

## GSM 1900 Test Report RH-36

|                                                         |                                                                                                                                                                                                                                                           |                                   |                                                                                                               |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Test Report no.:</b>                                 | Cph_FCC_0505_07.doc                                                                                                                                                                                                                                       | <b>Date of Report:</b>            | 02/04/05                                                                                                      |
| <b>Number of pages:</b>                                 | 16                                                                                                                                                                                                                                                        | <b>Customer's Contact person:</b> | Ole Sørensen                                                                                                  |
|                                                         |                                                                                                                                                                                                                                                           | <b>Responsible Test engineer:</b> | Jan Engelbrechtsen                                                                                            |
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| <b>Tested devices/ accessories:</b>                     | Phone RH-36, Battery BL-5C, AC Charger ACP-7E                                                                                                                                                                                                             |                                   |                                                                                                               |
| <b>Supplement reports:</b>                              |                                                                                                                                                                                                                                                           |                                   |                                                                                                               |
| <b>Testing has been carried out in accordance with:</b> | The tests listed in this report have been done to demonstrate compliance with the applicable requirements in FCC rules Part 24 and IC standard RSS-133.                                                                                                   |                                   |                                                                                                               |
| <b>Documentation:</b>                                   | The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 15 years at TCC Copenhagen. |                                   |                                                                                                               |
| <b>Test Results:</b>                                    | The EUT complies with the requirements in respect of all parameters subject to the test. The test results relate only to devices specified in this document                                                                                               |                                   |                                                                                                               |
| <b>Date and signatures for the contents:</b>            | 02/04/05                                                                                                                                                                                                                                                  |                                   |                                                                                                               |



**Allan Franch Henriksen**  
Test engineer

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## 1. Summary of test results

| Section in CFR 47             | Section in RSS-133 |                                            | Result |
|-------------------------------|--------------------|--------------------------------------------|--------|
| §2.1046 (a)                   | 6.2                | Conducted RF output                        | NA     |
| §24.232 (b)                   | 6.2                | Radiated RF output                         | -      |
| §2.1049 (h)                   | 5.6                | 99% occupied bandwidth                     | X      |
| §24.238 (a)                   | 6.3                | Bandedge compliance                        | PASS   |
| §24.238 (a), §2.1051          | 6.3                | Spurious emissions at antenna terminals    | NA     |
| §24.238 (a), §2.1053          | 6.3                | Spurious radiated emission                 | PASS   |
| §24.235, §2.1055<br>(a)(1)(b) | 7                  | Frequency stability, temperature variation | PASS   |
| §24.235, §2.1055<br>(d)(1)(2) | 7                  | Frequency stability, voltage variation     | PASS   |

PASS Pass

FAIL Fail

X Measured, but there is no applicable performance criteria

NA Not Applicable

- Not Measured

## 2. EUT Information

| Product    | Type   | SN                             | HW   | MV | SW    | DUT    |
|------------|--------|--------------------------------|------|----|-------|--------|
| Phone      | RH-36  | 010441/00/999913/1             | 0874 | -  | 04.22 | 28662  |
| Phone      | RH-36  | 01044100/159022/7              | 0874 | -  | 04.22 | 28882  |
| Battery    | BL-5C  | 0670400363563<br>L383310603009 | 4.0  | -  | -     | 28669  |
| Battery    | BL-5C  | 0670400382066<br>L24721BI91646 | 4.0  | -  | -     | 28880  |
| AC Charger | ACP-7E | -                              | -    | -  | -     | 233013 |
| AC Charger | ACP-7E | -                              | -    | -  | -     | 233018 |

### 2.1. EUT description

The EUT is a dual band (850MHz/1900MHz) GSM mobile phone.  
The EUT was not modified during the tests.

## 3. EUT Test Setup

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

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## 4. Applicable Standards

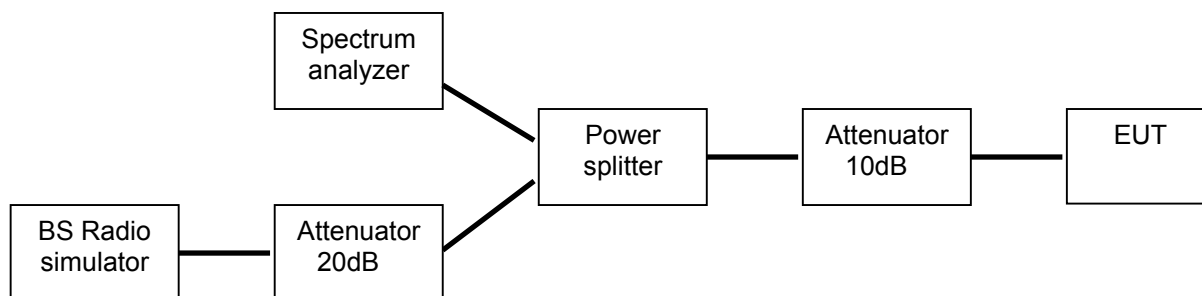
The tests were performed in guidance of CFR 47, part 24 and part 2, ANSI/TIA/EIA-603-A and RSS-133. Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method" for each test case.

## 5. 99% occupied bandwidth

|                              |                                  |        |             |
|------------------------------|----------------------------------|--------|-------------|
| EUT                          | RH-36 dut 28662, BL-5C dut 28669 |        |             |
| Accessories                  | ACP-7E dut 233013                |        |             |
| Temp, Humidity, Air Pressure | 21.4 °C                          | 43.5 % | 1010.8 mbar |
| Date of measurement          | 01/31/2005                       |        |             |
| FCC rule part                | §2.1049 (h)                      |        |             |
| RSS-133 section              | 5.6                              |        |             |
| Measured by                  | Jan Engelbrechtsen               |        |             |

### 5.1. Test setup

The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



### 5.2. EUT operation mode

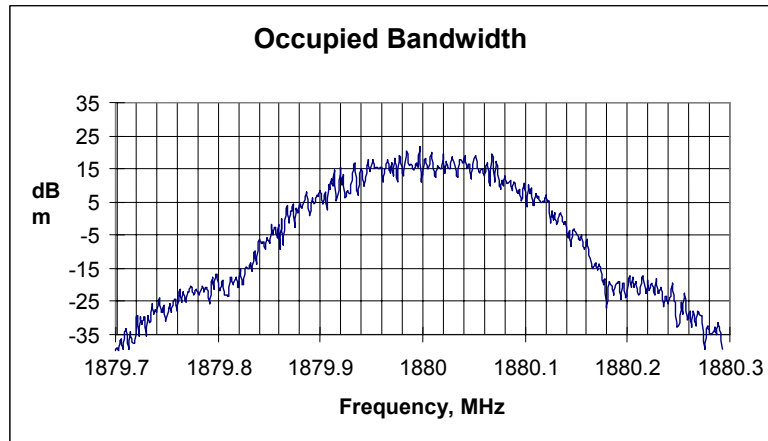
|                        |                                                         |
|------------------------|---------------------------------------------------------|
| EUT operation mode GSM | TX on, 1 time slot transmission, PRBS 2E9-1 data stream |
| EUT channel            | 661 GSM                                                 |
| EUT TX power level     | Maximum                                                 |

### 5.3. Results

The 99% occupied bandwidth was measured using the in-built function of the spectrum analyzer.

| EUT Channel | 99% occupied bandwidth [kHz] |
|-------------|------------------------------|
| 661, GSM    | 243                          |

#### 5.4. Screen shot



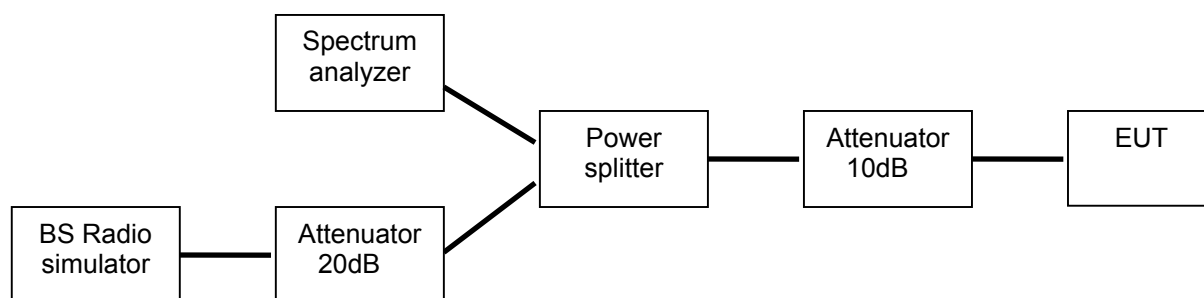
Picture 4. 99% occupied bandwidth, channel 661 GSM1900 3KHz Bw and VBw

## 6. Band edge compliance

|                              |                                  |        |             |
|------------------------------|----------------------------------|--------|-------------|
| EUT                          | RH-36 dut 28662, BL-5C dut 28669 |        |             |
| Accessories                  | ACP-7E dut 233013                |        |             |
| Temp, Humidity, Air Pressure | 21.4 °C                          | 43.5 % | 1010.8 mbar |
| Date of measurement          | 01/31/2005                       |        |             |
| FCC rule part                | §24.238 (a)                      |        |             |
| RSS-133 section              | 6.3                              |        |             |
| Measured by                  | Jan Engelbrechtsen               |        |             |
| Result                       | Passed                           |        |             |

### 6.1. Test setup

The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



### 6.2. EUT operation mode

|                        |                                                         |
|------------------------|---------------------------------------------------------|
| EUT operation mode GSM | TX on, 1 time slot transmission, PRBS 2E9-1 data stream |
| EUT channel            | See section 7.4                                         |
| EUT TX power level     | Maximum                                                 |

### 6.3. Limit

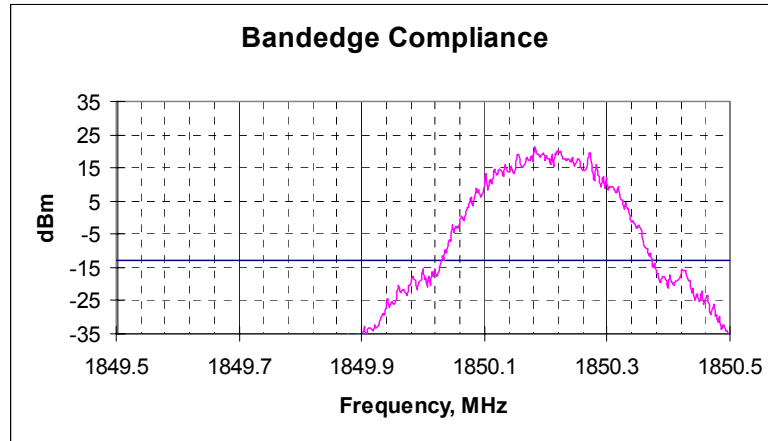
| Frequency [MHz] | Level [dBm] |
|-----------------|-------------|
| <1850 or 1910<  | -13         |

### 6.4. Results

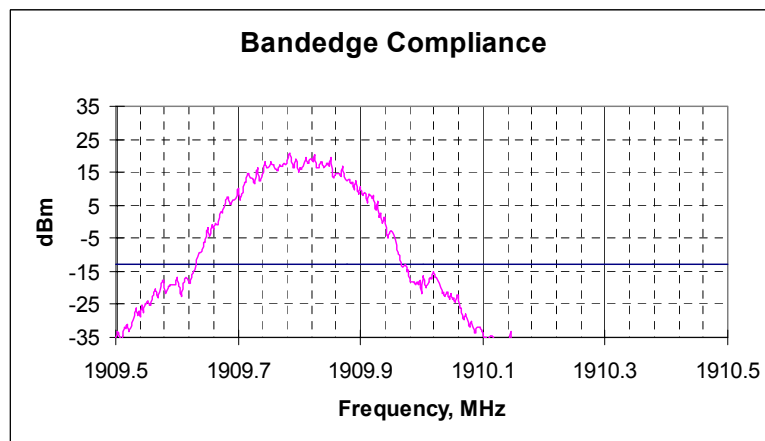
The line in the screen shots is the -13dBm limit line. The results were corrected with measurement path loss set as "offset" in the spectrum analyzer.

| EUT Channel | Level [dBm] |
|-------------|-------------|
| 512, GSM    | -15.67      |
| 810, GSM    | -15.2       |

### 6.5. Screen shots



Lower bandedge, channel 512 GSM 3KHz Bw and VBw



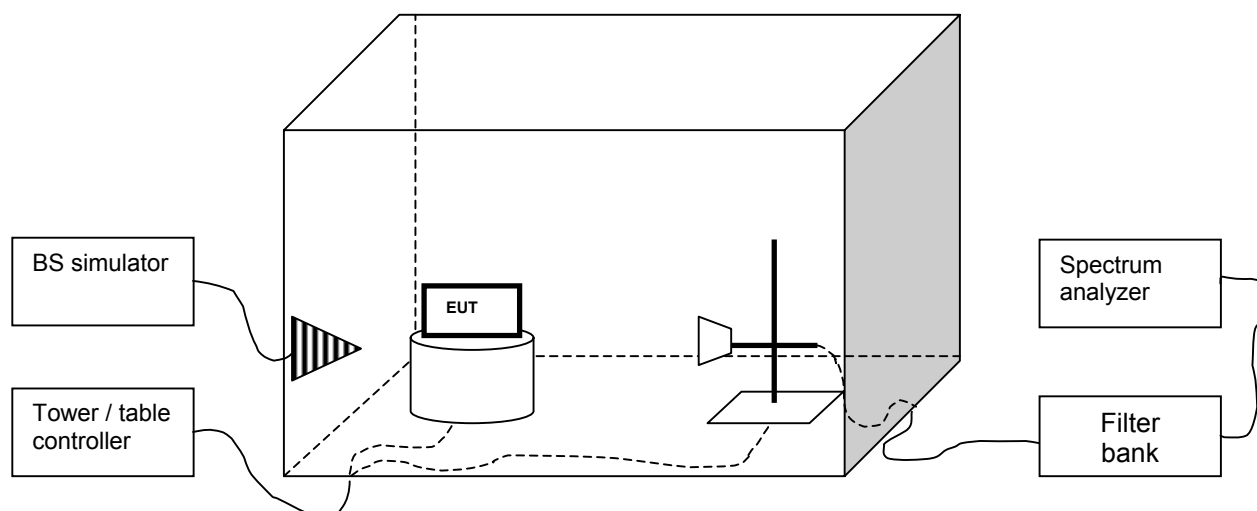
Upper bandedge, channel 810 GSM 3KHz Bw and VBw

## 7. Spurious radiated emission

|                              |                                    |     |          |
|------------------------------|------------------------------------|-----|----------|
| EUT                          | RH-36 Dut#28882                    |     |          |
| Accessories                  | BL-5C Dut#28880, ACP-7E Dut#233018 |     |          |
| Temp, Humidity, Air Pressure | 20°C                               | 42% | 1020mbar |
| Date of measurement          | 02/02/05                           |     |          |
| FCC rule part                | §24.238 (a), §2.1053               |     |          |
| RSS-133 section              | 6.3                                |     |          |
| Measured by                  | Christian Andersen                 |     |          |
| Result                       | Passed                             |     |          |

### 7.1. Test setup

A set of LP/HP/BS filters was used to prevent overloading the spectrum analyzer. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns. The test was done manually.



### 7.2. Test method

- The emissions were searched and maximized by moving the turn table and measuring antenna and manipulating the EUT.
- All suspicious frequencies with emission levels were recorded.
- The EUT was replaced with a substituting antenna.
- For each frequency recorded, the substituting antenna was fed with the power (from signal generator) giving the same reading as in (b). These power levels were reported.

### 7.3. EUT operation mode

|                    | GSM/GPRS                                                                |
|--------------------|-------------------------------------------------------------------------|
| EUT operation mode | TX on, 1 time slot transmission<br>GPRS TX on, x time slot transmission |
| EUT channel        | 661                                                                     |
| EUT TX power level | Maximum                                                                 |

### 7.4. Limit

| Frequency [MHz] | Level [dBm] |
|-----------------|-------------|
| 30 – 19100      | -13         |

### 7.5. Results

The formula below was used to calculate the EIRP of the spurious emissions. If there were no emissions closer than 20dB below the limit line, then the emission levels were documented only at the transmitter's mid-channel harmonics.

$$P_{Emission[dBm]} = P_{SubstTX[dBm]} - L_{Cable[dB]} + G_{Antenna[dBi]}$$

where the variables are as follows:

|                       |                                                                             |
|-----------------------|-----------------------------------------------------------------------------|
| $P_{Measured}$ [dBm]  | Measured emission level (from step b in 8.2)                                |
| $P_{Subst\_TX}$ [dBm] | Signal generator power (from step d in 8.2) fed to the substituting antenna |
| $L_{Cable}$ [dB]      | Loss of the cable between antenna and signal generator (from step d in 8.2) |
| $G_{Antenna}$ [dBi]   | Gain of the substitutive antenna over isotropic radiator                    |

#### Emission levels, channel 661, GSM

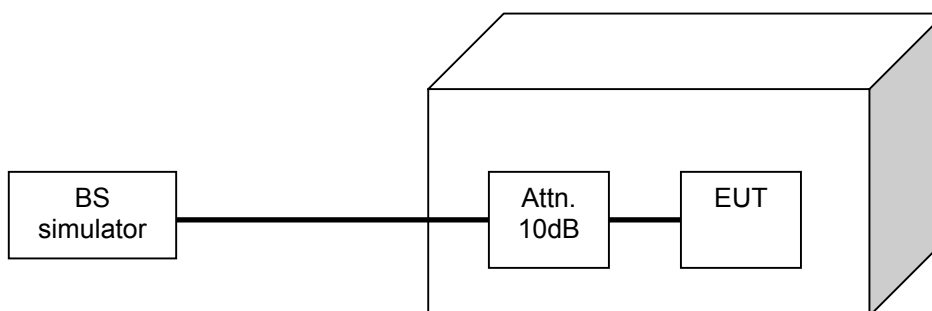
| Frequency [MHz] | $P_{Measured}$ [dBm] | $P_{Subst\_TX}$ [dBm] | $L_{Cable}$ [dB] | $G_{Antenna}$ [dBi] | $P_{Emission}$ [dBm] |
|-----------------|----------------------|-----------------------|------------------|---------------------|----------------------|
| 3760,00         | -66.20               | -58.7                 | 9.56             | 15.80               | -52.46               |
| 5640,00         | -51.87               | -39.2                 | 11.72            | 18.03               | -32.89               |

## 8. Frequency stability, temperature variation

|                              |                                  |        |             |
|------------------------------|----------------------------------|--------|-------------|
| EUT                          | RH-36 dut 28662, BL-5C dut 28669 |        |             |
| Accessories                  | ACP-7E dut 233013                |        |             |
| Temp, Humidity, Air Pressure | 21.4 °C                          | 43.5 % | 1010.8 mbar |
| Date of measurement          | 01/31/2005                       |        |             |
| FCC rule part                | §24.235, §2.1055 (a)(1)(b)       |        |             |
| RSS-133 section              | 7                                |        |             |
| Measured by                  | Jan Engelbrechtsen               |        |             |
| Result                       | Passed                           |        |             |

### 8.1. Test setup

The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



### 8.2. EUT operation mode

|                    |                                                         |
|--------------------|---------------------------------------------------------|
| EUT operation mode | TX on, 1 time slot transmission, PRBS 2E9-1 data stream |
| EUT channel        | 661                                                     |
| EUT TX power level | Maximum                                                 |

### 8.3. Limit

| Frequency deviation [ppm] |
|---------------------------|
| ± 2.5                     |

## 8.4. Test method

- a) The EUT was placed in the chamber
- b) The climate chamber temperature was set to the maximum value (50°C) and the temperature was allowed to stabilize for 45 minutes
- c) The EUT was set to transmit.
- d) The transmit frequency error was measured after 1 minute
- e) The call was released
- f) Temperature decreased 10 °C and allowed to stabilize for 45 minutes after set temperature was reached
- g) The steps c – f were repeated

## 8.5. Results

| Temperature [°C] | Deviation [Hz] | Deviation [ppm] |
|------------------|----------------|-----------------|
| +50              | +45            | +0.024          |
| +40              | +37            | +0.02           |
| +30              | +40            | +0.021          |
| +20              | +26            | +0.014          |
| +10              | +39            | +0.021          |
| 0                | -38            | -0.02           |
| -10              | -32            | -0.017          |
| -20              | -32            | -0.017          |
| -30              | -37            | -0.02           |

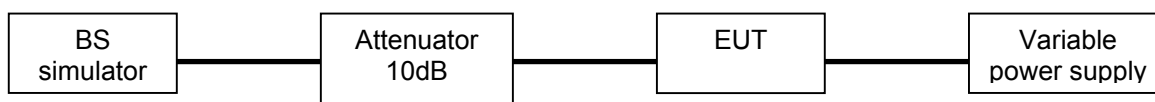
Table 15. Frequency deviation, temperature variation

## 9. Frequency stability, voltage variation

|                              |                                  |        |             |
|------------------------------|----------------------------------|--------|-------------|
| EUT                          | RH-36 dut 28662, BL-5C dut 28669 |        |             |
| Accessories                  | Dummy battery BTD-8              |        |             |
| Temp, Humidity, Air Pressure | 21.4 °C                          | 43.5 % | 1010,8 mbar |
| Date of measurement          | 01/31/2005                       |        |             |
| FCC rule part                | §24.235, §2.1055 (d)(1)(2)       |        |             |
| RSS-133 section              | 7                                |        |             |
| Measured by                  | Jan Engelbrechtsen               |        |             |
| Result                       | Passed                           |        |             |

### 9.1. Test setup

The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



### 9.2. EUT operation mode

|                    |                                                         |
|--------------------|---------------------------------------------------------|
| EUT operation mode | TX on, 1 time slot transmission, PRBS 2E9-1 data stream |
| EUT channel        | 661                                                     |
| EUT TX power level | Maximum                                                 |

### 9.3. Limit

| Frequency deviation [ppm] |
|---------------------------|
| ± 2.5                     |

### 9.4. Test method

The EUT battery was replaced with an adjustable power supply. The frequency stability was measured at nominal voltage and at the battery cut-off point.

### 9.5. Results

| Level                 | Voltage [V] | Deviation [Hz] | Deviation [ppm] |
|-----------------------|-------------|----------------|-----------------|
| Nominal               | 3.9         | -28            | -0.015          |
| Battery cut-off point | 3.39        | -37            | -0.02           |

Table 16. Frequency deviation, voltage variation

## 10. Test equipment

Each test equipment is calibrated once a year, except antennas which are calibrated every second year.

### 10.1. Conducted measurements

| Equipment # | Equipment                         | Type     | Serial # | Manufacturer     |
|-------------|-----------------------------------|----------|----------|------------------|
| 13357       | Signal Generator                  | SMP 02   |          | Rohde & Schwarz  |
| 13302       | Spectrum Analyzer                 | 8596E    |          | Hewlet Packard   |
| 13524       | BS Simulator                      | CMD-55   |          | Rohde & Schwartz |
| 17277       | Multimeter                        | 34401A   |          | Agilent          |
| 15761       | DC Power Supply                   | E3632A   |          | Hewlet Packard   |
| 13371       | Temperature chamber               | 2800     |          | Thermotron       |
| -           | RF Attenuator                     | 23-10-34 |          | Weinchel         |
| -           | Power Divider                     | -        |          | Suhner           |
| 17796       | BS Simulator                      | 4400M    |          | Wavetek          |
| -           | Antenna Mast                      | -        |          | Deisel           |
| 14900       | Antenna Mast Controller           | HD-100   |          | Deisel           |
| 15191       | Turn Table                        | G-800SDX |          | Yaesu            |
| 13668       | Antenna                           | CBL6112A |          | Chase            |
| 13935       | Two Line Artificial Mains Network | ESH-3-Z5 |          | Rohde & Schwarz  |
| 13666       | EMI Test Receiver                 | ESPC     |          | Rohde & Schwarz  |
|             |                                   |          |          |                  |

### 10.2. Radiated measurements

| Equipment # | Equipment                                   | Type           | Serial #   | Manufacturer  |
|-------------|---------------------------------------------|----------------|------------|---------------|
| 14993       | EMI Test Receiver 9KHz-2750MHz              | ESCS30         | 847124/001 | Rohde&Schwarz |
| 15191       | Turntable Controller Unit                   | G-800SDX       | ONO10000   | YAESU         |
| 14900       | Antenna Controller                          | HD100          | 100\552    | HD GmbH       |
| 18792       | Multi Device Controller                     | 2090           | 1606       | ETS-EMCO      |
| 13829       | Turntable Controller                        | 4630-100       | 100/510    | Comtest       |
| 14963       | RF Preamplifier 100MHz-4GHz (Metal Chassis) | AFS3-00100400  | 571131     | Miteq/NMP Cph |
| 13668       | BiLog Antenna 30-2000MHz                    | BiLog-CBL6112A | 2259       | Chase         |

|       |                                                    |                            |            |                           |
|-------|----------------------------------------------------|----------------------------|------------|---------------------------|
| 18861 | EMI Test Receiver<br>20Hz-26,5GHz                  | ESI                        | 833362/004 | Rohde&Schwarz             |
| 12679 | Dual Log Periodic<br>Antenna 1-26.5 GHz            | HL025                      | -----      | Rohde&Schwarz             |
| 18860 | Ultra Broadband<br>Antenna Ultralog 30-<br>3000MHz | HL562                      | 100154     | Rohde&Schwarz             |
| 18773 | Shielded Chamber                                   | RFD-100                    | 2420       | ETS-Lindgren              |
| 18774 | Shielded Chamber                                   | RFSD-F/A-100               | 2425       | ETS-Lindgren              |
| 18324 | High Pass Filter<br>3GHz SMA f Conn                | WHJS3000-10SS              | 1          | Wainwright                |
| 14114 | Highpass Filter<br>1000MHz-4500MHz                 | WHK1000-12SS               | 1          | Wainwright                |
| 13918 | Highpass Filter<br>2000-4000MHz<br>50OHM SMA Conn  | WHKS2000-10SS              |            | Wainwright<br>Instruments |
| 13937 | Ultra Stable Notch<br>Filter 902,4MHz              | WRCA902.4-0.2/40-<br>6SS   |            | Wainwright<br>Instruments |
| 13936 | Ultra Stable Notch<br>Filter 1747,5MHz             | WRCD1747.5-<br>0.2/40-10SS |            | Wainwright<br>Instruments |
| 16633 | Ultra Stable Notch<br>Filter 1880,0MHz             | WRCD1880.0-<br>0.2/40-10SS |            | Wainwright<br>Instruments |