HERMON LABORATORIES

839.01
Electrical

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# TEST REPORT

**ACCORDING TO: FCC CFR 47 PART 15 Subpart C, section 15.231 and subpart B; RSS-210, Issue 7, Annex 1; ICES-003 Issue 4:2004**

**FOR:**

## Visonic Ltd.

## Waterproof wireless transmitter

## Model:MCT-212 RL

# Table of contents

# 1 Applicant information

| | |
|---|---|
| **Client name:** | Visonic Ltd. |
| **Address:** | 24 Habarzel street, Tel Aviv 69720, Israel |
| **Telephone:** | 03-645 6714 |
| **Fax:** | 03-645 6788 |
| **E-mail:** | aelshtein@visonic.com |
| **Contact name:** | Mr. Arik Elshtein |

# 2 Equipment under test attributes

| | |
|---|---|
| **Product name:** | Waterproof wireless transmitter |
| **Model(s):** | MCT-212 RL |
| **Condition of equipment:** | New |
| **Receipt date** | 8/15/2007 |

# 3 Manufacturer information

| | |
|---|---|
| **Manufacturer name:** | Visonic Ltd. |
| **Address:** | 24 Habarzel street, Tel Aviv 69720, Israel |
| **Telephone:** | 03-645 6714 |
| **Fax:** | 03-645 6788 |
| **E-Mail:** | aelshtein@visonic.com |
| **Contact name:** | Mr. Arik Elshtein |

# 4 Test details

| | |
|---|---|
| **Project ID:** | 18130 |
| **Location:** | Hermon Laboratories Ltd., Harakevet Industrial Zone, Binyamina 30500, Israel |
| **Test started:** | 8/15/2007 |
| **Test completed:** | 8/22/2007 |
| **Test specification(s):** | FCC Part 15, subpart C, §15.231; subpart B, §15.109;<br>RSS-210 Issue 7:2007, Annex 1; RSS-Gen issue 2:2007; ICES-003 issue 4:2004 |

# 5 Tests summary

| Test | Status |
|---|---|
| **Transmitter characteristics** | |
| FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements | Pass |
| FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions | Pass |
| FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth | Pass |
| FCC Part 15, Section 207 / RSS-Gen, Section 7.2.2, Conducted emission | Not required |
| FCC Part 15, Section 203 / RSS-Gen, Section 7.1.4, Antenna requirements | Pass |
| **Unintentional emissions** | |
| FCC Part 15, Section 107 / RSS-Gen, Section 7.2.2, Conducted emission at AC power port | Not required |
| FCC Part 15, Section 109 / RSS-Gen, Section 7.1.6/ ICES-003 Section 5.5, Radiated emission | Pass |
| FCC Part 15, Section 111 / RSS-Gen, Section 6(b), Section 7.2.3.1, Conducted emission at receiver antenna port | 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. A. Lane, test engineer | August 22, 2007 | |
| **Reviewed by:** | Mrs. M. Cherniavsky, certification engineer | August 26, 2007 | |
| **Approved by:** | Mr. M. Nikishin, EMC and radio group leader | August 27, 2007 | |

# 6 EUT description

## 6.1 General information

The EUT is a miniature waterproof transmitter, designed for home health care signaling. It can be worn on the wrist or around the neck. The EUT is powered by 3 V internal battery and utilizes an integral antenna.

## 6.2 Operating frequencies

| Source | Frequency, MHz |
|---|---|
| Transmitter | 315 |

## 6.3 Changes made in the EUT

No changes were implemented.

## 6.4 EUT test configuration in “X-axis” position

## 6.5 Transmitter characteristics

| **Type of equipment** | |
|---|---|
| X | Stand-alone (Equipment with or without its own control provisions) |
| | Combined equipment (Equipment where the radio part is fully integrated within another type of equipment) |
| | Plug-in card (Equipment intended for a variety of host systems) |

| **Intended use** | | **Condition of use** |
|---|---|---|
| | fixed | Always at a distance more than 2 m from all people |
| | mobile | Always at a distance more than 20 cm from all people |
| X | portable | May operate at a distance closer than 20 cm to human body |

| | | |
|---|---|---|
| **Assigned frequency range** | 315 MHz | |
| **Operating frequency** | 315 MHz | |
| **Maximum rated output power** | At transmitter 50 Ω RF output connector | dBm |
| | Effective radiated power (for equipment with no RF connector) | -16.6 dBm |

| | | | | | |
|---|---|---|---|---|---|
| **Is transmitter output power variable?** | X | No | | | |
| | | Yes | | continuous variable | |
| | | | | stepped variable with stepsize | dB |
| | | | minimum RF power | | dBm |
| | | | maximum RF power | | dBm |

| **Antenna connection** | | | | | |
|---|---|---|---|---|---|
| unique coupling | standard connector | X | integral | | with temporary RF connector |
| | | | | X | without temporary RF connector |

| **Antenna/s technical characteristics** | | | |
|---|---|---|---|
| Type | Manufacturer | Model number | Gain |
| PCB print | Visonic | NA | NA |

| | | | | | |
|---|---|---|---|---|---|
| **Type of modulation** | ASK | | | | |
| **Modulating test signal (baseband)** | ID Code | | | | |
| **Transmitter duty cycle supplied for test** | 100 % | **Tx ON time** | msec | **Period** | msec |

| **Transmitter power source** | | | | | | |
|---|---|---|---|---|---|---|
| X | Battery | **Nominal rated voltage** | 3 VDC | Battery type | Lithium | |

| Test specification: | FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements | | |
|---|---|---|---|
| **Test procedure:** | Supplier declaration | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 10:34:17 AM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

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

## 7.1 Periodic operation requirements

### 7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- A manually operated transmitter shall employ switch that will automatically deactivate the transmitter within not more than 5 seconds of being released;
- A transmitter activated automatically shall cease transmission within 5 seconds after activation;
- Periodic transmissions, excluding polling or supervision transmissions, at regular predetermined intervals are not permitted;
- Total duration of polling or supervision transmissions, including data, to determine system integrity in security or safety applications shall not exceed 2 seconds per hour.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

### 7.1.2 Test procedure for transmitter shut down test

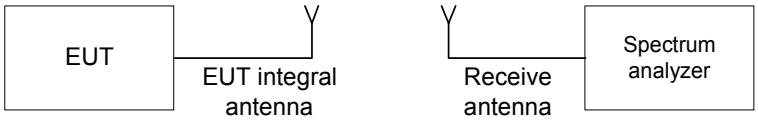
**7.1.2.1** The EUT was set up as shown in Figure 7.1.1.

**7.1.2.2** The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

**7.1.2.3** The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.

**7.1.2.4** The transmission time was captured and shown in Plot 7.1.1.

**Figure 7.1.1 Setup for transmitter shut down test**



| **Test specification:** | **FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements** | | |
|---|---|---|---|
| **Test procedure:** | Supplier declaration | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 10:34:17 AM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Table 7.1.1 Periodic operation requirements**

| Requirement | Rationale | Verdict |
|---|---|---|
| Continuous transmissions are not permitted | Supplier declaration | Comply |
| A manually operated transmitter shall be deactivated within not more than 5 seconds of switch being released | Plot 7.1.1 | Comply |
| Transmitter activated automatically shall cease transmission within 5 seconds | NA | NA |
| Periodic transmissions at regular predetermined intervals are not permitted | Supplier declaration | Comply |
| Total duration of polling or supervision transmissions shall not exceed 2 seconds per hour | NA | Comply |

**Plot 7.1.1 Transmitter shut down test result**

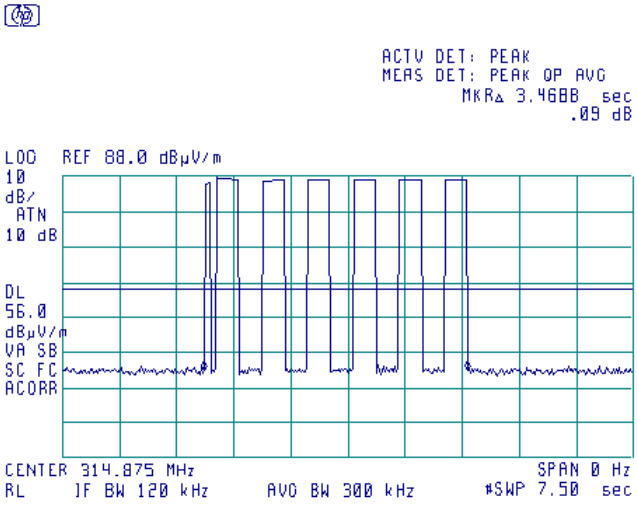



**Table 7.1.2 Total duration of polling / supervision transmissions**

| Duration, ms | Repetition period, ms | Maximum number of transmissions within 1 hour | Total duration within 1 hour, ms |
|---|---|---|---|
| No supervision signals | | | |

**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0521 | HL 0589 | HL 0604 | HL 2009 | | | | |

Full description is given in Appendix A.

| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

## 7.2 Field strength of emissions

### 7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

**Table 7.2.1 Radiated fundamental emission limits**

| Fundamental frequency, MHz | Field strength at 3 m, dB(μV/m) | |
|---|---|---|
| | Peak | Average |
| 315.0 | 95.62 | 75.62 |

**Table 7.2.2 Radiated spurious emissions limits**

| Frequency, MHz | Field strength at 3 m, dB(μV/m) | | | | |
|---|---|---|---|---|---|
| | Within restricted bands | | | Outside restricted bands | |
| | Peak | Quasi Peak | Average | Peak | Average |
| 0.009 – 0.090 | 148.5 – 128.5 | NA | 128.5 – 108.5** | 75.62 | 55.62 |
| 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 | | | |
| Above 1000 | 74.0 | NA | 54.0 | | |

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

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

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

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

*Note 1:* The fundamental emission limit in dB(μV/m) was calculated as follows:

$$Lim_{AVR} = 20 \times \log(56.81818 \times F - 6136.3636)$$ - within 130 – 174 MHz band;

$$Lim_{AVR} = 20 \times \log(41.6667 \times F - 7083.3333)$$ - within 260 – 470 MHz band,

where F is the carrier frequency in MHz.

The limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

*Note 2:* The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

| Test specification: | FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**7.2.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band**

**7.2.2.1** The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

**7.2.2.2** The measurements were performed in three EUT orthogonal positions.

**7.2.2.3** The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated $360^0$ and the measuring antenna was rotated around its vertical axis.

**7.2.2.4** The worst test results (the lowest margins) found in the EUT "X-axis" orthogonal position were recorded in Table 7.2.3 and shown in the associated plots.

**7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz**

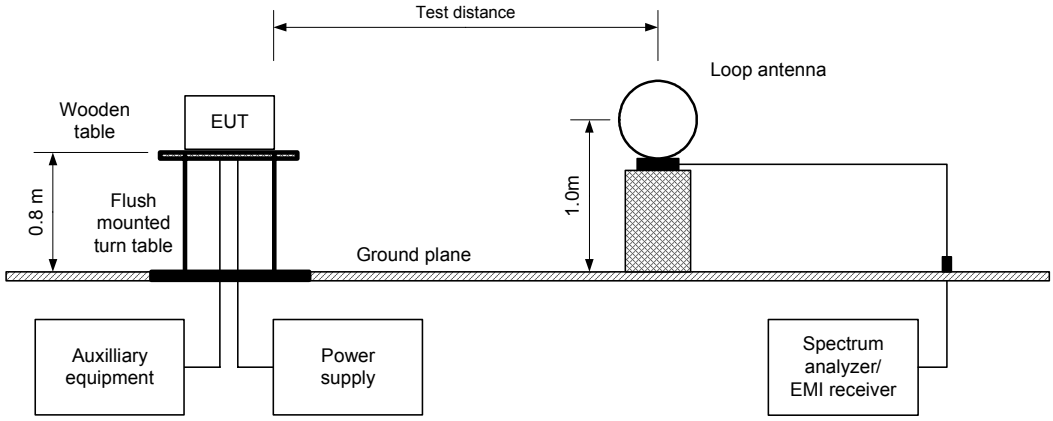
**7.2.3.1** The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.

**7.2.3.2** The measurements were performed in three EUT orthogonal positions.

**7.2.3.3** The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated $360^0$, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

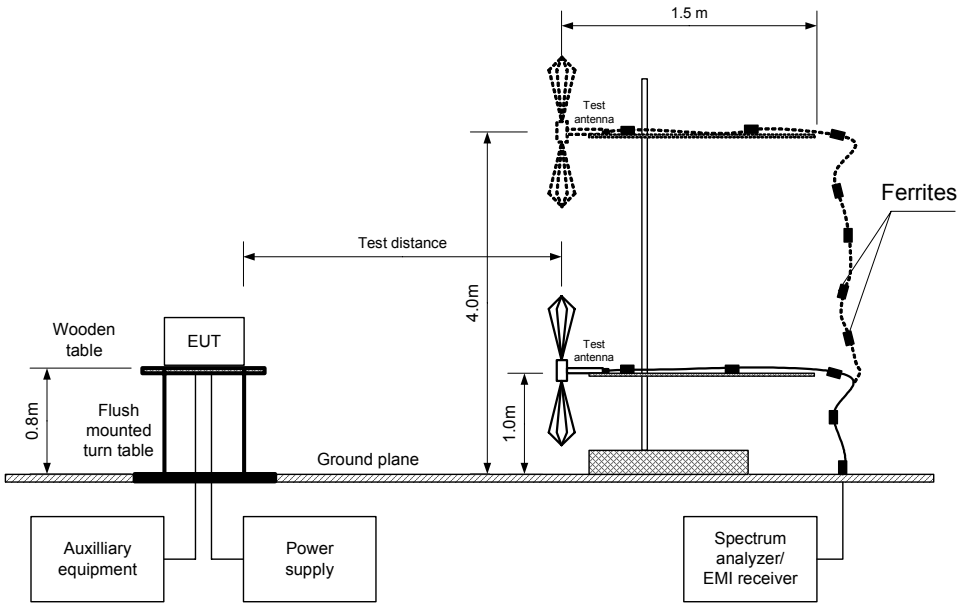
**7.2.3.4** The worst test results (the lowest margins) found in the EUT "X-axis" orthogonal position were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

**Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz**



| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz**



| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz**

| | |
|---|---|
| TEST DISTANCE: | 3 m |
| EUT POSITION: | 3 orthogonal (X / Y / Z) |
| MODULATION: | ASK |
| MODULATING SIGNAL: | ID code |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| INVESTIGATED FREQUENCY RANGE: | 0.009 - 4000 MHz |
| DETECTOR USED: | Peak |
| RESOLUTION BANDWIDTH: | 1 kHz (9 kHz – 150 kHz)<br>9.0 kHz (150 kHz – 30 MHz)<br>120 kHz (30 MHz – 1000 MHz)<br>1.0 MHz (above 1000 MHz) |
| VIDEO BANDWIDTH: | ≥ Resolution bandwidth |
| TEST ANTENNA TYPE: | Active loop (9 kHz – 30 MHz)<br>Biconilog (30 MHz – 1000 MHz)<br>Double ridged guide (above 1000 MHz) |

| F, MHz | Antenna | | Azimuth, degrees* | Peak field strength | | | Avr factor, dB | 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** | |
| **Fundamental emission** | | | | | | | | | | | |
| 314.880 | H | 1.0 | 230 | 78.63 | 95.62 | -16.99 | -3.14 | 75.49 | 75.62 | -0.13 | Pass |
| **Spurious emissions** | | | | | | | | | | | |
| 629.753 | H | 1.2 | 210 | 46.50 | 75.62 | -29.12 | -3.14 | 43.36 | 55.62 | -12.26 | Pass |

**The recorded test results were obtained throughout measurements in the EUT "X-axis" position**

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

**Table 7.2.4 Average factor calculation**

| Transmission pulse | | Transmission burst | | Transmission train duration, ms | Average factor, dB |
|---|---|---|---|---|---|
| Duration, ms | Period, ms | Duration, ms | Period, ms | | |
| 0.862 | 1.238 | 295 | 600 | 3468 | -3.14 |

*- Average factor was calculated as follows
for pulse train longer than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\,ms} \times Number\ of\ bursts\ within\ 100\,ms\right)$$

**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0446 | HL 0465 | HL 0521 | HL 0589 | HL 0592 | HL 0593 | HL 0594 | HL 0604 |
| HL 1556 | HL 1562 | HL 1947 | HL 1984 | HL 2009 | HL 2432 | | |

Full description is given in Appendix A.

| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Table 7.2.5 Field strength of emissions below 1 GHz within restricted bands**

| | |
|---|---|
| TEST DISTANCE: | 3 m |
| EUT POSITION: | 3 orthogonal (X / Y / Z) |
| MODULATION: | ASK |
| MODULATING SIGNAL: | ID code |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| INVESTIGATED FREQUENCY RANGE: | 0.009 – 1000 MHz |
| DETECTOR USED: | Peak |
| RESOLUTION BANDWIDTH: | 1 kHz (9 kHz – 150 kHz)<br>9.0 kHz (150 kHz – 30 MHz)<br>120 kHz (30 MHz – 1000 MHz) |
| VIDEO BANDWIDTH: | ≥ Resolution bandwidth |
| TEST ANTENNA TYPE: | Active loop (9 kHz – 30 MHz)<br>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*** | | | | |
| No spurious were found | | | | | | | | Pass |

***- Margin = Measured emission - specification limit.
****- EUT front panel refer to 0 degrees position of turntable.

**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0446 | HL 0465 | HL 0521 | HL 0589 | HL 0592 | HL 0593 | HL 0594 | HL 0604 |
| HL 1556 | HL 1562 | HL 1947 | HL 2009 | | | | |

Full description is given in Appendix A.

| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Table 7.2.6 Restricted bands according to FCC 15, Section 205**

| 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 | 12.290 - 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 | 16.420 - 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 | |

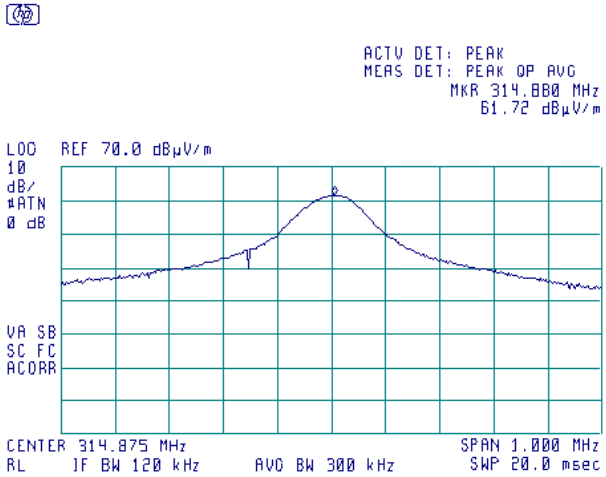
**Table 7.2.7 Restricted bands according to RSS-210, Section 2.7**

| MHz | MHz | MHz | MHz | MHz | GHz |
|---|---|---|---|---|---|
| 0.09 - 0.11 | 8.291 - 8.294 | 16.80425 - 16.80475 | 399.9 - 410 | 3260 - 3267 | 10.6 - 12.7 |
| 2.1735 - 2.190 | 8.362 - 8.366 | 25.5 - 25.67 | 608 - 614 | 3332 - 3339 | 13.25 - 13.4 |
| 3.020 - 3.026 | 8.37625 - 8.38675 | 37.5 - 38.25 | 960 - 1427 | 3345.8 - 3358 | 14.47 - 14.5 |
| 4.125 - 4.128 | 8.41425 - 8.41475 | 73 - 74.6 | 1435 - 1626.5 | 3500 - 4400 | 15.35 - 16.2 |
| 4.17725 - 4.17775 | 12.290 - 12.293 | 74.8 - 75.2 | 1645.5 - 1646.5 | 4500 - 5150 | 17.7 - 21.4 |
| 4.20725 - 4.20775 | 12.51975 - 12.52025 | 108 - 138 | 1660 - 1710 | 5350 – 5460 | 22.01 - 23.12 |
| 5.677 - 5.683 | 12.57675 - 12.57725 | 156.52475 - 156.52525 | 1718.8 - 1722.2 | 7250 - 7750 | 23.6 – 24.0 |
| 6.215 - 6.218 | 13.36 - 13.41 | 156.7 - 156.9 | 2200 - 2300 | 8025 - 8500 | 31.2 - 31.8 |
| 6.26775 - 6.26825 | 16.42 - 16.423 | 240 - 285 | 2310 - 2390 | 9000 - 9200 | 36.43 - 36.5 |
| 6.31175 - 6.31225 | 16.69475 - 16.69525 | 322 - 335.4 | 2655 - 2900 | 9300 - 9500 | Above 38.6 |

| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

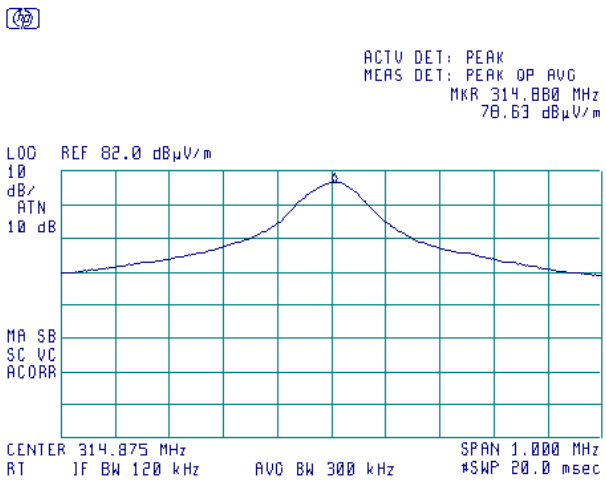
**Plot 7.2.1 Radiated emission measurements at the fundamental frequency**

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




**Plot 7.2.2 Radiated emission measurements at the fundamental frequency**

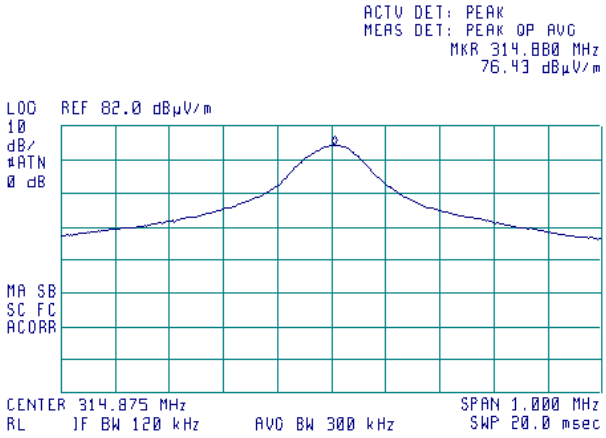
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: X-axis



| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

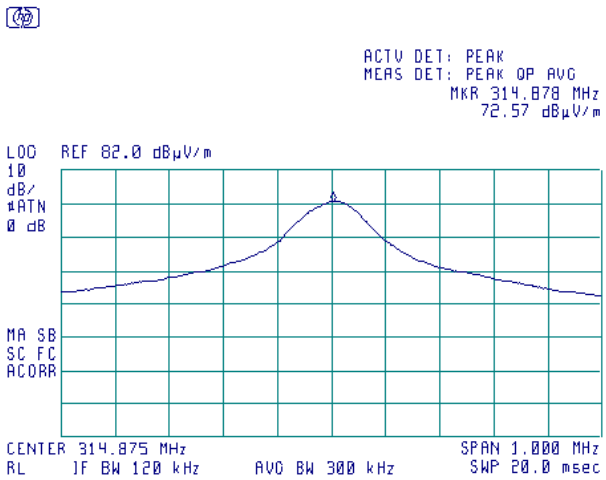
**Plot 7.2.3 Radiated emission measurements at the fundamental frequency**

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




**Plot 7.2.4 Radiated emission measurements at the fundamental frequency**

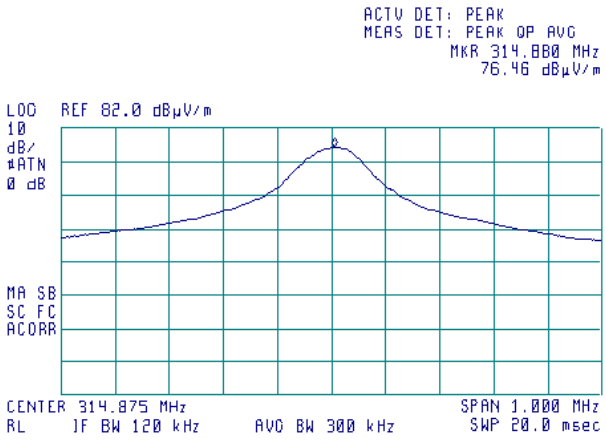
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSTION: Y-axis



| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

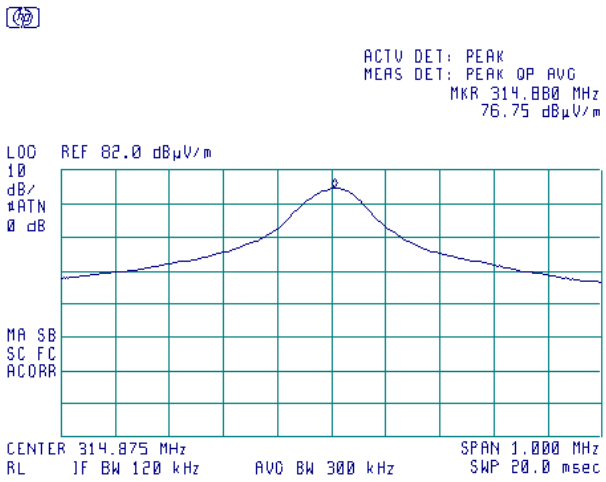
**Plot 7.2.5 Radiated emission measurements at the fundamental frequency**

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




**Plot 7.2.6 Radiated emission measurements at the fundamental frequency**

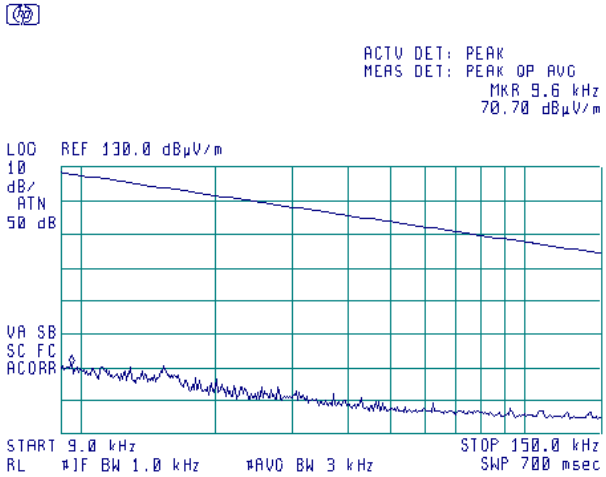
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Z-axis



| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

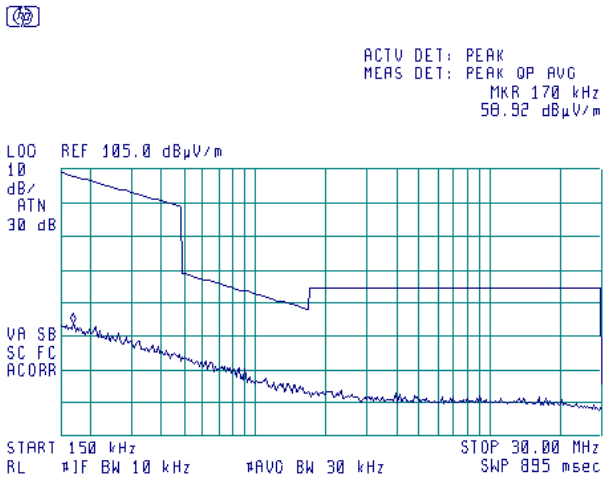
**Plot 7.2.7 Radiated emission measurements from 9 to 150 kHz**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X/ Y/ Z)




**Plot 7.2.8 Radiated emission measurements from 0.15 to 30 MHz**

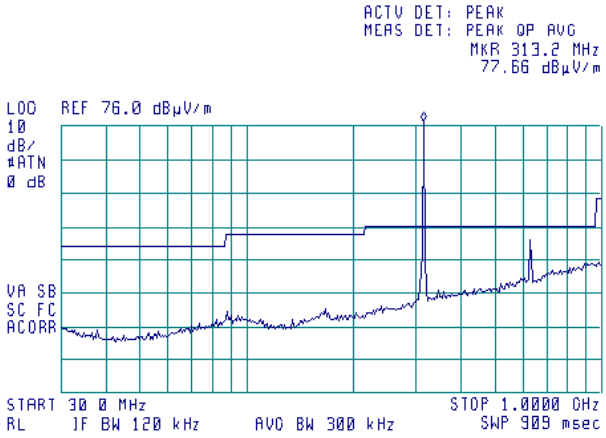
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: 3 orthogonal (X/ Y/ Z)



| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

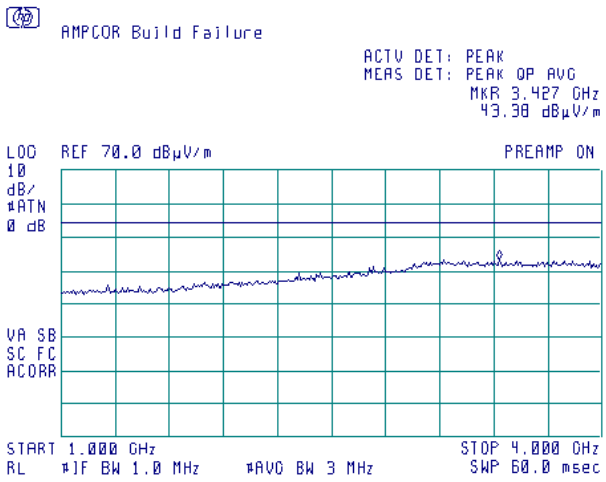
**Plot 7.2.9 Radiated emission measurements from 30 to 1000 MHz**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)




**Plot 7.2.10 Radiated emission measurements from 1000 to 4000MHz**

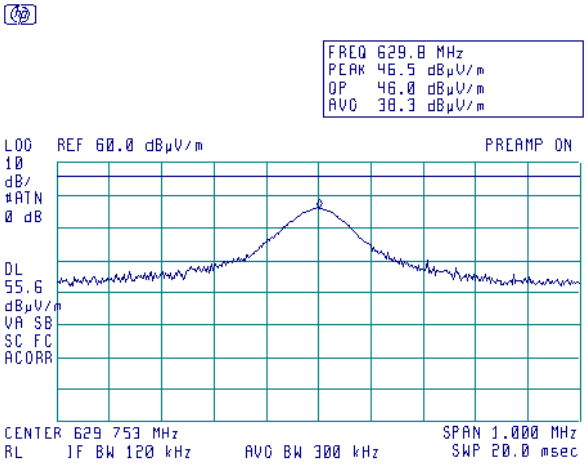
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

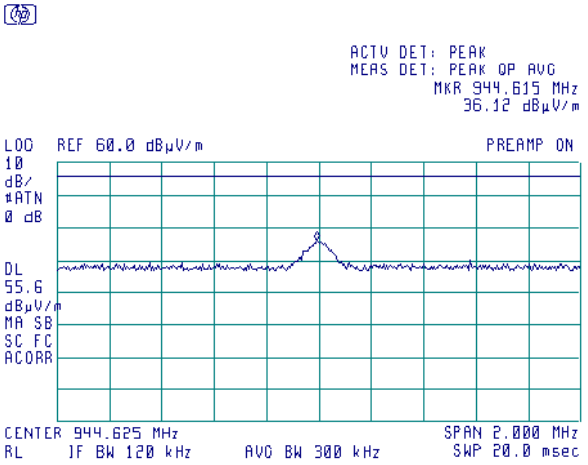
**Plot 7.2.11 Radiated emission measurements at the second harmonic frequency**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)




**Plot 7.2.12 Radiated emission measurements at the third harmonic frequency**

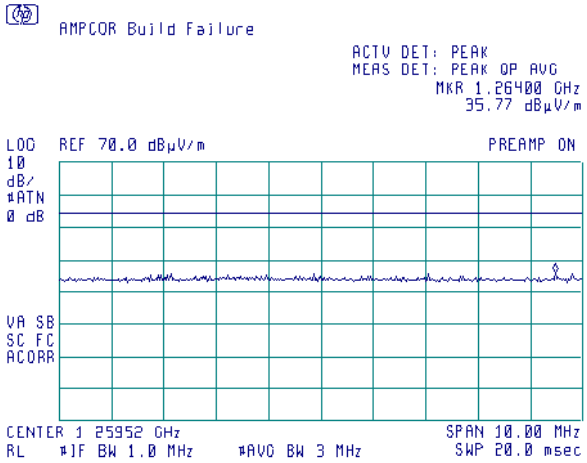
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

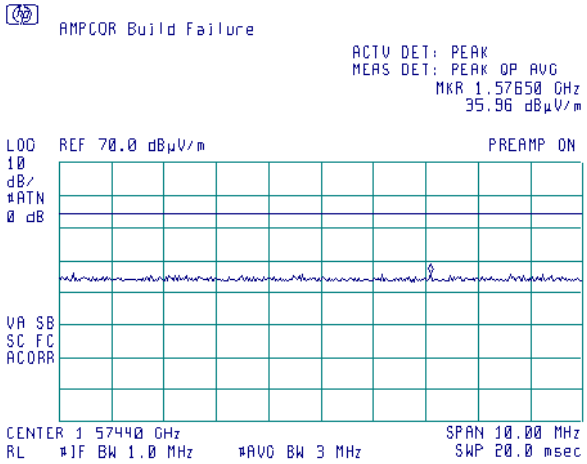
**Plot 7.2.13 Radiated emission measurements at the forth harmonic frequency**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)



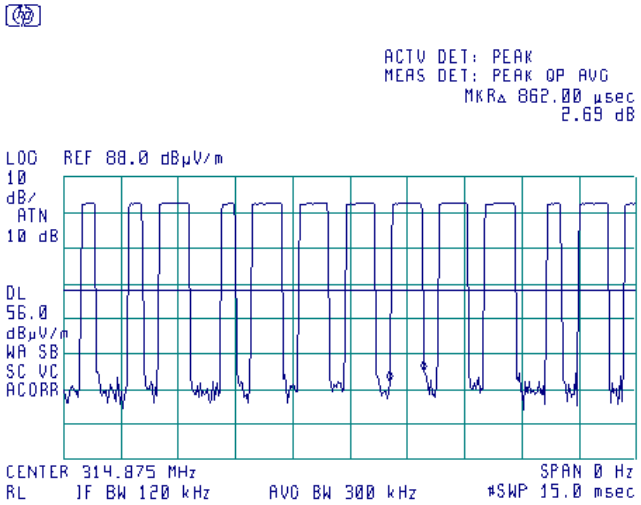

**Plot 7.2.14 Radiated emission measurements at the fifth harmonic frequency**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
EUT POSITION: 3 orthogonal (X/ Y/ Z)

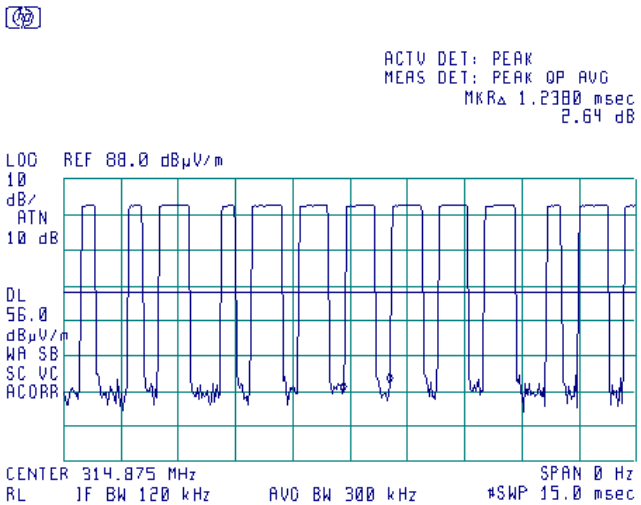


| Test specification: | FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 8/15/2007 1:11:02 PM | | |
| Temperature: 28ºC | Air Pressure: 1010 hPa | Relative Humidity: 48% | Power Supply: 3 V battery |
| Remarks: | | | |

**Plot 7.2.15 Transmission pulse duration**

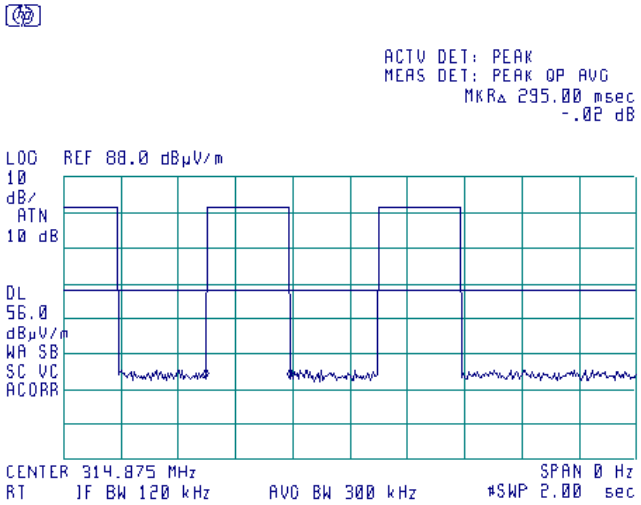



**Plot 7.2.16 Transmission pulse period**

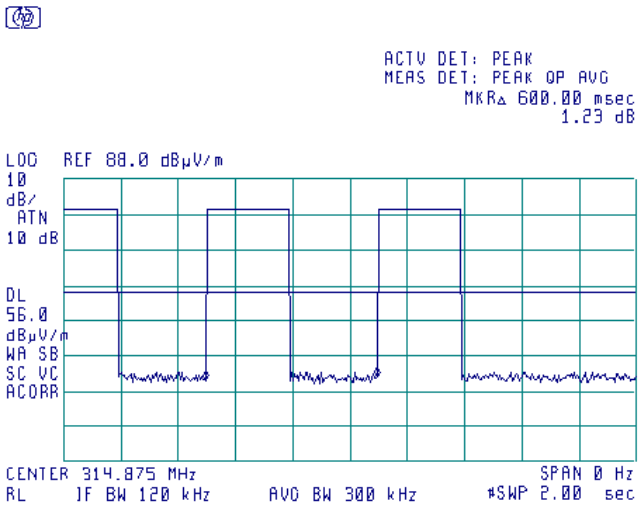


| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Plot 7.2.17 Transmission burst duration**

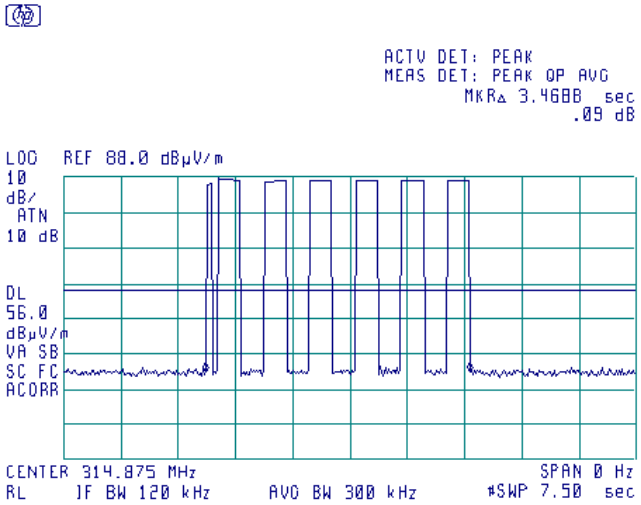



**Plot 7.2.18 Transmission burst period**



| **Test specification:** | **FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 1:11:02 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Plot 7.2.19 Transmission train duration**



| Test specification: | FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Section 13.1.7 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 8/15/2007 10:50:23 AM | | |
| Temperature: 28ºC | Air Pressure: 1009 hPa | Relative Humidity: 48% | Power Supply: 3 V battery |
| Remarks: | | | |

## 7.3 Occupied bandwidth test

### 7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

**Table 7.3.1 Occupied bandwidth limits**

| Assigned frequency, MHz | Modulation envelope reference points*, dBc | Maximum allowed bandwidth, % of the carrier frequency |
|---|---|---|
| 70 - 900 | 20.0 | 0.25 |
| Above 900 | | 0.50 |

*- Modulation envelope reference points provided in terms of attenuation below modulated carrier.

### 7.3.2 Test procedure

**7.3.2.1** The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

**7.3.2.2** The EUT was set to transmit modulated carrier.

**7.3.2.3** The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and associated plot.

**Figure 7.3.1 Occupied bandwidth test setup**

| **Test specification:** | **FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Section 13.1.7 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 10:50:23 AM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1009 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Table 7.3.2 Occupied bandwidth test results**

| | |
|---|---|
| DETECTOR USED: | Peak hold |
| RESOLUTION BANDWIDTH: | 10 kHz |
| VIDEO BANDWIDTH: | 30 kHz |
| MODULATION ENVELOPE REFERENCE POINTS: | 20 dBc |
| MODULATION: | ASK |
| MODULATING SIGNAL: | ID code |

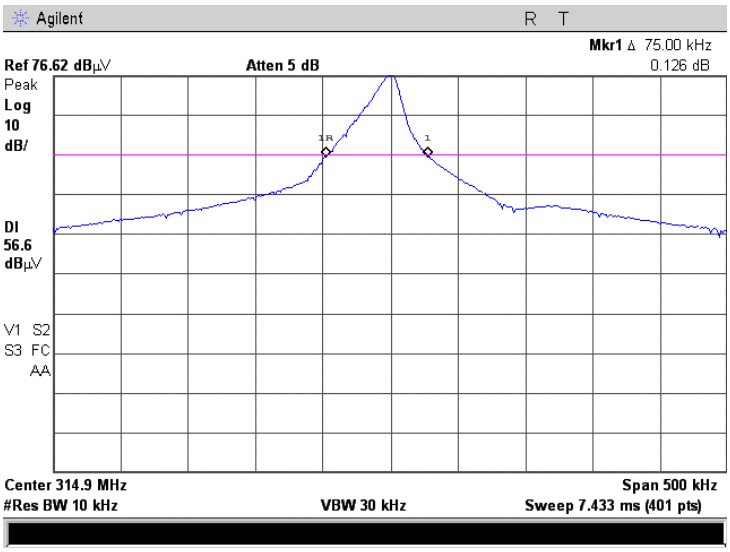
| Carrier frequency, MHz | Occupied bandwidth, kHz | Limit | | Margin, kHz | Verdict |
|---|---|---|---|---|---|
| | | % of the carrier frequency | kHz | | |
| 315 | 75 | 0.25 | 787.5 | -712.5 | Pass |

**Reference numbers of test equipment used**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HL 0521 | HL 0589 | HL 0604 | HL 2009 | | | | | |

Full description is given in Appendix A.

**Plot 7.3.1 Occupied bandwidth test result**



| Test specification: | FCC Part 15, Section 203 / RSS-Gen, Section 7.1.4, Antenna requirements | | |
|---|---|---|---|
| Test procedure: | Visual inspection / supplier declaration | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 8/15/2007 1:15:56 PM | | |
| Temperature: 28ºC | Air Pressure: 1010 hPa | Relative Humidity: 48% | Power Supply: 3 V battery |
| Remarks: | | | |

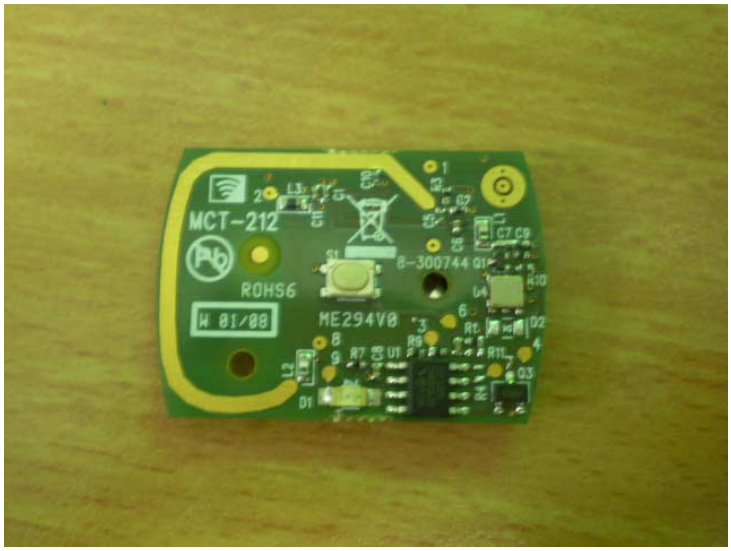
## 7.4 Antenna requirements

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 7.4.1.

**Table 7.4.1 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 | |

**Photograph 7.4.1 Antenna assembly**



| **Test specification:** | **FCC Part 15, Section 109 / RSS-Gen, Section 7.1.6 / ICES-003, Radiated emission** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Sections 11.6 and 12.1.4, Section 3.0 / CISPR 22 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 12:14:13 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

## 7.5 Radiated emission measurements

### 7.5.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits according to FCC Part 15, Section 109 are given in Table 7.5.1 and according to ICES-003, Section 5 - in Table 7.5.2.

**Table 7.5.1 Radiated emission limits according to FCC Part 15, Section 109**

| 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* |
| 960 - 5$^{th}$ harmonic** | 43.5* | 54.0 | 49.5 | 60.0* |

**Table 7.5.2 Radiated emission limits according to ICES-003, Section 5**

| 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 - 230 | 30 | 40.5* | 40 | 50.5* |
| 230 - 1000 | 37 | 47.5* | 47 | 57.5* |

* - The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where $S_1$ and $S_2$ – standard defined and test distance respectively in meters.

### 7.5.2 Test procedure for measurements in semi-anechoic chamber

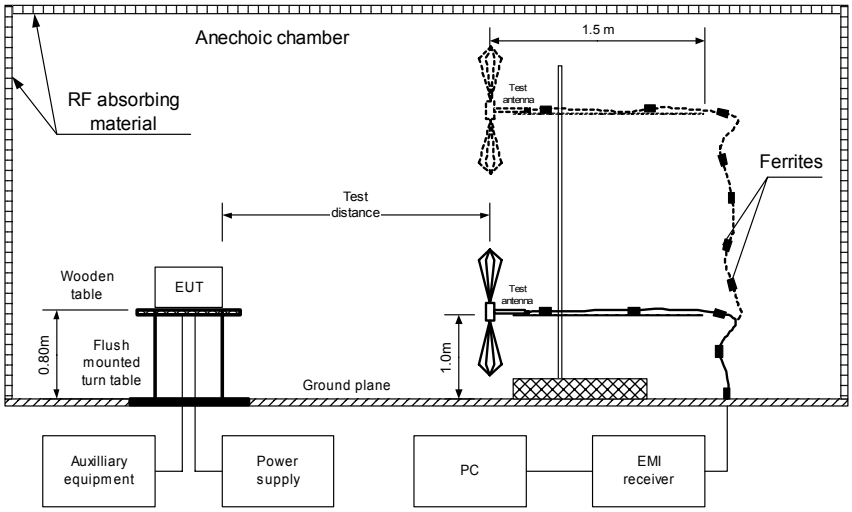
**7.5.2.1** The EUT was set up as shown in Figure 7.5.1, energized and the performance check was conducted.

**7.5.2.2** The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated $360^0$, 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.

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

| **Test specification:** | **FCC Part 15, Section 109 / RSS-Gen, Section 7.1.6 / ICES-003, Radiated emission** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Sections 11.6 and 12.1.4, Section 3.0 / CISPR 22 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 12:14:13 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Figure 7.5.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment**



| **Test specification:** | **FCC Part 15, Section 109 / RSS-Gen, Section 7.1.6 / ICES-003, Radiated emission** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Sections 11.6 and 12.1.4, Section 3.0 / CISPR 22 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 12:14:13 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

**Table 7.5.3 Radiated emission test results according to FCC Part 15, Section 109**

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Stand-by
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* | | | | |
| No spurious were found | | | | | | | | Pass |

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 1000 –4000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

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

**Table 7.5.4 Radiated emission test results according to ICES-003, Section 5**

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Stand-by
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* | | | | |
| No spurious were found | | | | | | | | Pass |

***- Margin = Measured emission - specification limit.
****- EUT front panel refer to 0 degrees position of turntable.

**Reference numbers of test equipment used**

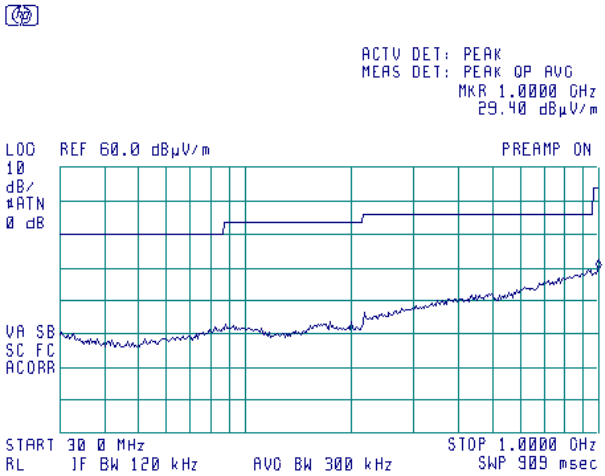
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0465 | HL 0521 | HL 0589 | HL 0604 | HL 1947 | HL 1984 | HL 2009 | |

Full description is given in Appendix A.

| **Test specification:** | **FCC Part 15, Section 109 / RSS-Gen, Section 7.1.6 / ICES-003, Radiated emission** | | |
|---|---|---|---|
| **Test procedure:** | ANSI C63.4, Sections 11.6 and 12.1.4, Section 3.0 / CISPR 22 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 8/15/2007 12:14:13 PM | | |
| **Temperature:** 28ºC | **Air Pressure:** 1010 hPa | **Relative Humidity:** 48% | **Power Supply:** 3 V battery |
| **Remarks:** | | | |

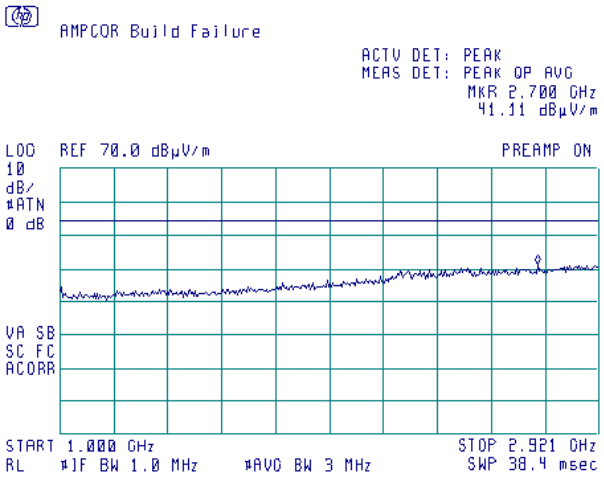
**Plot 7.5.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization**

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




**Plot 7.5.2 Radiated emission measurements above 1000 MHz, vertical & horizontal antenna polarization**

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



# 8 APPENDIX A Test equipment and ancillaries used for tests

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal. | Due Cal. |
|---|---|---|---|---|---|---|
| 0446 | Antenna, Loop active, 10kHz-30MHz | EMCO | 6502 | 2857 | 28-Jun-07 | 28-Jun-08 |
| 0465 | Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m | HL | AC - 1 | 023 | 23-Aug-05 | 23-Aug-08 |
| 0521 | EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz | Hewlett Packard | 8546A | 3617A 00319, 3448A002 53 | 26-Sep-06 | 26-Sep-07 |
| 0589 | Cable Coaxial, GORE A2P01POL118, 2.3 m | HL | GORE-3 | 176 | 02-Dec-06 | 02-Dec-07 |
| 0592 | Position Controller | HL | L2-SR3000 (HL CRL-3) | 100 | 18-May-07 | 18-May-08 |
| 0593 | Antenna Mast, 1-4 m Pneumatic | Madgesh | AM-F1 | 101 | 02-Feb-07 | 02-Feb-08 |
| 0594 | Turn Table FOR ANECHOIC CHAMBER flush mount d=1.2 m Pneumatic | HL | TT-WDC1 | 102 | 26-Jan-07 | 26-Jan-08 |
| 0604 | Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz | EMCO | 3141 | 9611-1011 | 10-Jan-07 | 10-Jan-08 |
| 1556 | Cable RF, 0.5 m | Telequis | MIL-C-17F-RG 058 CU | 1556 | 12-Sep-06 | 12-Sep-07 |
| 1562 | Oscilloscope 100 MHz, DMM | Tektronix | THS720A | B039444 | 20-Sep-06 | 20-Sep-07 |
| 1947 | Cable 18GHz, 6.5 m, blue | Rhophase Microwave Limited | NPS-1803A-6500-NPS | T4974 | 17-Oct-06 | 17-Oct-07 |
| 1984 | Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W | EMC Test Systems | 3115 | 9911-5964 | 03-Mar-07 | 03-Mar-08 |
| 2009 | Cable RF, 8 m | Alpha Wire | RG-214 | C-56 | 20-May-07 | 20-May-08 |
| 2432 | Antenna, Double-Ridged Waveguide Horn 1-18 GHz | EMC Test Systems | 3115 | 00027177 | 03-Mar-07 | 03-Mar-08 |

# 9 APPENDIX B Measurement uncertainties

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

| Test description | Expanded uncertainty |
|---|---|
| Radiated emissions at 10 m measuring distance<br>Horizontal polarization<br><br><br><br>Vertical polarization | <br>Biconilog antenna: ± 5.0 dB<br>Biconical antenna: ± 5.0 dB<br>Log periodic antenna: ± 5.1 dB<br>Double ridged horn antenna: ± 5.3 dB<br>Biconilog antenna: ± 5.5 dB<br>Biconical antenna: ± 5.5 dB<br>Log periodic antenna: ± 5.6 dB<br>Double ridged horn antenna: ± 5.8 dB |
| Radiated emissions at 3 m measuring distance<br>Horizontal polarization<br><br><br><br>Vertical polarization | <br>Biconilog antenna: ± 5.3 dB<br>Biconical antenna: ± 5.0 dB<br>Log periodic antenna: ± 5.3 dB<br>Double ridged horn antenna: ± 5.3 dB<br>Biconilog antenna: ± 6.0 dB<br>Biconical antenna: ± 5.7 dB<br>Log periodic antenna: ± 6.0 dB<br>Double ridged horn antenna: ± 6.0 dB |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements | ± 1.0 % |
| 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.

# 10 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) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

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Person for contact: Mr. Alex Usoskin, CEO.

# 11 APPENDIX D Specification references

| | |
|---|---|
| 47CFR part 15: 2006 | 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. |
| RSS-210 Issue 7: 2007 | Low Power Licence- Exempt Radiocommunication Devices |
| RSS-Gen Issue 2, September 2007 | General Requirements and Information for the certification of Radiocommunication Equipment |
| ICES-003 Issue 4: 2004 | Digital Apparatus |
| CAN/CSA-CEI/IEC CISPR 22: 2002 | Information Technology Equipment- Radio Disturbance Characteristics- Limits and Methods of measurement |

# 12 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(μV) to convert it into field intensity in dB(μV/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) |
|---|---|---|---|
| 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).

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

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

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

**Antenna factor**
**Double-ridged guide horn antenna**
**Model 3115, serial number: 00027177, HL 2432**

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

**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 | | |

**Cable loss**
**model: NPS-1803A-6500-NPS, S/N T4974, HL 1947**

| Frequency, GHz | Cable loss, dB |
|---|---|
| 0.03 | 0.30 |
| 0.05 | 0.38 |
| 0.10 | 0.53 |
| 0.20 | 0.74 |
| 0.30 | 0.91 |
| 0.40 | 1.05 |
| 0.50 | 1.18 |
| 0.60 | 1.29 |
| 0.70 | 1.40 |
| 0.80 | 1.50 |
| 0.90 | 1.59 |
| 1.00 | 1.68 |
| 1.10 | 1.77 |
| 1.20 | 1.86 |
| 1.30 | 1.94 |
| 1.40 | 2.01 |
| 1.50 | 2.08 |
| 1.60 | 2.16 |
| 1.70 | 2.22 |
| 1.80 | 2.29 |
| 1.90 | 2.36 |
| 2.00 | 2.42 |
| 2.10 | 2.48 |
| 2.20 | 2.54 |
| 2.30 | 2.60 |
| 2.40 | 2.66 |
| 2.50 | 2.71 |
| 2.60 | 2.77 |
| 2.70 | 2.83 |
| 2.80 | 2.89 |
| 2.90 | 2.95 |
| 3.10 | 3.06 |
| 3.30 | 3.17 |
| 3.50 | 3.28 |
| 3.70 | 3.39 |
| 3.90 | 3.51 |
| 4.10 | 3.62 |
| 4.30 | 3.76 |
| 4.50 | 3.87 |
| 4.70 | 4.01 |
| 4.90 | 4.10 |
| 5.10 | 4.21 |
| 5.30 | 4.31 |
| 5.50 | 4.43 |
| 5.70 | 4.56 |
| 5.90 | 4.71 |

| Frequency, GHz | Cable loss, dB |
|---|---|
| 6.10 | 4.87 |
| 6.30 | 4.95 |
| 6.50 | 4.94 |
| 6.70 | 4.88 |
| 6.90 | 4.87 |
| 7.10 | 4.83 |
| 7.30 | 4.85 |
| 7.50 | 4.86 |
| 7.70 | 4.91 |
| 7.90 | 4.96 |
| 8.10 | 5.03 |
| 8.30 | 5.08 |
| 8.50 | 5.13 |
| 8.70 | 5.21 |
| 8.90 | 5.22 |
| 9.10 | 5.34 |
| 9.30 | 5.35 |
| 9.50 | 5.52 |
| 9.70 | 5.51 |
| 9.90 | 5.66 |
| 10.10 | 5.70 |
| 10.30 | 5.78 |
| 10.50 | 5.79 |
| 10.70 | 5.82 |
| 10.90 | 5.86 |
| 11.10 | 5.94 |
| 11.30 | 6.06 |
| 11.50 | 6.21 |
| 11.70 | 6.44 |
| 11.90 | 6.61 |
| 12.10 | 6.76 |
| 12.40 | 6.68 |
| 13.00 | 6.66 |
| 13.50 | 6.81 |
| 14.00 | 6.90 |
| 14.50 | 6.90 |
| 15.00 | 6.97 |
| 15.50 | 7.17 |
| 16.00 | 7.28 |
| 16.50 | 7.27 |
| 17.00 | 7.38 |
| 17.50 | 7.68 |
| 18.00 | 7.92 |

**Cable loss**
**RF cable 8 m, model RG-214, HL 2009**

| No. | Frequency, MHz | Cable loss, dB | Tolerance (Specification), dB | Measurement uncertainty, dB |
|---|---|---|---|---|
| 1 | 1 | 0.10 | NA | ±0.12 |
| 2 | 10 | 0.14 | | |
| 3 | 30 | 0.25 | | |
| 4 | 50 | 0.34 | | |
| 5 | 100 | 0.53 | | |
| 6 | 300 | 0.99 | | |
| 7 | 500 | 1.31 | | |
| 8 | 800 | 1.73 | | |
| 9 | 1000 | 1.98 | | |
| 10 | 1100 | 2.11 | | |
| 11 | 1200 | 2.21 | | |
| 12 | 1300 | 2.35 | | |
| 13 | 1400 | 2.46 | | |
| 14 | 1500 | 2.55 | | |
| 15 | 1600 | 2.68 | | |
| 16 | 1700 | 2.78 | | |
| 17 | 1800 | 2.88 | | |
| 18 | 1900 | 2.98 | | |
| 19 | 2000 | 3.09 | | |

# 13 APPENDIX F Abbreviations and acronyms

| | |
|---|---|
| A | ampere |
| AC | alternating current |
| AM | amplitude modulation |
| AVRG | average (detector) |
| BB | broad band |
| 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 |
| dB(μA) | 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 |
| μs | microsecond |
| NA | not applicable |
| NB | narrow band |
| OATS | open area test site |
| Ω | Ohm |
| PCB | printed circuit board |
| PM | pulse modulation |
| 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 |
| VA | volt-ampere |
| WB | wideband |