HERMON LABORATORIES

ACCREDITED
839.01
Electrical

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 4628 8001
Fax.+972 4628 8277
e-mail: *mail@hermonlabs.com*

# RADIO TEST REPORT

**according to 47 CFR Part 15 subpart C §15.231 and subpart B**
**for**

## Electronics Line 3000 Ltd.

**EQUIPMENT UNDER TEST:**

## Remote control transmitter

## Model: EL2614





**Document ID: ELERAD_FCC.15673_EL2614_rev1.doc**
**Date of issue: March 2004**

# Contents

# 1 Project information

## Description of equipment under test

| | |
|---|---|
| Test items | Remote control transmitter |
| Manufacturer | Electronics Line 3000 Ltd. |
| Types (Models) | EL2614 |
| Equipment FCC code | DSR |

## Applicant information

| | |
|---|---|
| Applicant's responsible person | Mr. Shaul Aviezer, Quality and Approvals Manager |
| Company | Electronics Line 3000 Ltd. |
| Address | 58, Amal street |
| P.O.Box | 3253 |
| City | Petah Tikva |
| Postal code | 49130 |
| Country | Israel |
| Telephone number | +972 3921 1117 |
| Telefax number | +972 3921 2224 |

## Test performance

| | |
|---|---|
| Project number: | 15673 |
| Location | Hermon Laboratories |
| Receipt date | September 4, 2003 |
| Test completed | September 21, 2003 |
| Purpose of test | Apparatus compliance verification in accordance with emission requirements |
| Test specification(s) | 47CFR Part 15, subpart C, §15.231, §15.209, §15.205 and subpart B §15.109 |

# 2 Summary and signatures

The EUT, remote control transmitter, was tested according to FCC part 15 subpart C, §§15.231, 15.209, part 15 §15.109 and found to comply with the standard requirements.

| Test description | Specification reference | Tested by | Date tested | Test report paragraph | Verdict |
|---|---|---|---|---|---|
| Bandwidth of emission | 15.231(c) | Mr. M. Nikishin, test engineer | October 26, 2003 | 4.1 | Pass |
| Field strength of fundamental | 15.231(b)(2) | Mr. Y. Neuman, test engineer | September 8, 2003 | 4.2 | Pass |
| Field strength of spurious radiation | 15.231(b)(3) | Mr. I. Fershtater, test engineer | September 14, 21, 2003 | 4.3 | Pass |
| Radiated emissions | 15.109 | Mr. I. Fershtater, test engineer | September 11, 2003 | 4.4 | Pass |

**Test report prepared by:**

Mrs. M. Cherniavsky, MScEE, certification engineer _____

**Test report approved by:**

Mr. Michael Nikishin, MScEE, group leader _____

Mr. Edward Usoskin, PhD, C.E.O. _____

# 3 EUT description

## 3.1 General

The EUT, model number EL2614, is a four-button keyfob portable transmitter operating at 418 MHz and designed for use with Electronics Line's supervised receivers. The device utilizes integral, printed on PCB antenna and is powered by two 3 V lithium batteries; its controller clock generates 4 MHz. The EL2614 general view is shown in Photograph 3.1.1.

### 3.1.1 EUT compliance with §15.231(a)(1) requirements

The EUT is manually activated transmitter, which sends data once for 640 ms and stops automatically.
No periodic supervisory transmissions.

**Photograph 3.1.1**

**EUT general view**

# 4 Test results

## 4.1 Bandwidth of emission according to § 15.231 (c)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
DATE of TEST: October 26, 2003
RELATIVE HUMIDITY: 42 %
AMBIENT TEMPERATURE: 24°C
AIR PRESSURE: 1009 hPa
MODULATION: ON
DETECTOR USED: Peak

| Carrier frequency MHz | Occupied bandwidth, kHz | | | Verdict |
|---|---|---|---|---|
| | Measured | Limit | Reference to plot in Annex A | |
| 418 | 77.6 | 1045 | No.1 | Pass |
| Measurement uncertainty | 0.21 ppm | | | |

The maximum allowed occupied bandwidth was calculated as 0.0025 of the center frequency.

**TEST PROCEDURE**

The EUT was tested, being placed on a wooden 80 cm height table. The spectrum trace data around transmitter fundamental frequency was obtained with the spectrum analyzer in “Max Hold” mode. The bandwidth value was determined between two points 20 dB down from the modulated carrier.

**TEST EQUIPMENT USED:**

| | | | | | | |
|---|---|---|---|---|---|---|
| HL 0026 | HL 0337 | | | | | |

**LIMIT § 15.231 (c)**

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

## 4.2 Field strength of fundamental, § 15.231(b)(2)

| | |
|---|---|
| METHOD OF MEASUREMENT: | ANSI 63.4 §13.1.5 |
| DATE of TEST: | September 14, 2003 |
| RELATIVE HUMIDITY: | 42 % |
| AMBIENT TEMPERATURE: | 24°C |
| AIR PRESSURE: | 1011 hPa |
| TEST PERFORMED IN: | OATS |
| DISTANCE BETWEEN ANTENNA AND EUT: | 3 m |
| MODULATION: | ON |
| ANTENNA TYPE: | Log periodic |

| | § 15.231 (b) | § 15.231 (e) |
|---|---|---|
| The EUT complies with the requirements of | X | |

**Peak detector**

| Frequency, MHz | Measured field strength, dB(µV/m) | Antenna polarization | Antenna height, m | Turntable position, (°) | Specification limit, dB(µV/m) | Margin, dB | Verdict |
|---|---|---|---|---|---|---|---|
| 418.0 | 58.0 | Vertical | 1.4 | 278 | 80.3 | 22.3 | Pass |
| Measurement uncertainty, dB | ± 6.0 | | | | | | |

The recorded test result was obtained throughout measurements in the EUT Y-axis orthogonal position.

Turntable position in degrees, EUT front panel = $0^{o}$.
Margin = dB below (negative if above) specification limit.

**LIMIT § 15.231 (b)**

| Fundamental frequency, MHz | Field strength of fundamental @ 3 m, dB(µV/m) |
|---|---|
| 418 | 80.3 |

**The above field strength limits are based on average limits.**
**The provisions of section 15.35 for limiting peak emissions apply.**

**TEST PROCEDURE**

The EUT was tested, being placed on a wooden 80 cm height table, in three orthogonal positions (along X, Y and Z axes). To find maximum radiation the turntable was rotated $360^{o}$, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

**TEST EQUIPMENT USED:**

| HL 0034 | HL 0038 | HL 0091 | HL 0287 | HL 0415 | HL 0812 | HL 1430 |
|---|---|---|---|---|---|---|
| | | | | | | |

## 4.3 Field strength of spurious radiation, § 15.231(b)(3)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.4
DATE of TEST: September 14, 2003
RELATIVE HUMIDITY: 42 %
AMBIENT TEMPERATURE: 24°C
AIR PRESSURE: 1011 hPa
TEST PERFORMED IN: Anechoic chamber in 9 kHz to 2.9 GHz
OATS in 2.9 GHz to 4.2 GHz
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
DETECTOR USED: Peak
MEASUREMENT UNCERTAINTY: ± 6 dB max

The frequency spectrum was investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to the tenth harmonic (4.2 GHz)

**Test was performed with loop antenna**

| Frequency, MHz | Antenna polarization | RBW, kHz | VBW, kHz | Radiated emission, dB (µV/m) | Limit @ 3 m, dB(µV/m) | Margin, dB | Verdict |
|---|---|---|---|---|---|---|---|
| 0.009 – 0.150 | V | 0.2 | 0.3 | All emissions were found below the limit, refer to Plot No.2 | | | Pass |
| 0.150 - 30 | V | 9 | 30 | All emissions were found below the limit, refer to Plot No.3 | | | Pass |

**Test was performed with biconical antenna in 30 – 200 MHz range, with log periodic – in 200 to 1000 MHz range and with double ridged guide - in 1000 to 4200 MHz range**

| Frequency, MHz | EUT orthogon. position | Antenna polariz. | Antenna height, m | Turntable position, (°) | Radiated emissions, peak, dB (µV/m) | Limit (average) @ 3 m, dB (µV/m) | Margin, dB | Verdict |
|---|---|---|---|---|---|---|---|---|
| 836.0 | X, Y, Z | V, H | 1.0 | 0 | >20 dB below limit | 60.3 | >20 | Pass |
| 1254.0 | X, Y, Z | V, H | 1.0 | 0 | >20 dB below limit | 60.3 | >20 | Pass |
| 1672.0 | Y | V | 1.1 | 248 | 43.0 | 54.0 | 11.0 | Pass |
| 2090.0 | X, Y, Z | V, H | 1.0 | 0 | >20 dB below limit | 60.3 | >20 | Pass |
| 2508.0 | X, Y, Z | V, H | 1.0 | 0 | >20 dB below limit | 60.3 | >20 | Pass |

For full test results refer to Plots No. 4 to No.8.

**Notes to table:**

Antenna polarization: V- vertical, H- horizontal
Resolution bandwidth (RBW) and video bandwidth (VBW) settings are shown in the plots
Turntable position in degrees, EUT front panel = 0°.
Margin = dB below (negative if above) specification limit.

**TEST PROCEDURE**

The EUT was tested, being placed on a wooden 80 cm height turntable, in three orthogonal positions (along X, Y and Z axes).

**9 kHz – 30 MHz frequency range.** The loop antenna was positioned with its plane vertical. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis.

**30 MHz – 4.2 GHz frequency range.** To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

**TEST EQUIPMENT USED IN ANECHOIC CHAMBER:**

| | | | | | | |
|---|---|---|---|---|---|---|
| HL 0032 | HL 0446 | HL 0569 | HL 1425 | HL 1553 | HL 1566 | HL 1826 |
| HL 1849 | HL 1850 | HL 1942 | HL 1984 | HL 2109 | | |

**TEST EQUIPMENT USED AT OPEN AREA TEST SITE:**

| | | | | | | |
|---|---|---|---|---|---|---|
| HL 0034 | HL 0038 | HL 0091 | HL 0287 | HL 0415 | HL 0812 | HL 1200 |
| HL 1424 | HL 1430 | HL 1942 | HL 1984 | HL 2254 | HL 2259 | HL 2273 |

## 4.4 Unintentional radiated emissions test according to §15.109

| | |
|---|---|
| METHOD OF MEASUREMENT: | ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4 |
| DATE of TEST: | September 14, 2003 |
| RELATIVE HUMIDITY: | 42 % |
| AMBIENT TEMPERATURE: | 24°C |
| AIR PRESSURE: | 1011 hPa |
| TEST PERFROMED IN: | Anechoic chamber |
| DISTANCE BETWEEN ANTENNA AND EUT: | 3 m |
| THE EUT WAS TESTED AS: | Table-top |
| FREQUENCY RANGE: | 30 MHz – 1 GHz |
| DETECTOR TYPE: | Quasi-peak |
| RESOLUTION BANDWIDTH: | 120 kHz |
| ANTENNA TYPE: | Biconical in 30 –200 MHz range<br>Log periodic in 200 – 1000 MHz range |

| The EUT highest used frequency (not including operating frequency), MHz | Upper frequency of measurement range, MHz |
|---|---|
| Below 1.705 | 30 |
| **1.705 – 108** | **1000** |
| 108 – 500 | 2000 |
| 500 – 1000 | 5000 |
| Above 1000 | 5th harmonic of the highest frequency or 40 GHz, whichever is lower |

**TEST RESULTS:**

All the measured emissions were found at least 20 dB below specified limit, refer to Plots No.9, 10.

**TEST PROCEDURE**

The EUT was placed on a wooden 80 cm height table in three orthogonal positions. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

**TEST EQUIPMENT USED:**

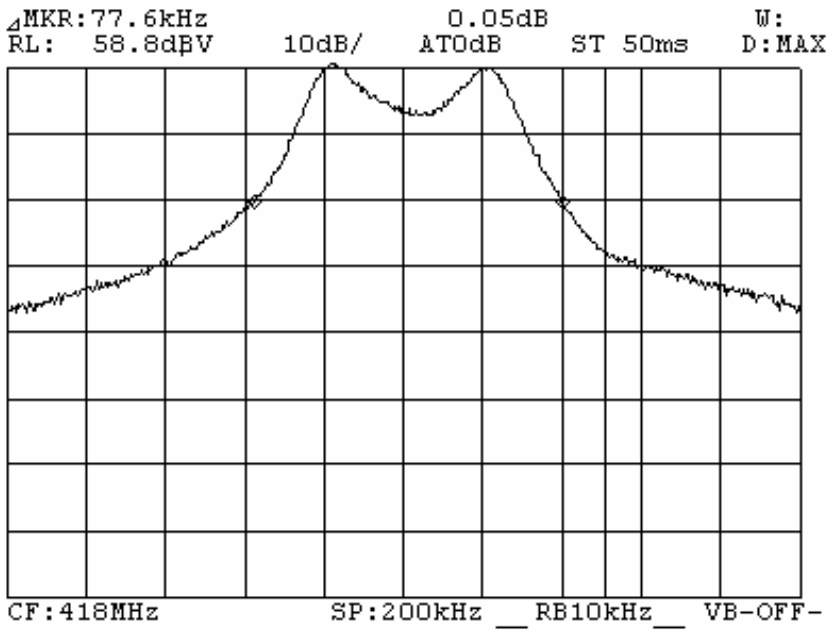
| | | | | | | |
|---|---|---|---|---|---|---|
| HL 0032 | HL 0569 | HL 1425 | HL 1553 | HL 1566 | HL 1826 | HL 1849 |
| HL 1850 | HL 2109 | | | | | |

**LIMIT § 15.109**

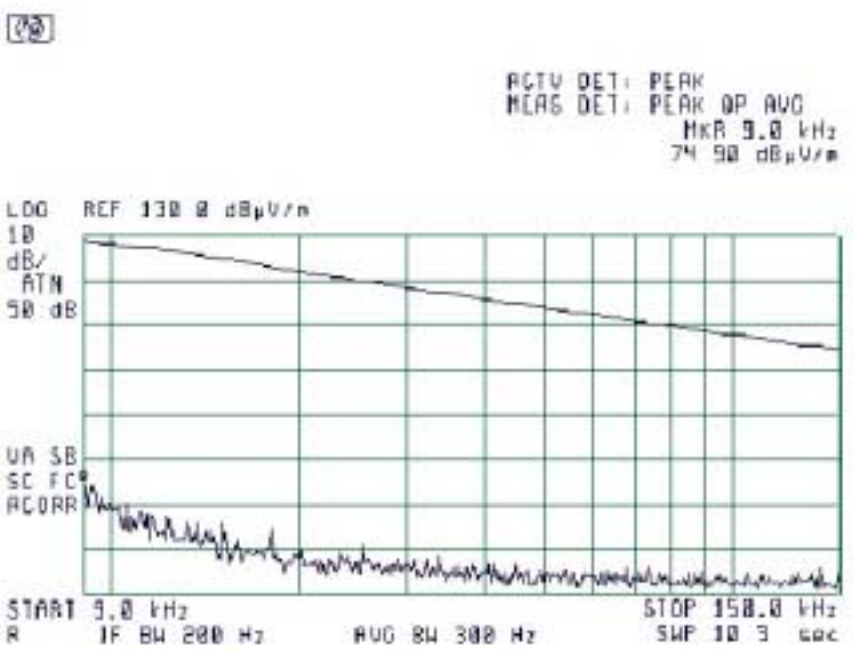
| Frequency, MHz | Class B equipment @ 3 m dB(μV/m) |
|---|---|
| 30 - 88 | 40 |
| 88 - 216 | 43.5 |
| 216 - 960 | 46 |
| 960 - 5000 | 54 |

# Appendix A - Plots

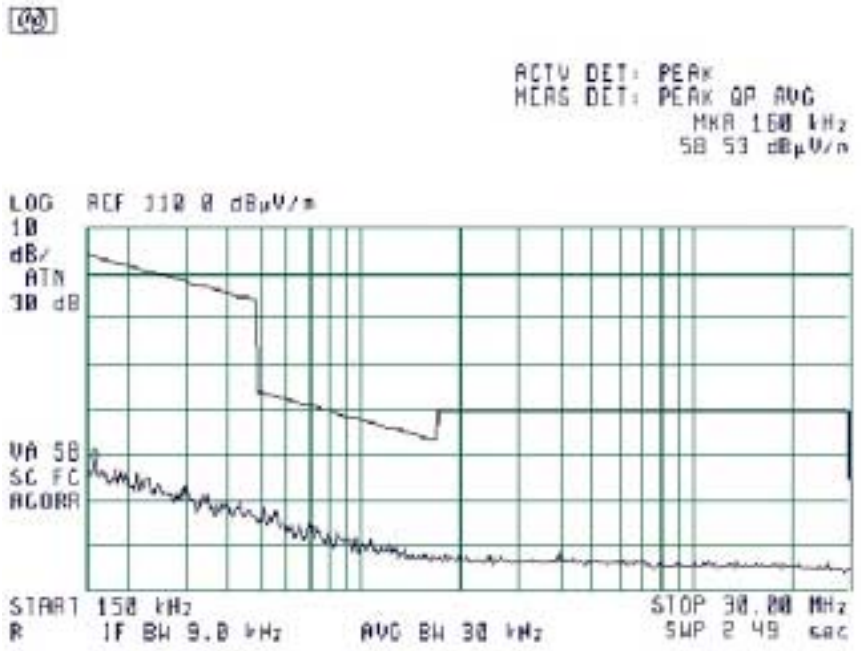
**Plot No.1**
**Occupied bandwidth measurement test result**



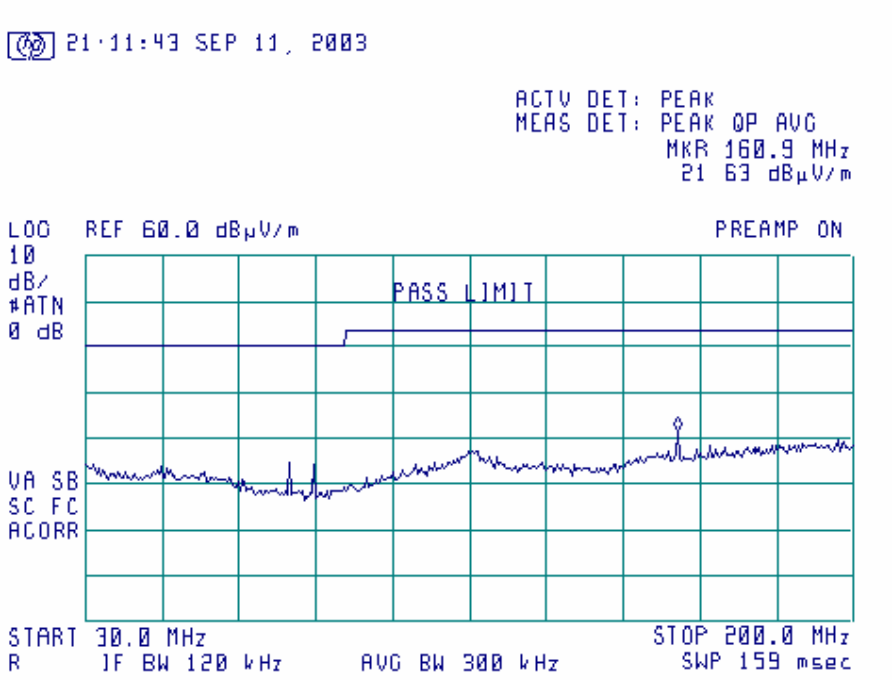
**Plot No.2**
**Spurious emissions measurement test results in anechoic chamber in 9 – 150 kHz range, vertical and horizontal antenna polarization**



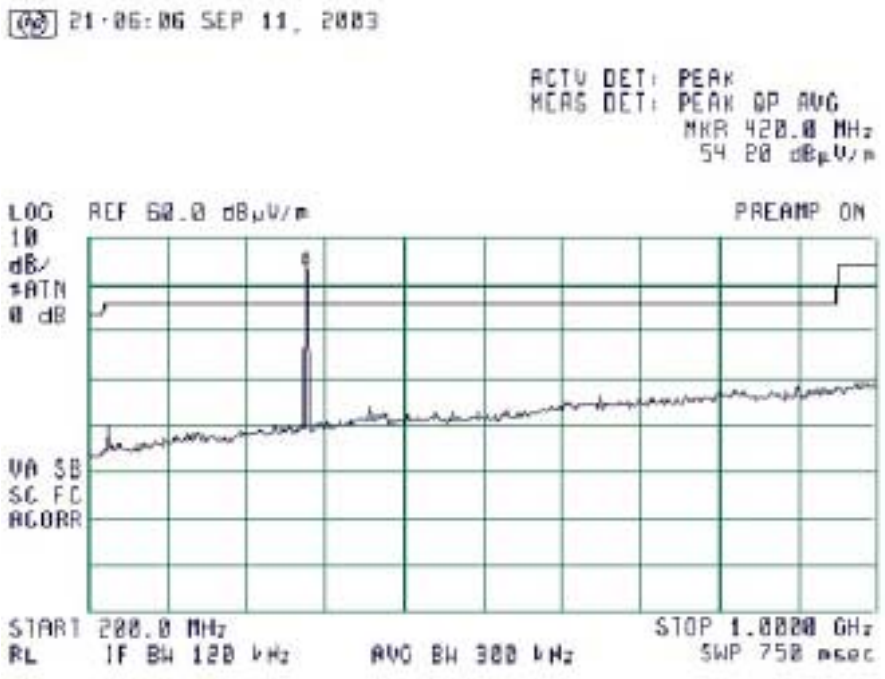
**Plot No.3**
**Spurious emissions measurement test results in anechoic chamber in 150 kHz – 30 MHz range, vertical and horizontal antenna polarization**



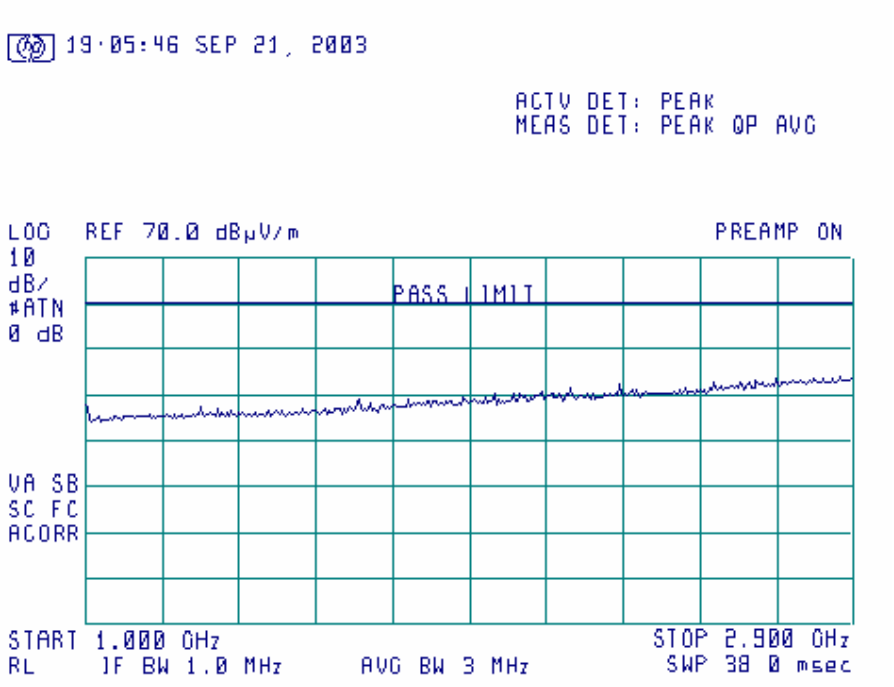
**Plot No.4**
**Spurious emissions measurement test results in anechoic chamber in 30 - 200 MHz range, vertical and horizontal antenna polarization**



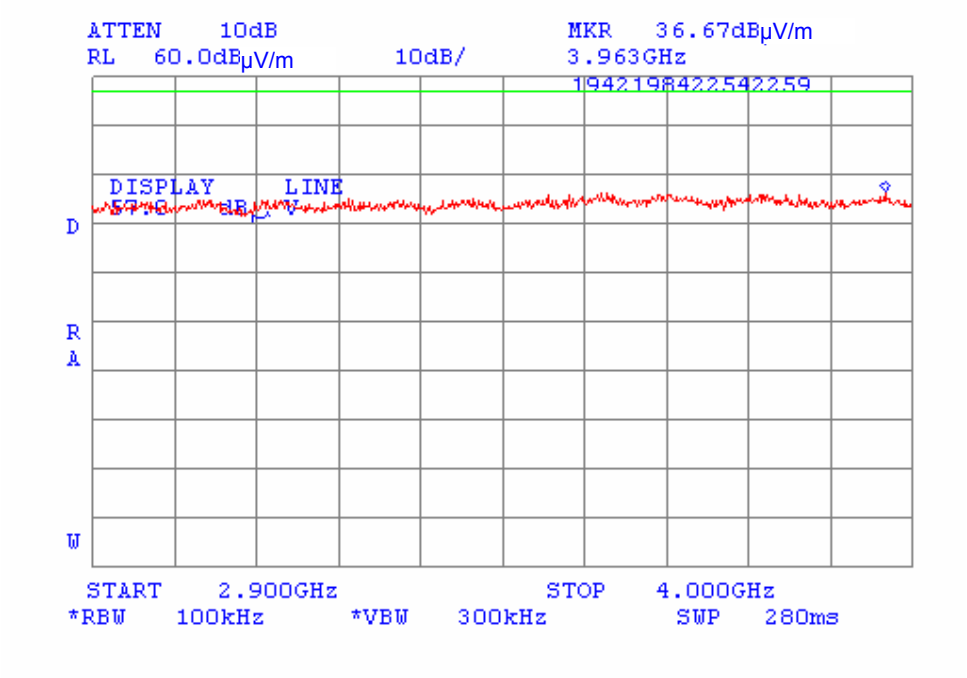
**Plot No.5**
**Spurious emissions measurement test results in anechoic chamber in 200 – 1000 MHz range, vertical and horizontal antenna polarization**



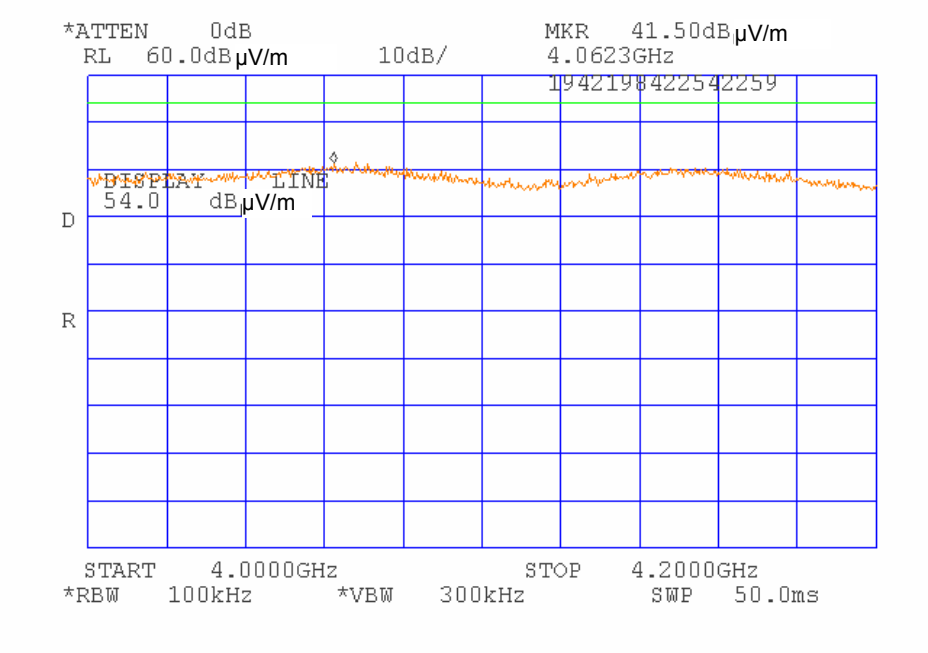
**Plot No.6**
**Spurious emissions measurement test results in anechoic chamber in 1000 – 2900 MHz range, vertical and horizontal antenna polarization**



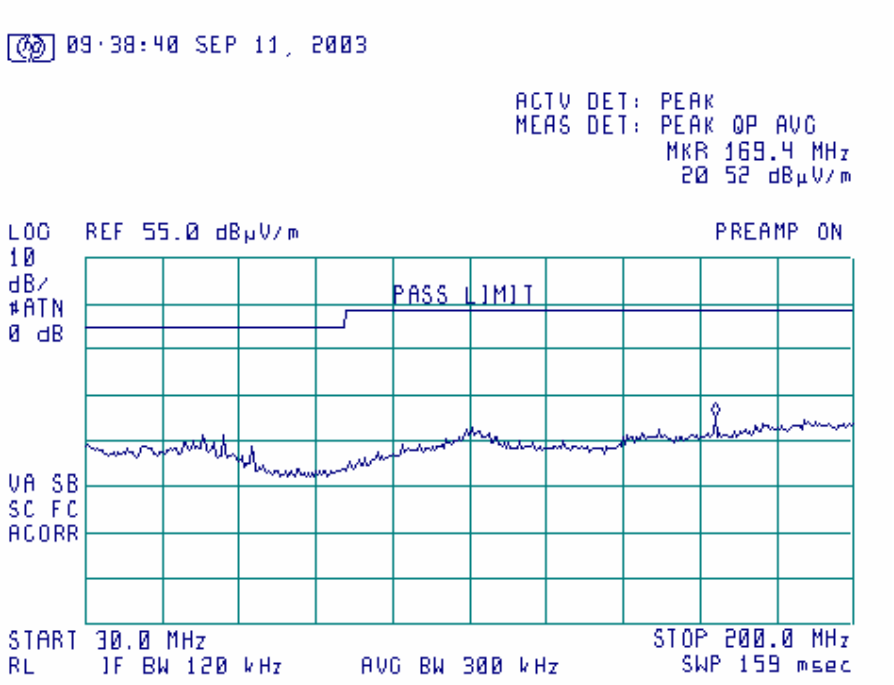
**Plot No.7**
**Spurious emissions measurement test results at OATS in 2.9 GHz - 4.0 GHz range, vertical and horizontal antenna polarization**



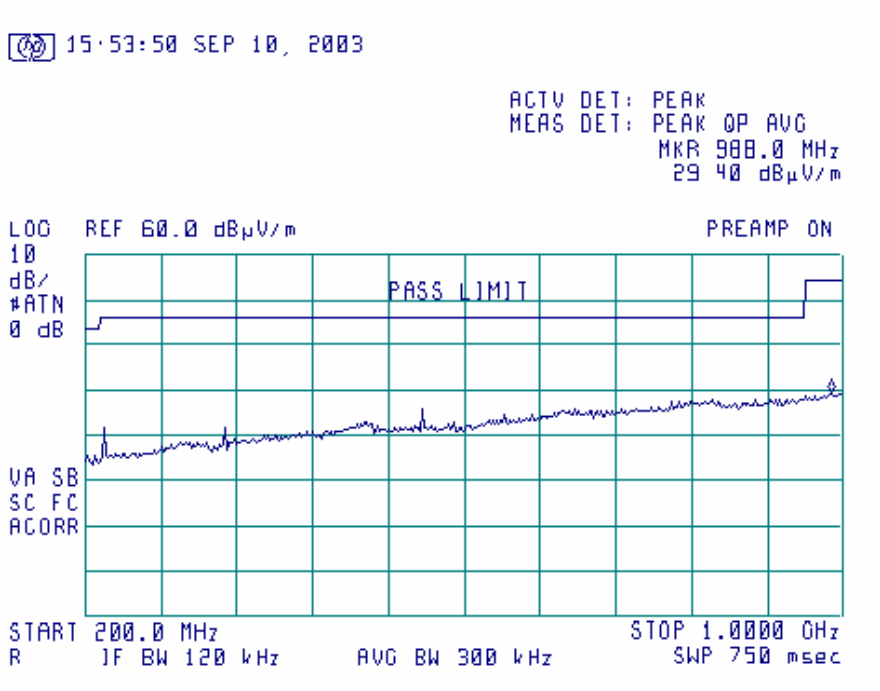
**Plot No.8**
**Spurious emissions measurement test results at OATS in 4.0 GHz - 4.2 GHz range, vertical and horizontal antenna polarization**



**Plot No.9**
**Unintentional radiated emissions test results,**
**vertical and horizontal antenna polarization**



**Plot No10**
**Unintentional radiated emissions test results,**
**vertical and horizontal antenna polarization**



# Appendix B - Test equipment used for tests

| HL Serial No. | Description | Manufacturer information | | | Due calibration Month/ year |
|---|---|---|---|---|---|
| | | Name | Model No. | Serial No. | |
| 0026 | Spectrum analyzer, 100 Hz-2.2 GHz | Anritsu | MS 2601A | 3460 | 9/04 |
| 0032 | Biconical antenna, 20 - 200 MHz | Electro-Metrics | BIA-25/30 | 3577 | 11/04 |
| 0034 | Log periodic antenna, 200 - 1000 MHz | Electro-Metrics | LPA 25/30 | 1988 | 1/05 |
| 0038 | Antenna mast, 1-4 m | Hermon Labs | AM-1 | 028 | 2/05 check |
| 0091 | Position controller for antenna mast + turntable, OFTS | Hermon Labs | CRL-2 | 091 | 4/04 check |
| 0287 | Turntable, motorized diameter, 2 m | Hermon Labs | TMD-2 | 042 | 11/04 check |
| 0337 | Probe set, hand held, 5 probes | Electro-Metrics | EHFP-30 | 238 | 6/04 |
| 0415 | Cable coax RF, RG-58 | Hermon Labs | CC-3 | 056 | 5/04 |
| 0446 | Active loop antenna, 10 kHz - 30 MHz | Electro-Mechanics | 6502 | 2857 | 10/04 |
| 0569 | Antenna, log periodic, 200 – 1000 MHz | Electro-Metrics | LPA 25/30 | 1953 | 1/05 |
| 0812 | Cable, coax, RG-214, 11.5 m, N-type connectors | Hermon Labs | C214-11 | 148 | 5/04 |
| 1200 | Quadruplexer, 1-12 GHz | Elettronica S.p.A.-Roma | UE 84 | 0240 | 4/04 check |
| 1424 | Spectrum analyzer, 30 Hz - 40 GHz | Agilent Technologies | 8564EC | 3946A00219 | 8/04 |
| 1425 | EMI receiver system, 9 kHz - 2.9 GHz | Agilent Technologies | 8542E | 3710A00222 | 9/04 |
| 1430 | EMI receiver system, 9 kHz - 2.9 GHz | Agilent Technologies | 8542E | 3807A00262 | 9/04 |
| 1553 | Cable RF, 3.5 m | Alpha wire | RG-214 | NA | 5/04 |
| 1566 | Cable RF, 2 m | Huber-Suhner | Sucoflex 104PE | 13094/4PE | 12/04 |
| 1826 | Antenna mast and turntable position controller | Sh. I. Machines | CRL-4 | 1 | 5/04 check |
| 1849 | Antenna mast with polarity control | Sh. I. Mashines | AM-F4 | NA | 1/05 check |
| 1850 | Turntable | Sh. I. Mashines | TT-M-3 | NA | 1/05 check |
| 1942 | Cable 18 GHz, 4 m, blue | Rhophase Microwave Ltd. | SPS-1803A-4000-NPS | T4658 | 10/04 |
| 1984 | Antenna, double ridged waveguide horn, 1-18 GHz, 300 W, N-type | EMC Test Systems | 3115 | 9911-5964 | 3/05 |
| 2109 | Anechoic chamber 6 (L) x 5.5 (W) x 2.95 (H) m | Hermon Labs | AC-2 | NA | 12/04 check |
| 2254 | Cable 40 GHz, 0.8 m, blue | Rhophase Microwave | KPS-1503A-800-KPS | W4907 | 11/04 |
| 2259 | Amplifier low noise, 2 - 20 GHz | Sophia Wireless | LNA0220-C | 0223 | 11/04 |
| 2273 | Power supply 11 V for HL2258, HL2259, HL2260 | Hermon Labs | S-11 | 2273 | 12/04 |

# Appendix C – Antenna factors and cable loss

**Antenna factor**
**Active loop antenna**
**Model 6502**
**S/N 2857**

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

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

**Antenna factor**
**Biconical antenna**
**Electro-Metrics, model BIA-25/30**
**Ser.No.3577, HL 0032**

| Frequency MHz | Antenna Factor dB(1/m) | Frequency MHz | Antenna Factor dB(1/m) |
|---|---|---|---|
| 20 | 15.1 | 115 | 16.7 |
| 25 | 14.6 | 120 | 14.1 |
| 30 | 13.7 | 125 | 13.1 |
| 35 | 11.8 | 130 | 13.0 |
| 40 | 11.4 | 135 | 12.9 |
| 45 | 11.7 | 140 | 12.7 |
| 50 | 11.4 | 145 | 12.5 |
| 55 | 10.5 | 150 | 14.3 |
| 60 | 10.3 | 155 | 14.8 |
| 65 | 8.9 | 160 | 14.7 |
| 70 | 7.6 | 165 | 15.1 |
| 75 | 7.3 | 170 | 15.6 |
| 80 | 7.3 | 175 | 16.5 |
| 85 | 7.8 | 180 | 16.7 |
| 90 | 9.4 | 185 | 17.3 |
| 95 | 10.6 | 190 | 17.9 |
| 100 | 11.8 | 195 | 17.6 |
| 105 | 12.5 | 200 | 17.9 |
| 110 | 13.7 | | |

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

**Antenna factor**
**Log periodic antenna**
**Electro-Metrics, model LPA-25/30**
**Ser.No.1988, HL 0034**

| Frequency MHz | Antenna Factor dB(1/m) | Frequency MHz | Antenna Factor dB(1/m) |
|---|---|---|---|
| 200 | 12.6 | 625 | 20.4 |
| 225 | 12.2 | 650 | 20.9 |
| 250 | 13.4 | 675 | 22.0 |
| 275 | 14.3 | 700 | 22.2 |
| 300 | 15.2 | 725 | 22.7 |
| 325 | 15.7 | 750 | 22.5 |
| 350 | 15.9 | 775 | 22.7 |
| 375 | 16.4 | 800 | 22.8 |
| 400 | 17.0 | 825 | 23.2 |
| 425 | 17.4 | 850 | 23.5 |
| 450 | 17.9 | 875 | 23.9 |
| 475 | 18.6 | 900 | 24.0 |
| 500 | 19.1 | 925 | 24.0 |
| 525 | 19.3 | 950 | 24.2 |
| 550 | 19.6 | 975 | 24.7 |
| 575 | 19.8 | 1000 | 25.1 |
| 600 | 20.0 | | |

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

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

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

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

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

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

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

**Cable loss**
**Cable Coaxial, RG-58/RG-214, s/n 056, HL 0415**
**+ Cable Coaxial, RG-214, 11.5m, s/n 148, HL 0812**

| No. | Frequency, MHz | Cable loss, dB | Measured uncertainty, dB |
|---|---|---|---|
| 1 | 20 | 0.73 | ±0.12 |
| 2 | 30 | 0.91 | |
| 3 | 50 | 1.2 | |
| 4 | 80 | 1.56 | |
| 5 | 100 | 1.76 | |
| 6 | 200 | 2.59 | |
| 7 | 300 | 3.26 | |
| 8 | 400 | 3.93 | |
| 9 | 500 | 4.42 | |
| 10 | 600 | 4.92 | |
| 11 | 700 | 5.36 | |
| 12 | 800 | 5.88 | |
| 13 | 900 | 6.41 | |
| 14 | 1000 | 6.71 | |
| 15 | 1500 | 8.63 | |
| 16 | 2000 | 10.39 | |

**Cable loss**
**RF cable 3.5 m, Alpha Wire, model RG-214, S/N 149, HL 1553**

| No. | Frequency, MHz | Cable loss, dB | Measurement uncertainty, dB |
|---|---|---|---|
| 1 | 1 | 0.01 | ±0.05 |
| 2 | 10 | 0.07 | |
| 3 | 30 | 0.12 | |
| 4 | 50 | 0.22 | |
| 5 | 100 | 0.26 | |
| 6 | 200 | 0.40 | |
| 7 | 300 | 0.52 | |
| 8 | 400 | 0.60 | |
| 9 | 500 | 0.70 | |
| 10 | 600 | 0.77 | |
| 11 | 700 | 0.84 | |
| 12 | 800 | 1.00 | |
| 13 | 900 | 1.00 | |
| 14 | 1000 | 1.05 | |
| 15 | 2000 | 1.70 | |

**Cable loss**
**Cable RF, 2m, model: Sucoflex 104PE, S/N 13094/4PE, HL 1566**

| No. | Frequency, MHz | Cable loss, dB | Tolerance, dB | Measurement uncertainty, dB |
|---|---|---|---|---|
| 1 | 30 | 0.10 | ≤ 5.0 | ±0.12 |
| 2 | 50 | 0.13 | | |
| 3 | 100 | 0.20 | | |
| 4 | 300 | 0.33 | | |
| 5 | 500 | 0.45 | | |
| 6 | 800 | 0.60 | | |
| 7 | 1000 | 0.65 | | |
| 8 | 1500 | 0.91 | | |
| 9 | 2000 | 1.08 | | |
| 10 | 2500 | 1.19 | | |
| 11 | 3000 | 1.28 | | |
| 12 | 3500 | 1.49 | | |
| 13 | 4000 | 1.63 | | |
| 14 | 4500 | 1.63 | ≤ 5.0 | ±0.17 |
| 15 | 5000 | 1.66 | | |
| 16 | 5500 | 1.88 | | |
| 17 | 6000 | 1.96 | | |
| 18 | 6500 | 1.93 | | |
| 19 | 7000 | 2.07 | | |
| 20 | 7500 | 2.37 | | |
| 21 | 8000 | 2.34 | | |
| 22 | 8500 | 2.64 | | |
| 23 | 9000 | 2.68 | | |
| 24 | 9500 | 2.64 | | |
| 25 | 10000 | 2.70 | | |
| 26 | 10500 | 2.84 | | |
| 27 | 11000 | 2.88 | | |
| 28 | 11500 | 3.19 | | |
| 29 | 12000 | 3.15 | | |
| 30 | 12500 | 3.20 | ≤ 5.0 | ±0.26 |
| 31 | 13000 | 3.22 | | |
| 32 | 13500 | 3.47 | | |
| 33 | 14000 | 3.41 | | |
| 34 | 14500 | 3.59 | | |
| 35 | 15000 | 3.79 | | |
| 36 | 15500 | 4.24 | | |
| 37 | 16000 | 4.12 | | |
| 38 | 16500 | 4.46 | | |
| 39 | 17000 | 4.50 | | |
| 40 | 17500 | 4.49 | | |
| 41 | 18000 | 4.45 | | |

**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 |

**Cable loss**
**Cable 40 GHz, 0.8 m, blue, model: KPS-1503A-800-KPS, S/N W4907, HL 2254**

| Frequency, GHz | Cable loss, dB | Frequency, GHz | Cable loss, dB | Frequency, GHz | Cable loss, dB |
|---|---|---|---|---|---|
| 0.03 | 0.04 | 5.10 | 0.80 | 15.00 | 1.49 |
| 0.05 | 0.07 | 5.30 | 0.83 | 15.50 | 1.49 |
| 0.10 | 0.09 | 5.50 | 0.83 | 16.00 | 1.46 |
| 0.20 | 0.15 | 5.70 | 0.84 | 16.50 | 1.47 |
| 0.30 | 0.19 | 5.90 | 0.87 | 17.00 | 1.50 |
| 0.40 | 0.25 | 6.10 | 0.86 | 17.50 | 1.57 |
| 0.50 | 0.29 | 6.30 | 0.89 | 18.00 | 1.63 |
| 0.60 | 0.33 | 6.50 | 0.90 | 18.50 | 1.57 |
| 0.70 | 0.37 | 6.70 | 0.89 | 19.00 | 1.63 |
| 0.80 | 0.41 | 6.90 | 0.93 | 19.50 | 1.65 |
| 0.90 | 0.44 | 7.10 | 0.92 | 20.00 | 1.64 |
| 1.00 | 0.45 | 7.30 | 0.95 | 20.50 | 1.75 |
| 1.10 | 0.48 | 7.50 | 0.96 | 21.00 | 1.72 |
| 1.20 | 0.51 | 7.70 | 0.97 | 21.50 | 1.78 |
| 1.30 | 0.53 | 7.90 | 1.01 | 22.00 | 1.76 |
| 1.40 | 0.54 | 8.10 | 1.00 | 22.50 | 1.72 |
| 1.50 | 0.57 | 8.30 | 1.05 | 23.00 | 1.83 |
| 1.60 | 0.59 | 8.50 | 1.04 | 23.50 | 1.80 |
| 1.70 | 0.04 | 8.70 | 1.07 | 24.00 | 1.90 |
| 1.80 | 0.07 | 8.90 | 1.11 | 24.50 | 1.81 |
| 1.90 | 0.09 | 9.10 | 1.09 | 25.00 | 1.98 |
| 2.00 | 0.15 | 9.30 | 1.14 | 25.50 | 1.91 |
| 2.10 | 0.19 | 9.50 | 1.12 | 26.00 | 2.02 |
| 2.20 | 0.25 | 9.70 | 1.15 | 26.50 | 1.92 |
| 2.30 | 0.29 | 9.90 | 1.16 | 27.00 | 1.97 |
| 2.40 | 0.33 | 10.10 | 1.16 | 28.00 | 2.02 |
| 2.50 | 0.37 | 10.30 | 1.19 | 29.00 | 1.95 |
| 2.60 | 0.41 | 10.50 | 1.14 | 30.00 | 1.94 |
| 2.70 | 0.44 | 10.70 | 1.19 | 31.00 | 2.11 |
| 2.80 | 0.45 | 10.90 | 1.17 | 32.00 | 2.17 |
| 2.90 | 0.48 | 11.10 | 1.13 | 33.00 | 2.27 |
| 3.10 | 0.61 | 11.30 | 1.20 | 34.00 | 2.27 |
| 3.30 | 0.64 | 11.50 | 1.13 | 35.00 | 2.29 |
| 3.50 | 0.65 | 11.70 | 1.20 | 36.00 | 2.35 |
| 3.70 | 0.68 | 11.90 | 1.18 | 37.00 | 2.37 |
| 3.90 | 0.69 | 12.10 | 1.14 | 38.00 | 2.40 |
| 4.10 | 0.71 | 12.40 | 1.19 | 39.00 | 2.57 |
| 4.30 | 0.73 | 13.00 | 1.34 | 40.00 | 2.36 |
| 4.50 | 0.75 | 13.50 | 1.33 | | |
| 4.70 | 0.77 | 14.00 | 1.48 | | |
| 4.90 | 0.79 | 14.50 | 1.45 | | |

# Appendix C - General information

## 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) and approved by Israel Ministry of environmental protection, radiation hazards department (Permit number 1158).

Address: PO Box 23, Binyamina 30500, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com
website: www.hermonlabs.com
Person for contact: Mr. Alex Usoskin, QA manager.

## Abbreviations and acronyms

The following abbreviations and acronyms are applicable to this test report:

| | |
|---|---|
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dB(μV) | decibel referred to one microvolt |
| dB(μV/m) | decibel referred to one microvolt per meter |
| EMC | electromagnetic compatibility |
| EUT | equipment under test |
| GHz | gigahertz |
| H | height |
| Hz | hertz |
| kHz | kilohertz |
| kV | kilovolt |
| L | length |
| LNA | low noise amplifier |
| m | meter |
| MHz | megahertz |
| NA | not applicable |
| QP | quasi-peak |
| RF | radio frequency |
| RE | radiated emission |
| rms | root mean square |
| s | second |
| V | volt |
| W | width |

## Specification references

| | |
|---|---|
| 47CFR part 15: 2003 | Radio Frequency Devices |
| ANSI C63.2:1996 | American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications. |
| ANSI C63.4:2001 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. |