

RADIATED EMISSIONS TEST REPORT

**ACCORDING TO: FCC CFR 47 PART 90 SECTION 90.210(m)
PART 15 SUBPART B SECTION 15.109**

FOR:

Motorola Israel Ltd.

Mobile radio

Model: Renegade 900

Model number: M01WJL4PW4_N

Transceiver

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.

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1 Applicant information

Client name: Motorola Israel Ltd.
Address: 3 Kremenetski street, P.O.B. 25016, 67899 Tel Aviv, Israel
Telephone: +972 3565 8888
Fax: +972 3565 8888
E-mail: BSB034@motorola.com
Contact name: Mr. Shlomo Ben Gigi

2 Equipment under test attributes

Product name: Mobile radio
Product type: Transceiver
Model: Renegade 900
Model number: M01WJL4PW4_N
Hardware version: Proto 4
Software release: P05_83A
Serial number: RWE00036
Receipt date: 3/15/2005

3 Manufacturer information

Manufacturer name: Motorola Israel Ltd.
Address: 3 Kremenetski street, P.O.B. 25016, 67899 Tel Aviv, Israel
Telephone: +972 3565 8888
Fax: +972 3565 8888
E-Mail: BSB034@motorola.com
Contact name: Mr. Shlomo Ben Gigi

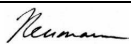
4 Test details

Project ID: 16251
Location: Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started: 3/15/2005
Test completed: 4/11/2005
Test specifications: FCC CFR 47 Part 90: 2004 Section 90.210(m)
Part 15: 2004 Subpart B Section 15.109

5 Tests summary

Test	Status
Transmitter characteristics	
Section 90.210, Radiated spurious emissions for low power	Pass
Section 90.210, Radiated spurious emissions for high power	Pass
Unintentional emissions	
Section 15.109, Radiated emission, Class B	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. Y. Neuman, test engineer	April 11, 2005	
Reviewed by:	Ms. N. Averin, certification engineer	April 11, 2005	
	Mr. M. Nikishin, EMC group leader	April 11, 2005	
Approved by:	Mr. A. Usoskin, C.E.O.	April 11, 2005	

6 EUT description

6.1 General information

The EUT is a mobile radio implementing 897.0125 MHz operating frequency.
The EUT is powered from 13.6 VDC.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Signal	PTT	EUT	Microphone	RJ 45	1	Shielded	2 m	Outdoor
Power	DC power	EUT	Power supply	DC jack	1	Unshielded	1.5 m*	Outdoor
RF	Antenna	EUT	Termination	Mini UHF	1	Coax	0.1 m*	Outdoor

* May be up to 6 m.

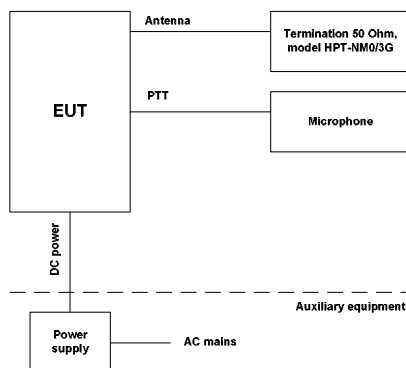
6.3 Operating frequencies

Source	Frequency, MHz					
Digital portion	2.1	16.8	NA	NA	NA	NA
Receiver	935 – 940	861.65-866.65	73.35	NA	NA	NA
Transmitter	896 – 901	935 – 940	NA	NA	NA	NA

6.4 Changes made in the EUT

No changes were implemented.

6.5 Test configuration



6.6 Transmitter characteristics

Type of equipment					
X	Stand-alone (Equipment with or without its own control provisions)				
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
	Plug-in card (Equipment intended for a variety of host systems)				
Intended use		Condition of use			
	fixed	Always at a distance more than 2 m from all people			
X	mobile	Always at a distance more than 20 cm from all people			
	portable	May operate at a distance closer than 20 cm to human body			
Assigned frequency ranges:		896 – 901 MHz, 935 – 940 MHz			
Operating frequency ranges:		896 – 901 MHz, 935 – 940 MHz			
RF channel spacing		12.5 kHz			
Maximum rated output power		At transmitter 50 Ω RF output connector			
		Effective radiated power (for equipment with no RF connector)			
Is transmitter output power variable?		No			
		X	Yes	Low RF power	36.02 dBm at carrier frequency 897.0125 MHz
				High RF power	44.77 dBm at carrier frequency 897.0125 MHz
Antenna connection					
unique coupling	X	standard connector	integral	with temporary RF connector	
				without temporary RF connector	
Antenna/s technical characteristics					
Type	Manufacturer		Model number		Gain
Roof antenna	Motorola		PRA4934A / PRA4935A / PRA4936A		3 dBi
Transmitter 99% power bandwidth			11 kHz		
Type of modulation			FM		
Modulating test signal (baseband)			1 kHz test tone		
Transmitter duty cycle supplied for test			100 %		
Transmitter power source					
	Battery	Nominal rated voltage		Battery type	Lithium
X	DC	Nominal rated voltage	13.6 VDC		
	AC mains	Nominal rated voltage	VAC	Frequency	Hz
Common power source for transmitter and receiver				X	yes
					no
Emission designator				11K0F1D, 11K0F2D, 11K0F3E	

Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

7 Transmitter test according to 47CFR part 90 requirements

7.1 Radiated spurious emission measurements for low power

7.1.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Radiated spurious emission test limits

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

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier

** - P is transmitter output power in Watts

*** - Equivalent field strength limit was calculated from maximum allowed 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

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

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

7.1.2.2 The 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.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

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

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

7.1.3.2 The specified frequency range was investigated with antenna 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.

7.1.3.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

7.1.4 Test procedure for substitution ERP measurements of spurious

7.1.4.1 The test equipment was set up as shown in Figure 7.1.3 and energized.

7.1.4.2 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.

7.1.4.3 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.

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

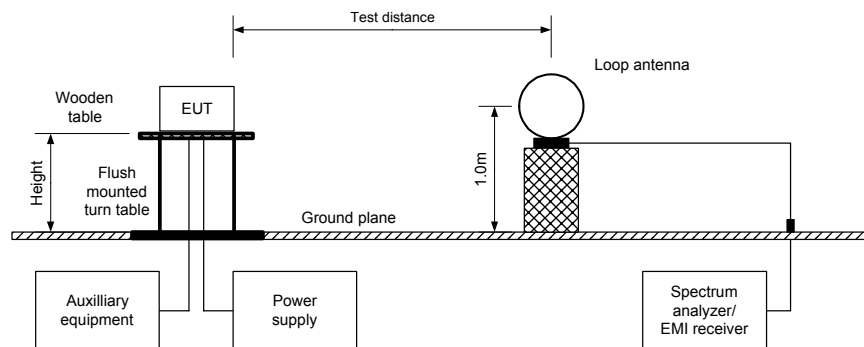
7.1.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

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

7.1.4.7 The worst test results (the lowest margins) were recorded in Table 7.1.3 and shown in the associated plots.

Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Figure 7.1.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

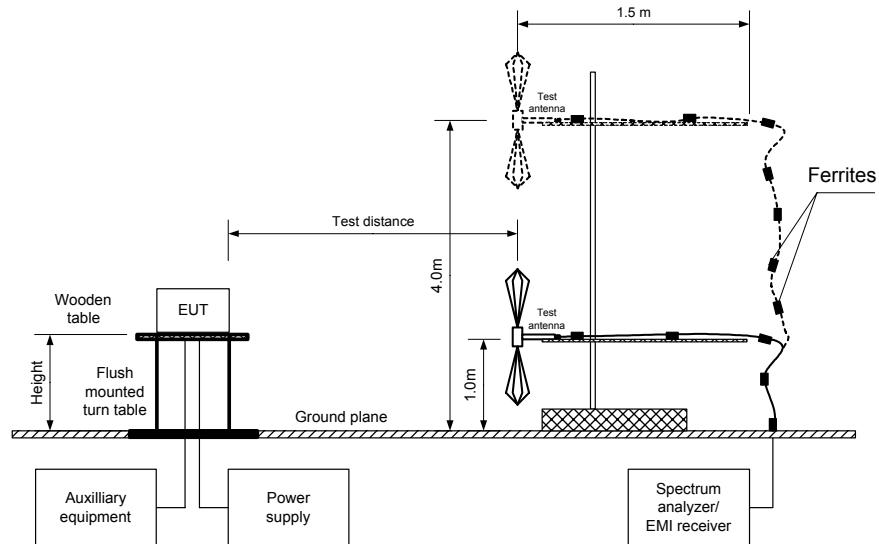


Photograph 7.1.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

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

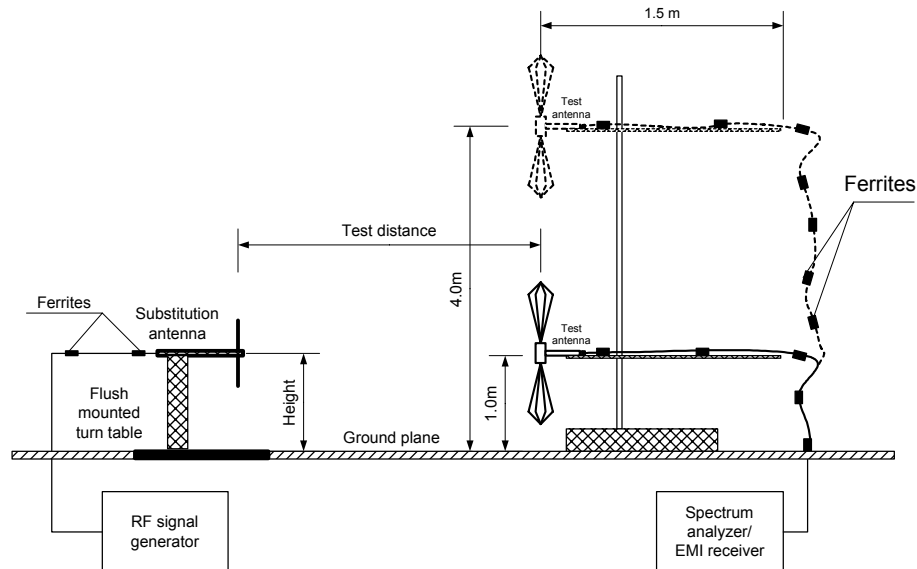


Photograph 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Figure 7.1.3 Setup for substitution ERP measurements of spurious



Photograph 7.1.3 Setup for substitution ERP measurements of spurious



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Table 7.1.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 896 – 901 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber / OATS
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 10000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Double ridged guide
MODULATION: FM
MODULATING SIGNAL: 1.0 kHz test tone
TRANSMITTER OUTPUT POWER SETTINGS: Minimum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Carrier frequency 897.0125 MHz							
1794.0250	79.8	84.4	-4.6	1000	Vertical	1.1	75
1794.0250	71.7	84.4	-12.7	1000	Horizontal	1.0	51
2691.0375	60.6	84.4	-23.8	1000	Vertical	1.0	81
2691.0375	56.5	84.4	-27.9	1000	Horizontal	2.2	21
3588.0500	-48.4	84.4	-132.8	1000	Horizontal	1.9	93
3588.0500	-49.0	84.4	-133.4	1000	Vertical	1.1	22
4485.0625	-51.3	84.4	-135.7	1000	Vertical	1.1	26
4485.0625	-53.8	84.4	-138.2	1000	Horizontal	1.8	178
5382.0750	-49.2	84.4	-133.6	1000	Vertical	1.5	163
5382.0750	-51.9	84.4	-136.3	1000	Horizontal	1.7	157
6279.0875	-57.6	84.4	-142.0	1000	Vertical	1.1	0
6279.0875	-59.3	84.4	-143.7	1000	Horizontal	1.2	8
7176.1000	-55.6	84.4	-140.0	1000	Vertical	1.1	168
7176.1000	-58.2	84.4	-142.6	1000	Horizontal	1.3	12
8073.1125	-55.8	84.4	-140.2	1000	Vertical	1.0	87
8073.1125	-55.0	84.4	-139.4	1000	Horizontal	1.3	16
8970.1250	-57.9	84.4	-142.3	1000	Vertical	1.2	73
8970.1250	-53.7	84.4	-138.1	1000	Horizontal	1.5	106

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

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

Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Table 7.1.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 896 – 901 MHz
 TRANSMITTER CARRIER ERP: 36.02 dBm
 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	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Attenuation below carrier, dBc	Limit, dBm	Margin, dB*	Verdict
Carrier frequency 897.0125 MHz											
1794.0250	79.8	1000	Vertical	-27.9	6.7	0.9	-22.1	58.1	-13	-9.1	Pass
2691.0375	60.6	1000	Vertical	-48.0	7.1	1.1	-42.0	78.0	-13	-29.0	Pass
3588.0500	-48.4	1000	Horizontal	-52.5	6.3	1.2	-47.4	83.4	-13	-34.4	Pass
3588.0500	-49.0	1000	Vertical	-51.8	6.3	1.2	-46.7	82.7	-13	-33.7	Pass
4485.0625	-51.3	1000	Vertical	-47.9	9.0	1.4	-40.3	76.3	-13	-27.3	Pass
5382.0750	-49.2	1000	Vertical	-48.8	7.8	1.5	-42.5	78.5	-13	-29.5	Pass
6279.0875	-57.6	1000	Vertical	-59.0	8.3	1.7	-52.4	88.4	-13	-39.4	Pass
7176.1000	-55.6	1000	Vertical	-54.9	8.6	1.8	-48.1	84.1	-13	-35.1	Pass
8073.1125	-55.0	1000	Horizontal	-52.4	8.9	1.9	-45.4	81.4	-13	-32.4	Pass
8970.1250	-53.7	1000	Horizontal	-50.9	8.5	2.0	-44.4	80.4	-13	-31.4	Pass

*- Margin = ERP – specification limit.

Reference numbers of test equipment used

HL 0025	HL 0410	HL 0446	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594
HL 0604	HL 0661	HL 0813	HL 1004	HL 1365	HL 1424	HL 1430	HL 1552
HL 1941	HL 1942	HL 1947	HL 1984	HL 2009	HL 2258	HL 2259	HL 2387
HL 2399	HL 2400	HL 2432	HL 2499				

Full description is given in Appendix A.

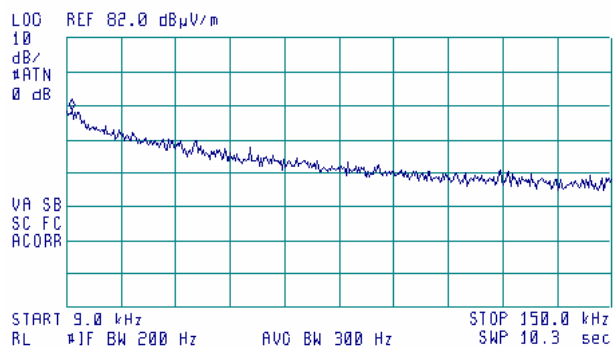
Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Plot 7.1.1 Radiated emission measurements in 9 - 150 kHz range

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

09:14:22 APR 10, 2005

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 10.4 kHz
60.95 dBμV/m

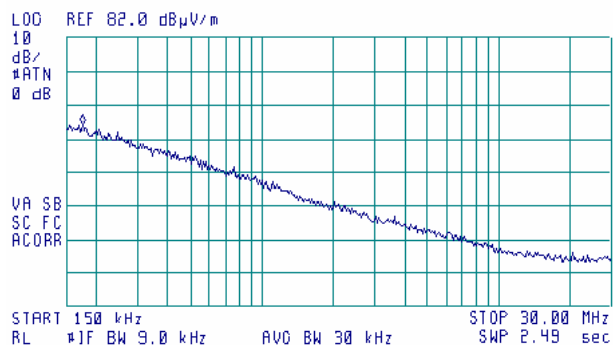


Plot 7.1.2 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

09:11:01 APR 10, 2005

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 180 kHz
56.20 dBμV/m

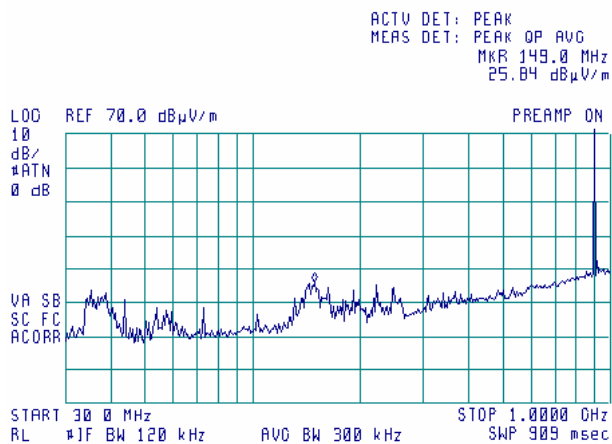


Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Plot 7.1.3 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

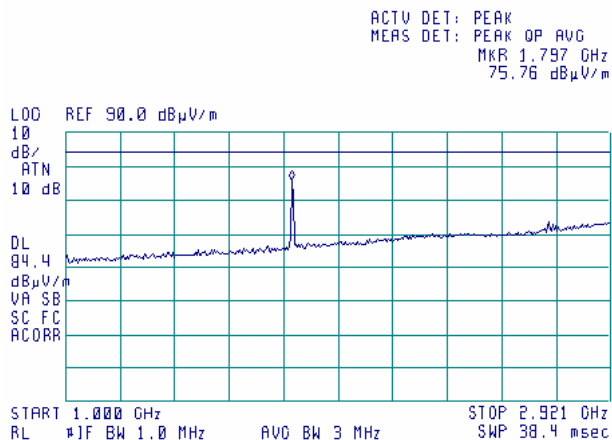
08:54:34 APR 10, 2005



Plot 7.1.4 Radiated emission measurements in 1000 - 2900 MHz range

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

08:12:15 APR 10, 2005

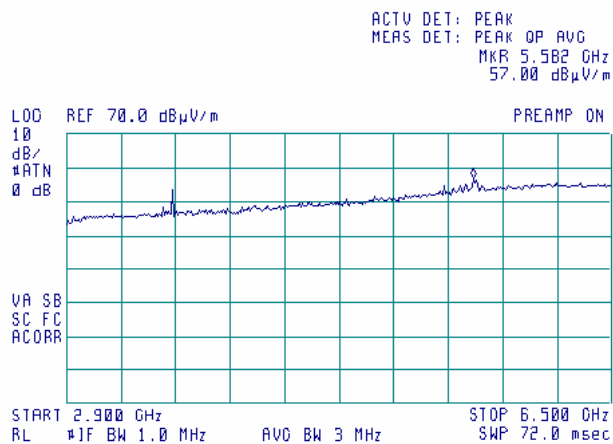


Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Plot 7.1.5 Radiated emission measurements in 2900 – 6500 MHz range

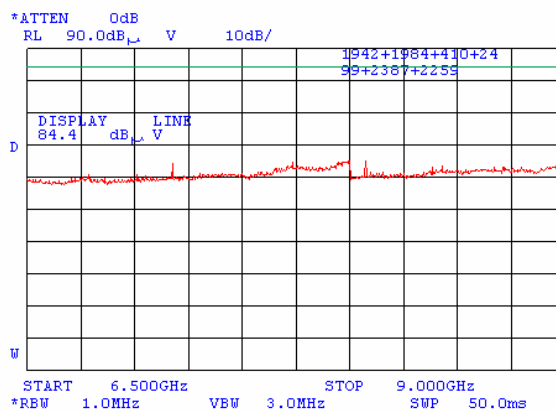
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

08:20:18 APR 10, 2005



Plot 7.1.6 Radiated emission measurements in 6500 – 9000 MHz range

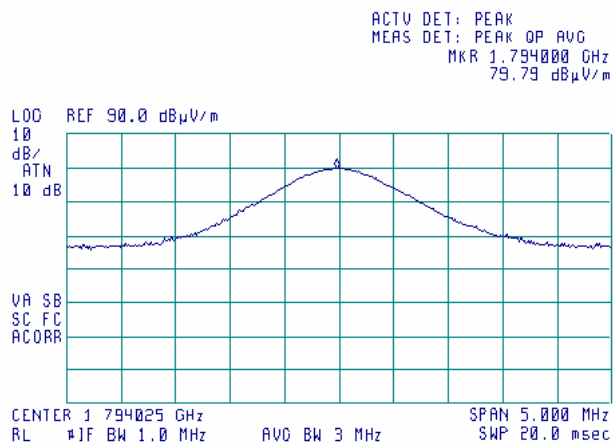
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

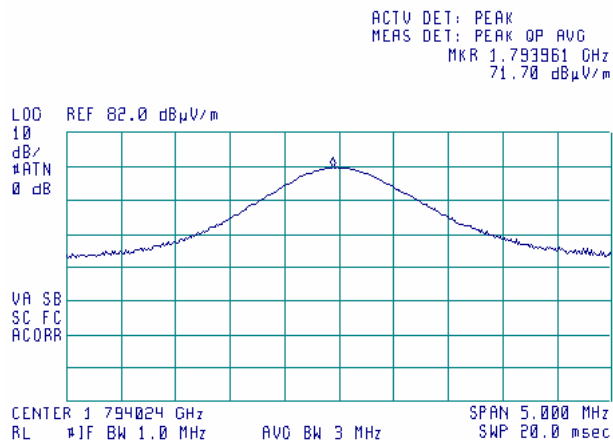
Plot 7.1.7 Radiated emission measurements at the 2nd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.1.8 Radiated emission measurements at the 2nd harmonic

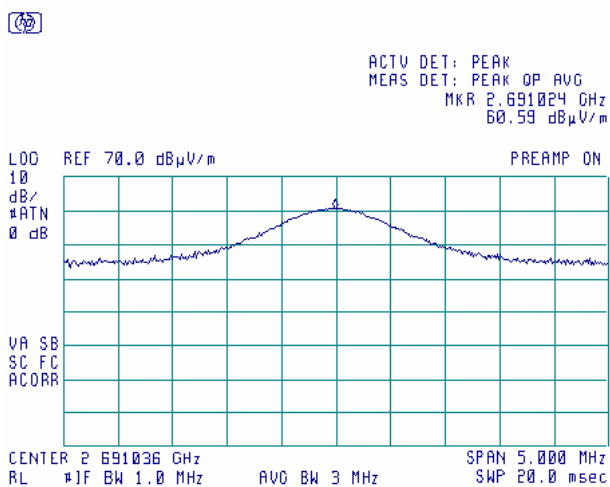
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

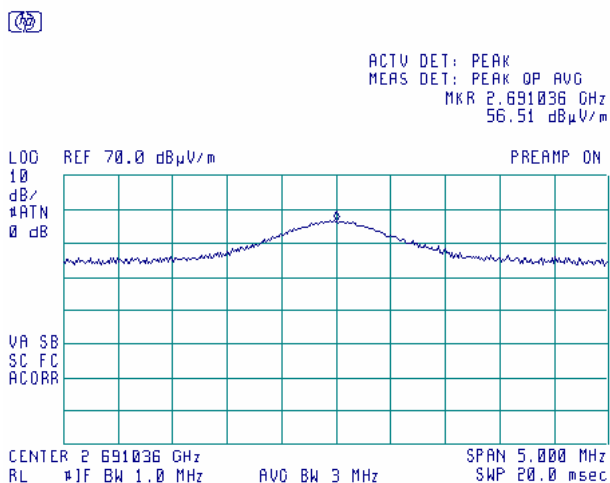
Plot 7.1.9 Radiated emission measurements at the 3rd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.1.10 Radiated emission measurements at the 3rd harmonic

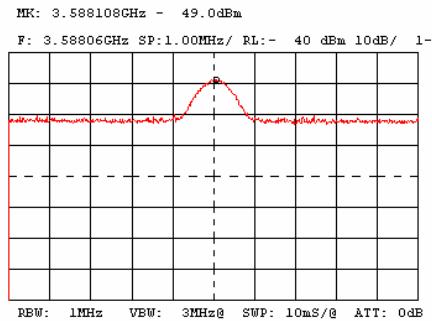
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

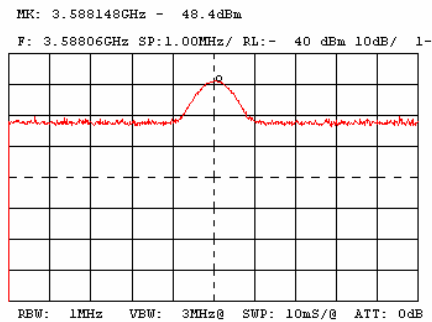
Plot 7.1.11 Radiated emission measurements at the 4th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.1.12 Radiated emission measurements at the 4th harmonic

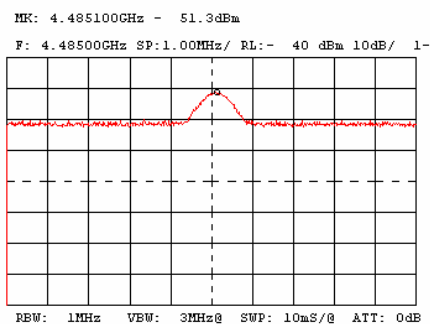
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

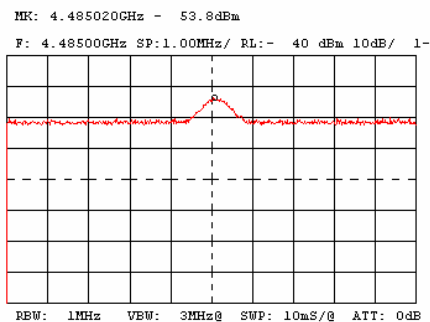
Plot 7.1.13 Radiated emission measurements at the 5th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.1.14 Radiated emission measurements at the 5th harmonic

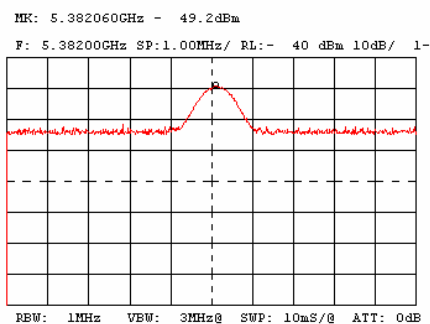
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

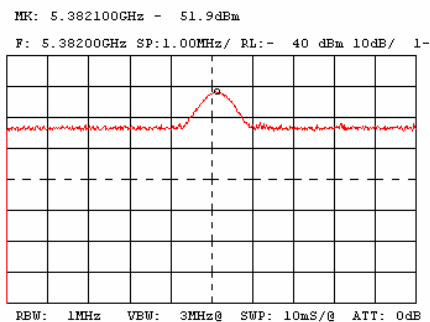
Plot 7.1.15 Radiated emission measurements at the 6th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.1.16 Radiated emission measurements at the 6th harmonic

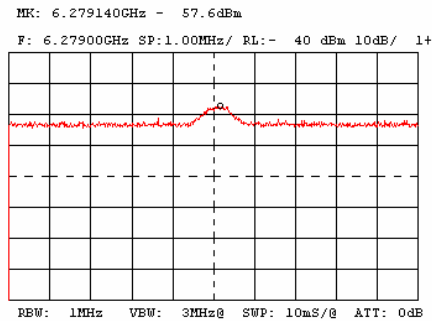
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

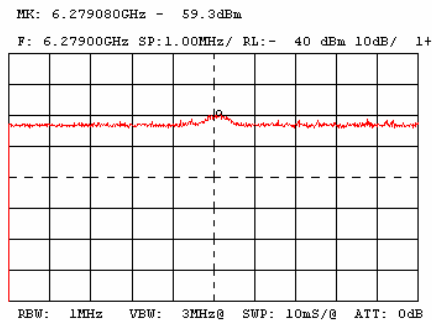
Plot 7.1.17 Radiated emission measurements at the 7th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.1.18 Radiated emission measurements at the 7th harmonic

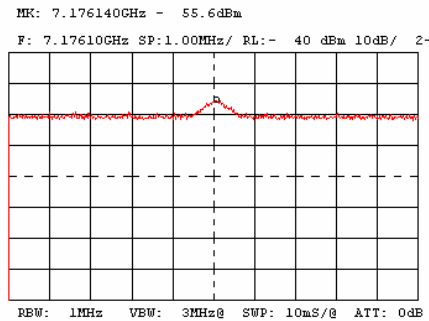
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

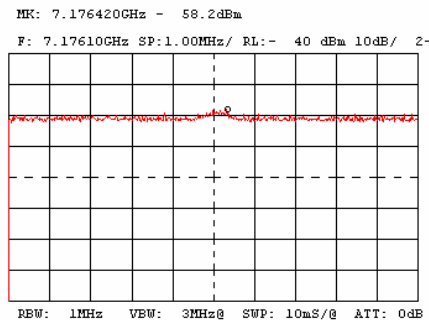
Plot 7.1.19 Radiated emission measurements at the 8th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.1.20 Radiated emission measurements at the 8th harmonic

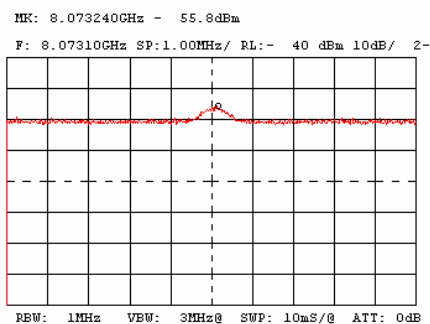
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

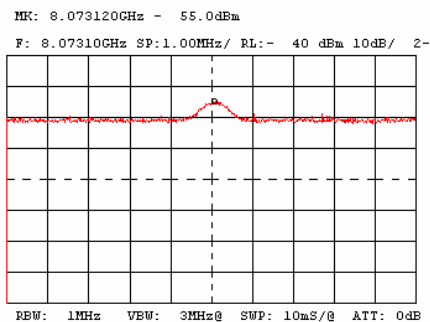
Plot 7.1.21 Radiated emission measurements at the 9th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.1.22 Radiated emission measurements at the 9th harmonic

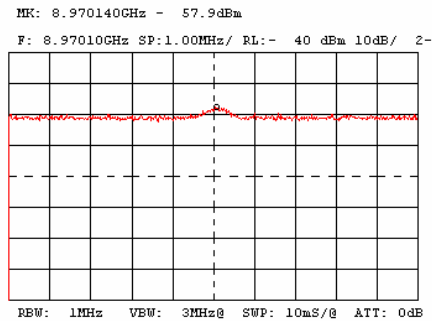
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for low power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

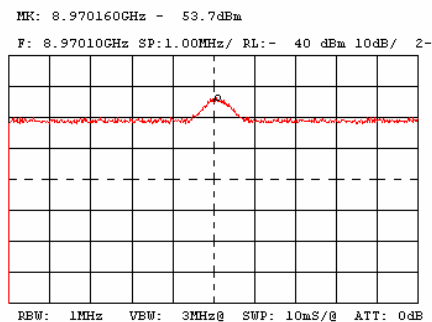
Plot 7.1.23 Radiated emission measurements at the 10th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.1.24 Radiated emission measurements at the 10th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

7.2 Radiated spurious emission measurements for high power

7.2.1 General

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

Table 7.2.1 Radiated spurious emission test limits

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

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier

** - P is transmitter output power in Watts

*** - Equivalent field strength limit was calculated from maximum allowed 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

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

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

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

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.2 and shown in the associated plots.

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

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.

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

7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.2.2 and shown in the associated plots.

7.2.4 Test procedure for substitution ERP measurements of spurious

7.2.4.1 The test equipment was set up as shown in Figure 7.2.3 and energized.

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

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

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

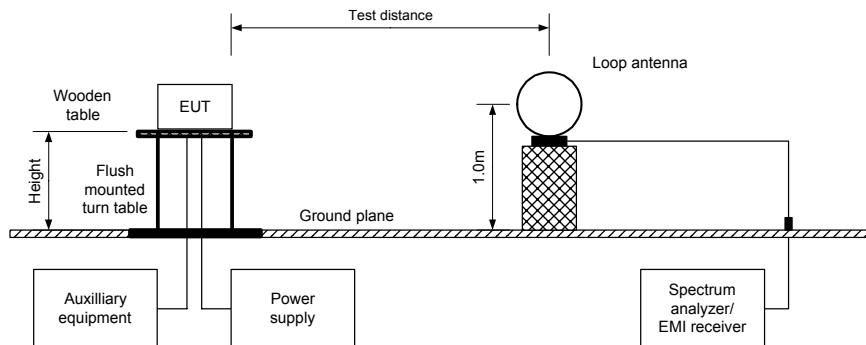
7.2.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

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

7.2.4.7 The worst test results (the lowest margins) were recorded in Table 7.2.3 and shown in the associated plots.

Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

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

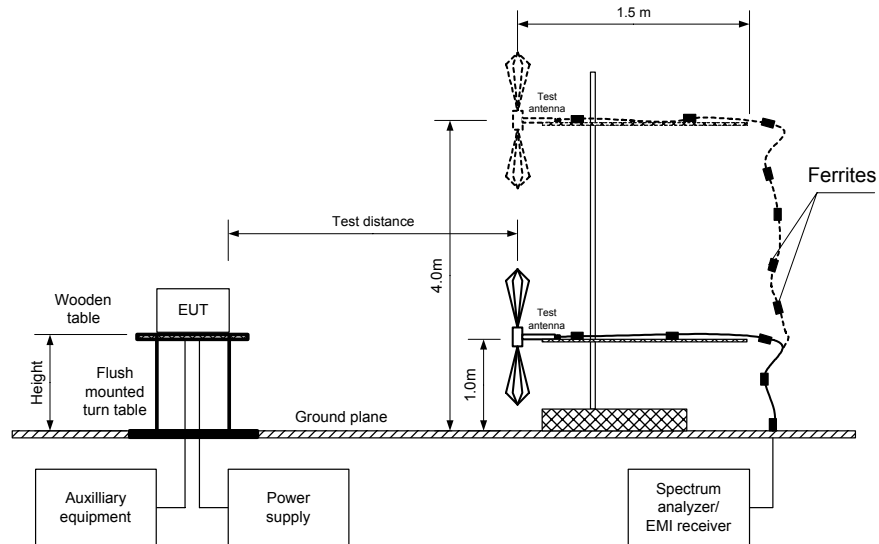


Photograph 7.2.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

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

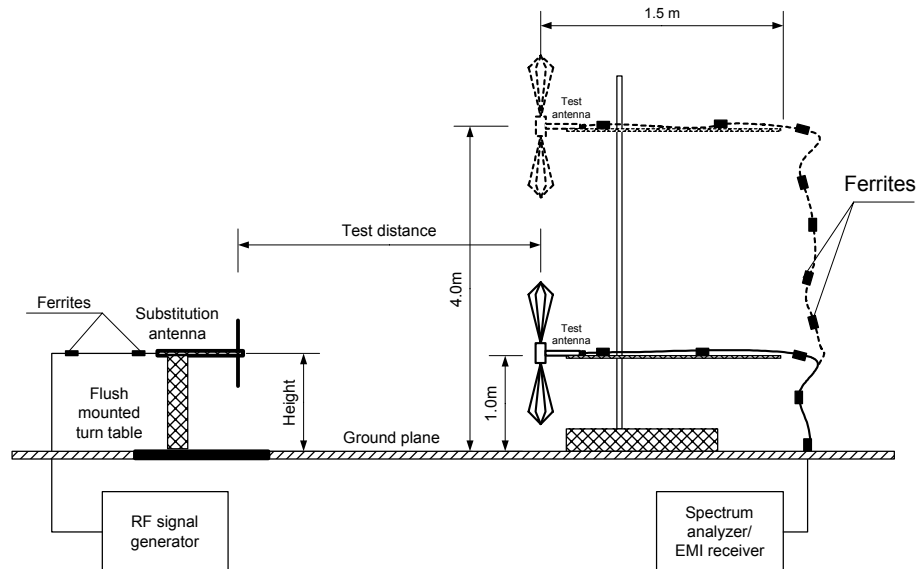


Photograph 7.2.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Figure 7.2.3 Setup for substitution ERP measurements of spurious



Photograph 7.2.3 Setup for substitution ERP measurements of spurious



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Table 7.2.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 896 – 901 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber / OATS
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 10000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Double ridged guide
MODULATION: FM
MODULATING SIGNAL: 1.0 kHz test tone
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Carrier frequency 897.0125 MHz							
1794.04	72.00	84.40	-12.40	1000	Vertical	1.1	270
1794.04	71.00	84.40	-13.40	1000	Horizontal	1.2	190
2691.00	65.50	84.40	-18.90	1000	Vertical	1.0	180
2691.00	68.00	84.40	-16.40	1000	Horizontal	1.5	180
3587.99	69.83	84.40	-14.57	1000	Vertical	1.3	180
3588.00	71.00	84.40	-13.40	1000	Horizontal	1.3	160
4485.04	60.67	84.40	-23.73	1000	Vertical	1.4	134
4485.03	60.50	84.40	-23.90	1000	Horizontal	1.0	195
5382.03	72.17	84.40	-12.23	1000	Vertical	1.1	176
5382.04	67.33	84.40	-17.07	1000	Horizontal	1.0	145
6279.09	58.67	84.40	-25.73	1000	Vertical	1.0	70
6729.04	59.17	84.40	-25.23	1000	Horizontal	1.1	199
7176.08	61.67	84.40	-22.73	1000	Vertical	1.0	189
7176.06	62.33	84.40	-22.07	1000	Horizontal	1.2	233
8073.12	67.17	84.40	-17.23	1000	Vertical	1.3	180
8073.12	64.50	84.40	-19.90	1000	Horizontal	1.4	167
8970.11	65.33	84.40	-19.07	1000	Horizontal	1.0	187
8970.06	62.00	84.40	-22.40	1000	Horizontal	1.0	234

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

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

Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Table 7.2.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 896 – 901 MHz
 TRANSMITTER CARRIER ERP: 44.77 dBm
 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	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Attenuation below carrier, dBc	Limit, dBm	Margin, dB*	Verdict
Carrier frequency 897.0125 MHz											
1794.04	72.00	1000	Vertical	-31.00	6.30	3.40	-28.10	72.87	-13.00	-15.10	Pass
1794.04	71.00	1000	Horizontal	-32.00	6.30	3.40	-29.10	73.87	-13.00	-16.10	Pass
2691.00	65.50	1000	Vertical	-36.50	7.30	4.25	-33.45	78.22	-13.00	-20.45	Pass
2691.00	68.00	1000	Horizontal	-34.80	7.30	4.25	-31.75	76.52	-13.00	-18.75	Pass
3587.99	69.83	1000	Vertical	-32.17	6.50	4.90	-30.57	75.34	-13.00	-17.57	Pass
3588.00	71.00	1000	Horizontal	-31.00	8.00	4.90	-27.90	72.67	-13.00	-14.90	Pass
5382.03	72.17	1000	Vertical	-30.43	8.00	6.14	-28.57	73.34	-13.00	-15.57	Pass
5382.04	67.33	1000	Horizontal	-34.17	8.00	6.14	-32.31	77.08	-13.00	-19.31	Pass
8073.12	67.17	1000	Vertical	-34.61	8.90	7.40	-33.11	77.88	-13.00	-20.11	Pass

*- Margin = ERP – specification limit.

Reference numbers of test equipment used

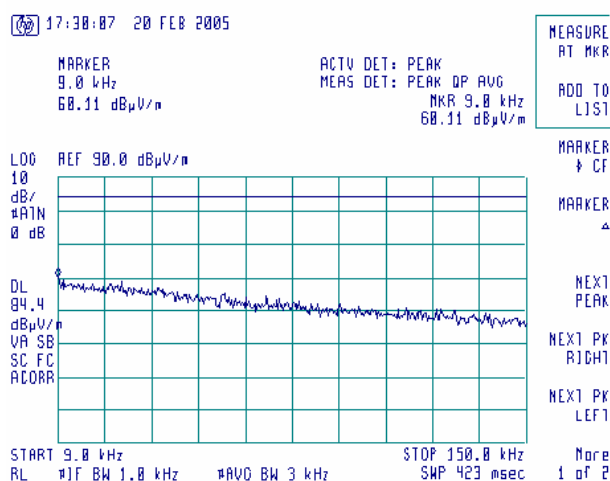
HL 0410	HL 0446	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604
HL 0661	HL 0784	HL 0813	HL 1004	HL 1424	HL 1430	HL 1552	HL 1942
HL 1947	HL 1984	HL 2009	HL 2259	HL 2387	HL 2432	HL 2499	

Full description is given in Appendix A.

Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

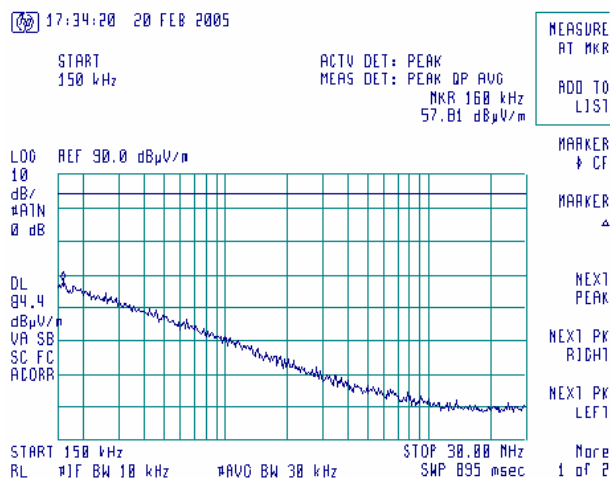
Plot 7.2.1 Radiated emission measurements in 9 - 150 kHz range

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Plot 7.2.2 Radiated emission measurements in 0.15 - 30 MHz range

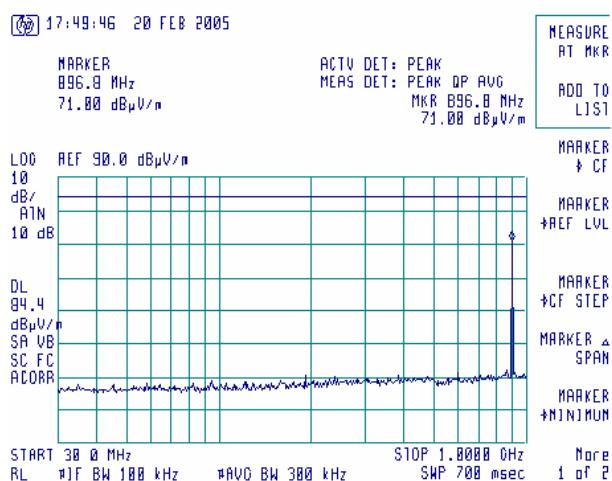
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

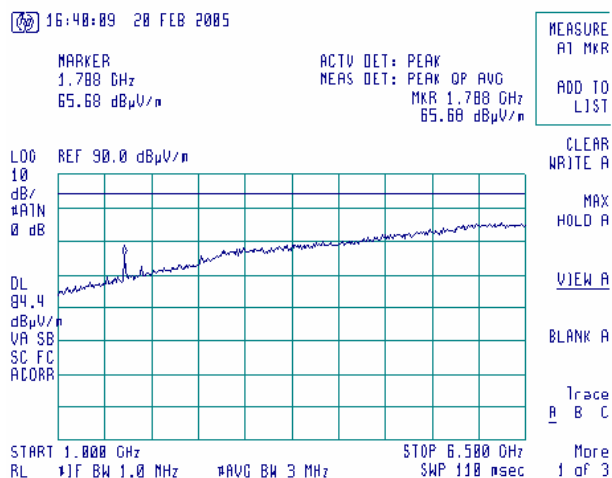
Plot 7.2.3 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Plot 7.2.4 Radiated emission measurements in 1000 – 6500 MHz range

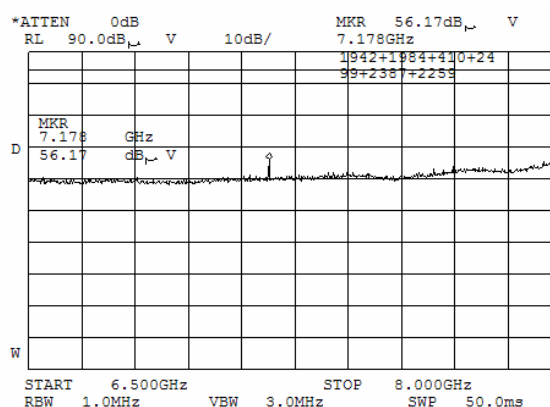
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

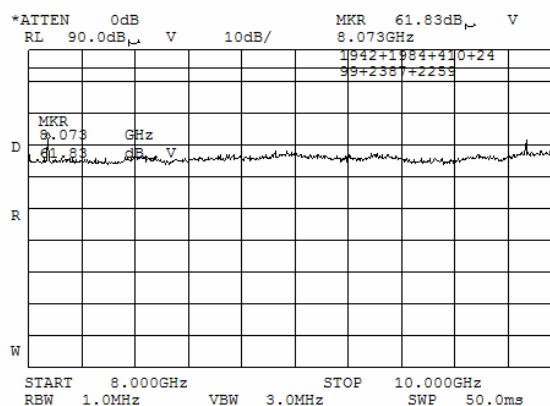
Plot 7.2.5 Radiated emission measurements in 6500 – 8000 MHz range

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Plot 7.2.6 Radiated emission measurements in 8000 – 10000 MHz range

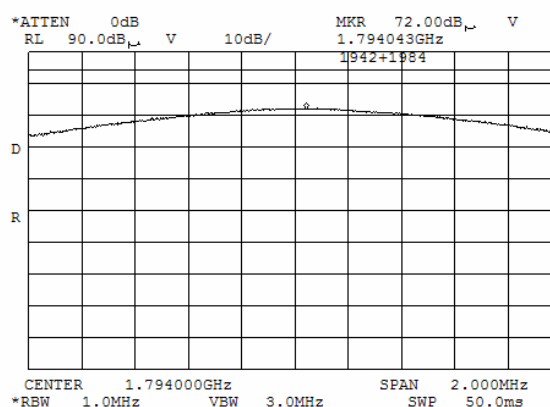
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

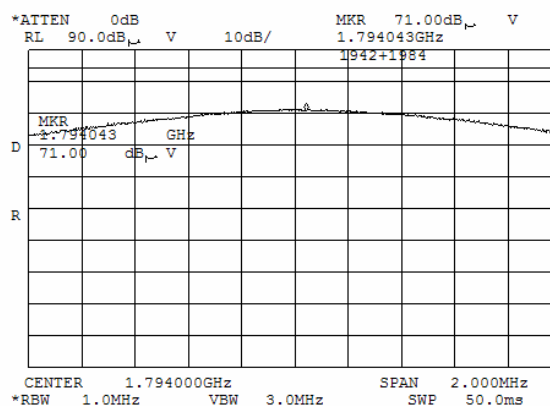
Plot 7.2.7 Radiated emission measurements at the 2nd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.2.8 Radiated emission measurements at the 2nd harmonic

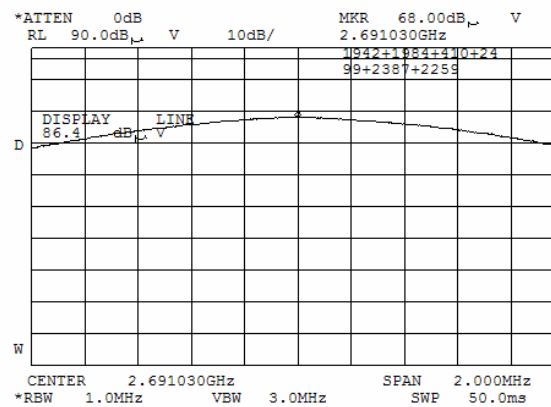
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

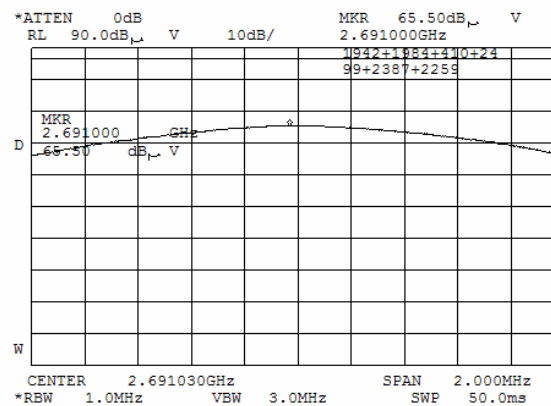
Plot 7.2.9 Radiated emission measurements at the 3rd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.2.10 Radiated emission measurements at the 3rd harmonic

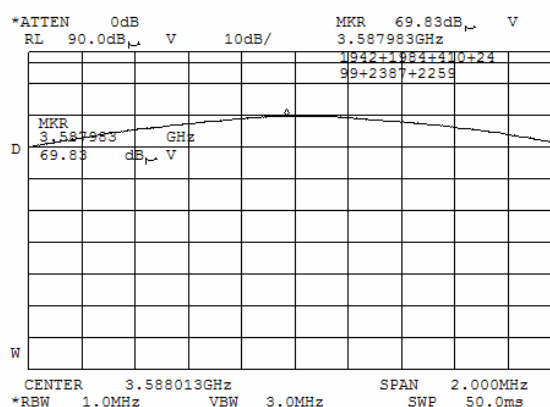
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

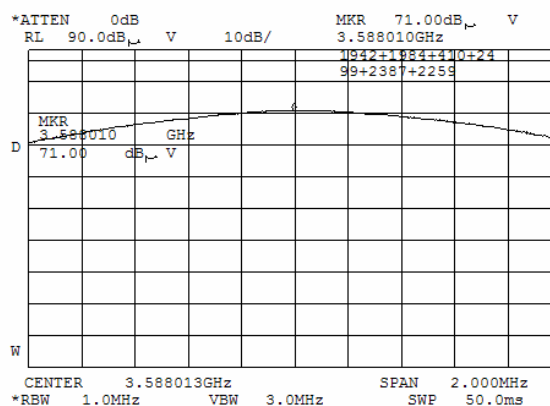
Plot 7.2.11 Radiated emission measurements at the 4th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.2.12 Radiated emission measurements at the 4th harmonic

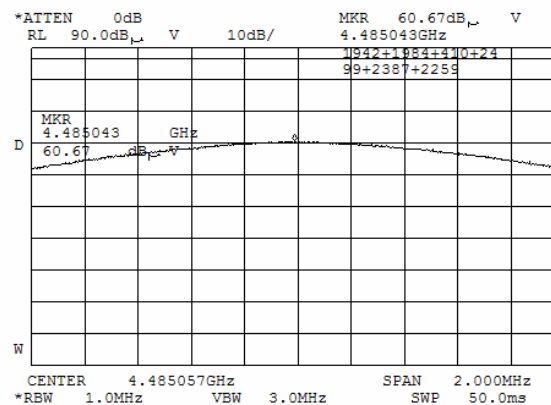
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

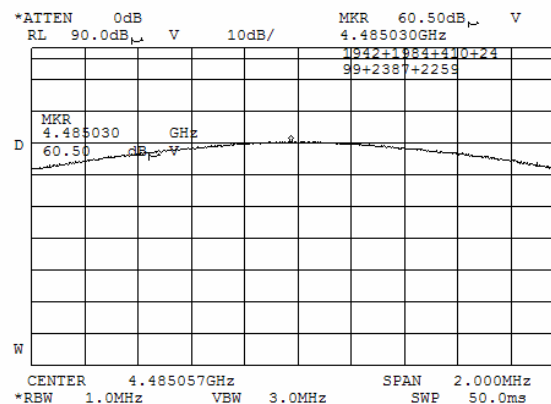
Plot 7.2.13 Radiated emission measurements at the 5th harmonic

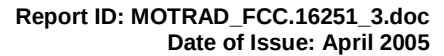
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.2.14 Radiated emission measurements at the 5th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m

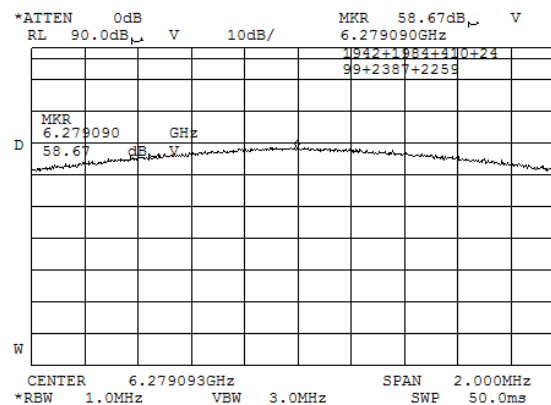




Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

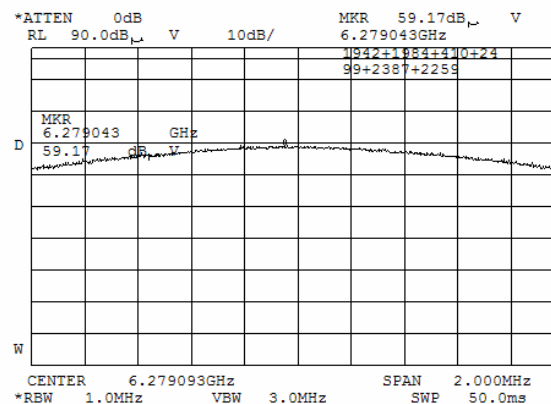
Plot 7.2.17 Radiated emission measurements at the 7th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.2.18 Radiated emission measurements at the 7th harmonic

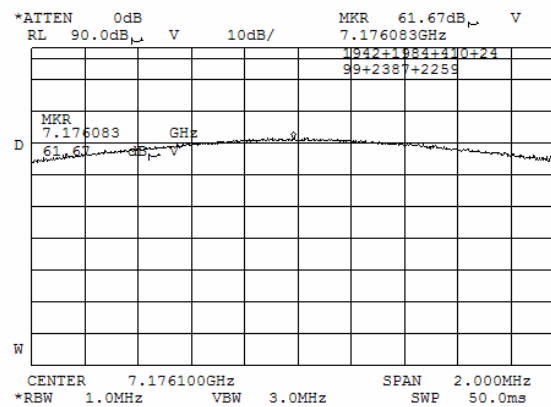
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

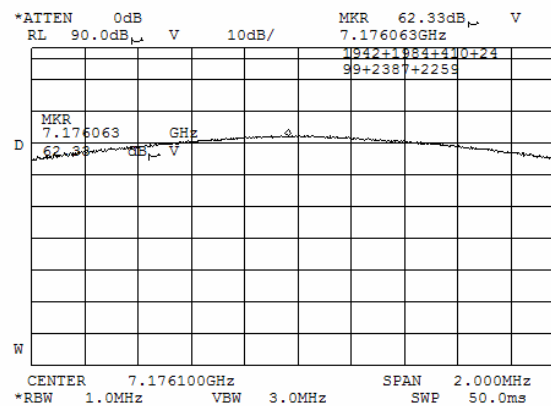
Plot 7.2.19 Radiated emission measurements at the 8th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.2.20 Radiated emission measurements at the 8th harmonic

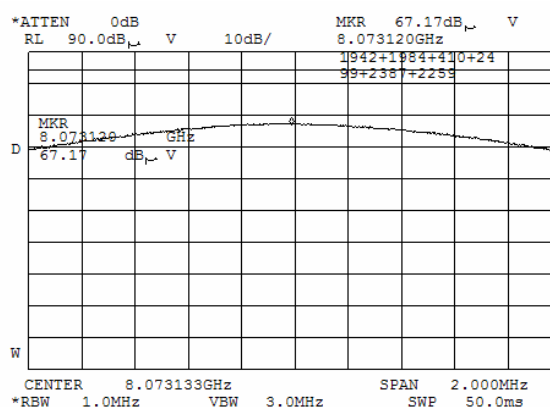
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

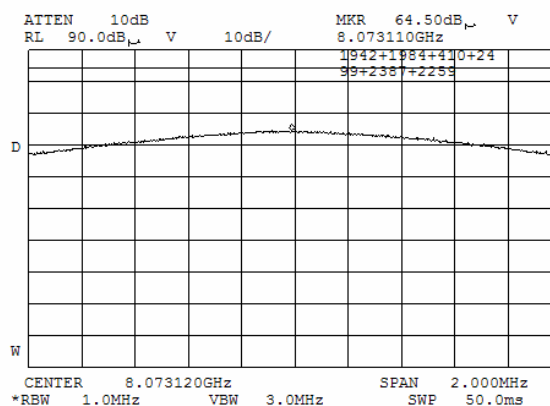
Plot 7.2.21 Radiated emission measurements at the 9th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.2.22 Radiated emission measurements at the 9th harmonic

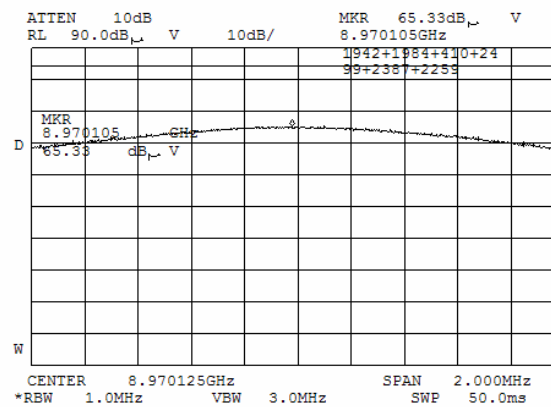
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions for high power		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/15/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

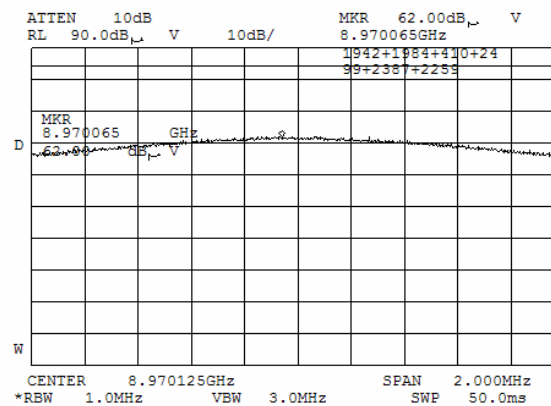
Plot 7.2.23 Radiated emission measurements at the 10th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.2.24 Radiated emission measurements at the 10th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	2/20/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

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

8.1 Radiated emission measurements

8.1.1 General

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

Table 8.1.1 Radiated emission test limits

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

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

8.1.2 Test procedure

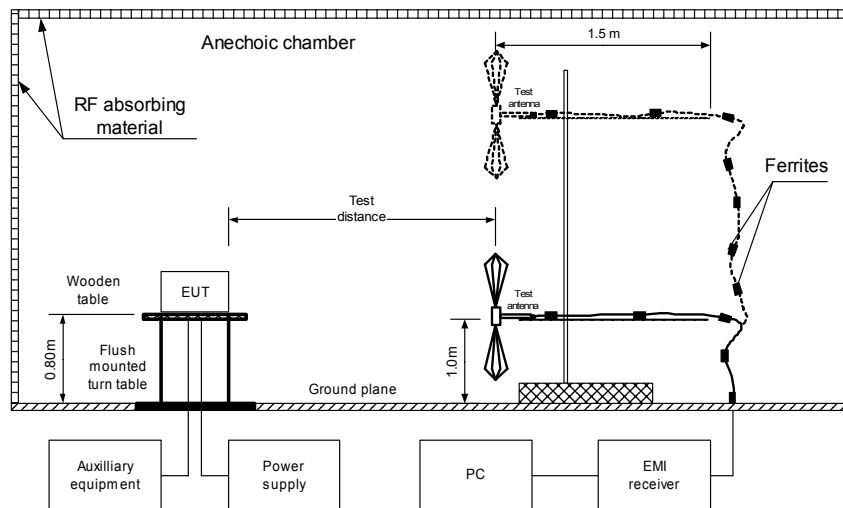
8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

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

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

Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	2/20/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

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



Photograph 8.1.1 Setup for radiated emission measurements



Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	2/20/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

Table 8.1.2 Radiated emission test results

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

Resolution bandwidth: 120 kHz					Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak						
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
Rx frequency 936.0125 MHz								
191.687500	30.14	27.76	43.50	-15.74	Vertical	1.2	123	Pass

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*				
Rx frequency 936.0125 MHz								
2587.97300	49.93	43.28	54.00	-10.72	Horizontal	1.45	234	Pass

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

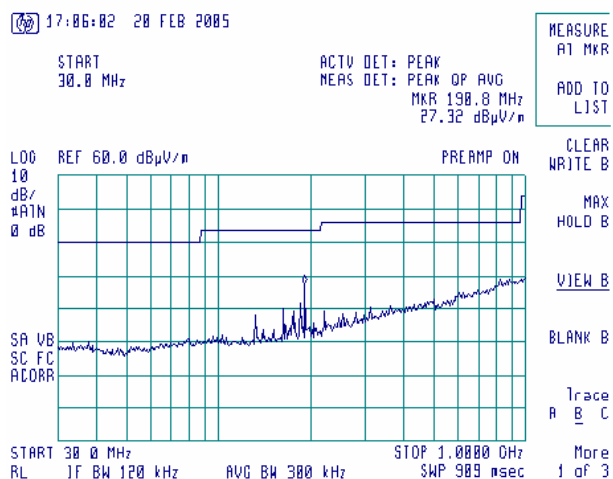
HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1004	HL 1947
HL 1984	HL 2009						

Full description is given in Appendix A.

Test specification:	Section 15.109, Radiated emissions, Class B		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	2/20/2005		
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 13.6 VDC
Remarks:			

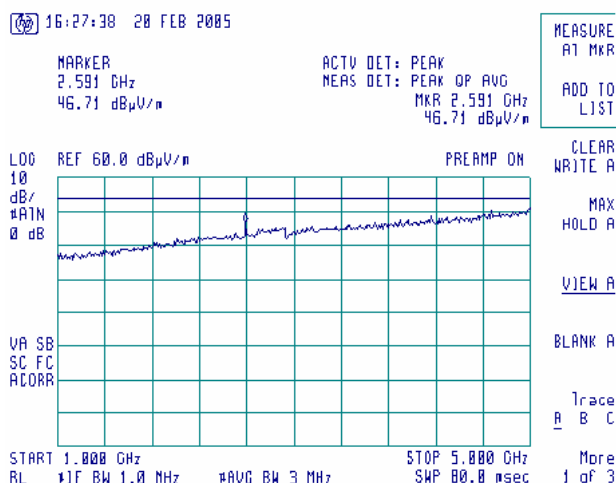
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by
Rx FREQUENCY: 936.0125 MHz



Plot 8.1.2 Radiated emission measurements in 1000 - 5000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by
Rx FREQUENCY: 936.0125 MHz



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0025	Spectrum analyzer, 10 kHz-23 GHz	Anritsu	MS-710C	5837	15-Oct-04	15-Oct-05
0410	Cable, Coax, Microwave, DC-18 GHz, N-N, 1 m	Gore	PFP01P010 394	9338767	17-Oct-04	17-Oct-05
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-04	28-Jun-05
0465	Anechoic Chamber 9(L) x 6,5(W) x 5,5(H) m	HL	AC - 1	023	10-Oct-04	10-Oct-05
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-2.9 GHz	Hewlett Packard	8546A	3617A00319, 3448A00253	11-Nov-04	11-Nov-05
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	11-Nov-04	11-Nov-05
0593	Antenna mast, 1-4 m/ 1-6 m Pneumatic	HL	AM-F1	101	03-Feb-05	03-Feb-06
0594	Turntable for anechoic chamber, flush mounted, d=1.2 m, pneumatic	HL	WDC1	102	27-Jan-05	27-Jan-06
0604	Antenna biconilog log-periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-05	10-Jan-06
0661	Generator swept signal, 10MHz to 40GHz+ 10dBm	Hewlett Packard	83640B	3614A00266	14-Sep-04	14-Sep-05
0813	Cable, coax, RG-214, 12 m, N-type connectors	HL	C214-12	149	02-Dec-04	02-Dec-05
1004	Cable, coaxial ANDREW PSWJ4,6 m	HL	ANDREW-6	163	02-Dec-04	02-Dec-05
1365	Cable coaxial, RG-214, 5 m	HL	C214-5	1365	02-Dec-04	02-Dec-05
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A00219	30-Aug-04	30-Aug-05
1430	EMI receiver, 9 kHz – 2.9 GHz	Agilent Technologies	8542E	3807A00262, 3705A00217	01-Sep-04	01-Sep-05
1552	Cable RF, 8 m	Alpha Wire	RG-214	1552	02-Dec-04	02-Dec-05

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
1941	Cable 18GHz, 4 m, green	Rhophase Microwave Ltd.	SPS-1803A-4000-NPS	T4657	17-Oct-04	17-Oct-05
1942	Cable 18GHz, 4 m, blue	Rhophase Microwave Ltd.	SPS-1803A-4000-NPS	T4658	17-Oct-04	17-Oct-05
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Ltd.	NPS-1803A-6500-NPS	T4974	17-Oct-04	17-Oct-05
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	21-Jul-04	21-Jul-05
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-04	02-Dec-05
2258	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0222	21-Jul-04	21-Jul-05
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	21-Jul-04	21-Jul-05
2387	Filter Bandpass, 8-14 GHz	HL	FBP8-14	2387	21-Jul-04	21-Jul-05
2399	Cable 40GHz, 1.5 m, blue	Rhophase Microwave Ltd.	KPS-1503A-1500-KPS	X2945	24-Jun-04	24-Jun-05
2400	Cable 40GHz, 1.5 m, green	Rhophase Microwave Ltd.	KPS-1503A-1500-KPS	X2946	24-Jun-04	24-Jun-05
2432	Antenna, double ridged waveguide horn	EMC Test Systems	3115	000271777	02-Jul-04	02-Jul-05
2499	Quadruplexer 1-12 GHz (1-2 GHz; 2-4GHz;4-8 GHz; 8-12GHz)	Elettronica S.p.A. - Roma	UE 84	D/00239	06-Feb-05	06-Feb-06

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Unintentional radiator tests	
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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e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

47CFR part 90: 2004	Private land mobile radio services
47CFR part 1: 2004	Practice and procedure
47CFR part 2: 2004	Frequency allocations and radio treaty matters; general rules and regulations
47CFR part 15: 2004	Radio Frequency Devices.
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
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
AF	antenna factor
AG	amplifier gain
AVRG	average (detector)
CL	cable loss
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
DC	direct current
DTS	digital transmission system
E	equivalent field strength
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
FHSS	frequency hopping spread spectrum
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
μs	microsecond
NA	not applicable
OATS	open area test site
Ω	Ohm
PCB	printed circuit board
PM	pulse modulation
PS	power supply
ppm	part per million (10 ⁻⁶)
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
SA	spectrum analyzer
T	temperature
Tx	transmit
V	volt

14 APPENDIX F Test equipment correction factors

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 18 GHz, 4 m, blue, model: SPS-1803A-4000-NPS, S/N 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

Insertion loss
Cable 18 GHz, 6.5 m, blue, model: NPS-1803A-6500-NPS, S/N T4974, HL 1947,
Cable coax microwave, 1 m, model: PFP01P10394, HL 0410

Frequency, GHz	Insertion Loss, dB		
	HL0410	HL0412	HL1947
0.03	0.04	0.09	0.37
0.05	0.06	0.13	0.46
0.1	0.08	0.18	0.63
0.2	0.11	0.27	0.86
0.3	0.13	0.34	1.05
0.5	0.19	0.47	1.34
0.7	0.23	0.57	1.58
0.9	0.26	0.67	1.80
1.1	0.30	0.76	2.00
1.3	0.32	0.84	2.17
1.5	0.33	0.93	2.34
1.7	0.39	1.01	2.49
1.9	0.38	1.08	2.64
2.1	0.43	1.11	2.78
2.3	0.44	1.19	2.92
2.5	0.48	1.29	3.07
2.7	0.49	1.31	3.17
2.9	0.49	1.37	3.28
3.1	0.53	1.44	3.39
3.3	0.50	1.47	3.50
3.5	0.58	1.51	3.61
3.7	0.56	1.54	3.72
3.9	0.71	1.64	3.81
4.1	0.66	1.71	3.92
4.3	0.79	1.73	4.03
4.5	0.72	1.78	4.10
4.7	0.71	1.90	4.22
4.9	0.68	1.85	4.30
5.1	0.65	1.82	4.40
5.3	0.66	1.89	4.54
5.5	0.78	1.95	4.61
5.7	0.86	2.02	4.74
5.9	0.85	2.07	4.84
6.1	0.99	2.20	4.90
6.3	0.82	2.21	4.98
6.5	0.87	2.15	5.03
6.7	0.77	2.14	5.09
6.9	0.81	2.17	5.18
7.1	0.84	2.16	5.25
7.3	0.97	2.18	5.35
7.5	0.90	2.23	5.41
7.7	0.90	2.24	5.49

Frequency, GHz	Insertion Loss, dB		
	HL0410	HL0412	HL1947
7.9	0.96	2.31	5.53
8.1	0.83	2.33	5.62
8.3	1.02	2.30	5.67
8.5	0.94	2.39	5.75
8.7	1.14	2.45	5.80
8.9	1.06	2.44	5.87
9.1	1.23	2.40	5.95
9.3	1.02	2.42	6.03
9.5	1.04	2.42	6.10
9.7	1.09	2.44	6.20
9.9	1.05	2.47	6.29
10.1	1.29	2.50	6.41
10.3	1.24	2.50	6.49
10.5	1.39	2.56	6.58
10.7	1.17	2.44	6.63
10.9	1.39	2.44	6.70
11.1	1.11	2.57	6.77
11.3	1.31	2.66	6.79
11.5	1.15	2.65	6.85
11.7	1.18	2.66	6.91
11.9	1.20	2.71	6.95
12.1	1.21	2.75	7.02
12.4	1.20	2.78	7.10
13.0	1.22	2.85	7.28
13.5	1.38	2.88	7.47
14.0	1.56	2.98	7.69
14.5	1.34	2.99	7.86
15.0	1.56	3.06	7.96
15.5	1.65	3.21	8.06
16.0	1.35	3.29	8.31
16.5	1.47	3.29	8.51
17.0	1.60	3.38	8.73
17.5	1.55	3.41	8.80
18.0	1.93	3.62	8.99

Cable loss
Cable Coaxial, GORE A2P01POL118, 2.3 m, model:GORE-3, HL 0589
+ Cable Coaxial, ANDREW PSWJ4, 6m, model: ANDREW-6, 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		
18	3300	3.47		±0.17
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
RF cable 8 m, model RG-214, 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		

Calibration data
RF cable 8 m, model RG-214, serial number 1552, HL 1552

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB
1	Insertion Loss	20	0.27	-	NA	±0.12
2		30	0.31	-		
3		50	0.40	-		
4		80	0.49	-		
5		100	0.55	-		
6		200	0.80	-		
7		300	0.99	-		
8		400	1.17	-		
9		500	1.32	-		
10		600	1.45	-		
11		700	1.60	-		
12		800	1.72	-		
13		900	1.84	-		
14		1000	2.00	-		
15		1200	2.19	-		
16		1400	2.40	-		
17		1500	2.51	-		
18		1600	2.61	-		
19		1800	2.82	-		
20		2000	3.00	-		

Calibration data
RF cable 12 m, RG-214, model C214-12, serial number 149, HL 813

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB
1	Insertion Loss	20	0.43	-	NA	±0.12
2		30	0.53	-		
3		50	0.71	-		
4		80	0.92	-		
5		100	1.04	-		
6		200	1.51	-		
7		300	1.90	-		
8		400	2.26	-		
9		500	2.54	-		
10		600	2.83	-		
11		700	3.12	-		
12		800	3.37	-		
13		900	3.61	-		
14		1000	3.85	-		
15		1200	4.31	-		
16		1400	4.74	-		
17		1500	4.92	-		
18		1600	5.17	-		
19		1800	5.58	-		
20		2000	5.95	-		

Cable 18GHz, 4 m, green, model: SPS-1803A-4000-NPS, s/n T4657 (HL 1941)
Calibration data

Frequency, GHz	Insertion Loss, dB
	HL1941
0.03	0.19
0.05	0.24
0.10	0.33
0.20	0.46
0.30	0.57
0.40	0.65
0.50	0.73
0.60	0.80
0.70	0.87
0.80	0.92
0.90	0.98
1.00	1.03
1.10	1.08
1.20	1.14
1.30	1.18
1.40	1.22
1.50	1.27
1.60	1.32
1.70	1.35
1.80	1.40
1.90	1.43
2.00	1.46
2.10	1.50
2.20	1.54
2.30	1.57
2.40	1.61
2.50	1.64
2.60	1.67
2.70	1.70
2.80	1.74
2.90	1.77
3.10	1.83
3.30	1.89
3.50	1.95
3.70	2.01
3.90	2.07
4.10	2.14
4.30	2.18
4.50	2.26
4.70	2.31
4.90	2.32
5.10	2.42
5.30	2.45
5.50	2.47
5.70	2.53
5.90	2.59

Frequency, GHz	Insertion Loss, dB
	HL1941
6.10	2.63
6.30	2.66
6.50	2.72
6.70	2.77
6.90	2.78
7.10	2.81
7.30	2.87
7.50	2.92
7.70	2.94
7.90	3.02
8.10	3.06
8.30	3.13
8.50	3.14
8.70	3.16
8.90	3.23
9.10	3.20
9.30	3.22
9.50	3.31
9.70	3.32
9.90	3.39
10.10	3.42
10.30	3.46
10.50	3.46
10.70	3.48
10.90	3.50
11.10	3.58
11.30	3.63
11.50	3.65
11.70	3.85
11.90	3.81
12.10	3.84
12.40	3.91
13.00	3.87
13.50	3.99
14.00	4.12
14.50	4.17
15.00	4.27
15.50	4.33
16.00	4.38
16.50	4.38
17.00	4.42
17.50	4.61
18.00	4.78

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 coaxial, RG-214, 5m, model: C214-5, s/n 1365 (HL 1365)
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (specification), dB	Measured uncertainty dB
1	Insertion Loss	1000	0.41	-	NA	±0.12
2		1200	0.44	-		
3		1400	0.48	-		
4		1600	0.52	-		
5		1800	0.55	-		
6		2000	0.58	-		
7		2200	0.61	-		
8		2400	0.64	-		±0.17
9		2600	0.67	-		
10		2800	0.7	-		
11		3000	0.73	-		
12		3300	0.79	-		
13		3600	0.84	-		
14		3900	0.94	-		
15		4200	1.22	-		

Cable RF 40 GHz, 1.5m, blue, model: KPS-1503A-1500-KPS, s/n X2945 (HL 2399)
Insertion loss

Frequency, GHz	Insertion Loss, dB
0.03	0.26
0.05	0.25
0.1	0.34
0.2	0.47
0.3	0.56
0.5	0.71
0.7	0.83
0.9	0.93
1.1	1.01
1.3	1.08
1.5	1.16
1.7	1.22
1.9	1.29
2.1	1.33
2.3	1.38
2.5	1.45
2.7	1.50
2.9	1.55
3.1	1.60
3.3	1.66
3.5	1.71
3.7	1.75
3.9	1.79
4.1	1.84
4.3	1.87
4.5	1.91
4.7	1.95
4.9	1.98
5.1	2.02
5.3	2.04
5.5	2.07
5.7	2.11
5.9	2.12
6.1	2.16
6.3	2.20
6.5	2.23
6.7	2.23
6.9	2.27
7.1	2.32
7.3	2.32
7.5	2.34
7.7	2.38
7.9	2.39
8.1	2.39
8.3	2.43
8.5	2.51
8.7	2.48
8.9	2.51
9.1	2.54
9.3	2.53
9.5	2.56
9.7	2.54
9.9	2.57