

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 | <i>Neuman</i> |
| Reviewed by: | Ms. N. Averin, certification engineer | April 11, 2005 | <i>af</i> |
| | Mr. M. Nikishin, EMC group leader | April 11, 2005 | <i>MN</i> |
| Approved by: | Mr. A. Usoskin, C.E.O. | April 11, 2005 | <i>AU</i> |

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.

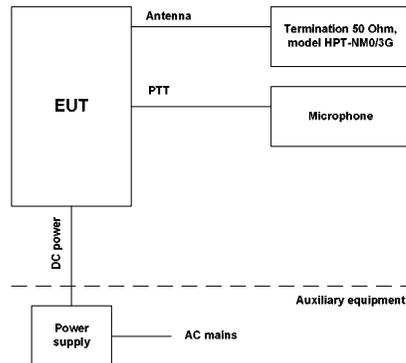
6.3 Operating frequencies

| 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.

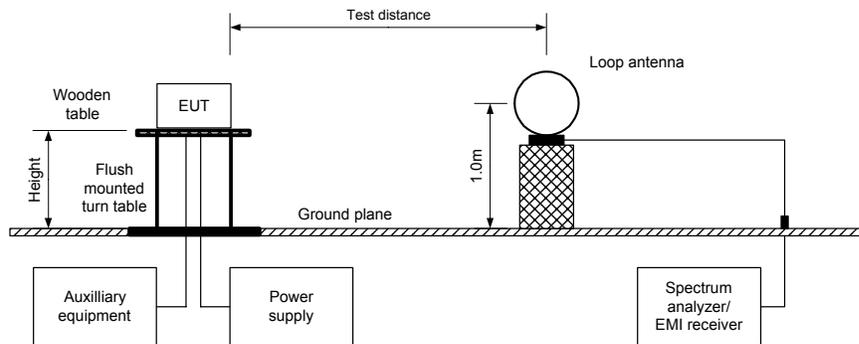
7.1.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

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

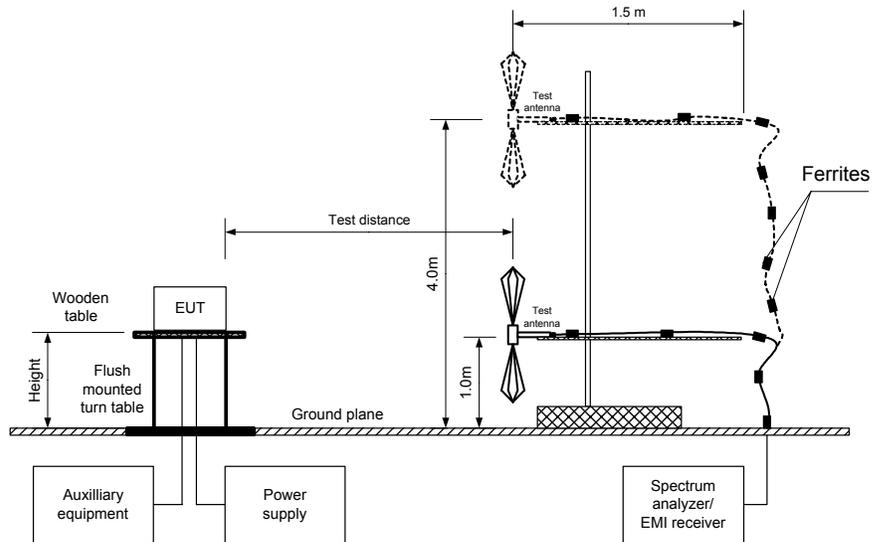


Photograph 7.1.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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

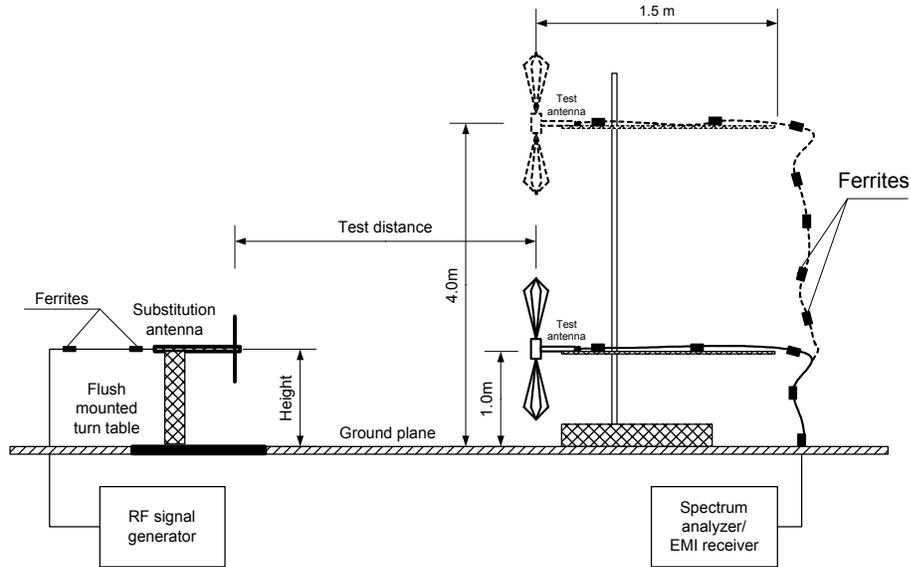


Photograph 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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.

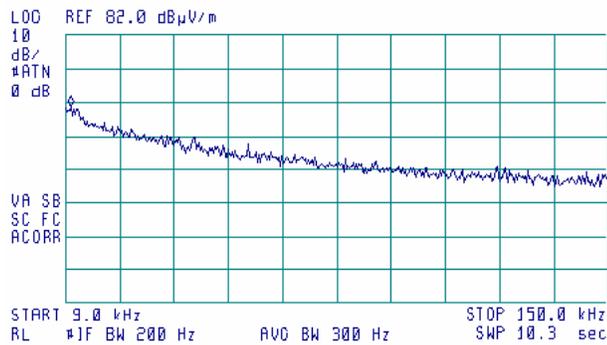
| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| Test specification: | Section 90.210, Radiated spurious emissions for low power | | |
| Test procedure: | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 | | |
| Test mode: | 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

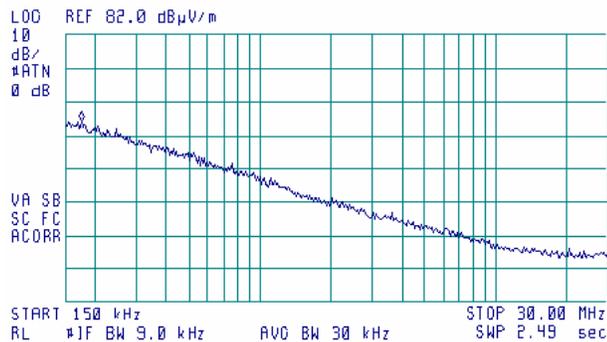


Plot 7.1.2 Radiated emission measurements in 0.15 - 30 MHz range

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

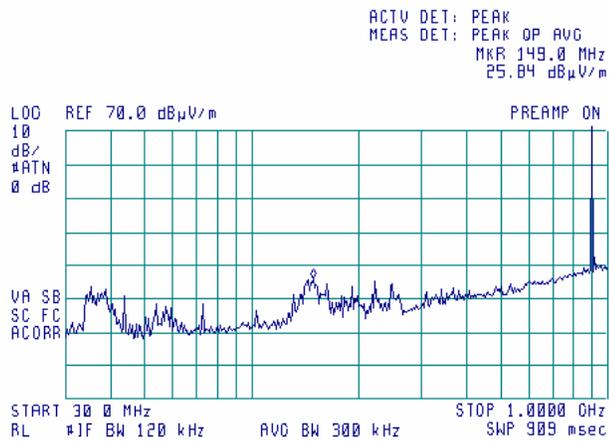


| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| Test specification: | Section 90.210, Radiated spurious emissions for low power | | |
| Test procedure: | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 | | |
| Test mode: | 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

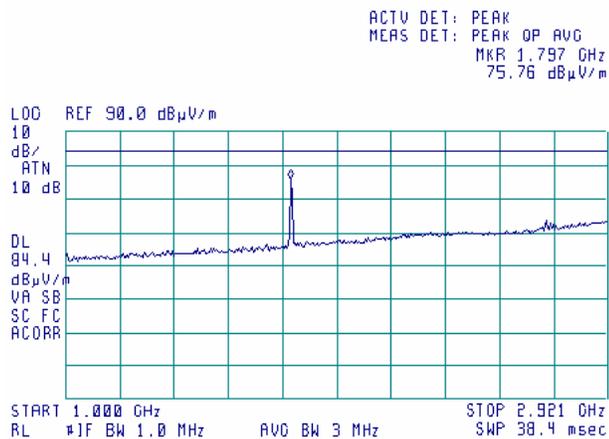
08:54:34 APR 10, 2005



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

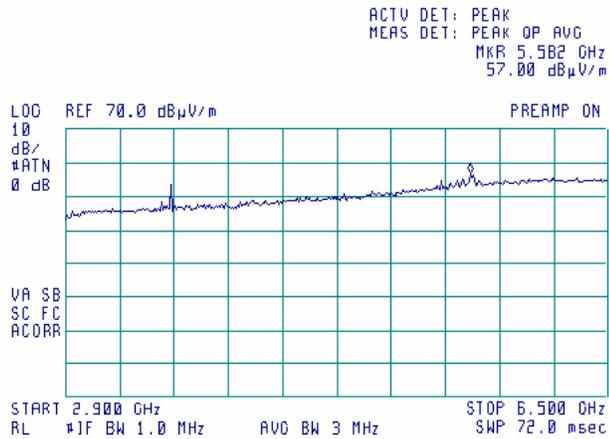


| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| Test specification: | Section 90.210, Radiated spurious emissions for low power | | |
| Test procedure: | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 | | |
| Test mode: | 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

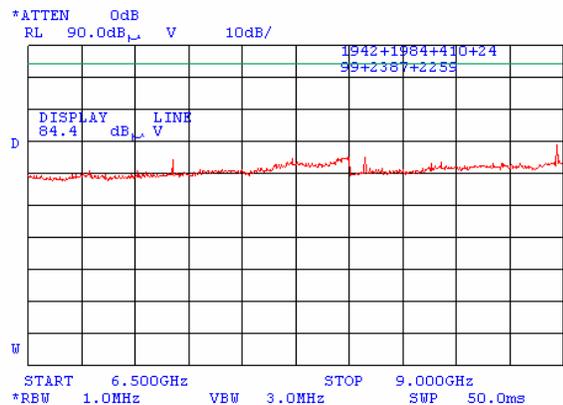
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m

08:20:18 APR 10, 2005



Plot 7.1.6 Radiated emission measurements in 6500 – 9000 MHz range

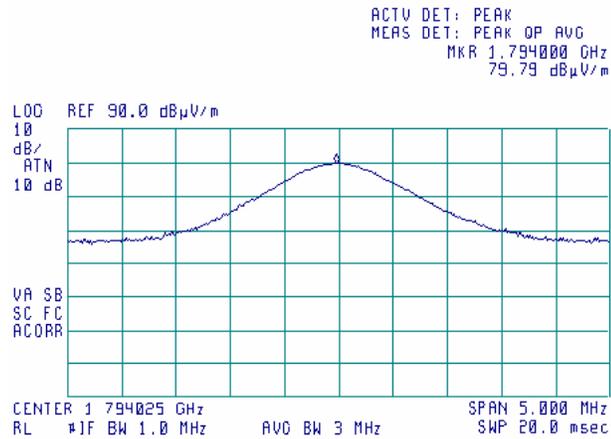
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

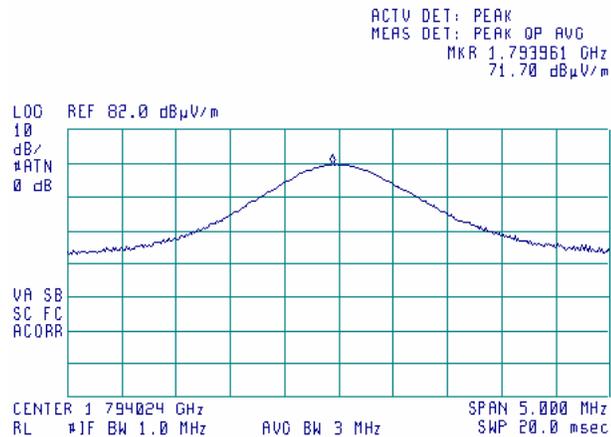
Plot 7.1.7 Radiated emission measurements at the 2nd harmonic

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

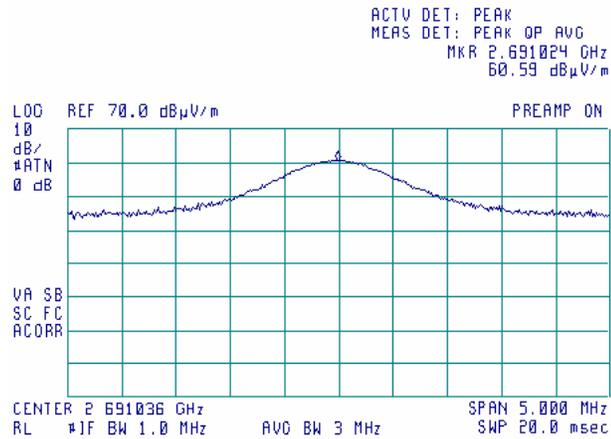
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

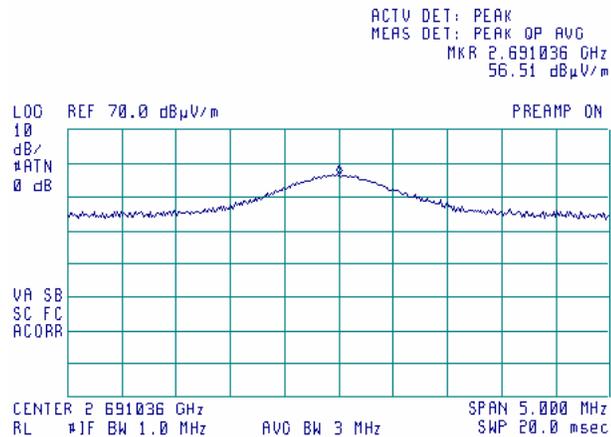
Plot 7.1.9 Radiated emission measurements at the 3rd harmonic

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

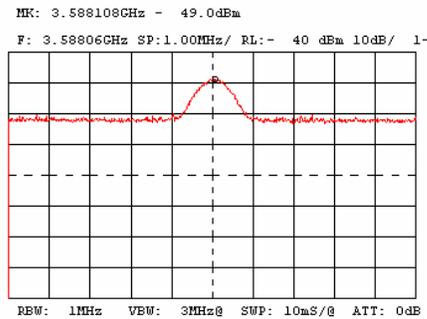
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

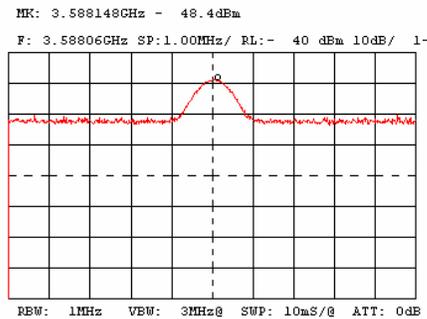
Plot 7.1.11 Radiated emission measurements at the 4th harmonic

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

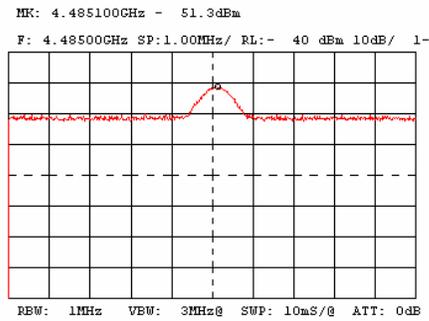
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

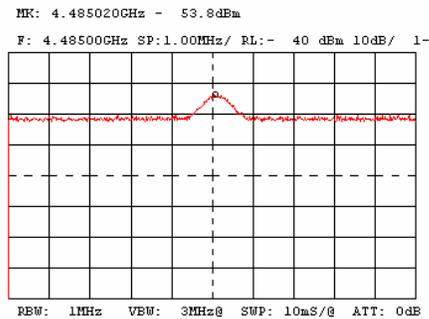
Plot 7.1.13 Radiated emission measurements at the 5th harmonic

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

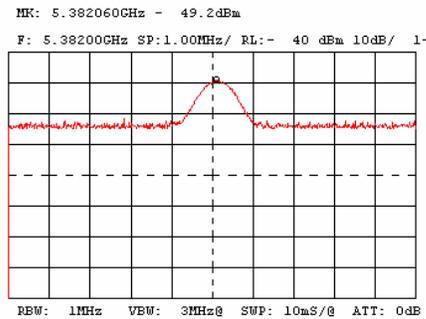
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

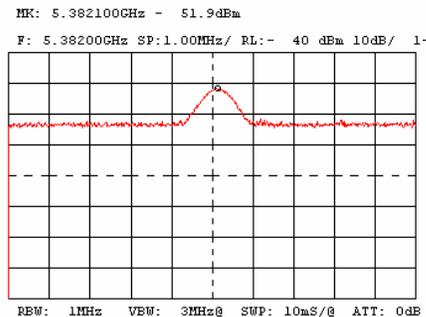
Plot 7.1.15 Radiated emission measurements at the 6th harmonic

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

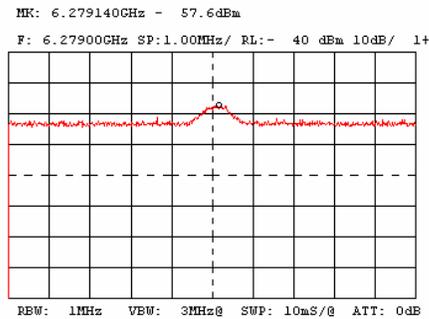
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

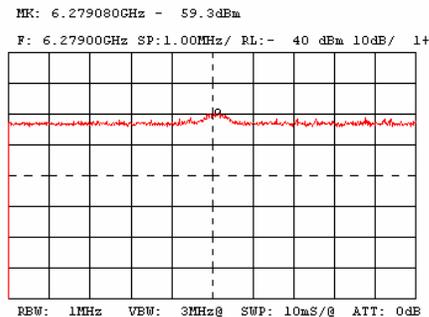
Plot 7.1.17 Radiated emission measurements at the 7th harmonic

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

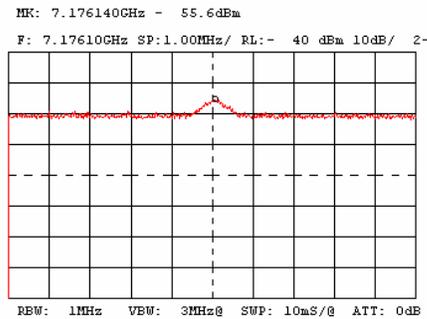
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

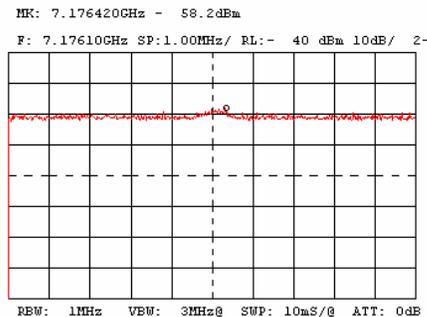
Plot 7.1.19 Radiated emission measurements at the 8th harmonic

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

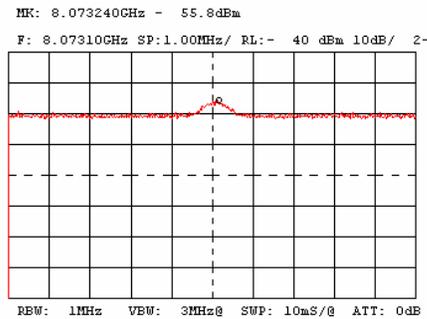
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

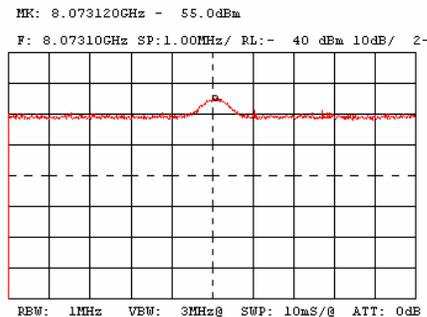
Plot 7.1.21 Radiated emission measurements at the 9th harmonic

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

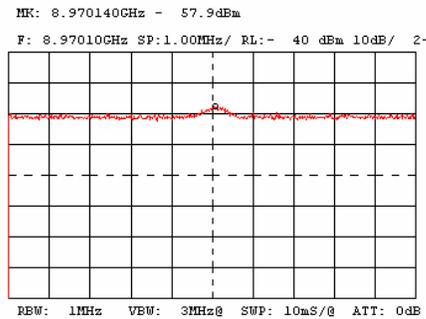
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

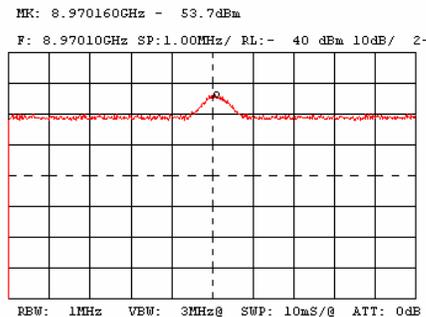
Plot 7.1.23 Radiated emission measurements at the 10th harmonic

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.

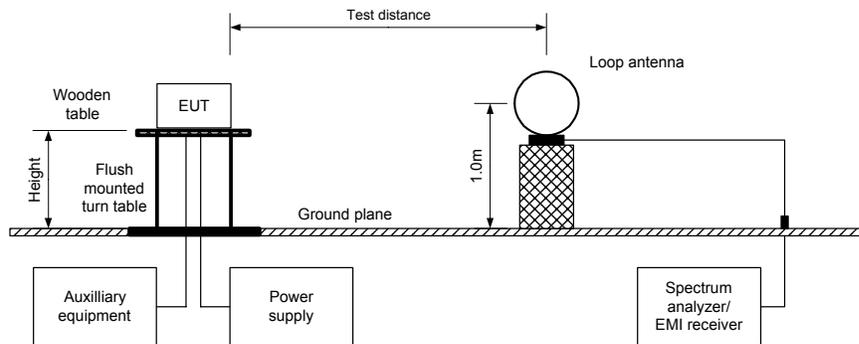
7.2.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

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

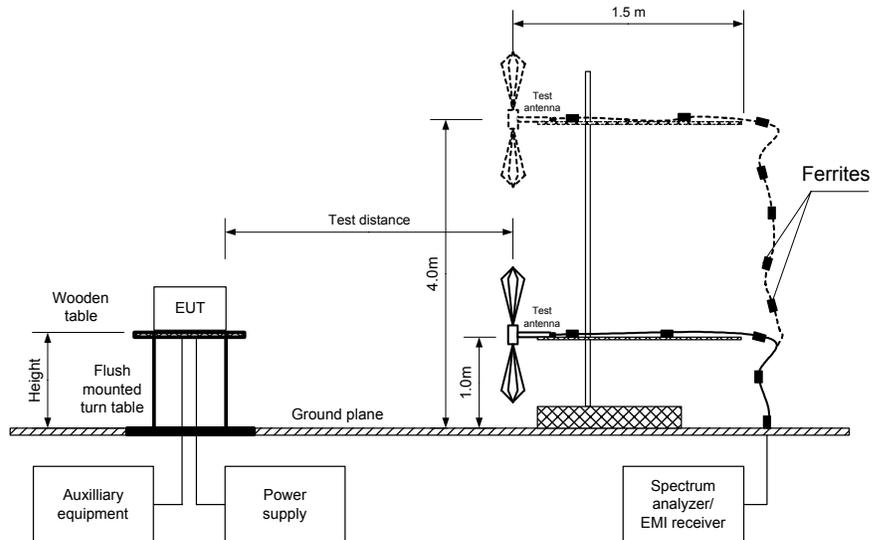


Photograph 7.2.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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

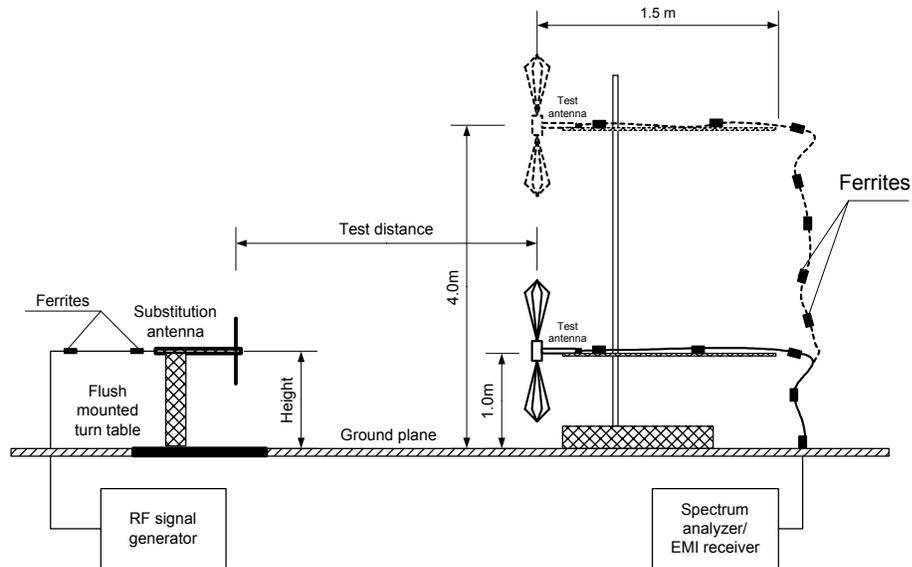


Photograph 7.2.2 Setup for spurious emission field strength measurements above 30 MHz



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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

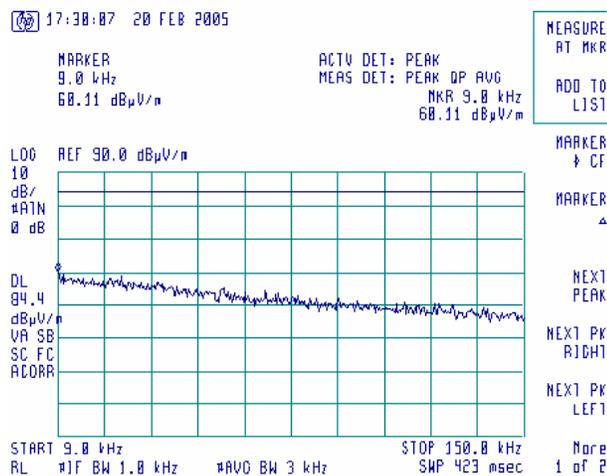
| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 0410 | HL 0446 | HL 0465 | HL 0521 | HL 0589 | HL 0593 | HL 0594 | HL 0604 |
| HL 0661 | HL 0784 | HL 0813 | HL 1004 | HL 1424 | HL 1430 | HL 1552 | HL 1942 |
| HL 1947 | HL 1984 | HL 2009 | HL 2259 | 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: | | | |

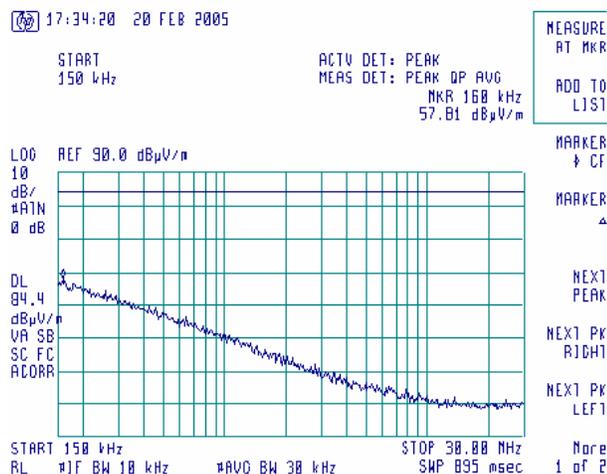
Plot 7.2.1 Radiated emission measurements in 9 - 150 kHz range

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

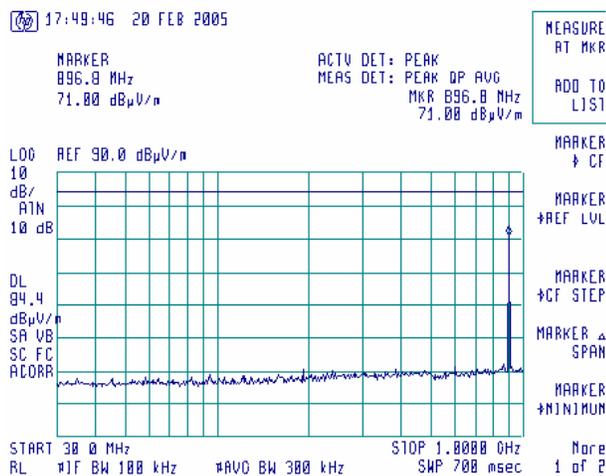
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

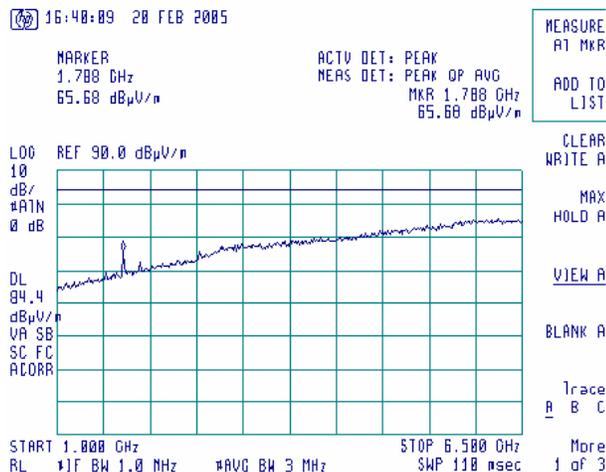
Plot 7.2.3 Radiated emission measurements in 30 - 1000 MHz range

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

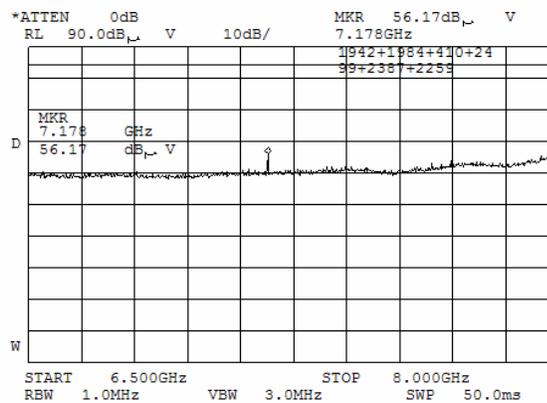
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

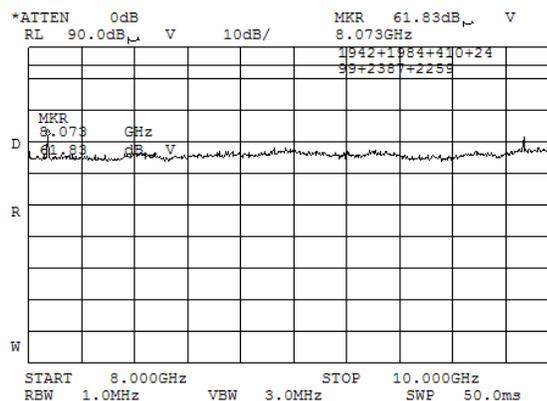
Plot 7.2.5 Radiated emission measurements in 6500 – 8000 MHz range

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

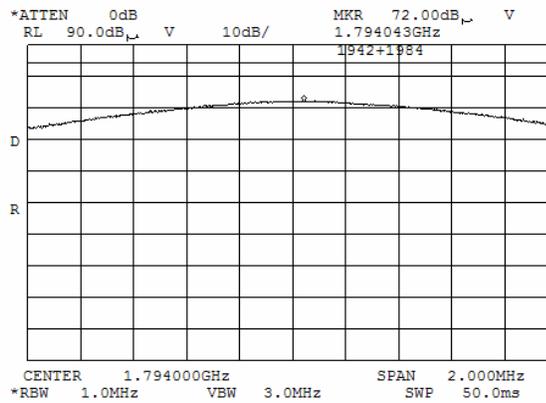
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

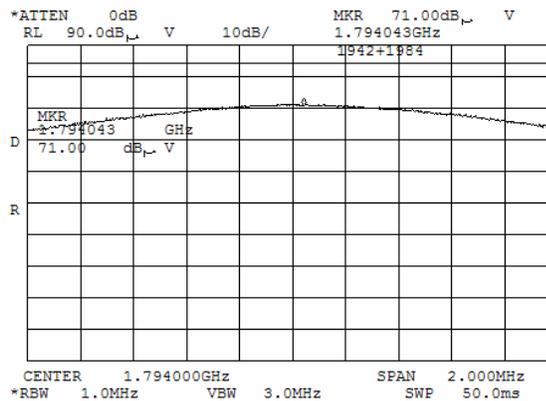
Plot 7.2.7 Radiated emission measurements at the 2nd harmonic

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

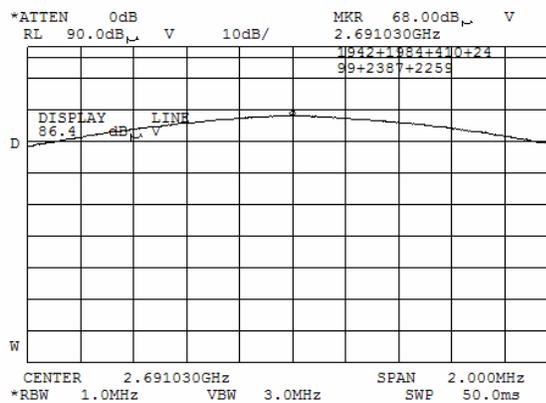
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

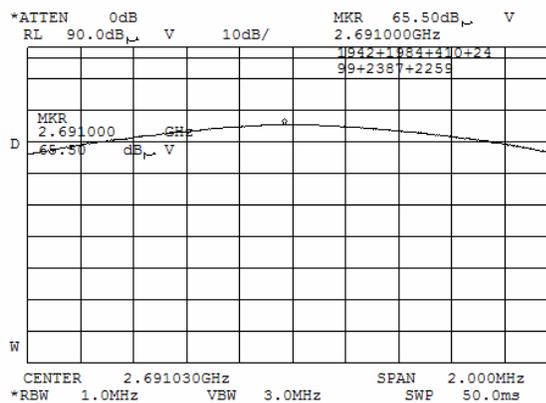
Plot 7.2.9 Radiated emission measurements at the 3rd harmonic

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

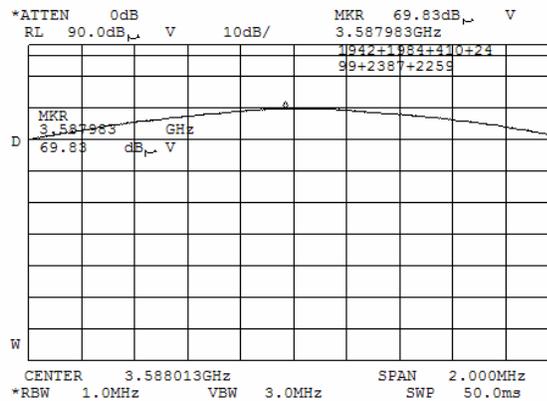
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

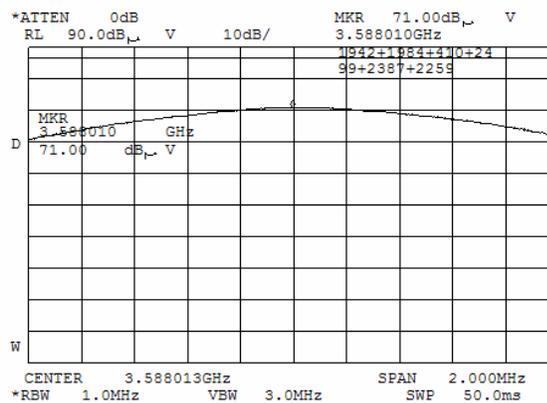
Plot 7.2.11 Radiated emission measurements at the 4th harmonic

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

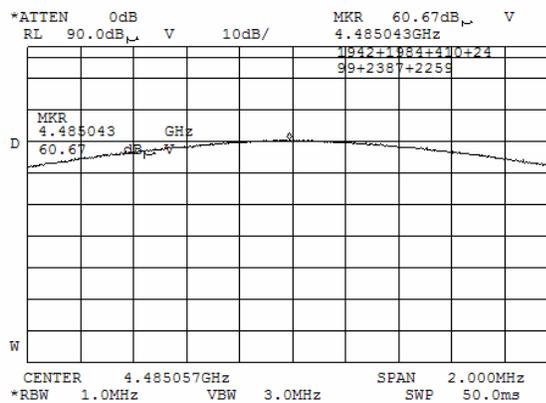
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

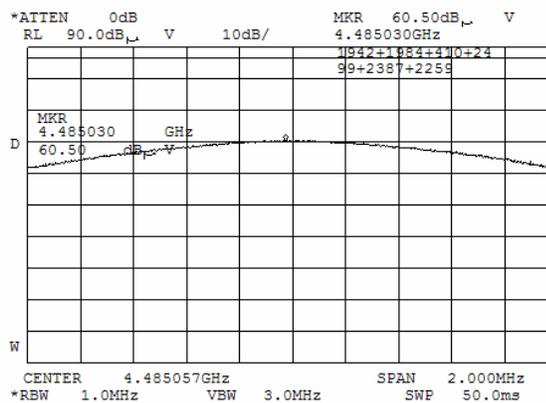
Plot 7.2.13 Radiated emission measurements at the 5th harmonic

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

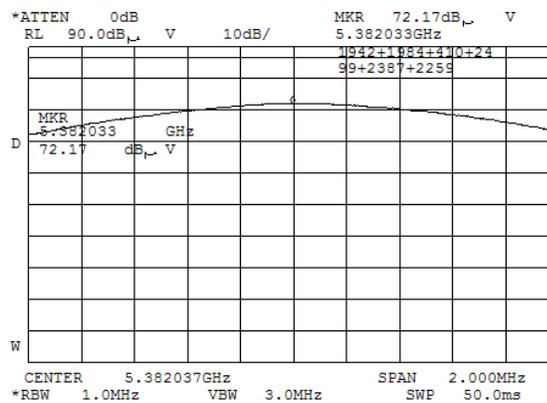
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

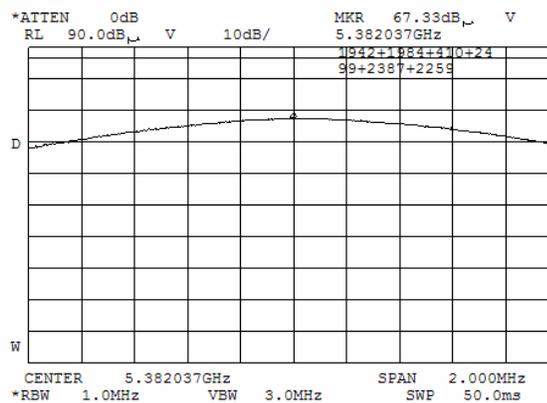
Plot 7.2.15 Radiated emission measurements at the 6th harmonic

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



Plot 7.2.16 Radiated emission measurements at the 6th harmonic

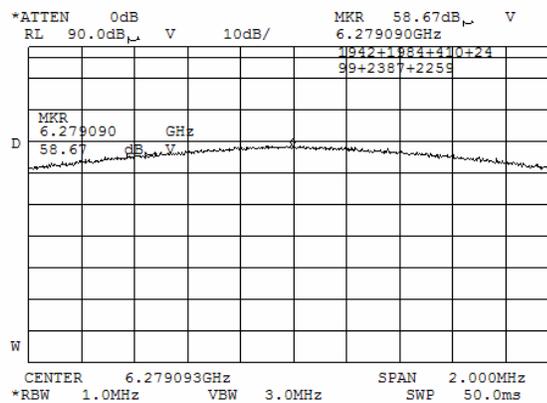
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| Test specification: | Section 90.210, Radiated spurious emissions for 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: | | | |

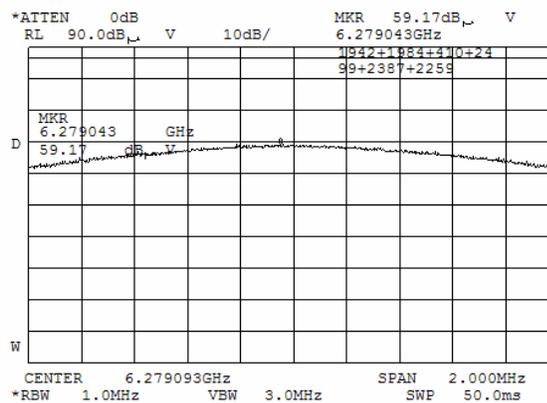
Plot 7.2.17 Radiated emission measurements at the 7th harmonic

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

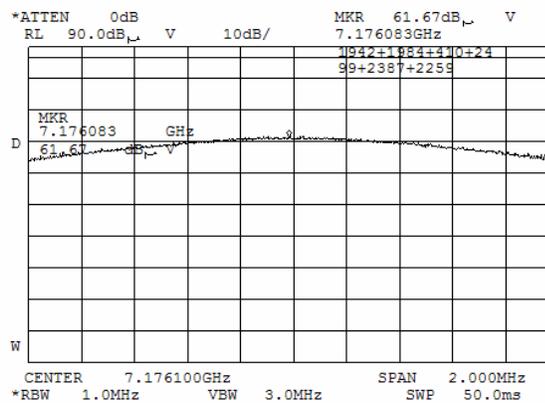
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

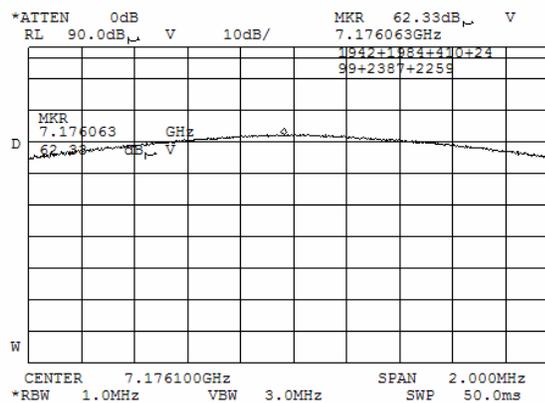
Plot 7.2.19 Radiated emission measurements at the 8th harmonic

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

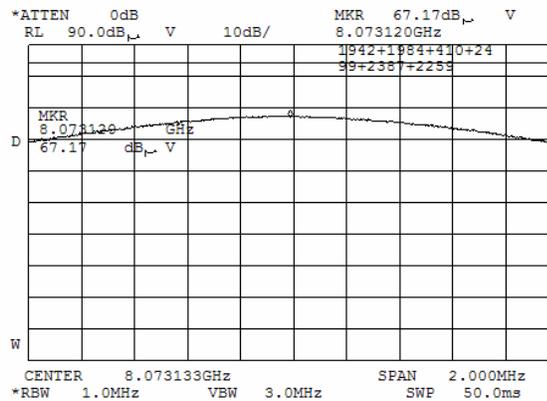
TEST SITE: OATS
 CARRIER FREQUENCY: 897.0125 MHz
 ANTENNA POLARIZATION: Horizontal
 TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

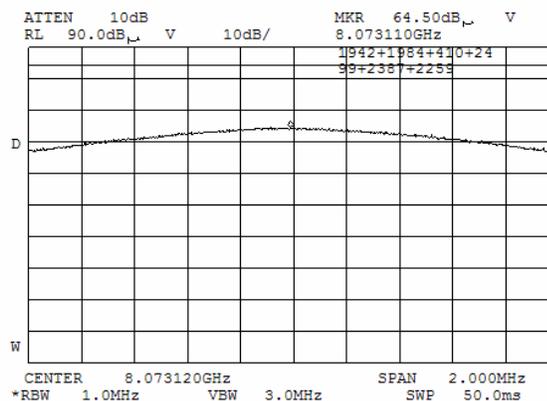
Plot 7.2.21 Radiated emission measurements at the 9th harmonic

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

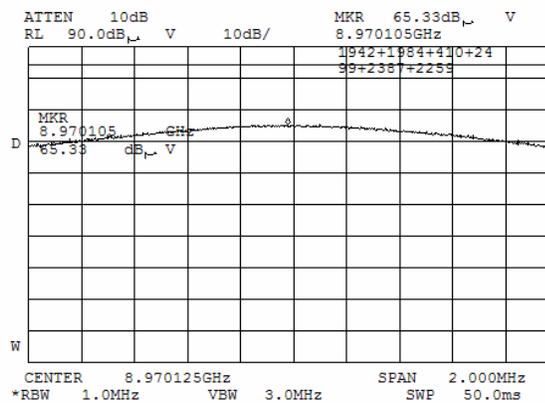
TEST SITE: OATS
CARRIER FREQUENCY: 897.0125 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



| | | | |
|----------------------------|--|--------------------------------|-------------------------------|
| 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: | | | |

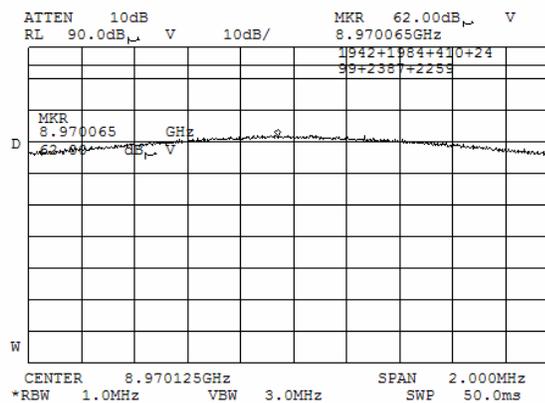
Plot 7.2.23 Radiated emission measurements at the 10th harmonic

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: $Lim_{S_2} = Lim_{S_1} + 20 \log(S_1/S_2)$, where S_1 and S_2 – standard defined and test distance respectively in meters.

8.1.2 Test procedure

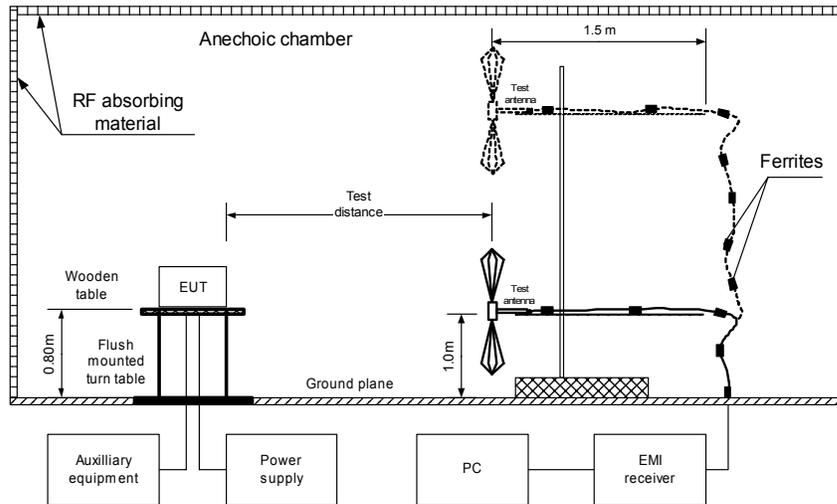
8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

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

| 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* | | | | |
| 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

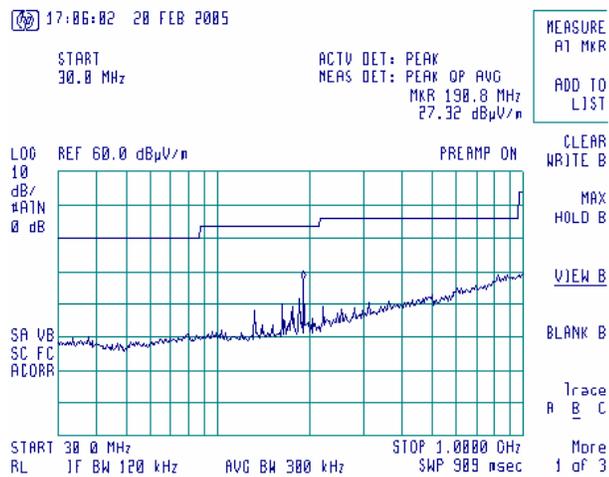
| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 0465 | HL 0521 | HL 0589 | HL 0593 | HL 0594 | HL 0604 | HL 1004 | HL 1947 |
| HL 1984 | HL 2009 | | | | | | |

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: | | | |

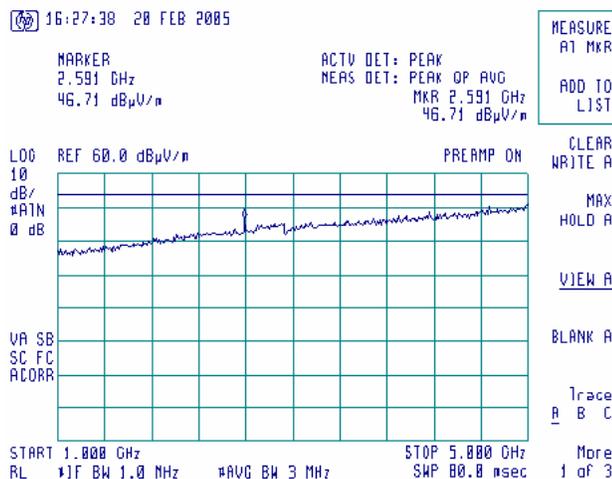
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

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 | PFP01P010394 | 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/NC SL 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 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(μ V) | decibel referred to one microvolt |
| dB(μ V/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 |
| μ s | 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 | | |
| 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 |