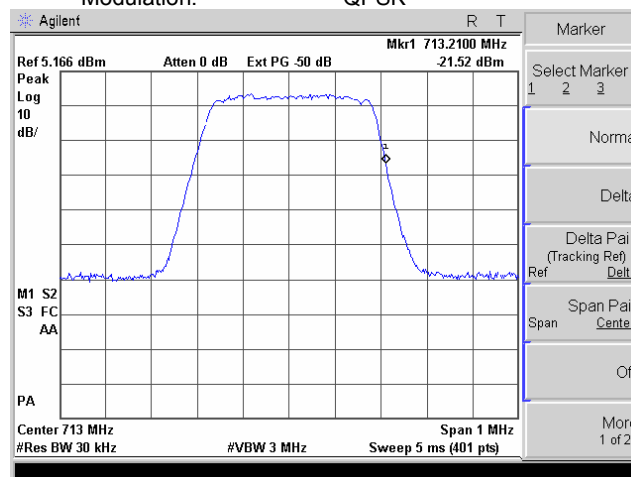
Plot 7.6.19 Occupied bandwidth test results at mid frequency

Band edge: Left
Bit rate: 0.640 Mbps
Symbol rate: 0.320 Msps
Modulation: QPSK



Plot 7.6.20 Occupied bandwidth test results at mid frequency

Band edge: Right
Bit rate: 0.640 Mbps
Symbol rate: 0.320 Msps
Modulation: QPSK





Test specification:	Section 15.107, Conducted emission at AC power port, Class B		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	11/25/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

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

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port. The specification test limits are given in Table 8.1.1. The worst test results with respect to the limits were recorded in Table 8.1.2 and shown in the associated plots.

Table 8.1.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μ V)	
	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.

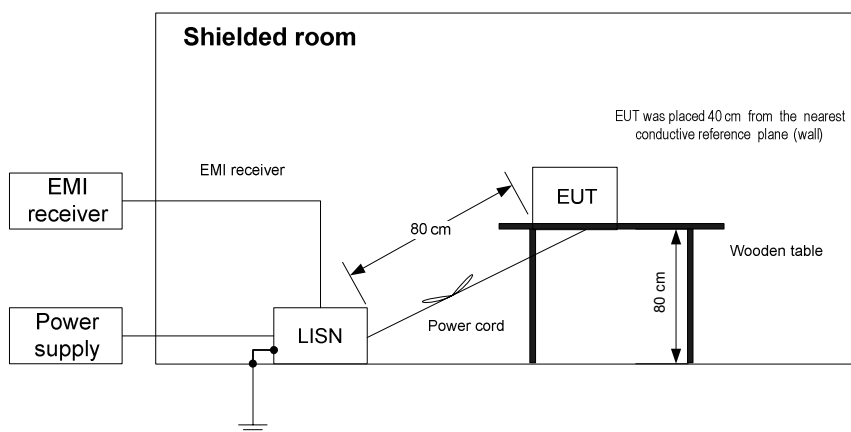
8.1.2 Test procedure

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

8.1.2.2 The measurements were performed at the EUT power terminals with the LISN, connected to the EMI receiver in the frequency range referred to in Table 8.1.2. The unused coaxial connector of the LISN was terminated with 50 Ohm.

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

Figure 8.1.1 Setup for conducted emission measurements at the mains power port, table-top EUT





Test specification:	Section 15.107, Conducted emission at AC power port, Class B		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	11/25/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Table 8.1.2 Conducted emission test results

LINE: AC mains
 EUT OPERATING MODE: Receive / Standby
 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*		
0.151110	42.57	37.66	65.95	-28.29	13.75	55.95	-42.20	L1	Pass
0.507025	43.68	39.99	56.00	-16.01	23.38	46.00	-22.62		
0.807073	42.96	37.86	56.00	-18.14	24.02	46.00	-21.98		
2.921490	43.73	40.71	56.00	-15.29	27.19	46.00	-18.81		
15.379675	36.63	34.90	60.00	-25.10	30.86	50.00	-19.14		
23.128950	36.75	34.57	60.00	-25.43	29.58	50.00	-20.42		
0.182786	45.41	40.31	64.40	-24.09	29.36	54.40	-25.04	L2	Pass
0.358750	42.66	39.51	58.82	-19.31	26.00	48.82	-22.82		
0.501750	42.69	39.25	56.00	-16.75	21.99	46.00	-24.01		
1.614863	40.91	37.28	56.00	-18.72	22.44	46.00	-23.56		
17.692925	48.19	47.07	60.00	-12.93	46.26	50.00	-3.74		
18.244548	47.86	46.41	60.00	-13.59	45.77	50.00	-4.23		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0163	HL 0447	HL 1430	HL 1502	HL 1510			
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Full description is given in Appendix A.

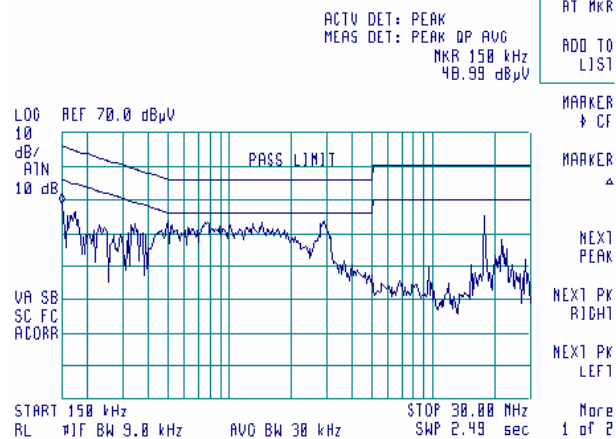


Test specification:	Section 15.107, Conducted emission at AC power port, Class B		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	11/25/2004		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Plot 8.1.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Receive / Standby
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK

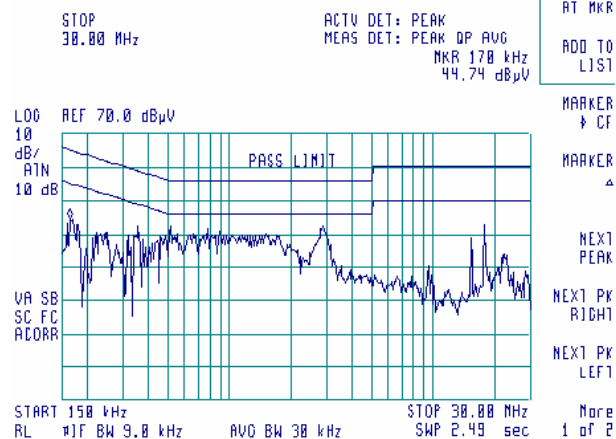
16:28:09 NOV 25, 2004



Plot 8.1.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Receive / Standby
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK

16:33:30 NOV 25, 2004





Test specification:	Section 15.109, Radiated emission, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1016 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

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

Table 8.2.1 Radiated emission test limits

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

* 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.

8.2.2 Test procedure

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

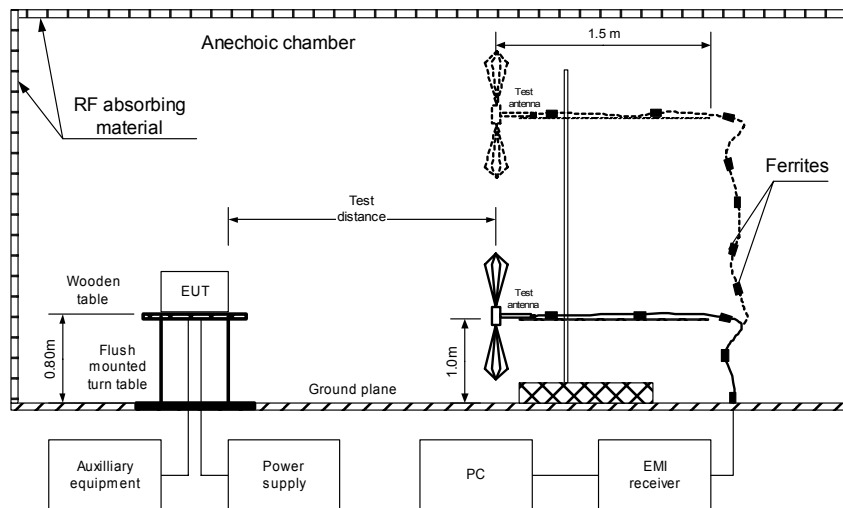
8.2.2.2 The measurements were performed in the anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.

8.2.2.3 The worst test results with respect to the limits were recorded in Table 8.2.2 and shown in the associated plots.



Test specification:	Section 15.109, Radiated emission, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1016 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

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





Test specification:	Section 15.109, Radiated emission, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1016 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

Table 8.2.2 Radiated emission test results

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

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
Low frequency channel								
66.450000	34.77	32.96	40.00	-7.04	Vertical	1.0	173	Pass
77.275000	30.48	22.12	40.00	-17.88	Vertical	1.0	102	
99.687500	46.74	43.00	43.50	-0.50	Vertical	1.0	168	
132.925000	38.88	36.67	43.50	-6.83	Vertical	1.0	335	
165.912500	36.11	33.66	43.50	-9.84	Vertical	1.0	261	
232.712500	30.88	27.43	46.00	-18.57	Vertical	1.0	124	
710.420000	34.61	30.55	46.00	-15.45	Vertical	1.0	315	
High frequency channel								
33.215000	28.30	26.05	40.00	-13.95	Vertical	1.0	360	Pass
66.445000	37.54	35.66	40.00	-4.34	Vertical	1.0	89	
99.405000	42.83	39.70	43.50	-3.80	Horizontal	2.6	149	
132.740000	39.04	35.39	43.50	-8.11	Vertical	1.0	360	
165.987500	39.70	37.17	43.50	-6.33	Vertical	1.0	274	
259.940000	38.07	33.73	46.00	-12.27	Horizontal	1.0	360	
389.885000	38.47	35.42	46.00	-10.58	Vertical	1.0	316	
454.866250	39.73	36.72	46.00	-9.28	Vertical	1.0	100	
597.550000	38.37	35.27	46.00	-10.73	Vertical	1.0	49	
715.555000	48.22	42.83	46.00	-3.17	Horizontal	1.0	293	

DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 5000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
Low frequency channel								
1093.87292	47.97	32.41	54.00	-21.59	Vertical	1.0	291	Pass
High frequency channel								
1095.47292	49.01	37.38	54.00	-16.62	Vertical	1.0	323	Pass

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1004	HL 1424
HL 2009	HL 2432						

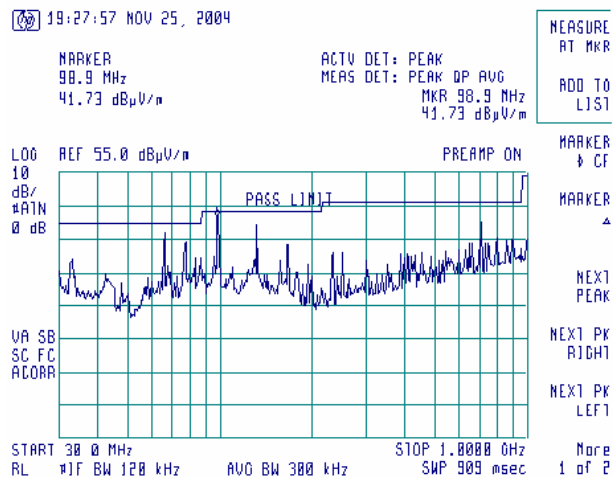
Full description is given in Appendix A.



Test specification:	Section 15.109, Radiated emission, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1016 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

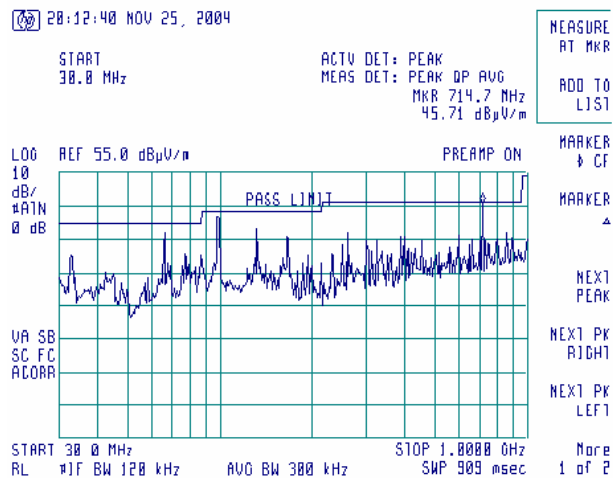
**Plot 8.2.1 Radiated emission measurements in 30- 1000 MHz range at low frequency channel,
horizontal and vertical antenna polarization**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Standby



**Plot 8.2.2 Radiated emission measurements in 30- 1000 MHz range at high frequency channel,
horizontal and vertical antenna polarization**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Standby

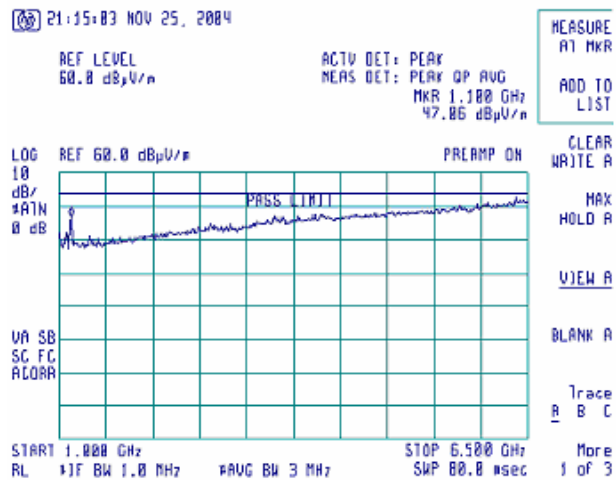




Test specification:	Section 15.109, Radiated emission, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	11/28/2004		
Temperature: 23 °C	Air Pressure: 1016 hPa	Relative Humidity: 40 %	Power Supply: 120 VAC
Remarks:			

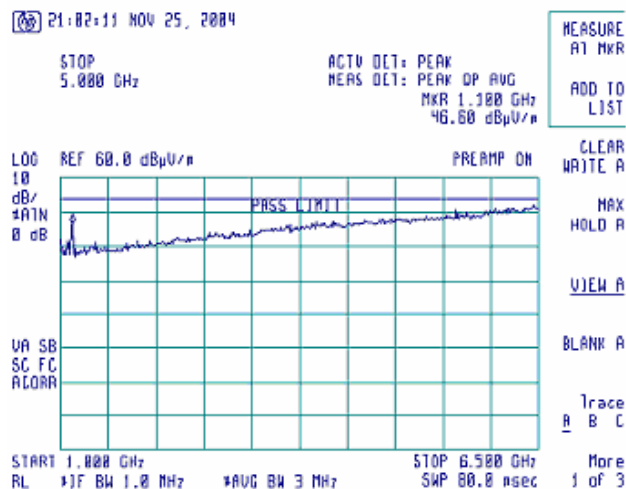
Plot 8.2.3 Radiated emission measurements in 1000 – 6500 MHz range at low frequency channel, horizontal and vertical antenna polarization

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Standby



Plot 8.2.4 Radiated emission measurements in 1000 – 6500 MHz range at high frequency channel, horizontal and vertical antenna polarization

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Standby





Test specification:	Section 15.111, Conducted emission at receiver antenna port		
Test procedure:	ANSI C63.4, Section 12.1.5		
Test mode:	Compliance	Verdict:	PASS
Date:	11/25/2004		
Temperature: 29 °C	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

8.3 Antenna power conducted measurements for receiver

8.3.1 General

This test was performed to measure spurious emissions at RF antenna connector of receiver operated within 30 to 960 MHz band which was tested for compliance with radiated emission limits with the antenna port connected to resistive termination. The specification test limits are given in Table 8.3.1.

Table 8.3.1 Spurious emission limits

Frequency, MHz	EUT type	Power of spurious	
		nW	dBm
30 MHz – 2 nd harmonic*	Superheterodyne receiver	2.0	-57.0

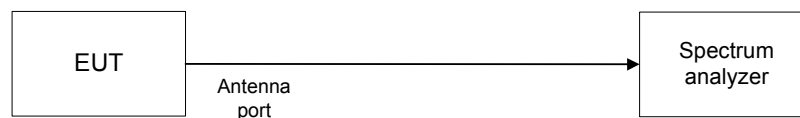
* - harmonic of the local oscillator frequency.

8.3.2 Test procedure

8.3.2.1 The EUT was set up as shown in Figure 8.3.1, energized and its proper operation was checked.

8.3.2.2 The spurious emission was measured with spectrum analyzer as provided in Table 8.3.2 and associated plots.

Figure 8.3.1 Spurious emission test setup





Test specification:	Section 15.111, Conducted emission at receiver antenna port		
Test procedure:	ANSI C63.4, Section 12.1.5		
Test mode:	Compliance	Verdict:	PASS
Date:	11/25/2004		
Temperature: 29 °C	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Table 8.3.2 Spurious emission test results

INVESTIGATED FREQUENCY RANGE: 30 – 1500 MHz
 RECEIVER TYPE: Superheterodyne
 EUT OPERATING MODE: Receive
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1000 kHz
 VIDEO BANDWIDTH: 3000 kHz

Frequency, MHz	Spurious emission, dBm	Limit, dBm	Margin, dB	Verdict
Low channel: 743.0 MHz				
52.73	-69.75	-57.0	-12.75	Pass
249.47	-68.30		-11.3	Pass
902.99	-68.70		-11.7	Pass
938.69	-68.84		-11.84	Pass
1054.46	-68.99		-11.99	Pass
1266.55	-69.54		-12.54	Pass
1463.45	-69.86		-12.86	Pass
High channel: 745.125 MHz				
36.80	-68.83	-57.0	-11.83	Pass
249.47	-68.14		-11.14	Pass
177.86	-69.41		-12.41	Pass
746.50	-69.16		-12.16	Pass
942.00	-65.90		-8.9	Pass
1403.00	-69.08		-12.08	Pass

Reference numbers of test equipment used

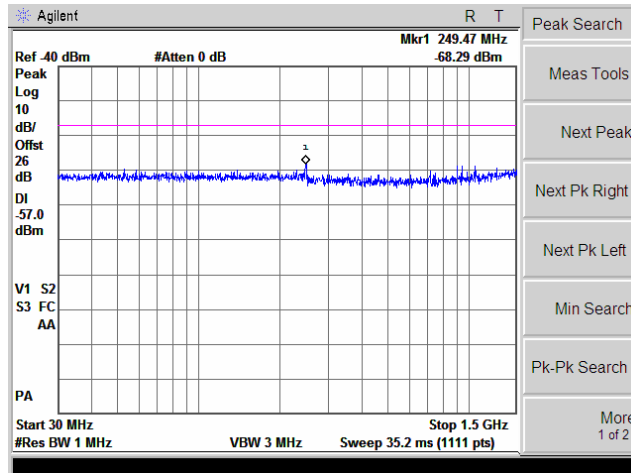
HL 1476	HL 1651	HL 1653					
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Full description is given in Appendix A.

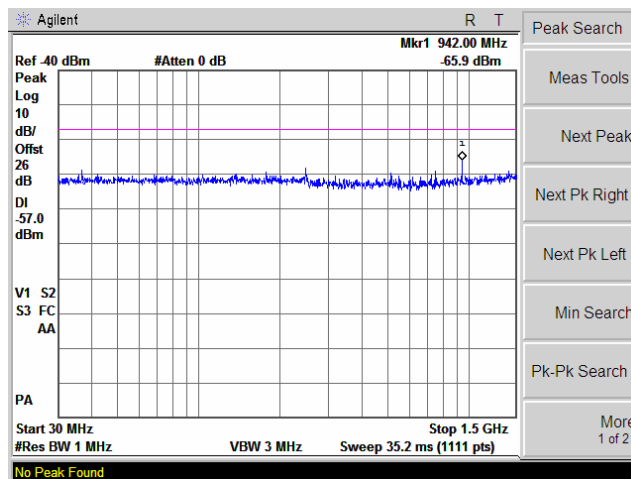


Test specification:	Section 15.111, Conducted emission at receiver antenna port		
Test procedure:	ANSI C63.4, Section 12.1.5		
Test mode:	Compliance	Verdict:	PASS
Date:	11/25/2004		
Temperature: 29 °C	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Plot 8.3.1 Spurious emission measurements at low channel



Plot 8.3.2 Spurious emission measurements at high channel



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

HL No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
0163	LISN FCC/VDE/MIL-STD	Electro-Metrics	ANS 25/2	1314	01-Oct-05
0278	Thermometer, -200 - +760C	Fluke	51K/J	5045468	28-Apr-05
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-05
0447	LISN, 16/2, 300V RMS	HL	LISN 16 - 1	066	03-Nov-05
0465	Anechoic Chamber 9(L) x 6,5(W) x 5,5(H) m	HL	AC - 1	023	10-Oct-05
0493	Oven temperature -45...175 deg C	Thermotron	S-1.2 Mini-Max	14016	23-Sep-05
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-2.9 GHz	Hewlett Packard	8546A	3617A00319, 3448A00253	26-Sep-05
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	2-Dec-05
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	03-Feb-05
0594	Turn Table for anechoic chamber flush mount d=1.2 m Pneumatic	HL	TT-WDC1	102	27-Jan-05
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-05
0613	Sensor Electric Field 10 kHz-1.0 GHz, 1-300 V/m (probe), w/charger	Amplifier Research	FP2000	18677	08-Dec-05
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	Hewlett Packard	83640B	3614A00266	14-Sep-05
1004	Cable Coaxial, ANDREW PSWJ4, 6m	HL	ANDREW-6	163	02-Dec-05
1097	Attenuator, 50 Ohm, 5 W, DC to 8 GHz, 20 dB	Midwest Microwave	0793-20-NN-07	1097	15-Jan-05
1200	Quadruplexer 1-12 GHz (1-2 GHz; 2-4GHz;4-8 GHz; 8-12GHz)	Elettronica S.p.A. - Roma	UE 84	D/00240	10-Feb-05
1204	One phase Voltage regulator, 2kVA, 0-250V	HL	TDGC-2	99	04-Jun-05
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies (HP)	8564EC	3946A00219	30-Aug-05
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies (HP)	8542E	3807A00262, 3705A00217	01-Sep-05
1455	Cable, 1 m	Harbour Industries	MIL 17/60- RG142	1455	23-Sep-05
1476	Cable, 1 m	Harbour Industries	MIL 17/60- RG142	1476	23-Sep-05
1488	Power Divider 0.5 - 18 GHz	Omni Spectra	2090-6204-00	1488	05-Dec-05
1502	Cable RF, 6 m	Belden	M17/167 MIL- C-17	1502	02-Dec-05
1510	Cable RF, 8 m	Belden	M17/167 MIL- C-17	1510	02-Dec-05



HL No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
1629	Isotropic Field Monitor	Amplifier Research	FM2000	23308	13-Feb-05
1651	Attenuators Set (2, 3, 5, 20 dB), DC-18 GHz	M/A-COM	2082	1651	03-Jan-05
1653	Analyzer EMC 9 kHz - 1.5 GHz	Agilent Technologies (HP)	E7401A	US39440281	06-Feb-05
1942	Cable 18GHz, 4 m, blue	Rhophase Microwave Limited	SPS-1803A-4000-NPS	T4658	17-Oct-05
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	17-Oct-05
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	22-Mar-05
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-05
2400	Cable 40GHz, 1.5 m, green	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2946	24-Jun-05
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	02-Jul-05

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency stability	± 168 Hz (0.56 ppm)
Unintentional radiator tests	
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB
Vertical polarization	Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of ISO/IEC 17025 (or alternately ANSI/NCSL Z540-1).

The laboratory calibrates its measurement standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements. The Hermon Labs EMC measurements uncertainty is given in the table above.

11 APPENDIX C Test facility description

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

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Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

47CFR part 27: 2003	Miscellaneous wireless communications services
47CFR part 1: 2003	Practice and procedure
47CFR part 2: 2002	Frequency allocations and radio treaty matters; general rules and regulations
47CFR part 15 subpart B: 2003	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: 2001	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI/TIA/EIA-603-A:2001	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

13 APPENDIX E 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(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
ITE	information technology equipment
k	kilo
kHz	kilohertz
LISN	line impedance stabilization network
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PCB	printed circuit board
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt

14 APPENDIX F Test equipment correction factors

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

Frequency, MHz	Correction factor, dB
0.01	5.0
0.02	2.2
0.03	1.1
0.04	0.7
0.05	0.5
0.1	0.2
0.2	0.1
0.4	0.1
0.6	0.1
0.8	0.1
1	0.1
2	0.1
3	0.1
4	0.1
6	0.2
10	0.3
12	0.4
16	0.5
18	0.6
20	0.7
25	0.9
28	1.2
30	1.3

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

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

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

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



Antenna Factor
Active Loop Antenna
EMC Test Systems, model 6502, serial number 2857

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

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

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

**Antenna factor****Biconilog antenna EMCO, model 3141, serial number 1011**

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

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



Antenna factor
Double-ridged wave guide horn antenna
EMC Test Systems, model 3115, serial no: 9911-5964

Frequency, MHz	Antenna gain, dBi	Antenna factor. dB(1/m)
1000.0	5.8	24.5
1500.0	9.0	24.8
2000.0	8.6	27.7
2500.0	9.5	28.7
3000.0	8.9	30.8
3500.0	8.2	32.9
4000.0	9.6	32.7
4500.0	11.2	32.1
5000.0	10.6	33.6
5500.0	9.8	35.3
6000.0	10.1	35.7
6500.0	10.7	35.8
7000.0	10.9	36.2
7500.0	10.5	37.2
8000.0	11.1	37.2
8500.0	10.8	38.1
9000.0	10.7	38.6
9500.0	11.5	38.3
10000.0	11.8	38.4
10500.0	12.3	38.3
11000.0	12.3	38.8
11500.0	11.5	39.9
12000.0	12.2	39.6
12500.0	12.6	39.5
13000.0	12.0	40.5
13500.0	11.7	41.1
14000.0	11.7	41.5
14500.0	12.7	40.8
15000.0	14.2	39.5
15500.0	16.0	38.1
16000.0	16.2	38.1
16500.0	14.5	40.1
17000.0	12.2	42.6
17500.0	9.7	45.4
18000.0	6.6	48.7

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



Antenna factor
Double-ridged wave guide horn antenna
EMC Test Systems, model 3115, serial no: 00027177

Frequency, MHz	Antenna gain, dBi	Antenna factor. dB(1/m)
1000.0	5.5	24.7
1500.0	8.0	25.7
2000.0	8.4	27.8
2500.0	9.3	28.9
3000.0	9.0	30.7
3500.0	9.3	31.8
4000.0	9.3	33.0
4500.0	10.4	32.8
5000.0	10.0	34.2
5500.0	10.1	34.9
6000.0	10.6	35.2
6500.0	11.0	35.4
7000.0	10.8	36.3
7500.0	10.4	37.3
8000.0	10.8	37.5
8500.0	10.8	38.0
9000.0	11.0	38.3
9500.0	11.5	38.3
10000.0	11.5	38.7
10500.0	11.9	38.7
11000.0	12.2	38.9
11500.0	11.9	39.5
12000.0	12.3	39.5
12500.0	12.7	39.4
13000.0	12.0	40.5
13500.0	12.0	40.8
14000.0	11.6	41.5
14500.0	12.2	41.3
15000.0	13.6	40.2
15500.0	15.3	38.7
16000.0	15.8	38.5
16500.0	14.8	39.8
17000.0	12.9	41.9
17500.0	9.2	45.8
18000.0	6.2	49.1

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

**Cable loss****Cable coaxial, GORE A2P01POL118, 2.3 m, model GORE-3, serial number 176, HL 0589****+ Cable coaxial, ANDREW PSWJ4, 6 m, model: ANDREW-6, serial number 163, HL 1004**

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	30	0.33	≤ 6.5	±0.12
2	50	0.40		
3	100	0.57		
4	300	0.97		
5	500	1.25		
6	800	1.59		
7	1000	1.81		
8	1200	1.97		
9	1400	2.15		
10	1600	2.28		
11	1800	2.43		
12	2000	2.61		
13	2200	2.75		
14	2400	2.89		
15	2600	2.97		
16	2800	3.21	≤ 6.5	±0.12
17	3000	3.32		±0.17
18	3300	3.47		
19	3600	3.62		
20	3900	3.84		
21	4200	3.92		
22	4500	4.07		
23	4800	4.36		
24	5100	4.62		
25	5400	4.78		
26	5700	5.16		
27	6000	5.67		
28	6500	5.99		



Cable loss
Cable 18 GHz, 4 m, blue, model SPS-1803A-4000-NPS, serial number T4658, HL 1942

Frequency, GHz	Cable loss, dB
0.03	0.21
0.05	0.26
0.10	0.36
0.20	0.50
0.30	0.61
0.40	0.70
0.50	0.78
0.60	0.85
0.70	0.93
0.80	0.99
0.90	1.04
1.00	1.10
1.10	1.16
1.20	1.22
1.30	1.26
1.40	1.31
1.50	1.35
1.60	1.41
1.70	1.45
1.80	1.49
1.90	1.53
2.00	1.57
2.10	1.61
2.20	1.65
2.30	1.69
2.40	1.72
2.50	1.76
2.60	1.79
2.70	1.83
2.80	1.87
2.90	1.90
3.10	1.97
3.30	2.04
3.50	2.11
3.70	2.18
3.90	2.24
4.10	2.31
4.30	2.38
4.50	2.43
4.70	2.53
4.90	2.53
5.10	2.63
5.30	2.65
5.50	2.72
5.70	2.76
5.90	2.79

Frequency, GHz	Cable loss, dB
6.10	2.88
6.30	2.90
6.50	2.97
6.70	3.02
6.90	3.04
7.10	3.07
7.30	3.12
7.50	3.13
7.70	3.19
7.90	3.24
8.10	3.30
8.30	3.36
8.50	3.45
8.70	3.41
8.90	3.45
9.10	3.42
9.30	3.55
9.50	3.48
9.70	3.58
9.90	3.61
10.10	3.66
10.30	3.68
10.50	3.70
10.70	3.70
10.90	3.75
11.10	3.78
11.30	3.86
11.50	3.98
11.70	4.10
11.90	4.12
12.10	4.09
12.40	4.13
13.00	4.23
13.50	4.35
14.00	4.40
14.50	4.44
15.00	4.57
15.50	4.66
16.00	4.64
16.50	4.66
17.00	4.75
17.50	4.85
18.00	4.93



Cable 18 GHz, 6.5 m, blue, model NPS-1803A-6500-NPS, serial number T4974, HL 1947
Calibration data

Frequency, GHz	Insertion loss, dB
0.03	0.30
0.05	0.38
0.10	0.53
0.20	0.74
0.30	0.91
0.40	1.05
0.50	1.18
0.60	1.29
0.70	1.40
0.80	1.50
0.90	1.59
1.00	1.68
1.10	1.77
1.20	1.86
1.30	1.94
1.40	2.01
1.50	2.08
1.60	2.16
1.70	2.22
1.80	2.29
1.90	2.36
2.00	2.42
2.10	2.48
2.20	2.54
2.30	2.60
2.40	2.66
2.50	2.71
2.60	2.77
2.70	2.83
2.80	2.89
2.90	2.95
3.10	3.06
3.30	3.17
3.50	3.28
3.70	3.39
3.90	3.51
4.10	3.62
4.30	3.76
4.50	3.87
4.70	4.01
4.90	4.10
5.10	4.21
5.30	4.31
5.50	4.43
5.70	4.56
5.90	4.71

Frequency, GHz	Insertion loss, dB
6.10	4.87
6.30	4.95
6.50	4.94
6.70	4.88
6.90	4.87
7.10	4.83
7.30	4.85
7.50	4.86
7.70	4.91
7.90	4.96
8.10	5.03
8.30	5.08
8.50	5.13
8.70	5.21
8.90	5.22
9.10	5.34
9.30	5.35
9.50	5.52
9.70	5.51
9.90	5.66
10.10	5.70
10.30	5.78
10.50	5.79
10.70	5.82
10.90	5.86
11.10	5.94
11.30	6.06
11.50	6.21
11.70	6.44
11.90	6.61
12.10	6.76
12.40	6.68
13.00	6.66
13.50	6.81
14.00	6.90
14.50	6.90
15.00	6.97
15.50	7.17
16.00	7.28
16.50	7.27
17.00	7.38
17.50	7.68
18.00	7.92



Cable loss
RF cable 8 m, model RG-214, serial number C-56, HL 2009

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	1	0.10	NA	±0.12
2	10	0.14		
3	30	0.25		
4	50	0.34		
5	100	0.53		
6	300	0.99		
7	500	1.31		
8	800	1.73		
9	1000	1.98		
10	1100	2.11		
11	1200	2.21		
12	1300	2.35		
13	1400	2.46		
14	1500	2.55		
15	1600	2.68		
16	1700	2.78		
17	1800	2.88		
18	1900	2.98		
19	2000	3.09		

Cable 40 GHz, 1.5 m, green; model KPS-1503A-1500-KPS, serial number X2946 (HL 2400)

Frequency, GHz	Insertion loss, dB
0.03	0.06
0.05	0.08
0.1	0.15
0.2	0.23
0.3	0.29
0.5	0.37
0.7	0.46
0.9	0.53
1.1	0.58
1.3	0.65
1.5	0.66
1.7	0.72
1.9	0.76
2.1	0.79
2.3	0.85
2.5	0.90
2.7	0.91
2.9	0.97
3.1	0.97
3.3	1.03
3.5	1.06
3.7	1.10
3.9	1.13
4.1	1.16
4.3	1.18
4.5	1.21
4.7	1.23
4.9	1.26
5.1	1.28
5.3	1.31
5.5	1.32
5.7	1.36
5.9	1.37
6.1	1.38
6.3	1.44
6.5	1.46
6.7	1.49
6.9	1.50
7.1	1.51
7.3	1.55
7.5	1.56
7.7	1.58
7.9	1.60
8.1	1.61
8.3	1.68
8.5	1.68
8.7	1.75
8.9	1.74
9.1	1.81
9.3	1.79
9.5	1.86
9.7	1.85
9.9	1.87
10.1	1.88

Frequency, GHz	Insertion loss, dB
10.30	1.82
10.50	1.92
10.70	1.86
10.90	1.96
11.10	1.90
11.30	1.99
11.50	1.95
11.70	2.00
11.90	2.01
12.10	1.99
12.40	2.06
13.00	2.11
13.50	2.17
14.00	2.36
14.50	2.32
15.00	2.30
15.50	2.34
16.00	2.34
16.50	2.40
17.00	2.46
17.50	2.54
18.00	2.61
18.50	2.59
19.00	2.59
19.50	2.67
20.00	2.62
20.50	2.73
21.00	2.71
21.50	2.78
22.00	2.83
22.50	2.81
23.00	2.91
23.50	2.97
24.00	2.98
24.50	2.97
25.00	3.03
25.50	3.04
26.00	3.11
26.50	2.97
27.00	3.15
28.00	3.07
29.00	3.13
30.00	3.13
31.00	3.18
32.00	3.31
33.00	3.32
34.00	3.37
35.00	3.36
36.00	3.46
37.00	3.49
38.00	3.52
39.00	3.62
40.00	3.77

Cable RF, 6m, model: M17/167 MIL-C-17, serial number 1502 (HL 1502)
Calibration data (0.1 – 1000 MHz)

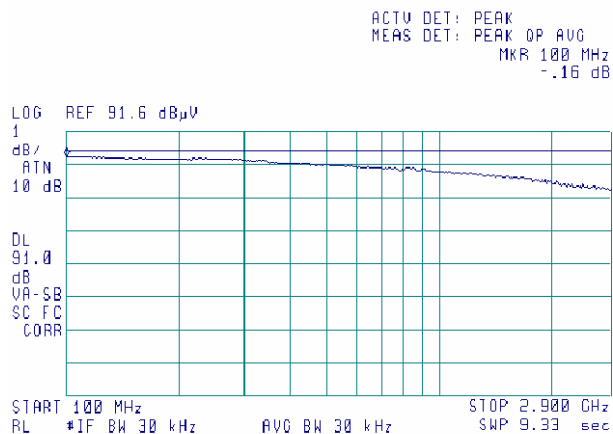
No.	Parameter	Set, MHz	Measured, dB	Deviation	Tolerance (specification), dB	Measured uncertainty dB
1	Attenuation	0.1	0.02	NA	NA	±0.12
2		1	0.07			
3		3	0.15			
4		5	0.17			
5		10	0.26			
6		30	0.43			
7		50	0.57			
8		80	0.72			
9		100	0.81			
10		300	1.48			
11		500	2.00			
12		800	2.70			
13		1000	3.09			

Cable RF, 8m, model: M17/167 MIL-C-17, serial number 1510 (HL 1510)
Calibration data (0.1 – 1000 MHz)

No.	Parameter	Set, MHz	Measured, dB	Deviation	Tolerance (specification), dB	Measured uncertainty dB
1	Attenuation	0.1	0.05	NA	NA	±0.12
2		1	0.09			
3		3	0.16			
4		5	0.18			
5		10	0.27			
6		30	0.44			
7		50	0.58			
8		80	0.69			
9		100	0.82			
10		300	1.48			
11		500	2.01			
12		800	2.65			
13		1000	3.12			

Cable RF, 1m, model: MIL 17/60-RG142, serial number 1455 (HL 1455)
Calibration data (100 – 2900 MHz)

No.	Parameter	SET	Measured	Deviation	Tolerance (Specification)	Meas. Uncert.
1	Insertion Loss	100 MHz – 2.9 GHz	See attached plot		≤ 2.0 dB	±0.52 dB



Cable RF, 1m, model: MIL 17/60-RG142, serial number 1476 (HL 1476)
Calibration data (100 – 2900 MHz)

No.	Parameter	SET	Measured	Deviation	Tolerance (Specification)	Meas. Uncert.
1	Insertion Loss	100 MHz – 2.9 GHz	See attached plot		≤ 2.0 dB	±0.52 dB

