

# TEST REPORT

No.: 2-0004-11-18-1e

According to:  
**FCC Regulations**  
 Part 15 B & Part 15.249(a)(c)(d)(e)  
**IC Regulations**  
 RSS-Gen, Issue 3  
 RSS-210: Issue 8

for

Sony Ericsson Mobile Communications AB  
 Mobile phone AAD-3880121-BV

FCC-ID: PY7A3880121  
 IC: 4170B-A3880121

| Laboratory Accreditation and Listings                                                                                                                                                                                                                                                                                                      |                                                                                                                           |                                                                                                                                                                        |                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Deutsche<br>Akkreditierungsstelle<br>D-PL-12047-01-01                                                                                                                                                                                               | <br>Reg. No.: 736496<br>MRA US-EU 0003 | <br>Industry Canada<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 |
|  AUTHORIZED<br>RF LABORATORY                                                                                                                                                                                                                            | <br>LAB CODE 20011130-00              |                                                                                                                                                                        |                                                                                                                                                                                                   |
| accredited according to DIN EN ISO/IEC 17025                                                                                                                                                                                                                                                                                               |                                                                                                                           |                                                                                                                                                                        |                                                                                                                                                                                                   |
| <p><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 chapter 3.1. 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 EUT is a mobile phone with integrated ANT+ wireless technology and integral antenna. For ANT+ technology below described tests show compliance, other implemented wireless technologies were not considered within this test report.

Following tests have been performed to show compliance with applicable FCC Part 2 and Part 15 rules of the FCC CFR 47 (10-1-10 Edition) and Industry Canada RSS-210, Issue 8 and RSS-Gen, Issue 3 regulations.

### 1.1. TESTS OVERVIEW FCC and Canada IC Standards (RSS)

| TEST CASES                                          | PORT                                        | REFERENCES & LIMITS               |                                                                    |                                                                                    | EUT set-up | EUT operating mode | Result                    |
|-----------------------------------------------------|---------------------------------------------|-----------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------|------------|--------------------|---------------------------|
|                                                     |                                             | FCC Standard                      | RSS Section                                                        | TEST LIMIT                                                                         |            |                    |                           |
| TX-Mode                                             |                                             |                                   |                                                                    |                                                                                    |            |                    |                           |
| 6dB bandwidth                                       | Antenna terminal (conducted)                | §15.247(a)(2)                     | RSS-210 Issue 8: A8.2 (a)                                          | ≥ 500 kHz for DTS systems                                                          | 2          | 1                  | For information only      |
| 99% occupied bandwidth                              | Antenna terminal (conducted)                | --                                | RSS-210 Issue 8: Chapter 4.6.1                                     | 99% Power bandwidth                                                                | 2          | 1                  | For information only      |
| Carrier field strength                              | Cabinet (radiated)                          | §15.249(a)                        | RSS-210 Issue 8:A2.9(a)                                            | 50mV/m                                                                             | 1          | 1                  | Passed                    |
| Field strength of harmonics                         | Cabinet + Interconnecting cables (radiated) | §15.247 (d)<br>§15.205<br>§15.209 | RSS-210 Issue 8:A2.9(a)                                            | 0.5mV/m                                                                            | 1          | 1                  | Passed                    |
| General field strength emissions + restricted bands |                                             |                                   | RSS-210 Issue 8, A2.9(b)<br><br>RSS-Gen: Issue 3: §7.2.5 Table 5+6 | Emissions in restricted bands must meet the general field-strength radiated limits | 1          | 1                  | Passed                    |
| AC-Power Lines<br><br>Conducted Emissions           | AC-Power lines                              | §15.207                           | RSS-Gen, Issue 3: Chapter 7.2.4, Table 4                           | FCC §15.107 class B limits<br>§15.207 limits<br><br>IC: Table 4, Chapter 7.2.4     | --         | --                 | Not performed<br>Remark 1 |

| RX Mode                               |                                             |                             |                                 |                                                                            |    |    |                           |
|---------------------------------------|---------------------------------------------|-----------------------------|---------------------------------|----------------------------------------------------------------------------|----|----|---------------------------|
| AC-Power Lines<br>Conducted Emissions | AC-Power lines (conducted)                  | §15.107                     | RSS-Gen, Issue 3: Chapter 7.2.4 | FCC §15.107 class B limits<br>§15.207 limits<br>IC: Table 2, Chapter 7.2.2 | -- | -- | Not performed<br>Remark 1 |
| RECEIVER<br>Radiated emissions        | Cabinet + Interconnecting cables (radiated) | §15.109<br>§15.33<br>§15.35 | RSS-Gen, Issue 3: Chapter 6.1   | FCC 15.109 class B limits<br>IC-limits: Table 2, Chapter 6                 | 1  | 2  | Passed                    |

Remark: 1.) in accordance with applicant's statement and information, covered by Bluetooth® test mode (same carrier generating chip), see other test report

**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  
Responsible for test section



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Fax: + 49 (0) 20 54 / 95 19 - 997



.....  
Dipl.-Ing. C. Lorenz  
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.:                                      | 2-0004-11-18-1           |
| Responsible for test report and project leader: | Dipl.-Ing. C. Lorenz     |
| Receipt of EUT:                                 | 2011-07-29               |
| Date(s) of test:                                | 2011-07-29 to 2011-08-31 |
| Date of report:                                 | 2011-09-05               |
| -----                                           |                          |
| Version of template:                            | 11.05 _All.Dotm          |

### 2.4. Applicant's details

|                   |                                               |
|-------------------|-----------------------------------------------|
| Applicant's name: | Sony Ericsson Mobile Communications AB        |
| Address:          | Nya Vattentornet<br>221-88 Lund<br><br>Sweden |
| Contact person:   | Mr. Anders Nordlöf                            |

### 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. Additional declaration and description of main EUT

|                                           |                                                                                                                                                                                                                                    |                                                    |                                      |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------|
| Main function                             | Mobile phone with integrated ANT+ Transceiver                                                                                                                                                                                      |                                                    |                                      |
| Type                                      | AAD-3880121-BV                                                                                                                                                                                                                     |                                                    |                                      |
| Frequency range<br>(US/Canada -bands)     | 2402 MHz (Channel 0) to 2480 MHz (Channel 78)<br>Channel spacing 1 MHz                                                                                                                                                             |                                                    |                                      |
| Type of modulation                        | GFSK with modulation Index 0.32                                                                                                                                                                                                    |                                                    |                                      |
| Number of channels<br>(USA/Canada -bands) | 0 to 78                                                                                                                                                                                                                            |                                                    |                                      |
| Data rate                                 | 1 MBps                                                                                                                                                                                                                             |                                                    |                                      |
| Antenna Type                              | <input checked="" type="checkbox"/> Integrated<br><input type="checkbox"/> External, no RF- connector<br><input type="checkbox"/> External, separate RF-connector                                                                  |                                                    |                                      |
| Antenna Gain                              | Max. -0.5 dBi gain according applicants information in 2.4 GHz band                                                                                                                                                                |                                                    |                                      |
| MAX Field strength (radiated):            | 100.73 dBμV/m@3m distance on nominal 2480 MHz (Channel 78)                                                                                                                                                                         |                                                    |                                      |
| FCC-ID                                    | PY7A3880121                                                                                                                                                                                                                        |                                                    |                                      |
| IC                                        | 4170B-A3880121                                                                                                                                                                                                                     |                                                    |                                      |
| Installed option                          | <input checked="" type="checkbox"/> additional wireless technologies: GSM/UMTS/Bluetooth®/WLAN<br><input checked="" type="checkbox"/> battery charging option over separated AC charger<br><input checked="" type="checkbox"/> GPS |                                                    |                                      |
| Power supply                              | Li-Io. Battery: range from 3.5 V ( $V_{min}$ ) to 4.1 V ( $V_{max}$ )                                                                                                                                                              |                                                    |                                      |
| Special EMI components                    | --                                                                                                                                                                                                                                 |                                                    |                                      |
| EUT sample type                           | <input type="checkbox"/> Production                                                                                                                                                                                                | <input checked="" type="checkbox"/> Pre-Production | <input type="checkbox"/> Engineering |

#### 3.1. 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               | Mobile phone             | AAD-3880121-BV | IMEI:<br>00440214-<br>2783384<br>(CB5A1EYWJ3)<br>(RAD#1,#20409) | AP1                | 4.0.1.A.0.57<br>ATP R1A034 |
| EUT B               | Battery Li-Io<br>1200mAh | EP500          | 1057114SWOE<br>NS                                               | 11W03              | --                         |
| EUT C               | Mobile phone             | AAD-3880121-BV | IMEI:<br>004402142783<br>376<br>(CB5A1EYWHP)<br>(COND BT)       | AP1                | 4.0.1.A.0.57<br>ATP R1A034 |

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

#### 3.2. 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                    | USB cable           | EC700     | #19321            | --                 | --                                    |
| AE 2                    | Notebook            | Dell D610 | CTC#4             | --                 | Windows XP + Special firmware program |
| AE 3                    | Dummy battery       | For EUT A | --                | --                 | --                                    |

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

### 3.3. EUT set-ups

| EUT set-up no. *) | Combination of EUT and AE   | Remarks                                                                      |
|-------------------|-----------------------------|------------------------------------------------------------------------------|
| Set. 1            | EUT A + EUT B + (AE1 + AE2) | AE1 and AE2 disconnected after successful set-up of necessary operating mode |
| Set. 2            | EUT C + AE 3 + (AE1)+(AE2)  | Used for conducted RF-measurements                                           |

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

### 3.4. Configuration of cables used for testing

| Cable number | Item | Type | S/N serial number | HW hardware status | Cable length |
|--------------|------|------|-------------------|--------------------|--------------|
| Cable 1      | --   | --   | --                | --                 | --           |

Remarks: no cable used

### 3.5. EUT operating modes

| EUT operating mode no. *) | Description of operating modes | Additional information                                                                                                          |
|---------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| op. 1                     | TX-Mode                        | With help of special test firmware and command a <u>continuous</u> traffic mode could be established. Duty Cycle of maximum 5%. |
| op. 2                     | RX-Mode                        | With help of special test firmware and command, RX-mode was set-up.                                                             |

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

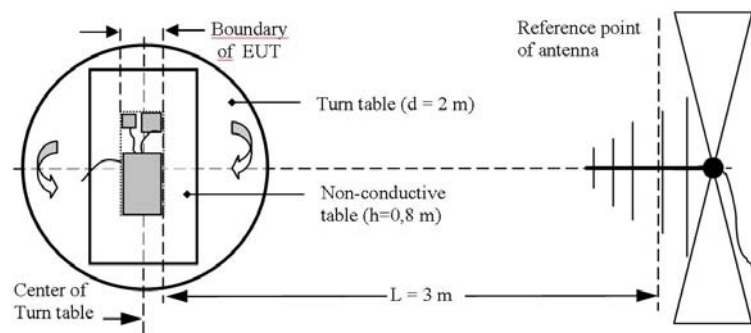
## 4. DESCRIPTION OF TEST SET-UP's

### 4.1. Test set-up for radiated measurements

Pls. see above description and schematic for radiated measurements used set-up.

#### MEASUREMENT METHOD (30 MHz < f < 1 GHz):

A EMI analyzer 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 (1 GHz < f < 26.5 GHz):

The EUT and accessories are placed on a non-conducting tipping table of 0.8 meter height (semi-anechoic chamber) or 1.55 m 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.

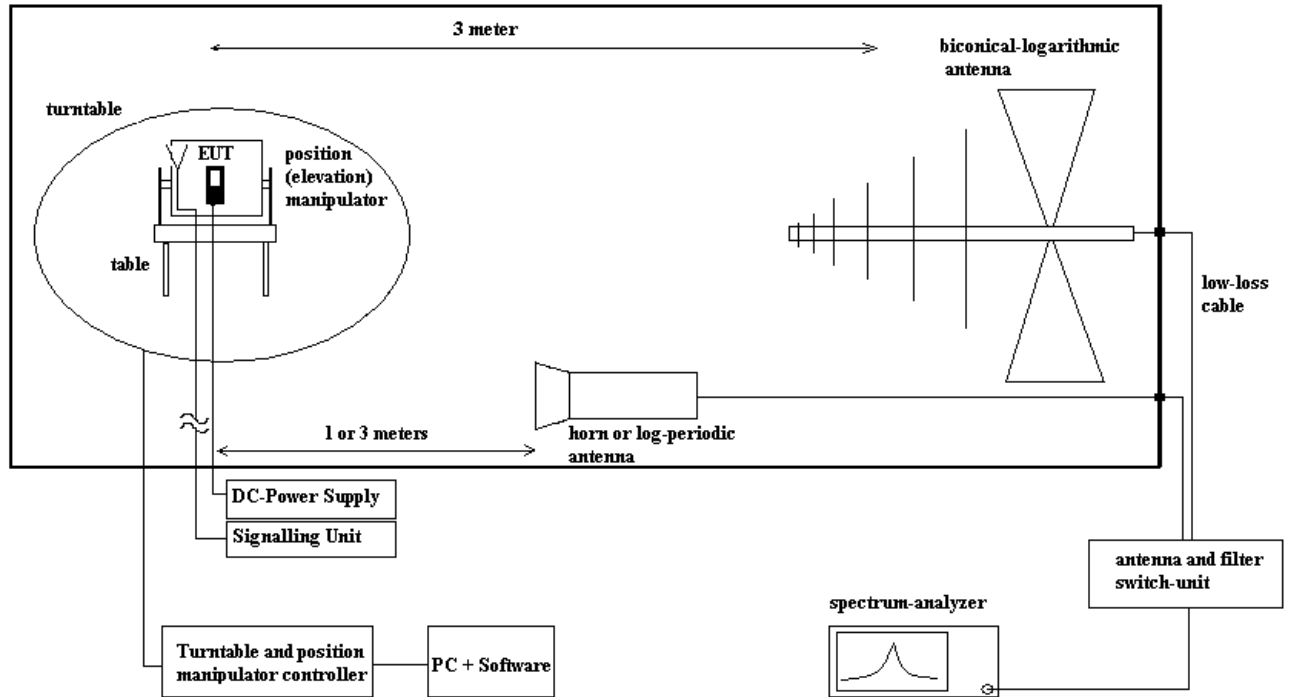
The measurements are performed for both receiving antenna polarisations: vertical and horizontal.

Up to 18 GHz a measurement distance of 3 meters is used, above 18 GHz the distance is 1 meter. A biconical-logarithmic antenna up to 1 GHz and 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 a external DC-supply with nominal voltage or a 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.



**Anechoic Chamber**



**Schematic: radiated measurements test set-up**

## 5. Measurements

### 5.1. Radiated field strength emissions below 30 MHz

**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"/> 337 OATS                  |
| receiver        | <input type="checkbox"/> 377 ESCS30                                | <input checked="" type="checkbox"/> 001 ESS        | <input type="checkbox"/> 347 Radio.lab.            |
| 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"/> 298 CMU                                   | <input type="checkbox"/> 460 CMU                   | <input type="checkbox"/> 289 CBL 6141              |
| otherwise       | <input type="checkbox"/> 400 FTC40x15E                             | <input type="checkbox"/> 401 FTC40x15E             | <input checked="" type="checkbox"/> 030 HFH-Z2     |
| DC power        | <input type="checkbox"/> 456 EA 3013A                              | <input type="checkbox"/> 457 EA 3013A              | <input type="checkbox"/> 392 MT8820A               |
| line voltage    | <input type="checkbox"/> 230 V 50 Hz via public mains              | <input type="checkbox"/> 110 V 60 Hz via PAS 5000  | <input type="checkbox"/> 482 Filter Matrix         |
|                 |                                                                    |                                                    | <input type="checkbox"/> 378 RadiSense             |
|                 |                                                                    |                                                    | <input type="checkbox"/> 494 AG6632A               |
|                 |                                                                    |                                                    | <input type="checkbox"/> 498 NGPE 40               |

### STANDARDS AND LIMITS: CFR 47, §15.205, §15.209, RSS-Gen, ANSI C63.10:2009

| Frequency<br>[ MHz] | Field strength |                         | Measurement<br>distance<br>[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: (20°C)                                                                                                                                                                                                                                                         | Rel. humidity: (66)%                       |                                                |
| EMI-Receiver (Analyzer) Settings | Span/Range: 9 kHz to 150 kHz; 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<1 GHz) |                                            |                                                |

### 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 in the chapter annexes.

## MEASUREMENT RESULTS

| Set-up No.     |                 | 1                      |                 |                 |                     |          |                          |                              |                 |                                  |
|----------------|-----------------|------------------------|-----------------|-----------------|---------------------|----------|--------------------------|------------------------------|-----------------|----------------------------------|
| Operating Mode |                 | 1                      |                 |                 |                     |          |                          |                              |                 |                                  |
| 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> ) |
| E_3.01         | 0.09 to 0.15    | < 63.27 <sup>1.)</sup> | 10.0            | 0.2             | 1.00                | --       | 0°..360°                 | Chapt. 7                     | > 20.0          | 29.54                            |
|                | 0.15 to 0.490   | < -65.0                | 10.0            | 10.0            |                     | --       |                          |                              | > 20.0          |                                  |
|                | 0.490 to 30     | < 14.77                | 10.0            | 10.0            |                     | --       |                          |                              | > 14.77         |                                  |

Remark: 1.) External interferer, not from EUT

2.) see also plots enclosed in separate document A1

| Set-up No.     |                 | 1                       |                 |                 |                     |          |                          |                              |                 |                                  |
|----------------|-----------------|-------------------------|-----------------|-----------------|---------------------|----------|--------------------------|------------------------------|-----------------|----------------------------------|
| Operating Mode |                 | 1                       |                 |                 |                     |          |                          |                              |                 |                                  |
| 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> ) |
| E_3.02         | 0.09 to 0.15    | < -63.01 <sup>1.)</sup> | 10.0            | 0.2             | 1.00                | --       | 0°..360°                 | Chapt. 7                     | > 20.0          | See diagram                      |
|                | 0.15 to 0.490   | < -65.0                 | 10.0            | 10.0            |                     | --       |                          |                              | > 20.0          |                                  |
|                | 0.490 to 30     | < 14.81                 | 10.0            | 10.0            |                     | --       |                          |                              | > 14.73         | 29.54                            |

Remark: 1.) External interferer, not from EUT

2.) see also plots enclosed in separate document A1

| Set-up No.     |                 | 1                      |                 |                 |                     |          |                          |                              |                 |                                  |
|----------------|-----------------|------------------------|-----------------|-----------------|---------------------|----------|--------------------------|------------------------------|-----------------|----------------------------------|
| Operating Mode |                 | 1                      |                 |                 |                     |          |                          |                              |                 |                                  |
| 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> ) |
| e_3.03         | 0.09 to 0.15    | < 63.47 <sup>1.)</sup> | 10.0            | 0.2             | 1.00                | --       | 0°..360°                 | Chapt. 7                     | > 20.0          | See diagram                      |
|                | 0.15 to 0.490   | < -65.0                | 10.0            | 10.0            |                     | --       |                          |                              | > 20.0          |                                  |
|                | 0.490 to 30     | < 15.16                | 10.0            | 10.0            |                     | --       |                          |                              | > 14.38         | 29.54                            |

Remark: 1.) External interferer, not from EUT

2.) see also plots enclosed in separate document A1

### Margin to Limit:

$$M = L_T - R_R + C_F + D_F$$

$$= L_T - R_R + (AF_{ANTENNA} + Cable_{LOSS}) + D_F$$

Remark: positive margin means passed result

### Abbreviations used:

- R<sub>R</sub> : Receiver readings in dBμV/m
- C<sub>F</sub>: Transducer in dB = AF (antenna factor) + CL (cable loss)
- D<sub>F</sub> : distance correction factor (if different measurement distance used than specified in the standard)
- L<sub>T</sub> : Limit in dBμV/m

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

## 5.2. Radiated field strength emissions, 30 MHz - 1 GHz

### 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"/> 337 OATS                     |
| receiver        | <input type="checkbox"/> 377 ESCS30                                | <input checked="" type="checkbox"/> 001 ESS           | <input type="checkbox"/> 347 Radio.lab.               |
| spectr. analys. | <input type="checkbox"/> 584 FSU                                   | <input type="checkbox"/> 120 FSEM                     | <input type="checkbox"/> 264 FSEK                     |
| antenna         | <input checked="" type="checkbox"/> 574 BTA-L                      | <input type="checkbox"/> 133 EMCO3115                 | <input type="checkbox"/> 302 BBHA9170                 |
| signaling       | <input type="checkbox"/> 298 CMU                                   | <input type="checkbox"/> 460 CMU                      | <input type="checkbox"/> 289 CBL 6141                 |
| otherwise       | <input type="checkbox"/> 400 FTC40x15E                             | <input type="checkbox"/> 401 FTC40x15E                | <input type="checkbox"/> 392 MT8820A                  |
| DC power        | <input type="checkbox"/> 456 EA 3013A                              | <input type="checkbox"/> 457 EA 3013A                 | <input checked="" type="checkbox"/> 482 Filter Matrix |
| line voltage    | <input type="checkbox"/> 400 FTC40x15E                             | <input type="checkbox"/> 110 USB LWL                  | <input type="checkbox"/> 378 RadiSense                |
|                 | <input type="checkbox"/> 456 EA 3013A                              | <input type="checkbox"/> 457 EA 3013A                 | <input type="checkbox"/> 459 EA 2032-50               |
|                 | <input type="checkbox"/> 230 V 50 Hz via public mains              | <input type="checkbox"/> 060 110 V 60 Hz via PAS 5000 | <input type="checkbox"/> 268 EA- 3050                 |
|                 |                                                                    |                                                       | <input type="checkbox"/> 494 AG6632A                  |
|                 |                                                                    |                                                       | <input type="checkbox"/> 498 NGPE                     |

**STANDARDS AND LIMITS: CFR 47, PART §15.249(a), RSS-Gen, ANSI C63.10:2009, (a )** *The field strength of the emissions from the intentional radiators operated within these frequency bands shall comply with the following:*

| Fundamental frequency [ MHz] | Field strength of fundamental |          | Field strength of harmonics |          |
|------------------------------|-------------------------------|----------|-----------------------------|----------|
|                              | [mV/m]                        | [dBμV/m] | [μV/m]                      | [dBμV/m] |
| 902-928                      | 50                            | 94.0     | 500                         | 54.0     |
| 2400-2483.5                  | 50                            | 94.0     | 500                         | 54.0     |
| 5725-5875                    | 50                            | 94.0     | 500                         | 54.0     |
| 24.0-24.25 GHz               | 250                           | 108.0    | 2500                        | 68.0     |

(c ) *field strength limits are specified at a distance of 3meters*

(d ) *Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.*

(e ) *for frequency above 1000 MHz, the field strength limits in paragraph (a) .. are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits above by more than 20dB under any condition of modulation.*

### STANDARDS AND LIMITS: CFR 47, PART 15B, §15.209, RSS-Gen, ANSI 63.4:2009

| Frequency [ MHz] | Radiated emission limits3 meters |                     |
|------------------|----------------------------------|---------------------|
|                  | QUASI-Peak [microvolts/meter]    | QUASI-Peak [dBμV/m] |
| 30-88            | 100                              | 40                  |
| 88-216           | 150                              | 43,5                |
| 216-960          | 200                              | 46,0                |
| above 960        | 500                              | 54,0                |

### 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 0.8m height   |                                            |                                                |
| Climatic conditions              | Temperature: (23°C)                                         |                                            |                                                |
| EMI-Receiver (Analyzer) Settings | Rel. humidity: (46)%                                        |                                            |                                                |
|                                  | Span/Range: 30 MHz to 1 GHz                                 |                                            |                                                |
|                                  | RBW/VBW: 120 kHz / (auto)                                   |                                            |                                                |
|                                  | Detector/ Mode: PEAK, TRACE max-hold mode, repetitive scan  |                                            |                                                |
|                                  | Quasi-Peak, for final measurement for critical measurements |                                            |                                                |

**RESTRICTED BANDS OF OPERATION, §15.205**

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090-0.110       | 16.42-16.423        | 399.9-410     | 4.5-5.15    |
| 0.495-0.505       | 16.69475-16.69525   | 608-614       | 5.35-5.46   |
| 2.1735-2.1905     | 16.80425-16.80475   | 960-1240      | 7.25-7.75   |
| 4.125-4.128       | 25.5-25.67          | 1300-1427     | 8.025-8.5   |
| 4.20725-4.20775   | 73-74.6             | 1645.5-1646.5 | 9.3-9.5     |
| 6.215-6.218       | 74.8-75.2           | 1660-1710     | 10.6-12.7   |
| 6.26775-6.26825   | 108-121.94          | 1718.8-1722.2 | 13.25-13.4  |
| 6.31175-6.31225   | 123-138             | 2200-2300     | 14.47-14.5  |
| 8.291-8.294       | 149.9-150.05        | 2310-2390     | 15.35-16.2  |
| 8.362-8.366       | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9         | 2690-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4           | 3600-4400     | --          |
| 13.36-13.41       | --                  | --            | --          |

Remark: only spurious emissions are allowed within these frequency bands not exceeding the limits per §15.209

**GENERAL MEASUREMENT PROCEDURES:**

The measurement test set-up and test procedure are in accordance with the provisions described in ANSI 63.4: 2009 or ANSI63.10:2009.

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

**MEASUREMENT METHOD (30 MHz < f < 1 GHz):**

Pls. see description in chapter 4.1

**5.2.1. MEASUREMENT RESULTS TX-MODE (§15.249)****Channel High ( Channel 78)**

| Set-up No.     |                  | 1                |                 |                  |                    |          |                          |                                 |                    |                                      |
|----------------|------------------|------------------|-----------------|------------------|--------------------|----------|--------------------------|---------------------------------|--------------------|--------------------------------------|
| Operating Mode |                  | 1                |                 |                  |                    |          |                          |                                 |                    |                                      |
| Diagram no.    | Frequency ( MHz) | MaxPeak (dBμV/m) | Meas. Time (ms) | Bandwidth ( kHz) | Antenna height (m) | Polarity | Turntable position (deg) | Corr. (dB)<br>(C <sub>F</sub> ) | Margin (dB)<br>(M) | Limit (dBμV /m)<br>(L <sub>T</sub> ) |
| E_2.01         | 30-1000          | < 36.0           | 10.0            | 120.0            | 1..4m              | H/V      | 0°..360°                 | --                              | > 18               | 54.0                                 |

Remark: \*.) see also plots enclosed in annex A1

**Channel middle ( Channel 39)**

| Set-up No.     |                  | 1                |                 |                  |                    |          |                          |                                 |                    |                                      |
|----------------|------------------|------------------|-----------------|------------------|--------------------|----------|--------------------------|---------------------------------|--------------------|--------------------------------------|
| Operating Mode |                  | 1                |                 |                  |                    |          |                          |                                 |                    |                                      |
| Diagram no.    | Frequency ( MHz) | MaxPeak (dBμV/m) | Meas. Time (ms) | Bandwidth ( kHz) | Antenna height (m) | Polarity | Turntable position (deg) | Corr. (dB)<br>(C <sub>F</sub> ) | Margin (dB)<br>(M) | Limit (dBμV /m)<br>(L <sub>T</sub> ) |
| E_2.02         | 886.55           | 29.88 (QP)       | 1000            | 120.0            | 1..4m              | V        | 309°                     | 26.29                           | 16.1               | 46.0                                 |
|                | 30-1000          | < 36.0 (PK)      | 10.0            | 120.0            | 1..4m              | H/V      | 0°..360°                 | --                              | > 18               | 54.0                                 |

Remark: \*.) see also plots enclosed in annex A1

**Channel low ( Channel 0)**

| Set-up No.     |                  | 1                |                 |                  |                    |          |                          |                                 |                    |                                      |
|----------------|------------------|------------------|-----------------|------------------|--------------------|----------|--------------------------|---------------------------------|--------------------|--------------------------------------|
| Operating Mode |                  | 1                |                 |                  |                    |          |                          |                                 |                    |                                      |
| Diagram no.    | Frequency ( MHz) | MaxPeak (dBμV/m) | Meas. Time (ms) | Bandwidth ( kHz) | Antenna height (m) | Polarity | Turntable position (deg) | Corr. (dB)<br>(C <sub>F</sub> ) | Margin (dB)<br>(M) | Limit (dBμV /m)<br>(L <sub>T</sub> ) |
| E_2.03         | 29.8             | 1000.0           | 120             | 129.0            | H                  | 341.0    | 0°..360°                 | 26.4                            | 16.20              | 46.0                                 |

Remark: \*.) see also plots enclosed in annex A1

**5.2.2. MEASUREMENT RESULTS RX-MODE (§15.109, CLASS B)****Channel middle(RX Ch.39)**

| Set-up No.     |                  | 1                |                 |                  |                    |          |                          |                                 |                    |                                      |
|----------------|------------------|------------------|-----------------|------------------|--------------------|----------|--------------------------|---------------------------------|--------------------|--------------------------------------|
| Operating Mode |                  | 2                |                 |                  |                    |          |                          |                                 |                    |                                      |
| Diagram no.    | Frequency ( MHz) | MaxPeak (dBμV/m) | Meas. Time (ms) | Bandwidth ( kHz) | Antenna height (m) | Polarity | Turntable position (deg) | Corr. (dB)<br>(C <sub>F</sub> ) | Margin (dB)<br>(M) | Limit (dBμV /m)<br>(L <sub>T</sub> ) |
| E_2.10         | 40.82            | 15.47            | 1000            | 120.0            | 2.27               | V        | 200°                     | 16.97                           | 24.50              | 40.0                                 |
|                | 738.83           | 27.59            | 1000            | 120.0            | 2.22               | V        | 211°                     | 23.92                           | 18.40              | 46.0                                 |
|                | 872.92           | 29.92            | 1000            | 120.0            | 2.77               | V        | 277°                     | 25.98                           | 16.10              | 46.0                                 |

Remark: \*.) see also plots enclosed in annex A1

|                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <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>Remark: positive margin means passed result</p> | <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 emissions above 30 MHz and below 1 GHz : Passed

### 5.3. Radiated emissions, above 1 GHz

#### TEST LOCATION AND EQUIPMENT (for reference numbers please see chapter 'List of test equipment')

|                 |                                                       |                                        |                                                       |                                               |                                          |                                  |
|-----------------|-------------------------------------------------------|----------------------------------------|-------------------------------------------------------|-----------------------------------------------|------------------------------------------|----------------------------------|
| test site       | <input type="checkbox"/> 441 EMI SAR                  | <input type="checkbox"/> 348 EMI cond. | <input checked="" type="checkbox"/> 443 EMI FAR       | <input type="checkbox"/> 347 Radio.lab.       | <input type="checkbox"/> 337 OATS        | <input type="checkbox"/>         |
| equipment       | <input type="checkbox"/> 331 HC 4055                  | <input type="checkbox"/>               | <input type="checkbox"/>                              | <input type="checkbox"/>                      | <input type="checkbox"/>                 | <input type="checkbox"/>         |
| spectr. analys. | <input type="checkbox"/> 584 FSU                      | <input type="checkbox"/> 120 FSEM      | <input type="checkbox"/> 264 FSEK                     | <input checked="" type="checkbox"/> 489 ESU   | <input type="checkbox"/>                 | <input type="checkbox"/>         |
| antenna meas    | <input type="checkbox"/> 574 BTA-L                    | <input type="checkbox"/> 289 CBL 6141  | <input type="checkbox"/> 439 HL 562                   | <input checked="" type="checkbox"/> 549 HL025 | <input type="checkbox"/> 302 BBHA9170    | <input type="checkbox"/> 477 GPS |
| antenna meas    | <input type="checkbox"/> 123 HUF-Z2                   | <input type="checkbox"/> 132 HUF-Z3    | <input type="checkbox"/> 030 HFH-Z2                   | <input type="checkbox"/>                      | <input type="checkbox"/>                 | <input type="checkbox"/>         |
| antenna subst   | <input type="checkbox"/> 071 HUF-Z2                   | <input type="checkbox"/> 020 EMCO3115  | <input type="checkbox"/> 063 LP 3146                  | <input type="checkbox"/> 303 BBHA9170         | <input type="checkbox"/>                 | <input type="checkbox"/>         |
| power meter     | <input type="checkbox"/> 009 NRV                      | <input type="checkbox"/> 010 URV5-Z2   | <input type="checkbox"/> 011 URV5-Z2                  | <input type="checkbox"/>                      | <input type="checkbox"/>                 | <input type="checkbox"/>         |
| signalgener.    | <input type="checkbox"/> 008 SMG                      | <input type="checkbox"/> 140 SMHU      | <input type="checkbox"/> 263 SMP04                    | <input type="checkbox"/>                      | <input type="checkbox"/>                 | <input type="checkbox"/>         |
| power meter     | <input type="checkbox"/> 262 NRV-S                    | <input type="checkbox"/> 266 NRV-Z31   | <input type="checkbox"/> 265 NRV-Z33                  | <input type="checkbox"/> 261 NRV-Z55          | <input type="checkbox"/> 356 NRV-Z1      | <input type="checkbox"/>         |
| multimeter      | <input type="checkbox"/> 341 Fluke 112                | <input type="checkbox"/>               | <input type="checkbox"/>                              | <input type="checkbox"/>                      | <input type="checkbox"/>                 | <input type="checkbox"/>         |
| signaling       | <input type="checkbox"/> 298 CMU                      | <input type="checkbox"/> 460 CMU       | <input type="checkbox"/> 295 RACAL                    | <input type="checkbox"/> 392 MT8820A          |                                          |                                  |
| DCpower         | <input type="checkbox"/> 086 LNG50-10                 | <input type="checkbox"/> 087 EA3013    | <input type="checkbox"/> 354 NGPE 40                  | <input type="checkbox"/> 349 car battery      | <input type="checkbox"/> 350 Car battery | <input type="checkbox"/>         |
| 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 LIMITS: CFR 47, PART §15.249(a), RSS-Gen, ANSI C63.10:2009(a )** *The field strength of the emissions from the intentional radiators operated within these frequency bands shall comply with the following:*

| Fundamental frequency [ MHz] | Field strength of fundamental |          | Field strength of harmonics |          |
|------------------------------|-------------------------------|----------|-----------------------------|----------|
|                              | [mV/m]                        | [dBµV/m] | [µV/m]                      | [dBµV/m] |
| 902-928                      | 50                            | 94.0     | 500                         | 54.0     |
| 2400-2483.5                  | 50                            | 94.0     | 500                         | 54.0     |
| 5725-5875                    | 50                            | 94.0     | 500                         | 54.0     |
| 24.0-24.25 GHz               | 250                           | 108.0    | 2500                        | 68.0     |

(c ) field strength limits are specified at a distance of 3meters

(d ) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

(e ) for frequency above 1000 MHz, the field strength limits in paragraph (a) .. are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits above by more than 20dB under any condition of modulation.

#### STANDARDS AND LIMITS: CFR 47, §15.109 (CLASS B), §15.209, RSS-Gen, RSS-210, ANSI C63.4:2009

| Frequency [ MHz] | Radiated emission limits, 3 meters measurement distance |             |                         |               |
|------------------|---------------------------------------------------------|-------------|-------------------------|---------------|
|                  | AV [microvolts/meter]                                   | AV [dBµV/m] | Peak [microvolts/meter] | Peak [dBµV/m] |
| above 1 GHz      | 500                                                     | 54.0        | 5000                    | 74.0          |

#### 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 1.5m height                                                                                    |                                            | <input type="checkbox"/> floor standing        |
| Climatic conditions            | Temperature: (25°C)                                                                                                                          |                                            | Rel. humidity: (41)%                           |
| Spectrum-Analyzer settings     | Span/Frequency range : 1..18 GHz +single frequencies determined in step 1                                                                    |                                            |                                                |
|                                | RBW/VBW: 1 MHz / 3 MHz                                                                                                                       |                                            |                                                |
|                                | Detector/ Mode: Peak, MAX-hold, repetitive scan for exploratory measurement<br>PEAK/ AVERAGE, for final measurement for critical frequencies |                                            |                                                |
|                                | Antenna Polarisation Horizontal / Vertical                                                                                                   |                                            |                                                |

## GENERAL MEASUREMENT PROCEDURES:

The measurement test set-up and test procedure are in accordance with the provisions described in ANSI 63.4: 2009 for RX-mode and ANSI 63.10:2009 for TX-mode.

The **Equipment under Test** (EUT) was placed on a non-conductive positioning table of 0.8 or 1.5 meter height depending from the frequency range. The measuring distance was set to 3 meter for frequencies up to 18 GHz and 1 meter above 18 GHz.

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

For RX-measurements following is valid regarding the frequency range of measurements:

For the upper frequency measurement range, it was assumed that the highest frequency generated in the device is same as the highest operable TX-frequency in ANT mode (2480 MHz). For practical reasons the upper frequency limit was set to 12.75 GHz

**1. Step exploratory measurement:** see above description as in the frequency range lower 1 GHz.

**2. Step Final Measurement(1 GHz < f < 18 GHz):** On the Worst-Case EUT configuration, frequency components with a margin lower than 6 dB to the limits, will be re-measured by maintaining the EUT's operating mode, cable position, etc.. For find the worst-case emission, the turntable was changed in the range 0 to 360 degree and the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurements are performed for both polarizations of the measuring antenna: horizontal and vertical.

### 5.3.1. CARRIER FIELD STRENGTH ACCORD. §15.249(a):

| Maximum Radiated field strength@3m distance                               |                               |                                   |                                         |
|---------------------------------------------------------------------------|-------------------------------|-----------------------------------|-----------------------------------------|
| Set-up no.: 1<br>Op. Mode: 1                                              | Low channel = 0<br>(2402 MHz) | Middle channel = 39<br>(2441 MHz) | High channel = 78<br>(2480 MHz)         |
| Determined<br>field strength [dBuV/m] in<br>3m distance with RBW=1<br>MHz | 98.32 (PK)<br>73.61 (AV)      | 100.62 (PK)<br>74.70 (AV)         | <b>100.73 (PK)</b><br><b>75.01 (AV)</b> |

Remark: standard refer to an carrier limit of 94 dBuV/m AVERAGE and 114 dBuV/m PEAK value.



### 5.3.2. MEASUREMENT OF SPURIOUS EMISSIONS TX-MODE (§15.209):

Channel low (Ch 0)

| Set-up No.:     |                  | 1                |                  |                  |                     |          |                          |                              |                 |                                   |
|-----------------|------------------|------------------|------------------|------------------|---------------------|----------|--------------------------|------------------------------|-----------------|-----------------------------------|
| Operating Mode: |                  | 1                |                  |                  |                     |          |                          |                              |                 |                                   |
| 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 (dBμ V/m) (L <sub>T</sub> ) |
| E_2.04          | PK-detector      |                  |                  |                  |                     |          |                          |                              |                 |                                   |
|                 | 2388.4           | 61.45            | 100              | 1000             | 155                 | H/V      | 0°..360°                 | --                           | 12.55           | 74.0                              |
|                 | AV-detector      |                  |                  |                  |                     |          |                          |                              |                 |                                   |
|                 | 2389.4           | 49.05            | 100              | 1000             | 155                 | H/V      | 0°..360°                 | --                           | 4.95            | 54.0                              |

Remark: 1.) diagrams shows PK/AV detector measurements see also plots enclosed in annex A1

| Set-up No.:     |                  | 1                            |                  |                  |                     |          |                          |                              |                 |                                   |
|-----------------|------------------|------------------------------|------------------|------------------|---------------------|----------|--------------------------|------------------------------|-----------------|-----------------------------------|
| Operating Mode: |                  | 1                            |                  |                  |                     |          |                          |                              |                 |                                   |
| 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 (dBμ V/m) (L <sub>T</sub> ) |
| E_2.05          | PK-detector      |                              |                  |                  |                     |          |                          |                              |                 |                                   |
|                 | 2800 to 18000    | < 63.66                      | 10.0             | 1000             | 155                 | H/V      | 0°..360°                 | --                           | >10.34          | 74.0                              |
|                 | AV-detector      |                              |                  |                  |                     |          |                          |                              |                 |                                   |
|                 | 2800 to 18000    | < 50.48                      | 10.0             | 1000             | 155                 | H/V      | 0°..360°                 | --                           | >3.52           | 54.0                              |
| --2.)           | 18000 to 25000   | < 60.99 (PK)<br>< 50.92 (AV) | No peaks found   |                  |                     |          |                          |                              |                 | 74(PK)<br>54(AV)                  |

Remark: 1.) diagrams shows PK/AV detector measurements see also plots enclosed in annex A1

2.) measurements from 18 to 25 GHz performed as exploratory measurements only, no peaks detected (harmonic or spurious)

## Channel middle (Ch 39)

| Set-up No.:     | 1                |                  |                |                  |                     |          |                          |                              |                 |                                   |
|-----------------|------------------|------------------|----------------|------------------|---------------------|----------|--------------------------|------------------------------|-----------------|-----------------------------------|
| Operating Mode: | 1                |                  |                |                  |                     |          |                          |                              |                 |                                   |
| 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 (dBμ V/m) (L <sub>T</sub> ) |
| E_2.06          | PK-detector      |                  |                |                  |                     |          |                          |                              |                 |                                   |
|                 | 2386.2           | 61.18            | 100            | 1000             | 155                 | H/V      | 0°..360°                 | --                           | 12.82           | 74.0                              |
|                 | AV-detector      |                  |                |                  |                     |          |                          |                              |                 |                                   |
|                 | 2389.2           | 49.08            | 100            | 1000             | 155                 | H/V      | 0°..360°                 | --                           | 4.92            | 54.0                              |

Remark: 1.) diagrams shows PK/AV detector measurements see also plots enclosed in annex A1

| Set-up No.:     | 1                |                              |                |                  |                     |          |                          |                              |                 |                                   |
|-----------------|------------------|------------------------------|----------------|------------------|---------------------|----------|--------------------------|------------------------------|-----------------|-----------------------------------|
| Operating Mode: | 1                |                              |                |                  |                     |          |                          |                              |                 |                                   |
| 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 (dBμ V/m) (L <sub>T</sub> ) |
| E_2.07          | PK-detector      |                              |                |                  |                     |          |                          |                              |                 |                                   |
|                 | 2800 to 18000    | < 64.74                      | 10.0           | 1000             | 155                 | H/V      | 0°..360°                 | --                           | >9.26           | 74.0                              |
|                 | AV-detector      |                              |                |                  |                     |          |                          |                              |                 |                                   |
|                 | 2800 to 18000    | < 50.39                      | 10.0           | 1000             | 155                 | H/V      | 0°..360°                 | --                           | >3.61           | 54.0                              |
| --3.)           | 18000 to 25000   | < 61.00 (PK)<br>< 50.61 (AV) | No peaks found |                  |                     |          |                          |                              |                 | 74(PK)<br>54(AV)                  |

Remark: 1.) diagrams shows PK/AV detector measurements see also plots enclosed in annex A1

2.) measurements from 18 to 25 GHz performed as exploratory measurements only, no peaks detected (harmonic or spurious)

## Channel middle (Ch 78)

| Set-up No.:     | 1                |                  |                |                  |                     |          |                          |                                 |                    |                                     |
|-----------------|------------------|------------------|----------------|------------------|---------------------|----------|--------------------------|---------------------------------|--------------------|-------------------------------------|
| Operating Mode: | 1                |                  |                |                  |                     |          |                          |                                 |                    |                                     |
| Diagram no.     | Frequency ( MHz) | MaxPeak (dBμV/m) | Meas Time (ms) | Bandwidth ( kHz) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB)<br>(C <sub>F</sub> ) | Margin (dB)<br>(M) | Limit (dBμV/m)<br>(L <sub>T</sub> ) |
| E_2.08          | PK-detector      |                  |                |                  |                     |          |                          |                                 |                    |                                     |
|                 | 2389.6           | 60.73            | 100            | 1000             | 155                 | H        | 176                      | 35.43                           | 13.3               | 74.0                                |
|                 | 2651.2           | 62.26            | 100            | 1000             | 155                 | V        | 180                      | 36.50                           | 2.)                | 74.0                                |
|                 | 2792.7           | 63.79            | 100            | 1000             | 155                 | H        | 354                      | 37.19                           | 10.2               | 74.0                                |
|                 | AV-detector      |                  |                |                  |                     |          |                          |                                 |                    |                                     |
|                 | 2395.1           | 49.11            | 100.0          | 1000.000         | 155.0               | H        | 135                      | 35.44                           | 2.)                | 54.0                                |
|                 | 2651.0           | 49.92            |                |                  |                     | V        | 37                       | 36.50                           | 2.)                | 54.0                                |
|                 | 2794.5           | 50.77            |                |                  |                     | V        | 6                        | 37.20                           | 3.2                | 54.0                                |

Remark: 1.) diagrams shows PK/AV detector measurements see also plots enclosed in annex A1

2.) Limit according FCC 15.209 less stringent

| Set-up No.:     | 1                |                              |                |                  |                     |          |                          |                                 |                    |                                     |
|-----------------|------------------|------------------------------|----------------|------------------|---------------------|----------|--------------------------|---------------------------------|--------------------|-------------------------------------|
| Operating Mode: | 1                |                              |                |                  |                     |          |                          |                                 |                    |                                     |
| Diagram no.     | Frequency ( MHz) | MaxPeak (dBμV/m)             | Meas Time (ms) | Bandwidth ( kHz) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB)<br>(C <sub>F</sub> ) | Margin (dB)<br>(M) | Limit (dBμV/m)<br>(L <sub>T</sub> ) |
| E_2.09          | PK-detector      |                              |                |                  |                     |          |                          |                                 |                    |                                     |
|                 | 2800 to 18000    | < 63.46                      | 10.0           | 1000             | 155                 | H/V      | 0°..360°                 | --                              | >10.54             | 74.0                                |
|                 | AV-detector      |                              |                |                  |                     |          |                          |                                 |                    |                                     |
|                 | 2800 to 18000    | < 50.39                      | 10.0           | 1000             | 155                 | H/V      | 0°..360°                 | --                              | >3.61              | 54.0                                |
| --2.)           | 18000 to 25000   | < 61.00 (PK)<br>< 50.61 (AV) | No peaks found |                  |                     |          |                          |                                 |                    | 74(PK)<br>54(AV)                    |

Remark: 1.) diagrams shows PK/AV detector measurements, see also plots enclosed in annex A1

2.) measurements from 18 to 25 GHz performed as exploratory measurements only, no peaks detected (harmonic or spurious)

### 5.3.3. MEASUREMENT OF SPURIOUS EMISSIONS RX-MODE (§15.109, CLASS B)

Channel middle (RX Ch 39)

| Set-up No.:     | 1                |                  |                  |                  |                     |          |                          |                              |                 |                                   |
|-----------------|------------------|------------------|------------------|------------------|---------------------|----------|--------------------------|------------------------------|-----------------|-----------------------------------|
| 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 (dBμ V/m) (L <sub>T</sub> ) |
| E_2.11          | PK-detector      |                  |                  |                  |                     |          |                          |                              |                 |                                   |
|                 | 1-2.8 GHz        | <45.0            | 10.0             | 1000             | 100                 | H/V      | 0°..360°                 | --                           | >20             | 74.0                              |
|                 | AV-detector      |                  |                  |                  |                     |          |                          |                              |                 |                                   |
|                 | 1-2.8 GHz        | <32.5            | 10.0             | 1000             | 100                 | H/V      | 0°..360°                 | --                           | >20             | 54.0                              |

Remark: --

| Set-up No.:     | 1                |                      |                  |                  |                     |          |                          |                              |                 |                                   |
|-----------------|------------------|----------------------|------------------|------------------|---------------------|----------|--------------------------|------------------------------|-----------------|-----------------------------------|
| 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 (dBμ V/m) (L <sub>T</sub> ) |
| E_2.12          | PK-detector      |                      |                  |                  |                     |          |                          |                              |                 |                                   |
|                 | 2.8-18 GHz       | <64.0 <sup>1.)</sup> | 10.0             | 1000             | 100                 | H/V      | 0°..360°                 | --                           | >10             | 74.0                              |
|                 | AV-detector      |                      |                  |                  |                     |          |                          |                              |                 |                                   |
|                 | 2.8-18 GHz       | <50.5 <sup>1.)</sup> | 10.0             | 1000             | 100                 | H/V      | 0°..360°                 | --                           | > 3.5           | 54.0                              |

Remark: 1.) no peaks within noise level

|                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <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>Remark: positive margin means passed result</p> | <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 emissions above 1 GHz : Passed

#### 5.4. 6-dB Bandwidth

FCC 15.247, RSS-210

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                  | <input checked="" type="checkbox"/> 347 Radio.lab.       | <input type="checkbox"/>                           |
| receiver      | <input type="checkbox"/> 377 ESCS30                                | <input type="checkbox"/> 001 ESS     | <input checked="" type="checkbox"/> 489 ESU        | <input checked="" type="checkbox"/> 431 Near field probe | <input type="checkbox"/>                           |
| otherwise     | <input type="checkbox"/> 530 10dB Attenuator                       |                                      |                                                    | <input type="checkbox"/> cable K15                       |                                                    |

#### REFERENCES: §15.247(a)(1), RSS-210

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

(2) DSSS Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

#### EUT SETTINGS:

The EUT was instructed to send with maximum power (if adjustable) according applicants instructions. Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

#### MEASUREMENT METHOD:

The measurement was performed with the RBW set to 50 kHz. The span was set to cover the complete carrier. A DELTA Marker method was set to measure the bandwidth compared to the highest peak within power envelope. The operating modes have been varied (e.g. data rate, modulation scheme, etc.), if applicable

Also the **99% emission bandwidth** was measured. Two markers are placed on frequency points such that left to lower f-marker and right to higher f-marker only 1% of the TX-power is contained. Between the markers, 99% of the power is laying. The RBW value is readjusted and the measurement repeated until the RBW/EBW ratio is around 1%.

#### SPECTRUM-ANALYZER SETTINGS:

|                            |                                                                                             |
|----------------------------|---------------------------------------------------------------------------------------------|
| Span                       | Set as to fully display the emissions and approximate 30dB below the PEAK level             |
| Resolution Bandwidth (RBW) | Set to approx 3% to 5% of the emission width                                                |
| Video Bandwidth (VBW)      | Minimum 3 times the resolution bandwidth                                                    |
| Sweep time                 | Coupled and low enough to have no gaps within power envelope                                |
| Detector                   | Sample (if bin width: Span/no. of frequency points SA < 0.5*RBW SA otherwise Peak detector) |
| Sweep mode                 | Repetitive Mode, MAX-HOLD                                                                   |

**RESULTS:**

| Set-up no.: 2<br>Op. Mode: 1                       | 6 dB Bandwidth<br>[kHz]       |                                   |                                 |
|----------------------------------------------------|-------------------------------|-----------------------------------|---------------------------------|
| T <sub>NOM</sub> = 21°C<br>V <sub>NOM</sub> = 4.1V | Low channel = 0<br>(2402 MHz) | Middle channel = 39<br>(2442 MHz) | High channel = 78<br>(2480 MHz) |
| Value                                              | 405.44                        | 395.83                            | 408.65                          |

**Remark:**

1.) see diagrams in separate document A1

**Conclusion:** 6dB bandwidth smaller than 500 kHz so tests according Part 15.249 should apply for this wireless technology.

| Set-up no.: 2<br>Op. Mode: 1                       | 99% EMISSION BANDWIDTH<br>[kHz] |                                   |                                 |
|----------------------------------------------------|---------------------------------|-----------------------------------|---------------------------------|
| T <sub>NOM</sub> = 21°C<br>V <sub>NOM</sub> = 4.1V | Low channel = 0<br>(2402 MHz)   | Middle channel = 39<br>(2442 MHz) | High channel = 78<br>(2480 MHz) |
| Value                                              | 745.192                         | 738.782 kHz                       | 767.628                         |

**Remark:**

1.) see diagrams in separate document A1

**VERDICT:** As 6dB bandwidth is smaller than 500 kHz standard Part 15.249(a) apply.

## 5.5. Band-Edge compliance measurements,

## FCC 15.205/15.209, RSS-210

### 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 checked="" type="checkbox"/> 443 System CTC-FAR-EMI- |                                                    | <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                           | <input checked="" type="checkbox"/> 347 Radio.lab. | <input type="checkbox"/>                           | <input type="checkbox"/>             |
| receiver        | <input type="checkbox"/> 377 ESCS30                                | <input type="checkbox"/> 001 ESS      | <input checked="" type="checkbox"/> 489 ESU                 | <input type="checkbox"/>                           | <input type="checkbox"/>                           | <input type="checkbox"/>             |
| antenna meas    | <input type="checkbox"/> 574 BTA-L                                 | <input type="checkbox"/> 289 CBL 6141 | <input type="checkbox"/> 439 HL 562                         | <input checked="" type="checkbox"/> 549 HL025      | <input type="checkbox"/>                           |                                      |
| spectr. analys. | <input type="checkbox"/> 489 ESU                                   | <input type="checkbox"/> 120 FSEM     | <input type="checkbox"/> 264 FSEK                           | <input type="checkbox"/>                           | <input type="checkbox"/>                           | <input type="checkbox"/>             |
| power supply    | <input type="checkbox"/> 456 EA 3013A                              | <input type="checkbox"/> 457 EA 3013A | <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"/> 530 10dB Attenuator                       |                                       |                                                             | <input type="checkbox"/> cable K15                 |                                                    |                                      |

### MEASUREMENT METHOD:

A Delta marker method was used for showing compliance to restricted bands according §15.205. The method is according Public Notice “Marker-Delta method”, Extract from DA00-705. The method consists of three independent steps:

1. Step: Prior to the measurement the fundamental radiated In-Band field strength was performed. The determined value is used as reference value.
2. Step: Second step consist of finding the relative attenuation between the fundamental emission and the maximum local out-of-band emission (within 2 MHz range around the band edge either on the band-edge directly or some modulation product if the level is greater than that on the band-edge) when measured with lower resolution bandwidth.
3. Step: The delta value recorded in step 2 will be subtracted from value recorded in step 1, thus giving the required field strength at the band-edge. This value must fulfil the requirements for radiated spurious emissions in restricted bands in §15.205 with the general limits of §15.209.

### EUT SETTINGS:

A typical ANT+ modulation was set-up according customers information. Carrier was modulated and working at maximum power.

### RESULTS

|                                                     |                                        |                    |                                      |         |
|-----------------------------------------------------|----------------------------------------|--------------------|--------------------------------------|---------|
| Set-up: 1                                           |                                        |                    |                                      |         |
| Op. Mode: 1                                         |                                        |                    |                                      |         |
| T <sub>NOM</sub> = 21°C,<br>V <sub>NOM</sub> = 4.1V | Fundamental field<br>strength-radiated | Delta Marker Value | Field strength value<br>at Band-Edge | Verdict |
|                                                     | [dBμV/m]                               | [dB]               | [dBμV/m]                             |         |
| Channel Low                                         | 98.32 (PK)                             | > 50.42            | 47.87 (PK)                           | Passed  |
| Channel High                                        | 100.73 (PK)<br>75.01 (AV)              | 54.74              | 45.99 (PK)<br>20.27 (AV)             | Passed  |

**VERDICT:** pass

## 5.6. 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.

| Measurement                                                | Frequency range   | Calculated uncertainty based on a confidence level of 95% | Remarks:            |
|------------------------------------------------------------|-------------------|-----------------------------------------------------------|---------------------|
| RF-Power Output conducted                                  | 9 kHz .. 20 GHz   | 1.0 dB                                                    | --                  |
| RF-Power Output radiated                                   | 30 MHz .. 4 GHz   | 3.17 dB                                                   | Substitution method |
| Conducted RF-emissions on antenna ports                    | 9 kHz .. 20 GHz   | 1.0 dB                                                    | --                  |
| Radiated RF-emissions enclosure                            | 150 kHz .. 30 MHz | 5.0 dB                                                    | Magnetic field      |
|                                                            | 30 MHz .. 1 GHz   | 4.2 dB                                                    | E-Field             |
|                                                            | 1 GHz .. 18 GHz   | 4.8 dB                                                    | E-Field             |
|                                                            | 1 GHz .. 20 GHz   | 3.17 dB                                                   | Substitution method |
| Occupied bandwidth                                         | 9 kHz .. 4 GHz    | 0.1272 ppm (Delta Marker method)                          | Frequency error     |
|                                                            |                   | 1 dB                                                      | Power               |
| Emission bandwidth                                         | 9 kHz .. 4 GHz    | 0.1272 ppm (Delta Marker method)                          | Frequency error     |
|                                                            |                   | 1 dB                                                      | Power               |
| Frequency stability                                        | 9 kHz .. 20 GHz   | 0.0636 ppm                                                | --                  |
| Conducted emissions on AC-mains port (U <sub>CISPR</sub> ) | 9 kHz .. 150 kHz  | 4.0 dB                                                    | --                  |
|                                                            | 150 kHz .. 30 MHz | 3.6 dB                                                    |                     |

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



## 6. Instruments and Ancillary

### 6.1. Used equipment “CTC”

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

#### 6.1.1. 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 |
| 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                                                        |

### 6.1.2. 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            | 1B 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      |            |
| 441      | CTC-SAR-EMI Cable Loss                  | System EMI field (SAR) Cable | -               | CETECOM               | 12 M                    | 5      | 30.09.2011 |

| 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        | 12 M                    | -      | 30.09.2011 |
| 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      |            |
| 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      |            |

### 6.1.3. 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                                                           |

## 7. Correction factors due to reduced meas. distance ( $f < 30$ MHz)

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

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