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Electrical

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# TEST REPORT

**ACCORDING TO: FCC part 15 subpart C, §15.247 and subpart B**

**FOR:**

## Telematics Wireless Ltd.

## Water meter reader

## Model:DMMR

# Table of contents

# 1 Applicant information

| | |
|---|---|
| **Client name:** | Telematics Wireless Ltd. |
| **Address:** | 26 Hamelaha street, POB 1911, Holon, 58117, Israel |
| **Telephone:** | 03-5575767 |
| **Fax:** | 03-5575703 |
| **E-mail:** | slavas@telematics-wireless.com |
| **Contact name:** | Mr. Slava Snitkovsky |

# 2 Equipment under test attributes

| | |
|---|---|
| **Product name:** | Water meter reader |
| **Product type:** | Transceiver |
| **Model(s):** | DMMR |
| **Receipt date** | 12/17/2006 |

# 3 Manufacturer information

| | |
|---|---|
| **Manufacturer name:** | Telematics Wireless Ltd. |
| **Address:** | 26 Hamelaha street, POB 1911, Holon, 58117, Israel |
| **Telephone:** | 03-5575767 |
| **Fax:** | 03-5575703 |
| **E-Mail:** | slavas@telematics-wireless.com |
| **Contact name:** | Mr. Slava Snitkovsky |

# 4 Test details

| | |
|---|---|
| **Project ID:** | 17607 |
| **Location:** | Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30550, Israel |
| **Test started:** | 12/17/2006 |
| **Test completed:** | 1/02/2007 |
| **Test specification(s):** | FCC part 15 subpart C §15.247; §15.207, subpart B §15.107, §15.109 |
| **Test suite:** | FCC 15.247_DTS _with RF antenna connector (11/19/2006) |

# 5 Tests summary

| Test | Status |
|---|---|
| **Transmitter characteristics** | |
| Section 15.247(a)2, 6 dB bandwidth | Pass |
| Section 15.247(b)3, Peak output power | Pass |
| Section 15.247(b)5, RF exposure | Pass |
| Section 15.247(c), Conducted spurious emissions | Pass |
| Section 15.247(c), Radiated spurious emissions | Pass |
| Section 15.247(d), Peak power density | Pass |
| Section 15.207(a), Conducted emission | Pass |
| Section 15.203, Antenna requirement | Pass |
| **Unintentional emissions** | |
| Section 15.107, Conducted emission at AC power port | Pass |
| Section 15.109, Radiated emission | Pass |
| Section 15.111, Conducted emission at receiver antenna port | Not required |

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

| | Name and Title | Date | Signature |
|---|---|---|---|
| **Tested by:** | Mr. A. Lane, test engineer | January 2, 2007 |  |
| **Reviewed by:** | Mrs. M. Cherniavsky, certification engineer | January 15, 2007 |  |
| **Approved by:** | Mr. M. Nikishin, EMC and Radio group leader | January 16, 2007 |  |

# 6 EUT description

## 6.1 General information

The DMMR is a compact RF receiver/transmitter unit operating at 900 MHz ISM band (multi frequency) and used for wireless data collection (transmitted from water meters). Following the data collection, the collected data is transmitted via the RF transmitter to another DMMR.

## 6.2 Ports and lines

| Port type | Port description | Connected | | Connector type | Qty. | Cable type | Cable length, m |
|---|---|---|---|---|---|---|---|
| | | From | To | | | | |
| Power | DC | EUT J7 | charger | HRS 3-pin | 1 | unshielded | 1.5 |
| Power | DC in | EUT J5 | Open circuit | Molex 4-pin | 1 | unshielded | 1.5 |
| Power | PWR out | EUTJ4 | Open circuit | Molex 2-pin | 1 | unshielded | 1.5 |
| Signal | RS232 | EUT P1 | PC | D-type 9- pin | 1 | unshielded | 1.5 |
| Signal | USB | EUT J13 | Open circuit | Type B | 1 | shielded | 1.5 |
| Signal (RF) | antenna | EUT J2 | antenna | TNC | 1 | shielded | 2.0 |

## 6.3 Support and test equipment

| Description | Manufacturer | Model number | Serial number |
|---|---|---|---|
| Laptop | IBM | T42 | 2373-2VG99HN23W |
| DC adapter | IBM | 08K8202 | 11S08K820221ZA5B |
| Charger | Telematics | FW75550/12 | 0505 |
| Printer LX-810 | Seiko Epson Corp. | P80SA | 44B1127035 |
| Mouse | Microsoft | 52463-OEM | 5835482-40000 |

## 6.4 Operating frequencies

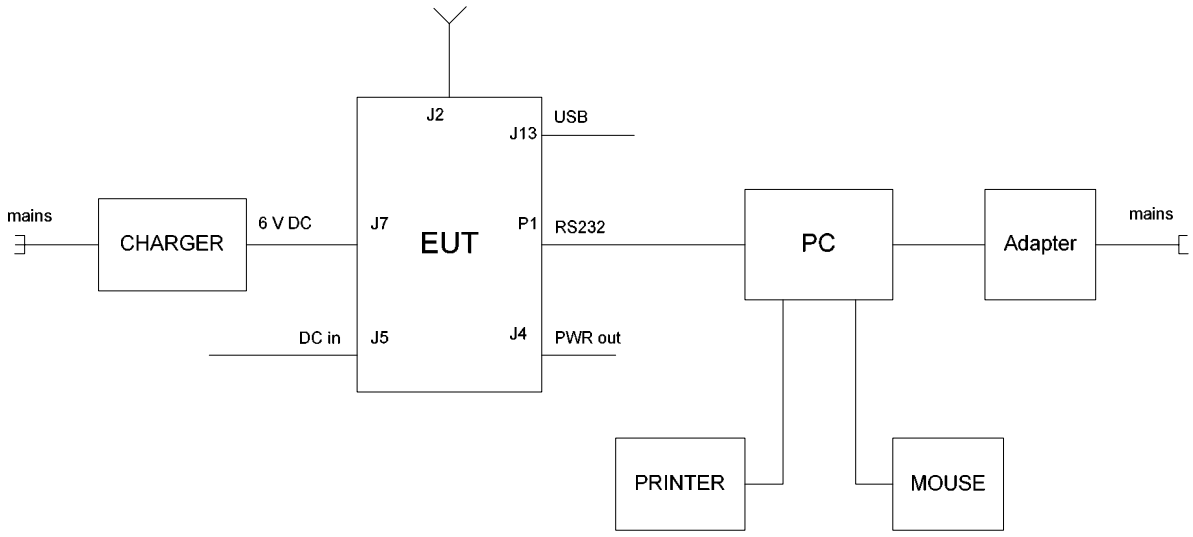
| Source | Frequency, MHz | | | |
|---|---|---|---|---|
| Digital portion | 0.32768 (clock) | 8 (clock) | 26 (clock) | 14.487 (reference) |
| Receiver | 835 ÷ 853 (LO1) | 766 (LO2) | | 836 (LO3) |
| Transmitter | 902 - 928 | | | |

## 6.5 Changes made in the EUT

To withstand the standard requirements the ferrite bead with one turn, S/N 0444164181, manufactured by Fair-Rite Corp., was installed at RS232 cable. It is the manufacturer responsibility to implement the changes in the production version of the EUT. In any case the test report applies to the tested item only.

**Photograph 6.5.1 Changes made in the EUT**

## 6.6 Test configuration



## 6.7 Transmitter characteristics

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

| **Intended use** | | **Condition of use** |
|---|---|---|
| | fixed | Always at a distance more than 2 m from all people |
| X | 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 |

| | | | | |
|---|---|---|---|---|
| **Assigned frequency range** | 902 - 928 MHz | | | |
| **Operating frequency range** | 905.44 – 923.55 MHz | | | |
| **RF channel spacing** | 3.62 MHz | | | |
| **Maximum rated output power** | At transmitter 50 Ω RF output connector | | | 14.24 dBm (FSK)<br>21.34 dBm (PSK) |
| | Effective radiated power (for equipment with no RF connector) | | | |
| **Is transmitter output power variable?** | X | No | | |
| | | Yes | | continuous variable |
| | | | | stepped variable with stepsize dB |
| | | | minimum RF power | dBm |
| | | | maximum RF power | dBm |

| **Antenna connection** | | | | |
|---|---|---|---|---|
| unique coupling | X | standard connector<br>TNC | integral | with temporary RF connector<br>without temporary RF connector |

| **Antenna/s technical characteristics** | | | |
|---|---|---|---|
| Type | Manufacturer | Model number | Gain |
| Short | MAT | MA115V00 | 3 dBi |
| | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Transmitter 99% power bandwidth** | 900 kHz (PSK modulated), 560 kHz (FSK modulated) | | | | | |
| **Transmitter aggregate data rate/s** | 900 kBps (PSK modulated), 60 kBps (FSK modulated) | | | | | |
| **Transmitter aggregate symbol (baud) rate/s** | 0.9 Msymbols (MBaud) per second (PSK modulated) | | | | | |
| **Type of modulation** | PSK, FSK | | | | | |
| **Type of multiplexing** | NA | | | | | |
| **Modulating test signal (baseband)** | PRBS | | | | | |
| **Maximum transmitter duty cycle in normal use** | 20 % | **Tx ON time** | msec | **Period** | msec | |
| **Transmitter duty cycle supplied for test** | 100 % | **Tx ON time** | msec | **Period** | msec | |

| **Transmitter power source** | | | | | | |
|---|---|---|---|---|---|---|
| | Battery | **Nominal rated voltage** | VDC | Battery type | | |
| X | DC | **Nominal rated voltage** | 15 VDC | | | |
| | AC mains | **Nominal rated voltage** | VAC | Frequency | Hz | |

| | | | |
|---|---|---|---|
| **Common power source for transmitter and receiver** | X | yes | no |

| Test specification: | Section 15.247(a)2, 6 dB bandwidth | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(a)2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 9:49:53 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

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

## 7.1 Minimum 6 dB bandwidth

### 7.1.1 General

This test was performed to measure 6 dB bandwidth of the EUT carrier frequency. Specification test limits are given in Table 7.1.1.

**Table 7.1.1 6 dB bandwidth limits**

| Assigned frequency, MHz | Modulation envelope reference points*, dBc | Minimum bandwidth, kHz |
|---|---|---|
| 902.0 – 928.0 | 6.0 | 500.0 |
| 2400.0 – 2483.5 | | |
| 5725.0 – 5850.0 | | |

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

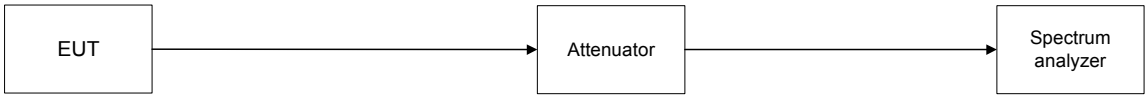
### 7.1.2 Test procedure

**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 set to transmit modulated carrier.

**7.1.2.3** The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

**Figure 7.1.1 6 dB bandwidth test setup**



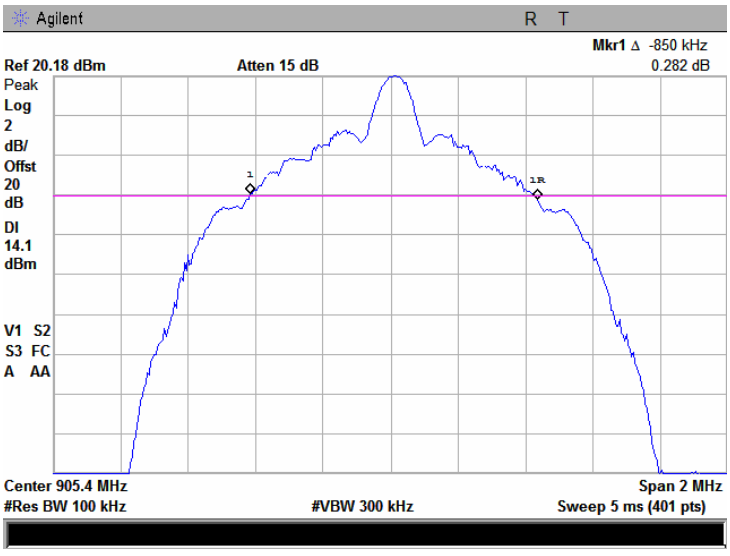
| Test specification: | Section 15.247(a)2, 6 dB bandwidth | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(a)2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 9:49:53 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 7.1.2 The 6 dB bandwidth test results**

| | |
|---|---|
| ASSIGNED FREQUENCY BAND: | 902 - 928 MHz |
| DETECTOR USED: | Peak |
| SWEEP MODE: | Single |
| SWEEP TIME: | Auto |
| RESOLUTION BANDWIDTH: | 100 kHz |
| VIDEO BANDWIDTH: | 300 kHz |
| MODULATION ENVELOPE REFERENCE POINTS: | 6.0 dBc |
| MODULATION: | PSK |
| MODULATING SIGNAL: | PRBS |
| BIT RATE: | 900 kbps |

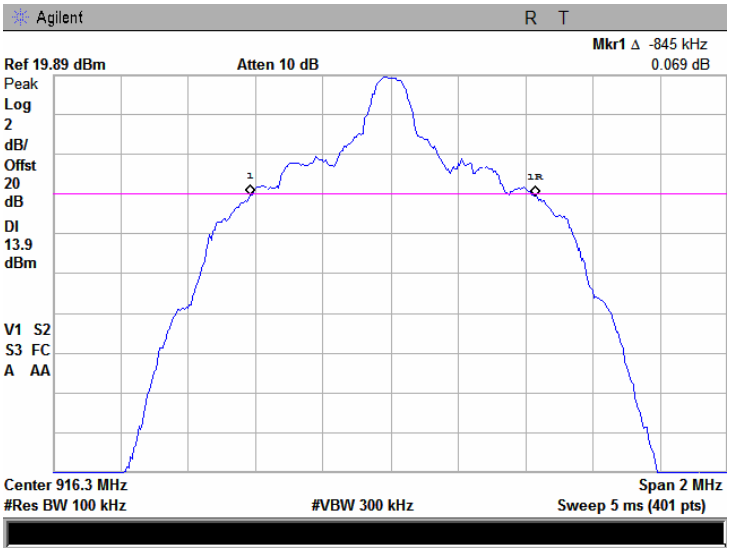
| Carrier frequency, MHz | 6 dB bandwidth, kHz | Limit, kHz | Margin, kHz | Verdict |
|---|---|---|---|---|
| Low frequency | | | | |
| 905.4375 | 850 | 500 | -350 | Pass |
| Mid frequency | | | | |
| 916.3020 | 845 | 500 | -345 | Pass |
| High frequency | | | | |
| 923.5462 | 850 | 500 | -350 | Pass |

**Plot 7.1.1 6 The dB bandwidth test result at low frequency**

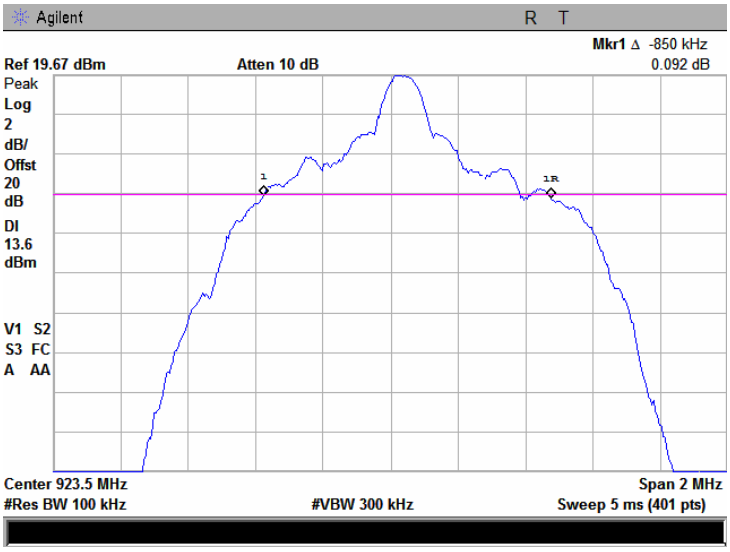


| Test specification: | Section 15.247(a)2, 6 dB bandwidth | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(a)2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 9:49:53 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.1.2 The 6 dB bandwidth test result at mid frequency**




**Plot 7.1.3 The 6 dB bandwidth test result at high frequency**



| Test specification: | Section 15.247(a)2, 6 dB bandwidth | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(a)2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 9:49:53 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 7.1.3 6 The 6 dB bandwidth test results**

| | |
|---|---|
| ASSIGNED FREQUENCY BAND: | 902 - 928 MHz |
| DETECTOR USED: | Peak |
| SWEEP MODE: | Single |
| SWEEP TIME: | Auto |
| RESOLUTION BANDWIDTH: | 100 kHz |
| VIDEO BANDWIDTH: | 300 kHz |
| MODULATION ENVELOPE REFERENCE POINTS: | 6.0 dBc |
| MODULATION: | FSK |
| MODULATING SIGNAL: | PRBS |
| BIT RATE: | 60 kbps |

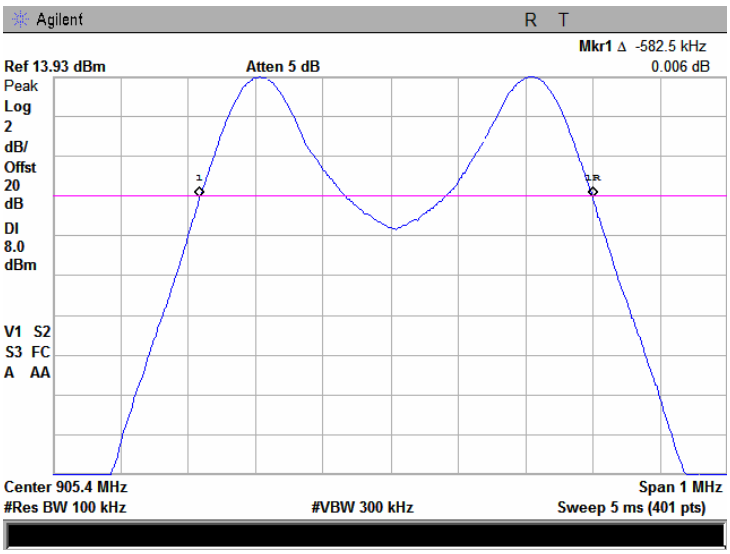
| Carrier frequency, MHz | 6 dB bandwidth, kHz | Limit, kHz | Margin, kHz | Verdict |
|---|---|---|---|---|
| Low frequency | | | | |
| 905.4375 | 582.5 | 500 | -82.5 | Pass |
| Mid frequency | | | | |
| 916.3020 | 557.5 | 500 | -57.5 | Pass |
| High frequency | | | | |
| 923.5462 | 550.0 | 500 | -50.0 | Pass |

**Reference numbers of test equipment used**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HL 1424 | HL 2866 | HL 2909 | | | | | | |

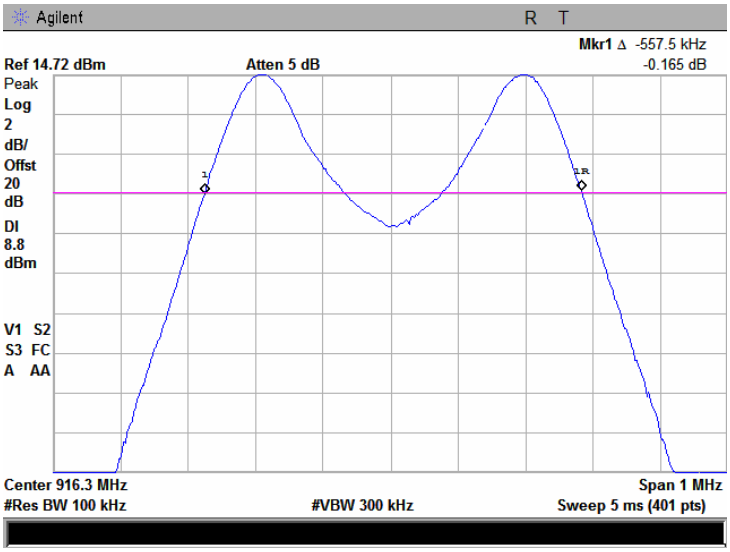
Full description is given in Appendix A.

**Plot 7.1.4 The 6 dB bandwidth test result at low frequency**

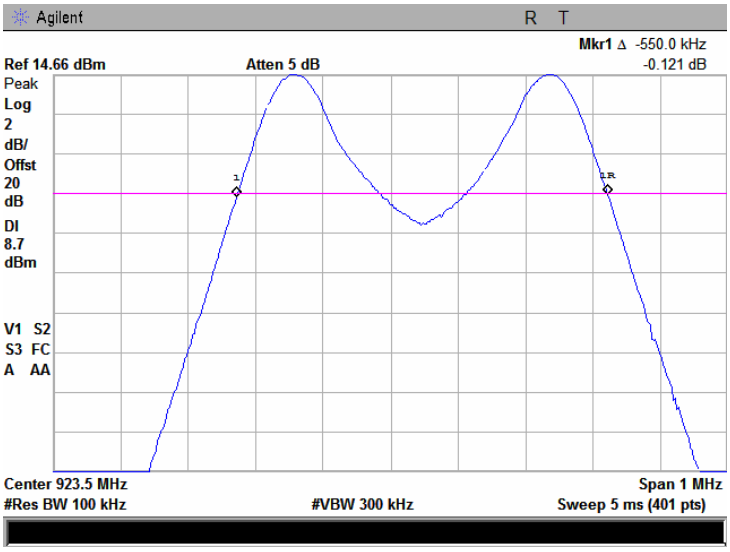


| Test specification: | Section 15.247(a)2, 6 dB bandwidth | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(a)2 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 9:49:53 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.1.5 The 6 dB bandwidth test result at mid frequency**




**Plot 7.1.6 The 6 dB bandwidth test result at high frequency**



| Test specification: | Section 15.247(b)3, Peak output power | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(b) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 7:37:24 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

## 7.2 Peak output power

### 7.2.1 General

This test was performed to measure the maximum peak output power at the transmitter RF antenna connector. Specification test limits are given in Table 7.2.1.

**Table 7.2.1 Peak output power limits**

| Assigned frequency range, MHz | Maximum antenna gain, dBi | Peak output power* | |
|---|---|---|---|
| | | W | dBm |
| 902.0 – 928.0 | 6.0 | 1.0 | 30.0 |
| 2400.0 – 2483.5 | | | |
| 5725.0 – 5850.0 | | | |

*- If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:
by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

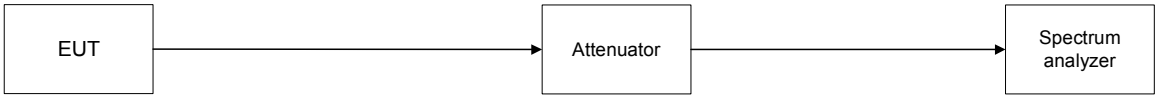
### 7.2.2 Test procedure

**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 adjusted to produce maximum available for end user RF output power.

**7.2.2.3** The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the maximum peak output power was measured as provided in Table 7.2.2 and associated plots.

**Figure 7.2.1 Peak output power test setup**



| Test specification: | Section 15.247(b)3, Peak output power | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(b) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 7:37:24 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

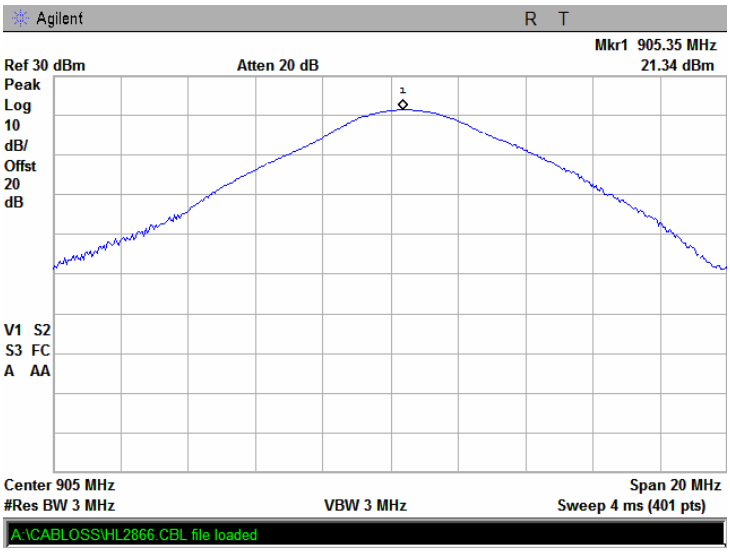
**Table 7.2.2 Peak output power test results**

| | |
|---|---|
| ASSIGNED FREQUENCY: | 902 - 928 MHz |
| MODULATION: | PSK |
| MODULATING SIGNAL: | PRBS |
| BIT RATE: | 900 kbps |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| DETECTOR USED: | Peak |
| EUT 6 dB BANDWIDTH: | 0.56 MHz |
| RESOLUTION BANDWIDTH: | 3 MHz |
| VIDEO BANDWIDTH: | 3 MHz |

| Carrier frequency, MHz | Spectrum analyzer reading, dBm | External attenuation, dB | Cable loss, dB | Peak output power, dBm | Limit, dBm | Margin*, dB | Verdict |
|---|---|---|---|---|---|---|---|
| 905.4375 | 21.34 | included | included | 21.34 | 30.00 | -8.66 | Pass |
| 916.3020 | 21.12 | included | included | 21.12 | 30.00 | -8.88 | Pass |
| 923.5462 | 20.88 | included | included | 20.88 | 30.00 | -9.12 | Pass |

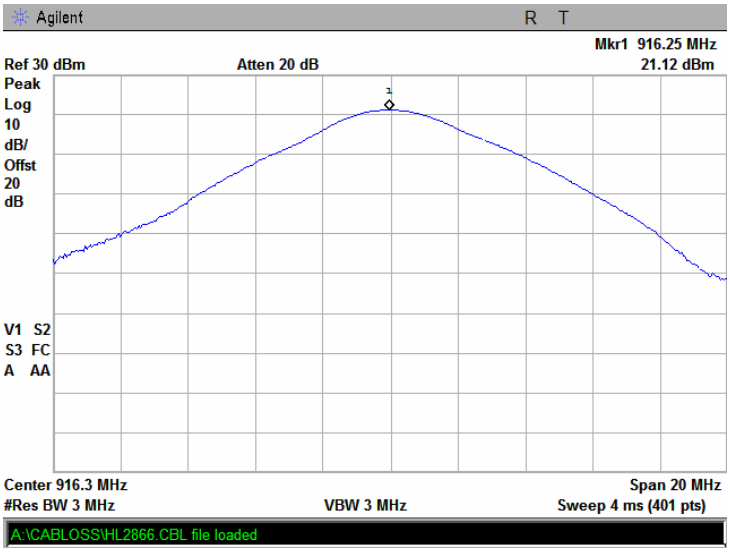
* - Margin = Peak output power – specification limit.

**Plot 7.2.1 Peak output power at low frequency**

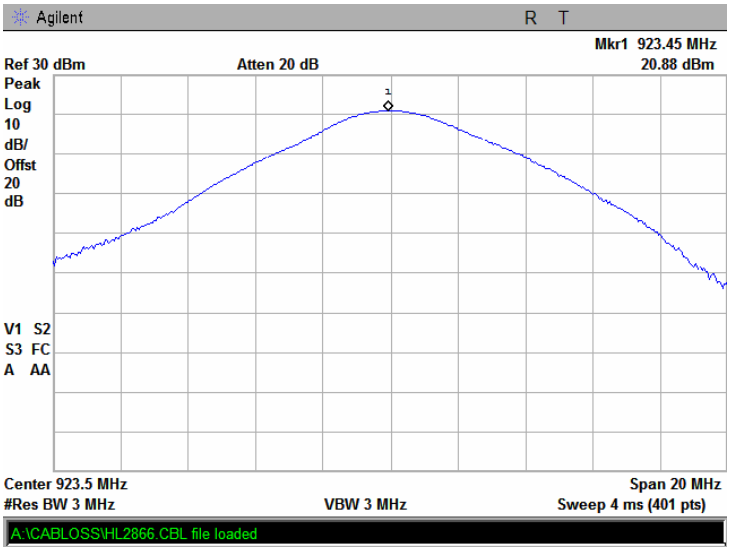


| Test specification: | Section 15.247(b)3, Peak output power | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(b) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 7:37:24 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.2.2 Peak output power at mid frequency**




**Plot 7.2.3 Peak output power at high frequency**



| Test specification: | Section 15.247(b)3, Peak output power | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(b) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 7:37:24 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 7.2.3 Peak output power test results**

ASSIGNED FREQUENCY: 902 - 928 MHz
MODULATION: FSK
MODULATING SIGNAL: PRBS
BIT RATE: 60 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
EUT 6 dB BANDWIDTH: 0.9 MHz
RESOLUTION BANDWIDTH: 3 MHz
VIDEO BANDWIDTH: 3 MHz

| Carrier frequency, MHz | Spectrum analyzer reading, dBm | External attenuation, dB | Cable loss, dB | Peak output power, dBm | Limit, dBm | Margin*, dB | Verdict |
|---|---|---|---|---|---|---|---|
| 905.4375 | 14.13 | included | included | 14.13 | 30.00 | -15.87 | Pass |
| 916.3020 | 14.24 | included | included | 14.24 | 30.00 | -15.76 | Pass |
| 923.5462 | 14.18 | included | included | 14.18 | 30.00 | -15.82 | Pass |

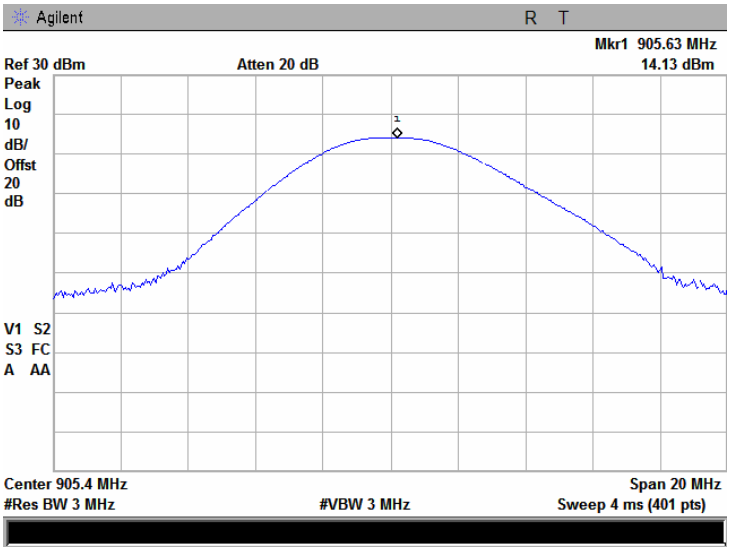
* - Margin = Peak output power – specification limit.

**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 2866 | HL 2909 | | | | | | |

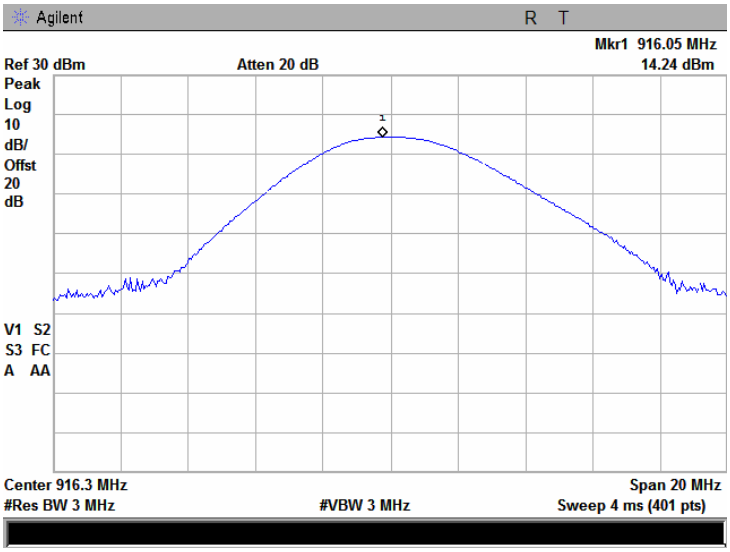
Full description is given in Appendix A.

**Plot 7.2.4 Peak output power at low frequency**

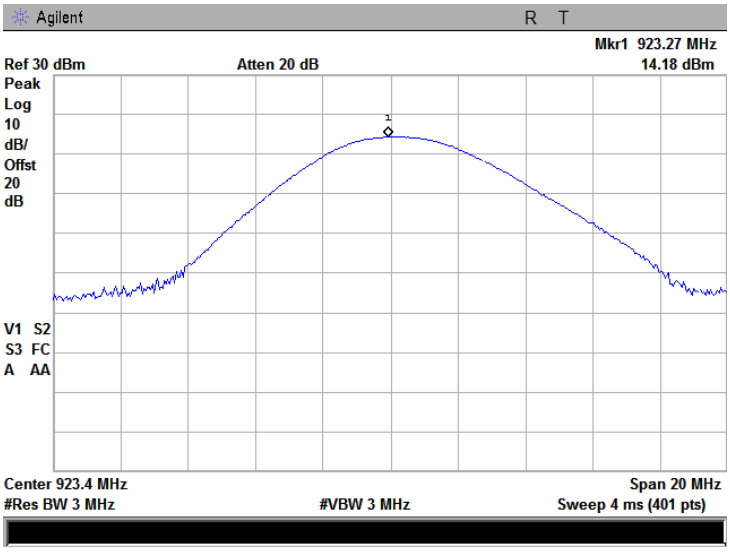


| Test specification: | Section 15.247(b)3, Peak output power | | |
|---|---|---|---|
| Test procedure: | FR Vol.62, page 26243, Section 15.247(b) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 7:37:24 PM | | |
| Temperature: °C | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.2.5 Peak output power at mid frequency**




**Plot 7.2.6 Peak output power at high frequency**



| Test specification: | Section 15.247(b)5, RF exposure | | |
|---|---|---|---|
| Test procedure: | 47 CFR, Section 1.1307(b)1 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 6:19:38 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

## 7.3 RF exposure

### 7.3.1 General

This test was performed to determine the minimum safe distance between the transmitter antenna and human to avoid public exposure in excess of limits for general population (uncontrolled exposure). Specification test limits are given in Table 7.3.1.

**Table 7.3.1 RF exposure limits**

| Frequency range, MHz | Power density | |
|---|---|---|
| | mW/cm$^2$ | W/m$^2$ |
| 902.0 – 928.0 | 0.60 – 0.62* | 6.0 – 6.2 |
| 2400.0 – 2483.5 | 1.00 | 10.0 |
| 5725.0 – 5850.0 | 1.00 | 10.0 |

*- Power density limit within 300 - 1500 MHz was calculated according to the following equation: S = F / 1500, where S is power density in mW/cm$^2$ and F is frequency in MHz.

### 7.3.2 Power density calculation for mobile transmitter

The power density at the specified distance was calculated from the following equation as provided in Table 7.3.2:

$$S = P \times G / (4 \times \pi \times r^2),$$

where S is power density in W/m$^2$, P is the transmitter output power in W, G is the transmitter antenna numeric gain and r is distance to transmit antenna in m.

**Table 7.3.2 Power density calculation**

ASSIGNED FREQUENCY: 902 – 928 MHz
SPECIFIED DISTANCE: 0.20 m*
MODULATION PSK

| Carrier frequency, MHz | Peak output power, dBm | Antenna gain, dBi | EIRP | | Power density, W/m$^2$ | Limit, W/m$^2$ | Margin, W/m$^2$ | Verdict |
|---|---|---|---|---|---|---|---|---|
| | | | dBm | W | | | | |
| 905.4375 | 21.39 | 3.00 | 24.39 | 0.274 | 0.54538217 | 6.030 | -5.484 | Pass |
| 916.3020 | 21.12 | 3.00 | 24.12 | 0.258 | 0.51353503 | 6.110 | -5.596 | Pass |
| 923.5462 | 20.88 | 3.00 | 23.88 | 0.244 | 0.48566879 | 6.170 | -5.684 | Pass |

ASSIGNED FREQUENCY: 902 – 928 MHz
SPECIFIED DISTANCE: 0.20 m*
MODULATION FSK

| Carrier frequency, MHz | Peak output power, dBm | Antenna gain, dBi | EIRP | | Power density, W/m$^2$ | Limit, W/m$^2$ | Margin, W/m$^2$ | Verdict |
|---|---|---|---|---|---|---|---|---|
| | | | dBm | W | | | | |
| 905.4375 | 14.13 | 3.00 | 17.13 | 0.051 | 0.10151274 | 6.030 | -5.928 | Pass |
| 916.302 | 14.24 | 3.00 | 17.24 | 0.052 | 0.10350318 | 6.110 | -6.006 | Pass |
| 923.5462 | 14.18 | 3.00 | 17.18 | 0.052 | 0.10350318 | 6.170 | -6.066 | Pass |

* - The equipment deemed mobile as intended for use at a distance of more than 20 cm from humans.

| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

## 7.4 Spurious emissions at RF antenna connector

### 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.

**Table 7.4.1 Spurious emission limits**

| Frequency*, MHz | Attenuation below carrier*, dBc |
|---|---|
| 0.009 – 10$^{th}$ harmonic | 20.0 |

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

** - Spurious emission limit is provided in terms of attenuation below the peak of modulated carrier measured with the same resolution bandwidth.

### 7.4.2 Test procedure

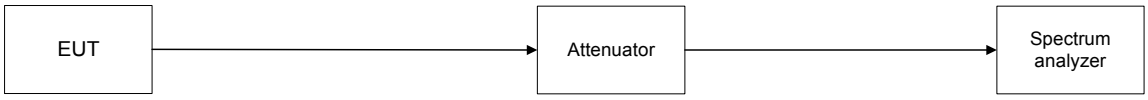
**7.4.2.1** The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.

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

**7.4.2.3** The highest emission level within the authorized band was measured.

**7.4.2.4** The spurious emission was measured with spectrum analyzer as provided in Table 7.4.2, Table 7.4.3 and associated plots and referenced to the highest emission level measured within the authorized band.

**Figure 7.4.1 Spurious emission test setup**



| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| 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 |
| RESOLUTION BANDWIDTH: | 100 kHz |
| VIDEO BANDWIDTH: | 300 kHz |
| MODULATION: | PSK |
| MODULATING SIGNAL: | PRBS |
| BIT RATE: | 900 kbps |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| TRANSMITTER OUTPUT POWER: | 19.33 dBm at low carrier frequency<br>18.86 dBm at mid carrier frequency<br>18.66 dBm at high carrier frequency |

| Frequency, MHz | Spurious emission, dBm | Emission at carrier, dBm | Attenuation below carrier, dBc | Limit, dBc | Margin, dB* | Verdict |
|---|---|---|---|---|---|---|
| **All carrier frequencies** | | | | | | |
| All spurious were found at least 20 dB bellow limit | | | | | | Pass |

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

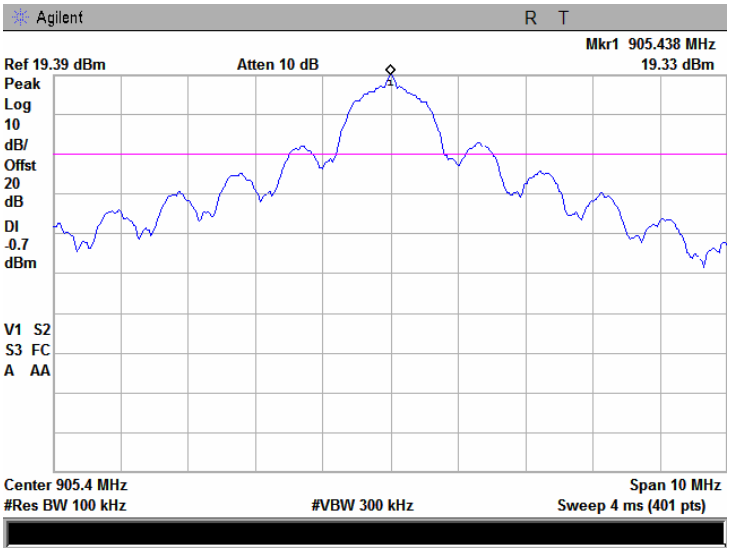
**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 1424 | HL 1651 | HL 2399 | | | | | |

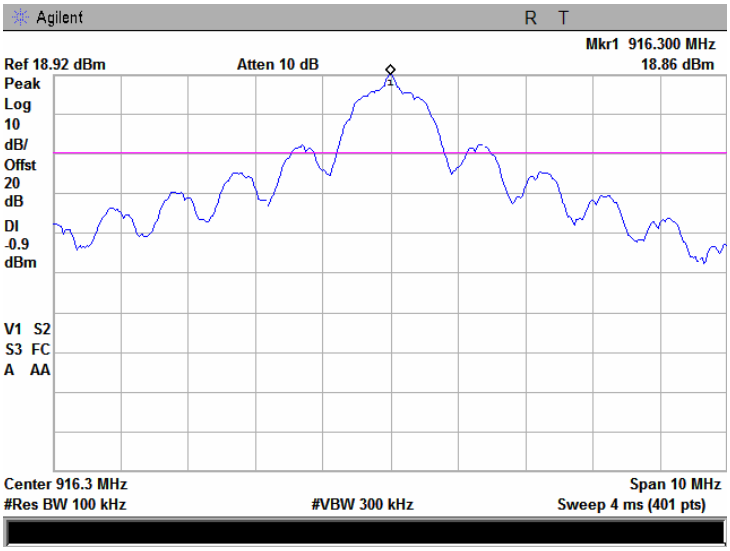
Full description is given in Appendix A.

| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.1 The highest emission level within the assigned band at low carrier frequency**

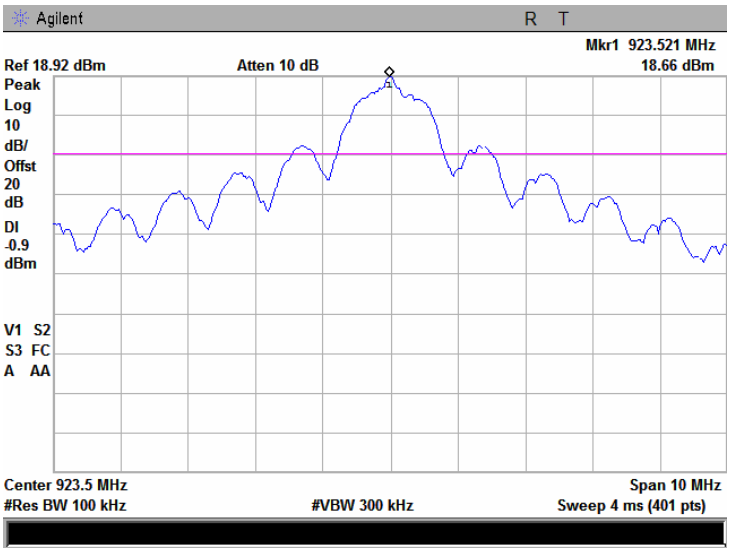



**Plot 7.4.2 The highest emission level within the assigned band at mid carrier frequency**

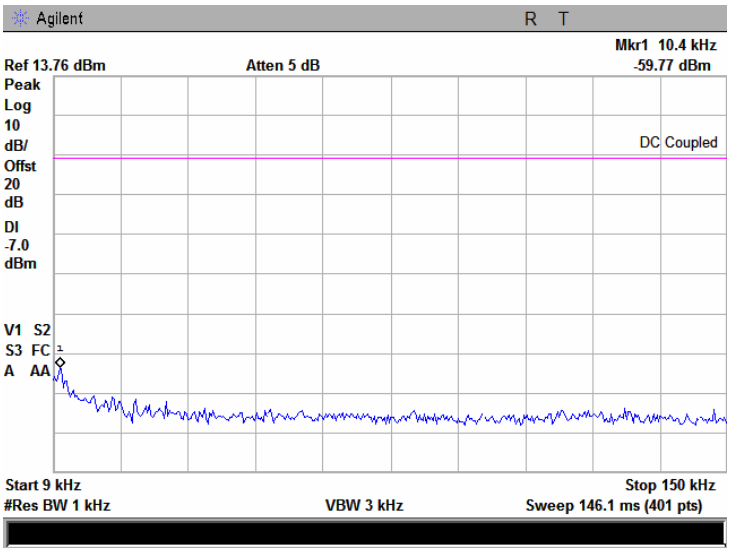


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.3 The highest emission level within the assigned band at high carrier frequency**

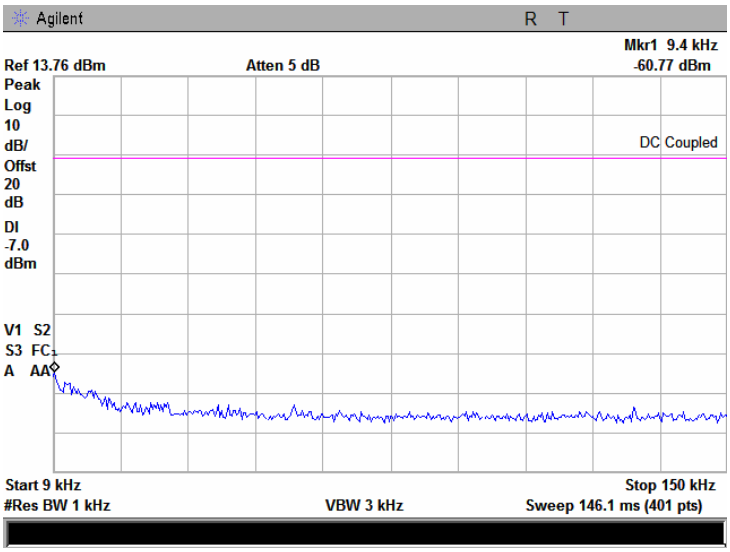



**Plot 7.4.4 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency**

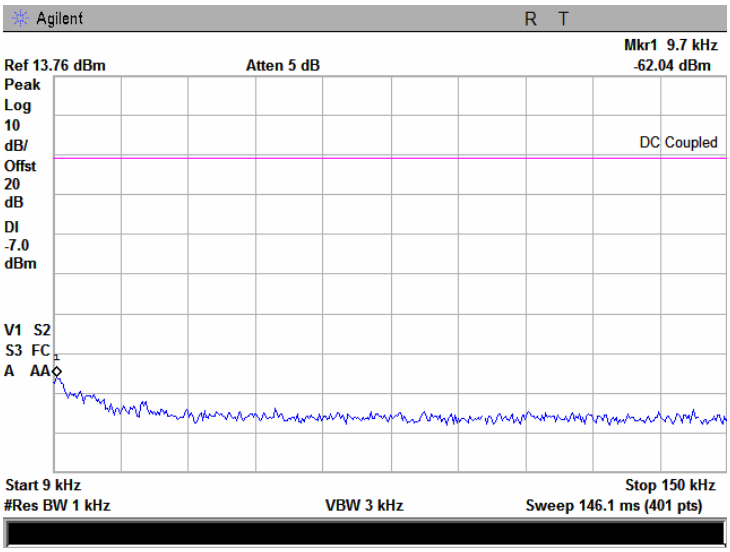


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.5 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency**

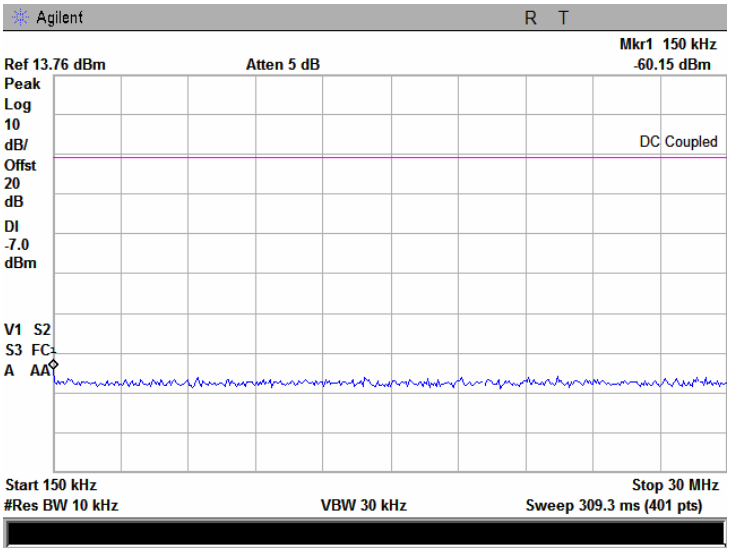



**Plot 7.4.6 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency**

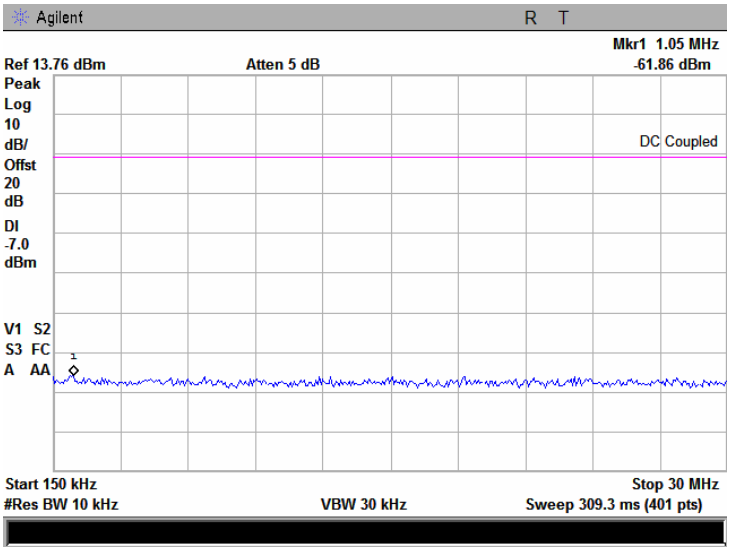


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.7 Spurious emission measurements in 0.15 - 30 MHz range at low carrier frequency**

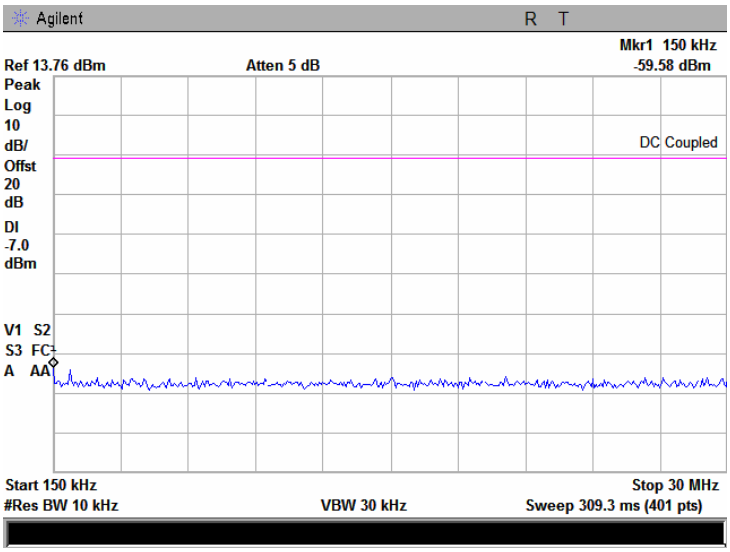



**Plot 7.4.8 Spurious emission measurements in 0.15 - 30 MHz range at mid carrier frequency**

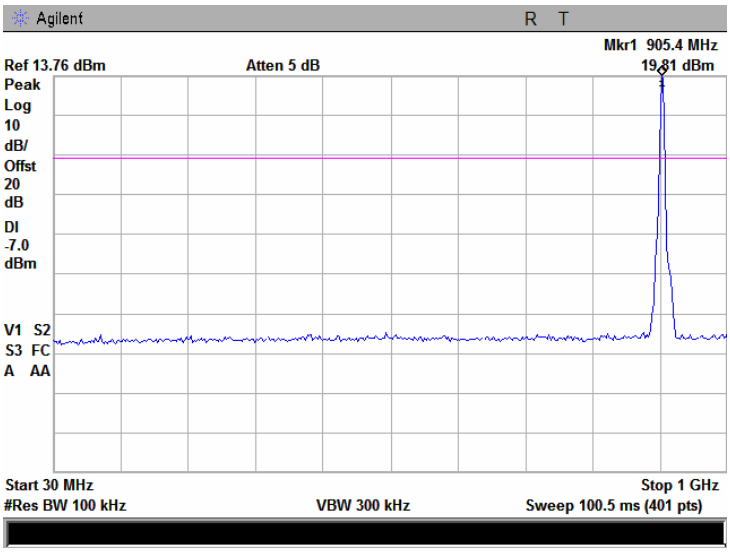


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.9 Spurious emission measurements in 0.15 - 30 MHz range at high carrier frequency**

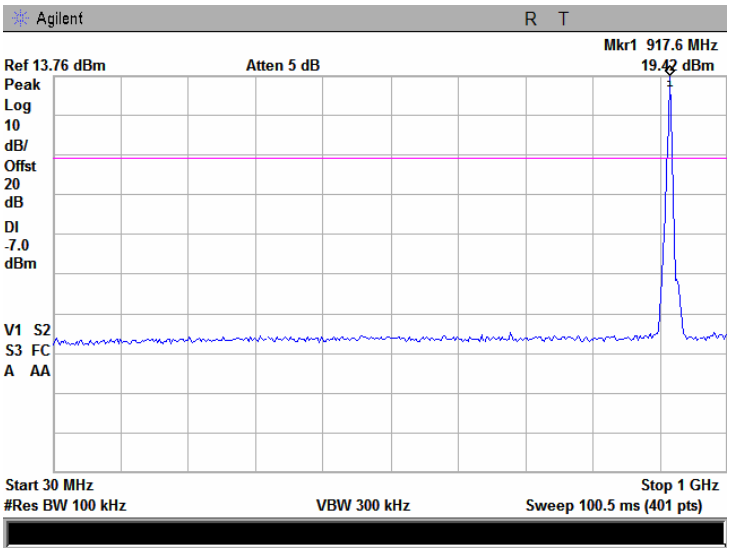



**Plot 7.4.10 Spurious emission measurements in 30 - 1000 MHz range at low carrier frequency**

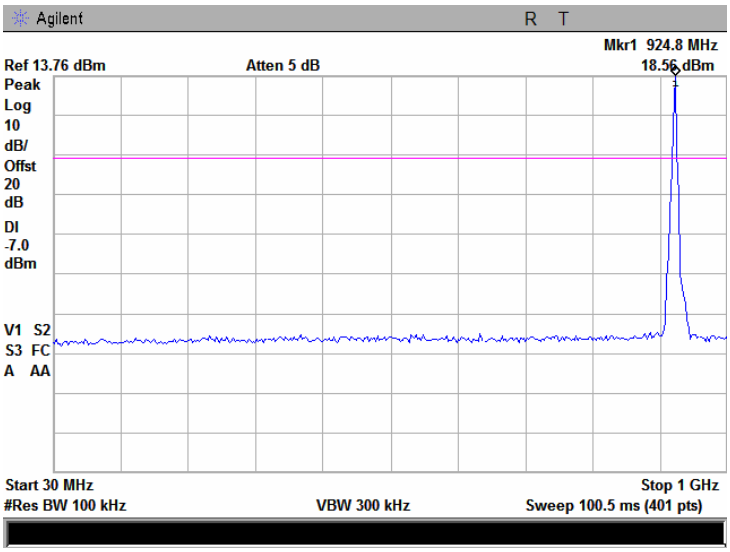


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.11 Spurious emission measurements in 30 - 1000 MHz range at mid carrier frequency**

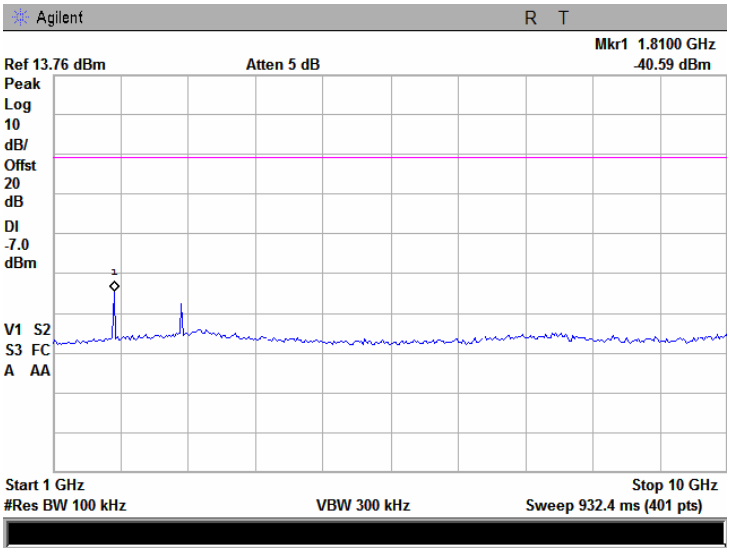



**Plot 7.4.12 Spurious emission measurements in 30 - 1000 MHz range at high carrier frequency**

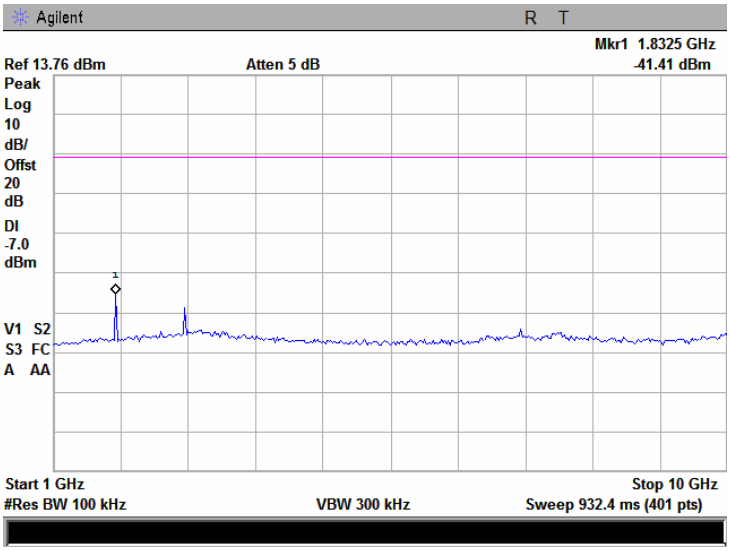


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.13 Spurious emission measurements in 1000 – 10000 MHz range at low carrier frequency**

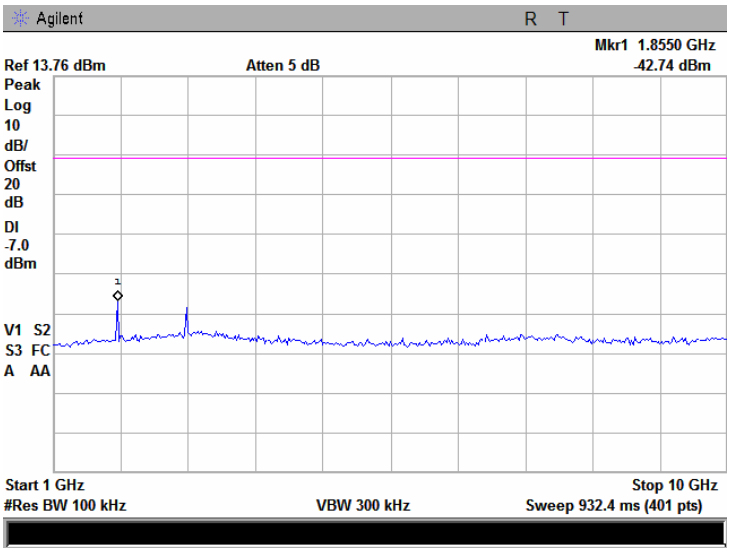



**Plot 7.4.14 Spurious emission measurements in 1000 – 10000 MHz range at mid carrier frequency**

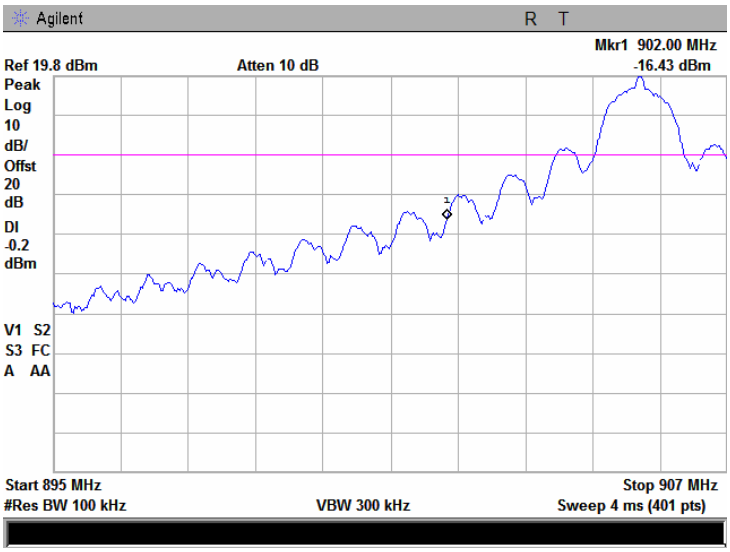


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: °C | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.15 Spurious emission measurements in 1000 – 10000 MHz range at high carrier frequency**

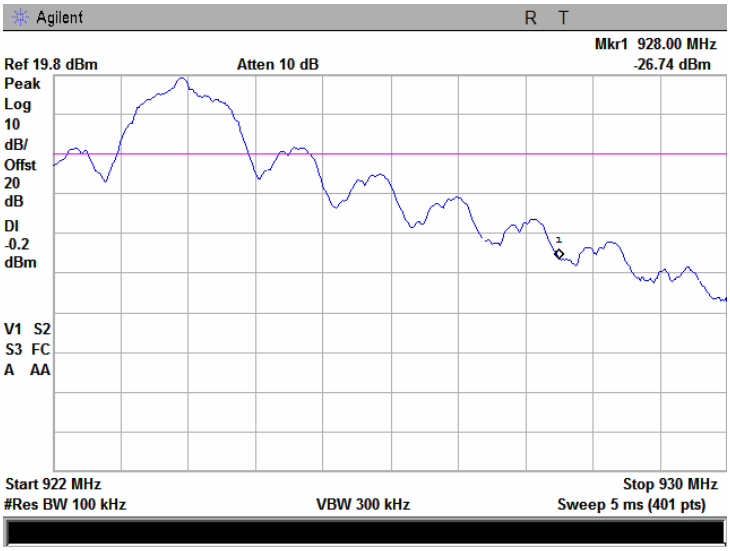



**Plot 7.4.16 Spurious emission measurements band edge at low carrier frequency**

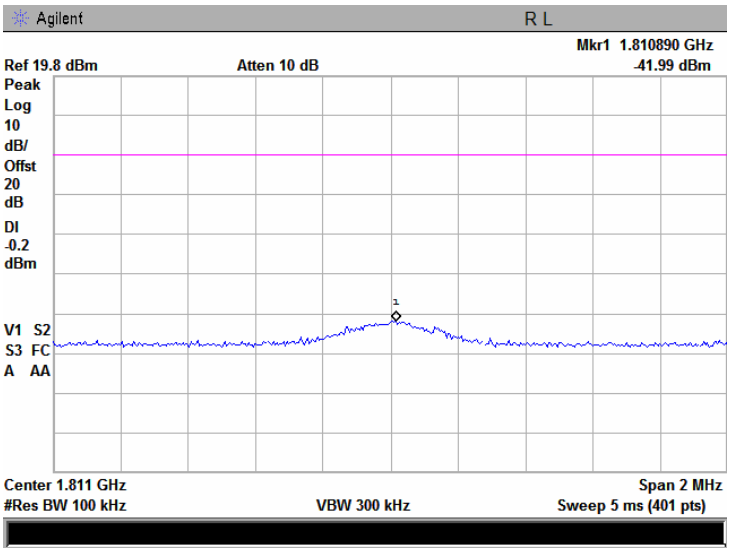


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.17 Spurious emission measurements band edge at high carrier frequency**

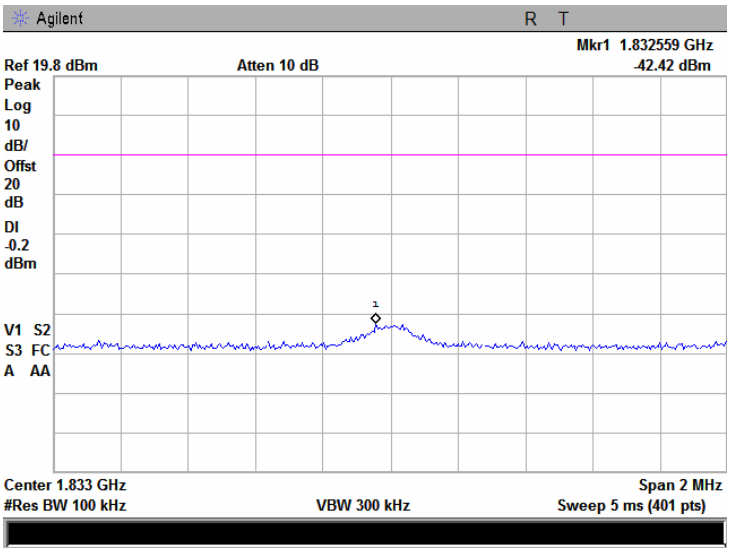



**Plot 7.4.18 Conducted spurious emission measurements at the 2nd harmonic of low carrier frequency**

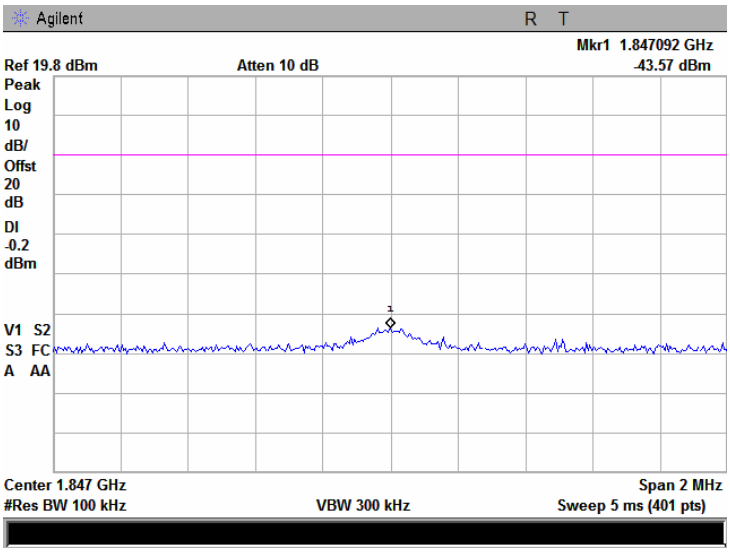


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.19 Conducted spurious emission measurements at the 2nd harmonic of mid carrier frequency**

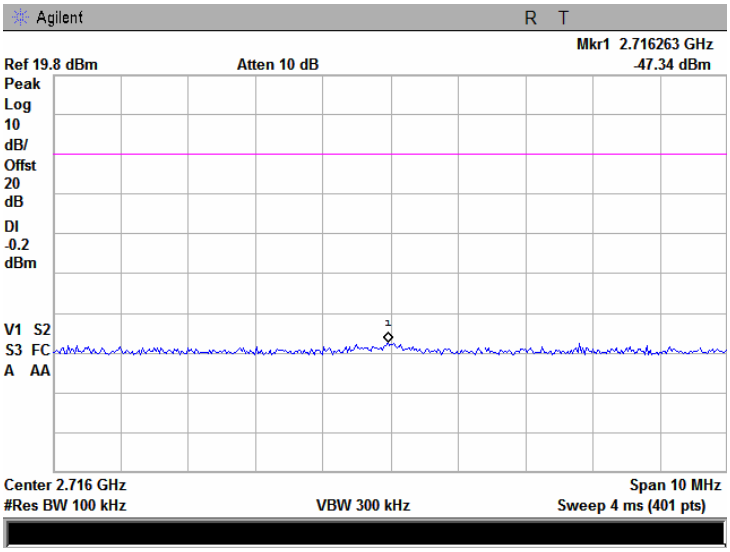



**Plot 7.4.20 Conducted spurious emission measurements at the 2nd harmonic of high carrier frequency**

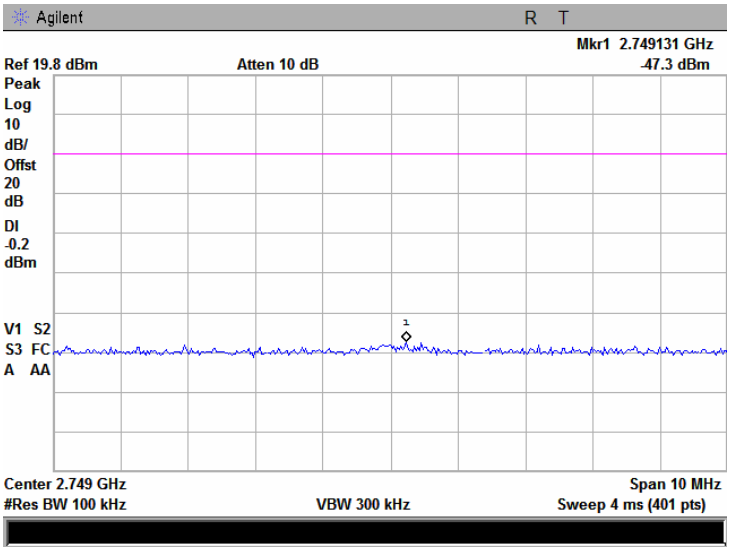


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.21 Conducted spurious emission measurements at the 3rd harmonic of low carrier frequency**

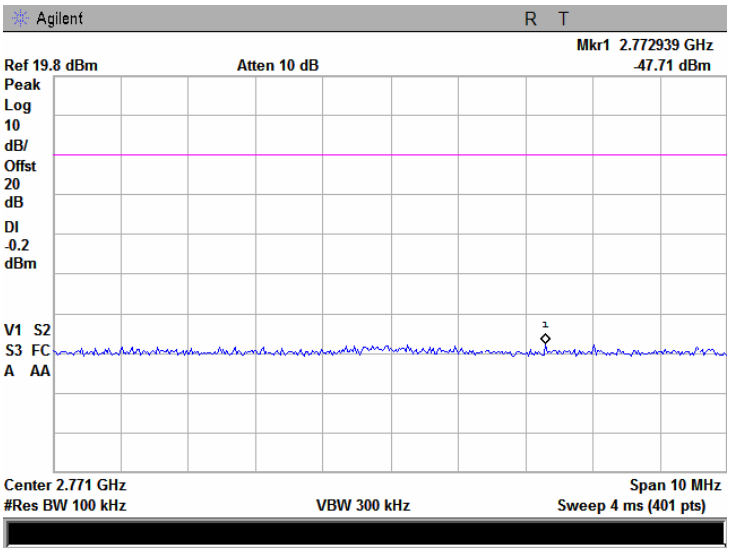



**Plot 7.4.22 Conducted spurious emission measurements at the 3rd harmonic of mid carrier frequency**



| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.23 Conducted spurious emission measurements at the 3rd harmonic of high carrier frequency**



| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 7.4.3 Spurious emission test results**

| | |
|---|---|
| ASSIGNED FREQUENCY RANGE: | 902 – 928 MHz |
| INVESTIGATED FREQUENCY RANGE: | 0.009 – 10000 MHz |
| DETECTOR USED: | Peak |
| RESOLUTION BANDWIDTH: | 100 kHz |
| VIDEO BANDWIDTH: | 300 kHz |
| MODULATION: | FSK |
| MODULATING SIGNAL: | PRBS |
| BIT RATE: | 60 kbps |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| TRANSMITTER OUTPUT POWER: | 13.54 dBm at low carrier frequency<br>13.87 dBm at mid carrier frequency<br>13.73 dBm at high carrier frequency |

| Frequency, MHz | Spurious emission, dBm | Emission at carrier, dBm | Attenuation below carrier, dBc | Limit, dBc | Margin, dB* | Verdict |
|---|---|---|---|---|---|---|
| **All carrier frequency** | | | | | | |
| All spurious were found at least 20 dB bellow limit | | | | | | Pass |

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

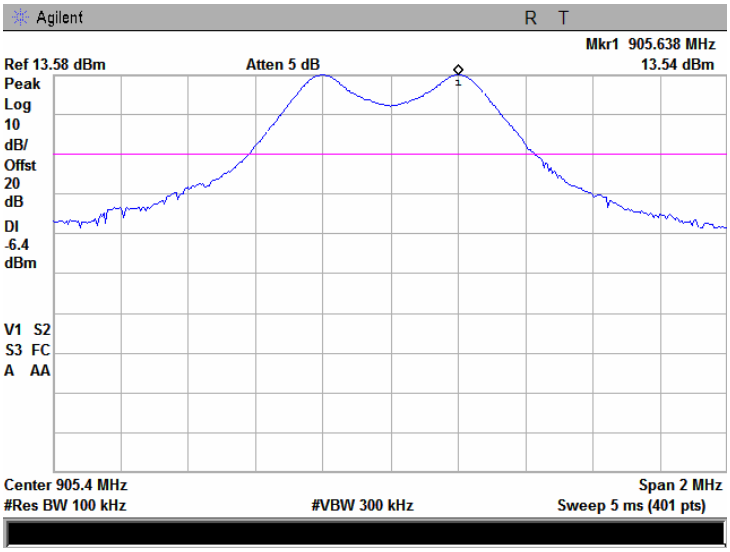
**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 1424 | HL 1651 | HL 2399 | | | | | |

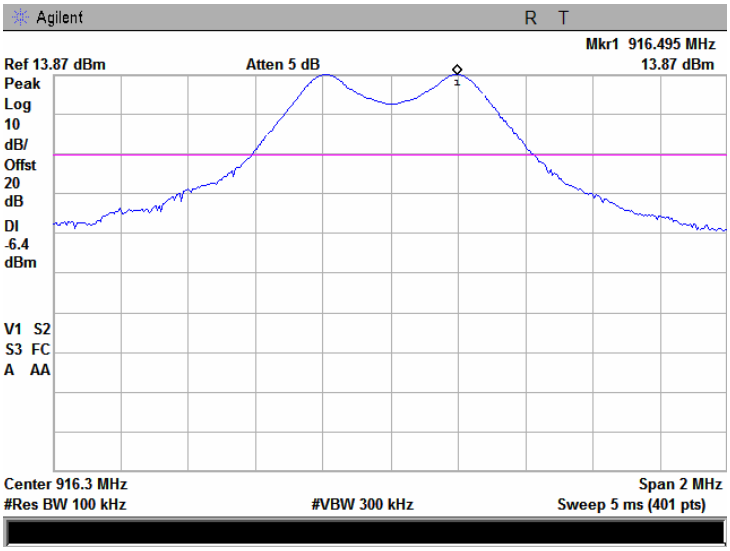
Full description is given in Appendix A.

| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.24 The highest emission level within the assigned band at low carrier frequency**

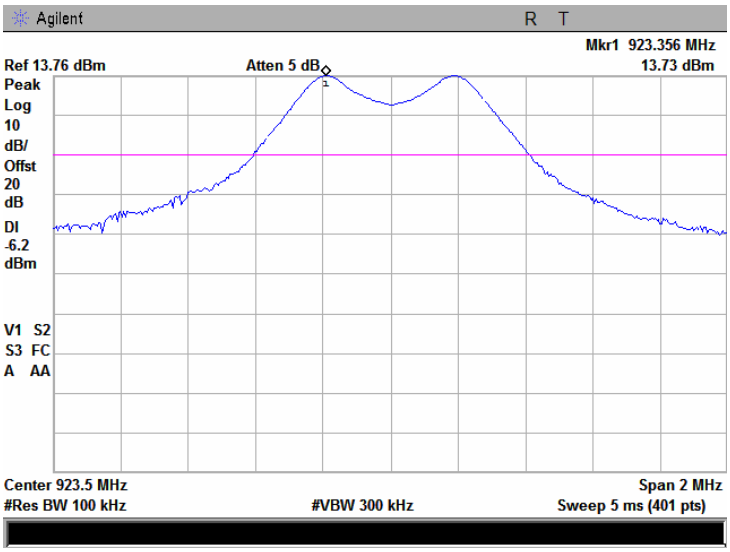



**Plot 7.4.25 The highest emission level within the assigned band at mid carrier frequency**

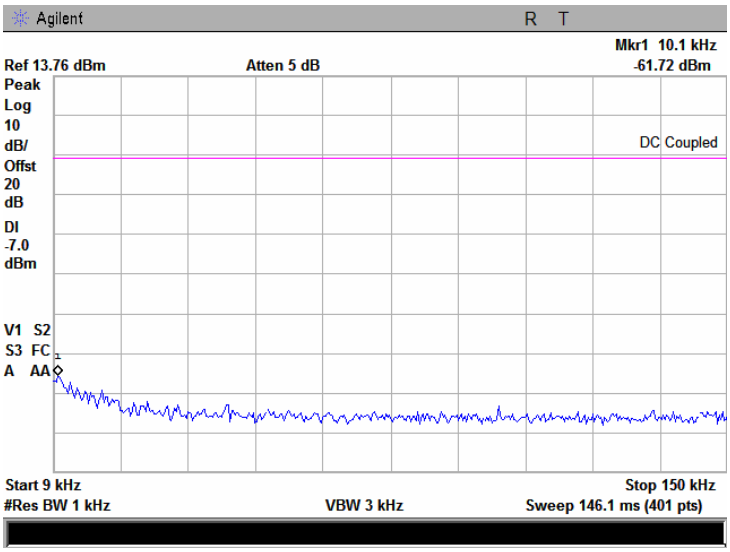


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.26 The highest emission level within the assigned band at high carrier frequency**

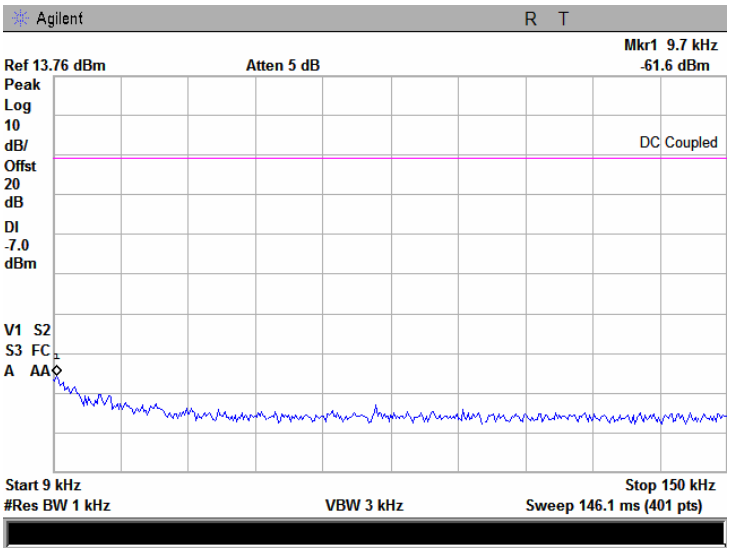



**Plot 7.4.27 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency**

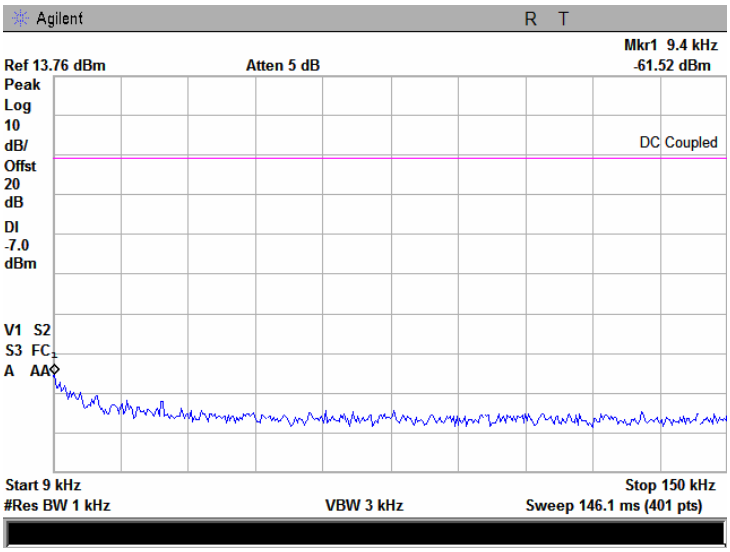


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.28 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency**

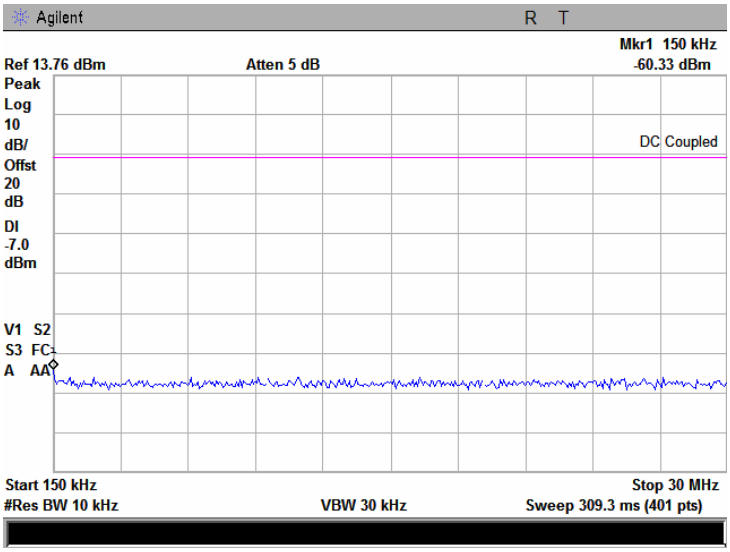



**Plot 7.4.29 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency**

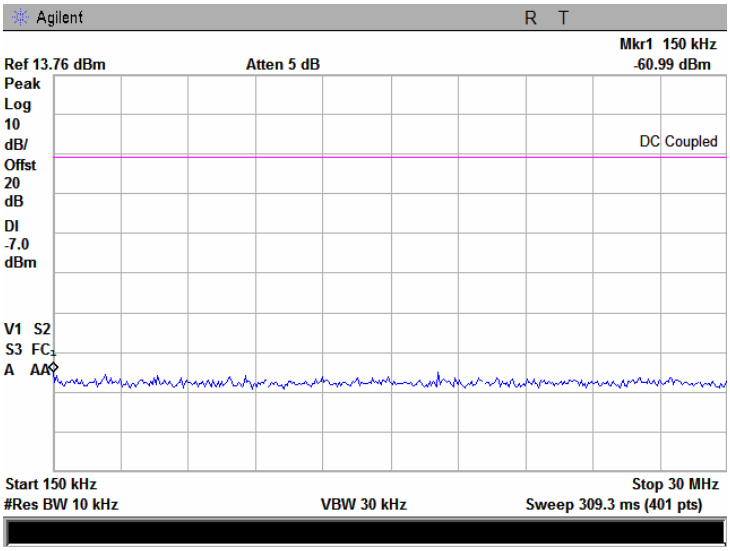


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.30 Spurious emission measurements in 0.15 - 30 MHz range at low carrier frequency**

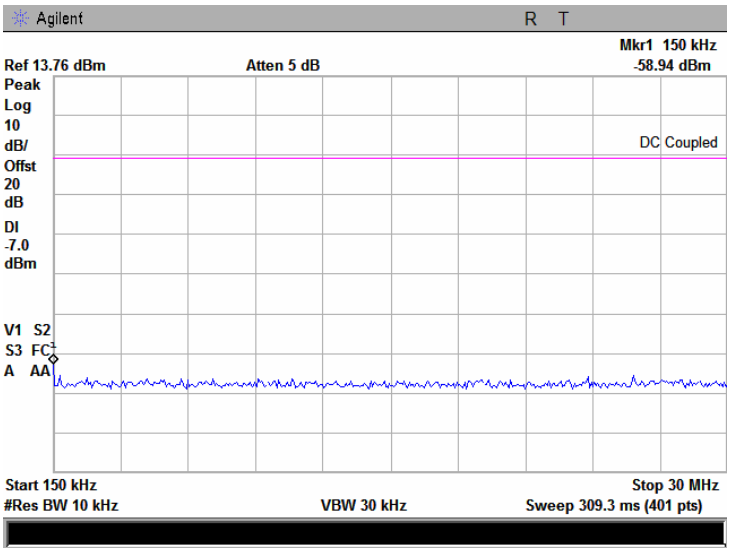



**Plot 7.4.31 Spurious emission measurements in 0.15 - 30 MHz range at mid carrier frequency**

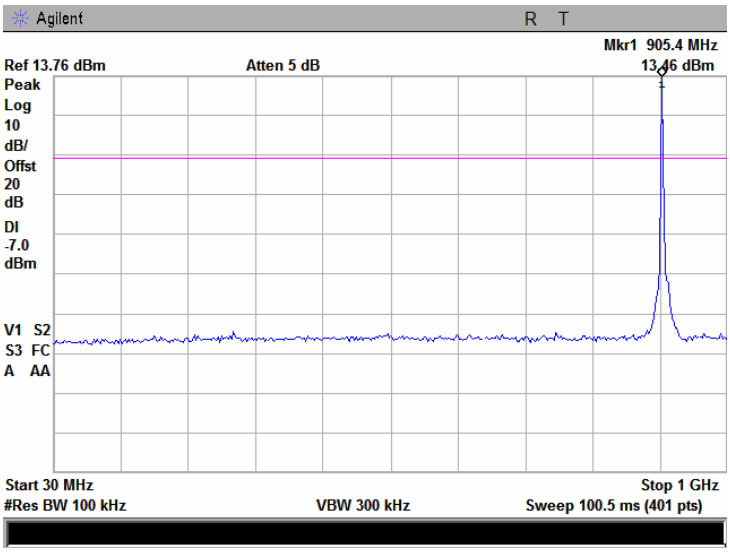


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.32 Spurious emission measurements in 0.15 - 30 MHz range at high carrier frequency**

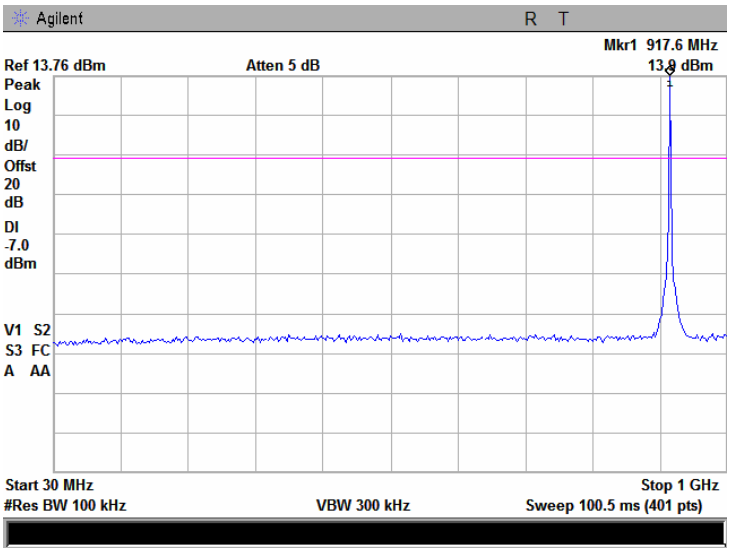



**Plot 7.4.33 Spurious emission measurements in 30 - 1000 MHz range at low carrier frequency**

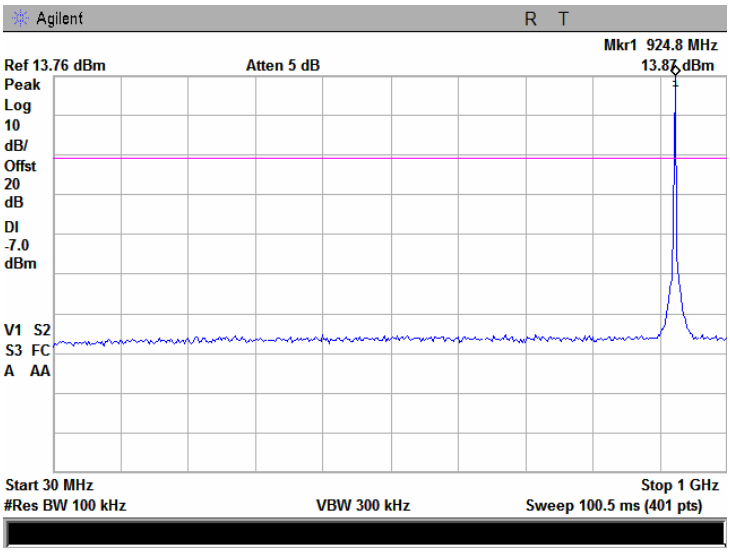


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.34 Spurious emission measurements in 30 - 1000 MHz range at mid carrier frequency**

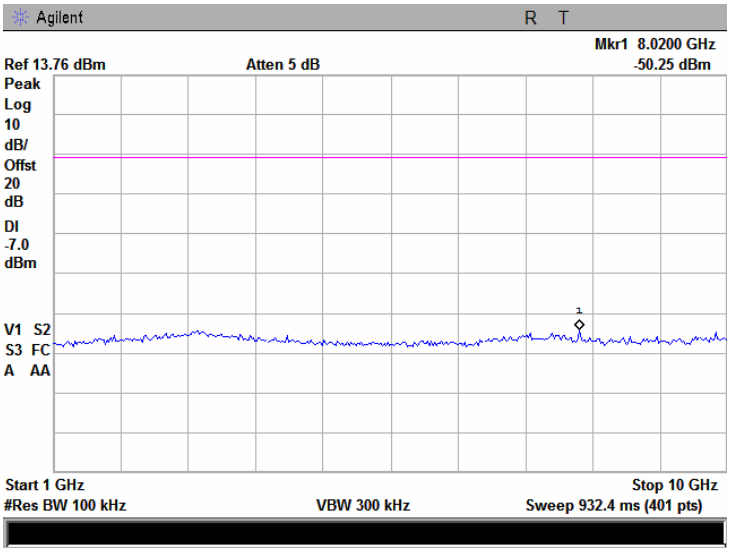



**Plot 7.4.35 Spurious emission measurements in 30 - 1000 MHz range at high carrier frequency**

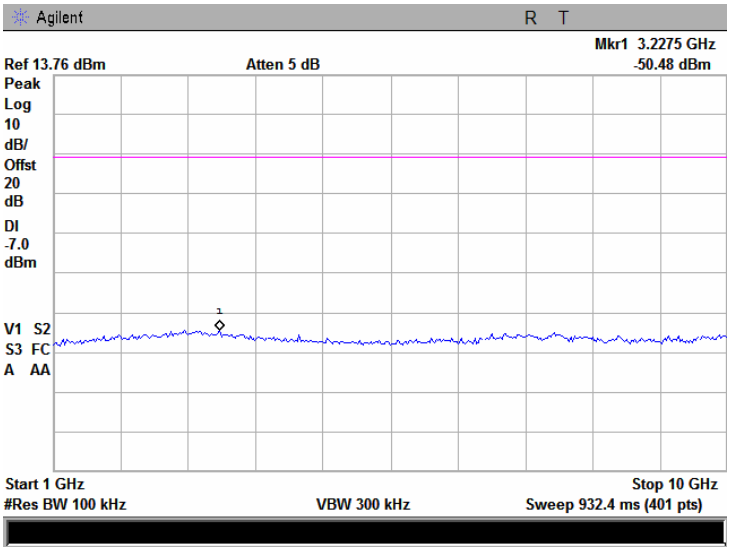


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.36 Spurious emission measurements in 1000 – 10000 MHz range at low carrier frequency**

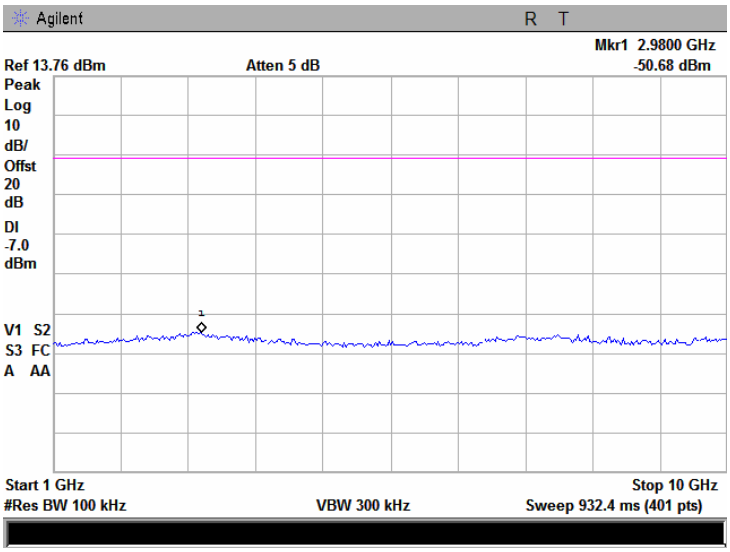



**Plot 7.4.37 Spurious emission measurements in 1000 – 10000 MHz range at mid carrier frequency**

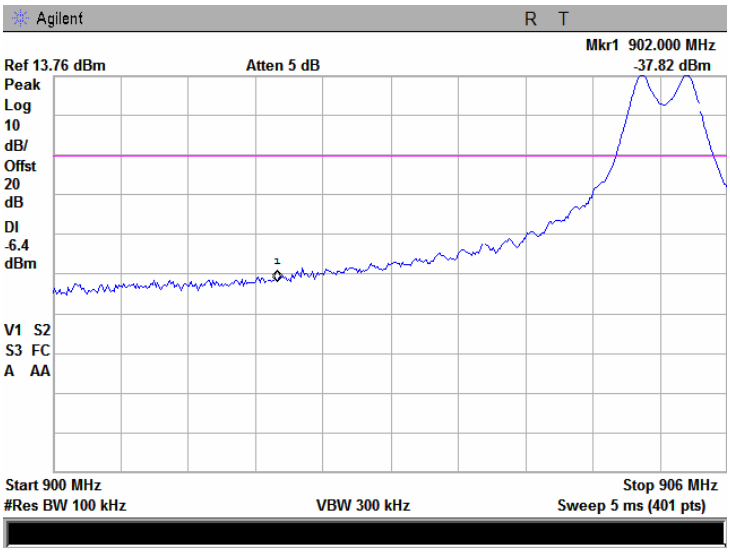


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.38 Spurious emission measurements in 1000 – 10000 MHz range at high carrier frequency**

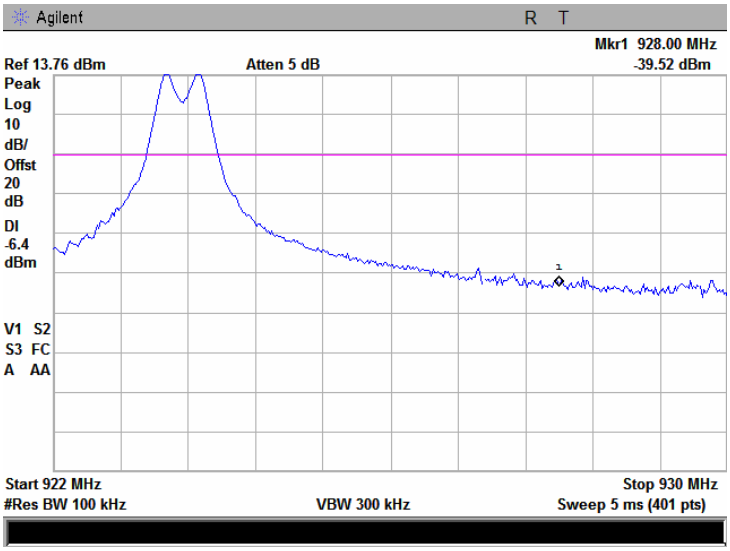



**Plot 7.4.39 Spurious emission measurements band edge at low carrier frequency**



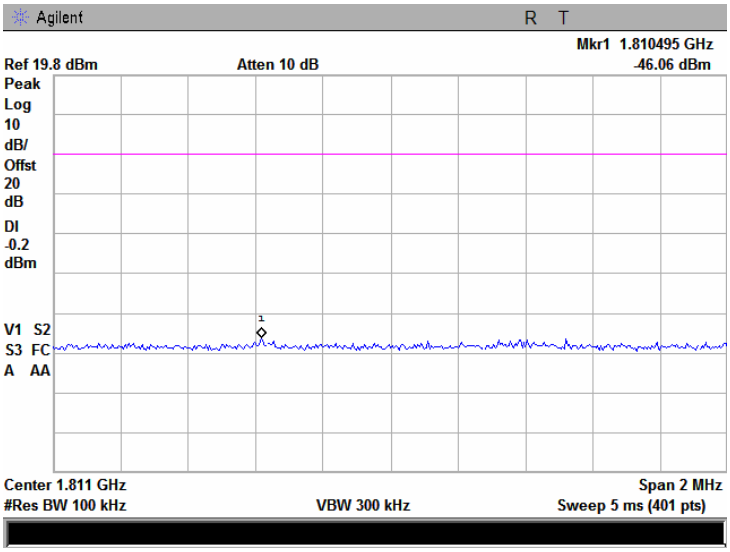
| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.40 Spurious emission measurements band edge at high carrier frequency**

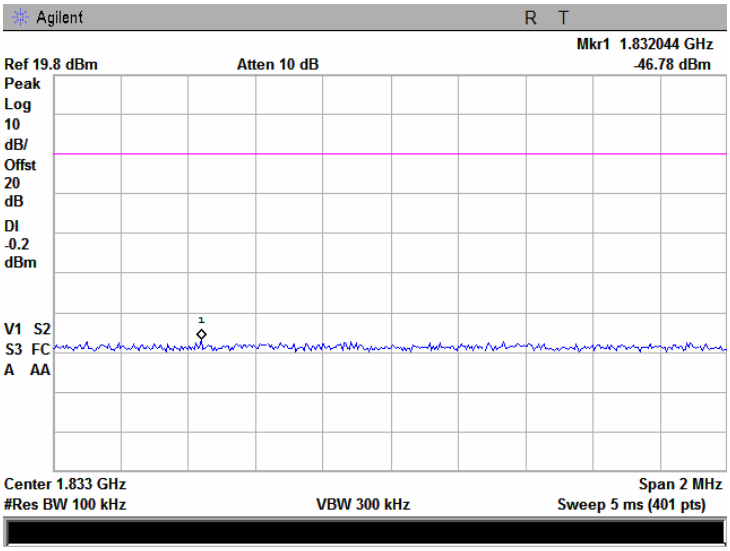


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.41 Conducted spurious emission measurements at the 2nd harmonic of low carrier frequency**

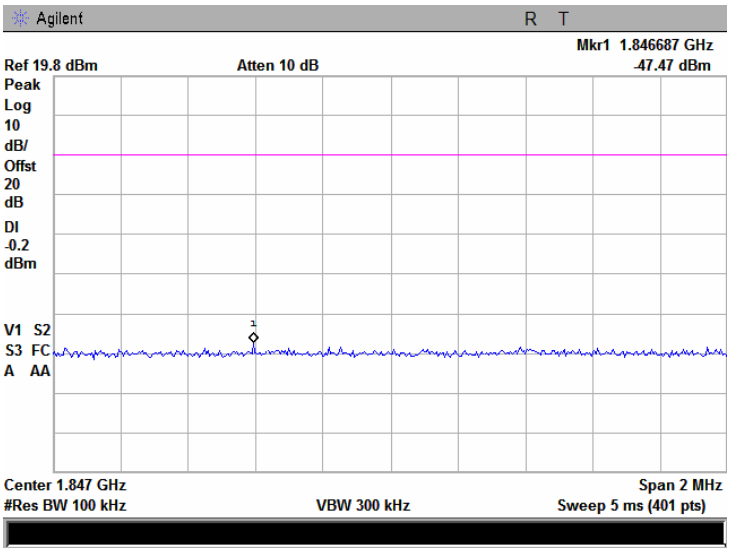



**Plot 7.4.42 Conducted spurious emission measurements at the 2nd harmonic of mid carrier frequency**

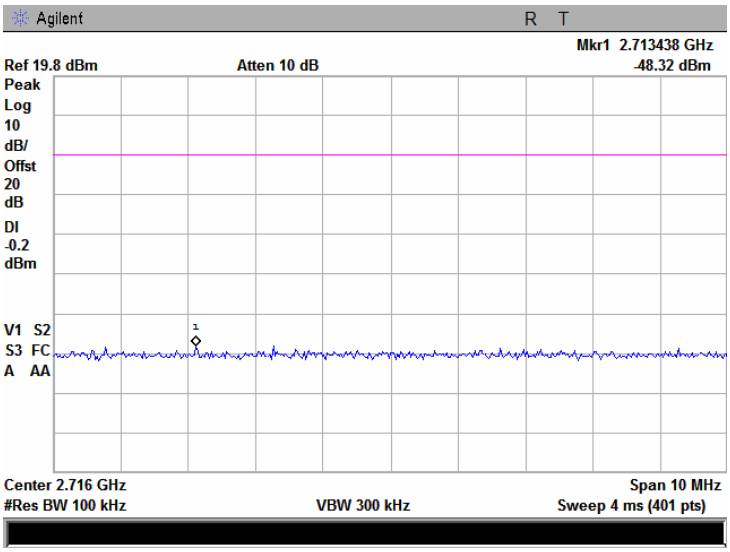


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.43 Conducted spurious emission measurements at the 2nd harmonic of high carrier frequency**

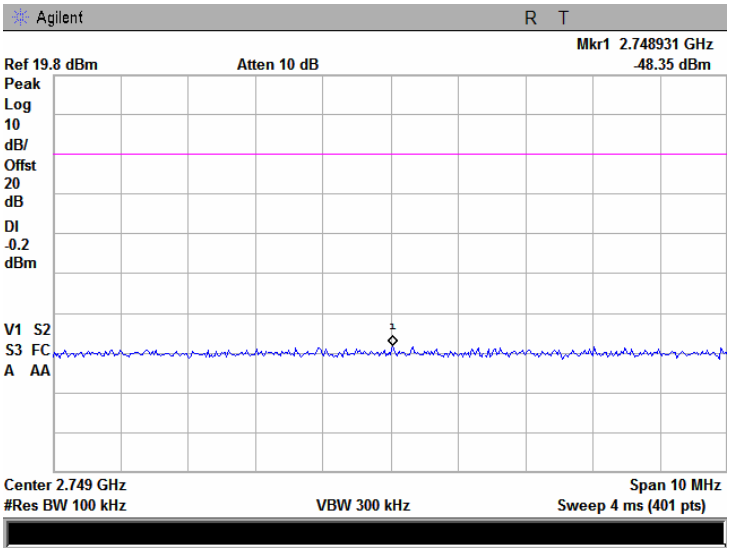



**Plot 7.4.44 Conducted spurious emission measurements at the 3rd harmonic of low carrier frequency**

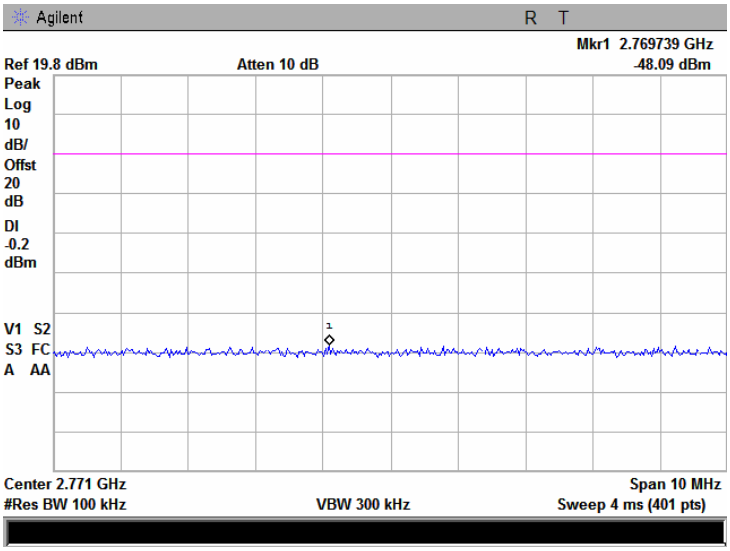


| Test specification: | Section 15.247(c), Conducted spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:20:00 AM | | |
| Temperature: °C | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.4.45 Conducted spurious emission measurements at the 3rd harmonic of mid carrier frequency**




**Plot 7.4.46 Conducted spurious emission measurements at the 3rd harmonic of high carrier frequency**



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

## 7.5 Field strength of spurious emissions

### 7.5.1 General

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

**Table 7.5.1 Radiated spurious emissions limits**

| Frequency, MHz | Field strength at 3 m within restricted bands, dB(µV/m)* | | | Attenuation of field strength of spurious versus carrier outside restricted bands, dBc*** |
|---|---|---|---|---|
| | Peak | Quasi Peak | Average | |
| 0.009 – 0.090 | 148.5 – 128.5 | NA | 128.5 – 108.5** | 20.0 |
| 0.090 – 0.110 | NA | 108.5 – 106.8** | NA | |
| 0.110 – 0.490 | 126.8 – 113.8 | NA | 106.8 – 93.8** | |
| 0.490 – 1.705 | NA | 73.8 – 63.0** | NA | |
| 1.705 – 30.0* | | 69.5 | | |
| 30 – 88 | | 40.0 | | |
| 88 – 216 | | 43.5 | | |
| 216 – 960 | | 46.0 | | |
| 960 - 1000 | | 54.0 | | |
| 1000 – 10th harmonic | 74.0 | NA | 54.0 | |

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

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

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

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

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

### 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/ EMI receiver. To find maximum radiation the turntable was rotated $360^0$ and the measuring antenna was rotated around its vertical axis.

**7.5.2.3** The worst test results (the lowest margins) were recorded 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/ EMI receiver. To find maximum radiation the turntable was rotated $360^0$, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

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

| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Figure 7.5.1 Setup for spurious emission field strength measurements below 30 MHz**

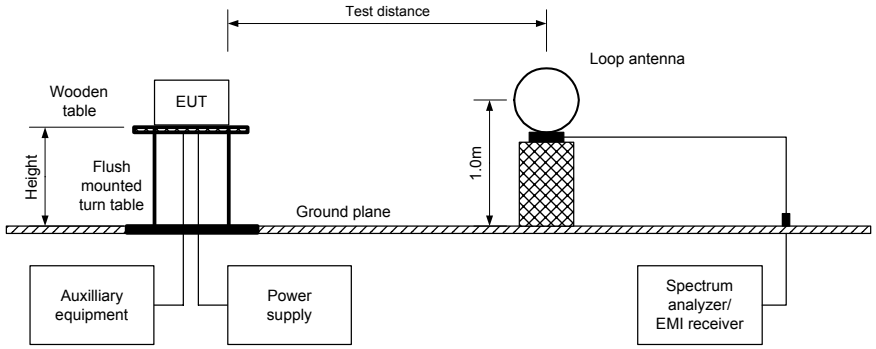
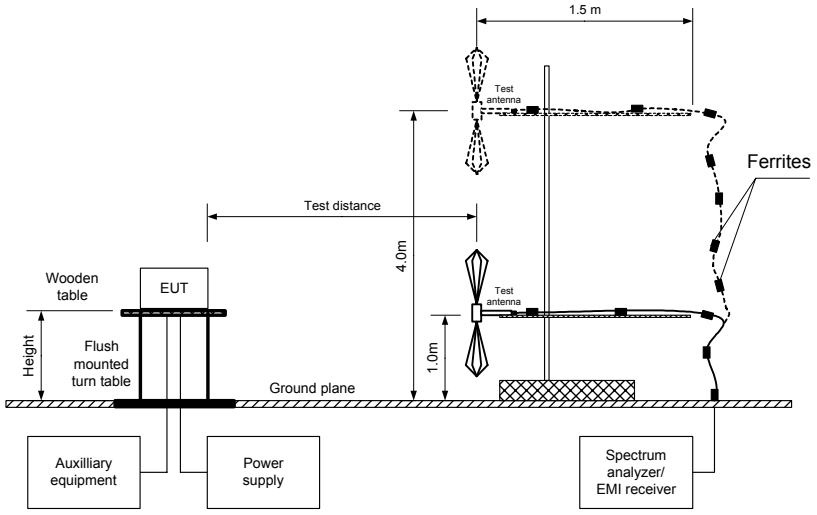



**Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz**



| **Test specification:** | **Section 15.247(c), Radiated spurious emissions** | | |
|---|---|---|---|
| **Test procedure:** | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| **Test mode:** | Compliance | **Verdict:** | PASS |
| **Date & Time:** | 12/31/2006 9:04:08 AM | | |
| **Temperature:** ºC | **Air Pressure:** hPa | **Relative Humidity:** % | **Power Supply:** |
| **Remarks:** | | | |

**Table 7.5.2 Field strength of spurious emissions above 1 GHz within restricted bands**

| | |
|---|---|
| ASSIGNED FREQUENCY: | 902-928 MHz |
| INVESTIGATED FREQUENCY RANGE: | 1000 -10000 MHz |
| TEST DISTANCE: | 3 m |
| MODULATION: | FSK / PSK |
| MODULATING SIGNAL: | PRBS |
| BIT RATE: | FSK –60 kbps / PSK -900 kbps |
| DUTY CYCLE: | 100 % |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| DETECTOR USED: | Peak |
| RESOLUTION BANDWIDTH: | 1000 kHz |
| TEST ANTENNA TYPE: | Double ridged guide |

| Frequency, MHz | Antenna | | Azimuth, degrees* | Peak field strength(VBW=3 MHz) | | | Average field strength(VBW=10 Hz) | | | | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Polarization | Height, m | | Measured, dB(µV/m) | Limit, dB(µV/m) | Margin, dB** | Measured, dB(µV/m) | Calculated, dB(µV/m) | Limit, dB(µV/m) | Margin, dB*** | |
| **All carrier frequency** | | | | | | | | | | | |
| All spurious were found at least 20 dB bellow limit | | | | | | | | | | | Pass |

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = Measured field strength - specification limit.
***- Margin = Calculated field strength - specification limit,
where Calculated field strength = Measured field strength + average factor.

**Table 7.5.3 Average factor calculation**

| Transmission pulse | | Transmission burst | | Transmission train duration, ms | Average factor, dB |
|---|---|---|---|---|---|
| Duration, ms | Period, ms | Duration, ms | Period, ms | | |
| 100% duty cycle | | | | | 0 |

*- Average factor was calculated as follows

for pulse train shorter than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{Train\ duration} \times Number\ of\ bursts\ within\ pulse\ train\right)$$

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

| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 7.5.4 Field strength of spurious emissions below 1 GHz within restricted bands**

| | |
|---|---|
| ASSIGNED FREQUENCY: | 902-928 MHz |
| INVESTIGATED FREQUENCY RANGE: | 0.009 – 1000 MHz |
| TEST DISTANCE: | 3 m |
| MODULATION: | FSK / PSK |
| MODULATING SIGNAL: | PRBS |
| BIT RATE: | FSK –60 kbps / PSK -900 kbps |
| DUTY CYCLE: | 100 % |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| RESOLUTION BANDWIDTH: | 1 kHz (9 kHz – 150 kHz)<br>9.0 kHz (150 kHz – 30 MHz)<br>120 kHz (30 MHz – 1000 MHz) |
| VIDEO BANDWIDTH: | > Resolution bandwidth |
| TEST ANTENNA TYPE: | Active loop (9 kHz – 30 MHz)<br>Biconical (30 MHz – 200 MHz)<br>Log periodic (200 MHz – 1000 MHz)<br>Biconilog (30 MHz – 1000 MHz) |

| Frequency, MHz | Peak emission, dB(µV/m) | Quasi-peak | | | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|---|---|---|---|---|---|---|---|---|
| | | Measured emission, dB(µV/m) | Limit, dB(µV/m) | Margin, dB* | | | | |
| **All carrier frequencies** | | | | | | | | |
| All spurious were found at least 20 dB bellow limit | | | | | | | | Pass |

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

**Table 7.5.5 Restricted bands**

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

**Reference numbers of test equipment used**

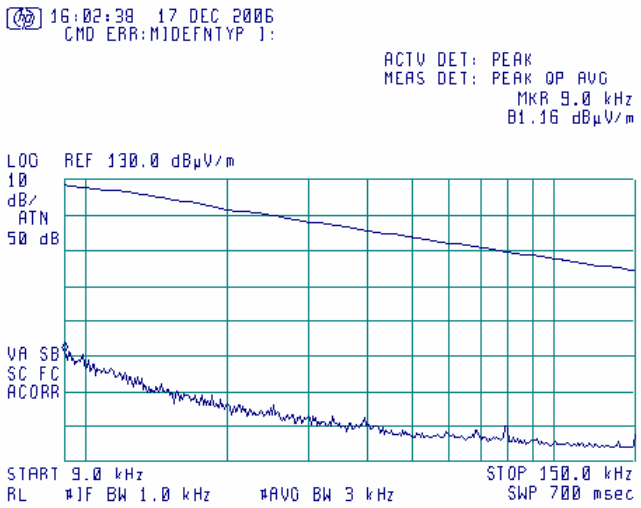
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0446 | HL 0465 | HL 0592 | HL 0593 | HL 0594 | HL 0604 | HL 1425 | HL 1553 |
| HL 1566 | HL 1947 | HL 1984 | HL 2499 | | | | |

Full description is given in Appendix A.

| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

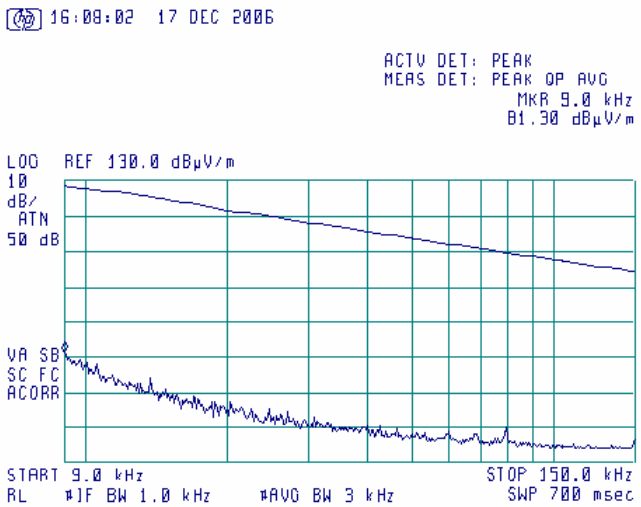
**Plot 7.5.1 Radiated emission measurements from 9 to 150 kHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
MODULATION: PSK




**Plot 7.5.2 Radiated emission measurements from 9 to 150 kHz at the mid carrier frequency**

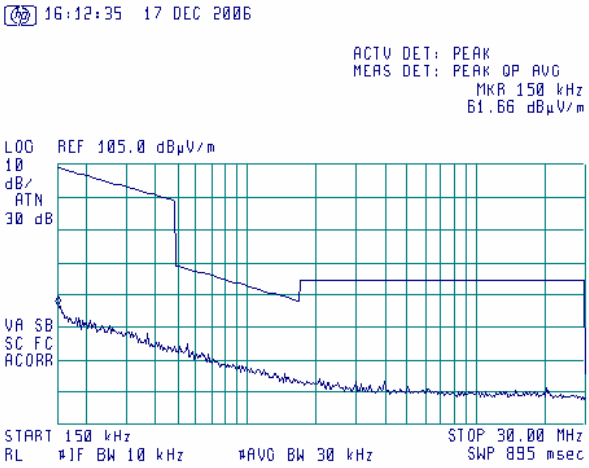
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

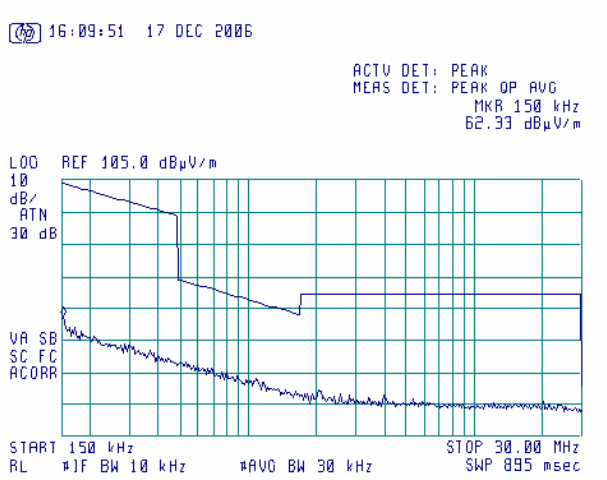
**Plot 7.5.3 Radiated emission measurements from 0.15 to 30 MHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
MODULATION: PSK




**Plot 7.5.4 Radiated emission measurements from 0.15 to 30 MHz at the mid carrier frequency**

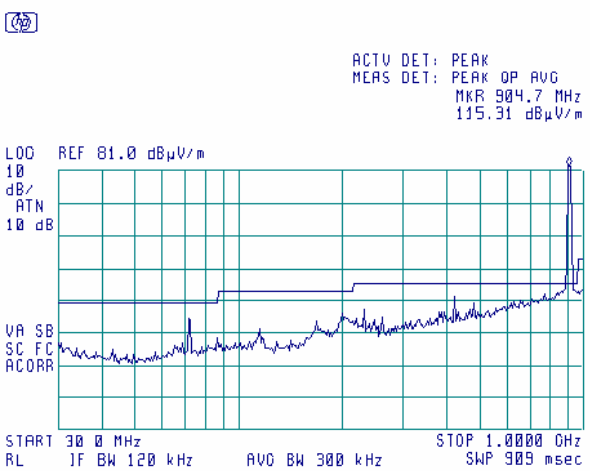
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.5.5 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency**

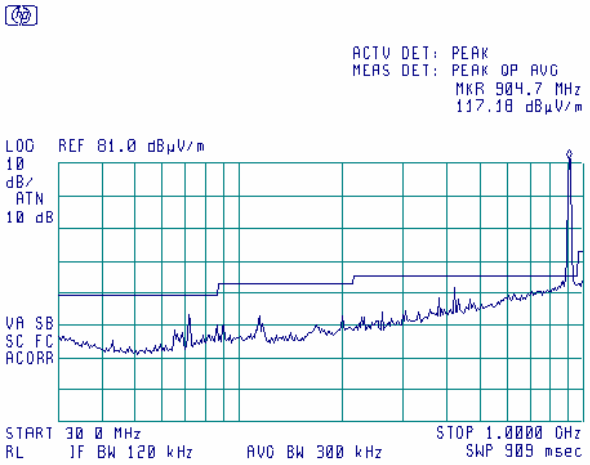
TEST SITE: Semi-Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**All spurious are from digital part of EUT**

**Plot 7.5.6 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency**

TEST SITE: Semi-Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK

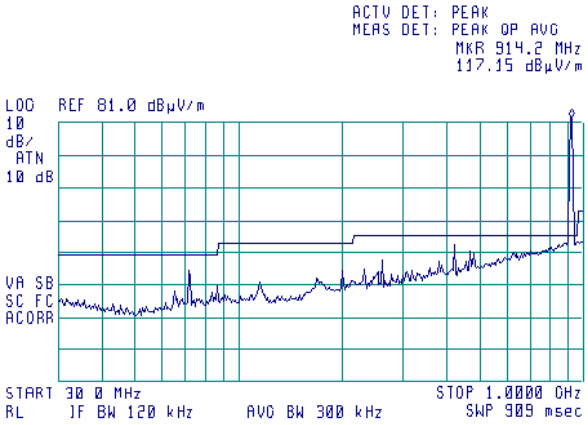



**All spurious are from digital part of EUT**

| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.5.7 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency**

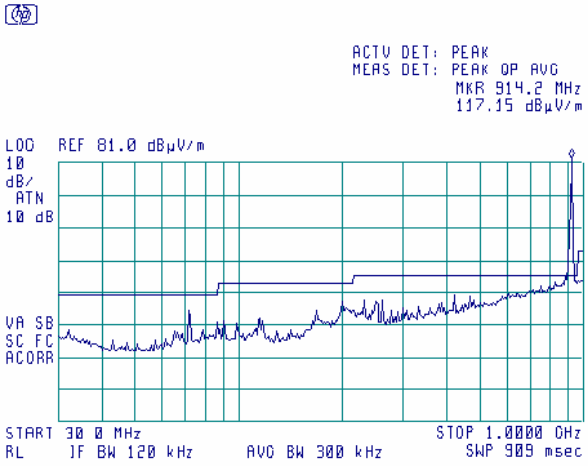
TEST SITE: Semi-Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**All spurious are from digital part of EUT**

**Plot 7.5.8 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency**

TEST SITE: Semi-Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK

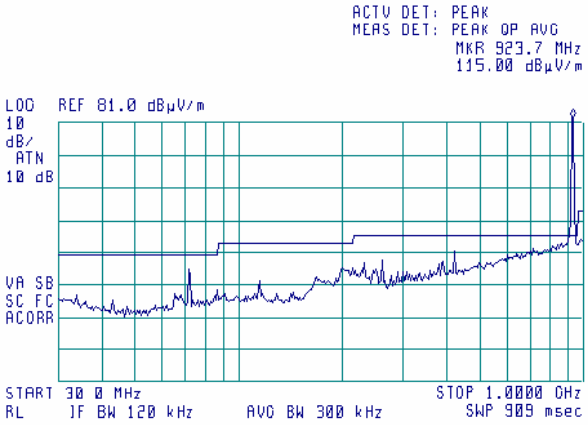



**All spurious are from digital part of EUT**

| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.5.9 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency**

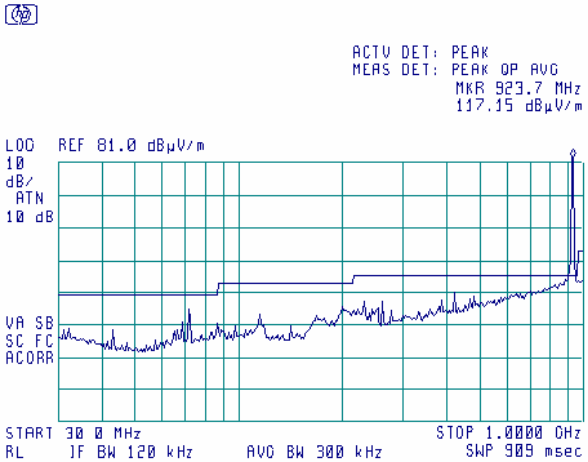
TEST SITE: Semi-Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**All spurious are from digital part of EUT**

**Plot 7.5.10 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency**

TEST SITE: Semi-Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK

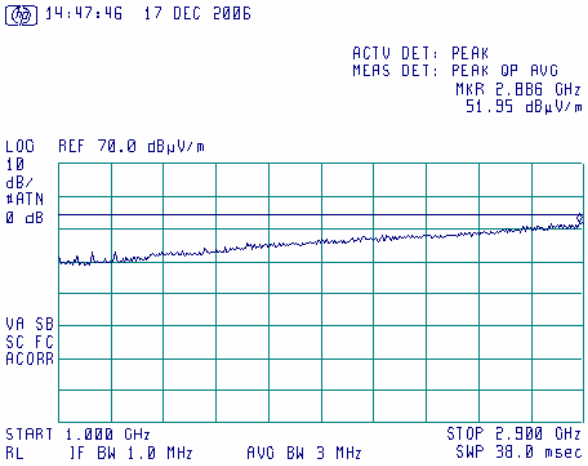



**All spurious are from digital part of EUT**

| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

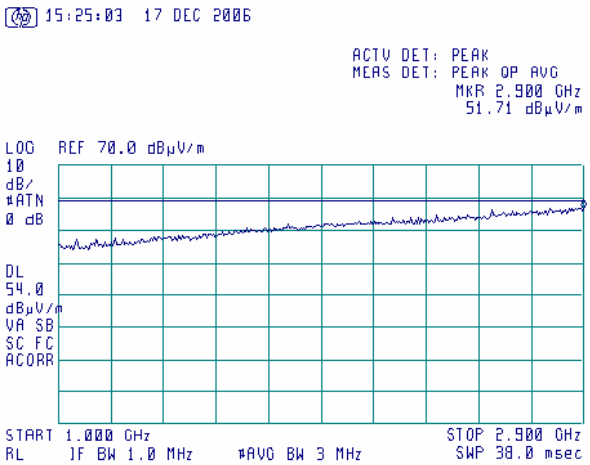
**Plot 7.5.11 Radiated emission measurements from 1000 to 2900 MHz at the low carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK




**Plot 7.5.12 Radiated emission measurements from 1000 to 2900 MHz at the low carrier frequency**

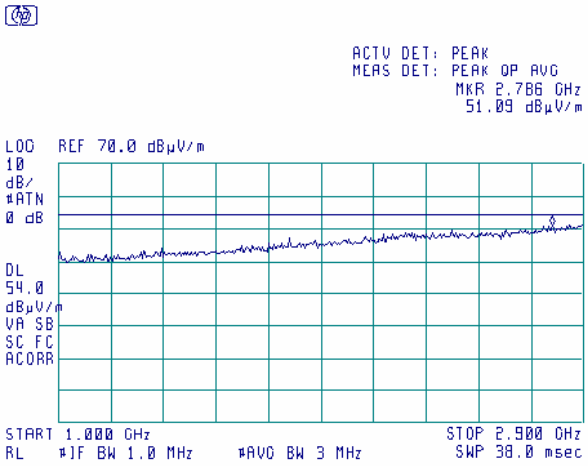
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

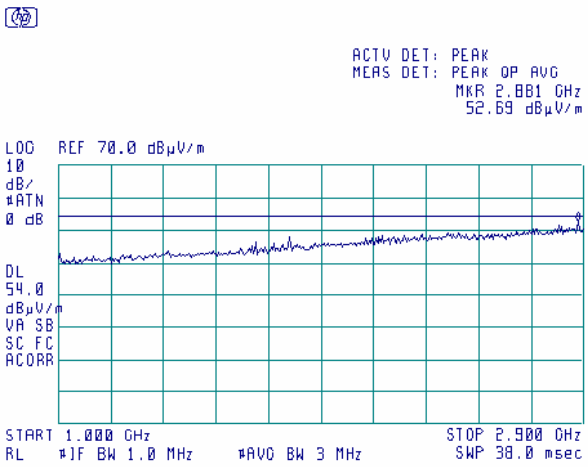
**Plot 7.5.13 Radiated emission measurements from 1000 to 2900 MHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK




**Plot 7.5.14 Radiated emission measurements from 1000 to 2900 MHz at the mid carrier frequency**

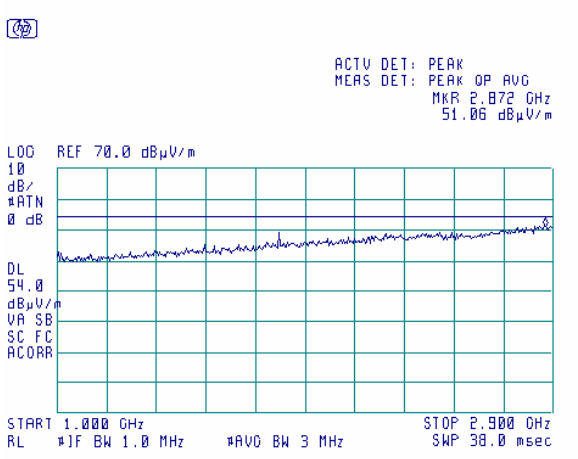
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

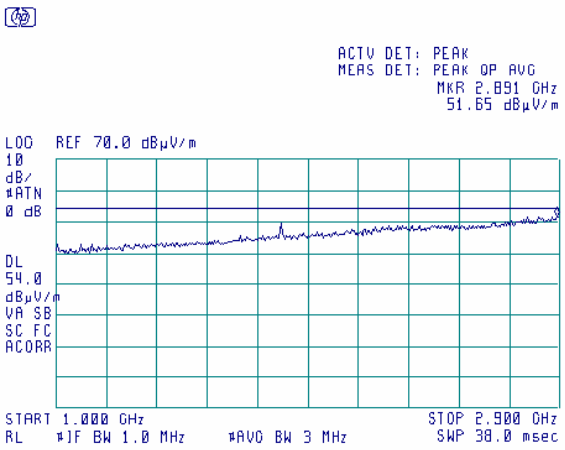
**Plot 7.5.15 Radiated emission measurements from 1000 to 2900 MHz at the high carrier frequency**

| | |
|---|---|
| TEST SITE: | Anechoic chamber |
| TEST DISTANCE: | 3 m |
| ANTENNA POLARIZATION: | Vertical and Horizontal |
| MODULATION: | PSK |
| DETECTOR: | Peak |




**Plot 7.5.16 Radiated emission measurements from 1000 to 2900 MHz at the high carrier frequency**

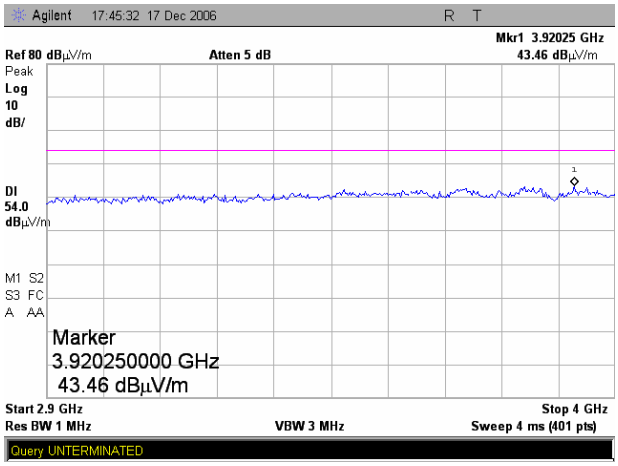
| | |
|---|---|
| TEST SITE: | Anechoic chamber |
| TEST DISTANCE: | 3 m |
| ANTENNA POLARIZATION: | Vertical and Horizontal |
| MODULATION: | FSK |
| DETECTOR: | Peak |



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

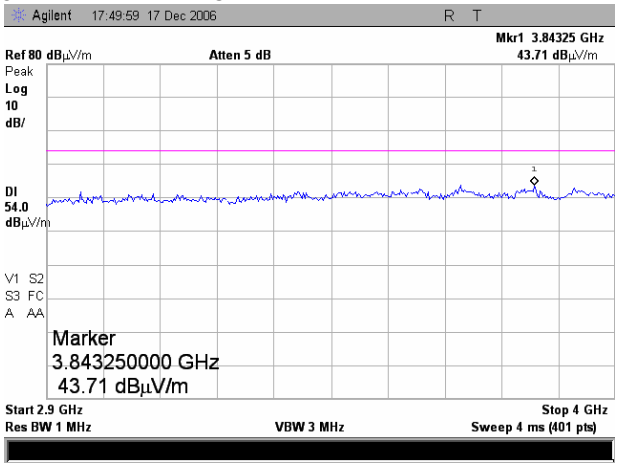
**Plot 7.5.17 Radiated emission measurements from 2900 to 4000 MHz at the low carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK




**Plot 7.5.18 Radiated emission measurements from 2900 to 4000 MHz at the low carrier frequency**

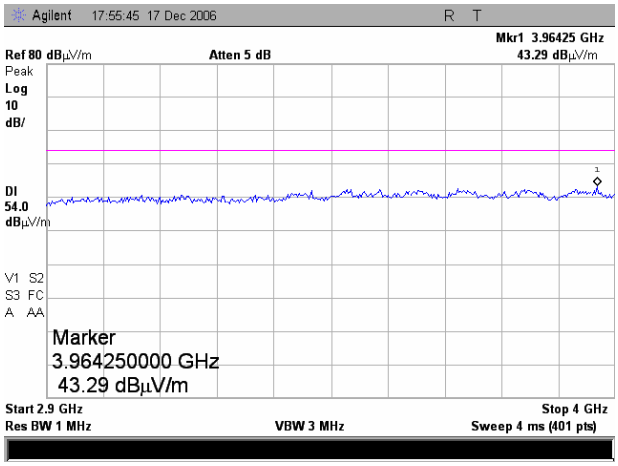
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

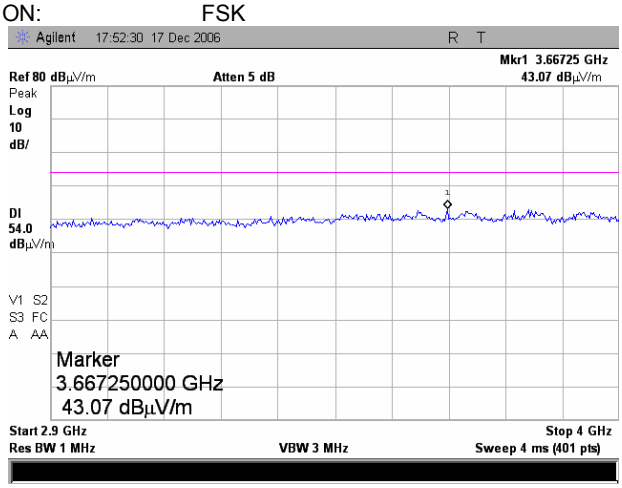
**Plot 7.5.19 Radiated emission measurements from 2900 to 4000 MHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK




**Plot 7.5.20 Radiated emission measurements from 2900 to 4000 MHz at the mid carrier frequency**

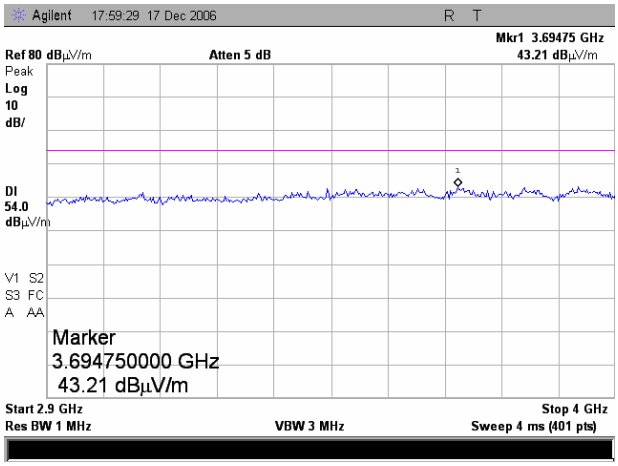
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

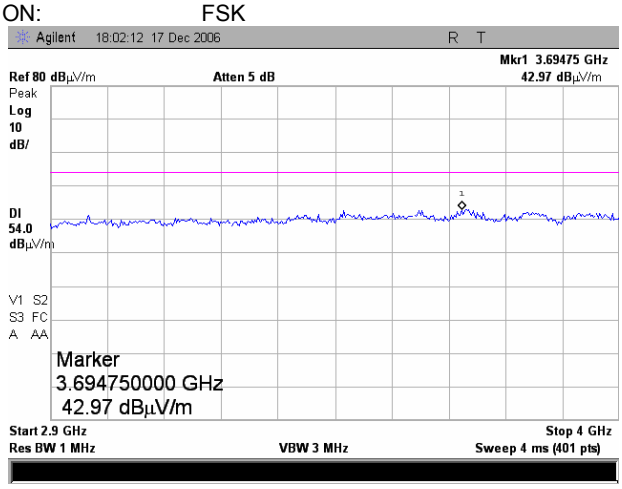
**Plot 7.5.21 Radiated emission measurements from 2900 to 4000 MHz at the high carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK




**Plot 7.5.22 Radiated emission measurements from 2900 to 4000 MHz at the high carrier frequency**

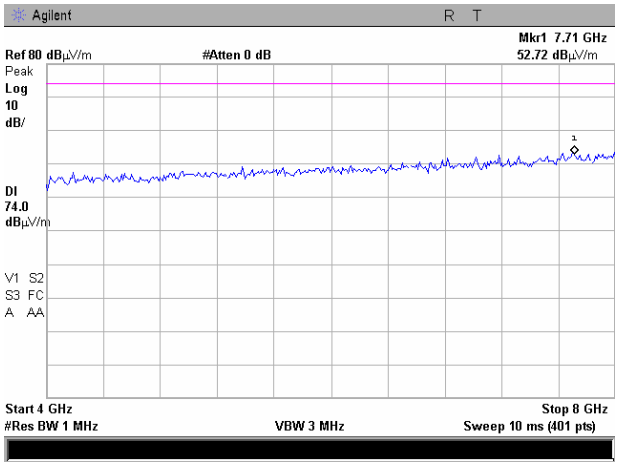
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

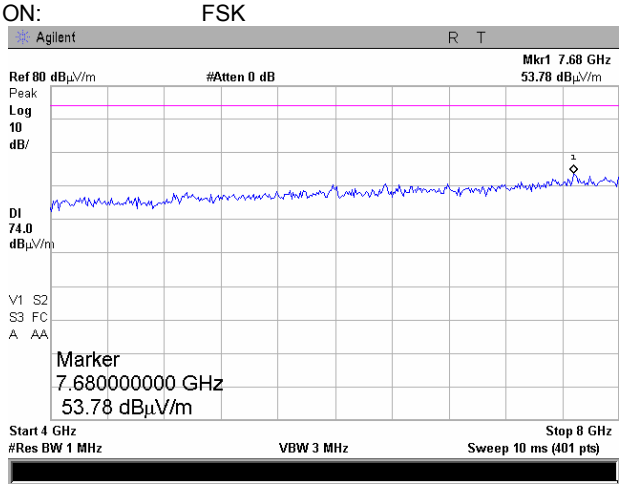
**Plot 7.5.23 Radiated emission measurements from 4000 to 8000 MHz at the low carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK




**Plot 7.5.24 Radiated emission measurements from 4000 to 8000 MHz at the low carrier frequency**

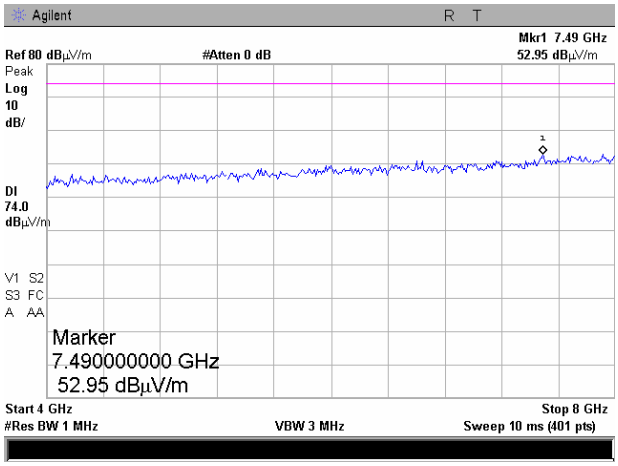
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

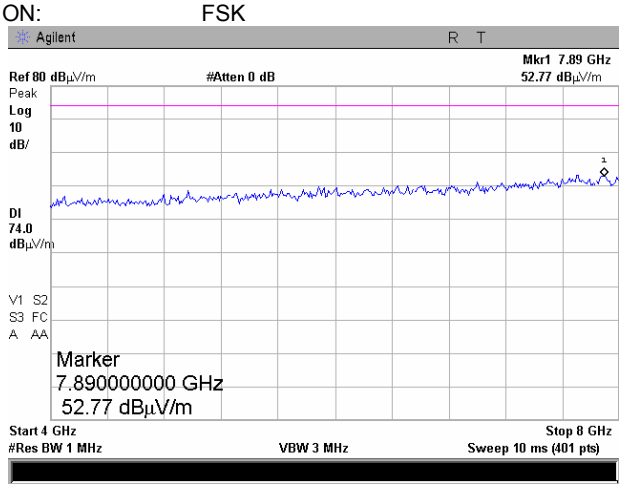
**Plot 7.5.25 Radiated emission measurements from 4000 to 8000 MHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK




**Plot 7.5.26 Radiated emission measurements from 4000 to 8000 MHz at the mid carrier frequency**

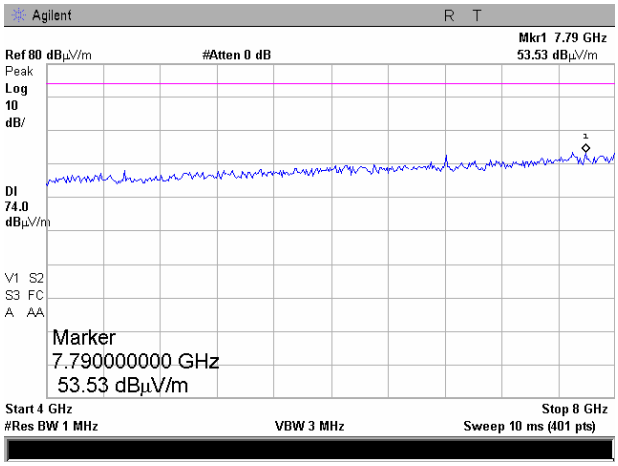
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

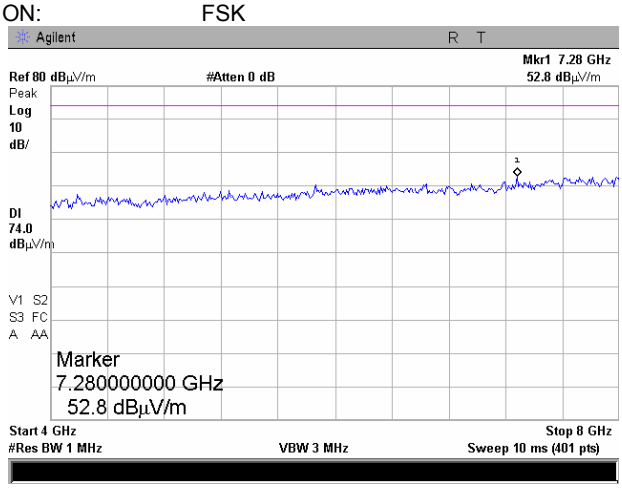
**Plot 7.5.27 Radiated emission measurements from 4000 to 8000 MHz at the high carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK




**Plot 7.5.28 Radiated emission measurements from 4000 to 8000 MHz at the high carrier frequency**

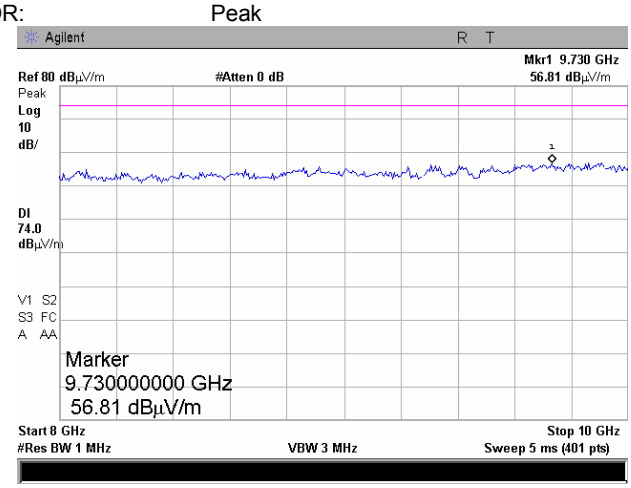
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

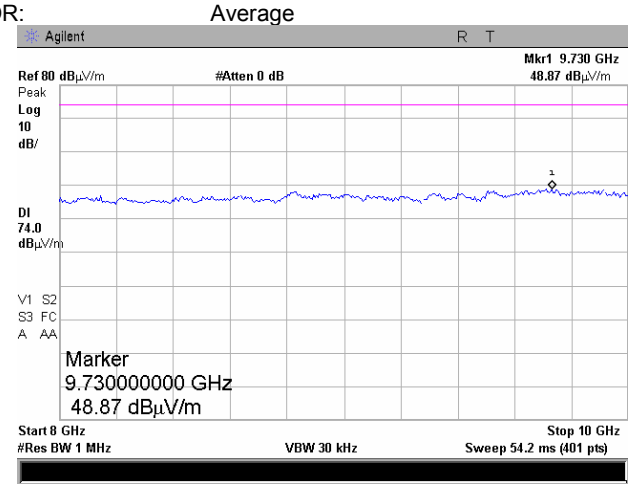
**Plot 7.5.29 Radiated emission measurements from 8000 to 10000 MHz at the low carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK
DETECTOR: Peak




**Plot 7.5.30 Radiated emission measurements from 8000 to 10000 MHz at the low carrier frequency**

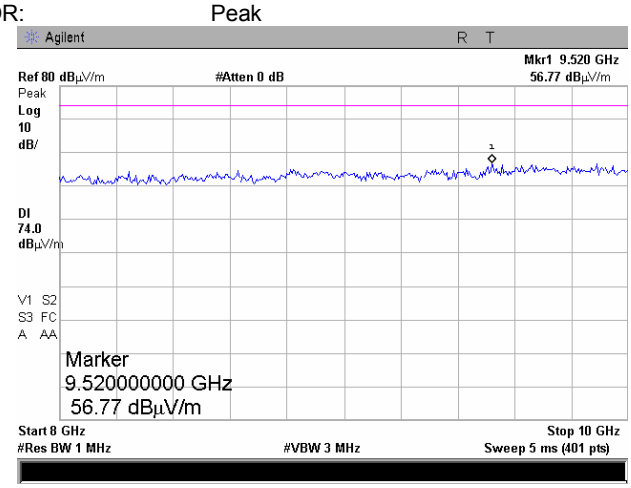
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK
DETECTOR: Average



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

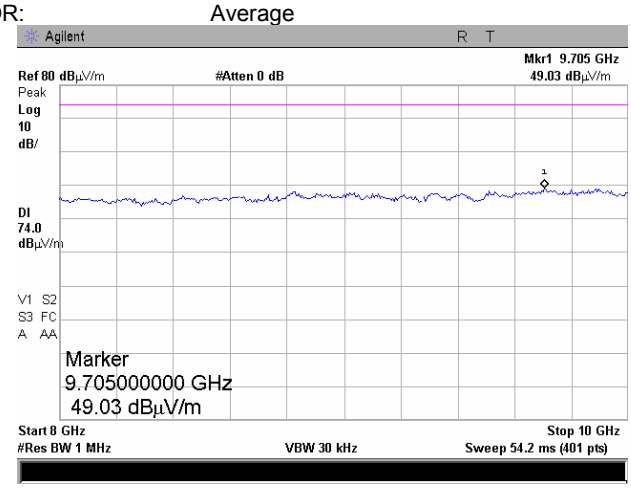
**Plot 7.5.31 Radiated emission measurements from 8000 to 10000 MHz at the low carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK
DETECTOR: Peak




**Plot 7.5.32 Radiated emission measurements from 8000 to 10000 MHz at the low carrier frequency**

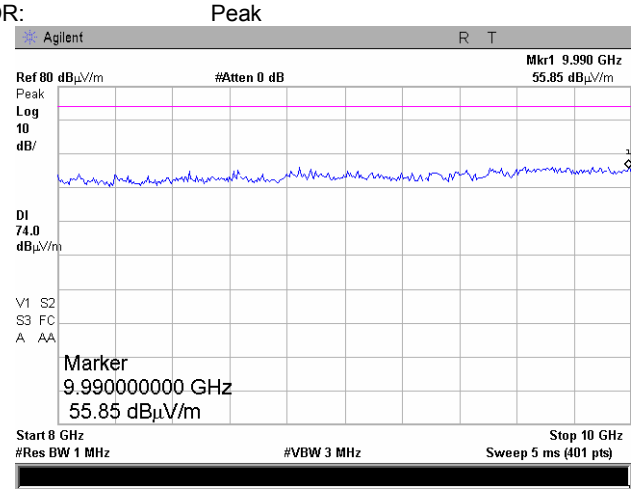
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK
DETECTOR: Average



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

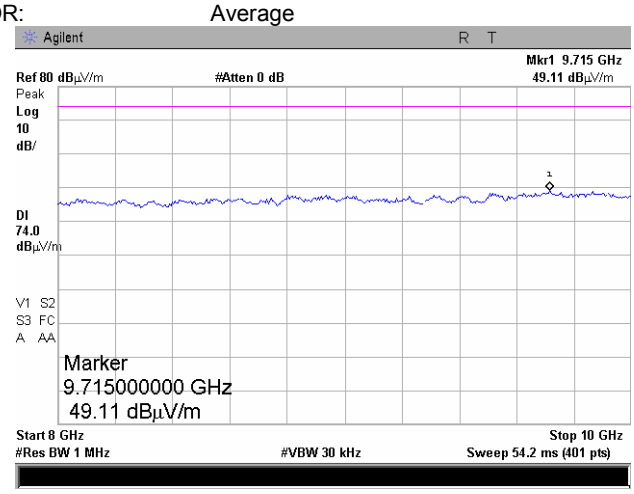
**Plot 7.5.33 Radiated emission measurements from 8000 to 10000 MHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK
DETECTOR: Peak




**Plot 7.5.34 Radiated emission measurements from 8000 to 10000 MHz at the mid carrier frequency**

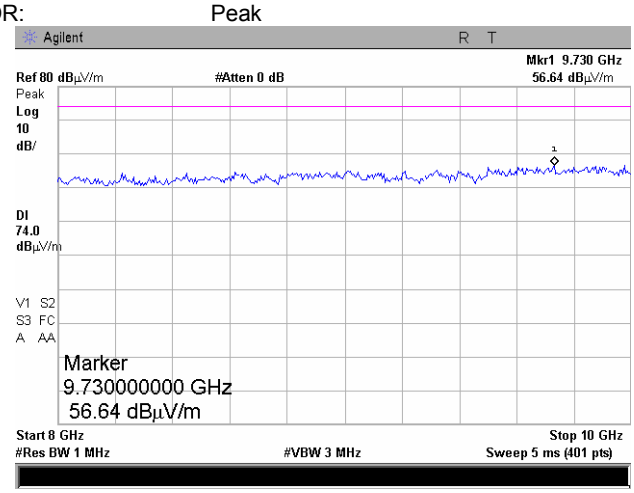
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK
DETECTOR: Average



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

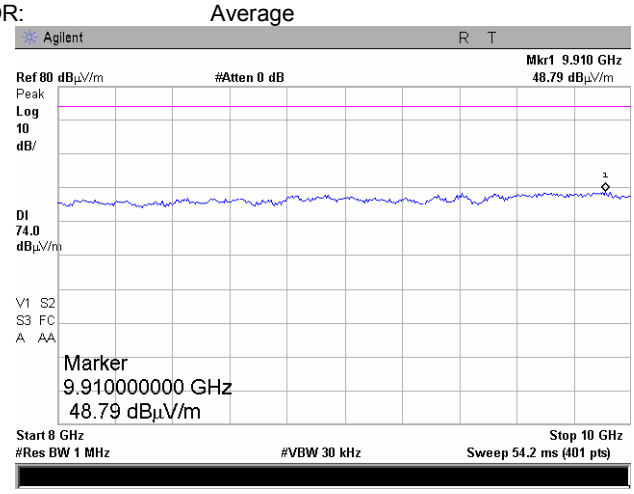
**Plot 7.5.35 Radiated emission measurements from 8000 to 10000 MHz at the mid carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK
DETECTOR: Peak




**Plot 7.5.36 Radiated emission measurements from 8000 to 10000 MHz at the mid carrier frequency**

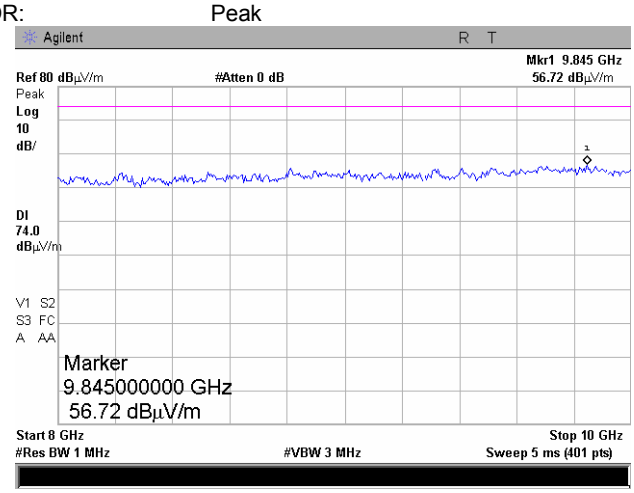
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK
DETECTOR: Average



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

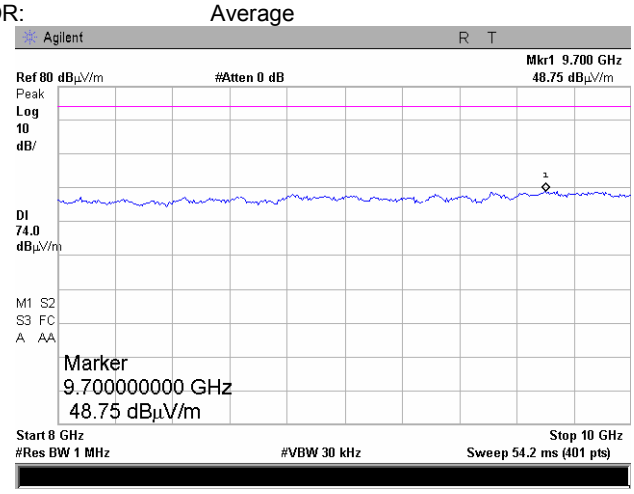
**Plot 7.5.37 Radiated emission measurements from 8000 to 10000 MHz at the high carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK
DETECTOR: Peak




**Plot 7.5.38 Radiated emission measurements from 8000 to 10000 MHz at the high carrier frequency**

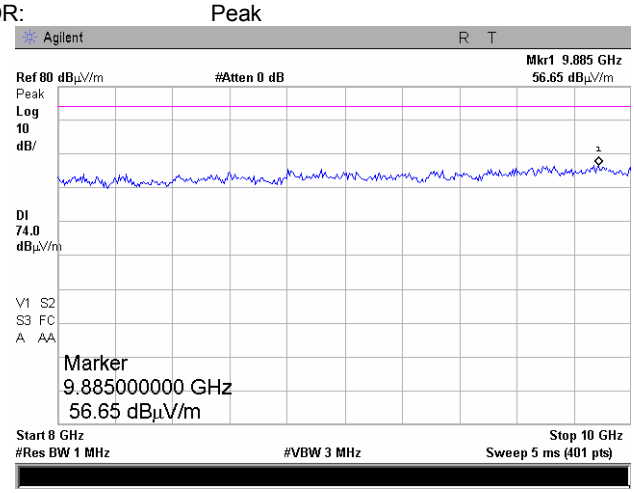
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: PSK
DETECTOR: Average



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

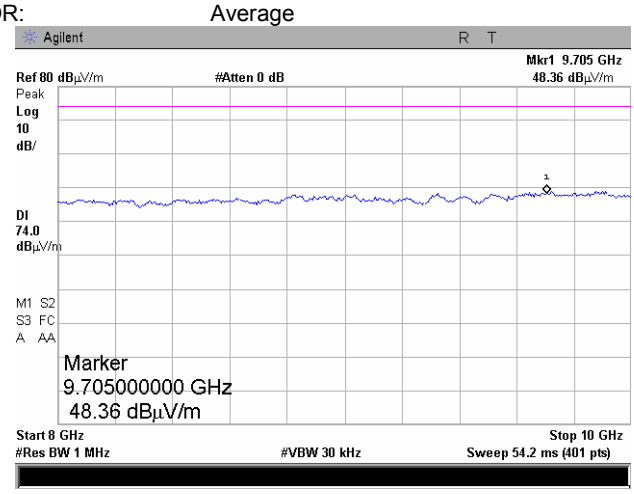
**Plot 7.5.39 Radiated emission measurements from 8000 to 10000 MHz at the high carrier frequency**

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK
DETECTOR: Peak




**Plot 7.5.40 Radiated emission measurements from 8000 to 10000 MHz at the high carrier frequency**

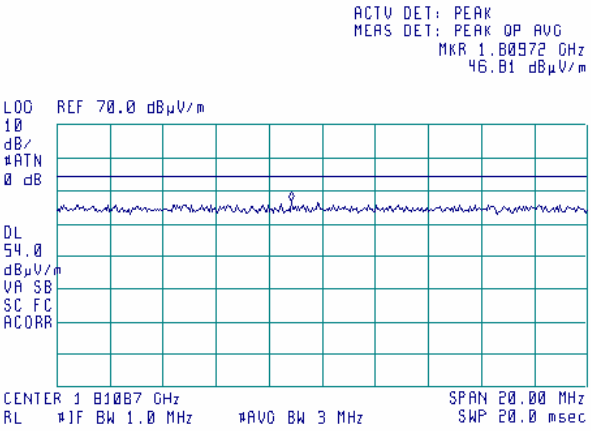
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
MODULATION: FSK
DETECTOR: Average



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

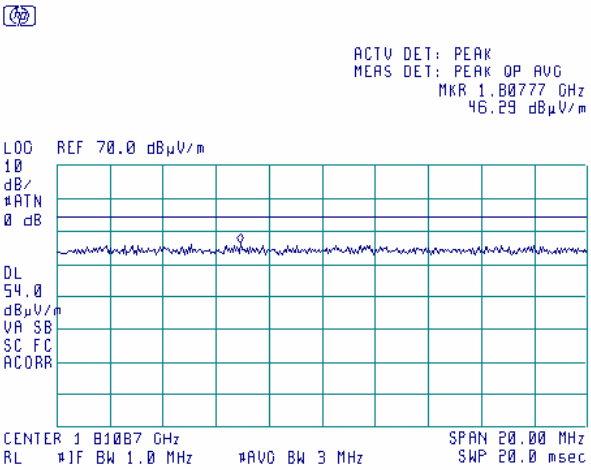
**Plot 7.5.41 Radiated emission measurements at the second harmonic of low carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.42 Radiated emission measurements at the second harmonic of low carrier frequency**

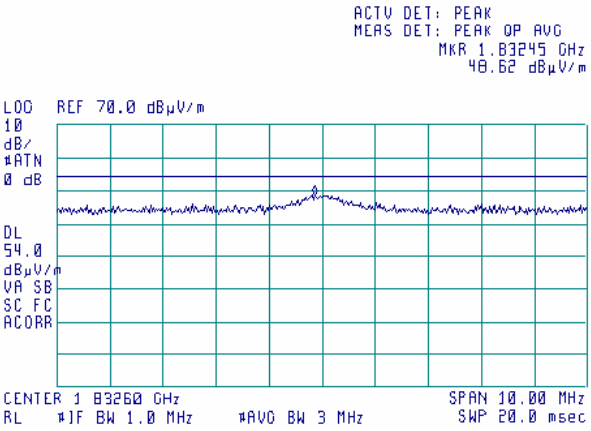
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

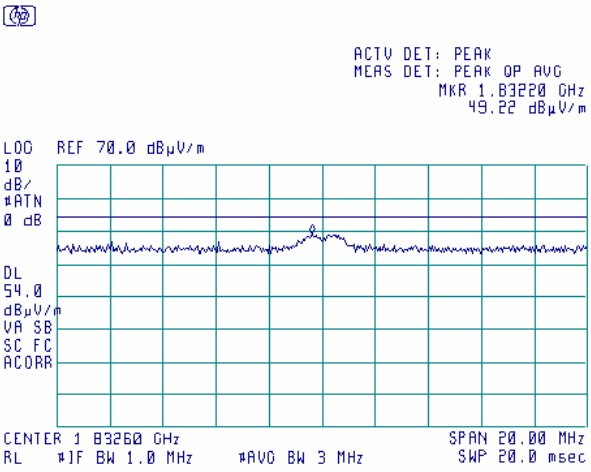
**Plot 7.5.43 Radiated emission measurements at the second harmonic of mid carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.44 Radiated emission measurements at the second harmonic of mid carrier frequency**

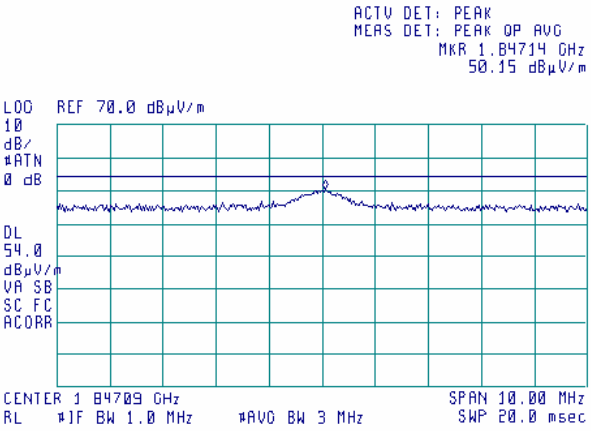
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

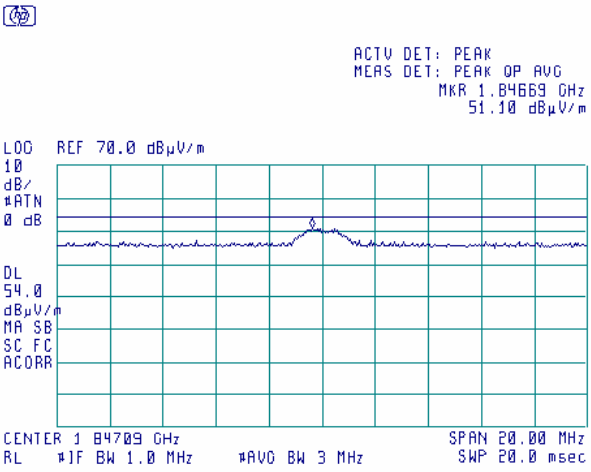
**Plot 7.5.45 Radiated emission measurements at the second harmonic of high carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.46 Radiated emission measurements at the second harmonic of high carrier frequency**

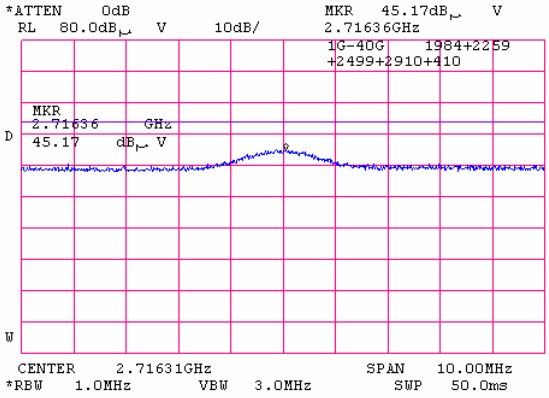
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

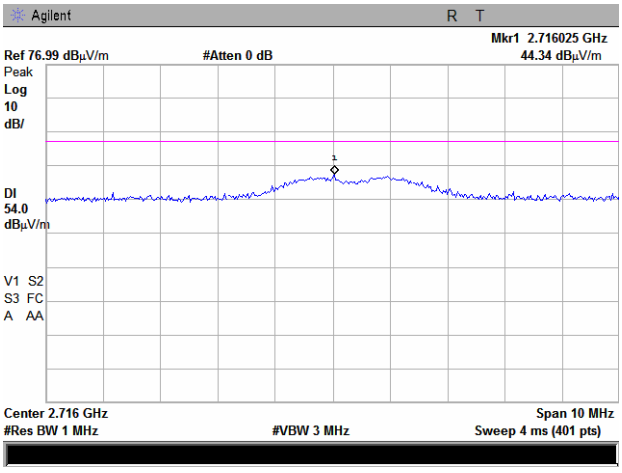
**Plot 7.5.47 Radiated emission measurements at the third harmonic of low carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.48 Radiated emission measurements at the third harmonic of low carrier frequency**

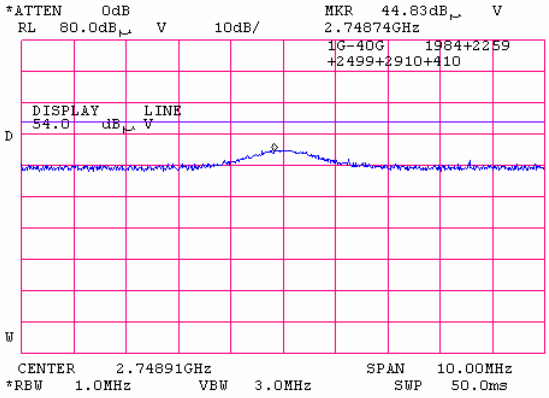
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

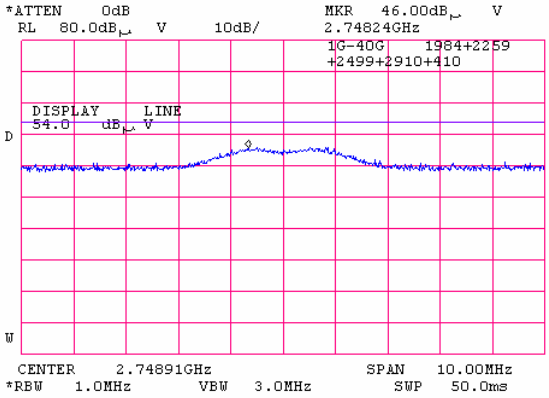
**Plot 7.5.49 Radiated emission measurements at the third harmonic of mid carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.50 Radiated emission measurements at the third harmonic of mid carrier frequency**

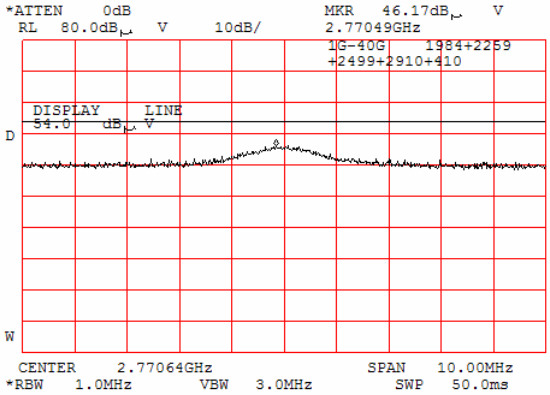
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

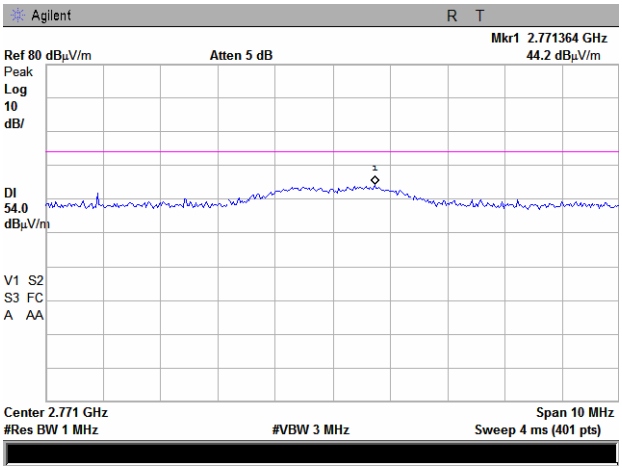
**Plot 7.5.51 Radiated emission measurements at the third harmonic of high carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.52 Radiated emission measurements at the third harmonic of high carrier frequency**

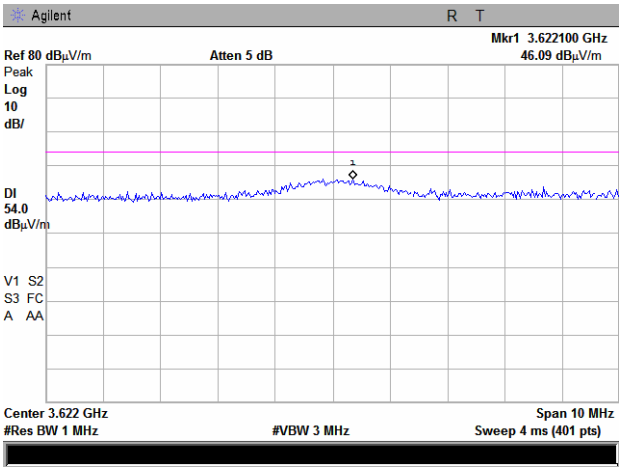
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

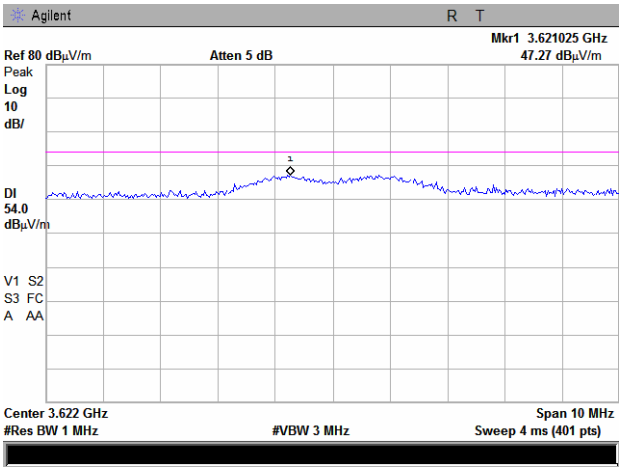
**Plot 7.5.53 Radiated emission measurements at the forth harmonic of low carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.54 Radiated emission measurements at the forth harmonic of low carrier frequency**

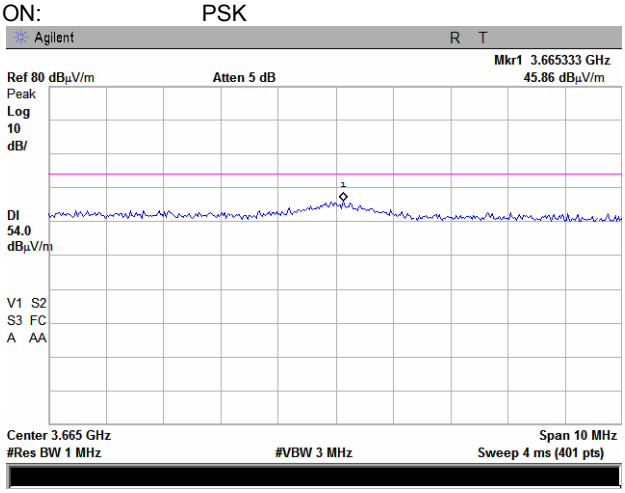
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

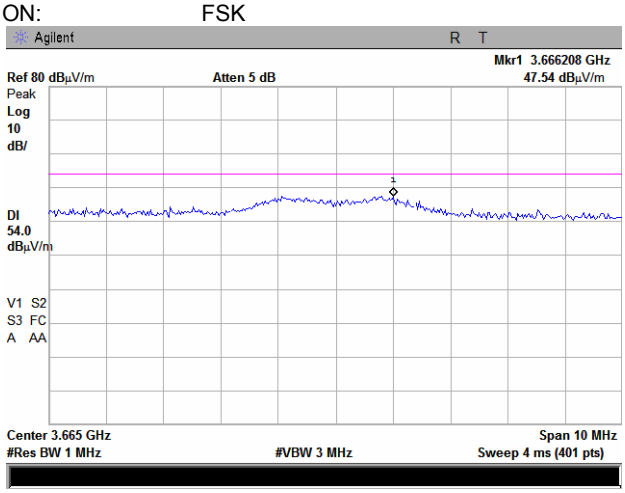
**Plot 7.5.55 Radiated emission measurements at the forth harmonic of mid carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.56 Radiated emission measurements at the forth harmonic of mid carrier frequency**

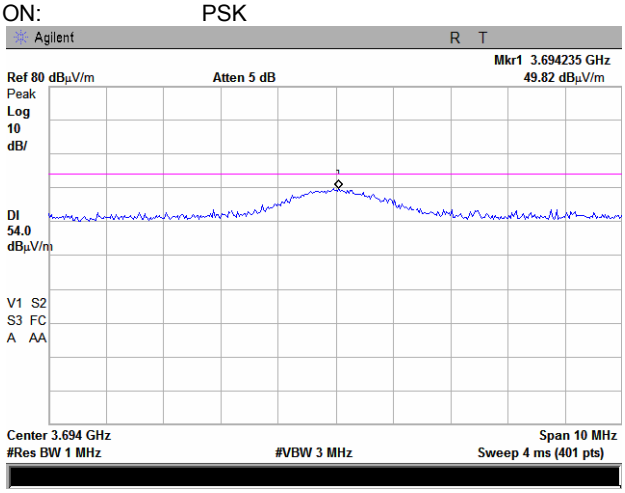
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

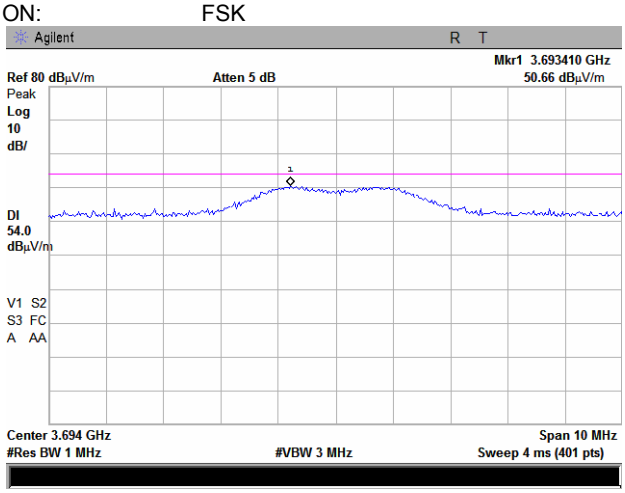
**Plot 7.5.57 Radiated emission measurements at the forth harmonic of high carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.58 Radiated emission measurements at the forth harmonic of high carrier frequency**

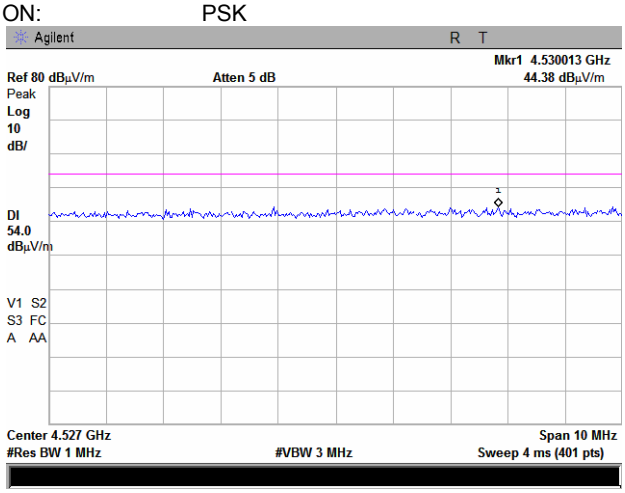
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

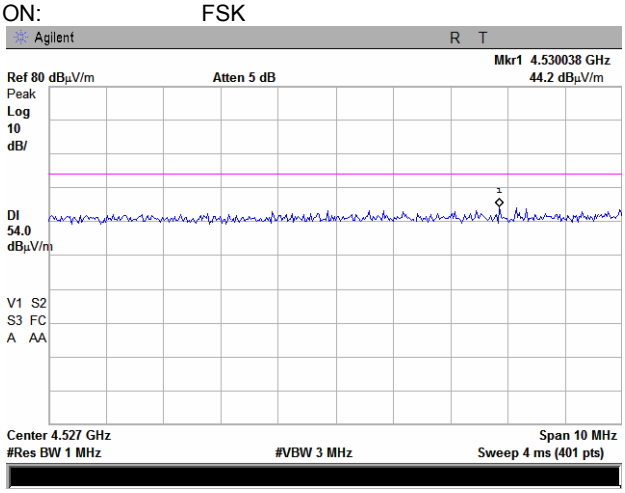
**Plot 7.5.59 Radiated emission measurements at the fifth harmonic of low carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.60 Radiated emission measurements at the fifth harmonic of low carrier frequency**

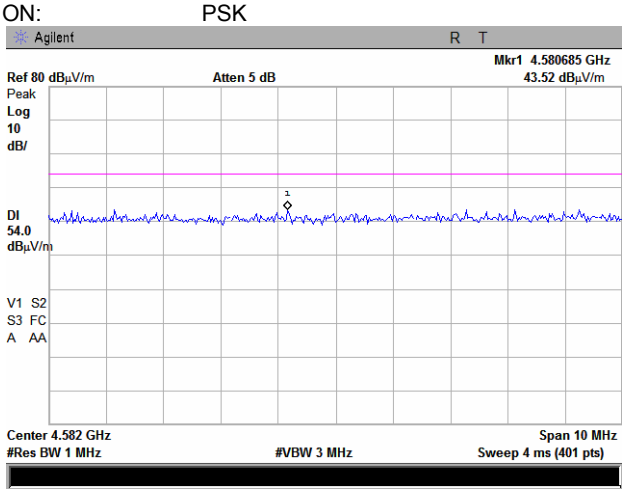
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

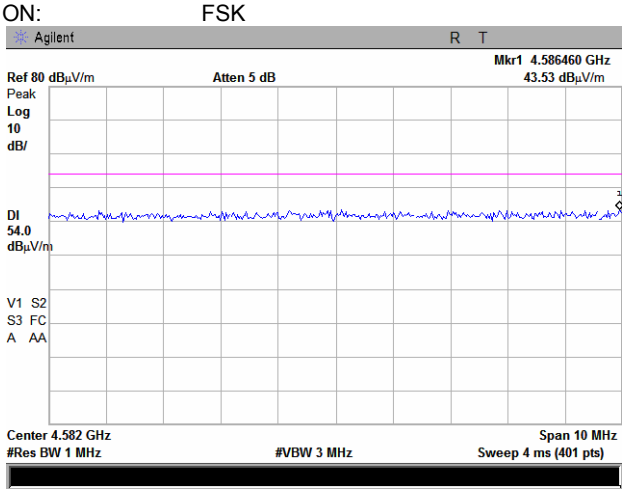
**Plot 7.5.61 Radiated emission measurements at the fifth harmonic of mid carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK




**Plot 7.5.62 Radiated emission measurements at the fifth harmonic of mid carrier frequency**

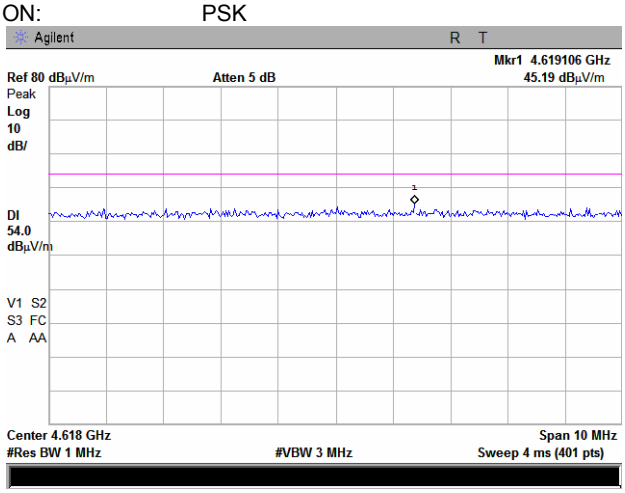
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

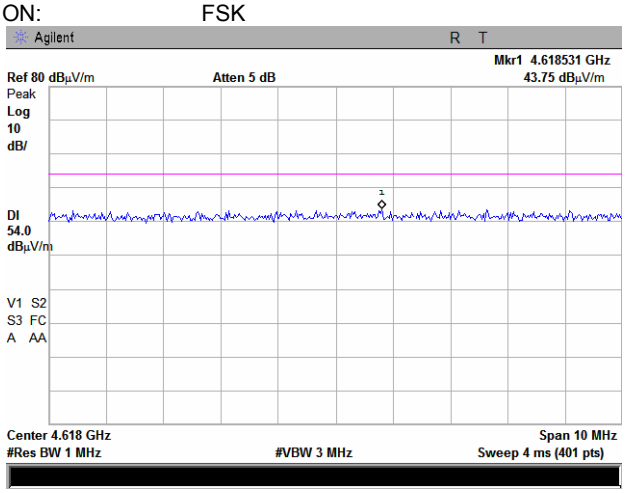
**Plot 7.5.63 Radiated emission measurements at the fifth harmonic of high carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: PSK



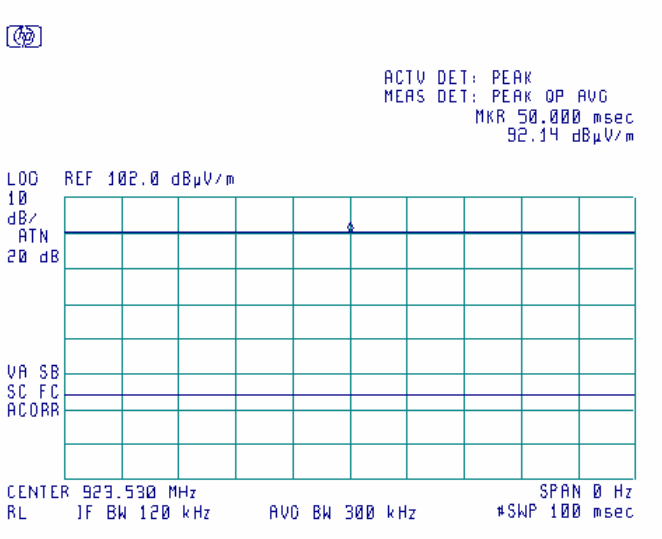

**Plot 7.5.64 Radiated emission measurements at the fifth harmonic of high carrier frequency**

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
MODULATION: FSK



| Test specification: | Section 15.247(c), Radiated spurious emissions | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/31/2006 9:04:08 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.5.65 Transmission pulse duration**



| Test specification: | Section 15.247(d), Peak power density | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(d) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 8:00:43 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

## 7.6 Peak spectral power density

### 7.6.1 General

This test was performed to measure the peak spectral power density at the transmitter RF antenna connector. Specification test limits are given in Table 7.2.1.

**Table 7.6.1 Peak spectral power density limits**

| Assigned frequency range, MHz | Measurement bandwidth, kHz | Peak spectral power density, dBm |
|---|---|---|
| 902 - 928 | 3.0 | 8.0 |

### 7.6.2 Test procedure

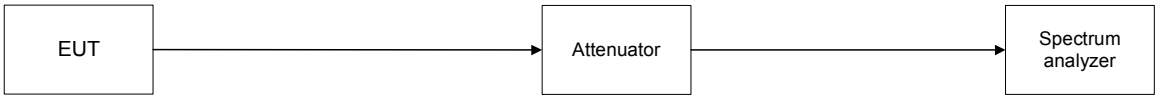
**7.6.2.1** The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

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

**7.6.2.3** The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in peak hold mode with resolution bandwidth set to 3.0 kHz, video bandwidth wider than resolution bandwidth, auto sweep time and sufficient number of sweeps was allowed for trace stabilization. The spectrum lines spacing was verified to be wider than 3 kHz. Otherwise the resolution bandwidth was reduced until individual spectrum lines were resolved and the power of individual spectrum lines was integrated over 3 kHz band.

**7.6.2.4** The peak of emission was zoomed with span set just wide enough to capture the emission peak area and sweep time was set equal to span width divided by resolution bandwidth. Spectrum analyzer was set in peak hold mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.2.2 and associated plots.

**Figure 7.6.1 Peak spectral power density test setup**



| Test specification: | Section 15.247(d), Peak power density | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(d) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 8:00:43 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 7.6.2 Peak spectral power density test results**

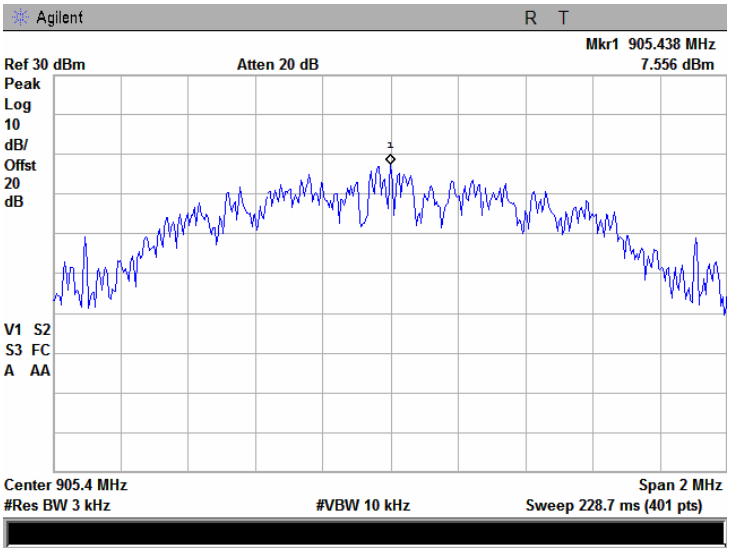
| | |
|---|---|
| ASSIGNED FREQUENCY: | 902 - 928 MHz |
| MODULATION: | PSK |
| MODULATING SIGNAL: | PRBS |
| BIT RATE: | 900 kbps |
| TRANSMITTER OUTPUT POWER SETTINGS: | Maximum |
| TRANSMITTER OUTPUT POWER: | 21.39 dBm at low carrier frequency<br>21.12 dBm at mid carrier frequency<br>20.88 dBm at high carrier frequency |
| DETECTOR USED: | Peak |
| RESOLUTION BANDWIDTH: | 3 kHz |
| VIDEO BANDWIDTH: | 10 kHz |

| Carrier frequency, MHz | Spectrum analyzer reading, dBm | External attenuation, dB | Cable loss, dB | Peak power density, dB(mW/3 kHz) | Limit, dBm | Margin*, dB | Verdict |
|---|---|---|---|---|---|---|---|
| 905.4375 | 7.610 | included | included | 7.610 | 8.00 | -0.390 | Pass |
| 916.3020 | 7.309 | included | included | 7.309 | 8.00 | -0.691 | Pass |
| 923.5462 | 7.109 | included | included | 7.109 | 8.00 | -0.891 | Pass |

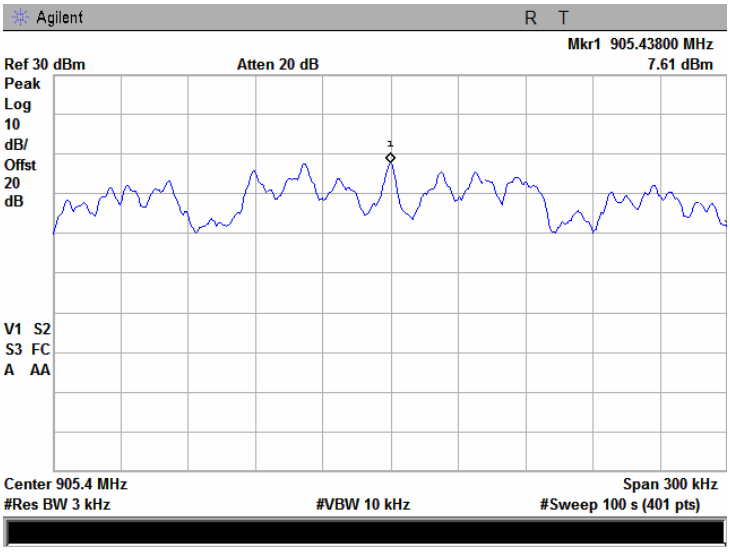
* - Margin = Peak power density – specification limit.

| Test specification: | Section 15.247(d), Peak power density | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(d) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 8:00:43 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.6.1 Peak spectral power density at low frequency within 6 dB band**

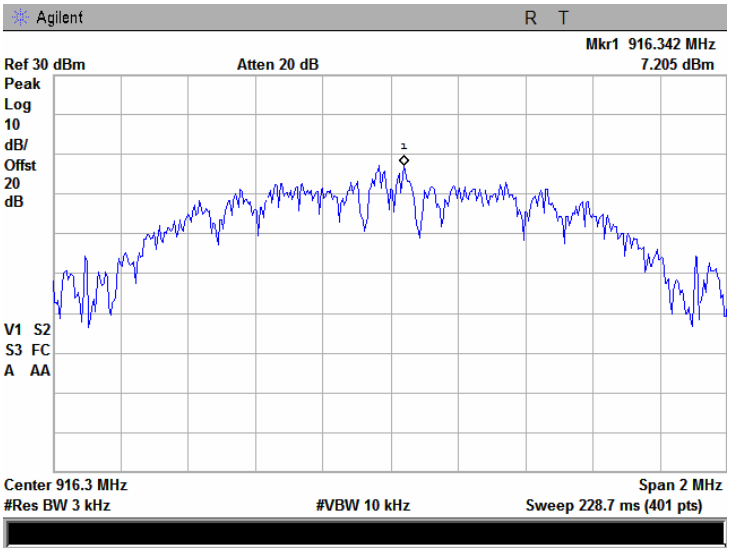



**Plot 7.6.2 Peak spectral power density at low frequency zoomed at the peak**

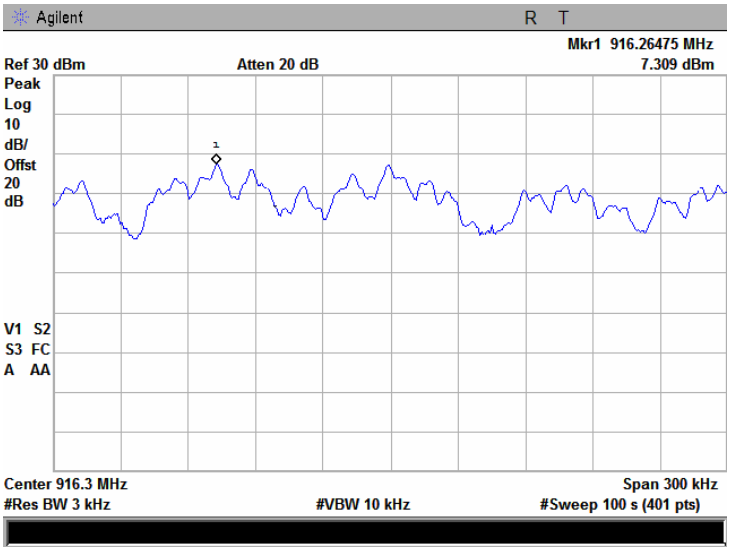


| Test specification: | Section 15.247(d), Peak power density | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(d) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 8:00:43 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.6.3 Peak spectral power density at mid frequency within 6 dB band**

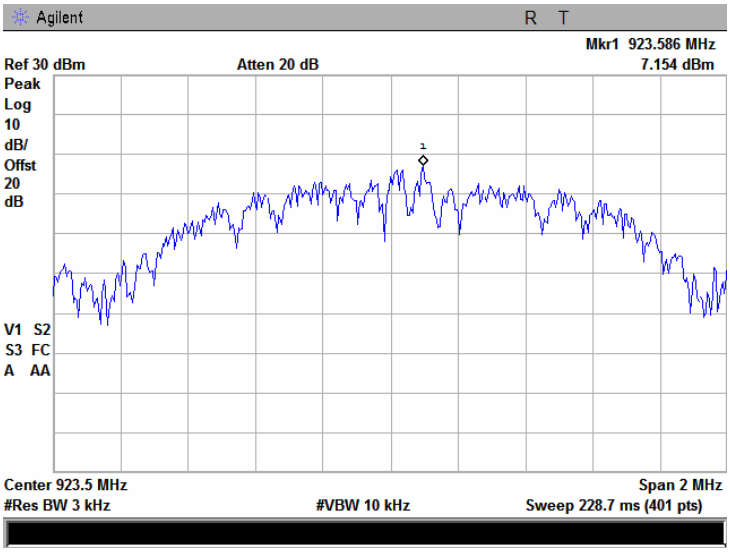



**Plot 7.6.4 Peak spectral power density at mid frequency zoomed at the peak**

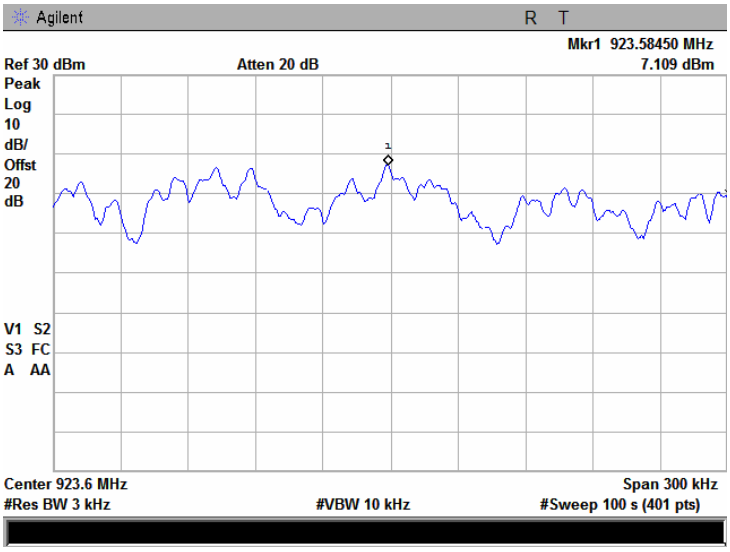


| Test specification: | Section 15.247(d), Peak power density | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(d) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 8:00:43 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.6.5 Peak spectral power density at high frequency within 6 dB band**




**Plot 7.6.6 Peak spectral power density at high frequency zoomed at the peak**



| Test specification: | Section 15.247(d), Peak power density | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(d) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 8:00:43 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 7.6.3 Peak spectral power density test results**

ASSIGNED FREQUENCY: 902 - 928 MHz
MODULATION: FSK
MODULATING SIGNAL: PRBS
BIT RATE: 60 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
TRANSMITTER OUTPUT POWER: 14.13 dBm at low carrier frequency
14.24 dBm at mid carrier frequency
14.18 dBm at high carrier frequency
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 3 kHz
VIDEO BANDWIDTH: 10 kHz

| Carrier frequency, MHz | Spectrum analyzer reading, dBm | External attenuation, dB | Cable loss, dB | Peak power density, dB(mW/3 kHz) | Limit, dBm | Margin*, dB | Verdict |
|---|---|---|---|---|---|---|---|
| 905.4375 | 7.597 | included | included | 7.597 | 8.00 | -0.403 | Pass |
| 916.3020 | 6.739 | included | included | 6.739 | 8.00 | -1.261 | Pass |
| 923.5462 | 6.018 | included | included | 6.018 | 8.00 | -1.982 | Pass |

* - Margin = Peak power density – specification limit.

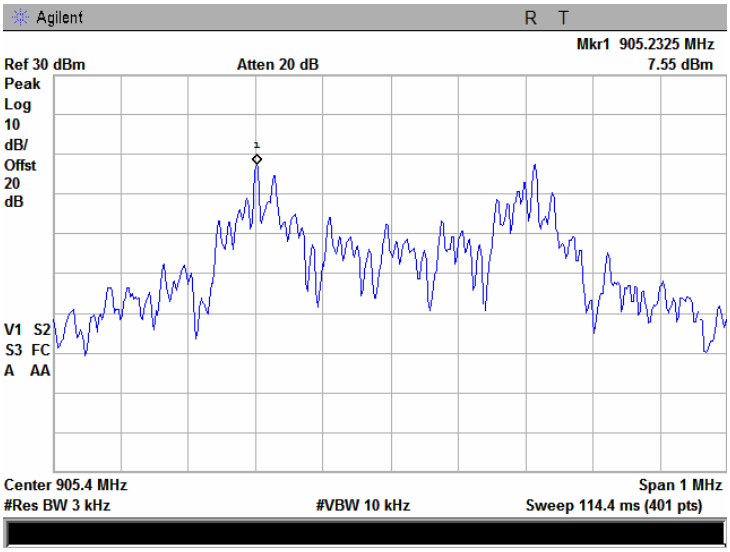
**Reference numbers of test equipment used**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 2866 | HL 2909 | | | | | | |

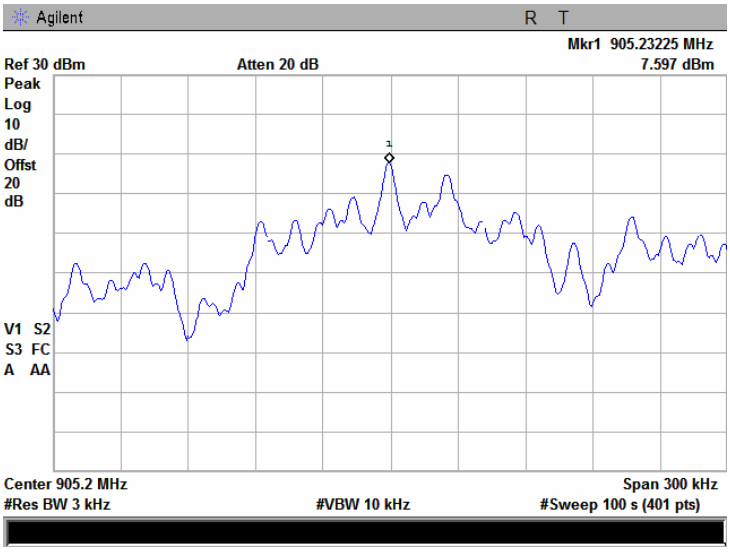
Full description is given in Appendix A.

| Test specification: | Section 15.247(d), Peak power density | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(d) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 8:00:43 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.6.7 Peak spectral power density at low frequency within 6 dB band**

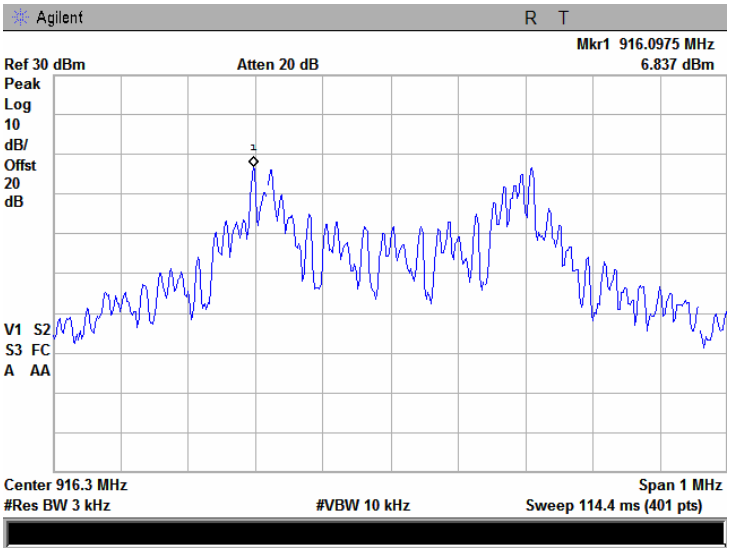



**Plot 7.6.8 Peak spectral power density at low frequency zoomed at the peak**

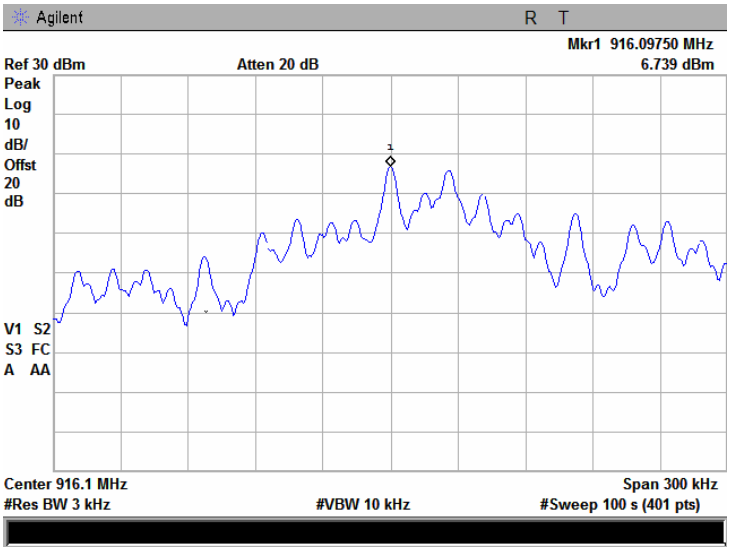


| Test specification: | Section 15.247(d), Peak power density | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(d) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 8:00:43 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.6.9 Peak spectral power density at mid frequency within 6 dB band**

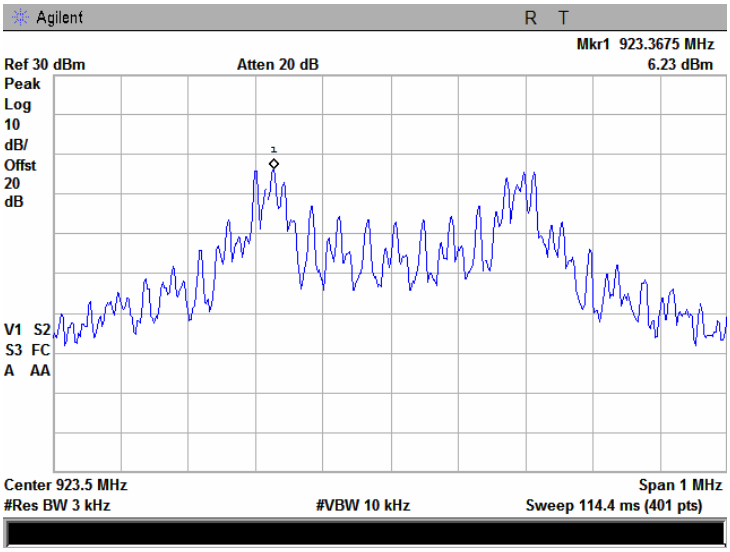



**Plot 7.6.10 Peak spectral power density at mid frequency zoomed at the peak**

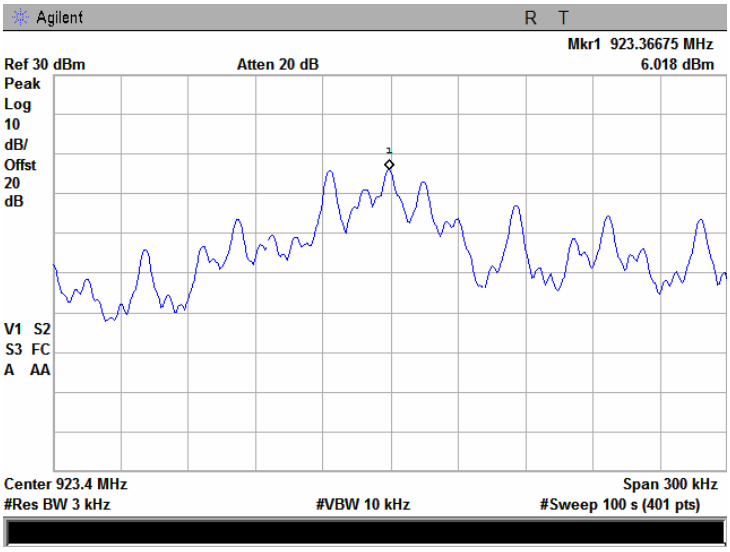


| Test specification: | Section 15.247(d), Peak power density | | |
|---|---|---|---|
| Test procedure: | FR Vol. 62, page 26243, Section 15.247(d) | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/18/2006 8:00:43 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 7.6.11 Peak spectral power density at high frequency within 6 dB band**




**Plot 7.6.12 Peak spectral power density at high frequency zoomed at the peak**



| Test specification: | Section 15.207(a), Conducted emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Section 13.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:48:39 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

## 7.7 Conducted emissions

### 7.7.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.7.1.

**Table 7.7.1 Limits for conducted emissions**

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

* The limit decreases linearly with the logarithm of frequency.

### 7.7.2 Test procedure

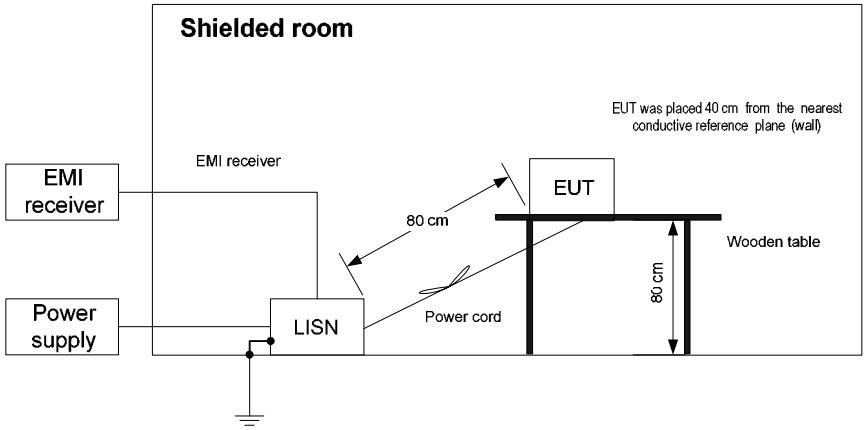
**7.7.2.1** The EUT was set up as shown in Figure 7.7.1, energized and the performance check was conducted.

**7.7.2.2** The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.7.2, Table 7.7.3. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

**7.7.2.4** The worst test results (the lowest margins) were recorded in in Table 7.7.2, Table 7.7.3 and shown in the associated plots.

**Figure 7.7.1 Setup for conducted emission measurements, table-top equipment**



| Test specification: | Section 15.207(a), Conducted emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Section 13.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:48:39 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 7.7.2 Conducted emission test results at the EUT power ports**

| | |
|---|---|
| LINE: | AC mains |
| LIMIT: | Class B |
| EUT OPERATING MODE: | Transmit |
| 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, MHz | Peak emission, dB(µV) | Quasi-peak | | | Average | | | Line ID | Verdict |
|---|---|---|---|---|---|---|---|---|---|
| | | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | | |
| 2.509142 | 28.00 | 26.65 | 56.00 | -29.35 | 25.96 | 46.00 | -20.04 | L1 | Pass |
| 4.768165 | 31.74 | 27.96 | 56.00 | -28.04 | 25.29 | 46.00 | -20.71 | | |
| 16.775881 | 34.90 | 33.12 | 60.00 | -26.88 | 30.53 | 50.00 | -19.47 | | |
| 28.880631 | 35.85 | 30.23 | 60.00 | -29.77 | 19.85 | 50.00 | -30.15 | | |
| 3.763726 | 27.56 | 25.79 | 56.00 | -30.21 | 25.07 | 46.00 | -20.93 | L2 | Pass |
| 4.767808 | 32.10 | 29.61 | 56.00 | -26.39 | 26.49 | 46.00 | -19.51 | | |
| 9.935485 | 33.01 | 29.02 | 60.00 | -30.98 | 24.07 | 50.00 | -25.93 | | |
| 16.026249 | 36.12 | 32.27 | 60.00 | -27.73 | 24.83 | 50.00 | -25.17 | | |

*- Margin = Measured emission - specification limit.

**Reference numbers of test equipment used**

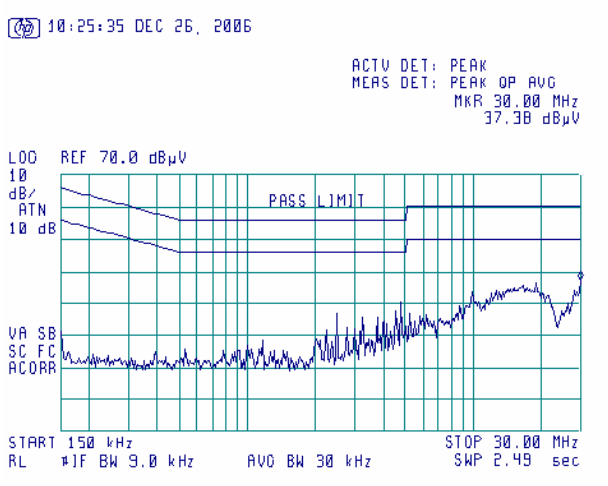
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0163 | HL 0787 | HL 1503 | HL 1215 | HL 1430 | HL 2924 | | |

Full description is given in Appendix A.

| Test specification: | Section 15.207(a), Conducted emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Section 13.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:48:39 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

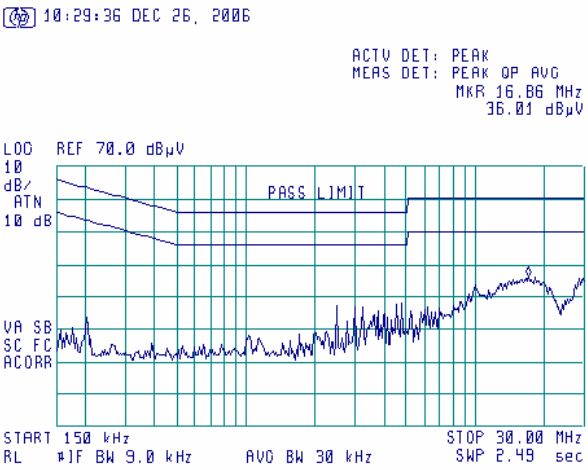
**Plot 7.7.1 Conducted emission measurements at the EUT power ports**

| | |
|---|---|
| LINE: | L1 |
| LIMIT: | Class B |
| EUT OPERATING MODE: | Transmit, PSK |
| LIMIT: | QUASI-PEAK, AVERAGE |
| DETECTOR: | PEAK |




**Plot 7.7.2 Conducted emission measurements at the EUT power ports**

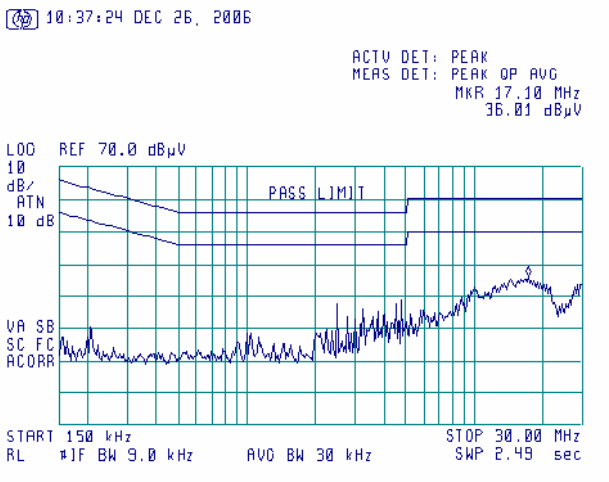
| | |
|---|---|
| LINE: | L2 |
| LIMIT: | Class B |
| EUT OPERATING MODE: | Transmit, PSK |
| LIMIT: | QUASI-PEAK, AVERAGE |
| DETECTOR: | PEAK |



| Test specification: | Section 15.207(a), Conducted emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Section 13.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:48:39 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

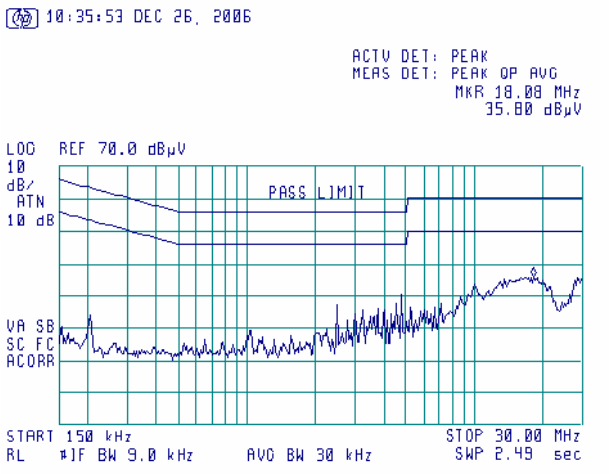
**Plot 7.7.3 Conducted emission measurements at the EUT power ports**

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




**Plot 7.7.4 Conducted emission measurements at the EUT power ports**

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



| Test specification: | Section 15.207(a), Conducted emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Section 13.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:48:39 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 7.7.3 Conducted emission test results at the laptop power ports**

| | |
|---|---|
| LINE: | AC mains |
| LIMIT: | Class B |
| EUT OPERATING MODE: | Transmit |
| 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, MHz | Peak emission, dB(µV) | Quasi-peak | | | Average | | | Line ID | Verdict |
|---|---|---|---|---|---|---|---|---|---|
| | | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | | |
| 0.160450 | 60.56 | 53.48 | 65.49 | -12.01 | 23.20 | 55.49 | -32.29 | L1 | Pass |
| 0.165812 | 59.63 | 53.15 | 65.23 | -12.08 | 21.80 | 55.23 | -33.43 | | |
| 0.177270 | 58.96 | 51.60 | 64.67 | -13.07 | 20.71 | 54.67 | -33.96 | | |
| 0.200584 | 55.44 | 48.99 | 63.63 | -14.64 | 17.83 | 53.63 | -35.80 | | |
| 0.239813 | 53.23 | 45.50 | 62.12 | -16.62 | 14.78 | 52.12 | -37.34 | | |
| 0.296676 | 48.71 | 41.02 | 60.37 | -19.35 | 10.73 | 50.37 | -39.64 | | |
| 0.152462 | 62.11 | 55.33 | 65.88 | -10.55 | 24.26 | 55.88 | -31.62 | L2 | Pass |
| 0.160740 | 61.01 | 54.22 | 65.48 | -11.26 | 22.86 | 55.48 | -32.62 | | |
| 0.176118 | 58.76 | 52.21 | 64.73 | -12.52 | 20.91 | 54.73 | -33.82 | | |
| 0.210197 | 55.56 | 48.42 | 63.26 | -14.84 | 24.45 | 53.26 | -28.81 | | |
| 0.215429 | 54.72 | 47.82 | 63.06 | -15.24 | 26.86 | 53.06 | -26.20 | | |
| 0.223504 | 53.58 | 47.01 | 62.75 | -15.74 | 16.51 | 52.75 | -36.24 | | |

*- Margin = Measured emission - specification limit.

**Reference numbers of test equipment used**

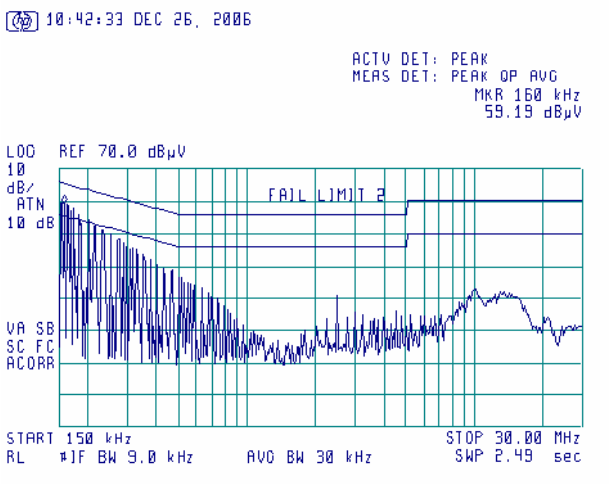
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0163 | HL 0787 | HL 1215 | HL 1503 | HL 1430 | HL 2924 | | |

Full description is given in Appendix A.

| Test specification: | Section 15.207(a), Conducted emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Section 13.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:48:39 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

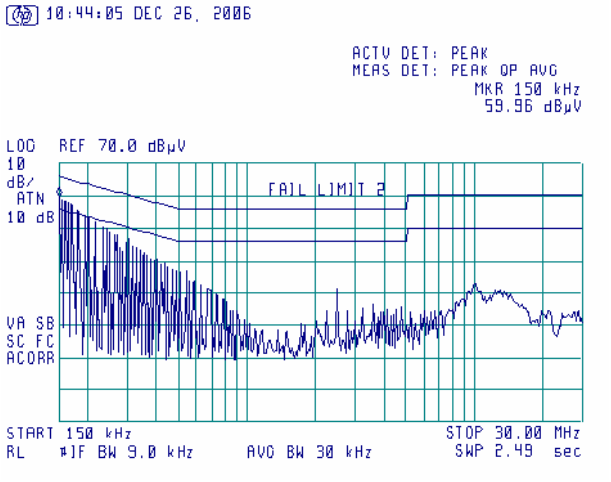
**Plot 7.7.5 Conducted emission measurements at the laptop power ports**

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




**Plot 7.7.6 Conducted emission measurements at the laptop power ports**

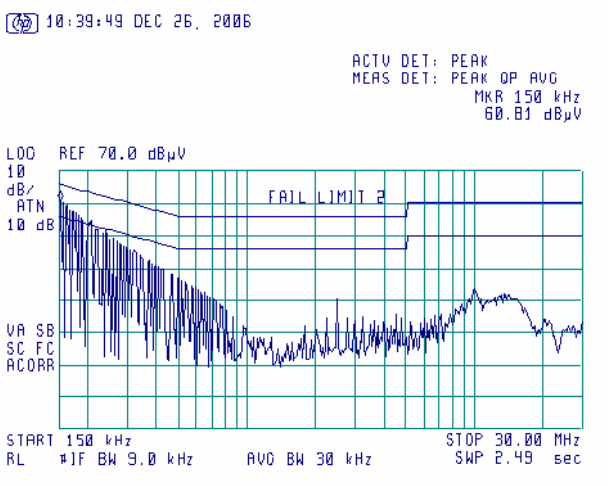
LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Transmit, PSK
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



| Test specification: | Section 15.207(a), Conducted emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Section 13.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:48:39 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

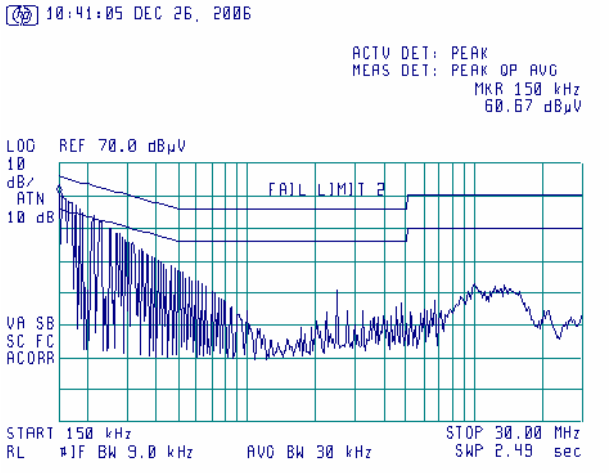
**Plot 7.7.7 Conducted emission measurements at the laptop power ports**

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




**Plot 7.7.8 Conducted emission measurements at the laptop power ports**

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



| Test specification: | Section 15.203, Antenna requirement | | |
|---|---|---|---|
| Test procedure: | Visual inspection | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/19/2006 10:11:27 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

## 7.8 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.8.1.

**Table 7.8.1 Antenna requirements**

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

**Photograph 7.8.1 Antenna assembly**

| Test specification: | Section 15.107, Conducted emission at AC power port | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.5 and 12.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:24:01 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

# 8 Emission tests according to 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.

**Table 8.1.1 Limits for conducted emissions**

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

* The limit decreases linearly with the logarithm of frequency.

### 8.1.2 Test procedure

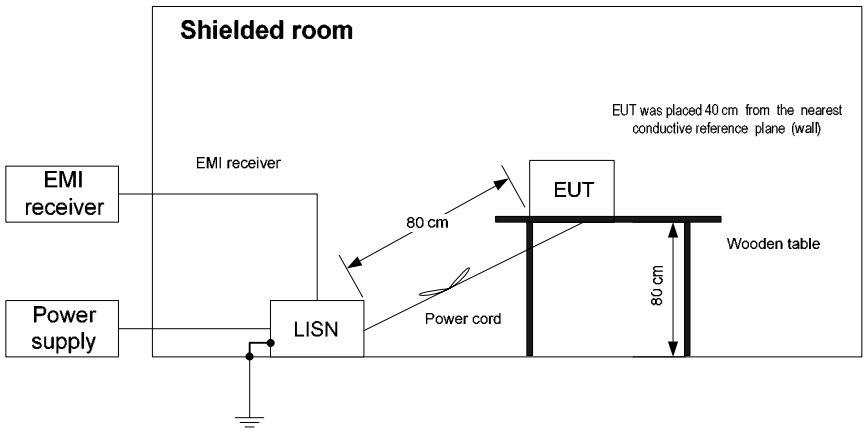
**8.1.2.1** The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

**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, Table 8.1.3. 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.

**8.1.2.4** The worst test results (the lowest margins) were recorded in Table 8.1.2, Table 8.1.3 and shown in the associated plots.

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



| Test specification: | Section 15.107, Conducted emission at AC power port | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.5 and 12.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:24:01 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 8.1.2 Conducted emission test results at the EUT power ports**

| | |
|---|---|
| LINE: | AC mains |
| LIMIT: | Class B |
| EUT OPERATING MODE: | Receive |
| 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, MHz | Peak emission, dB(µV) | Quasi-peak | | | Average | | | Line ID | Verdict |
|---|---|---|---|---|---|---|---|---|---|
| | | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | | |
| 2.509142 | 28.00 | 26.65 | 56.00 | -29.35 | 25.96 | 46.00 | -20.04 | L1 | Pass |
| 4.768165 | 31.74 | 27.96 | 56.00 | -28.04 | 25.29 | 46.00 | -20.71 | | |
| 16.775881 | 34.90 | 33.12 | 60.00 | -26.88 | 30.53 | 50.00 | -19.47 | | |
| 28.880631 | 35.85 | 30.23 | 60.00 | -29.77 | 19.85 | 50.00 | -30.15 | | |
| 3.763726 | 27.56 | 25.79 | 56.00 | -30.21 | 25.07 | 46.00 | -20.93 | L2 | Pass |
| 4.767808 | 32.10 | 29.61 | 56.00 | -26.39 | 26.49 | 46.00 | -19.51 | | |
| 9.935485 | 33.01 | 29.02 | 60.00 | -30.98 | 24.07 | 50.00 | -25.93 | | |
| 16.026249 | 36.12 | 32.27 | 60.00 | -27.73 | 24.83 | 50.00 | -25.17 | | |

*****- Margin = Measured emission - specification limit.

**Reference numbers of test equipment used**

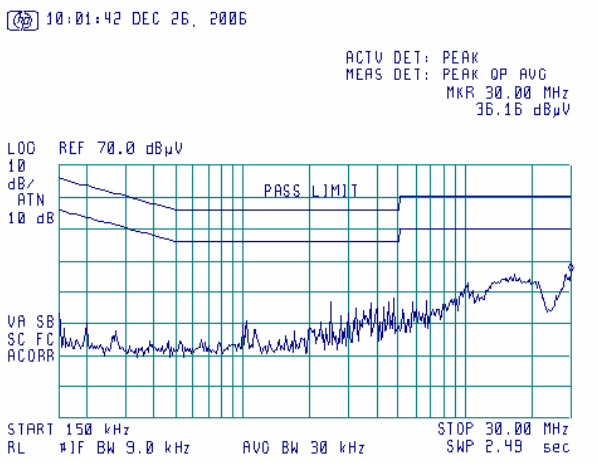
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0163 | HL 0787 | HL 1503 | HL 1215 | HL 1430 | HL 2924 | | |

Full description is given in Appendix A.

| Test specification: | Section 15.107, Conducted emission at AC power port | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.5 and 12.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:24:01 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

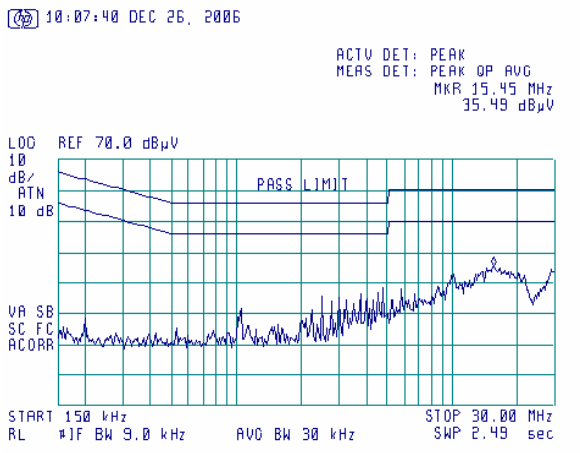
**Plot 8.1.1 Conducted emission measurements at the EUT power ports**

LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Receive
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK




**Plot 8.1.2 Conducted emission measurements at the EUT power ports**

LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Receive
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



| Test specification: | Section 15.107, Conducted emission at AC power port | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.5 and 12.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:24:01 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 8.1.3 Conducted emission test results at the laptop power ports**

| | |
|---|---|
| LINE: | AC mains |
| LIMIT: | Class B |
| EUT OPERATING MODE: | Receive / Stand-by |
| 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, MHz | Peak emission, dB(µV) | Quasi-peak | | | Average | | | Line ID | Verdict |
|---|---|---|---|---|---|---|---|---|---|
| | | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | | |
| 0.160450 | 60.56 | 53.48 | 65.49 | -12.01 | 23.20 | 55.49 | -32.29 | L1 | Pass |
| 0.165812 | 59.63 | 53.15 | 65.23 | -12.08 | 21.80 | 55.23 | -33.43 | | |
| 0.177270 | 58.96 | 51.60 | 64.67 | -13.07 | 20.71 | 54.67 | -33.96 | | |
| 0.200584 | 55.44 | 48.99 | 63.63 | -14.64 | 17.83 | 53.63 | -35.80 | | |
| 0.239813 | 53.23 | 45.50 | 62.12 | -16.62 | 14.78 | 52.12 | -37.34 | | |
| 0.296676 | 48.71 | 41.02 | 60.37 | -19.35 | 10.73 | 50.37 | -39.64 | | |
| 0.152462 | 62.11 | 55.33 | 65.88 | -10.55 | 24.26 | 55.88 | -31.62 | L2 | Pass |
| 0.160740 | 61.01 | 54.22 | 65.48 | -11.26 | 22.86 | 55.48 | -32.62 | | |
| 0.176118 | 58.76 | 52.21 | 64.73 | -12.52 | 20.91 | 54.73 | -33.82 | | |
| 0.210197 | 55.56 | 48.42 | 63.26 | -14.84 | 24.45 | 53.26 | -28.81 | | |
| 0.215429 | 54.72 | 47.82 | 63.06 | -15.24 | 26.86 | 53.06 | -26.20 | | |
| 0.223504 | 53.58 | 47.01 | 62.75 | -15.74 | 16.51 | 52.75 | -36.24 | | |

*- Margin = Measured emission - specification limit.

**Reference numbers of test equipment used**

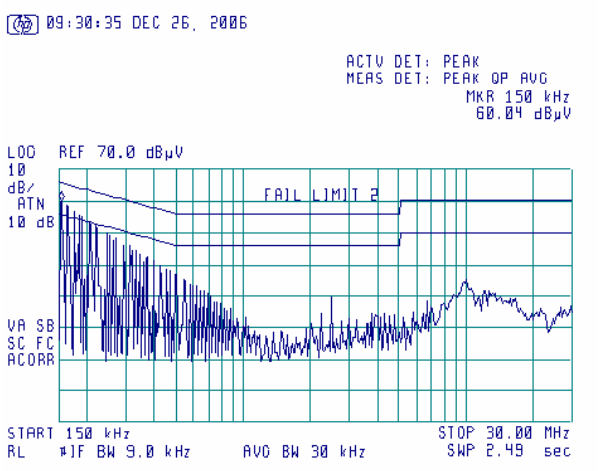
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HL 0163 | HL 0787 | HL 1503 | HL 1215 | HL 1430 | HL 2924 | | |

Full description is given in Appendix A.

| Test specification: | Section 15.107, Conducted emission at AC power port | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.5 and 12.1.3 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/26/2006 10:24:01 AM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

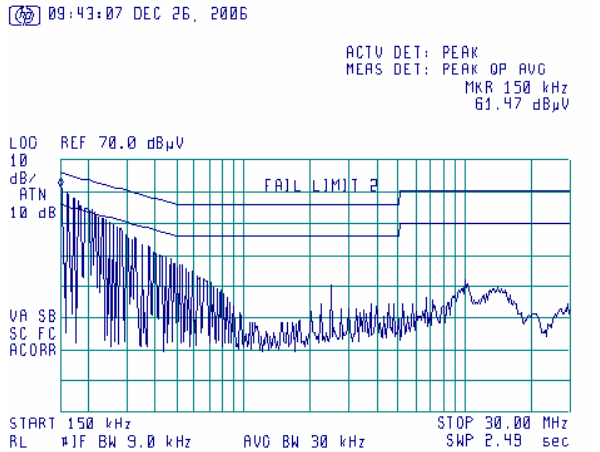
**Plot 8.1.3 Conducted emission measurements at the laptop power ports**

LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Receive
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK




**Plot 8.1.4 Conducted emission measurements at the laptop power ports**

LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Receive
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



| Test specification: | Section 15.109, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/27/2006 4:56:37 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

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

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

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

**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 $360^0$, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

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

### 8.2.3 Test procedure for measurements at OATS

**8.2.3.1** The EUT was set up as shown in Figure 8.2.1 and associated photograph/s, energized and the performance check was conducted.

**8.2.3.2** Preliminary measurements were performed in the anechoic chamber at 3 m test distance. The specified frequency range was investigated with biconical and log periodic antennas connected to EMI receiver. To find maximum radiation the turntable was rotated $360^0$, the measuring antenna height was changed, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

**8.2.3.3** The EUT was set up as shown in Figure 8.2.2, energized and the performance check was conducted.

**8.2.3.4** Final measurements were performed at the open area test site at 10 m test distance. The EUT wires and cables were arranged to produce maximum emission as it was found during preliminary measurements. The frequencies yield the worst test results (the lowest margins) during preliminary testing were investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated $360^0$, the measuring antenna height was changed from 1 to 4 m and its polarization was changed from vertical to horizontal. At frequencies where high ambient noise was encountered, the final measurements were taken in the anechoic chamber at 3 m distance.

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

| Test specification: | Section 15.109, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/27/2006 4:56:37 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

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

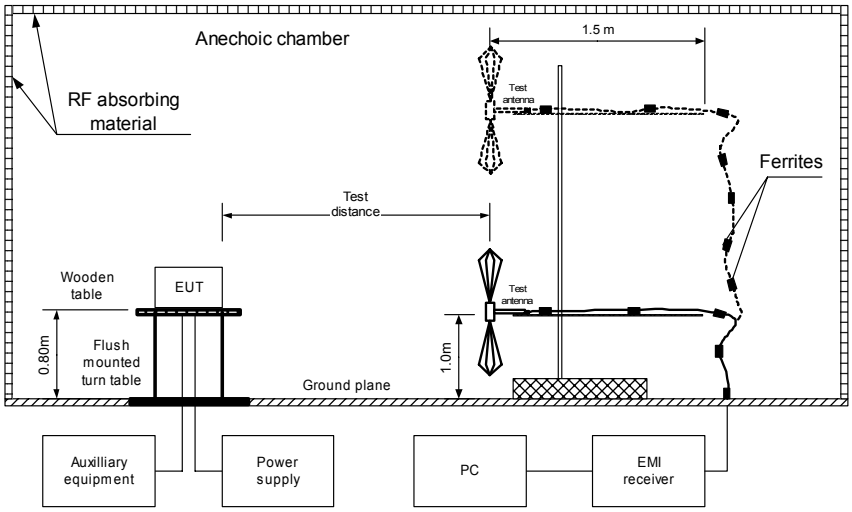
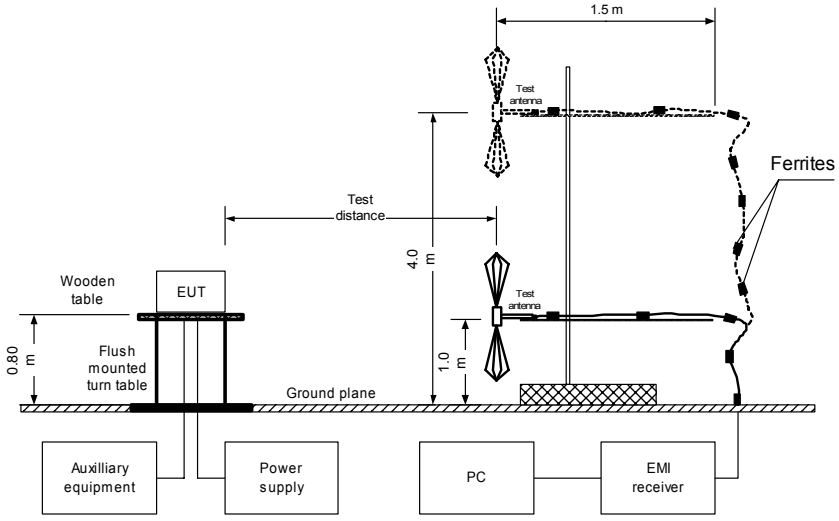



**Figure 8.2.2 Setup for radiated emission measurements at OATS, table-top equipment**



| Test specification: | Section 15.109, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/27/2006 4:56:37 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Table 8.2.2 Radiated emission test results**

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
TEST SITE: OATS
TEST DISTANCE: 10 m
DETECTORS USED: PEAK / QUASI-PEAK
FREQUENCY RANGE: 30 MHz – 2900 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* | | | | |
| 115.906900 | 33.00 | 30.94 | 33.00 | -2.06 | V | 1.1 | 145 | Pass |
| 231.791000 | 35.05 | 32.88 | 35.50 | -2.62 | V | 1.0 | 220 | |
| 251.962100 | 37.97 | 34.33 | 35.50 | -1.17 | V | 1.0 | 38 | |
| 260.761800 | 26.77 | 22.34 | 35.50 | -13.16 | V | 1.0 | 151 | |
| 468.081200 | 32.16 | 27.22 | 35.50 | -8.28 | V | 1.0 | 41 | |

NOTE: Due to high ambient noise following signals were tested in semi anechoic chamber

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
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* | | | | |
| 168.043750 | 46.02 | 42.57 | 43.50 | -0.93 | H | 1 | 145 | Pass |

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

**Reference numbers of test equipment used**

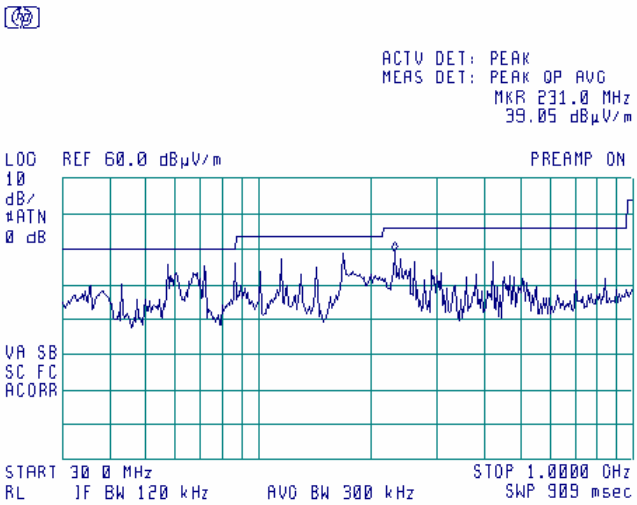
| HL 0287 | HL 0566 | HL 0569 | HL 0784 | HL 0813 | HL 1425 | HL 1430 | HL 1552 |
|---|---|---|---|---|---|---|---|
| HL 1553 | HL 1566 | | | | | | |

Full description is given in Appendix A.

| Test specification: | Section 15.109, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/27/2006 4:56:37 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

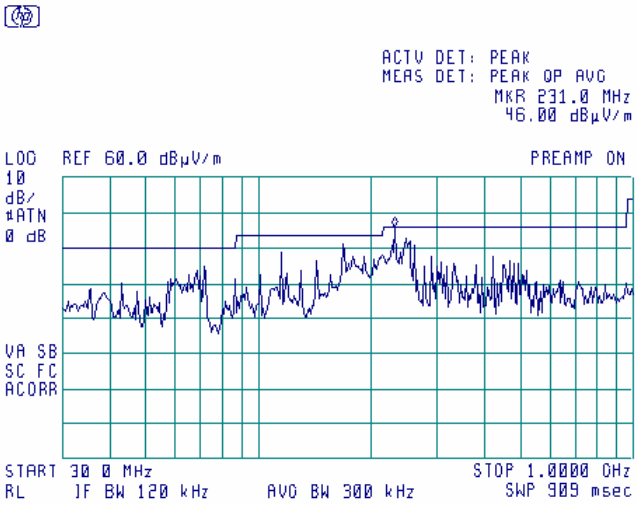
**Plot 8.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization**

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




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

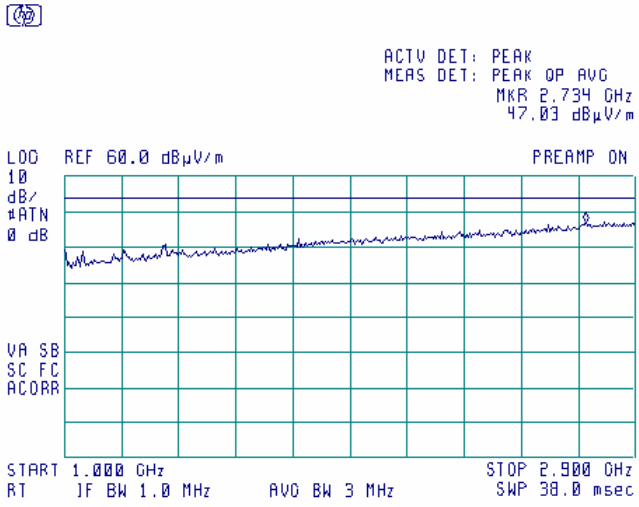
TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by



| Test specification: | Section 15.109, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/27/2006 4:56:37 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

**Plot 8.2.3 Radiated emission measurements 1000 -2900 MHz, vertical & horizontal antenna polarization**

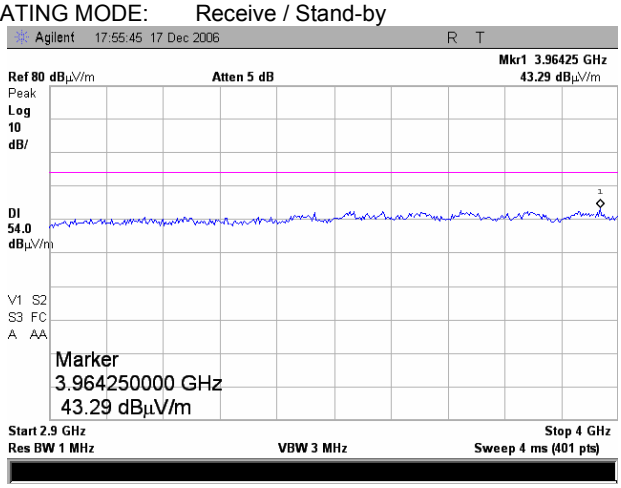
| | |
|---|---|
| TEST SITE: | Anechoic chamber |
| LIMIT: | Class B |
| TEST DISTANCE: | 3 m |
| EUT OPERATING MODE: | Receive / Stand-by |



| Test specification: | Section 15.109, Radiated emission | | |
|---|---|---|---|
| Test procedure: | ANSI C63.4, Sections 11.6 and 12.1.4 | | |
| Test mode: | Compliance | Verdict: | PASS |
| Date & Time: | 12/27/2006 4:56:37 PM | | |
| Temperature: ºC | Air Pressure: hPa | Relative Humidity: % | Power Supply: |
| Remarks: | | | |

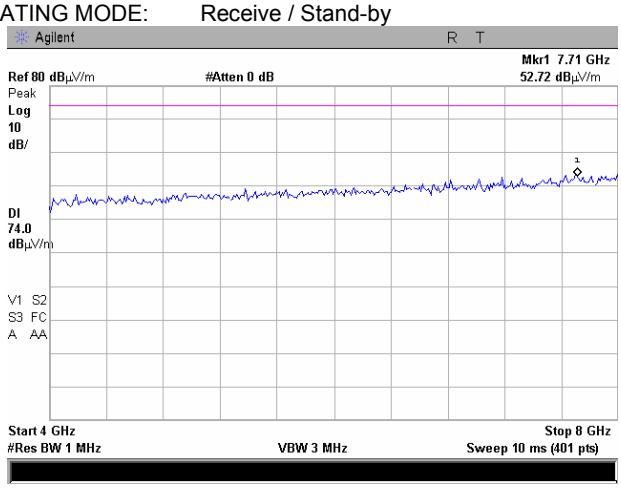
**Plot 8.2.4 Radiated emission measurements from 2900 to 4000 MHz, vertical & horizontal antenna polarization**

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




**Plot 8.2.5 Radiated emission measurements from 4000 to 8000 MHz, vertical & horizontal antenna polarization**

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



# 9 APPENDIX A 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) and approved by Israel Ministry of environmental protection, radiation hazards department (Permit number 1158).

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e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

# 10 APPENDIX B Specification references

| | |
|---|---|
| 47CFR part 15: 2006 | Radio Frequency Devices. |
| FR Vol.62 | Federal Register, Volume 62, May 13, 1997 |
| 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. |

# 11 APPENDIX C Test equipment and ancillaries used for tests

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal. | Due Cal. |
|---|---|---|---|---|---|---|
| 0163 | LISN FCC/VDE/50 Ohm/50 uH + 5 Ohm, MIL-STD-461E, CISPR 16-1 | Electro-Metrics | ANS 25/2 | 1314 | 01-Oct-06 | 01-Oct-07 |
| 0287 | Turntable, Motorized Diameter, 2 m (OATS) | HL | TMD-2 | 042 | 11-Nov-06 | 11-Nov-07 |
| 0446 | Antenna, Loop, Active, 10 kHz - 30 MHz | EMCO | 6502 | 2857 | 28-Jun-06 | 28-Jun-07 |
| 0465 | Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m | HL | AC - 1 | 023 | 11-Nov-06 | 11-Nov-07 |
| 0566 | Antenna, Biconical, 20 - 200 MHz | Electro-Metrics | BIA 25/30 | 3566 | 10-Jan-07 | 10-Jan-08 |
| 0569 | Antenna, Log Periodic, 200 - 1000 MHz | Electro-Metrics | LPA 25/30 | 1953 | 10-Jan-07 | 10-Jan-08 |
| 0592 | Position Controller | HL | L2-SR3000 (HL CRL-3) | 100 | 18-May-06 | 18-May-07 |
| 0593 | Antenna Mast, 1-4 m Pneumatic | Madgesh | AM-F1 | 101 | 02-Feb-06 | 02-Feb-07 |
| 0594 | Turn Table FOR ANECHOIC CHAMBER flush mount d=1.2 m Pneumatic | HL | TT-WDC1 | 102 | 26-Jan-06 | 26-Jan-07 |
| 0604 | Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz | EMCO | 3141 | 9611-1011 | 10-Jan-07 | 10-Jan-08 |
| 0784 | Antenna X-WING BILOG 20 MHz - 2 GHz | Schaffner-Chase EMC | CBL6140 A | 1120 | 10-Jan-07 | 10-Jan-08 |
| 0787 | Transient Limiter 9 kHz-200 MHz | Hewlett Packard | 11947A | 3107A01877 | 21-Nov-06 | 21-Nov-07 |
| 0813 | Cable Coax, RG-214, 12 m, N-type connectors | HL | C214-12 | 149 | 02-Dec-06 | 02-Dec-07 |
| 1215 | Gertsch ratio transformer, 350V | Singer, Alfred, Eaton | RT-60 | 1077 | 01-Jan-07 | 01-Jan-08 |
| 1424 | Spectrum Analyzer, 30 Hz- 40 GHz | Agilent Technologies | 8564EC | 3946A00219 | 30-Aug-06 | 30-Aug-07 |
| 1425 | EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427 | Agilent Technologies | 8542E | 3710A00222, 3705A00204 | 01-Sep-06 | 01-Sep-07 |
| 1430 | EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432 | Agilent Technologies | 8542E | 3807A00262,3705A00217 | 01-Sep-06 | 01-Sep-07 |
| 1503 | Cable RF, 6 m, BNC/BNC | Belden | M17/167 MIL-C-17 | 1503 | 11-Sep-06 | 11-Sep-07 |
| 1552 | Cable RF, 8 m | Alpha Wire | RG-214 | 1552 | 02-Dec-06 | 02-Dec-07 |
| 1553 | Cable RF, 3.5 m | Alpha Wire | RG-214 | 1553 | 02-Dec-06 | 02-Dec-07 |
| 1566 | Cable RF, 2 m | Huber-Suhner | Sucoflex 104PE | 13094/4PE | 02-Dec-06 | 02-Dec-07 |
| 1651 | Attenuators Set (2, 3, 5, 20 dB), DC-18 GHz | M/A-COM | 2082 | 1651 | 03-Jan-07 | 03-Jan-08 |
| 1947 | Cable 18GHz, 6.5 m, blue | Rhophase Microwave Limited | NPS-1803A-6500-NPS | T4974 | 17-Oct-06 | 17-Oct-07 |
| 1984 | Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type | EMC Test Systems | 3115 | 9911-5964 | 03-Mar-06 | 03-Mar-07 |
| 2399 | Cable 40GHz, 1.5 m, blue | Rhophase Microwave Limited | KPS-1503A-1500-KPS | X2945 | 01-Jan-07 | 01-Jan-08 |
| 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-07 |
| 2866 | Cable, 18 GHz, 0.6 m, SMA - SMA | Gore | NA | 91P67960 | 16-Feb-06 | 16-Feb-07 |

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal. | Due Cal. |
|---|---|---|---|---|---|---|
| 2909 | Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz | Agilent Technologies | E4407B | MY41444762 | 10-Apr-06 | 10-Apr-07 |
| 2924 | Line Impedance Stabilization Network (LISN), 50Ohm/50 µH+5Ohm, 25 A, 2 lines,STD: MIL-461E,CISPR 16-1 | Electro-Metrics | FCC VDE 25-2 | 1178 | 04-Jul-06 | 04-Jul-07 |

# 12 APPENDIX D Abbreviations and acronyms

| | |
|---|---|
| A | ampere |
| AC | alternating current |
| AM | amplitude modulation |
| AVRG | average (detector) |
| BB | broad band |
| cm | centimeter |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dB(μV) | decibel referred to one microvolt |
| dB(μV/m) | decibel referred to one microvolt per meter |
| dB(μA) | decibel referred to one microampere |
| DC | direct current |
| DTS | digital transmission system |
| EIRP | equivalent isotropically radiated power |
| ERP | effective radiated power |
| EUT | equipment under test |
| F | frequency |
| FHSS | frequency hopping spread spectrum |
| GHz | gigahertz |
| GND | ground |
| H | height |
| HL | Hermon laboratories |
| Hz | hertz |
| k | kilo |
| kHz | kilohertz |
| LISN | line impedance stabilization network |
| LO | local oscillator |
| m | meter |
| Mbps | Mega but per second |
| MHz | megahertz |
| min | minute |
| mm | millimeter |
| ms | millisecond |
| μs | microsecond |
| NA | not applicable |
| NB | narrow band |
| NT | not tested |
| OATS | open area test site |
| Ω | Ohm |
| PCB | printed circuit board |
| PM | pulse modulation |
| PS | power supply |
| ppm | part per million ($10^{-6}$) |
| QP | quasi-peak |
| RE | radiated emission |
| RF | radio frequency |
| rms | root mean square |
| Rx | receive |
| s | second |
| T | temperature |
| Tx | transmit |
| V | volt |
| WB | wideband |

# 13 APPENDIX E Test equipment correction factors

**Correction factor**
**Line impedance stabilization network**
**Model ANS-25/2**
**Electro-Metrics, HL 0163**

| Frequency, kHz | Correction factor, dB |
|---|---|
| 10 | 4.9 |
| 15 | 2.86 |
| 20 | 1.83 |
| 25 | 1.25 |
| 30 | 0.91 |
| 35 | 0.69 |
| 40 | 0.53 |
| 50 | 0.35 |
| 60 | 0.25 |
| 70 | 0.18 |
| 80 | 0.14 |
| 90 | 0.11 |
| 100 | 0.09 |
| 125 | 0.06 |
| 150 | 0.04 |

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**
**Model 6502, S/N 2857, HL 0446**

| Frequency, MHz | Magnetic antenna factor, dB | Electric antenna factor, dB |
|---|---|---|
| 0.009 | -32.8 | 18.7 |
| 0.010 | -33.8 | 17.7 |
| 0.020 | -38.3 | 13.2 |
| 0.050 | -41.1 | 10.4 |
| 0.075 | -41.3 | 10.2 |
| 0.100 | -41.6 | 9.9 |
| 0.150 | -41.7 | 9.8 |
| 0.250 | -41.6 | 9.9 |
| 0.500 | -41.8 | 9.8 |
| 0.750 | -41.9 | 9.7 |
| 1.000 | -41.4 | 10.1 |
| 2.000 | -41.5 | 10.0 |
| 3.000 | -41.4 | 10.2 |
| 4.000 | -41.4 | 10.1 |
| 5.000 | -41.5 | 10.1 |
| 10.000 | -41.9 | 9.6 |
| 15.000 | -41.9 | 9.6 |
| 20.000 | -42.2 | 9.3 |
| 25.000 | -42.8 | 8.7 |
| 30.000 | -44.0 | 7.5 |

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

**Antenna factor**
**Biconical antenna**
**Electro-Metrics, model BIA-25/30**
**Ser.No.3566, HL 0566**

| Frequency MHz | Antenna Factor dB(1/m) | Frequency MHz | Antenna Factor dB(1/m) |
|---|---|---|---|
| 30 | 14.7 | 120 | 16.8 |
| 35 | 12.9 | 125 | 15.5 |
| 40 | 12.6 | 130 | 15.5 |
| 45 | 12.8 | 135 | 15.1 |
| 50 | 12.6 | 140 | 14.8 |
| 55 | 11.8 | 145 | 15.1 |
| 60 | 11.7 | 150 | 16.9 |
| 65 | 10.4 | 155 | 17.2 |
| 70 | 9.2 | 160 | 17.3 |
| 75 | 9.1 | 165 | 17.8 |
| 80 | 9.1 | 170 | 18.3 |
| 85 | 9.5 | 175 | 19.0 |
| 90 | 11.2 | 180 | 19.5 |
| 95 | 12.6 | 185 | 20.0 |
| 100 | 13.7 | 190 | 20.4 |
| 105 | 14.2 | 195 | 20.5 |
| 110 | 15.3 | 200 | 20.6 |
| 115 | 17.1 | | |

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

**Log periodic antenna factor**
**Electro-Metrics, model LPA-25/30, serial number 1953, HL 0569**

| Frequency, MHz | Antenna factor, dB(1/m) | Frequency, MHz | Antenna factor, dB(1/m) |
|---|---|---|---|
| 200 | 15.2 | 625 | 25.2 |
| 225 | 15.1 | 650 | 25.8 |
| 250 | 16.3 | 675 | 27.2 |
| 275 | 17.2 | 700 | 27.6 |
| 300 | 19.6 | 725 | 27.6 |
| 325 | 18.4 | 750 | 27.6 |
| 350 | 19.0 | 775 | 28.0 |
| 375 | 20.0 | 800 | 28.2 |
| 400 | 20.9 | 825 | 29.4 |
| 425 | 21.3 | 850 | 29.9 |
| 450 | 22.1 | 875 | 30.0 |
| 475 | 22.7 | 900 | 30.4 |
| 500 | 23.2 | 925 | 30.6 |
| 525 | 23.9 | 950 | 30.8 |
| 550 | 24.2 | 975 | 31.6 |
| 575 | 24.6 | 1000 | 32.1 |
| 600 | 24.7 | | |

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

**Antenna factor**

**Biconilog antenna EMCO, model 3141, serial number 1011, HL 0604**

| Frequency, MHz | Antenna factor, dB(1/m) | Frequency, MHz | Antenna factor, dB(1/m) | Frequency, MHz | Antenna factor, dB(1/m) |
|---|---|---|---|---|---|
| 26 | 7.8 | 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(μV) to convert it into field intensity in dB(μV/m).

**Biconilog antenna factor**

**Schaffner Chase EMC, model CBL 6140A, serial number 1120, HL 0784**

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

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

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

**Antenna factor**
**Double-ridged wave guide horn antenna**
**EMC Test Systems, model 3115, serial no: 9911-5964, HL 1984**

| Frequency, MHz | Antenna gain, dBi | Antenna factor. 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(μV) to convert it into field intensity in dB(μV/m).

**Cable loss**
**Cable RG-214, HL 0813**

| No. | Frequency, MHz | Cable loss, dB |
|---|---|---|
| 1 | 10 | 0.15 |
| 2 | 20 | 0.40 |
| 3 | 30 | 0.51 |
| 4 | 40 | 0.61 |
| 5 | 50 | 0.68 |
| 6 | 60 | 0.76 |
| 7 | 70 | 0.80 |
| 8 | 80 | 0.92 |
| 9 | 90 | 0.96 |
| 10 | 100 | 0.99 |
| 11 | 200 | 1.60 |
| 12 | 300 | 1.85 |
| 13 | 400 | 2.25 |
| 14 | 500 | 2.43 |
| 15 | 600 | 2.80 |
| 16 | 700 | 3.14 |
| 17 | 800 | 3.34 |
| 18 | 900 | 3.75 |
| 19 | 1000 | 4.05 |
| 20 | 1200 | 4.41 |
| 21 | 1400 | 4.81 |
| 22 | 1600 | 5.18 |
| 23 | 1800 | 5.58 |
| 24 | 2000 | 6.09 |
| 25 | 2500 | 7.27 |
| 26 | 2900 | 8.01 |

**Cable loss**
**RF cable 3.5 m, Alpha Wire, model RG-214, S/N 149, HL 1553**

| No. | Frequency, MHz | Cable loss, dB | Measurement uncertainty, dB |
|---|---|---|---|
| 1 | 1 | 0.01 | ±0.05 |
| 2 | 10 | 0.07 | |
| 3 | 30 | 0.12 | |
| 4 | 50 | 0.22 | |
| 5 | 100 | 0.26 | |
| 6 | 200 | 0.40 | |
| 7 | 300 | 0.52 | |
| 8 | 400 | 0.60 | |
| 9 | 500 | 0.70 | |
| 10 | 600 | 0.77 | |
| 11 | 700 | 0.84 | |
| 12 | 800 | 1.00 | |
| 13 | 900 | 1.00 | |
| 14 | 1000 | 1.05 | |
| 15 | 2000 | 1.70 | |

**Cable loss**
**RF cable 8 m, model RG-214, HL 1552**

| No. | Frequency, MHz | Cable loss, dB | Measurement uncertainty, dB | Notes |
|---|---|---|---|---|
| 1 | 0.010 | 0.01 | ±0.05 | |
| 2 | 0.1 | 0.01 | | |
| 3 | 1 | 0.03 | | |
| 4 | 10 | 0.12 | | |
| 5 | 20 | 0.23 | | |
| 6 | 30 | 0.30 | | |
| 7 | 40 | 0.32 | | |
| 8 | 50 | 0.34 | | |
| 9 | 60 | 0.39 | | |
| 10 | 70 | 0.43 | | |
| 11 | 80 | 0.48 | | |
| 12 | 90 | 0.50 | | |
| 13 | 100 | 0.55 | | |
| 14 | 200 | 0.78 | | |
| 15 | 300 | 1.04 | | |
| 16 | 400 | 1.16 | | |
| 17 | 500 | 1.33 | | |
| 18 | 600 | 1.51 | | |
| 19 | 700 | 1.65 | | |
| 20 | 800 | 1.77 | | |
| 21 | 900 | 1.92 | | |
| 22 | 1000 | 2.04 | | |
| 23 | 1200 | 2.26 | | |
| 24 | 1400 | 2.49 | | |
| 25 | 1600 | 2.74 | | |
| 26 | 1800 | 2.94 | | |
| 27 | 2000 | 3.18 | | |
| 28 | 2500 | 3.65 | | |
| 29 | 2900 | 4.08 | | |

**Cable loss**
**Cable RF, 2m, model: Sucoflex 104PE, S/N 13094/4PE, HL 1566**

| No. | Frequency, MHz | Cable loss, dB | Tolerance, dB | Measurement uncertainty, dB |
|---|---|---|---|---|
| 1 | 30 | 0.10 | ≤ 5.0 | ±0.12 |
| 2 | 50 | 0.13 | | |
| 3 | 100 | 0.20 | | |
| 4 | 300 | 0.33 | | |
| 5 | 500 | 0.45 | | |
| 6 | 800 | 0.60 | | |
| 7 | 1000 | 0.65 | | |
| 8 | 1500 | 0.91 | | |
| 9 | 2000 | 1.08 | | |
| 10 | 2500 | 1.19 | | |
| 11 | 3000 | 1.28 | | |
| 12 | 3500 | 1.49 | | |
| 13 | 4000 | 1.63 | | |
| 14 | 4500 | 1.63 | ≤ 5.0 | ±0.17 |
| 15 | 5000 | 1.66 | | |
| 16 | 5500 | 1.88 | | |
| 17 | 6000 | 1.96 | | |
| 18 | 6500 | 1.93 | | |
| 19 | 7000 | 2.07 | | |
| 20 | 7500 | 2.37 | | |
| 21 | 8000 | 2.34 | | |
| 22 | 8500 | 2.64 | | |
| 23 | 9000 | 2.68 | | |
| 24 | 9500 | 2.64 | | |
| 25 | 10000 | 2.70 | | |
| 26 | 10500 | 2.84 | | |
| 27 | 11000 | 2.88 | | |
| 28 | 11500 | 3.19 | | |
| 29 | 12000 | 3.15 | | |
| 30 | 12500 | 3.20 | ≤ 5.0 | ±0.26 |
| 31 | 13000 | 3.22 | | |
| 32 | 13500 | 3.47 | | |
| 33 | 14000 | 3.41 | | |
| 34 | 14500 | 3.59 | | |
| 35 | 15000 | 3.79 | | |
| 36 | 15500 | 4.24 | | |
| 37 | 16000 | 4.12 | | |
| 38 | 16500 | 4.46 | | |
| 39 | 17000 | 4.50 | | |
| 40 | 17500 | 4.49 | | |
| 41 | 18000 | 4.45 | | |

**Cable loss**
**Cable 18 GHz, 6.5 m, blue, model: NPS-1803A-6500-NPS, S/N T4974, HL 1947**

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

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

**Cable loss**
**Cable coaxial, 40GHz, 1.5 m, Blue, Rhophase Microwave Limited, model: KPS-1503A-1500-KPS, HL 2399**

| Frequency, GHz | Cable loss, dB | Frequency, GHz | Cable loss, dB | Frequency, GHz | Cable loss, dB |
|---|---|---|---|---|---|
| 0.03 | 0.07 | 6.5 | 1.57 | 15.50 | 2.50 |
| 0.05 | 0.10 | 6.7 | 1.60 | 16.00 | 2.51 |
| 0.1 | 0.16 | 6.9 | 1.55 | 16.50 | 2.58 |
| 0.2 | 0.26 | 7.1 | 1.65 | 17.00 | 2.65 |
| 0.3 | 0.33 | 7.3 | 1.65 | 17.50 | 2.73 |
| 0.5 | 0.38 | 7.5 | 1.70 | 18.00 | 2.74 |
| 0.7 | 0.41 | 7.7 | 1.71 | 18.50 | 2.67 |
| 0.9 | 0.58 | 7.9 | 1.73 | 19.00 | 2.67 |
| 1.1 | 0.64 | 8.1 | 1.79 | 19.50 | 2.74 |
| 1.3 | 0.70 | 8.3 | 1.81 | 20.00 | 2.69 |
| 1.5 | 0.75 | 8.5 | 1.84 | 20.50 | 2.80 |
| 1.7 | 0.79 | 8.7 | 1.85 | 21.00 | 2.82 |
| 1.9 | 0.83 | 8.9 | 1.90 | 21.50 | 2.87 |
| 2.1 | 0.88 | 9.1 | 1.95 | 22.00 | 2.87 |
| 2.3 | 0.93 | 9.3 | 1.93 | 22.50 | 2.92 |
| 2.5 | 0.97 | 9.5 | 1.98 | 23.50 | 3.04 |
| 2.7 | 1.01 | 9.7 | 1.96 | 24.00 | 3.05 |
| 2.9 | 1.04 | 9.9 | 2.03 | 24.50 | 3.03 |
| 3.1 | 1.08 | 10.1 | 1.99 | 25.00 | 3.11 |
| 3.3 | 1.14 | 10.30 | 2.02 | 25.50 | 3.10 |
| 3.5 | 1.17 | 10.50 | 2.02 | 26.00 | 3.17 |
| 3.7 | 1.21 | 10.70 | 2.02 | 26.50 | 3.11 |
| 3.9 | 1.24 | 10.90 | 2.08 | 27.00 | 3.16 |
| 4.1 | 1.26 | 11.10 | 2.02 | 28.00 | 3.19 |
| 4.3 | 1.26 | 11.30 | 2.09 | 29.00 | 3.19 |
| 4.5 | 1.29 | 11.50 | 2.05 | 30.00 | 3.30 |
| 4.7 | 1.34 | 11.70 | 2.11 | 31.00 | 3.31 |
| 4.9 | 1.34 | 11.90 | 2.11 | 32.00 | 3.35 |
| 5.1 | 1.40 | 12.10 | 2.12 | 33.00 | 3.46 |
| 5.3 | 1.43 | 12.40 | 2.17 | 34.00 | 3.45 |
| 5.5 | 1.45 | 13.00 | 2.29 | 35.00 | 3.49 |
| 5.7 | 1.47 | 13.50 | 2.31 | 36.00 | 3.54 |
| 5.9 | 1.40 | 14.00 | 2.43 | 37.00 | 3.62 |
| 6.1 | 1.53 | 14.50 | 2.43 | 39.00 | 3.69 |
| 6.3 | 1.55 | 15.00 | 2.46 | 40.00 | 3.75 |

**Cable loss**
**Cable coaxial, Gore, 18 GHz, 0.6 m, SMA - SMA, model Right Angle, S/N 91P67960**
**HL 2866**

| Frequency, GHz | Cable loss, dB | Frequency, GHz | Cable loss, dB | Frequency, GHz | Cable loss, dB |
|---|---|---|---|---|---|
| 10 | 0.03 | 5750 | 0.56 | 12000 | 0.77 |
| 30 | 0.02 | 6000 | 0.60 | 12250 | 0.68 |
| 100 | 0.02 | 6250 | 0.54 | 12500 | 0.67 |
| 250 | 0.10 | 6500 | 0.60 | 12750 | 0.71 |
| 500 | 0.15 | 6750 | 0.56 | 13000 | 0.80 |
| 750 | 0.11 | 7000 | 0.63 | 13250 | 0.75 |
| 1000 | 0.13 | 7250 | 0.59 | 13500 | 0.66 |
| 1250 | 0.14 | 7500 | 0.62 | 13750 | 0.68 |
| 1500 | 0.16 | 7750 | 0.63 | 14000 | 0.69 |
| 1750 | 0.20 | 8000 | 0.60 | 14250 | 0.69 |
| 2000 | 0.26 | 8250 | 0.59 | 14500 | 0.62 |
| 2250 | 0.26 | 8500 | 0.57 | 14750 | 0.71 |
| 2500 | 0.32 | 8750 | 0.54 | 15000 | 0.73 |
| 2750 | 0.35 | 9000 | 0.53 | 15250 | 0.64 |
| 3000 | 0.45 | 9250 | 0.54 | 15500 | 0.62 |
| 3250 | 0.51 | 9500 | 0.55 | 15750 | 0.76 |
| 3500 | 0.63 | 9750 | 0.54 | 16000 | 0.92 |
| 3750 | 0.56 | 10000 | 0.58 | 16250 | 0.86 |
| 4000 | 0.52 | 10250 | 0.63 | 16500 | 0.84 |
| 4250 | 0.49 | 10500 | 0.73 | 16750 | 0.86 |
| 4500 | 0.47 | 10750 | 0.77 | 17000 | 1.02 |
| 4750 | 0.42 | 11000 | 0.81 | 17250 | 1.02 |
| 5000 | 0.42 | 11250 | 0.84 | 17500 | 0.91 |
| 5250 | 0.47 | 11500 | 0.87 | 17750 | 0.91 |
| 5500 | 0.56 | 11750 | 0.84 | 18000 | 1.07 |

# 14 APPENDIX F Measurement uncertainties

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

| Test description | Expanded uncertainty |
|---|---|
| Conducted carrier power at RF antenna connector | Below 12.4 GHz: ± 1.7 dB<br>12.4 GHz to 40 GHz: ± 2.3 dB |
| Conducted emissions at RF antenna connector | 9 kHz to 2.9 GHz: ± 2.6 dB<br>2.9 GHz to 6.46 GHz: ± 3.5 dB<br>6.46 GHz to 13.2 GHz: ± 4.3 dB<br>13.2 GHz to 22.0 GHz: ± 5.0 dB<br>22.0 GHz to 26.8 GHz: ± 5.5 dB<br>26.8 GHz to 40.0 GHz: ± 4.8 dB |
| Occupied bandwidth | ± 8.0 % |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements | ± 1.0 % |
| Conducted emissions with LISN | 9 kHz to 150 kHz: ± 3.9 dB<br>150 kHz to 30 MHz: ± 3.8 dB |
| Radiated emissions at 3 m measuring distance<br>Horizontal polarization<br><br><br><br>Vertical polarization | <br>Biconilog antenna: ± 5.3 dB<br>Biconical antenna: ± 5.0 dB<br>Log periodic antenna: ± 5.3 dB<br>Double ridged horn antenna: ± 5.3 dB<br>Biconilog antenna: ± 6.0 dB<br>Biconical antenna: ± 5.7 dB<br>Log periodic antenna: ± 6.0 dB<br>Double ridged horn antenna: ± 6.0 dB |

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