

TEST REPORT

ACCORDING TO: FCC 47 CFR PART 15 subpart C, section 15.209 and subpart B

FOR:

Logitag Systems Ltd.
4 channel RFID reader LF 125 kHz
with CAN bus
Model: LT-LFS03
Part number: EA-1149460
FCC ID:Z97-1149466

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

Client name: LogiTag Systems Ltd.
Address: 2 Hamelacha street, Poleg Industrial Zone, Netanya 42504, Israel
Telephone: +972 9835 4848
Fax: +972 9865 6262
E-mail: golank@Logi-tag.com
Contact name: Mr. Golan Kormian

2 Equipment under test attributes

Product name: 4 channel RFID reader LF 125 kHz with CAN bus
Product type: Transceiver
Model(s): LT-LFS03
Part number: EA-1149460
Serial number: L-LF3-0313-LT043
Hardware version: C01
Software release: V1.0
Receipt date: 8/11/2013

3 Manufacturer information

Manufacturer name: LogiTag Systems Ltd.
Address: 2 Hamelacha street, Poleg Industrial Zone, Netanya 42504, Israel
Telephone: +972 9835 4848
Fax: +972 9865 6262
E-Mail: golank@Logi-tag.com
Contact name: Mr. Golan Kormian




4 Test details

Project ID: 24374
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 8/11/2013
Test completed: 8/13/2013
Test specification(s): FCC 15.209

5 Tests summary

| Test | Status |
|---|--------|
| Transmitter characteristics | |
| FCC Section 15.209, Field strength of emissions | Pass |
| FCC Section 15.203, Antenna requirements | Pass |
| Unintentional emissions | |
| FCC Part 15, Section 109, Radiated emission | Pass |

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 | August 13, 2013 |  |
| Reviewed by: | Mrs. M. Cherniavsky, certification engineer | August 15, 2013 |  |
| Approved by: | Mr. M. Nikishin, EMC and Radio group manager | September 17, 2013 |  |

6 EUT description

6.1 General information

The EUT is a RFID reader of 4 channels operating at 125 kHz. The Reader has 3 communication interfaces: RS-232, USB and CAN bus.

6.2 Ports and lines

| Port type | Port description | Connected from | Connected to | Qty. | Cable type | Cable length, m |
|-----------|------------------|----------------|--------------|------|------------|-----------------|
| Signal | RS-232 | EUT | PC | 1 | Unshielded | 10 |
| Signal | CAN bus | EUT | Open circuit | 1 | Unshielded | 10 |
| Signal | USB | EUT | Open circuit | 1 | Unshielded | 10 |
| Signal | Antenna | EUT | Antenna | 4 | Unshielded | 0.3 |
| Signal | Control* | Open circuit | Open circuit | NA | NA | NA |
| Signal | IR Control* | Open circuit | Open circuit | NA | NA | NA |

*- Only for support

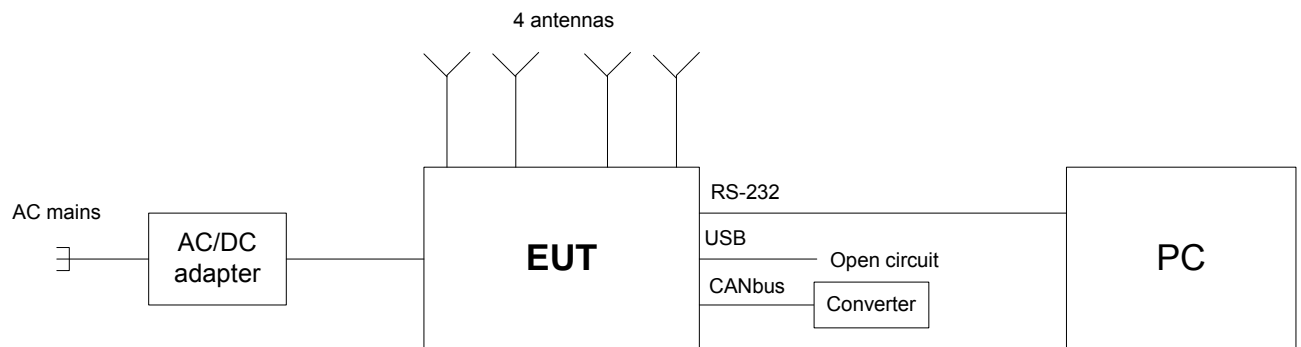
6.3 Support and test equipment

| Description | Manufacturer | Model number | Serial number |
|--------------------------|-----------------|--------------|-------------------------|
| PC | INTEL | Pentium 4 | 55274-640-3355156-23412 |
| Monitor | LG | E2241T-BN | 107NDUN4H262 |
| Keyboard | Deluxe Keyboard | 867652-0119 | 8T631DG0343 |
| Mouse | Microsoft | X802382-003 | 56180 |
| Converter CAN bus/RS-232 | CAN232 | Gridconnect | NA |

6.4 Changes made in EUT

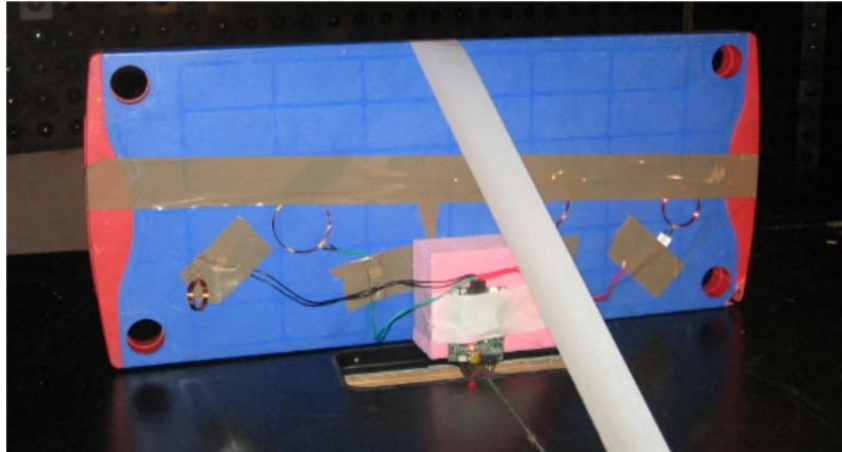
No changes were implemented in the EUT during the testing.

6.5 Test configuration

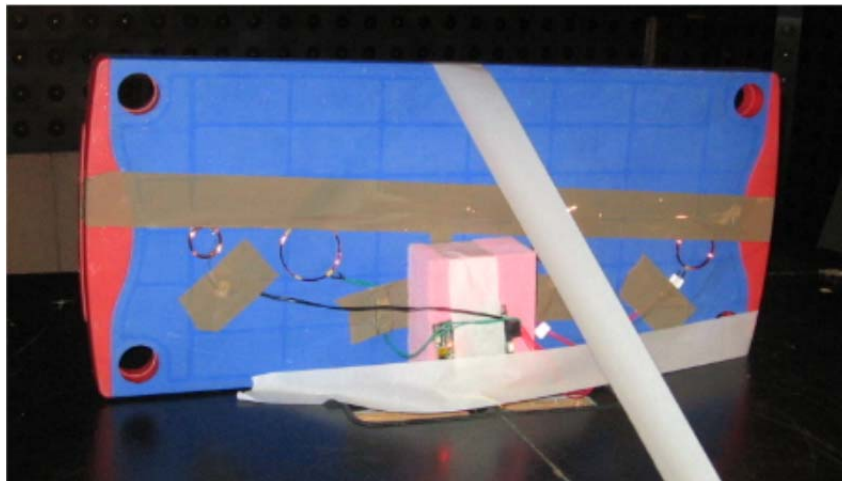


6.6 EUT test positions

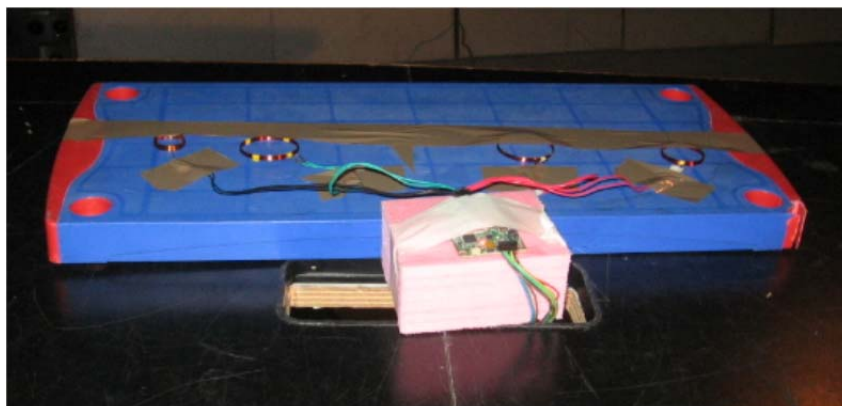
Photograph 6.6.1 EUT in X-axis orthogonal position



Photograph 6.6.2 EUT in Y-axis orthogonal position



Photograph 6.6.3 EUT in Z-axis orthogonal position



6.7 Transmitter characteristics

| | | | | | |
|---|--|---|---------------------------|--|----|
| Type of equipment | | | | | |
| <input checked="" type="checkbox"/> | Stand-alone (Equipment with or without its own control provisions) | | | | |
| <input type="checkbox"/> | Combined equipment (Equipment where the radio part is fully integrated within another type of equipment) | | | | |
| <input type="checkbox"/> | Plug-in card (Equipment intended for a variety of host systems) | | | | |
| Operating frequencies; | | 125 kHz | | | |
| Maximum field strength | | 77.5 dB(μ V/m) at 3 m test distance | | | |
| Is transmitter output power variable? | | <input checked="" type="checkbox"/> | No | | |
| | | <input type="checkbox"/> | Yes | continuous variable | |
| | | | | stepped variable with stepsize, software controlled | dB |
| | | | | | |
| Antenna connection | | | | | |
| unique coupling | | standard connector | | <input checked="" type="checkbox"/> Integral | |
| | | | | <input checked="" type="checkbox"/> with temporary RF connector | |
| | | | | <input checked="" type="checkbox"/> without temporary RF connector | |
| Antenna/s technical characteristics | | | | | |
| Type | Manufacturer | | Model number | | |
| External | LogiTag | | Loop | | |
| Type of modulation | | ASK | | | |
| Transmitter duty cycle supplied for test | | 100% | | | |
| Transmitter power source | | | | | |
| | Battery | Nominal rated voltage | Battery type | | |
| <input checked="" type="checkbox"/> | DC | Nominal rated voltage | 15 V DC via AC/DC adapter | | |
| | | Rated voltage | 10-24 V DC | | |
| | AC mains | Nominal rated voltage | Frequency | | |
| Common power source for transmitter and receiver | | <input checked="" type="checkbox"/> yes <input type="checkbox"/> no | | | |

| | | | |
|-----------------------------|---|--------------------------------|-----------------------------|
| Test specification: | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | | |
| Test procedure: | ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date(s): | 8/11/2013 - 8/11/2013 | | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 Field strength of emissions

7.1.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given Table 7.1.1 and Table 7.1.2.

Table 7.1.1 Radiated fundamental emission limits

| Fundamental frequency, kHz | Field strength at 3 m, dB(μV/m) |
|----------------------------|---------------------------------|
| | Average |
| 125.0 | 105.67 |

Table 7.1.2 Radiated spurious emissions limits

| Frequency, MHz | Field strength at 3 m, dB(μV/m) | | |
|----------------------------------|---------------------------------|-----------------|-----------------|
| | Within restricted bands | | |
| | Peak | Quasi Peak | Average |
| 0.009 – 0.090 | 148.5 – 128.5 | NA | 128.5 – 108.5** |
| 0.090 – 0.110 | NA | 108.5 – 106.8** | NA |
| 0.110 – 0.490 | 126.8 – 113.8 | NA | 106.8 – 93.8** |
| 0.490 – 1.705 | NA | 73.8 – 63.0** | NA |
| 1.705 – 30.0* | | 69.5 | |
| 30 – 88 | | 40.0 | |
| 88 – 216 | | 43.5 | |
| 216 – 960 | | 46.0 | |
| 960 – 1000 | | 54.0 | |
| 1000 – 10 th harmonic | 74.0 | NA | 54.0 |

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

$$\text{Lim}_{S2} = \text{Lim}_{S1} + 40 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

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

7.1.2 Test procedure for fundamental and spurious emission field strength measurements in 9 kHz to 30 MHz

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and the performance check was conducted.

7.1.2.2 The specified frequency range was investigated with a loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna was rotated around its vertical axis. The measuring antenna polarization was switched from vertical to horizontal.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.3 and shown in the associated plots.

7.1.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.1.3.1 The EUT was set up as shown in Figure 7.1.2, energized and the performance check was conducted.

7.1.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.1.3.3 The worst test results (the lowest margins) were recorded in Table 7.1.4 and shown in the associated plots.

| | | | |
|-----------------------------|-------------------------------|---|-----------------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

Figure 7.1.1 Setup for spurious emission field strength measurements below 30 MHz

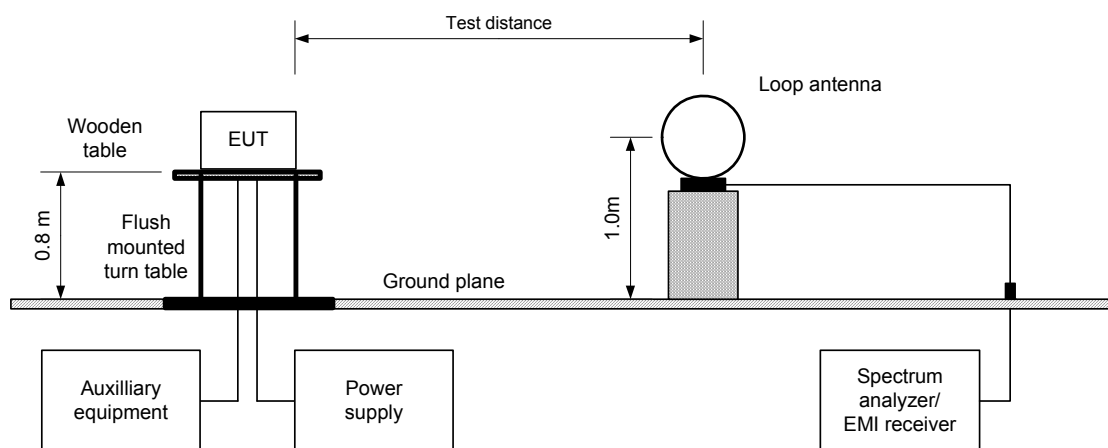
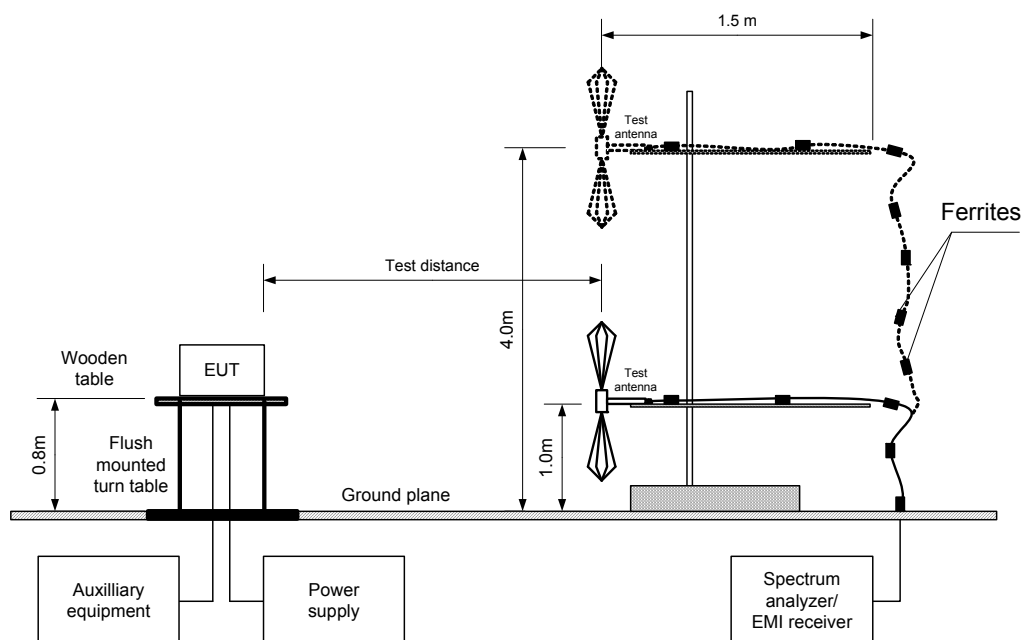


Figure 7.1.2 Setup for spurious emission field strength measurements above 30 MHz





| | | | |
|-----------------------------|-------------------------------|---|-----------------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

Table 7.1.3 Field strength of fundamental emission

TEST DISTANCE: 3 m
 TEST SITE: Anechoic chamber
 EUT POSITION: 3 orthogonal positions
 MODULATION: ASK
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1 kHz (9 kHz – 150 kHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 NOTE: EUT with cover removed

| F, kHz | Antenna | | Azimuth, degrees* | Peak field strength | | | Average field strength | | | Verdict |
|---------|---------|-----------|-------------------|---------------------|-----------------|--------------|------------------------|-----------------|--------------|---------|
| | Pol. | Height, m | | Measured, dB(μV/m) | Limit, dB(μV/m) | Margin, dB** | Measured, dB(μV/m) | Limit, dB(μV/m) | Margin, dB** | |
| 124.989 | Vert | 1.0 | 118 | 77.52 | 125.67 | -48.15 | 77.52 | 105.67 | -28.15 | Pass |

Note: the recorded result was obtained in Y-axis position at Unom

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

** - Margin (dB) = measured result - specification limit.

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|--|--|--|--|
| HL 0446 | HL 2871 | HL 3818 | HL 4347 | | | | |
|---------|---------|---------|---------|--|--|--|--|

Full description is given in Appendix A.



| | | | |
|---|-------------------------------|--------------------------------|-----------------------------|
| Test specification: Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | | | |
| Test procedure: ANSI C63.4, Section 13.1.4 | | | |
| Test mode: | Compliance | Verdict: PASS | |
| Date(s): | 8/11/2013 - 8/11/2013 | | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

Table 7.1.4 Field strength of spurious emissions

TEST DISTANCE: 3 m
 TEST SITE: Anechoic chamber
 EUT POSITION: Y-axis (worst case)
 MODULATION: ASK
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)

| 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* | | | | |
| 48.000 | 40.49 | 39.60 | 40.0 | -0.40 | Vert | 1.0 | 21 | Pass |
| 111.90 | 34.96 | 33.01 | 40.0 | -6.99 | Vert | 1.0 | 319 | |
| 127.90 | 39.04 | 37.60 | 43.5 | -5.90 | Vert | 1.0 | 332 | |
| 135.90 | 38.42 | 36.89 | 43.5 | -6.61 | Vert | 1.0 | 321 | |
| 144.10 | 37.58 | 35.54 | 43.5 | -7.96 | Vert | 1.0 | 328 | |
| 152.10 | 36.80 | 35.27 | 43.5 | -8.23 | Vert | 1.0 | 299 | |

*- Margin = Measured emission - specification limit.

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

Table 7.1.5 Restricted bands

| MHz | MHz | MHz | MHz | MHz | GHz |
|-------------------|---------------------|-----------------------|-----------------|---------------|---------------|
| 0.09 - 0.11 | 8.37625 - 8.38675 | 73 - 74.6 | 399.9 - 410 | 2690 - 2900 | 10.6 - 12.7 |
| 0.495 - 0.505 | 8.41425 - 8.41475 | 74.8 - 75.2 | 608 - 614 | 3260 - 3267 | 13.25 - 13.4 |
| 2.1735 - 2.1905 | 12.29 - 12.293 | 108 - 121.94 | 960 - 1240 | 3332 - 3339 | 14.47 - 14.5 |
| 4.125 - 4.128 | 12.51975 - 12.52025 | 123 - 138 | 1300 - 1427 | 3345.8 - 3358 | 15.35 - 16.2 |
| 4.17725 - 4.17775 | 12.57675 - 12.57725 | 149.9 - 150.05 | 1435 - 1626.5 | 3600 - 4400 | 17.7 - 21.4 |
| 4.20725 - 4.20775 | 13.36 - 13.41 | 156.52475 - 156.52525 | 1645.5 - 1646.5 | 4500 - 5150 | 22.01 - 23.12 |
| 6.215 - 6.218 | 16.42 - 16.423 | 156.7 - 156.9 | 1660 - 1710 | 5350 - 5460 | 23.6 - 24 |
| 6.26775 - 6.26825 | 16.69475 - 16.69525 | 162.0125 - 167.17 | 1718.8 - 1722.2 | 7250 - 7750 | 31.2 - 31.8 |
| 6.31175 - 6.31225 | 16.80425 - 16.80475 | 167.72 - 173.2 | 2200 - 2300 | 8025 - 8500 | 36.43 - 36.5 |
| 8.291 - 8.294 | 25.5 - 25.67 | 240 - 285 | 2310 - 2390 | 9000 - 9200 | Above 38.6 |
| 8.362 - 8.366 | 37.5 - 38.25 | 322 - 335.4 | 2483.5 - 2500 | 9300 - 9500 | |

Reference numbers of test equipment used

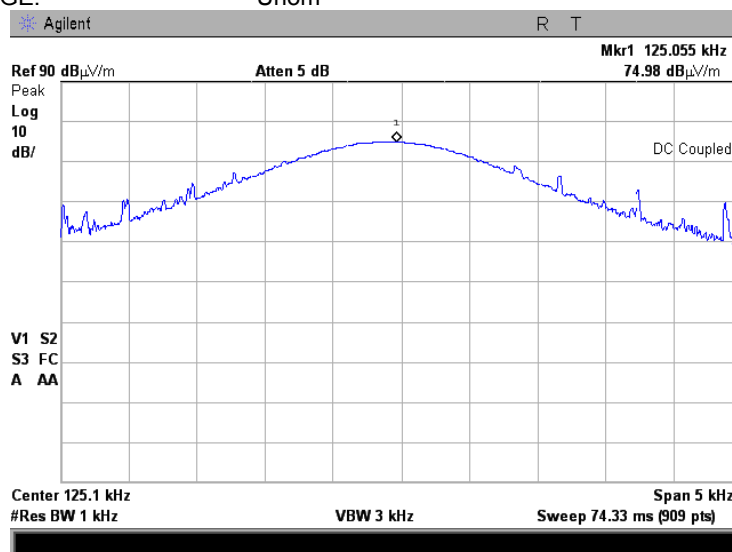
| | | | | | | | |
|---------|---------|---------|---------|---------|--|--|--|
| HL 0446 | HL 0604 | HL 2871 | HL 3818 | HL 4347 | | | |
|---------|---------|---------|---------|---------|--|--|--|

Full description is given in Appendix A.

| | | | |
|-----------------------------|-------------------------------|---|-----------------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

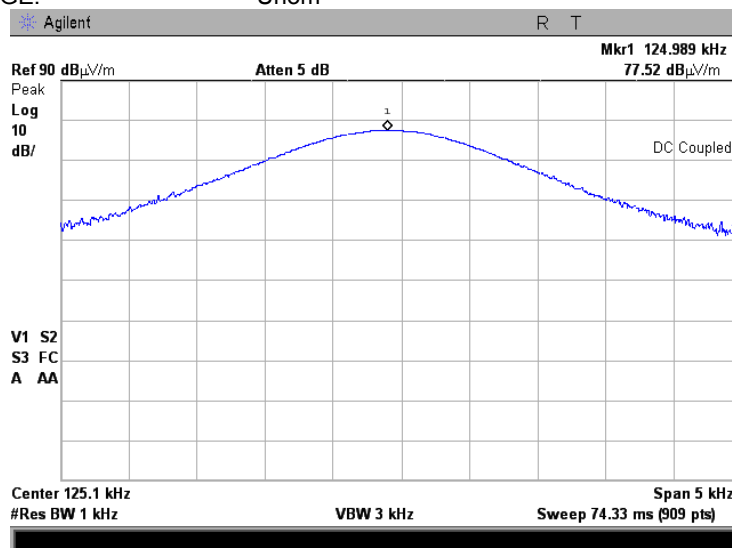
Plot 7.1.1 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis
VOLTAGE: Unom



Plot 7.1.2 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Y-axis
VOLTAGE: Unom





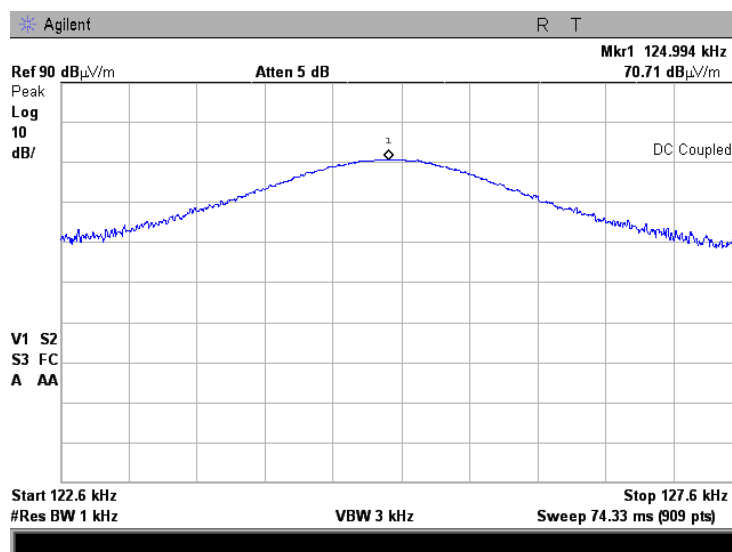
HERMON LABORATORIES

Report ID: LOGRAD_FCC.24374.docx
Date of Issue: 15-Aug-13

| | | | |
|----------------------|------------------------|--|----------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

Plot 7.1.3 Radiated emission measurements at the fundamental frequency

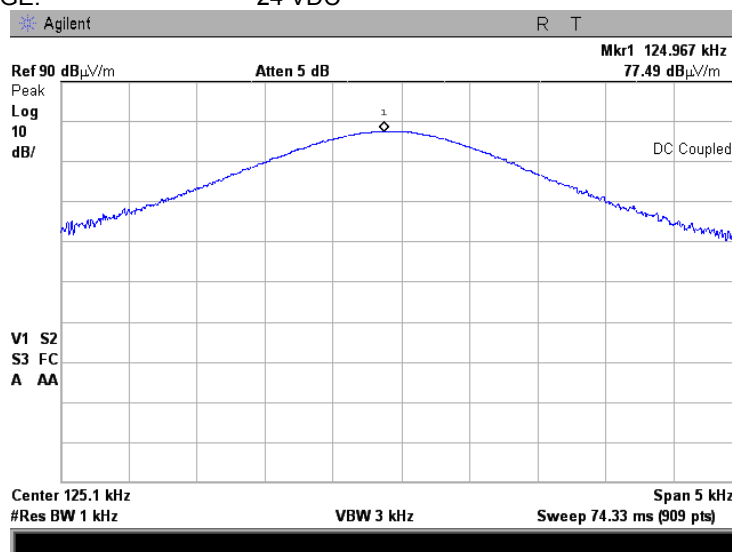
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Z-axis
VOLTAGE: Unom



| | | | |
|-----------------------------|-------------------------------|---|-----------------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

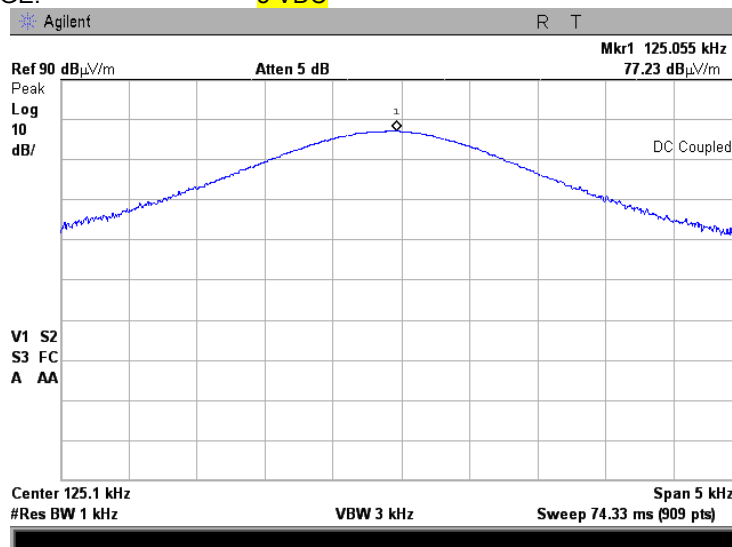
Plot 7.1.4 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Y-axis
VOLTAGE: 24 VDC



Plot 7.1.5 Radiated emission measurements at the fundamental frequency

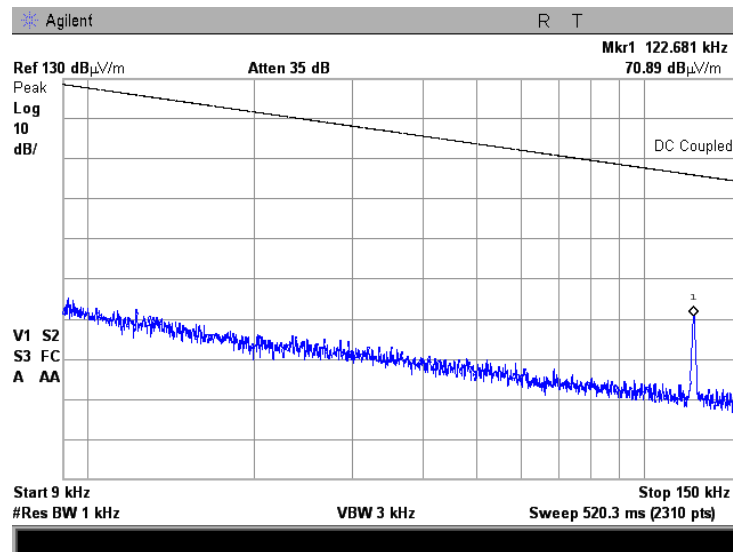
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Y-axis
VOLTAGE: 5 VDC



| | | | |
|-----------------------------|-------------------------------|---|-----------------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

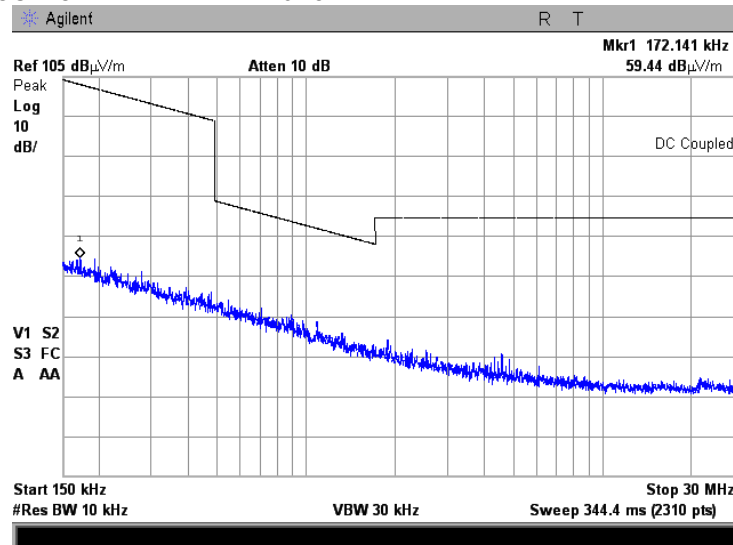
Plot 7.1.6 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Y-axis



Plot 7.1.7 Radiated emission measurements from 0.15 to 30 MHz

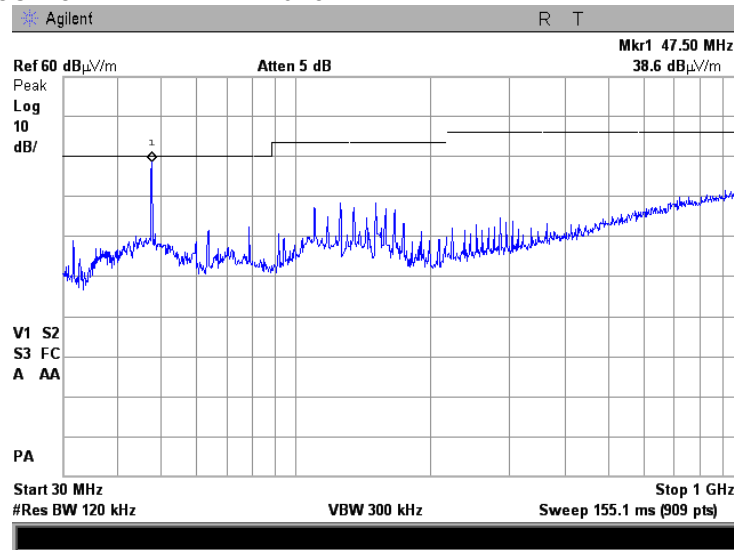
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Y-axis



| | | | |
|-----------------------------|-------------------------------|---|-----------------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

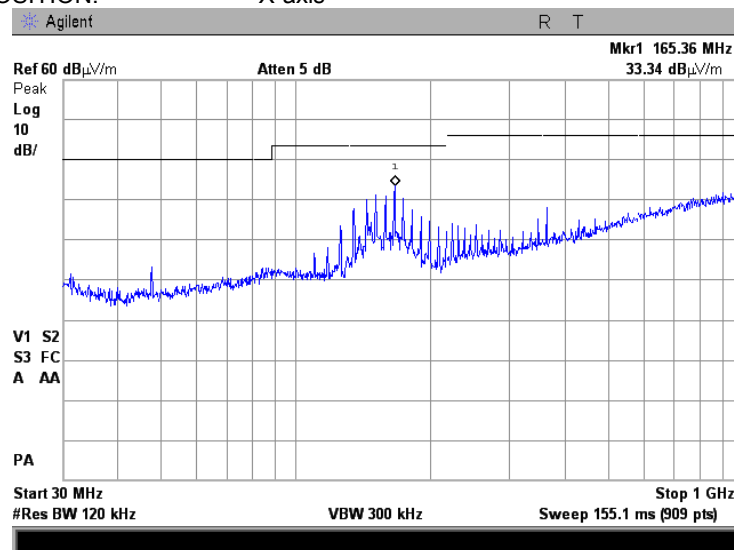
Plot 7.1.8 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: X-axis



Plot 7.1.9 Radiated emission measurements from 30 to 1000 MHz

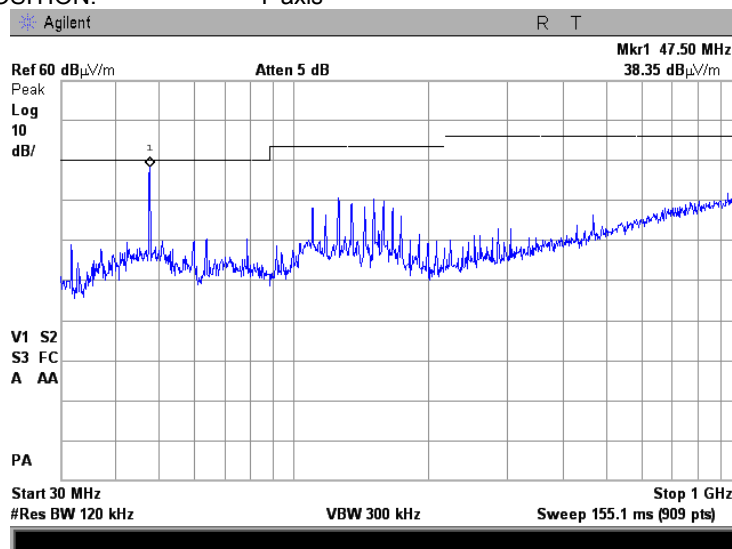
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis



| | | | |
|-----------------------------|-------------------------------|---|-----------------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

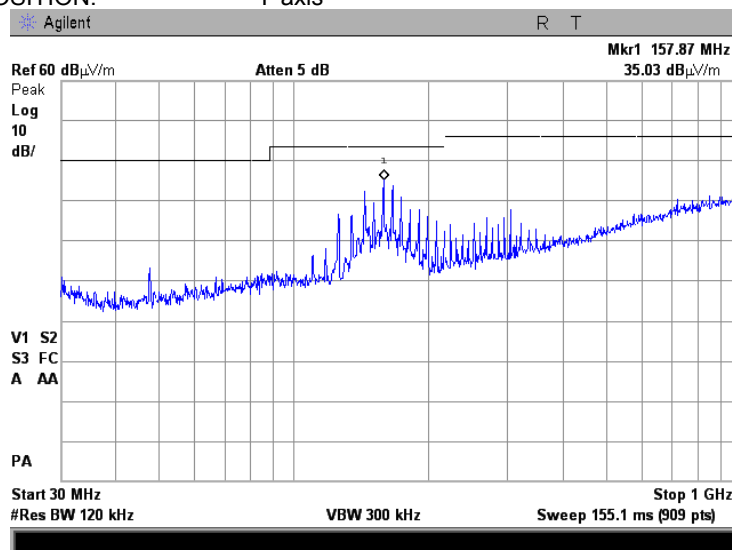
Plot 7.1.10 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Y-axis



Plot 7.1.11 Radiated emission measurements from 30 to 1000 MHz

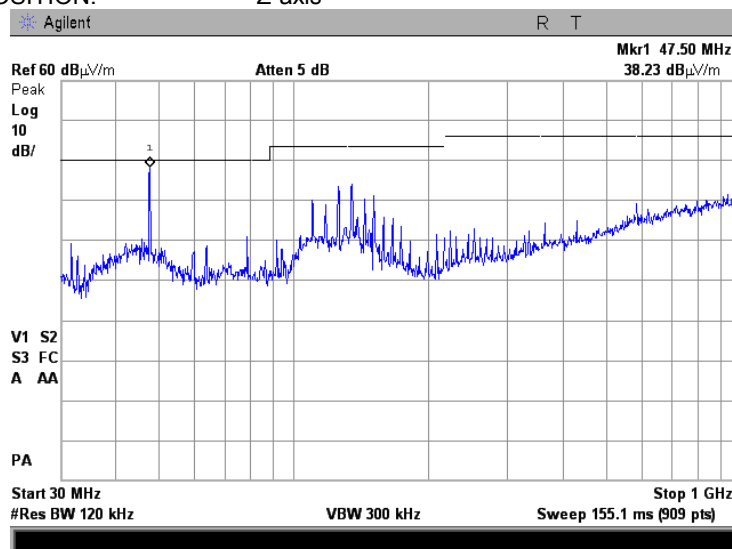
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Y-axis



| | | | |
|-----------------------------|-------------------------------|---|-----------------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

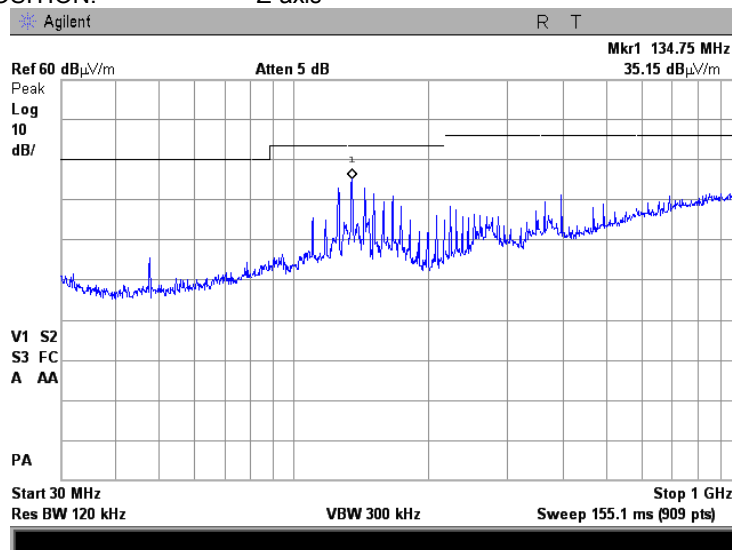
Plot 7.1.12 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Z-axis



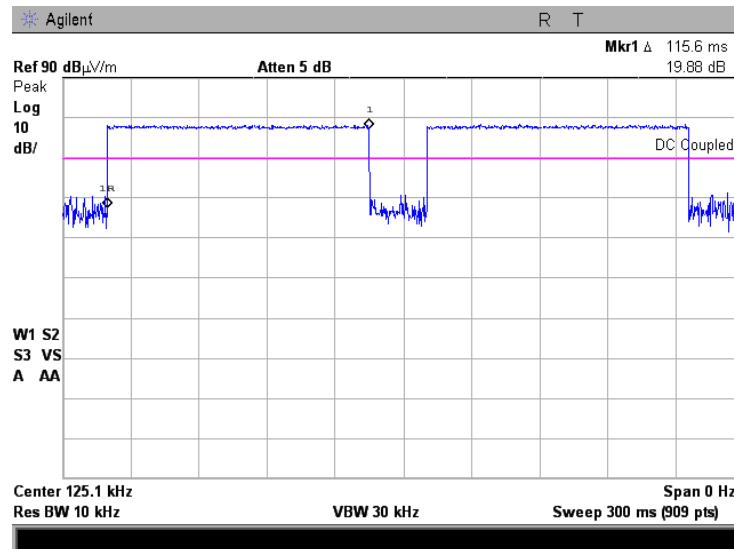
Plot 7.1.13 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Z-axis

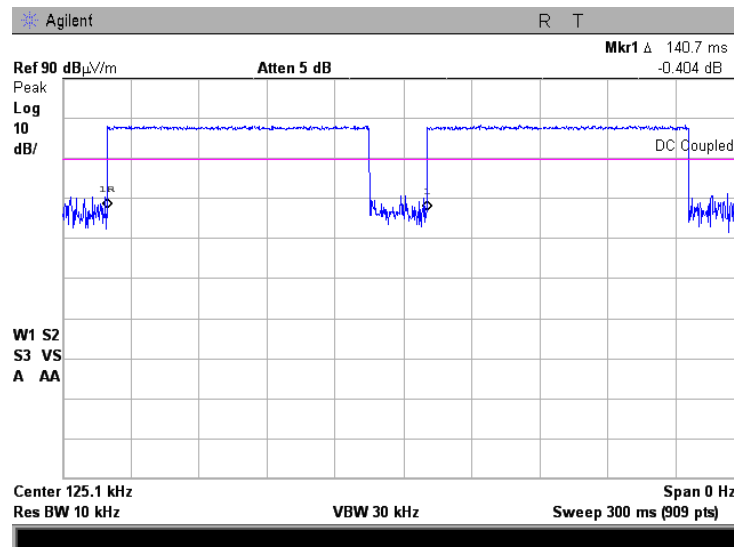


| | | | |
|-----------------------------|-------------------------------|---|-----------------------------|
| Test specification: | | Section 15.209 / RSS-210, Tables 2, 3, Field strength of emissions | |
| Test procedure: | | ANSI C63.4, Section 13.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/11/2013 - 8/11/2013 | |
| Temperature: 24.2 °C | Air Pressure: 1007 hPa | Relative Humidity: 43 % | Power Supply: 15 VDC |
| Remarks: | | | |

Plot 7.1.14 Transmission pulse duration



Plot 7.1.15 Transmission pulse period





| | | | |
|----------------------------|--------------------------|--|-----------------------------|
| Test specification: | | Section 15.203 / RSS-Gen, Section 7.1.4, Antenna requirements | |
| Test procedure: | | Visual inspection/supplier declaration | |
| Test mode: | | Verdict: | |
| Date(s): | | | |
| Temperature: °C | Air Pressure: hPa | Relative Humidity: % | Power Supply: 15 VDC |
| Remarks: | | | |

7.2 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.2.1.

Table 7.2.1 Antenna requirements

| Requirement | Rationale | Verdict |
|--|-------------------|---------|
| The transmitter antenna is permanently attached | Visual inspection | Comply |
| The transmitter employs a unique antenna connector | NA | |
| The transmitter requires professional installation | NA | |



| | | | |
|----------------------------|-------------------------------|--|-----------------------------|
| Test specification: | | Section 15.109, Radiated emission | |
| Test procedure: | | ANSI C63.4, Sections 11.6 and 12.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/13/2013 | |
| Temperature: 24 °C | Air Pressure: 1007 hPa | Relative Humidity: 42 % | Power Supply: 15 VDC |
| Remarks: | | | |

8 Unintentional emissions

8.1 Radiated emission measurements

8.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.1.1.

Table 8.1.1 Radiated emission limits

| Frequency, MHz | Class B limit, dB(μ V/m) | | Class A limit, dB(μ V/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* |
| 960 - 5 th harmonic** | 43.5* | 54.0 | 49.5 | 60.0* |

8.1.2 Test procedure

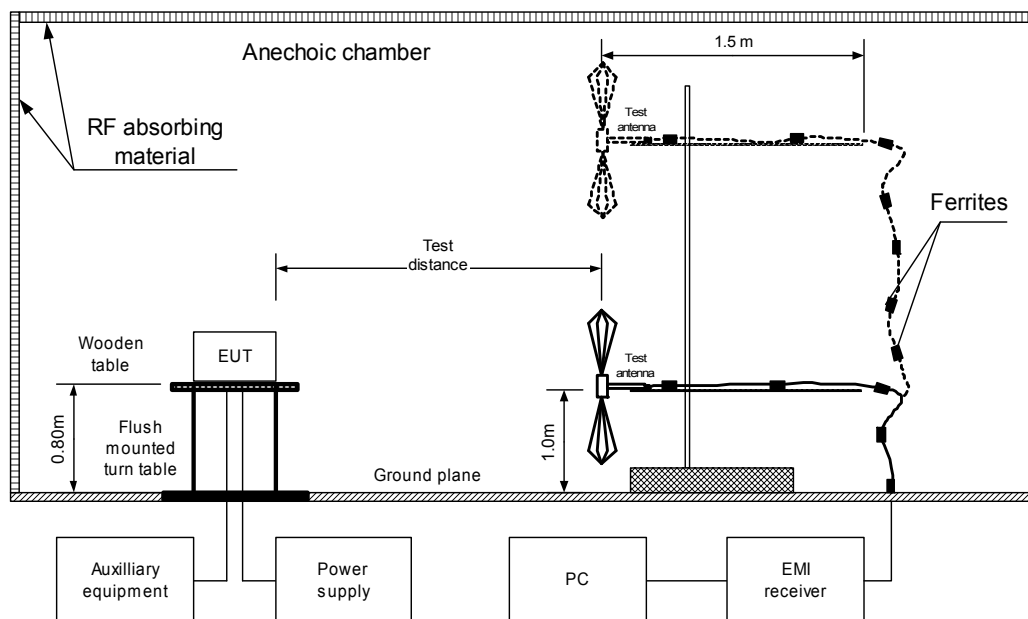
8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photograph, energized and the performance check was conducted.

8.1.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

8.1.2.3 The worst test results (the lowest margins) were provided in the associated tables and plots.

| | | | |
|----------------------------|-------------------------------|--|-----------------------------|
| Test specification: | | Section 15.109, Radiated emission | |
| Test procedure: | | ANSI C63.4, Sections 11.6 and 12.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/13/2013 | |
| Temperature: 24 °C | Air Pressure: 1007 hPa | Relative Humidity: 42 % | Power Supply: 15 VDC |
| Remarks: | | | |

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Photograph 8.1.1 Setup for preliminary radiated emission measurements





HERMON LABORATORIES

| | | | |
|----------------------------|-------------------------------|--|-----------------------------|
| Test specification: | | Section 15.109, Radiated emission | |
| Test procedure: | | ANSI C63.4, Sections 11.6 and 12.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/13/2013 | |
| Temperature: 24 °C | Air Pressure: 1007 hPa | Relative Humidity: 42 % | Power Supply: 15 VDC |
| Remarks: | | | |

Table 8.1.2 Radiated emission test results

| | |
|-----------------------|-----------------------|
| EUT SET UP: | TABLE-TOP |
| LIMIT: | Class B |
| EUT OPERATING MODE: | Stand-by and Receive |
| TEST SITE: | SEMI ANECHOIC CHAMBER |
| TEST DISTANCE: | 3 m |
| FREQUENCY RANGE: | 30 MHz – 1000 MHz |
| RESOLUTION BANDWIDTH: | 120 kHz |

| Frequency, MHz | Peak emission, dB(μV/m) | Quasi-peak | | | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|-------------------|-------------------------------|-----------------------------------|--------------------|----------------|-------------------------|-------------------------|--------------------------------------|---------|
| | | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* | | | | |
| 48.000 | 40.49 | 39.60 | 40.0 | -0.40 | Vert | 1.0 | 21 | Pass |
| 111.90 | 34.96 | 33.01 | 40.0 | -6.99 | Vert | 1.0 | 319 | |
| 127.90 | 39.04 | 37.60 | 43.5 | -5.90 | Vert | 1.0 | 332 | |
| 135.90 | 38.42 | 36.89 | 43.5 | -6.61 | Vert | 1.0 | 321 | |
| 144.10 | 37.58 | 35.54 | 43.5 | -7.96 | Vert | 1.0 | 328 | |
| 152.10 | 36.80 | 35.27 | 43.5 | -8.23 | Vert | 1.0 | 299 | |

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

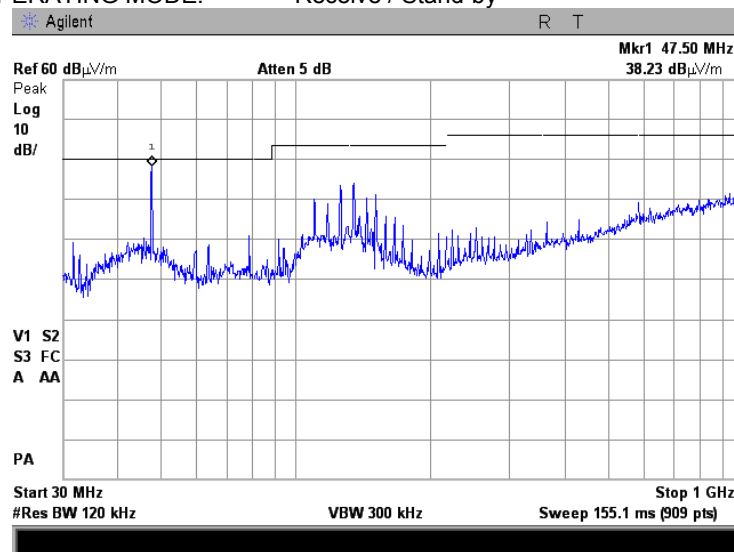
| | | | | | | | |
|---------|---------|---------|---------|---------|--|--|--|
| HL 0446 | HL 0604 | HL 2871 | HL 3818 | HL 4347 | | | |
|---------|---------|---------|---------|---------|--|--|--|

Full description is given in Appendix A.

| | | | |
|----------------------------|-------------------------------|--|-----------------------------|
| Test specification: | | Section 15.109, Radiated emission | |
| Test procedure: | | ANSI C63.4, Sections 11.6 and 12.1.4 | |
| Test mode: | | Compliance | Verdict: PASS |
| Date(s): | | 8/13/2013 | |
| Temperature: 24 °C | Air Pressure: 1007 hPa | Relative Humidity: 42 % | Power Supply: 15 VDC |
| Remarks: | | | |

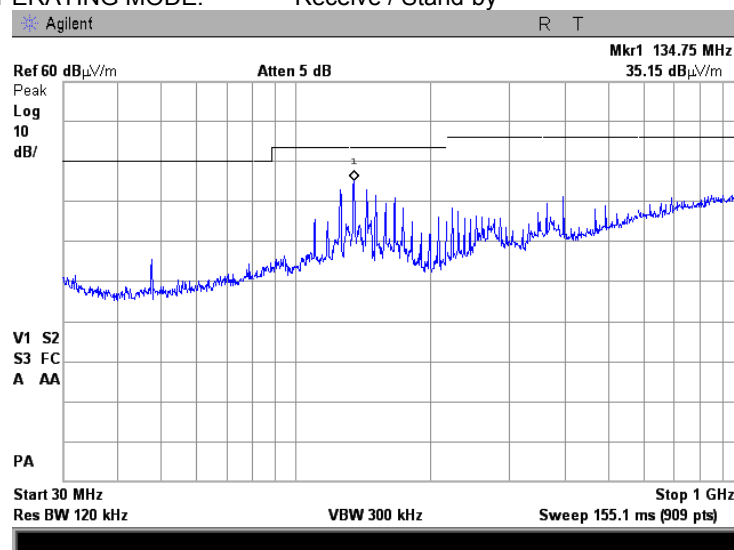
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by



Plot 8.1.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by



9 APPENDIX A Test equipment and ancillaries used for tests

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal./ Check | Due Cal./ Check |
|-------|--|----------------------|--------------|-------------|------------------|-----------------|
| 0446 | Antenna, Loop, Active, 10 kHz - 30 MHz | EMCO | 6502 | 2857 | 03-Jul-12 | 03-Jul-14 |
| 0604 | Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz | EMCO | 3141 | 9611-1011 | 04-Jun-13 | 04-Jun-14 |
| 2871 | Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA | Huber-Suhner | 198-8155-00 | 2871 | 04-Dec-12 | 04-Dec-13 |
| 3818 | PSA Series Spectrum Analyzer, 3 Hz- 44 GHz | Agilent Technologies | E4446A | MY48250288 | 24-Apr-13 | 24-Apr-14 |
| 4347 | Low Loss Armored Test Cable, DC - 18 GHz, 2.0 m, N type-M/N type-M | MegaPhase | NC29-N1N1-79 | 12025103001 | 06-Mar-13 | 06-Mar-14 |

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

| Test description | Expanded uncertainty |
|---|--|
| Radiated emissions at 3 m measuring distance Horizontal polarization | Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB |
| Vertical polarization | Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB |
| Occupied bandwidth | ± 8.0 % |

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.

11 APPENDIX C 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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website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

| | |
|-------------------------|---|
| FCC 47CFR part 15: 2012 | 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 |

13 APPENDIX E Test equipment correction factors

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

| 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(μ V) to convert it into field intensity in dB(μ V/m).

Antenna factor
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604

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

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

Cable loss
Cable coaxial, Huber-Suhner, 18 GHz, 6.4 m, SMA - SMA, model 198-8155-00,
HL 2871

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10 | 0.12 | 5750 | 2.34 | 12000 | 3.55 |
| 30 | 0.14 | 6000 | 2.39 | 12250 | 3.61 |
| 100 | 0.27 | 6250 | 2.46 | 12500 | 3.67 |
| 250 | 0.45 | 6500 | 2.52 | 12750 | 3.74 |
| 500 | 0.63 | 6750 | 2.58 | 13000 | 3.79 |
| 750 | 0.76 | 7000 | 2.64 | 13250 | 3.82 |
| 1000 | 0.89 | 7250 | 2.68 | 13500 | 3.83 |
| 1250 | 1.01 | 7500 | 2.73 | 13750 | 3.83 |
| 1500 | 1.12 | 7750 | 2.78 | 14000 | 3.88 |
| 1750 | 1.23 | 8000 | 2.83 | 14250 | 3.93 |
| 2000 | 1.32 | 8250 | 2.88 | 14500 | 3.96 |
| 2250 | 1.41 | 8500 | 2.94 | 14750 | 4.01 |
| 2500 | 1.49 | 8750 | 2.97 | 15000 | 4.00 |
| 2750 | 1.58 | 9000 | 3.02 | 15250 | 4.01 |
| 3000 | 1.66 | 9250 | 3.07 | 15500 | 4.00 |
| 3250 | 1.73 | 9500 | 3.13 | 15750 | 4.13 |
| 3500 | 1.80 | 9750 | 3.18 | 16000 | 4.22 |
| 3750 | 1.87 | 10000 | 3.21 | 16250 | 4.29 |
| 4000 | 1.93 | 10250 | 3.26 | 16500 | 4.29 |
| 4250 | 2.01 | 10500 | 3.30 | 16750 | 4.32 |
| 4500 | 2.06 | 10750 | 3.36 | 17000 | 4.37 |
| 4750 | 2.12 | 11000 | 3.39 | 17250 | 4.45 |
| 5000 | 2.17 | 11250 | 3.44 | 17500 | 4.49 |
| 5250 | 2.24 | 11500 | 3.48 | 17750 | 4.53 |
| 5500 | 2.29 | 11750 | 3.52 | 18000 | 4.55 |

Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-79 S/N 12025103 001,
HL 4347

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|-------------------|-------------------|-------------------|-------------------|
| 50 | 0.08 | 9000 | 0.92 |
| 100 | 0.11 | 9500 | 1.00 |
| 300 | 0.18 | 10000 | 1.05 |
| 500 | 0.23 | 10500 | 1.04 |
| 1000 | 0.32 | 11000 | 1.05 |
| 1500 | 0.39 | 11500 | 1.09 |
| 2000 | 0.45 | 12000 | 1.13 |
| 2500 | 0.50 | 12500 | 1.15 |
| 3000 | 0.54 | 13000 | 1.19 |
| 3500 | 0.59 | 13500 | 1.19 |
| 4000 | 0.62 | 14000 | 1.22 |
| 4500 | 0.65 | 14500 | 1.26 |
| 5000 | 0.69 | 15000 | 1.32 |
| 5500 | 0.71 | 15500 | 1.38 |
| 6000 | 0.77 | 16000 | 1.34 |
| 6500 | 0.82 | 16500 | 1.36 |
| 7000 | 0.84 | 17000 | 1.46 |
| 7500 | 0.85 | 17500 | 1.49 |
| 8000 | 0.88 | 18000 | 1.46 |
| 8500 | 0.90 | | |

14 APPENDIX F Abbreviations and acronyms

| | |
|----------------|---|
| A | ampere |
| AC | alternating current |
| A/m | ampere per meter |
| AVRG | average (detector) |
| 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 |
| dB(μ A) | decibel referred to one microampere |
| DC | direct current |
| EIRP | equivalent isotropically radiated power |
| ERP | effective radiated power |
| EUT | equipment under test |
| F | frequency |
| GHz | gigahertz |
| GND | ground |
| H | height |
| HL | Hermon laboratories |
| Hz | hertz |
| k | kilo |
| kHz | kilohertz |
| LO | local oscillator |
| m | meter |
| MHz | megahertz |
| min | minute |
| mm | millimeter |
| ms | millisecond |
| μ s | microsecond |
| NA | not applicable |
| OATS | open area test site |
| Ω | Ohm |
| PS | power supply |
| ppm | part per million (10^{-6}) |
| QP | quasi-peak |
| RE | radiated emission |
| RF | radio frequency |
| rms | root mean square |
| Rx | receive |
| s | second |
| T | temperature |
| Tx | transmit |
| V | volt |

END OF DOCUMENT