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ELECTROMAGNETIC EMISSIONS TEST REPORT

ACCORDING TO FCC CFR 47 PART 15 SUBPART B, PART 90 SUBPART I
for

Head Connection Systems Ltd.

EQUIPMENT UNDER TEST:

**Private address wireless network,
model PAWN 101-460C**

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Description of equipment under test

| | |
|----------------|----------------------------------|
| Test items | Private address wireless network |
| Manufacturer | Head Connection Systems Ltd. |
| Types (Models) | PAWN 101-460C |
| Serial number | 1600277 |
| Receipt date | December 12, 1999 |

Applicant information

| | |
|------------------------------|------------------------------|
| Applicant's representative & | |
| Responsible person | Mr. Yoram Peled |
| Company | Head Connection Systems Ltd. |
| Address | Moshav Ben Shemen 11 |
| Postal code | 73115 |
| Country | Israel |
| Telephone number | +972 89211918 |
| Telefax number | +972 89202702 |

Test performance

| | |
|-----------------------|---|
| Project Number: | 13823 |
| Location | Hermon Laboratories |
| Test started | December 12, 1999 |
| Test completed | March 4, 2000 |
| Purpose of test | Apparatus verification in accordance with emissions requirements |
| Test specification(s) | FCC part 15 subpart B class B, part 90 subpart I |



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1 Summary and signatures

The EUT, Private address wireless network PAWN 101-460C, was tested according to FCC part 15 subpart B class B and part 90 subpart I and found to comply with the standard requirements.

Test performed by:

Mrs. Eleonora Pitt, test engineer

Test report prepared by:

Mrs. Valeria Mednikov, certification engineer

Test report approved by:

Mr. Michael Nikishin, EMC group leader

Mr. Alex Usoskin, QA manager

The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation by A2LA.

Through this report a point is used as the decimal separator, while thousands are counted with a comma.

This report is in conformity with EN 45001 and ISO GUIDE 25.

The test results relate only to the items tested.

This test report must not be reproduced in any form except in full with the approval of Hermon Laboratories Ltd.



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2 General information

2.1 Abbreviations and acronyms

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

| | |
|----------|--|
| AC | alternating current |
| cm | centimeter |
| CE | conducted emissions |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dB(µV) | decibel referred to one microvolt |
| dB(µV/m) | decibel referred to one microvolt per meter |
| DC | direct current |
| EMC | electromagnetic compatibility |
| EUT | equipment under test |
| GHz | gigahertz |
| H | height |
| Hz | hertz |
| kHz | kilohertz |
| kV | kilovolt |
| L | length |
| LISN | line impedance stabilization network |
| m | meter |
| MHz | megahertz |
| NA | not applicable |
| NARTE | National Association of Radio and Telecommunications Engineers, Inc. |
| PC | personal computer |
| QP | quasi-peak (detector) |
| RE | radiated emission |
| RMS | root-mean-square |
| sec | second |
| V | volt |
| W | width |

2.2 Specification references

| | |
|--------------------------------------|--|
| CFR 47 part 15 subpart B: 10/1998 | Radio Frequency Devices, Subpart B. |
| CFR 47 part 90 subpart I: 10/1998 | Private land mobile radio services, Subpart I |
| ANSI C63.2:06/1996 | American National Standard for Instrumentation- Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications. |
| ANSI C63.4:1992 | 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. |



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2.3 EUT description

The EUT, Private address wireless network, is a two way, 4 frequencies/channels, wireless UHF transceiver, rechargeable battery operated, built into a highly efficient hearing protection for secure voice communications in noisy environments. The unit provides intelligible speech in noise levels up to 135 dB(A).

The EUT operating frequencies are:

$$F_{\min} = 451.0175 \text{ MHz}$$

$$F_{\text{mid}} = 460.6487 \text{ MHz}$$

$$F_{\max} = 469.9796 \text{ MHz.}$$

2.4 EUT test configuration

Test configuration is given in Figure 2.4.1.



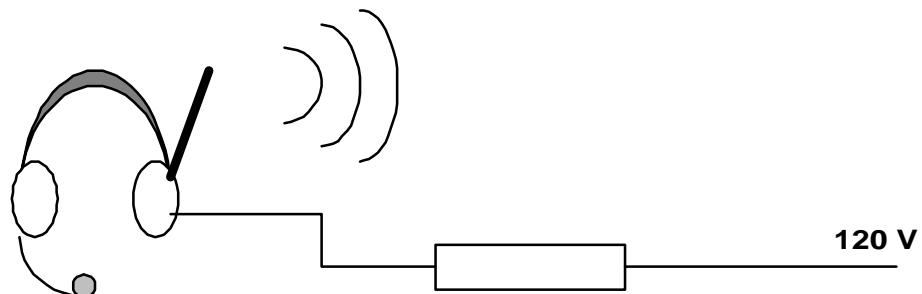
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Figure 2.4.1
EUT test configuration

a) Radiated



b) Conducted



Adaptor EDC-78
120 V AC / 6 V DC



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2.5 EUT verification. Labeling requirements (CFR 47, FCC part 15, sections 15.19, 15.109)

A device subject to verification shall bear the following label in a conspicuous location on the device:

**This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including
interference that may cause undesired operation.**

For a Class B digital device the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.**
- Increase the separation between the equipment and receiver.**
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.**
- Consult the dealer or an experienced radio/TV technician for help.**

For a Class A and Class B digital device the instructions furnished the user shall include the following caution:

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



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3 Test facility description

3.1 General

Tests were performed at Hermon Laboratories, which is a fully independent, private EMC, Safety 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 radiated measurements (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-809 for anechoic chamber, C-845 for conducted emissions site), assessed by NMi Certin B.V. (Netherlands) for a number of EMC, Telecommunications, Safety standards, and assessed by AMTAC (UK) for safety of Medical Devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO GUIDE 25/EN 45001 for EMC, Telecommunications and Product Safety Information Technology Equipment (Certificate No. 839.01).

Address: PO Box 23, Binyamina 30550, Israel
Telephone: +972 6628 8001
Fax: +972 6628 8277

Person for contact: Mr. Alex Usoskin, testing and QA manager.

3.2 Equipment calibration

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 MIL-STD-45662A.

The laboratory standards are calibrated by the third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

3.2.1 Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

| | |
|---|--|
| Radiated emissions in the open field test site at 10 m measuring distance | Biconilog antenna: ± 3.2 dB Log periodic antenna: ± 3 dB Biconical antenna: ± 4 dB Double ridged guide antenna: ± 2.36 dB |
| Radiated emissions in the anechoic chamber at 3 m measuring distance | Biconilog antenna: ± 3.2 dB |



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3.3 Statement of qualification

The test measurement data supplied in this test measurement report having been received by me, is hereby duly certified. The following is a statement of my qualifications:

I am an engineer, graduated from university in 1974 with an MScEE degree, have obtained 26 years experience in EMC measurements and have been with Hermon Laboratories since 1991.

Name: Mrs. Eleonora Pitt
Position: test engineer

Signature:
Date:


March 26, 2000

I hereby certify that this test measurement report was prepared by me and is hereby duly certified. The following is a statement of my qualifications.

I have a university degree and more than 10 years experience in document processing.
I have been with Hermon Laboratories since May 1999.

Name: Mrs. Valeria Mednikov
Position: technical writer

Signature:
Date:


March 26, 2000



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4 Emissions measurements

4.1 Conducted emission measurements according to FCC part 15 subpart B

4.1.1 General

Conducted emission measurements specification limits are given in Table 4.1.1 below.

Table 4.1.1
Limits for conducted emission on AC power lines

| Frequency MHz | Class B equipment limit dB(mV) |
|------------------|--------------------------------------|
| 0.45 - 30 | 48 |

4.1.2 Test procedure

The test was performed in the shielded room. The EUT was set up on the wooden table as shown Figure 4.1.1, Photograph 4.1.1 in configuration, given in Figure 2.4.1. Frequency range from 450 kHz to 30 MHz was investigated.

The measurements were performed on the 120 V AC 60 Hz power lines (both neutral and phase) by means of the LISN, connected to the spectrum analyzer. The unused coaxial connector of the LISN was terminated in 50Ω . The position of the EUT cables was varied to determine maximum emission level. Quasi peak detector (resolution bandwidth = 9 kHz) was used.

The test results are recorded in Table 4.1.2 and shown in Plot 4.1.1 to 4.1.3.

Reference numbers of test equipment used

| | | | |
|---------|---------|---------|---------|
| HL 0026 | HL 0447 | HL 0580 | HL 0590 |
|---------|---------|---------|---------|

Full description is in Appendix A.



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Table 4.1.2 Conducted emission measurement results on EUT power lines

Frequency range : 450 kHz - 30 MHz

Detector : quasi peak

Resolution bandwidth = 9 kHz

Line: neutral, phase

TEST SPECIFICATION: FCC part 15, subpart B, Class B

DATE: January 23, 2000

RELATIVE HUMIDITY: 63%

AMBIENT TEMPERATURE: 24°C

| Frequency, MHz | Conducted Emissions, dB (mV) | Limit , dB (mV) | Margin, dB | Pass/ Fail |
|-------------------|------------------------------------|--------------------|---------------|---------------|
| 0.501 | 31.86 | 48 | 16.14 | Pass |
| 0.580 | 33.84 | 48 | 14.16 | Pass |
| 0.609 | 33.05 | 48 | 14.95 | Pass |
| 0.648 | 32.90 | 48 | 15.10 | Pass |
| 0.655 | 32.15 | 48 | 15.85 | Pass |
| 0.734 | 31.03 | 48 | 16.97 | Pass |

Table calculations and abbreviations:

Conducted emission = EMI meter reading (dB μ V) + cable loss (dB) + LISN correction factor (dB).

For LISN correction factor refer to Appendix B.

Limit margin = dB below (negative if above) limit.

Line ID = Line identification (Ph - phase, N - neutral).



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**Plot 4.1.1
Conducted emission measurements on power line**

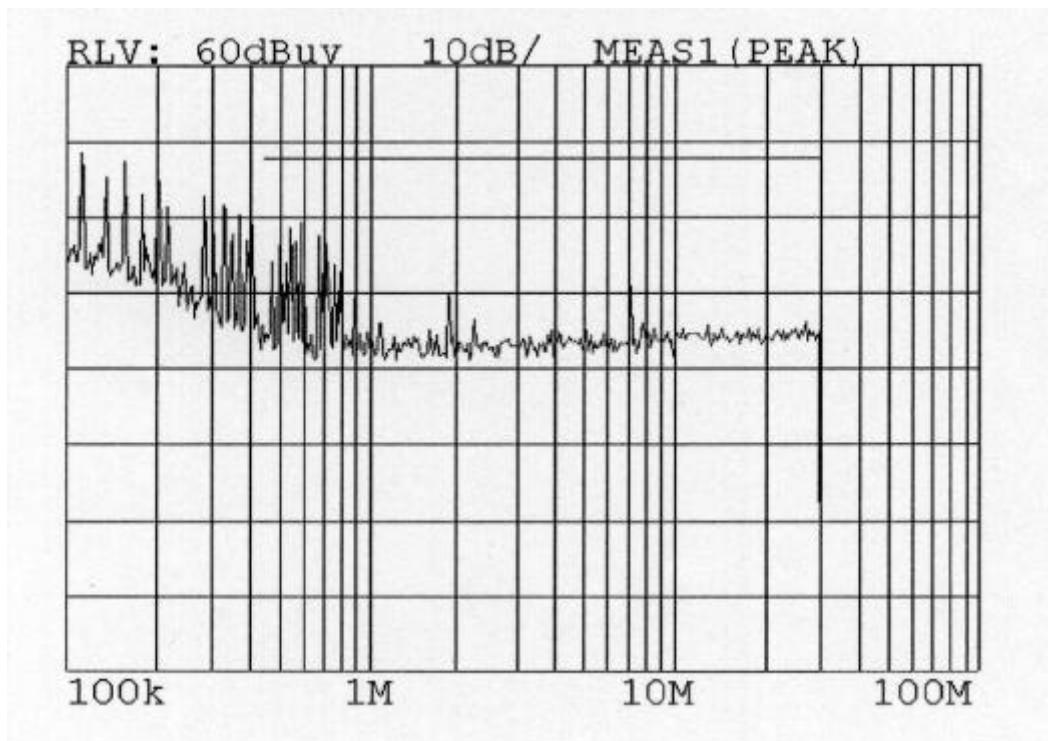
Test specification: FCC part 15 subpart B class B

Frequency range: 450 kHz-30 MHz

EUT: PAWN 460C

Line: phase

Detector: peak





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**Plot 4.1.2
Conducted emission measurements on power line**

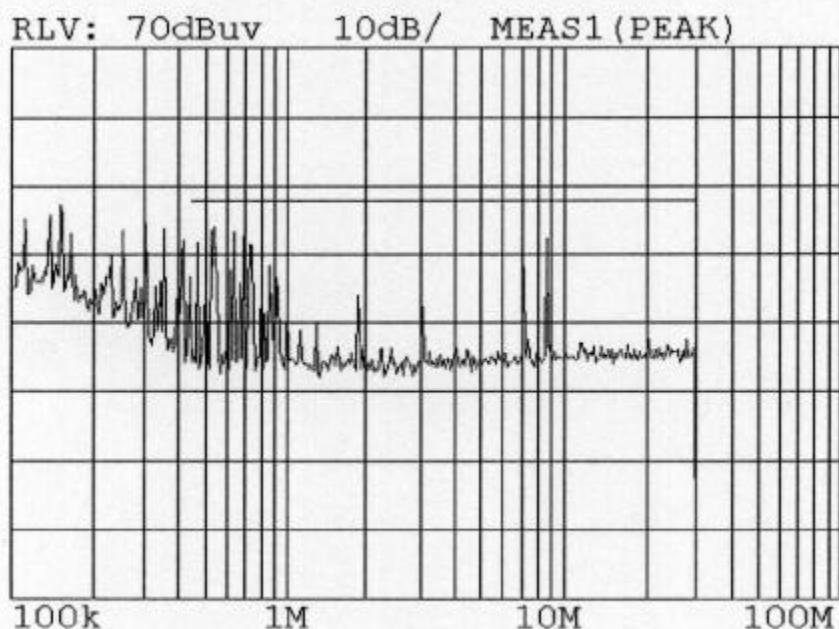
Test specification: FCC part 15 subpart B class B

Frequency range: 450 kHz-30 MHz

EUT: PAWN 460C

Line: neutral

Detector: peak

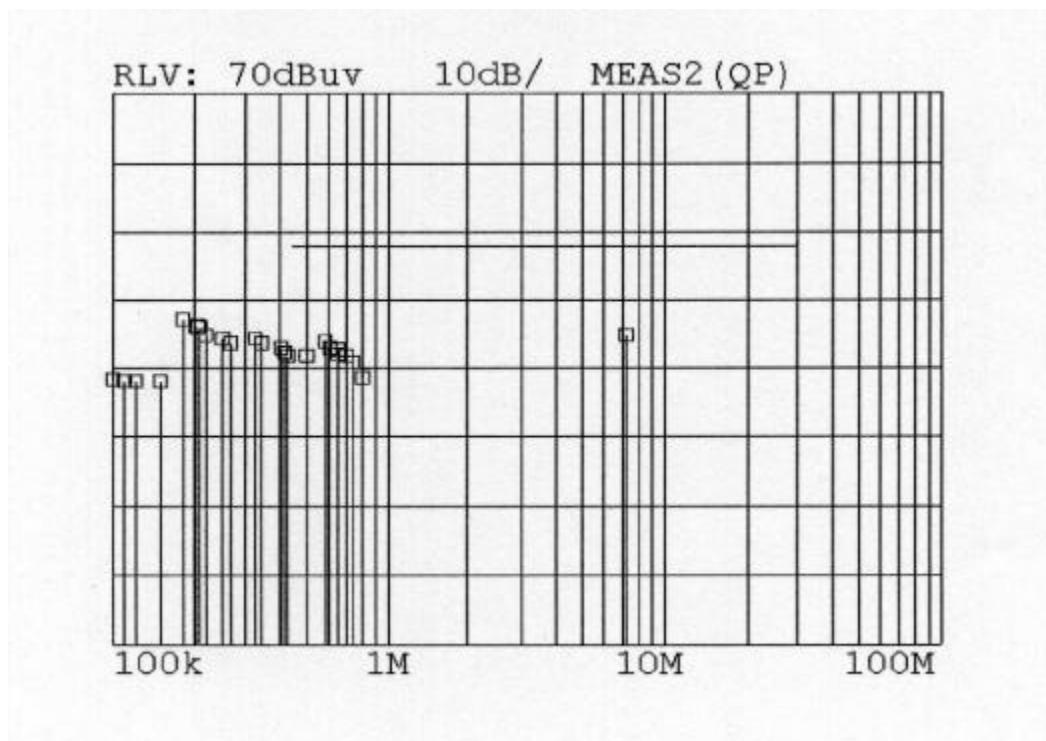




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Plot 4.1.3
Conducted emission measurements on power line

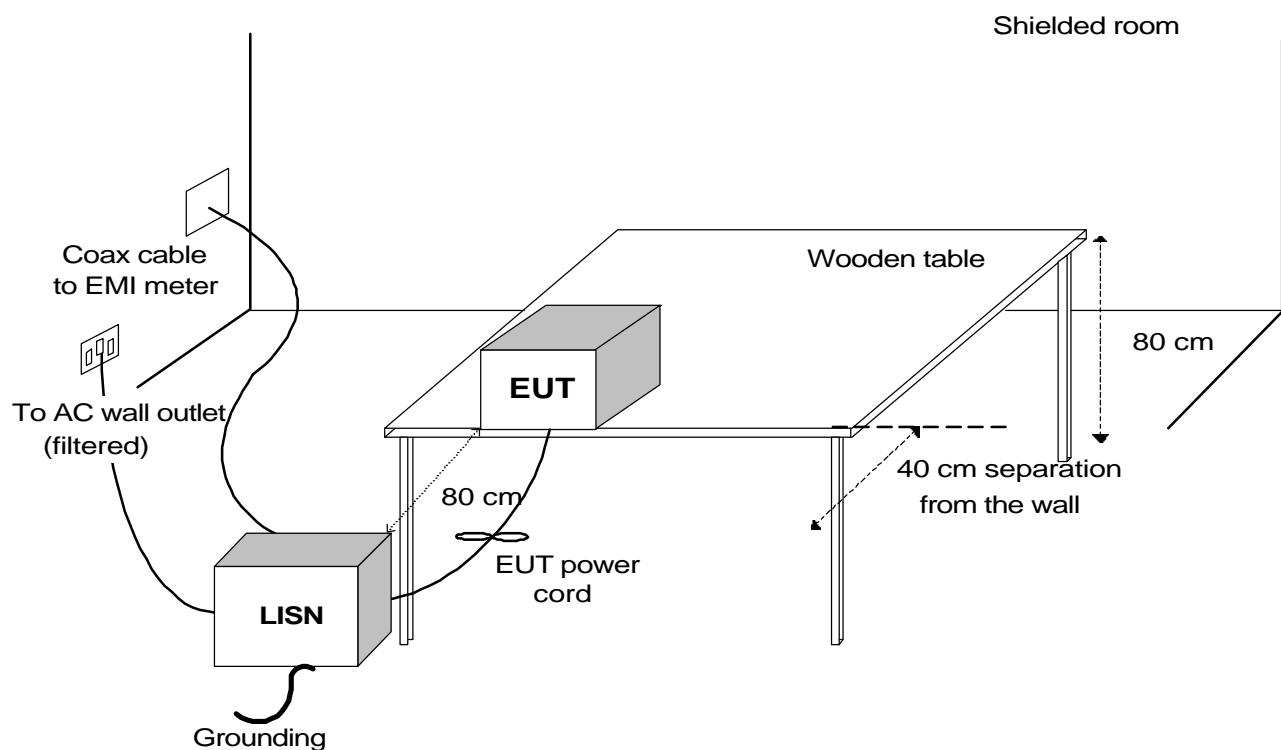
Test specification: FCC part 15 subpart B class B
Frequency range: 450 kHz-30 MHz
EUT: PAWN 460C
Line: neutral
Detector: quasi-peak





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Figure 4.1.1
Conducted emissions test setup for table-top equipment





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Photograph 4.1.1
Setup for conducted emissions measurements





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4.2 Radiated emission measurements according to FCC part 15 subpart B

4.2.1 General

The test was performed to measure radiated emissions from the receiver and incorporated digital device of the EUT.

Radiated emission measurements specification limits are given in Table 4.2.1 below:

Table 4.2.1
Limits for electric field strength, quasi-peak detector

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

4.2.2 Test procedure

The radiated emissions measurements of the EUT receiver and incorporated digital device in the frequency range from 30 MHz to 2 GHz were performed in the anechoic chamber at 3 meter measuring distance.

The EUT was set up on the wooden table, as shown in Figure 4.2.1, Photographs 4.2.1 to 4.2.2. For full test configuration refer to Figure 2.4.1a.

The biconilog antenna was used. To find maximum radiation the turntable was rotated 360°, the measuring antenna height varied from 1 to 4 m and the antennas polarization was changed from vertical to horizontal. The measurements from 30 MHz to 1 GHz were performed with EMI receiver settings: RBW=120 kHz, quasi-peak detector. The receiver radiated emissions measurements from 1 GHz to 2 GHz were performed with spectrum analyzer settings: RBW = VBW = 1 MHz, peak detector.

The EUT was found to be in compliance with 15.109 class B limits. The results of measurements are shown in Plots 4.2.1, 4.2.2 and Table 4.2.1.

Reference numbers of test equipment used

| | | | | |
|---------|---------|---------|---------|---------|
| HL 0041 | HL 0465 | HL 0521 | HL 0589 | HL 0604 |
|---------|---------|---------|---------|---------|

Full description is in Appendix A.



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**Table 4.1.2 Radiated emission measurements test results,
electric field, frequency range 30 MHz - 2 GHz**

TEST SPECIFICATION: FCC part 15, subpart B, Class B
DATE: January 24, 2000
RELATIVE HUMIDITY: 63%
AMBIENT TEMPERATURE: 24°C

MEASUREMENTS PERFORMED AT 3-METER DISTANCE

| Frequency, MHz | Ant. pol. | Radiated emission, dB(μ V/m) | Limit, dB(μ V/m) | Margin, dB | Pass/ Fail |
|-------------------|--------------|---|--------------------------|---------------|---------------|
| 457.6665 | H | 29.15 | 46 | 16.85 | Pass |
| 457.6678 | V | 25.83 | 46 | 20.17 | Pass |
| 915.3125 | V | 30.45 | 46 | 15.55 | Pass |
| 915.3338 | H | 28.39 | 46 | 17.61 | Pass |

Test results listed in the Table were obtained throughout testing with biconilog antenna at 1 m height.

Test parameters:

Detector type = QP (quasi peak).

Resolution bandwidth = 120 kHz (in the range 30 MHz to 1 GHz) and 1 MHz (1 GHz to 2 GHz).

Table calculations and abbreviations:

Radiated emission dB (μ V/m) = measured results dB(μ V) + correction factor dB(1/m).

Correction factor = antenna factor + cable loss (for antenna factor and cable loss refer to Appendix B).

Ant. pol. = antenna polarization (V-vertical, H-horizontal).

Margin = dB below (negative if above) limit.



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**Plot 4.1.1 Radiated emission measurements test results,
electric field, frequency range 30 MHz - 1 GHz
Stand-by mode, vertical polarization**

