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# ELECTROMAGNETIC EMISSION TEST REPORT

**ACCORDING TO 47CFR part 15, subpart C §15.209, §15.207**

**for**

## S.A.E Afikim Ltd.

**EQUIPMENT UNDER TEST:**

## Transceiver for livestock identification system

## Model: IDEAL-SMT





**Document ID: SAERAD_FCC.15792.doc**
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# Contents

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# 1 Project information

## EUT attributes

| | |
|---|---|
| Test item | Transceiver for livestock identification system |
| Type (Model) | IDEAL-SMT |
| Category number | 4022900 H |
| Software release | Rev. 45.00.49.00 |
| Hardware version | Rev. 2 |

## Applicant information

| | |
|---|---|
| Applicant's responsible person | Mr. Yaron Kopelevsky, project manager |
| Company | S.A.E. Afikim Ltd. |
| Address | Kibbutz Afikim |
| Postal code | 15148 |
| Country | Israel |
| Telephone number | +972 4675 4811 |
| Telefax number | +972 4675 1862 |

## Test details

| | |
|---|---|
| Project number: | 15792 |
| Location | Hermon Laboratories |
| Test started | February 23, 2004 |
| Test completed | February 24, 2004 |
| Purpose of test | Apparatus compliance verification in accordance with emission requirements |
| Test specification(s) | 47CFR Part 15, §§15.209, 15.207 |

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# 2 Summary of tests and signatures

The tests listed in the table below were performed.
The EUT was found complying with the limits of 47CFR Part 15, §15.209 and §15.207.

| Test description | Specification reference | Tested by | Date tested | Test report paragraph | Verdict |
|---|---|---|---|---|---|
| **Transmitter parameters** | | | | | |
| Field strength of fundamental | 15.209(a) | Mr. Y. Neuman, test engineer | February 23, 2004 | 4.1 | Pass |
| Out of band spurious emissions (radiated) | 15.209(c) | Mr. Y. Neuman, test engineer | February 23, 2004 | 4.2 | Pass |
| Conducted emissions | 15.207 | Mr. Y. Neuman, test engineer | February 24, 2004 | 4.3 | Pass |

**Test report prepared by:**

Mrs. M. Cherniavsky, MScEE, certification engineer

**Test report approved by:**

Mr. Michael Nikishin, MScEE, group leader

Mr. Alex Usoskin, C.E.O.

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# 3 EUT description

## 3.1 General description

The EUT, IDEAL-SMT transceiver, is a part of livestock identification system, that includes controller box, switch box and antennas with tags. The IDEAL-SMT supervises automatic cow identification and collects cow activity data.
The controller is powered from 24 V AC (120-230 V / 24 V AC, 50 / 60 Hz transformer).

## 3.2 EUT test configuration

The EUT ports and lines description is given in Table 3.2.1, auxiliary equipment list is provided in Table 3.2.2, the test configuration is provided in Figure 3.2.1. The device operating frequencies are given in Table 3.2.3.

**Table 3.2.1**

**EUT ports and lines**

| Port type | Port description | Connector type | Quantity | Indoor / outdoor cable | Cable type description | Cable length, m | Connected from - to |
|---|---|---|---|---|---|---|---|
| Power | 120 VAC | Non detachable | 1 | Outdoor | Unshielded | 1.5 | Transformer – AC mains |
| Power | 24 VAC | Non detachable | 1 | Outdoor | Unshielded | 6.0* | Transformer – controller |
| Signal | Serial | Non detachable | 1 | Outdoor | Shielded | 15.0** | PC – controller |
| Signal | Antenna | Non detachable | 4 | Outdoor | Shielded | 3.0* | Switch box – antennas |
| Signal | Select | Non detachable | 1 | Outdoor | Shielded | 3.0* | Controller – switch box |
| Signal | Signal | Non detachable | 1 | Outdoor | Shielded | 3.0* | Controller – switch box |
| Protective earth | GND | Non detachable | 1 | Outdoor | AWG 10 | 3.0* | Controller – reference ground plane |

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**Table 3.2.2**

**Auxiliary equipment**

| Description | Manufacturer | Model number | Serial number |
|---|---|---|---|
| PC | Siemens Nixdorf | Scenic Pro M5 | QKO28799 |
| Monitor | Packard Bell | 2020 | LIMN 55/02042 |
| Keyboard | Fujitsu | N860-8729-T500 | OZ614979 |
| Mouse | Fujitsu - Siemens | NA | 912047982 |
| Mouse | IBM | MU29J | 23-159692 |
| Printer | Seiko Epson Corp. | P80SA | 44B1127035 |
| 120-230/24 V AC transformer (radiated emission test) | Maytronics Ltd. | 5003, 188W | NA |
| 120/24 V AC transformer (conducted emission test) | Hermon Labs | TDGC-2 | 99 |

**Table 3.2.3**

**EUT operating frequencies**

| Frequency | Source |
|---|---|
| 200 kHz | Receiver |
| 358 kHz | Transmitter |
| 3.6864 MHz | Clock |
| 33 MHz | PCI |

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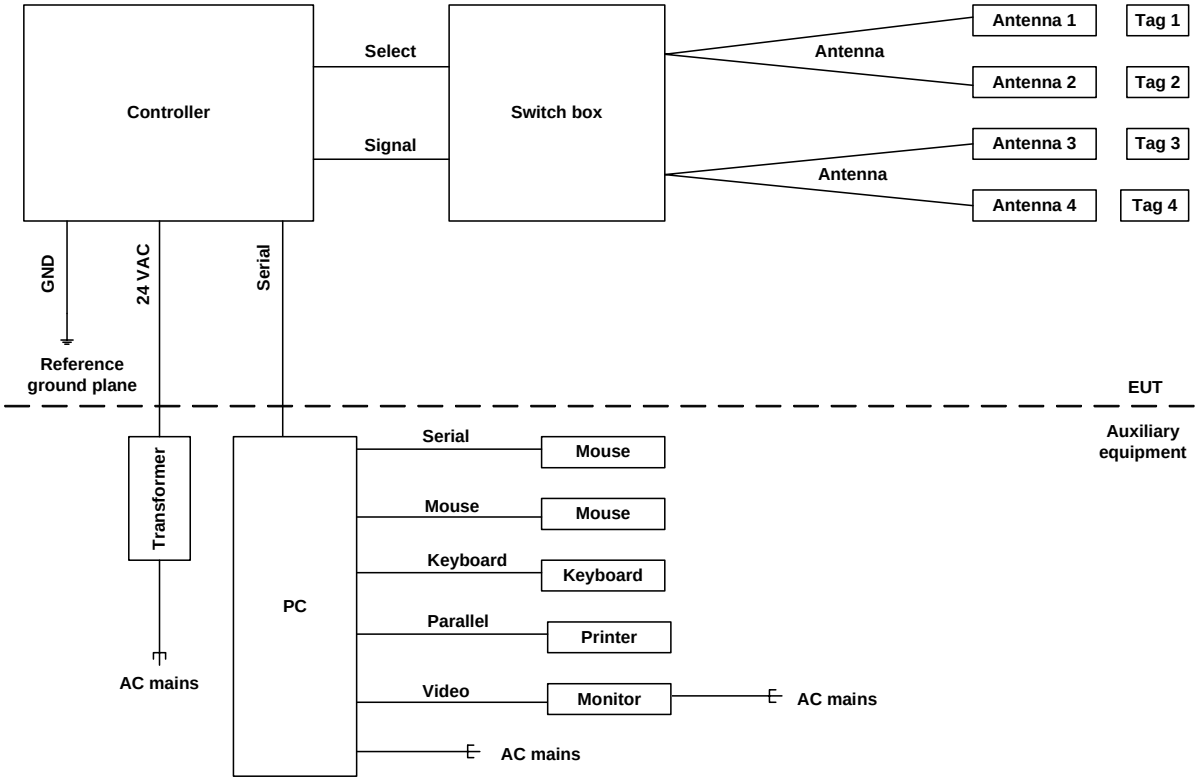
**Figure 3.2.1**

**EUT test configuration**



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# 4 Tests results

## 4.1 Field strength of fundamental according to § 15.209(a)

| | |
|---|---|
| METHOD OF MEASUREMENTS | ANSI 63.4 §13.1.4 |
| DATE of TEST: | February 23, 2004 |
| TEST PERFROMED AT: | Anechoic chamber |
| AMBIENT TEMPERATURE: | 22°C |
| RELATIVE HUMIDITY: | 44% |
| AIR PRESSURE: | 1020 hPa |
| TEST DISTANCE | 3 m |
| MEASUREMENT UNCERTAINTY: | ± 4 dB |
| ANTENNA TYPE: | LOOP |

| Carrier frequency, kHz | Peak detector measurement, dB(µV/m) | Average detector measurement, dB(µV/m) | Limit*, dB(µV/m) | Margin, dB | Reference to plots in Appendix A |
|---|---|---|---|---|---|
| 358 | 95.3 | 48.3 | 96.5 | 48.2 | A1, A2 |

* The limit is based on measurements employing an average detector according to §15.209(d).
The § 15.35 (b) peak limits (20 dB above average limits) were met.

**LIMIT, §15.209(a)**

| Frequency, MHz | Specification limit, µV/m | Measurement distance, m |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300** |

**The limit for 3 m distance was calculated using the square of the inverse linear distance extrapolation factor as follows:

$Lim_{3m} = Lim_{300m} + 40 \log (S_1/S_2)$, where $S_1 = 300$ m, $S_2 = 3$ m;
Limit for 300 m test distance: $Lim_{300m} = 2400/358 = 6.704$ µV/m=16.5 dB(µV/m)
$Lim_{3m} = 16.5$ dB(µV/m) + 80 dB = 96.5 dB(µV/m).

**TEST PROCEDURE**

The EUT was tested, being placed on a wooden 80 cm height table in typical installation position.

The loop antenna was positioned with its plane horizontal. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360°. Then the loop position was changed to vertical. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis. Plots A1, A2 in Appendix A refer to vertical antenna polarization as the worst case.

**TEST EQUIPMENT USED:**

| | | | | | | |
|---|---|---|---|---|---|---|
| HL 0446 | HL 0465 | HL 0521 | HL 0589 | HL 0592 | HL 0593 | HL 0594 |
| HL 1004 | | | | | | |

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## 4.2 Field strength of emission according to §15.209(c)

| | |
|---|---|
| METHOD OF MEASUREMENTS | ANSI 63.4 §13.1.4/ §13.1.5 |
| DATE of TEST: | February 23, 24, 2004 |
| TEST PERFROMED AT: | Anechoic chamber |
| AMBIENT TEMPERATURE: | 22°C |
| RELATIVE HUMIDITY: | 44% |
| AIR PRESSURE: | 1020 hPa |
| TEST DISTANCE | 3 m |
| FREQUENCY RANGE | 9 kHz to 1000 MHz |
| DETECTOR TYPE: | QUASI-PEAK |
| MEASUREMENT UNCERTAINTY: | Loop antenna: ± 4 dB; biconilog antenna: ± 6 dB |

**Loop antenna**

| Frequency, MHz | Resolution bandwidth, kHz | Turn-table position*, degrees | Radiated emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB | Reference to plots in Appendix A |
|---|---|---|---|---|---|---|
| 0.009 – 0.15 | 1 | 0 | No spurious emissions found | | | A3 |
| 0.716 | 9 | 0 | 64 | 70.5* | 6.5 | A4, A5 |
| 1.074 | 9 | 0 | 50.3 | 67* | 16.7 | A4, A6 |

*The limit for 3 m distance was calculated using the square of the inverse linear distance extrapolation factor as follows:

$Lim_{3m} = Lim_{30m} + 40 \log (S_1/S_2) = 24000/F(kHz) + 40$ dB, where $S_1 = 30$ m, $S_2 = 3$ m (see plots A5, A6 in Appendix A).

**Biconilog antenna**

| Frequency, MHz | Peak emission, dB(μV/m) | Quasi-peak | | | Antenna height, m | Antenna polarization | Turn-table position*, degrees | Verdict |
|---|---|---|---|---|---|---|---|---|
| | | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB | | | | |
| 40.635 | 41.60 | 37.79 | 40.00 | 2.21 | 1.0 | V | 189 | Pass |
| 108.550 | 40.14 | 36.84 | 43.50 | 6.66 | 1.0 | V | 311 | |
| 208.971 | 37.70 | 32.90 | 43.50 | 10.60 | 1.0 | H | 206 | |
| 236.247 | 43.58 | 37.29 | 46.00 | 8.71 | 1.2 | V | 296 | |
| 731.240 | 47.78 | 44.13 | 46.00 | 1.87 | 1.0 | H | 175 | |
| 797.716 | 46.18 | 44.86 | 46.00 | 1.14 | 1.1 | H | 234 | |
| 930.669 | 45.34 | 43.95 | 46.00 | 2.05 | 1.0 | H | 206 | |

The listed test results were obtained throughout the measurements with resolution bandwidth 120 kHz. For full test results refer to Plot A7 in Appendix A.

**Table abbreviations:**
Margin = dB below (negative if above) specification limit.
*****- EUT front panel refers to 0 degrees position of turntable

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**TEST PROCEDURE**

The EUT was set up on the 80 cm height wooden table in typical installation position as shown in Figures 4.2.1, 4.2.2. Radiated emissions were measured at 3-m test distance in the anechoic chamber with the loop antenna in the 9 kHz to 30 MHz range and the biconilog antenna in 30 MHz – 1000 MHz range.
**9 kHz – 30 MHz range:** the loop antenna was positioned with its plane horizontal. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360°. Then the loop position was changed to vertical. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis. Plots A3 to A6 in Appendix A refer to vertical antenna polarization as the worst case.
**30 MHz – 1000 MHz 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:**

| | | | | | | |
|---|---|---|---|---|---|---|
| HL 0446 | HL 0465 | HL 0521 | HL 0589 | HL 0592 | HL 0593 | HL 0594 |
| HL 0604 | HL 1004 | | | | | |

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**Figure 4.2.1**
**Set up for radiated emissions measurement in 9 kHz – 30 MHz range**

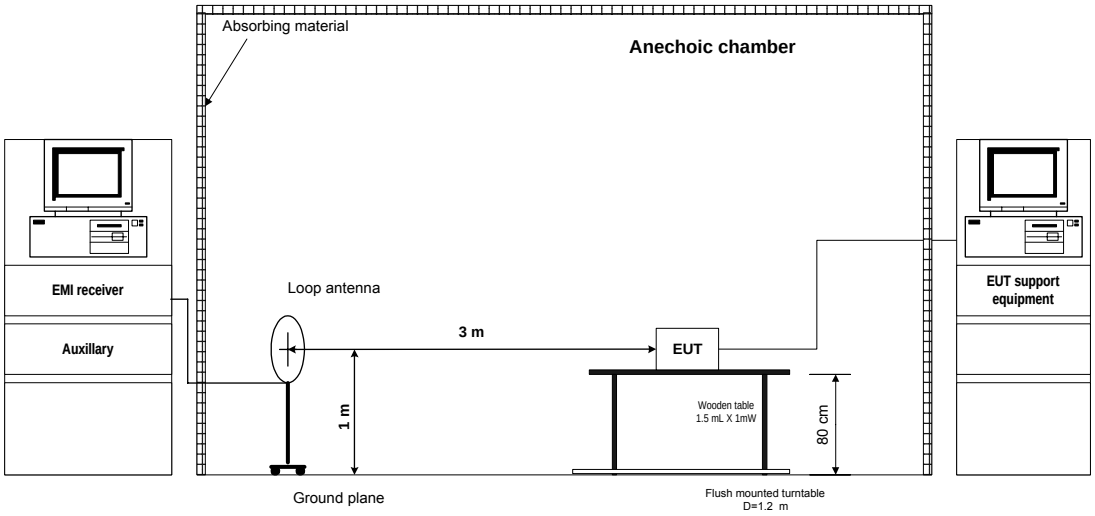
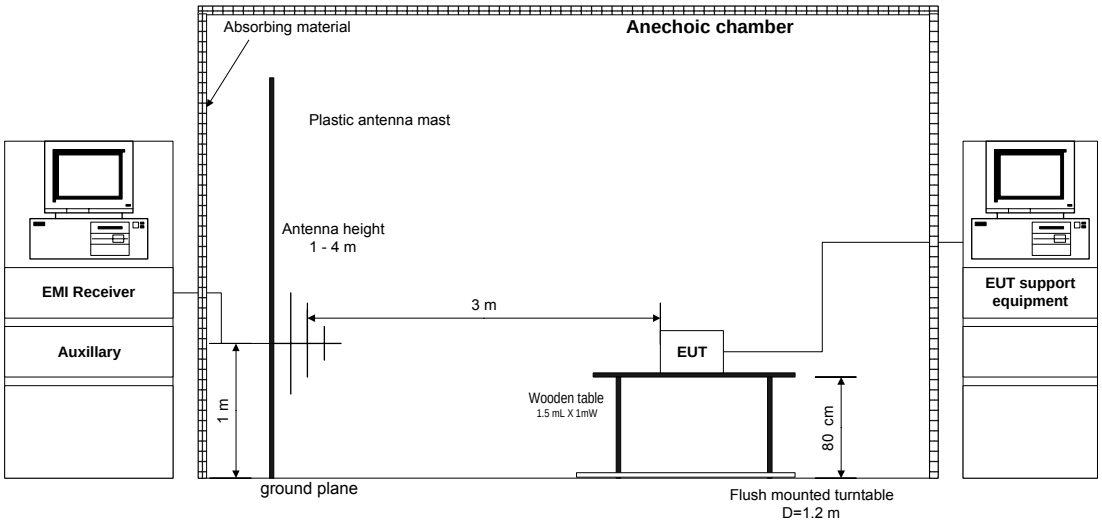



**Figure 4.2.2**

**Set up for radiated emissions measurement in 30 – 1000 MHz range**



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## 4.3 Conducted emissions test according to §15.207

| | |
|---|---|
| METHOD OF MEASUREMENTS | ANSI 63.4 §13.1.3 |
| DATE of TEST: | February 26, 2004 |
| RELATIVE HUMIDITY: | 43% |
| AMBIENT TEMPERATURE: | 21°C |
| AIR PRESSURE: | 1016 hPa |
| THE EUT WAS TESTED AS: | TABLE-TOP |
| FREQUENCY RANGE: | 150 kHz – 30 MHz |
| RESOLUTION BANDWIDTH: | 9 kHz |
| MEASUREMENT UNCERTAINTY, dB | ± 3.9 dB in 9 – 150 kHz<br>± 3.8 dB in 150 kHz – 30 MHz |

**EUT power lines (at 120 VAC port of transformer)**

| Frequency, MHz | Peak emission, dB(µV) | Quasi-peak | | | Average | | | Line ID | Verdict |
|---|---|---|---|---|---|---|---|---|---|
| | | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | | |
| 0.187 | 43.58 | 39.31 | 64.21 | 24.90 | 15.46 | 54.21 | 38.75 | L1 | Pass |
| 8.943 | 44.72 | 44.03 | 60.00 | 15.97 | 40.38 | 50.00 | 9.62 | | |
| 9.363 | 46.96 | 46.31 | 60.00 | 13.69 | 42.57 | 50.00 | 7.43 | | |
| 14.030 | 43.80 | 42.47 | 60.00 | 17.53 | 41.07 | 50.00 | 8.93 | | |
| 14.705 | 39.69 | 37.59 | 60.00 | 22.41 | 32.79 | 50.00 | 17.21 | | |
| 9.183 | 35.27 | 34.02 | 60.00 | 25.98 | 30.75 | 50.00 | 19.25 | L2 | Pass |
| 23.888 | 45.47 | 44.76 | 60.00 | 15.24 | 42.45 | 50.00 | 7.55 | | |
| 25.089 | 37.40 | 36.60 | 60.00 | 23.40 | 35.46 | 50.00 | 14.54 | | |

*****- Margin = dB below (negative if above) specification limit.

For full test results refer to Plots A8, A9 in Appendix A.
For measurement results at PC power ports refer to test report SAEEMC_FCC.15792.

**LIMIT**

| Frequency, MHz | Class B equipment, dB(µV) | |
|---|---|---|
| | QP | AVRG |
| 0.15 - 0.5 | 66 - 56* | 56 - 46* |
| 0.5 - 5 | 56 | 46 |
| 5 - 30 | 60 | 50 |

*The limit decreases linearly with the logarithm of frequency.

**TEST PROCEDURE**

The measurements were performed at mains terminals by means of LISN, connected to spectrum analyzer in the frequency range as referred to in the table above. The unused coaxial connector of the LISN was terminated with 50 Ω. The measurements were made with quasi-peak and average detectors as referred to in the tables.
The position of the EUT cables was varied to determine maximum emission level.

**TEST EQUIPMENT USED:**

| | | | | | | |
|---|---|---|---|---|---|---|
| HL 0163 | HL 0447 | HL 0672 | HL 0787 | HL 1430 | HL 1502 | HL 1510 |

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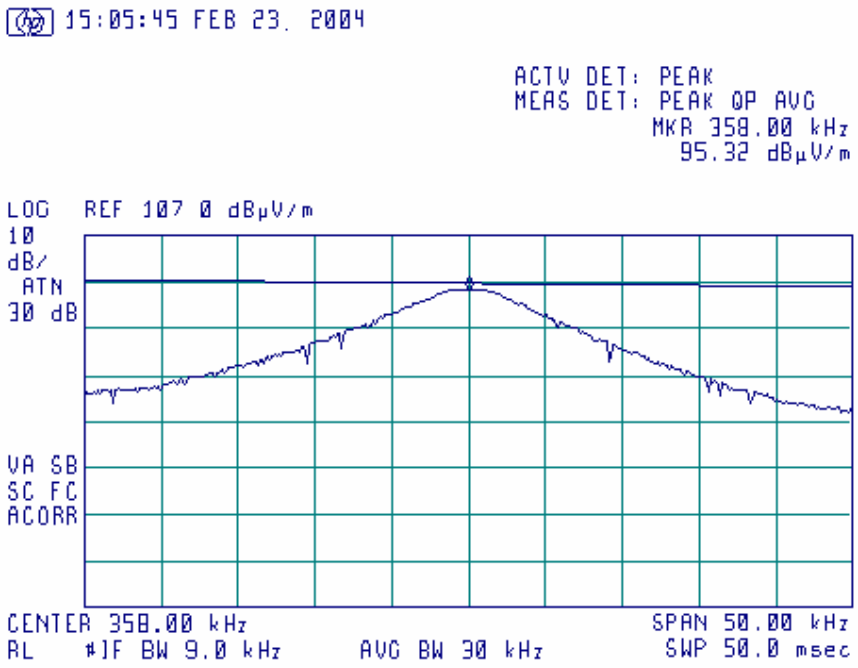
# Appendix A Plots

**Plot A 1**

**Field strength of fundamental measurement in the anechoic chamber**



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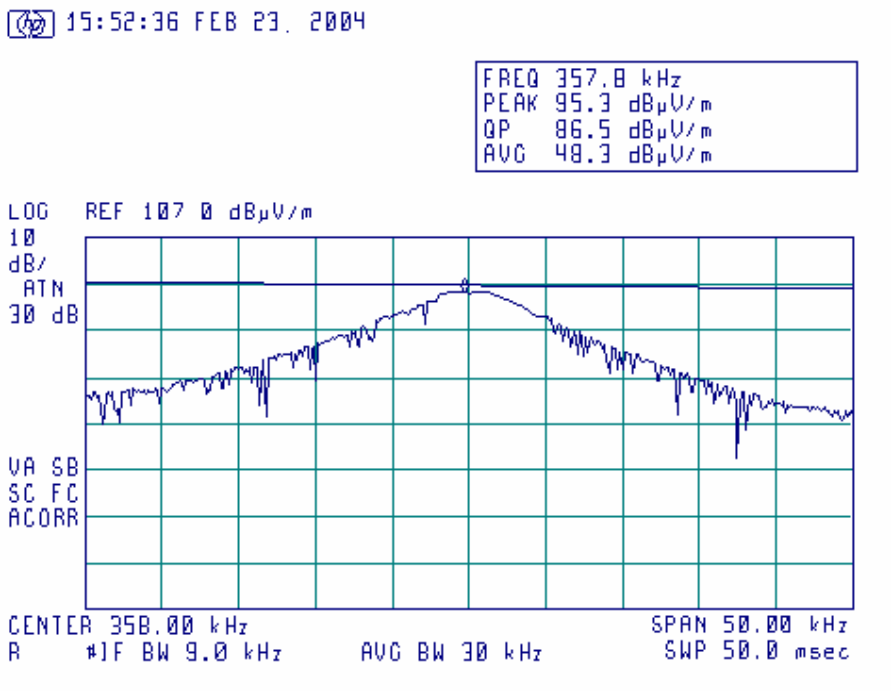
**Plot A 2**

**Field strength of fundamental measurement in the anechoic chamber**



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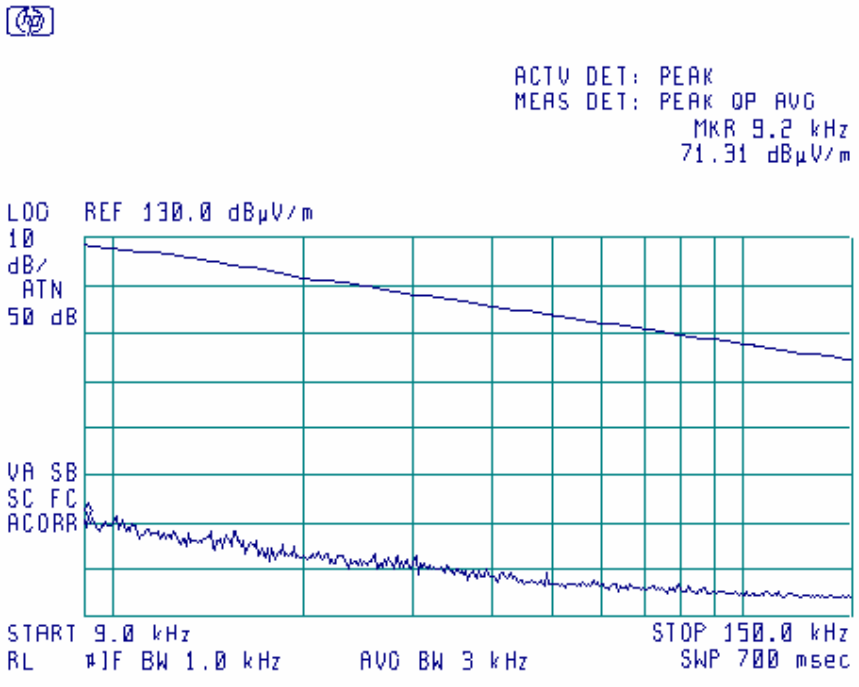
**Plot A 3**

**Radiated emissions measurement from 9 kHz to 150 kHz in the anechoic chamber**



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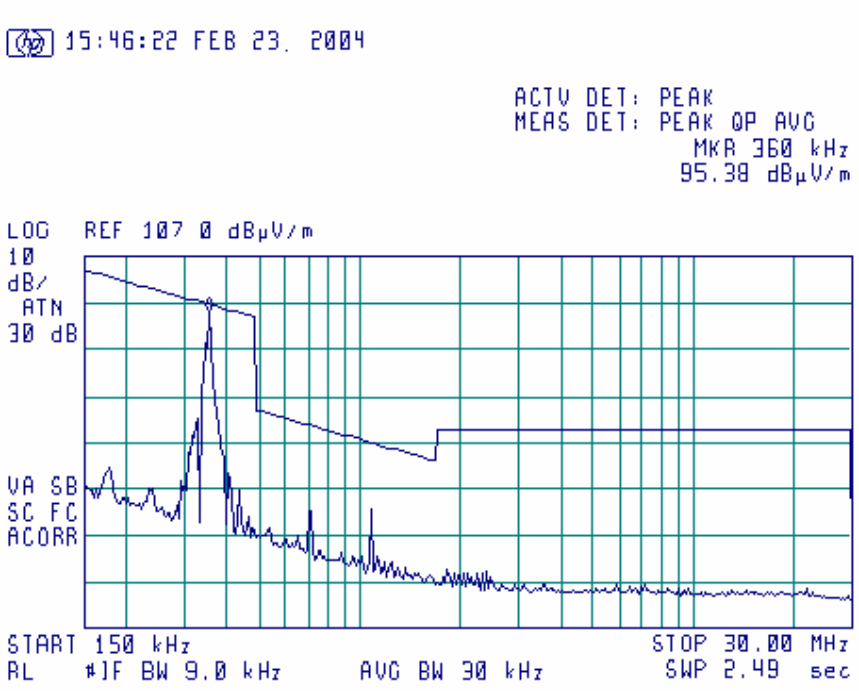
**Plot A 4**

**Radiated emissions measurement from 150 kHz to 30 MHz in the anechoic chamber**




Fundamental, 2nd and 3rd harmonics

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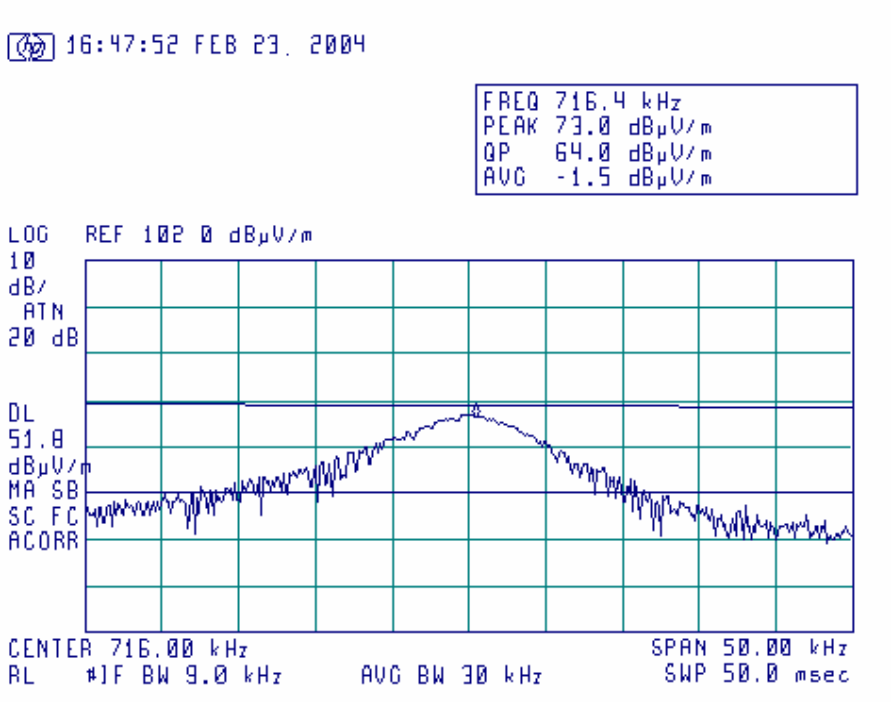
**Plot A 5**

**Field strength of second harmonic measurement in the anechoic chamber**




QP limit
Limit for 30 m test distance: 24000/716=33.5 µV/m=30.5 dB(µV/m)
The test was performed at distance 3 m.
Distance factor 40 dB/dec
Limit@3meters=70.5 dB(µV/m)

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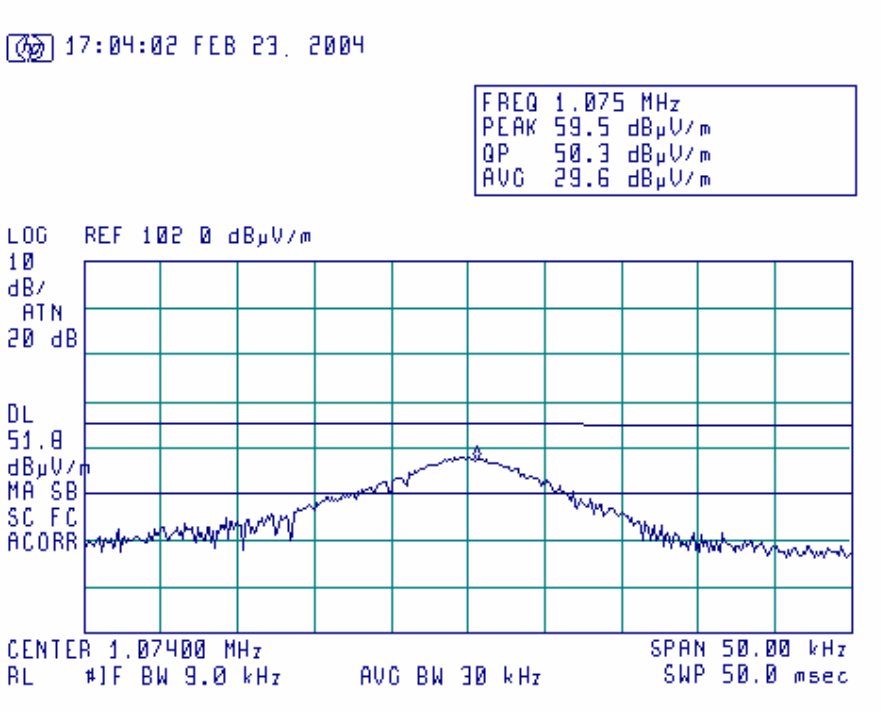
**Plot A 6**

**Field strength of third harmonic measurement in the anechoic chamber**




QP limit
Limit for 30 m test distance: 24000/1074=22.3 µV/m=27 dB(µV/m)
The test was performed at distance 3 m.
Distance factor 40 dB/dec
Limit@3meters=67 dB(µV/m)

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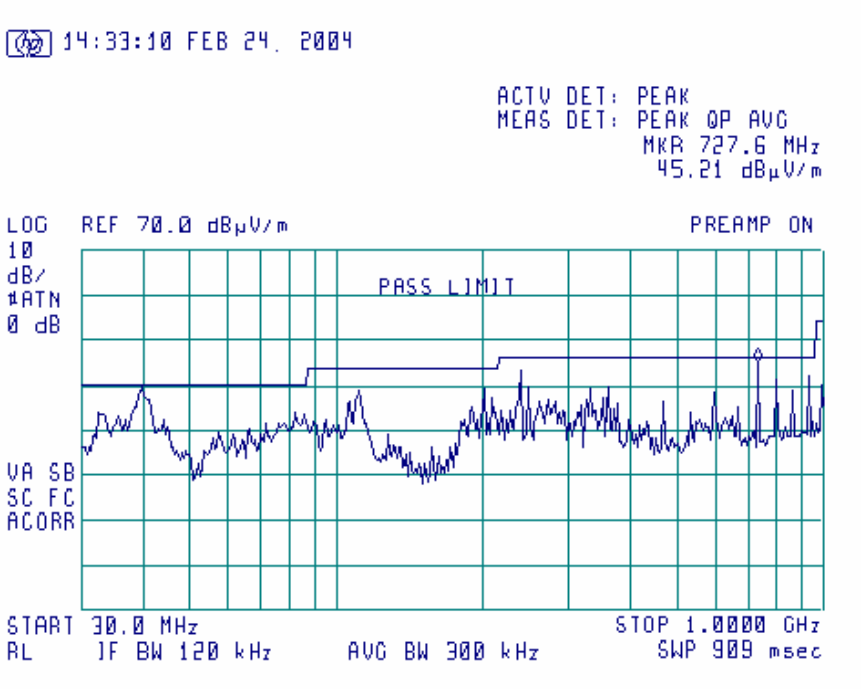
**Plot A 7**

**Radiated emissions measurement from 30 MHz to 1000 MHz in the anechoic chamber**



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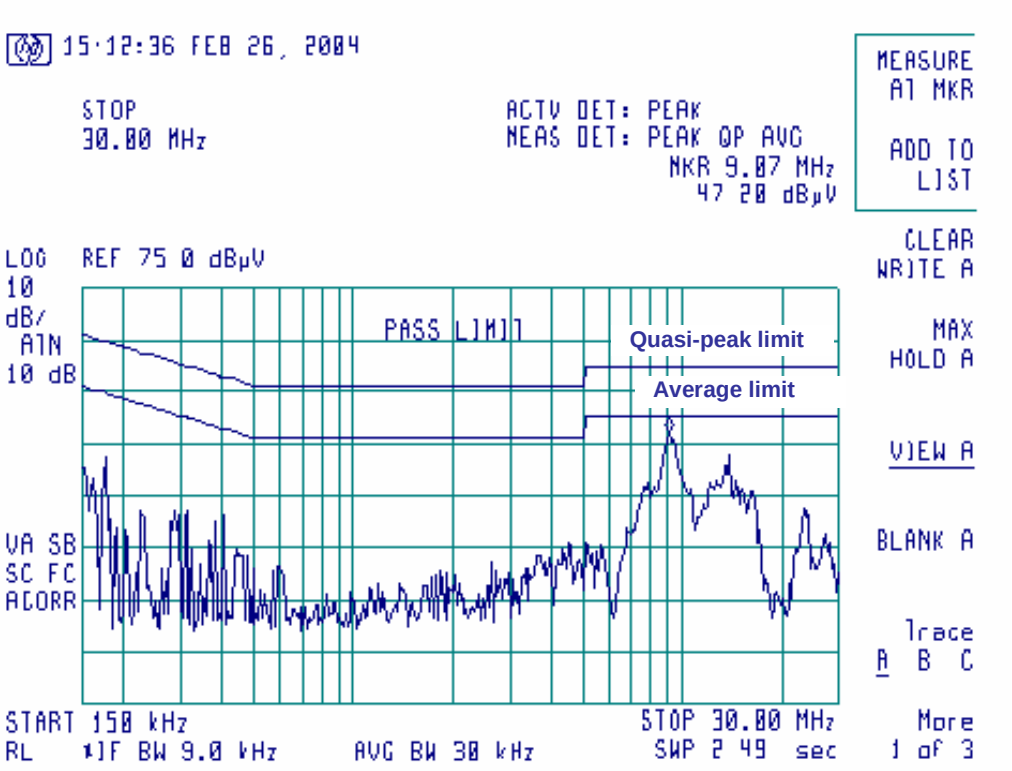
**Plot A 8**

**Conducted emission measurements at 120 VAC power line of EUT**

| | |
|---|---|
| LINE: | L1 |
| LIMIT: | QUASI-PEAK, AVERAGE |
| DETECTOR: | PEAK |



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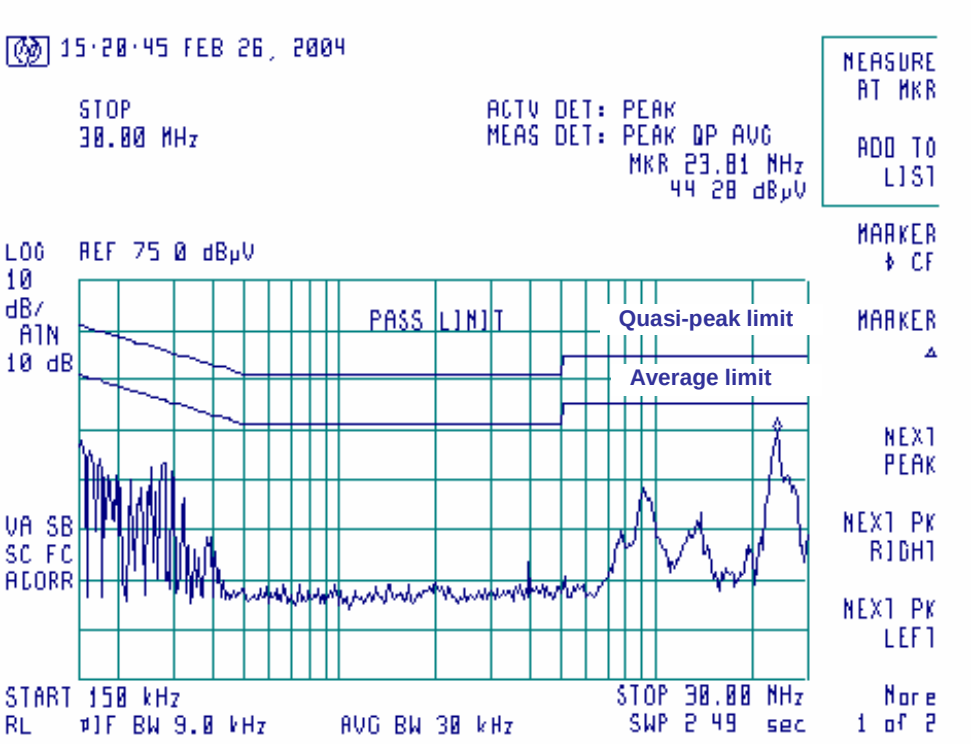
**Plot A 9**

**Conducted emission measurements at 120 VAC power line of EUT**

| | |
|---|---|
| LINE: | L2 |
| LIMIT: | QUASI-PEAK, AVERAGE |
| DETECTOR: | PEAK |



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# Appendix B Test equipment used for tests

| HL Serial No. | Description | Manufacturer information | | | Due Calibr. Month/ year |
|---|---|---|---|---|---|
| | | Name | Model No. | Serial No. | |
| 0163 | LISN FCC/VDE/MIL –STD | Electro-Metrics | ANS-25/2 | 1314 | 10/04 |
| 0446 | Active loop antenna 10 kHz-30 MHz | Electro-Mechanics | 6502 | 2857 | 11/04 |
| 0447 | LISN, 16/2, 300 V RMS | Hermon Labs | LISN 16-1 | 447 | 12/04 |
| 0465 | Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m | Hermon Labs | AC-1 | 023 | 10/05 check |
| 0521 | Spectrum analyzer with RF filter section (EMI Receiver 9 kHz – 6.5 GHz) | Hewlett Packard | 8546A | 0319 | 7/04 |
| 0589 | Cable coaxial, GORE A2POL118.2, 3 m | Hermon Labs | GORE-3 | 589 | 11/04 |
| 0592 | Position controller | Hermon Labs | L2-SR3000 | 100 | 5/05 check |
| 0593 | Antenna mast, 1-4 m/ 1-6 m Pneumatic | Hermon Labs | AM-F1 | 101 | 2/05 check |
| 0594 | Turntable for Anechoic Chamber, flush mounted, d=1.2 m, pneumatic | Hermon Labs | WDC1 | 102 | 1/05 check |
| 0604 | Antenna biconilog log-periodic/T Bow-Tie, 26 - 2000 MHz | EMCO | 3141 | 9611-1011 | 1/05 |
| 0672 | Shielded room 4.6(L) x 4.2(W) x2.4(H) m | Hermon Labs | SR-3 | 027 | 11/04 check |
| 0787 | Transient limiter | Hewlett Packard | 11947A-8ZE | 3107A01877 | 11/04 |
| 1004 | Cable coaxial, ANDREW PSWJ4, 6 m | Hermon Labs | ANDREW-6 | 163 | 12/04 |
| 1430 | EMI receiver, 9 kHz – 2.9 GHz | Agilent Technologies | 8542E | 3807A00262, 3705A00217 | 9/04 |
| 1502 | Cable RF, 6 m | Belden | M17/167 MIL-C-17 | 1502 | 12/04 check |
| 1510 | Cable RF, 8 m | Belden | M17/167 MIL-C-17 | 1510 | 12/04 |

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# 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).

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**Antenna factor**
**Biconilog antenna EMCO Model 3141**
**Ser.No.1011**

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

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).

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**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 | | ±0.17 |
| 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 | | |

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**Cable loss**
**Cable coaxial, 6 m, model: M17/167 MIL-C-17, HL 1502**

| Frequency, MHz | Cable loss, dB |
|---|---|
| 0.1 | 0.02 |
| 1 | 0.07 |
| 3 | 0.15 |
| 5 | 0.17 |
| 10 | 0.26 |
| 30 | 0.43 |
| 50 | 0.57 |
| 80 | 0.72 |
| 100 | 0.81 |
| 300 | 1.48 |
| 500 | 2.00 |
| 800 | 2.70 |
| 1000 | 3.09 |

**Cable loss**
**Cable M17/167 MIL-C-17, HL 1510**

| No. | Frequency, MHz | Cable loss, dB |
|---|---|---|
| 1 | 0.1 | 0.05 |
| 2 | 1 | 0.09 |
| 3 | 3 | 0.16 |
| 4 | 5 | 0.18 |
| 5 | 10 | 0.27 |
| 6 | 30 | 0.44 |
| 7 | 50 | 0.58 |
| 8 | 80 | 0.69 |
| 9 | 100 | 0.82 |
| 10 | 300 | 1.48 |
| 11 | 500 | 2.01 |
| 12 | 800 | 2.65 |
| 13 | 1000 | 3.12 |

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

| Frequency, kHz | Correction factor, dB |
|---|---|
| 10 | 4.9 |
| 15 | 2.86 |
| 20 | 1.83 |
| 25 | 1.25 |
| 30 | 0.91 |
| 35 | 0.69 |
| 40 | 0.53 |
| 50 | 0.35 |
| 60 | 0.25 |
| 70 | 0.18 |
| 80 | 0.14 |
| 90 | 0.11 |
| 100 | 0.09 |
| 125 | 0.06 |
| 150 | 0.04 |

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

| Frequency, kHz | Correction factor, dB |
|---|---|
| 10 | 4.9 |
| 15 | 2.86 |
| 20 | 1.83 |
| 25 | 1.25 |
| 30 | 0.91 |
| 35 | 0.69 |
| 40 | 0.53 |
| 50 | 0.35 |
| 60 | 0.25 |
| 70 | 0.18 |
| 80 | 0.14 |
| 90 | 0.11 |
| 100 | 0.09 |
| 125 | 0.06 |
| 150 | 0.04 |

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

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# Appendix D General information

## Test facility description

Tests were performed at Hermon Laboratories Ltd., 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 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, 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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## Abbreviations and acronyms

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

| | |
|---|---|
| AC | alternating current |
| cm | centimeter |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dB(μV) | decibel referred to one microvolt |
| dB(μV/m) | decibel referred to one microvolt per meter |
| 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 |
| μV/m | microvolt per meter |
| 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 C63.2:96 | 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. |