

TEST REPORT

ACCORDING TO: FCC 47CFR part 15: 2009, subpart B, Class B

FOR:

**Aplica Technologies Ltd.
RF Dongle 2.4 GHz
Model number: 500-09908A**

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.
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1 Applicant information

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Telephone: +972 3924 9393
Fax: +972 3924 9394
E-mail: arik@aplicatech.com
Contact name: Mr. Arik Israel

2 Equipment under test attributes

Product name: RF Dongle 2.4 GHz
Product type: Transceiver operating in 2401 – 2480 MHz range
Model: 500-09908A
Serial number: 15
Hardware version: AD6024
Receipt date: 2/11/2010

3 Manufacturer information

Manufacturer name: Aplica Technologies Ltd.
Address: P.O.Box 7291, Petach-Tikva 49170, Israel
Telephone: +972 3924 9393
Fax: +972 3924 9394
E-mail: arik@aplicatech.com
Contact name: Mr. Arik Israel

4 Test details

Project ID: 20521
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 10/4/2010
Test completed: 10/13/2010
Test specification: FCC 47CFR part 15: 2009, subpart B, Class B

5 Tests summary

| Test | Status |
|--|--------------|
| FCC 47 CFR part 15, subpart B | |
| Section 15.107 Class B, AC power lines conducted emissions | Pass |
| Section 15.109 Class B, Radiated emissions | Pass |
| Section 15.111, Spurious emissions at RF antenna connector | Not required |
| Section 15.115 (b)(2)), Conducted emissions at RF output terminals of TV interface | Not required |

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.

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. S. Samokha, test engineer | October 13, 2010 |  |
| Reviewed by: | Ms. N. Averin, certification engineer | March 10, 2011 |  |
| Approved by: | Mr. M. Nikishin, EMC and radio group leader | March 13, 2011 |  |

6 EUT description

6.1 General information

The EUT, RF dongle, is a small PCB with a transceiver operating in 2.4 – 2.48 GHz ISM band and a USB connector. It is packaged just like a USB memory stick, and has the same embedded antenna as the modular unit. The EUT operates by connecting it to a PC and is powered from 5 VDC obtained from the PC.

6.2 Ports and lines

| Port type | Port description | Connected from | Connected to | Qty. | Cable type | Cable length | Indoor / outdoor |
|------------------|------------------|----------------|------------------|------|------------|--------------|------------------|
| Power and signal | USB | EUT | Laptop | 1 | NA* | NA* | Indoor |
| Power | AC power | AC/DC adapter | AC mains | 1 | Unshielded | 2.5 m | Indoor |
| Power | DC power | Laptop | AC/DC adapter | 1 | Unshielded | 2.5 m | Indoor |
| Signal | RS-232 | Laptop | RF Sensor Module | 1 | Unshielded | 2.8 m | Indoor |

* Temporary connection via USB cable was used for testing purposes during the tests.

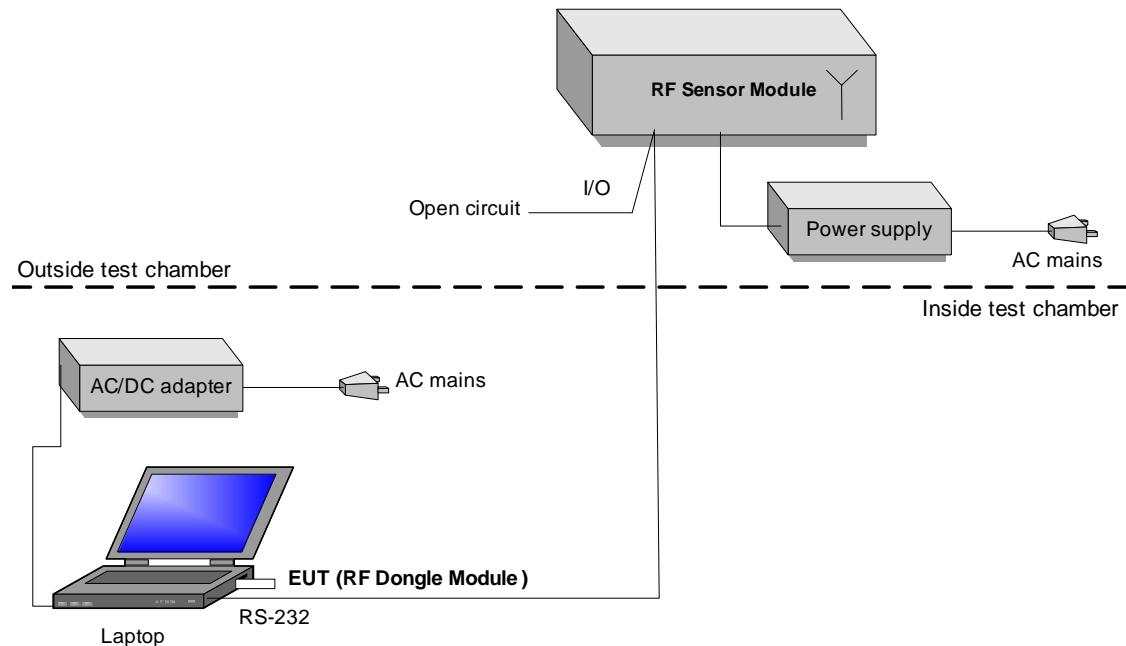
6.3 Auxiliary equipment

| Description | Manufacturer | Model number | Serial number |
|------------------|---------------------|----------------|---------------|
| Laptop | Dell | Latitude D-630 | 5ZYVB3J |
| AC/DC adapter | Dell | HA65NS1-00 | 7AR-C155 |
| Power supply | CUS Listed | MS-10US09-A-2 | NA |
| RF Sensor Module | Aplica Technologies | 500-09898A | 2 |

6.4 Operating frequencies

| Source | Frequency, MHz | | | | | |
|--------|----------------|------|------|----|----|----|
| | 2401 | 2441 | 2480 | NA | NA | NA |
| Tx/Rx | | | | | | |

6.5 Test configuration



Note Temporary connection of the EUT via USB cable was used for testing purposes during the tests.

| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.107 Class B, AC power lines conducted emissions | | |
| Test procedure: | ANSI C63.4, Section 11.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 24.3 °C | Air Pressure: 1015 hPa | Relative Humidity: 42 % | Power Supply: 120 VAC |
| Remarks: | | | |

7 Emissions tests according to FCC 47CFR part 15 subpart B requirements

7.1 Conducted emissions

7.1.1 General

This test was performed to measure the common mode conducted emissions at the EUT power port. The specification test limits are given in Table 7.1.1.

Table 7.1.1 Limits for conducted emissions

| Frequency, MHz | Class B limit, dB(µV) | | Class A limit, dB(µV) | |
|-------------------|--------------------------|----------|--------------------------|------|
| | QP | AVRG | QP | AVRG |
| 0.15 - 0.5 | 66 - 56* | 56 - 46* | 79 | 66 |
| 0.5 - 5.0 | 56 | 46 | 73 | 60 |
| 5.0 - 30 | 60 | 50 | 73 | 60 |

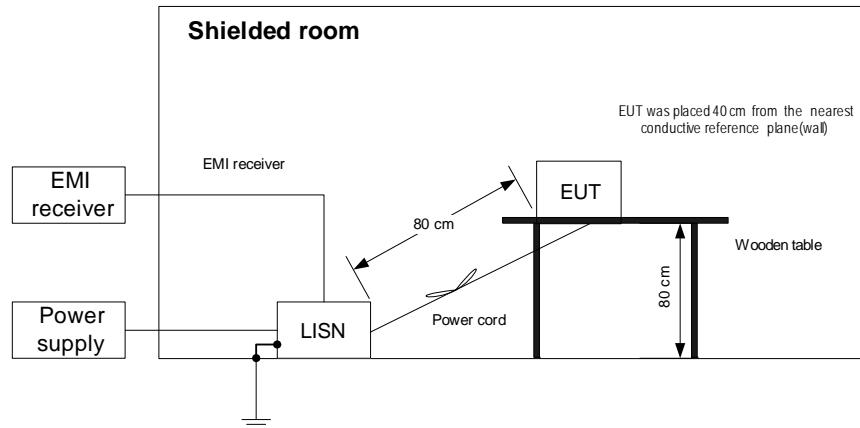
* - The limit decreases linearly with the logarithm of frequency.

7.1.2 Test procedure

- 7.1.2.1 The EUT was set up as shown in Figure 7.1.1 and the associated photograph, energized and the EUT performance was checked.
- 7.1.2.2 The measurements were performed at the EUT power terminals with the LISN connected to the EMI receiver in the frequency range referred to in Table 7.1.2. The unused coaxial connector of the LISN was terminated with 50 Ohm.
- 7.1.2.3 The position of the EUT cables was varied to find the highest emission.
- 7.1.2.4 The worst test results with respect to the limits were recorded in Table 7.1.2 and shown in the associated plots.

| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.107 Class B, AC power lines conducted emissions | | |
| Test procedure: | ANSI C63.4, Section 11.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 24.3 °C | Air Pressure: 1015 hPa | Relative Humidity: 42 % | Power Supply: 120 VAC |
| Remarks: | | | |

Figure 7.1.1 Setup for conducted emission measurements, table-top EUT



Photograph 7.1.1 Setup for conducted emission measurements



| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.107 Class B, AC power lines conducted emissions | | |
| Test procedure: | ANSI C63.4, Section 11.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 24.3 °C | Air Pressure: 1015 hPa | Relative Humidity: 42 % | Power Supply: 120 VAC |
| Remarks: | | | |

Table 7.1.2 Conducted emission test results

LINE: AC mains input of laptop AC/DC adapter
 EUT SET UP: TABLE-TOP
 TEST SITE: SHIELDED ROOM
 DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
 FREQUENCY RANGE: 150 kHz - 30 MHz
 RESOLUTION BANDWIDTH: 9 kHz
 NOTE: Laptop

| 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* | | |
| 0.176750 | 54.04 | 52.24 | 64.70 | -12.46 | 41.04 | 54.70 | -13.66 | L1 | Pass |
| 0.236625 | 46.73 | 44.89 | 62.25 | -17.36 | 32.85 | 52.25 | -19.40 | | |
| 0.295000 | 40.84 | 38.19 | 60.42 | -22.23 | 26.71 | 50.42 | -23.71 | | |
| 0.471738 | 39.33 | 35.86 | 56.53 | -20.67 | 28.83 | 46.53 | -17.70 | | |
| 4.964475 | 38.31 | 33.62 | 56.00 | -22.38 | 22.99 | 46.00 | -23.01 | | |
| 5.083100 | 39.61 | 34.12 | 60.00 | -25.88 | 24.38 | 50.00 | -25.62 | | |
| 0.177500 | 53.60 | 52.11 | 64.66 | -12.55 | 41.07 | 54.66 | -13.59 | | |
| 0.235588 | 47.49 | 44.73 | 62.29 | -17.56 | 32.04 | 52.29 | -20.25 | | |
| 0.295000 | 41.11 | 38.62 | 60.42 | -21.80 | 26.06 | 50.42 | -24.36 | | |
| 0.474340 | 39.51 | 35.96 | 56.48 | -20.52 | 28.43 | 46.48 | -18.05 | | |
| 4.843250 | 38.39 | 34.84 | 56.00 | -21.16 | 25.15 | 46.00 | -20.85 | | |
| 5.492500 | 38.52 | 33.70 | 60.00 | -26.30 | 23.44 | 50.00 | -26.56 | | |

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

| | | | | | | |
|---------|---------|---------|---------|---------|---------|--|
| HL 0447 | HL 0672 | HL 0787 | HL 1513 | HL 2888 | HL 3612 | |
|---------|---------|---------|---------|---------|---------|--|

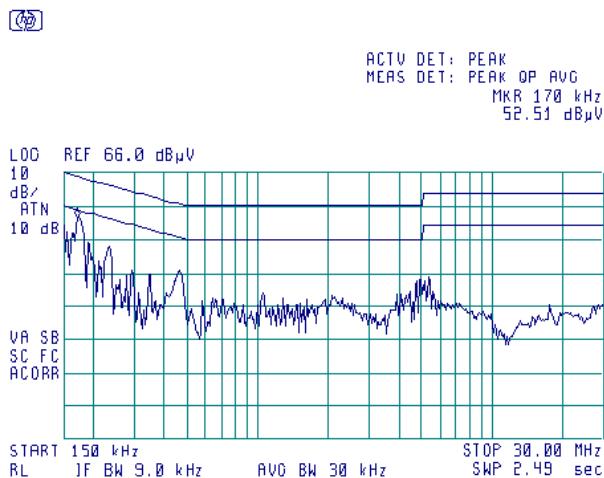
Full description is given in Appendix A.

| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.107 Class B, AC power lines conducted emissions | | |
| Test procedure: | ANSI C63.4, Section 11.5 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 24.3 °C | Air Pressure: 1015 hPa | Relative Humidity: 42 % | Power Supply: 120 VAC |
| Remarks: | | | |

Plot 7.1.1 Conducted emission measurements, AC mains input of laptop AC/DC adapter

LINE:
LIMIT:
DETECTOR:

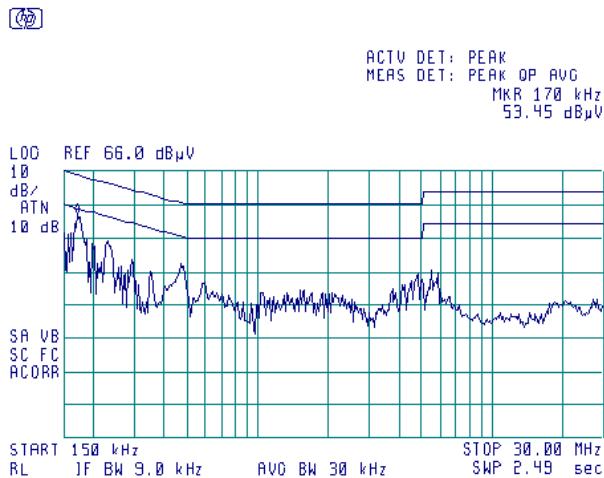
L1
QUASI-PEAK, AVERAGE
PEAK



Plot 7.1.2 Conducted emission measurements, AC mains input of laptop AC/DC adapter

LINE:
LIMIT:
DETECTOR:

L2
QUASI-PEAK, AVERAGE
PEAK



| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.109 Class B, Radiated emissions | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | Relative Humidity: 44 % | Power Supply: 120 VAC |
| Remarks: | | | |

7.2 Radiated emission measurements

7.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. The specification test limits are given in Table 7.2.1.

Table 7.2.1 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 a test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $\text{Lim}_{S2} = \text{Lim}_{S1} + 20 \log (S_1/S_2)$, where S_1 and S_2 – the standard defined and the test distance respectively in meters.

7.2.2 Test procedure

7.2.2.1 The EUT was set up as shown in Figure 7.2.1 and the associated photograph, energized and the EUT performance was checked.

7.2.2.2 The preliminary measurements were performed in the anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.

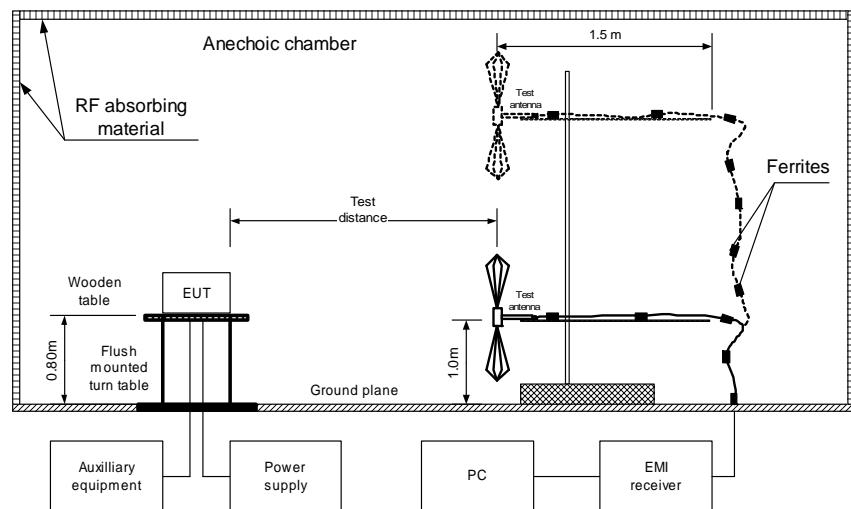
7.2.2.3 The EUT was set up as shown in Figure 7.2.2 and the associated photographs, energized and the EUT performance was checked.

7.2.2.4 The final measurements were performed at the open area test site at 10 m test distance with the antenna connected to the EMI receiver. The EUT wires and cables were arranged to produce the highest emission as it was found during the preliminary measurements. The frequencies, produced the highest emissions with respect to the limits during the preliminary test were investigated. To find the highest emission the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. At frequencies, where the high ambient noise was encountered, the final measurements were taken at 3 m distance.

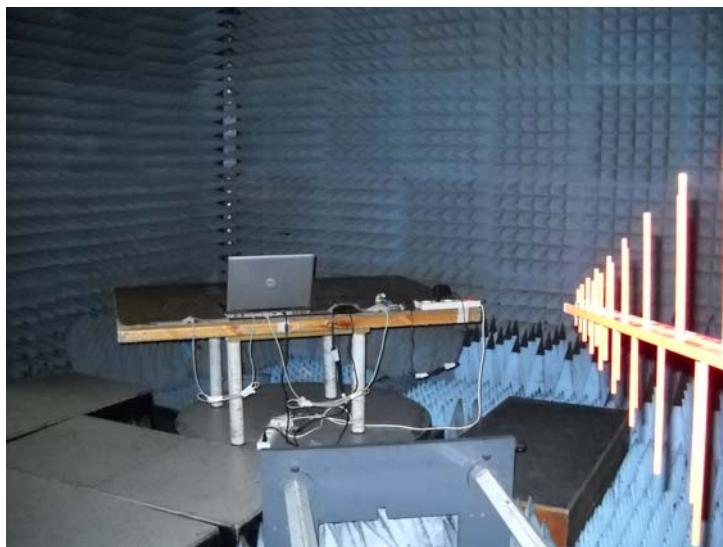
7.2.2.5 The worst test results with respect to the limits were recorded in Table 7.2.2 and shown in the associated plots.

| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.109 Class B, Radiated emissions | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | Relative Humidity: 44 % | Power Supply: 120 VAC |
| Remarks: | | | |

Figure 7.2.1 Setup for radiated emission measurements in anechoic chamber, table-top EUT

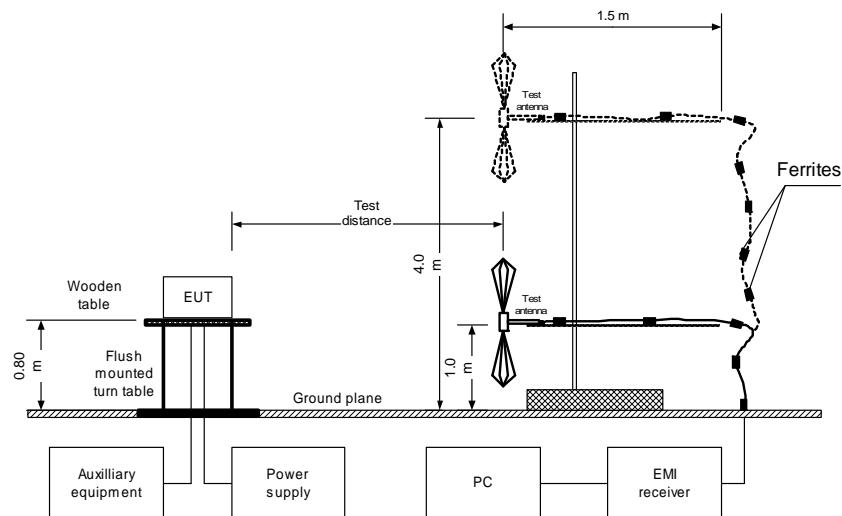


Photograph 7.2.1 Setup for radiated emission measurements in anechoic chamber



| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.109 Class B, Radiated emissions | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | Relative Humidity: 44 % | Power Supply: 120 VAC |
| Remarks: | | | |

Figure 7.2.2 Setup for radiated emission measurements at OATS, table-top EUT



| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.109 Class B, Radiated emissions | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | Relative Humidity: 44 % | Power Supply: 120 VAC |
| Remarks: | | | |

Photograph 7.2.2 Setup for radiated emission measurements at OATS, general view



Photograph 7.2.3 Setup for radiated emission measurements at OATS, EUT cabling



| | | | | | | | | |
|-----------------------------|---|--|--------------------------------|------------------------------|-------------|--|--|--|
| Test specification: | Section 15.109 Class B, Radiated emissions | | | | | | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | | | | | | |
| Test mode: | Compliance | | | Verdict: | PASS | | | |
| Date: | 10/13/2010 | | | | | | | |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | | Relative Humidity: 44 % | Power Supply: 120 VAC | | | | |
| Remarks: | | | | | | | | |

Table 7.2.2 Radiated emission test results

EUT SET UP:

TABLE-TOP

FREQUENCY RANGE:

30 MHz – 1000 MHz

DETECTORS USED:

PEAK / QUASI-PEAK

RESOLUTION BANDWIDTH:

120 kHz

TEST SITE:

OATS

TEST DISTANCE:

10 m

| 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* | | | | |
| 72.747000 | 34.36 | 22.88 | 29.50 | -6.62 | Vertical | 1.0 | 270 | Pass |
| 250.010000 | 33.14 | 29.56 | 35.50 | -5.94 | Vertical | 1.0 | 45 | |

TEST SITE:

OATS

TEST DISTANCE:

3 m

| 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* | | | | |
| 204.821200 | 31.97 | 25.71 | 43.50 | -17.79 | Vertical | 1.0 | 180 | Pass |

TEST SITE:

SEMI ANECHOIC CHAMBER

TEST DISTANCE:

3 m

| 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* | | | | |
| 99.900000 | 44.98 | 35.56 | 43.50 | -7.94 | Vertical | 1.0 | 90 | Pass |
| 109.339200 | 39.77 | 32.35 | 43.50 | -11.15 | Vertical | 1.5 | 53 | |

FREQUENCY RANGE:

1000 MHz – 12500 MHz

DETECTORS USED:

PEAK / AVERAGE

RESOLUTION BANDWIDTH:

1000 kHz

TEST SITE:

ANECHOIC CHAMBER

TEST DISTANCE:

3 m

| Frequency, MHz | Peak | | | Average | | | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|--------------------------|-----------------------------------|--------------------|----------------|-----------------------------------|--------------------|----------------|-------------------------|-------------------------|--------------------------------------|---------|
| | Measured emission, dB(µV/m) | Limit, dB(µV/m) | Margin, dB* | Measured emission, dB(µV/m) | Limit, dB(µV/m) | Margin, dB* | | | | |
| No emissions were found. | | | | | | | | | | |

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

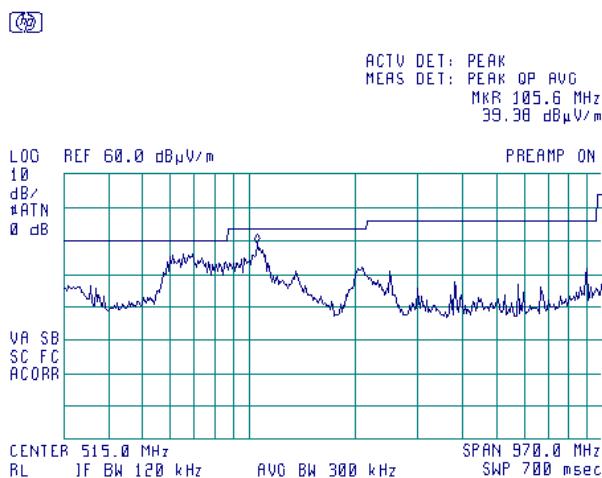
| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 0032 | HL 0465 | HL 0521 | HL 0604 | HL 0784 | HL 1431 | HL 2109 | HL 2432 |
| HL 2697 | HL 2882 | HL 2909 | HL 3390 | HL 3884 | | | |

Full description is given in Appendix A.

| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.109 Class B, Radiated emissions | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | |
| Test mode: | Compliance | | Verdict: |
| Date: | 10/13/2010 | | PASS |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | Relative Humidity: 44 % | Power Supply: 120 VAC |
| Remarks: | | | |

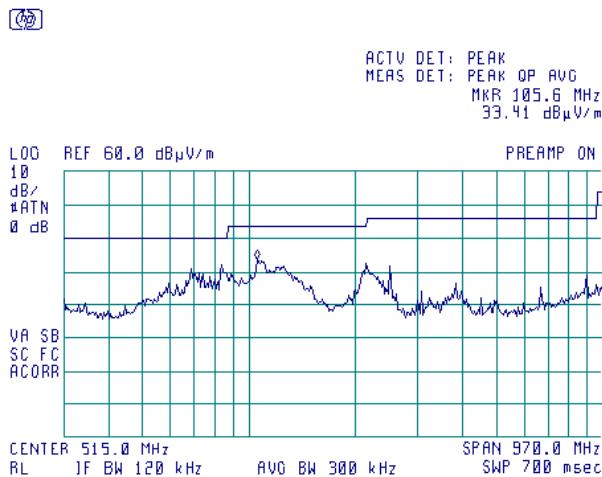
Plot 7.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



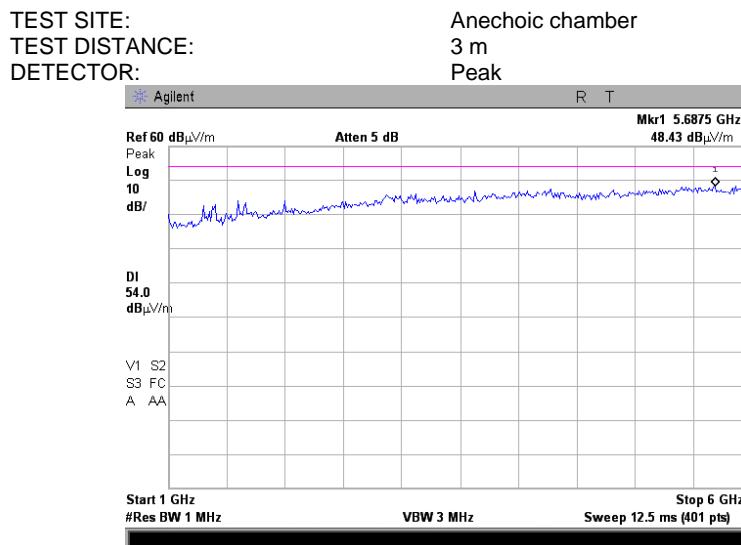
Plot 7.2.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m

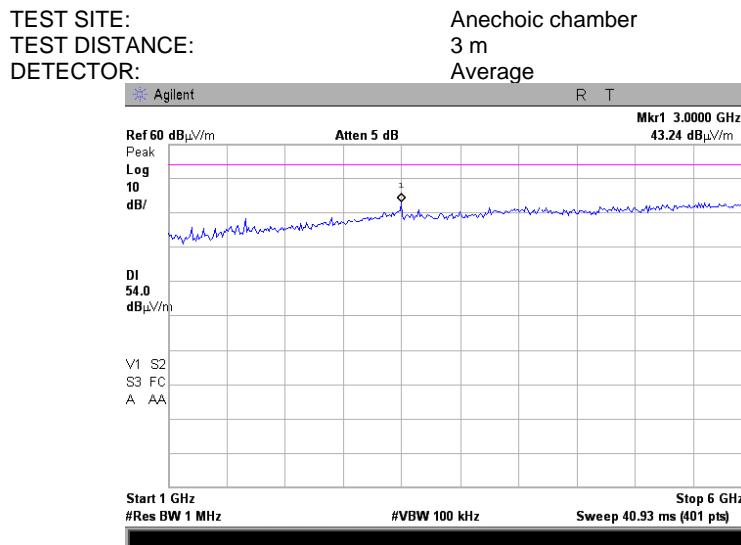


| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.109 Class B, Radiated emissions | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | Relative Humidity: 44 % | Power Supply: 120 VAC |
| Remarks: | | | |

Plot 7.2.3 Radiated emission measurements in 1000 – 6000 MHz range, vertical antenna polarization



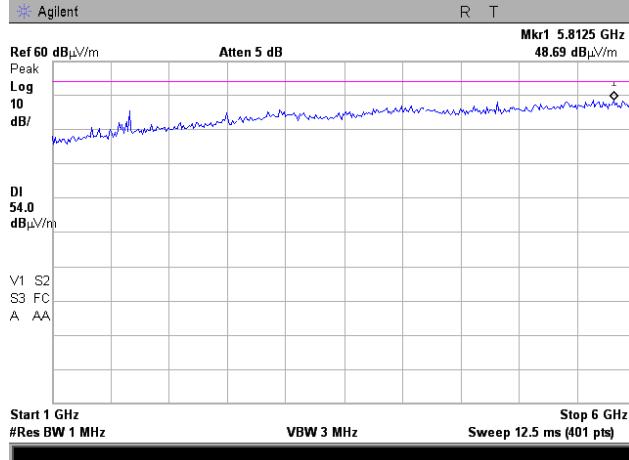
Plot 7.2.4 Radiated emission measurements in 1000 – 6000 MHz range, vertical antenna polarization



| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.109 Class B, Radiated emissions | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | Relative Humidity: 44 % | Power Supply: 120 VAC |
| Remarks: | | | |

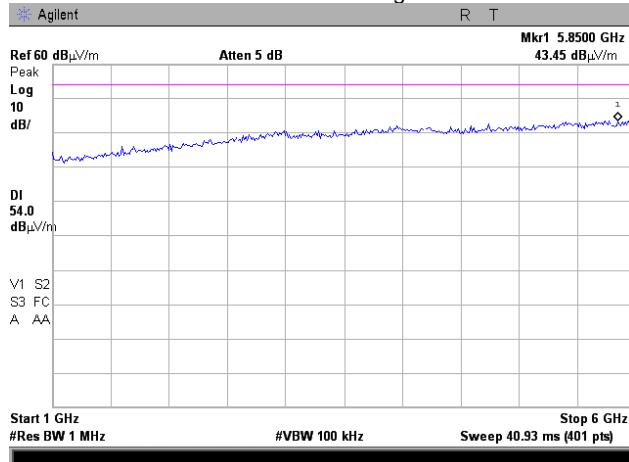
Plot 7.2.5 Radiated emission measurements in 1000 – 6000 MHz range, horizontal antenna polarization

TEST SITE: Anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak



Plot 7.2.6 Radiated emission measurements in 1000 – 6000 MHz range, horizontal antenna polarization

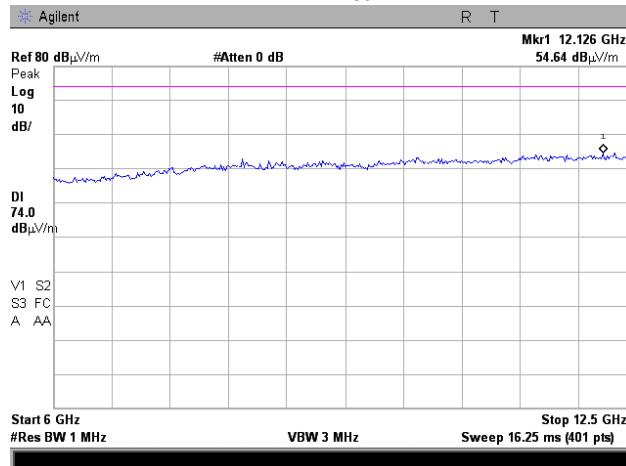
TEST SITE: Anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Average



| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.109 Class B, Radiated emissions | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | Relative Humidity: 44 % | Power Supply: 120 VAC |
| Remarks: | | | |

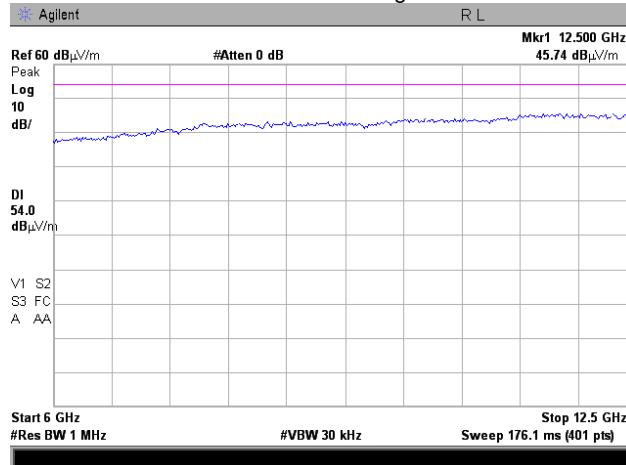
Plot 7.2.7 Radiated emission measurements in 6000 – 12500 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Peak



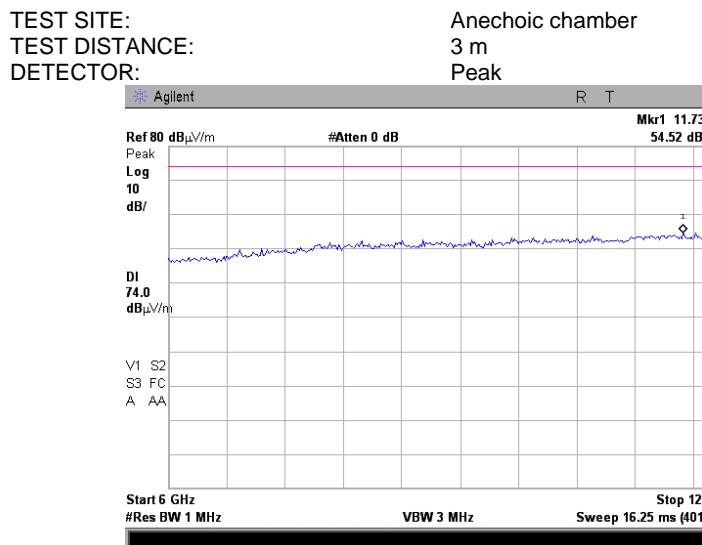
Plot 7.2.8 Radiated emission measurements in 6000 – 12500 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Average

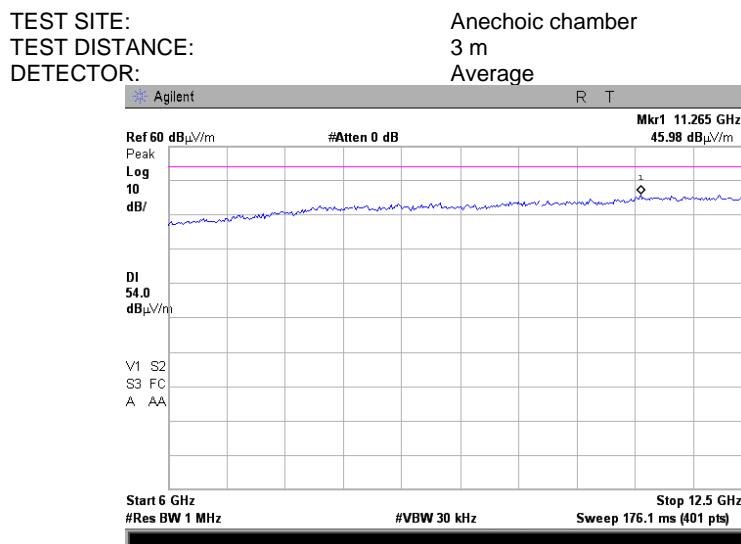


| | | | |
|-----------------------------|---|--------------------------------|------------------------------|
| Test specification: | Section 15.109 Class B, Radiated emissions | | |
| Test procedure: | ANSI C63.4, Section 11.6 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date: | 10/13/2010 | | |
| Temperature: 23.2 °C | Air Pressure: 1015 hPa | Relative Humidity: 44 % | Power Supply: 120 VAC |
| Remarks: | | | |

Plot 7.2.9 Radiated emission measurements in 6000 – 12500 MHz range, horizontal antenna polarization



Plot 7.2.10 Radiated emission measurements in 6000 – 12500 MHz range, horizontal antenna polarization



8 APPENDIX A Test equipment and ancillaries used for tests

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal./Check | Due Cal./Check |
|-------|---|-----------------------|---------------------|--------------------------|-----------------|----------------|
| 0032 | Antenna, Biconical, 20 - 200 MHz | Electro-Metrics | BIA 25/30 | 3577 | 17-Jan-11 | 17-Jan-12 |
| 0447 | LISN, 16/2, 300V RMS, 50 Ohm/50 uH + 5 Ohm, STD CISPR 16-1 | Hermon Laboratories | LISN 16 - 1 | 066 | 26-Oct-10 | 26-Oct-11 |
| 0465 | Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m | Hermon Laboratories | AC - 1 | 023 | 16-Sep-10 | 16-Sep-11 |
| 0521 | EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz | Hewlett Packard | 8546A | 3617A00319 3448A00253 | 25-Aug-10 | 25-Aug-11 |
| 0604 | Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz | EMCO | 3141 | 9611-1011 | 11-Jan-11 | 11-Jan-12 |
| 0672 | Shielded Room 4,6(L) x 4,2(W) x 2,4(H) m | Hermon Laboratories | SR - 3 | 027 | 10-Nov-10 | 10-Nov-11 |
| 0784 | Antenna X-WING BILOG, 20 MHz - 2 GHz | Schaffner-Chase EMC | CBL6140 A | 1120 | 11-Jan-11 | 11-Jan-12 |
| 0787 | Transient Limiter 9 kHz-200 MHz | Hewlett Packard | 11947A | 3107A018 77 | 18-Oct-10 | 18-Oct-11 |
| 1431 | Receiver RF Section, 9 kHz-2.9 GHz, part of HL1430 system | Agilent Technologies | 85422E | 308070026 2 | 25-Nov-10 | 25-Nov-11 |
| 1513 | Cable RF, 8 m, BNC/BNC | Belden | M17/167 MIL-C-17 | 1513 | 01-Sep-10 | 01-Sep-11 |
| 2109 | Anechoic Chamber 6(L) x 5.5(W) x 2.95(H) m | Hermon Laboratories | AC-2 | 2109 | 10-Nov-10 | 10-Nov-11 |
| 2432 | Antenna, Double-Ridged Waveguide Horn 1-18 GHz | EMC Test Systems | 3115 | 00027177 | 11-Jun-10 | 11-Jun-11 |
| 2697 | Antenna, 30 MHz - 3.0 GHz | Sunol Sciences | JB3 | A022805 | 11-Jan-11 | 11-Jan-12 |
| 2882 | Cable, 18 GHz N-type, M-F, 3 m | Bird Electronic Corp. | TC-MNFn-3.0 | 211539 001 | 03-Oct-10 | 03-Oct-11 |
| 2888 | LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1 | Rolf Heine | NNB-2/16Z | 02/10018 | 07-Jul-10 | 07-Jul-11 |
| 2909 | Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz | Agilent Technologies | E4407B | MY414447 62 | 07-May-10 | 07-May-11 |
| 3390 | Microwave Cable Assembly, 26.5 GHz, 1.0 m, N type/N type | Suhner Sucoflex | 104EA | 3390 | 07-Feb-11 | 07-Feb-12 |
| 3612 | Cable RF, 17.5 m, N type-N type | Teldor | RG-214/U | NA | 01-Dec-10 | 01-Dec-11 |
| 3884 | Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type(f) in, N-type(m) out. | Agilent Technologies | 87405C | MY470104 18 | 13-Jan-11 | 13-Jan-12 |

9 APPENDIX B Test laboratory 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), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. 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). The FCC Designation Number is US1003.

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10 APPENDIX C Abbreviations and acronyms

| | |
|----------------|---|
| A | ampere |
| AC | alternating current |
| A/m | ampere per meter |
| AVRG | average (detector) |
| BB | broad band |
| 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 |
| EMC | electromagnetic compatibility |
| EMI | electromagnetic interference |
| EUT | equipment under test |
| GHz | gigahertz |
| GND | ground |
| H | height |
| HL | Hermon laboratories |
| Hz | hertz |
| k | kilo |
| kHz | kilohertz |
| kV | kilovolt |
| L | length |
| LISN | line impedance stabilization network |
| m | meter |
| MHz | megahertz |
| min | minute |
| mm | millimeter |
| ms | millisecond |
| μ s | microsecond |
| NA | not applicable |
| NB | narrow band |
| NT | not tested |
| OATS | open area test site |
| Ω | Ohm |
| QP | quasi-peak |
| PM | pulse modulation |
| PS | power supply |
| RE | radiated emission |
| RF | radio frequency |
| rms | root mean square |
| s | second |
| V | volt |
| W | width |

11 APPENDIX D Test equipment correction factors

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

Voltage division factor (insertion loss)

| No. | Parameter | Applied, kHz | Measured (L1), dB | Measured (L2), dB | Uncertainty, dB |
|-----|--|--------------|-------------------|-------------------|-----------------|
| 1 | Voltage division factor (insertion loss) | 150 | 0.11 | 0.14 | ±0.22 |
| 2 | | 170 | 0.10 | 0.14 | ±0.22 |
| 3 | | 200 | 0.09 | 0.13 | ±0.22 |
| 4 | | 250 | 0.08 | 0.13 | ±0.22 |
| 5 | | 300 | 0.08 | 0.12 | ±0.22 |
| 6 | | 350 | 0.07 | 0.12 | ±0.22 |
| 7 | | 400 | 0.07 | 0.11 | ±0.22 |
| 8 | | 500 | 0.07 | 0.12 | ±0.22 |
| 9 | | 600 | 0.07 | 0.12 | ±0.22 |
| 10 | | 700 | 0.07 | 0.12 | ±0.22 |
| 11 | | 800 | 0.07 | 0.12 | ±0.22 |
| 12 | | 900 | 0.07 | 0.12 | ±0.22 |
| 13 | | 1000 | 0.07 | 0.12 | ±0.22 |
| 14 | | 1200 | 0.08 | 0.12 | ±0.22 |
| 15 | | 1500 | 0.08 | 0.12 | ±0.22 |
| 16 | | 2000 | 0.08 | 0.13 | ±0.22 |
| 17 | | 2500 | 0.08 | 0.14 | ±0.22 |
| 18 | | 3000 | 0.09 | 0.14 | ±0.22 |
| 19 | | 4000 | 0.09 | 0.15 | ±0.22 |
| 20 | | 5000 | 0.10 | 0.16 | ±0.22 |
| 21 | | 7000 | 0.12 | 0.18 | ±0.22 |
| 22 | | 10000 | 0.14 | 0.20 | ±0.22 |
| 23 | | 15000 | 0.19 | 0.25 | ±0.22 |
| 24 | | 20000 | 0.25 | 0.30 | ±0.22 |
| 25 | | 30000 | 0.43 | 0.47 | ±0.22 |

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

Antenna calibration
Sunol Sciences Inc., model JB3, serial number A022805

| Frequency, MHz | Antenna factor, dB(1/m) |
|-------------------|----------------------------|
| 30 | 22.7 |
| 35 | 18.4 |
| 40 | 14.5 |
| 45 | 10.9 |
| 50 | 8.3 |
| 60 | 7.9 |
| 70 | 9.0 |
| 80 | 9.3 |
| 90 | 9.7 |
| 100 | 11.2 |
| 120 | 14.4 |
| 140 | 13.7 |
| 160 | 13.8 |
| 180 | 11.8 |
| 200 | 12.8 |
| 250 | 12.3 |
| 300 | 13.4 |
| 400 | 16.0 |
| 500 | 17.7 |
| 600 | 18.1 |
| 700 | 20.7 |
| 800 | 21.1 |
| 900 | 22.2 |
| 1000 | 23.1 |
| 1100 | 24.2 |
| 1200 | 25.1 |
| 1300 | 25.1 |
| 1400 | 25.8 |
| 1500 | 26.3 |
| 1600 | 27.6 |
| 1700 | 28.1 |
| 1800 | 27.9 |
| 1900 | 28.1 |
| 2000 | 28.3 |
| 2500 | 31.9 |
| 3000 | 34.0 |

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to obtain field strength in dB(μ V/m).

Biconical antenna factor

Electro-Metrics, model BIA-25/30, serial number 3577

| 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(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).

Biconilog antenna factor

Schaffner Chase EMC, model CBL 6140A, serial number 1120

| Frequency, MHz | Antenna factor, dB(1/m) |
|----------------|-------------------------|
| 20 | 12.1 |
| 22 | 8.8 |
| 24 | 5.5 |
| 26 | 3.0 |
| 28 | 2.8 |
| 30 | 3.9 |
| 40 | 8.4 |
| 50 | 9.3 |
| 60 | 9.7 |
| 70 | 9.3 |
| 80 | 7.5 |
| 90 | 6.8 |
| 100 | 7.6 |
| 110 | 6.6 |
| 120 | 6.9 |
| 140 | 7.6 |
| 160 | 11.6 |
| 170 | 8.3 |
| 190 | 9.2 |
| 200 | 9.9 |
| 220 | 10.5 |
| 240 | 11.2 |
| 260 | 12.9 |
| 280 | 12.1 |
| 300 | 12.9 |
| 320 | 13.2 |
| 340 | 13.9 |
| 360 | 15.2 |
| 380 | 15.3 |
| 400 | 15.7 |
| 420 | 16.6 |
| 440 | 16.8 |
| 460 | 17.6 |
| 480 | 18.3 |
| 500 | 18.0 |
| 520 | 18.0 |
| 540 | 18.7 |
| 560 | 19.2 |
| 580 | 19.0 |

| Frequency, MHz | Antenna factor, dB(1/m) |
|----------------|-------------------------|
| 600 | 19.1 |
| 620 | 19.8 |
| 640 | 20.6 |
| 660 | 20.7 |
| 680 | 20.9 |
| 700 | 21.0 |
| 720 | 21.4 |
| 740 | 21.7 |
| 760 | 21.6 |
| 780 | 21.6 |
| 800 | 21.9 |
| 820 | 22.2 |
| 840 | 22.6 |
| 860 | 22.7 |
| 880 | 22.7 |
| 900 | 22.9 |
| 920 | 23.2 |
| 940 | 23.7 |
| 960 | 24.3 |
| 980 | 24.6 |
| 1000 | 24.4 |
| 1.060 | 24.3 |
| 1.120 | 24.8 |
| 1.180 | 25.3 |
| 1.240 | 26.1 |
| 1.300 | 26.9 |
| 1.360 | 27.6 |
| 1.420 | 26.8 |
| 1.480 | 26.9 |
| 1.520 | 28.1 |
| 1.560 | 28.1 |
| 1.640 | 28.2 |
| 1.700 | 28.6 |
| 1.760 | 30.0 |
| 1.840 | 31.3 |
| 1.900 | 31.8 |
| 1.960 | 31.6 |
| 2.000 | 32.0 |

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 waveguide horn antenna
EMC Test Systems, model 3115, serial number: 00027177

| Frequency, MHz | Antenna factor. dB(1/m) |
|-------------------|----------------------------|
| 1000.0 | 24.7 |
| 1500.0 | 25.7 |
| 2000.0 | 27.8 |
| 2500.0 | 28.9 |
| 3000.0 | 30.7 |
| 3500.0 | 31.8 |
| 4000.0 | 33.0 |
| 4500.0 | 32.8 |
| 5000.0 | 34.2 |
| 5500.0 | 34.9 |
| 6000.0 | 35.2 |
| 6500.0 | 35.4 |
| 7000.0 | 36.3 |
| 7500.0 | 37.3 |
| 8000.0 | 37.5 |
| 8500.0 | 38.0 |
| 9000.0 | 38.3 |
| 9500.0 | 38.3 |
| 10000.0 | 38.7 |
| 10500.0 | 38.7 |
| 11000.0 | 38.9 |
| 11500.0 | 39.5 |
| 12000.0 | 39.5 |
| 12500.0 | 39.4 |
| 13000.0 | 40.5 |
| 13500.0 | 40.8 |
| 14000.0 | 41.5 |
| 14500.0 | 41.3 |
| 15000.0 | 40.2 |
| 15500.0 | 38.7 |
| 16000.0 | 38.5 |
| 16500.0 | 39.8 |
| 17000.0 | 41.9 |
| 17500.0 | 45.8 |
| 18000.0 | 49.1 |

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).

12 APPENDIX E Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

| Test description | Expanded uncertainty |
|---|--|
| Conducted emissions at mains port with LISN and HP 8542E or HP 8546A receiver | 9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB |
| Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization | Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB |
| Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization | Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB |

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

13 APPENDIX F Specification references

| | |
|-----------------------------------|--|
| FCC 47CFR part 15: 2009 subpart B | 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. |
| CISPR 16-1-1: 2006 | Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus |

END OF DOCUMENT