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# FCC Measurement/Technical Report on GSM/UMTS Module Siemens HMS1

**Report Reference:** 4\_Siem\_0706\_UMTS\_FCCb

**Test Laboratory:**

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**Note:**

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the testing laboratory.

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## **0 Summary**

### **0.1 Technical Report Summary**

#### **Type of Authorization**

Certification for a GSM cellular radiotelephone device

#### **Applicable FCC Rules**

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 19 and Parts 20 to 69 (10-1-05 Edition). The following subparts are applicable to the results in this test report.

#### **Part 2**

##### **Subpart J - Equipment Authorization Procedures, Certification**

- § 2.1046 Measurement required: RF power output
- § 2.1049 Measurement required: Occupied bandwidth
- § 2.1051 Measurement required: Spurious emissions at antenna terminals
- § 2.1053 Measurement required: Field strength of spurious radiation
- § 2.1055 Measurement required: Frequency stability
- § 2.1057 Frequency spectrum to be investigated

#### **Part 24**

##### **Subpart E - Broadband PCS**

- § 24.232 Power and antenna height limits
- § 24.235 Frequency stability
- § 24.236 Field strength limits
- § 24.238 Emission limitations for Broadband PCS equipment

#### **Summary Test Results:**

**The EUT complied with all performed tests as listed in chapter 0.2 Measurement Summary.**

## 0.2 Measurement Summary

### RF Power Output

The measurement was performed according to FCC §2.1046 10-1-05

| OP-Mode   | Setup     | Port              | Final Result |
|-----------|-----------|-------------------|--------------|
| op-mode 1 | Setup_a01 | antenna connector | passed       |
| op-mode 2 | Setup_a01 | antenna connector | passed       |
| op-mode 3 | Setup_a01 | antenna connector | passed       |
| op-mode 4 | Setup_a01 | antenna connector | passed       |
| op-mode 5 | Setup_a01 | antenna connector | passed       |
| op-mode 6 | Setup_a01 | antenna connector | passed       |

### Frequency stability

The measurement was performed according to FCC §2.1055 10-1-05

| OP-Mode   | Setup     | Port              | Final Result |
|-----------|-----------|-------------------|--------------|
| op-mode 2 | Setup_a01 | antenna connector | passed       |
| op-mode 4 | Setup_a01 | antenna connector | passed       |

### Spurious emissions at antenna terminals

The measurement was performed according to FCC §2.1051 10-1-05

| OP-Mode   | Setup     | Port              | Final Result |
|-----------|-----------|-------------------|--------------|
| op-mode 1 | Setup_a01 | antenna connector | passed       |
| op-mode 2 | Setup_a01 | antenna connector | passed       |
| op-mode 3 | Setup_a01 | antenna connector | passed       |
| op-mode 4 | Setup_a01 | antenna connector | passed       |
| op-mode 5 | Setup_a01 | antenna connector | passed       |
| op-mode 6 | Setup_a01 | antenna connector | passed       |

### Field strength of spurious radiation

The measurement was performed according to FCC §2.1053 10-1-05

| OP-Mode   | Setup     | Port      | Final Result |
|-----------|-----------|-----------|--------------|
| op-mode 1 | Setup_a01 | enclosure | passed       |
| op-mode 2 | Setup_a01 | enclosure | passed       |
| op-mode 3 | Setup_a01 | enclosure | passed       |
| op-mode 4 | Setup_a01 | enclosure | passed       |
| op-mode 5 | Setup_a01 | enclosure | passed       |
| op-mode 6 | Setup_a01 | enclosure | passed       |

### Emission and Occupied Bandwidth

The measurement was performed according to FCC §2.1049 10-1-05

| OP-Mode   | Setup     | Port              | Final Result |
|-----------|-----------|-------------------|--------------|
| op-mode 1 | Setup_a01 | antenna connector | passed       |
| op-mode 2 | Setup_a01 | antenna connector | passed       |
| op-mode 3 | Setup_a01 | antenna connector | passed       |
| op-mode 4 | Setup_a01 | antenna connector | passed       |
| op-mode 5 | Setup_a01 | antenna connector | passed       |
| op-mode 6 | Setup_a01 | antenna connector | passed       |

---

**Band edge compliance**

The measurement was performed according to FCC §24.238

10-1-05

| OP-Mode   | Setup     | Port              | Final Result |
|-----------|-----------|-------------------|--------------|
| op-mode 1 | Setup_a01 | antenna connector | passed       |
| op-mode 3 | Setup_a01 | antenna connector | passed       |
| op-mode 4 | Setup_a01 | antenna connector | passed       |
| op-mode 6 | Setup_a01 | antenna connector | passed       |

Responsible for  
Accreditation Scope:

*Machulec*

Responsible  
for Test Report:

*A. Polz*



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## **1 Administrative Data**

### **1.1 Testing Laboratory**

|               |                                            |
|---------------|--------------------------------------------|
| Company Name: | 7 Layers AG                                |
| Address       | Borsigstr. 11<br>40880 Ratingen<br>Germany |

This facility has been fully described in a report submitted to the FCC and accepted under the registration number 96716 .

The test facility is also accredited by the following accreditation organisation:  
- Deutscher Akkreditierungs Rat                      DAR-Registration no. DAT-P-192/99-01

|                                      |                                                                                    |
|--------------------------------------|------------------------------------------------------------------------------------|
| Responsible for Accreditation Scope: | Dipl.-Ing. Bernhard Retka<br>Dipl.-Ing. Robert Machulec<br>Dipl.-Ing. Thomas Hoell |
|--------------------------------------|------------------------------------------------------------------------------------|

|                          |            |
|--------------------------|------------|
| Report Template Version: | 2006-08-31 |
|--------------------------|------------|

### **1.2 Project Data**

|                                     |                          |
|-------------------------------------|--------------------------|
| Responsible for testing and report: | Dipl.-Ing. Andreas Petz  |
| Receipt of EUT:                     | 2006-07-28               |
| Date of Test(s):                    | 2006-07-29 to 2006-08-02 |
| Date of Report:                     | 2006-09-25               |

### **1.3 Applicant Data**

|                 |                                           |
|-----------------|-------------------------------------------|
| Company Name:   | Siemens AG                                |
| Address:        | Siemensdamm 50<br>13629 Berlin<br>Germany |
| Contact Person: | Mr. Thorsten Liebig                       |

### **1.4 Manufacturer Data**

|                 |                           |
|-----------------|---------------------------|
| Company Name:   | please see applicant data |
| Address:        |                           |
| Contact Person: |                           |

## 2 Testobject Data

### 2.1 General EUT Description

|                                             |                                                |
|---------------------------------------------|------------------------------------------------|
| <b>Equipment under Test:</b>                | GSM/UMTS Module                                |
| <b>Type Designation:</b>                    | Siemens HMS1                                   |
| <b>Kind of Device:</b><br><b>(optional)</b> | GSM 850/900/1800/1900 and UMTS FDD I<br>module |
| <b>Voltage Type:</b>                        | DC                                             |
| <b>Nominal Voltage:</b>                     | 3.6 V                                          |
| <b>Maximum Voltage:</b>                     | –                                              |
| <b>Minimum Voltage:</b>                     | –                                              |

#### **General product description:**

The Equipment Under Test (EUT) is a GSM 850/900/1800/1900 module and supports GSM and EDGE mode and FDD I.

The manufacturer declared that nominal voltage is equal to minimum as well as maximum voltage.

In PCS1900 mode the EUT operates in blocks A through F from 1850.2 MHz (lowest channel = 512) to 1909.8 MHz (highest channel = 810).

#### **The EUT provides the following ports:**

##### **Ports**

antenna connector  
enclosure  
control connector

**The main components of the EUT are listed and described in Chapter 2.2**

## 2.2 EUT Main components

### Type, S/N, Short Descriptions etc. used in this Test Report

| Short Description                                                                                                                                                                                                                     | Equipment under Test              | Type Designation            | Serial No. | HW Status | SW Status               | Date of Receipt |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------|------------|-----------|-------------------------|-----------------|
| EUT A<br>(Code: 01800e03)<br>Remark:<br>EUT A is equipped with a port for an integral antenna and also with a temporary/service antenna connector which automatically switches off the integral antenna if a connector is plugged-in. | GSM/UMTS Module                   | Siemens HMS1                | 008578     | B2.3      | 1.62 + changed NV items | 2006-07-28      |
| EUT B<br>(Code: 01800ant1)                                                                                                                                                                                                            | Integral Antenna for Siemens HMS1 | Skycross WBA ELEMENT 2-2645 | –          | 08/02/05  | –                       | 2006-07-28      |

Remark: EUT B is an integral antenna (gain= 2.25 dBi) which is permanently connected to the EUT A.

**NOTE:** The short description is used to simplify the identification of the EUT in this test report.

## 2.3 Ancillary Equipment

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

| Short Description | Equipment under Test | Type Designation | HW Status   | SW Status | Serial no. | FCC ID |
|-------------------|----------------------|------------------|-------------|-----------|------------|--------|
| AE1               | DSB75 Support Board  | DSB75 BCTB       | B1.1 / 94V0 | –         | 0412383    | –      |

## 2.4 EUT Setups

This chapter describes the combination of EUT's and ancillary equipment used for testing.

| Setup No. | Combination of EUTs | Description                            |
|-----------|---------------------|----------------------------------------|
| setup_a01 | EUT A + EUT B + AE1 | setup for conducted and radiated tests |

## 2.5 Operating Modes

This chapter describes the operating modes of the EUT's used for testing.

| Op. Mode              | Description of Operating Modes                                                 | Remarks                                      |
|-----------------------|--------------------------------------------------------------------------------|----------------------------------------------|
| <b>PCS data call</b>  |                                                                                |                                              |
| op-mode 1             | Call established on Traffic Channel (TCH)<br>512, Carrier Frequency 1850.2 MHz | 512 is the lowest channel<br>PCS data call   |
| op-mode 2             | Call established on Traffic Channel (TCH)<br>661, Carrier Frequency 1880 MHz   | 661 is a mid channel<br>PCS data call        |
| op-mode 3             | Call established on Traffic Channel (TCH)<br>810, Carrier Frequency 1909.8 MHz | 810 is the highest channel<br>PCS data call  |
| <b>EDGE data call</b> |                                                                                |                                              |
| op-mode 4             | Call established on Traffic Channel (TCH)<br>512, Carrier Frequency 1850.2 MHz | 512 is the lowest channel<br>EDGE data call  |
| op-mode 5             | Call established on Traffic Channel (TCH)<br>661, Carrier Frequency 1880 MHz   | 661 is a mid channel<br>EDGE data call       |
| op-mode 6             | Call established on Traffic Channel (TCH)<br>810, Carrier Frequency 1909.8 MHz | 810 is the highest channel<br>EDGE data call |

## 3 Test Results

### 3.1 RF Power Output

**Standard**      FCC Part 24, 10-1-05  
                     Subpart E

The test was performed according to: FCC §2.1046, 10-1-05

#### 3.1.1 Test Description

1) The EUT was coupled to the R&S Spectrum Analyser and the R&S CMD55 / CMU200 Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".

2) The total insertion losses for RF Path 1 and RF Path 2 were measured. The values were used to correct the readings from the R&S Spectrum Analyser and the R&S CMD55 / CMU200 Digital Communication Tester.

3) A call was established on a Traffic Channel (TCH) between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).

Important Settings:

- Discontinuous Transmission: OFF
- Modulation Signal: PSR16-1 (Pseudo Random Sequence)
- Output Power: Varied during measurements
- Channel (Frequency): Varied during measurements

4) The transmitted power of the EUT was recorded for all possible power control level by using an internal measurement function of the CMD55 / CMU200.

5) During this test the Spectrum Analyser was only used to check if the results are comprehensible.

#### 3.1.2 Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.

§24.232 Power and antenna height limits

(c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

(d) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the

emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

### 3.1.3 Test Protocol

Temperature: 26 °C  
Air Pressure: 1004 hPa  
Humidity: 42 %

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 1 | setup_a01 | antenna connector |

| Power Control Level | Output power Nominal (dBm) | Output power Measured (dBm) | Difference dB |
|---------------------|----------------------------|-----------------------------|---------------|
| 0                   | 30                         | 29.4                        | -0.6          |
| 1                   | 28                         | 27.4                        | -0.6          |
| 2                   | 26                         | 24.9                        | -1.1          |
| 3                   | 24                         | 23.4                        | -0.6          |
| 4                   | 22                         | 21.9                        | -0.1          |
| 5                   | 20                         | 20.4                        | 0.4           |
| 6                   | 18                         | 18.4                        | 0.4           |
| 7                   | 16                         | 16.4                        | 0.4           |
| 8                   | 14                         | 14.4                        | 0.4           |
| 9                   | 12                         | 12.4                        | 0.4           |
| 10                  | 10                         | 10.4                        | 0.4           |
| 11                  | 8                          | 8.4                         | 0.4           |
| 12                  | 6                          | 6.4                         | 0.4           |
| 13                  | 4                          | 4.4                         | 0.4           |
| 14                  | 2                          | 2.4                         | 0.4           |
| 15                  | 0                          | 0.4                         | 0.4           |

Remark: The EIRP including antenna gain (2.25 dBi) is 31.65 dBm.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 2 | setup_a01 | antenna connector |

| Power Control Level | Output power Nominal (dBm) | Output power Measured (dBm) | Difference dB |
|---------------------|----------------------------|-----------------------------|---------------|
| 0                   | 30                         | 29.6                        | -0.4          |
| 1                   | 28                         | 27.6                        | -0.4          |
| 2                   | 26                         | 25.0                        | -1.0          |
| 3                   | 24                         | 23.5                        | -0.5          |
| 4                   | 22                         | 22.0                        | 0.0           |
| 5                   | 20                         | 20.5                        | 0.5           |
| 6                   | 18                         | 18.5                        | 0.5           |
| 7                   | 16                         | 16.5                        | 0.5           |
| 8                   | 14                         | 14.5                        | 0.5           |
| 9                   | 12                         | 12.5                        | 0.5           |
| 10                  | 10                         | 10.5                        | 0.5           |
| 11                  | 8                          | 8.5                         | 0.5           |
| 12                  | 6                          | 6.5                         | 0.5           |
| 13                  | 4                          | 4.5                         | 0.5           |
| 14                  | 2                          | 2.5                         | 0.5           |
| 15                  | 0                          | 0.5                         | 0.5           |

Remark: The EIRP including antenna gain (2.25 dBi) is 31.85 dBm.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 3 | setup_a01 | antenna connector |

| Power Control Level | Output power Nominal (dBm) | Output power Measured (dBm) | Difference dB |
|---------------------|----------------------------|-----------------------------|---------------|
| 0                   | 30                         | 29.5                        | -0.5          |
| 1                   | 28                         | 27.5                        | -0.5          |
| 2                   | 26                         | 25.0                        | -1.0          |
| 3                   | 24                         | 23.5                        | -0.5          |
| 4                   | 22                         | 22.0                        | 0.0           |
| 5                   | 20                         | 20.5                        | 0.5           |
| 6                   | 18                         | 18.5                        | 0.5           |
| 7                   | 16                         | 16.5                        | 0.5           |
| 8                   | 14                         | 14.5                        | 0.5           |
| 9                   | 12                         | 12.5                        | 0.5           |
| 10                  | 10                         | 10.5                        | 0.5           |
| 11                  | 8                          | 8.5                         | 0.5           |
| 12                  | 6                          | 6.5                         | 0.5           |
| 13                  | 4                          | 4.5                         | 0.5           |
| 14                  | 2                          | 2.5                         | 0.5           |
| 15                  | 0                          | 0.4                         | 0.4           |

Remark: The EIRP including antenna gain (2.25 dBi) is 31.75 dBm.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 4 | setup_a01 | antenna connector |

| Power Control Level | Output power Nominal (dBm) | Output power Measured (dBm) | Difference dB |
|---------------------|----------------------------|-----------------------------|---------------|
| 0                   | 30                         | 28.3                        | -1.7          |

Remark: The EIRP including antenna gain (2.25 dBi) is 30.55 dBm.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 5 | setup_a01 | antenna connector |

| Power Control Level | Output power Nominal (dBm) | Output power Measured (dBm) | Difference dB |
|---------------------|----------------------------|-----------------------------|---------------|
| 0                   | 30                         | 28.4                        | -1.6          |

Remark: The EIRP including antenna gain (2.25 dBi) is 30.65 dBm.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 6 | setup_a01 | antenna connector |

| Power Control Level | Output power Nominal (dBm) | Output power Measured (dBm) | Difference dB |
|---------------------|----------------------------|-----------------------------|---------------|
| 0                   | 30                         | 28.4                        | -1.6          |

Remark: The EIRP including antenna gain (2.25 dBi) is 30.65 dBm.



### 3.1.4 Test result: RF Power Output

| FCC Part 24, Subpart E | Op. Mode  | Result |
|------------------------|-----------|--------|
|                        | op-mode 1 | passed |
|                        | op-mode 2 | passed |
|                        | op-mode 3 | passed |
|                        | op-mode 4 | passed |
|                        | op-mode 5 | passed |
|                        | op-mode 6 | passed |
|                        |           |        |

### 3.2 Frequency stability

**Standard**      FCC Part 24, 10-1-05  
                     Subpart E

**The test was performed according to FCC §2.1055, 10-1-05**

#### 3.2.1 Test Description

- 1) The EUT was placed inside the climatic chamber.
- 2) The EUT was coupled to the R&S CMD55 / CMU200 Digital Communication Tester. Refer to chapter "Setup Drawings".
- 3) The climatic chamber was cycled down/up to a certain temperature, starting with  $-30^{\circ}\text{C}$ .
- 4) After the temperature was stabilized (at least one hour) the EUT was switched on and a call was established on a Traffic Channel (TCH) between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).  
Important Settings:
  - Discontinuous Transmission: OFF
  - Modulation Signal: PSR16-1 (Pseudo Random Sequence)
  - Output Power: Maximum
  - Mid channel
- 5) The frequency error of the EUT were recorded by using an internal measurement function of the CMD55 / CMU200 immediately after the call was established, five minutes after the call was established and ten minutes after the call was established.
- 6) This measurement procedure was performed for all combinations of voltage (low, nominal, high) and temperature (from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  in increments of  $10^{\circ}\text{C}$ ).

#### 3.2.2 Test Requirements / Limits

§2.1055 Measurements required: Frequency stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From  $-30^{\circ}$  to  $+50^{\circ}$  centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than  $10^{\circ}$  centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.



(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

#### §24.235 Frequency stability

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

### 3.2.3 Test Protocol

Temperature: 24 °C  
Air Pressure: 1008 hPa  
Humidity: 50 %

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 2 | setup_a01 | antenna connector |

|          |              | Minimum Voltage / V      |                       | Normal Voltage / V       |                       | Maximum Voltage / V      |                       |
|----------|--------------|--------------------------|-----------------------|--------------------------|-----------------------|--------------------------|-----------------------|
|          |              | –                        |                       | 3.6                      |                       | –                        |                       |
| Temp. °C | Duration min | Freq. error Average (Hz) | Freq. error Max. (Hz) | Freq. error Average (Hz) | Freq. error Max. (Hz) | Freq. error Average (Hz) | Freq. error Max. (Hz) |
| -30      | 0            |                          |                       | 18                       | 36                    |                          |                       |
| -30      | 5            |                          |                       | 7                        | 22                    |                          |                       |
| -30      | 10           |                          |                       | 10                       | 23                    |                          |                       |
| -20      | 0            |                          |                       | 16                       | 32                    |                          |                       |
| -20      | 5            |                          |                       | 3                        | 18                    |                          |                       |
| -20      | 10           |                          |                       | 4                        | 18                    |                          |                       |
| -10      | 0            |                          |                       | -24                      | -38                   |                          |                       |
| -10      | 5            |                          |                       | -32                      | -46                   |                          |                       |
| -10      | 10           |                          |                       | -25                      | -39                   |                          |                       |
| 0        | 0            |                          |                       | -12                      | -26                   |                          |                       |
| 0        | 5            |                          |                       | -16                      | -31                   |                          |                       |
| 0        | 10           |                          |                       | -15                      | -30                   |                          |                       |
| 10       | 0            |                          |                       | 6                        | 18                    |                          |                       |
| 10       | 5            |                          |                       | 6                        | 18                    |                          |                       |
| 10       | 10           |                          |                       | -3                       | -18                   |                          |                       |
| 20       | 0            |                          |                       | 14                       | 30                    |                          |                       |
| 20       | 5            |                          |                       | 2                        | 15                    |                          |                       |
| 20       | 10           |                          |                       | 6                        | 20                    |                          |                       |
| 30       | 0            |                          |                       | -12                      | -24                   |                          |                       |
| 30       | 5            |                          |                       | 5                        | 17                    |                          |                       |
| 30       | 10           |                          |                       | 0                        | -18                   |                          |                       |
| 40       | 0            |                          |                       | -1                       | -14                   |                          |                       |
| 40       | 5            |                          |                       | 1                        | 15                    |                          |                       |
| 40       | 10           |                          |                       | -12                      | -25                   |                          |                       |
| 50       | 0            |                          |                       | -8                       | -22                   |                          |                       |
| 50       | 5            |                          |                       | -5                       | -17                   |                          |                       |
| 50       | 10           |                          |                       | -14                      | -24                   |                          |                       |

Remark: The manufacturer declared that nominal voltage is equal to minimum as well as maximum voltage.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 5 | setup_a01 | antenna connector |

|          |              | Minimum Voltage / V      |                       | Normal Voltage / V       |                       | Maximum Voltage / V      |                       |
|----------|--------------|--------------------------|-----------------------|--------------------------|-----------------------|--------------------------|-----------------------|
|          |              | –                        |                       | 3.6                      |                       | –                        |                       |
| Temp. °C | Duration min | Freq. error Average (Hz) | Freq. error Max. (Hz) | Freq. error Average (Hz) | Freq. error Max. (Hz) | Freq. error Average (Hz) | Freq. error Max. (Hz) |
| -30      | 0            |                          |                       | 17                       | 37                    |                          |                       |
| -30      | 5            |                          |                       | 25                       | 41                    |                          |                       |
| -30      | 10           |                          |                       | -36                      | -51                   |                          |                       |
| -20      | 0            |                          |                       | 19                       | 36                    |                          |                       |
| -20      | 5            |                          |                       | 25                       | 42                    |                          |                       |
| -20      | 10           |                          |                       | -18                      | -37                   |                          |                       |
| -10      | 0            |                          |                       | -1                       | -17                   |                          |                       |
| -10      | 5            |                          |                       | -34                      | -48                   |                          |                       |
| -10      | 10           |                          |                       | -29                      | -45                   |                          |                       |
| 0        | 0            |                          |                       | 5                        | 21                    |                          |                       |
| 0        | 5            |                          |                       | 18                       | 33                    |                          |                       |
| 0        | 10           |                          |                       | 8                        | 25                    |                          |                       |
| 10       | 0            |                          |                       | 8                        | 25                    |                          |                       |
| 10       | 5            |                          |                       | 23                       | 38                    |                          |                       |
| 10       | 10           |                          |                       | 22                       | 43                    |                          |                       |
| 20       | 0            |                          |                       | -22                      | -38                   |                          |                       |
| 20       | 5            |                          |                       | 23                       | 38                    |                          |                       |
| 20       | 10           |                          |                       | 16                       | 31                    |                          |                       |
| 30       | 0            |                          |                       | 24                       | 38                    |                          |                       |
| 30       | 5            |                          |                       | 22                       | 46                    |                          |                       |
| 30       | 10           |                          |                       | 19                       | 33                    |                          |                       |
| 40       | 0            |                          |                       | -11                      | -27                   |                          |                       |
| 40       | 5            |                          |                       | -16                      | -32                   |                          |                       |
| 40       | 10           |                          |                       | -9                       | -24                   |                          |                       |
| 50       | 0            |                          |                       | -5                       | -20                   |                          |                       |
| 50       | 5            |                          |                       | -38                      | -54                   |                          |                       |
| 50       | 10           |                          |                       | -42                      | -57                   |                          |                       |

Remark: The manufacturer declared that nominal voltage is equal to minimum as well as maximum voltage.

### 3.2.4 Test result: Frequency stability

| FCC Part 24, Subpart E |  | Op. Mode  | Result |
|------------------------|--|-----------|--------|
|                        |  | op-mode 2 | passed |
|                        |  | op-mode 5 | passed |

### 3.3 Spurious emissions at antenna terminals

**Standard**      FCC Part 24, 10-1-05  
                     Subpart E

**The test was performed according to FCC §2.1051, 10-1-05**

#### 3.3.1 Test Description

1) The EUT was coupled to the R&S Spectrum Analyser and the R&S CMD55 / CMU200 Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".

2) The total insertion losses for RF Path 1 and RF Path 2 were measured. The values were used to correct the readings from the R&S Spectrum Analyser and the R&S CMD55 / CMU200 Digital Communication Tester.

3) A call was established on a Traffic Channel (TCH) between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).

Important Settings:

- Discontinuous Transmission: OFF
- Modulation Signal: PSR16-1 (Pseudo Random Sequence)
- Output Power: Maximum
- Channel: Varied during measurements

4) Important Analyser Settings

- [Resolution Bandwidth / Video Bandwidth]:

a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the PCS-Band,

b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz -> 10 kHz) was used

c) [1 MHz / 3 MHz] otherwise

- Sweep Time: Calculated by using a formula given in the Product Standard

"PCS 11.10-1 edition 4" for spurious emissions measurements (depending on the transmitting signal, the span and the resolution bandwidth)

5) The spurious emissions (peak) were measured in the frequency range from 9 kHz to 20 GHz (up to the 10th harmonic) during the call is established on the lowest channel, mid channel and on the highest channel.

#### 3.3.2 Test Requirements / Limits

§ 2.1051 Spurious emissions at antenna terminals

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Sec. 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 24.238 Emission limitations for Broadband PCS equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

Remark of the test laboratory: This is calculated to be -13 dBm.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas [...].

(d) If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

### 3.3.3 Test Protocol

Temperature: 25 °C  
Air Pressure: 1007 hPa  
Humidity: 47 %

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 1 | setup_a01 | antenna connector |

| Frequency<br>MHz | Bandwidth<br>kHz | Measured Level<br>dBm | Limit<br>dBm |
|------------------|------------------|-----------------------|--------------|
| 1850             | 3.0              | -16.2                 | -13.0        |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 2 | setup_a01 | antenna connector |

| Frequency<br>MHz | Bandwidth<br>kHz | Measured Level<br>dBm | Limit<br>dBm |
|------------------|------------------|-----------------------|--------------|
| –                | –                | –                     | -13.0        |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 3 | setup_a01 | antenna connector |

| Frequency<br>MHz | Bandwidth<br>kHz | Measured Level<br>dBm | Limit<br>dBm |
|------------------|------------------|-----------------------|--------------|
| 1910             | 3.0              | -16.7                 | -13.0        |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 4 | setup_a01 | antenna connector |

| Frequency<br>MHz | Bandwidth<br>kHz | Measured Level<br>dBm | Limit<br>dBm |
|------------------|------------------|-----------------------|--------------|
| 1850             | 3.0              | -21.5                 | -13.0        |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 5 | setup_a01 | antenna connector |

| Frequency<br>MHz | Bandwidth<br>kHz | Measured Level<br>dBm | Limit<br>dBm |
|------------------|------------------|-----------------------|--------------|
| 1850             | 3.0              | -29.7                 | -13.0        |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 6 | setup_a01 | antenna connector |

| Frequency<br>MHz | Bandwidth<br>kHz | Measured Level<br>dBm | Limit<br>dBm |
|------------------|------------------|-----------------------|--------------|
| 1910             | 3.0              | -21.9                 | -13.0        |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

### 3.3.4 Test result: Spurious emissions at antenna terminals

| FCC Part 24, Subpart E | Op. Mode  | Result |
|------------------------|-----------|--------|
|                        | op-mode 1 | passed |
|                        | op-mode 2 | passed |
|                        | op-mode 3 | passed |
|                        | op-mode 4 | passed |
|                        | op-mode 5 | passed |
|                        | op-mode 6 | passed |
|                        |           |        |

### 3.4 Field strength of spurious radiation

**Standard**      FCC Part 24, 10-1-05  
                     Subpart E

The test was performed according to: FCC §2.1053, 10-1-05

#### 3.4.1 Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to the R&S CMD55 / CMU200 Digital Communication Tester which was located outside the chamber via coaxial cable.

2) A call was established on a Traffic Channel (TCH) between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).

Important Settings:

- Discontinuous Transmission: OFF
- Modulation Signal: PSR16-1 (Pseudo Random Sequence)
- Output Power: Maximum
- Channel : Varied during measurements

3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a  $\lambda/2$  dipole).

4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antennas for the frequency range of 30 MHz to 20 GHz (up to the 10th harmonic of the transmit frequency).

5) Important Analyser Settings

- [Resolution Bandwidth / Video Bandwidth]:

a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the GSM-Band,

b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz  $\rightarrow$  10 kHz) was used

c) [1 MHz / 3 MHz] otherwise

- Sweep Time: Calculated by using a formula given in the Product Standard "GSM 11.10-1 edition 4" for spurious emissions measurements (depending on the transmitting signal, the span and the resolution bandwidth)

6) The spurious emissions (peak) were measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel.

#### 3.4.2 Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally

required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 24.238 Emission limitations for Broadband PCS equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas [...].

(d) If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

### 3.4.3 Test Protocol

Temperature: 25-29 °C  
Air Pressure: 1010-1015 hPa  
Humidity: 38-50 %

| Op. Mode  | Setup     | Port      |
|-----------|-----------|-----------|
| op-mode 1 | setup_a01 | enclosure |

| Frequency MHz | Antenna Polarisation | Bandwidth kHz | Measured Level dBm | Limit dBm |
|---------------|----------------------|---------------|--------------------|-----------|
| 1850          | Vertical             | 3.0           | -17.8              | -13.0     |
| 12972         | Horizontal           | 1000          | -32.9              | -13.0     |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port      |
|-----------|-----------|-----------|
| op-mode 2 | setup_a01 | enclosure |

| Frequency MHz | Antenna Polarisation | Bandwidth kHz | Measured Level dBm | Limit dBm |
|---------------|----------------------|---------------|--------------------|-----------|
| –             | –                    | –             | –                  | -13.0     |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port      |
|-----------|-----------|-----------|
| op-mode 3 | setup_a01 | enclosure |

| Frequency MHz | Antenna Polarisation | Bandwidth kHz | Measured Level dBm | Limit dBm |
|---------------|----------------------|---------------|--------------------|-----------|
| 1910          | Horizontal           | 3.0           | -15.4              | -13.0     |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port      |
|-----------|-----------|-----------|
| op-mode 4 | setup_a01 | enclosure |

| Frequency MHz | Antenna Polarisation | Bandwidth kHz | Measured Level dBm | Limit dBm |
|---------------|----------------------|---------------|--------------------|-----------|
| 1850          | Horizontal           | 3.0           | -22.4              | -13.0     |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port      |
|-----------|-----------|-----------|
| op-mode 5 | setup_a01 | enclosure |

| Frequency MHz | Antenna Polarisation | Bandwidth kHz | Measured Level dBm | Limit dBm |
|---------------|----------------------|---------------|--------------------|-----------|
| 1849          | Horizontal           | 3.0           | -30.1              | -13.0     |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

| Op. Mode  | Setup     | Port      |
|-----------|-----------|-----------|
| op-mode 6 | setup_a01 | enclosure |

| Frequency MHz | Antenna Polarisation | Bandwidth kHz | Measured Level dBm | Limit dBm |
|---------------|----------------------|---------------|--------------------|-----------|
| 1910          | Horizontal           | 3.0           | -20.7              | -13.0     |

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.

#### 3.4.4 Test result: Field strength of spurious radiation

| FCC Part 24, Subpart E | Op. Mode  | Result |
|------------------------|-----------|--------|
|                        | op-mode 1 | passed |
|                        | op-mode 2 | passed |
|                        | op-mode 3 | passed |
|                        | op-mode 4 | passed |
|                        | op-mode 5 | passed |
|                        | op-mode 6 | passed |
|                        |           |        |

### **3.5 Emission and Occupied Bandwidth**

**Standard**      FCC Part 24, 10-1-05  
                     Subpart E

The test was performed according to: FCC §2.1049, 10-1-05

#### **3.5.1 Test Description**

1) The EUT was coupled to the R&S Spectrum Analyser and the R&S CMD55 / CMU200 Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".

2) The total insertion losses for RF Path 1 and RF Path 2 were measured. The values were used to correct the readings from the R&S Spectrum Analyser and the R&S CMD55 / CMU200 Digital Communication Tester.

3) A call was established on a Traffic Channel (TCH) between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).

Important Settings:

- Discontinuous Transmission: OFF
- Modulation Signal: PSR16-1 (Pseudo Random Sequence)
- Output Power: Maximum
- Channel : Varied during measurements

4) Important Analyser Settings:

- Resolution Bandwidth: 3 kHz (1% of the manufacturers stated occupied bandwidth)
- Video Bandwidth: 10 kHz (three times the Resolution Bandwidth)
- Sweep Span: 1 MHz ( at least 250% of the emission bandwidth)

5) The maximum spectral level of the modulated signal was recorded as the reference.

6) The emission bandwidth is measured as follows:

the two furthest frequencies above and below the frequency of the maximum reference level where the spectrum is –26 dB down have to be found.

7) The occupied bandwidth (99% Bandwidth) is measured as follows:

the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power.

### **3.5.2 Test Requirements / Limits**

#### **§ 2.1049 Measurements required: Occupied bandwidth**

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions (as applicable):

(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

### 3.5.3 Test Protocol

Temperature: 26 °C  
Air Pressure: 1004 hPa  
Humidity: 42 %

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 1 | setup_a01 | antenna connector |

| Bandwidth<br>kHz | Remarks          |
|------------------|------------------|
| 317              | please see annex |

Remark: The given value is the result of the 26dB bandwidth measurement.  
The 99% Bandwidth is 242 kHz.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 2 | setup_a01 | antenna connector |

| Bandwidth<br>kHz | Remarks          |
|------------------|------------------|
| 313              | please see annex |

Remark: The given value is the result of the 26dB bandwidth measurement.  
The 99% Bandwidth is 244 kHz.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 3 | setup_a01 | antenna connector |

| Bandwidth<br>kHz | Remarks          |
|------------------|------------------|
| 317              | please see annex |

Remark: The given value is the result of the 26dB bandwidth measurement.  
The 99% Bandwidth is 248 kHz.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 4 | setup_a01 | antenna connector |

| Bandwidth<br>kHz | Remarks          |
|------------------|------------------|
| 311              | please see annex |

Remark: The given value is the result of the 26dB bandwidth measurement.  
The 99% Bandwidth is 246 kHz.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 5 | setup_a01 | antenna connector |

| Bandwidth<br>kHz | Remarks          |
|------------------|------------------|
| 311              | please see annex |

Remark: The given value is the result of the 26dB bandwidth measurement.  
The 99% Bandwidth is 244 kHz.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 6 | setup_a01 | antenna connector |

| Bandwidth<br>kHz | Remarks          |
|------------------|------------------|
| 317              | please see annex |

Remark: The given value is the result of the 26dB bandwidth measurement.  
The 99% Bandwidth is 244 kHz.

### 3.5.4 Test result: Emission and Occupied Bandwidth

| FCC Part 24, Subpart E | Op. Mode  | Result |
|------------------------|-----------|--------|
|                        | op-mode 1 | passed |
|                        | op-mode 2 | passed |
|                        | op-mode 3 | passed |
|                        | op-mode 4 | passed |
|                        | op-mode 5 | passed |
|                        | op-mode 6 | passed |
|                        |           |        |

### **3.6 Band edge compliance**

**Standard** FCC Part 24, 10-1-05  
Subpart E

The test was performed according to: FCC §24.238, 10-1-05

#### **3.6.1 Test Description**

- 1) The EUT was coupled to the R&S CMU200 Digital Communications Tester via a 10 dB attenuator and a 6 dB coupler.
- 2) For the measurement the EUT is connected to the Spectrum Analyser via 30 dB attenuator and 6 dB coupler.
- 3) The spectrum analyser is set to a RBW/VBW of 3 kHz/3 kHz.

#### **3.6.2 Test Requirements / Limits**

§ 24.238 Effective radiated power limits

### 3.6.3 Test Protocol

Temperature: 26 °C  
Air Pressure: 1004 hPa  
Humidity: 42 %

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 1 | Setup_a01 | antenna connector |

| Frequency<br>MHz | Measured value<br>dBm | Limit<br>dBm |
|------------------|-----------------------|--------------|
| 1850             | -14.8                 | -13          |

Remark: Please see annex for the measurement plot.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 3 | Setup_a01 | antenna connector |

| Frequency<br>MHz | Measured value<br>dBm | Limit<br>dBm |
|------------------|-----------------------|--------------|
| 1910             | -15.2                 | -13          |

Remark: Please see annex for the measurement plot.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 4 | Setup_a01 | antenna connector |

| Frequency<br>MHz | Measured value<br>dBm | Limit<br>dBm |
|------------------|-----------------------|--------------|
| 1850             | -20.0                 | -13          |

Remark: Please see annex for the measurement plot.

| Op. Mode  | Setup     | Port              |
|-----------|-----------|-------------------|
| op-mode 6 | Setup_a01 | antenna connector |

| Frequency<br>MHz | Measured value<br>dBm | Limit<br>dBm |
|------------------|-----------------------|--------------|
| 1910             | -21.4                 | -13          |

Remark: Please see annex for the measurement plot.

### 3.6.4 Test result: Band edge compliance

| FCC Part 24, Subpart E | Op. Mode  | Result |
|------------------------|-----------|--------|
|                        | op-mode 1 | passed |
|                        | op-mode 3 | passed |
|                        | op-mode 4 | passed |
|                        | op-mode 6 | passed |

## 4 Test Equipment

### *EUT Digital Signalling System*

| Equipment                                        | Type    | Serial No. | Manufacturer    |
|--------------------------------------------------|---------|------------|-----------------|
| Digital Radio Communication Tester               | CMD 55  | 831050/020 | Rohde & Schwarz |
| Signalling Unit for Bluetooth Spurious Emissions | PTW60   | 100004     | Rohde & Schwarz |
| Universal Radio Communication Tester             | CMU 200 | 102366     | Rohde & Schwarz |

### *EMI Test System*

| Equipment                | Type    | Serial No. | Manufacturer    |
|--------------------------|---------|------------|-----------------|
| Comparison Noise Emitter | CNE III | 99/016     | York            |
| EMI Analyzer             | ESI 26  | 830482/004 | Rohde & Schwarz |
| Signal Generator         | SMR 20  | 846834/008 | Rohde & Schwarz |

### *EMI Radiated Auxiliary Equipment*

| Equipment                       | Type                 | Serial No.          | Manufacturer          |
|---------------------------------|----------------------|---------------------|-----------------------|
| Antenna mast 4m                 | MA 240               | 240/492             | HD GmbH H. Deisel     |
| Biconical dipole                | VUBA 9117            | 9117108             | Schwarzbeck           |
| Broadband Amplifier 18MHz-26GHz | JS4-18002600-32      | 849785              | Miteq                 |
| Broadband Amplifier 30MHz-18GHz | JS4-00101800-35      | 896037              | Miteq                 |
| Broadband Amplifier 45MHz-27GHz | JS4-00102600-42      | 619368              | Miteq                 |
| Cable "ESI to EMI Antenna"      | EcoFlex10            | W18.01-2 + W38.01-2 | Kabel Kusch           |
| Cable "ESI to Horn Antenna"     | UFB311A + UFB293C    | W18.02-2 + W38.02-2 | Rosenberger-Microcoax |
| Double-ridged horn              | HF 906               | 357357/002          | Rohde & Schwarz       |
| Double-ridged horn              | HF 906               | 357357/001          | Rohde & Schwarz       |
| High Pass Filter                | 5HC3500/12750-1.2-KK | 200035008           | Trilithic             |
| High Pass Filter                | 5HC2700/12750-1.5-KK | 9942012             | Trilithic             |
| High Pass Filter                | 4HC1600/12750-1.5-KK | 9942011             | Trilithic             |
| KUEP pre amplifier              | Kuep 00304000        | 001                 | 7layers               |
| Log.-per. Antenna               | HL 562 Ultralog      | 830547/003          | Rohde & Schwarz       |
| Loop Antenna                    | HFH2-Z2              | 829324/006          | Rohde & Schwarz       |
| Pyramidal Horn Antenna 26.5 GHz | Model 3160-09        | 9910-1184           | EMCO                  |

### EMI Conducted Auxiliary Equipment

| Equipment           | Type     | Serial No.    | Manufacturer    |
|---------------------|----------|---------------|-----------------|
| Cable "LISN to ESI" | RG214    | W18.03+W48.03 | Huber+Suhner    |
| Two-Line V-Network  | ESH 3-Z5 | 828304/029    | Rohde & Schwarz |
| Two-Line V-Network  | ESH 3-Z5 | 829996/002    | Rohde & Schwarz |

### Auxiliary Test Equipment

| Equipment                              | Type                 | Serial No.     | Manufacturer                         |
|----------------------------------------|----------------------|----------------|--------------------------------------|
| Broadband Resist.<br>Power Divider N   | 1506A / 93459        | LM390          | Weinschel                            |
| Broadband Resist.<br>Power Divider SMA | 1515 / 93459         | LN673          | Weinschel                            |
| Digital Multimeter 01                  | Voltcraft M-3860M    | IJ096055       | Conrad                               |
| Digital Multimeter 02                  | Voltcraft M-3860M    | IJ095955       | Conrad                               |
| Digital Oscilloscope                   | TDS 784C             | B021311        | Tektronix                            |
| Fibre optic link Satellite             | FO RS232 Link        | 181-018        | Pontis                               |
| Fibre optic link<br>Transceiver        | FO RS232 Link        | 182-018        | Pontis                               |
| I/Q Modulation<br>Generator            | AMIQ-B1              | 832085/018     | Rohde & Schwarz                      |
| Notch Filter ultra stable              | WRCA800/960-6E       | 24             | Wainwright                           |
| Spectrum Analyzer 9<br>kHz to 3 GHz    | FSP3                 | 838164/004     | Rohde & Schwarz                      |
| Temperature Chamber                    | VT 4002              | 58566002150010 | Vötsch                               |
| Temperature Chamber                    | KWP 120/70           | 59226012190010 | Weiss                                |
| ThermoHygro<br>Datalogger 03           | Opus10 THI (8152.00) | 7482           | Lufft Mess- und<br>Regeltechnik GmbH |

### Anechoic Chamber

| Equipment                            | Type           | Serial No.                | Manufacturer                           |
|--------------------------------------|----------------|---------------------------|----------------------------------------|
| Air Compressor<br>(pneumatic)        |                |                           | Atlas Copco                            |
| Controller                           | CO 2000        | CO2000/328/12470406<br>/L | Innco innovative<br>constructions GmbH |
| EMC Camera                           | CE-CAM/1       |                           | CE-SYS                                 |
| EMC Camera for<br>observation of EUT | CCD-400E       | 0005033                   | Mitsubishi                             |
| Filter ISDN                          | B84312-C110-E1 |                           | Siemens&Matsushita                     |
| Filter telephone systems<br>/ modem  | B84312-C40-B1  |                           | Siemens&Matsushita                     |
| Filter Universal 1A                  | B84312-C30-H3  |                           | Siemens&Matsushita                     |
| Fully/Semi AE Chamber                | 10.58x6.38x6   |                           | Frankonia                              |
| Turntable                            | DS 420S        | 420/573/99                | HD GmbH, H. Deisel                     |
| Valve Control Unit<br>(pneum.)       | VE 615P        | 615/348/99                | HD GmbH, H. Deisel                     |



**7 layers Bluetooth™ Full RF Test Solution**

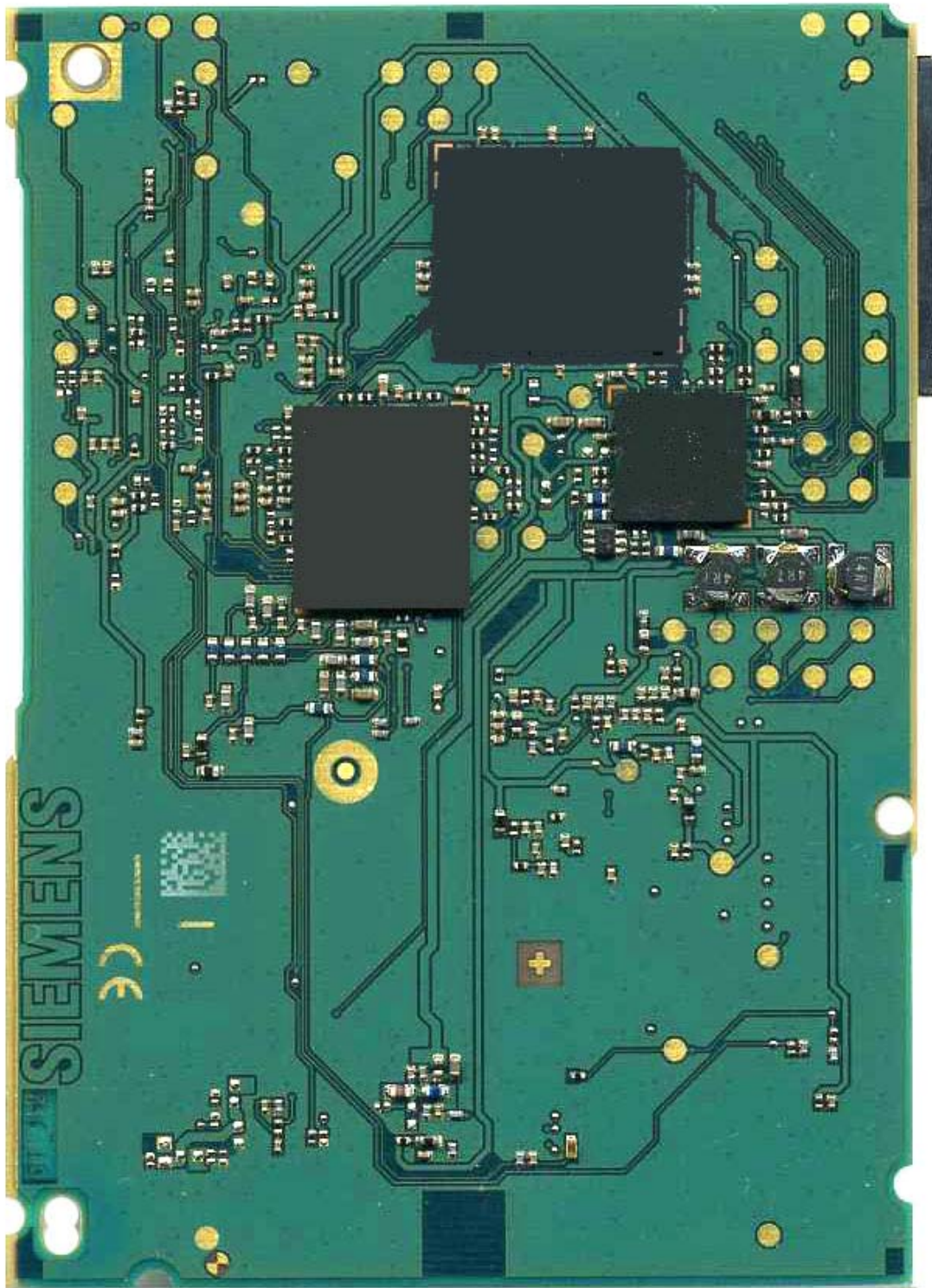
**Bluetooth RF Conformance Test System TS8960**

| <b>Equipment</b>                          | <b>Type</b>      | <b>Serial No.</b> | <b>Manufacturer</b> |
|-------------------------------------------|------------------|-------------------|---------------------|
| 10 MHz Reference                          | MFS              | 5489/001          | Efratom             |
| Power Meter<br>832025/059                 | NRVD             | 832025/059        | Rohde & Schwarz     |
| Power Sensor A<br>832279/013              | NRV-Z1           | 832279/013        | Rohde & Schwarz     |
| Power Sensor B<br>832279/015              | NRV-Z1           | 832279/015        | Rohde & Schwarz     |
| Power Supply                              | E3632A           | MY40003776        | Agilent             |
| Power Supply                              | PS-2403D         | -                 | Conrad              |
| RF Step Attenuator<br>833695/001          | RSP              | 833695/001        | Rohde & Schwarz     |
| Rubidium Frequency<br>Normal              | MFS              | 002               | Efratom             |
| Signal Analyzer FSIQ26<br>832695/007      | FSIQ26           | 832695/007        | Rohde & Schwarz     |
| Signal Generator<br>833680/003            | SMP 03           | 833680/003        | Rohde & Schwarz     |
| Signal Generator A<br>834344/002          | SMIQ03B          | 834344/002        | Rohde & Schwarz     |
| Signal Generator B<br>832870/017          | SMIQ03B          | 832870/017        | Rohde & Schwarz     |
| Signal Switching and<br>Conditioning Unit | SSCU             | 338826/005        | Rohde & Schwarz     |
| Signalling Unit PTW60<br>838312/014       | PTW60 for TS8960 | 838312/014        | Rohde & Schwarz     |
| System Controller<br>829323/008           | PSM12            | 829323/008        | Rohde & Schwarz     |

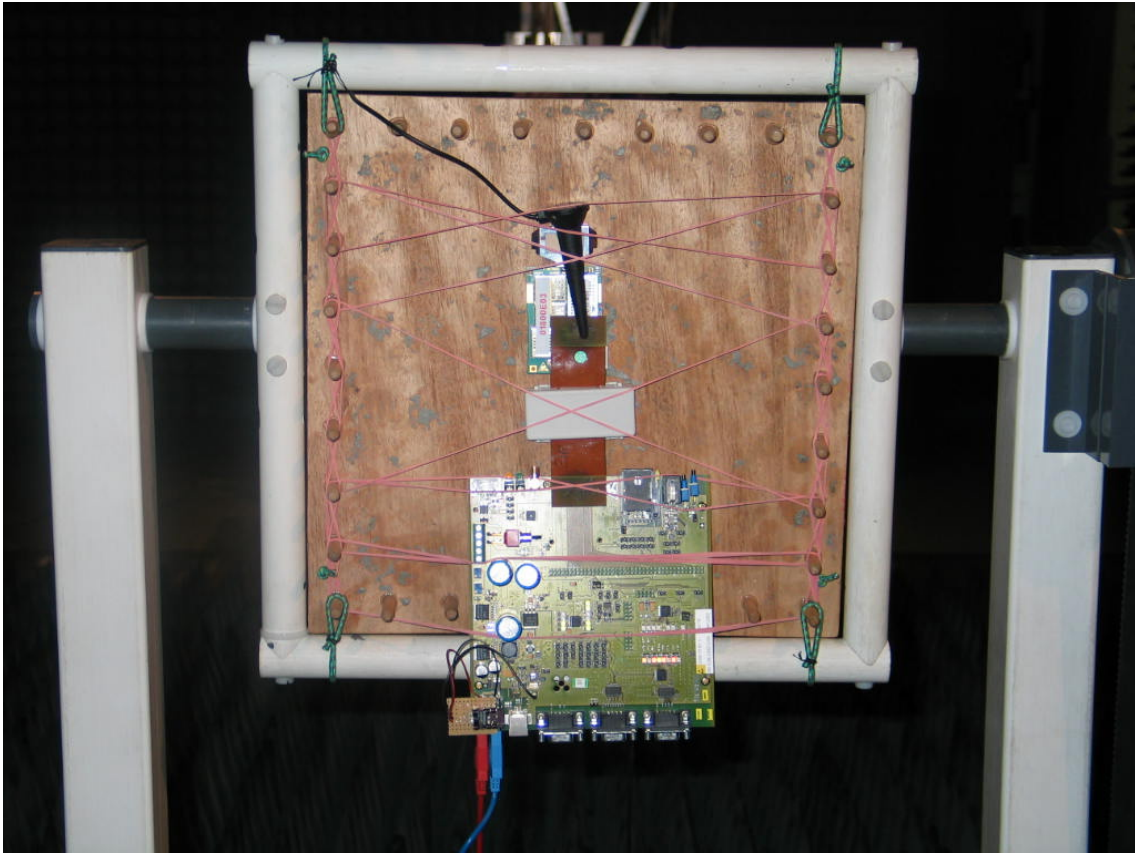
## 5 Photo Report



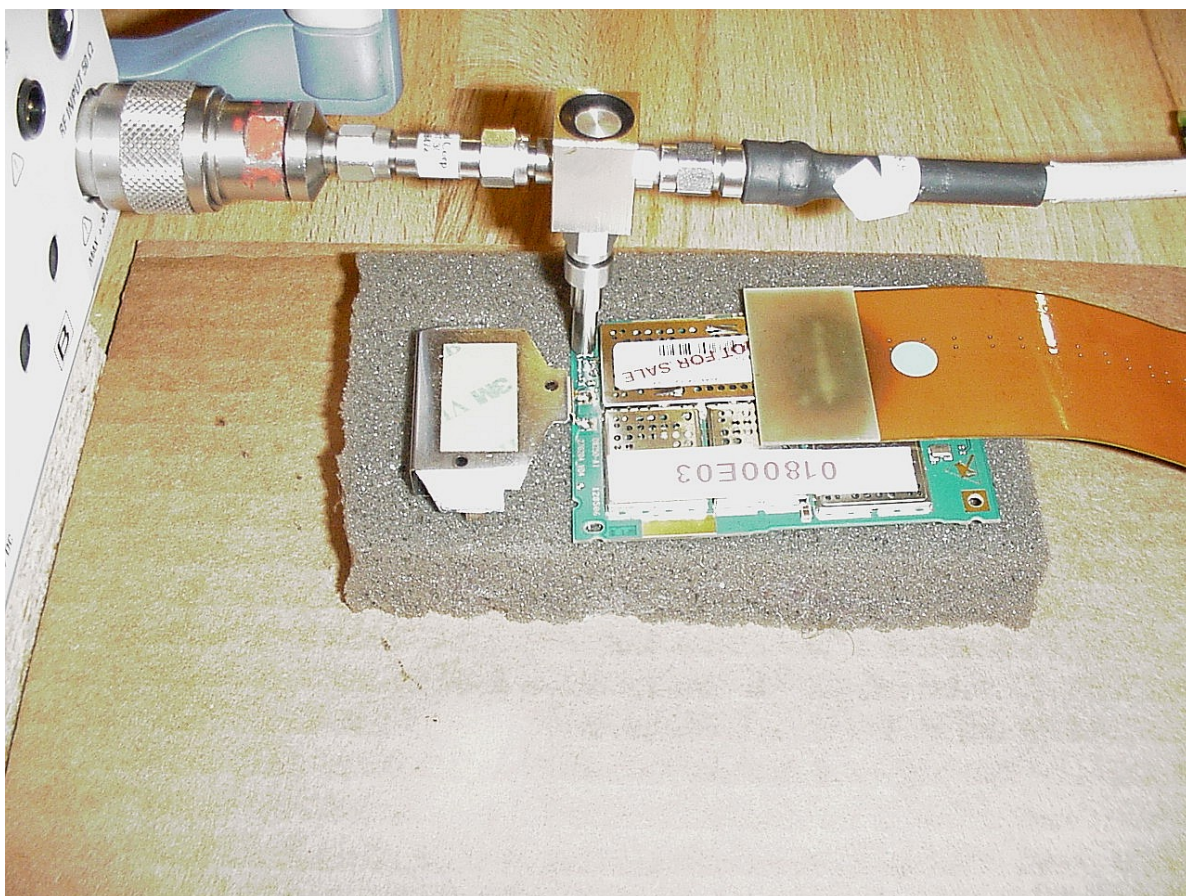
**Photo 1:** EUT (top side of module) picture provided by manufacturer and may not shown the tested sample.



**Photo 2:** EUT (bottom side of module) picture provided by manufacturer and may not shown the tested sample.

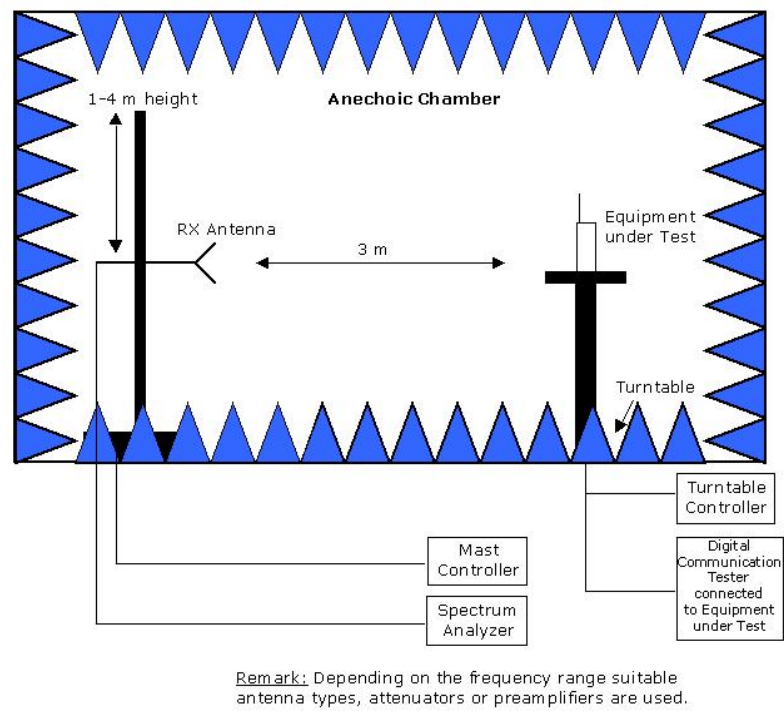


**Photo 3:** Setup for radiated tests

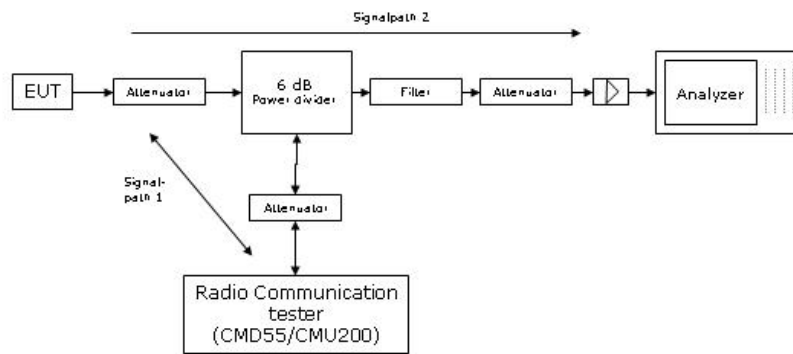


**Photo 4:** Setup for conducted tests

## 6 Setup Drawings

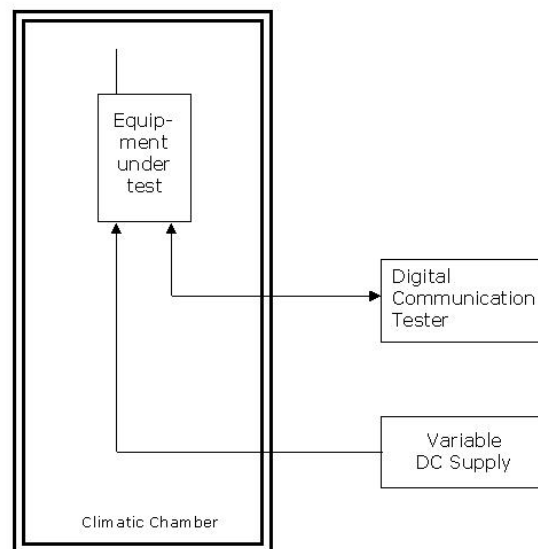


**Drawing 1:** Principle setup for radiated measurements.



Remark: Depending on the frequency range suitable attenuators and/or filters and/or amplifiers are used.

**Drawing 2:** Principle setup for conducted measurements under nominal conditions



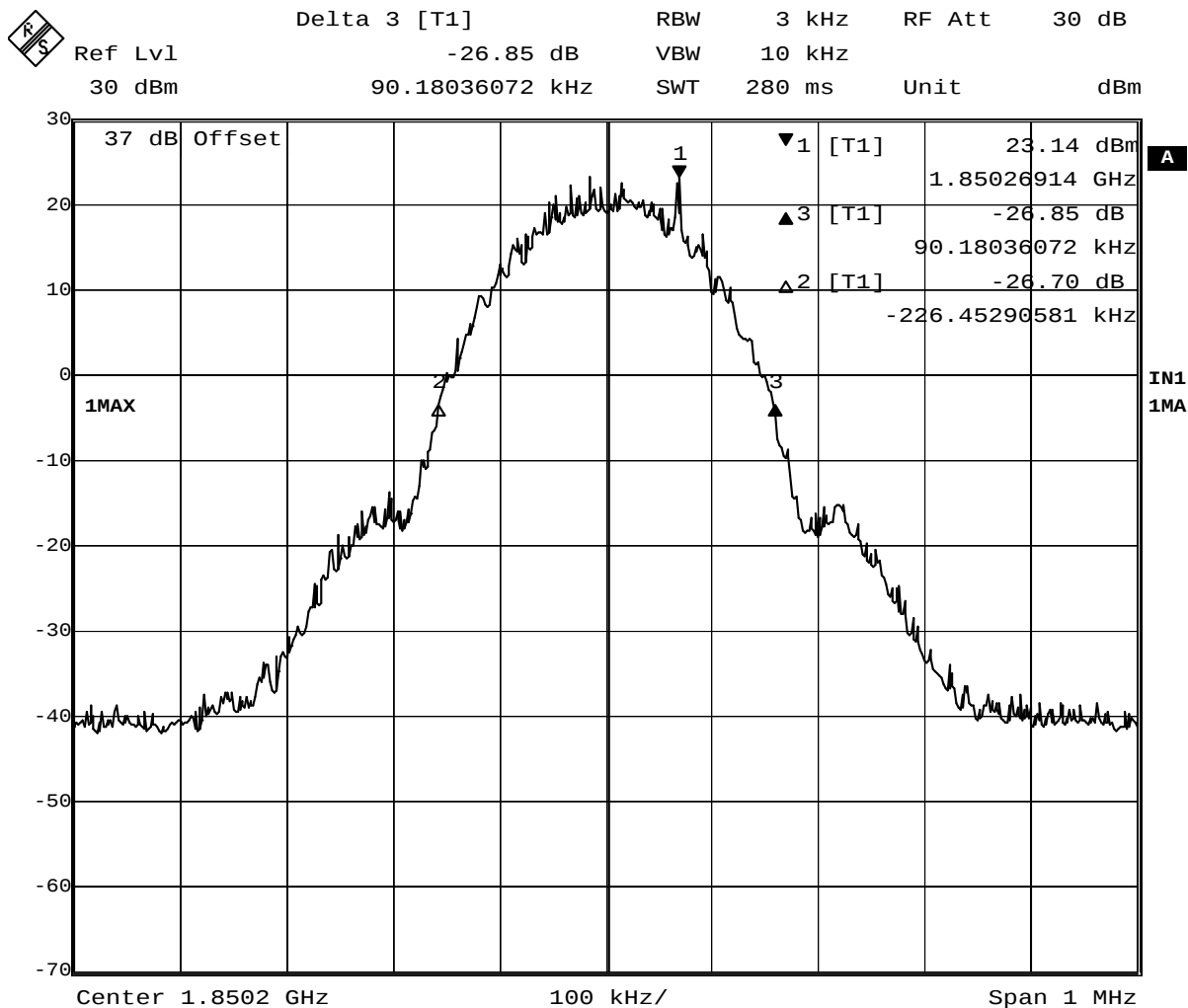
**Drawing 3:** Principle setup for tests under extreme test conditions

## 7 Annex

### Measurement plots Emission and Occupied Bandwidth

#### Op. Mode

op-mode 1

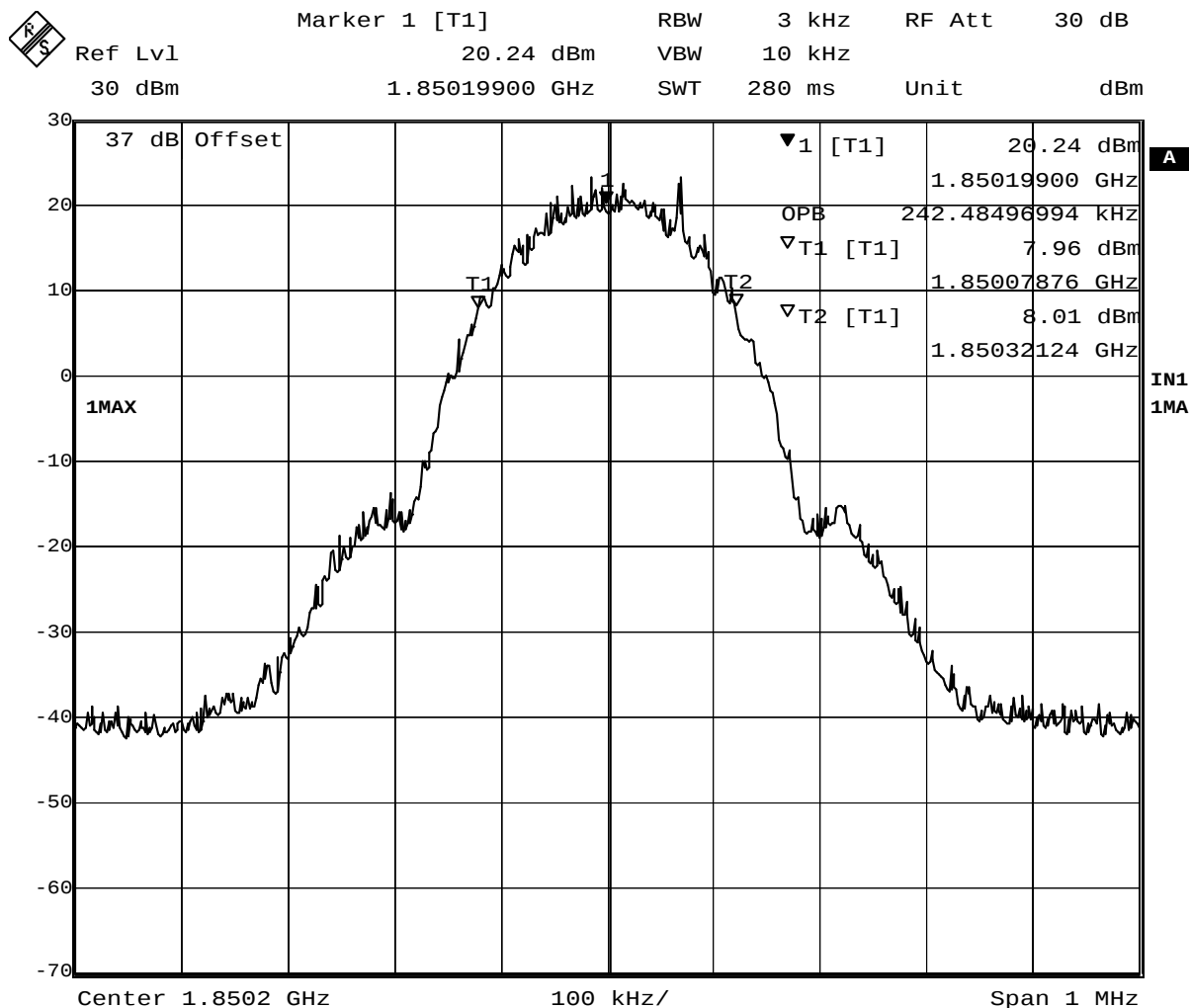


Date: 2.AUG.2006 20:34:35

Test: Emissions bandwidth (26 dB bandwidth), Channel 512 (1850.2 MHz)

## Op. Mode

op-mode 1

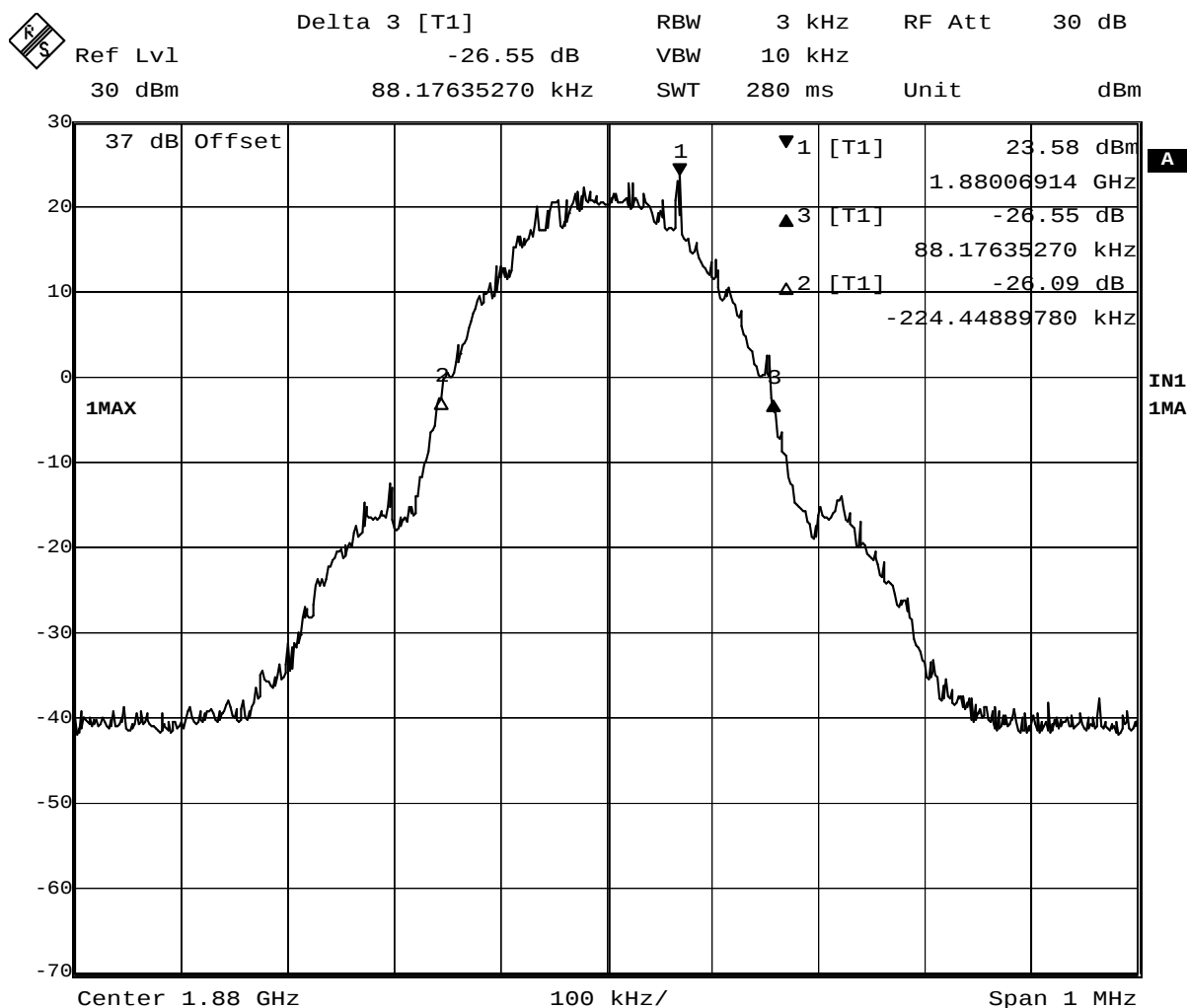


Date: 2.AUG.2006 20:33:40

Test: Occupied bandwidth, Channel 512 (1850.2 MHz)

## Op. Mode

op-mode 2

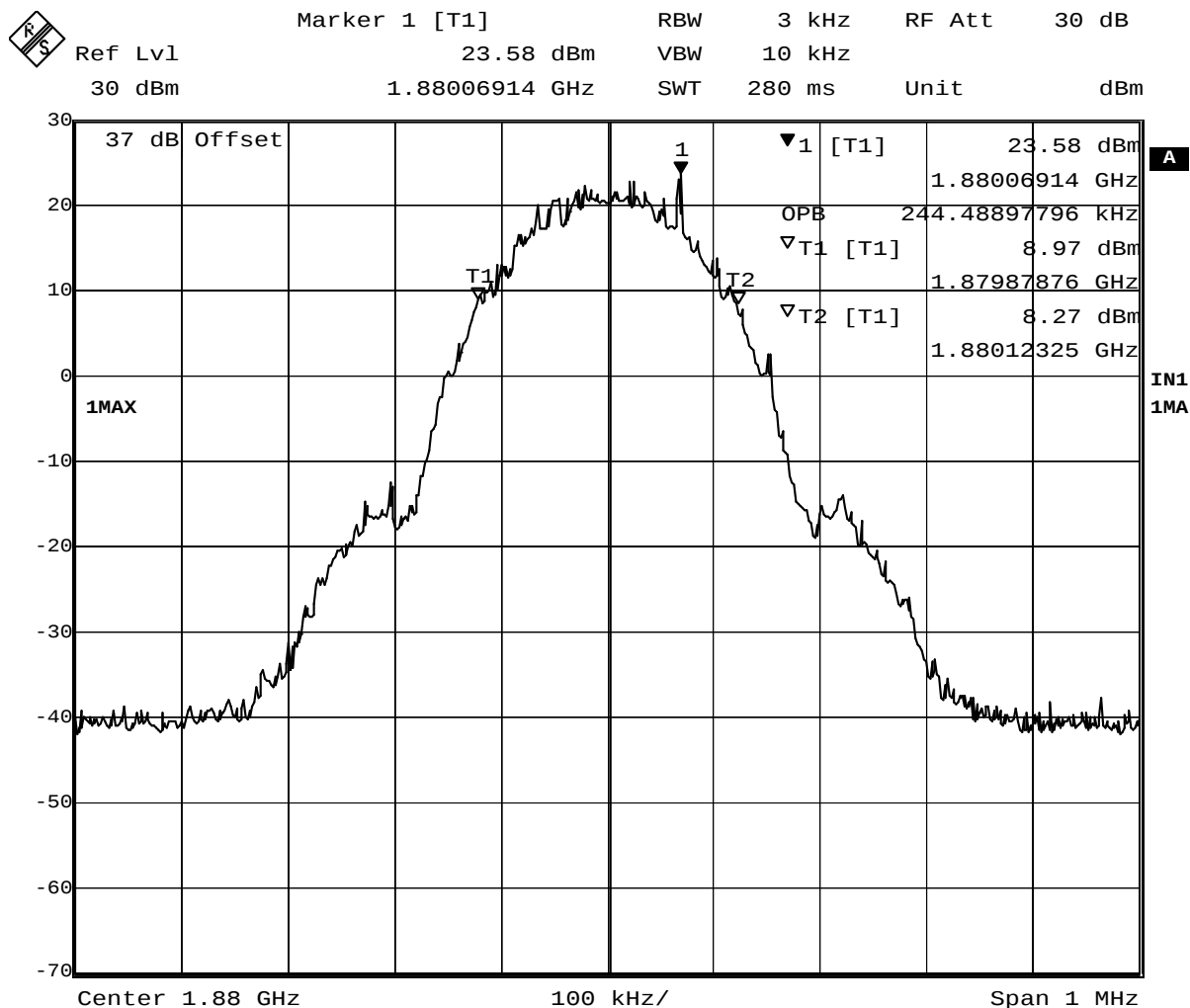


Date: 2.AUG.2006 20:37:35

Test: Emissions bandwidth (26 dB bandwidth), Channel 661 (1880.0 MHz)

## Op. Mode

op-mode 2

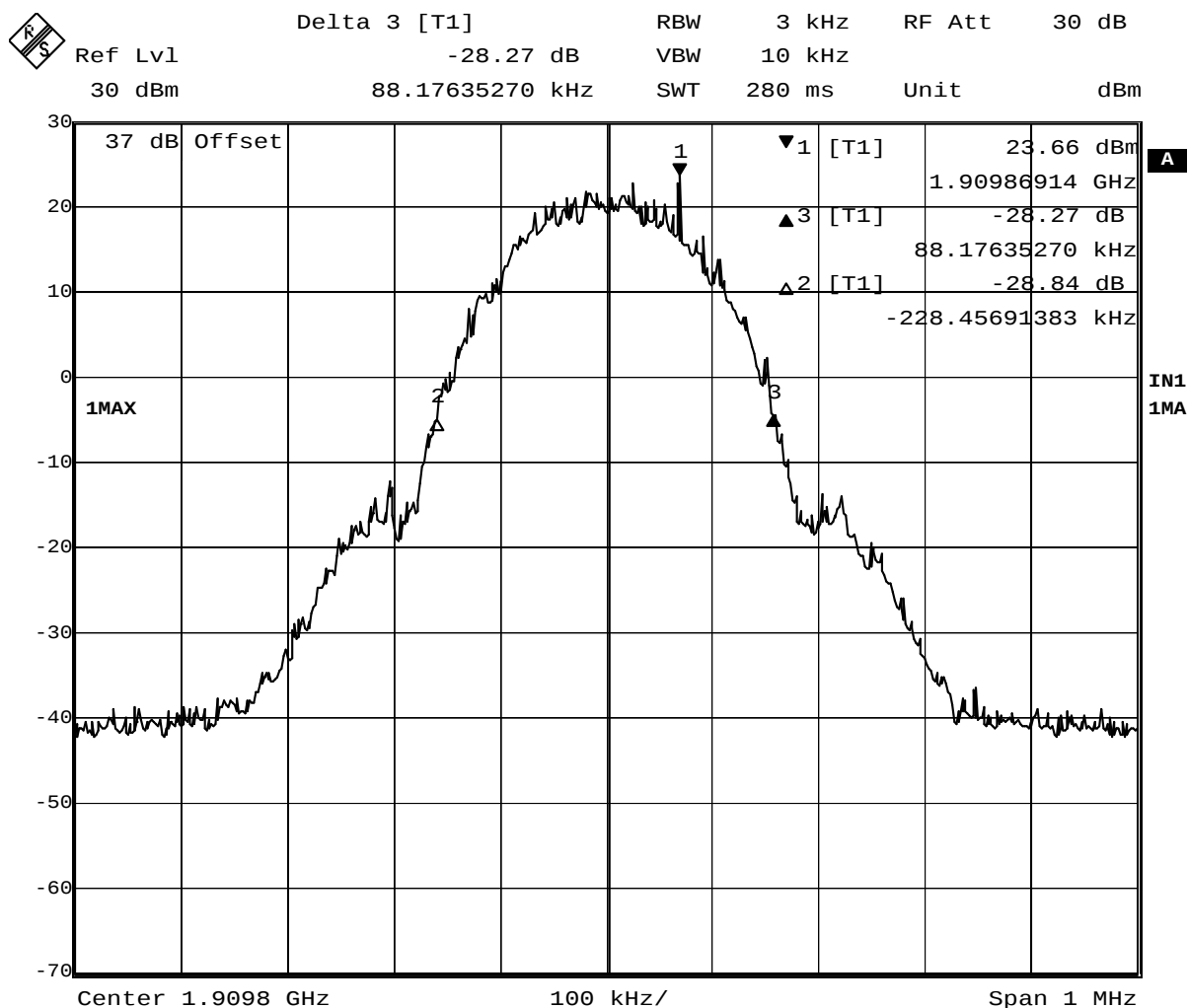


Date: 2.AUG.2006 20:38:02

Test: Occupied bandwidth, Channel 661 (1880.0 MHz)

## Op. Mode

op-mode 3

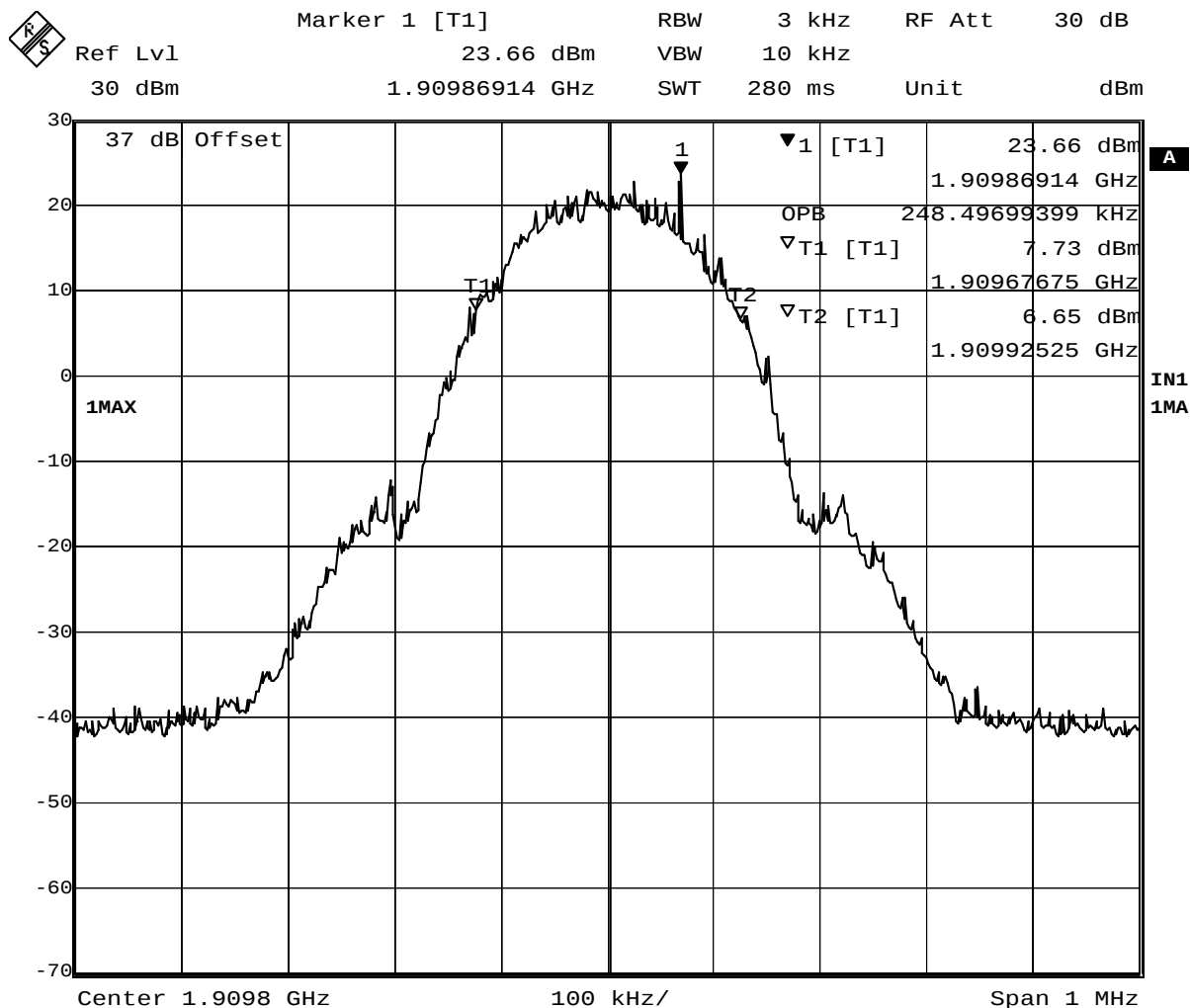


Date: 2.AUG.2006 20:53:52

Test: Emissions bandwidth (26 dB bandwidth), Channel 810 (1909.8 MHz)

## Op. Mode

op-mode 3

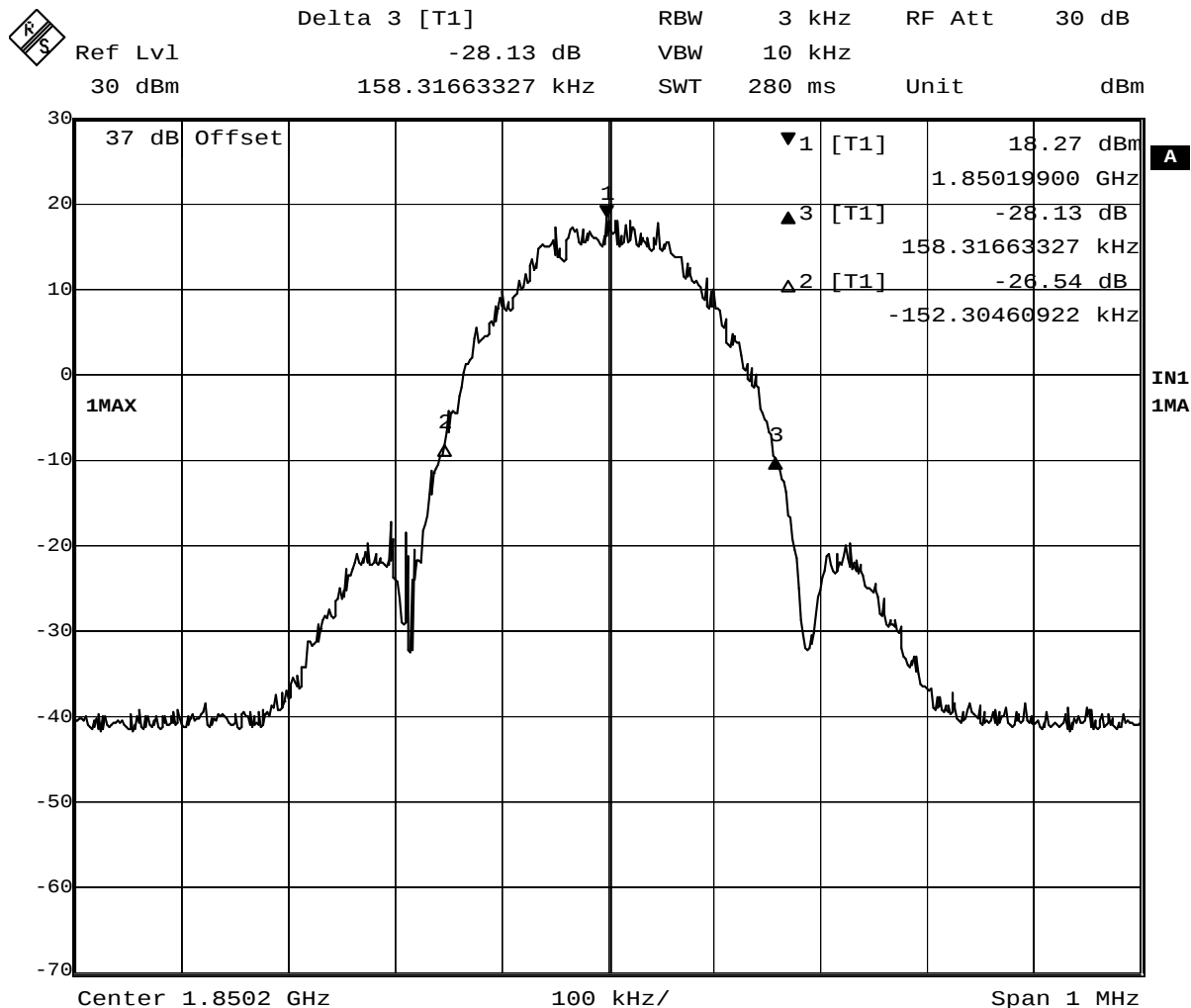


Date: 2.AUG.2006 20:53:03

Test: Occupied bandwidth, Channel 810 (1909.8 MHz)

## Op. Mode

op-mode 4

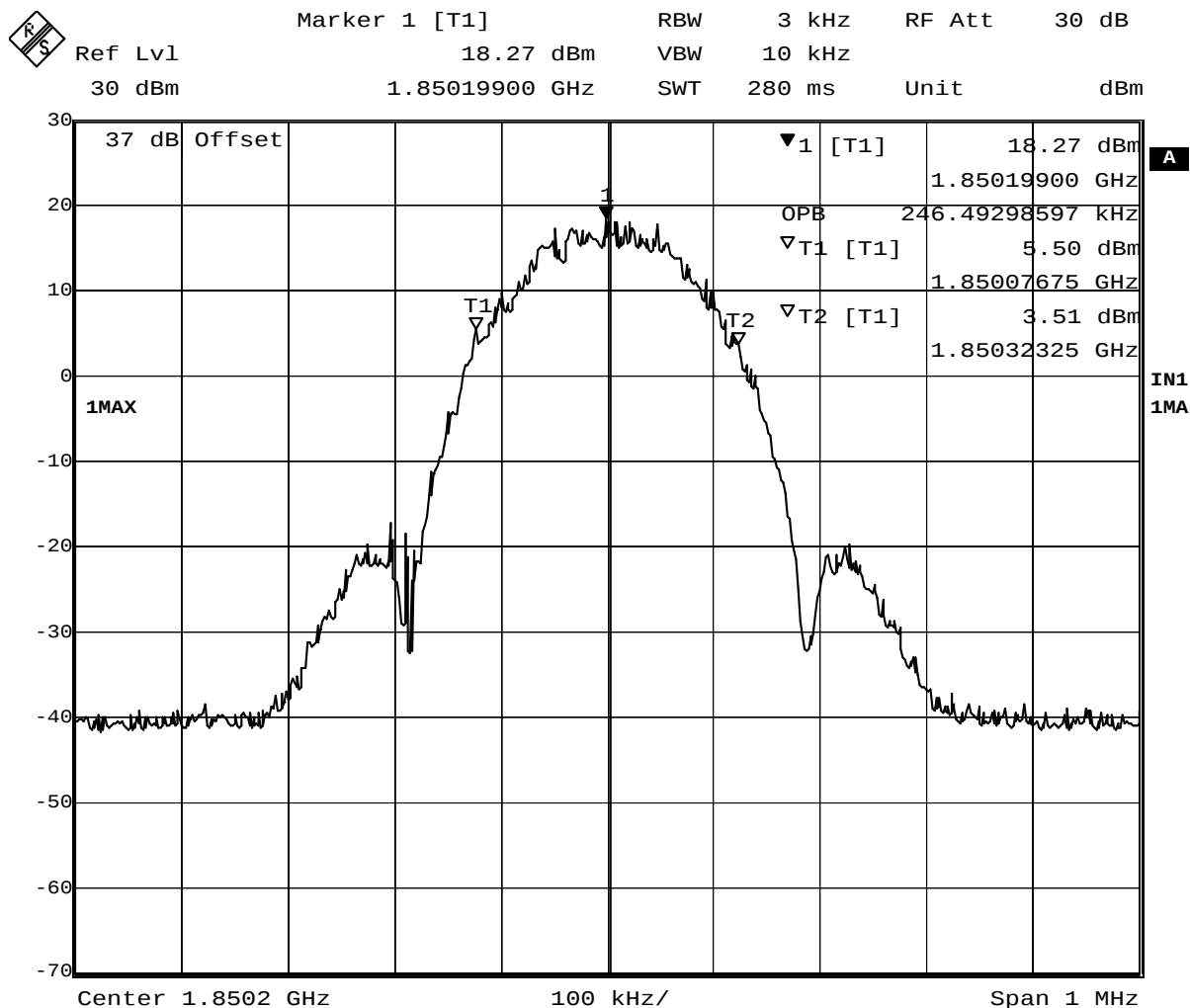


Date: 2.AUG.2006 20:30:05

Test: Emissions bandwidth (26 dB bandwidth), Channel 512 (1850.2 MHz)

## Op. Mode

op-mode 4

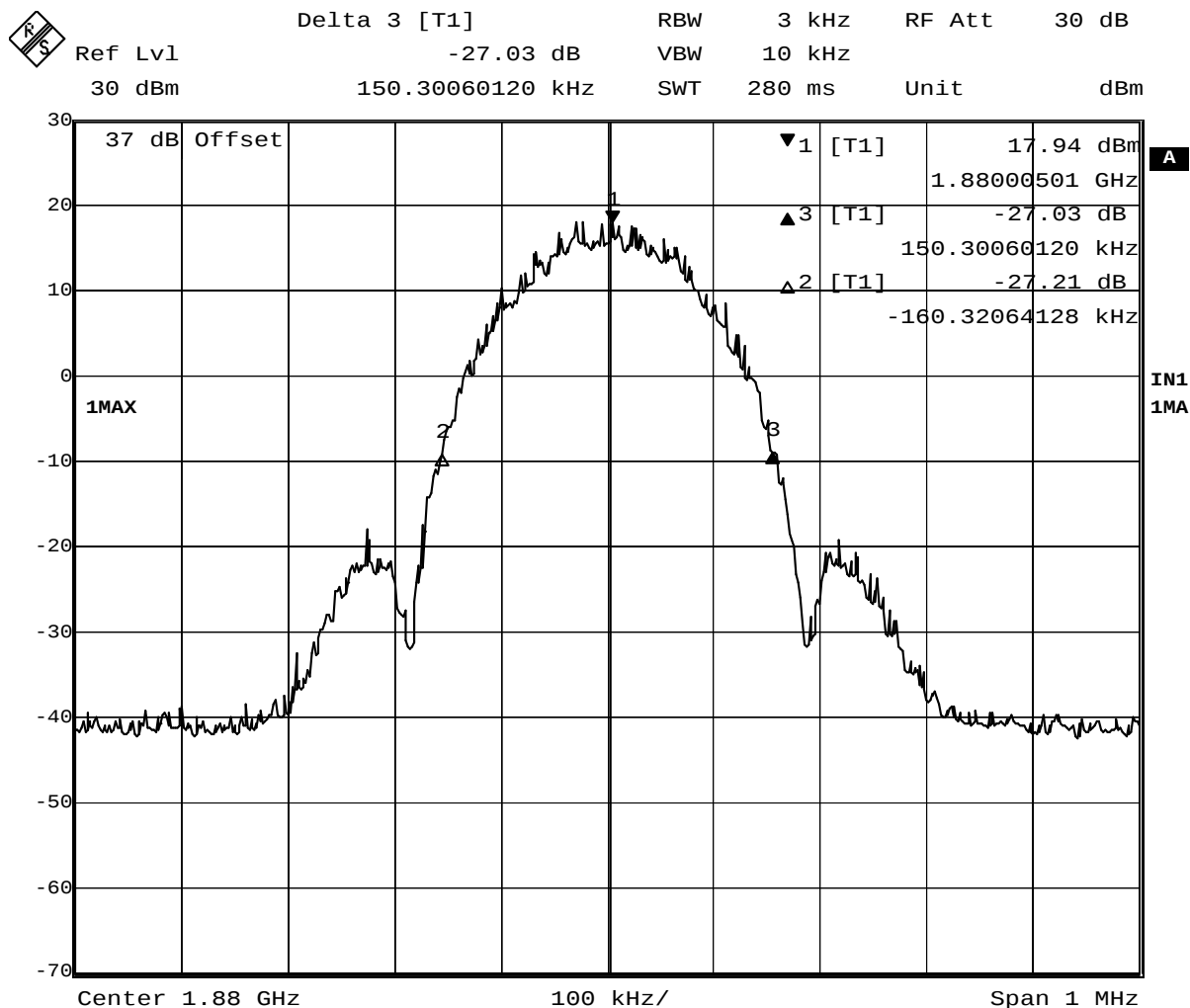


Date: 2.AUG.2006 20:30:42

Test: Occupied bandwidth, Channel 512 (1850.2 MHz)

## Op. Mode

op-mode 5

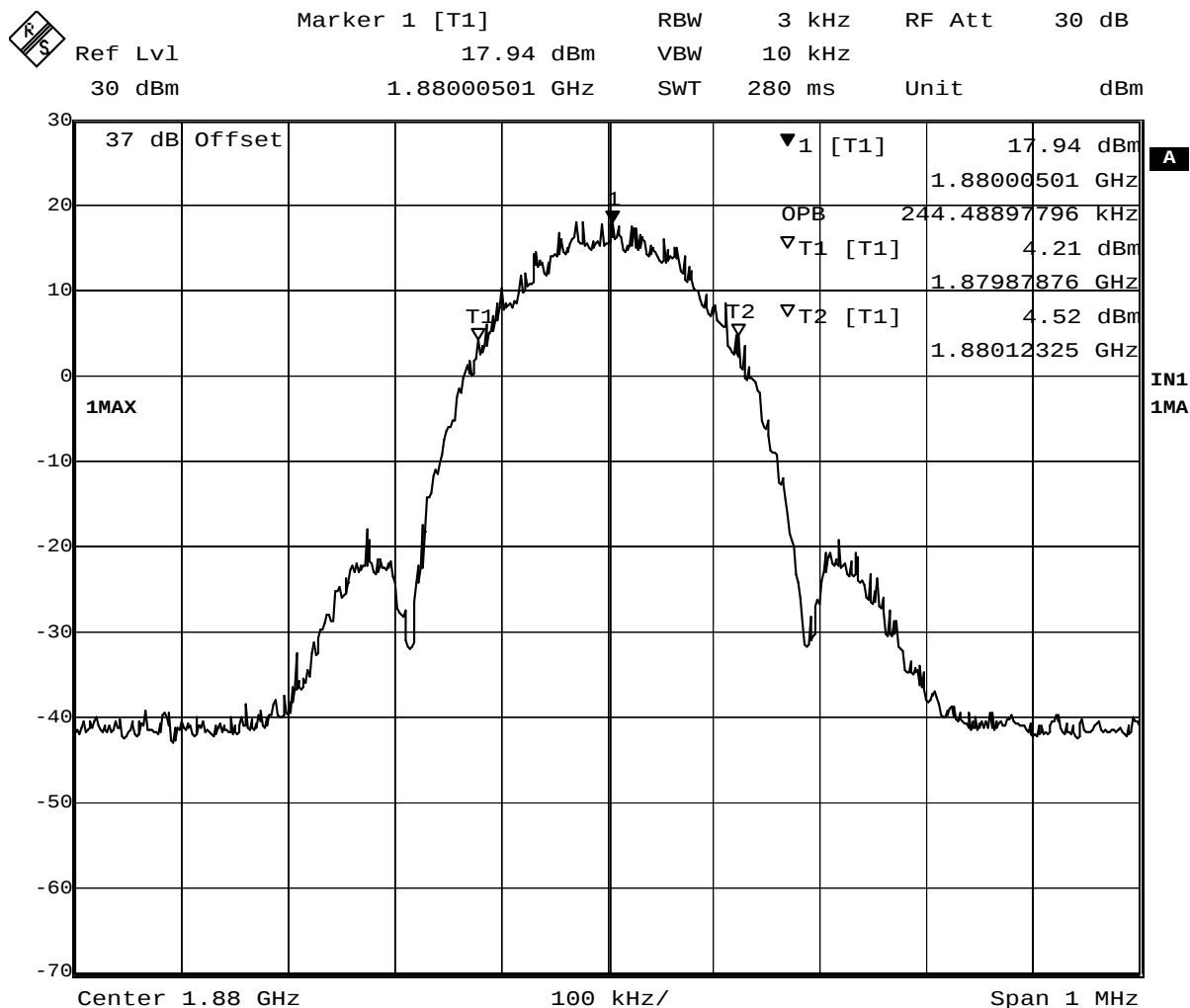


Date: 2.AUG.2006 20:42:47

Test: Emissions bandwidth (26 dB bandwidth), Channel 661 (1880.0 MHz)

## Op. Mode

op-mode 5

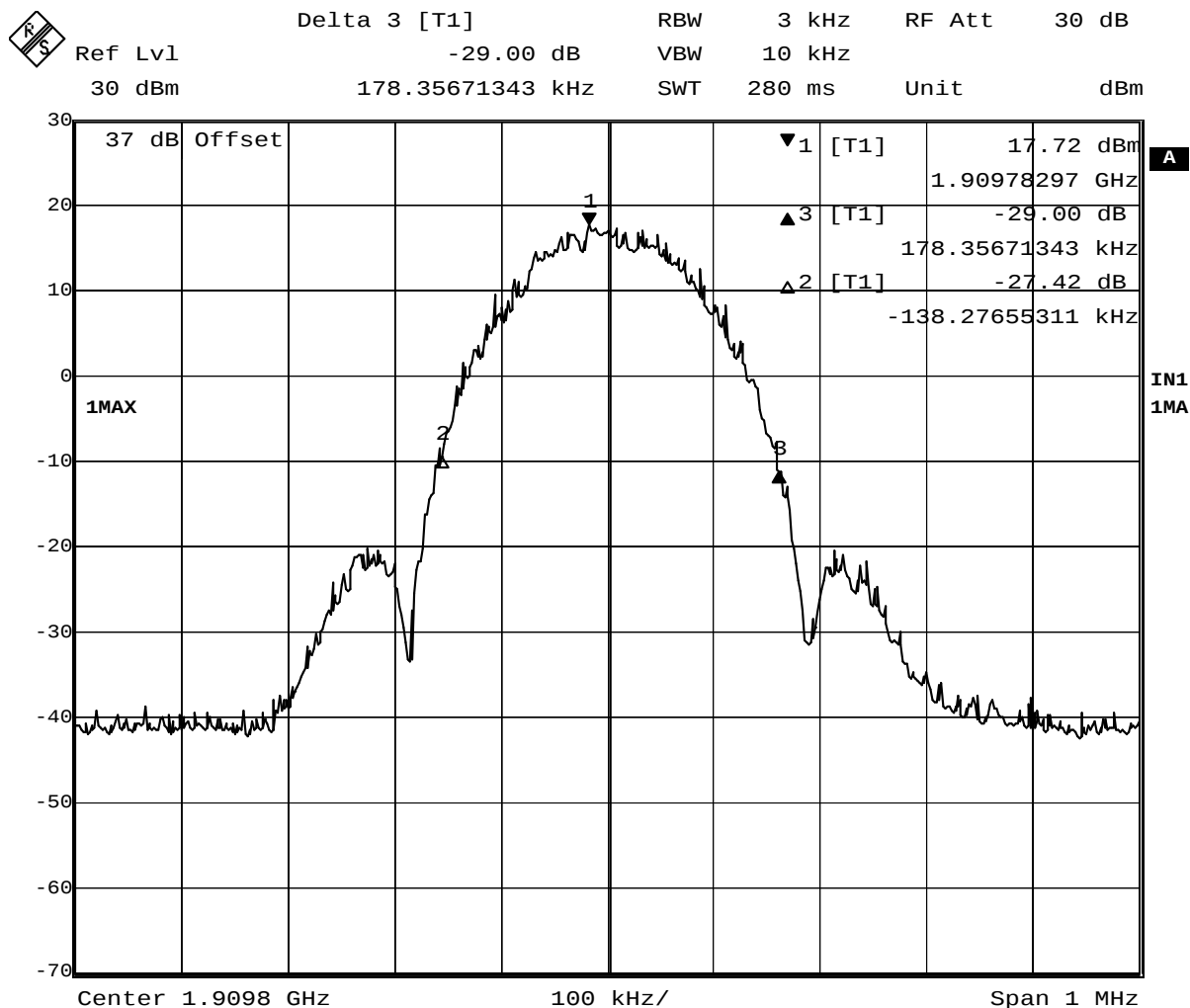


Date: 2.AUG.2006 20:41:54

Test: Occupied bandwidth, Channel 661 (1880.0 MHz)

## Op. Mode

op-mode 6

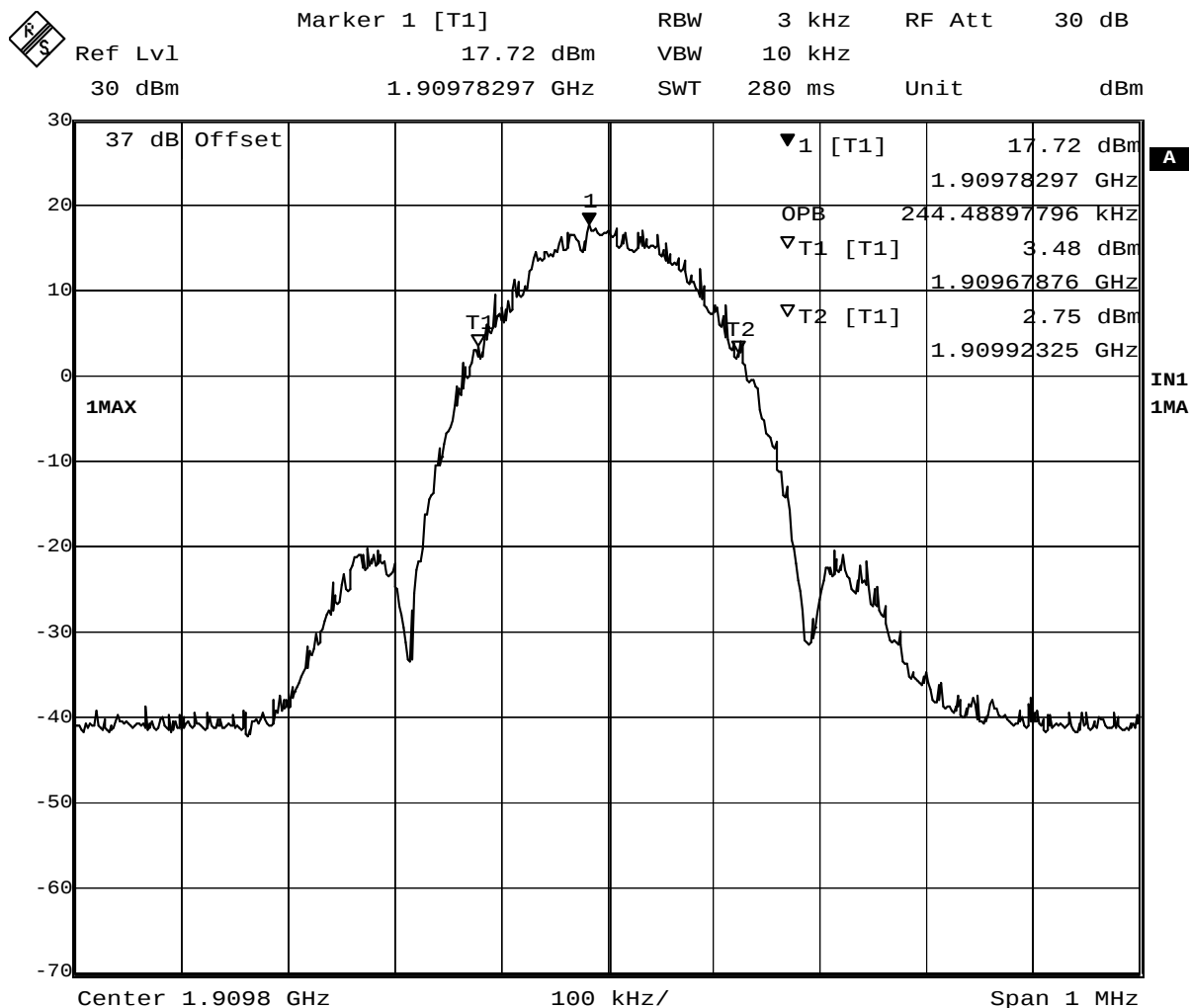


Date: 2.AUG.2006 20:45:53

Test: Emissions bandwidth (26 dB bandwidth), Channel 810 (1909.8 MHz)

## Op. Mode

op-mode 6



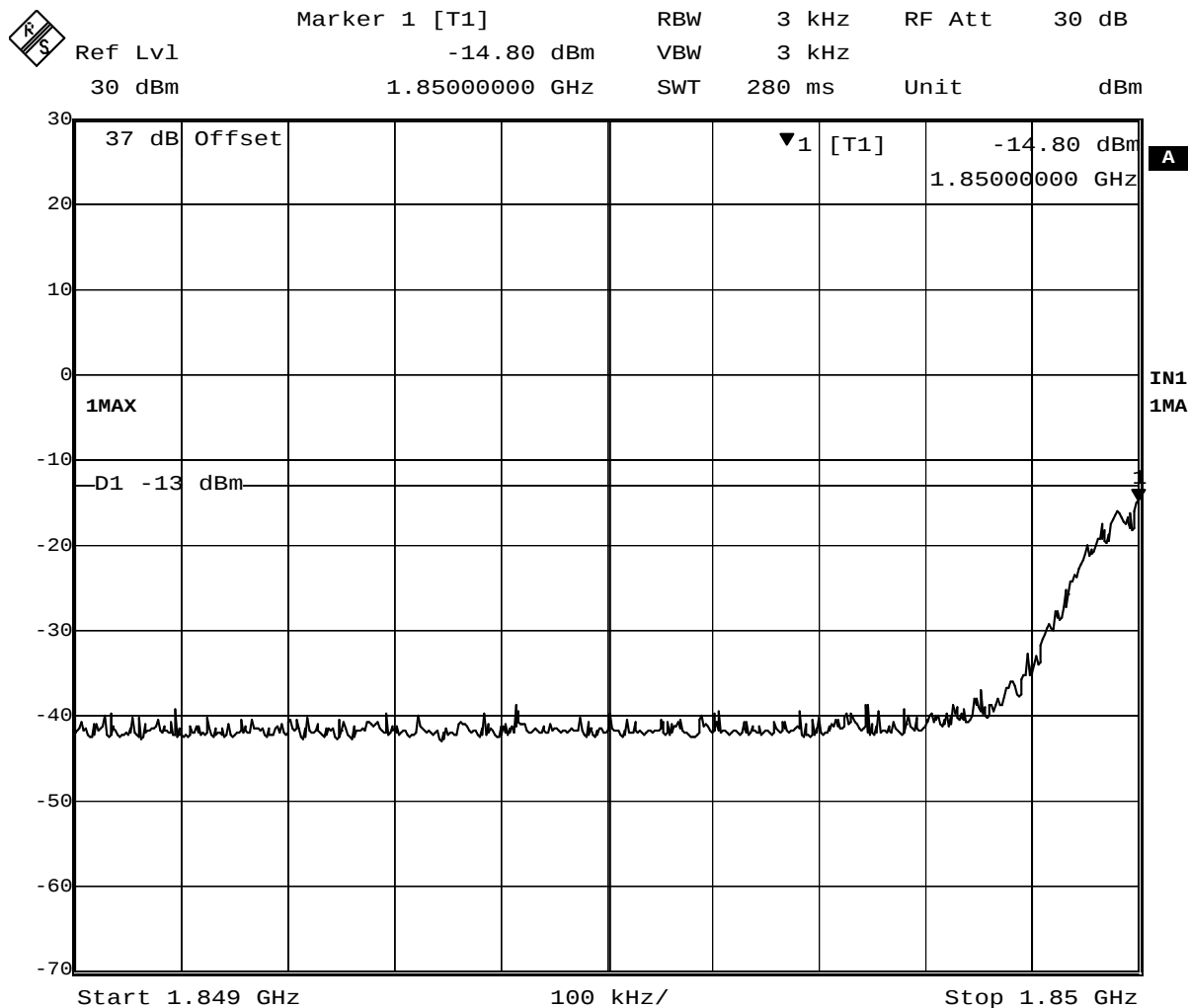
Date: 2.AUG.2006 20:49:49

Test: Occupied bandwidth, Channel 810 (1909.8 MHz)

## Measurement plots Band edge compliance

### Op. Mode

op-mode 1

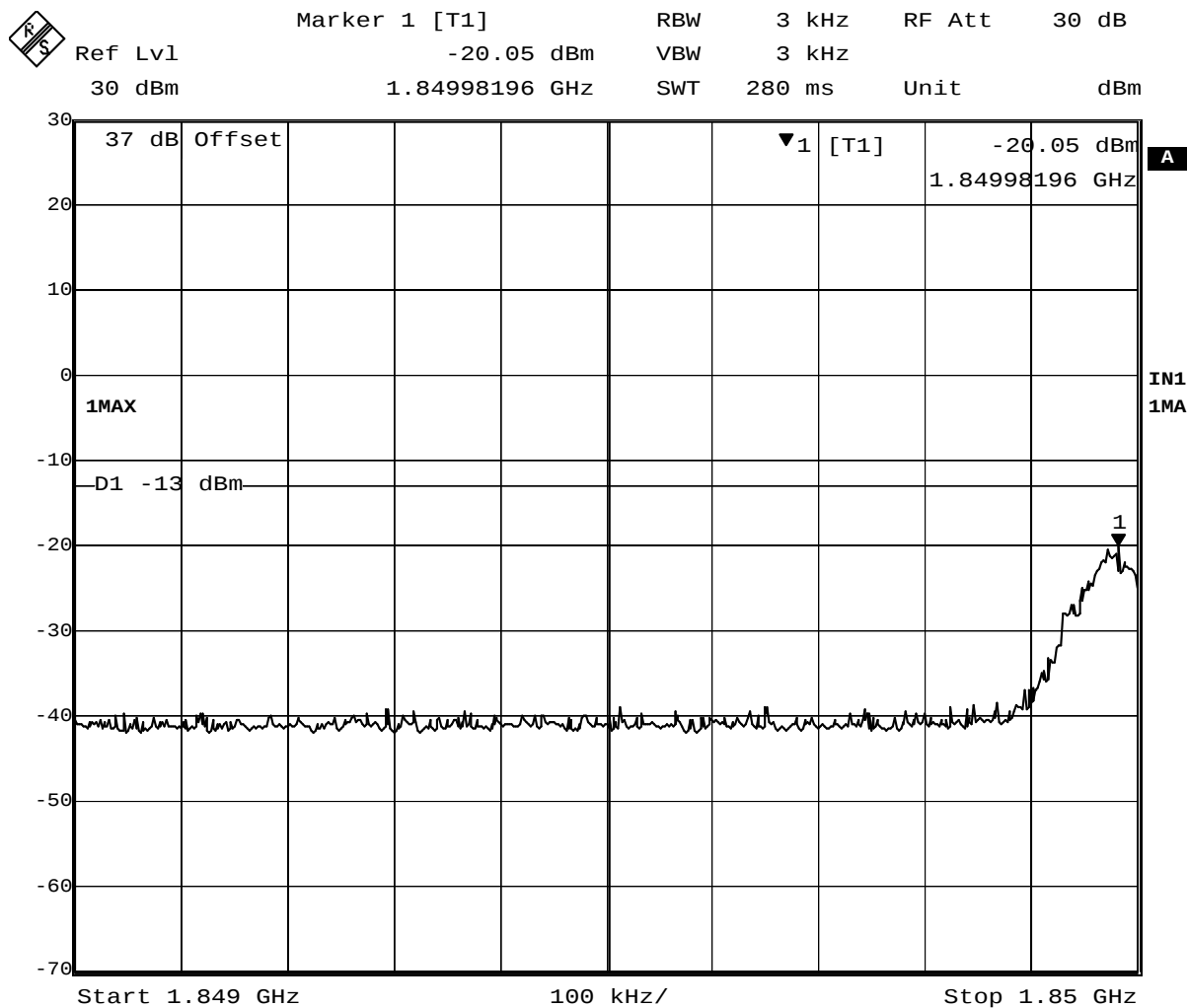


Date: 2.AUG.2006 20:15:19

Test: band edge compliance , Channel 512, PCS

## Op. Mode

op-mode 4

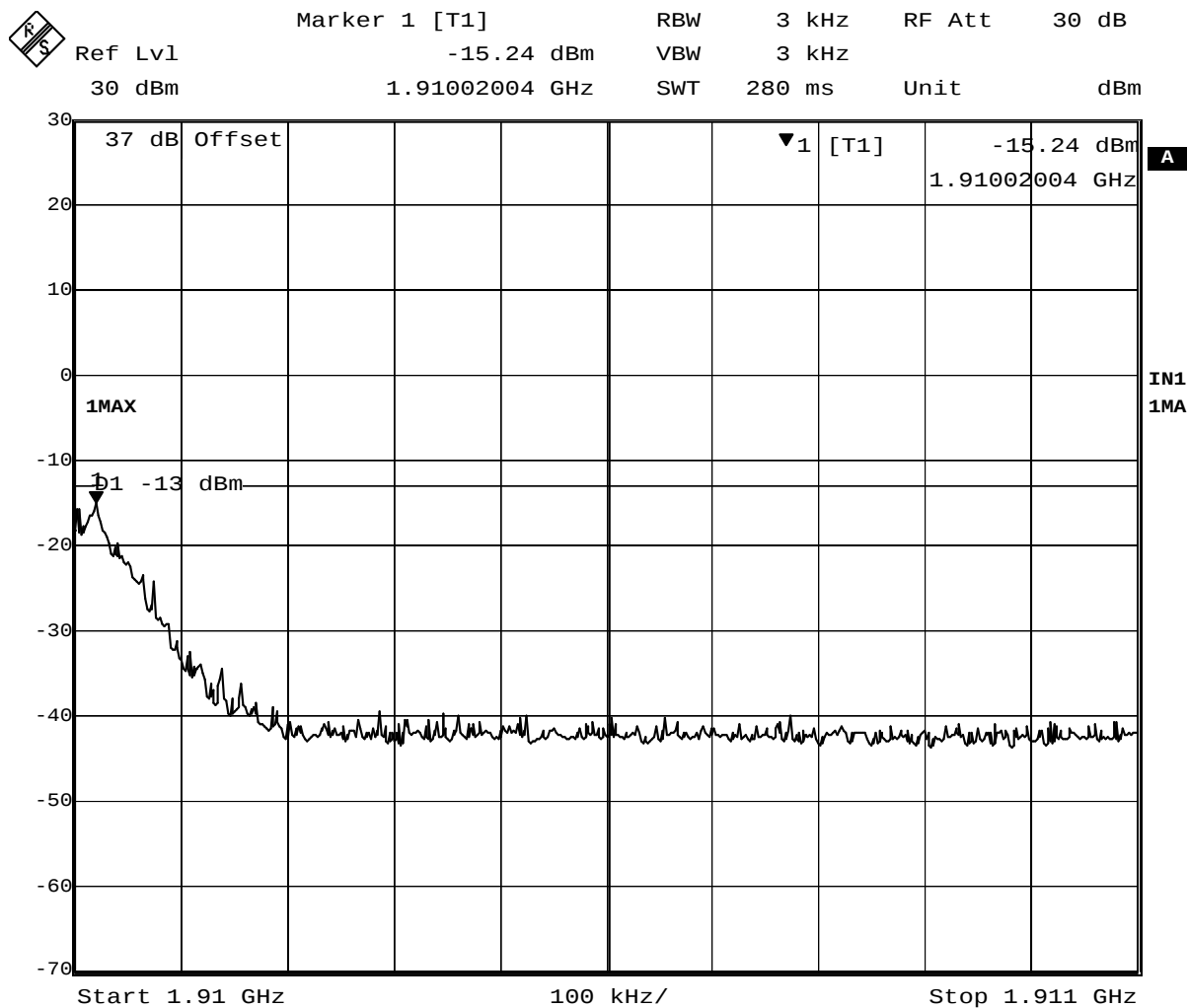


Date: 2.AUG.2006 20:10:51

Test: band edge compliance , Channel 512, EDGE

## Op. Mode

op-mode 3

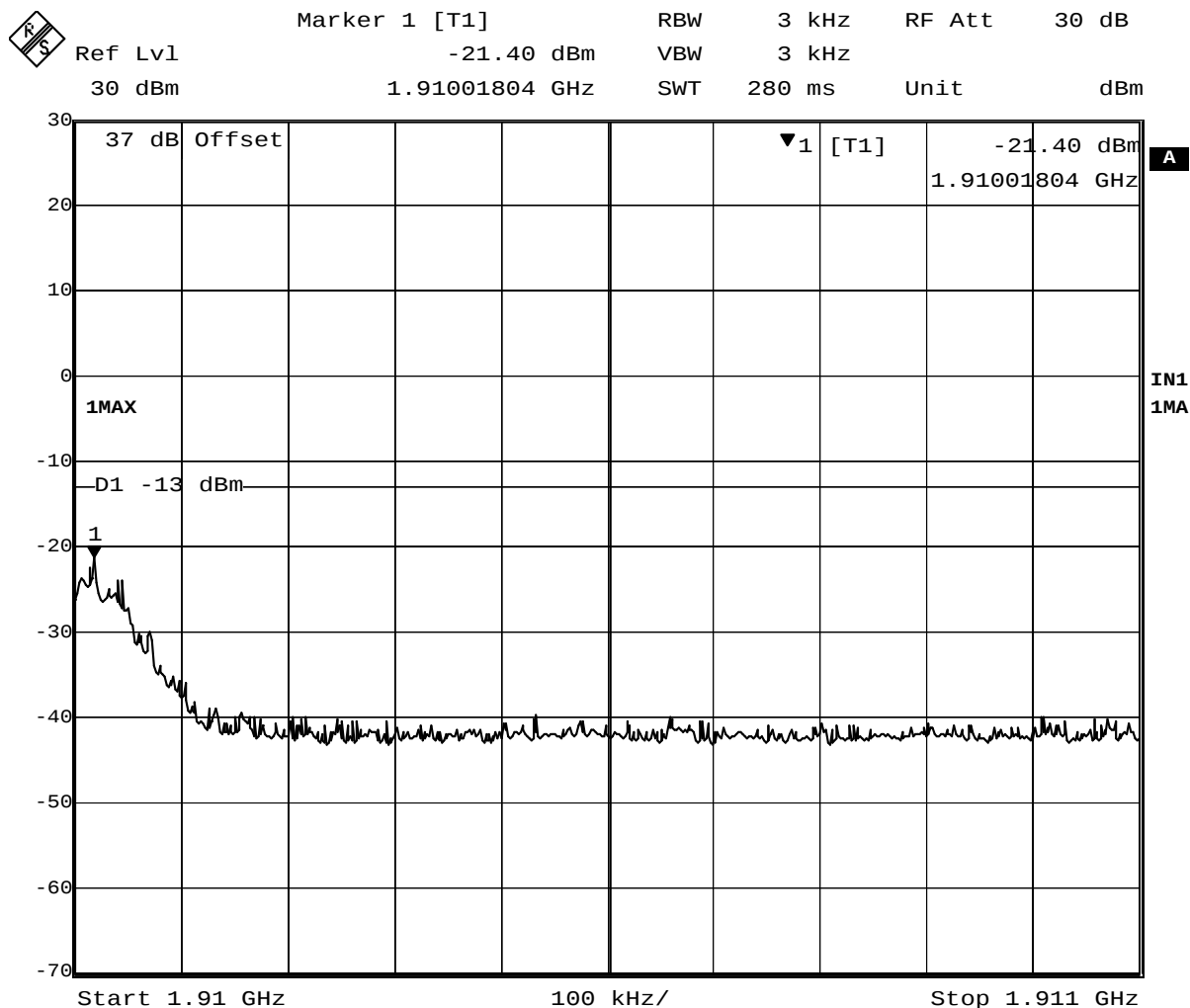


Date: 2.AUG.2006 20:19:21

Test: band edge compliance , Channel 810, PCS

## Op. Mode

op-mode 6



Date: 2.AUG.2006 20:23:11

Test: band edge compliance , Channel 810, EDGE