

Test report for BHS-801

Report Date: February 20, 2007

Signatures:

Tested by:



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Testing Engineer

Contents approved:



Tuomo Hahl

Testing Engineer

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1 LABORATORY INFORMATION

| | |
|---|--|
| Test Laboratory | NATLABS OY EMC Laboratory Koneenkatu 12 / K17 05830 Hyvinkää FINLAND Tel: +358 10 307 1040 Fax: +358 10 307 1041 e-mail: firstname.surname@ette.com |
| FCC registration number: IC file number: | 910391 (January 27, 2003) IC 4616A-1 (May 14, 2003) |

2 CUSTOMER INFORMATION

| | |
|------------------------|--|
| Client | Iqua Ltd. Kimmeltie 3 02110 Espoo Finland Tel. +358207419850 Fax +358 2 733 9988 |
| Contact person: | Mika Katainen Iqua Ltd. Hyvoninkatu 1 24240 Salo Finland Tel. +358 400 740 186 Fax +358 2 733 9988 |
| Receipt of EUT: | January 19, 2007 |
| Testing date: | January 22-February 13, 2007 |
| Report date: | February 16, 2007 |

The tests listed in this report have been done to demonstrate compliance to the FCC rules section §15.247, §15.207 and IC standard RSS-GEN / RSS-210.

3 SUMMARY OF TEST RESULTS

Transmitter measurements

| Section in CFR 47 | Section in RSS-210 | Test | Result |
|-------------------|--------------------|--------------------------------------|--------|
| 15.247, a 1 | A8.1 (2) | Carrier frequency separation | PASS |
| 15.247, a 1 iii | A8.1 (4) | Number of hopping frequencies | PASS |
| 15.247, a 1 iii | A8.1 (4) | Time of occupancy | PASS |
| 15.247, a | A8.1 (1) | 20dB bandwidth | PASS |
| - | RSS-GEN 4.4.1 | 99% bandwidth | PASS |
| 15.215, c | RSS-GEN 7.2.4 | Frequency stability | PASS |
| 15.247, b 1 | A8.4 (2) | Peak output power | PASS |
| 15.247, d | A8.5 | Band-edge compliance of RF emissions | PASS |
| 15.247, d | A8.5 | Spurious RF conducted emissions | PASS |
| 15.247, d | A8.5 | Spurious radiated emissions | PASS |

Receiver measurements

| Section in CFR 47 | Section in RSS-GEN | Section in ICES-003 | Test | Result |
|-------------------|--------------------|---------------------|---------------------------------------|--------|
| §15.107 | 7.2.2 | 5.3 | Conducted emissions to AC-power lines | PASS |
| §15.109 | 7.2.3 | 5.5 | Radiated emissions | PASS |

PASS Pass
 FAIL Fail
 X Measured, but there is no applicable performance criteria
 - Not required

4 EUT INFORMATION

The EUT and accessories used in the tests are listed below. Later in this report only EUT numbers are used as reference.

| | Device | Type | S/N | EUT number |
|-------------|-------------------|--------------------|-----------------|------------|
| EUT | Bluetooth headset | BHS-801 ** | 046512010000069 | 20801 |
| | Bluetooth headset | BHS-801 ** | - | 20802 *** |
| Accessories | USB cable | - | - | 20803 |
| | BT tester | Anritsu MT8850A | - | 20804 |
| | Laptop computer | Dell PR04S | - | 20805 |
| | Printer | HP Deskjet 890C | SG78I19082 | 20806 |
| | Serial mouse | Logitech | LZB83902452 | 20807 |

Notes:

** Version B6.0

*** Antenna replaced with SMA-connector

4.1 EUT description

EUT is battery powered Bluetooth headset. Battery can be charged via USB-connector. A computer or charger can be used as charging device.

The EUT was not modified during the tests.

5 EUT TEST SETUPS

For each test the EUT was exercised to find out the worst case of operation modes and device configuration.

Two different test setups were used: one for conducted measurements, another for radiated measurements. One EUT was equipped with an external antenna connector for conductive measurements.

The test setup photographs are in the document referenced in section 20.

6 APPLICABLE STANDARDS

The tests were performed in guidance of CFR 47 Part 15.247, 15.209, 15.107, 15.109 and Part 2, ANSI C63.4 (2003), ICES-003 and RSS-GEN / RSS-210

Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method" for each test case.

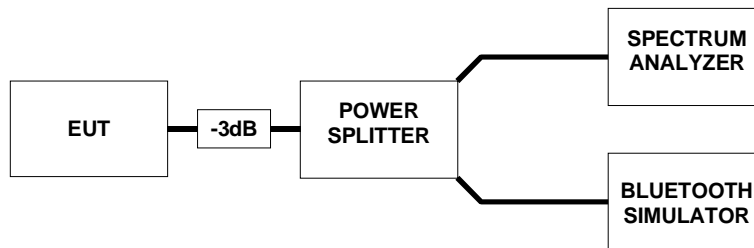
7 CARRIER FREQUENCY SEPARATION

| | | | |
|-------------------------------------|-------------------|--------|----------|
| EUT | 20802 | | |
| Accessories | 20804 | | |
| Temp, Humidity, Air Pressure | 22 °C | 35 RH% | 1001 hPa |
| Date of measurement | February 13, 2007 | | |
| FCC rule part | 15.247, a 1 | | |
| RSS-210 section | A8.1 (2) | | |
| Measured by | Jani Kiiski | | |

7.1 Test setup and testing method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 1: Test setup for carrier frequency separation measurement

Spectrum analyzer was set to sweep the Bluetooth operating band 2.40 – 2.483 GHz.

100 kHz resolution bandwidth and maximum hold function was used to measure the EUT transmission over sufficient time. Carrier frequency separation was read from the screen.

7.2 EUT operation mode

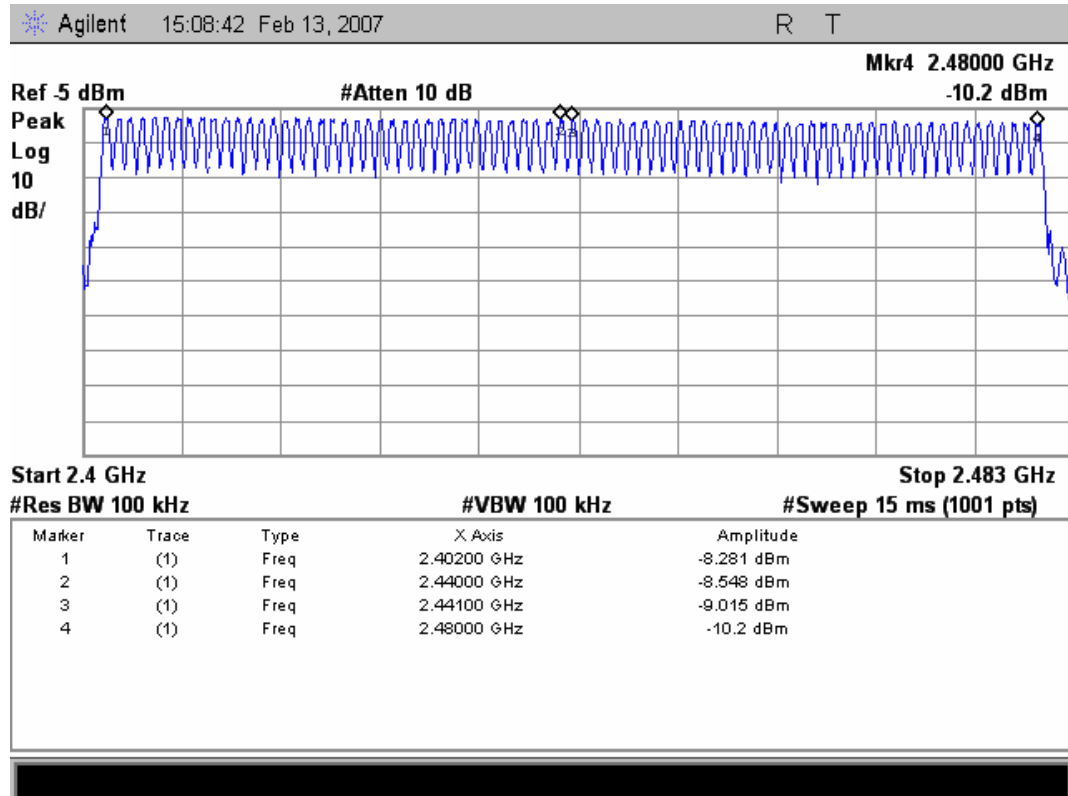
| | |
|---------------------------|-----------------------|
| EUT operation mode | Connection, DM5, PRBS |
| EUT channel | Hopping |
| EUT TX power level | 0 dBm |

7.3 Results

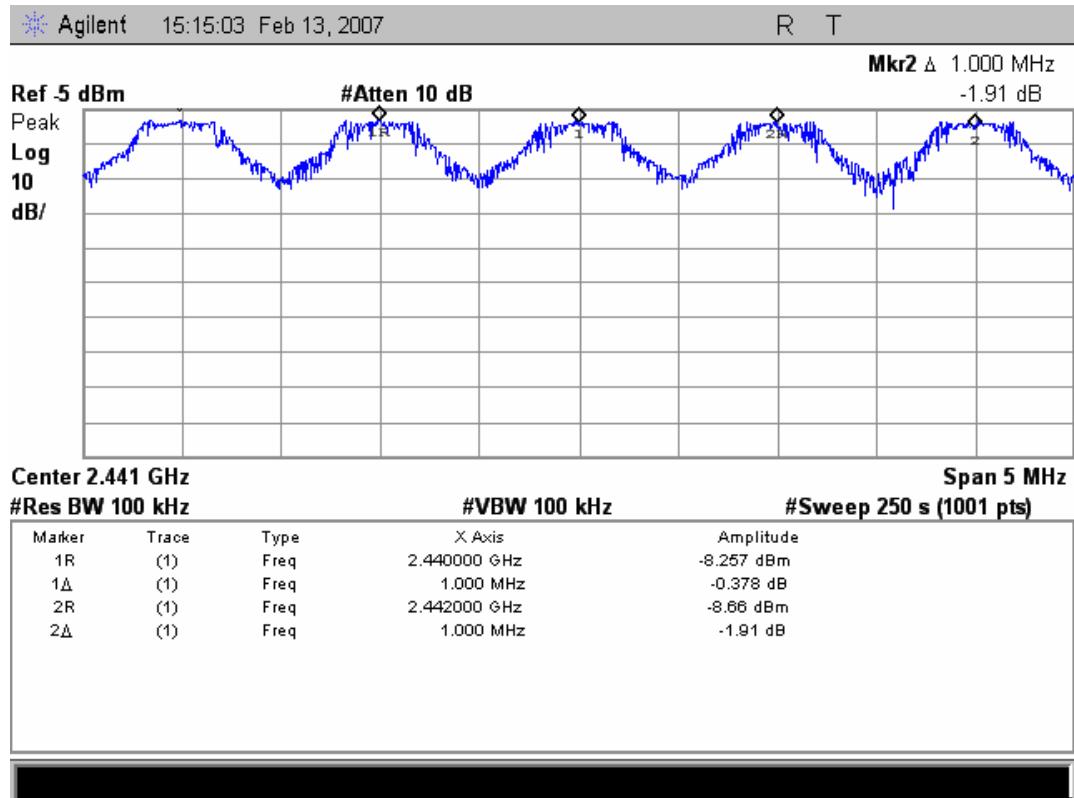
Table 1: Carrier frequency separation measurement results

| Limit | Result |
|-------------------------|----------|
| ≥ 0.025 or 20dB BW | 1.00 MHz |

7.4 Screen shots



Picture 2: Carrier frequency separation, General overview of the spectrum



Picture 3: Carrier frequency separation, Channels 38 and 39

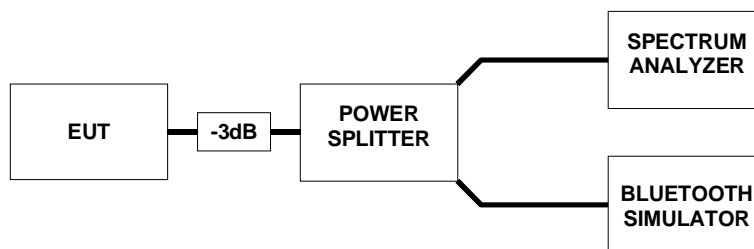
8 NUMBER OF HOPPING FREQUENCIES

| | | | |
|-------------------------------------|-------------------|--------|----------|
| EUT | 20802 | | |
| Accessories | 20804 | | |
| Temp, Humidity, Air Pressure | 22 °C | 35 RH% | 1001 hPa |
| Date of measurement | February 13, 2007 | | |
| FCC rule part | 15.247, a 1 iii | | |
| RSS-210 section | A8.1 (4) | | |
| Measured by | Jani Kiiski | | |

8.1 Test setup

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 4: Test setup for measurement of number of hopping frequencies

Spectrum analyzer was set to sweep the Bluetooth operating band 2.40 – 2.483 GHz.

100 kHz resolution bandwidth and maximum hold function was used to measure the EUT transmission over sufficient time. Number of hopping frequencies was calculated from the screen.

8.2 EUT operation mode

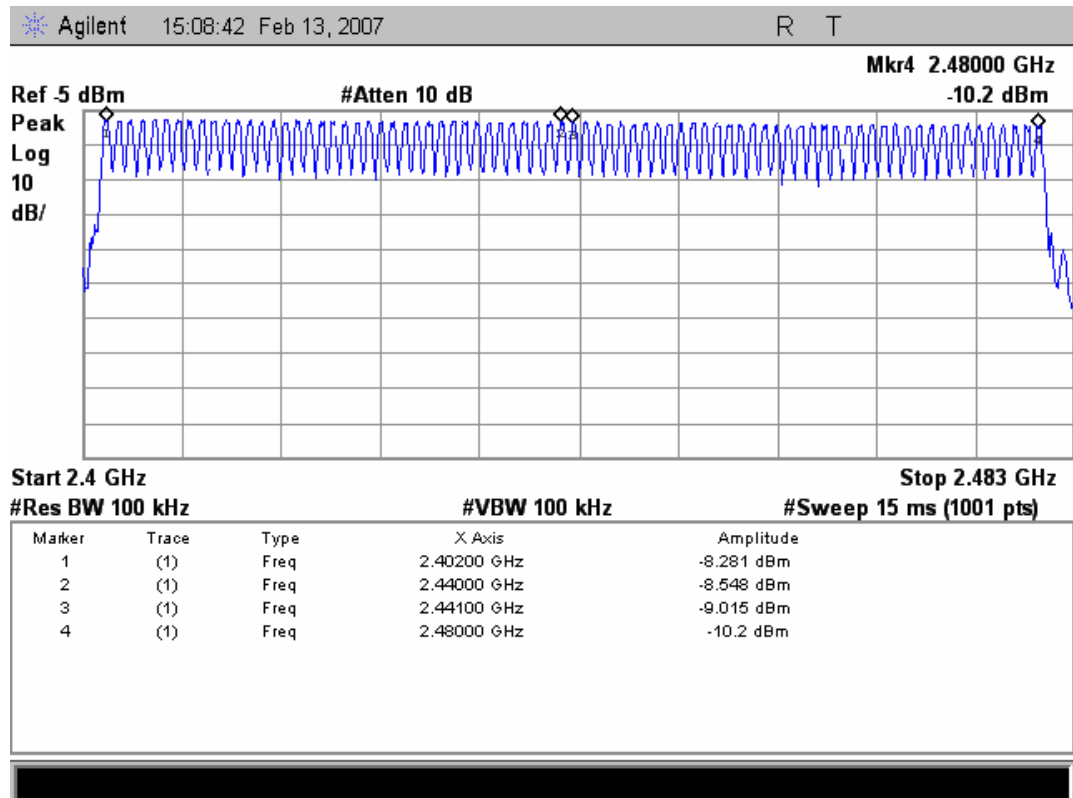
| | |
|---------------------------|-----------------------|
| EUT operation mode | Connection, DM5, PRBS |
| EUT channel | Hopping |
| EUT TX power level | 0 dBm |

8.3 Results

Table 2: Number of hopping frequencies measurement results

| Limit | Result |
|-----------|--------|
| ≥ 75 | 79 |

8.4 Screen shots



Picture 5: Number of hopping frequencies measurement

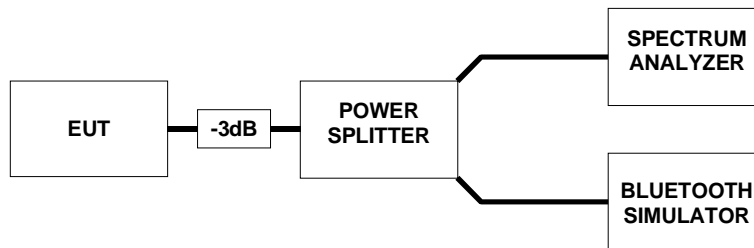
9 TIME OF OCCUPANCY

| | | | |
|-------------------------------------|-------------------|--------|----------|
| EUT | 20802 | | |
| Accessories | 20804 | | |
| Temp, Humidity, Air Pressure | 22 °C | 35 RH% | 1001 hPa |
| Date of measurement | February 13, 2007 | | |
| FCC rule part | 15.247, a 1 iii | | |
| RSS-210 section | A8.1 (4) | | |
| Measured by | Jani Kiiski | | |

9.1 Test setup and testing method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 6: Test setup for conducted RF output power measurement

Spectrum analyzer with single sweep and 0 Hz span was used to monitor the transmitter operation over time.

9.2 Connection mode

9.2.1 EUT operation mode

| | |
|---------------------------|-----------------------|
| EUT operation mode | Connection, DH5, PRBS |
| EUT channel | Hopping |
| EUT TX power level | 0 dBm |

9.2.2 Results

Table 3: Time of occupancy during connection mode measurement results

| Limit | Result |
|---------------------------------|---------------|
| ≤ 0.4 s over 31.6 s period | 0.1635 s |

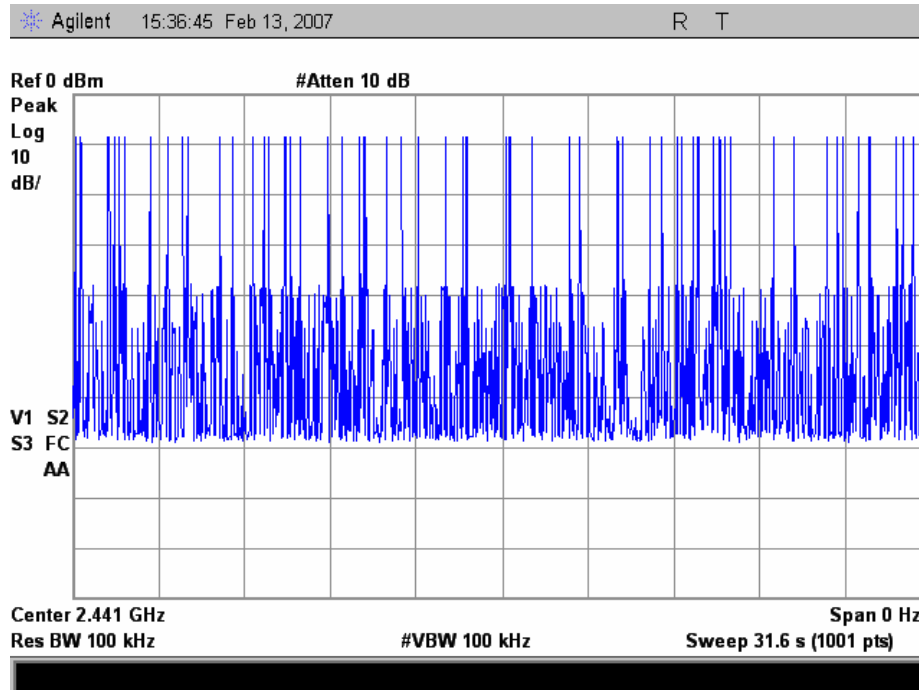
Limit:

In the connection mode Bluetooth uses 79 channels. As defined in 15.247, a 1 iii, the limit for time of occupancy is 0.4s over time of number of channels multiplied with 0.4s ($79 * 0.4s = 31.6$ s).

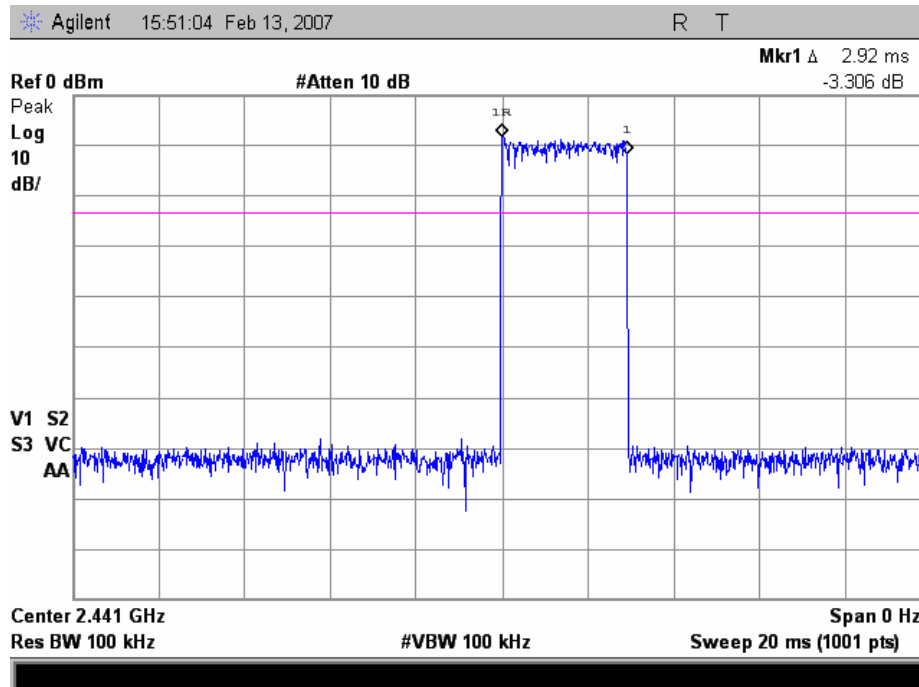
Results:

In measurement time of 31.6 s, total of 56 transmissions occurred. The duration of one transmission was 2.92ms. Based on these measurements the transmitter operated $56 * 2.92$ ms = 0.1635 s during the 31.6 s period

9.2.3 Screen shots



Picture 7: Number of transmissions on connection state, channel 39



Picture 8: Duration of one transmission on connection state, channel 39

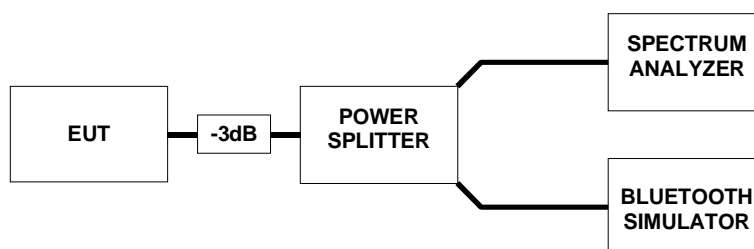
10 20 DB BANDWIDTH

| | | | |
|-------------------------------------|-------------------|--------|----------|
| EUT | 20802 | | |
| Accessories | 20804 | | |
| Temp, Humidity, Air Pressure | 22 °C | 35 RH% | 1001 hPa |
| Date of measurement | February 13, 2007 | | |
| FCC rule part | 15.247, a | | |
| RSS-210 section | A8.1 (1) | | |
| Measured by | Jani Kiiski | | |

10.1 Test setup and measurement method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 9: Test setup for conducted RF output power measurement

The 20dB bandwidth was measured using 10 kHz resolution bandwidth and maximum hold function of the spectrum analyzer. 20dB bandwidth was defined by measuring the maximum level on the measured channel and by placing display line 20 dB below this value and by reading the bandwidth from the intersection of the measured trace and display line.

10.2 EUT operation mode

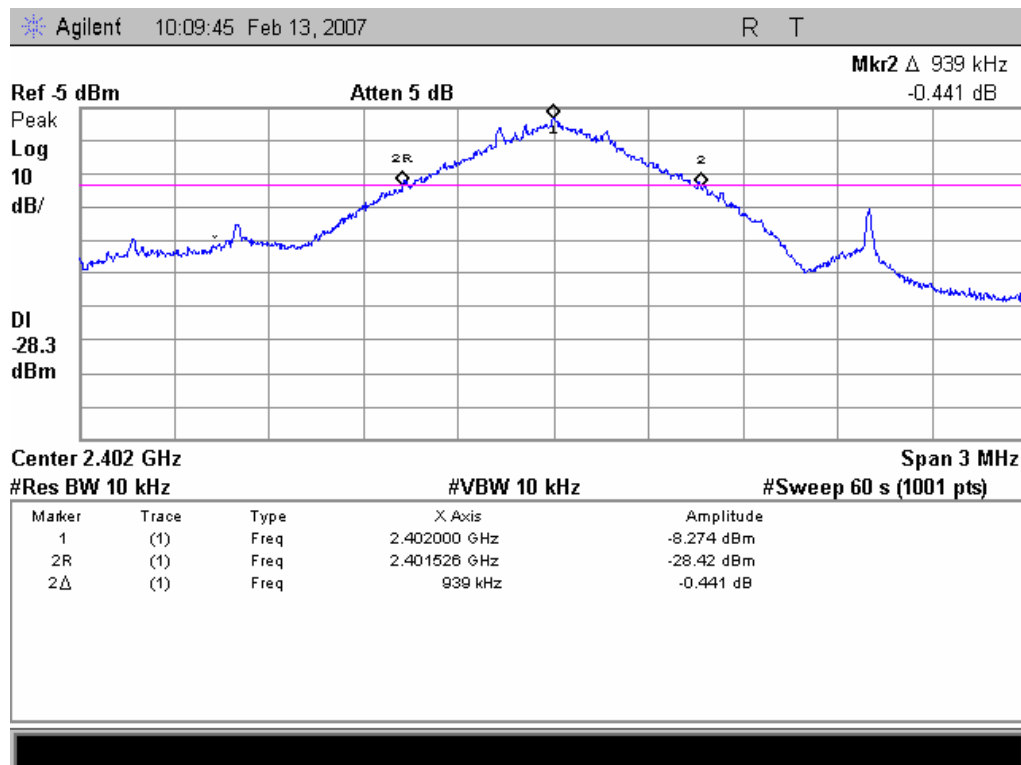
| | |
|---------------------------|-----------------------|
| EUT operation mode | Connection, DM5, PRBS |
| EUT channel | 0, 39 and 78 |
| EUT TX power level | 0 dBm |

10.3 Results

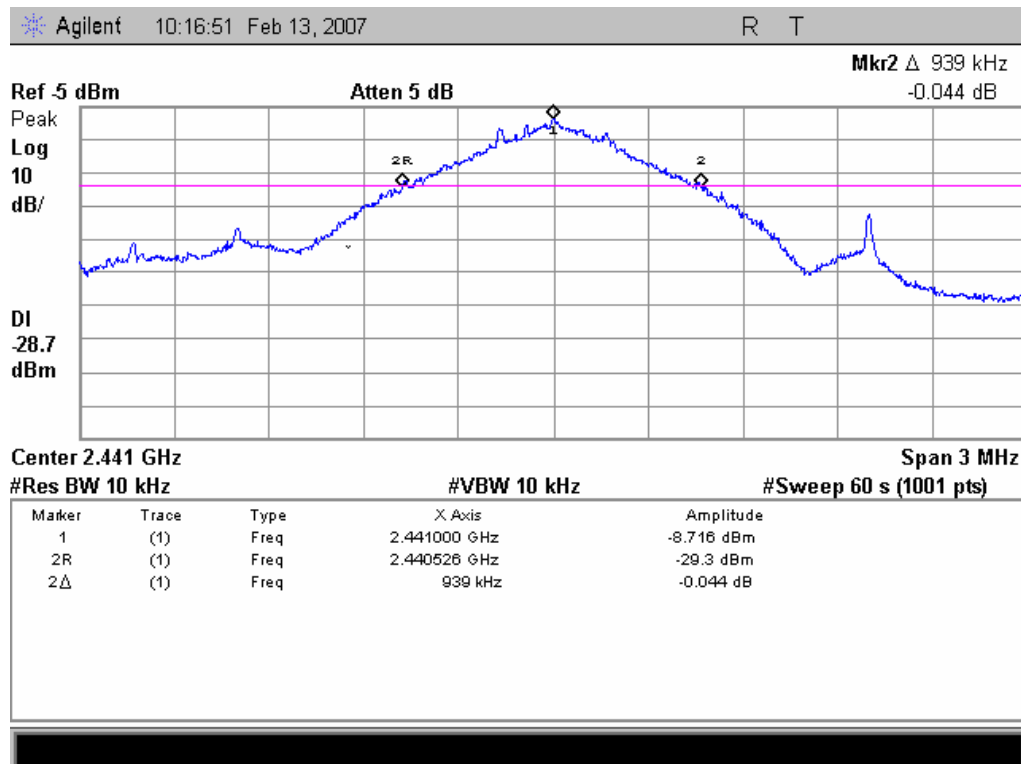
Table 4: 20dB bandwidth measurement results

| EUT Channel | Limit (MHz) | Measured value (MHz) |
|-------------|-------------|----------------------|
| 0 | ≤ 1.0 | 0.939 |
| 39 | | 0.939 |
| 78 | | 0.954 |

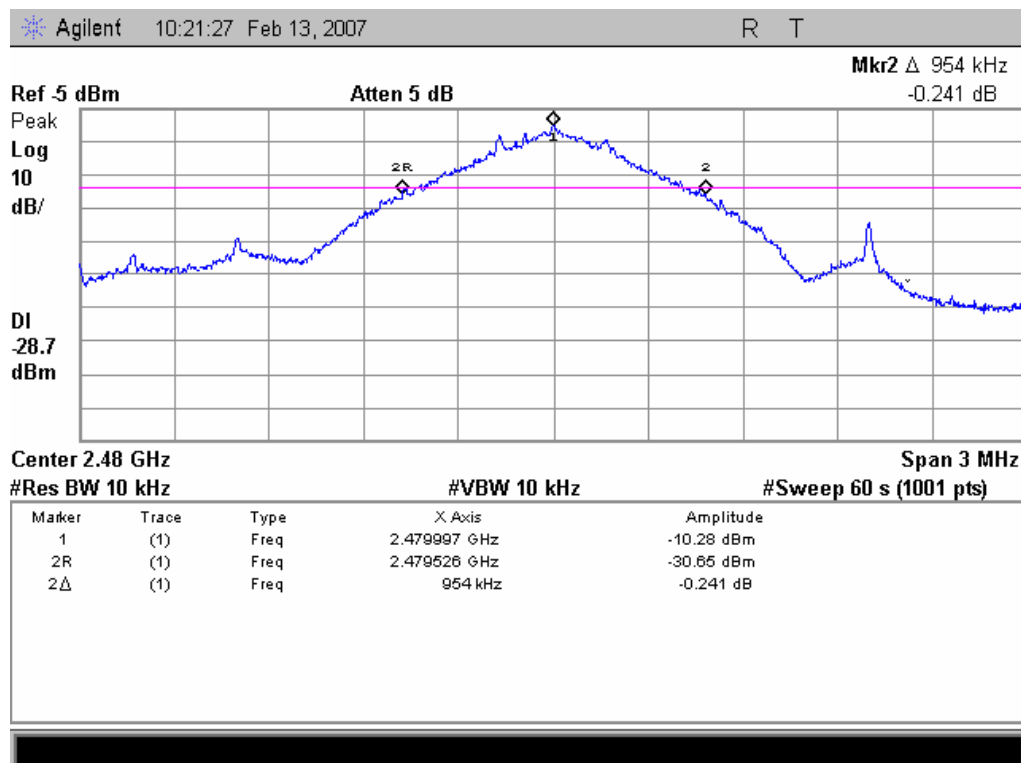
10.4 Screen shots



Picture 10: 20dB Bandwidth measurement result, Channel 0



Picture 11: 20dB Bandwidth measurement result, Channel 39



Picture 12: 20dB Bandwidth measurement result, Channel 78

11 99 % BANDWIDTH

| | | | |
|---|-------------------|--------|----------|
| EUT | 20802 | | |
| Accessories | 20804 | | |
| Temp, Humidity, Air Pressure | 22 °C | 35 RH% | 1001 hPa |
| Date of measurement | February 13, 2007 | | |
| FCC rule part | | | |
| RSS-GEN section | 4.4.1 | | |
| Measured by | Jani Kiiski | | |

11.1 Test setup and measurement method

The 99% occupied bandwidth was calculated from spectrum analyzer measurements.

The measurement data was read from the analyzer to computer.

Software in computer calculated the total power from the measurement data and defined the frequency band containing 99% of the total power.

Markers in the spectrum analyzer were then placed between the calculated frequencies to show the calculated 99% power band in the screenshots.

11.2 EUT operation mode

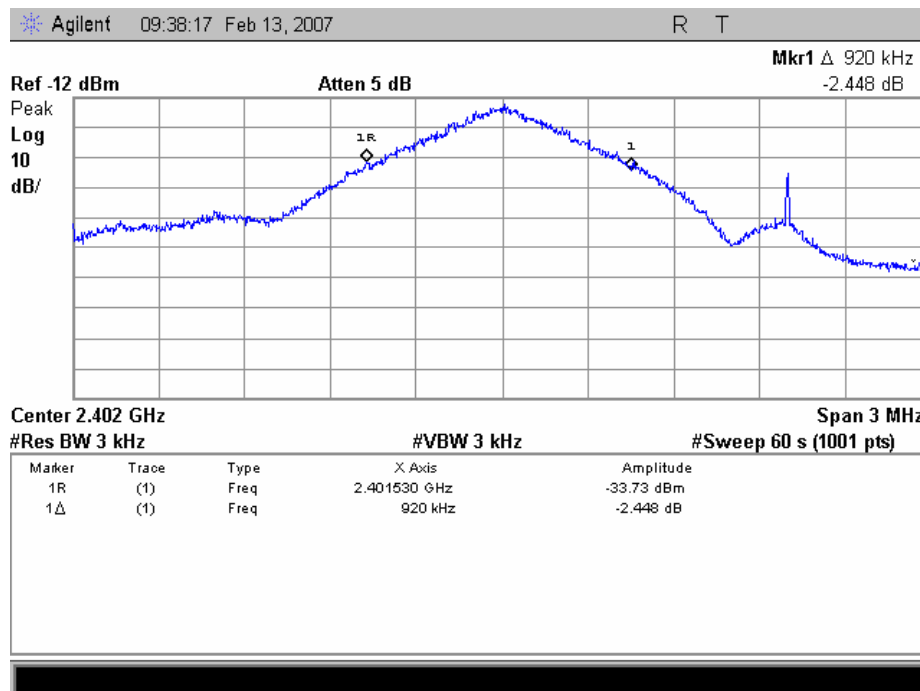
| | |
|---------------------------|-----------------------|
| EUT operation mode | Connection, DM5, PRBS |
| EUT channel | 0, 39 and 78 |
| EUT TX power level | 0 dBm |

11.3 Results

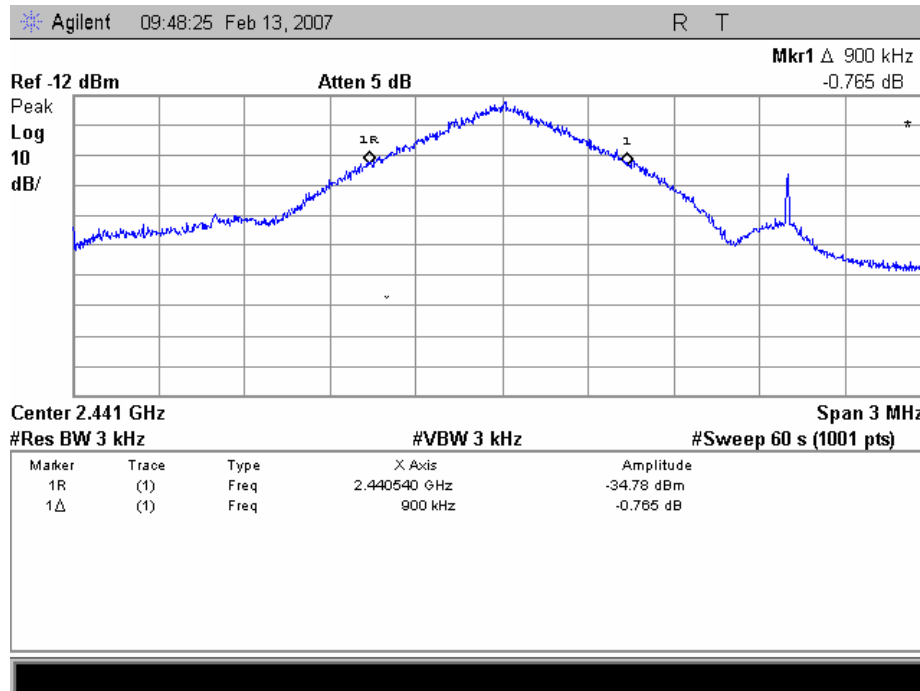
Table 5: 99% bandwidth measurement results

| EUT Channel | Limit (MHz) | Measured value(MHz) |
|-------------|-------------|---------------------|
| 0 | - | 0.917 |
| 39 | | 0.902 |
| 78 | | 0.902 |

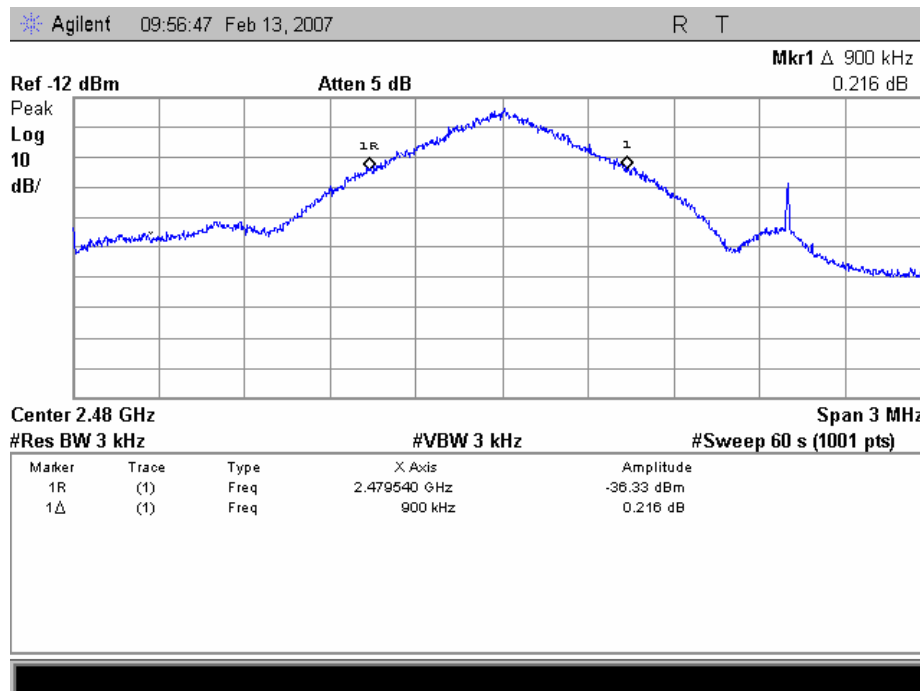
11.4 Screen shots



Picture 13: 99% Bandwidth measurement result, ch 0



Picture 14: 99% Bandwidth measurement result, ch 39

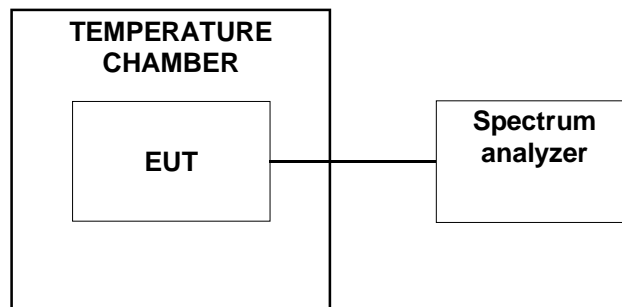


Picture 15: 99% Bandwidth measurement result, ch 78

12 FREQUENCY STABILITY

| | | | |
|-------------------------------------|-------------------|-------|-------|
| EUT | 20802 | | |
| Accessories | - | | |
| Temp, Humidity, Air Pressure | - °C | - RH% | - hPa |
| Date of measurement | February 12, 2007 | | |
| FCC rule part | §15.215 (c) | | |
| RSS-GEN section | 7.2.4 | | |
| Measured by | Jani Kiiski | | |

12.1 Test setup and measurement method



1. The climate chamber temperature was set to the maximum value and the temperature was allowed to stabilize
2. The EUT was placed in the chamber power off
3. The EUT temperature was allowed to stabilize for 30 minutes
4. The EUT was turned on and set to transmit
5. Transmitter peak frequency was measured with spectrum analyzer
6. The steps 3 - 5 were repeated for each temperature

12.2 EUT operation mode

| | |
|---------------------------|-------------------------|
| EUT operation mode | Continuous transmission |
| EUT channel | 39 |
| EUT TX power level | 0 dBm |

12.3 Results

Table 6: Frequency stability measurement results

| Temperature (°C) | Transmitter frequency (MHz) |
|---------------------|--------------------------------|
| 50 | 2440.991 |
| 40 | 2440.993 |
| 30 | 2440.997 |
| 20 | 2441.001 |
| 10 | 2441.005 |
| 0 | 2441.005 |
| -10 | 2441.002 |
| -20 | 2440.994 |
| -30 | 2440.980 |

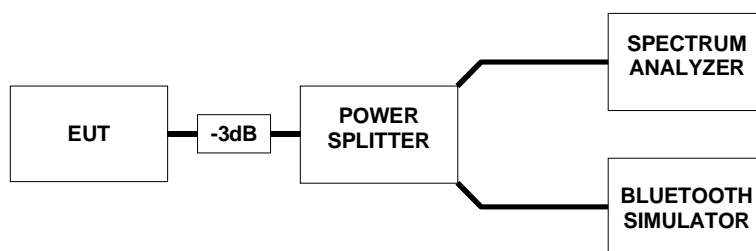
13 PEAK OUTPUT POWER

| | | | |
|-------------------------------------|-------------------|--------|----------|
| EUT | 20802 | | |
| Accessories | 20804 | | |
| Temp, Humidity, Air Pressure | 22 °C | 35 RH% | 1001 hPa |
| Date of measurement | February 13, 2007 | | |
| FCC rule part | 15.247, b 1 | | |
| RSS-210 section | A8.4 (2) | | |
| Measured by | Jani Kiiski | | |

13.1 Test setup and measurement method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 16: Test setup for conducted RF output power measurement

In the peak output power measurement the power splitter, attenuator and cable attenuations were measured prior to the power measurement and set as parameter for external preamplifier gain in the spectrum analyzer to correct the reading of the peak output power. Spectrum analyzer subtracts the set PG value shown in the screenshots from the measured reading.

The measurement was made using 1 MHz resolution bandwidth and 3 MHz video bandwidth and maximum hold function to record the maximum peak output power.

13.2 EUT operation mode

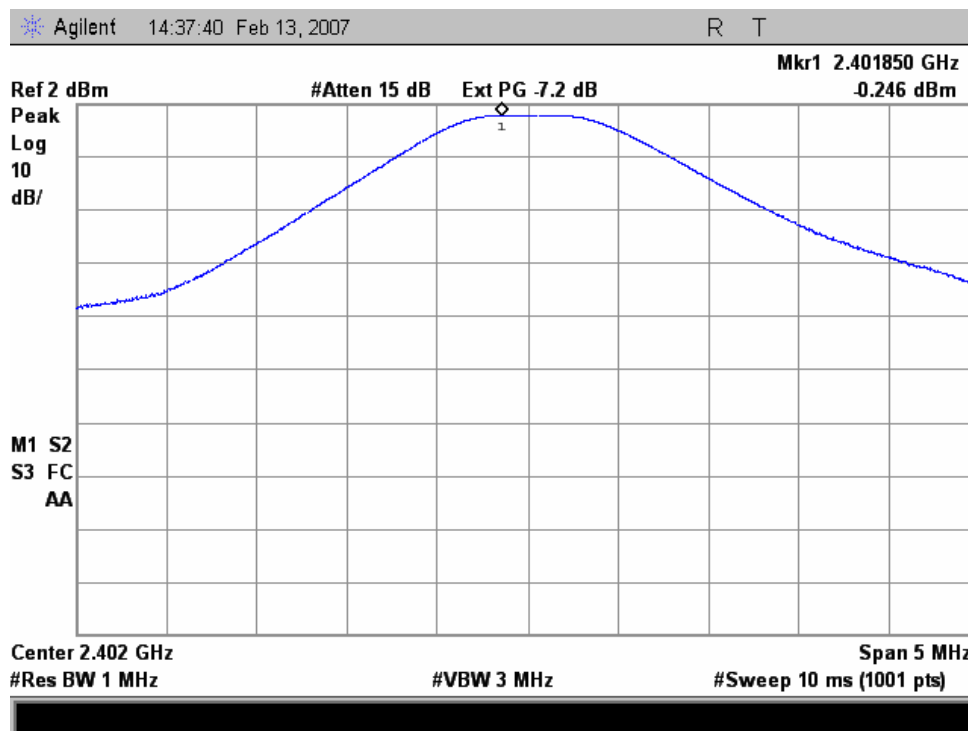
| | |
|---------------------------|-----------------------|
| EUT operation mode | Connection, DM5, PRBS |
| EUT channel | 0, 39 and 78 |
| EUT TX power level | 0 dBm |

13.3 Results

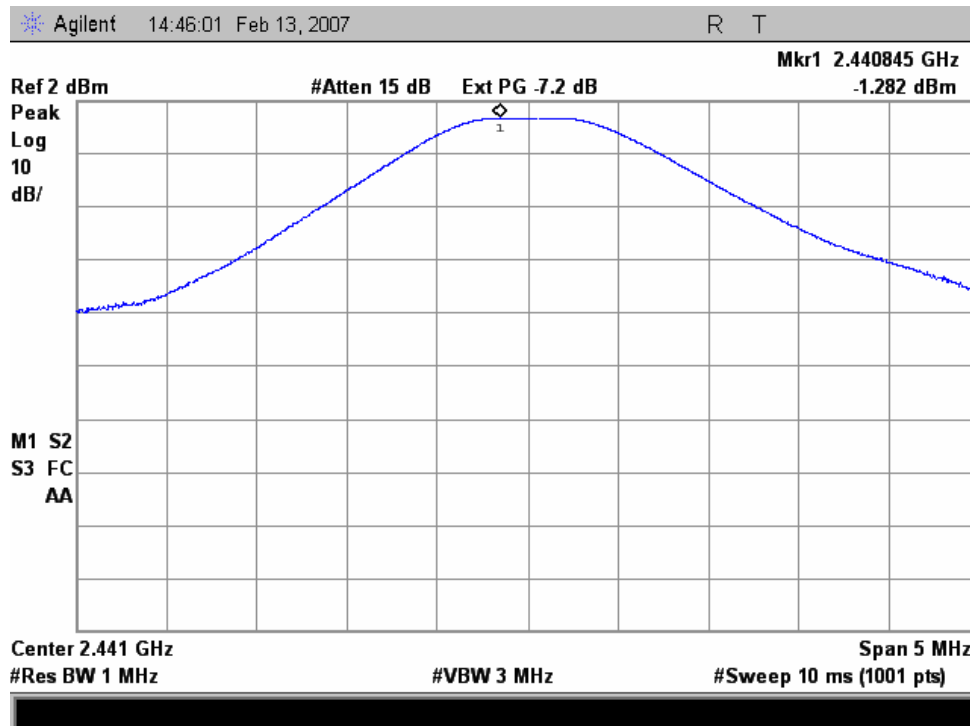
Table 7: Peak output power measurement results

| EUT Channel | Limit (W) | Test result (W) | Limit (dBm) | Test result (dBm) |
|-------------|-----------|-----------------|-------------|-------------------|
| 0 | ≤ 1 | 0.000945 | ≤ 30 | -0.246 |
| 39 | | 0.000744 | | -1.282 |
| 78 | | 0.000606 | | -2.174 |

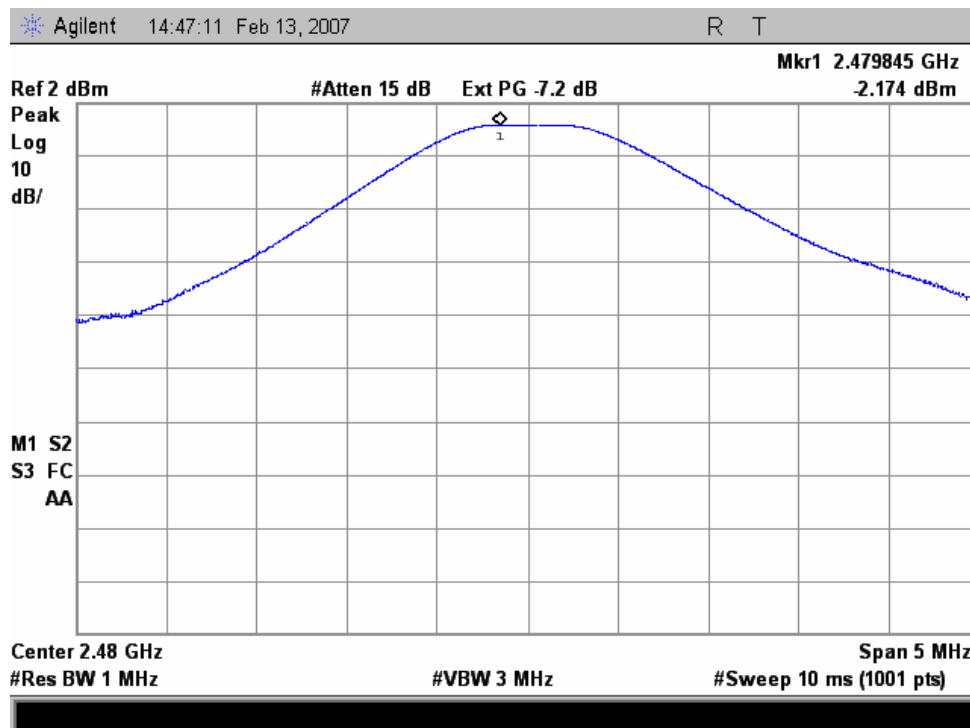
13.4 Screen shots



Picture 17: Peak output power, channel 0



Picture 18: Peak output power, channel 39



Picture 19: Peak output power, channel 78

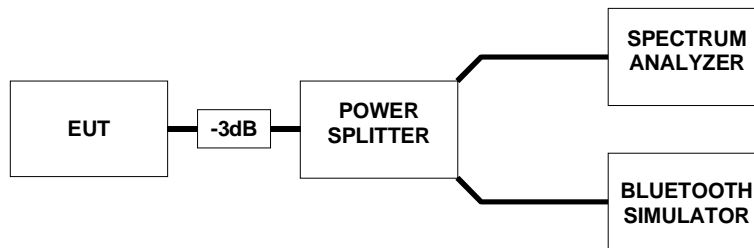
14 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

| | | | |
|-------------------------------------|-------------------|--------|----------|
| EUT | 20802 | | |
| Accessories | 20804 | | |
| Temp, Humidity, Air Pressure | 23 °C | 38 RH% | 1024 hPa |
| Date of measurement | February 16, 2007 | | |
| FCC rule part | 15.247, d | | |
| RSS-210 section | A8.5 | | |
| Measured by | Marko Turkkila | | |

14.1 Test setup and measurement method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 20: Test setup for band edge compliance measurement

Band edge compliance of RF-conducted emissions was measured by setting the band edge as center frequency in the spectrum analyzer and measuring the power on the transmission on channels 0 and 79. The measured power and power on the band edge was then compared.

14.2 Hopping enabled

14.2.1 EUT operation mode

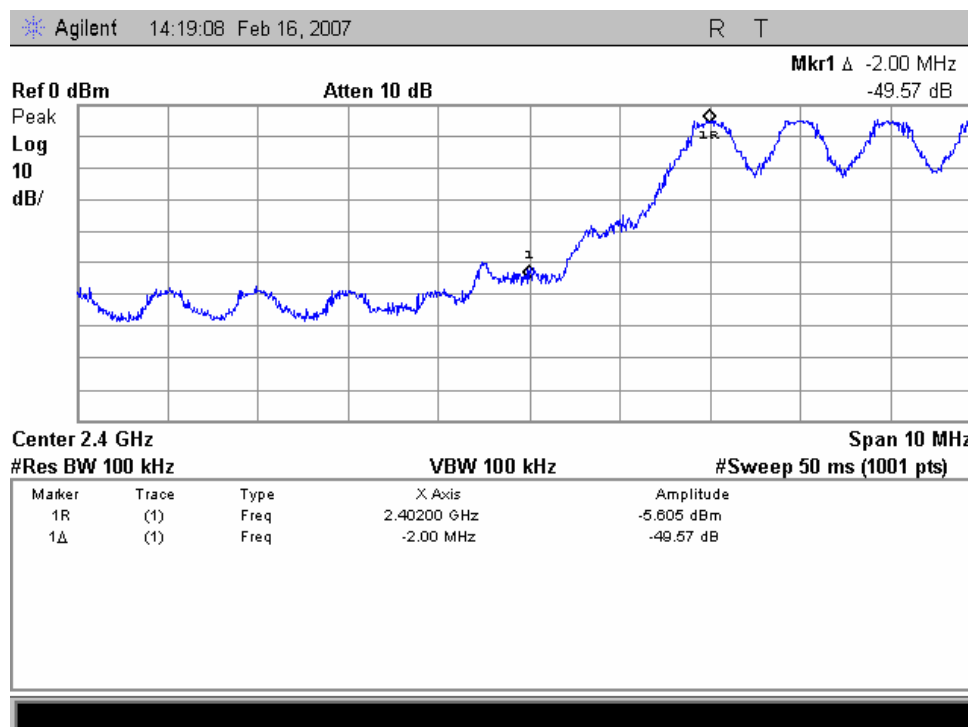
| | |
|---------------------------|-----------------------|
| EUT operation mode | Connection, DH5, PRBS |
| EUT channel | Hopping |
| EUT TX power level | 0 dBm |

14.2.2 Results

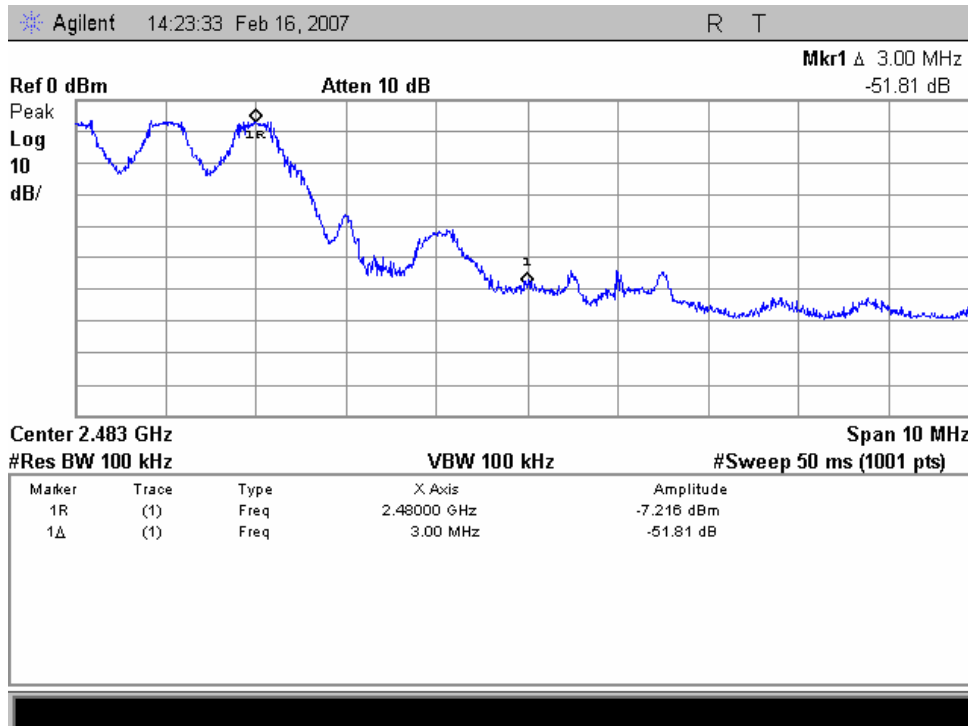
Table 8: Band edge compliance measurement results

| EUT Channel | Limit (dBc) | Test result (dBc) |
|-------------|-------------|-------------------|
| 0 | ≤ -20 | -49.6 |
| 78 | | -51.8 |

14.2.3 Screen shots



Picture 21: Band edge compliance, channel 0, hopping enabled



Picture 22: Band edge compliance, channel 78, hopping enabled

14.3 Hopping disabled

14.3.1 EUT operation mode

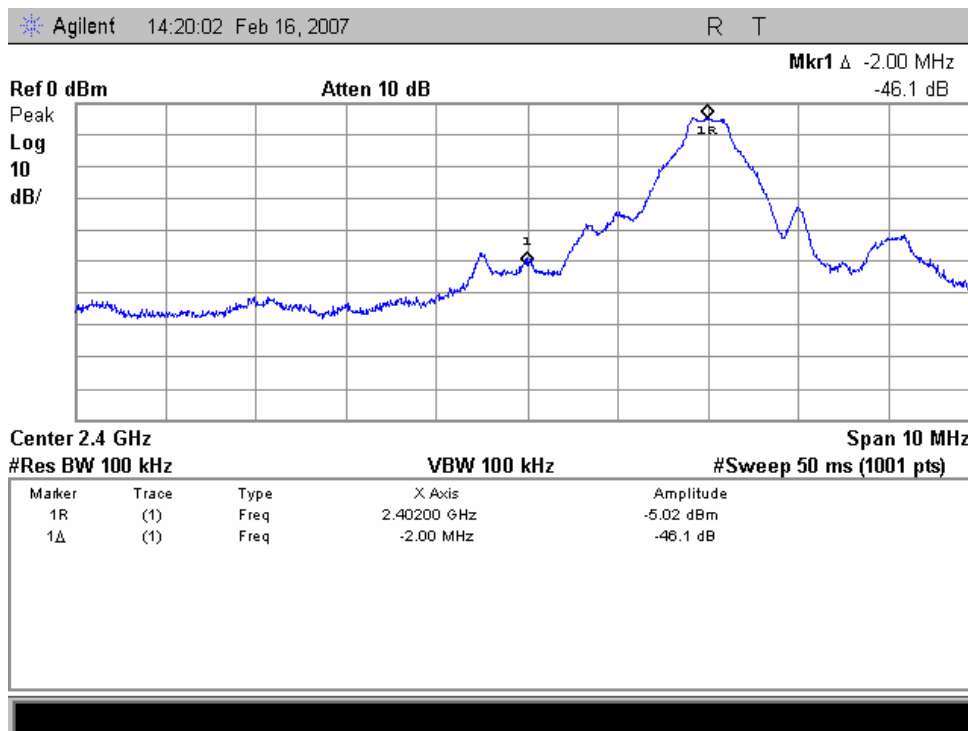
| | |
|---------------------------|-----------------------------|
| EUT operation mode | Connection, DM5, PRBS |
| EUT channel | 0 (2402 MHz), 78 (2480 MHz) |
| EUT TX power level | 0 dBm |

14.3.2 Results

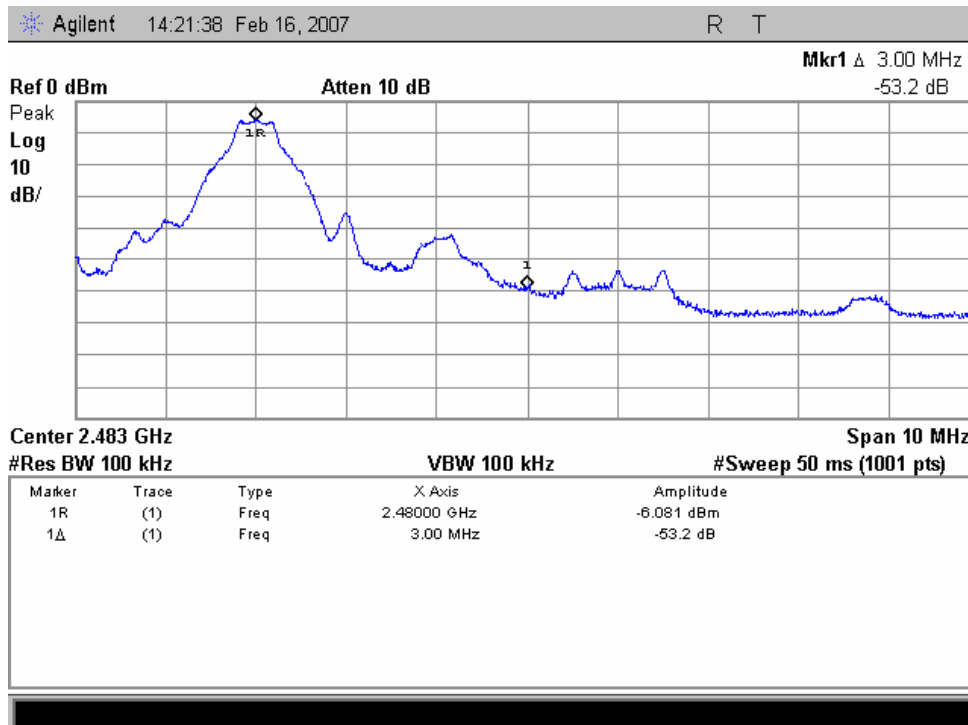
Table 9: Band edge compliance measurement results

| EUT Channel | Limit (dBc) | Test result (dBc) |
|-------------|-------------|-------------------|
| 0 | ≤ -20 | -46.1 |
| 79 | | -53.2 |

14.3.3 Screen shots



Picture 23: Band edge compliance, channel 0, hopping disabled



Picture 24: Band edge compliance, channel 78, hopping disabled

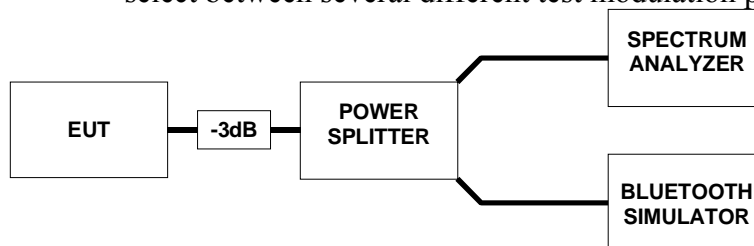
15 SPURIOUS RF CONDUCTED EMISSIONS

| | | | |
|-------------------------------------|------------------|--------|----------|
| EUT | 20802 | | |
| Accessories | 20804 | | |
| Temp, Humidity, Air Pressure | 19 °C | 29 RH% | 1008 hPa |
| Date of measurement | February 8, 2007 | | |
| FCC rule part | 15.247, d | | |
| RSS-210 section | A8.5 | | |
| Measured by | Jani Kiiski | | |

15.1 Test setup and measurement method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 25: Test setup for band edge compliance measurement

Spectrum analyzer and automated software were used to record conducted spurious emissions on frequency range 30 MHz – 25 GHz. Frequency range was scanned using 100 kHz resolution bandwidth and 50 kHz steps.

Spurious emissions levels relative to the carrier level were read from the measured results.

15.2 EUT operation mode

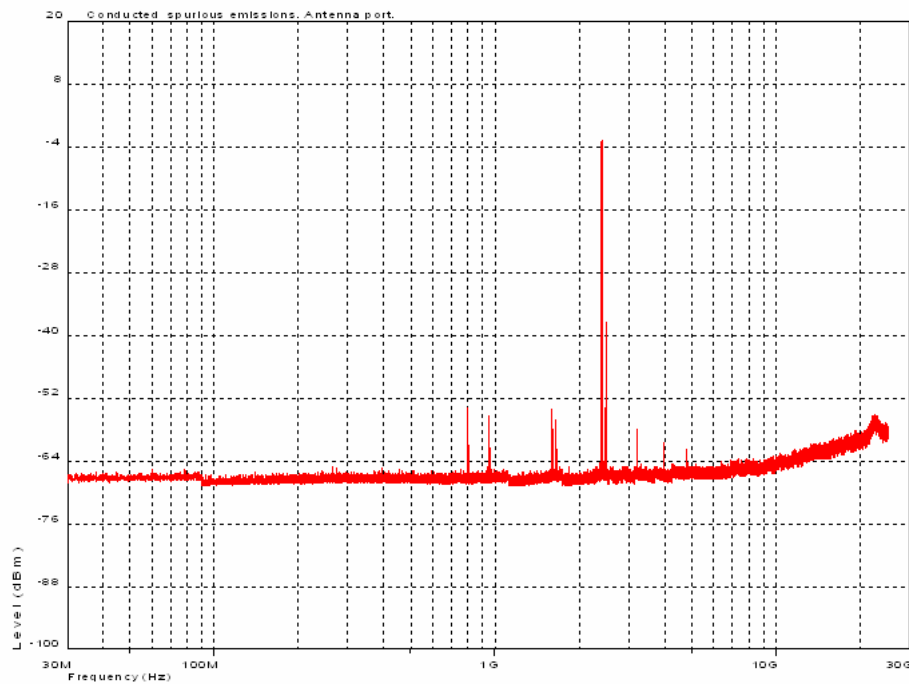
| | |
|---------------------------|-----------------------|
| EUT operation mode | Connection, DM5, PRBS |
| EUT channel | 0, 39 and 78 |
| EUT TX power level | 0 dBm |

15.3 Limit

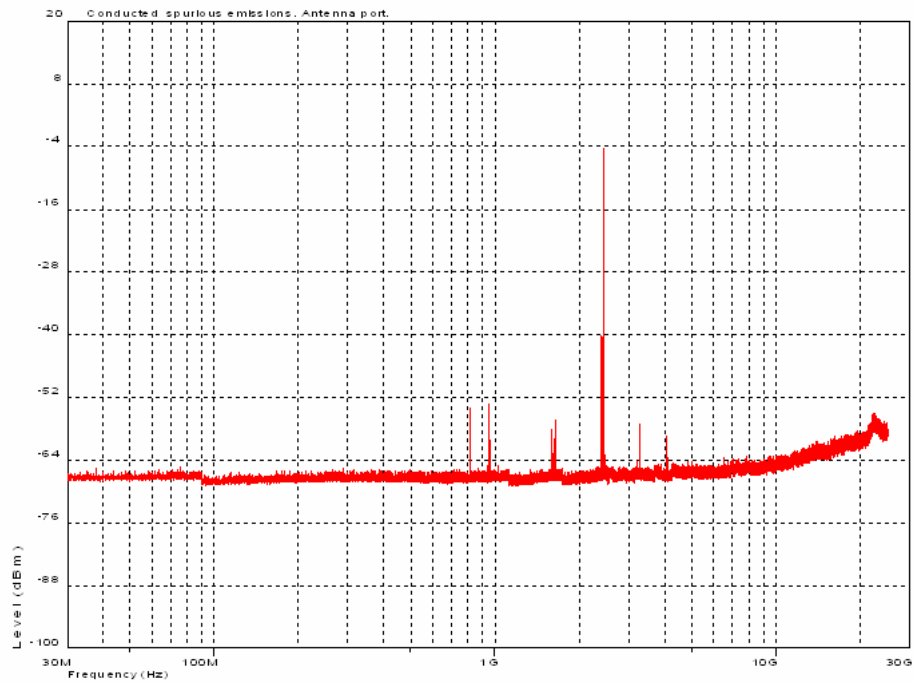
| EUT Channel | Limit (dBc) |
|-------------|-------------|
| 0 | ≤ -20 |
| 39 | |
| 78 | |

15.4 Results

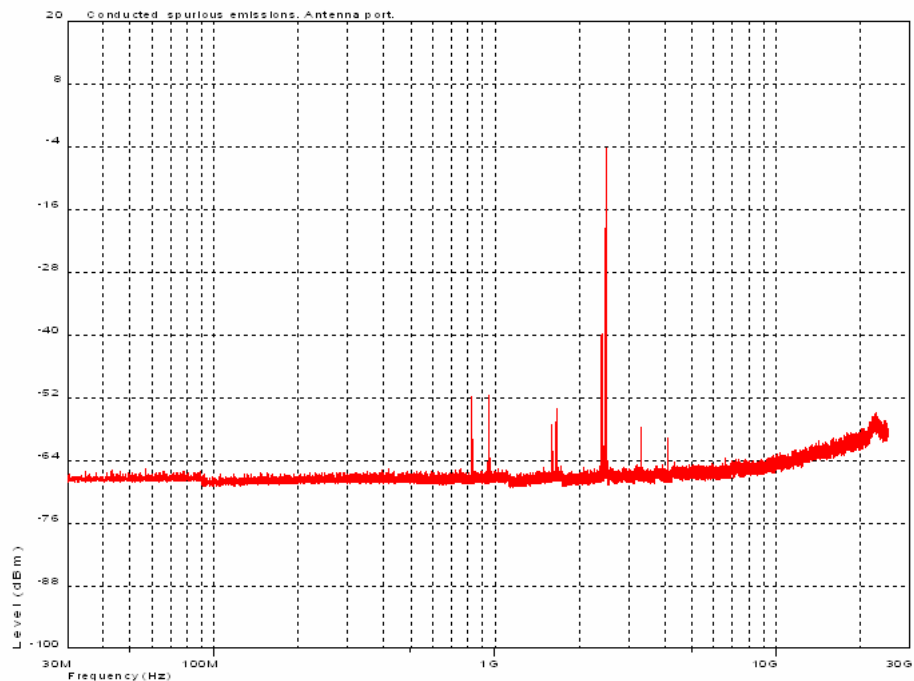
All spurious emissions measured were least 45 dB below the carrier level.



Picture 26: Conducted spurious emissions on antenna port, Channel 0



Picture 27: Conducted spurious emissions on antenna port, Channel 39



Picture 28: Conducted spurious emissions on antenna port, Channel 78

16 RADIATED SPURIOUS EMISSIONS

| | | | |
|-------------------------------------|----------------------|--------|---------|
| EUT | 20801 | | |
| Accessories | 20804 | | |
| Temp, Humidity, Air Pressure | 22 °C | 35 RH% | 992 hPa |
| Date of measurement | February 5 - 7, 2007 | | |
| FCC rule part | 15.247, d | | |
| RSS-210 section | A8.5 | | |
| Measured by | Jani Kiiski | | |

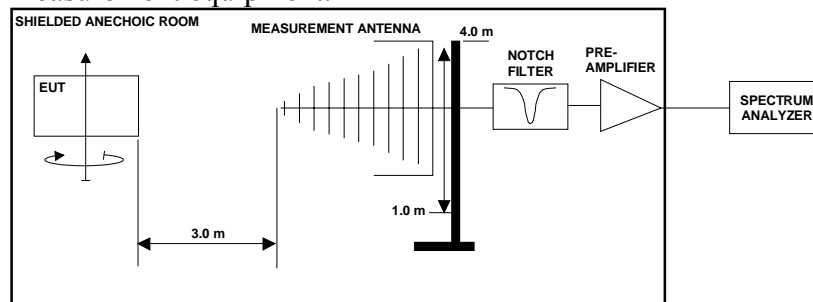
16.1 Test setup

The Bluetooth simulator was used to:

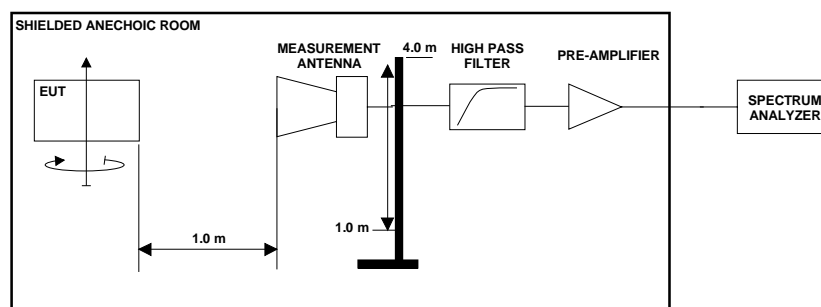
- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping

select between several different test modulation patterns

The test was done using an automated test system, where a computer controlled the measurement equipment.



Picture 29: Test setup for radiated spurious emissions measurement
30 MHz - 3 GHz frequencies



Picture 30: Test setup for radiated spurious emissions measurement
3 GHz – 25 GHz frequencies

16.2 Test method

1. The emissions were searched and maximized by moving the turntable, changing the measuring antenna polarization and height and manipulating the EUT.
2. Levels of suspicious signals and levels of EUT transmitter harmonics were recorded.
3. The recorded levels were corrected in the automated test system with the measurement antenna factor, cable attenuations and filter attenuation.
4. The corrected values, giving the EUT radiated spurious emission levels as dB μ V/m at 3 m distance, are reported.

16.3 EUT operation mode

| | |
|---------------------------|---|
| EUT operation mode | Connection mode, DM5, PRBS |
| EUT channel | 0 (2402 MHz), 39 (2441 MHz) and 78 (2480 MHz) |
| EUT TX power level | 0 dBm |

16.4 Limit

Table 10: Radiated spurious emission limits at measurement distance 3m

| Frequency band (MHz) | 3m Limit (μ V/m) | 3m Limit (dB μ V/m) | Detector |
|----------------------|-----------------------|-------------------------|----------|
| 30 – 88 | 100 | 40 | QP |
| 88 -216 | 150 | 43.5 | QP |
| 216 - 960 | 200 | 46 | QP |
| 960 - 1000 | 500 | 54.0 | QP |
| 1000 - 25000 | 500 | 54.0 | AVG |
| 1000 - 25000 | 5000 | 74.0 | PEAK |

As default, all emissions were compared against the general limits. If any emission exceeded that limit, it was further checked, if it was outside the restricted band thus complying with the -20dBc requirement.

16.5 Results

Measurement system noise level was least 15 dB below the spurious emission limit. Only levels of suspicious signals and transmitter harmonic frequencies, which were above the measurement system noise, are reported.

Table 11: Emission levels PEAK (QP) detector, channel 0

| Freq MHz | Measured Value dBuV | Correction Factor dB | Result dBuV/m | Marginal dBuV/m | EUT Position | Ant Pol. | Ant height |
|----------|---------------------|----------------------|---------------|-----------------|--------------|----------|------------|
| 4804.00 | 70.9 | -15.6 | 55.3 | -18.7 | Pos 1 | -- | 1.05 |
| 7206.00 | 53.3 | -3.8 | 49.5 | -24.5 | Pos 1 | -- | 1.1 |
| 9608.00 | 60.7 | -3.7 | 57.1 | -16.9 | Pos 1 | -- | 1.05 |
| 12010.00 | 55.3 | 1.8 | 57.0 | -17.0 | Pos 1 | V | 1.05 |

Table 12: Emission levels PEAK (QP) detector, channel 39

| Freq MHz | Measured Value dBuV | Correction Factor dB | Result dBuV/m | Marginal dBuV/m | EUT Position | Ant Pol. | Ant height |
|----------|---------------------|----------------------|---------------|-----------------|--------------|----------|------------|
| 4882.00 | 67.8 | -15.4 | 52.4 | -21.6 | Pos 1 | H | 1 |
| 7322.50 | 51.7 | -3.4 | 48.4 | -25.7 | Pos 3 | V | 1.15 |
| 9763.50 | 56.0 | -3.8 | 52.3 | -21.8 | Pos 1 | H | 1.1 |
| 12204.00 | 51.8 | 1.5 | 53.4 | -20.6 | Pos 1 | V | 1 |

Table 13: Emission levels PEAK (QP) detector, channel 78

| Freq MHz | Measured Value dBuV | Correction Factor dB | Result dBuV/m | Marginal dBuV/m | EUT Position | Ant Pol. | Ant height |
|----------|---------------------|----------------------|---------------|-----------------|--------------|----------|------------|
| 1600.00 | 39.5 | 10.9 | 50.4 | -23.6 | Pos 1 | V | 1 |
| 1654.00 | 40.5 | 11.3 | 51.8 | -22.2 | Pos 1 | V | 1 |
| 4960.00 | 67.0 | -15.2 | 51.8 | -22.2 | Pos 1 | H | 1.05 |
| 7440.00 | 45.8 | -3.0 | 42.8 | -31.2 | Pos 2 | V | 1.2 |
| 9920.00 | 47.0 | -3.4 | 43.6 | -30.4 | Pos 3 | V | 1.1 |
| 12400.00 | 44.9 | 1.3 | 46.2 | -27.8 | Pos 2 | V | 1 |

Table 14: Emission levels AVERAGE detector, channel 0

| Freq MHz | Measured Value dBuV | Correction Factor dB | Result dBuV/m | Marginal dBuV/m | EUT Position | Ant Pol. | Ant height |
|----------|---------------------|----------------------|---------------|-----------------|--------------|----------|------------|
| 4804.00 | 62.5 | -15.6 | 46.9 | -7.1 | Pos 1 | H | 1.05 |
| 7206.00 | 44.48 | -3.8 | 37.4 | -16.6 | Pos 3 | V | 1.15 |
| 9608.00 | 61.27 | -3.7 | 44.7 | -9.3 | Pos 1 | H | 1.05 |
| 12010.00 | 53.88 | 1.8 | 44.6 | -9.4 | Pos 1 | V | 1.05 |

Table 15: Emission levels AVERAGE detector, channel 39

| Freq MHz | Measured Value dBuV | Correction Factor dB | Result dBuV/m | Marginal dBuV/m | EUT Position | Ant Pol. | Ant height |
|----------|---------------------|----------------------|---------------|-----------------|--------------|----------|------------|
| 4882.00 | 52 | -15.4 | 36.6 | -17.4 | Pos 1 | H | 1 |
| 7322.50 | 54.04 | -3.4 | 36.6 | -17.4 | Pos 3 | V | 1.15 |
| 9763.50 | 57.62 | -3.8 | 40.2 | -13.8 | Pos 1 | H | 1.1 |
| 12204.00 | 53.64 | 1.5 | 39.8 | -14.3 | Pos 1 | V | 1 |

Table 16: Emission levels AVERAGE detector, channel 78

| Freq MHz | Measured Value dBuV | Correction Factor dB | Result dBuV/m | Marginal dBuV/m | EUT Position | Ant Pol. | Ant height |
|----------|---------------------|----------------------|---------------|-----------------|--------------|----------|------------|
| 1600.00 | 39.49 | 10.9 | 39.4 | -14.6 | Pos 1 | V | 1 |
| 1654.00 | 66.41 | 11.3 | 43.0 | -11.0 | Pos 1 | V | 1 |
| 4960.00 | 48.26 | -15.2 | 37.3 | -16.7 | Pos 1 | H | 1.05 |
| 7440.00 | 45.68 | -3.0 | 29.0 | -25.0 | Pos 2 | V | 1.2 |
| 9920.00 | 53.84 | -3.4 | 28.8 | -25.2 | Pos 3 | V | 1.1 |
| 12400.00 | 55.86 | 1.3 | 30.7 | -23.4 | Pos 3 | V | 1.05 |

17 CONDUCTED EMISSIONS TO AC-MAINS

| | | | |
|-------------------------------------|----------------------------|--------|----------|
| EUT | 20801 | | |
| Accessories | 20803, 20805, 20806, 20807 | | |
| Temp, Humidity, Air Pressure | 19 °C | 38 RH% | 1007 hPa |
| Date of measurement | February 12, 2007 | | |
| FCC rule part | §15.107 | | |
| RSS-GEN section | 7.2.2 | | |
| ICES-003 section | 5.3 | | |
| Measured by | Tuomo Eloranta | | |

17.1 Test setup

Charger was connected to line impedance stabilization network and conducted emissions to AC-mains were measured using measurement receiver.

The measurements were made using 110 V AC voltage.

17.2 EUT operation mode

EUT was connected to Laptop pc USB connector for charging mode.

17.3 Limits

| Frequency of emission [MHz] | FCC / IC | |
|-----------------------------|-------------------------|----------------------|
| | Limit [dBµV] Quasi peak | Limit [dBµV] Average |
| 0,15 – 0,50 | 66 – 56* | 56 – 46* |
| 0,50 – 5 | 56 | 46 |
| 5 – 30 | 60 | 50 |

* The limit decreases linearly with the logarithm of the frequency

17.4 Results

The measured interference values using peak and average detectors are shown in the pictures 3 and 4 below.

All signals closer than 6 dB to the limit have been measured using quasi peak and average detectors and reported in the table 17 and 18.

Table 17: Quasi peak detector measurement results, AC live

| Frequency [MHz] | Measured value [dB μ V] | Limit [dB μ V] | Margin to limit [dB] |
|-----------------|-----------------------------|--------------------|----------------------|
| 1.697 | 37.0 | 56.0 | -19.0 |
| 1.986 | 35.2 | 56.0 | -20.8 |

Table 18: Average detector measurement results. AC live

| Frequency [MHz] | Measured value [dB μ V] | Limit [dB μ V] | Margin to limit [dB] |
|-----------------|-----------------------------|--------------------|----------------------|
| - | - | - | - |

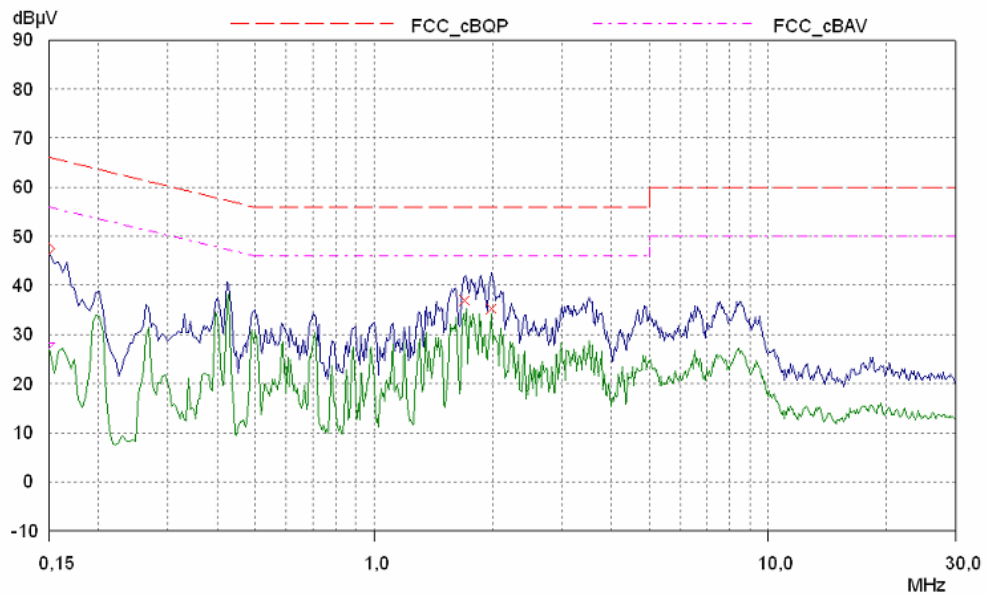
Table 19: Quasi peak detector measurement results. AC neutral

| Frequency [MHz] | Measured value [dB μ V] | Limit [dB μ V] | Margin to limit [dB] |
|-----------------|-----------------------------|--------------------|----------------------|
| 0.423 | 40.4 | 57.4 | -17.0 |
| 1.806 | 37.0 | 56.0 | -19.0 |

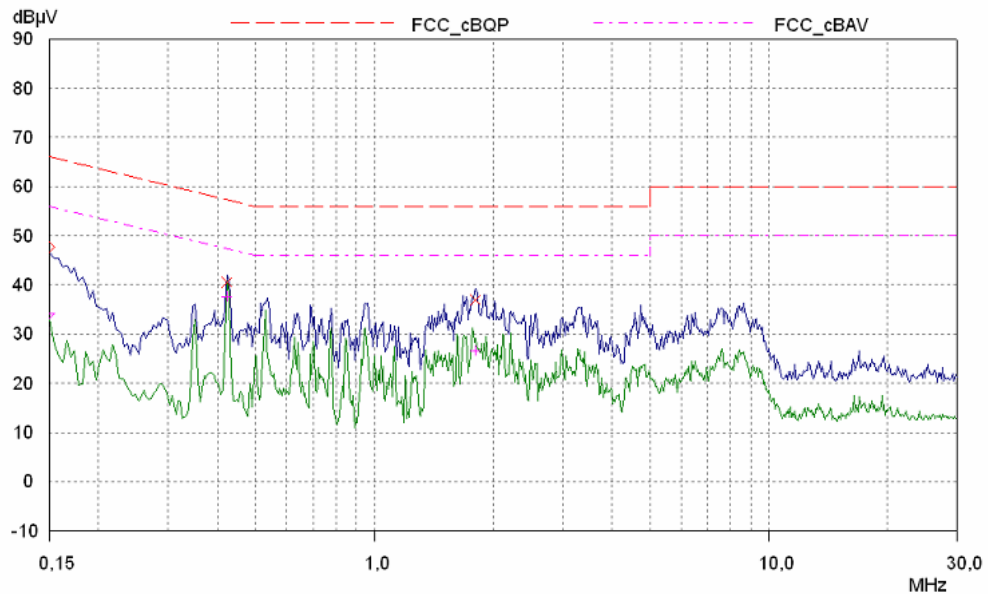
Table 20: Average detector measurement results. AC neutral

| Frequency [MHz] | Measured value [dB μ V] | Limit [dB μ V] | Margin to limit [dB] |
|-----------------|-----------------------------|--------------------|----------------------|
| 0.423 | 37.6 | 47.4 | -9.8 |
| 1.806 | 26.7 | 46.0 | -19.3 |

17.5 Screen shots



Picture 31: AC-mains conducted emission measurement results. AC live



Picture 32: AC-mains conducted emission measurement results. AC neutral

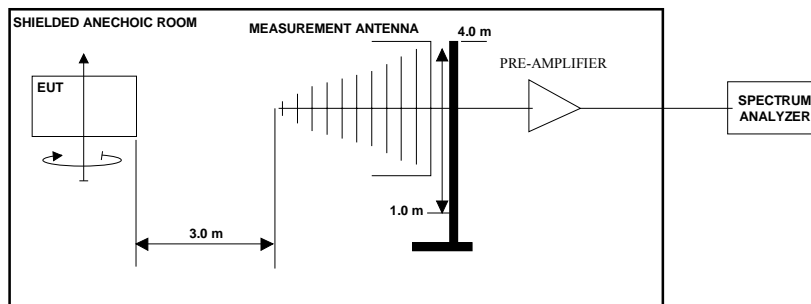
18 RECEIVER RADIATED EMISSION

| | | | |
|---|----------------------------|--------|----------|
| EUT | 20801 | | |
| Accessories | 20803. 20805. 20806. 20807 | | |
| Temp. Humidity. Air Pressure | 20 °C | 30 RH% | 1010 hPa |
| Date of measurement | February 9 - 14. 2007 | | |
| FCC rule part | §15.109 | | |
| RSS-GEN section | 7.2.3 | | |
| ICES-003 section | 5.5 | | |
| Measured by | Tuomo Eloranta | | |

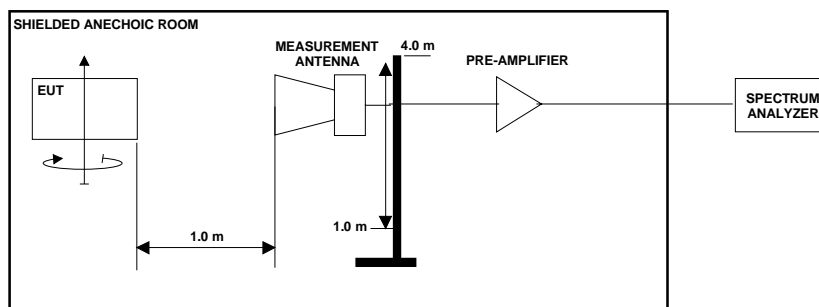
18.1 Test setup

The test was done using an automated test system, where a computer controlled the measurement equipments.

The measurements were made using 110 V AC voltage.



Picture 33: Test setup for radiated spurious emissions measurement
30 MHz - 1 GHz frequencies



Picture 34: Test setup for radiated spurious emissions measurement
1 GHz - 12.4 GHz frequencies

18.2 Test method

1. The emissions were searched and maximized by moving the turntable. changing the measuring antenna polarization and height and manipulating the EUT.
2. Levels of suspicious signals and levels of EUT transmitter harmonics were recorded.
3. The recorded levels were corrected in the automated test system with the measurement antenna factor. cable attenuations and filter attenuation.
4. The corrected values. giving the EUT radiated spurious emission levels as dB μ V/m at 3 m distance. are reported.

18.3 EUT operation mode

EUT was connected to Laptop pc USB connector for charging mode.

| | |
|---------------------------|---------------|
| EUT operation mode | Receiver mode |
| EUT frequency | Na |
| EUT TX power level | Na |

18.4 Limit

Table 21: Radiated spurious emission limits at measurement distance 3m

| Frequency band (MHz) | 3m Limit (μV/m) | 3m Limit (dBμV/m) | Detector |
|-----------------------------|---------------------------------------|---|-----------------|
| 30 – 88 | 100 | 40 | QP |
| 88 -216 | 150 | 43.5 | QP |
| 216 - 960 | 200 | 46 | QP |
| 960 - 1000 | 500 | 54.0 | QP |
| 1000 - 12400 | 500 | 54.0 | AVG |
| 1000 - 12400 | 5000 | 74.0 | PEAK |

As default. all emissions were compared against the general limits. If any emission exceeded that limit. it was further checked. if it was outside the restricted band thus complying with the -20dBc requirement.

18.5 Results

The measured interference values using Quasi peak and average detectors are shown in the pictures below.

All signals closer than 6 dB to the limit below 1 GHz have been measured using quasi peak or average detector and reported in the table 22. 23 and 24.

Table 22: Radiated emissions using Quasi peak detector

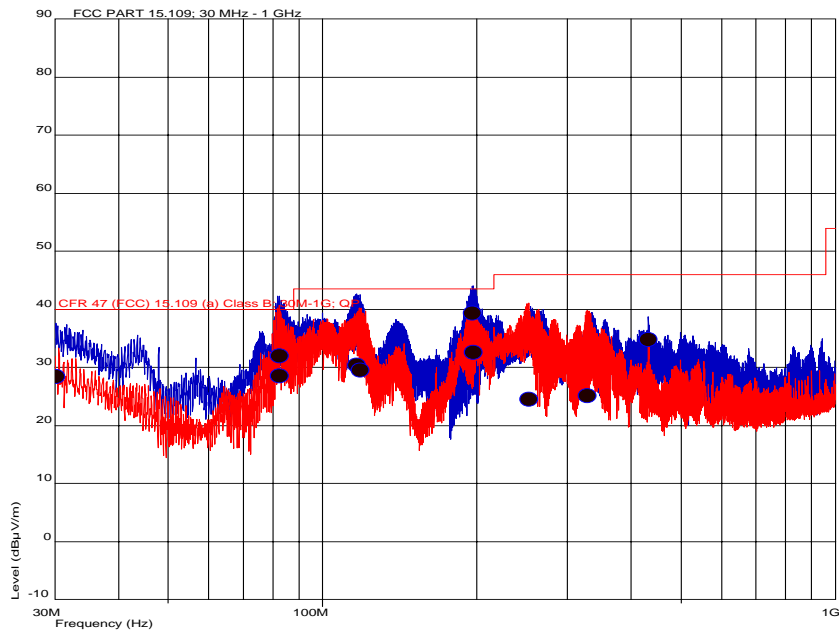
| Freq MHz | Measured Value dBuV | Correction Factor dB | Result dBuV/m | Marginal dBuV/m | EUT Position | Ant Pol. | Ant height | TT angle |
|----------|---------------------|----------------------|---------------|-----------------|--------------|----------|------------|----------|
| 30.240 | 27.9 | 0.5 | 28.4 | -11.5 | POS 1 | V | 2.3 | 234 |
| 82.200 | 42.6 | -14.0 | 28.5 | -11.4 | POS 1 | H | 2.4 | 34 |
| 82.320 | 46.0 | -14.0 | 32.0 | -7.9 | POS 1 | V | 2.6 | 100 |
| 116.580 | 41.1 | -10.7 | 30.3 | -13.1 | POS 1 | V | 1.1 | 22 |
| 118.440 | 40.1 | -10.6 | 29.5 | -13.9 | POS 1 | V | 1 | 25 |
| 195.720 | 50.9 | -11.5 | 39.4 | -4.1 | POS 1 | V | 1 | 65 |
| 196.380 | 44.1 | -11.4 | 32.6 | -10.8 | POS 1 | V | 1.3 | 77 |
| 252.120 | 34.0 | -9.4 | 24.5 | -21.4 | POS 1 | H | 1.3 | 246 |
| 328.560 | 31.9 | -6.8 | 25.1 | -20.8 | POS 1 | H | 2.8 | 254 |
| 431.640 | 39.0 | -4.2 | 34.7 | -11.2 | POS 1 | V | 1.2 | 159 |

Table 23: Radiated emissions using Peak detector

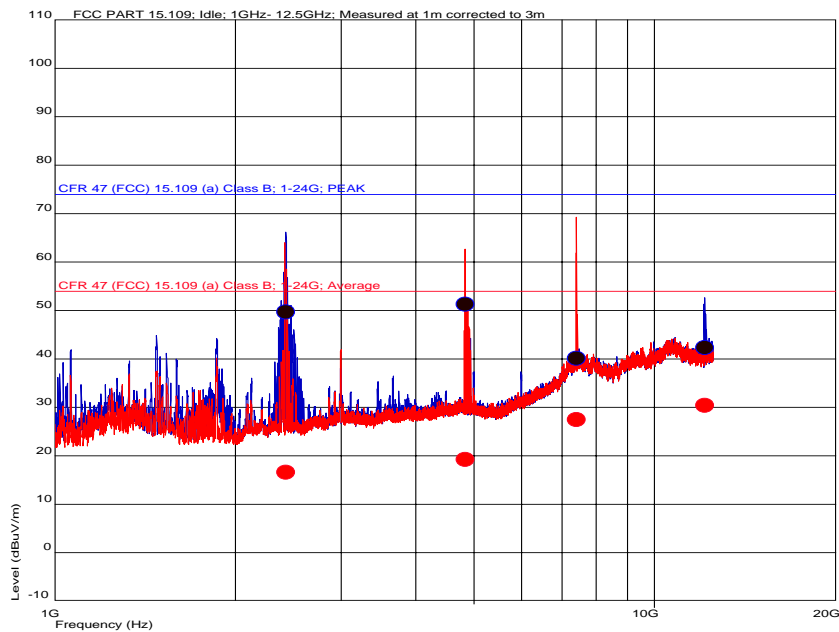
| Freq MHz | Measured Value dBuV | Correction Factor dB | Result dBuV/m | Marginal dBuV/m | EUT Position | Ant Pol. | Ant height | TT angle |
|-----------|---------------------|----------------------|---------------|-----------------|--------------|----------|------------|----------|
| 2427.500 | 72.8 | -23.2 | 49.6 | -24.3 | POS 1 | V | 1.4 | 94 |
| 4826.000 | 67.6 | -16.2 | 51.3 | -22.6 | POS 1 | H | 1.8 | 24 |
| 7412.500 | 43.7 | -3.5 | 40.2 | -33.8 | POS 1 | H | 1.9 | 136 |
| 12128.500 | 41.1 | 1.1 | 42.2 | -31.7 | POS 1 | V | 1.4 | 321 |

Table 24: Radiated emissions using Average detector

| Freq MHz | Measured Value dBuV | Correction Factor dB | Result dBuV/m | Marginal dBuV/m | EUT Position | Ant Pol. | Ant height | TT angle |
|-----------|---------------------|----------------------|---------------|-----------------|--------------|----------|------------|----------|
| 2427.500 | 39.7 | -23.2 | 16.5 | -37.4 | POS 1 | V | 1.4 | 94 |
| 4826.000 | 35.5 | -16.2 | 19.2 | -34.7 | POS 1 | H | 1.8 | 24 |
| 7412.500 | 30.9 | -3.5 | 27.4 | -26.5 | POS 1 | H | 1.9 | 136 |
| 12128.500 | 29.3 | 1.1 | 30.4 | -23.5 | POS 1 | V | 1.4 | 321 |



Picture 35: radiated emission results. 30 – 1000 MHz.
Red= horizontal polarization. blue = vertical polarization



Picture 36: radiated emission results. 1 – 12.4 GHz.
Red= horizontal polarization. blue = vertical polarization

19 TEST EQUIPMENT

All testing and measurement equipment has been calibrated once a year, except the antennas which are calibrated every two years.

19.1 Conducted measurements

| Equipment | Manufacturer | Model |
|---|-----------------|----------|
| Spectrum Analyzer | Agilent | E7405A |
| Bluetooth Simulator | Anritsu | MT8850A |
| Measurement receiver | Rohde & Schwarz | ESCS 30 |
| Attenuator 3 dB | Narda | 779-3 |
| Power splitter | Mini Circuits | ZFSC-2-4 |
| Power splitter | Narda | 4426-2 |
| Transient limiter / 10 dB attenuator | Chase | CFL 9206 |
| Line Impedance Stabilization Network (LISN) | Rohde & Schwarz | ESH 3-Z5 |

19.2 Radiated measurements

| Equipment | Manufacturer | Model |
|--------------------------------------|------------------------|------------------------|
| Spectrum Analyzer | Agilent | E7405A |
| Bluetooth simulator | Anritsu | MT8850A |
| Antenna | Chase | CBL 6141 |
| Antenna | Schwarzbeck | BBHA 9120D |
| Antenna | Schwarzbeck | BBHA 9170 |
| High pass filter | Wainwright Instruments | WHK3.0/18GST |
| Pre-amplifier | Agilent | 87405B |
| Pre-amplifier | JCA | 118-400 |
| Pre-amplifier | Miteq | AMF-6F-18002650-25-10P |
| Turn table / antenna mast controller | EMCO | 2090 |
| Antenna mast | EMCO | 2075-2 |

20 TEST SETUP PHOTOGRAPHS

Test setup photograph can be found in a separate document

T07-208A-EMC_PHOTOS.doc