

## HAC RF Emissions Test Report

|                                                         |                                                                                                                                                                                                                                                                                       |                                |                                                                                                                         |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>Test report no.:</b>                                 | RF_RM-1104_01                                                                                                                                                                                                                                                                         | <b>Date of report:</b>         | 2015-09-04                                                                                                              |
| <b>Template version:</b>                                | 13.0                                                                                                                                                                                                                                                                                  | <b>Number of pages:</b>        | 14                                                                                                                      |
| <b>Testing laboratory:</b>                              | TCC Microsoft Salo Laboratory<br>P.O.Box 303<br>Joensuunkatu 7E<br>FIN-24101 SALO, FINLAND<br>Tel. +358 71 800 8000<br>Fax. +358 71 80 44122                                                                                                                                          | <b>Client:</b>                 | Microsoft<br>P.O.Box 303<br>Joensuunkatu 7<br>FIN-24101 SALO, FINLAND<br>Tel. +358 71 800 8000<br>Fax. +358 71 80 44122 |
| <b>Responsible test engineer:</b>                       | Janne Hirsimäki                                                                                                                                                                                                                                                                       | <b>Product contact person:</b> | Jari Rontu                                                                                                              |
| <b>Measurements made by:</b>                            | Sami Savela                                                                                                                                                                                                                                                                           |                                |                                                                                                                         |
| <b>Tested devices:</b>                                  | RM-1104, RM-1118                                                                                                                                                                                                                                                                      |                                |                                                                                                                         |
| <b>FCC ID:</b>                                          | PYASTT                                                                                                                                                                                                                                                                                | <b>IC:</b>                     | 661X-STT                                                                                                                |
| <b>Supplement reports:</b>                              | T-Coil_RM-1104_02, HAC_Photo_RM-1104_03                                                                                                                                                                                                                                               |                                |                                                                                                                         |
| <b>Testing has been carried out in accordance with:</b> | <p><b>ANSI C63.19-2011</b><br/>American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids</p> <p><b>CTIA Test Plan for Hearing Aid Compatibility, Revision 3.0, November 2013</b></p>                            |                                |                                                                                                                         |
| <b>Documentation:</b>                                   | The documentation of the testing performed on the tested devices is archived for 15 years at TCC Microsoft.                                                                                                                                                                           |                                |                                                                                                                         |
| <b>Test results:</b>                                    | <p><b>The tested device complies with the requirements in respect of all parameters subject to the test.</b> The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory.</p> |                                |                                                                                                                         |
| <b>Date and signatures:</b>                             |                                                                                                                                                                                                                                                                                       |                                |                                                                                                                         |
| For the contents:                                       |                                                                                                                                                                                                                                                                                       |                                |                                                                                                                         |

## CONTENTS

|                                                               |           |
|---------------------------------------------------------------|-----------|
| <b>1. SUMMARY OF HAC RF EMISSION TEST REPORT .....</b>        | <b>3</b>  |
| 1.1 TEST DETAILS.....                                         | 3         |
| 1.2 MAXIMUM RESULTS .....                                     | 3         |
| 1.2.1 Electric field measurements .....                       | 3         |
| 1.2.2 Overall RF emissions category of the tested device..... | 3         |
| 1.2.3 Maximum Drift .....                                     | 3         |
| 1.2.4 Measurement Uncertainty.....                            | 3         |
| <b>2. DESCRIPTION OF THE DEVICE UNDER TEST .....</b>          | <b>4</b>  |
| 2.1 PICTURE OF DEVICE .....                                   | 5         |
| <b>3. TEST CONDITIONS.....</b>                                | <b>5</b>  |
| 3.1 TEMPERATURE AND HUMIDITY.....                             | 5         |
| 3.2 TEST SIGNAL, FREQUENCIES, AND OUTPUT POWER .....          | 5         |
| <b>4. DESCRIPTION OF THE TEST EQUIPMENT .....</b>             | <b>6</b>  |
| 4.1 MEASUREMENT SYSTEM AND COMPONENTS .....                   | 6         |
| 4.1.1 Isotropic E-field probe ER3DV6.....                     | 7         |
| 4.1.2 Device Holder .....                                     | 7         |
| 4.2 VALIDATION OF THE SYSTEM.....                             | 8         |
| <b>5. DESCRIPTION OF THE TEST PROCEDURE .....</b>             | <b>9</b>  |
| 5.1 TEST ARCH AND DEVICE HOLDER.....                          | 9         |
| 5.2 TEST POSITIONS.....                                       | 9         |
| 5.2.1 Scan area centered at the acoustic output .....         | 9         |
| 5.3 SCAN PROCEDURES.....                                      | 10        |
| 5.4 MODULATION INTERFERENCE FACTOR.....                       | 10        |
| 5.5 SUB-GRID EXCLUSION .....                                  | 11        |
| 5.6 CATEGORY LIMITS.....                                      | 11        |
| <b>6. LOW-POWER EXEMPTION.....</b>                            | <b>12</b> |
| <b>7. MEASUREMENT UNCERTAINTY.....</b>                        | <b>13</b> |
| <b>8. RESULTS .....</b>                                       | <b>14</b> |

## APPENDIX A: SYSTEM VALIDATION SCANS

## APPENDIX B: MEASUREMENT SCANS

## APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)

## APPENDIX D: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORT(S)

## 1. SUMMARY OF HAC RF EMISSION TEST REPORT

### 1.1 Test Details

|                                    |                                                |
|------------------------------------|------------------------------------------------|
| Period of test                     | 2015-09-01                                     |
| HW and SW numbers of tested device | RM-1104, HW: 2012, SW: 01066.00001.15267.14000 |
| Batteries used in testing          | BV-T5E                                         |
| Other accessories used in testing  | -                                              |
| State of sample                    | Prototype unit                                 |
| Notes                              | -                                              |

### 1.2 Maximum Results

The maximum measured HAC RF emissions values and categories for electric and magnetic fields are given in section 1.2.1 and 1.2.2 respectively.

#### 1.2.1 Electric field measurements

| Mode    | Limit of E-field max. value in category M3 [dB V/m] | Maximum E-field value after exclusion [dB V/m] | Category |
|---------|-----------------------------------------------------|------------------------------------------------|----------|
| GSM850  | 40 - 45                                             | 37.82                                          | M4       |
| GSM1900 | 30 - 35                                             | 29.76                                          | M4       |

#### 1.2.2 Overall RF emissions category of the tested device

| Mode                  | E-field Category | Pass / Fail |
|-----------------------|------------------|-------------|
| GSM850                | M4               | Pass        |
| GSM1900               | M4               | Pass        |
| <b>Final Category</b> | <b>M4</b>        | <b>Pass</b> |

#### 1.2.3 Maximum Drift

|                                   |          |
|-----------------------------------|----------|
| Maximum drift during measurements | ≤ 0.2 dB |
|-----------------------------------|----------|

#### 1.2.4 Measurement Uncertainty

|                                         |        |
|-----------------------------------------|--------|
| Extended Uncertainty (k=2) 95%, E-field | 16.3 % |
|-----------------------------------------|--------|

## 2. DESCRIPTION OF THE DEVICE UNDER TEST

| Air-interface | Band (MHz)                                                                                             | Type | C63.19/<br>tested | Simultaneous<br>Transmissions        | Reduced<br>power | Voice<br>Over Digital<br>Transport<br>OTT Capability | HAC report number |
|---------------|--------------------------------------------------------------------------------------------------------|------|-------------------|--------------------------------------|------------------|------------------------------------------------------|-------------------|
| GSM           | 850                                                                                                    | VO   | Yes               | Yes<br>BT, WLAN                      | N/A              | NA                                                   | RF_RM-1104_01     |
|               | 1900                                                                                                   |      |                   |                                      | N/A              | NA                                                   | RF_RM-1104_01     |
|               | GPRS/EDGE                                                                                              | DT   | N/A               | Yes<br>BT, WLAN                      | N/A              | YES*                                                 | -                 |
| WCDMA         | 850 (Band 5)<br>1700/2100 (Band 4)<br>1900 (Band 2)                                                    | V/D  | Yes**             | Yes<br>BT, WLAN                      | N/A              | YES                                                  | RF_RM-1104_01     |
| FDD- LTE      | 750 (Band 12)<br>750 (Band 17)<br>850 (Band 5)<br>1700/2100 (Band 4)<br>1900 (Band 2)<br>2500 (Band 7) | V/D  | Yes**             | Yes<br>BT, WLAN                      | N/A              | YES*                                                 | RF_RM-1104_01     |
| BT            | 2450                                                                                                   | DT   | N/A               | Yes<br>GSM, GPRS/EDGE,<br>WCDMA, LTE | N/A              | YES*                                                 | -                 |
| WLAN          | 2450<br>5000                                                                                           | DT   | N/A               | Yes<br>GSM, GPRS/EDGE,<br>WCDMA, LTE | N/A              | YES*                                                 | -                 |

VO Voice CMRS/PSTN Service Only

V/D Voice CMRS/PSTN and Data Service

DT Digital Transport

\*supports only non CMRS voice (OTT).

\*\*RF Emission testing was not required for WCDMA or LTE air-interface because of Low-power exemption.

HAC rating was evaluated for voice mode only in GSM and air interface in this report.

No LTE Associated T-Coil measurement has been made in accordance with 285076 D02 T-Coil testing for CMRS IP.

Outside of USA the transmitter of the device is capable of operating also in 900MHz, 1800MHz, 2100MHz and 2300MHz bands, which are not part of this filing.

The HAC testing has been carried out only with RM-1104 HW: 2012. The only difference between RM-1104 and RM-1118 is in the number of SIM cards the product will support: RM-1118 supports dual-SIM card, RM-1104 supports only a single SIM card.

Two antennas are used for transmission of some of the cellular bands in diversity-Tx mode. In this mode the antennas can not transmit at the same time. See table below for applicable antennas in each transmission band and mode. A separate single antenna is used for WLAN. All antennas are fully and separately HAC RF tested for individual transmission.

|                         | Tx Antennas |           |
|-------------------------|-------------|-----------|
|                         | Antenna 1   | Antenna 2 |
| LTE700 (Band 12)        | ✓           | ✓         |
| LTE700 (Band 17)        | ✓           | ✓         |
| GSM850                  | ✓           | ✓         |
| WCDMA850 (Band 5)       | ✓           | ✓         |
| LTE850 (Band 5)         | ✓           | ✓         |
| WCDMA1700/2100 (Band 4) | ✓           | ✓         |
| LTE1700/2100 (Band 4)   | ✓           | ✓         |
| GSM1900                 | ✓           | ✓         |
| WCDMA1900 (Band 2)      | ✓           | ✓         |
| LTE1900 (Band 2)        | ✓           | ✓         |
| LTE2500 (Band 7)        | ✓           | -         |
| WLAN2450                | ✓           | ✓         |
| WLAN5000                | ✓           | ✓         |

## 2.1 Picture of Device

See separate report HAC\_Photo\_RM-1104\_03.

## 3. TEST CONDITIONS

### 3.1 Temperature and Humidity

|                           |             |
|---------------------------|-------------|
| Ambient temperature [°C]: | 20.5 – 22.5 |
| Ambient humidity [RH %]:  | 35 – 55     |

### 3.2 Test Signal, Frequencies, and Output Power

The transmitter of the device was put into operation by using a call tester. Communications between the device and the call tester were established by air link.

The device output power was set to maximum power level for all tests; a fully charged battery was used for every test sequence.

The transmission mode of the device in WCDMA HAC RF emission tests was configured to 12.2kbps RMC with all TPC bits set as "1".

The measurements were performed on lowest, middle and highest channels.

The conducted output power of the device was measured by a separate test laboratory on the same unit as used for HAC testing. The results are given in the HAC result tables.

#### 4. DESCRIPTION OF THE TEST EQUIPMENT

##### 4.1 Measurement system and components

The measurements were performed using an automated near-field scanning system, DASY5, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland.

The following table lists calibration dates of SPEAG components:

| Test Equipment                  | Serial Number | Calibration interval | Calibration expiry |
|---------------------------------|---------------|----------------------|--------------------|
| DAE 4                           | 555           | 12 months            | 2015-11            |
| E-field Probe ER3DV6            | 2309          | 12 months            | 2015-10            |
| Dipole Validation Kit, CD835V3  | 1064          | 24 months            | 2017-04            |
| Dipole Validation Kit, CD1880V3 | 1052          | 24 months            | 2017-04            |
| DASY52 software                 | Version 52.8  | -                    | -                  |

Additional test equipment used in testing and validation:

| Test Equipment   | Model   | Serial Number | Calibration interval | Calibration expiry |
|------------------|---------|---------------|----------------------|--------------------|
| Signal Generator | SME 06  | 836407/007    | 12 months            | 2016-04            |
| Amplifier        | ZHL-42  | 854105        | -                    | -                  |
| Power Meter      | NRVD    | 840297/032    | 12 months            | 2016-04            |
| Power Sensor     | NRV-Z53 | 848532/001    | 12 months            | 2016-04            |
| Call Tester      | CMU-200 | 101111        | -                    | -                  |

#### 4.1.1 Isotropic E-field probe ER3DV6

|                      |                                                                                                                                                          |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Construction</b>  | One dipole parallel, two dipoles normal to probe axis<br>Built-in shielding against static charges<br>PEEK enclosure material                            |
| <b>Frequency</b>     | In air 100 MHz to >6 GHz; Linearity: $\pm 0.2$ dB (100 MHz to 3 GHz)                                                                                     |
| <b>Directivity</b>   | $\pm 0.2$ dB in air (rotation around probe axis)<br>$\pm 0.4$ dB in air (rotation normal to probe axis)                                                  |
| <b>Dynamic Range</b> | 2 V/m to > 1000 V/m; Linearity: $\pm 0.2$ dB                                                                                                             |
| <b>Dimensions</b>    | Overall length: 330 mm<br>Tip length: 16 mm<br>Body diameter: 12 mm<br>Tip diameter: 8 mm<br>Distance from probe tip to nearest point of dipole: 1.25 mm |
| <b>Application</b>   | General near-field measurements up to 6 GHz<br>Field component measurements<br>Fast automatic scanning in phantoms                                       |

#### 4.1.2 Device Holder

The Device Holder and Test Arch are manufactured by Speag ([www.speag.com](http://www.speag.com)). Test arch is used for all tests i.e. for both validation testing and device testing. The holder and test arch conforms to the requirements of ANSI C63.19.

The SPEAG device holder (see Section 5.1) was used to position the test device in all tests.

## 4.2 Validation of the System

The manufacturer calibrates the probes annually. Validation measurements are made regularly using the dipole validation kit. The power level used by manufacturer in dipole calibration is supplied to the dipole antenna. The antenna is scanned at 15mm distance between top surface of the dipole and calibration point of the probe.

| System Validation, E-field |           |                                       |                       |
|----------------------------|-----------|---------------------------------------|-----------------------|
| f [MHz]                    | Dipole SN | Description                           | E-field [V/m]         |
| 835                        | 1064      | Reference result<br>$\pm 10\%$ window | 104.2<br>93.8 – 114.6 |
|                            |           | 2015-09-01                            | 108.6                 |
| 1880                       | 1052      | Reference result<br>$\pm 10\%$ window | 89.8<br>80.8 – 98.8   |
|                            |           | 2015-09-01                            | 90.80                 |

Plots of the system validation scans are given in Appendix A.

## 5. DESCRIPTION OF THE TEST PROCEDURE

### 5.1 Test Arch and Device Holder

The test device was placed in the Device Holder (illustrated below) that is supplied by SPEAG. Using this positioner the tested device is positioned under Test Arch.



Device holder and Test Arch supplied by SPEAG

### 5.2 Test Positions

#### 5.2.1 Scan area centered at the acoustic output

The device was positioned such that Device Reference plane was touching the bottom of the Test Arch. The scan is centered at the acoustic output by aligning the acoustic output with the intersection of the Test Arch's middle bar and dielectric wire.

### 5.3 Scan Procedures

Near field scans of 5cm x 5cm were used for determination of the field distribution. Measurement plane distance from WD reference plane is 15mm. Scans were performed for E-field using appropriate probe. DASY software divides detected values into 3 x 3 sub grids as described in the C63.19 standard.

### 5.4 Modulation Interference Factor

The HAC Standard ANSI C63.19-2011 defines a new scaling using the Modulation Interference Factor (MIF) which replaces the need for the Articulation Weighting Factor (AWF) during the evaluation and is applicable to any modulation scheme.

The Modulation Interference Factor (MIF, in dB) is added to the measured average E-field (in dBV/m) and converts it to the RF Audio Interference Potential (RFAIP, in dBV/m). This level considers the audible amplitude modulation components in the RF E-field. CW fields without amplitude modulation are assumed to not interfere with the hearing aid electronics. Modulations without time slots and low fluctuations at low frequencies have low MIF values, TDMA modulations with narrow transmission slots and repetition rates of few 100 Hz have high MIF values and give similar classification as ANSI C63.19-2007.

DASY52 is using the indirect measurement method according to ANSI C63.19-2011 and near field probe read the averaged E-field. Especially for the new high peak-to-average (PAR) signal types, the probes shall be linearized by PMR calibration in order to not overestimate the field reading.

DASY52 uses well-defined signals for PMR calibration. The MIF of these signals has been determined numerically. It allows a precise scaling and is therefore automatically applied. The following table lists the MIF values evaluated by SPEAG and the detailed parameters for E-field probe can be found in the probe calibration report in the appendix C.

| UID       | UID Version Date | Communication system                    | MIF (dB) |
|-----------|------------------|-----------------------------------------|----------|
| 10021-DAB | 2014-08-05       | GSM-FDD (TDMA, GMSK)                    | 3.63     |
| 10011-CAB | 2014-08-05       | UMTS-FDD (WCDMA)                        | -27.23   |
| 10170-CAB | 2014-08-05       | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM) | -9.76    |

The MIF measurement uncertainty is estimated by SPEAG:

| MIF (dB)   | MIF Measurement Uncertainty (dB) |
|------------|----------------------------------|
| -7 to +5   | 0.2                              |
| -13 to +11 | 0.5                              |
| > -20      | 1.0                              |

## 5.5 Sub-grid Exclusion

The measurement grid defined in C63.19 consists of 9 evenly sized blocks, which are used to define permissible exclusion areas. For E-field measurements three contiguous blocks may be excluded from the measurements except the center block may never be excluded.

## 5.6 Category Limits

From remaining maximum values after exclusion process, Hearing Aid M-category is defined according to the category limits of C63.19 – 2011.

| Category | Limits for E-Field Emissions |                           |
|----------|------------------------------|---------------------------|
|          | E-field <960 MHz [dB V/m]    | E-field >960 MHz [dB V/m] |
| M1       | 50 – 55                      | 40 – 45                   |
| M2       | 45 – 50                      | 35 – 40                   |
| M3       | 40 – 45                      | 30 – 35                   |
| M4       | < 40                         | < 30                      |

## 6. LOW-POWER EXEMPTION

An RF air interface technology of a device can be exempt from testing when its average antenna input power added to its MIF is  $\leq 17$  dBm.

| Air-interface           | Power Tuning Target (dBm) | Upper limit of Power Tuning Tolerance (dBm) | MIF (dB) | Upper limit of Power Tuning Tolerance + MIF (dBm) | HAC tested |
|-------------------------|---------------------------|---------------------------------------------|----------|---------------------------------------------------|------------|
| LTE700 (Band 12)        | 23.2                      | 23.6                                        | -9.76    | 13.84                                             | No         |
| LTE700 (Band 17)        | 23.1                      | 23.5                                        | -9.76    | 13.74                                             | No         |
| GSM850                  | 32.8                      | 33.2                                        | 3.63     | 36.83                                             | Yes        |
| WCDMA850 (Band 5)       | 24.5                      | 24.9                                        | -27.23   | -2.33                                             | No         |
| LTE850 (Band 5)         | 23.4                      | 23.8                                        | -9.76    | 14.04                                             | No         |
| WCDMA1700/2100 (Band 4) | 24.0                      | 24.4                                        | -27.23   | -2.83                                             | No         |
| LTE1700/2100 (Band 4)   | 22.9                      | 23.3                                        | -9.76    | 13.54                                             | No         |
| GSM1900                 | 30.2                      | 30.6                                        | 3.63     | 34.23                                             | Yes        |
| WCDMA1900 (Band 2)      | 23.9                      | 24.3                                        | -27.23   | -2.93                                             | No         |
| LTE1900 (Band 2)        | 23.0                      | 23.4                                        | -9.76    | 13.64                                             | No         |
| LTE2500 (Band 7)        | 24.0                      | 24.4                                        | -9.76    | 14.64                                             | No         |

LTE low-power exemption calculations are based on 1RB 16-QAM MIF which is worst case for the LTE-FDD.

## 7. MEASUREMENT UNCERTAINTY

| Source of Uncertainty                | Tolerance<br>±% | Prob.<br>Dist. | Div. | ci<br>E | ci<br>H | Standard<br>Uncertainty<br>±%, E |
|--------------------------------------|-----------------|----------------|------|---------|---------|----------------------------------|
| <b>MEASUREMENT SYSTEM</b>            |                 |                |      |         |         |                                  |
| Probe Calibration                    | 5.1             | N              | 1    | 1       | 1       | 5.1                              |
| Axial Isotropy                       | 4.7             | R              | √3   | 1       | 1       | 2.7                              |
| Sensor Displacement                  | 16.5            | R              | √3   | 1       | 0.145   | 9.5                              |
| Boundary Effects                     | 2.4             | R              | √3   | 1       | 1       | 1.4                              |
| Phantom Boundary Effect              | 7.2             | R              | √3   | 1       | 0       | 4.1                              |
| Linearity                            | 4.7             | R              | √3   | 1       | 1       | 2.7                              |
| Scaling with PMR calibration         | 10.0            | R              | √3   | 1       | 1       | 5.8                              |
| System Detection Limit               | 1.0             | R              | √3   | 1       | 1       | 0.6                              |
| Readout Electronics                  | 0.3             | N              | 1    | 1       | 1       | 0.3                              |
| Response Time                        | 0.8             | R              | √3   | 1       | 1       | 0.5                              |
| Integration Time                     | 2.6             | R              | √3   | 1       | 1       | 1.5                              |
| RF Ambient Conditions                | 3.0             | R              | √3   | 1       | 1       | 1.7                              |
| RF Reflections                       | 12.0            | R              | √3   | 1       | 1       | 6.9                              |
| Probe Positioner                     | 1.2             | R              | √3   | 1       | 0.67    | 0.7                              |
| Probe Positioning                    | 4.7             | R              | √3   | 1       | 0.67    | 2.7                              |
| Extrapolation and Interpolation      | 1.0             | R              | √3   | 1       | 1       | 0.6                              |
| <b>TEST SAMPLE RELATED</b>           |                 |                |      |         |         |                                  |
| Device Positioning Vertical          | 4.7             | R              | √3   | 1       | 0.67    | 2.7                              |
| Device Positioning Lateral           | 1.0             | R              | √3   | 1       | 1       | 0.6                              |
| Device Holder and Phantom            | 2.4             | R              | √3   | 1       | 1       | 1.4                              |
| Power Drift                          | 5.0             | R              | √3   | 1       | 1       | 2.9                              |
| <b>PHANTOM AND SETUP RELATED</b>     |                 |                |      |         |         |                                  |
| Phantom Thickness                    | 2.4             | R              | √3   | 1       | 0.67    | 1.4                              |
| Combined Standard Uncertainty        |                 |                |      |         |         | 16.3                             |
| <b>Expanded Uncertainty on Power</b> |                 |                |      |         |         | <b>32.6</b>                      |
| <b>Expanded Uncertainty on Field</b> |                 |                |      |         |         | <b>16.3</b>                      |

## 8. RESULTS

The calculated maximum field values for the test device are tabulated below:

**GSM850, RF emissions results – Antenna 1**

| Mode   | Test configuration | Ch 128<br>824.2 MHz | Ch 190<br>836.6 MHz | Ch 251<br>848.8 MHz |
|--------|--------------------|---------------------|---------------------|---------------------|
| GSM850 | Conducted Power    | 33.0 dBm            | 32.9 dBm            | 33.0 dBm            |
|        | E-field [dB V/m]   | 37.28               | <b>37.82</b>        | 36.41               |
|        | Category           | M4                  | M4                  | M4                  |

**GSM850, RF emissions results – Antenna 2**

| Mode   | Test configuration | Ch 128<br>824.2 MHz | Ch 190<br>836.6 MHz | Ch 251<br>848.8 MHz |
|--------|--------------------|---------------------|---------------------|---------------------|
| GSM850 | Conducted Power    | 33.0 dBm            | 32.9 dBm            | 33.0 dBm            |
|        | E-field [dB V/m]   | 33.10               | 32.48               | 34.99               |
|        | Category           | M4                  | M4                  | M4                  |

**GSM1900, RF emissions results – Antenna 1**

| Mode    | Test configuration | Ch 512<br>1850.2MHz | Ch 661<br>1880.0MHz | Ch 810<br>1909.8MHz |
|---------|--------------------|---------------------|---------------------|---------------------|
| GSM1900 | Conducted Power    | 30.3 dBm            | 30.2 dBm            | 30.6 dBm            |
|         | E-field [dB V/m]   | 28.81               | 29.08               | 28.49               |
|         | Category           | M4                  | M4                  | M4                  |

**GSM1900, RF emissions results – Antenna 2**

| Mode    | Test configuration | Ch 512<br>1850.2MHz | Ch 661<br>1880.0MHz | Ch 810<br>1909.8MHz |
|---------|--------------------|---------------------|---------------------|---------------------|
| GSM1900 | Conducted Power    | 30.3 dBm            | 30.2 dBm            | 30.6 dBm            |
|         | E-field [dB V/m]   | <b>29.76</b>        | 29.02               | 28.52               |
|         | Category           | M4                  | M4                  | M4                  |

Plots of the measurement scans are shown in **Appendix B**. Excluded cells are colored orange.



---

## APPENDIX A: SYSTEM VALIDATION SCANS

Test Laboratory: TCC Microsoft

**Type: CD835V3; Serial: 1064**

Communication System: CW

Frequency: 835 MHz; Duty Cycle: 1:1

Medium: Air

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Dipole E-Field measurement 835MHz/E Scan - measurement distance from the probe sensor center to CD835 Dipole = 15mm/Hearing Aid Compatibility Test (41x361x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

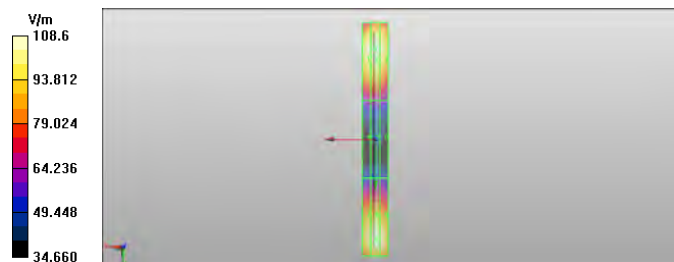
Device Reference Point: 0, 0, -6.3 mm

Reference Value = 104.2 V/m; Power Drift = -0.00 dB

PMR not calibrated. PMF = 1.000 is applied.

E-field emissions = 108.6 V/m

|                        |                        |                        |
|------------------------|------------------------|------------------------|
| Grid 1 M4<br>107.5 V/m | Grid 2 M4<br>108.6 V/m | Grid 3 M4<br>105.9 V/m |
| Grid 4 M4<br>63.53 V/m | Grid 5 M4<br>64.07 V/m | Grid 6 M4<br>62.54 V/m |
| Grid 7 M4<br>104.6 V/m | Grid 8 M4<br>106.8 V/m | Grid 9 M4<br>105.7 V/m |



Test Laboratory: TCC Microsoft  
**Type: CD1880V3; Serial: 1052**

Communication System: CW  
Frequency: 1880 MHz; Duty Cycle: 1:1  
Medium: Air  
Medium parameters used:  $\sigma = 0 \text{ S/m}$ ,  $\epsilon_r = 1$ ;  $\rho = 0 \text{ kg/m}^3$   
Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Dipole E-Field measurement 1880MHz/E Scan - measurement distance from the probe sensor center to CD1880 Dipole = 15mm/Hearing Aid Compatibility Test (41x181x1):** Interpolated grid:  $dx=0.5000 \text{ mm}$ ,  $dy=0.5000 \text{ mm}$

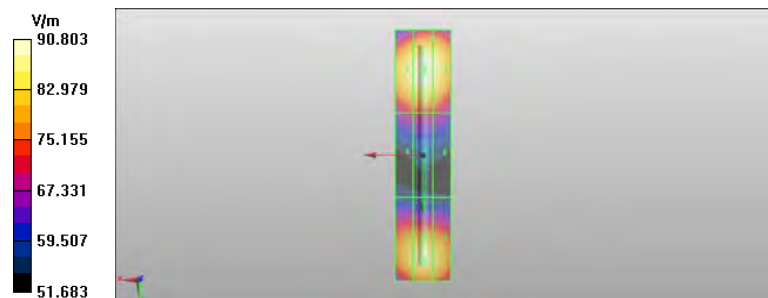
Device Reference Point: 0, 0, -6.3 mm

Reference Value = 156.2 V/m; Power Drift = 0.00 dB

PMR not calibrated. PMF = 1.000 is applied.

E-field emissions = 90.80 V/m

|                        |                        |                        |
|------------------------|------------------------|------------------------|
| Grid 1 M3<br>88.96 V/m | Grid 2 M3<br>90.80 V/m | Grid 3 M3<br>89.41 V/m |
| Grid 4 M3<br>71.66 V/m | Grid 5 M3<br>72.49 V/m | Grid 6 M3<br>71.27 V/m |
| Grid 7 M3<br>85.30 V/m | Grid 8 M3<br>87.21 V/m | Grid 9 M3<br>86.33 V/m |





---

## APPENDIX B: MEASUREMENT SCANS

Date/Time: 2015-09-01 14:39:43

Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 824.2 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM850 - Low - Ant 1/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

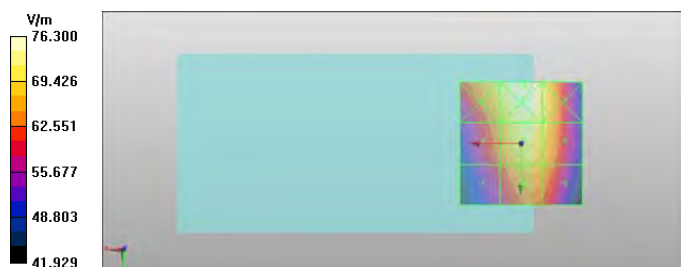
Reference Value = 59.30 V/m; Power Drift = 0.01 dB

Applied MIF = 3.63 dB

RF audio interference level = 37.28 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M4</b><br><b>37.16 dBV/m</b> | Grid 2 <b>M4</b><br><b>37.65 dBV/m</b> | Grid 3 <b>M4</b><br><b>37.28 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>36.45 dBV/m</b> | Grid 5 <b>M4</b><br><b>37.28 dBV/m</b> | Grid 6 <b>M4</b><br><b>37.07 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>35.82 dBV/m</b> | Grid 8 <b>M4</b><br><b>36.76 dBV/m</b> | Grid 9 <b>M4</b><br><b>36.59 dBV/m</b> |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 836.6 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM850 - Middle - Ant 1/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

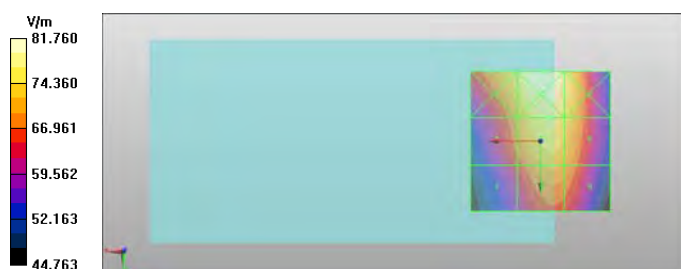
Reference Value = 62.37 V/m; Power Drift = 0.04 dB

Applied MIF = 3.63 dB

RF audio interference level = 37.82 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M4</b><br><b>37.69 dBV/m</b> | Grid 2 <b>M4</b><br><b>38.25 dBV/m</b> | Grid 3 <b>M4</b><br><b>37.84 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>36.95 dBV/m</b> | Grid 5 <b>M4</b><br><b>37.82 dBV/m</b> | Grid 6 <b>M4</b><br><b>37.6 dBV/m</b>  |
| Grid 7 <b>M4</b><br><b>36.23 dBV/m</b> | Grid 8 <b>M4</b><br><b>37.22 dBV/m</b> | Grid 9 <b>M4</b><br><b>37.08 dBV/m</b> |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 848.8 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM850 - High - Ant 1/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

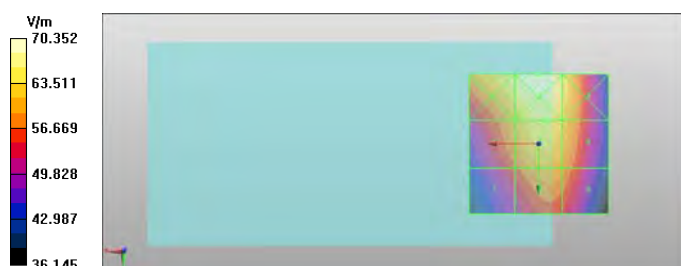
Reference Value = 53.11 V/m; Power Drift = 0.04 dB

Applied MIF = 3.63 dB

RF audio interference level = 36.41 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M4</b><br><b>36.58 dBV/m</b> | Grid 2 <b>M4</b><br><b>36.95 dBV/m</b> | Grid 3 <b>M4</b><br><b>36.37 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>35.77 dBV/m</b> | Grid 5 <b>M4</b><br><b>36.41 dBV/m</b> | Grid 6 <b>M4</b><br><b>36.1 dBV/m</b>  |
| Grid 7 <b>M4</b><br><b>34.93 dBV/m</b> | Grid 8 <b>M4</b><br><b>35.74 dBV/m</b> | Grid 9 <b>M4</b><br><b>35.53 dBV/m</b> |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 824.2 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM850 - Low - Ant 2/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

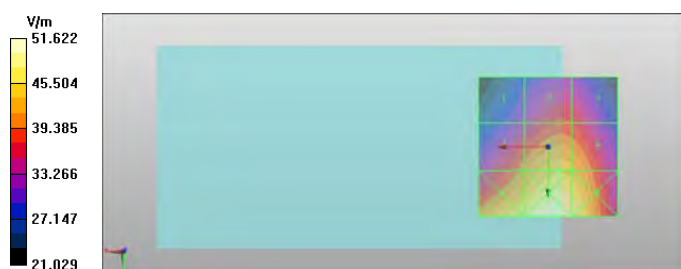
Reference Value = 34.27 V/m; Power Drift = -0.08 dB

Applied MIF = 3.63 dB

RF audio interference level = 33.10 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M4</b><br><b>30.41 dBV/m</b> | Grid 2 <b>M4</b><br><b>31.59 dBV/m</b> | Grid 3 <b>M4</b><br><b>31.45 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>32.2 dBV/m</b>  | Grid 5 <b>M4</b><br><b>33.1 dBV/m</b>  | Grid 6 <b>M4</b><br><b>32.91 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>33.7 dBV/m</b>  | Grid 8 <b>M4</b><br><b>34.26 dBV/m</b> | Grid 9 <b>M4</b><br><b>33.94 dBV/m</b> |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 836.6 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM850 - Middle - Ant 2/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

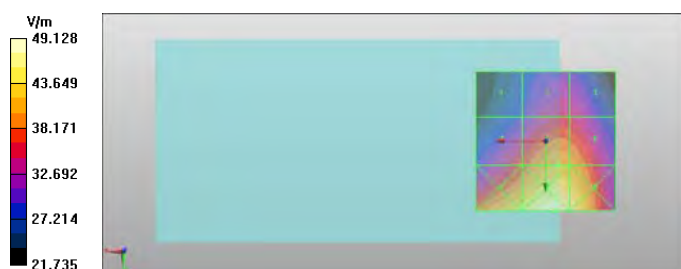
Reference Value = 31.21 V/m; Power Drift = -0.00 dB

Applied MIF = 3.63 dB

RF audio interference level = 32.48 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M4</b><br><b>29.51 dBV/m</b> | Grid 2 <b>M4</b><br><b>30.88 dBV/m</b> | Grid 3 <b>M4</b><br><b>30.83 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>31.39 dBV/m</b> | Grid 5 <b>M4</b><br><b>32.48 dBV/m</b> | Grid 6 <b>M4</b><br><b>32.37 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>33.16 dBV/m</b> | Grid 8 <b>M4</b><br><b>33.83 dBV/m</b> | Grid 9 <b>M4</b><br><b>33.56 dBV/m</b> |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 848.8 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM850 - High - Ant 2/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

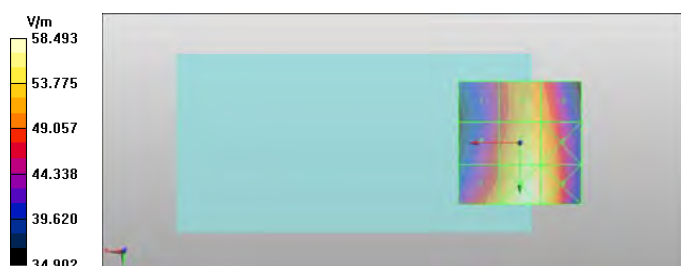
Reference Value = 44.75 V/m; Power Drift = -0.00 dB

Applied MIF = 3.63 dB

RF audio interference level = 34.99 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M4</b><br><b>33.4 dBV/m</b>  | Grid 2 <b>M4</b><br><b>34.52 dBV/m</b> | Grid 3 <b>M4</b><br><b>34.37 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>33.85 dBV/m</b> | Grid 5 <b>M4</b><br><b>34.99 dBV/m</b> | Grid 6 <b>M4</b><br><b>34.84 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>34.48 dBV/m</b> | Grid 8 <b>M4</b><br><b>35.34 dBV/m</b> | Grid 9 <b>M4</b><br><b>35.08 dBV/m</b> |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 1850.2 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM1900 - Low - Ant 1/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

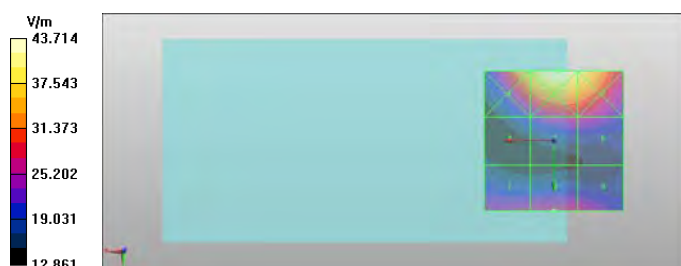
Reference Value = 13.67 V/m; Power Drift = -0.13 dB

Applied MIF = 3.63 dB

RF audio interference level = 28.81 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M3</b><br><b>31.55 dBV/m</b> | Grid 2 <b>M3</b><br><b>32.81 dBV/m</b> | Grid 3 <b>M3</b><br><b>32.38 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>26.79 dBV/m</b> | Grid 5 <b>M4</b><br><b>28.31 dBV/m</b> | Grid 6 <b>M4</b><br><b>28.24 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>28.51 dBV/m</b> | Grid 8 <b>M4</b><br><b>28.81 dBV/m</b> | Grid 9 <b>M4</b><br><b>28.43 dBV/m</b> |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 1880 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM1900 - Middle - Ant 1/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

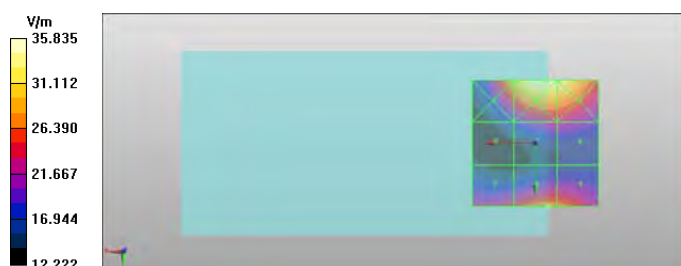
Reference Value = 12.41 V/m; Power Drift = -0.09 dB

Applied MIF = 3.63 dB

RF audio interference level = 29.08 dBV/m

**Emission category: M4**

|                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| Grid 1 <b>M4</b><br>29.5 dBV/m  | Grid 2 <b>M3</b><br>31.09 dBV/m | Grid 3 <b>M3</b><br>30.83 dBV/m |
| Grid 4 <b>M4</b><br>25.31 dBV/m | Grid 5 <b>M4</b><br>26.93 dBV/m | Grid 6 <b>M4</b><br>26.91 dBV/m |
| Grid 7 <b>M4</b><br>27.92 dBV/m | Grid 8 <b>M4</b><br>29.08 dBV/m | Grid 9 <b>M4</b><br>28.99 dBV/m |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 1909.8 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM1900 - High - Ant 1/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

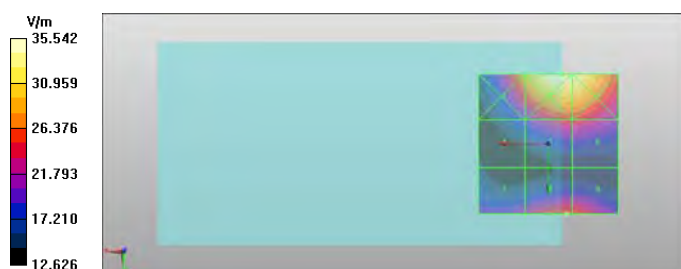
Reference Value = 13.66 V/m; Power Drift = -0.02 dB

Applied MIF = 3.63 dB

RF audio interference level = 28.49 dBV/m

**Emission category: M4**

|                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| Grid 1 <b>M4</b><br>29.23 dBV/m | Grid 2 <b>M3</b><br>31.01 dBV/m | Grid 3 <b>M3</b><br>30.88 dBV/m |
| Grid 4 <b>M4</b><br>25.82 dBV/m | Grid 5 <b>M4</b><br>27.77 dBV/m | Grid 6 <b>M4</b><br>27.75 dBV/m |
| Grid 7 <b>M4</b><br>27.05 dBV/m | Grid 8 <b>M4</b><br>28.49 dBV/m | Grid 9 <b>M4</b><br>28.43 dBV/m |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 1850.2 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM1900 - Low - Ant 2/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

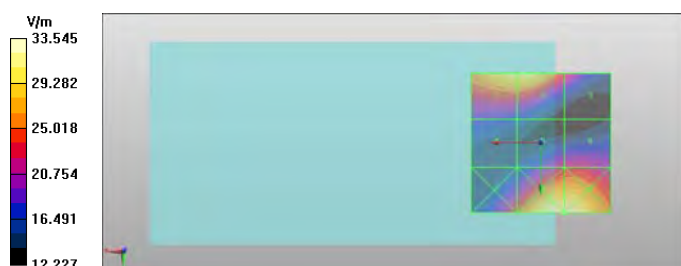
Reference Value = 10.91 V/m; Power Drift = 0.14 dB

Applied MIF = 3.63 dB

RF audio interference level = 29.76 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M4</b><br><b>29.7 dBV/m</b>  | Grid 2 <b>M4</b><br><b>29.76 dBV/m</b> | Grid 3 <b>M4</b><br><b>27.42 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>25.37 dBV/m</b> | Grid 5 <b>M4</b><br><b>26.82 dBV/m</b> | Grid 6 <b>M4</b><br><b>26.99 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>27.85 dBV/m</b> | Grid 8 <b>M3</b><br><b>30.51 dBV/m</b> | Grid 9 <b>M3</b><br><b>30.51 dBV/m</b> |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 1880 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM1900 - Middle - Ant 2/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

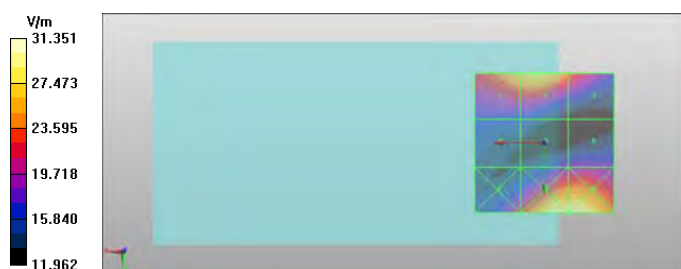
Reference Value = 9.184 V/m; Power Drift = -0.11 dB

Applied MIF = 3.63 dB

RF audio interference level = 29.02 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M4</b><br><b>28.68 dBV/m</b> | Grid 2 <b>M4</b><br><b>29.02 dBV/m</b> | Grid 3 <b>M4</b><br><b>27.72 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>24.67 dBV/m</b> | Grid 5 <b>M4</b><br><b>25.17 dBV/m</b> | Grid 6 <b>M4</b><br><b>25.43 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>26.86 dBV/m</b> | Grid 8 <b>M4</b><br><b>29.92 dBV/m</b> | Grid 9 <b>M4</b><br><b>29.93 dBV/m</b> |



Test Laboratory: TCC Microsoft

**Type: RM-1104, HW:2012; Serial: 004402/74/217824/1**

Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK)

Frequency: 1909.8 MHz; Duty Cycle: 1:8.6896

Medium: Air;

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 0$  kg/m<sup>3</sup>

Phantom section: RF Section

DASY Configuration:

- Probe: ER3DV6 - SN2039
- ConvF(1, 1, 1); Calibrated: 2014-10-20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 2014-11-03
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**E Scan/GSM1900 - High - Ant 2/Hearing Aid Compatibility Test (101x101x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

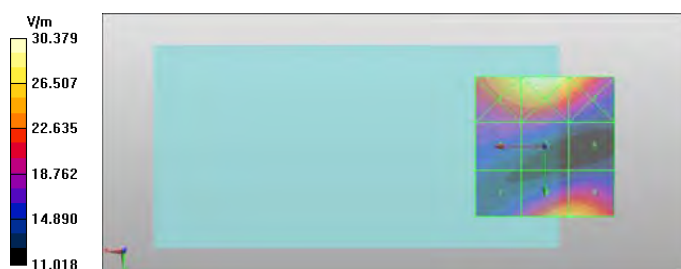
Reference Value = 9.704 V/m; Power Drift = -0.15 dB

Applied MIF = 3.63 dB

RF audio interference level = 28.52 dBV/m

**Emission category: M4**

|                                        |                                        |                                        |
|----------------------------------------|----------------------------------------|----------------------------------------|
| Grid 1 <b>M4</b><br><b>29.1 dBV/m</b>  | Grid 2 <b>M4</b><br><b>29.65 dBV/m</b> | Grid 3 <b>M4</b><br><b>28.74 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>25.49 dBV/m</b> | Grid 5 <b>M4</b><br><b>25.49 dBV/m</b> | Grid 6 <b>M4</b><br><b>23.75 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>25.37 dBV/m</b> | Grid 8 <b>M4</b><br><b>28.52 dBV/m</b> | Grid 9 <b>M4</b><br><b>28.54 dBV/m</b> |





---

**APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)**



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **TCC Microsoft**

Certificate No: **ER3-2309\_Oct14**

## CALIBRATION CERTIFICATE

Object **ER3DV6 - SN:2309**

Calibration procedure(s) **QA CAL-02.v8, QA CAL-25.v6**  
 Calibration procedure for E-field probes optimized for close near field  
 evaluations in air

Calibration date: **October 20, 2014**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^{\circ}\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 03-Apr-14 (No. 217-01911)         | Apr-15                 |
| Power sensor E4412A        | MY41498087      | 03-Apr-14 (No. 217-01911)         | Apr-15                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 03-Apr-14 (No. 217-01915)         | Apr-15                 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 03-Apr-14 (No. 217-01919)         | Apr-15                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 03-Apr-14 (No. 217-01920)         | Apr-15                 |
| Reference Probe ER3DV6     | SN: 2328        | 08-Oct-14 (No. ER3-2328_Oct14)    | Oct-15                 |
| DAE4                       | SN: 789         | 30-Apr-14 (No. DAE4-789_Apr14)    | Apr-15                 |
|                            |                 |                                   |                        |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-99 (in house check Apr-13)  | In house check: Apr-16 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |

|                                                                                                                 | Name           | Function              | Signature                |
|-----------------------------------------------------------------------------------------------------------------|----------------|-----------------------|--------------------------|
| Calibrated by:                                                                                                  | Israe El-Naouq | Laboratory Technician |                          |
| Approved by:                                                                                                    | Katja Pokovic  | Technical Manager     |                          |
|                                                                                                                 |                |                       | Issued: October 21, 2014 |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                |                       |                          |

# DASY/EASY - Parameters of Probe: ER3DV6 - SN:2309

## Basic Calibration Parameters

|                                              | Sensor X | Sensor Y | Sensor Z | Unc (k=2)     |
|----------------------------------------------|----------|----------|----------|---------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) | 1.65     | 1.46     | 1.83     | $\pm 10.1 \%$ |
| DCP (mV) <sup>B</sup>                        | 98.9     | 100.4    | 100.1    |               |

## Modulation Calibration Parameters

| UID       | Communication System Name                      |   | A<br>dB | B<br>dB $\sqrt{\mu\text{V}}$ | C    | D<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-----------|------------------------------------------------|---|---------|------------------------------|------|---------|----------|---------------------------|
| 0         | CW                                             | X | 0.0     | 0.0                          | 1.0  | 0.00    | 149.1    | $\pm 2.5 \%$              |
|           |                                                | Y | 0.0     | 0.0                          | 1.0  |         | 197.4    |                           |
|           |                                                | Z | 0.0     | 0.0                          | 1.0  |         | 198.1    |                           |
| 10011-CAB | UMTS-FDD (WCDMA)                               | X | 3.32    | 66.9                         | 19.2 | 2.91    | 120.0    | $\pm 0.5 \%$              |
|           |                                                | Y | 3.44    | 68.0                         | 20.0 |         | 118.1    |                           |
|           |                                                | Z | 3.10    | 65.9                         | 18.0 |         | 119.9    |                           |
| 10012-CAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)       | X | 3.04    | 69.0                         | 19.6 | 1.87    | 123.0    | $\pm 0.9 \%$              |
|           |                                                | Y | 2.84    | 68.6                         | 19.9 |         | 120.0    |                           |
|           |                                                | Z | 2.88    | 68.3                         | 18.6 |         | 122.1    |                           |
| 10013-CAA | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)  | X | 12.44   | 73.5                         | 25.5 | 9.46    | 123.0    | $\pm 3.5 \%$              |
|           |                                                | Y | 11.06   | 71.1                         | 24.3 |         | 110.3    |                           |
|           |                                                | Z | 11.26   | 70.4                         | 23.2 |         | 119.7    |                           |
| 10021-DAB | GSM-FDD (TDMA, GMSK)                           | X | 21.65   | 99.4                         | 29.6 | 9.39    | 96.4     | $\pm 1.7 \%$              |
|           |                                                | Y | 6.46    | 84.4                         | 24.2 |         | 107.3    |                           |
|           |                                                | Z | 24.63   | 99.4                         | 28.3 |         | 146.6    |                           |
| 10039-CAB | CDMA2000 (1xRTT, RC1)                          | X | 4.97    | 67.0                         | 19.6 | 4.57    | 123.9    | $\pm 0.7 \%$              |
|           |                                                | Y | 4.79    | 67.1                         | 19.9 |         | 118.3    |                           |
|           |                                                | Z | 4.65    | 66.0                         | 18.6 |         | 121.2    |                           |
| 10059-CAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)       | X | 3.85    | 72.7                         | 21.3 | 2.12    | 121.6    | $\pm 0.7 \%$              |
|           |                                                | Y | 3.39    | 71.9                         | 21.7 |         | 117.1    |                           |
|           |                                                | Z | 3.07    | 68.4                         | 18.5 |         | 120.1    |                           |
| 10060-CAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)     | X | 13.21   | 98.0                         | 30.4 | 2.83    | 112.0    | $\pm 0.5 \%$              |
|           |                                                | Y | 10.19   | 99.8                         | 32.9 |         | 146.7    |                           |
|           |                                                | Z | 7.45    | 86.1                         | 25.4 |         | 110.0    |                           |
| 10061-CAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)      | X | 11.11   | 89.6                         | 27.7 | 3.60    | 115.1    | $\pm 0.7 \%$              |
|           |                                                | Y | 7.17    | 86.8                         | 28.2 |         | 147.9    |                           |
|           |                                                | Z | 7.45    | 81.5                         | 24.0 |         | 113.3    |                           |
| 10071-CAA | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)  | X | 12.79   | 74.2                         | 26.2 | 9.83    | 121.2    | $\pm 3.8 \%$              |
|           |                                                | Y | 11.19   | 71.4                         | 24.8 |         | 107.3    |                           |
|           |                                                | Z | 11.86   | 72.0                         | 24.5 |         | 117.4    |                           |
| 10072-CAA | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps) | X | 12.47   | 74.2                         | 26.0 | 9.62    | 117.7    | $\pm 3.3 \%$              |
|           |                                                | Y | 10.66   | 70.8                         | 24.3 |         | 104.4    |                           |
|           |                                                | Z | 11.17   | 70.8                         | 23.5 |         | 115.2    |                           |

|           |                                                |   |       |      |      |       |       |        |
|-----------|------------------------------------------------|---|-------|------|------|-------|-------|--------|
| 10073-CAA | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps) | X | 12.83 | 75.1 | 26.8 | 9.94  | 115.6 | ±2.5 % |
|           |                                                | Y | 11.71 | 74.4 | 27.0 |       | 148.8 |        |
|           |                                                | Z | 11.35 | 71.3 | 24.0 |       | 113.0 |        |
| 10074-CAA | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps) | X | 13.16 | 75.9 | 27.6 | 10.30 | 113.5 | ±3.0 % |
|           |                                                | Y | 11.84 | 74.8 | 27.5 |       | 145.4 |        |
|           |                                                | Z | 11.53 | 71.6 | 24.5 |       | 110.8 |        |
| 10075-CAA | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps) | X | 13.71 | 77.2 | 28.7 | 10.77 | 112.0 | ±2.7 % |
|           |                                                | Y | 12.04 | 75.4 | 28.4 |       | 141.0 |        |
|           |                                                | Z | 11.87 | 72.4 | 25.3 |       | 109.4 |        |
| 10076-CAA | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps) | X | 13.87 | 77.7 | 29.1 | 10.94 | 110.4 | ±2.7 % |
|           |                                                | Y | 11.98 | 75.4 | 28.5 |       | 138.3 |        |
|           |                                                | Z | 11.95 | 72.6 | 25.5 |       | 108.6 |        |
| 10077-CAA | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps) | X | 13.92 | 77.8 | 29.3 | 11.00 | 109.6 | ±2.5 % |
|           |                                                | Y | 12.00 | 75.5 | 28.6 |       | 137.4 |        |
|           |                                                | Z | 11.97 | 72.7 | 25.6 |       | 108.0 |        |
| 10081-CAB | CDMA2000 (1xRTT, RC3)                          | X | 4.06  | 66.3 | 19.2 | 3.97  | 117.8 | ±0.7 % |
|           |                                                | Y | 4.04  | 66.7 | 19.6 |       | 117.1 |        |
|           |                                                | Z | 3.82  | 65.4 | 18.3 |       | 119.1 |        |
| 10103-CAB | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)       | X | 13.58 | 83.1 | 30.4 | 9.29  | 132.3 | ±3.8 % |
|           |                                                | Y | 9.04  | 73.7 | 26.3 |       | 112.6 |        |
|           |                                                | Z | 11.35 | 77.4 | 26.9 |       | 132.1 |        |
| 10104-CAB | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)     | X | 14.52 | 83.0 | 31.3 | 9.97  | 146.9 | ±3.8 % |
|           |                                                | Y | 10.05 | 73.6 | 26.8 |       | 122.6 |        |
|           |                                                | Z | 12.41 | 77.5 | 27.6 |       | 146.9 |        |
| 10105-CAB | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)     | X | 14.67 | 83.0 | 31.3 | 10.01 | 148.8 | ±2.5 % |
|           |                                                | Y | 10.22 | 73.8 | 26.9 |       | 124.8 |        |
|           |                                                | Z | 10.17 | 71.1 | 24.2 |       | 97.5  |        |
| 10151-CAB | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)        | X | 12.51 | 81.5 | 29.8 | 9.28  | 126.5 | ±3.8 % |
|           |                                                | Y | 8.50  | 72.8 | 26.0 |       | 109.0 |        |
|           |                                                | Z | 10.57 | 76.3 | 26.5 |       | 127.4 |        |
| 10152-CAB | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)      | X | 13.52 | 81.7 | 30.7 | 9.92  | 138.3 | ±3.5 % |
|           |                                                | Y | 9.47  | 72.9 | 26.5 |       | 116.8 |        |
|           |                                                | Z | 11.70 | 76.8 | 27.3 |       | 139.3 |        |
| 10153-CAB | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)      | X | 13.76 | 81.8 | 30.9 | 10.05 | 140.1 | ±3.5 % |
|           |                                                | Y | 9.71  | 73.1 | 26.7 |       | 118.4 |        |
|           |                                                | Z | 11.96 | 77.0 | 27.5 |       | 142.1 |        |
| 10169-CAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)          | X | 5.28  | 66.7 | 20.1 | 5.73  | 114.5 | ±0.9 % |
|           |                                                | Y | 5.05  | 67.0 | 20.6 |       | 111.7 |        |
|           |                                                | Z | 5.01  | 65.8 | 19.2 |       | 118.3 |        |
| 10170-CAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)        | X | 6.29  | 68.5 | 21.4 | 6.52  | 115.5 | ±1.2 % |
|           |                                                | Y | 5.79  | 68.0 | 21.4 |       | 110.6 |        |
|           |                                                | Z | 5.91  | 67.2 | 20.2 |       | 119.6 |        |
| 10171-AAB | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)        | X | 6.27  | 68.4 | 21.3 | 6.49  | 115.4 | ±0.9 % |
|           |                                                | Y | 5.80  | 68.2 | 21.5 |       | 110.4 |        |
|           |                                                | Z | 5.91  | 67.2 | 20.2 |       | 119.8 |        |

|           |                                         |   |       |      |      |       |       |        |
|-----------|-----------------------------------------|---|-------|------|------|-------|-------|--------|
| 10172-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)   | X | 14.52 | 92.7 | 35.5 | 9.21  | 145.4 | ±2.5 % |
|           |                                         | Y | 7.35  | 76.1 | 28.4 |       | 120.5 |        |
|           |                                         | Z | 8.03  | 74.4 | 25.8 |       | 101.3 |        |
| 10173-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM) | X | 15.43 | 93.9 | 36.0 | 9.48  | 146.8 | ±2.7 % |
|           |                                         | Y | 7.70  | 77.0 | 28.8 |       | 120.2 |        |
|           |                                         | Z | 8.49  | 75.2 | 26.2 |       | 101.6 |        |
| 10174-CAB | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM) | X | 15.34 | 93.0 | 36.8 | 10.25 | 147.8 | ±2.7 % |
|           |                                         | Y | 8.14  | 76.1 | 29.1 |       | 120.1 |        |
|           |                                         | Z | 8.96  | 74.9 | 26.8 |       | 101.9 |        |
| 10175-CAB | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)   | X | 5.35  | 67.2 | 20.5 | 5.72  | 113.9 | ±0.9 % |
|           |                                         | Y | 5.01  | 66.7 | 20.4 |       | 110.3 |        |
|           |                                         | Z | 5.03  | 65.9 | 19.3 |       | 118.7 |        |
| 10176-CAB | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM) | X | 6.22  | 68.1 | 21.2 | 6.52  | 115.2 | ±1.2 % |
|           |                                         | Y | 5.79  | 68.0 | 21.4 |       | 109.7 |        |
|           |                                         | Z | 5.88  | 67.0 | 20.1 |       | 120.1 |        |
| 10177-CAB | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)    | X | 5.29  | 66.8 | 20.2 | 5.73  | 114.3 | ±0.9 % |
|           |                                         | Y | 5.06  | 67.0 | 20.6 |       | 110.0 |        |
|           |                                         | Z | 5.06  | 66.0 | 19.3 |       | 119.1 |        |
| 10178-CAB | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)  | X | 6.27  | 68.4 | 21.4 | 6.52  | 115.8 | ±1.4 % |
|           |                                         | Y | 5.81  | 68.1 | 21.5 |       | 109.5 |        |
|           |                                         | Z | 5.90  | 67.1 | 20.1 |       | 120.4 |        |
| 10179-CAB | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM) | X | 6.24  | 68.3 | 21.3 | 6.50  | 116.1 | ±1.2 % |
|           |                                         | Y | 5.76  | 67.9 | 21.3 |       | 109.2 |        |
|           |                                         | Z | 5.90  | 67.2 | 20.2 |       | 120.5 |        |
| 10180-CAB | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)  | X | 6.29  | 68.5 | 21.4 | 6.50  | 116.3 | ±1.2 % |
|           |                                         | Y | 5.80  | 68.2 | 21.5 |       | 109.0 |        |
|           |                                         | Z | 5.90  | 67.1 | 20.1 |       | 120.4 |        |
| 10181-CAB | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)   | X | 5.30  | 66.9 | 20.3 | 5.72  | 115.1 | ±0.9 % |
|           |                                         | Y | 5.06  | 67.1 | 20.7 |       | 109.3 |        |
|           |                                         | Z | 5.03  | 65.9 | 19.2 |       | 119.1 |        |
| 10182-CAB | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM) | X | 6.29  | 68.4 | 21.4 | 6.52  | 116.1 | ±1.2 % |
|           |                                         | Y | 5.77  | 67.9 | 21.4 |       | 108.6 |        |
|           |                                         | Z | 5.91  | 67.1 | 20.2 |       | 120.0 |        |
| 10183-AAA | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM) | X | 6.25  | 68.3 | 21.3 | 6.50  | 116.8 | ±1.2 % |
|           |                                         | Y | 5.82  | 68.2 | 21.5 |       | 109.8 |        |
|           |                                         | Z | 5.93  | 67.2 | 20.2 |       | 119.9 |        |
| 10184-CAB | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)    | X | 5.35  | 67.1 | 20.4 | 5.73  | 115.4 | ±0.9 % |
|           |                                         | Y | 5.05  | 66.9 | 20.5 |       | 111.4 |        |
|           |                                         | Z | 5.04  | 65.9 | 19.3 |       | 118.3 |        |
| 10185-CAB | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)  | X | 6.29  | 68.5 | 21.5 | 6.51  | 116.6 | ±1.2 % |
|           |                                         | Y | 5.83  | 68.2 | 21.6 |       | 111.1 |        |
|           |                                         | Z | 5.93  | 67.2 | 20.2 |       | 119.2 |        |
| 10186-AAB | LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)  | X | 6.32  | 68.6 | 21.5 | 6.50  | 117.4 | ±1.2 % |
|           |                                         | Y | 5.83  | 68.3 | 21.6 |       | 111.3 |        |
|           |                                         | Z | 5.94  | 67.3 | 20.3 |       | 119.1 |        |

|           |                                          |   |       |      |      |       |       |        |
|-----------|------------------------------------------|---|-------|------|------|-------|-------|--------|
| 10187-CAB | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)   | X | 5.29  | 66.8 | 20.2 | 5.73  | 115.8 | ±0.9 % |
|           |                                          | Y | 5.12  | 67.3 | 20.8 |       | 110.2 |        |
|           |                                          | Z | 5.06  | 66.0 | 19.3 |       | 117.4 |        |
| 10188-CAB | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM) | X | 6.31  | 68.5 | 21.5 | 6.52  | 117.6 | ±1.2 % |
|           |                                          | Y | 5.84  | 68.2 | 21.5 |       | 111.1 |        |
|           |                                          | Z | 5.90  | 67.1 | 20.1 |       | 118.2 |        |
| 10189-AAB | LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM) | X | 6.28  | 68.4 | 21.4 | 6.50  | 118.2 | ±1.2 % |
|           |                                          | Y | 5.77  | 67.9 | 21.3 |       | 110.9 |        |
|           |                                          | Z | 5.93  | 67.3 | 20.2 |       | 118.5 |        |
| 10226-CAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM) | X | 9.43  | 78.2 | 28.6 | 9.49  | 100.3 | ±2.7 % |
|           |                                          | Y | 7.47  | 75.8 | 28.1 |       | 118.9 |        |
|           |                                          | Z | 11.73 | 84.4 | 30.7 |       | 148.8 |        |
| 10227-CAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM) | X | 10.00 | 78.3 | 29.4 | 10.26 | 100.9 | ±3.3 % |
|           |                                          | Y | 8.19  | 76.2 | 29.1 |       | 119.9 |        |
|           |                                          | Z | 11.83 | 83.3 | 31.0 |       | 149.3 |        |
| 10228-CAA | LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)   | X | 15.68 | 95.1 | 36.5 | 9.22  | 149.8 | ±3.0 % |
|           |                                          | Y | 7.33  | 75.9 | 28.3 |       | 120.3 |        |
|           |                                          | Z | 11.02 | 83.3 | 30.2 |       | 147.9 |        |
| 10229-CAB | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)   | X | 9.69  | 79.1 | 29.0 | 9.48  | 100.8 | ±2.7 % |
|           |                                          | Y | 7.50  | 76.0 | 28.3 |       | 119.0 |        |
|           |                                          | Z | 11.66 | 84.3 | 30.6 |       | 147.3 |        |
| 10230-CAB | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)   | X | 10.21 | 79.0 | 29.9 | 10.25 | 101.5 | ±3.3 % |
|           |                                          | Y | 7.97  | 74.9 | 28.1 |       | 123.5 |        |
|           |                                          | Z | 11.73 | 83.1 | 31.0 |       | 148.1 |        |
| 10231-CAB | LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)     | X | 9.39  | 79.0 | 28.9 | 9.19  | 101.5 | ±2.7 % |
|           |                                          | Y | 7.13  | 74.8 | 27.4 |       | 124.3 |        |
|           |                                          | Z | 10.89 | 83.0 | 30.0 |       | 147.2 |        |
| 10232-CAB | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)   | X | 9.65  | 79.0 | 29.0 | 9.48  | 100.9 | ±3.0 % |
|           |                                          | Y | 7.50  | 75.7 | 27.9 |       | 123.7 |        |
|           |                                          | Z | 11.63 | 84.2 | 30.6 |       | 147.3 |        |
| 10233-CAB | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)   | X | 10.24 | 79.2 | 29.9 | 10.25 | 101.8 | ±3.3 % |
|           |                                          | Y | 7.98  | 75.0 | 28.2 |       | 124.1 |        |
|           |                                          | Z | 11.80 | 83.3 | 31.1 |       | 148.0 |        |
| 10234-CAB | LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)     | X | 9.45  | 79.1 | 29.0 | 9.21  | 101.7 | ±2.7 % |
|           |                                          | Y | 7.17  | 74.9 | 27.5 |       | 124.9 |        |
|           |                                          | Z | 11.00 | 83.3 | 30.1 |       | 147.2 |        |
| 10235-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)  | X | 9.71  | 79.2 | 29.0 | 9.48  | 101.3 | ±2.7 % |
|           |                                          | Y | 7.49  | 75.7 | 27.9 |       | 124.5 |        |
|           |                                          | Z | 11.55 | 84.0 | 30.4 |       | 147.5 |        |
| 10236-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)  | X | 10.28 | 79.3 | 30.0 | 10.25 | 101.8 | ±3.3 % |
|           |                                          | Y | 8.05  | 75.4 | 28.4 |       | 124.6 |        |
|           |                                          | Z | 11.76 | 83.2 | 31.0 |       | 148.1 |        |
| 10237-CAB | LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)    | X | 9.28  | 78.6 | 28.7 | 9.21  | 101.6 | ±2.7 % |
|           |                                          | Y | 7.22  | 75.2 | 27.6 |       | 125.6 |        |
|           |                                          | Z | 10.90 | 83.0 | 29.9 |       | 146.9 |        |

|           |                                            |   |       |      |      |       |       |        |
|-----------|--------------------------------------------|---|-------|------|------|-------|-------|--------|
| 10238-CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)    | X | 9.83  | 79.6 | 29.3 | 9.48  | 101.0 | ±3.0 % |
|           |                                            | Y | 7.51  | 75.8 | 27.9 |       | 125.1 |        |
|           |                                            | Z | 11.57 | 84.0 | 30.5 |       | 148.3 |        |
| 10239-CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)    | X | 10.16 | 78.9 | 29.8 | 10.25 | 101.4 | ±3.3 % |
|           |                                            | Y | 8.05  | 75.4 | 28.4 |       | 125.4 |        |
|           |                                            | Z | 11.82 | 83.4 | 31.1 |       | 149.0 |        |
| 10240-CAB | LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)      | X | 9.46  | 79.2 | 29.0 | 9.21  | 101.6 | ±2.7 % |
|           |                                            | Y | 7.24  | 75.3 | 27.7 |       | 126.1 |        |
|           |                                            | Z | 11.06 | 83.5 | 30.2 |       | 148.6 |        |
| 10241-CAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM) | X | 10.82 | 79.6 | 29.8 | 9.82  | 110.1 | ±3.5 % |
|           |                                            | Y | 8.42  | 75.4 | 28.0 |       | 135.9 |        |
|           |                                            | Z | 9.15  | 74.4 | 26.2 |       | 108.0 |        |
| 10242-CAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM) | X | 10.82 | 79.4 | 29.7 | 9.86  | 110.8 | ±3.5 % |
|           |                                            | Y | 8.46  | 75.5 | 28.0 |       | 136.3 |        |
|           |                                            | Z | 9.23  | 74.5 | 26.2 |       | 108.5 |        |
| 10243-CAA | LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)   | X | 10.40 | 79.8 | 29.8 | 9.46  | 109.3 | ±3.3 % |
|           |                                            | Y | 7.88  | 74.8 | 27.7 |       | 134.7 |        |
|           |                                            | Z | 8.71  | 74.4 | 26.0 |       | 107.1 |        |
| 10244-CAB | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)   | X | 12.19 | 80.7 | 30.6 | 10.06 | 124.2 | ±3.3 % |
|           |                                            | Y | 8.17  | 70.7 | 25.2 |       | 105.7 |        |
|           |                                            | Z | 10.33 | 75.5 | 26.9 |       | 120.5 |        |
| 10245-CAB | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)   | X | 12.20 | 80.6 | 30.5 | 10.06 | 123.3 | ±3.5 % |
|           |                                            | Y | 8.20  | 70.6 | 25.1 |       | 105.8 |        |
|           |                                            | Z | 10.46 | 75.7 | 27.0 |       | 121.9 |        |
| 10246-CAB | LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)     | X | 11.03 | 80.1 | 29.6 | 9.30  | 117.0 | ±3.5 % |
|           |                                            | Y | 8.44  | 75.6 | 27.9 |       | 144.5 |        |
|           |                                            | Z | 9.11  | 74.5 | 25.8 |       | 114.1 |        |
| 10247-CAB | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)   | X | 12.51 | 81.2 | 30.7 | 9.91  | 127.6 | ±3.5 % |
|           |                                            | Y | 8.32  | 70.9 | 25.2 |       | 108.8 |        |
|           |                                            | Z | 10.58 | 75.9 | 27.0 |       | 125.7 |        |
| 10248-CAB | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)   | X | 12.72 | 81.4 | 31.0 | 10.09 | 128.3 | ±3.5 % |
|           |                                            | Y | 8.54  | 71.2 | 25.5 |       | 109.9 |        |
|           |                                            | Z | 10.82 | 76.2 | 27.3 |       | 126.5 |        |
| 10249-CAB | LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)     | X | 11.46 | 80.9 | 30.0 | 9.29  | 119.2 | ±3.5 % |
|           |                                            | Y | 8.69  | 75.9 | 28.0 |       | 147.7 |        |
|           |                                            | Z | 9.42  | 75.0 | 26.1 |       | 117.3 |        |
| 10250-CAB | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)  | X | 13.09 | 81.9 | 30.9 | 9.81  | 134.5 | ±3.3 % |
|           |                                            | Y | 8.69  | 71.2 | 25.3 |       | 115.9 |        |
|           |                                            | Z | 11.12 | 76.6 | 27.2 |       | 133.1 |        |
| 10251-CAB | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)  | X | 13.60 | 82.3 | 31.5 | 10.17 | 136.5 | ±3.5 % |
|           |                                            | Y | 9.12  | 71.6 | 25.7 |       | 116.7 |        |
|           |                                            | Z | 11.50 | 76.7 | 27.6 |       | 136.0 |        |
| 10252-CAB | LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)    | X | 11.94 | 81.2 | 29.9 | 9.24  | 123.6 | ±3.8 % |
|           |                                            | Y | 7.78  | 71.0 | 24.9 |       | 109.3 |        |
|           |                                            | Z | 10.01 | 75.9 | 26.4 |       | 122.9 |        |

|           |                                             |   |       |      |      |       |       |        |
|-----------|---------------------------------------------|---|-------|------|------|-------|-------|--------|
| 10253-CAB | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)   | X | 14.04 | 82.9 | 31.4 | 9.90  | 142.8 | ±3.5 % |
|           |                                             | Y | 9.26  | 71.8 | 25.6 |       | 121.4 |        |
|           |                                             | Z | 11.87 | 77.3 | 27.6 |       | 142.6 |        |
| 10254-CAB | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)   | X | 14.42 | 83.2 | 31.8 | 10.14 | 145.8 | ±2.7 % |
|           |                                             | Y | 9.60  | 72.1 | 25.9 |       | 124.2 |        |
|           |                                             | Z | 12.26 | 77.6 | 28.0 |       | 145.4 |        |
| 10255-CAB | LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)     | X | 12.79 | 82.1 | 30.1 | 9.20  | 130.6 | ±3.8 % |
|           |                                             | Y | 8.22  | 71.5 | 25.0 |       | 114.5 |        |
|           |                                             | Z | 10.76 | 76.9 | 26.8 |       | 130.7 |        |
| 10256-CAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM) | X | 11.39 | 79.1 | 29.6 | 9.96  | 118.4 | ±3.8 % |
|           |                                             | Y | 9.31  | 76.3 | 28.6 |       | 149.2 |        |
|           |                                             | Z | 10.15 | 75.6 | 26.9 |       | 119.8 |        |
| 10257-CAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM) | X | 11.64 | 79.5 | 29.9 | 10.08 | 119.1 | ±3.8 % |
|           |                                             | Y | 9.33  | 75.9 | 28.4 |       | 149.1 |        |
|           |                                             | Z | 10.27 | 75.6 | 27.0 |       | 119.8 |        |
| 10258-CAA | LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)   | X | 10.85 | 79.8 | 29.5 | 9.34  | 115.0 | ±3.5 % |
|           |                                             | Y | 8.37  | 75.4 | 27.8 |       | 143.3 |        |
|           |                                             | Z | 9.07  | 74.5 | 25.9 |       | 114.2 |        |
| 10259-CAB | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)   | X | 12.69 | 81.2 | 30.7 | 9.98  | 129.3 | ±3.0 % |
|           |                                             | Y | 8.53  | 71.1 | 25.4 |       | 111.6 |        |
|           |                                             | Z | 10.81 | 76.1 | 27.1 |       | 128.0 |        |
| 10260-CAB | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)   | X | 12.76 | 81.2 | 30.7 | 9.97  | 131.0 | ±3.5 % |
|           |                                             | Y | 8.64  | 71.4 | 25.5 |       | 112.6 |        |
|           |                                             | Z | 10.96 | 76.3 | 27.2 |       | 129.2 |        |
| 10261-CAB | LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)     | X | 11.72 | 81.3 | 30.0 | 9.24  | 120.2 | ±3.8 % |
|           |                                             | Y | 7.54  | 70.8 | 24.9 |       | 106.7 |        |
|           |                                             | Z | 9.60  | 75.3 | 26.2 |       | 117.8 |        |
| 10262-CAB | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)   | X | 13.14 | 82.0 | 31.0 | 9.83  | 134.3 | ±3.8 % |
|           |                                             | Y | 8.75  | 71.5 | 25.4 |       | 115.8 |        |
|           |                                             | Z | 10.99 | 76.1 | 27.0 |       | 131.7 |        |
| 10263-CAB | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)   | X | 13.52 | 82.1 | 31.3 | 10.16 | 136.6 | ±3.8 % |
|           |                                             | Y | 9.14  | 71.7 | 25.8 |       | 117.0 |        |
|           |                                             | Z | 11.42 | 76.4 | 27.4 |       | 133.8 |        |
| 10264-CAB | LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)     | X | 12.17 | 81.8 | 30.2 | 9.23  | 123.6 | ±2.5 % |
|           |                                             | Y | 7.80  | 71.1 | 25.0 |       | 109.8 |        |
|           |                                             | Z | 9.93  | 75.7 | 26.3 |       | 121.1 |        |
| 10265-CAB | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)  | X | 13.90 | 82.6 | 31.2 | 9.92  | 142.3 | ±3.8 % |
|           |                                             | Y | 9.31  | 72.0 | 25.7 |       | 121.9 |        |
|           |                                             | Z | 11.72 | 76.8 | 27.3 |       | 138.9 |        |
| 10266-CAB | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)  | X | 14.43 | 83.4 | 31.8 | 10.07 | 145.5 | ±3.5 % |
|           |                                             | Y | 9.63  | 72.5 | 26.1 |       | 124.4 |        |
|           |                                             | Z | 12.01 | 77.1 | 27.6 |       | 141.2 |        |
| 10267-CAB | LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)    | X | 13.18 | 83.0 | 30.6 | 9.30  | 130.5 | ±3.8 % |
|           |                                             | Y | 8.43  | 72.2 | 25.4 |       | 114.7 |        |
|           |                                             | Z | 10.59 | 76.2 | 26.5 |       | 126.5 |        |

|           |                                                           |   |       |      |      |       |       |        |
|-----------|-----------------------------------------------------------|---|-------|------|------|-------|-------|--------|
| 10268-CAB | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)                | X | 11.92 | 76.0 | 27.5 | 10.06 | 98.8  | ±3.0 % |
|           |                                                           | Y | 10.08 | 73.0 | 26.2 |       | 130.6 |        |
|           |                                                           | Z | 12.64 | 77.7 | 27.8 |       | 148.8 |        |
| 10269-CAB | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)                | X | 12.10 | 76.0 | 27.6 | 10.13 | 100.5 | ±3.3 % |
|           |                                                           | Y | 10.29 | 73.2 | 26.4 |       | 133.1 |        |
|           |                                                           | Z | 10.33 | 71.1 | 24.2 |       | 98.3  |        |
| 10270-CAB | LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)                  | X | 14.28 | 84.0 | 31.2 | 9.58  | 139.9 | ±3.8 % |
|           |                                                           | Y | 9.22  | 72.9 | 25.9 |       | 121.2 |        |
|           |                                                           | Z | 11.56 | 77.1 | 27.0 |       | 134.9 |        |
| 10290-AAB | CDMA2000, RC1, SO55, Full Rate                            | X | 4.56  | 67.5 | 19.6 | 3.91  | 124.0 | ±0.7 % |
|           |                                                           | Y | 4.42  | 67.8 | 20.0 |       | 125.8 |        |
|           |                                                           | Z | 4.22  | 66.3 | 18.5 |       | 122.9 |        |
| 10291-AAB | CDMA2000, RC3, SO55, Full Rate                            | X | 3.74  | 66.7 | 19.2 | 3.46  | 118.8 | ±0.5 % |
|           |                                                           | Y | 3.78  | 67.8 | 20.1 |       | 122.2 |        |
|           |                                                           | Z | 3.51  | 65.9 | 18.3 |       | 118.3 |        |
| 10292-AAB | CDMA2000, RC3, SO32, Full Rate                            | X | 3.69  | 66.8 | 19.3 | 3.39  | 118.5 | ±0.5 % |
|           |                                                           | Y | 3.77  | 68.1 | 20.2 |       | 121.8 |        |
|           |                                                           | Z | 3.48  | 66.1 | 18.3 |       | 118.2 |        |
| 10293-AAB | CDMA2000, RC3, SO3, Full Rate                             | X | 3.73  | 66.3 | 19.0 | 3.50  | 118.6 | ±0.5 % |
|           |                                                           | Y | 3.75  | 67.3 | 19.8 |       | 121.9 |        |
|           |                                                           | Z | 3.50  | 65.6 | 18.2 |       | 118.4 |        |
| 10295-AAB | CDMA2000, RC1, SO3, 1/8th Rate 25 fr.                     | X | 18.90 | 99.0 | 39.4 | 12.49 | 132.7 | ±3.0 % |
|           |                                                           | Y | 11.07 | 90.4 | 37.8 |       | 100.4 |        |
|           |                                                           | Z | 18.73 | 99.6 | 39.2 |       | 129.3 |        |
| 10315-AAA | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle) | X | 2.85  | 68.5 | 19.5 | 1.71  | 122.0 | ±0.7 % |
|           |                                                           | Y | 3.12  | 71.3 | 21.3 |       | 124.4 |        |
|           |                                                           | Z | 2.77  | 68.4 | 18.8 |       | 123.6 |        |
| 10403-AAB | CDMA2000 (1xEV-DO, Rev. 0)                                | X | 4.81  | 67.1 | 18.9 | 3.76  | 129.5 | ±0.5 % |
|           |                                                           | Y | 4.93  | 69.2 | 20.1 |       | 128.2 |        |
|           |                                                           | Z | 4.56  | 66.6 | 18.1 |       | 130.3 |        |
| 10404-AAB | CDMA2000 (1xEV-DO, Rev. A)                                | X | 4.88  | 67.9 | 19.3 | 3.77  | 128.2 | ±0.7 % |
|           |                                                           | Y | 4.82  | 69.1 | 20.0 |       | 126.5 |        |
|           |                                                           | Z | 4.63  | 67.3 | 18.6 |       | 129.3 |        |

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



---

**APPENDIX D: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORT(S)**



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Client **TCC Microsoft**

Certificate No: **CD835V3-1064\_Apr15**

## CALIBRATION CERTIFICATE

Object **CD835V3 - SN: 1064**

Calibration procedure(s) **QA CAL-20.v6**  
**Calibration procedure for dipoles in air**

Calibration date: **April 17, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID #               | Cal Date (Certificate No.)     | Scheduled Calibration |
|----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A       | GB37480704         | 07-Oct-14 (No. 217-02020)      | Oct-15                |
| Power sensor HP 8481A      | US37292783         | 07-Oct-14 (No. 217-02020)      | Oct-15                |
| Power sensor HP 8481A      | MY41092317         | 07-Oct-14 (No. 217-02021)      | Oct-15                |
| Reference 10 dB Attenuator | SN: 5047.2 / 06327 | 01-Apr-15 (No. 217-02130)      | Mar-16                |
| Probe ER3DV6               | SN: 2336           | 31-Dec-14 (No. ER3-2336_Dec14) | Dec-15                |
| Probe H3DV6                | SN: 6065           | 31-Dec-14 (No. H3-6065_Dec14)  | Dec-15                |
| DAE4                       | SN: 781            | 12-Sep-14 (No. DAE4-781_Sep14) | Sep-15                |

| Secondary Standards       | ID #           | Check Date (in house)             | Scheduled Check        |
|---------------------------|----------------|-----------------------------------|------------------------|
| Power meter Agilent 4419B | SN: GB42420191 | 09-Oct-09 (in house check Sep-14) | In house check: Sep-16 |
| Power sensor HP E4412A    | SN: US38485102 | 05-Jan-10 (in house check Sep-14) | In house check: Sep-16 |
| Power sensor HP 8482A     | SN: US37295597 | 09-Oct-09 (in house check Sep-14) | In house check: Sep-16 |
| Network Analyzer HP 8753E | US37390585     | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |
| RF generator R&S SMT-06   | SN: 832283/011 | 27-Aug-12 (in house check Oct-13) | In house check: Oct-16 |

Calibrated by: **Claudio Leubler** Name: **Claudio Leubler** Function: **Laboratory Technician**

Approved by: **Fin Bornholt** Deputy Technical Manager

Signature

Issued: April 17, 2015

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

## References

- [1] ANSI-C63.19-2011  
American National Standard, Methods of Measurement of Compatibility between Wireless Communications  
Devices and Hearing Aids.

## Methods Applied and Interpretation of Parameters:

- **Coordinate System:** y-axis is in the direction of the dipole arms, z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with the standards [1], the measurement planes (probe sensor center) are selected to be at a distance of 15 mm above the top metal edge of the dipole arms.
- **Measurement Conditions:** Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- **Antenna Positioning:** The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections. It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY5 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- **Feed Point Impedance and Return Loss:** These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- **E-field distribution:** E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 15 mm (in z) above the metal top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, in the plane above the dipole surface.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

|                                    |                     |         |
|------------------------------------|---------------------|---------|
| DASY Version                       | DASY5               | V52.8.8 |
| Phantom                            | HAC Test Arch       |         |
| Distance Dipole Top - Probe Center | 15 mm               |         |
| Scan resolution                    | dx, dy = 5 mm       |         |
| Frequency                          | 835 MHz $\pm$ 1 MHz |         |
| Input power drift                  | < 0.05 dB           |         |

## Maximum Field values at 835 MHz

| E-field 15 mm above dipole surface | condition         | Interpolated maximum        |
|------------------------------------|-------------------|-----------------------------|
| Maximum measured above high end    | 100mW input power | 104.2V/m = 40.36 dBV/m      |
| Maximum measured above low end     | 100mW input power | 102.2V/m = 40.19 dBV/m      |
| Averaged maximum above arm         | 100mW input power | 103.2V/m $\pm$ 12.8 % (k=2) |

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters

| Frequency | Return Loss | Impedance                       |
|-----------|-------------|---------------------------------|
| 800 MHz   | 16.5 dB     | 42.7 $\Omega$ - 11.9 j $\Omega$ |
| 835 MHz   | 24.9 dB     | 50.4 $\Omega$ + 5.7 j $\Omega$  |
| 900 MHz   | 17.2 dB     | 56.9 $\Omega$ - 13.2 j $\Omega$ |
| 950 MHz   | 22.1 dB     | 48.4 $\Omega$ + 7.6 j $\Omega$  |
| 960 MHz   | 16.0 dB     | 52.9 $\Omega$ + 16.3 j $\Omega$ |

### 3.2 Antenna Design and Handling

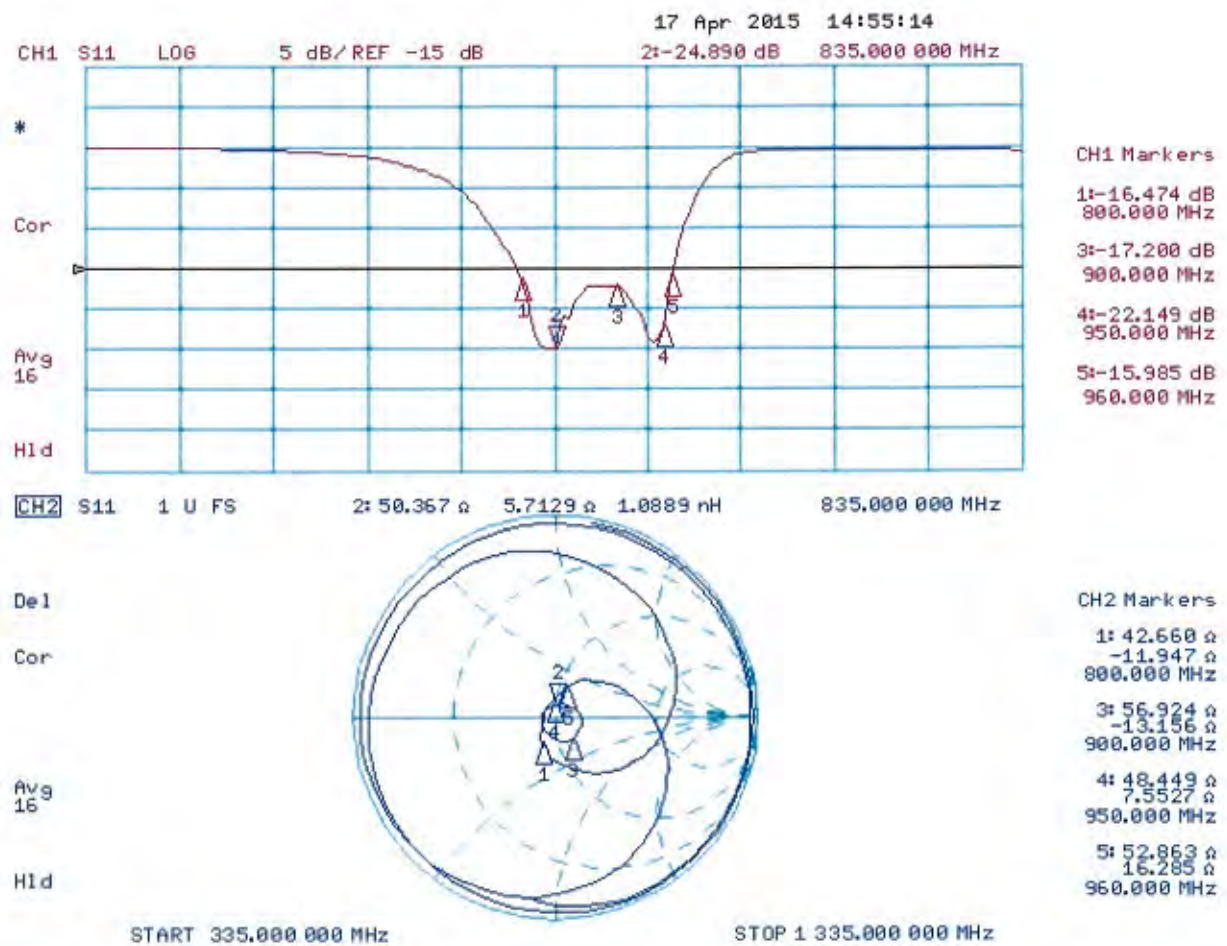
The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

# Impedance Measurement Plot



## DASY5 E-field Result

Date: 17.04.2015

Test Laboratory: SPEAG Lab2

**DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1064**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: RF Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 31.12.2014;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 12.09.2014
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole E-Field measurement @ 835MHz/E-Scan - 835MHz d=15mm/Hearing Aid Compatibility Test (41x361x1):**

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 117.7 V/m; Power Drift = -0.02 dB

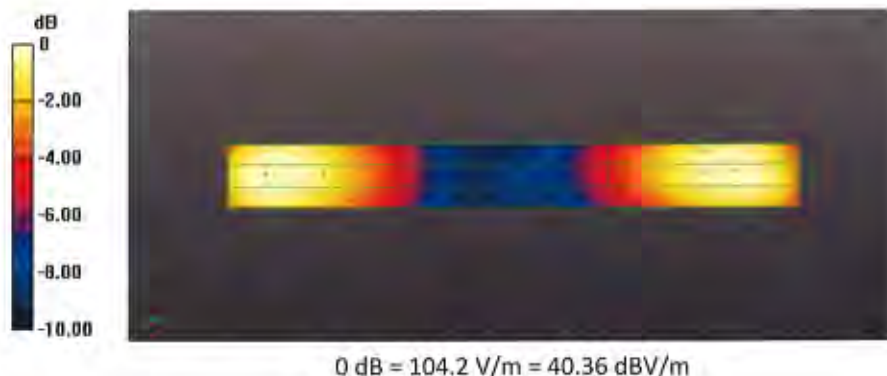
Applied MIF = 0.00 dB

RF audio interference level = 40.36 dBV/m

**Emission category: M3**

MIF scaled E-field

|             |             |             |
|-------------|-------------|-------------|
| Grid 1 M3   | Grid 2 M3   | Grid 3 M3   |
| 40.11 dBV/m | 40.36 dBV/m | 40.24 dBV/m |
| Grid 4 M4   | Grid 5 M4   | Grid 6 M4   |
| 35.56 dBV/m | 35.85 dBV/m | 35.84 dBV/m |
| Grid 7 M4   | Grid 8 M3   | Grid 9 M3   |
| 39.89 dBV/m | 40.19 dBV/m | 40.14 dBV/m |





Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Client **TCC Microsoft**

Certificate No: **CD1880V3-1052\_Apr15**

## CALIBRATION CERTIFICATE

Object **CD1880V3 - SN: 1052**

Calibration procedure(s) **QA CAL-20.v6  
Calibration procedure for dipoles in air**

Calibration date: **April 17, 2015**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID #               | Cal Date (Certificate No.)     | Scheduled Calibration |
|----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A       | GB37480704         | 07-Oct-14 (No. 217-02020)      | Oct-15                |
| Power sensor HP 8481A      | US37292783         | 07-Oct-14 (No. 217-02020)      | Oct-15                |
| Power sensor HP 8481A      | MY41092317         | 07-Oct-14 (No. 217-02021)      | Oct-15                |
| Reference 10 dB Attenuator | SN: 5047.2 / 06327 | 01-Apr-15 (No. 217-02130)      | Mar-16                |
| Probe ER3DV6               | SN: 2336           | 31-Dec-14 (No. ER3-2336_Dec14) | Dec-15                |
| Probe H3DV6                | SN: 6065           | 31-Dec-14 (No. H3-6065_Dec14)  | Dec-15                |
| DAE4                       | SN: 781            | 12-Sep-14 (No. DAE4-781_Sep14) | Sep-15                |

| Secondary Standards       | ID #           | Check Date (in house)             | Scheduled Check        |
|---------------------------|----------------|-----------------------------------|------------------------|
| Power meter Agilent 4419B | SN: GB42420191 | 09-Oct-09 (in house check Sep-14) | In house check: Sep-16 |
| Power sensor HP E4412A    | SN: US38485102 | 05-Jan-10 (in house check Sep-14) | In house check: Sep-16 |
| Power sensor HP 8482A     | SN: US37295597 | 09-Oct-09 (in house check Sep-14) | In house check: Sep-16 |
| Network Analyzer HP 8753E | US37390585     | 18-Oct-01 (in house check Oct-14) | In house check: Oct-15 |
| RF generator R&S SMT-06   | SN: 832283/011 | 27-Aug-12 (in house check Oct-13) | In house check: Oct-16 |

Calibrated by: **Claudio Leubler** Name: **Claudio Leubler** Function: **Laboratory Technician**

Approved by: **Fin Bornholt** Name: **Fin Bornholt** Function: **Deputy Technical Manager**

Signature

Issued: April 17, 2015

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

## References

- [1] ANSI-C63.19-2011  
American National Standard, Methods of Measurement of Compatibility between Wireless Communications  
Devices and Hearing Aids.

## Methods Applied and Interpretation of Parameters:

- Coordinate System:** y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with the standards [1], the measurement planes (probe sensor center) are selected to be at a distance of 15 mm above the top metal edge of the dipole arms.
- Measurement Conditions:** Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- Antenna Positioning:** The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections. It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY5 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- Feed Point Impedance and Return Loss:** These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminated by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- E-field distribution:** E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 15 mm (in z) above the metal top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, in the plane above the dipole surface.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

|                                    |                      |         |
|------------------------------------|----------------------|---------|
| DASY Version                       | DASY5                | V52.8.8 |
| Phantom                            | HAC Test Arch        |         |
| Distance Dipole Top - Probe Center | 15 mm                |         |
| Scan resolution                    | dx, dy = 5 mm        |         |
| Frequency                          | 1880 MHz $\pm$ 1 MHz |         |
| Input power drift                  | < 0.05 dB            |         |

## Maximum Field values at 1880 MHz

| E-field 15 mm above dipole surface | condition         | Interpolated maximum       |
|------------------------------------|-------------------|----------------------------|
| Maximum measured above high end    | 100mW input power | 89.8V/m = 39.07 dBV/m      |
| Maximum measured above low end     | 100mW input power | 89.0V/m = 38.99 dBV/m      |
| Averaged maximum above arm         | 100mW input power | 89.4V/m $\pm$ 12.8 % (k=2) |

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters

| Frequency | Return Loss | Impedance                      |
|-----------|-------------|--------------------------------|
| 1730 MHz  | 22.0 dB     | 48.6 $\Omega$ + 7.7 j $\Omega$ |
| 1880 MHz  | 20.5 dB     | 51.4 $\Omega$ + 9.5 j $\Omega$ |
| 1900 MHz  | 20.8 dB     | 54.4 $\Omega$ + 8.5 j $\Omega$ |
| 1950 MHz  | 26.5 dB     | 54.8 $\Omega$ - 1.1 j $\Omega$ |
| 2000 MHz  | 21.4 dB     | 42.2 $\Omega$ - 0.4 j $\Omega$ |

### 3.2 Antenna Design and Handling

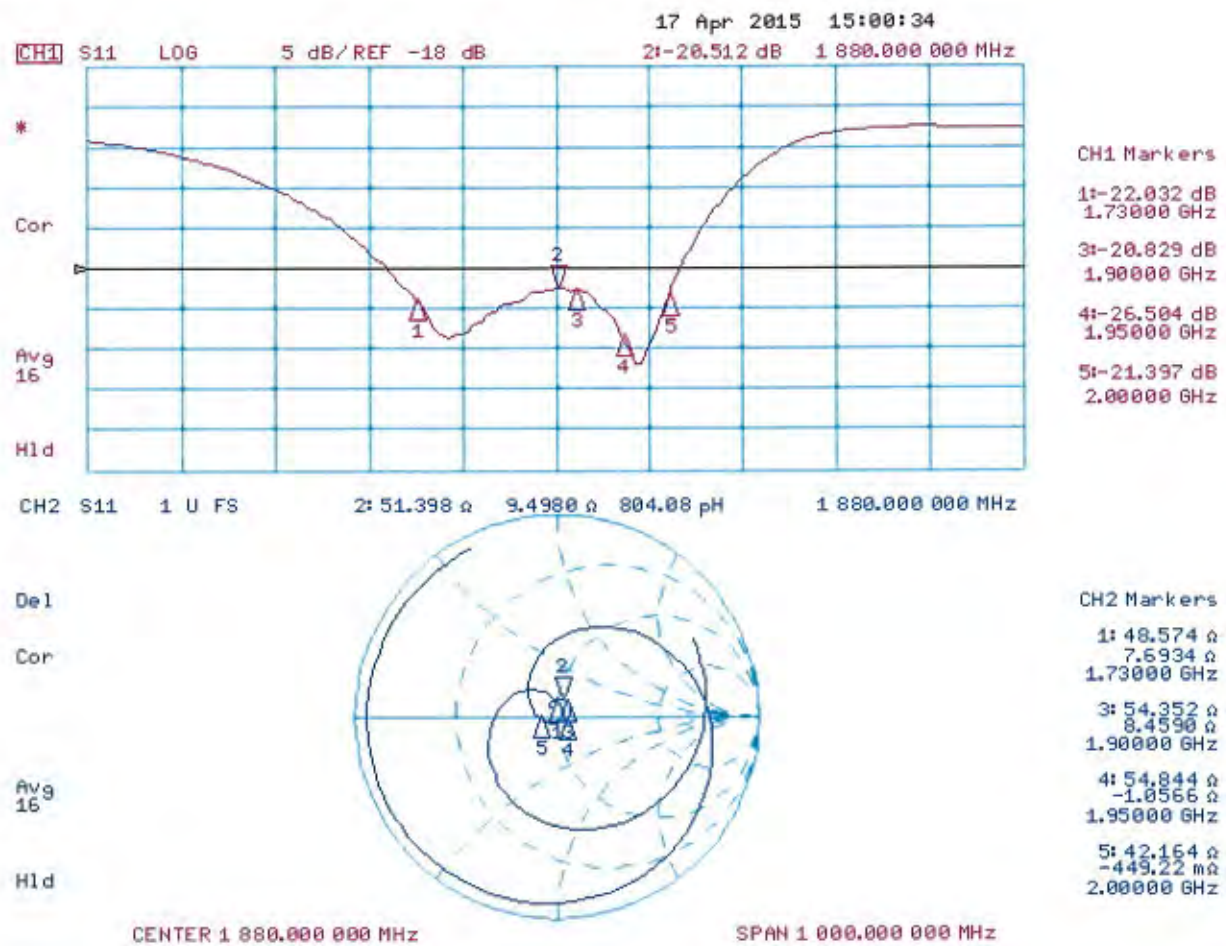
The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Impedance Measurement Plot



## DASY5 E-field Result

Date: 17.04.2015

Test Laboratory: SPEAG Lab2

**DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1052**

Communication System: UID 0 - CW; Frequency: 1880 MHz

Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: RF Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 31.12.2014;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 12.09.2014
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole E-Field measurement @ 1880MHz/E-Scan - 1880MHz d=15mm/Hearing Aid Compatibility Test (41x181x1):**

Interpolated grid; dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 136.7 V/m; Power Drift = -0.04 dB

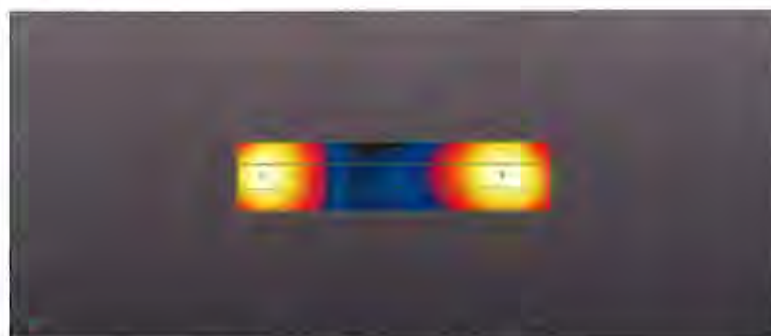
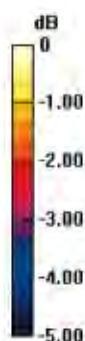
Applied MIF = 0.00 dB

RF audio interference level = 38.99 dBV/m

**Emission category: M2**

MIF scaled E-field

|             |             |             |
|-------------|-------------|-------------|
| Grid 1 M2   | Grid 2 M2   | Grid 3 M2   |
| 38.77 dBV/m | 38.99 dBV/m | 38.87 dBV/m |
| Grid 4 M2   | Grid 5 M2   | Grid 6 M2   |
| 36.57 dBV/m | 36.75 dBV/m | 36.69 dBV/m |
| Grid 7 M2   | Grid 8 M2   | Grid 9 M2   |
| 38.74 dBV/m | 38.91 dBV/m | 38.79 dBV/m |



0 dB = 89.02 V/m = 38.99 dBV/m