

# TEST REPORT







## No.: 6-0082-11-1-2a

According to:  
**FCC Regulations**  
 Part 22 & Part 24

**IC-Regulations**  
 RSS-132 Issue 2, RSS-133 Issue 5 &  
 RSS-Gen Issue 3

for  
**u-blox AG**

RF Data-Module LISA-U200  
*FCC-ID: XPYLISAU200*  
*IC-ID: 8595A-LISAU200*

| Laboratory Accreditation and Listings  |   |   |   |
|--|---|---|---|
| <br>D-PL-12047-01-01  | <br>Reg. No.: 736496<br>MRA US-EU 0003 | <br>Reg. No.: 3462D-1<br>Reg. No.: 3462D-2<br>Reg. No.: 3462D-3 | <br>Voluntary Controls for<br>Electromagnetic Emissions<br>Reg. No.: R-2665, R-2666<br>C-2914, T-1967, G-301 |
|  <b>AUTHORIZED<br/>           RF LABORATORY</b>   | <br><b>LAB CODE 20011130-00</b>       |   |   |
| accredited according to DIN EN ISO/IEC 17025   |   |   |   |
| <p align="center"> <b>CETECOM GmbH</b><br/>           Laboratory Radio Communications &amp; Electromagnetic Compatibility<br/>           Im Teelbruch 116 • 45219 Essen • Germany<br/>           Registered in Essen, Germany, Reg. No.: HRB Essen 8984<br/>           Tel.: + 49 (0) 20 54 / 95 19-954 • Fax: + 49 (0) 20 54 / 95 19-964<br/>           E-mail: info@cetecom.com • Internet: www.cetecom.com         </p> |   |   |   |

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## 1. Summary of test results

The test results apply exclusively to the test samples as presented in this Report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests.

The presented RF data-module includes GPRS/(E)GPRS and W-CDMA Band II and V technologies. This test report shows results for GPRS and (E)GPRS technologies only.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H and Part 24, Subpart E (Broadband PCS) of the FCC CFR 47 Rules, Edition 1<sup>st</sup> October 2010 and Canada RSS-132, RSS-133 and RSS-Gen standards.

### 1.1. TX Mode TESTS OVERVIEW FCC Part 15/22/24 and Canada IC Standards (RSS)

| TEST CASES                                     | PORT                             | REFERENCES & LIMITS                                     |   |  | EUT set-up | EUT op-mode      | Result |
|--|----------------------------------|---|---|--|------------|------------------|--------|
|  |                                  | FCC Standard  | RSS Section   | TEST LIMIT   |            |                  |        |
| Emissions AC-Power Lines 0,15-30 MHz conducted | AC-Power lines                   | §15.207   | RSS-Gen, Issue 3: Chapter 7.2.4   | FCC §15.107 class B limits §15.207 limits<br>IC: Table 4, Chapter 7.2.4          | 3          | 2 + 4            | Passed |
| field strength <30 MHz radiated                | Cabinet + Interconnecting cables | §15.209(a)  | RSS-Gen: 4.11   | 2400/F(kHz) µV/m<br>24000/F(kHz) µV/m<br>30 µV/m                                 | 3          | 2 + 4            | Passed |
| RF POWER conducted                             | Antenna terminal                 | §2.1046   | --  | N/A  | 2          | 1+ 2+<br>3+ 4    | Passed |
| RF-POWER (ERP/EIRP) radiated                   | Cabinet                          | §2.1046<br>§22.913(a)(2)<br>§24.232(c)                  | RSS-132: 4.4<br>SRSP-503: 5.1.3<br><br>RSS-133:4.1/6.4<br>SRSP-510: 5.1.2 | < 7 Watt (ERP)<br><br>< 2 Watt (EIRP)  | 1          | 1 + 2 +<br>3 + 4 | Passed |
| Radio frequency Exposure EVALUATION (MPE)      | Antenna terminal                 | §1.1310<br>§2.1091                                      | RSS-102, Issue 2  | FCC: §1.1310 Table 1, Limits for General Population<br>IC: Chapter 4.2 RF-Limits | 2          | 1 + 3            | Passed |
| SPURIOUS EMISSIONS conducted                   | Antenna terminal                 | §2.1051<br>§2.1057<br>§22.917(a)(b)<br>§24.238(a)(b)    | RSS 132: 4.5.1<br>RSS 133: 6.5.1(a)(b)                                    | 43+10log(P) dBc  | 2          | 1+ 2+<br>3+ 4    | Passed |
| 26dB EMISSION BANDWIDTH                        | Antenna terminal                 | §2.202<br>§2.1049<br>§22.917(a)<br>§24.238(a)           | RSS Gen:4.6.1   | 99% Power  | 2          | 1+ 2+<br>3+ 4    | Passed |
| 99%OCCUPIED BANDWIDTH                          | Antenna terminal                 | §2.202<br>§2.1049<br>§22.917(a)<br>§24.238(a)           | RSS Gen:4.6.1   | 99% Power  | 2          | 1+ 2+<br>3+ 4    | Passed |
| SPURIOUS EMISSIONS radiated                    | Cabinet + Interconnecting cables | §2.1053(a)<br>§2.1057<br>§22.917(a)(b)<br>§24.238(a)(b) | RSS-132: 4.5.1 & 4.5.2<br><br>RSS 133: 6.5.1(a)(b)                        | 43+10log(P) dBc  | 1          | 2 + 4            | Passed |
| FREQUENCY STABILITY conducted                  | Antenna terminal                 | §22.355, table C-1<br>§24.235<br>§2.1055(a)(2)          | RSS-132: 4.3<br><br>RSS 133: 6.3  | < ±2.5ppm<br><br><±0.1 ppm   | 2          | 1+ 2+<br>3+ 4    | Passed |


**1.2. RX Mode TESTS OVERVIEW FCC Part 15/22/24 and Canada IC Standards (RSS)**

| TEST CASES  | PORT                                | REFERENCES & LIMITS         |  |   | EUT set-up | EUT op-mode | Result             |
|---|-------------------------------------|-----------------------------|--|---|------------|-------------|--------------------|
|   |                                     | FCC Standard                | RSS Section  | TEST LIMIT  |            |             |                    |
| Emissions<br>AC-Power Lines<br>0,15-30 MHz<br>conducted | AC-Power lines                      | §15.107<br>§15.207          | RSS-Gen, Issue 3:<br>Chapter 7.2.4   | FCC §15.107<br>class B limits<br>§15.207 limits<br><br>IC: Table 4, Chapter 7.2.4 | --         | --          | Passed<br>Remark 1 |
| RECEIVER<br>emissions<br>radiated                       | Cabinet +<br>Interconnecting cables | §15.109<br>§15.33<br>§15.35 | RSS-132,<br>Issue 2: 4.6<br>RSS-Gen,<br>Issue 3: 6.1<br><br>RSS 133,<br>Issue 5: 6.6 | FCC 15.109<br>class B limits<br><br>IC-limits:<br>Table 1, Chapter 6              | --         | --          | Passed<br>Remark 1 |
| RECEIVER<br>Emissions<br>30-1000MHz<br>conducted        | Antenna terminal                    | §2.1051                     | RSS-Gen: 6.2<br>RSS132: 4.6<br>RSS133: 6.7(b)  | 43+10log(P) dBc<br>IC: < 2 nW/4kHz<br>< 5nW/4kHz<br>(P > 1GHz)                    | --         | --          | Passed<br>Remark 1 |

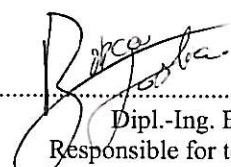
Remark: 1.) See separate test report TR6-0082-11-1-2c for measurements according Part 15, Subpart B.

**ATTESTATION:**

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Industry Canada standards. All requirements as shown in above table are met in accordance with enumerated standards.

  
.....  
Dipl.-Ing. W. Richter  
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.....  
Dipl.-Ing. B. Taslica  
Responsible for test report

## 2. Administrative Data

### 2.1. Identification of the testing laboratory

|                                     |   |
|-------------------------------------|---|
| Company name:                       | CETECOM GmbH  |
| Address:                            | Im Teelbruch 116<br>45219 Essen - Kettwig<br>Germany  |
| Responsible for testing laboratory: | Dipl.-Ing. W. Richter   |
| Deputy:                             | Dipl.-Ing. J. Schmitt   |
| Laboratory accreditations/Listings: | DAkkS-Registration No. D-PL-12047-01-01<br>FCC-Registration No.: 736496, MRA US-EU 0003<br>IC-Registration No. 3462D-1, 3462D-2, 3462D-3<br>VCCI Reg. No. R-2665, R-2666, C-2914, T-1967, G-301 |

### 2.2. Test location

#### 2.2.1. Test laboratory "CTC"

|               |   |
|---------------|---|
| Company name: | see chapter 2.1. Identification of the testing laboratory |
|---------------|---|

### 2.3. Organizational items

|   |                        |
|---|------------------------|
| Order No.:                                      | E600082001             |
| Responsible for test report and project leader: | Dipl.-Ing. B. Taslica  |
| Receipt of EUT:                                 | 2011-10-26             |
| Date(s) of test:                                | 2011-10-26- 2011-11-15 |
| Date of report:                                 | 2011-11-23             |
| -----   |                        |
| Version of template:                            | 11.10                  |

### 2.4. Applicant's details

|                   |  |
|-------------------|--|
| Applicant's name: | u-blox AG  |
| Address:          | Zürcherstrasse 68<br>8800 Thalwil<br><br>Switzerland |
| Contact person:   | Mr. Andreas Thiel                                    |

### 2.5. Manufacturer's details

|                      |                                |
|----------------------|--------------------------------|
| Manufacturer's name: | please see Applicant's details |
| Address:             | please see Applicant's details |

### 3. Equipment under test (EUT)

#### 3.1. Technical description of main EUT

|  |  |  |                                      |
|--|--|--|--------------------------------------|
| Main function  | E-GPRS/UMTS RF Module  |  |                                      |
| Type   | RF data module   |  |                                      |
| GSM Frequency range<br>(US/Canada -bands)                            | GSM 850: 824 – 849MHz (Uplink), 869-894MHz (Downlink)<br>GSM1900: 1850-1910MHz (Uplink), 1930-1990MHz (Downlink)   |  |                                      |
| Type of modulation   | GMSK/8-PSK   |  |                                      |
| Number of channels<br>(USA/Canada -bands)                            | GSM 850: 128 – 251, 125 channels<br>GSM1900: 512 – 810, 300 channels   |  |                                      |
| EMISSION DESIGNATOR(S)   | 247KGXW (GPRS850)<br>250KGXW (EDGE850)<br>247KG7W (GPRS1900)<br>256KG7W (EDGE 1900)  |  |                                      |
| Antenna Type   | <input type="checkbox"/> Integrated<br><input type="checkbox"/> External, no RF- connector<br><input checked="" type="checkbox"/> External, separate RF-connector  | Frequency range of antenna:<br>800MHz to 2200MHz   |                                      |
| Antenna Gain   | <input checked="" type="checkbox"/> radiated:.3.0 dBi average gain   |  |                                      |
| MAX PEAK/AVERAGE<br>Output Power (conducted): GPRS 850<br>EDGE 850   | 32.80 dBm (PK) / 32.67 dBm (AV)<br>30.11 dBm (PK) / 27.30 dBm (AV)   |  |                                      |
| MAX PEAK/AVERAGE<br>Output Power (radiated): GPRS 850<br>EDGE850     | 26.80 dBm (PK)<br>26.20 dBm (PK)   |  |                                      |
| MAX PEAK/AVERAGE<br>Output Power (conducted): GPRS 1900<br>EDGE 1900 | 30.45 dBm (PK) / 30.27 dBm (AV)<br>29.04 dBm (PK) / 26.47 dBm (AV)   |  |                                      |
| MAX PEAK/AVERAGE<br>Output Power (radiated): GPRS 1900<br>EDGE 1900  | 26.30 dBm (PK)<br>27.20 dBm (PK)   |  |                                      |
| FCC-ID   | XPYLISAU200  |  |                                      |
| IC   | 8595-LISAU200  |  |                                      |
| Installed options  | <input checked="" type="checkbox"/> GSM900 and GSM1800 Bands (not usable in USA/Canada)<br><input checked="" type="checkbox"/> W-CDMA Band II and Band V (usable in USA/Canada)<br><input checked="" type="checkbox"/> W-CDMA Band I and VI (not usable in USA/Canada) |  |                                      |
| Power supply   | <input checked="" type="checkbox"/> over AC/DC adaptor: 110V/60Hz<br><input checked="" type="checkbox"/> DC power 3.8 Volt (nominal)   |  |                                      |
| Special EMI components   | --   |  |                                      |
| Lowest radio frequency signal  | Master clock 26 MHz  |  |                                      |
| EUT sample type  | <input type="checkbox"/> Production  | <input checked="" type="checkbox"/> Pre-Production | <input type="checkbox"/> Engineering |

### 3.2. EUT: Type, S/N etc. and short descriptions used in this test report

| Short description*) | EUT                    | Type                          | S/N serial number            | HW hardware status    | SW software status |
|---------------------|------------------------|-------------------------------|------------------------------|-----------------------|--------------------|
| EUT A               | RF Data-Module         | LISA-U200<br>LISA-U200-00S-00 | IMEI:<br>35890104000<br>1353 | 146001                | 21.03.00           |
| EUT B               | RF Data-Module         | LISA-U200<br>LISA-U200-00S-00 | IMEI:<br>35890104000<br>1734 | 146001                | 21.03.00           |
| EUT C               | Adapter Board          | LISA-U200 FAE                 | SN095                        | IP02_HW_CS_<br>150000 | --                 |
| EUT D               | Magnetic Mount Antenna | Taoglas GA.107                | #1                           | --                    | --                 |

\*) EUT short description is used to simplify the identification of the EUT in this test report.

### 3.3. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

| AE short description *) | Auxiliary Equipment                         | Type  | S/N serial number | HW hardware status | SW software status |
|-------------------------|---|---|-------------------|--------------------|--------------------|
| AE 1                    | AC/DC adaptor<br>(AC 110V/60Hz,<br>DC 12 V) | 0055<br>(Power supply<br>connected on<br>EUT B) | # 1               | --                 | --                 |

\*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

### 3.4. EUT set-ups

| EUT set-up no. *) | Combination of EUT and AE   | Remarks   |
|-------------------|-----------------------------|---|
| Set. 1            | EUT A + EUT C + EUT D+ AE 1 | Used for radiated tests   |
| Set. 2            | EUT A + EUT C               | Used for conducted tests (power supply cables at EUT B for low, high and low voltage) |
| Set. 3            | EUT B + EUT C+ EUT D+ AE 1  | Used for radiated tests   |

\*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

### 3.5. EUT operating modes

| EUT operating mode no. *) | Description of operating modes                                  | Additional information   |
|---------------------------|---|--|
| op. 1                     | GPRS 850<br>TCH mode<br>TCH=128/192/251                         | A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (33dBm).<br>The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.  |
| op. 2                     | EGPRS 850<br>TCH mode<br>TCH=128/192/251                        | A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8PSK modulation, slot 3 active, uplink gamma: 6 (27dBm).<br>The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. |
| op. 3                     | GPRS 1900<br>TCH mode<br>TCH=512/661/810                        | A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (30dBm).<br>The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link   |
| op. 4                     | EGPRS 1900<br>TCH mode<br>PCL=0 (max. power)<br>TCH=512/661/810 | A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8-PSK modulation, slot 3 active, uplink gamma: 5 (26dBm).<br>The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link |

\*) EUT operating mode no. is used to simplify the test report.



### 3.6. Parameter Settings on mobile phone and base station CMU200

Following settings apply to the MS during the measurements in **GPRS/(E)GPRS-Mode** only:

| Parameter   | Traffic Mode  | Idle Mode         |
|---|---|-------------------|
| Traffic Channels mobile station (EUT)                   | GSM 850 TCH <sub>MS</sub> = 128/ 192 /251<br>GSM 1900 TCH <sub>MS</sub> = 512 / 661 / 810 | --                |
| maximum power level (PCL)                               | GSM 850: PCL = 5 (2 Watt)<br>GSM 1900: PCL = 0 (1 Watt)                                   | --                |
| Modulation  | GPRS: GMSK-Modulation Scheme<br>EDGE: 8-PSK Modulation Scheme                             | --                |
| DTX   | Off   | --                |
| Bitstream   | PRBS 2E9-1 (pseudo-random-sequence) – CCITT 0.153   |                   |
| Timeslot  | 3   |                   |
| Hopping   | Off   |                   |
| Timeslot (slot mode)                                    | GPRS/EDGE-Mode: maximum power on one uplink slot according MS class                       |                   |
| MS slot class   | Class 8   |                   |
| Maximum data transmission rate, single time slot        | GPRS: 20,0 kbit/s Slot<br>EDGE: 59,2 kbit/s Slot  |                   |
| Speech transcoding (Traffic Mode)                       | Full rate Version 1   |                   |
| Domain  | Packet Switched(PS)   |                   |
| Mode  | BCCH and TCH  |                   |
| BCCH – base station (CMU,CMD)                           | GSM 850: 182<br>GSM 1900: 651   |                   |
| TCH – base station (CMD, CMU)                           | auto  |                   |
| Power level TCH – base station (used timeslot level)    | - 70 dBm  |                   |
| Power level BCCH – base station (control channel level) | - 80 dBm  |                   |
| External attenuation RF/AF-Input/Output                 | Accord. calibration prior to measurements   |                   |
| Mobile Country Code                                     | 310   | 310               |
| BS_AG_BLKS_RES  | Not applicable  | 0                 |
| Paging reorganisation                                   |   | Off (0)           |
| Signalling channel                                      |   | SDCCH             |
| Location Update   |   | Auto              |
| Cell access   |   | Disabled (barred) |
|   |   |                   |

#### Settings for CMU (general)

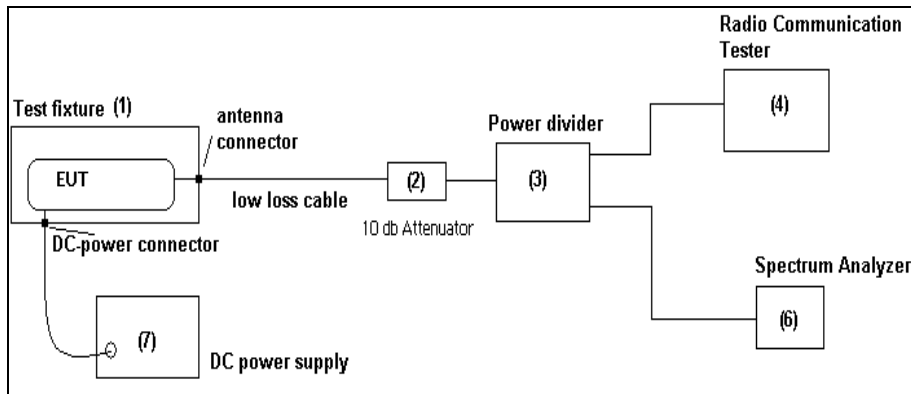
|                 |             |  |
|-----------------|-------------|--|
| Repetition      | Continuous  |  |
| Stop condition  | None        |  |
| Display mode    | Max./Min    |  |
| Statistic Count | 1000 Bursts |  |
| Decoder         | Standard    |  |

Additional settings on the base stations CMU200 for frequency stability measurements

## 4. DESCRIPTION OF TEST SET-UP's

### 4.1. GSM-Mode Test Set-up for conducted measurements

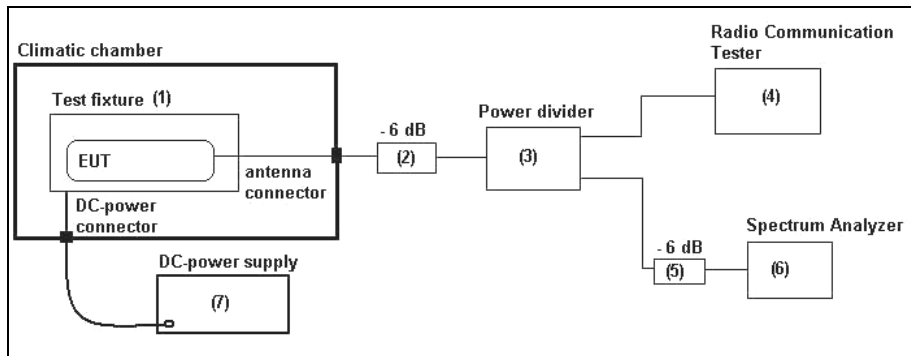
The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first 10 dB attenuated (2) before it is 0° divided by a power divider (3). One of the signal path is connected to the communication base station (4), other branch is connected to the spectrum – analyzer (5). The specific attenuation losses for both signal paths/branches are determined prior to the measurement within a set-up calibration. These are then taken into account by correcting the measurement readings on the spectrum-analyzer.



**Schematic: Test set-up conducted**

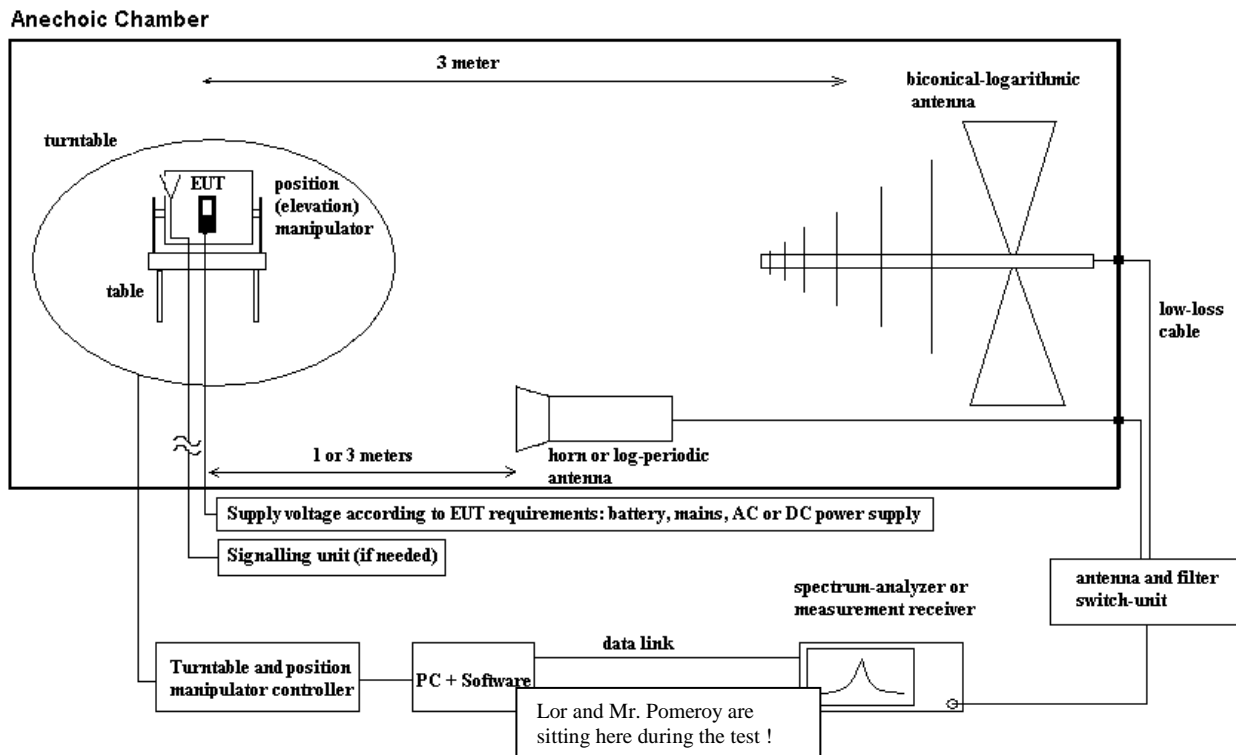
Following modified test set-up schematic apply for tests performed inside the climatic chamber: (Frequency stability)

In case an external connector is available (test fixture), following set-up is used for measurements.



**Schematic: Test set-up conducted within climatic chamber**

## 4.2. Test set-up for radiated measurements



Schematic: radiated measurements test set-up

### MEASUREMENT METHOD in the range 30 MHz to 1 GHz

An EMI receiver together with a broadband antenna was used in order to identify the emissions from the EUT by positioning the antenna close to the EUT surfaces. The interconnecting cables and equipment position were varied in order to maximize the emissions. Then most critical frequencies are recorded for further investigations. Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's operating mode, cable position, etc. The EUT was placed on a non-conductive support of 0.8 m height. By rotating the turntable angle in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position) and the measurement antenna height from 1 meter to 4 meters, the maximized emissions are recorded. The measurements are performed for both polarizations of the measuring antenna: horizontal and vertical.

### MEASUREMENT METHOD in the range 1 GHz to 26.5 GHz or 40 GHz):

The EUT and accessories are placed on a non-conducting tipping table of 0.8 meter height (semi-anechoic chamber) or 1.55m height (fully-anechoic chamber) which is situated in the middle of the turntable. The turntable can rotate the device under test 360 degree, the tipping table can rotate the device from laid to standing position. This way the device under test can be rotated in all three orthogonal planes in order to maximize the detected emissions. The turn- and tipping table are controlled by a controller unit. All positions manipulations are software controlled from a operator PC.

The measurements are performed for both receiving antenna polarisations: vertical and horizontal.

Up to 18 GHz a measurement distance of 3 meters is used, above 18 GHz the distance is 1 meter. A logarithmic-periodic antenna for frequencies above 1 GHz up to 26.5 GHz is used. For frequencies above 26.5 GHz a horn antenna is used, pls. compare the equipment list for more details.

The EUT is powered either by an external DC-supply with nominal voltage or an AC/DC power supply as accessory. The communication signalling (if necessary for operation) is performed from outside the chamber with a communication test simulator (CMU200 from Rohde&Schwarz) and a signalling antenna place near the EUT.

## 5. Measurements

### 5.1. Conducted emissions on AC-Power lines

#### 5.1.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

|               |   |   |  |   |  |
|---------------|---|---|--|---|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter 2.2.1) | <input type="checkbox"/> Please see Chapter 2.2.2 |  | <input type="checkbox"/> Please see Chapter 2.2.3 |  |
| test site     | <input type="checkbox"/> 333 EMI field                            | <input checked="" type="checkbox"/> 348 EMI cond. |  |   |  |
| receiver      | <input type="checkbox"/> 001 ESS                                  | <input checked="" type="checkbox"/> 377 ESCS 30   |  |   |  |
| LISN          | <input checked="" type="checkbox"/> 005 ESH2-Z5                   | <input type="checkbox"/> 007 ESH3-Z6              | <input type="checkbox"/> 300 ESH3-Z5 & 50Ω used for AE           | <input type="checkbox"/> no LISN for AE           |  |
| signaling     | <input type="checkbox"/> 392 MT8820A                              | <input type="checkbox"/> 436 CMU                  | <input type="checkbox"/> 547 CMU                                 |   |  |
| line voltage  | <input type="checkbox"/> 230 V 50 Hz via public mains             |   | <input checked="" type="checkbox"/> 060 110 V 60 Hz via PAS 5000 |   |  |

#### TEST CONDITION AND MEASUREMENT PROCEDURES TEST SET-UP

|                                  |  |  |  |
|----------------------------------|--|--|--|
| link to test system (if used):   | <input type="checkbox"/> air link  | <input type="checkbox"/> cable connection  | <input type="checkbox"/>   |
| EUT-grounding                    | <input type="checkbox"/> none  | <input type="checkbox"/> with power supply | <input type="checkbox"/> additional connection   |
| Equipment set up                 | <input checked="" type="checkbox"/> table top<br>(40 cm distance to reference ground plane (wall)) |  | <input type="checkbox"/> floor standing<br>EUT stands isolated on reference ground plane (floor) |
| Climatic conditions              | Temperature: (22±3°C)  |  | Rel. humidity: (40±20)%  |
| EMI-Receiver (Analyzer) Settings | Frequency Range: 150 kHz to 30 MHz<br>RBW: 9 kHz   |  |  |

Devices which can be connected to the public AC-power network, should be tested against the radio frequency voltage conducted back into the AC-power line in the frequency range 150kHz to 30 MHz. Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.

A 500hm/50μH line impedance stabilization network (LISN) is used therefore. The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the GND-plane. The measuring instrument is connected to the coaxial output of the LISN.

Tabletop devices were set-up on a 80 cm height over reference ground plane, floor standing equipment 10 cm raised above ground plane.

Measurements have been performed on each phase line and neutral line of the devices AC-power lines. The EUT was power supplied with 110 V/60Hz.

The EUT was tested in the defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

**Preliminary testing** as a first step, determines the worst-case phase line (neutral or phase) as well as the most critical amplitude by changing the operating mode. A complete frequency-sweep is performed with PK-Detector.

**Final testing** for power phases and critical frequencies (Margin to AV- or QP limit lower than 3dB) as a second step includes measurements either on discrete frequency components with receivers detector set to Quasi-Peak and Average per frequency component or a complete frequency sweep with corresponding detector according to ANSI 63.4, CISPR 16.

**MEASUREMENT RESULTS**

| EUT Type and S/N or EUT set-up no. |                                   | EUT set-up 3   |            |   |   |        |
|------------------------------------|-----------------------------------|--|------------|---|---|--------|
| Diagram No.                        | EUT operating mode no. or comment | Used Detector  | Power line | Limit Class   | Additional (scan-) information  | Result |
| a_1.2                              | EUT operating mode 1 (ARFCN 128)  | <input type="checkbox"/> Peak<br><input checked="" type="checkbox"/> CAV<br><input checked="" type="checkbox"/> QP | L1/ N      | <input type="checkbox"/> A<br><input checked="" type="checkbox"/> B | The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode.   | passed |
| a_1.3                              | EUT operating mode 1 (ARFCN 192)  | <input type="checkbox"/> Peak<br><input checked="" type="checkbox"/> CAV<br><input checked="" type="checkbox"/> QP | L1/ N      | <input type="checkbox"/> A<br><input checked="" type="checkbox"/> B | The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode.   | passed |
| a_1.4                              | EUT operating mode 1 (ARFCN 251)  | <input type="checkbox"/> Peak<br><input checked="" type="checkbox"/> CAV<br><input checked="" type="checkbox"/> QP | L1/ N      | <input type="checkbox"/> A<br><input checked="" type="checkbox"/> B | The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode.   | passed |
| a_1.5                              | EUT operating mode 2 (ARFCN 512)  | <input type="checkbox"/> Peak<br><input checked="" type="checkbox"/> CAV<br><input checked="" type="checkbox"/> QP | L1/ N      | <input type="checkbox"/> A<br><input checked="" type="checkbox"/> B | The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode. Final measurement QP and AV was carried out on at least one frequency | passed |
| a_1.6                              | EUT operating mode 2 (ARFCN 661)  | <input type="checkbox"/> Peak<br><input checked="" type="checkbox"/> CAV<br><input checked="" type="checkbox"/> QP | L1/ N      | <input type="checkbox"/> A<br><input checked="" type="checkbox"/> B | The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode. Final measurement QP and AV was carried out on at least one frequency | passed |
| a_1.7                              | EUT operating mode 2 (ARFCN 810)  | <input type="checkbox"/> Peak<br><input checked="" type="checkbox"/> CAV<br><input checked="" type="checkbox"/> QP | L1/ N      | <input type="checkbox"/> A<br><input checked="" type="checkbox"/> B | The Diagram shows QP/CAV detector measurements on L1 and N with maxhold mode. Final measurement QP and AV was carried out on at least one frequency | passed |

Remarks:

For more information please see diagrams enclosed in the annex to this Report.

Positive margin means passed result.

Margin to Limit for verdict:  $M = L_T - R_R + C_{Loss}$

Abbreviations used:

- $R_R$  : Receiver readings in dB $\mu$ V
- $C_{Loss}$ : cable loss
- $L_T$  : Limit in dB $\mu$ V

**VERDICT**

Summary of measurement results for conducted emissions on AC-Power lines: Passed

## 5.2. Radiated field strength emissions below 30 MHz

### 5.2.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

|                 |  |   |  |
|-----------------|--|---|--|
| test location   | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2  | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site       | <input checked="" type="checkbox"/> 441 EMI SAR                    | <input type="checkbox"/> 487 SAR NSA                | <input type="checkbox"/> 347 Radio.lab.            |
| receiver        | <input type="checkbox"/> 377 ESCS30                                | <input checked="" type="checkbox"/> 001 ESS         | <input type="checkbox"/>                           |
| spectr. analys. | <input type="checkbox"/> 584 FSU                                   | <input type="checkbox"/> 120 FSEM                   | <input type="checkbox"/> 264 FSEK                  |
| antenna         | <input type="checkbox"/> 574 BTA-L                                 | <input type="checkbox"/> 133 EMCO3115               | <input type="checkbox"/> 302 BBHA9170              |
| signaling       | <input type="checkbox"/> 392 MT8820A                               | <input type="checkbox"/> 436 CMU                    | <input type="checkbox"/> 547 CMU                   |
| otherwise       | <input type="checkbox"/> 400 FTC40x15E                             | <input type="checkbox"/> 401 FTC40x15E              | <input type="checkbox"/> 110 USB LWL               |
| DC power        | <input type="checkbox"/> 456 EA 3013A                              | <input type="checkbox"/> 457 EA 3013A               | <input type="checkbox"/> 459 EA 2032-50            |
| line voltage    | <input type="checkbox"/> 230 V 50 Hz via public mains              | <input checked="" type="checkbox"/> 060 110 V 60 Hz | via PAS 5000                                       |

### STANDARDS AND LIMITS: CFR 47, §15.205, §15.209, RSS-Gen

| Frequency [MHz] | Field strength |                        | Measurement distance [meters] | Remarks  |
|-----------------|----------------|------------------------|-------------------------------|--|
|                 | [µV/m]         | [dBuV/m]               |                               |  |
| 0.009 – 0.490   | 2400/f (kHz)   | 67.6 – 20Log(f) (kHz)  | 300                           | Correction factor used due to measurement distance of 3m |
| 0.490 – 1.705   | 24000/f (kHz)  | 87.6 – 20 Log(f) (kHz) | 30                            | Correction factor used due to measurement distance of 3m |
| 1.705 – 30      | 30             | 29.54                  | 30                            | Correction factor used due to measurement distance of 3m |

Remark: \* decreases with the logarithm of the frequency

### TEST CONDITION AND MEASUREMENT TEST SET-UP

|                                  |  |  |  |
|----------------------------------|--|--|--|
| link to test system (if used):   | <input type="checkbox"/> air link  | <input type="checkbox"/> cable connection  | <input type="checkbox"/>                       |
| EUT-grounding                    | <input type="checkbox"/> none  | <input type="checkbox"/> with power supply | <input type="checkbox"/> additional connection |
| Equipment set up                 | <input checked="" type="checkbox"/> table top  |  | <input type="checkbox"/> floor standing        |
| Climatic conditions              | Temperature: (22±3°C)  |  | Rel. humidity: (40±20)%                        |
| EMI-Receiver (Analyzer) Settings | Span/Range: 9kHz to 150kHz; 150 kHz to 30 MHz<br>RBW/VBW: 200Hz/auto; 10 kHz/ auto (ANSI63.10/CISPR#16)<br>Detector/ Mode: PEAK, TRACE max-hold mode, repetitive scan for exploratory measurements<br>Quasi-Peak, for final measurement on critical frequencies (f<1GHz) |  |  |

### GENERAL MEASUREMENT PROCEDURES:

The measurement test set-up and test procedure are in accordance with the provisions described in ANSI 63.10: 2009

The **Equipment under Test (EUT)** was set-up to defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

The measurement loop antenna was situated in 3m distance to the EUT. Between EUT and measurement antenna absorbers are covering the GND-Plane. With these absorbers the chamber fulfills CIPR16-1-4 site VSWR-criteria. Radiated magnetic emission measurements were made with the antenna situated in 1 meter height. The loop antenna was moved at least to 2-perpendicular axes (antenna vector in direction of EUT and parallel to EUT) in order to maximize the emissions, the EUT itself either over 3-orthogonal axes (no defined usage position) or 2-orthogonal axis (defined usage position) by the position manipulator.

According the standard the compliance should be checked in 30m and 300m measurement distance. Therefore a additional extrapolation factor was used in order to normalize the measurement data. The frequency dependent extrapolation factor used for this reduced measurement distance, can be found on page 16.

**MEASUREMENT RESULTS**

Due to uncritical measurements (only noise floor) measurements have been performed only in E-GPRS Mode.

| Set-up No.           |                           | 3                |                 |                           |                     |          |                          |                              |                 |                                  |
|----------------------|---------------------------|------------------|-----------------|---------------------------|---------------------|----------|--------------------------|------------------------------|-----------------|----------------------------------|
| Operating Mode       |                           | 2                |                 |                           |                     |          |                          |                              |                 |                                  |
| Diagram no.          | Frequency (MHz)           | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz)           | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) (C <sub>F</sub> ) | Margin (dB) (M) | Limit (dBµV/m) (L <sub>T</sub> ) |
| a_3.05 (mid. ch.)    | Same settings (see below) | See diagram      | 10              | Same settings (see below) | 100                 | --       | 0°..360°                 | Same settings (see below)    | See diagram     |                                  |
| a_3.06 (high ch.)    |                           |                  |                 |                           |                     |          |                          |                              |                 |                                  |
| a_3.04 (low channel) | 0.009 to 0.150            | <-55             | 10              | 0.2                       | 100                 | --       | 0°..360°                 | 300 to 3m                    | >20             | See diagram                      |
|                      | 0.150 to 0.5              | -66.63           |                 | 10                        |                     |          |                          | 300 to 3m                    | >20             |                                  |
|                      | 0.5 to 30                 | 19.23            |                 | 10                        |                     |          |                          | 300 to 3m<br>30 to 3m        | 10.31           |                                  |

Remark: Selected worst-case measurement to the closest limit of EDGE mode. Please see the other measured channels as diagrams in the separate annex.

| Set-up No.            |                           | 3                |                 |                           |                     |          |                          |                              |                 |                                  |
|-----------------------|---------------------------|------------------|-----------------|---------------------------|---------------------|----------|--------------------------|------------------------------|-----------------|----------------------------------|
| Operating Mode        |                           | 4                |                 |                           |                     |          |                          |                              |                 |                                  |
| Diagram no.           | Frequency (MHz)           | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz)           | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) (C <sub>F</sub> ) | Margin (dB) (M) | Limit (dBµV/m) (L <sub>T</sub> ) |
| a_3.01 (low. ch.)     | Same settings (see below) | See diagram      | 10              | Same settings (see below) | 100                 | --       | 0°..360°                 | Same settings (see below)    | See diagram     |                                  |
| a_3.02 (mid. ch.)     |                           |                  |                 |                           |                     |          |                          |                              |                 |                                  |
| a_3.03 (high channel) | 0.009 to 0.150            | <-55             | 10              | 0.2                       | 100                 | --       | 0°..360°                 | 300 to 3m                    | >20             | See diagram                      |
|                       | 0.150 to 0.5              | <-60             |                 | 10                        |                     |          |                          | 300 to 3m                    | >20             |                                  |
|                       | 0.5 to 30                 | 20.41            |                 | 10                        |                     |          |                          | 300 to 3m<br>30 to 3m        | 9.13            |                                  |

Remark: Selected worst-case measurement to the closest limit of EDGE mode. Please see the other measured channels as diagrams in the separate annex.

|  |  |
|--|--|
| <p><b>Margin to Limit:</b></p> $M = L_T - R_R + C_F + D_F$ $= L_T - R_R + (AF_{ANTENNA} + Cable_{LOSS}) + D_F$ | <p><b>Abbreviations used:</b></p> <ul style="list-style-type: none"> <li>• R<sub>R</sub> : Receiver readings in dBµV/m</li> <li>• C<sub>F</sub>: Transducer in dB = AF (antenna factor) + CL (cable loss)</li> <li>• D<sub>F</sub>: distance correction factor (if different measurement distance used than specified in the standard)</li> <li>• L<sub>T</sub> : Limit in dBµV/m</li> </ul> |
|--|--|

**VERDICT:** Summary of measurement results for radiated frequencies below 30 MHz - Passed

**5.2.2. Correction factors due to reduced meas. distance (f < 30 MHz)**

The used correction factors when the measurement distance is reduced, are taken from IIEC Transaction EMC, Vol 47, No.3, Aug. 2005, Journal Paper "EXTRAPOLATING NEAR-FIELD EMISSIONS OF LOW-FREQUENCY LOOP TRANSMITTERS".

| Used Transducer factors (f < 30 MHz) |                |                  |           |            |                   |
|--------------------------------------|----------------|------------------|-----------|------------|-------------------|
| 1                                    | 2              | 3                | 4         | 5          | 6                 |
|                                      |                |                  |           |            | =2+3+4+5          |
| Frequency                            | Antenna factor | Corection factor |           | Cable loss | Transducer factor |
|                                      |                | 300m to 3m       | 30m to 3m |            |                   |
| kHz                                  | dB $\mu$ V/m   | dB               | dB        | dB         | dB $\mu$ V/m      |
| 9.0                                  | 20.0           | -116.7           |           | 0.0        | -96.7             |
| 10.6                                 | 20.0           | -116.7           |           | 0.0        | -96.7             |
| 12.6                                 | 20.0           | -116.7           |           | 0.0        | -96.7             |
| 14.8                                 | 20.0           | -116.7           |           | 0.0        | -96.7             |
| 17.5                                 | 20.0           | -116.6           |           | 0.0        | -96.6             |
| 20.7                                 | 20.0           | -116.6           |           | 0.0        | -96.6             |
| 24.4                                 | 20.0           | -116.6           |           | 0.0        | -96.6             |
| 28.9                                 | 20.0           | -116.6           |           | 0.0        | -96.6             |
| 34.1                                 | 20.0           | -116.5           |           | 0.0        | -96.5             |
| 40.3                                 | 20.0           | -116.4           |           | 0.0        | -96.4             |
| 47.6                                 | 20.0           | -116.3           |           | 0.0        | -96.3             |
| 56.2                                 | 20.0           | -116.2           |           | 0.0        | -96.2             |
| 66.4                                 | 20.0           | -116.0           |           | 0.0        | -96.0             |
| 78.4                                 | 20.0           | -115.8           |           | 0.0        | -95.8             |
| 92.7                                 | 20.0           | -115.4           |           | 0.0        | -95.4             |
| 109.4                                | 20.0           | -115.0           |           | 0.0        | -95.0             |
| 129.3                                | 20.0           | -114.5           |           | 0.0        | -94.5             |
| 152.7                                | 20.0           | -113.9           |           | 0.0        | -93.9             |
| 180.4                                | 20.0           | -113.1           |           | 0.0        | -93.1             |
| 213.1                                | 20.0           | -112.2           |           | 0.0        | -92.2             |
| 251.7                                | 20.0           | -111.3           |           | 0.0        | -91.3             |
| 297.3                                | 20.0           | -108.3           |           | 0.0        | -88.3             |
| 351.2                                | 20.0           | -105.2           |           | 0.0        | -85.2             |
| 414.8                                | 20.0           | -102.1           |           | 0.0        | -82.1             |
| 490.0                                | 20.0           | -99.1            |           | 0.0        | -79.1             |
| 490.0                                | 20.0           |                  | -56.4     | 0.1        | -36.3             |
| 582.0                                | 20.0           |                  | -56.2     | 0.1        | -36.1             |
| 690.0                                | 20.0           |                  | -56.0     | 0.2        | -35.8             |
| 820.0                                | 20.0           |                  | -55.7     | 0.2        | -35.5             |
| 973.0                                | 20.0           |                  | -55.4     | 0.2        | -35.2             |
| 1,155.0                              | 20.0           |                  | -54.9     | 0.3        | -34.6             |
| 1,371.0                              | 20.0           |                  | -54.4     | 0.3        | -34.1             |
| 1,627.0                              | 20.0           |                  | -53.7     | 0.3        | -33.4             |
| 1,931.0                              | 20.0           |                  | -52.9     | 0.4        | -32.5             |
| 2,292.0                              | 20.0           |                  | -52.0     | 0.4        | -31.6             |
| 2,721.0                              | 20.0           |                  | -49.8     | 0.5        | -29.3             |
| 3,230.0                              | 20.0           |                  | -46.6     | 0.5        | -26.1             |
| 3,834.0                              | 20.0           |                  | -43.3     | 0.6        | -22.7             |
| 4,551.0                              | 20.0           |                  | -40.1     | 0.6        | -19.5             |
| 5,402.0                              | 20.0           |                  | -36.8     | 0.7        | -16.1             |
| 6,412.0                              | 20.0           |                  | -33.5     | 0.7        | -12.8             |
| 7,612.0                              | 20.0           |                  | -30.3     | 0.8        | -9.5              |
| 9,035.0                              | 20.0           |                  | -27.0     | 0.8        | -6.2              |
| 10,725.0                             | 20.0           |                  | -23.9     | 0.9        | -3.0              |
| 12,730.0                             | 20.0           |                  | -21.2     | 0.9        | -0.3              |
| 15,111.0                             | 20.0           |                  | -19.3     | 1.0        | 1.7               |
| 17,937.0                             | 20.0           |                  | -18.4     | 1.0        | 2.6               |
| 21,292.0                             | 20.0           |                  | -18.2     | 1.1        | 2.9               |
| 25,274.0                             | 20.0           |                  | -18.3     | 1.1        | 2.8               |
| 30,000.0                             | 20.0           |                  | -18.4     | 1.2        | 2.8               |



### 5.3. Occupied and emission bandwidth

#### 5.3.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

|               |  |  |  |
|---------------|--|--|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site     | <input type="checkbox"/> 441 EMI SAR                               | <input type="checkbox"/> 487 SAR NSA               | <input checked="" type="checkbox"/> 337 OATS       |
| receiver      | <input type="checkbox"/> 377 ESCS30                                | <input type="checkbox"/> 001 ESS                   | <input checked="" type="checkbox"/> 489 ESU        |
| otherwise     | <input checked="" type="checkbox"/> 530 10dB Attenuator            |  | <input checked="" type="checkbox"/> cable K15      |

#### 5.3.2. References of occupied and emission bandwidth

FCC: §2.202, §2.1049, §22.917(a), §24.238(a)

IC: RSS-Gen: 4.6.1

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

#### Test Set-up

- see conducted measurement set-up described in 4.1

#### Mobile phone settings

- Provisions with the requirements is based on the fact, that GSM modulation scheme is GMSK Modulation for GSM equipment with a maximum data transmission rate of 17,6 kBit/s per Slot.
- Provisions with the requirements is based on the fact, that EDGE modulation scheme is 8-PSK Modulation for EDGE equipment with a maximum data transmission rate of 69,2 kBit/s per Slot.
- a call was established with settings according chapter 3.7

#### Settings of the Spectrum-Analyser

| Frequency range                | RBW (resolution bandwidth)                            | VBW (video bandwidth) |
|--------------------------------|---|-----------------------|
| 1 MHz around carrier frequency | 1% from applicants stated/measured emission bandwidth | 3..10 times the RBW   |

#### Test method

The measurements were made at the upper, middle and lower carrier traffic frequencies of the operating band. Choosing three TX-carrier frequencies of the mobile phone within each operable GSM band, should be sufficient to demonstrate compliance

Additionally the emission bandwidth (-26 dBc bandwidth) was recorded for all three channels. The results were taken in order to determine according the §24.238 the measurement resolution bandwidth, which should be approximately 1% of the emission bandwidth.

#### Results

##### Set-up 2, Op-Mode 1

| Channel/ Frequency (MHz) | Occupied 99% bandwidth [kHz] | Emission bandwidth [kHz] |
|--------------------------|------------------------------|--------------------------|
| GPRS 850                 | Channel 128/ 824.2 MHz       | <b>246.79</b>            |
|                          | Channel 192/ 837.0 MHz       | 243.59                   |
|                          | Channel 251/ 848.8 MHz       | 243.59                   |

Remarks: see annex A1 for diagrams

##### Set-up 2, Op-Mode 2

| Channel/ Frequency (MHz) | Occupied 99% bandwidth [kHz] | Emission bandwidth [kHz] |
|--------------------------|------------------------------|--------------------------|
| EGPRS 850                | Channel 128/ 824.2 MHz       | <b>250.0</b>             |
|                          | Channel 192/ 837.0 MHz       | <b>250.0</b>             |
|                          | Channel 251/ 848.8 MHz       | 248.4                    |

Remarks: see annex A1 for diagrams

##### Set-up 2, Op-Mode 3

| Channel/ Frequency (MHz) |                         | Occupied 99% bandwidth [kHz] | Emission bandwidth [kHz] |
|--------------------------|-------------------------|------------------------------|--------------------------|
| GPRS<br>1900             | Channel 512/ 1850.2 MHz | 240.38                       | 312.50                   |
|                          | Channel 661/ 1880.0 MHz | <b>246.79</b>                | <b>317.31</b>            |
|                          | Channel 810/ 1909.8 MHz | 245.19                       | 314.10                   |

Remarks: see annex A1 for diagrams

Set-up 2, Op-Mode 4

| Channel/ Frequency (MHz) |                         | Occupied 99% bandwidth [kHz] | Emission bandwidth [kHz] |
|--------------------------|-------------------------|------------------------------|--------------------------|
| EGPRS<br>1900            | Channel 512/ 1850.2 MHz | <b>250.00</b>                | <b>323.72</b>            |
|                          | Channel 661/ 1880.0 MHz | 246.79                       | 317.31                   |
|                          | Channel 810/ 1909.8 MHz | <b>250.00</b>                | 317.31                   |

Remarks: see annex A1 for diagrams

**VERDICT:** Passed

## 5.4. RF Peak power output conducted

### 5.4.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

|                 |  |   |   |
|-----------------|--|---|---|
| test location   | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2      | <input type="checkbox"/> Please see Chapter. 2.2.3    |
| test site       | <input type="checkbox"/> 441 EMI SAR                               | <input type="checkbox"/> 487 SAR NSA                    | <input type="checkbox"/> 347 Radio.lab.               |
| receiver        | <input type="checkbox"/> 377 ESCS30                                | <input type="checkbox"/> 001 ESS                        | <input type="checkbox"/> 489 ESU 40                   |
| spectr. analys. | <input type="checkbox"/> 584 FSU                                   | <input type="checkbox"/> 120 FSEM                       | <input type="checkbox"/> 264 FSEK                     |
| antenna         | <input type="checkbox"/> 574 BTA-L                                 | <input type="checkbox"/> 133 EMCO3115                   | <input type="checkbox"/> 302 BBHA9170                 |
| signaling       | <input type="checkbox"/> 392 MT8820A                               | <input checked="" type="checkbox"/> 436 CMU             | <input type="checkbox"/> 547 CMU                      |
| otherwise       | <input type="checkbox"/> 400 FTC40x15E                             | <input type="checkbox"/> 401 FTC40x15E                  | <input type="checkbox"/> 110 USB LWL                  |
| DC power        | <input type="checkbox"/> 456 EA 3013A                              | <input checked="" type="checkbox"/> 463 HP3245A         | <input type="checkbox"/> 459 EA 2032-50               |
| otherwise       | <input type="checkbox"/> 331 HC 4055                               | <input checked="" type="checkbox"/> 248 6 dB Attenuator | <input type="checkbox"/> 529 Power divider            |
| line voltage    | <input type="checkbox"/> 230 V 50 Hz via public mains              |   | <input type="checkbox"/> 060 110 V 60 Hz via PAS 5000 |

### Standards and References

FCC: §2.1046 (conducted), §22.913(a)(2), § 24.232(c)

IC: RSS-132:4.4 + SRSP 503:5.1.3 for GSM 850; RSS-133:4.1/6.4 + SRSP-510:5.1.2 for GSM 1900

- Maximum Power Output of the mobile phone should be determined while measured conducted E(IRP).
- Limit GSM850: 7 Watt
- Limit GSM1900: 2 Watt

### Test condition and measurement test set-up

|                                |                                   |  |                          |
|--------------------------------|-----------------------------------|--|--------------------------|
| link to test system (if used): | <input type="checkbox"/> air link | <input checked="" type="checkbox"/> cable connection | <input type="checkbox"/> |
| Climatic conditions            | Temperature: (22±3°C)             |  | Rel. humidity: (40±20)%  |

### TEST SET-UP (CONDUCTED)

- see conducted measurement set-up, description in chapter 4.1
- a suitable artificial antenna or RF-connector is provided by the applicant in order to perform the conducted measurements. Any data provided with the artificial antenna or connector, have been taken in account in order to correct the measurement data. (0.3dB for attenuation of antenna connector)

### MOBILE PHONE SETTINGS

- according chapter 3.6

### BASE STATION SETTING

- according 3.6 chapter

**RESULTS (CONDUCTED)**

**Op. Mode 1, Set-up 2**

| Channel/ Frequency (MHz) |                        | Peak Output Power (dBm) | Average Output Power (dBm) |
|--------------------------|------------------------|-------------------------|----------------------------|
| GPRS 850                 | Channel 128/ 824.2 MHz | 32.79                   | 32.57                      |
|                          | Channel 192/ 837.0 MHz | 32.79                   | 32.60                      |
|                          | Channel 251/ 848.8 MHz | <b>32.80</b>            | <b>32.67</b>               |

**Op. Mode 2, Set-up 2**

| Channel/ Frequency (MHz) |                        | Peak Output Power (dBm) | Average Output Power (dBm) |
|--------------------------|------------------------|-------------------------|----------------------------|
| E-GPRS 850               | Channel 128/ 824.2 MHz | 29.92                   | 27.13                      |
|                          | Channel 192/ 837.0 MHz | 29.98                   | 27.22                      |
|                          | Channel 251/ 848.8 MHz | <b>30.11</b>            | <b>27.30</b>               |

**Op. Mode 3, Set-up 2**

| Channel/ Frequency (MHz) |                         | Peak Output Power (dBm) | Average Output Power (dBm) |
|--------------------------|-------------------------|-------------------------|----------------------------|
| GPRS 1900                | Channel 512/ 1850.2 MHz | <b>30.45</b>            | <b>30.27</b>               |
|                          | Channel 661/ 1880.0 MHz | 30.32                   | 30.14                      |
|                          | Channel 810/ 1909.8 MHz | 30.32                   | 30.15                      |

**Op. Mode 4, Set-up 2**

| Channel/ Frequency (MHz) |                         | Peak Output Power (dBm) | Average Output Power (dBm) |
|--------------------------|-------------------------|-------------------------|----------------------------|
| E-GPRS 1900              | Channel 512/ 1850.2 MHz | <b>29.04</b>            | <b>26.47</b>               |
|                          | Channel 661/ 1880.0 MHz | 28.95                   | 26.36                      |
|                          | Channel 810/ 1909.8 MHz | 28.94                   | 26.37                      |

**VERDICT:** Passed

## 5.5. RF Peak power output radiated

### 5.5.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

|                 |   |  |   |
|-----------------|---|--|---|
| test location   | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)  | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3  |
| test site       | <input type="checkbox"/> 441 EMI SAR  | <input type="checkbox"/> 487 SAR NSA               | <input type="checkbox"/> 347 Radio.lab. <input checked="" type="checkbox"/> 443 FAR   |
| receiver        | <input type="checkbox"/> 377 ESCS30   | <input type="checkbox"/> 001 ESS                   | <input checked="" type="checkbox"/> 489 ESU 40  |
| spectr. analys. | <input type="checkbox"/> 584 FSU  | <input type="checkbox"/> 120 FSEM                  | <input type="checkbox"/> 264 FSEK   |
| antenna         | <input type="checkbox"/> 574 BTA-L  | <input type="checkbox"/> 133 EMCO3115              | <input type="checkbox"/> 302 BBHA9170 <input checked="" type="checkbox"/> 608 HL 562  |
| signaling       | <input type="checkbox"/> 392 MT8820A  | <input type="checkbox"/> 436 CMU                   | <input checked="" type="checkbox"/> 546 CMU   |
| otherwise       | <input type="checkbox"/> 400 FTC40x15E  | <input type="checkbox"/> 401 FTC40x15E             | <input type="checkbox"/> 110 USB LWL <input type="checkbox"/> 482 Filter Matrix <input type="checkbox"/> 378 RadiSense                                  |
| DC power        | <input type="checkbox"/> 456 EA 3013A   | <input checked="" type="checkbox"/> 463 HP3245A    | <input type="checkbox"/> 459 EA 2032-50 <input type="checkbox"/> 268 EA- 3050 <input type="checkbox"/> 494 AG6632A <input type="checkbox"/> 498 NGPE 40 |
| otherwise       | <input type="checkbox"/> 331 HC 4055  | <input type="checkbox"/> 248 6 dB Attenuator       | <input type="checkbox"/> 529 Power divider <input type="checkbox"/> - cable OTA20   |
| line voltage    | <input type="checkbox"/> 230 V 50 Hz via public mains <input type="checkbox"/> 060 110 V 60 Hz via PAS 5000 |  |   |

## REFERENCES

FCC: §2.1046 (conducted), §22.913(a)(2), § 24.232(c)

IC: RSS-132:4.4 + SRSP 503:5.1.3 for GSM 850; RSS-133:4.1/6.4 + SRSP-510:5.1.2 for GSM 1900

- Maximum Power Output of the mobile phone should be determined while measured radiated E(I)RP.
- Limit GSM850: 7 Watt
- Limit GSM1900: 2 Watt

### Test condition and measurement test set-up

|                                |                                   |   |                          |
|--------------------------------|-----------------------------------|---|--------------------------|
| link to test system (if used): | <input type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input type="checkbox"/> |
| Climatic conditions            | Temperature: (22±3°C)             |   | Rel. humidity: (40±20)%  |

## MOBILE PHONE SETTINGS

- according to chapter 3.6

## BASE STATION SETTING

- according to chapter 3.6

## 5.5.2. RADIATED RF-POWER

### TEST METHOD

- 1.) The measurements were made at the upper, middle and lower carrier traffic frequencies of the operating band. Choosing three TX-carrier frequencies of the mobile phone within each operable GSM band, should be sufficient to demonstrate compliance.
- 2.) The measurements were performed with the integrated power measurement function of the „radio communication tester CMU200 from Rohde&Schwarz company. In this way spectrum-analyzers instrument limitations can be avoided or minimized. Instead, CMU manufacturers declared measurement error can be considered for this measurement.
- 3.) The attenuation (insertion loss) at the RF Inputs/Outputs of CMU were set according to the path loss of the test set-up, determined in a step before starting the measurements.
- 4.) PK and Average Values have been recorded for each channel and band.

The measurements were made at the upper, center, and lower carrier traffic frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.

The measurements were performed by using the **substitution method** (ANSI/TIA/EIA 603) with a spectrum-analyzer. This method can be described like follows:

1. choosing of suitable spectrum-analyzer settings for performing the measurements. This settings of the spectrum analyzer must be maintained for both stages of the measurements: EUT emission measurements and also for measurements of the substituted level.

| Parameter           | Setting for GSM measurements | Settings for UTRA/FDD measurements |
|---------------------|------------------------------|------------------------------------|
| RBW <sub> 3dB</sub> | 3 MHz                        | 10 MHz                             |
| VBW                 | 10 MHz                       | 10 MHz                             |
| Span                | 20 MHz                       | 50 MHz                             |
| Detector Mode       | Positive max-hold            | Positive max-hold                  |
| Average             | off                          | off                                |
| Sweep Time          | coupled                      | coupled                            |
|                     |                              |                                    |

2. The maximum level of the peak power was recorded, while the emissions were maximized by rotating the EUT in three orthogonal axes, which was situated on a non-conductive turntable of 1.55 m height ( $P_{MEAS,1}$ ). This was performed for both measuring antenna polarisations (vertical/horizontal), the maximum of both values is used for further measurements and final substitution ( $P_{MEAS, 1, MAX}$ ).
3. As the maximum emission is recorded, the EUT is replaced by a frequency dependant suitable antenna, which is connected to a RF-signal generator, which is transmitting on the determined worst-case frequency as determined in step 2.
4. The RF-signal level of the signal generator is adjusted as long the same worst-case level determined first step is measured at the spectrum analyzer ( $P_{SMHU}=P_{MEAS,1, MAX}$ )
5. Than the RF-signal cable is disconnected from the antenna and connected to a power-level meter. The level is determined ( $P_{MEAS,2}$ ).
6. The final result is calculated by adding the ERP/EIRP gain of the antenna which substitutes the EUT.  
 $P_{EUT,SUBST} = P_{MEAS,2} + G_{ANTENNA}$

**G850 RESULTS (RADIATED)**

| Channel/ Frequency (MHz)<br>(SET-up 1) |                        | Peak Output Power (dBm) |     | Antenna Polarisation for maximum Power | Verdict |        |
|--|------------------------|-------------------------|-----|--|---------|--------|
|  |                        | PK                      | AV  |  |         |        |
| GPRS 850                               | Channel 128/ 824.2 MHz | <b>26.8</b>             | 1.) | ERP-Value                              | V/H     | Passed |
|  | Channel 192/ 837.0 MHz | 26.7                    |     |  |         |        |
|  | Channel 251/ 848.8 MHz | 26.2                    |     |  |         |        |
| E-GPRS 850                             | Channel 128/ 824.2 MHz | 25.3                    | 1.) | ERP-Value                              | V/H     | Passed |
|  | Channel 192/ 837.0 MHz | <b>26.2</b>             |     |  |         |        |
|  | Channel 251/ 848.8 MHz | 26.1                    |     |  |         |        |

Remark: 1.) see conducted measurements for PAR factor

**PCS 1900 RESULTS (RADIATED)**

| Channel/ Frequency (MHz)<br>(SET-up 1) |                         | Peak Output Power (dBm) |     | Antenna Polarisation for maximum Power | Verdict |        |
|--|-------------------------|-------------------------|-----|--|---------|--------|
|  |                         | PK                      | AV  |  |         |        |
| GPRS 1900                              | Channel 512/ 1850.2 MHz | 25.7                    | 1.) | EIRP-Value                             | V/H     | Passed |
|  | Channel 661/ 1880.0 MHz | <b>26.3</b>             |     |  |         |        |
|  | Channel 810/ 1909.8 MHz | 26.2                    |     |  |         |        |
| E-GPRS 1900                            | Channel 512/ 1850.2 MHz | 26.9                    | 1.) | EIRP-Value                             | V/H     | Passed |
|  | Channel 661/ 1880.0 MHz | <b>27.2</b>             |     |  |         |        |
|  | Channel 810/ 1909.8 MHz | 25.6                    |     |  |         |        |

Remark: 1.) see conducted measurements for PAR factor

## 5.6. Radio Frequency Exposure Evaluation

The calculation of RF Exposure exist also separate MPE test report no. 'TR-6-0082-11-1-2e'.

### References:

The criteria used for the evaluation of human exposure to radio frequency radiation is table 1 according FCC §1.1310 and table chapter 4.2 of RSS-102 standard and it is subject for evaluation of the RF exposure prior to equipment authorization.

§2.1091: Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, 'Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation.'

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits given in Table 1 of Appendix A.

### §24.232

- (a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT.
- b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power, ...

### §22.913

- (a) Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

| Frequency range (MHz)  | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| 30–300 .....   | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300–1500 .....   | .....                         | .....                         | f/300                               | 6                        |
| 1500–100,000 .....   | .....                         | .....                         | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3–1.34 .....   | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30 .....  | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |
| 30–300 .....   | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300–1500 .....   | .....                         | .....                         | f/1500                              | 30                       |
| 1500–100,000 .....   | .....                         | .....                         | 1.0                                 | 30                       |

f = frequency in MHz

**Table 1: LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

For given Power density limit at a single frequency (accord. Table 1 Limits) the maximum antenna gain can be calculated:

The used equation to predict the power density in the far-field of one single radiating antenna can be made by following equation:

$$S = \frac{EIRP}{4\pi R^2} = \frac{P * G}{4\pi R^2}$$

$$G_{NUMERIC} = \frac{S * 4\pi R^2}{P}$$

Abbreviations:

- S: Power density (unit: mW/cm<sup>2</sup>)
- P: Power Input to the antenna
- G: Gain of the antenna relative to an isotropic radiator,
- EIRP: Equivalent isotropically radiated power, determined within a separate measurement (unit: mW)
- R: distance to the center of the radiation of the antenna (unit: cm)

General Limits:

**§1.1307**

Cellular Radiotelephone Service (subpart H of part 22)

Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP)

**§1.1307**

Personal Communications Services (part 24)

Broadband PCS (subpart E): non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 2000 W ERP (3280 W EIRP)

**§1.1310 LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

Table 1(B) Limits for General Population/Uncontrolled Exposure

300–1500 MHz:  $f/1500$  mW/cm<sup>2</sup>

1500–100,000 MHz: 1.0 mW/cm<sup>2</sup>

**§2.1091**

Subject to routine evaluation is required when the device operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more.

**RSS-102**

Standard requires the RF-exposure value in W/m<sup>2</sup> unit., therefore the value determined in mW/cm<sup>2</sup> unit should be multiplied by 10 to have the required unit.

**METHOD:** The RF-exposure values were derived from the measured conducted Peak Power with assumed antenna gain of 0dBi. The gain does not include path losses of interconnecting cables between RF-delivering output port and antenna gain. Typical path losses are 0.7 to 1.5 dB per meter depending of cable quality.

The power was checked on 3 frequencies (lowest/middle/highest) within each operable GPRS/(E)GPRS-band. Please refer to chapter 4.1 for the measurement set-up.

A correction factor of  $10 \cdot \log_{10}(\text{number of possible active slots}/8 \text{ slots})$  for GPRS/E-GPRS can be applied, as result was used here and further details of the calculation see in the table mentioned-below at the next page.



**5.6.1. General result for fixed GSM operations with assumed 0dBi antenna gain**

| Operational Bands | Channel no. | Channel Freq. (MHz) | Max. Power-Value (conducted) |  |                                 |                            | MPE-Value                      |  | Margin to limit: | Maximum admissible antenna gain at 20 cm distance (cable losses not considered)<br>(Unit: dBi) |        |
|-------------------|-------------|---------------------|------------------------------|--|---------------------------------|----------------------------|--------------------------------|--|------------------|--|--------|
|                   |             |                     | Peak value<br>(Unit: dBm)    | Duty-cycle correction factor acc. max. no. of uplink slots <sup>1)</sup><br>(Unit: dB) | Equivalent value<br>(Unit: dBm) | Converted<br>(Unit: mWatt) | (Unit: mWatt/cm <sup>2</sup> ) |  |                  |  |        |
| GPRS 850          | 128         | 824.2               | 32.79                        | -3.01  | 29.78                           | 950.60                     | 0.1891                         |  | 0.5495           | 0.3603   | 4.6320 |
|                   | 192         | 837                 | 33.00                        | -3.01  | 29.99                           | 997.70                     | 0.1985                         |  | 0.5580           | 0.3595   | 4.4889 |
|                   | 251         | 848.8               | 32.80                        | -3.01  | 29.79                           | 952.80                     | 0.1896                         |  | 0.5659           | 0.3763   | 4.7497 |
| GPRS 1900         | 512         | 1850.2              | 30.45                        | -3.01  | 27.44                           | 554.63                     | 0.1103                         |  | 1.0000           | 0.8897   | 9.5726 |
|                   | 661         | 1880                | 30.32                        | -3.01  | 27.31                           | 538.27                     | 0.1071                         |  | 1.0000           | 0.8929   | 9.7026 |
|                   | 810         | 1808.8              | 30.32                        | -3.01  | 27.31                           | 538.27                     | 0.1071                         |  | 1.0000           | 0.8929   | 9.7026 |

Remark: 1) 'EUT A' support GPRS/(E)GPRS multislots class 33 (max. 4 uplink time slots).

**Canadian RSS-102** standard requires the RF-exposure value in W/m<sup>2</sup> unit., therefore the value determined in mW/cm<sup>2</sup> unit, should be multiplied by 10 to have the required unit.

**Conclusion:**

For the actual project a commercial available magnetic antenna (EUT D) with the antenna gain of 3.0 dBi was used. Measuring the conducted e.r.p. power shows at the middle channel of the GPRS 850 Band within the maximum admissible antenna gain.

**5.6.2. Results for mobile operations**

**Prediction for Part 22 (max antenna gain for mobile operations)**

Maximum conducted peak power: 32,80 dBm on ARFCN 251.

Highest admissible antenna gain for **850 MHz mobile operations (@20cm)** where no routine evaluation is required according § 2.1091 (c) for P= 1.5W ERP

$$G = 10 \log 1500\text{mW [ERP]} - 32.80\text{dBm} + 2.15 \text{ dB} = \mathbf{1.11 \text{ dBi}}$$

**Prediction for Part 24 (max antenna gain for mobile operations)**

Maximum conducted peak power: 30,45 dBm on ARFCN 512.

Highest admissible antenna gain for **1900 MHz mobile operations (@20cm)** where no routine evaluation is required accord. §2.1091 (c) and §24.232 for P= 2W EIRP

$$G = 10 \log 2000\text{mW [EIRP]} - 30,45 \text{ dBm} = \mathbf{2.55 \text{ dBi}}$$

## 5.7. Radiated and Conducted out of Band RF emissions and Block Edge

### 5.7.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

|                 |  |  |  |
|-----------------|--|--|--|
| test location   | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2               | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site       | <input type="checkbox"/> 441 EMI SAR                               | <input type="checkbox"/> 487 SAR NSA                             | <input type="checkbox"/> 337 OATS                  |
| receiver        | <input type="checkbox"/> 377 ESCS30                                | <input type="checkbox"/> 001 ESS                                 | <input checked="" type="checkbox"/> 489 ESU        |
| spectr. analys. | <input type="checkbox"/> 584 FSU                                   | <input type="checkbox"/> 120 FSEM                                | <input type="checkbox"/> 264 FSEK                  |
| antenna         | <input type="checkbox"/> 574 BTA-L                                 | <input type="checkbox"/> 133 EMCO3115                            | <input type="checkbox"/> 302 BBHA9170              |
| signaling       | <input type="checkbox"/> 017 CMD 65                                | <input type="checkbox"/> 323 CMD 55                              | <input type="checkbox"/> 340 CMD 55                |
| signaling       | <input type="checkbox"/> 392 MT8820A                               | <input type="checkbox"/> 436 CMU                                 | <input checked="" type="checkbox"/> 547 CMU        |
| power supply    | <input type="checkbox"/> 463 HP3245A                               | <input type="checkbox"/> 457 EA 3013A                            | <input type="checkbox"/> 459 EA 2032-50            |
| otherwise       | <input checked="" type="checkbox"/> 529 6dB divider                | <input checked="" type="checkbox"/> 530 10dB Att.                | <input type="checkbox"/> 110 USB LWL               |
| line voltage    | <input checked="" type="checkbox"/> 110 V 60 Hz via public mains   | <input checked="" type="checkbox"/> 060 110 V 60 Hz via PAS 5000 | <input type="checkbox"/> 268 EA- 3050              |
|                 |  |  | <input type="checkbox"/> 494 AG6632A               |
|                 |  |  | <input checked="" type="checkbox"/> 498 NGPE 40    |
|                 |  |  | <input type="checkbox"/> 431 Near field            |

## REFERENCES

FCC: §2.1051-conducted, §2.1053(a)-radiated, §2.1057, §22.917(a)(b); §24.238(a)(b)

IC: RSS-132: 4.5.1&4.5.2, RSS-133: 6.5.1(a)(b)

„the power of emissions shall be attenuated below the transmitter output power (p) by at least least  $43+10\log(P)$  dB“

### Test condition and measurement test set-up

|                                |   |  |                          |
|--------------------------------|---|--|--------------------------|
| link to test system (if used): | <input checked="" type="checkbox"/> air link (radiated) | <input checked="" type="checkbox"/> cable connection (conducted) | <input type="checkbox"/> |
| Climatic conditions            | Temperature: (22±3°C)                                   |  | Rel. humidity: (40±20)%  |

## FREQUENCY RANGE

The spectrum was scanned from 9 kHz to the 10th harmonic of the highest frequency generated within the equipment. A PEAK detector was used except measurements near the block-edge where a AVERAGE detector applied.

“The specification that all emissions shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB, translates in the relevant power range of the mobile phone (1 to 0.001 W) to a constant limit of -13 dBm.”

“§ 2.1057 Frequency spectrum to be investigated. (a) In all of the measurements set forth in §§ 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”

## DESCRIPTION OF SET-UP

- see conducted set-up in chapter 4.1
- see radiated set-up in chapter 4.2

## SETTINGS ON MOBILE PHONE

The measurements were made at the upper, middle, and lower carrier frequencies of the operating band. Choosing three representative TX-carrier frequencies of the mobile phone within each operable GSM band, should be sufficient to demonstrate compliance with the emissions limits outside and adjacent to the frequency blocks.

A call was established with settings according chapter 3.7

## TEST METHOD RADIATED:

By rotating the EUT in three orthogonal planes, the emissions were recorded with Peak-Detector and Hold-Max function of the spectrum-analyzer. If the harmonic could not be detected above the noise floor, the ambient level was recorded. Measurement distance is 3m for frequencies up to 20GHz and 1m for frequencies greater then 18GHz. The readings on the spectrum analyzer are corrected with annually performed chamber path calibration values so the readings shown are equivalent to ERP/EIRP values. Critical measurements near the limit are re-measured with a substitution method accord. ANSI/TIA/EIA 603 as described in.

**SETTINGS OF SPECTRUM-ANALYSER**

| Frequency range   | RBW (resolution bandwidth)  | VBW (video bandwidth) |
|---|---|-----------------------|
| <b>BLOCK-EDGE compliance:</b><br>1 MHz immediately adjacent to the frequency blocks | 1% from applicants stated/measured emission bandwidth   | 3..10 times the RBW   |
| More than 1 MHz outside and adjacent the frequency blocks                           | 1kHz or 100kHz to measurement frequencies up to 1MHz<br>1 MHz for measurement frequency range 1MHz to maximum 10-times TX-frequency | 3..10 times the RBW   |

**Settings for G850 Mode (conducted)**

|                       | Start freq. MHz | Stop freq. MHz | R-BW MHz | V-BW MHz | Sweep time sec. | Att. | Detector |
|-----------------------|-----------------|----------------|----------|----------|-----------------|------|----------|
| Sweep 1 (subrange 1)  | 0.009           | 1              | 0.001    | 0.01     | 10              | 25   | MaxH-PK  |
| Sweep 1 (subrange 2)  | 1               | 30             | 0.1      | 1        | 5               | 25   | MaxH-PK  |
| Sweep 2 (subrange 1)  | 30              | 1000           | 1        | 1        | 10              | 35   | MaxH-PK  |
| Sweep 2 (subrange 2)  | 1000            | 2500           | 1        | 1        | 15              | 35   | MaxH-PK  |
| Sweep 2 (subrange 3)  | 2500            | 9000           | 1        | 1        | 60              | 35   | MaxH-PK  |
| Sweep 3a (Block-Edge) | 823             | 824            | 0.003    | 0.01     | 30              | 35   | MaxH-PK  |
| Sweep 3b (Block-Edge) | 823             | 824            | 0.003    | 0.01     | 30              | 35   | MaxH-AV  |
| Sweep 4a (Block-Edge) | 850             | 851            | 0.003    | 0.01     | 30              | 35   | MaxH-PK  |
| Sweep 4b (Block-Edge) | 850             | 851            | 0.003    | 0.01     | 30              | 35   | MaxH-AV  |

**Settings for PCS1900 Mode (conducted)**

|                          | Start freq.<br>MHz | Stop freq.<br>MHz | R-BW<br>MHz | V-BW<br>MHz | Sweep time<br>sec. | Att. | Detector |
|--------------------------|--------------------|-------------------|-------------|-------------|--------------------|------|----------|
| Sweep 1<br>(subrange 1)  | 0.009              | 1                 | 0.001       | 0.01        | 10                 | 25   | MaxH-PK  |
| Sweep 1<br>(subrange 2)  | 1                  | 30                | 0.1         | 1           | 5                  | 25   | MaxH-PK  |
| Sweep 2<br>(subrange 1)  | 30                 | 1000              | 1           | 1           | 10                 | 35   | MaxH-PK  |
| Sweep 2<br>(subrange 2)  | 1000               | 2500              | 1           | 1           | 15                 | 35   | MaxH-PK  |
| Sweep 2<br>(subrange 3)  | 2500               | 19500             | 1           | 1           | 160                | 35   | MaxH-PK  |
| Sweep 3a<br>(Block-Edge) | 1849               | 1850              | 0.003       | 0.01        | 30                 | 35   | MaxH-PK  |
| Sweep 3b<br>(Block-Edge) | 1849               | 1850              | 0.003       | 0.01        | 30                 | 35   | MaxH-AV  |
| Sweep 4a<br>(Block-Edge) | 1910               | 1911              | 0.003       | 0.01        | 30                 | 35   | MaxH-PK  |
| Sweep 4b<br>(Block-Edge) | 1910               | 1911              | 0.003       | 0.01        | 30                 | 35   | MaxH-AV  |

**5.7.2. Results (conducted)**

**5.7.2.1. GPRS TCH 850: Op. Mode 1, Set-up 2**

**Lowest channel: 128**

| Transmitting channel/ frequency: TX = 824.2 MHz |                |                                |                           |  |                 |                |         |
|---|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.                                       | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1   | a_4.17         | 0.009 to 30                    | --                        | --                                     | <-50.36         | -13            | Passed  |
| Sweep 2   | a_4.20         | 30 to 12750                    | --                        | --                                     | <-23.00         |                | Passed  |
| Sweep 3 <sup>1.)</sup>                          | a_4.36         | 823.98                         | --                        | --                                     | -27.32 (AV)     |                | Passed  |

Remark: see diagrams in Annex A1 for more details

1.) Block-Edge compliance

**Middle channel = 192**

| Transmitting channel/ frequency: TX = 837 MHz |                |                                |                           |  |                 |                |         |
|---|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.                                     | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1                                       | a_4.18         | 0.009 to 30                    | --                        | --                                     | <-49.96         | -13            | Passed  |
| Sweep 2 <sup>1.)</sup>                        | a_4.21         | 30 to 12750                    | --                        | --                                     | <-22.93         |                | Passed  |

Remark: see diagrams in Annex A1 for more details

**Highest channel: 251**

| Transmitting channel/ frequency: TX = 848.8 MHz |                |                                |                           |  |                 |                |         |
|---|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.                                       | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1   | a_4.19         | 0.009 to 30                    | --                        | --                                     | <-50.49         | -13            | Passed  |
| Sweep 2   | a_4.22         | 30 to 12750                    | --                        | --                                     | <-23.00         |                | Passed  |
| Sweep 3 <sup>1.)</sup>                          | a_4.38         | 849.02                         | --                        | --                                     | -27.30 (AV)     |                | Passed  |

Remark: see diagrams in Annex A1 for more details

1.) Band-Edge compliance

5.7.3. E-GPRS TCH 850: Op. Mode 2, Set-up 2

**Lowest channel: 128**

| Transmitting channel/ frequency: TX = 824.2 MHz |                |                                |                           |  |                 |                |         |
|---|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.                                       | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1   | a_4.01         | 0.009 to 30                    | --                        | --                                     | <-51.57         | -13            | Passed  |
| Sweep 2 <sup>1)</sup>                           | a_4.04         | 30 to 12750                    | --                        | --                                     | <-23.38         |                | Passed  |
| Sweep 3 <sup>2.)</sup>                          | a_4.07         | 823.98                         | --                        | --                                     | -19.48 (PK)     |                | Passed  |

Remark: see diagrams in Annex A1 for more details

- 1.) Carrier of wanted TX on diagram
- 2.) Block-Edge compliance

**Middle channel = 192**

| Transmitting channel/ frequency: TX = 837 MHz |                |                                |                           |  |                 |                |         |
|---|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.                                     | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1                                       | a_4.02         | 0.009 to 30                    | --                        | --                                     | <-50.78         | -13            | Passed  |
| Sweep 2 <sup>1)</sup>                         | a_4.05         | 30 to 12750                    | --                        | --                                     | <-23.60         |                | Passed  |

Remark: see diagrams in Annex A1 for more details

- 1.) Carrier of wanted TX on diagram

**Highest channel: 251**

| Transmitting channel/ frequency: TX = 848.8 MHz |                |                                |                           |  |                 |                |         |
|---|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.                                       | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1   | a_4.03         | 0.009 to 30                    | --                        | --                                     | <-50.40         | -13            | Passed  |
| Sweep 2 <sup>1)</sup>                           | a_4.06         | 30 to 12750                    | --                        | --                                     | <-23.23         |                | Passed  |
| Sweep 3 <sup>2.)</sup>                          | a_4.08         | 849.0                          | --                        | --                                     | -18.97 (PK)     |                | Passed  |

Remark: see diagrams in Annex A1 for more details

- 1.) Carrier of wanted TX on diagram
- 2.) Block-Edge compliance

**5.7.4. GPRS 1900 Mode: Op. Mode 3, Set-up 2**

**Lowest channel: 512**

| Transmitting channel/ frequency: TX = 1850,2 MHz |                |                                |                           |  |                 |                |         |
|--|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.  | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1  | a_4.09         | 0.009 to 30                    | --                        | --                                     | <-50.98         | -13            | Passed  |
| Sweep 2 <sup>1)</sup>                            | a_4.10         | 30 to 12750                    | --                        | --                                     | <-19.75         |                | Passed  |
| Sweep 3 <sup>2.)</sup>                           | a_4.39         | 1849.98                        | --                        | --                                     | -30.22 (AV)     |                | Passed  |

Remark: see diagrams for more details

- 1.) Carrier of wanted TX on diagram
- 2.) Block-Edge compliance

**Middle channel: 661**

| Transmitting channel/ frequency: TX = 1880,0 MHz |                |                                |                           |  |                 |                |         |
|--|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.  | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1  | a_4.11         | 0.009 to 30                    | --                        | --                                     | <-51.17         | -13            | Passed  |
| Sweep 2 <sup>1)</sup>                            | a_4.12         | 30 to 12750                    | --                        | --                                     | <-20.30         |                | Passed  |

Remark: see diagrams for more details

- 1.) Carrier of wanted TX on diagram

**Highest channel: 810**

| Transmitting channel/ frequency: TX = 1908,8 MHz |                |                                |                           |  |                 |                |         |
|--|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.  | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1  | a_4.13         | 0.009 to 30                    | --                        | --                                     | <-50.91         | -13            | Passed  |
| Sweep 2 <sup>1)</sup>                            | a_4.14         | 30 to 12750                    | --                        | --                                     | <-19.75         |                | Passed  |
| Sweep 3 <sup>2.)</sup>                           | a_4.40         | 1910.02                        | --                        | --                                     | -29.13 (AV)     |                | Passed  |

Remark: see diagrams for more details

- 1.) Carrier of wanted TX on diagram
- 2.) Block-Edge compliance

5.7.5. E-GPRS 1900 Mode: Op. Mode 4, Set-up 2

**Lowest channel: 512**

| Transmitting channel/ frequency: TX = 1850,2 MHz |                |                                |                           |  |                 |                |         |
|--|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.  | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1  | a_4.23         | 0.009 to 30                    | --                        | --                                     | <-50.18         | -13            | Passed  |
| Sweep 2 <sup>1)</sup>                            | a_4.26         | 30 to 12750                    | --                        | --                                     | <-19.76         |                | Passed  |
| Sweep 3 <sup>2.)</sup>                           | a_4.15         | 1849.99                        | --                        | --                                     | -45.45 (PK)     |                | Passed  |

Remark: see diagrams for more details

- 1.) Carrier of wanted TX on diagram
- 2.) Block-Edge compliance

**Middle channel: 661**

| Transmitting channel/ frequency: TX = 1880,0 MHz |                |                                |                           |  |                 |                |         |
|--|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.  | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1  | a_4.24         | 0.009 to 30                    | --                        | --                                     | <-50.31         | -13            | Passed  |
| Sweep 2 <sup>1)</sup>                            | a_4.27         | 30 to 12750                    | --                        | --                                     | <-19.55         |                | Passed  |

Remark: see diagrams for more details

- 1.) Carrier of wanted TX on diagram

**Highest channel: 810**

| Transmitting channel/ frequency: TX = 1908,8 MHz |                |                                |                           |  |                 |                |         |
|--|----------------|--------------------------------|---------------------------|--|-----------------|----------------|---------|
| Sweep no.  | Diagram number | Frequency of emission<br>[MHz] | Worst-Peak level<br>[dBm] | Frequency of worst-peak level<br>[MHz] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
| Sweep 1  | a_4.25         | 0.009 to 30                    | -54.44                    | 7.97                                   | <-51.11         | -13            | Passed  |
| Sweep 2 <sup>1)</sup>                            | a_4.28         | 30 to 12750                    | --                        | --                                     | <-19.70         |                | Passed  |
| Sweep 3 <sup>2.)</sup>                           | a_4.16         | 1910.02                        | --                        | --                                     | -44.34 (PK)     |                | Passed  |

Remark: see diagrams for more details

- 1.) Carrier of wanted TX on diagram
- 2.) Block-Edge compliance



### 5.7.6. Results (Radiated)

Due to uncritical measurements (only noise floor) measurements have been performed only in E-GPRS Mode.

#### 5.7.6.1. E-GPRS 850 Mode: Op. Mode 1, Set-up 1

##### Lowest channel: 128

| Transmitting channel/ frequency: TX = 824.2 MHz |                      |                             |                          |                                |              |             |                       |
|---|----------------------|-----------------------------|--------------------------|--------------------------------|--------------|-------------|-----------------------|
| Sweep no.                                       | Diagram number (H/V) | Frequency of emission [MHz] | Worst-Level Polarisation | Frequency of worst-level [MHz] | Result [dBm] | Limit [dBm] | Verdict               |
| Sweep 1 <sup>1.)</sup>                          | a_5.03               | 30 to 9000                  | H/V                      | --                             | Passed       | -13         | Passed <sup>1.)</sup> |
| Sweep 2 <sup>2.)</sup>                          | a_5.03_BE            | 823.97                      | V                        | --                             | -52.0 (AV)   |             | Passed <sup>2.)</sup> |

Remarks: see diagrams enclosed in annex A1

- 1.) Carrier of wanted TX on diagram and performed as pre-measurement
- 2.) Block-Edge compliance and performed as final-measurement

##### Middle channel: 192

| Transmitting channel/ frequency: TX = 837.0 MHz |                      |                             |                          |                                |              |             |                       |
|---|----------------------|-----------------------------|--------------------------|--------------------------------|--------------|-------------|-----------------------|
| Sweep no.                                       | Diagram number (H/V) | Frequency of emission [MHz] | Worst-Level Polarisation | Frequency of worst-level [MHz] | Result [dBm] | Limit [dBm] | Verdict               |
| Sweep 1 <sup>1.)</sup>                          | a_5.05               | 30 to 9000                  | H/V                      | 150.52                         | -35.44       | -13         | Passed <sup>1.)</sup> |
|   |                      |                             |                          | 4183.37                        | -40.98       | -13         | Passed <sup>1.)</sup> |

Remarks: see diagrams enclosed in annex A1

- 1.) Carrier of wanted TX on diagram and performed as pre-measurement

##### Highest channel: 251

| Transmitting channel/ frequency: TX = 849.8 MHz |                      |                             |                          |                                |              |             |                       |
|---|----------------------|-----------------------------|--------------------------|--------------------------------|--------------|-------------|-----------------------|
| Sweep no.                                       | Diagram number (H/V) | Frequency of emission [MHz] | Worst-Level Polarisation | Frequency of worst-level [MHz] | Result [dBm] | Limit [dBm] | Verdict               |
| Sweep 1 <sup>1.)</sup>                          | a_5.04               | 30 to 9000                  | H/V                      | --                             | Passed       | -13         | Passed <sup>1.)</sup> |
| Sweep 2 <sup>2.)</sup>                          | a_5.04_BE            | 849.03                      | H/V                      | --                             | -24.01 (PK)  |             | Passed <sup>2.)</sup> |

Remarks: see diagrams enclosed in annex A1

- 1.) Carrier of wanted TX on diagram and performed as pre-measurement
- 2.) Block-Edge compliance

**5.7.6.2. E-GPRS 1900 Mode: Op. Mode 4, Set-up 1**

**Lowest channel: 512**

| <b>Transmitting channel/ frequency: TX = 1850,2 MHz</b> |                      |                             |                          |                                |              |             |                       |
|---|----------------------|-----------------------------|--------------------------|--------------------------------|--------------|-------------|-----------------------|
| Sweep no.   | Diagram number (H/V) | Frequency of emission [MHz] | Worst-Level Polarisation | Frequency of worst-level [MHz] | Result [dBm] | Limit [dBm] | Verdict               |
| Sweep 1   | a_5.06               | 0.003 - 20000               | H                        | 3700                           | -37.6        | -13         | Passed <sup>1.)</sup> |
| Sweep 2   | a_5.06_BE            | 1850.0                      | H/V                      | --                             | -23.94       |             | Passed <sup>2.)</sup> |

Remarks: see diagrams enclosed in annex A1

- 1.) Carrier of wanted TX on diagram and performed as final-measurement
- 2.) Block-Edge compliance and performed as final-measurement

**Middle channel: 661**

| <b>Transmitting channel/ frequency: TX = 1880,0 MHz</b> |                      |                             |                          |                                |              |             |                       |
|---|----------------------|-----------------------------|--------------------------|--------------------------------|--------------|-------------|-----------------------|
| Sweep no.   | Diagram number (H/V) | Frequency of emission [MHz] | Worst-Level Polarisation | Frequency of worst-level [MHz] | Result [dBm] | Limit [dBm] | Verdict               |
| Sweep 1   | a_5.07               | 0.003 - 20000               | H                        | 3759.99                        | -33.2        | -13         | Passed <sup>1.)</sup> |

Remarks: see diagrams enclosed in annex A1

- 1.) Carrier of wanted TX on diagram and performed as final-measurement

**Highest channel: 810**

| <b>Transmitting channel/ frequency: TX = 1908,8 MHz</b> |                      |                             |                          |                                |              |             |                       |
|---|----------------------|-----------------------------|--------------------------|--------------------------------|--------------|-------------|-----------------------|
| Sweep no.   | Diagram number (H/V) | Frequency of emission [MHz] | Worst-Level Polarisation | Frequency of worst-level [MHz] | Result [dBm] | Limit [dBm] | Verdict               |
| Sweep 1   | a_5.08               | 0.003 - 20000               | H                        | 3819.97                        | -32.6        | -13         | Passed <sup>1.)</sup> |
| Sweep 2   | a_5.08_BE            | 1910.0                      | H/V                      | --                             | -22.88       |             | Passed <sup>2.)</sup> |

Remark: see diagrams for more details, only worst-case level mentioned.

- 1.) Carrier of wanted TX on diagram and performed as final-measurement
- 2.) Block-Edge compliance

## 5.8. Frequency stability on temperature and voltage variations

### 5.8.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

|                       |  |   |  |
|-----------------------|--|---|--|
| test location         | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2    | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site             | <input type="checkbox"/> 441 EMI SAR                               | <input type="checkbox"/> 487 SAR NSA                  | <input checked="" type="checkbox"/> 347 Radio.lab. |
| receiver              | <input type="checkbox"/> 377 ESCS30                                | <input type="checkbox"/> 001 ESS                      | <input type="checkbox"/> 489 ESU 40                |
| spectr. analys.       | <input type="checkbox"/> 584 FSU                                   | <input type="checkbox"/> 120 FSEM                     | <input type="checkbox"/> 264 FSEK                  |
| antenna               | <input type="checkbox"/> 574 BTA-L                                 | <input type="checkbox"/> 133 EMCO3115                 | <input type="checkbox"/> 302 BBHA9170              |
| signaling             | <input type="checkbox"/> 392 MT8820A                               | <input type="checkbox"/> 436 CMU                      | <input checked="" type="checkbox"/> 547 CMU        |
| otherwise             | <input type="checkbox"/> 400 FTC40x15E                             | <input type="checkbox"/> 401 FTC40x15E                | <input type="checkbox"/> 110 USB LWL               |
| DC power              | <input type="checkbox"/> 456 EA 3013A                              | <input type="checkbox"/> 457 EA 3013A                 | <input type="checkbox"/> 459 EA 2032-50            |
| Climatic test chamber | <input checked="" type="checkbox"/> 331 HC 4055                    |   |  |
| line voltage          | <input type="checkbox"/> 230 V 50 Hz via public mains              | <input type="checkbox"/> 060 110 V 60 Hz via PAS 5000 |  |

### STANDARDS AND REFERENCES:

FCC: §2.1055(a)(2), §22.355, §24.235

IC: RSS-132: 4.3, RSS-133: 6.3

### §22.355 Table C-1; § 24.235

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

### TEST CONDITION AND MEASUREMENT TEST SET-UP

|                                |                                   |  |                          |
|--------------------------------|-----------------------------------|--|--------------------------|
| link to test system (if used): | <input type="checkbox"/> air link | <input checked="" type="checkbox"/> cable connection | <input type="checkbox"/> |
| Climatic conditions            | Temperature: (22±3°C)             |  | Rel. humidity: (40±20)%  |

### TEST SET-UP

In order to maintain the voltage constant over the time period of the tests, a dummy battery was connected to a laboratory power supply. The power supply voltage was controlled on the input of the power supply terminals of the EUT.

A conducted measurement test set-up like described in chapter 4.1 was used.

### MOBILE PHONE SETTINGS

The measurements were made at the upper, middle, and lower carrier frequencies of the operating band. Choosing three representative TX-carrier frequencies of the mobile phone within each operable GSM band, should be sufficient to demonstrate compliance.

*A call was established with settings according chapter 3.7*

### TEST METHOD

The RF Channel spacing is 200 kHz, with a guard band of 200 kHz of each band of the sub-bands. The aim of the EUT is to function under all extreme conditions within authorized sub-bands in regard to temperature and voltage variations. The frequency deviation was recorded with base station's build in capability. (CMU) As the standard requires that the fundamental emissions stays within the authorized band, a limit of 0.1ppm is considered low enough to ensure this.

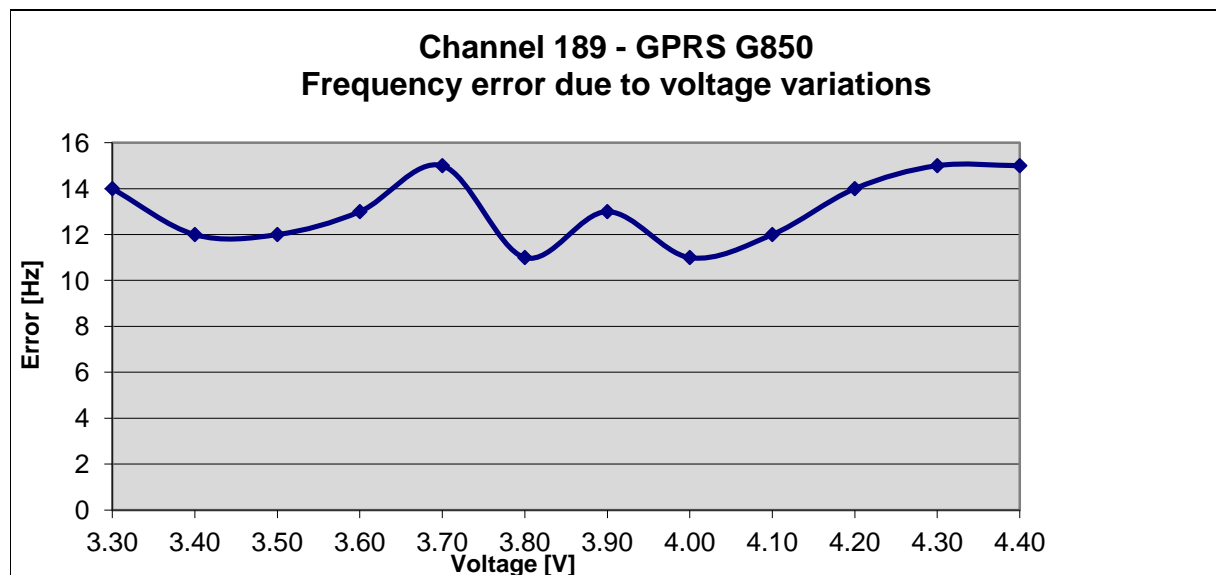
**5.8.2. Frequency shift of carrier against a voltage range at constant nominal temperature of 20° Celsius**

- 1.) determine the carrier frequency for the lowest and highest channel at room temperature and nominal voltage [20°C]
- 2.) The voltage was reduced in 0.1V steps to the lower end point, where the mobile phone stops working. (this shall be specified by the manufacturer) Record the carrier frequency shift within 2 minutes after powering on the mobile phone, to prevent for self heating effects.
- 3.) The voltage was increased in 0.1V steps to the upper declared voltage of the battery. Record the carrier frequency shift within 2 minutes after powering on the mobile phone, to prevent for self heating effects.

**RESULTS**

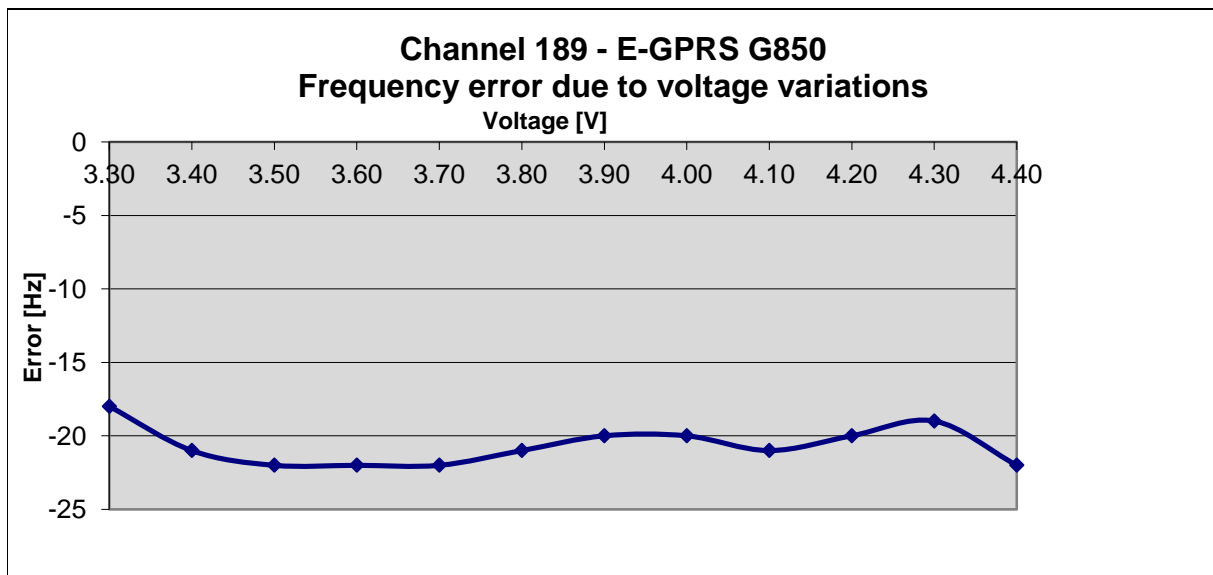
**5.8.2.1. GPRS 850 Mode: Op. Mode 1, set-up 2**

| Voltage [V] | Nominal Frequency [Hz] | Maximum frequency error |       | Verdict<br>Limit=±2.5ppm |
|-------------|------------------------|-------------------------|-------|--------------------------|
|             |                        | [Hz]                    | [ppm] |                          |
| 3.30        | 836400000              | 14                      | 0.017 | Passed                   |
| 3.40        |                        | 12                      | 0.014 |                          |
| 3.50        |                        | 12                      | 0.014 |                          |
| 3.60        |                        | 13                      | 0.016 |                          |
| 3.70        |                        | 15                      | 0.018 |                          |
| 3.80        |                        | 11                      | 0.013 |                          |
| 3.90        |                        | 13                      | 0.016 |                          |
| 4.00        |                        | 11                      | 0.013 |                          |
| 4.10        |                        | 12                      | 0.014 |                          |
| 4.20        |                        | 14                      | 0.017 |                          |
| 4.30        |                        | 15                      | 0.018 |                          |
| 4.40        |                        | 15                      | 0.018 |                          |



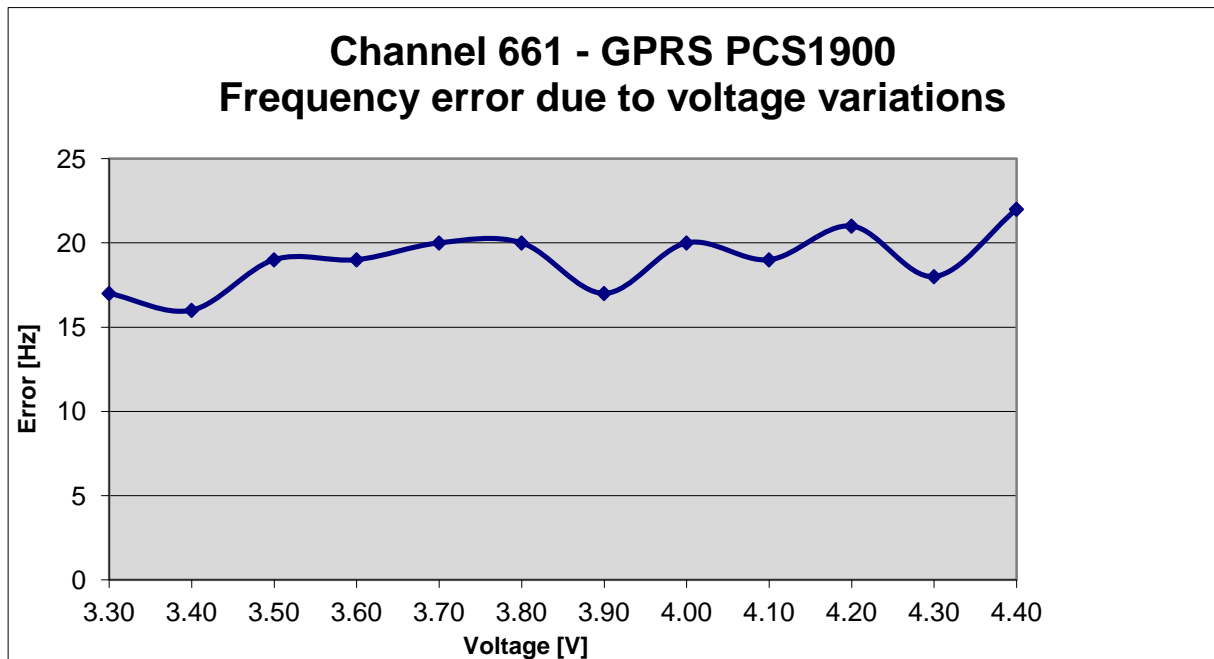
5.8.2.2. E-GPRS G850 Mode: Op. Mode 2, set-up 1

| Voltage [V] | Nominal Frequency [Hz] | Maximum frequency error |        | Verdict<br>Limit=±2.5ppm |
|-------------|------------------------|-------------------------|--------|--------------------------|
|             |                        | [Hz]                    | [ppm]  |                          |
| 3.30        | 836400000              | -18                     | -0.022 | Passed                   |
| 3.40        |                        | -21                     | -0.025 |                          |
| 3.50        |                        | -22                     | -0.026 |                          |
| 3.60        |                        | -22                     | -0.026 |                          |
| 3.70        |                        | -22                     | -0.026 |                          |
| 3.80        |                        | -21                     | -0.025 |                          |
| 3.90        |                        | -20                     | -0.024 |                          |
| 4.00        |                        | -20                     | -0.024 |                          |
| 4.10        |                        | -21                     | -0.025 |                          |
| 4.20        |                        | -20                     | -0.024 |                          |
| 4.30        |                        | -19                     | -0.023 |                          |
| 4.40        |                        | -22                     | -0.026 |                          |



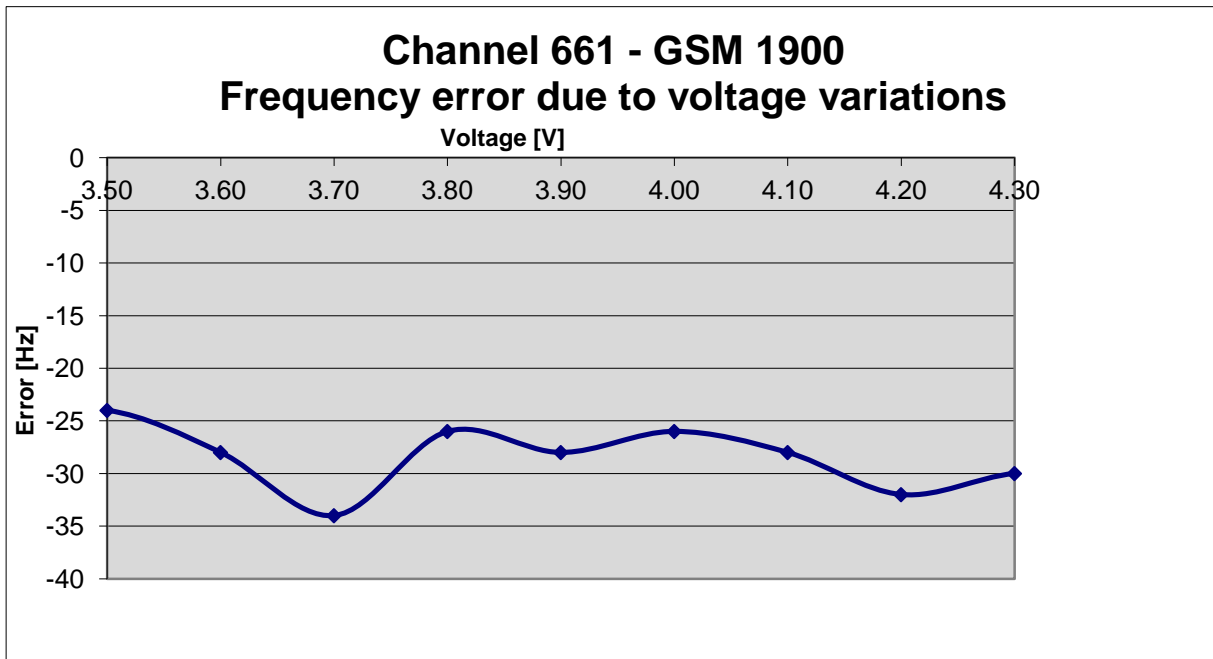
**5.8.2.3. GPRS PCS 1900 Mode: Op. Mode 3, set-up 2**

| Voltage [V] | Nominal Frequency [Hz] | Maximum frequency error |       | Verdict<br>Limit=±0.1ppm |
|-------------|------------------------|-------------------------|-------|--------------------------|
|             |                        | [Hz]                    | [ppm] |                          |
| 3.30        | 1880000000             | 17                      | 0.009 | Passed                   |
| 3.40        |                        | 16                      | 0.009 |                          |
| 3.50        |                        | 19                      | 0.010 |                          |
| 3.60        |                        | 19                      | 0.010 |                          |
| 3.70        |                        | 20                      | 0.011 |                          |
| 3.80        |                        | 20                      | 0.011 |                          |
| 3.90        |                        | 17                      | 0.009 |                          |
| 4.00        |                        | 20                      | 0.011 |                          |
| 4.10        |                        | 19                      | 0.010 |                          |
| 4.20        |                        | 21                      | 0.011 |                          |
| 4.30        |                        | 18                      | 0.010 |                          |
| 4.40        |                        | 22                      | 0.012 |                          |



**5.8.2.4. GPRS PCS 1900 Mode: Op. Mode 4, set-up 2**

| Voltage [V] | Nominal Frequency [Hz] | Maximum frequency error |        | Verdict<br>Limit=±0.1ppm |
|-------------|------------------------|-------------------------|--------|--------------------------|
|             |                        | [Hz]                    | [ppm]  |                          |
| 3.30        | 1880000000             | -27                     | -0.014 | Passed                   |
| 3.40        |                        | -25                     | -0.013 |                          |
| 3.50        |                        | -24                     | -0.013 |                          |
| 3.60        |                        | -28                     | -0.015 |                          |
| 3.70        |                        | -34                     | -0.018 |                          |
| 3.80        |                        | -26                     | -0.014 |                          |
| 3.90        |                        | -28                     | -0.015 |                          |
| 4.00        |                        | -26                     | -0.014 |                          |
| 4.10        |                        | -28                     | -0.015 |                          |
| 4.20        |                        | -32                     | -0.017 |                          |
| 4.30        |                        | -30                     | -0.016 |                          |
| 4.40        |                        | -30                     | -0.016 |                          |



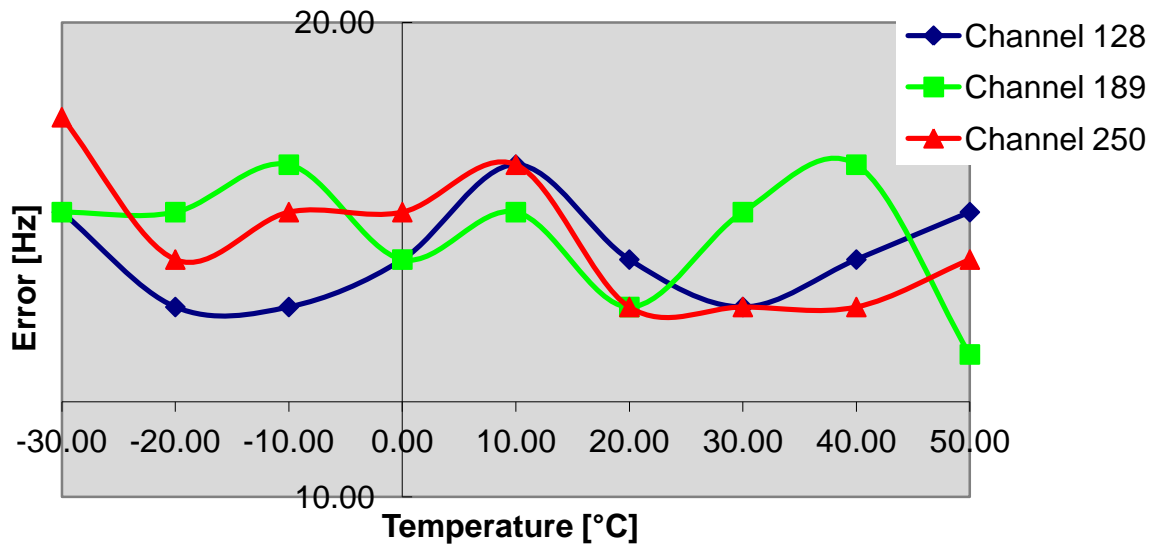
**5.8.3. Frequency shift of carrier against temperature at constant power supply voltage**

- 1.) determine the carrier frequency for the lowest, middle and highest channel at room temperature and nominal voltage [20°C]
- 2.) expose the mobile station to -30°C, wait sufficient time to have constant temperature.
- 3.) Perform the carrier frequencies measurements in 10°C increments from -30°C to +60°C. For about half hour at the specified temperature the mobile was powered-off. After powering-on, the measurements were made within 2 minute for the channel lower channel, in order to prevent self-warming of the mobile.

**5.8.3.1. GPRS 850 Mode: Op. Mode 1, set-up 3**

| Temperature | Maximum frequency error |             |             |             |             |             | Verdict<br>Limit=±2.5ppm |
|-------------|-------------------------|-------------|-------------|-------------|-------------|-------------|--------------------------|
|             | Channel 128             | Channel 189 | Channel 250 | Channel 128 | Channel 189 | Channel 250 |                          |
|             | [Hz]                    |             |             | [ppm]       |             |             |                          |
| -30         | 16                      | 16          | 18          | 0.019       | 0.019       | 0.021       | Passed                   |
| -20         | 14                      | 16          | 15          | 0.017       | 0.019       | 0.018       |                          |
| -10         | 14                      | 17          | 16          | 0.017       | 0.020       | 0.019       |                          |
| 0           | 15                      | 15          | 16          | 0.018       | 0.018       | 0.019       |                          |
| 10          | 17                      | 16          | 17          | 0.021       | 0.019       | 0.020       |                          |
| 20          | 15                      | 14          | 14          | 0.018       | 0.018       | 0.016       |                          |
| 30          | 14                      | 16          | 14          | 0.017       | 0.019       | 0.016       |                          |
| 40          | 15                      | 17          | 14          | 0.018       | 0.020       | 0.016       |                          |
| 50          | 16                      | 13          | 15          | 0.019       | 0.016       | 0.018       |                          |

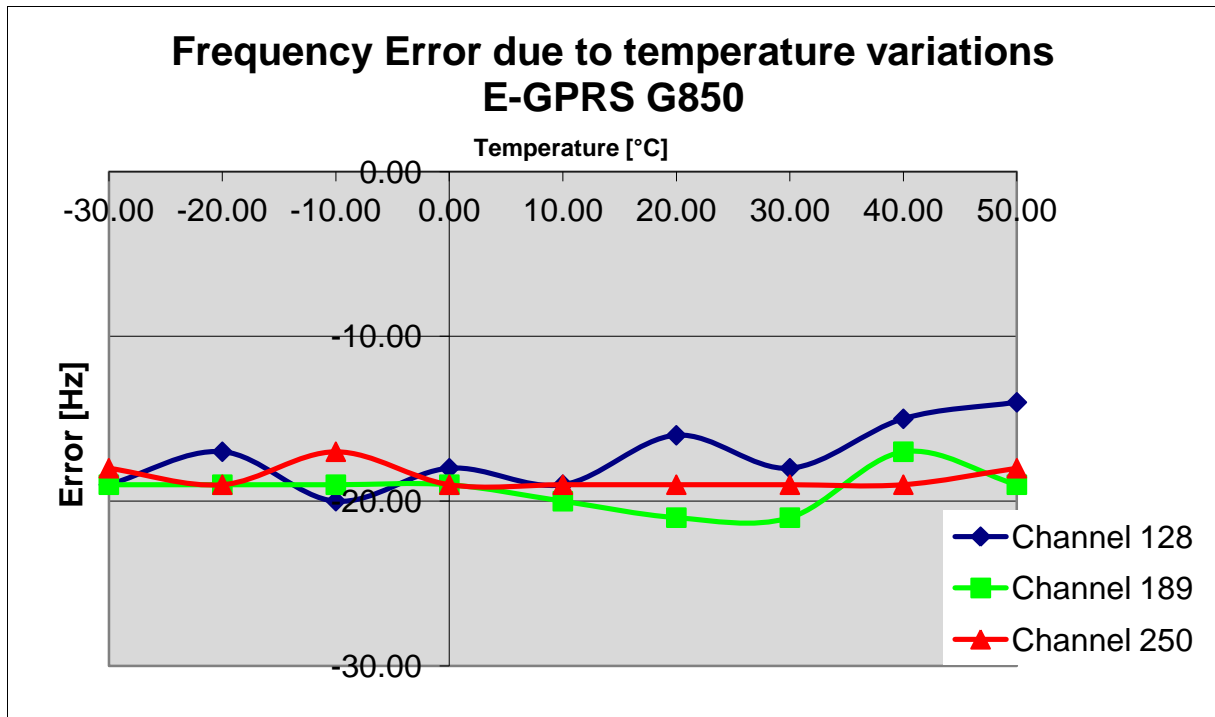
**Frequency Error due to temperature variations  
GPRS 850**





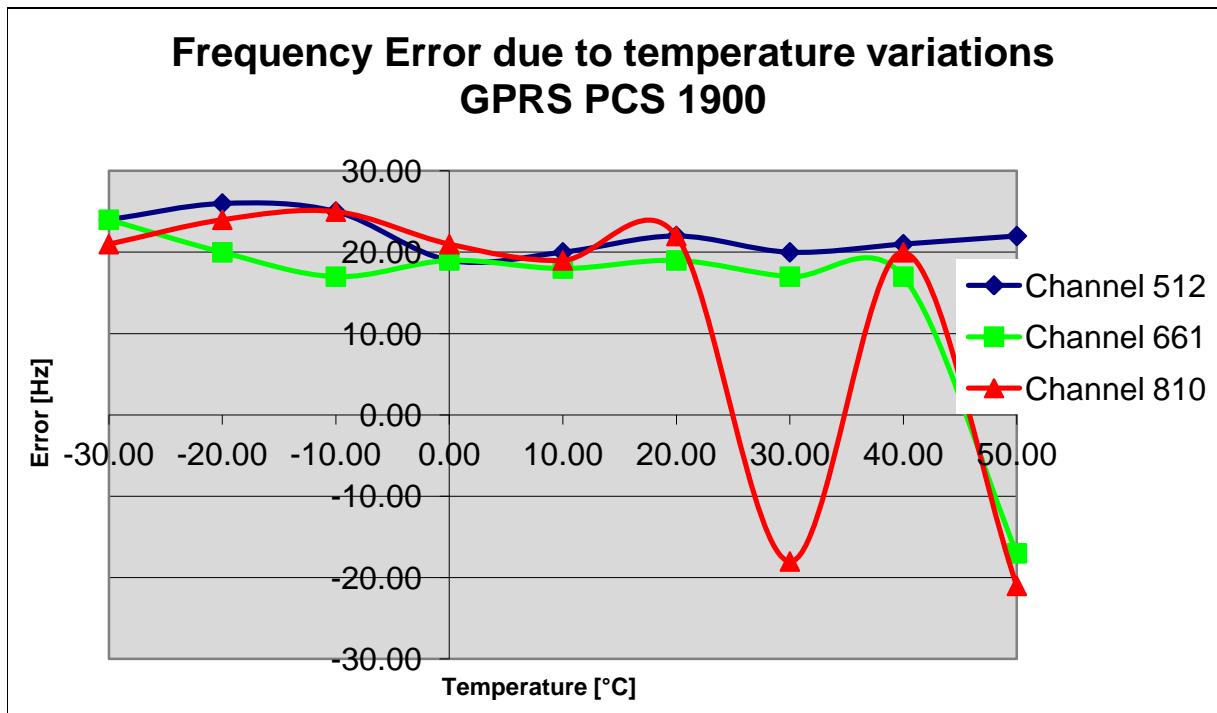
5.8.3.2. E-GPRS 850 Mode: Op. Mode 2, set-up 2

| Temperature | Maximum frequency error |             |             |             |             |             | Verdict<br>Limit=±2.5ppm |
|-------------|-------------------------|-------------|-------------|-------------|-------------|-------------|--------------------------|
|             | Channel 128             | Channel 189 | Channel 250 | Channel 128 | Channel 189 | Channel 250 |                          |
|             | [Hz]                    |             |             | [ppm]       |             |             |                          |
| -30         | -19                     | -19         | -18         | -0.023      | -0.023      | -0.021      | Passed                   |
| -20         | -17                     | -19         | -19         | -0.021      | -0.023      | -0.022      |                          |
| -10         | -20                     | -19         | -17         | -0.024      | -0.023      | -0.020      |                          |
| 0           | -18                     | -19         | -19         | -0.022      | -0.023      | -0.022      |                          |
| 10          | -19                     | -20         | -19         | -0.023      | -0.024      | -0.022      |                          |
| 20          | -16                     | -21         | -19         | 0.018       | 0.017       | 0.016       |                          |
| 30          | -18                     | -21         | -19         | -0.022      | -0.025      | -0.022      |                          |
| 40          | -15                     | -17         | -19         | -0.018      | -0.020      | -0.022      |                          |
| 50          | -14                     | -19         | -18         | -0.017      | -0.023      | -0.021      |                          |



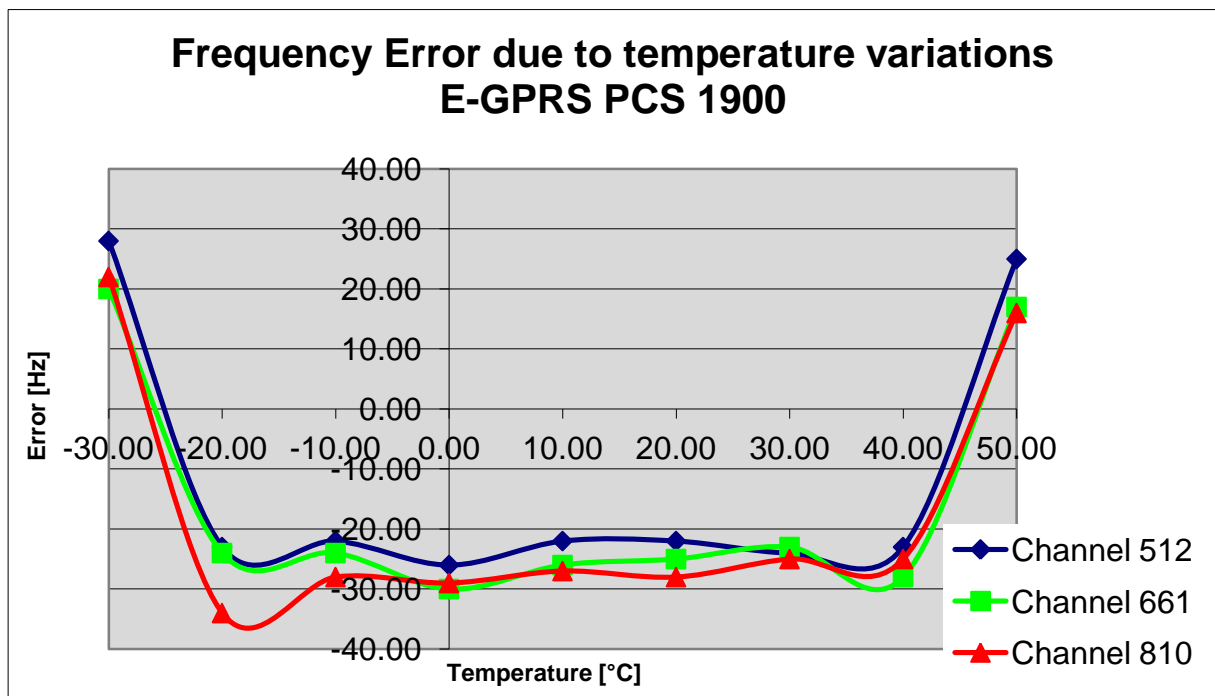
5.8.3.3. GPRS PCS 1900 Mode: Op. Mode 3, set-up 2

| Temperature | Maximum frequency error |             |             |             |             |             | Verdict<br>Limit=±0.1ppm |
|-------------|-------------------------|-------------|-------------|-------------|-------------|-------------|--------------------------|
|             | Channel 512             | Channel 661 | Channel 810 | Channel 512 | Channel 661 | Channel 810 |                          |
|             | [Hz]                    |             |             | [ppm]       |             |             |                          |
| -30         | 24                      | 24          | 21          | 0.013       | 0.013       | 0.011       | Passed                   |
| -20         | 26                      | 20          | 24          | 0.014       | 0.011       | 0.013       |                          |
| -10         | 25                      | 17          | 25          | 0.014       | 0.009       | 0.013       |                          |
| 0           | 19                      | 19          | 21          | 0.010       | 0.010       | 0.011       |                          |
| 10          | 20                      | 18          | 19          | 0.011       | 0.010       | 0.010       |                          |
| 20          | 22                      | 19          | 22          | 0.012       | 0.010       | 0.012       |                          |
| 30          | 20                      | 17          | -18         | 0.011       | 0.009       | -0.009      |                          |
| 40          | 21                      | 17          | 20          | 0.011       | 0.009       | 0.010       |                          |
| 50          | 22                      | -17         | -21         | 0.012       | -0.009      | -0.011      |                          |



5.8.3.4. GPRS PCS 1900 Mode: Op. Mode 4, set-up 2

| Temperature | Maximum frequency error |             |             |             |             |             | Verdict<br>Limit=±0.1ppm |
|-------------|-------------------------|-------------|-------------|-------------|-------------|-------------|--------------------------|
|             | Channel 512             | Channel 661 | Channel 810 | Channel 512 | Channel 661 | Channel 810 |                          |
|             | [Hz]                    |             |             | [ppm]       |             |             |                          |
| -30         | 28                      | 20          | 22          | 0.015       | 0.011       | 0.012       | Passed                   |
| -20         | -23                     | -24         | -34         | -0.012      | -0.013      | -0.018      |                          |
| -10         | -22                     | -24         | -28         | -0.012      | -0.013      | -0.015      |                          |
| 0           | -26                     | -30         | -29         | -0.014      | -0.016      | -0.015      |                          |
| 10          | -22                     | -26         | -27         | -0.012      | -0.014      | -0.014      |                          |
| 20          | -22                     | -25         | -28         | -0.012      | -0.013      | -0.015      |                          |
| 30          | -24                     | -23         | -25         | -0.013      | -0.012      | -0.013      |                          |
| 40          | -23                     | -28         | -25         | -0.012      | -0.015      | -0.013      |                          |
| 50          | 25                      | 17          | 16          | 0.014       | 0.009       | 0.008       |                          |



### 5.9. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved.

For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it's contribution to the overall uncertainty according it's statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

| RF-Measurement                                       | Frequency range   | Calculated uncertainty based on a confidence level of 95% | Remarks:            |
|--|-------------------|---|---------------------|
| Power Output conducted                               | 9 kHz .. 20 GHz   | 1 dB  | --                  |
| Power Output radiated                                | 30 MHz .. 4 GHz   | 3,17 dB   | Substitution method |
| Conducted emissions on antenna ports                 | 9 kHz .. 20 GHz   | 1 dB  | --                  |
| Radiated emissions enclosure                         | 150 kHz .. 30 MHz | 5 dB  | Magnetic field      |
|  | 30 MHz .. 1 GHz   | 4.2 dB  | E-Field             |
|  | 1 GHz .. 20 GHz   | 3.17 dB   | Substitution method |
| Occupied bandwidth                                   | 9 kHz .. 4 GHz    | 0.1272 ppm (Delta Marker )                                | Frequency error     |
|  |                   | 1 dB  | Power               |
| Emission bandwidth                                   | 9 kHz .. 4 GHz    | 0,1272 ppm (Delta Marker)                                 | Frequency error     |
|  |                   | 1 dB  | Power               |
| Frequency stability                                  | 9 kHz .. 20 GHz   | 0,0636 ppm  | --                  |
| Conducted emissions on AC-mains port ( $U_{CISPR}$ ) | 9 kHz .. 150 kHz  | 4 dB  | --                  |
|  | 150 kHz .. 30 MHz | 3.6 dB  | --                  |

**Table: measurement uncertainties, valid for conducted/radiated measurements**

### 6. Accreditation details of CETECOM's laboratories and test sites

| Ref.-No.  | Accreditation Certificate                     | Valid for laboratory area or test site   | Accreditation Body  |
|---|---|--|---|
| -   | D-PL-12047-01-01                              | All laboratories and test sites of CETECOM GmbH, Essen   | DAkKS, Deutsche Akkreditierungsstelle GmbH  |
| 337<br>487<br>558<br>348<br>348   | 736496  | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS)<br>Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR)<br>Radiated Measurements above 1 GHz, 3 m (FAR)<br>Mains Ports Conducted Interference Measurements<br>Telecommunication Ports Conducted Interference Measur.    | FCC, Federal Communications Commission<br>Laboratory Division, USA (MRA US-EU 0003)         |
| 337<br>487<br>550<br>558  | 3462D-1<br>3462D-2<br>3462D-2<br>3462D-3      | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS)<br>Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR)<br>Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR)<br>Radiated Measurements above 1 GHz, 3 m (FAR)  | IC, Industry Canada Certification and Engineering Bureau                                    |
| 337<br>487<br>550<br>348<br>348   | R-2665<br>R-2666<br>G-301<br>C-2914<br>T-1967 | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS)<br>Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR)<br>Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR)<br>Mains Ports Conducted Interference Measurements<br>Telecommunication Ports Conducted Interference Measur. | VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan |
| OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room |   |  |   |

## 7. Instruments and Ancillary

### 7.1. Used equipment “CTC”

The “Ref.-No” in the left column of the following tables allows the clear identification of the laboratory equipment.

#### 7.1.1. Test software and firmware of equipment

| Ref.-No. | Equipment                               | Type                         | Serial-No.     | Version of Firmware or Software during the test  |
|----------|---|------------------------------|----------------|--|
| 001      | Emi Test Receiver                       | ESS                          | 825132/017     | Firm.= 1.21 , OTP=2.0, GRA=2.0   |
| 012      | Signal Generator (EMS-cond.)            | SMY 01                       | 839069/027     | Firm.= V 2.02  |
| 013      | Power Meter (EMS cond.)                 | NRVD                         | 839111/003     | Firm.= V 1.51  |
| 017      | Digital Radiocommunication Tester       | CMD 60 M                     | 844365/014     | Firmware = V 3.52 .22.01.99, DECT = D2.87 13.01.99   |
| 053      | Audio Analyzer                          | UPA3                         | 860612/022     | Firm. V 4,3  |
| 119      | RT Harmonics Analyzer dig. Flickermeter | B10                          | G60547         | Firm.= V 3.1DHG  |
| 140      | Signal Generator                        | SMHU                         | 831314/006     | Firm.= 3.21  |
| 261      | Thermal Power Sensor                    | NRV-Z55                      | 825083/0008    | EPROM-Datum 02.12.04, SE EE 1 B  |
| 262      | Power Meter                             | NRV-S                        | 825770/0010    | Firm.= 2.6   |
| 263      | Signal Generator                        | SMP 04                       | 826190/0007    | Firm.=3.21   |
| 264      | Spectrum Analyzer                       | FSEK 30                      | 826939/005     | Bios=2.1, Analyzer= 3.20   |
| 295      | Racal Digital Radio Test Set            | 6103                         | 1572           | UNIT Firmware= 4.04, SW-Main=4.04, SW-BBP=1.04, SW-DSP=1.02, Hardboot=1.02, Softboot=2.02                    |
| 298      | Univ. Radio Communication Tester        | CMU 200                      | 832221/091     | R&S Test Firmware =3.53 /3.54 (current Testsoftw. f. all band used   |
| 323      | Digital Radiocommunication Tester       | CMD 55                       | 825878/0034    | Firm.= 3.52 .22.01.99  |
| 331      | Climatic Test Chamber -40/+80 Grad      | HC 4055                      | 43146          | TSI 1.53   |
| 335      | System-CTC-EMS-Conducted                | System EMS Conducted         | -              | EMC 32 V 8.40  |
| 340      | Digital Radiocommunication Tester       | CMD 55                       | 849709/037     | Firm.= 3.52 .22.01.99  |
| 355      | Power Meter                             | URV 5                        | 891310/027     | Firm.= 1.31  |
| 365      | 10V Insertion Unit 50 Ohm               | URV5-Z2                      | 100880         | Eprom Data = 31.03.08  |
| 366      | Ultra Compact Simulator                 | UCS 500 M4                   | V0531100594    | Firm. UCS 500=001925/3.06a02, rc=ISMIEC 4.10   |
| 371      | Bluetooth Tester                        | CBT32                        | 100153         | CBT V5.30+ SW-Option K55   |
| 377      | Emi Test Receiver                       | ESCS 30                      | 100160         | Firm.= 2.30, OTP= 02.01, GRA= 02.36  |
| 378      | Broadband RF Field Monitor              | RadiSense III                | 03D00013SNO-08 | Firm.= V.03D13   |
| 383      | Signal Generator                        | SME 03                       | 842 828 /034   | Firm.= 4.61  |
| 389      | Digital Multimeter                      | Keithley 2000                | 0583926        | Firm. = A13 (Mainboard) A02 (Display)  |
| 392      | Radio Communication Tester              | MT8820A                      | 6K00000788     | Firm.= 4.50 #005, IPL=4.01#001,OS=4.02#001, GSM=4.41#013, W-CDMA= 4.54#004, scenario= 4.52#002               |
| 436      | Univ. Radio Communication Tester        | CMU 200                      | 103083         | R&S Test Firmware Base=5.14, Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band to be used , |
| 441      | CTC-SAR-EMI Cable Loss                  | System EMI field (SAR) Cable | -              | EMC 32 Version 8.40  |
| 442      | CTC-SAR-EMS                             | System EMS field (SAR)       | -              | EMC 32 Version 8.40  |
| 443      | CTC-FAR-EMI-RSE                         | System CTC-FAR-EMI-RSE       | -              | Spuri 7.2.5 or EMC 32 Ver. 8.40  |
| 444      | CTC-FAR-EMS field                       | System-EMS-Field (FAR)       | -              | EMC 32 Version 8.40  |
| 460      | Univ. Radio Communication Tester        | CMU 200                      | 108901         | R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used,                 |
| 489      | Emi Test Receiver                       | ESU40                        | 1000-30        | Firmware=4.43 SP3, Bios=V5.1-16-3, Spec. =01.00  |
| 491      | ESD Simulator dito                      | ESD dito                     | dito307022     | V 2.30   |
| 524      | Voltage Drop Simulator                  | VDS 200                      | 0196-16        | Software Nr. 000037 Version V4.20a01   |
| 526      | Burst Generator                         | EFT 200 A                    | 0496-06        | Software Nr. 000034 Version V2.32  |
| 527      | Micro Pulse Generator                   | MPG 200 B                    | 0496-05        | Software-Nr. 000030 Version V2.43  |
| 528      | Load Dump Simulator                     | LD 200B                      | 0496-06        | Software-Nr. 000031 Version V2.35a01   |
| 546      | Univ. Radio Communication Tester        | CMU 200                      | 106436         | R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used                  |
| 547      | Univ. Radio Communication Tester        | CMU 200                      | 835390/014     | R&S Test Firmware Base=V5.1403 (current Testsoftw., f. all band used, GSM = 5.14 WCDMA: = 5.14               |
| 584      | Spectrum Analyzer                       | FSU 8                        | 100248         | 2.82_SP3   |
| 594      | Univ. Radio Communication Tester        | CMW500                       | 101757         | Firmware Base=2.0.20.9, LTE=2.0.20.8. CDMA= 2.0.10   |
| 597      | Univ. Radio Communication Tester        | CMU 200                      | 100347         | R&S Test Firmware Base=5.01, GSM=5.02 WCDMA= not installed, Mainboard= µP1=V.850                             |
| 598      | Spectrum Analyzer                       | FSEM 30 (Reserve)            | 831259/013     | Firmware Bios 3.40 , Analyzer 3.40 Sp 2  |

7.1.2. Single instruments and test systems

| Ref.-No. | Equipment                               | Type                         | Serial-No.      | Manufacturer          | Interval of calibration | Remark | Cal due    |
|----------|---|------------------------------|-----------------|-----------------------|-------------------------|--------|------------|
| 001      | Emi Test Receiver                       | ESS                          | 825132/017      | Rohde & Schwarz       | 12 M                    | -      | 31.03.2012 |
| 005      | AC - LISN (50 Ohm/50µH, test site 1)    | ESH2-Z5                      | 861741/005      | Rohde & Schwarz       | 24/12 M                 | -      | 31.03.2012 |
| 007      | DC - LISN (50 Ohm/5µH)                  | ESH3-Z6                      | 892563/002      | Rohde & Schwarz       | 24/12 M                 | -      | 31.03.2012 |
| 009      | Power Meter (EMS-radiated)              | NRV                          | 863056/017      | Rohde & Schwarz       | 24 M                    | -      | 31.03.2013 |
| 016      | Line Impedance Simulating Network       | Op. 24-D                     | B6366           | Spitzenberger+Spies   | 36 M                    | -      | 31.03.2013 |
| 020      | Horn Antenna 18 GHz (Subst 1)           | 3115                         | 9107-3699       | EMCO                  | 36/12 M                 | -      | 31.03.2013 |
| 021      | Loop Antenna (H-Field)                  | 6502                         | 9206-2770       | EMCO                  | 36 M                    | -      | 31.03.2013 |
| 030      | Loop Antenna (H-field)                  | HFH-Z2                       | 879604/026      | Rohde & Schwarz       | 36 M                    | -      | 31.03.2012 |
| 033      | RF-current probe (100kHz-30MHz)         | ESH2-Z1                      | 879581/18       | Rohde & Schwarz       | 24 M                    | -      | 31.03.2013 |
| 057      | relay-switch-unit (EMS system)          | RSU                          | 494440/002      | Rohde & Schwarz       | pre-m                   | 1a     |            |
| 060      | power amplifier (DC-2kHz)               | PAS 5000                     | B6363           | Spitzenberger+Spies   | -                       | 3      |            |
| 066      | notch filter (WCDMA; FDD1)              | WRCT 1900/2200-5/40-10EEK    | 5               | Wainwright GmbH       | 12 M                    | 1c     | 30.06.2012 |
| 086      | DC - power supply, 0 -10 A              | LNG 50-10                    | -               | Heinzinger Electronic | pre-m                   | 2      |            |
| 087      | DC - power supply, 0 -5 A               | EA-3013 S                    | -               | Elektro Automatik     | pre-m                   | 2      |            |
| 090      | Helmholtz coil: 2x10 coils in series    | -                            | -               | RWTÜV                 | -                       | 4      |            |
| 091      | USB-LWL-Converter                       | OLS-1                        | 007/2006        | Ing. Büro Scheiba     | -                       | 4      |            |
| 099      | passive voltage probe                   | ESH2-Z3                      | 299.7810.52     | Rohde & Schwarz       | 36 M                    | -      | 31.03.2012 |
| 100      | passive voltage probe                   | Probe TK 9416                | without         | Schwarzbeck           | 36 M                    | -      | 31.03.2012 |
| 110      | USB-LWL-Converter                       | OLS-1                        | -               | Ing. Büro Scheiba     | -                       | 4      |            |
| 119      | RT Harmonics Analyzer dig. Flickermeter | B10                          | G60547          | BOCONSULT             | 36 M                    | -      | 31.03.2013 |
| 134      | horn antenna 18 GHz (Subst 2)           | 3115                         | 9005-3414       | EMCO                  | 12 M                    | -      | 31.03.2012 |
| 136      | adjustable dipole antenna (Dipole 1)    | 3121C-DB4                    | 9105-0697       | EMCO                  | 12 M                    | -      | 31.03.2012 |
| 140      | Signal Generator                        | SMHU                         | 831314/006      | Rohde & Schwarz       | 24 M                    | -      | 31.03.2012 |
| 248      | attenuator                              | SMA 6dB 2W                   | -               | Radiall               | pre-m                   | 2      |            |
| 249      | attenuator                              | SMA 10dB 10W                 | -               | Radiall               | pre-m                   | 2      |            |
| 252      | attenuator                              | N 6dB 12W                    | -               | Radiall               | pre-m                   | 2      |            |
| 256      | attenuator                              | SMA 3dB 2W                   | -               | Radiall               | pre-m                   | 2      |            |
| 257      | hybrid                                  | 4031C                        | 04491           | Narda                 | pre-m                   | 2      |            |
| 260      | hybrid coupler                          | 4032C                        | 11342           | Narda                 | pre-m                   | 2      |            |
| 261      | Thermal Power Sensor                    | NRV-Z55                      | 825083/0008     | Rohde & Schwarz       | 24/12 M                 | -      | 31.03.2012 |
| 262      | Power Meter                             | NRV-S                        | 825770/0010     | Rohde & Schwarz       | 24 M                    | -      | 31.03.2012 |
| 263      | Signal Generator                        | SMP 04                       | 826190/0007     | Rohde & Schwarz       | 36 M                    | -      | 31.03.2013 |
| 264      | Spectrum Analyzer                       | FSEK 30                      | 826939/005      | Rohde & Schwarz       | 12 M                    | -      | 31.03.2014 |
| 265      | peak power sensor                       | NRV-Z33, Model 04            | 840414/009      | Rohde & Schwarz       | 24 M                    | -      | 31.03.2012 |
| 266      | peak power sensor                       | NRV-Z31, Model 04            | 843383/016      | Rohde & Schwarz       | 24 M                    | -      | 31.03.2012 |
| 267      | notch filter GSM 850                    | WRCA 800/960-6EEK            | 9               | Wainwright GmbH       | pre-m                   | 2      |            |
| 268      | AC/DC power supply                      | EA 3050-A                    | 9823636         | Elektro Automatik     | pre-m                   | 2      |            |
| 270      | termination                             | 1418 N                       | BB6935          | Weinschel             | pre-m                   | 2      |            |
| 271      | termination                             | 1418 N                       | BE6384          | Weinschel             | pre-m                   | 2      |            |
| 272      | attenuator (20 dB) 50 W                 | Model 47                     | BF6239          | Weinschel             | pre-m                   | 2      |            |
| 273      | attenuator (10 dB) 100 W                | Model 48                     | BF9229          | Weinschel             | pre-m                   | 2      |            |
| 274      | attenuator (10 dB) 50 W                 | Model 47 (10 dB) 50 W        | BG0321          | Weinschel             | pre-m                   | 2      |            |
| 275      | DC-Block                                | Model 7003 (N)               | C5129           | Weinschel             | pre-m                   | 2      |            |
| 276      | DC-Block                                | Model 7006 (SMA)             | C7061           | Weinschel             | pre-m                   | 2      |            |
| 279      | power divider                           | 1515 (SMA)                   | LH855           | Weinschel             | pre-m                   | 2      |            |
| 287      | pre-amplifier 25MHz - 4GHz              | AMF-2D-100M4G-35-10P         | 379418          | Miteq                 | 12 M                    | 1c     | 30.06.2012 |
| 291      | high pass filter GSM 850/900            | WHJ 2200-4EE                 | 14              | Wainwright GmbH       | 12 M                    | 1c     | 30.06.2012 |
| 298      | Univ. Radio Communication Tester        | CMU 200                      | 832221/091      | Rohde & Schwarz       | pre-m                   | 3      |            |
| 300      | AC LISN (50 Ohm/50µH, 1-phase)          | ESH3-Z5                      | 892 239/020     | Rohde & Schwarz       | 24/12 M                 | -      | 31.03.2012 |
| 301      | attenuator (20 dB) 50W, 18GHz           | 47-20-33                     | AW0272          | Lucas Weinschel       | pre-m                   | 2      |            |
| 302      | horn antenna 40 GHz (Meas 1)            | BBHA9170                     | 155             | Schwarzbeck           | 36 M                    | -      | 31.03.2014 |
| 303      | horn antenna 40 GHz (Subst 1)           | BBHA9170                     | 156             | Schwarzbeck           | 36 M                    | -      | 31.03.2014 |
| 331      | Climatic Test Chamber -40/+80 Grad      | HC 4055                      | 43146           | Heraeus Vötsch        | 24 M                    | -      | 30.11.2012 |
| 341      | Digital Multimeter                      | Fluke 112                    | 81650455        | Fluke                 | 24 M                    | -      | 31.03.2012 |
| 342      | Digital Multimeter                      | Voltcraft M-4660A            | IB 255466       | Voltcraft             | 24 M                    | -      | 31.03.2013 |
| 347      | laboratory site                         | radio lab.                   | -               | -                     | -                       | 5      |            |
| 348      | laboratory site                         | EMI conducted                | -               | -                     | -                       | 5      |            |
| 354      | DC - Power Supply 40A                   | NGPE 40/40                   | 448             | Rohde & Schwarz       | pre-m                   | 2      |            |
| 355      | Power Meter                             | URV 5                        | 891310/027      | Rohde & Schwarz       | 24 M                    | -      | 31.03.2012 |
| 356      | power sensor                            | NRV-Z1                       | 882322/014      | Rohde & Schwarz       | 24 M                    | -      | 31.03.2013 |
| 357      | power sensor                            | NRV-Z1                       | 861761/002      | Rohde & Schwarz       | 24 M                    | -      | 31.03.2013 |
| 373      | V-Network 5µH/50 Ohm                    | ESH3-Z6                      | 100535          | Rohde & Schwarz       | 24/12 M                 | -      | 31.03.2012 |
| 376      | Horn Antenna 6 GHz                      | BBHA9120 E                   | BBHA 9120 E.179 | Schwarzbeck           | 12 M                    | -      | 31.03.2012 |
| 377      | Emi Test Receiver                       | ESCS 30                      | 100160          | Rohde & Schwarz       | 12 M                    | -      | 31.03.2012 |
| 389      | Digital Multimeter                      | Keithley 2000                | 0583926         | Keithley              | 24 M                    | -      | 31.03.2013 |
| 392      | Radio Communication Tester              | MT8820A                      | 6K00000788      | Anritsu               | 12 M                    | -      | 31.03.2012 |
| 431      | Model 7405                              | Near-Field Probe Set         | 9305-2457       | EMCO                  | -                       | 4      |            |
| 436      | Univ. Radio Communication Tester        | CMU 200                      | 103083          | Rohde & Schwarz       | 12 M                    | -      | 31.03.2012 |
| 441      | CTC-SAR-EMI Cable Loss                  | System EMI field (SAR) Cable | -               | CETECOM               | 12 M                    | 5      | 31.10.2012 |

| Ref.-No. | Equipment                               | Type                          | Serial-No.   | Manufacturer                | Interval of calibration | Remark | Cal due    |
|----------|---|-------------------------------|--------------|-----------------------------|-------------------------|--------|------------|
| 443      | CTC-FAR-EMI-RSE                         | System CTC-FAR-EMI-RSE        | -            | ETS-Lindgren/CETECOM        | 12 M                    | 5      | 30.06.2012 |
| 448      | notch filter WCDMA_FDD II               | WRCT 1850.0/2170.0-5/40-10SSK | 5            | Wainwright Instruments GmbH | 12 M                    | 1c     | 30.06.2012 |
| 449      | notch filter WCDMA FDD V                | WRCT 824.0/894.0-5/40-8SSK    | 1            | Wainwright                  | 12 M                    | 1c     | 30.06.2012 |
| 454      | Oscilloscope                            | HM 205-3                      | 9210 P 29661 | Hameg                       | -                       | 4      |            |
| 456      | DC-Power supply 0-5 A                   | EA 3013 S                     | 207810       | Elektro Automatik           | pre-m                   | 2      |            |
| 459      | DC -Power supply 0-5 A , 0-32 V         | EA-PS 2032-50                 | 910722       | Elektro Automatik           | pre-m                   | 2      |            |
| 460      | Univ. Radio Communication Tester        | CMU 200                       | 108901       | Rohde & Schwarz             | 12 M                    | -      | 31.03.2012 |
| 463      | Universal source                        | HP3245A                       | 2831A03472   | Agilent                     | -                       | 4      |            |
| 466      | Digital Multimeter                      | Fluke 112                     | 89210157     | Fluke USA                   | 24 M                    | -      | 31.03.2012 |
| 467      | Digital Multimeter                      | Fluke 112                     | 89680306     | Fluke USA                   | 24 M                    | -      | 31.03.2012 |
| 468      | Digital Multimeter                      | Fluke 112                     | 90090455     | Fluke USA                   | 24 M                    | -      | 31.03.2012 |
| 477      | ReRadiating GPS-System                  | AS-47                         | -            | Automotive Cons. Fink       | -                       | 3      |            |
| 480      | power meter (Fula)                      | NRVS                          | 838392/031   | Rohde & Schwarz             | 24 M                    | -      | 31.03.2013 |
| 482      | filter matrix                           | Filter matrix SAR 1           | -            | CETECOM (Brl)               | -                       | 1d     |            |
| 484      | pre-amplifier 2,5 - 18 GHz              | AMF-5D-02501800-25-10P        | 1244554      | Miteq                       | 12 M                    | -      | 30.07.2012 |
| 487      | System CTC NSA-Verification SAR-EMI     | System EMI field (SAR) NSA    | -            | ETS Lindgren/CETECOM        | 24 M                    | -      | 30.09.2013 |
| 489      | Emi Test Receiver                       | ESU40                         | 1000-30      | Rohde & Schwarz             | 12 M                    | -      | 31.03.2012 |
| 502      | band reject filter                      | WRCG 1709/1786-1699/1796-     | SN 9         | Wainwright                  | pre-m                   | 2      |            |
| 503      | band reject filter                      | WRCG 824/849-814/859-60/10SS  | SN 5         | Wainwright                  | pre-m                   | 2      |            |
| 512      | notch filter GSM 850                    | WRCA 800/960-02/40-6EEK       | SN 24        | Wainwright                  | 12 M                    | 1c     | 30.06.2012 |
| 517      | relais switch matrix                    | HF Relais Box Keithley System | SE 04        | Keithley                    | pre-m                   | 2      |            |
| 523      | Digital Multimeter                      | L4411A                        | MY46000154   | Agilent                     | 24 M                    | -      | 31.03.2013 |
| 529      | 6 dB Broadband resistive power divider  | Model 1515                    | LH 855       | Weinschel                   | pre-m                   | 2      |            |
| 530      | 10 dB Broadband resistive power divider | R 416110000                   | LOT 9828     | -                           | pre-m                   | 2      |            |
| 546      | Univ. Radio Communication Tester        | CMU 200                       | 106436       | R&S                         | 12 M                    | -      | 31.03.2012 |
| 547      | Univ. Radio Communication Tester        | CMU 200                       | 835390/014   | Rohde & Schwarz             | 12 M                    | -      | 31.03.2012 |
| 548      | Digital-Barometer                       | GBP 2300                      | without      | Greisinger GmbH             | 36/12 M                 | -      | 31.03.2012 |
| 549      | Log.Per-Antenna                         | HL025                         | 1000060      | Rohde & Schwarz             | 36/12 M                 | -      | 31.03.2012 |
| 552      | high pass filter 2,8-18GHz              | WHKX 2.8/18G-10SS             | 4            | Wainwright                  | 12 M                    | 1c     | 30.07.2012 |
| 558      | System CTC FAR S-VSWR                   | System CTC FAR S-VSWR         | -            | CTC                         | 24 M                    | -      | 31.07.2013 |
| 574      | Biconilog Hybrid Antenna                | BTA-L                         | 980026L      | Frankonia                   | 36/12 M                 | -      | 30.03.2013 |
| 584      | Spectrum Analyzer                       | FSU 8                         | 100248       | Rohde & Schwarz             | 12 M                    | -      | 31.03.2012 |
| 594      | Univ. Radio Communication Tester        | CMW500                        | 101757       | Rohde & Schwarz             | 24 M                    | -      | 31.03.2012 |
| 597      | Univ. Radio Communication Tester        | CMU 200                       | 100347       | Rohde & Schwarz             | 12 M                    | -      | 31.03.2012 |
| 598      | Spectrum Analyzer                       | FSEM 30 (Reserve)             | 831259/013   | Rohde & Schwarz             | 24 M                    | -      | 13.01.2013 |
| 600      | power meter                             | NRVD (Reserve)                | 834501/018   | Rohde & Schwarz             | 24 M                    | -      | 31.03.2013 |
| 601      | medium-sensitivity diode sensor         | NRV-Z5 (Reserve)              | 8435323/003  | Rohde & Schwarz             | 24 M                    | -      | 12.01.2013 |
| 602      | peak power sensor                       | NRV-Z32 (Reserve)             | 835080       | Rohde & Schwarz             | 24 M                    | -      | 12.01.2013 |
| 608      | UltraLog-Antenna                        | HL 562                        | 830547/009   | Rohde & Schwarz             | 36/12 M                 | -      | 31.03.2014 |
| 611      | DC power supply                         | E3632A                        | KR 75305854  | Agilent                     | pre-m                   | 2      |            |
| 612      | DC power supply                         | E3632A                        | MY 40001321  | Agilent                     | pre-m                   | 2      |            |
| 613      | Attenuator                              | R416120000 20dB 10W           | Lot. 9828    | Radiall                     | pre-m                   | 2      |            |

### 7.1.3. Legend

| Note / remarks |     | Calibrated during system calibration:   |
|----------------|-----|---|
|                | 1a  | System CTC-SAR-EMS (Ref.-No. 442)   |
|                | 1b  | System-CTC-EMS-Conducted (Ref.-No. 335)   |
|                | 1c  | System CTC-FAR-EMI-RSE (Ref.-No. 443)   |
|                | 1d  | System CTC-SAR-EMI (Ref.-No. 441)   |
|                | 1e  | System CTC-OATS (EMI radiated) (Ref.-No. 337)   |
|                | 1 f | System CTC-CTIA-OTA (Ref.-No. 420)  |
|                | 1 g | System CTC-FAR-EMS (Ref.-No. 444)   |
|                | 2   | Calibration or equipment check immediately before measurement                             |
|                | 3   | Regulatory maintained equipment for functional check or support purpose                   |
|                | 4   | Ancillary equipment without calibration e.g. mechanical equipment or monitoring equipment |
|                | 5   | Test System   |

|                         |      |          |
|-------------------------|------|----------|
| Interval of calibration | 12 M | 12 month |
|-------------------------|------|----------|

|  |         |   |
|--|---------|---|
|  | 24 M    | 24 month  |
|  | 36 M    | 36 month  |
|  | 24/12 M | Calibration every 24 months, between this every 12 months internal validation |
|  | 36/12 M | Calibration every 36 months, between this every 12 months internal validation |
|  | Pre-m   | Check before starting the measurement   |
|  | -       | Without calibration   |