

# TEST REPORT

ACCORDING TO: FCC part 90, subpart I and part 15, subpart B

FOR:

**Telematics Wireless Ltd.**

**ASTM Reader**

**Model: FP-300RA**

This report is in conformity with ISO/ IEC 17025. The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.

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## 1 Applicant information

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**Contact name:** Mr. Gyora Keydar

## 2 Equipment under test attributes

**Product name:** ASTM Reader  
**Model:** FP-300RA  
**Receipt date:** 7/7/2005

## 3 Manufacturer information

**Manufacturer name:** Telematics Wireless Ltd.  
**Address:** 26 Hamelaha, POB 1911, Holon, 58117, Israel  
**Telephone:** +972 3557 5767  
**Fax:** +972 3557 5753  
**E-mail:** gyorak@tlmw.com  
**Contact name:** Mr. Gyora Keydar

## 4 Test details

**Project ID:** 16547  
**Location:** Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel  
**Test started:** 7/7/2005  
**Test completed:** 7/18/2005  
**Test specifications:** FCC part 90, subpart I; part 15, subpart B, §§15.107, 15.111, 15.109  
**Test suite:** FCC\_90\_BS\_with\_RF\_connector (3/2/2005 6:04:18 PM, modified)

## 5 Tests summary

| Test                                                         | Status               |
|--------------------------------------------------------------|----------------------|
| <b>Transmitter characteristics</b>                           |                      |
| Section 90.205, Maximum output power                         | Pass                 |
| Section 90.209, Occupied bandwidth                           | Pass                 |
| Section 90.210, Emission mask                                | Pass                 |
| Section 90.210, Radiated spurious emissions                  | Pass                 |
| Section 90.210, Conducted spurious emissions                 | Pass                 |
| Section 90.213, Frequency stability                          | Tested with no limit |
| Section 90.214, Transient frequency behaviour                | Not required         |
| Section 2.1091, RF radiation exposure evaluation             | Pass                 |
| <b>Unintentional emissions</b>                               |                      |
| Section 15.107, Conducted emission at AC power port, Class B | Pass                 |
| Section 15.109, Radiated emission, Class B                   | Pass                 |
| Section 15.111, Conducted emission at receiver antenna port  | Pass                 |

Testing was completed against all relevant requirements of the test standard. 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.

**This test report replaces the previously issued test report identified by Doc. ID: TELRAD\_FCC.16547.**

|                     | Name and Title                        | Date            | Signature                                                                             |
|---------------------|---------------------------------------|-----------------|---------------------------------------------------------------------------------------|
| <b>Tested by:</b>   | Mr. A. Adelberg, test engineer        | July 18, 2005   |  |
| <b>Reviewed by:</b> | Ms. N. Averin, certification engineer | August 17, 2005 |  |
|                     | Mr. M. Nikishin, EMC group leader     | August 17, 2005 |  |
| <b>Approved by:</b> | Mr. A. Usoskin, C.E.O.                | August 17, 2005 |  |

## 6 EUT description

### 6.1 General information

The EUT is the roadside reader of a vehicle identification system, operating in 912 MHz - 918 MHz with ASK modulation and utilizing external antenna. Data bit rate is 500 kbps. The EUT is powered from 8 – 30 VDC sources including batteries.

During conducted emission test the EUT was powered from AC mains via AC/12 VDC adapter.

The frequencies generated or used in the EUT are: 50 kHz, 16 MHz (reference clock), 70 MHz (Tx IF), 422.5 MHz (Tx VCO), 925 MHz (Rx LO).

The conducted measurements were performed at “Ant main” port because of lesser attenuation from the RF amplifier output (connectors “Ant 1” – “Ant 4” can be used instead of “Ant main”, in this case the additional multiplexer is involved, as shown in RF switch block diagram attached to this Application).

### 6.2 Ports and lines

| Port type | Port description    | Connected     |                       | Connector type | Qty. | Cable type | Cable length |
|-----------|---------------------|---------------|-----------------------|----------------|------|------------|--------------|
|           |                     | From          | To                    |                |      |            |              |
| Power     | DC power            | EUT           | DC PS / AC/DC adapter | DC IN 4 pin    | 1    | Unshielded | 1.5 m        |
| Power     | AC power            | AC/DC adapter | AC mains              | IEC 320        | 1    | Unshielded | 1 m          |
| Signal    | HOST (RS232)        | EUT           | Open circuit          | D-type 9 pin   | 1    | Unshielded | 2 m          |
| Signal    | AUX (RS232/422)     | EUT           | Open circuit          | D-type 9 pin   | 1    | Unshielded | 2 m          |
| Signal    | Maintenance (RS232) | EUT           | PC                    | D-type 9 pin   | 1    | Unshielded | 2 m          |
| Signal    | I/O                 | EUT           | Open circuit          | D-type 25 pin  | 1    | Unshielded | 1 m          |
| Signal    | Antenna             | EUT           | 50 Ohm termination    | SMA            | 5    | NA         | NA           |

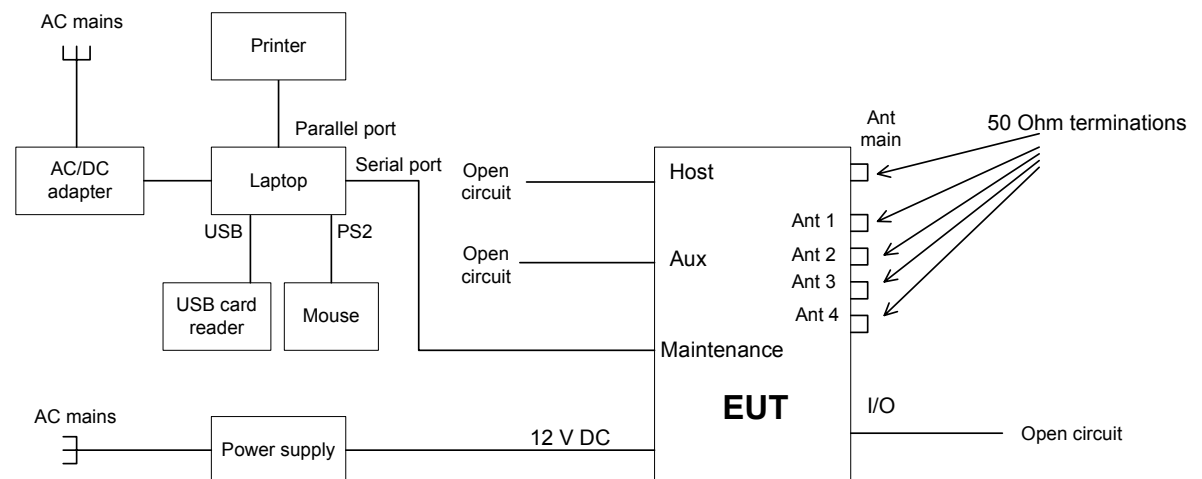
### 6.3 Auxiliary equipment

| Description                                  | Manufacturer             | Model number | Serial number |
|----------------------------------------------|--------------------------|--------------|---------------|
| Laptop                                       | Toshiba                  | PA1262E      | 28012460      |
| AC/DC adapter of laptop                      | Toshiba                  | PA2444U      | 0/44642       |
| ITE power supply (AC/DC adapter for CE test) | Potrans Electrical Corp. | UP30437      | 1711-030-A    |
| Printer                                      | Epson                    | LX-810       | 44B1127035    |
| Mouse                                        | IBM                      | BH6690       | 06H4590       |
| USB card reader                              | Delkin Devices           | DDREADER-12  | 115700263     |

### 6.4 Changes made in the EUT

No changes were implemented.

### 6.5 Test configuration





## 6.6 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>Intended use</b>                                     |                                                                                                          |                                                           |                    |              | <b>Condition of use</b>                                       |                   |                                |               |           |                                |  |  |  |  |                  |
| X                                                       | fixed                                                                                                    | Always at a distance more than 2 m from all people        |                    |              |                                                               |                   |                                |               |           |                                |  |  |  |  |                  |
|                                                         | mobile                                                                                                   | Always at a distance more than 20 cm from all people      |                    |              |                                                               |                   |                                |               |           |                                |  |  |  |  |                  |
|                                                         | portable                                                                                                 | May operate at a distance closer than 20 cm to human body |                    |              |                                                               |                   |                                |               |           |                                |  |  |  |  |                  |
| <b>Assigned frequency range</b>                         |                                                                                                          |                                                           |                    |              | 902 - 928 MHz                                                 |                   |                                |               |           |                                |  |  |  |  |                  |
| <b>Operating frequencies</b>                            |                                                                                                          |                                                           |                    |              | 912 MHz - 918 MHz                                             |                   |                                |               |           |                                |  |  |  |  |                  |
| <b>RF channel spacing</b>                               |                                                                                                          |                                                           |                    |              | 100 kHz                                                       |                   |                                |               |           |                                |  |  |  |  |                  |
| <b>Maximum rated output power</b>                       |                                                                                                          |                                                           |                    |              | At transmitter 50 $\Omega$ RF output connector                |                   |                                |               | 31.17 dBm |                                |  |  |  |  |                  |
|                                                         |                                                                                                          |                                                           |                    |              | Effective radiated power (for equipment with no RF connector) |                   |                                |               | dBm       |                                |  |  |  |  |                  |
| <b>Is transmitter output power variable?</b>            |                                                                                                          |                                                           |                    |              | No                                                            |                   |                                |               |           |                                |  |  |  |  |                  |
|                                                         |                                                                                                          |                                                           |                    |              | X                                                             |                   |                                |               |           | Yes                            |  |  |  |  |                  |
|                                                         |                                                                                                          |                                                           |                    |              |                                                               |                   |                                |               |           | continuous variable            |  |  |  |  |                  |
|                                                         |                                                                                                          |                                                           |                    |              |                                                               |                   |                                |               |           | stepped variable with stepsize |  |  |  |  | 1 dB             |
|                                                         |                                                                                                          |                                                           |                    |              |                                                               |                   |                                |               |           |                                |  |  |  |  | minimum RF power |
|                                                         |                                                                                                          |                                                           |                    |              | maximum RF power                                              |                   |                                |               |           | 31.17 dBm                      |  |  |  |  |                  |
| <b>Antenna connection</b>                               |                                                                                                          |                                                           |                    |              |                                                               |                   |                                |               |           |                                |  |  |  |  |                  |
| unique coupling                                         |                                                                                                          | X                                                         | standard connector |              | integral                                                      |                   | with temporary RF connector    |               |           |                                |  |  |  |  |                  |
|                                                         |                                                                                                          |                                                           |                    |              |                                                               |                   | without temporary RF connector |               |           |                                |  |  |  |  |                  |
| <b>Antenna/s technical characteristics</b>              |                                                                                                          |                                                           |                    |              |                                                               |                   |                                |               |           |                                |  |  |  |  |                  |
| Type                                                    |                                                                                                          | Manufacturer                                              |                    | Model number |                                                               | Gain              |                                |               |           |                                |  |  |  |  |                  |
| Flat                                                    |                                                                                                          | OR ANTENNA                                                |                    | OR-900-930-8 |                                                               | 8 dB              |                                |               |           |                                |  |  |  |  |                  |
| <b>Transmitter 99% power bandwidth</b>                  |                                                                                                          |                                                           |                    |              | 2.575 MHz                                                     |                   |                                |               |           |                                |  |  |  |  |                  |
| <b>Transmitter aggregate data rate/s</b>                |                                                                                                          |                                                           |                    |              | 0.5 Mbps                                                      |                   |                                |               |           |                                |  |  |  |  |                  |
| <b>Type of modulation</b>                               |                                                                                                          |                                                           |                    |              | ASK                                                           |                   |                                |               |           |                                |  |  |  |  |                  |
| <b>Modulating test signal (baseband)</b>                |                                                                                                          |                                                           |                    |              | PRBS                                                          |                   |                                |               |           |                                |  |  |  |  |                  |
| <b>Maximum transmitter duty cycle in normal use</b>     |                                                                                                          |                                                           |                    |              | 12 %                                                          | <b>Tx ON time</b> | 1.2 ms                         | <b>Period</b> | 10 ms     |                                |  |  |  |  |                  |
| <b>Transmitter duty cycle supplied for test</b>         |                                                                                                          |                                                           |                    |              | 12.5 %                                                        | <b>Tx ON time</b> | 10 ms                          | <b>Period</b> | 70 ms     |                                |  |  |  |  |                  |
| <b>Transmitter power source</b>                         |                                                                                                          |                                                           |                    |              |                                                               |                   |                                |               |           |                                |  |  |  |  |                  |
|                                                         | Battery                                                                                                  | <b>Nominal rated voltage</b>                              |                    | VDC          | <b>Battery type</b>                                           |                   |                                |               |           |                                |  |  |  |  |                  |
| X                                                       | DC                                                                                                       | <b>Nominal rated voltage</b>                              |                    | 12 VDC       |                                                               |                   |                                |               |           |                                |  |  |  |  |                  |
|                                                         | AC mains                                                                                                 | <b>Nominal rated voltage</b>                              |                    | VAC          | <b>Frequency</b>                                              |                   | Hz                             |               |           |                                |  |  |  |  |                  |
| <b>Common power source for transmitter and receiver</b> |                                                                                                          |                                                           |                    |              | X                                                             | yes               |                                | no            |           |                                |  |  |  |  |                  |
| <b>Emission designator</b>                              |                                                                                                          |                                                           |                    |              | 2M575K1D                                                      |                   |                                |               |           |                                |  |  |  |  |                  |



|                            |                                                      |                                |                             |
|----------------------------|------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.205, Maximum output power</b>          |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1 |                                |                             |
| <b>Test mode:</b>          | Compliance                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 11:22:49 AM                                |                                |                             |
| <b>Temperature:</b> 24 °C  | <b>Air Pressure:</b> 1011 hPa                        | <b>Relative Humidity:</b> 46 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                      |                                |                             |

## 7 Transmitter tests according to FCC 47 CFR part 90 requirements

### 7.1 Peak output power test

#### 7.1.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.1.1. The test results are provided in Table 7.1.2 and the associated plots.

Table 7.1.1 Peak output power limits

| Assigned frequency range, MHz | Maximum peak output power |      |
|-------------------------------|---------------------------|------|
|                               | W                         | dBm  |
| 902 - 928                     | 30                        | 44.7 |

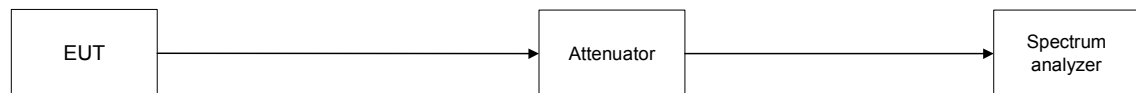
#### 7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

7.1.2.2 The EUT was adjusted to produce maximum available to the end user RF output power.

7.1.2.3 The peak output power was measured with spectrum analyzer as provided in Table 7.1.2 and associated plots.

Figure 7.1.1 Peak output power test setup





|                            |                                                      |                                |                             |
|----------------------------|------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.205, Maximum output power</b>          |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1 |                                |                             |
| <b>Test mode:</b>          | Compliance                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 11:22:49 AM                                |                                |                             |
| <b>Temperature:</b> 24 °C  | <b>Air Pressure:</b> 1011 hPa                        | <b>Relative Humidity:</b> 46 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                      |                                |                             |

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 902 - 928 MHz  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 2000 kHz  
 VIDEO BANDWIDTH: 3000 kHz  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 0.5 Mbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

| Carrier frequency, MHz | Spectrum analyzer reading, dBm | External attenuation, dB | Cable loss, dB | RF output power, dBm | Limit, dBm | Margin, dB | Verdict |
|------------------------|--------------------------------|--------------------------|----------------|----------------------|------------|------------|---------|
| 912                    | 30.83                          | Included                 | Included       | 30.83                | 44.70      | -13.87     | Pass    |
| 915                    | 31.17                          | Included                 | Included       | 31.17                | 44.70      | -13.53     | Pass    |
| 918                    | 30.83                          | Included                 | Included       | 30.83                | 44.70      | -13.87     | Pass    |

## Reference numbers of test equipment used

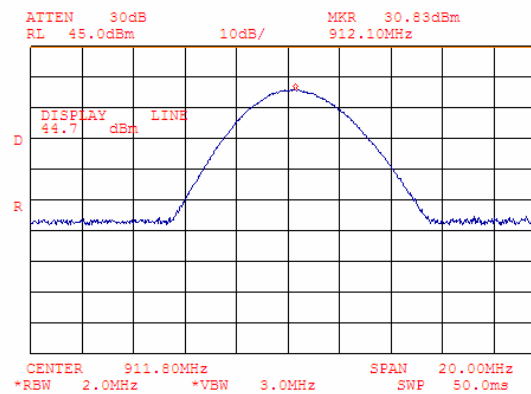
|         |         |         |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|
| HL 1424 | HL 2399 | HL 2524 |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|

Full description is given in Appendix A.

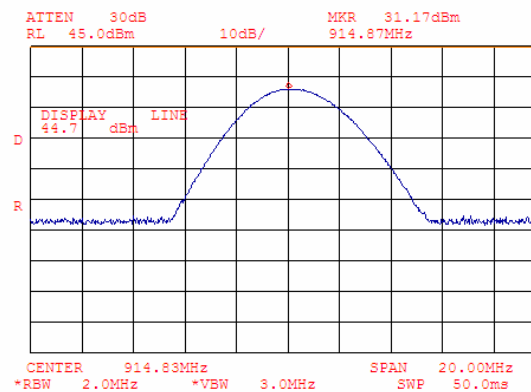


|                     |                                                      |                         |                      |
|---------------------|------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.205, Maximum output power                 |                         |                      |
| Test procedure:     | 47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1 |                         |                      |
| Test mode:          | Compliance                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 11:22:49 AM                                |                         |                      |
| Temperature: 24 °C  | Air Pressure: 1011 hPa                               | Relative Humidity: 46 % | Power Supply: 12 VDC |
| Remarks:            |                                                      |                         |                      |

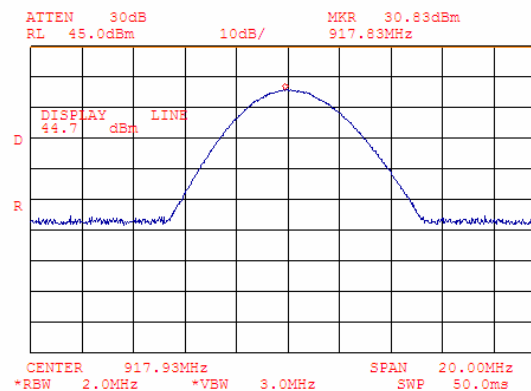
Plot 7.1.1 Peak output power test results at main antenna at low carrier frequency



Plot 7.1.2 Peak output power test results at main antenna at mid carrier frequency



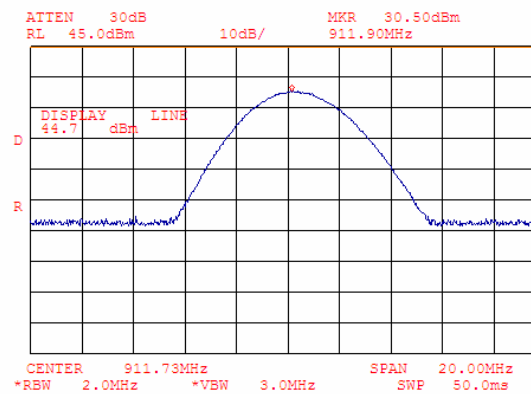
Plot 7.1.3 Peak output power test results at main antenna at high carrier frequency



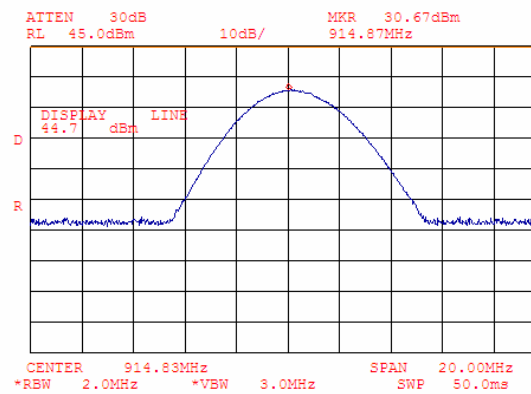


|                     |                                                      |                         |                      |
|---------------------|------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.205, Maximum output power                 |                         |                      |
| Test procedure:     | 47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1 |                         |                      |
| Test mode:          | Compliance                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 11:22:49 AM                                |                         |                      |
| Temperature: 24 °C  | Air Pressure: 1011 hPa                               | Relative Humidity: 46 % | Power Supply: 12 VDC |
| Remarks:            |                                                      |                         |                      |

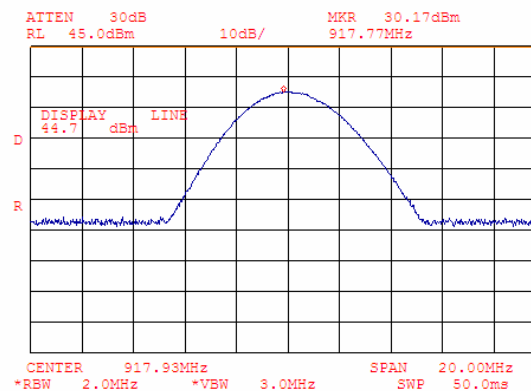
Plot 7.1.4 Peak output power test results at antenna No.1 at low carrier frequency



Plot 7.1.5 Peak output power test results at antenna No.1 at mid carrier frequency



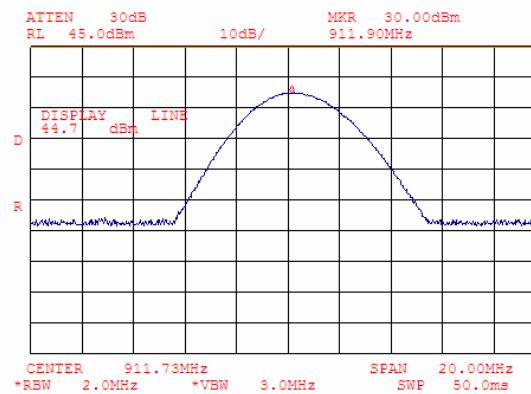
Plot 7.1.6 Peak output power test results at antenna No.1 at high carrier frequency



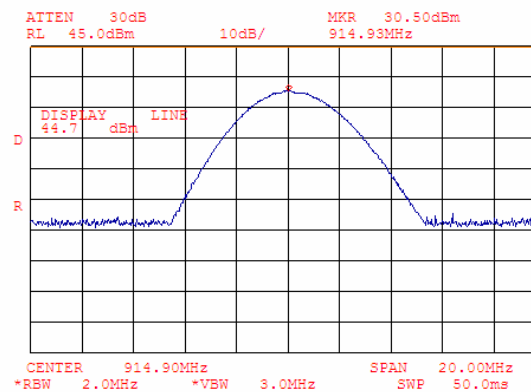


|                     |                                                      |                         |                      |
|---------------------|------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.205, Maximum output power                 |                         |                      |
| Test procedure:     | 47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1 |                         |                      |
| Test mode:          | Compliance                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 11:22:49 AM                                |                         |                      |
| Temperature: 24 °C  | Air Pressure: 1011 hPa                               | Relative Humidity: 46 % | Power Supply: 12 VDC |
| Remarks:            |                                                      |                         |                      |

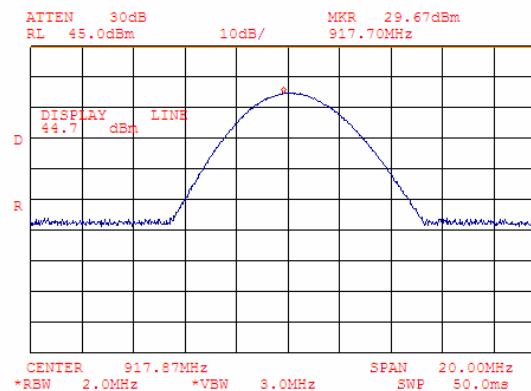
Plot 7.1.7 Peak output power test results at antenna No.2 at low carrier frequency



Plot 7.1.8 Peak output power test results at antenna No.2 at mid carrier frequency



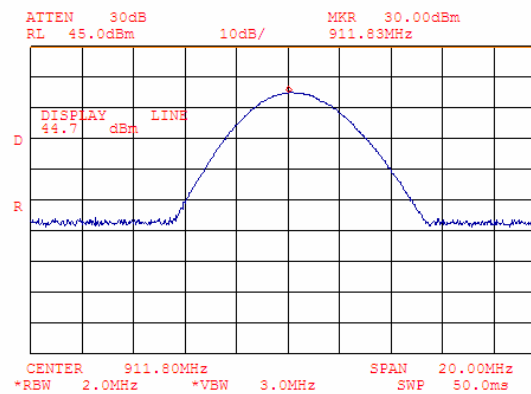
Plot 7.1.9 Peak output power test results at antenna No.2 at high carrier frequency



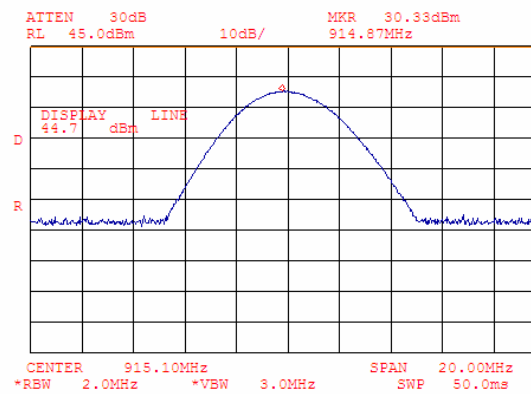


|                            |                                                      |                                |                             |
|----------------------------|------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.205, Maximum output power</b>          |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1 |                                |                             |
| <b>Test mode:</b>          | Compliance                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 11:22:49 AM                                |                                |                             |
| <b>Temperature:</b> 24 °C  | <b>Air Pressure:</b> 1011 hPa                        | <b>Relative Humidity:</b> 46 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                      |                                |                             |

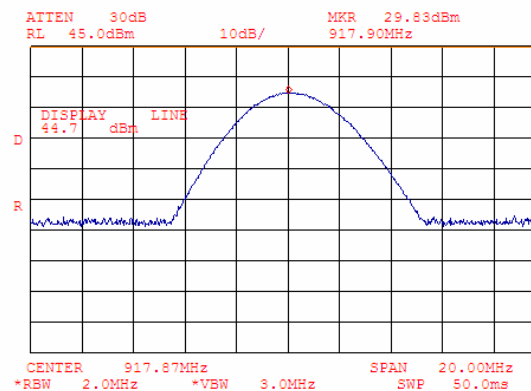
Plot 7.1.10 Peak output power test results at antenna No.3 at low carrier frequency



Plot 7.1.11 Peak output power test results at antenna No.3 at mid carrier frequency



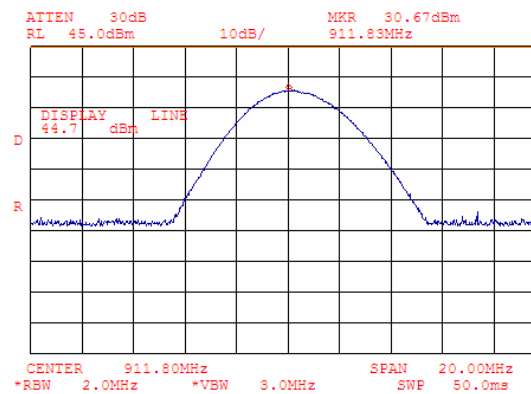
Plot 7.1.12 Peak output power test results at antenna No.3 at high carrier frequency



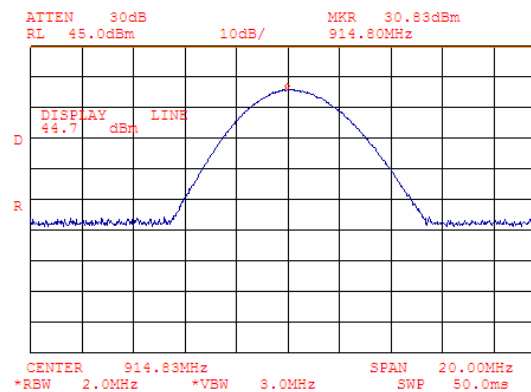


|                     |                                                      |                         |                      |
|---------------------|------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.205, Maximum output power                 |                         |                      |
| Test procedure:     | 47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1 |                         |                      |
| Test mode:          | Compliance                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 11:22:49 AM                                |                         |                      |
| Temperature: 24 °C  | Air Pressure: 1011 hPa                               | Relative Humidity: 46 % | Power Supply: 12 VDC |
| Remarks:            |                                                      |                         |                      |

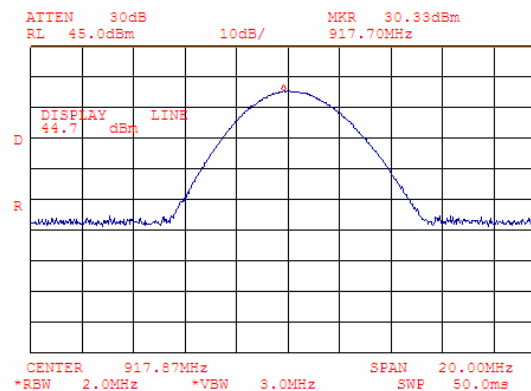
Plot 7.1.13 Peak output power test results at antenna No.4 at low carrier frequency



Plot 7.1.14 Peak output power test results at antenna No.4 at mid carrier frequency



Plot 7.1.15 Peak output power test results at antenna No.4 at high carrier frequency





|                            |                                           |                                |                             |
|----------------------------|-------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.209, Occupied bandwidth</b> |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Section 2.1049                    |                                |                             |
| <b>Test mode:</b>          | Compliance                                | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 11:57:06 AM                     |                                |                             |
| <b>Temperature:</b> 24 °C  | <b>Air Pressure:</b> 1010 hPa             | <b>Relative Humidity:</b> 43 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                           |                                |                             |

## 7.2 Occupied bandwidth test

### 7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1. The test results are provided in Table 7.2.2 and the associated plots.

**Table 7.2.1 Occupied bandwidth limits**

| Assigned frequency, MHz | Modulation envelope reference points*, dBc | Maximum allowed bandwidth, MHz |
|-------------------------|--------------------------------------------|--------------------------------|
| 902 - 928               | 26                                         | 12                             |

\* - Modulation envelope reference points are provided in terms of attenuation below the unmodulated carrier.

### 7.2.2 Test procedure

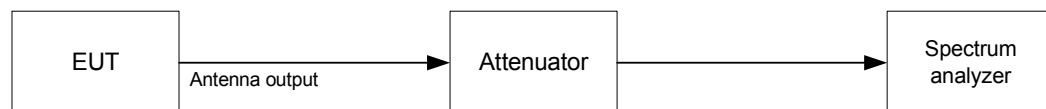
**7.2.2.1** The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

**7.2.2.2** The EUT was set to transmit the unmodulated carrier and the reference peak power level was measured.

**7.2.2.3** The EUT was set to transmit the normally modulated carrier.

**7.2.2.4** The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.2.2 and the associated plots.

**Figure 7.2.1 Occupied bandwidth test setup**





|                            |                                           |                                |                             |
|----------------------------|-------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.209, Occupied bandwidth</b> |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Section 2.1049                    |                                |                             |
| <b>Test mode:</b>          | Compliance                                | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 11:57:06 AM                     |                                |                             |
| <b>Temperature:</b> 24 °C  | <b>Air Pressure:</b> 1010 hPa             | <b>Relative Humidity:</b> 43 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                           |                                |                             |

**Table 7.2.2 Occupied bandwidth test results**

MODE OF OPERATION: Continuous transmission  
 DETECTOR USED: Peak hold  
 RESOLUTION BANDWIDTH: 30 kHz\*  
 VIDEO BANDWIDTH: 100 kHz  
 MODULATION ENVELOPE REFERENCE POINTS: 26 dBc  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 500 kbps

| Carrier frequency, MHz | Occupied bandwidth, MHz | Limit, MHz | Margin, MHz | Verdict |
|------------------------|-------------------------|------------|-------------|---------|
| 912                    | 2.550                   | 12.0       | -9.450      | Pass    |
| 915                    | 2.550                   | 12.0       | -9.450      | Pass    |
| 918                    | 2.575                   | 12.0       | -9.425      | Pass    |

\* RBW > 1% of OBW, if 1% of 2.6 MHz is 26 kHz, then RBW = 30 kHz

**Reference numbers of test equipment used**

|         |         |         |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|
| HL 1653 | HL 2399 | HL 2524 |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|

Full description is given in Appendix A.



|                     |                                    |                         |                      |
|---------------------|------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.209, Occupied bandwidth |                         |                      |
| Test procedure:     | 47 CFR, Section 2.1049             |                         |                      |
| Test mode:          | Compliance                         | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 11:57:06 AM              |                         |                      |
| Temperature: 24 °C  | Air Pressure: 1010 hPa             | Relative Humidity: 43 % | Power Supply: 12 VDC |
| Remarks:            |                                    |                         |                      |

Plot 7.2.1 Occupied bandwidth test result at low carrier frequency



Plot 7.2.2 Occupied bandwidth test result at mid carrier frequency



Plot 7.2.3 Occupied bandwidth test result at high carrier frequency





|                            |                                                                              |                                |                             |
|----------------------------|------------------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Emission mask</b>                                         |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                                   | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 11:19:07 AM                                                        |                                |                             |
| <b>Temperature:</b> 23 °C  | <b>Air Pressure:</b> 1010 hPa                                                | <b>Relative Humidity:</b> 48 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                              |                                |                             |

## 7.3 Emission mask test

### 7.3.1 General

This test was performed to measure emission mask at RF antenna connector. Specification test limits are given in Table 7.3.1. The test results are provided in Table 7.3.2 and the associated plots.

Table 7.3.1 Emission mask limits

| Frequency displacement from carrier | Attenuation below carrier, dBc |
|-------------------------------------|--------------------------------|
| Emission mask K (3)                 |                                |
| 0 – 12.0 MHz                        | 0                              |
| More than 12.0 MHz                  | 55+10logP(W)                   |

### 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 emission mask was measured with spectrum analyzer as provided in the associated plots.

Figure 7.3.1 Emission mask test setup

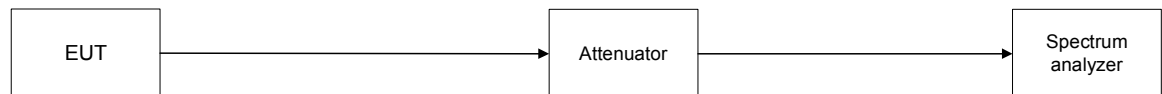


Table 7.3.2 Emission mask test results

ASSIGNED FREQUENCY RANGE: 902 - 928 MHz  
 DETECTOR USED: Peak  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 0.5 Mbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

| Carrier frequency, MHz | Limit           | Verdict |
|------------------------|-----------------|---------|
| 912                    | Emission mask K | Pass    |
| 915                    |                 |         |
| 918                    |                 |         |

### Reference numbers of test equipment used

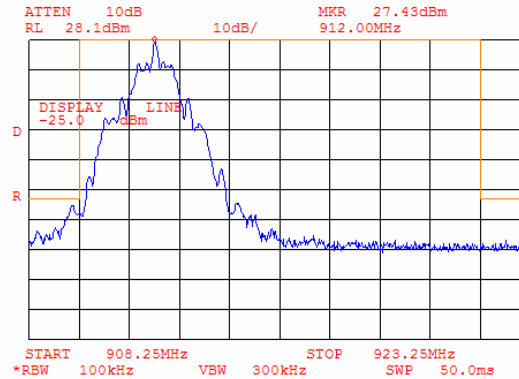
|         |         |         |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|
| HL 1424 | HL 2399 | HL 2524 |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|

Full description is given in Appendix A.



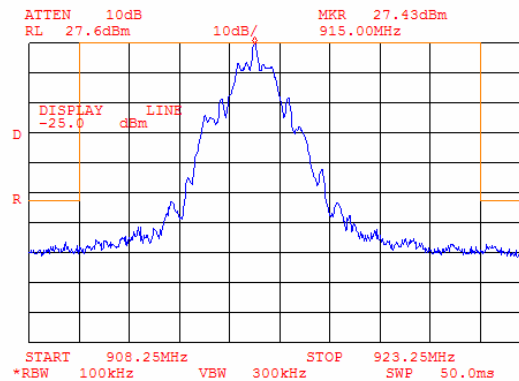
|                            |                                                                              |                                |                             |
|----------------------------|------------------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Emission mask</b>                                         |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                                   | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 11:19:07 AM                                                        |                                |                             |
| <b>Temperature:</b> 23 °C  | <b>Air Pressure:</b> 1010 hPa                                                | <b>Relative Humidity:</b> 48 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                              |                                |                             |

Plot 7.3.1 Emission mask test results at low carrier frequency



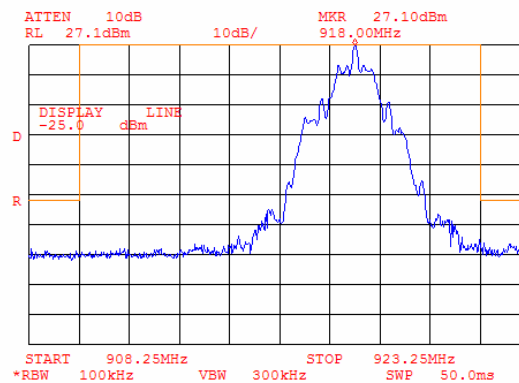
Attenuation below carrier:  $55 + 10 \log P(W) = 55.83$  (dBc)

Plot 7.3.2 Emission mask test results at mid carrier frequency



Attenuation below carrier:  $55 + 10 \log P(W) = 56.17$  (dBc)

Plot 7.3.3 Emission mask test results at high carrier frequency



Attenuation below carrier:  $55 + 10 \log P(W) = 55.83$  (dBc)



|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Conducted spurious emissions</b>                  |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 1:14:02 PM                                                 |                                |                             |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                        | <b>Relative Humidity:</b> 47 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

## 7.4 Spurious emissions at RF antenna connector test

### 7.4.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.4.1. The test results are provided in Table 7.4.2 and associated plots.

**Table 7.4.1 Spurious emission limits**

| Frequency, MHz                     | Attenuation below carrier, dBc | ERP of spurious, dBm |
|------------------------------------|--------------------------------|----------------------|
| 0.009 – 10 <sup>th</sup> harmonic* | 55+10logP** (mask K(3))        | -25.0                |

\* - spurious emission limits do not apply to the in band emission within  $\pm 250$  % of the authorized bandwidth from the carrier; investigated in course of emission mask testing

\*\* - P is transmitter output power in Watts

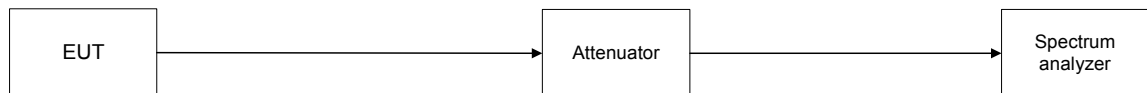
### 7.4.2 Test procedure

**7.4.2.1** The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.

**7.4.2.2** The EUT was adjusted to produce maximum available for end user RF output power.

**7.4.2.3** The spurious emission was measured with spectrum analyzer as provided in Table 7.4.2 and associated plots.

**Figure 7.4.1 Spurious emission at RF antenna connector test setup**





|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Table 7.4.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 902 - 928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 10000 MHz  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: ≥ Resolution bandwidth  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 0.5 Mbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 TRANSMITTER OUTPUT POWER: 30.83 dBm at low carrier frequency  
 31.17 dBm at mid carrier frequency  
 30.83 dBm at high carrier frequency

| Frequency, MHz                | SA reading, dBm | Attenuator, dB | Cable loss, dB | RBW, kHz | Spurious emission, dBm | Attenuation below carrier, dBc | Limit, dBc | Margin, dB* | Verdict |
|-------------------------------|-----------------|----------------|----------------|----------|------------------------|--------------------------------|------------|-------------|---------|
| <b>Low carrier frequency</b>  |                 |                |                |          |                        |                                |            |             |         |
| 0.249                         | -41.00          | Included       | Included       | 10       | -41.00                 | 71.83                          | 55.83      | 16.00       | Pass    |
| 0.842                         | -36.79          | Included       | Included       | 100      | -36.79                 | 67.62                          | 55.83      | 11.79       | Pass    |
| 0.614                         | -39.42          | Included       | Included       | 100      | -39.42                 | 70.25                          | 55.83      | 14.42       | Pass    |
| 0.925                         | -26.96          | Included       | Included       | 100      | -26.96                 | 57.79                          | 55.83      | 1.96        | Pass    |
| 1824.000                      | -36.74          | Included       | Included       | 100      | -36.74                 | 67.57                          | 55.83      | 11.74       | Pass    |
| 2735.975                      | -42.90          | Included       | Included       | 100      | -42.90                 | 73.73                          | 55.83      | 17.90       | Pass    |
| <b>Mid carrier frequency</b>  |                 |                |                |          |                        |                                |            |             |         |
| 0.249                         | -40.83          | Included       | Included       | 10       | -40.83                 | 72.00                          | 56.17      | 15.83       | Pass    |
| 0.845                         | -34.53          | Included       | Included       | 100      | -34.53                 | 65.70                          | 56.17      | 9.53        | Pass    |
| 0.612                         | -39.86          | Included       | Included       | 100      | -39.86                 | 71.03                          | 56.17      | 14.86       | Pass    |
| 0.925                         | -27.58          | Included       | Included       | 100      | -27.58                 | 58.75                          | 56.17      | 2.58        | Pass    |
| 1830.000                      | -36.87          | Included       | Included       | 100      | -36.87                 | 68.04                          | 56.17      | 11.87       | Pass    |
| 2744.987                      | -43.34          | Included       | Included       | 100      | -43.34                 | 74.51                          | 56.17      | 18.34       | Pass    |
| <b>High carrier frequency</b> |                 |                |                |          |                        |                                |            |             |         |
| 0.250                         | -41.33          | Included       | Included       | 10       | -41.33                 | 72.16                          | 55.83      | 16.33       | Pass    |
| 0.848                         | -32.31          | Included       | Included       | 100      | -32.31                 | 63.14                          | 55.83      | 7.31        | Pass    |
| 0.615                         | -39.67          | Included       | Included       | 100      | -39.67                 | 70.50                          | 55.83      | 14.67       | Pass    |
| 0.925                         | -27.87          | Included       | Included       | 100      | -27.87                 | 58.70                          | 55.83      | 2.87        | Pass    |
| 1836.000                      | -37.77          | Included       | Included       | 100      | -37.77                 | 68.60                          | 55.83      | 12.77       | Pass    |
| 2754.075                      | -43.63          | Included       | Included       | 100      | -43.63                 | 74.46                          | 55.83      | 18.63       | Pass    |

\*- Margin = Attenuation below carrier – specification limit.

#### Reference numbers of test equipment used

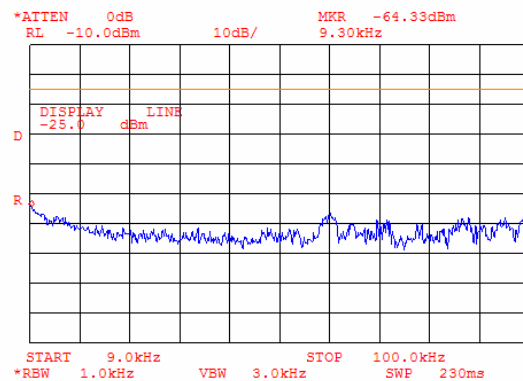
|         |         |         |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|
| HL 1424 | HL 2399 | HL 2524 |  |  |  |  |  |
|---------|---------|---------|--|--|--|--|--|

Full description is given in Appendix A.

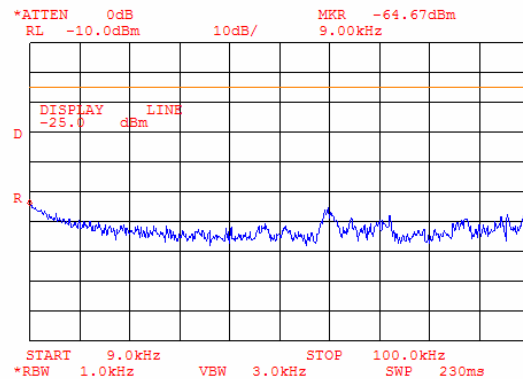


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

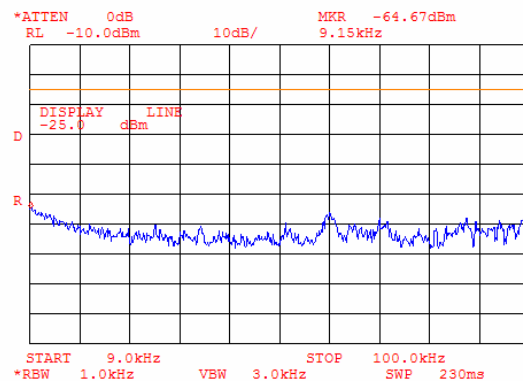
Plot 7.4.1 Spurious emission measurements in 9 - 100 kHz range at low carrier frequency



Plot 7.4.2 Spurious emission measurements in 9 - 100 kHz range at mid carrier frequency



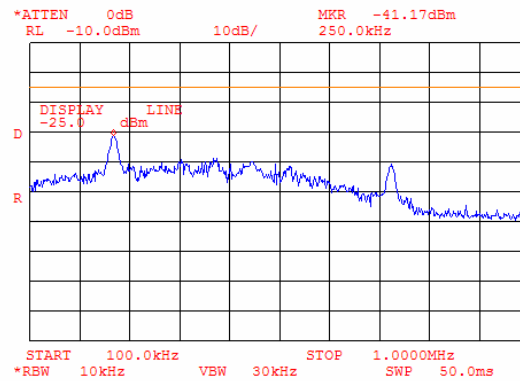
Plot 7.4.3 Spurious emission measurements in 9 - 100 kHz range at high carrier frequency



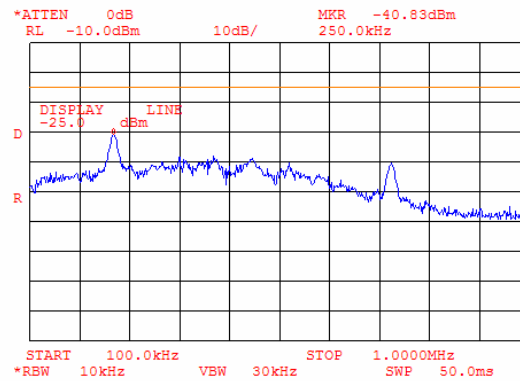


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.4.4 Spurious emission measurements in 0.10 - 1.0 MHz range at low carrier frequency



Plot 7.4.5 Spurious emission measurements in 0.10 - 1.0 MHz range at mid carrier frequency



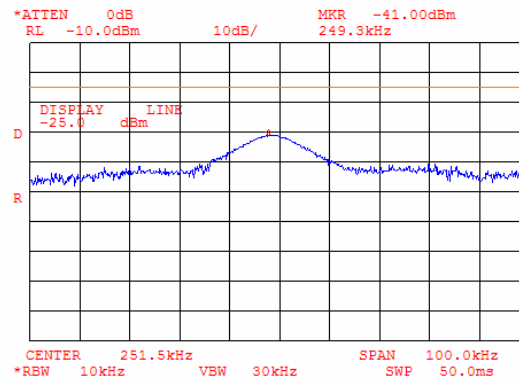
Plot 7.4.6 Spurious emission measurements in 0.10 - 1.0 MHz range at high carrier frequency



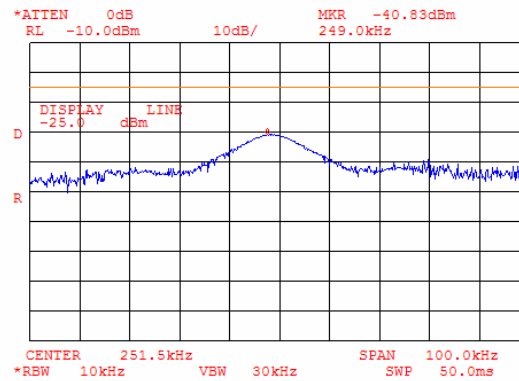


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

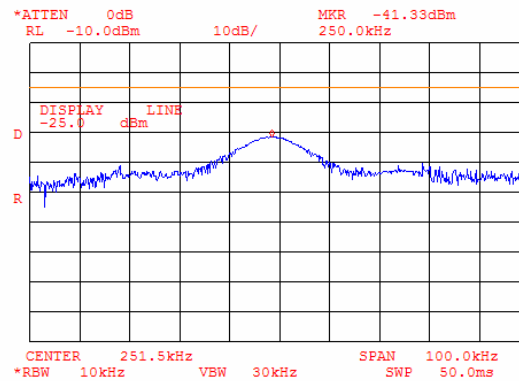
Plot 7.4.7 Spurious emission measurement at 250 kHz at low carrier frequency



Plot 7.4.8 Spurious emission measurement at 250 kHz at mid carrier frequency



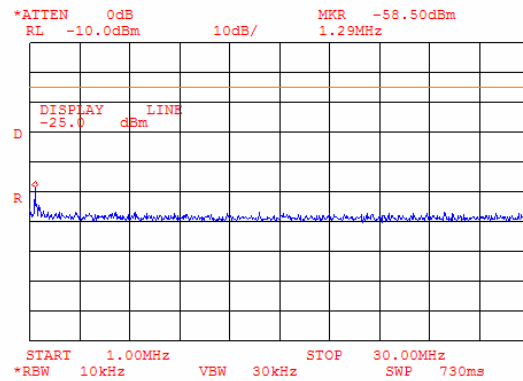
Plot 7.4.9 Spurious emission measurement at 250 kHz at high carrier frequency



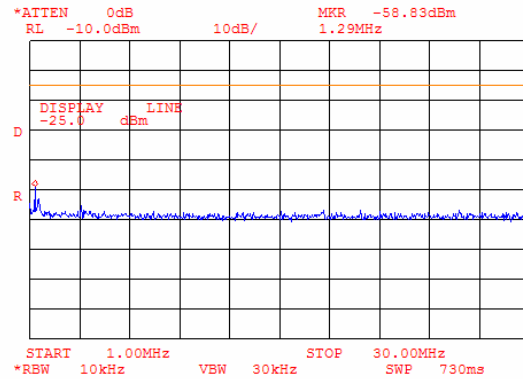


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

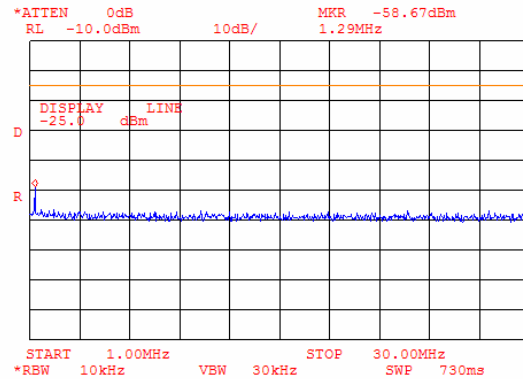
Plot 7.4.10 Spurious emission measurements in 1.0 - 30 MHz range at low carrier frequency



Plot 7.4.11 Spurious emission measurements in 1.0 - 30 MHz range at mid carrier frequency



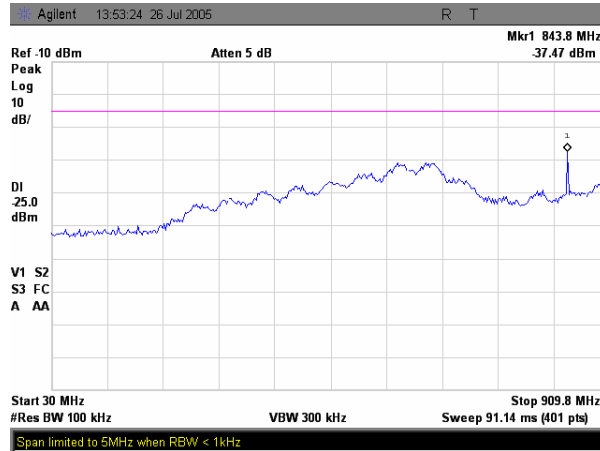
Plot 7.4.12 Spurious emission measurements in 1.0 - 30 MHz range at high carrier frequency



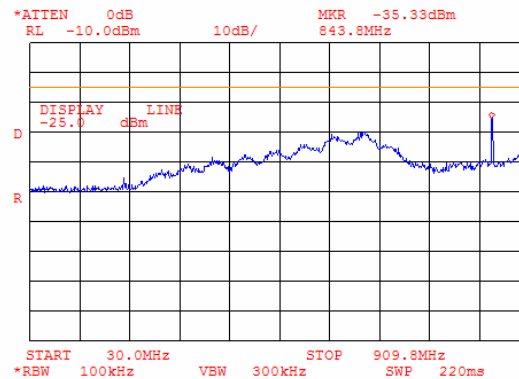


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

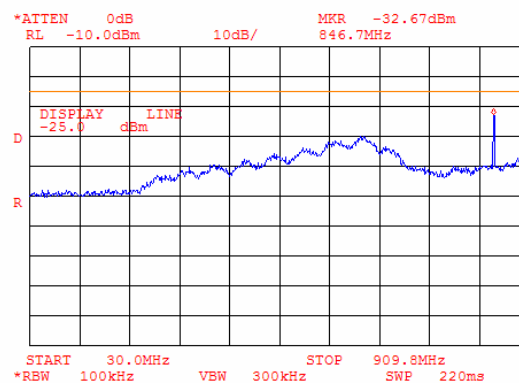
Plot 7.4.13 Spurious emission measurements in 30 – 909.75 MHz range at low carrier frequency



Plot 7.4.14 Spurious emission measurements in 30 – 909.8 MHz range at mid carrier frequency



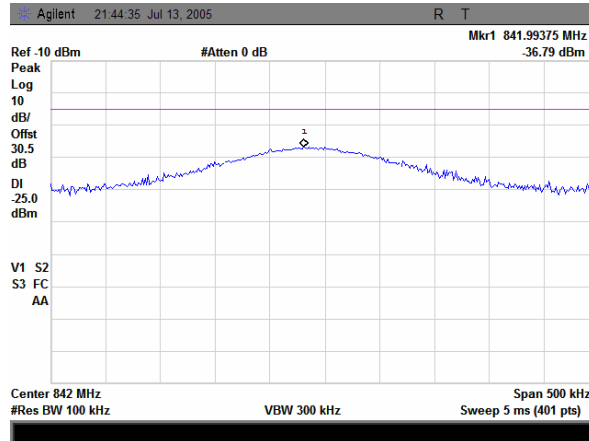
Plot 7.4.15 Spurious emission measurements in 30 – 909.8 MHz range at high carrier frequency



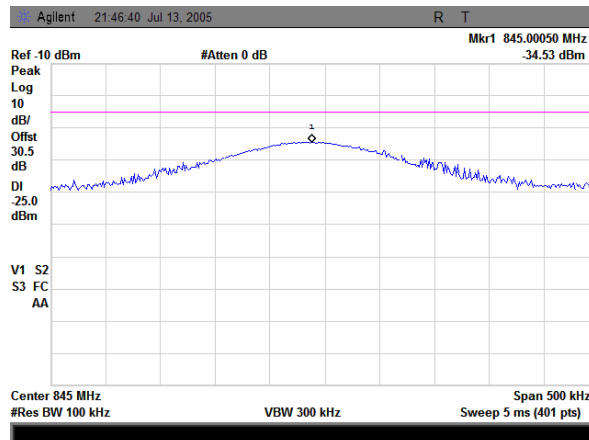


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

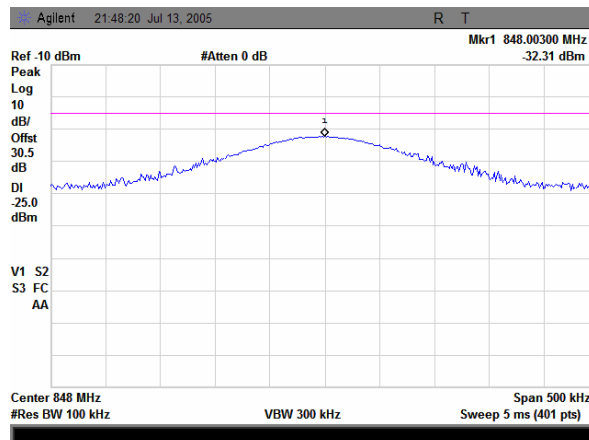
Plot 7.4.16 Spurious emission measurement at 842 MHz at low carrier frequency



Plot 7.4.17 Spurious emission measurement at 845 MHz at mid carrier frequency



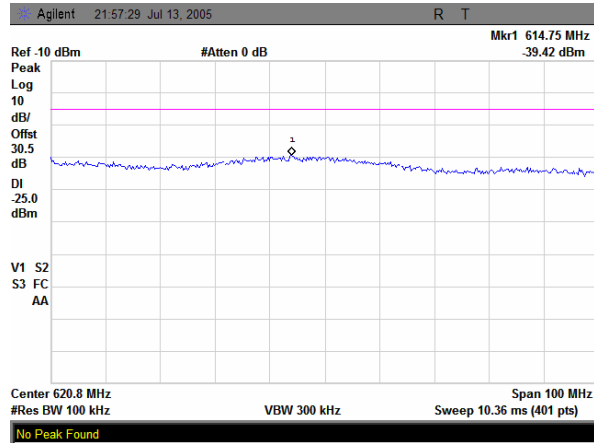
Plot 7.4.18 Spurious emission measurement at 848 MHz at high carrier frequency



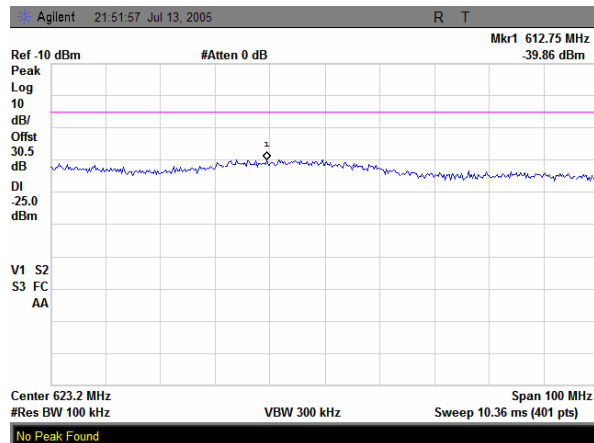


|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Conducted spurious emissions</b>                  |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 1:14:02 PM                                                 |                                |                             |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                        | <b>Relative Humidity:</b> 47 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

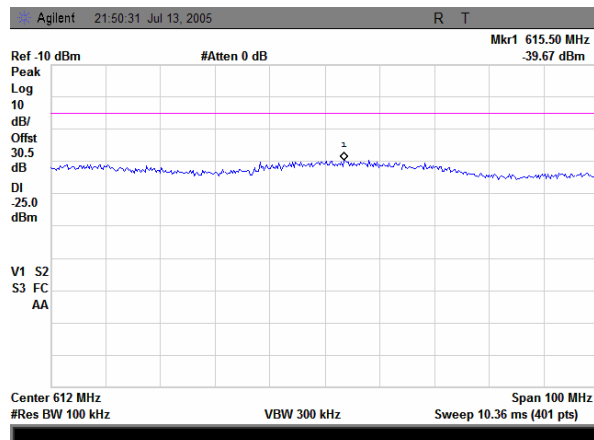
Plot 7.4.19 Spurious emission measurement at 614 MHz at low carrier frequency



Plot 7.4.20 Spurious emission measurement at 612 MHz at mid carrier frequency



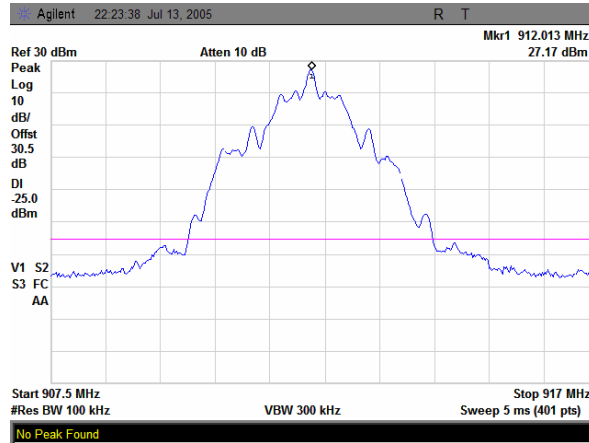
Plot 7.4.21 Spurious emission measurement at 615 MHz at high carrier frequency





|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Conducted spurious emissions</b>                  |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | PASS                        |
| <b>Date &amp; Time:</b>    | 7/18/2005 1:14:02 PM                                                 |                                |                             |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                        | <b>Relative Humidity:</b> 47 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

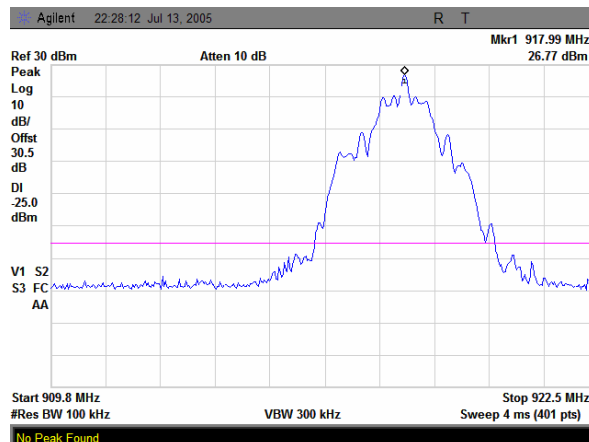
Plot 7.4.22 Spurious emission measurements in 907.5 – 917 MHz range at low carrier frequency



Plot 7.4.23 Spurious emission measurements in 909.8 – 919.5 MHz range at mid carrier frequency



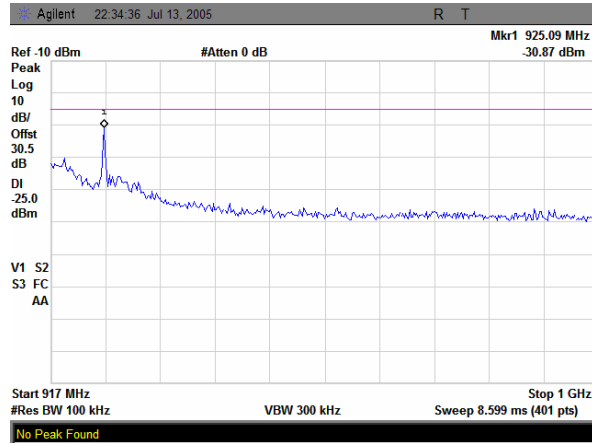
Plot 7.4.24 Spurious emission measurements in 909.8 – 922.5 MHz range at high carrier frequency



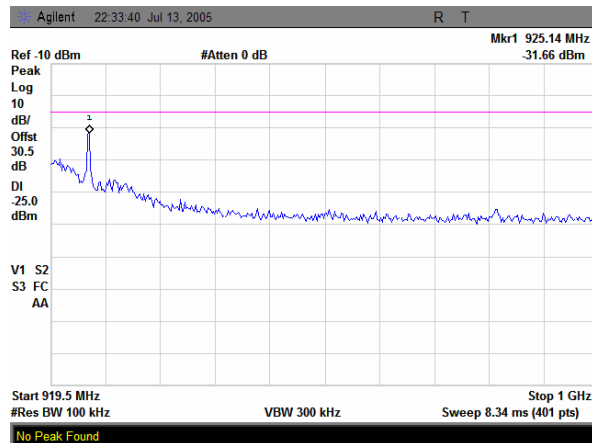


|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Conducted spurious emissions</b>                  |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | PASS                        |
| <b>Date &amp; Time:</b>    | 7/18/2005 1:14:02 PM                                                 |                                |                             |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                        | <b>Relative Humidity:</b> 47 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

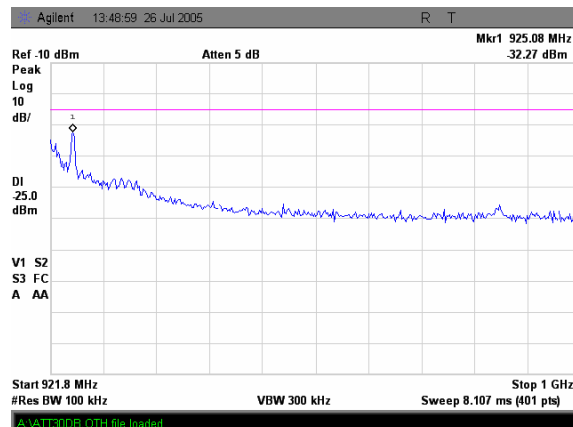
Plot 7.4.25 Spurious emission measurements in 917 – 1000 MHz range at low carrier frequency



Plot 7.4.26 Spurious emission measurements in 919.5 – 1000 MHz range at mid carrier frequency



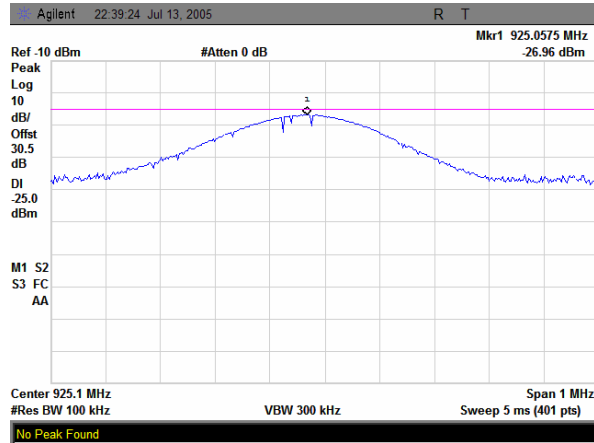
Plot 7.4.27 Spurious emission measurements in 921.75 – 1000 MHz range at high carrier frequency



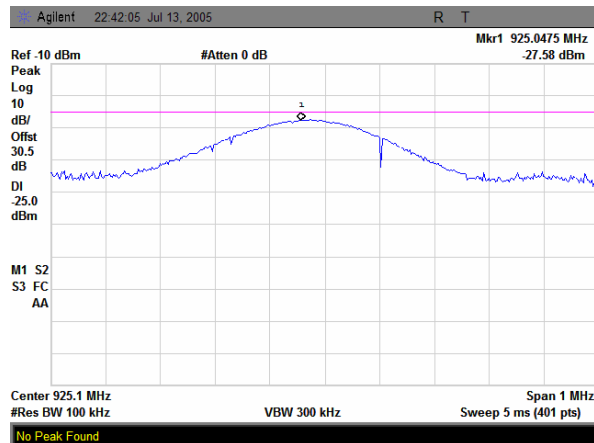


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

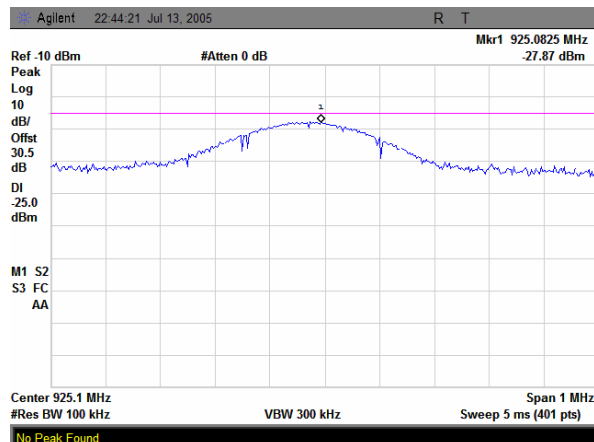
Plot 7.4.28 Spurious emission measurement at 925 MHz at low carrier frequency



Plot 7.4.29 Spurious emission measurement at 925 MHz at mid carrier frequency



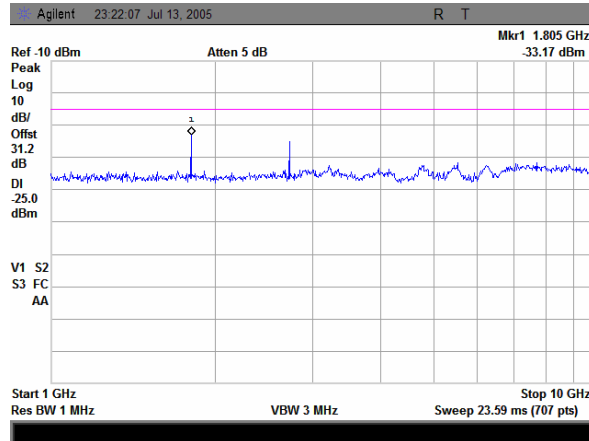
Plot 7.4.30 Spurious emission measurement at 925 MHz at high carrier frequency



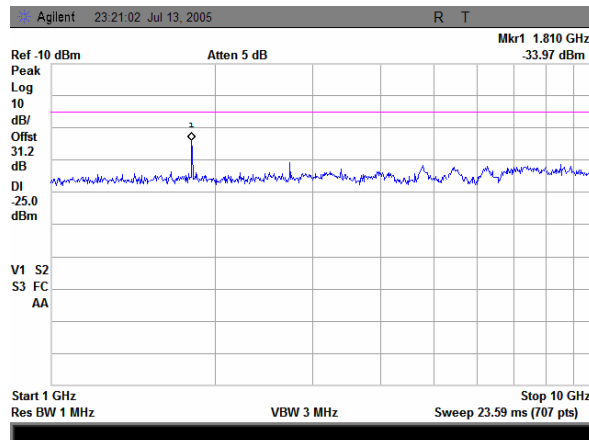


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

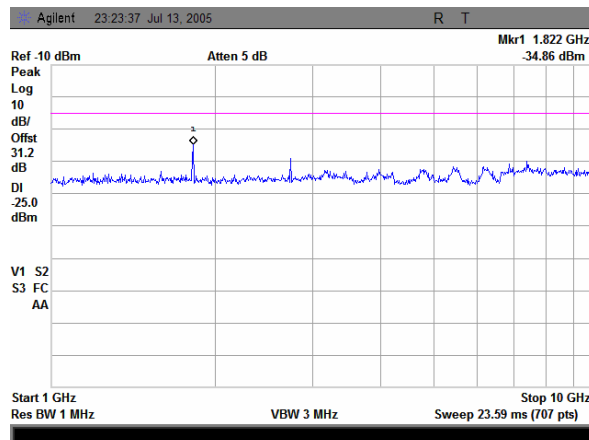
Plot 7.4.31 Spurious emission measurements in 1000 - 10000 MHz range at low carrier frequency



Plot 7.4.32 Spurious emission measurements in 1000 - 10000 MHz at mid carrier frequency

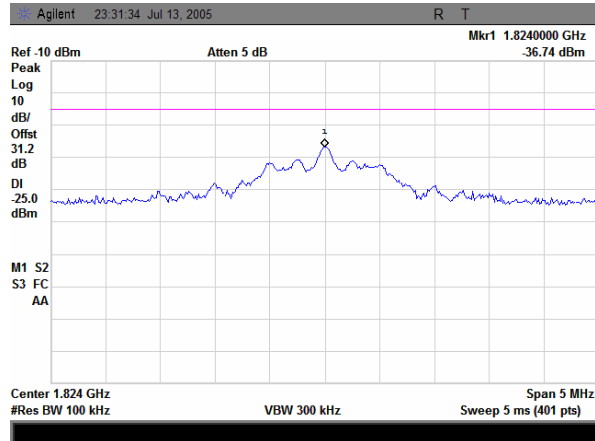
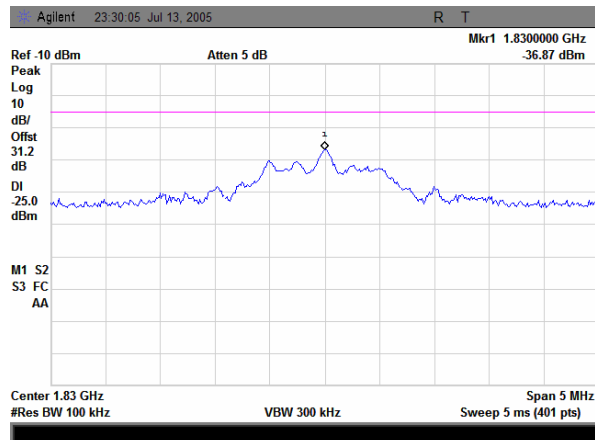
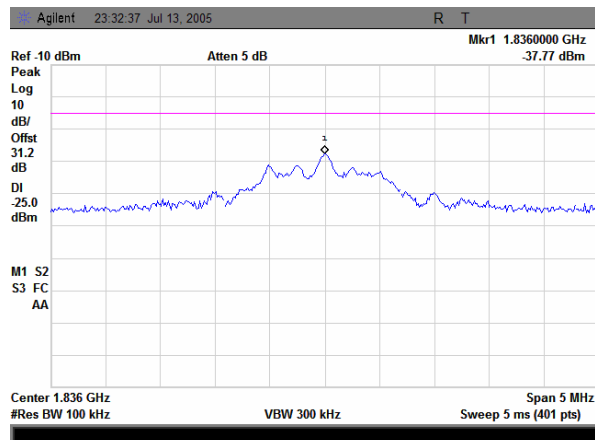


Plot 7.4.33 Spurious emission measurements in 1000 - 10000 MHz at high carrier frequency



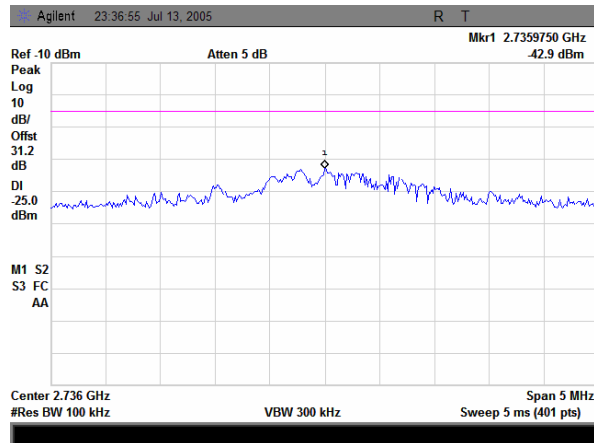
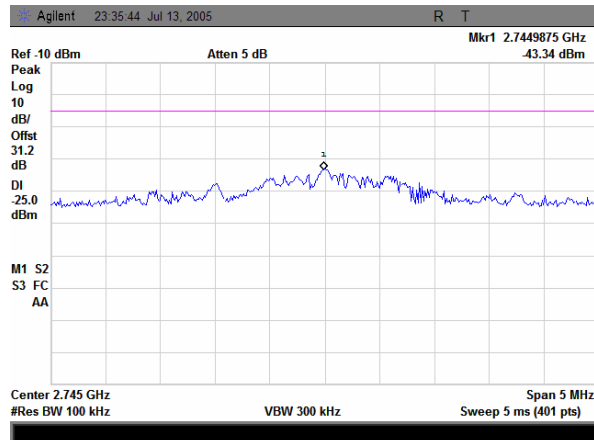
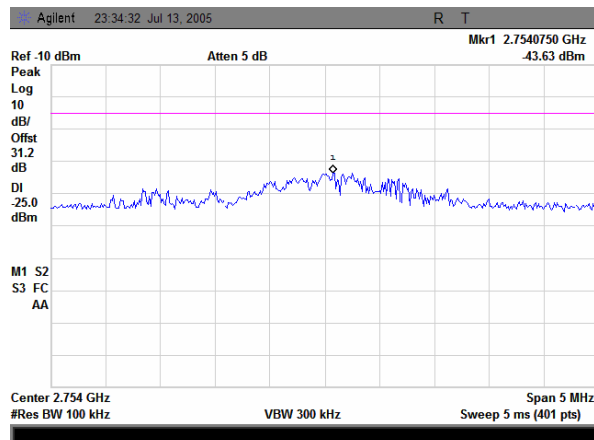


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.4.34 Conducted spurious emission measurements at the 2<sup>nd</sup> harmonic of low carrier frequencyPlot 7.4.35 Conducted spurious emission measurements at the 2<sup>nd</sup> harmonic of mid carrier frequencyPlot 7.4.36 Conducted spurious emission measurements at the 2<sup>nd</sup> harmonic of high carrier frequency



|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Conducted spurious emissions                         |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:14:02 PM                                                 |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                               | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.4.37 Conducted spurious emission measurements at the 3<sup>rd</sup> harmonic of low carrier frequencyPlot 7.4.38 Conducted spurious emission measurements at the 3<sup>rd</sup> harmonic of mid carrier frequencyPlot 7.4.39 Conducted spurious emission measurements at the 3<sup>rd</sup> harmonic of high carrier frequency



|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

## 7.5 Radiated spurious emission measurements

### 7.5.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.5.1.

**Table 7.5.1 Radiated spurious emission test limits**

| Frequency, MHz                     | Attenuation below carrier, dBc | ERP of spurious, dBm | Equivalent field strength limit @ 3m, dB(μV/m)*** |
|------------------------------------|--------------------------------|----------------------|---------------------------------------------------|
| 0.009 – 10 <sup>th</sup> harmonic* | 55+10logP**                    | -25                  | 72.4                                              |

\* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier

\*\* - P is transmitter output power in Watts

\*\*\* - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows:  $E = \sqrt{30 \times P \times 1.64} / r$ , where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

### 7.5.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

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

**7.5.2.2** The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

**7.5.2.3** The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

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

**7.5.3.1** The EUT was set up as shown in Figure 7.5.2, energized and the performance check was conducted.

**7.5.3.2** The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

**7.5.3.3** The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

### 7.5.4 Test procedure for substitution ERP measurements of spurious

**7.5.4.1** The test equipment was set up as shown in Figure 7.5.3 and energized.

**7.5.4.2** RF signal generator was set to the frequency of investigated spurious emission and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

**7.5.4.3** The test antenna height was swept from 1 to 4 m to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

**7.5.4.4** The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.

**7.5.4.5** The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

**7.5.4.6** The above procedure was repeated at the rest of investigated frequencies.

**7.5.4.7** The worst test results (the lowest margins) were recorded in Table 7.5.3 and shown in the associated plots.



|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

Figure 7.5.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

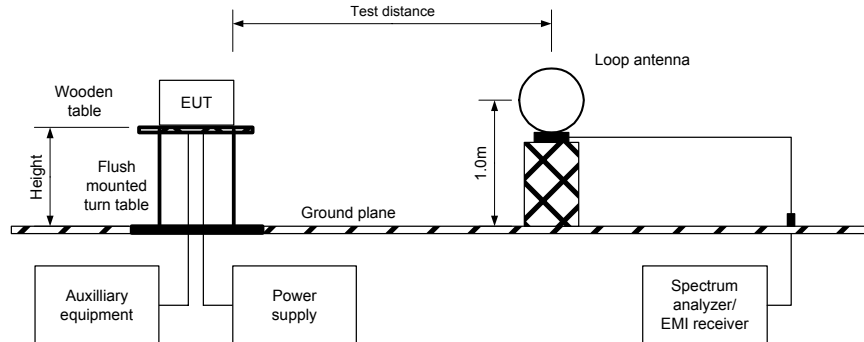
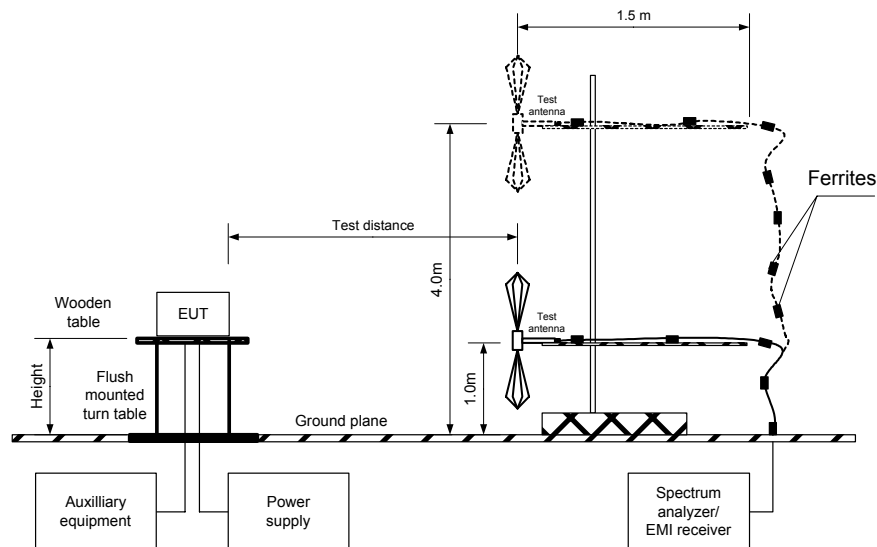


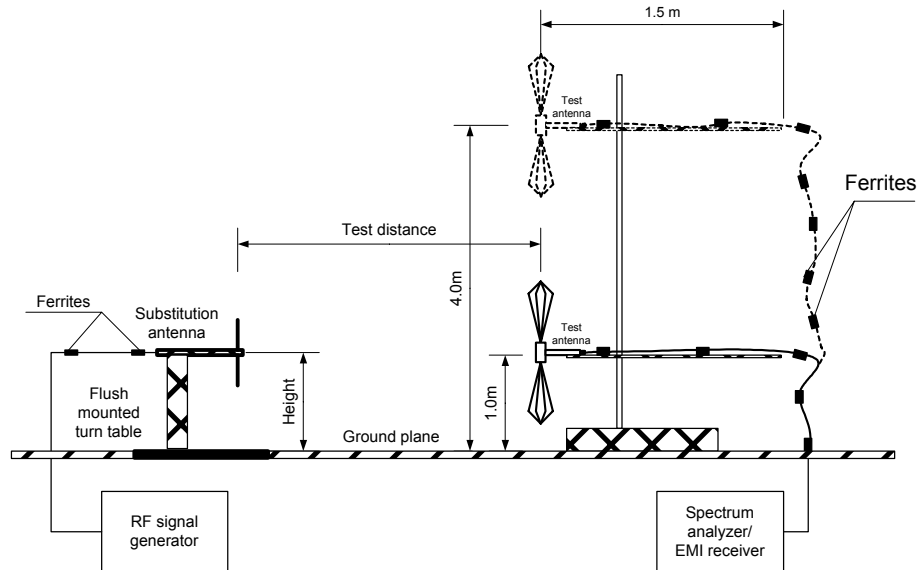
Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz





|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

Figure 7.5.3 Setup for substitution ERP measurements of spurious





|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Table 7.5.2 Spurious emission field strength test results**

ASSIGNED FREQUENCY RANGE: 902 - 928 MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: Semi anechoic chamber / OATS  
 EUT HEIGHT: 0.8 m  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 10000 MHz  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: > Resolution bandwidth  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 0.5 Mbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

| Frequency, MHz                | Field strength, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* | RBW, kHz | Antenna polarization | Antenna height, m | Turn-table position**, degrees |
|-------------------------------|--------------------------|-----------------|-------------|----------|----------------------|-------------------|--------------------------------|
| <b>Low carrier frequency</b>  |                          |                 |             |          |                      |                   |                                |
| 2736.200                      | 51.50                    | 72.4            | -20.9       | 1000     | Vertical             | 1.1               | 118                            |
| <b>Mid carrier frequency</b>  |                          |                 |             |          |                      |                   |                                |
| 2745.130                      | 53.00                    | 72.4            | -19.4       | 1000     | Vertical             | 1.0               | 133                            |
| <b>High carrier frequency</b> |                          |                 |             |          |                      |                   |                                |
| 2754.320                      | 51.00                    | 72.4            | -21.4       | 1000     | Vertical             | 1.0               | 129                            |

\*- Margin = Field strength of spurious – calculated field strength limit.

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

**Table 7.5.3 Substitution ERP of spurious test results**

ASSIGNED FREQUENCY RANGE: 902 - 928 MHz  
 TRANSMITTER CARRIER ERP: 30.83 dBm at low frequency  
 31.17 dBm at mid frequency  
 30.83 dBm at high frequency  
 TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 SUBSTITUTION ANTENNA HEIGHT: 0.8 m  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: > Resolution bandwidth  
 SUBSTITUTION ANTENNA TYPE: Double ridged guide (above 1000 MHz)

| Frequency, MHz                | Field strength, dB(μV/m) | RBW, kHz | Antenna polarization | RF generator output, dBm | Ant gain, dBd | Cable loss, dB | ERP, dBm | Attenuation below carrier, dBc | Limit, dBc | Margin, dB* | Verdict |
|-------------------------------|--------------------------|----------|----------------------|--------------------------|---------------|----------------|----------|--------------------------------|------------|-------------|---------|
| <b>Low carrier frequency</b>  |                          |          |                      |                          |               |                |          |                                |            |             |         |
| 2736.200                      | 51.50                    | 1000     | Vertical             | -48.52                   | 5.47          | 3.48           | -46.53   | 77.36                          | 55.83      | 21.53       | Pass    |
| <b>Mid carrier frequency</b>  |                          |          |                      |                          |               |                |          |                                |            |             |         |
| 2745.130                      | 53.00                    | 1000     | Vertical             | -47.02                   | 5.49          | 3.54           | -40.77   | 71.94                          | 56.17      | 15.77       | Pass    |
| <b>High carrier frequency</b> |                          |          |                      |                          |               |                |          |                                |            |             |         |
| 2754.320                      | 51.00                    | 1000     | Vertical             | -49.02                   | 5.51          | 3.61           | -42.82   | 73.65                          | 55.83      | 17.82       | Pass    |

\*- Margin = Spurious emission – specification limit.

**Reference numbers of test equipment used**

|         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 0410 | HL 0446 | HL 0521 | HL 0589 | HL 0604 | HL 0661 | HL 1200 | HL 1424 |
| HL 1941 | HL 1984 | HL 2009 | HL 2259 | HL 2399 | HL 2400 | HL 2432 | HL 2499 |

Full description is given in Appendix A.

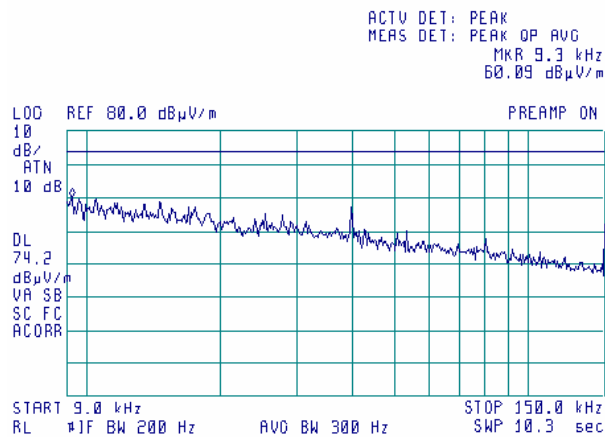


|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.1 Radiated emission measurements in 9 - 150 kHz range**

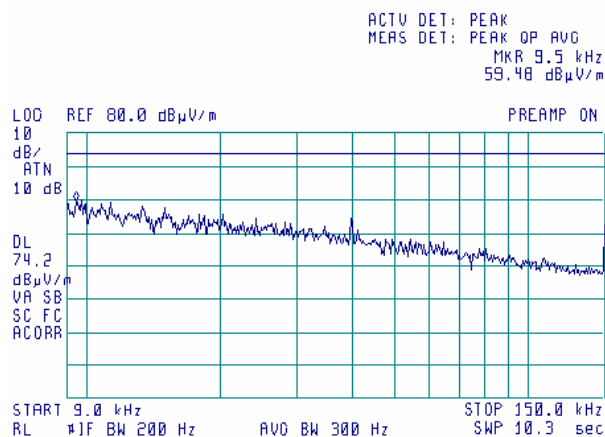
TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Low  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

13:20:26 JUL 07, 2005

**Plot 7.5.2 Radiated emission measurements in 9 - 150 kHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Mid  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

13:15:16 JUL 07, 2005



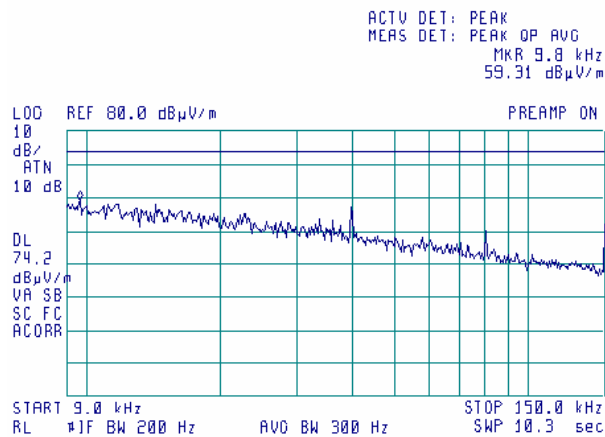


|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.3 Radiated emission measurements in 9 - 150 kHz range**

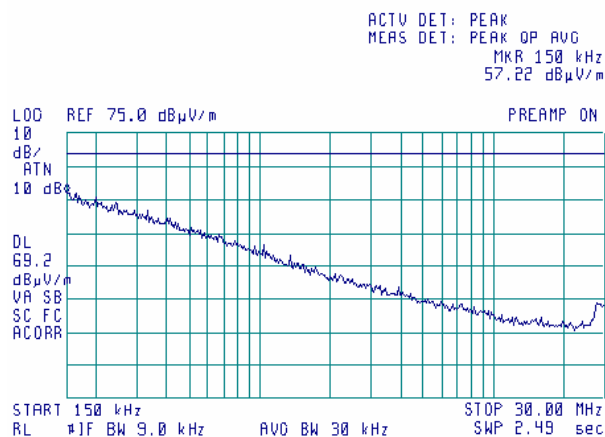
TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: High  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

13:24:25 JUL 07, 2005

**Plot 7.5.4 Radiated emission measurements in 0.15 - 30 MHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Low  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

13:36:02 JUL 07, 2005



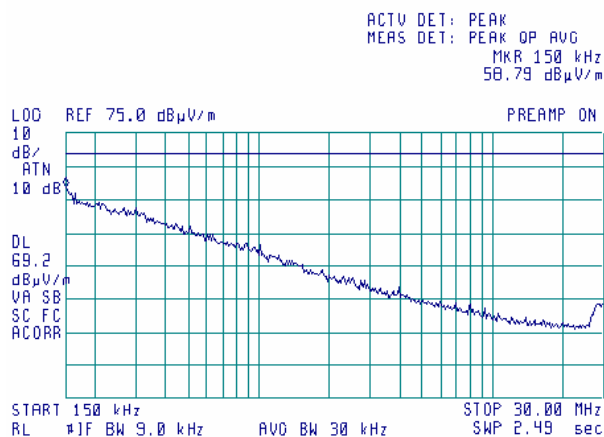


|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.5 Radiated emission measurements in 0.15 - 30 MHz range**

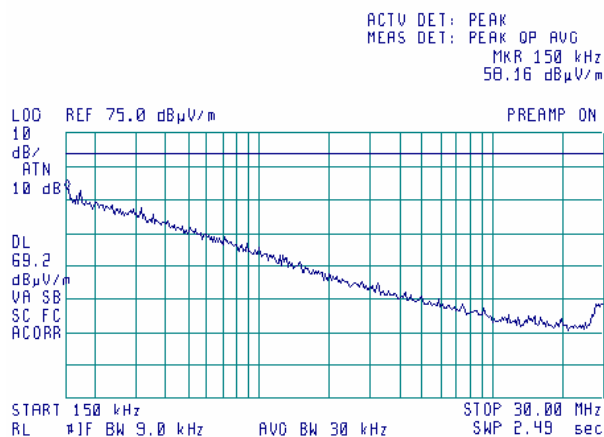
TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Mid  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

13:31:49 JUL 07, 2005

**Plot 7.5.6 Radiated emission measurements in 0.15 - 30 MHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: High  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

13:28:11 JUL 07, 2005



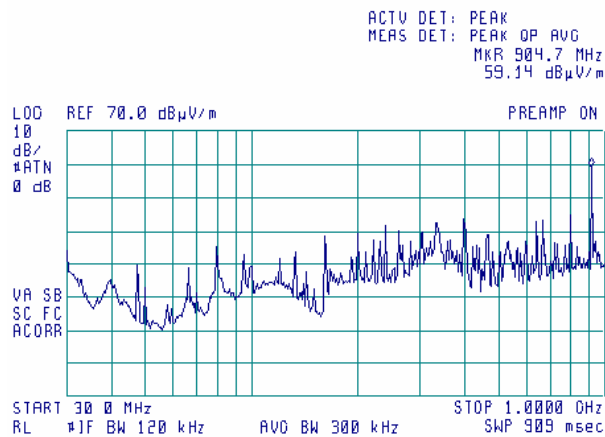


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

**Plot 7.5.7 Radiated emission measurements in 30 - 1000 MHz range**

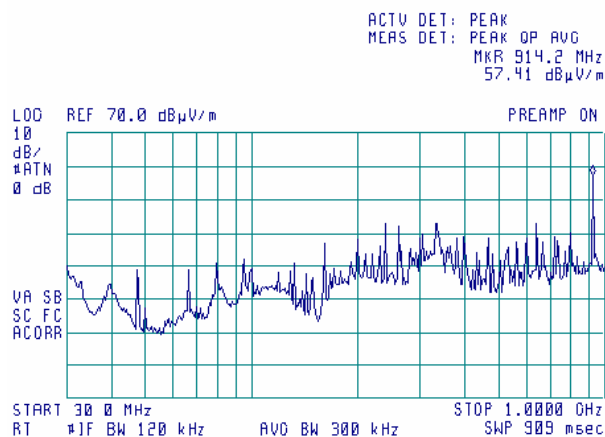
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m

12:21:23 JUL 07, 2005

**Plot 7.5.8 Radiated emission measurements in 30 - 1000 MHz range**

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m

12:34:24 JUL 07, 2005



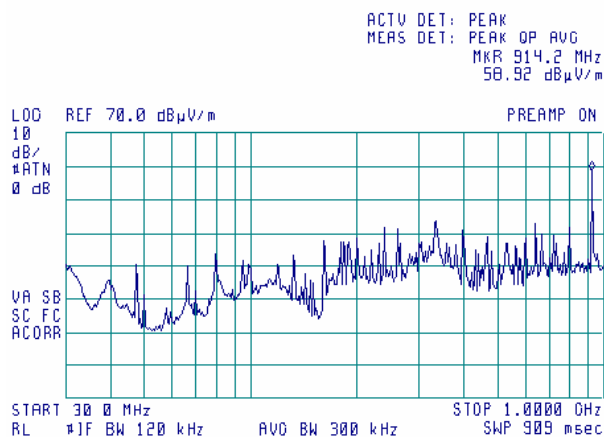


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

**Plot 7.5.9 Radiated emission measurements in 30 - 1000 MHz range**

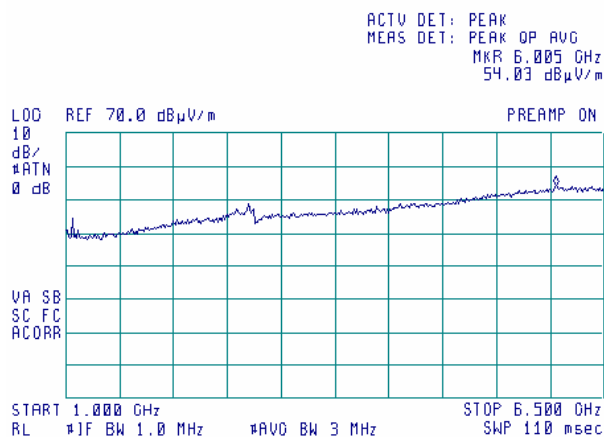
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m

12:30:57 JUL 07, 2005

**Plot 7.5.10 Radiated emission measurements in 1000 - 6500 MHz range**

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m

11:11:46 JUL 07, 2005



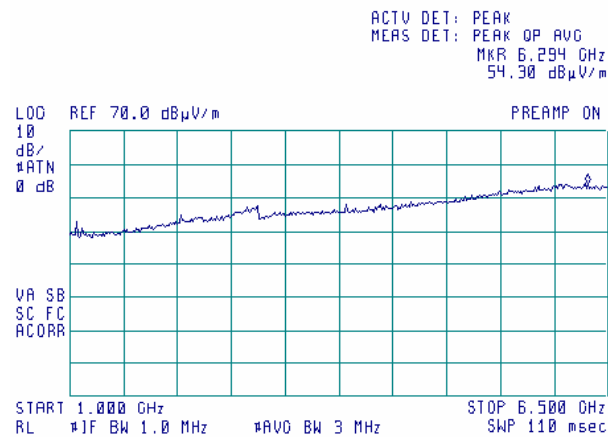


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.5.11 Radiated emission measurements in 1000 – 6500 MHz range

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m

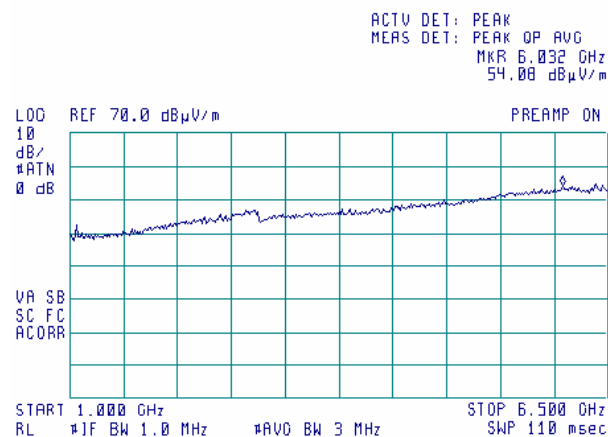
11:18:27 JUL 07, 2005



Plot 7.5.12 Radiated emission measurements in 1000 – 6500 MHz range

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m

11:22:46 JUL 07, 2005

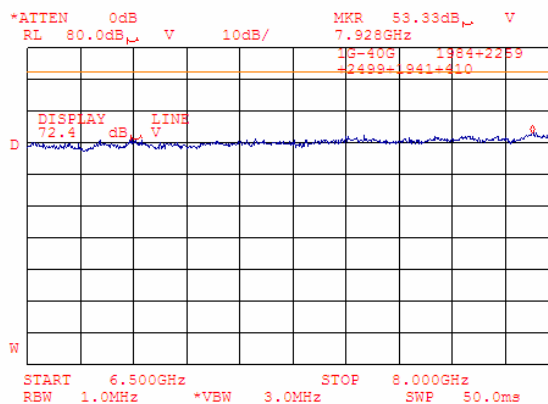




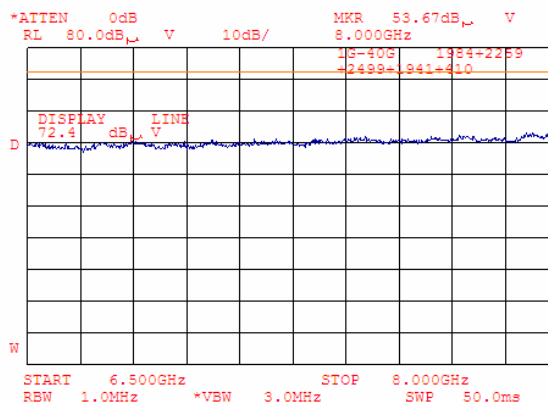
|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.13 Radiated emission measurements in 6.5 – 8.0 GHz range**

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m

**Plot 7.5.14 Radiated emission measurements in 6.5 – 8.0 GHz range**

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m

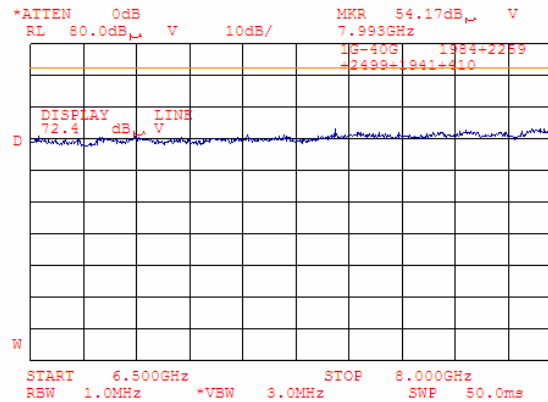




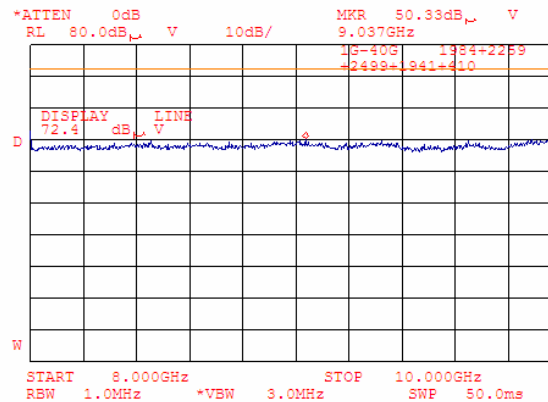
|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.15 Radiated emission measurements in 6.5 – 8.0 GHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: High  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

**Plot 7.5.16 Radiated emission measurements in 8 – 10 GHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Low  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

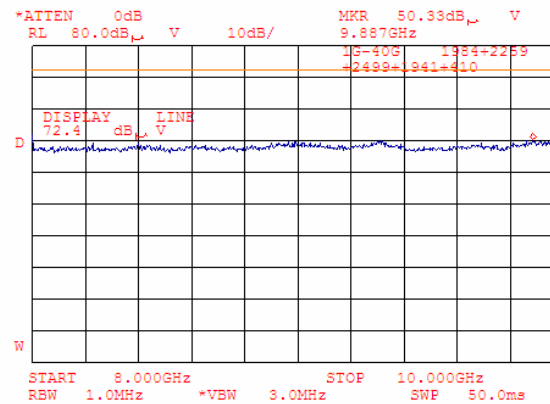




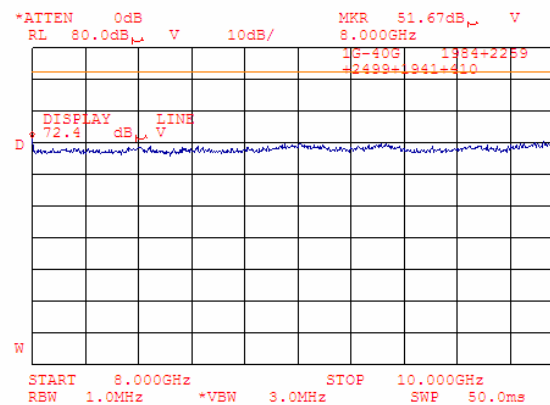
|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.17 Radiated emission measurements in 8 – 10 GHz range**

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m

**Plot 7.5.18 Radiated emission measurements in 8 – 10 GHz range**

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



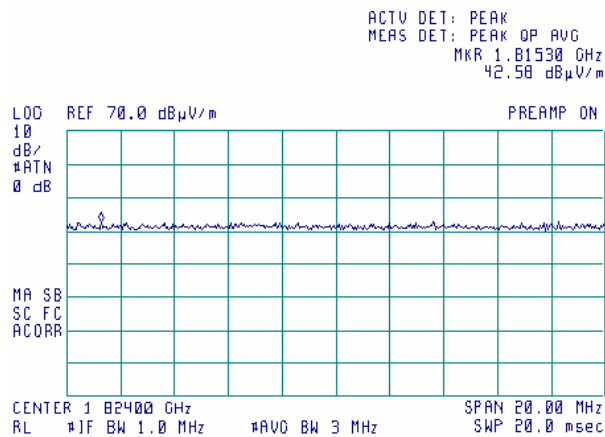


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.5.19 Radiated emission measurements at the 2<sup>nd</sup> harmonic

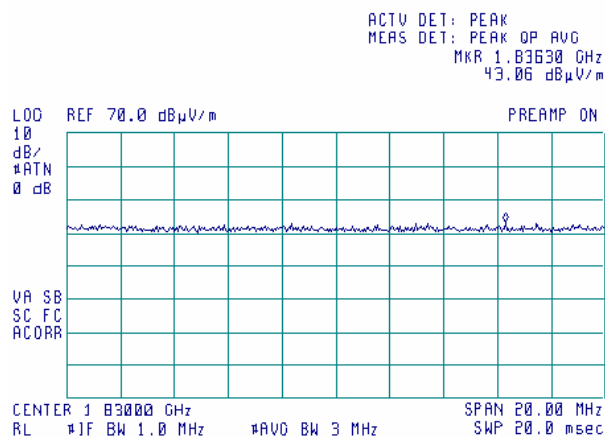
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

14:24:27 JUL 08, 2005

Plot 7.5.20 Radiated emission measurements at the 2<sup>nd</sup> harmonic

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

14:29:38 JUL 08, 2005



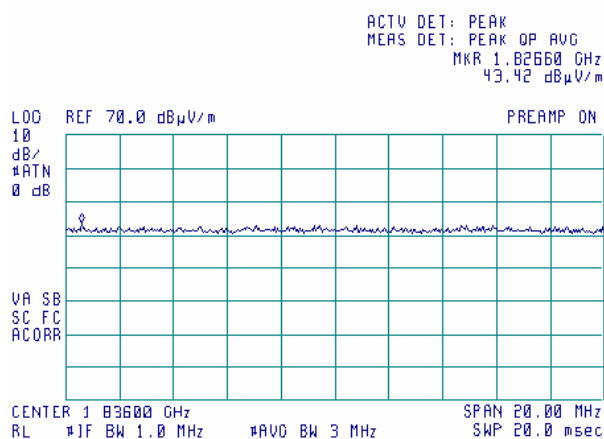


|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

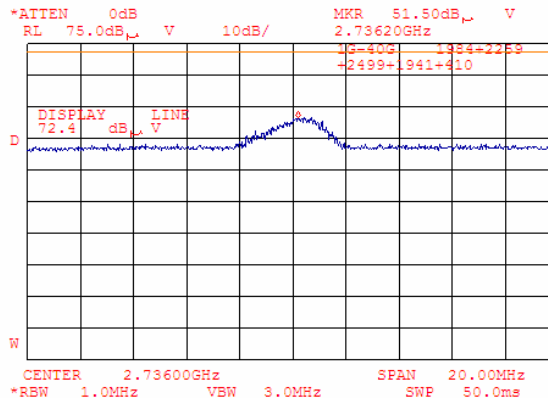
Plot 7.5.21 Radiated emission measurements at the 2<sup>nd</sup> harmonic

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

14:35:17 JUL 08, 2005

Plot 7.5.22 Radiated emission measurements at the 3<sup>rd</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m

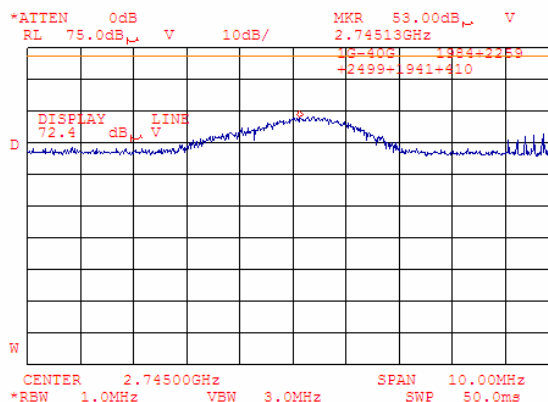




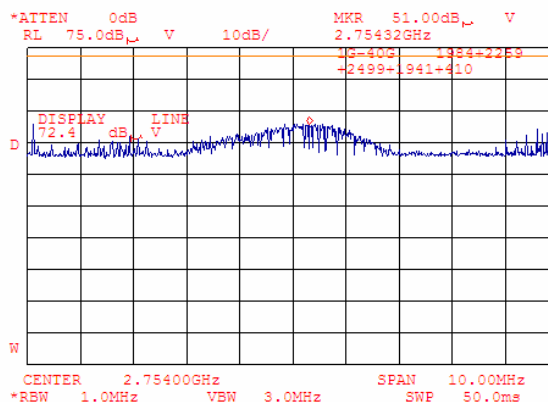
|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.23 Radiated emission measurements at the 3<sup>rd</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m

**Plot 7.5.24 Radiated emission measurements at the 3<sup>rd</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

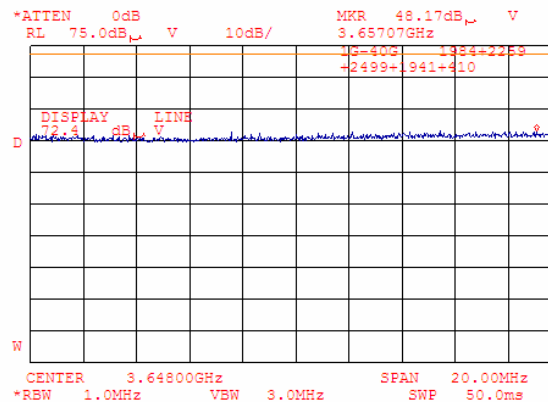




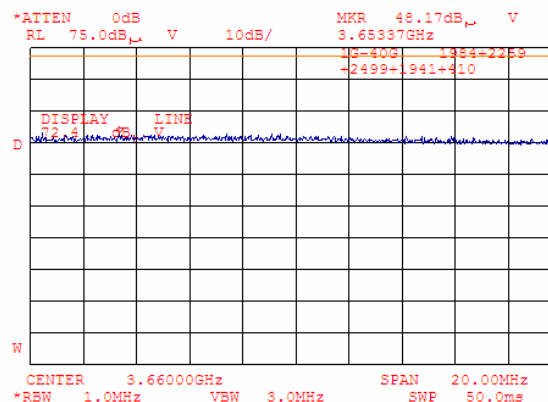
|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.25 Radiated emission measurements at the 4<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

**Plot 7.5.26 Radiated emission measurements at the 4<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

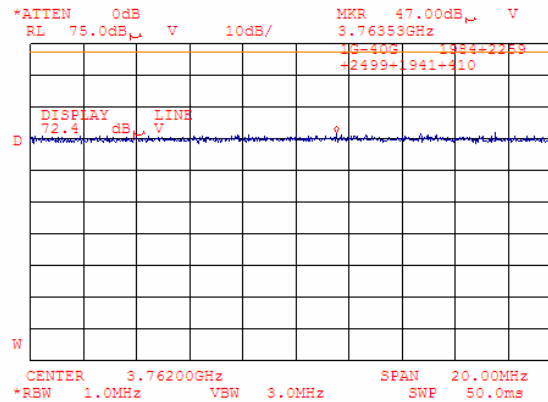




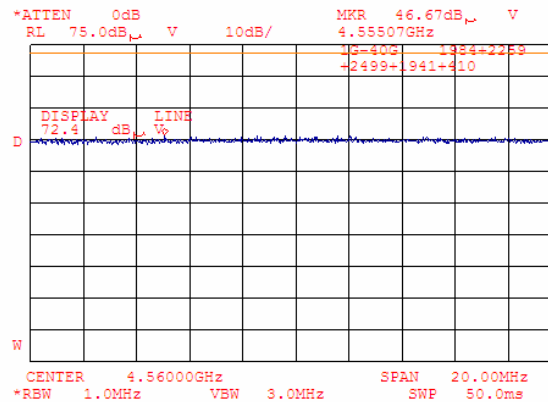
|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.5.27 Radiated emission measurements at the 4<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

Plot 7.5.28 Radiated emission measurements at the 5<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

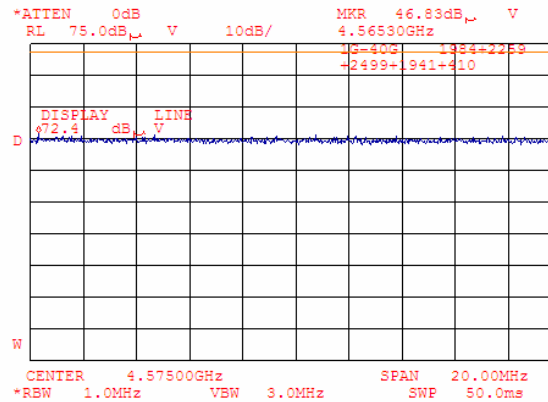




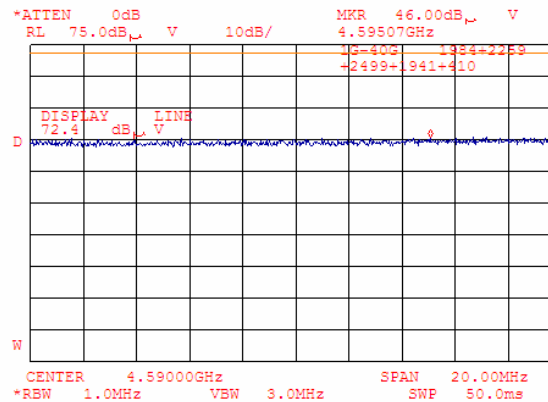
|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.29 Radiated emission measurements at the 5<sup>th</sup> harmonic**

TEST SITE: OATS  
 CARRIER FREQUENCY: Mid  
 ANTENNA POLARIZATION: Vertical and horizontal  
 TEST DISTANCE: 3 m

**Plot 7.5.30 Radiated emission measurements at the 5<sup>th</sup> harmonic**

TEST SITE: OATS  
 CARRIER FREQUENCY: High  
 ANTENNA POLARIZATION: Vertical and horizontal  
 TEST DISTANCE: 3 m

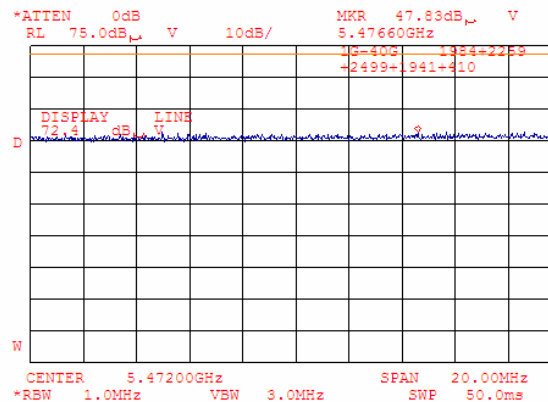




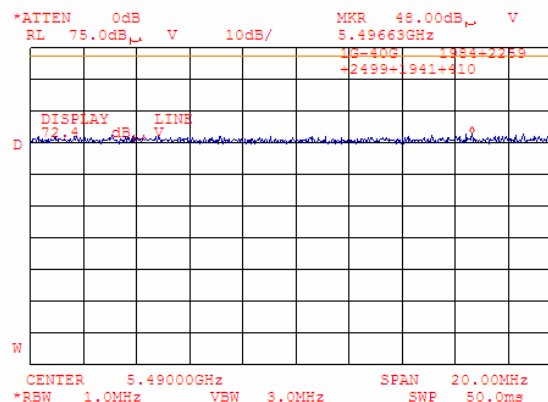
|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.5.31 Radiated emission measurements at the 6<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

Plot 7.5.32 Radiated emission measurements at the 6<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

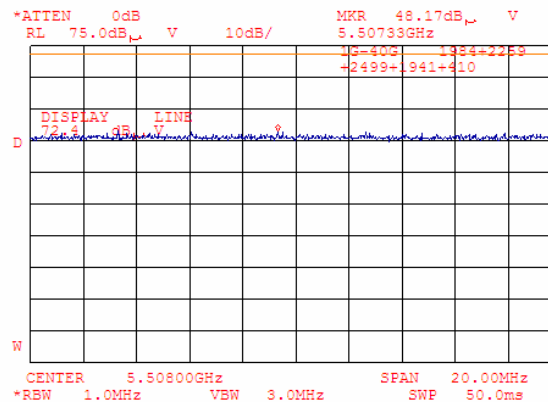




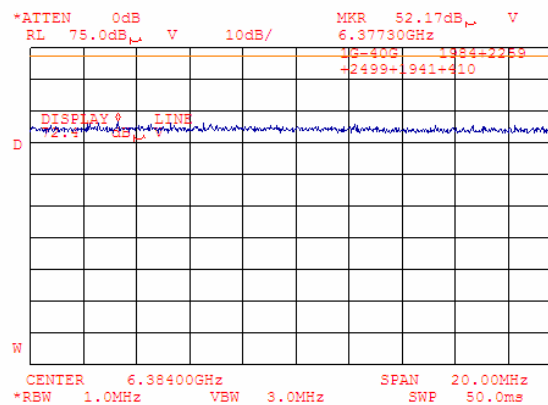
|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.33 Radiated emission measurements at the 6<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

**Plot 7.5.34 Radiated emission measurements at the 7<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

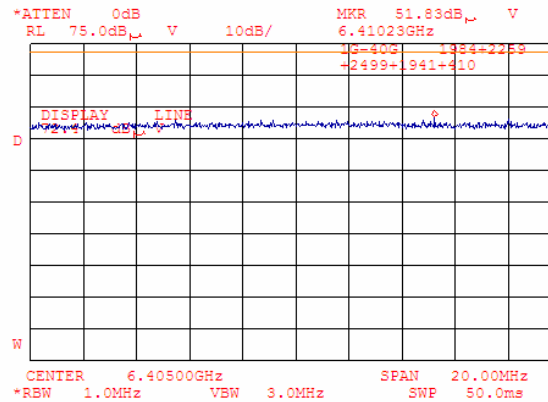




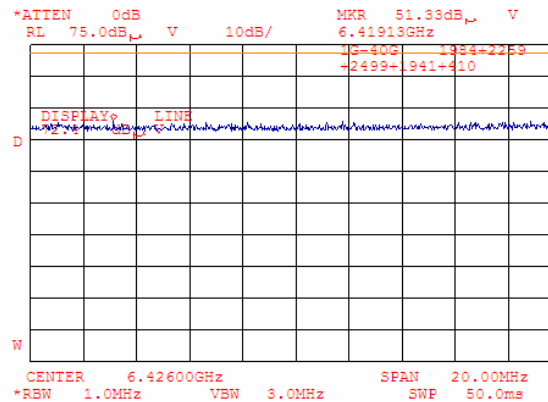
|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.5.35 Radiated emission measurements at the 7<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

Plot 7.5.36 Radiated emission measurements at the 7<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

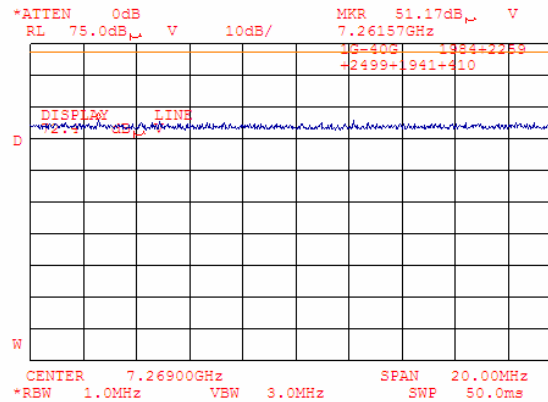




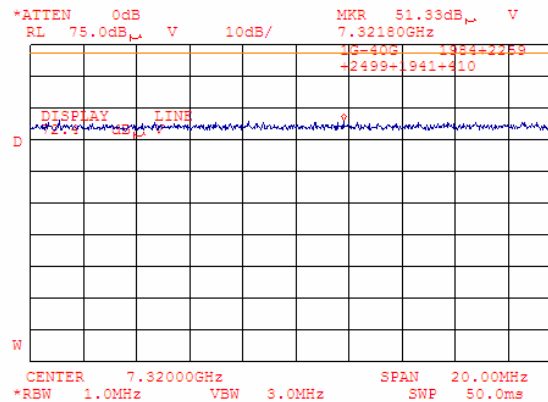
|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.37 Radiated emission measurements at the 8<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

**Plot 7.5.38 Radiated emission measurements at the 8<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

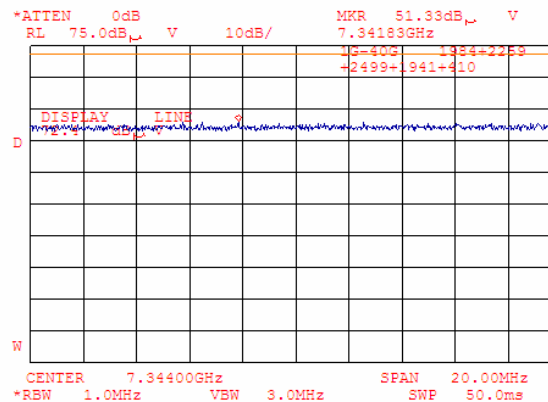




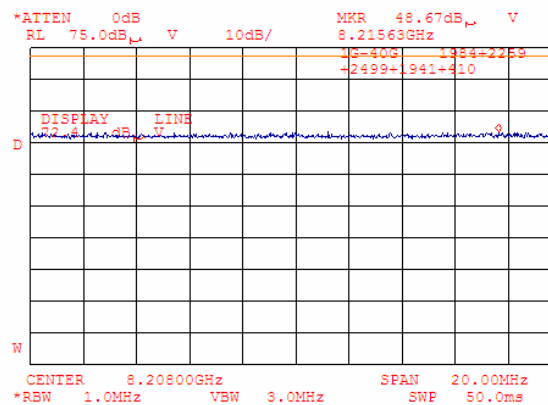
|                            |                                                                      |                                |                             |
|----------------------------|----------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.210, Radiated spurious emissions</b>                   |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                                |                             |
| <b>Test mode:</b>          | Compliance                                                           | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 12:15:18 PM                                                |                                |                             |
| <b>Temperature:</b> 28 °C  | <b>Air Pressure:</b> 1012 hPa                                        | <b>Relative Humidity:</b> 40 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                      |                                |                             |

**Plot 7.5.39 Radiated emission measurements at the 8<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

**Plot 7.5.40 Radiated emission measurements at the 9<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

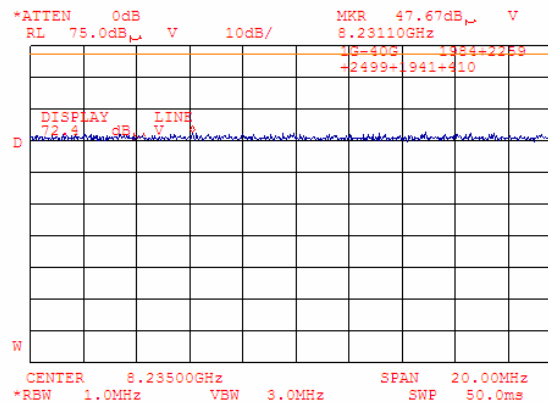




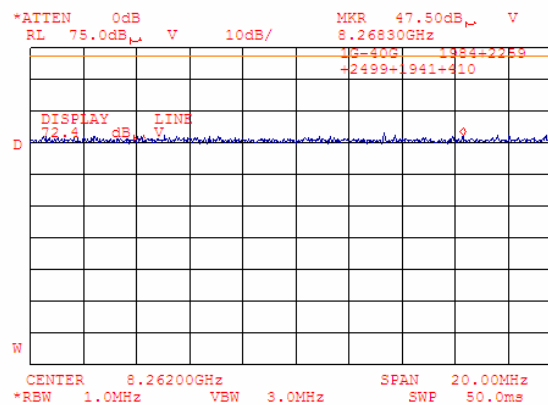
|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.5.41 Radiated emission measurements at the 9<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

Plot 7.5.42 Radiated emission measurements at the 9<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

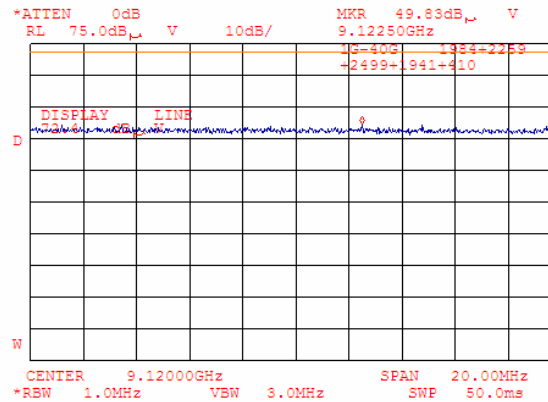




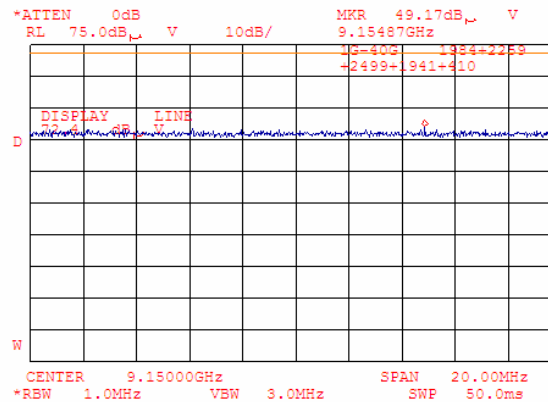
|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.5.43 Radiated emission measurements at the 10<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

Plot 7.5.44 Radiated emission measurements at the 10<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m

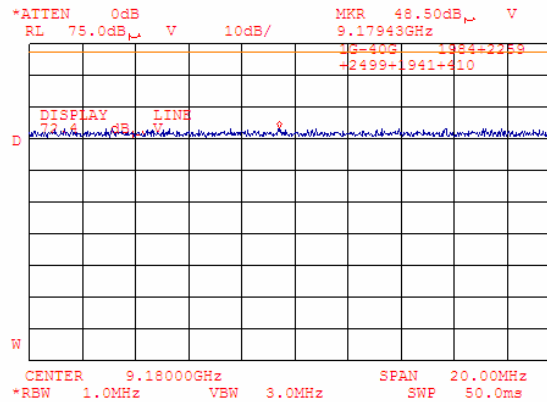




|                     |                                                                      |                         |                      |
|---------------------|----------------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.210, Radiated spurious emissions                          |                         |                      |
| Test procedure:     | 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12 |                         |                      |
| Test mode:          | Compliance                                                           | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 12:15:18 PM                                                |                         |                      |
| Temperature: 28 °C  | Air Pressure: 1012 hPa                                               | Relative Humidity: 40 % | Power Supply: 12 VDC |
| Remarks:            |                                                                      |                         |                      |

Plot 7.5.45 Radiated emission measurements at the 10<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and horizontal  
TEST DISTANCE: 3 m





|                            |                                                     |                                |                             |
|----------------------------|-----------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 90.213, Frequency stability</b>          |                                |                             |
| <b>Test procedure:</b>     | 47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2 |                                |                             |
| <b>Test mode:</b>          | Compliance                                          | <b>Verdict:</b>                | PASS                        |
| <b>Date &amp; Time:</b>    | 7/18/2005 1:21:29 PM                                |                                |                             |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1008 hPa                       | <b>Relative Humidity:</b> 46 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                     |                                |                             |

## 7.6 Frequency stability test

### 7.6.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.6.1. The test results are provided in Table 7.6.2.

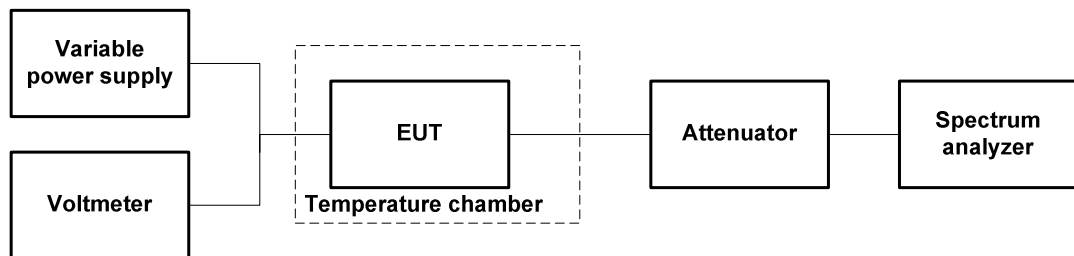
**Table 7.6.1 Frequency stability limits**

| Assigned frequency, MHz | Maximum allowed frequency displacement |      |
|-------------------------|----------------------------------------|------|
|                         | ppm                                    | Hz   |
| 912                     | 2.5                                    | 2280 |
| 915                     |                                        | 2288 |
| 918                     |                                        | 2295 |

### 7.6.2 Test procedure

- 7.6.2.1** The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.
- 7.6.2.2** The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.6.2.3** The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.6.2.4** The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.6.2.5** The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 7.6.2.6** Frequency displacement was calculated and compared with the limit as provided in Table 7.6.2.

**Figure 7.6.1 Frequency stability test setup**





|                     |                                                     |                         |                      |
|---------------------|-----------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 90.213, Frequency stability                 |                         |                      |
| Test procedure:     | 47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2 |                         |                      |
| Test mode:          | Compliance                                          | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:21:29 PM                                |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1008 hPa                              | Relative Humidity: 46 % | Power Supply: 12 VDC |
| Remarks:            |                                                     |                         |                      |

Table 7.6.2 Frequency stability test results

ASSIGNED FREQUENCY RANGE: 902 - 928 MHz  
 NOMINAL POWER VOLTAGE: 12 V  
 TEMPERATURE STABILIZATION PERIOD: 20 min  
 POWER DURING TEMPERATURE TRANSITION: Off  
 SPECTRUM ANALYZER MODE: Counter  
 RESOLUTION BANDWIDTH: 1000 Hz  
 VIDEO BANDWIDTH: 1000 Hz  
 MODULATION: Unmodulated

| T, °C                  | Voltage, V | Frequency, MHz |                     |                     |                     |                     |                     |                      | Max frequency drift, Hz |          | Limit, Hz | Margin, Hz |
|------------------------|------------|----------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|-------------------------|----------|-----------|------------|
|                        |            | Start up       | 1 <sup>st</sup> min | 2 <sup>nd</sup> min | 3 <sup>rd</sup> min | 4 <sup>th</sup> min | 5 <sup>th</sup> min | 10 <sup>th</sup> min | Positive                | Negative |           |            |
| Low carrier frequency  |            |                |                     |                     |                     |                     |                     |                      |                         |          |           |            |
| -30                    | nominal    | 911.708252     | 911.708113          | 911.708010          | 911.708068          | 911.707731          | 911.707815          | 911.708153           | 0                       | -716     | NA        | NA         |
| -20                    | nominal    | 911.707185     | NA                  | NA                  | NA                  | NA                  | NA                  | 911.707711           | 0                       | -1262    |           | NA         |
| -10                    | nominal    | 911.709156     | NA                  | NA                  | NA                  | NA                  | NA                  | 911.710068           | 1621                    | 0        |           | NA         |
| 0                      | nominal    | 911.705537     | 911.704777          | 911.705161          | 911.705341          | 911.705144          | 911.705226          | 911.706151           | 0                       | -3670    |           | NA         |
| 10                     | nominal    | 911.720777     | NA                  | NA                  | NA                  | NA                  | NA                  | 911.721416           | 12969                   | 0        |           | NA         |
| 20                     | +15%       | 911.709447     | NA                  | NA                  | NA                  | NA                  | NA                  | 911.709993           | 1546                    | 0        |           | NA         |
| 20                     | nominal    | 911.709626     | NA                  | NA                  | NA                  | NA                  | NA                  | 911.708447*          | 1179                    | 0        |           | NA         |
| 20                     | -15%       | 911.709229     | NA                  | NA                  | NA                  | NA                  | NA                  | 911.708388           | 782                     | -59      |           | NA         |
| 30                     | nominal    | 911.708853     | 911.708257          | 911.708382          | 911.707983          | 911.708813          | 911.708854          | 911.708920           | 473                     | -464     |           | NA         |
| 40                     | nominal    | 911.707556     | NA                  | NA                  | NA                  | NA                  | NA                  | 911.707669           | 0                       | -891     |           | NA         |
| 50                     | nominal    | 911.708231     | NA                  | NA                  | NA                  | NA                  | NA                  | 911.707665           | 0                       | -782     | NA        |            |
| Mid carrier frequency  |            |                |                     |                     |                     |                     |                     |                      |                         |          |           |            |
| -30                    | nominal    | 914.707004     | 914.707723          | 914.707364          | 914.707249          | 914.707439          | 914.707413          | 914.707165           | 0                       | -2244    | NA        | NA         |
| -20                    | nominal    | 914.710405     | NA                  | NA                  | NA                  | NA                  | NA                  | 914.707074           | 1157                    | -2174    |           | NA         |
| -10                    | nominal    | 914.710779     | NA                  | NA                  | NA                  | NA                  | NA                  | 914.707142           | 1531                    | -2106    |           | NA         |
| 0                      | nominal    | 914.708168     | 914.709011          | 914.709239          | 914.709199          | 914.709178          | 914.709335          | 914.709849           | 601                     | -1080    |           | NA         |
| 10                     | nominal    | 914.698807     | NA                  | NA                  | NA                  | NA                  | NA                  | 914.699320           | 0                       | -10441   |           | NA         |
| 20                     | +15%       | 914.708145     | NA                  | NA                  | NA                  | NA                  | NA                  | 914.708086           | 0                       | -1162    |           | NA         |
| 20                     | nominal    | 914.708095     | NA                  | NA                  | NA                  | NA                  | NA                  | 914.709248*          | 0                       | -1153    |           | NA         |
| 20                     | -15%       | 914.707482     | NA                  | NA                  | NA                  | NA                  | NA                  | 914.708215           | 0                       | -1766    |           | NA         |
| 30                     | nominal    | 914.707421     | 914.707773          | 914.707401          | 914.707117          | 914.707421          | 914.707499          | 914.708100           | 0                       | -2131    |           | NA         |
| 40                     | nominal    | 914.708054     | NA                  | NA                  | NA                  | NA                  | NA                  | 914.708721           | 0                       | -1194    |           | NA         |
| 50                     | nominal    | 914.707665     | NA                  | NA                  | NA                  | NA                  | NA                  | 914.707991           | 0                       | -1583    | NA        |            |
| High carrier frequency |            |                |                     |                     |                     |                     |                     |                      |                         |          |           |            |
| -30                    | nominal    | 917.707285     | 917.707811          | 917.707163          | 917.708326          | 917.707823          | 917.707427          | 917.706932           | 2024                    | 0        | NA        | NA         |
| -20                    | nominal    | 917.708153     | NA                  | NA                  | NA                  | NA                  | NA                  | 917.708087           | 1851                    | 0        |           | NA         |
| -10                    | nominal    | 917.708505     | NA                  | NA                  | NA                  | NA                  | NA                  | 917.708570           | 2268                    | 0        |           | NA         |
| 0                      | nominal    | 917.705602     | 917.705982          | 917.706672          | 917.705455          | 917.705497          | 917.706127          | 917.706383           | 370                     | -847     |           | NA         |
| 10                     | nominal    | 917.700125     | NA                  | NA                  | NA                  | NA                  | NA                  | 917.700548           | 0                       | -6177    |           | NA         |
| 20                     | +15%       | 917.707913     | NA                  | NA                  | NA                  | NA                  | NA                  | 917.708271           | 1969                    | 0        |           | NA         |
| 20                     | nominal    | 917.706856     | NA                  | NA                  | NA                  | NA                  | NA                  | 917.706302*          | 554                     | 0        |           | NA         |
| 20                     | -15%       | 917.706751     | NA                  | NA                  | NA                  | NA                  | NA                  | 917.706479           | 449                     | 0        |           | NA         |
| 30                     | nominal    | 917.706625     | 917.706161          | 917.707001          | 917.706211          | 917.706620          | 917.706637          | 917.706711           | 699                     | -141     |           | NA         |
| 40                     | nominal    | 917.706251     | NA                  | NA                  | NA                  | NA                  | NA                  | 917.707800           | 1498                    | -51      |           | NA         |
| 50                     | nominal    | 917.706466     | NA                  | NA                  | NA                  | NA                  | NA                  | 917.706990           | 688                     | 0        | NA        |            |

\* - Reference frequency

Note: According to Note 13 of – FCC 47 CFR part 90 subpart I §90.213 (a) “Fixed non-multilateration transmitters with an authorized bandwidth is more than 40 kHz from the band edge are not subject to frequency tolerance restrictions”  
According to occupied bandwidth test, authorized bandwidth is more than 40 kHz from the band edges.

#### Reference numbers of test equipment used

|         |         |         |         |  |  |  |  |
|---------|---------|---------|---------|--|--|--|--|
| HL 0493 | HL 1460 | HL 1653 | HL 2524 |  |  |  |  |
|---------|---------|---------|---------|--|--|--|--|

Full description is given in Appendix A.



|                            |                                                                     |                                |                              |
|----------------------------|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Test specification:</b> | <b>Section 15.107, Conducted emission at AC power port, Class B</b> |                                |                              |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.5 and 12.1.3                                |                                |                              |
| <b>Test mode:</b>          | Compliance                                                          | <b>Verdict:</b>                | <b>PASS</b>                  |
| <b>Date &amp; Time:</b>    | 7/18/2005 2:45:57 PM                                                |                                |                              |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                       | <b>Relative Humidity:</b> 35 % | <b>Power Supply:</b> 120 VAC |
| <b>Remarks:</b>            |                                                                     |                                |                              |

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

### 8.1 Conducted emissions

#### 8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits are given in Table 8.1.1. The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

**Table 8.1.1 Limits for conducted emissions**

| Frequency,<br>MHz | Class B limit,<br>dB( $\mu$ V) |          | Class A limit,<br>dB( $\mu$ V) |      |
|-------------------|--------------------------------|----------|--------------------------------|------|
|                   | QP                             | AVRG     | QP                             | AVRG |
| 0.15 - 0.5        | 66 - 56*                       | 56 - 46* | 79                             | 66   |
| 0.5 - 5.0         | 56                             | 46       | 73                             | 60   |
| 5.0 - 30          | 60                             | 50       | 73                             | 60   |

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

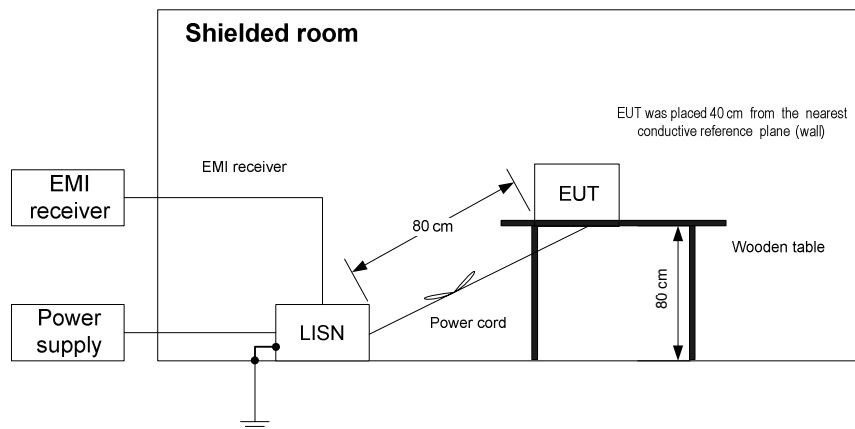
#### 8.1.2 Test procedure

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

**8.1.2.2** The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 8.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

**8.1.2.3** The position of the device cables was varied to determine maximum emission level.

**Figure 8.1.1 Setup for conducted emission measurements, table-top EUT**





|                            |                                                                     |                                |                              |
|----------------------------|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Test specification:</b> | <b>Section 15.107, Conducted emission at AC power port, Class B</b> |                                |                              |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.5 and 12.1.3                                |                                |                              |
| <b>Test mode:</b>          | Compliance                                                          | <b>Verdict:</b>                | <b>PASS</b>                  |
| <b>Date &amp; Time:</b>    | 7/18/2005 2:45:57 PM                                                |                                |                              |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                       | <b>Relative Humidity:</b> 35 % | <b>Power Supply:</b> 120 VAC |
| <b>Remarks:</b>            |                                                                     |                                |                              |

Table 8.1.2 Conducted emission test results

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

| Frequency,<br>MHz                                                | Peak<br>emission,<br>dB(μV) | Quasi-peak                      |                  |                | Average                         |                  |                | Line ID | Verdict |
|------------------------------------------------------------------|-----------------------------|---------------------------------|------------------|----------------|---------------------------------|------------------|----------------|---------|---------|
|                                                                  |                             | Measured<br>emission,<br>dB(μV) | Limit,<br>dB(μV) | Margin,<br>dB* | Measured<br>emission,<br>dB(μV) | Limit,<br>dB(μV) | Margin,<br>dB* |         |         |
| AC mains input of EUT power adapter, EUT in transmit mode        |                             |                                 |                  |                |                                 |                  |                |         |         |
| 0.173989                                                         | 47.40                       | 40.64                           | 64.83            | -24.19         | 34.29                           | 54.83            | -14.19         | L1      | Pass    |
| 0.232654                                                         | 42.89                       | 35.87                           | 62.40            | -26.53         | 27.64                           | 52.40            | -16.53         |         |         |
| 0.233362                                                         | 43.80                       | 36.50                           | 62.37            | -25.87         | 28.55                           | 52.37            | -15.87         |         |         |
| 0.235156                                                         | 41.29                       | 37.04                           | 62.30            | -25.26         | 28.99                           | 52.30            | -15.26         |         |         |
| 2.111204                                                         | 38.21                       | 34.71                           | 56.00            | -21.29         | 30.45                           | 46.00            | -11.29         |         |         |
| 2.754379                                                         | 37.97                       | 34.00                           | 56.00            | -22.00         | 27.15                           | 46.00            | -12.00         | L2      | Pass    |
| 0.229990                                                         | 39.20                       | 32.11                           | 62.50            | -30.39         | 25.62                           | 52.50            | -20.39         |         |         |
| 0.253412                                                         | 41.14                       | 26.85                           | 61.68            | -34.83         | 2.96                            | 51.68            | -24.83         |         |         |
| 0.932025                                                         | 29.08                       | 24.78                           | 56.00            | -31.22         | 22.51                           | 46.00            | -21.22         |         |         |
| 1.110573                                                         | 29.41                       | 25.63                           | 56.00            | -30.37         | 22.29                           | 46.00            | -20.37         |         |         |
| 9.451289                                                         | 33.43                       | 28.56                           | 60.00            | -31.44         | 21.20                           | 50.00            | -21.44         |         |         |
| 14.358223                                                        | 36.05                       | 33.05                           | 60.00            | -26.95         | 25.26                           | 50.00            | -16.95         |         |         |
| AC mains input of EUT power adapter, EUT in receive/standby mode |                             |                                 |                  |                |                                 |                  |                |         |         |
| 0.174822                                                         | 41.34                       | 40.54                           | 64.79            | -24.25         | 36.82                           | 54.79            | -14.25         | L1      | Pass    |
| 0.232343                                                         | 34.77                       | 33.61                           | 62.41            | -28.80         | 31.47                           | 52.41            | -18.80         |         |         |
| 0.757165                                                         | 33.75                       | 32.81                           | 56.00            | -23.19         | 31.91                           | 46.00            | -13.19         |         |         |
| 2.039034                                                         | 36.48                       | 34.04                           | 56.00            | -21.96         | 31.65                           | 46.00            | -11.96         |         |         |
| 2.739380                                                         | 34.66                       | 33.49                           | 56.00            | -22.51         | 29.73                           | 46.00            | -12.51         |         |         |
| 2.855183                                                         | 34.35                       | 33.23                           | 56.00            | -22.77         | 28.88                           | 46.00            | -12.77         | L2      | Pass    |
| 0.174802                                                         | 39.45                       | 38.59                           | 64.79            | -26.20         | 35.33                           | 54.79            | -16.20         |         |         |
| 2.039650                                                         | 34.31                       | 32.49                           | 56.00            | -23.51         | 29.93                           | 46.00            | -13.51         |         |         |
| 2.155845                                                         | 34.21                       | 30.94                           | 56.00            | -25.06         | 26.55                           | 46.00            | -15.06         |         |         |
| 2.798661                                                         | 33.55                       | 32.23                           | 56.00            | -23.77         | 27.24                           | 46.00            | -13.77         |         |         |
| 2.855803                                                         | 32.90                       | 31.67                           | 56.00            | -24.33         | 25.57                           | 46.00            | -14.33         |         |         |
| 15.273183                                                        | 34.32                       | 32.53                           | 60.00            | -27.47         | 30.24                           | 50.00            | -17.47         |         |         |

\*- Margin = Measured emission - specification limit.



|                            |                                                                     |                                |                              |
|----------------------------|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Test specification:</b> | <b>Section 15.107, Conducted emission at AC power port, Class B</b> |                                |                              |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.5 and 12.1.3                                |                                |                              |
| <b>Test mode:</b>          | Compliance                                                          | <b>Verdict:</b>                | <b>PASS</b>                  |
| <b>Date &amp; Time:</b>    | 7/18/2005 2:45:57 PM                                                |                                |                              |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                       | <b>Relative Humidity:</b> 35 % | <b>Power Supply:</b> 120 VAC |
| <b>Remarks:</b>            |                                                                     |                                |                              |

Table 8.1.2 (continued) Conducted emission test results

| Frequency,<br>MHz                                                   | Peak<br>emission,<br>dB(μV) | Quasi-peak                      |                  |                | Average                         |                  |                | Line ID | Verdict |
|---------------------------------------------------------------------|-----------------------------|---------------------------------|------------------|----------------|---------------------------------|------------------|----------------|---------|---------|
|                                                                     |                             | Measured<br>emission,<br>dB(μV) | Limit,<br>dB(μV) | Margin,<br>dB* | Measured<br>emission,<br>dB(μV) | Limit,<br>dB(μV) | Margin,<br>dB* |         |         |
| AC mains input of laptop power adapter, EUT in transmit mode        |                             |                                 |                  |                |                                 |                  |                |         |         |
| 0.157728                                                            | 54.70                       | 47.90                           | 65.62            | -17.72         | 17.98                           | 55.62            | -7.72          | L1      | Pass    |
| 0.173436                                                            | 52.96                       | 45.95                           | 64.86            | -18.91         | 32.23                           | 54.86            | -8.91          |         |         |
| 0.190951                                                            | 50.17                       | 43.37                           | 64.00            | -20.63         | 13.85                           | 54.00            | -10.63         |         |         |
| 0.316092                                                            | 38.90                       | 32.38                           | 59.83            | -27.45         | 7.42                            | 49.83            | -17.45         |         |         |
| 0.698729                                                            | 35.96                       | 34.68                           | 56.00            | -21.32         | 32.22                           | 46.00            | -11.32         |         |         |
| 1.806951                                                            | 35.86                       | 34.65                           | 56.00            | -21.35         | 32.73                           | 46.00            | -11.35         | L2      | Pass    |
| 0.165124                                                            | 54.07                       | 46.92                           | 65.26            | -18.34         | 17.64                           | 55.26            | -8.34          |         |         |
| 0.173543                                                            | 52.92                       | 45.81                           | 64.85            | -19.04         | 32.09                           | 54.85            | -9.04          |         |         |
| 0.186428                                                            | 50.64                       | 43.87                           | 64.22            | -20.35         | 14.90                           | 54.22            | -10.35         |         |         |
| 0.292072                                                            | 44.04                       | 35.87                           | 60.51            | -24.64         | 31.66                           | 50.51            | -14.64         |         |         |
| 0.640344                                                            | 36.01                       | 34.42                           | 56.00            | -21.58         | 32.48                           | 46.00            | -11.58         |         |         |
| 1.223265                                                            | 35.62                       | 34.59                           | 56.00            | -21.41         | 26.45                           | 46.00            | -11.41         |         |         |
| AC mains input of laptop power adapter, EUT in receive/standby mode |                             |                                 |                  |                |                                 |                  |                |         |         |
| 0.152893                                                            | 54.56                       | 47.94                           | 65.86            | -17.92         | 19.23                           | 55.86            | -7.92          | L1      | Pass    |
| 0.155704                                                            | 54.43                       | 47.69                           | 65.72            | -18.03         | 17.94                           | 55.72            | -8.03          |         |         |
| 0.175105                                                            | 53.00                       | 45.43                           | 64.78            | -19.35         | 34.38                           | 54.78            | -9.35          |         |         |
| 0.699134                                                            | 36.36                       | 35.16                           | 56.00            | -20.84         | 35.05                           | 46.00            | -10.84         |         |         |
| 1.107170                                                            | 34.49                       | 33.83                           | 56.00            | -22.17         | 33.68                           | 46.00            | -12.17         |         |         |
| 1.572992                                                            | 35.66                       | 35.02                           | 56.00            | -20.98         | 34.91                           | 46.00            | -10.98         | L2      | Pass    |
| 0.175261                                                            | 52.80                       | 45.73                           | 64.77            | -19.04         | 34.53                           | 54.77            | -9.04          |         |         |
| 0.200194                                                            | 49.05                       | 42.23                           | 63.65            | -21.42         | 14.15                           | 53.65            | -11.42         |         |         |
| 0.230098                                                            | 46.23                       | 39.32                           | 62.50            | -23.18         | 24.77                           | 52.50            | -13.18         |         |         |
| 0.291724                                                            | 44.39                       | 37.31                           | 60.52            | -23.21         | 35.06                           | 50.52            | -13.21         |         |         |
| 0.641155                                                            | 36.68                       | 35.18                           | 56.00            | -20.82         | 35.07                           | 46.00            | -10.82         |         |         |
| 1.572836                                                            | 35.71                       | 35.11                           | 56.00            | -20.89         | 34.98                           | 46.00            | -10.89         |         |         |

\*- Margin = Measured emission - specification limit.

## Reference numbers of test equipment used

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

Full description is given in Appendix A.

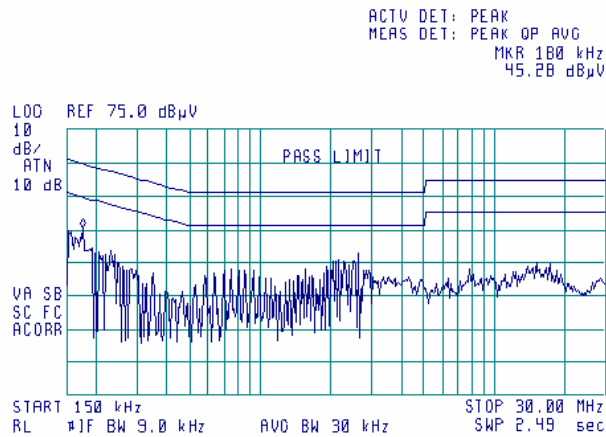


|                            |                                                                     |                                |                              |
|----------------------------|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Test specification:</b> | <b>Section 15.107, Conducted emission at AC power port, Class B</b> |                                |                              |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.5 and 12.1.3                                |                                |                              |
| <b>Test mode:</b>          | Compliance                                                          | <b>Verdict:</b>                | <b>PASS</b>                  |
| <b>Date &amp; Time:</b>    | 7/18/2005 2:45:57 PM                                                |                                |                              |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                       | <b>Relative Humidity:</b> 35 % | <b>Power Supply:</b> 120 VAC |
| <b>Remarks:</b>            |                                                                     |                                |                              |

**Plot 8.1.1 Conducted emission measurements, AC mains input of EUT power adapter**

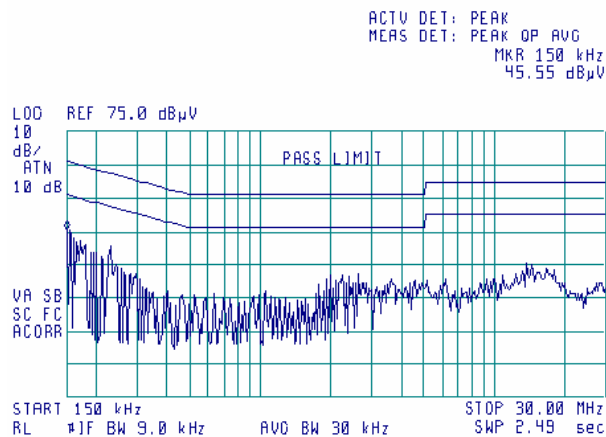
LINE: L1  
 EUT OPERATING MODE: Transmit  
 LIMIT: QUASI-PEAK, AVERAGE  
 DETECTOR: PEAK

12:10:20 JUL 18, 2005

**Plot 8.1.2 Conducted emission measurements, AC mains input of EUT power adapter**

LINE: L2  
 EUT OPERATING MODE: Transmit  
 LIMIT: QUASI-PEAK, AVERAGE  
 DETECTOR: PEAK

12:36:47 JUL 18, 2005



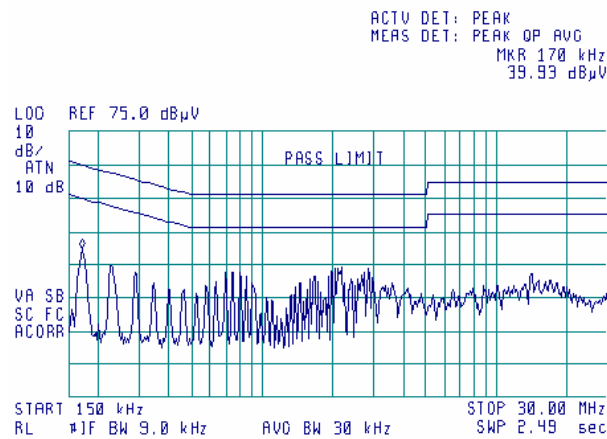


|                            |                                                                     |                                |                              |
|----------------------------|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Test specification:</b> | <b>Section 15.107, Conducted emission at AC power port, Class B</b> |                                |                              |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.5 and 12.1.3                                |                                |                              |
| <b>Test mode:</b>          | Compliance                                                          | <b>Verdict:</b>                | <b>PASS</b>                  |
| <b>Date &amp; Time:</b>    | 7/18/2005 2:45:57 PM                                                |                                |                              |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                       | <b>Relative Humidity:</b> 35 % | <b>Power Supply:</b> 120 VAC |
| <b>Remarks:</b>            |                                                                     |                                |                              |

**Plot 8.1.3 Conducted emission measurements, AC mains input of EUT power adapter**

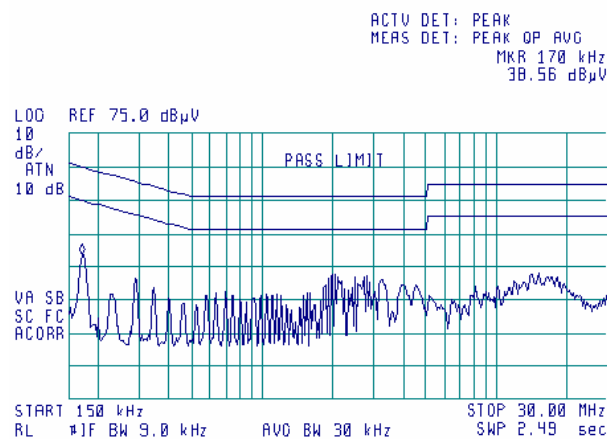
LINE: L1  
 EUT OPERATING MODE: Receive / Standby  
 LIMIT: QUASI-PEAK, AVERAGE  
 DETECTOR: PEAK

13:31:48 JUL 18, 2005

**Plot 8.1.4 Conducted emission measurements, AC mains input of EUT power adapter**

LINE: L2  
 EUT OPERATING MODE: Receive / Standby  
 LIMIT: QUASI-PEAK, AVERAGE  
 DETECTOR: PEAK

13:22:52 JUL 18, 2005





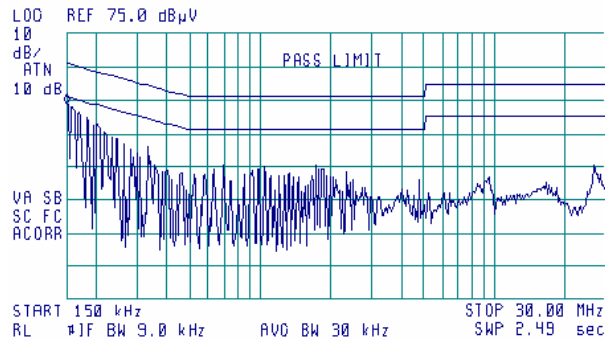
|                            |                                                                     |                                |                              |
|----------------------------|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Test specification:</b> | <b>Section 15.107, Conducted emission at AC power port, Class B</b> |                                |                              |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.5 and 12.1.3                                |                                |                              |
| <b>Test mode:</b>          | Compliance                                                          | <b>Verdict:</b>                | <b>PASS</b>                  |
| <b>Date &amp; Time:</b>    | 7/18/2005 2:45:57 PM                                                |                                |                              |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                       | <b>Relative Humidity:</b> 35 % | <b>Power Supply:</b> 120 VAC |
| <b>Remarks:</b>            |                                                                     |                                |                              |

**Plot 8.1.5 Conducted emission measurements, AC mains input of laptop power adapter**

LINE: L1  
 EUT OPERATING MODE: Transmit  
 LIMIT: QUASI-PEAK, AVERAGE  
 DETECTOR: PEAK

14:25:01 JUL 18, 2005

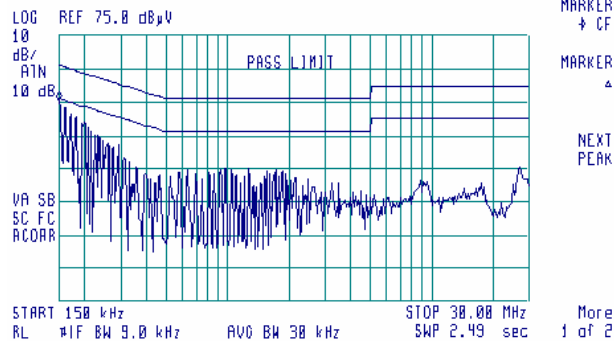
ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 150 kHz  
 53.92 dBμV

**Plot 8.1.6 Conducted emission measurements, AC mains input of laptop power adapter**

LINE: L2  
 EUT OPERATING MODE: Transmit  
 LIMIT: QUASI-PEAK, AVERAGE  
 DETECTOR: PEAK

14:09:41 JUL 18, 2005

STOP 30.00 MHz  
 ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 150 kHz  
 55.41 dBμV





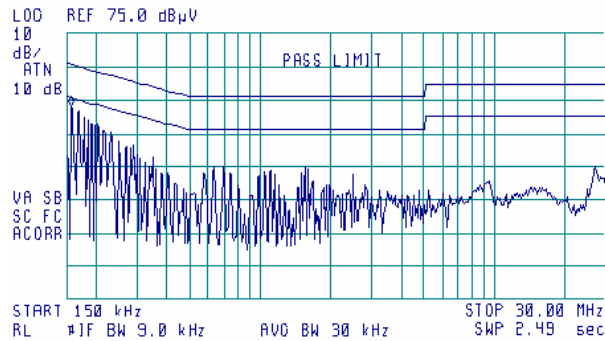
|                            |                                                                     |                                |                              |
|----------------------------|---------------------------------------------------------------------|--------------------------------|------------------------------|
| <b>Test specification:</b> | <b>Section 15.107, Conducted emission at AC power port, Class B</b> |                                |                              |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.5 and 12.1.3                                |                                |                              |
| <b>Test mode:</b>          | Compliance                                                          | <b>Verdict:</b>                | <b>PASS</b>                  |
| <b>Date &amp; Time:</b>    | 7/18/2005 2:45:57 PM                                                |                                |                              |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                       | <b>Relative Humidity:</b> 35 % | <b>Power Supply:</b> 120 VAC |
| <b>Remarks:</b>            |                                                                     |                                |                              |

**Plot 8.1.7 Conducted emission measurements, AC mains input of laptop power adapter**

LINE: L1  
EUT OPERATING MODE: Receive / Stand-by  
LIMIT: QUASI-PEAK, AVERAGE  
DETECTOR: PEAK

13:43:43 JUL 18, 2005

ACTV DET: PEAK  
MEAS DET: PEAK OP AVG  
MKR 150 kHz  
53.16 dBμV

**Plot 8.1.8 Conducted emission measurements, AC mains input of laptop power adapter**

LINE: L2  
EUT OPERATING MODE: Receive / Stand-by  
LIMIT: QUASI-PEAK, AVERAGE  
DETECTOR: PEAK

13:56:11 JUL 18, 2005

STOP  
30.00 MHz

ACTV DET: PEAK  
MEAS DET: PEAK OP AVG  
MKR 150 kHz  
55.30 dBμV

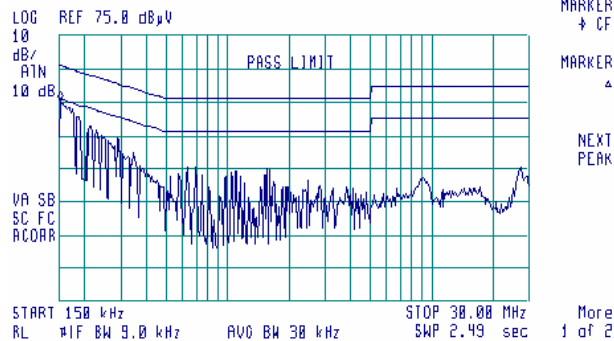
MEASURE  
AT MKR

ADD TO  
LIST

MARKER  
+ CF

MARKER  
A

NEXT  
PEAK





|                            |                                                   |                                |                             |
|----------------------------|---------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 15.109, Radiated emission, Class B</b> |                                |                             |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.6 and 12.1.4              |                                |                             |
| <b>Test mode:</b>          | Compliance                                        | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 1:29:59 PM                              |                                |                             |
| <b>Temperature:</b> 24 °C  | <b>Air Pressure:</b> 1012 hPa                     | <b>Relative Humidity:</b> 45 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                   |                                |                             |

## 8.2 Radiated emission measurements

### 8.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.2.1.

**Table 8.2.1 Radiated emission test limits**

| Frequency,<br>MHz | Class B limit,<br>dB(μV/m) |              | Class A limit,<br>dB(μV/m) |              |
|-------------------|----------------------------|--------------|----------------------------|--------------|
|                   | 10 m distance              | 3 m distance | 10 m distance              | 3 m distance |
| 30 - 88           | 29.5*                      | 40.0         | 39.0                       | 49.5*        |
| 88 - 216          | 33.0*                      | 43.5         | 43.5                       | 54.0*        |
| 216 - 960         | 35.5*                      | 46.0         | 46.4                       | 56.9*        |
| Above 960         | 43.5*                      | 54.0         | 49.5                       | 60.0*        |

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

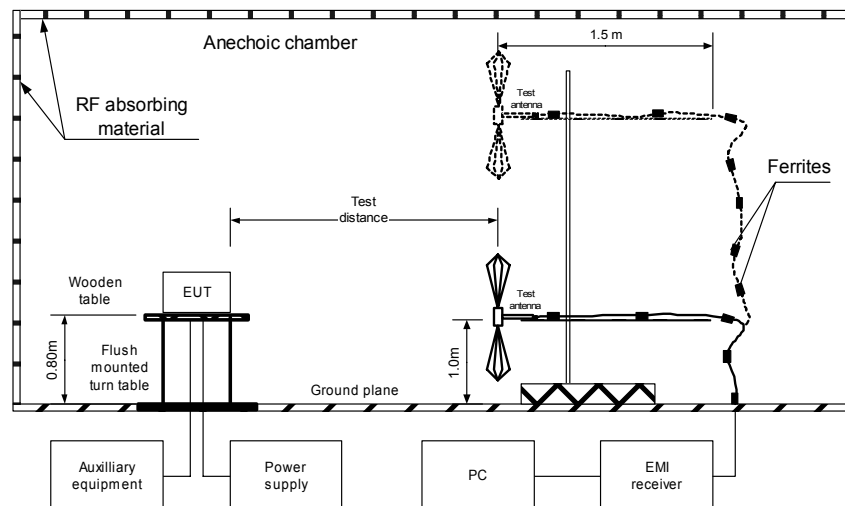
### 8.2.2 Test procedure

**8.2.2.1** The EUT was set up as shown in Figure 8.2.1, energized and the performance check was conducted.

**8.2.2.2** 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.

**8.2.2.3** The worst test results (the lowest margins) were recorded in Table 8.2.2 and shown in the associated plots.

**Figure 8.2.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment**





|                            |                                                   |                                |                             |
|----------------------------|---------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 15.109, Radiated emission, Class B</b> |                                |                             |
| <b>Test procedure:</b>     | ANSI C63.4, Sections 11.6 and 12.1.4              |                                |                             |
| <b>Test mode:</b>          | Compliance                                        | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 1:29:59 PM                              |                                |                             |
| <b>Temperature:</b> 24 °C  | <b>Air Pressure:</b> 1012 hPa                     | <b>Relative Humidity:</b> 45 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                   |                                |                             |

Table 8.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP  
EUT OPERATING MODE: Receive / Standby  
TEST SITE: SEMI ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
DETECTORS USED: PEAK / QUASI-PEAK  
FREQUENCY RANGE: 30 MHz – 1000 MHz  
RESOLUTION BANDWIDTH: 120 kHz

| Frequency, MHz | Peak emission, dB(μV/m) | Quasi-peak                  |                 |             | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|----------------|-------------------------|-----------------------------|-----------------|-------------|----------------------|-------------------|--------------------------------|---------|
|                |                         | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* |                      |                   |                                |         |
| 160.010000     | 40.99                   | 40.40                       | 43.50           | -3.10       | Vertical             | 1.0               | 150                            | Pass    |
| 199.965000     | 39.22                   | 38.09                       | 43.50           | -5.41       | Horizontal           | 1.6               | 303                            |         |
| 240.537500     | 44.29                   | 42.22                       | 46.00           | -3.78       | Horizontal           | 1.0               | 58                             |         |
| 299.912500     | 35.68                   | 33.16                       | 46.00           | -12.84      | Vertical             | 1.8               | 342                            |         |
| 333.250000     | 46.50                   | 45.47                       | 46.00           | -0.53       | Vertical             | 1.1               | 128                            |         |
| 533.166828     | 46.00                   | 45.21                       | 46.00           | -0.79       | Vertical             | 1.7               | 167                            |         |
| 640.000000     | 46.36                   | 45.43                       | 46.00           | -0.57       | Horizontal           | 1.0               | 155                            |         |
| 666.475000     | 42.70                   | 41.53                       | 46.00           | -4.47       | Vertical             | 1.1               | 186                            |         |

DETECTORS USED: PEAK / AVERAGE  
FREQUENCY RANGE: 1000 MHz – 5000 MHz  
RESOLUTION BANDWIDTH: 1000 kHz

| Frequency, MHz | Peak emission, dB(μV/m) | Average                     |                 |             | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|----------------|-------------------------|-----------------------------|-----------------|-------------|----------------------|-------------------|--------------------------------|---------|
|                |                         | Measured emission, dB(μV/m) | Limit, dB(μV/m) | Margin, dB* |                      |                   |                                |         |
| 1066.37500     | 48.67                   | 31.09                       | 54.00           | -22.91      | Vertical             | 1.5               | 86                             | Pass    |

\*- Margin = Measured emission - specification limit.

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

## Reference numbers of test equipment used

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

Full description is given in Appendix A.

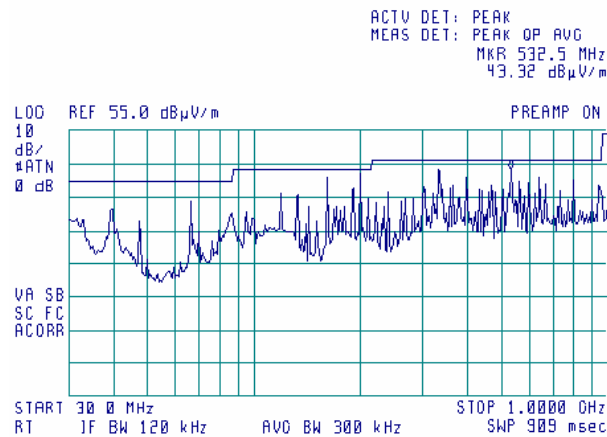


|                     |                                            |                         |                      |
|---------------------|--------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 15.109, Radiated emission, Class B |                         |                      |
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4       |                         |                      |
| Test mode:          | Compliance                                 | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:29:59 PM                       |                         |                      |
| Temperature: 24 °C  | Air Pressure: 1012 hPa                     | Relative Humidity: 45 % | Power Supply: 12 VDC |
| Remarks:            |                                            |                         |                      |

**Plot 8.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization**

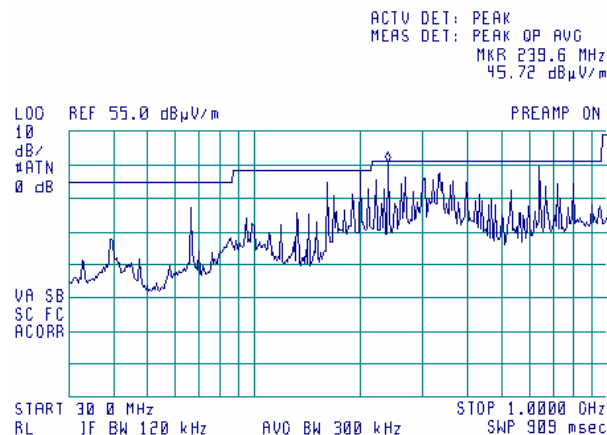
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Standby

09:07:34 JUL 07, 2005

**Plot 8.2.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Standby

08:57:06 JUL 07, 2005



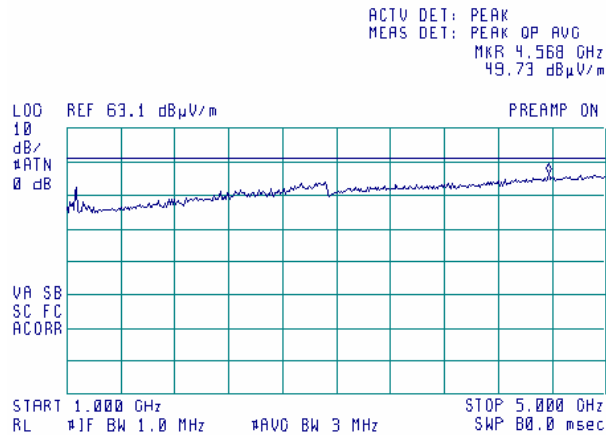


|                     |                                            |                         |                      |
|---------------------|--------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 15.109, Radiated emission, Class B |                         |                      |
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4       |                         |                      |
| Test mode:          | Compliance                                 | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:29:59 PM                       |                         |                      |
| Temperature: 24 °C  | Air Pressure: 1012 hPa                     | Relative Humidity: 45 % | Power Supply: 12 VDC |
| Remarks:            |                                            |                         |                      |

**Plot 8.2.3 Radiated emission measurements in 1000 - 5000 MHz range, vertical antenna polarization**

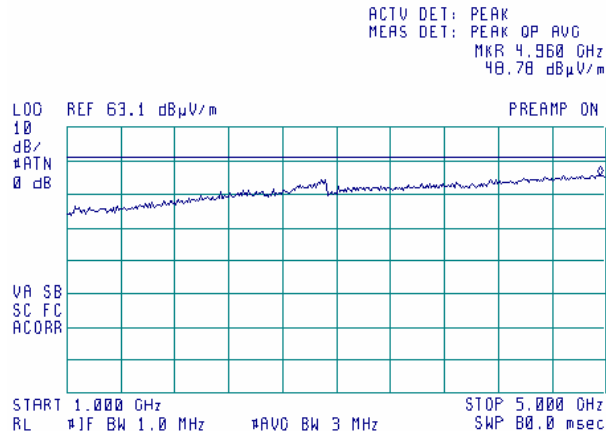
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Standby

10:11:04 JUL 07, 2005

**Plot 8.2.4 Radiated emission measurements in 1000 - 5000 MHz range, horizontal antenna polarization**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Standby

10:15:38 JUL 07, 2005





|                            |                                                                    |                                |                             |
|----------------------------|--------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 15.111, Conducted emission at receiver antenna port</b> |                                |                             |
| <b>Test procedure:</b>     | ANSI C63.4, Section 12.1.5                                         |                                |                             |
| <b>Test mode:</b>          | Compliance                                                         | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 1:31:41 PM                                               |                                |                             |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                      | <b>Relative Humidity:</b> 47 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                    |                                |                             |

### 8.3 Spurious emissions at RF antenna connector

#### 8.3.1 General

This test was performed to measure spurious emissions at RF antenna connector of receiver operated within 30 to 960 MHz band which was tested for compliance with radiated emission limits with the antenna port connected to resistive termination. Specification test limits are given in Table 8.3.1. The test results are provided in Table 8.3.2 and associated plots.

**Table 8.3.1 Spurious emission limits**

| Frequency, MHz                      | EUT type                                    | Power of spurious |       |
|-------------------------------------|---------------------------------------------|-------------------|-------|
|                                     |                                             | nW                | dBm   |
| 25 MHz – 5 <sup>th</sup> harmonic*  | Citizens band (CB) receiver                 | 2.0               | -57.0 |
| 30 MHz – 2 <sup>nd</sup> harmonic** | Superheterodyne receiver                    |                   |       |
| 30 MHz – 5 <sup>th</sup> harmonic*  | Other receiver operates within 30 – 960 MHz |                   |       |

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

\*\* - harmonic of the local oscillator frequency.

#### 8.3.2 Test procedure

**8.3.2.1** The EUT was set up as shown in Figure 8.3.1, energized and its proper operation was checked.

**8.3.2.2** The spurious emission was measured with spectrum analyzer as provided in Table 8.3.2 and associated plots.

**Figure 8.3.1 Spurious emission test setup**





|                            |                                                                    |                                |                             |
|----------------------------|--------------------------------------------------------------------|--------------------------------|-----------------------------|
| <b>Test specification:</b> | <b>Section 15.111, Conducted emission at receiver antenna port</b> |                                |                             |
| <b>Test procedure:</b>     | ANSI C63.4, Section 12.1.5                                         |                                |                             |
| <b>Test mode:</b>          | Compliance                                                         | <b>Verdict:</b>                | <b>PASS</b>                 |
| <b>Date &amp; Time:</b>    | 7/18/2005 1:31:41 PM                                               |                                |                             |
| <b>Temperature:</b> 25 °C  | <b>Air Pressure:</b> 1010 hPa                                      | <b>Relative Humidity:</b> 47 % | <b>Power Supply:</b> 12 VDC |
| <b>Remarks:</b>            |                                                                    |                                |                             |

Table 8.3.2 Spurious emission test results

INVESTIGATED FREQUENCY RANGE: 30 MHz – 4.6 GHz  
RECEIVER TYPE: Other than CB or superheterodyne  
EUT OPERATING MODE: Receive  
DETECTOR USED: Peak  
RESOLUTION BANDWIDTH: 100 kHz  
VIDEO BANDWIDTH: 300 kHz

| Frequency, MHz | Spurious emission, dBm | Limit, dBm | Margin, dB | Verdict |
|----------------|------------------------|------------|------------|---------|
| 925.070        | -75.04                 | -57.0      | -18.04     | Pass    |

## Reference numbers of test equipment used

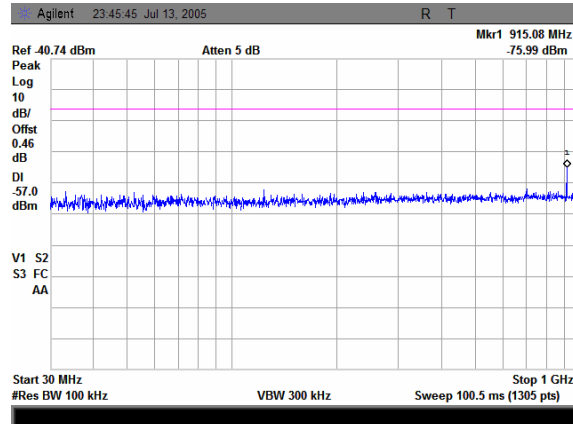
|         |         |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|
| HL 2254 | HL 2780 |  |  |  |  |  |  |
|---------|---------|--|--|--|--|--|--|

Full description is given in Appendix A.

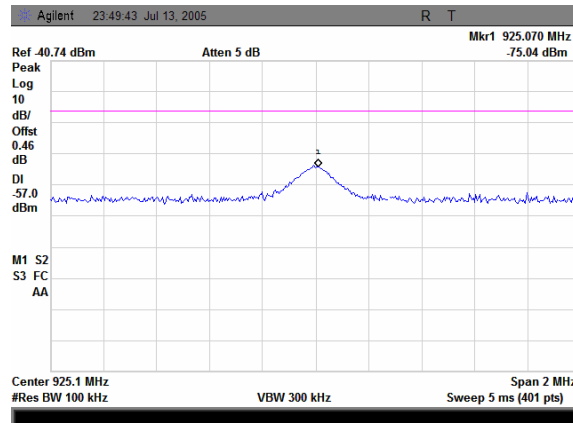


|                     |                                                             |                         |                      |
|---------------------|-------------------------------------------------------------|-------------------------|----------------------|
| Test specification: | Section 15.111, Conducted emission at receiver antenna port |                         |                      |
| Test procedure:     | ANSI C63.4, Section 12.1.5                                  |                         |                      |
| Test mode:          | Compliance                                                  | Verdict:                | PASS                 |
| Date & Time:        | 7/18/2005 1:31:41 PM                                        |                         |                      |
| Temperature: 25 °C  | Air Pressure: 1010 hPa                                      | Relative Humidity: 47 % | Power Supply: 12 VDC |
| Remarks:            |                                                             |                         |                      |

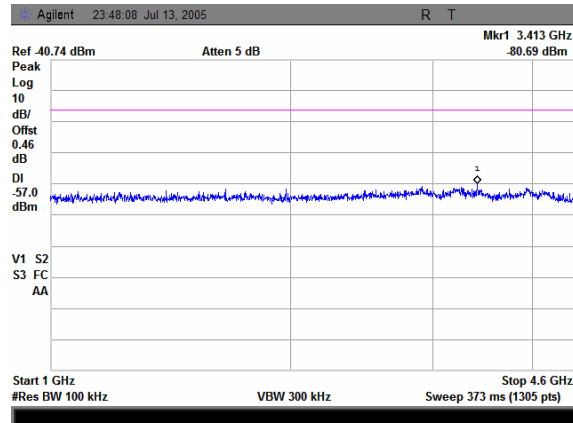
Plot 8.3.1 Spurious emission test results in 30 – 1000 MHz frequency range



Plot 8.3.2 Spurious emission test result at 925 MHz



Plot 8.3.3 Spurious emission test results in 1.0 – 4.6 GHz frequency range



**9 APPENDIX A Test equipment and ancillaries used for tests**

| HL No | Description                                                           | Manufacturer               | Model              | Ser. No.                 | Last Cal. | Due Cal.  |
|-------|-----------------------------------------------------------------------|----------------------------|--------------------|--------------------------|-----------|-----------|
| 0174  | Monitor, Field, 10kHz-1GHz, 1-300 V/m, w/fiberoptic                   | Amplifier Research         | FM1000             | 60525                    | 13-Feb-05 | 13-Feb-06 |
| 0410  | Cable, Coax, Microwave, DC-18 GHz, N-N, 1 m                           | Gore                       | PFP01P0 1039.4     | 9338767                  | 13-Feb-05 | 13-Feb-06 |
| 0446  | Antenna, Loop active, 10kHz-30MHz                                     | EMCO                       | 6502               | 2857                     | 13-Feb-05 | 13-Feb-06 |
| 0447  | LISN, 16/2, 300V RMS                                                  | HL                         | LISN 16 - 1        | 066                      | 13-Feb-05 | 13-Feb-06 |
| 0465  | Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m                             | HL                         | AC - 1             | 023                      | 03-Nov-04 | 03-Nov-05 |
| 0493  | Oven temperature -45...175 deg C                                      | Thermotron                 | S-1.2 Mini-Max     | 14016                    | 10-Oct-04 | 10-Oct-05 |
| 0521  | EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz | Hewlett Packard            | 8546A              | 3617A 00319, 3448A002 53 | 10-Oct-04 | 10-Oct-05 |
| 0589  | Cable Coaxial, GORE A2P01POL118, 2.3 m                                | HL                         | GORE-3             | 176                      | 02-Dec-04 | 02-Dec-05 |
| 0604  | Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz                | EMCO                       | 3141               | 9611-1011                | 10-Jan-05 | 10-Jan-06 |
| 0661  | Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm                    | Hewlett Packard            | 83640B             | 3614A002 66              | 10-Oct-04 | 10-Oct-05 |
| 0672  | Shielded Room 4,6(L) x 4,2(W) x 2,4(H) m                              | HL                         | SR - 3             | 027                      | 11-Nov-04 | 11-Nov-05 |
| 0787  | Transient Limiter                                                     | Hewlett Packard            | 11947A             | 3107A018 77              | 21-Nov-04 | 21-Nov-05 |
| 1200  | Quadruplexer 1-12 GHz (1-2 GHz; 2-4GHz;4-8 GHz; 8-12GHz)              | Elettronica S.p.A. - Roma  | UE 84              | D/00240                  | 10-Feb-05 | 10-Feb-06 |
| 1424  | Spectrum Analyzer, 30 Hz- 40 GHz                                      | Agilent Technologies (HP)  | 8564EC             | 3946A002 19              | 11-Nov-04 | 11-Nov-05 |
| 1430  | EMI Receiver, 9 kHz - 2.9 GHz                                         | Agilent Technologies (HP)  | 8542E              | 3807A002 62,3705A0 0217  | 11-Nov-04 | 11-Nov-05 |
| 1460  | Cable, 1 m                                                            | Harbour Industries         | MIL 17/60-RG142    | 1460                     | 23-Sep-04 | 23-Sep-05 |
| 1502  | Cable RF, 6 m                                                         | Belden                     | M17/167 MIL-C-17   | 1502                     | 12-Feb-05 | 12-Feb-06 |
| 1510  | Cable RF, 8 m                                                         | Belden                     | M17/167 MIL-C-17   | 1510                     | 02-Dec-04 | 02-Dec-05 |
| 1628  | Isotropic Field Probe 0.01-1000 MHz, 1-300 V/m                        | Amplifier Research         | FP2000             | 22122                    | 06-Apr-05 | 06-Apr-06 |
| 1653  | Analyzer EMC 9 kHz - 1.5 GHz                                          | Agilent Technologies (HP)  | E7401A             | US394402 81              | 06-Feb-05 | 06-Feb-06 |
| 1941  | Cable 18GHz, 4 m, green                                               | Rhophase Microwave Limited | SPS-1803A-4000-NPS | T4657                    | 17-Oct-04 | 17-Oct-05 |
| 1947  | Cable 18GHz, 6.5 m, blue                                              | Rhophase Microwave Limited | NPS-1803A-6500-NPS | T4974                    | 17-Oct-04 | 17-Oct-05 |
| 1984  | Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type        | EMC Test Systems           | 3115               | 9911-5964                | 22-Mar-05 | 22-Mar-06 |



| HL No | Description                                              | Manufacturer               | Model              | Ser. No.  | Last Cal. | Due Cal.  |
|-------|----------------------------------------------------------|----------------------------|--------------------|-----------|-----------|-----------|
| 2009  | Cable RF, 8 m                                            | Alpha Wire                 | RG-214             | C-56      | 02-Dec-04 | 02-Dec-05 |
| 2254  | Cable 40GHz, 0.8 m, blue                                 | Rhophase Microwave Limited | KPS-1503A-800-KPS  | W4907     | 23-Sep-04 | 23-Sep-05 |
| 2259  | Amplifier Low Noise 2-20 GHz                             | Sophia Wireless            | LNA0220-C          | 0223      | 05-Nov-04 | 05-Nov-05 |
| 2399  | Cable 40GHz, 1.5 m, blue                                 | Rhophase Microwave Limited | KPS-1503A-1500-KPS | X2945     | 24-Jun-05 | 24-Jun-06 |
| 2400  | Cable 40GHz, 1.5 m, green                                | Rhophase Microwave Limited | KPS-1503A-1500-KPS | X2946     | 23-Sep-04 | 23-Sep-05 |
| 2432  | Antenna, Double-Ridged Waveguide Horn 1-18 GHz           | EMC Test Systems           | 3115               | 00027177  | 22-Mar-05 | 22-Mar-06 |
| 2499  | Quadruplexer 1-12 GHz (1-2 GHz; 2-4GHz;4-8 GHz; 8-12GHz) | Elettronica S.p.A. - Roma  | UE 84              | D/00239   | 10-Feb-05 | 10-Feb-06 |
| 2524  | Attenuator, 10 dB, DC-18 GHz                             | Midwest Microwave          | 263-10             | 2524      | 03-Jan-05 | 03-Jan-06 |
| 2780  | EMS analyzer, 100 Hz to 26.5 GHz                         | Agilent Technologies (HP)  | E7405A             | MY4510246 | 11-Jun-05 | 11-Jun-06 |

**10 APPENDIX B Measurement uncertainties****Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements**

| Test description                                                        | Expanded uncertainty                                                                                                                                                                                                        |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Transmitter tests</b>                                                |                                                                                                                                                                                                                             |
| Carrier power conducted at antenna connector                            | $\pm 1.7$ dB                                                                                                                                                                                                                |
| Carrier power radiated (substitution method)                            | $\pm 4.5$ dB                                                                                                                                                                                                                |
| Occupied bandwidth                                                      | $\pm 8\%$                                                                                                                                                                                                                   |
| Conducted emissions at RF antenna connector                             | 9 kHz to 2.9 GHz: $\pm 2.6$ dB<br>2.9 GHz to 6.46 GHz: $\pm 3.5$ dB<br>6.46 GHz to 13.2 GHz: $\pm 4.3$ dB<br>13.2 GHz to 22.0 GHz: $\pm 5.0$ dB<br>22.0 GHz to 26.8 GHz: $\pm 5.5$ dB<br>26.8 GHz to 40.0 GHz: $\pm 4.8$ dB |
| Spurious emissions radiated 30 MHz – 40 GHz (substitution method)       | $\pm 4.5$ dB                                                                                                                                                                                                                |
| Frequency error                                                         | 30 – 300 MHz: $\pm 50.5$ Hz (1.68 ppm)<br>300 – 1000 MHz: $\pm 168$ Hz (0.56 ppm)                                                                                                                                           |
| Transient frequency behaviour                                           | 187 Hz<br>$\pm 13.9\%$                                                                                                                                                                                                      |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements        | $\pm 1.0\%$                                                                                                                                                                                                                 |
| <b>Unintentional radiator tests</b>                                     |                                                                                                                                                                                                                             |
| Conducted emissions with LISN                                           | 9 kHz to 150 kHz: $\pm 3.9$ dB<br>150 kHz to 30 MHz: $\pm 3.8$ dB                                                                                                                                                           |
| 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                                                                        |

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of ISO/IEC 17025 (or alternately ANSI/NCSL Z540-1).

The laboratory calibrates its measurement standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements. The Hermon Labs EMC measurements uncertainty is given in the table above.

## 11 APPENDIX C Test facility description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

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Telephone: +972 4628 8001  
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e-mail: mail@hermonlabs.com  
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

## 12 APPENDIX D Specification references

|                         |                                                                                                                                                                      |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 47CFR part 90: 2004     | Private land mobile radio services                                                                                                                                   |
| 47CFR part 1: 2004      | Practice and procedure                                                                                                                                               |
| 47CFR part 2: 2004      | Frequency allocations and radio treaty matters; general rules and regulations                                                                                        |
| 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. |
| ANSI/TIA/EIA-603-A:2001 | Land Mobile FM or PM Communications Equipment Measurement and Performance Standards                                                                                  |

**13 APPENDIX E Abbreviations and acronyms**

|                |                                             |
|----------------|---------------------------------------------|
| A              | ampere                                      |
| AC             | alternating current                         |
| A/m            | ampere per meter                            |
| AM             | amplitude modulation                        |
| AVRG           | average (detector)                          |
| BB             | broad band                                  |
| 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         |
| dB $\Omega$    | decibel referred to one Ohm                 |
| 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                                       |
| ITE            | information technology equipment            |
| k              | kilo                                        |
| kHz            | kilohertz                                   |
| LISN           | line impedance stabilization network        |
| LO             | local oscillator                            |
| m              | meter                                       |
| MHz            | megahertz                                   |
| min            | minute                                      |
| mm             | millimeter                                  |
| ms             | millisecond                                 |
| $\mu$ s        | microsecond                                 |
| NA             | not applicable                              |
| NB             | narrow band                                 |
| NT             | not tested                                  |
| OATS           | open area test site                         |
| $\Omega$       | Ohm                                         |
| QP             | quasi-peak                                  |
| PCB            | printed circuit board                       |
| PM             | pulse modulation                            |
| PS             | power supply                                |
| RE             | radiated emission                           |
| RF             | radio frequency                             |
| rms            | root mean square                            |
| Rx             | receive                                     |
| s              | second                                      |
| T              | temperature                                 |
| Tx             | transmit                                    |
| V              | volt                                        |
| VA             | volt-ampere                                 |

**14 APPENDIX F Test equipment correction factors**

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

| Frequency,<br>MHz | Correction factor,<br>dB |
|-------------------|--------------------------|
| 0.01              | 5.0                      |
| 0.02              | 2.2                      |
| 0.03              | 1.1                      |
| 0.04              | 0.7                      |
| 0.05              | 0.5                      |
| 0.1               | 0.2                      |
| 0.2               | 0.1                      |
| 0.4               | 0.1                      |
| 0.6               | 0.1                      |
| 0.8               | 0.1                      |
| 1                 | 0.1                      |
| 2                 | 0.1                      |
| 3                 | 0.1                      |
| 4                 | 0.1                      |
| 6                 | 0.2                      |
| 10                | 0.3                      |
| 12                | 0.4                      |
| 16                | 0.5                      |
| 18                | 0.6                      |
| 20                | 0.7                      |
| 25                | 0.9                      |
| 28                | 1.2                      |
| 30                | 1.3                      |

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

**Antenna Factor**  
**Active Loop Antenna, EMC Test Systems, model 6502, serial number 2857**

| Frequency,<br>MHz | Magnetic Antenna Factor,<br>dB(S/m) | Electric Antenna Factor,<br>dB(1/m) |
|-------------------|-------------------------------------|-------------------------------------|
| 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                               | 9.7                                 |
| 0.750             | -41.9                               | 9.6                                 |
| 1.000             | -41.4                               | 10.1                                |
| 2.000             | -41.5                               | 10.0                                |
| 3.000             | -41.4                               | 10.1                                |
| 4.000             | -41.4                               | 10.1                                |
| 5.000             | -41.5                               | 10.0                                |
| 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(S/m) is to be added to receiver meter reading in dB( $\mu$ V) to convert it into field intensity in dB( $\mu$ A/m).  
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, serial number 1011

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

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



**Antenna factor**  
**Double-ridged wave guide horn antenna**  
**EMC Test Systems, model 3115, serial no: 9911-5964**

| Frequency,<br>MHz | Antenna gain,<br>dBi | Antenna factor.<br>dB(1/m) |
|-------------------|----------------------|----------------------------|
| 1000.0            | 5.8                  | 24.5                       |
| 1500.0            | 9.0                  | 24.8                       |
| 2000.0            | 8.6                  | 27.7                       |
| 2500.0            | 9.5                  | 28.7                       |
| 3000.0            | 8.9                  | 30.8                       |
| 3500.0            | 8.2                  | 32.9                       |
| 4000.0            | 9.6                  | 32.7                       |
| 4500.0            | 11.2                 | 32.1                       |
| 5000.0            | 10.6                 | 33.6                       |
| 5500.0            | 9.8                  | 35.3                       |
| 6000.0            | 10.1                 | 35.7                       |
| 6500.0            | 10.7                 | 35.8                       |
| 7000.0            | 10.9                 | 36.2                       |
| 7500.0            | 10.5                 | 37.2                       |
| 8000.0            | 11.1                 | 37.2                       |
| 8500.0            | 10.8                 | 38.1                       |
| 9000.0            | 10.7                 | 38.6                       |
| 9500.0            | 11.5                 | 38.3                       |
| 10000.0           | 11.8                 | 38.4                       |
| 10500.0           | 12.3                 | 38.3                       |
| 11000.0           | 12.3                 | 38.8                       |
| 11500.0           | 11.5                 | 39.9                       |
| 12000.0           | 12.2                 | 39.6                       |
| 12500.0           | 12.6                 | 39.5                       |
| 13000.0           | 12.0                 | 40.5                       |
| 13500.0           | 11.7                 | 41.1                       |
| 14000.0           | 11.7                 | 41.5                       |
| 14500.0           | 12.7                 | 40.8                       |
| 15000.0           | 14.2                 | 39.5                       |
| 15500.0           | 16.0                 | 38.1                       |
| 16000.0           | 16.2                 | 38.1                       |
| 16500.0           | 14.5                 | 40.1                       |
| 17000.0           | 12.2                 | 42.6                       |
| 17500.0           | 9.7                  | 45.4                       |
| 18000.0           | 6.6                  | 48.7                       |

Antenna factor 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**  
**EMC Test Systems, model 3115, serial no: 00027177**

| Frequency,<br>MHz | Antenna gain,<br>dBi | Antenna factor.<br>dB(1/m) |
|-------------------|----------------------|----------------------------|
| 1000.0            | 5.5                  | 24.7                       |
| 1500.0            | 8.0                  | 25.7                       |
| 2000.0            | 8.4                  | 27.8                       |
| 2500.0            | 9.3                  | 28.9                       |
| 3000.0            | 9.0                  | 30.7                       |
| 3500.0            | 9.3                  | 31.8                       |
| 4000.0            | 9.3                  | 33.0                       |
| 4500.0            | 10.4                 | 32.8                       |
| 5000.0            | 10.0                 | 34.2                       |
| 5500.0            | 10.1                 | 34.9                       |
| 6000.0            | 10.6                 | 35.2                       |
| 6500.0            | 11.0                 | 35.4                       |
| 7000.0            | 10.8                 | 36.3                       |
| 7500.0            | 10.4                 | 37.3                       |
| 8000.0            | 10.8                 | 37.5                       |
| 8500.0            | 10.8                 | 38.0                       |
| 9000.0            | 11.0                 | 38.3                       |
| 9500.0            | 11.5                 | 38.3                       |
| 10000.0           | 11.5                 | 38.7                       |
| 10500.0           | 11.9                 | 38.7                       |
| 11000.0           | 12.2                 | 38.9                       |
| 11500.0           | 11.9                 | 39.5                       |
| 12000.0           | 12.3                 | 39.5                       |
| 12500.0           | 12.7                 | 39.4                       |
| 13000.0           | 12.0                 | 40.5                       |
| 13500.0           | 12.0                 | 40.8                       |
| 14000.0           | 11.6                 | 41.5                       |
| 14500.0           | 12.2                 | 41.3                       |
| 15000.0           | 13.6                 | 40.2                       |
| 15500.0           | 15.3                 | 38.7                       |
| 16000.0           | 15.8                 | 38.5                       |
| 16500.0           | 14.8                 | 39.8                       |
| 17000.0           | 12.9                 | 41.9                       |
| 17500.0           | 9.2                  | 45.8                       |
| 18000.0           | 6.2                  | 49.1                       |

Antenna factor is to be added to receiver meter reading in dB( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).

**Cable loss**

Cable coaxial, GORE A2P01POL118, 2.3 m, model GORE-3, serial number 176, HL 0589  
+ Cable coaxial, ANDREW PSWJ4, 6 m, model: ANDREW-6, serial number 163, HL 1004

| No. | Frequency,<br>MHz | Cable loss,<br>dB | Tolerance<br>(Specification),<br>dB | Measurement<br>uncertainty,<br>dB |
|-----|-------------------|-------------------|-------------------------------------|-----------------------------------|
| 1   | 30                | 0.33              | $\leq 6.5$                          | $\pm 0.12$                        |
| 2   | 50                | 0.40              |                                     |                                   |
| 3   | 100               | 0.57              |                                     |                                   |
| 4   | 300               | 0.97              |                                     |                                   |
| 5   | 500               | 1.25              |                                     |                                   |
| 6   | 800               | 1.59              |                                     |                                   |
| 7   | 1000              | 1.81              |                                     |                                   |
| 8   | 1200              | 1.97              |                                     |                                   |
| 9   | 1400              | 2.15              |                                     |                                   |
| 10  | 1600              | 2.28              |                                     |                                   |
| 11  | 1800              | 2.43              |                                     |                                   |
| 12  | 2000              | 2.61              |                                     |                                   |
| 13  | 2200              | 2.75              |                                     |                                   |
| 14  | 2400              | 2.89              |                                     |                                   |
| 15  | 2600              | 2.97              |                                     |                                   |
| 16  | 2800              | 3.21              | $\leq 6.5$                          | $\pm 0.12$                        |
| 17  | 3000              | 3.32              |                                     |                                   |
| 18  | 3300              | 3.47              |                                     |                                   |
| 19  | 3600              | 3.62              |                                     |                                   |
| 20  | 3900              | 3.84              |                                     |                                   |
| 21  | 4200              | 3.92              |                                     | $\pm 0.17$                        |
| 22  | 4500              | 4.07              |                                     |                                   |
| 23  | 4800              | 4.36              |                                     |                                   |
| 24  | 5100              | 4.62              |                                     |                                   |
| 25  | 5400              | 4.78              |                                     |                                   |
| 26  | 5700              | 5.16              |                                     |                                   |
| 27  | 6000              | 5.67              |                                     |                                   |
| 28  | 6500              | 5.99              |                                     |                                   |



**Cable loss**  
**RF cable 8 m, model RG-214, serial number C-56, HL 2009**

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



Cable 40 GHz, 0.8 m, blue, model KPS-1503A-800-KPS, serial number W4907 (HL 2254), insertion loss

| Frequency,<br>GHz | Insertion loss,<br>dB | Frequency,<br>GHz | Insertion loss,<br>dB |
|-------------------|-----------------------|-------------------|-----------------------|
| 0.03              | 0.05                  | 10.30             | 1.20                  |
| 0.05              | 0.09                  | 10.50             | 1.22                  |
| 0.1               | 0.10                  | 10.70             | 1.30                  |
| 0.2               | 0.16                  | 10.90             | 1.21                  |
| 0.3               | 0.21                  | 11.10             | 1.19                  |
| 0.5               | 0.26                  | 11.30             | 1.26                  |
| 0.7               | 0.31                  | 11.50             | 1.25                  |
| 0.9               | 0.36                  | 11.70             | 1.23                  |
| 1.1               | 0.39                  | 11.90             | 1.29                  |
| 1.3               | 0.42                  | 12.10             | 1.25                  |
| 1.5               | 0.46                  | 12.40             | 1.33                  |
| 1.7               | 0.47                  | 13.00             | 1.41                  |
| 1.9               | 0.51                  | 13.50             | 1.42                  |
| 2.1               | 0.55                  | 14.00             | 1.61                  |
| 2.3               | 0.54                  | 14.50             | 1.53                  |
| 2.5               | 0.56                  | 15.00             | 1.63                  |
| 2.7               | 0.60                  | 15.50             | 1.53                  |
| 2.9               | 0.61                  | 16.00             | 1.53                  |
| 3.1               | 0.63                  | 16.50             | 1.54                  |
| 3.3               | 0.66                  | 17.00             | 1.67                  |
| 3.5               | 0.68                  | 17.50             | 1.88                  |
| 3.7               | 0.72                  | 18.00             | 1.76                  |
| 3.9               | 0.70                  | 18.50             | 2.03                  |
| 4.1               | 0.75                  | 19.00             | 1.66                  |
| 4.3               | 0.75                  | 19.50             | 1.71                  |
| 4.5               | 0.80                  | 20.00             | 1.65                  |
| 4.7               | 0.78                  | 20.50             | 1.87                  |
| 4.9               | 0.81                  | 21.00             | 1.75                  |
| 5.1               | 0.82                  | 21.50             | 1.86                  |
| 5.3               | 0.84                  | 22.00             | 1.81                  |
| 5.5               | 0.84                  | 22.50             | 2.03                  |
| 5.7               | 0.86                  | 23.00             | 1.91                  |
| 5.9               | 0.90                  | 23.50             | 1.87                  |
| 6.1               | 0.91                  | 24.00             | 1.97                  |
| 6.3               | 0.95                  | 24.50             | 1.85                  |
| 6.5               | 0.92                  | 25.00             | 2.01                  |
| 6.7               | 0.91                  | 25.50             | 2.02                  |
| 6.9               | 0.95                  | 26.00             | 2.15                  |
| 7.1               | 0.98                  | 26.50             | 2.11                  |
| 7.3               | 1.03                  | 27.00             | 2.00                  |
| 7.5               | 0.98                  | 28.00             | 2.04                  |
| 7.7               | 1.06                  | 29.00             | 1.97                  |
| 7.9               | 1.08                  | 30.00             | 1.97                  |
| 8.1               | 1.06                  | 31.00             | 2.31                  |
| 8.3               | 1.10                  | 32.00             | 2.24                  |
| 8.5               | 1.10                  | 33.00             | 2.31                  |
| 8.7               | 1.12                  | 34.00             | 2.36                  |
| 8.9               | 1.12                  | 35.00             | 2.33                  |
| 9.1               | 1.14                  | 36.00             | 2.47                  |
| 9.3               | 1.18                  | 37.00             | 2.56                  |
| 9.5               | 1.16                  | 38.00             | 2.45                  |
| 9.7               | 1.18                  | 39.00             | 2.68                  |
| 9.9               | 1.17                  | 40.00             | 2.60                  |
| 10.1              | 1.18                  |                   |                       |



Cable 18GHz, 4 m, green, model: SPS-1803A-4000-NPS, s/n T4657 (HL 1941)  
Calibration data

| Frequency,<br>GHz | Insertion loss,<br>dB |
|-------------------|-----------------------|
| 0.03              | 0.19                  |
| 0.05              | 0.24                  |
| 0.10              | 0.33                  |
| 0.20              | 0.46                  |
| 0.30              | 0.57                  |
| 0.40              | 0.65                  |
| 0.50              | 0.73                  |
| 0.60              | 0.80                  |
| 0.70              | 0.87                  |
| 0.80              | 0.92                  |
| 0.90              | 0.98                  |
| 1.00              | 1.03                  |
| 1.10              | 1.08                  |
| 1.20              | 1.14                  |
| 1.30              | 1.18                  |
| 1.40              | 1.22                  |
| 1.50              | 1.27                  |
| 1.60              | 1.32                  |
| 1.70              | 1.35                  |
| 1.80              | 1.40                  |
| 1.90              | 1.43                  |
| 2.00              | 1.46                  |
| 2.10              | 1.50                  |
| 2.20              | 1.54                  |
| 2.30              | 1.57                  |
| 2.40              | 1.61                  |
| 2.50              | 1.64                  |
| 2.60              | 1.67                  |
| 2.70              | 1.70                  |
| 2.80              | 1.74                  |
| 2.90              | 1.77                  |
| 3.10              | 1.83                  |
| 3.30              | 1.89                  |
| 3.50              | 1.95                  |
| 3.70              | 2.01                  |
| 3.90              | 2.07                  |
| 4.10              | 2.14                  |
| 4.30              | 2.18                  |
| 4.50              | 2.26                  |
| 4.70              | 2.31                  |
| 4.90              | 2.32                  |
| 5.10              | 2.42                  |
| 5.30              | 2.45                  |
| 5.50              | 2.47                  |
| 5.70              | 2.53                  |
| 5.90              | 2.59                  |

| Frequency,<br>GHz | Insertion loss,<br>dB |
|-------------------|-----------------------|
| 6.10              | 2.63                  |
| 6.30              | 2.66                  |
| 6.50              | 2.72                  |
| 6.70              | 2.77                  |
| 6.90              | 2.78                  |
| 7.10              | 2.81                  |
| 7.30              | 2.87                  |
| 7.50              | 2.92                  |
| 7.70              | 2.94                  |
| 7.90              | 3.02                  |
| 8.10              | 3.06                  |
| 8.30              | 3.13                  |
| 8.50              | 3.14                  |
| 8.70              | 3.16                  |
| 8.90              | 3.23                  |
| 9.10              | 3.20                  |
| 9.30              | 3.22                  |
| 9.50              | 3.31                  |
| 9.70              | 3.32                  |
| 9.90              | 3.39                  |
| 10.10             | 3.42                  |
| 10.30             | 3.46                  |
| 10.50             | 3.46                  |
| 10.70             | 3.48                  |
| 10.90             | 3.50                  |
| 11.10             | 3.58                  |
| 11.30             | 3.63                  |
| 11.50             | 3.65                  |
| 11.70             | 3.85                  |
| 11.90             | 3.81                  |
| 12.10             | 3.84                  |
| 12.40             | 3.91                  |
| 13.00             | 3.87                  |
| 13.50             | 3.99                  |
| 14.00             | 4.12                  |
| 14.50             | 4.17                  |
| 15.00             | 4.27                  |
| 15.50             | 4.33                  |
| 16.00             | 4.38                  |
| 16.50             | 4.38                  |
| 17.00             | 4.42                  |
| 17.50             | 4.61                  |
| 18.00             | 4.78                  |



**Insertion loss**  
**Cable coax microwave, 1 m, model: PFP01P10394, HL 0410**

| Frequency,<br>GHz | Insertion loss,<br>dB |
|-------------------|-----------------------|
| 0.03              | 0.04                  |
| 0.05              | 0.06                  |
| 0.1               | 0.08                  |
| 0.2               | 0.11                  |
| 0.3               | 0.13                  |
| 0.5               | 0.19                  |
| 0.7               | 0.23                  |
| 0.9               | 0.26                  |
| 1.1               | 0.30                  |
| 1.3               | 0.32                  |
| 1.5               | 0.33                  |
| 1.7               | 0.39                  |
| 1.9               | 0.38                  |
| 2.1               | 0.43                  |
| 2.3               | 0.44                  |
| 2.5               | 0.48                  |
| 2.7               | 0.49                  |
| 2.9               | 0.49                  |
| 3.1               | 0.53                  |
| 3.3               | 0.50                  |
| 3.5               | 0.58                  |
| 3.7               | 0.56                  |
| 3.9               | 0.71                  |
| 4.1               | 0.66                  |
| 4.3               | 0.79                  |
| 4.5               | 0.72                  |
| 4.7               | 0.71                  |
| 4.9               | 0.68                  |
| 5.1               | 0.65                  |
| 5.3               | 0.66                  |
| 5.5               | 0.78                  |
| 5.7               | 0.86                  |
| 5.9               | 0.85                  |
| 6.1               | 0.99                  |
| 6.3               | 0.82                  |
| 6.5               | 0.87                  |
| 6.7               | 0.77                  |
| 6.9               | 0.81                  |
| 7.1               | 0.84                  |
| 7.3               | 0.97                  |
| 7.5               | 0.90                  |
| 7.7               | 0.90                  |

| Frequency,<br>GHz | Insertion loss,<br>dB |
|-------------------|-----------------------|
| 7.9               | 0.96                  |
| 8.1               | 0.83                  |
| 8.3               | 1.02                  |
| 8.5               | 0.94                  |
| 8.7               | 1.14                  |
| 8.9               | 1.06                  |
| 9.1               | 1.23                  |
| 9.3               | 1.02                  |
| 9.5               | 1.04                  |
| 9.7               | 1.09                  |
| 9.9               | 1.05                  |
| 10.1              | 1.29                  |
| 10.3              | 1.24                  |
| 10.5              | 1.39                  |
| 10.7              | 1.17                  |
| 10.9              | 1.39                  |
| 11.1              | 1.11                  |
| 11.3              | 1.31                  |
| 11.5              | 1.15                  |
| 11.7              | 1.18                  |
| 11.9              | 1.20                  |
| 12.1              | 1.21                  |
| 12.4              | 1.20                  |
| 13.0              | 1.22                  |
| 13.5              | 1.38                  |
| 14.0              | 1.56                  |
| 14.5              | 1.34                  |
| 15.0              | 1.56                  |
| 15.5              | 1.65                  |
| 16.0              | 1.35                  |
| 16.5              | 1.47                  |
| 17.0              | 1.60                  |
| 17.5              | 1.55                  |
| 18.0              | 1.93                  |



**Cable RF 40 GHz, 1.5m, blue, model: KPS-1503A-1500-KPS, s/n X2945 (HL 2399)**  
**Insertion loss**

| Frequency, GHz | Insertion Loss, dB |
|----------------|--------------------|
| 0.03           | 0.26               |
| 0.05           | 0.25               |
| 0.1            | 0.34               |
| 0.2            | 0.47               |
| 0.3            | 0.56               |
| 0.5            | 0.71               |
| 0.7            | 0.83               |
| 0.9            | 0.93               |
| 1.1            | 1.01               |
| 1.3            | 1.08               |
| 1.5            | 1.16               |
| 1.7            | 1.22               |
| 1.9            | 1.29               |
| 2.1            | 1.33               |
| 2.3            | 1.38               |
| 2.5            | 1.45               |
| 2.7            | 1.50               |
| 2.9            | 1.55               |
| 3.1            | 1.60               |
| 3.3            | 1.66               |
| 3.5            | 1.71               |
| 3.7            | 1.75               |
| 3.9            | 1.79               |
| 4.1            | 1.84               |
| 4.3            | 1.87               |
| 4.5            | 1.91               |
| 4.7            | 1.95               |
| 4.9            | 1.98               |
| 5.1            | 2.02               |
| 5.3            | 2.04               |
| 5.5            | 2.07               |
| 5.7            | 2.11               |
| 5.9            | 2.12               |
| 6.1            | 2.16               |
| 6.3            | 2.20               |
| 6.5            | 2.23               |
| 6.7            | 2.23               |
| 6.9            | 2.27               |
| 7.1            | 2.32               |
| 7.3            | 2.32               |
| 7.5            | 2.34               |
| 7.7            | 2.38               |
| 7.9            | 2.39               |
| 8.1            | 2.39               |
| 8.3            | 2.43               |
| 8.5            | 2.51               |
| 8.7            | 2.48               |
| 8.9            | 2.51               |
| 9.1            | 2.54               |
| 9.3            | 2.53               |
| 9.5            | 2.56               |
| 9.7            | 2.54               |
| 9.9            | 2.57               |



## Cable 40 GHz, 1.5 m, green; model KPS-1503A-1500-KPS, serial number X2946 (HL 2400)

| Frequency,<br>GHz | Insertion loss,<br>dB |
|-------------------|-----------------------|
| 0.03              | 0.06                  |
| 0.05              | 0.08                  |
| 0.1               | 0.15                  |
| 0.2               | 0.23                  |
| 0.3               | 0.29                  |
| 0.5               | 0.37                  |
| 0.7               | 0.46                  |
| 0.9               | 0.53                  |
| 1.1               | 0.58                  |
| 1.3               | 0.65                  |
| 1.5               | 0.66                  |
| 1.7               | 0.72                  |
| 1.9               | 0.76                  |
| 2.1               | 0.79                  |
| 2.3               | 0.85                  |
| 2.5               | 0.90                  |
| 2.7               | 0.91                  |
| 2.9               | 0.97                  |
| 3.1               | 0.97                  |
| 3.3               | 1.03                  |
| 3.5               | 1.06                  |
| 3.7               | 1.10                  |
| 3.9               | 1.13                  |
| 4.1               | 1.16                  |
| 4.3               | 1.18                  |
| 4.5               | 1.21                  |
| 4.7               | 1.23                  |
| 4.9               | 1.26                  |
| 5.1               | 1.28                  |
| 5.3               | 1.31                  |
| 5.5               | 1.32                  |
| 5.7               | 1.36                  |
| 5.9               | 1.37                  |
| 6.1               | 1.38                  |
| 6.3               | 1.44                  |
| 6.5               | 1.46                  |
| 6.7               | 1.49                  |
| 6.9               | 1.50                  |
| 7.1               | 1.51                  |
| 7.3               | 1.55                  |
| 7.5               | 1.56                  |
| 7.7               | 1.58                  |
| 7.9               | 1.60                  |
| 8.1               | 1.61                  |
| 8.3               | 1.68                  |
| 8.5               | 1.68                  |
| 8.7               | 1.75                  |
| 8.9               | 1.74                  |
| 9.1               | 1.81                  |
| 9.3               | 1.79                  |
| 9.5               | 1.86                  |
| 9.7               | 1.85                  |
| 9.9               | 1.87                  |
| 10.1              | 1.88                  |

| Frequency,<br>GHz | Insertion loss,<br>dB |
|-------------------|-----------------------|
| 10.30             | 1.82                  |
| 10.50             | 1.92                  |
| 10.70             | 1.86                  |
| 10.90             | 1.96                  |
| 11.10             | 1.90                  |
| 11.30             | 1.99                  |
| 11.50             | 1.95                  |
| 11.70             | 2.00                  |
| 11.90             | 2.01                  |
| 12.10             | 1.99                  |
| 12.40             | 2.06                  |
| 13.00             | 2.11                  |
| 13.50             | 2.17                  |
| 14.00             | 2.36                  |
| 14.50             | 2.32                  |
| 15.00             | 2.30                  |
| 15.50             | 2.34                  |
| 16.00             | 2.34                  |
| 16.50             | 2.40                  |
| 17.00             | 2.46                  |
| 17.50             | 2.54                  |
| 18.00             | 2.61                  |
| 18.50             | 2.59                  |
| 19.00             | 2.59                  |
| 19.50             | 2.67                  |
| 20.00             | 2.62                  |
| 20.50             | 2.73                  |
| 21.00             | 2.71                  |
| 21.50             | 2.78                  |
| 22.00             | 2.83                  |
| 22.50             | 2.81                  |
| 23.00             | 2.91                  |
| 23.50             | 2.97                  |
| 24.00             | 2.98                  |
| 24.50             | 2.97                  |
| 25.00             | 3.03                  |
| 25.50             | 3.04                  |
| 26.00             | 3.11                  |
| 26.50             | 2.97                  |
| 27.00             | 3.15                  |
| 28.00             | 3.07                  |
| 29.00             | 3.13                  |
| 30.00             | 3.13                  |
| 31.00             | 3.18                  |
| 32.00             | 3.31                  |
| 33.00             | 3.32                  |
| 34.00             | 3.37                  |
| 35.00             | 3.36                  |
| 36.00             | 3.46                  |
| 37.00             | 3.49                  |
| 38.00             | 3.52                  |
| 39.00             | 3.62                  |
| 40.00             | 3.77                  |

**Cable RF, 8m, model: M17/167 MIL-C-17, s/n 1510 (HL 1510)**  
**Calibration data (0.1 – 1000 MHz)**

| No. | Parameter   | Set,<br>MHz | Measured,<br>dB | Deviation | Tolerance<br>(specification),<br>dB | Measured<br>uncertainty<br>dB |
|-----|-------------|-------------|-----------------|-----------|-------------------------------------|-------------------------------|
| 1   | Attenuation | 0.1         | 0.05            | NA        | NA                                  | ±0.12                         |
| 2   |             | 1           | 0.09            |           |                                     |                               |
| 3   |             | 3           | 0.16            |           |                                     |                               |
| 4   |             | 5           | 0.18            |           |                                     |                               |
| 5   |             | 10          | 0.27            |           |                                     |                               |
| 6   |             | 30          | 0.44            |           |                                     |                               |
| 7   |             | 50          | 0.58            |           |                                     |                               |
| 8   |             | 80          | 0.69            |           |                                     |                               |
| 9   |             | 100         | 0.82            |           |                                     |                               |
| 10  |             | 300         | 1.48            |           |                                     |                               |
| 11  |             | 500         | 2.01            |           |                                     |                               |
| 12  |             | 800         | 2.65            |           |                                     |                               |
| 13  |             | 1000        | 3.12            |           |                                     |                               |

Cable RF, 6m, model: M17/167 MIL-C-17, s/n 1502 (HL 1502)  
Calibration data (0.1 – 1000 MHz)

| No. | Parameter   | Set,<br>MHz | Measured,<br>dB | Deviation | Tolerance<br>(specification),<br>dB | Measured<br>uncertainty<br>dB |
|-----|-------------|-------------|-----------------|-----------|-------------------------------------|-------------------------------|
| 1   | Attenuation | 0.1         | 0.02            | NA        | NA                                  | ±0.12                         |
| 2   |             | 1           | 0.07            |           |                                     |                               |
| 3   |             | 3           | 0.15            |           |                                     |                               |
| 4   |             | 5           | 0.17            |           |                                     |                               |
| 5   |             | 10          | 0.26            |           |                                     |                               |
| 6   |             | 30          | 0.43            |           |                                     |                               |
| 7   |             | 50          | 0.57            |           |                                     |                               |
| 8   |             | 80          | 0.72            |           |                                     |                               |
| 9   |             | 100         | 0.81            |           |                                     |                               |
| 10  |             | 300         | 1.48            |           |                                     |                               |
| 11  |             | 500         | 2.00            |           |                                     |                               |
| 12  |             | 800         | 2.70            |           |                                     |                               |
| 13  |             | 1000        | 3.09            |           |                                     |                               |