

# TEST REPORT

ACCORDING TO: FCC CFR 47 Part 15 subpart C, section 15.231 (e) and subpart B  
RSS-210 issue 8 Annex 1, ICES-003 Issue 5:2012

FOR:

**Elpas Solutions Ltd.**  
**Curtain PIR detector**  
**Model: 5-PIR00433**  
**FCC ID:O4X5-PIR00433**  
**IC:1467G-5PIR00433**

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

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**Telephone:** +972 3768 1421  
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**E-mail:** MErenkrantz@tycoint.com  
**Contact name:** Mr. Meir Erenkrantz

## 2 Equipment under test attributes

**Product name:** Curtain PIR detector  
**Product type:** Transceiver operating at 433 MHz  
**Model(s):** 5-PIR00433  
**Serial number:** Prototype  
**Hardware version:** 00  
**Software release:** B1  
**Receipt date** 3/8/2012

## 3 Manufacturer information

**Manufacturer name:** Elpas Solutions Ltd.  
**Address:** 23 Habarzel street, Tel Aviv 69710, Israel  
**Telephone:** +972 3768 1421  
**Fax:** +972 3768 1415  
**E-Mail:** MErenkrantz@tycoint.com  
**Contact name:** Mr. Meir Erenkrantz

## 4 Test details

**Project ID:** 22955  
**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel  
**Test started:** 3/8/2012  
**Test completed:** 2/17/2013  
**Test specification(s):** FCC 47CFR part 15, subpart C, §15.231(e) subpart B;  
RSS-210 issue 8 Annex 1, RSS-Gen issue 3, ICES-003 issue 5:2012

## 5 Tests summary

| Test                                                                                              | Status       |
|---------------------------------------------------------------------------------------------------|--------------|
| <b>Transmitter characteristics</b>                                                                |              |
| FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements            | Pass         |
| FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, 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 7.2.4, Conducted emission                             | Not required |
| FCC Part 15, Section 203 / RSS-Gen, Section 7.1.2, Antenna requirements                           | Pass         |
| <b>Unintentional emissions</b>                                                                    |              |
| FCC Part 15, Section 107 / RSS-Gen, Section 7.2.4, Conducted emission at AC power port            | Not required |
| FCC Part 15, Section 109 / RSS-Gen, Section 6.1, ICES-003, Section 6.2 class B, 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.

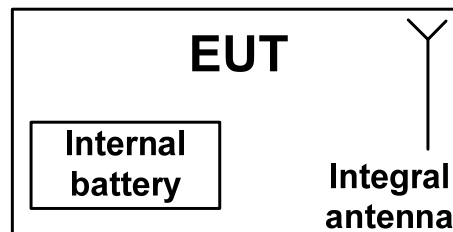
|                     | Name and Title                               | Date              | Signature                                                                             |
|---------------------|----------------------------------------------|-------------------|---------------------------------------------------------------------------------------|
| <b>Tested by:</b>   | Mrs. E. Pitt, test engineer                  | February 17, 2013 |  |
| <b>Reviewed by:</b> | Mrs. M. Cherniavsky, certification engineer  | March 6, 2013     |  |
| <b>Approved by:</b> | Mr. M. Nikishin, EMC and Radio group manager | April 4, 2013     |  |

## 6 EUT description

### 6.1 General information

The EUT is an access unit with PIR detector, powered by 3 V battery, comprises 433 MHz transceiver.

### 6.2 Test configuration



### 6.3 Changes made in EUT

No changes were performed in the EUT.

## 6.4 Transmitter characteristics

|                                                         |                                                                                                          |                                                |                                |                          |                                |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------|--------------------------|--------------------------------|
| <b>Type of equipment</b>                                |                                                                                                          |                                                |                                |                          |                                |
| 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)                                          |                                                |                                |                          |                                |
| <b>Operating frequency</b>                              |                                                                                                          | 433.92 MHz                                     |                                |                          |                                |
| <b>Maximum rated output power</b>                       |                                                                                                          | At transmitter 50 $\Omega$ RF output connector |                                |                          | dBm                            |
|                                                         |                                                                                                          | Field strength at 3 m distance                 |                                |                          | 89.6 dB( $\mu$ V/m)            |
| <b>Is transmitter output power variable?</b>            | X                                                                                                        | No                                             |                                |                          |                                |
|                                                         |                                                                                                          | Yes                                            | continuous variable            |                          |                                |
|                                                         |                                                                                                          |                                                | stepped variable with stepsize |                          |                                |
|                                                         |                                                                                                          |                                                | minimum RF power               |                          |                                |
|                                                         |                                                                                                          |                                                | maximum RF power               |                          |                                |
| <b>Antenna connection</b>                               |                                                                                                          |                                                |                                |                          |                                |
| unique coupling                                         |                                                                                                          | standard connector                             |                                | X                        | integral                       |
|                                                         |                                                                                                          |                                                |                                | X                        | with temporary RF connector    |
|                                                         |                                                                                                          |                                                |                                |                          | without temporary RF connector |
| <b>Antenna/s technical characteristics</b>              |                                                                                                          |                                                |                                |                          |                                |
| <b>Type</b>                                             |                                                                                                          | <b>Manufacturer</b>                            |                                | <b>Model number</b>      |                                |
| Internal                                                |                                                                                                          | Elpas                                          |                                | Built-in helical antenna |                                |
| <b>Transmitter aggregate data rate/s</b>                |                                                                                                          |                                                | 19.2 kbps                      |                          |                                |
| <b>Type of modulation</b>                               |                                                                                                          |                                                | ASK                            |                          |                                |
| <b>Transmitter power source</b>                         |                                                                                                          |                                                |                                |                          |                                |
| X                                                       | Battery                                                                                                  | <b>Nominal rated voltage</b>                   | 3.0 VDC                        | <b>Battery type</b>      | Lithium                        |
|                                                         | DC                                                                                                       | <b>Nominal rated voltage</b>                   | VDC                            |                          |                                |
|                                                         | AC mains                                                                                                 | <b>Nominal rated voltage</b>                   | VAC                            | <b>Frequency</b>         |                                |
| <b>Common power source for transmitter and receiver</b> |                                                                                                          |                                                |                                | X                        | yes                            |
|                                                         |                                                                                                          |                                                |                                |                          | no                             |

|                     |                                                                                        |                         |                          |
|---------------------|----------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements |                         |                          |
| Test procedure:     | Supplier declaration                                                                   |                         |                          |
| Test mode:          | Compliance                                                                             | Verdict:                | PASS                     |
| Date(s):            | 1/29/2013                                                                              |                         |                          |
| Temperature: 23 °C  | Air Pressure: 1010 hPa                                                                 | Relative Humidity: 49 % | Power Supply: 3V battery |
| Remarks:            |                                                                                        |                         |                          |

## 7 Transmitter tests according to 47CFR part 15 subpart C and RSS-210 issue 8 Annex 1 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;
- Duration of each transmission shall not be greater than 1 second;
- Silent period between transmissions shall be at least 30 times the duration of the transmission;
- Silent period between transmissions shall be in no case less than 10 seconds.

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 the associated plots. The test results were recorded in Table 7.1.2.

Figure 7.1.1 Setup for transmitter shut down test





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|                     |                                                                                        |                         |                          |
|---------------------|----------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements |                         |                          |
| Test procedure:     | Supplier declaration                                                                   |                         |                          |
| Test mode:          | Compliance                                                                             | Verdict:                | PASS                     |
| Date(s):            | 1/29/2013                                                                              |                         |                          |
| Temperature: 23 °C  | Air Pressure: 1010 hPa                                                                 | Relative Humidity: 49 % | Power Supply: 3V battery |
| Remarks:            |                                                                                        |                         |                          |

Table 7.1.1 Periodic operation requirements

| Requirement                                                                                     | Rationale            | Verdict |
|-------------------------------------------------------------------------------------------------|----------------------|---------|
| Continuous transmissions are not permitted                                                      | Supplier declaration | Comply  |
| Duration of each transmission shall not be greater than 1 second                                | Plot 7.1.1           | Comply  |
| Silent period between transmissions shall be at least 30 times the duration of the transmission | Plot 7.1.2           | Comply  |
| Silent period between transmissions shall be in no case less than 10 seconds                    | Plot 7.1.2           | Comply  |

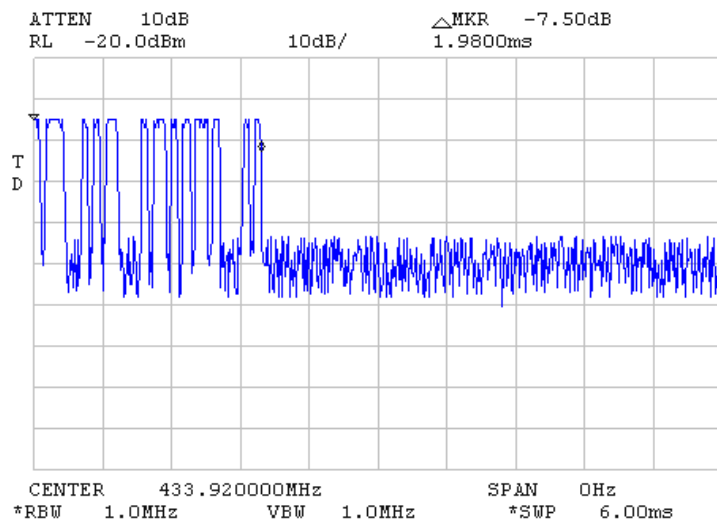




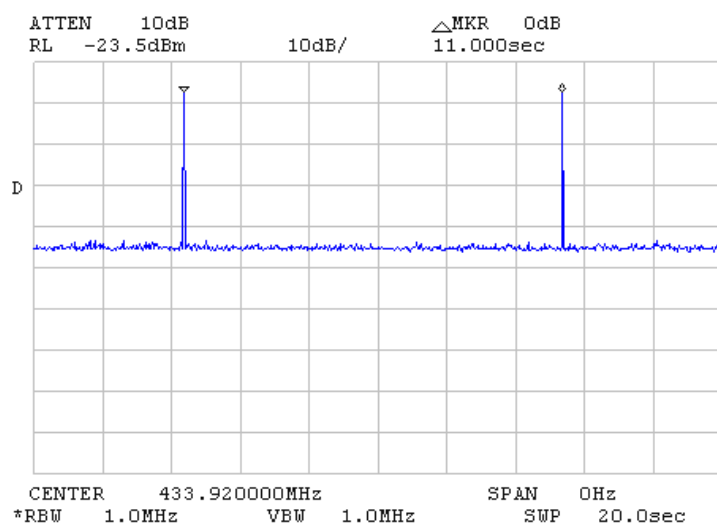
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|                     |                                                                                        |                         |                          |
|---------------------|----------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements |                         |                          |
| Test procedure:     | Supplier declaration                                                                   |                         |                          |
| Test mode:          | Compliance                                                                             | Verdict:                | PASS                     |
| Date(s):            | 1/29/2013                                                                              |                         |                          |
| Temperature: 23 °C  | Air Pressure: 1010 hPa                                                                 | Relative Humidity: 49 % | Power Supply: 3V battery |
| Remarks:            |                                                                                        |                         |                          |

Plot 7.1.1 Transmitter pulse duration



Plot 7.1.2 Transmission pulse period





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|                     |                                                                                        |                         |                          |
|---------------------|----------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements |                         |                          |
| Test procedure:     | Supplier declaration                                                                   |                         |                          |
| Test mode:          | Compliance                                                                             | Verdict:                | PASS                     |
| Date(s):            | 1/29/2013                                                                              |                         |                          |
| Temperature: 23 °C  | Air Pressure: 1010 hPa                                                                 | Relative Humidity: 49 % | Power Supply: 3V battery |
| Remarks:            |                                                                                        |                         |                          |

Table 7.1.2 Total duration of transmissions

| Total transmission duration, ms | Silent period between transmissions, s | Silent period between transmissions limit, s | Margin, s | Verdict |
|---------------------------------|----------------------------------------|----------------------------------------------|-----------|---------|
| 1.98                            | 11                                     | 10                                           | -1        | Pass    |

Reference numbers of test equipment used

|         |  |  |  |  |  |  |  |
|---------|--|--|--|--|--|--|--|
| HL 1424 |  |  |  |  |  |  |  |
|---------|--|--|--|--|--|--|--|

Full description is given in Appendix A.

|                     |                                                                                    |                         |                          |
|---------------------|------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions |                         |                          |
| Test procedure:     | ANSI C63.4, Section 13.1.4                                                         |                         |                          |
| Test mode:          | Compliance                                                                         | Verdict:                | PASS                     |
| Date(s):            | 3/18/2012                                                                          |                         |                          |
| Temperature: 22 °C  | Air Pressure: 1031 hPa                                                             | Relative Humidity: 41 % | Power Supply: 3V 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 |
| 433.9                      | 92.9                            | 72.9    |

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** | 72.9                     | 52.9    |
| 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:

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

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

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

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.

|                            |                               |                                                                                           |                                 |
|----------------------------|-------------------------------|-------------------------------------------------------------------------------------------|---------------------------------|
| <b>Test specification:</b> |                               | <b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b> |                                 |
| <b>Test procedure:</b>     |                               | ANSI C63.4, Section 13.1.4                                                                |                                 |
| <b>Test mode:</b>          |                               | Compliance                                                                                | <b>Verdict:</b> PASS            |
| <b>Date(s):</b>            |                               | 3/18/2012                                                                                 |                                 |
| <b>Temperature:</b> 22 °C  | <b>Air Pressure:</b> 1031 hPa | <b>Relative Humidity:</b> 41 %                                                            | <b>Power Supply:</b> 3V battery |
| <b>Remarks:</b>            |                               |                                                                                           |                                 |

## 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 specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

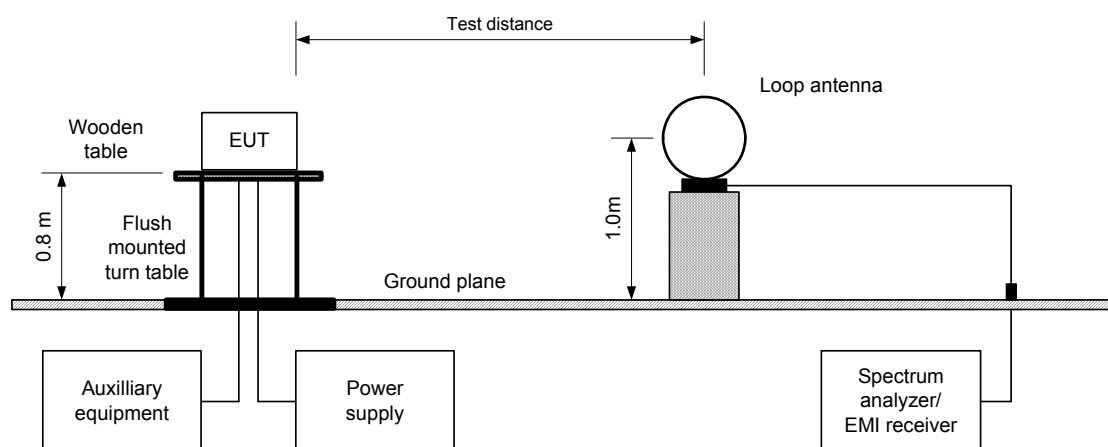
## 7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

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 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.

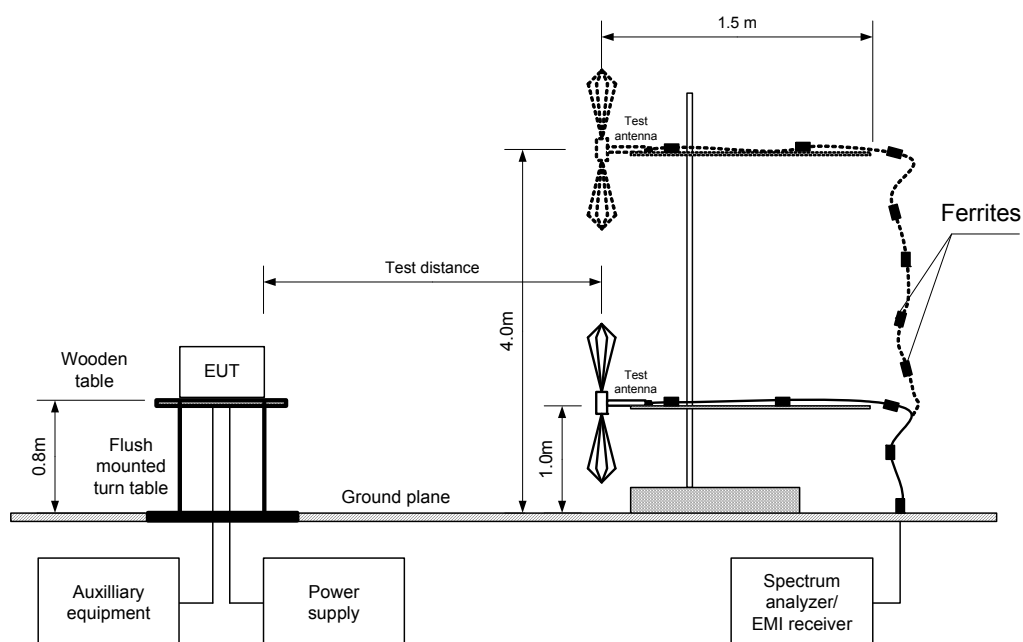
7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

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



|                            |                               |                                                                                           |                                 |
|----------------------------|-------------------------------|-------------------------------------------------------------------------------------------|---------------------------------|
| <b>Test specification:</b> |                               | <b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b> |                                 |
| <b>Test procedure:</b>     |                               | ANSI C63.4, Section 13.1.4                                                                |                                 |
| <b>Test mode:</b>          |                               | Compliance                                                                                | <b>Verdict:</b> PASS            |
| <b>Date(s):</b>            |                               | 3/18/2012                                                                                 |                                 |
| <b>Temperature:</b> 22 °C  | <b>Air Pressure:</b> 1031 hPa | <b>Relative Humidity:</b> 41 %                                                            | <b>Power Supply:</b> 3V battery |
| <b>Remarks:</b>            |                               |                                                                                           |                                 |

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



|                     |                                                                                    |                         |  |                          |  |
|---------------------|------------------------------------------------------------------------------------|-------------------------|--|--------------------------|--|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions |                         |  |                          |  |
| Test procedure:     | ANSI C63.4, Section 13.1.4                                                         |                         |  |                          |  |
| Test mode:          | Compliance                                                                         | Verdict: PASS           |  |                          |  |
| Date(s):            | 3/18/2012                                                                          |                         |  |                          |  |
| Temperature: 22 °C  | Air Pressure: 1031 hPa                                                             | Relative Humidity: 41 % |  | Power Supply: 3V 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:                      | Typical (Vertical)                                                                                                                         |
| MODULATION:                        | ASK                                                                                                                                        |
| MODULATING SIGNAL:                 | PRBS                                                                                                                                       |
| BIT RATE:                          | 19.2 kbps                                                                                                                                  |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum                                                                                                                                    |
| INVESTIGATED FREQUENCY RANGE:      | 0.009 - 4500 MHz                                                                                                                           |
| DETECTOR USED:                     | Peak                                                                                                                                       |
| RESOLUTION BANDWIDTH:              | 0.2 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>Log periodic (200 MHz – 1000 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** |                | Calculated, dB(μV/m)   | Limit, dB(μV/m) | Margin, dB** |         |
| Fundamental emission*** |         |           |                   |                     |                 |              |                |                        |                 |              |         |
| 433.9245                | V       | 1.4       | 360               | 89.60               | 92.90           | -3.30        | -34            | 55.60                  | 72.90           | -17.30       | Pass    |
| Spurious emissions      |         |           |                   |                     |                 |              |                |                        |                 |              |         |
| 867.8555                | V       | 1.2       | 300               | 41.68               | 72.90           | -31.22       | -34            | 7.68                   | 52.90           | -45.22       | Pass    |
| 1301.628                | V       | 1.2       | 330               | 47.87               | 74.00           | -26.13       | -34            | 13.87                  | 54.00           | -40.13       |         |
| 4339.403                | V       | 1.3       | 360               | 51.73               | 74.00           | -22.27       | -34            | 17.73                  | 54.00           | -36.27       |         |

\*- 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, s | Duration, ms       | Period, ms |                                 |                    |
| 2                  | 11        | NA                 | NA         | NA                              | -34                |

\*- Average factor was calculated as follows  
for pulse train shorter than 100 ms:

$$\text{Average factor} = 20 \times \log_{10} \left( \frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{\text{Train duration}} \times \text{Number of bursts within pulse train} \right)$$

for pulse train longer than 100 ms:

$$\text{Average factor} = 20 \times \log_{10} \left( \frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{100 \text{ ms}} \times \text{Number of bursts within 100 ms} \right)$$

#### Reference numbers of test equipment used

|         |         |         |         |         |         |         |  |
|---------|---------|---------|---------|---------|---------|---------|--|
| HL 0446 | HL 0569 | HL 2432 | HL 2780 | HL 3206 | HL 3531 | HL 3901 |  |
|---------|---------|---------|---------|---------|---------|---------|--|

Full description is given in Appendix A.



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|                            |                                                                                           |                                |                                 |
|----------------------------|-------------------------------------------------------------------------------------------|--------------------------------|---------------------------------|
| <b>Test specification:</b> | <b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b> |                                |                                 |
| <b>Test procedure:</b>     | ANSI C63.4, Section 13.1.4                                                                |                                |                                 |
| <b>Test mode:</b>          | Compliance                                                                                | <b>Verdict:</b>                | <b>PASS</b>                     |
| <b>Date(s):</b>            | 3/18/2012                                                                                 |                                |                                 |
| <b>Temperature:</b> 22 °C  | <b>Air Pressure:</b> 1031 hPa                                                             | <b>Relative Humidity:</b> 41 % | <b>Power Supply:</b> 3V battery |
| <b>Remarks:</b>            |                                                                                           |                                |                                 |

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

TEST DISTANCE: 3 m  
 EUT POSITION: Typical (Vertical)  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 19.2 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 0.2 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,<br>MHz     | Peak<br>emission,<br>dB(μV/m) | Quasi-peak                        |                    |                | Antenna<br>polarization | Antenna<br>height,<br>m | Turn-table<br>position**,<br>degrees | Verdict |
|-----------------------|-------------------------------|-----------------------------------|--------------------|----------------|-------------------------|-------------------------|--------------------------------------|---------|
|                       |                               | Measured<br>emission,<br>dB(μV/m) | Limit,<br>dB(μV/m) | Margin,<br>dB* |                         |                         |                                      |         |
| No emission was found |                               |                                   |                    |                |                         |                         |                                      | Pass    |

\*- Margin = Measured emission - specification limit.

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

**Reference numbers of test equipment used**

|         |         |         |         |  |  |  |  |
|---------|---------|---------|---------|--|--|--|--|
| HL 0521 | HL 0604 | HL 2871 | HL 3617 |  |  |  |  |
|---------|---------|---------|---------|--|--|--|--|

Full description is given in Appendix A.



|                     |                                                                                    |                         |                          |      |
|---------------------|------------------------------------------------------------------------------------|-------------------------|--------------------------|------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions |                         |                          |      |
| Test procedure:     | ANSI C63.4, Section 13.1.4                                                         |                         |                          |      |
| Test mode:          | Compliance                                                                         | Verdict:                |                          | PASS |
| Date(s):            | 3/18/2012                                                                          |                         |                          |      |
| Temperature: 22 °C  | Air Pressure: 1031 hPa                                                             | Relative Humidity: 41 % | Power Supply: 3V 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    |



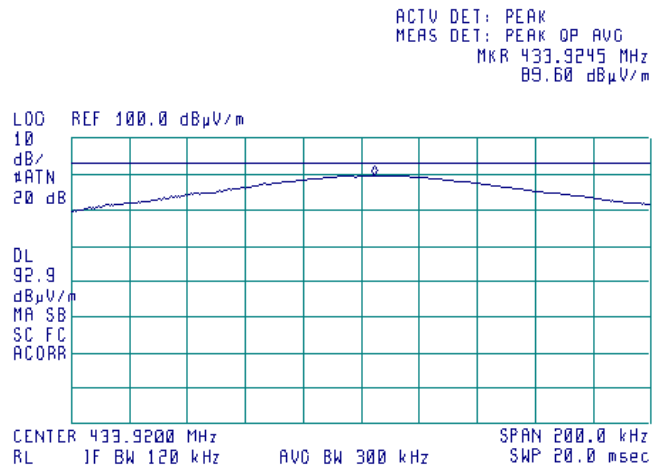


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|                     |                                                                                    |                         |                          |
|---------------------|------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions |                         |                          |
| Test procedure:     | ANSI C63.4, Section 13.1.4                                                         |                         |                          |
| Test mode:          | Compliance                                                                         | Verdict:                | PASS                     |
| Date(s):            | 3/18/2012                                                                          |                         |                          |
| Temperature: 22 °C  | Air Pressure: 1031 hPa                                                             | Relative Humidity: 41 % | Power Supply: 3V battery |
| Remarks:            |                                                                                    |                         |                          |

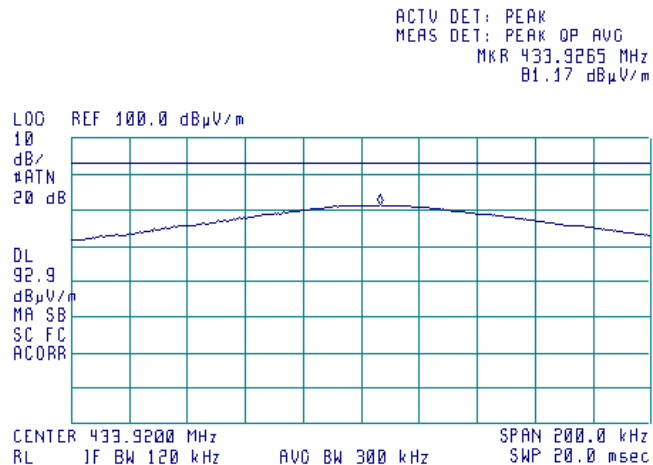
**Plot 7.2.1 Radiated emission measurements at the fundamental frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Typical (Vertical)  
INPUT VOLTAGE: Unom 3V



**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: Typical (Vertical)  
INPUT VOLTAGE: Unom 3V



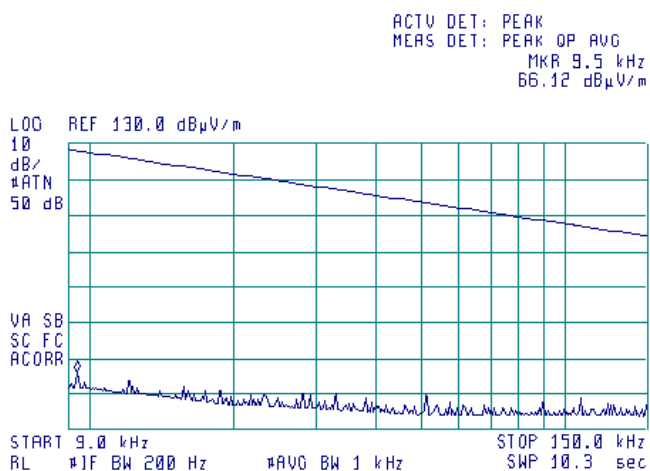


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|                     |                                                                                    |                         |                          |
|---------------------|------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions |                         |                          |
| Test procedure:     | ANSI C63.4, Section 13.1.4                                                         |                         |                          |
| Test mode:          | Compliance                                                                         | Verdict:                | PASS                     |
| Date(s):            | 3/18/2012                                                                          |                         |                          |
| Temperature: 22 °C  | Air Pressure: 1031 hPa                                                             | Relative Humidity: 41 % | Power Supply: 3V battery |
| Remarks:            |                                                                                    |                         |                          |

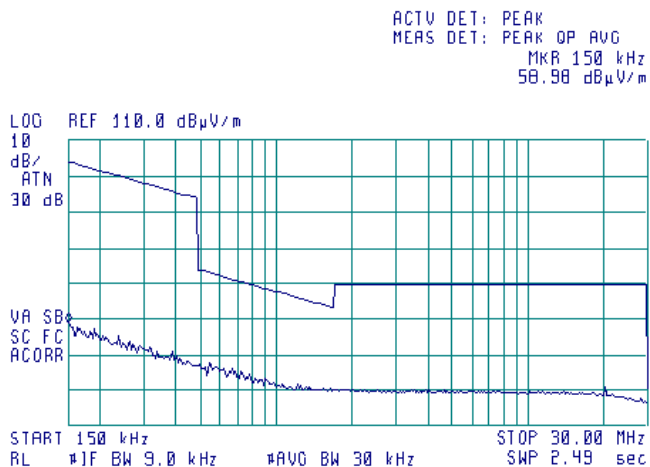
#### Plot 7.2.3 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Typical (Vertical)



#### Plot 7.2.4 Radiated emission measurements from 0.15 to 30 MHz

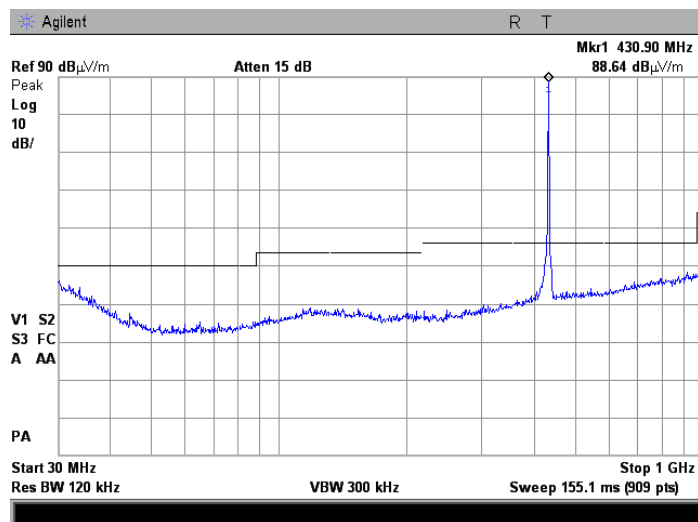
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Typical (Vertical)



|                     |                                                                                    |                         |                          |
|---------------------|------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions |                         |                          |
| Test procedure:     | ANSI C63.4, Section 13.1.4                                                         |                         |                          |
| Test mode:          | Compliance                                                                         | Verdict:                | PASS                     |
| Date(s):            | 3/18/2012                                                                          |                         |                          |
| Temperature: 22 °C  | Air Pressure: 1031 hPa                                                             | Relative Humidity: 41 % | Power Supply: 3V battery |
| Remarks:            |                                                                                    |                         |                          |

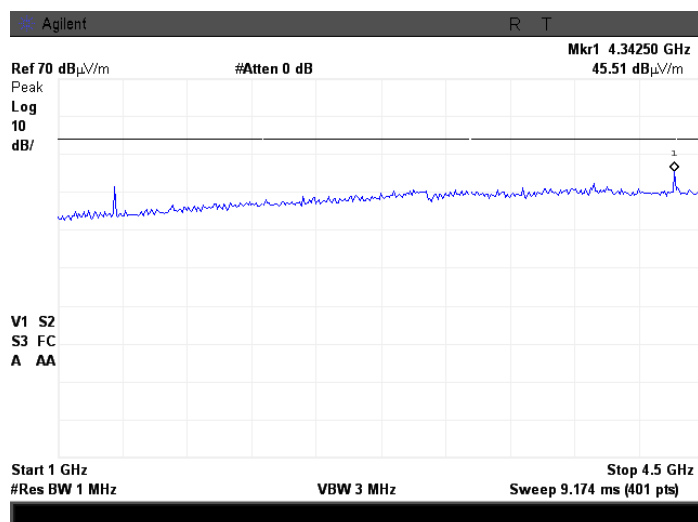
#### Plot 7.2.5 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal  
EUT POSITION: Typical (Vertical)



#### Plot 7.2.6 Radiated emission measurements from 1000 to 4500 MHz

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal  
EUT POSITION: Typical (Vertical)



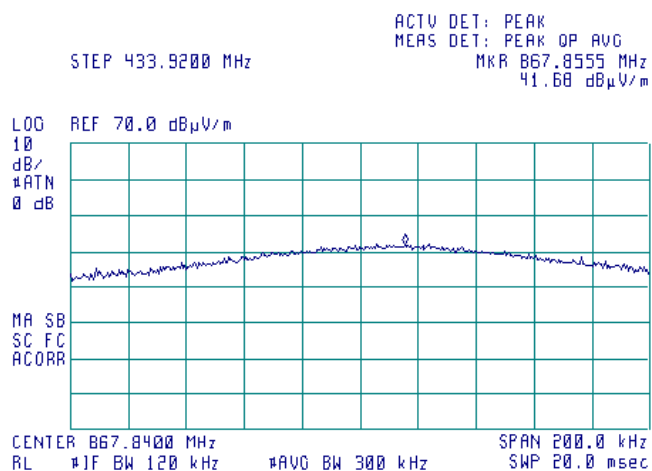


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|                     |                                                                                    |                         |                          |
|---------------------|------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions |                         |                          |
| Test procedure:     | ANSI C63.4, Section 13.1.4                                                         |                         |                          |
| Test mode:          | Compliance                                                                         | Verdict:                | PASS                     |
| Date(s):            | 3/18/2012                                                                          |                         |                          |
| Temperature: 22 °C  | Air Pressure: 1031 hPa                                                             | Relative Humidity: 41 % | Power Supply: 3V battery |
| Remarks:            |                                                                                    |                         |                          |

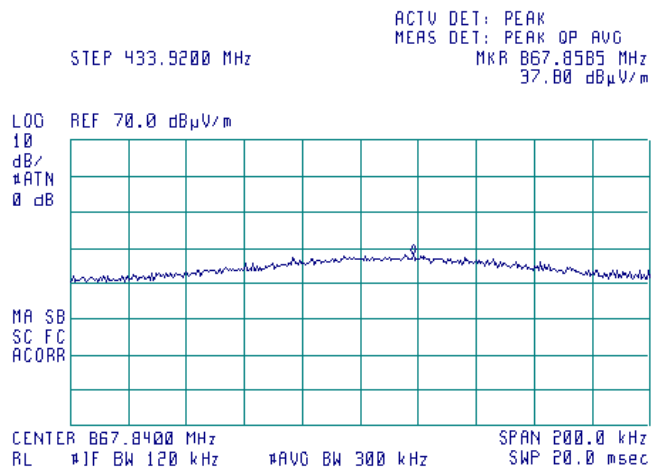
#### Plot 7.2.7 Radiated emission measurements at the second harmonic frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Typical (Vertical)



#### Plot 7.2.8 Radiated emission measurements at the second harmonic frequency

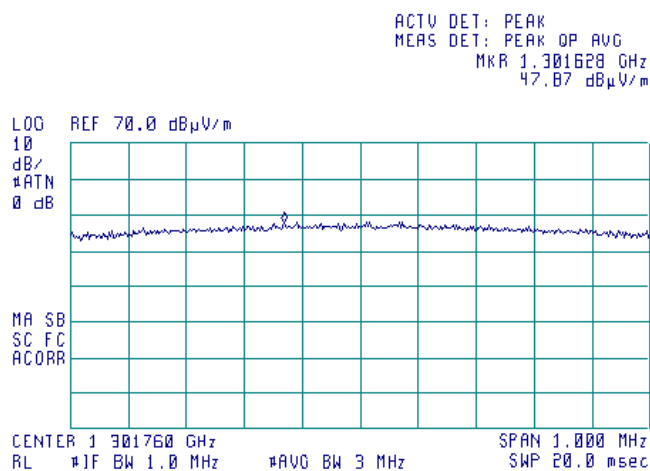
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal  
EUT POSITION: Typical (Vertical)



|                     |                                                                                    |                         |                          |
|---------------------|------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions |                         |                          |
| Test procedure:     | ANSI C63.4, Section 13.1.4                                                         |                         |                          |
| Test mode:          | Compliance                                                                         | Verdict:                | PASS                     |
| Date(s):            | 3/18/2012                                                                          |                         |                          |
| Temperature: 22 °C  | Air Pressure: 1031 hPa                                                             | Relative Humidity: 41 % | Power Supply: 3V battery |
| Remarks:            |                                                                                    |                         |                          |

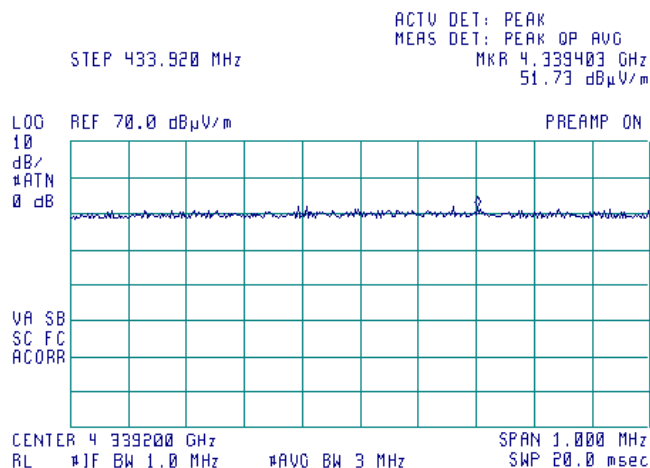
#### Plot 7.2.9 Radiated emission measurements at the third harmonic frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal  
EUT POSITION: Typical (Vertical)



#### Plot 7.2.10 Radiated emission measurements at the tenth harmonic frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal  
EUT POSITION: Typical (Vertical)





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Report ID: ELPRAD\_FCC.22955.docx  
Date of Issue: 4-Apr-13

|                     |                                                                                    |                         |                          |
|---------------------|------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions |                         |                          |
| Test procedure:     | ANSI C63.4, Section 13.1.4                                                         |                         |                          |
| Test mode:          | Compliance                                                                         | Verdict:                | PASS                     |
| Date(s):            | 3/18/2012                                                                          |                         |                          |
| Temperature: 22 °C  | Air Pressure: 1031 hPa                                                             | Relative Humidity: 41 % | Power Supply: 3V battery |
| Remarks:            |                                                                                    |                         |                          |

Intentionally blank

|                             |                               |                                                                                  |                                 |
|-----------------------------|-------------------------------|----------------------------------------------------------------------------------|---------------------------------|
| <b>Test specification:</b>  |                               | <b>FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth</b> |                                 |
| <b>Test procedure:</b>      |                               | ANSI C63.4, Section 13.1.7                                                       |                                 |
| <b>Test mode:</b>           |                               | Compliance                                                                       | <b>Verdict:</b> PASS            |
| <b>Date(s):</b>             |                               | 2/17/2013                                                                        |                                 |
| <b>Temperature:</b> 21.1 °C | <b>Air Pressure:</b> 1016 hPa | <b>Relative Humidity:</b> 50 %                                                   | <b>Power Supply:</b> 3V battery |
| <b>Remarks:</b>             |                               |                                                                                  |                                 |

## 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* | Maximum allowed bandwidth, % of the carrier frequency |
|-------------------------|---------------------------------------|-------------------------------------------------------|
| 70 - 900                | 20.0 dBc*/99% BW                      | 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 the associated plots.

Figure 7.3.1 Occupied bandwidth test setup





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|                             |                               |                                                                                  |                                 |
|-----------------------------|-------------------------------|----------------------------------------------------------------------------------|---------------------------------|
| <b>Test specification:</b>  |                               | <b>FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth</b> |                                 |
| <b>Test procedure:</b>      |                               | ANSI C63.4, Section 13.1.7                                                       |                                 |
| <b>Test mode:</b>           |                               | Compliance                                                                       | <b>Verdict:</b> PASS            |
| <b>Date(s):</b>             |                               | 2/17/2013                                                                        |                                 |
| <b>Temperature:</b> 21.1 °C | <b>Air Pressure:</b> 1016 hPa | <b>Relative Humidity:</b> 50 %                                                   | <b>Power Supply:</b> 3V battery |
| <b>Remarks:</b>             |                               |                                                                                  |                                 |

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  
 BIT RATE: 19.2 kbps

| Carrier frequency,<br>MHz | Occupied bandwidth,<br>kHz | Limit                      |        | Margin,<br>kHz | Verdict |
|---------------------------|----------------------------|----------------------------|--------|----------------|---------|
|                           |                            | % of the carrier frequency | kHz    |                |         |
| 433.92                    | 67.5                       | 0.25                       | 1084.8 | -1017.3        | Pass    |

## Reference numbers of test equipment used

|         |         |  |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|--|
| HL 1425 | HL 4135 |  |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|--|

Full description is given in Appendix A.

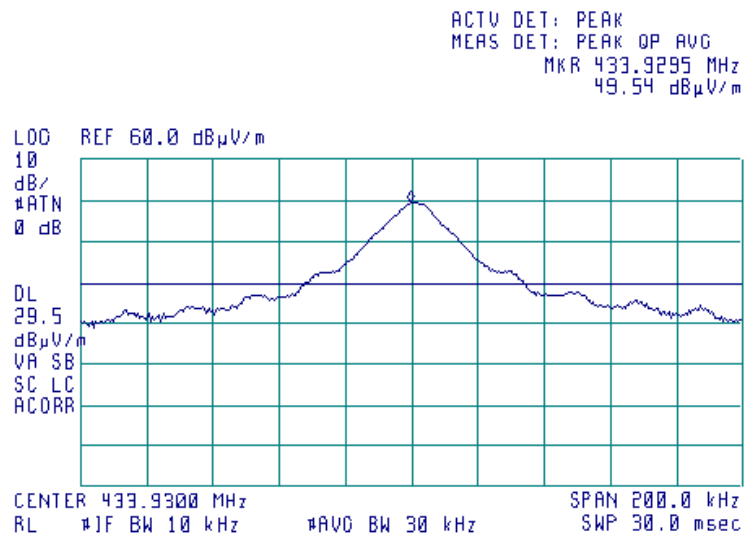




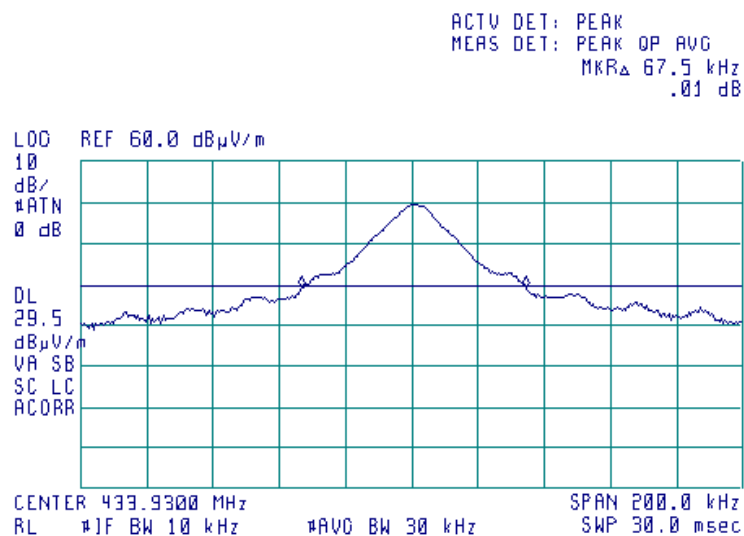
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|                      |                                                                           |                         |                          |
|----------------------|---------------------------------------------------------------------------|-------------------------|--------------------------|
| 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(s):             | 2/17/2013                                                                 |                         |                          |
| Temperature: 21.1 °C | Air Pressure: 1016 hPa                                                    | Relative Humidity: 50 % | Power Supply: 3V battery |
| Remarks:             |                                                                           |                         |                          |

Plot 7.3.1 Occupied bandwidth test result



Plot 7.3.2 Occupied bandwidth test result



|                            |                               |                                                                                |                                 |
|----------------------------|-------------------------------|--------------------------------------------------------------------------------|---------------------------------|
| <b>Test specification:</b> |                               | <b>FCC Part 15, Section 203 / RSS-Gen, Section 7.1.2, Antenna requirements</b> |                                 |
| <b>Test procedure:</b>     |                               | Visual inspection / supplier declaration                                       |                                 |
| <b>Test mode:</b>          | Compliance                    | <b>Verdict:</b>                                                                | <b>PASS</b>                     |
| <b>Date(s):</b>            | 3/18/2012                     |                                                                                |                                 |
| <b>Temperature:</b> 22 °C  | <b>Air Pressure:</b> 1031 hPa | <b>Relative Humidity:</b> 38 %                                                 | <b>Power Supply:</b> 3V battery |
| <b>Remarks:</b>            |                               |                                                                                |                                 |

## 7.4 Antenna requirements

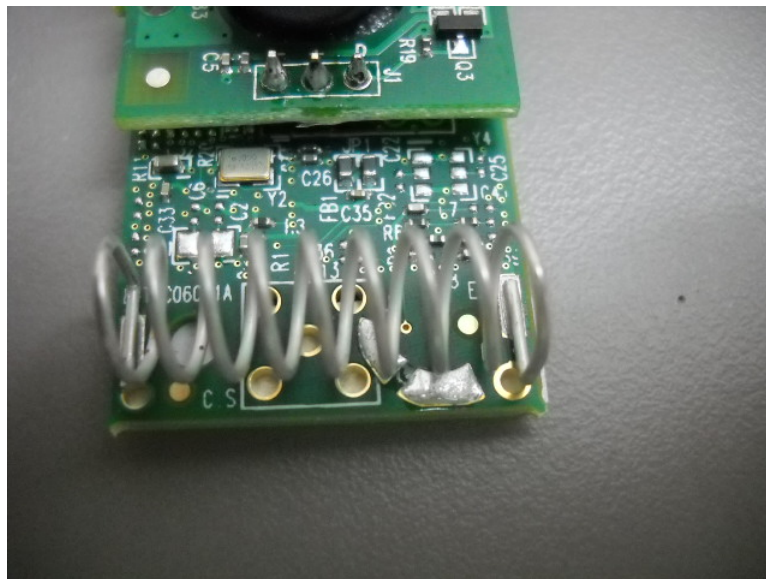
The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed 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 / ICES-003 Class B, RSS-Gen, Section 6.1, Radiated emission |                         |                          |
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22              |                         |                          |
| Test mode:          | Compliance                                                                           | Verdict:                | PASS                     |
| Date(s):            | 3/8/2012                                                                             |                         |                          |
| Temperature: 21 °C  | Air Pressure: 1021 hPa                                                               | Relative Humidity: 39 % | Power Supply: 3V battery |
| 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 and in Table 8.1.2.

Table 8.1.1 Radiated emission limits according to FCC Part 15, Section 109 and ICES-003 section 6.2

| 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 <sup>th</sup> harmonic** | 43.5*                   | 54.0         | 49.5                    | 60.0*        |

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

Table 8.1.2 Radiated emission limits according to RSS-Gen Section 6.1

| Frequency, MHz                   | Field strength limit at 3 m test distance, dB(μV/m) |
|----------------------------------|-----------------------------------------------------|
| 30 - 88                          | 40.0                                                |
| 88 - 216                         | 43.5                                                |
| 216 - 960                        | 46.0                                                |
| 960 - 3 <sup>rd</sup> harmonic** | 54.0                                                |

\*\* - harmonic of the highest frequency the EUT generates, uses, operates or tunes to.

#### 8.1.2 Test procedure

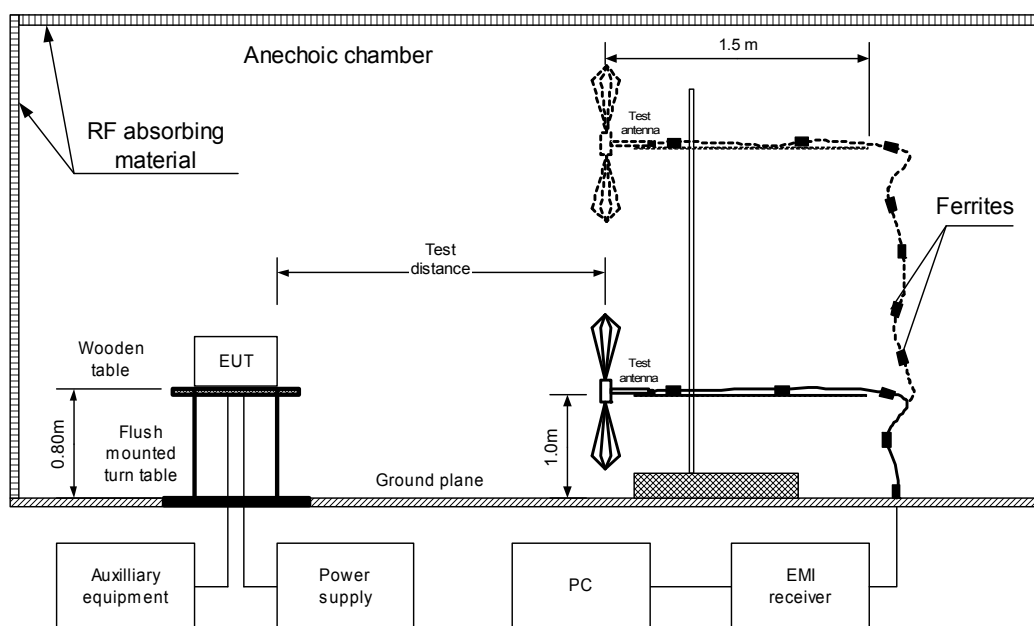
8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photograph/s, energized and the performance check was conducted.

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.

|                            |                               |                                                                                             |                                 |
|----------------------------|-------------------------------|---------------------------------------------------------------------------------------------|---------------------------------|
| <b>Test specification:</b> |                               | <b>FCC Part 15, Section 109 / ICES-003 Class B, RSS-Gen, Section 6.1, Radiated emission</b> |                                 |
| <b>Test procedure:</b>     |                               | ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22                     |                                 |
| <b>Test mode:</b>          | Compliance                    | <b>Verdict:</b>                                                                             | <b>PASS</b>                     |
| <b>Date(s):</b>            | 3/8/2012                      |                                                                                             |                                 |
| <b>Temperature:</b> 21 °C  | <b>Air Pressure:</b> 1021 hPa | <b>Relative Humidity:</b> 39 %                                                              | <b>Power Supply:</b> 3V battery |
| <b>Remarks:</b>            |                               |                                                                                             |                                 |

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





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|                            |                                                                                             |                                |                                 |
|----------------------------|---------------------------------------------------------------------------------------------|--------------------------------|---------------------------------|
| <b>Test specification:</b> | <b>FCC Part 15, Section 109 / ICES-003 Class B, RSS-Gen, Section 6.1, Radiated emission</b> |                                |                                 |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22                     |                                |                                 |
| <b>Test mode:</b>          | Compliance                                                                                  | <b>Verdict:</b>                | <b>PASS</b>                     |
| <b>Date(s):</b>            | 3/8/2012                                                                                    |                                |                                 |
| <b>Temperature:</b> 21 °C  | <b>Air Pressure:</b> 1021 hPa                                                               | <b>Relative Humidity:</b> 39 % | <b>Power Supply:</b> 3V battery |
| <b>Remarks:</b>            |                                                                                             |                                |                                 |

**Table 8.1.3 Radiated emission test results**

EUT SET UP: TABLE-TOP  
LIMIT: Class B  
EUT OPERATING MODE: Receive / Stand-by  
TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m

DETECTORS USED: PEAK / QUASI-PEAK  
FREQUENCY RANGE: 30 MHz – 1000 MHz  
RESOLUTION BANDWIDTH: 120 kHz

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

DETECTORS USED: PEAK / AVERAGE  
FREQUENCY RANGE: 1000 MHz – 4500 MHz  
RESOLUTION BANDWIDTH: 1000 kHz

| RECESSION BANDWIDTH:    |                             |                 |             | 1000 KHz                    |                 |             | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|-------------------------|-----------------------------|-----------------|-------------|-----------------------------|-----------------|-------------|----------------------|-------------------|--------------------------------|---------|
| Frequency, MHz          | Peak                        |                 |             | Average                     |                 |             |                      |                   |                                |         |
|                         | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* |                      |                   |                                |         |
| No emissions were found |                             |                 |             |                             |                 |             |                      |                   |                                | Pass    |

\*- Margin = Measured emission - specification limit.

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

**Reference numbers of test equipment used**

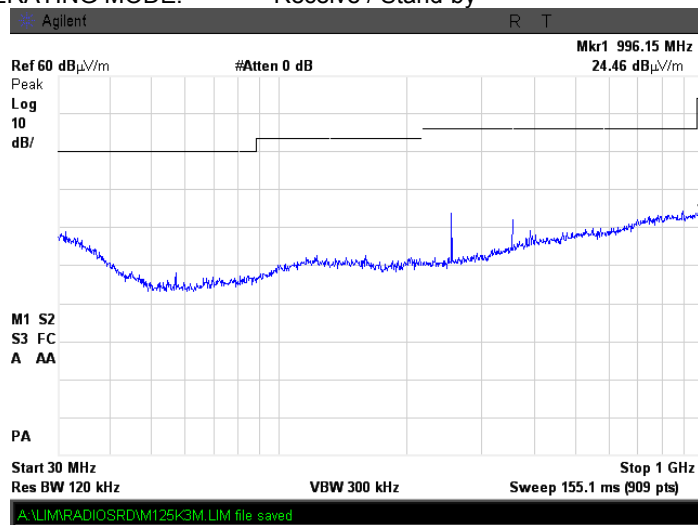
|         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 0521 | HL 0604 | HL 1984 | HL 2909 | HL 2871 | HL 2883 | HL 3390 | HL 3623 |
|---------|---------|---------|---------|---------|---------|---------|---------|

Full description is given in Appendix A.

|                     |                                                                                      |                         |                          |
|---------------------|--------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Test specification: | FCC Part 15, Section 109 / ICES-003 Class B, RSS-Gen, Section 6.1, Radiated emission |                         |                          |
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22              |                         |                          |
| Test mode:          | Compliance                                                                           | Verdict:                | PASS                     |
| Date(s):            | 3/8/2012                                                                             |                         |                          |
| Temperature: 21 °C  | Air Pressure: 1021 hPa                                                               | Relative Humidity: 39 % | Power Supply: 3V battery |
| Remarks:            |                                                                                      |                         |                          |

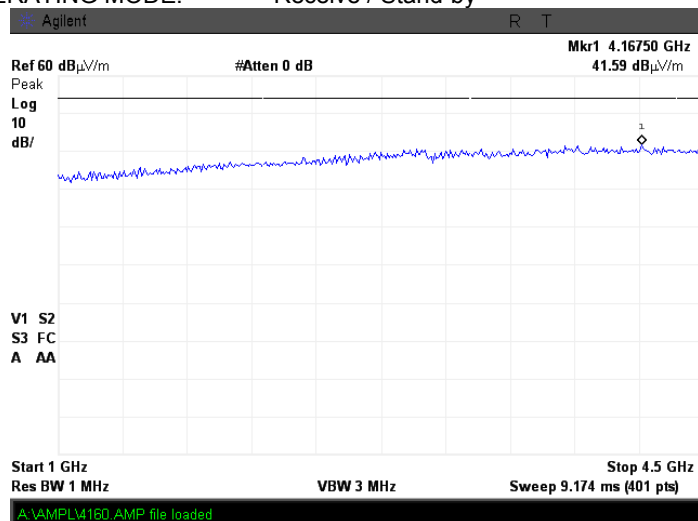
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

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



Plot 8.1.2 Radiated emission measurements above 1000 MHz, vertical and horizontal antenna polarization

TEST SITE: 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-13       |
| 0521  | EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz | Hewlett Packard       | 8546A           | 3617A<br>00319,<br>3448A002<br>53 | 24-Sep-12        | 24-Sep-13       |
| 0604  | Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz               | EMCO                  | 3141            | 9611-1011                         | 20-May-12        | 20-May-14       |
| 1425  | EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427                 | Agilent Technologies  | 8542E           | 3710A002<br>22,<br>3705A002<br>04 | 26-Aug-12        | 26-Aug-13       |
| 1984  | Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W                | EMC Test Systems      | 3115            | 9911-5964                         | 07-Dec-12        | 07-Dec-13       |
| 2432  | Antenna, Double-Ridged Waveguide Horn 1-18 GHz                        | EMC Test Systems      | 3115            | 00027177                          | 07-Dec-12        | 07-Dec-13       |
| 2780  | EMC analyzer, 100 Hz to 26.5 GHz                                      | Agilent Technologies  | E7405A          | MY451024<br>62                    | 09-Jul-12        | 09-Jul-13       |
| 2871  | Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA                    | Huber-Suhner          | 198-8155-00     | 2871                              | 04-Dec-12        | 04-Dec-13       |
| 2883  | Cable, 18 GHz N-type, M-F, 3 m                                        | Bird Electronic Corp. | TC-MNFN-3.0     | 211539<br>003                     | 04-Dec-12        | 04-Dec-13       |
| 2909  | Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz                          | Agilent Technologies  | E4407B          | MY414447<br>62                    | 20-Dec-12        | 20-Dec-13       |
| 3206  | Cable 40 GHz, 0.6 m                                                   | Gore                  | GOR245          | 05118336                          | 30-Dec-12        | 30-Dec-13       |
| 3390  | Microwave Cable Assembly, 26.5 GHz, 1.0 m, N type/N type              | Suhner Sucoflex       | 104EA           | 3390                              | 06-Feb-13        | 06-Feb-14       |
| 3531  | Amplifier, low noise, 2 to 8 GHz                                      | Quinstar Technology   | QLJ-02084040-J0 | 111590020<br>02                   | 25-Dec-12        | 25-Dec-13       |
| 3617  | Cable RF, 6.5 m, N type-N type, DC-6.5 GHz                            | Suhner Switzerland    | RG 214/U        | NA                                | 30-Dec-12        | 30-Dec-13       |
| 3623  | Cable RF, 6.0 m, N type-N type, DC-6.5 GHz                            | Belden                | MIL C-17        | NA                                | 09-May-12        | 09-May-13       |
| 3901  | Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA                    | Huber-Suhner          | SUCOFLEX 102A   | 1225/2A                           | 06-Feb-13        | 06-Feb-14       |
| 4135  | Shield Box                                                            | TESCOM CO., LTD       | TC-5916A        | 5916A000<br>136                   | 11-Apr-12        | 11-Apr-13       |

## 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<br>Horizontal polarization | Biconilog antenna: $\pm 5.3$ dB<br>Biconical antenna: $\pm 5.0$ dB<br>Log periodic antenna: $\pm 5.3$ dB<br>Double ridged horn antenna: $\pm 5.3$ dB |
| Vertical polarization                                                   | Biconilog antenna: $\pm 6.0$ dB<br>Biconical antenna: $\pm 5.7$ dB<br>Log periodic antenna: $\pm 6.0$ dB<br>Double ridged horn antenna: $\pm 6.0$ dB |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements        | $\pm 1.0$ %                                                                                                                                          |
| Occupied bandwidth                                                      | $\pm 8.0$ %                                                                                                                                          |

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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e-mail: mail@hermonlabs.com  
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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 |
| RSS-210 Issue 8: 2010   | Low Power Licence- Exempt Radiocommunication Devices                                                                                                                |
| RSS-Gen Issue 3: 2010   | General Requirements and Information for the Certification of Radiocommunication Equipment                                                                          |
| ICES-003 issue 5:2012   | Information Technology Equipment (ITE) – Limits and methods of measurement                                                                                          |

### 13 APPENDIX E Test equipment correction factors

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

| Frequency,<br>MHz | Magnetic antenna factor,<br>dB | Electric antenna factor,<br>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( $\mu$ V) to convert it into field intensity in dB( $\mu$ 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) |
|----------------|-------------------------|----------------|-------------------------|
| 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( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).

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

| Frequency,<br>MHz | Antenna factor,<br>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( $\mu$ V) to convert it into field strength in dB( $\mu$ V/m).

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

| Frequency,<br>MHz | Antenna factor.<br>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( $\mu$ V) to convert it into field strength in dB( $\mu$ V/m).

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

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>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**  
**Cable coaxial, Bird, 18 GHz, N-type, M-F, model TC-MNFN-3.0, S/N 211539 003**  
**HL 2883**

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.06              | 5750              | 1.70              | 12000             | 2.46              |
| 30                | 0.12              | 6000              | 1.75              | 12250             | 2.48              |
| 100               | 0.21              | 6250              | 1.80              | 12500             | 2.52              |
| 250               | 0.34              | 6500              | 1.81              | 12750             | 2.50              |
| 500               | 0.47              | 6750              | 1.86              | 13000             | 2.54              |
| 750               | 0.59              | 7000              | 1.86              | 13250             | 2.48              |
| 1000              | 0.67              | 7250              | 1.92              | 13500             | 2.63              |
| 1250              | 0.76              | 7500              | 1.96              | 13750             | 2.65              |
| 1500              | 0.84              | 7750              | 1.98              | 14000             | 2.72              |
| 1750              | 0.92              | 8000              | 2.02              | 14250             | 2.67              |
| 2000              | 0.98              | 8250              | 2.03              | 14500             | 2.70              |
| 2250              | 1.05              | 8500              | 2.05              | 14750             | 2.72              |
| 2500              | 1.12              | 8750              | 2.11              | 15000             | 2.79              |
| 2750              | 1.17              | 9000              | 2.17              | 15250             | 2.80              |
| 3000              | 1.22              | 9250              | 2.17              | 15500             | 2.83              |
| 3250              | 1.27              | 9500              | 2.20              | 15750             | 2.75              |
| 3500              | 1.33              | 9750              | 2.19              | 16000             | 2.82              |
| 3750              | 1.38              | 10000             | 2.22              | 16250             | 2.85              |
| 4000              | 1.42              | 10250             | 2.25              | 16500             | 2.90              |
| 4250              | 1.46              | 10500             | 2.30              | 16750             | 2.89              |
| 4500              | 1.51              | 10750             | 2.28              | 17000             | 2.88              |
| 4750              | 1.54              | 11000             | 2.32              | 17250             | 2.85              |
| 5000              | 1.59              | 11250             | 2.34              | 17500             | 2.96              |
| 5250              | 1.62              | 11500             | 2.39              | 17750             | 3.04              |
| 5500              | 1.65              | 11750             | 2.42              | 18000             | 3.04              |

**Cable loss**  
**Cable coaxial, GORE-TEX, GOR245, 40 GHz, 0.6 m, SMA-SMA, S/N 05118336**  
**HL 3206**

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 10             | 0.09           | 4900           | 0.85           | 10000          | 1.20           | 15200          | 1.51           | 29500          | 1.94           |
| 30             | 0.09           | 5000           | 0.85           | 10100          | 1.23           | 15300          | 1.56           | 30000          | 2.11           |
| 50             | 0.10           | 5100           | 0.86           | 10200          | 1.24           | 15400          | 1.54           | 30500          | 2.25           |
| 100            | 0.14           | 5200           | 0.87           | 10300          | 1.25           | 15500          | 1.55           | 31000          | 2.23           |
| 200            | 0.18           | 5300           | 0.88           | 10400          | 1.24           | 15600          | 1.50           | 31500          | 2.24           |
| 300            | 0.22           | 5400           | 0.89           | 10500          | 1.20           | 15700          | 1.56           | 32000          | 2.21           |
| 400            | 0.26           | 5500           | 0.90           | 10600          | 1.23           | 15800          | 1.50           | 32500          | 2.19           |
| 500            | 0.29           | 5600           | 0.92           | 10700          | 1.25           | 15900          | 1.58           | 33000          | 2.24           |
| 600            | 0.31           | 5700           | 0.93           | 10800          | 1.28           | 16000          | 1.56           | 33500          | 2.26           |
| 700            | 0.33           | 5800           | 0.93           | 10900          | 1.35           | 16100          | 1.59           | 34000          | 2.25           |
| 800            | 0.35           | 5900           | 0.95           | 11000          | 1.30           | 16200          | 1.57           | 34500          | 2.28           |
| 900            | 0.38           | 6000           | 0.93           | 11100          | 1.31           | 16300          | 1.59           | 35000          | 2.27           |
| 1000           | 0.39           | 6100           | 0.97           | 11200          | 1.31           | 16400          | 1.57           | 35500          | 2.31           |
| 1100           | 0.41           | 6200           | 0.95           | 11300          | 1.35           | 16500          | 1.60           | 36000          | 2.36           |
| 1200           | 0.42           | 6300           | 0.99           | 11400          | 1.32           | 16600          | 1.60           | 36500          | 2.39           |
| 1300           | 0.45           | 6400           | 0.98           | 11500          | 1.38           | 16700          | 1.63           | 37000          | 2.39           |
| 1400           | 0.46           | 6500           | 0.99           | 11600          | 1.33           | 16800          | 1.66           | 37500          | 2.41           |
| 1500           | 0.48           | 6600           | 0.99           | 11700          | 1.37           | 16900          | 1.64           | 38000          | 2.40           |
| 1600           | 0.49           | 6700           | 0.99           | 11800          | 1.36           | 17000          | 1.66           | 38500          | 2.40           |
| 1700           | 0.50           | 6800           | 0.99           | 11900          | 1.42           | 17100          | 1.65           | 39000          | 2.54           |
| 1800           | 0.52           | 6900           | 1.02           | 12000          | 1.34           | 17200          | 1.67           | 39500          | 2.39           |
| 1900           | 0.53           | 7000           | 1.02           | 12100          | 1.41           | 17300          | 1.66           | 40000          | 2.48           |
| 2000           | 0.53           | 7100           | 1.06           | 12200          | 1.36           | 17400          | 1.69           |                |                |
| 2100           | 0.54           | 7200           | 1.05           | 12300          | 1.40           | 17500          | 1.66           |                |                |
| 2200           | 0.55           | 7300           | 1.02           | 12400          | 1.34           | 17600          | 1.69           |                |                |
| 2300           | 0.56           | 7400           | 1.03           | 12500          | 1.39           | 17700          | 1.70           |                |                |
| 2400           | 0.57           | 7500           | 1.04           | 12600          | 1.40           | 17800          | 1.74           |                |                |
| 2500           | 0.59           | 7600           | 1.05           | 12700          | 1.42           | 17900          | 1.67           |                |                |
| 2600           | 0.60           | 7700           | 1.10           | 12800          | 1.37           | 18000          | 1.72           |                |                |
| 2700           | 0.62           | 7800           | 1.11           | 12900          | 1.39           | 18500          | 1.72           |                |                |
| 2800           | 0.62           | 7900           | 1.10           | 13000          | 1.40           | 19000          | 1.78           |                |                |
| 2900           | 0.65           | 8000           | 1.10           | 13100          | 1.42           | 19500          | 1.77           |                |                |
| 3000           | 0.65           | 8100           | 1.10           | 13200          | 1.41           | 20000          | 1.82           |                |                |
| 3100           | 0.66           | 8200           | 1.10           | 13300          | 1.43           | 20500          | 1.82           |                |                |
| 3200           | 0.67           | 8300           | 1.16           | 13400          | 1.45           | 21000          | 1.94           |                |                |
| 3300           | 0.69           | 8400           | 1.15           | 13500          | 1.45           | 21500          | 1.92           |                |                |
| 3400           | 0.70           | 8500           | 1.20           | 13600          | 1.54           | 22000          | 2.07           |                |                |
| 3500           | 0.71           | 8600           | 1.19           | 13700          | 1.54           | 22500          | 1.90           |                |                |
| 3600           | 0.71           | 8700           | 1.15           | 13800          | 1.49           | 23000          | 1.96           |                |                |
| 3700           | 0.73           | 8800           | 1.16           | 13900          | 1.50           | 23500          | 1.88           |                |                |
| 3800           | 0.74           | 8900           | 1.19           | 14000          | 1.50           | 24000          | 1.96           |                |                |
| 3900           | 0.75           | 9000           | 1.18           | 14100          | 1.52           | 24500          | 1.96           |                |                |
| 4000           | 0.76           | 9100           | 1.23           | 14200          | 1.60           | 25000          | 2.10           |                |                |
| 4100           | 0.76           | 9200           | 1.20           | 14300          | 1.57           | 25500          | 2.05           |                |                |
| 4200           | 0.78           | 9300           | 1.20           | 14400          | 1.57           | 26000          | 2.05           |                |                |
| 4300           | 0.79           | 9400           | 1.19           | 14600          | 1.50           | 26500          | 2.05           |                |                |
| 4400           | 0.80           | 9500           | 1.23           | 14700          | 1.54           | 27000          | 1.97           |                |                |
| 4500           | 0.80           | 9600           | 1.21           | 14800          | 1.51           | 27500          | 2.09           |                |                |
| 4600           | 0.82           | 9700           | 1.22           | 14900          | 1.54           | 28000          | 2.10           |                |                |
| 4700           | 0.82           | 9800           | 1.20           | 15000          | 1.57           | 28500          | 2.05           |                |                |
| 4800           | 0.83           | 9900           | 1.18           | 15100          | 1.56           | 29000          | 2.08           |                |                |



**Cable loss**  
**Cable coaxial, Microwave Cable Assembly, 104EA, 18 GHz, 1.0 m**  
**Suhner Sucoflex, HL 3390**

| Frequency,<br>MHz | Cable<br>loss,<br>dB | Frequency,<br>MHz | Cable<br>loss,<br>dB | Frequency,<br>MHz | Cable<br>loss, dB | Frequency,<br>MHz | Cable<br>loss, dB |
|-------------------|----------------------|-------------------|----------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.03                 | 4800              | 0.55                 | 9800              | 0.89              | 14900             | 1.07              |
| 30                | 0.04                 | 4900              | 0.56                 | 9900              | 0.89              | 15000             | 1.07              |
| 50                | 0.05                 | 5000              | 0.57                 | 10000             | 0.86              | 15100             | 1.08              |
| 100               | 0.07                 | 5100              | 0.58                 | 10100             | 0.86              | 15200             | 1.07              |
| 200               | 0.10                 | 5200              | 0.58                 | 10200             | 0.88              | 15300             | 1.09              |
| 300               | 0.12                 | 5300              | 0.59                 | 10300             | 0.92              | 15400             | 1.10              |
| 400               | 0.14                 | 5400              | 0.59                 | 10400             | 0.94              | 15500             | 1.10              |
| 500               | 0.16                 | 5500              | 0.60                 | 10500             | 0.96              | 15600             | 1.12              |
| 600               | 0.17                 | 5600              | 0.61                 | 10600             | 0.93              | 15700             | 1.15              |
| 700               | 0.18                 | 5700              | 0.61                 | 10700             | 0.89              | 15800             | 1.15              |
| 800               | 0.20                 | 5800              | 0.63                 | 10800             | 0.89              | 15900             | 1.17              |
| 900               | 0.21                 | 5900              | 0.63                 | 10900             | 0.88              | 16000             | 1.14              |
| 1000              | 0.23                 | 6000              | 0.64                 | 11000             | 0.92              | 16100             | 1.14              |
| 1100              | 0.24                 | 6100              | 0.64                 | 11100             | 0.91              | 16200             | 1.15              |
| 1200              | 0.25                 | 6200              | 0.64                 | 11200             | 0.89              | 16300             | 1.14              |
| 1300              | 0.27                 | 6300              | 0.65                 | 11300             | 0.88              | 16400             | 1.13              |
| 1400              | 0.28                 | 6400              | 0.65                 | 11400             | 0.88              | 16500             | 1.13              |
| 1500              | 0.28                 | 6500              | 0.66                 | 11500             | 0.90              | 16600             | 1.13              |
| 1600              | 0.30                 | 6600              | 0.67                 | 11600             | 0.94              | 16700             | 1.14              |
| 1700              | 0.31                 | 6700              | 0.67                 | 11700             | 0.96              | 16800             | 1.14              |
| 1800              | 0.32                 | 6800              | 0.67                 | 11800             | 0.92              | 16900             | 1.14              |
| 1900              | 0.33                 | 6900              | 0.68                 | 11900             | 0.92              | 17000             | 1.14              |
| 2000              | 0.34                 | 7000              | 0.67                 | 12000             | 0.91              | 17100             | 1.15              |
| 2100              | 0.35                 | 7100              | 0.68                 | 12100             | 0.92              | 17200             | 1.14              |
| 2200              | 0.35                 | 7200              | 0.69                 | 12200             | 0.95              | 17300             | 1.15              |
| 2300              | 0.36                 | 7300              | 0.69                 | 12300             | 0.98              | 17400             | 1.15              |
| 2400              | 0.37                 | 7400              | 0.68                 | 12400             | 0.96              | 17500             | 1.16              |
| 2500              | 0.39                 | 7500              | 0.69                 | 12500             | 0.99              | 17600             | 1.16              |
| 2600              | 0.40                 | 7600              | 0.70                 | 12600             | 0.96              | 17700             | 1.16              |
| 2700              | 0.41                 | 7700              | 0.71                 | 12700             | 0.93              | 17800             | 1.19              |
| 2800              | 0.42                 | 7800              | 0.72                 | 12800             | 0.94              | 17900             | 1.21              |
| 2900              | 0.42                 | 7900              | 0.72                 | 12900             | 0.98              | 18000             | 1.25              |
| 3000              | 0.43                 | 8000              | 0.72                 | 13000             | 0.99              |                   |                   |
| 3100              | 0.44                 | 8100              | 0.73                 | 13100             | 0.99              |                   |                   |
| 3200              | 0.45                 | 8200              | 0.74                 | 13200             | 0.99              |                   |                   |
| 3300              | 0.46                 | 8300              | 0.75                 | 13300             | 0.99              |                   |                   |
| 3400              | 0.46                 | 8400              | 0.74                 | 13400             | 1.00              |                   |                   |
| 3500              | 0.47                 | 8500              | 0.73                 | 13500             | 1.02              |                   |                   |
| 3600              | 0.47                 | 8600              | 0.73                 | 13600             | 1.05              |                   |                   |
| 3700              | 0.47                 | 8700              | 0.75                 | 13700             | 1.03              |                   |                   |
| 3800              | 0.49                 | 8800              | 0.77                 | 13800             | 1.02              |                   |                   |
| 3900              | 0.49                 | 8900              | 0.77                 | 13900             | 1.03              |                   |                   |
| 4000              | 0.50                 | 9000              | 0.77                 | 14000             | 1.03              |                   |                   |
| 4100              | 0.51                 | 9100              | 0.77                 | 14100             | 1.05              |                   |                   |
| 4200              | 0.52                 | 9200              | 0.78                 | 14200             | 1.05              |                   |                   |
| 4300              | 0.52                 | 9300              | 0.80                 | 14300             | 1.04              |                   |                   |
| 4400              | 0.53                 | 9400              | 0.82                 | 14400             | 1.03              |                   |                   |
| 4500              | 0.53                 | 9500              | 0.82                 | 14600             | 1.06              |                   |                   |
| 4600              | 0.54                 | 9600              | 0.83                 | 14700             | 1.07              |                   |                   |
| 4700              | 0.56                 | 9700              | 0.89                 | 14800             | 1.08              |                   |                   |

**Cable loss**  
Cable coaxial, RG-214/U, N type-N type, 6.5 m  
Suhner Switzerland, HL 3617

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.13              | 2200              | 2.97              | 4500              | 5.10              |
| 50                | 0.33              | 2300              | 3.06              | 4600              | 5.20              |
| 100               | 0.48              | 2400              | 3.16              | 4700              | 5.34              |
| 200               | 0.71              | 2500              | 3.23              | 4800              | 5.36              |
| 300               | 0.89              | 2600              | 3.34              | 4900              | 5.48              |
| 400               | 1.04              | 2700              | 3.42              | 5000              | 5.52              |
| 500               | 1.19              | 2800              | 3.52              | 5100              | 5.61              |
| 600               | 1.32              | 2900              | 3.61              | 5200              | 5.72              |
| 700               | 1.44              | 3000              | 3.69              | 5300              | 5.81              |
| 800               | 1.56              | 3100              | 3.80              | 5400              | 5.93              |
| 900               | 1.68              | 3200              | 3.86              | 5500              | 6.08              |
| 1000              | 1.80              | 3300              | 3.98              | 5600              | 6.12              |
| 1100              | 1.90              | 3400              | 4.07              | 5700              | 6.25              |
| 1200              | 2.00              | 3500              | 4.14              | 5800              | 6.31              |
| 1300              | 2.11              | 3600              | 4.27              | 5900              | 6.41              |
| 1400              | 2.21              | 3700              | 4.36              | 6000              | 6.51              |
| 1500              | 2.30              | 3800              | 4.47              | 6100              | 6.62              |
| 1600              | 2.40              | 3900              | 4.62              | 6200              | 6.73              |
| 1700              | 2.49              | 4000              | 4.63              | 6300              | 6.86              |
| 1800              | 2.61              | 4100              | 4.76              | 6400              | 6.94              |
| 1900              | 2.69              | 4200              | 4.83              | 6500              | 7.06              |
| 2000              | 2.79              | 4300              | 4.89              |                   |                   |
| 2100              | 2.88              | 4400              | 5.04              |                   |                   |

**Cable loss**  
**Cable coaxial, MIL C-17, N type-N type, 6 m**  
**Belden, HL 3623**

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.10              | 2600              | 4.35              | 5300              | 7.67              |
| 50                | 0.30              | 2700              | 4.54              | 5400              | 7.79              |
| 100               | 0.45              | 2800              | 4.70              | 5500              | 7.89              |
| 200               | 0.69              | 2900              | 4.87              | 5600              | 7.94              |
| 300               | 0.89              | 3000              | 5.04              | 5700              | 8.01              |
| 400               | 1.06              | 3100              | 5.19              | 5800              | 8.12              |
| 500               | 1.24              | 3200              | 5.35              | 5900              | 8.19              |
| 600               | 1.38              | 3300              | 5.50              | 6000              | 8.30              |
| 700               | 1.54              | 3400              | 5.65              | 6100              | 8.35              |
| 800               | 1.69              | 3500              | 5.79              | 6200              | 8.45              |
| 900               | 1.83              | 3600              | 5.92              | 6300              | 8.55              |
| 1000              | 1.96              | 3700              | 6.07              | 6400              | 8.65              |
| 1100              | 2.14              | 3800              | 6.17              | 6500              | 8.75              |
| 1200              | 2.31              | 3900              | 6.30              |                   |                   |
| 1300              | 2.38              | 4000              | 6.43              |                   |                   |
| 1400              | 2.51              | 4100              | 6.53              |                   |                   |
| 1500              | 2.63              | 4200              | 6.65              |                   |                   |
| 1600              | 2.76              | 4300              | 6.75              |                   |                   |
| 1700              | 2.90              | 4400              | 6.85              |                   |                   |
| 1800              | 3.04              | 4500              | 7.01              |                   |                   |
| 1900              | 3.19              | 4600              | 7.09              |                   |                   |
| 2000              | 3.35              | 4700              | 7.20              |                   |                   |
| 2100              | 3.51              | 4800              | 7.24              |                   |                   |
| 2200              | 3.67              | 4900              | 7.31              |                   |                   |
| 2300              | 3.84              | 5000              | 7.41              |                   |                   |
| 2400              | 4.01              | 5100              | 7.48              |                   |                   |
| 2500              | 4.18              | 5200              | 7.56              |                   |                   |

**Cable loss**  
**Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A**  
**HL 3901**

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.09              | 9500              | 4.29              | 21000             | 6.67              |
| 100               | 0.41              | 10000             | 4.40              | 22000             | 6.92              |
| 500               | 0.93              | 10500             | 4.52              | 23000             | 7.00              |
| 1000              | 1.33              | 11000             | 4.64              | 24000             | 7.18              |
| 1500              | 1.63              | 11500             | 4.76              | 25000             | 7.29              |
| 2000              | 1.90              | 12000             | 4.87              | 26000             | 7.55              |
| 2500              | 2.12              | 12500             | 4.99              | 27000             | 7.70              |
| 3000              | 2.33              | 13000             | 5.11              | 28000             | 7.88              |
| 3500              | 2.50              | 13500             | 5.20              | 29000             | 8.02              |
| 4000              | 2.67              | 14000             | 5.31              | 30000             | 8.15              |
| 4500              | 2.82              | 14500             | 5.42              | 31000             | 8.35              |
| 5000              | 2.99              | 15000             | 5.51              | 32000             | 8.40              |
| 5500              | 3.16              | 15500             | 5.58              | 33000             | 8.62              |
| 6000              | 3.32              | 16000             | 5.68              | 34000             | 8.73              |
| 6500              | 3.51              | 16500             | 5.78              | 35000             | 8.78              |
| 7000              | 3.65              | 17000             | 5.91              | 36000             | 8.94              |
| 7500              | 3.79              | 17500             | 5.99              | 37000             | 9.21              |
| 8000              | 3.92              | 18000             | 6.07              | 38000             | 9.37              |
| 8500              | 4.04              | 19000             | 6.36              | 39000             | 9.45              |
| 9000              | 4.18              | 20000             | 6.49              | 40000             | 9.52              |

## 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( $\mu$ V)   | decibel referred to one microvolt           |
| dB( $\mu$ V/m) | decibel referred to one microvolt per meter |
| dB( $\mu$ 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                                 |
| $\mu$ s        | microsecond                                 |
| NA             | not applicable                              |
| OATS           | open area test site                         |
| $\Omega$       | 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                                        |

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