



# TEST REPORT

No. B23N01649-HAC RF

For

**DIALN PRODUCTS INC**

**Smart Phone**

**Model Name: Nova**

**With**

**Hardware Version: YK583-MB-V0.1**

**Software Version: DILAN\_nova\_maxsip\_v1.0\_20230925\_1110**

**FCC ID: 2BAHU2023024**

**Results Summary: M Category = M3**

**Issued Date: 2023-11-02**

**Designation Number: CN1210**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

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## **REPORT HISTORY**

| <b>Report Number</b> | <b>Revision</b> | <b>Description</b> | <b>Issue Date</b> |
|----------------------|-----------------|--------------------|-------------------|
| B23N01649-HAC RF     | Rev.0           | 1st edition        | 2023-11-02        |



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## 1. Summary of Test Report

### 1.1. Test Items

|                      |                    |
|----------------------|--------------------|
| Description:         | Smart Phone        |
| Model Name:          | Nova               |
| Applicant's Name:    | DIALN PRODUCTS INC |
| Manufacturer's Name: | DIALN PRODUCTS INC |

### 1.2. Test Standards

ANSI C63.19-2011

### 1.3. Test Result

Pass

### 1.4. Testing Location

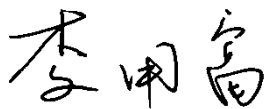
Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China

### 1.5. Project Data

Testing Start Date: 2023-10-18

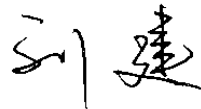
Testing End Date: 2023-10-29

### 1.6. Signature



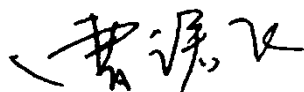
Li Yongfu

(Prepared this test report)



Liu Jian

(Reviewed this test report)



Cao Junfei

(Approved this test report)

## 2. Client Information

### 2.1. Applicant Information

|               |                                                |
|---------------|------------------------------------------------|
| Company Name: | DIALN PRODUCTS INC                             |
| Address:      | 8312 Page Ave, St. Louis, Missouri, 63130, USA |
| City:         | /                                              |
| Country:      | USA                                            |
| Telephone:    | /                                              |

### 2.2. Manufacturer Information

|               |                                                |
|---------------|------------------------------------------------|
| Company Name: | DIALN PRODUCTS INC                             |
| Address:      | 8312 Page Ave, St. Louis, Missouri, 63130, USA |
| City:         | /                                              |
| Country:      | USA                                            |
| Telephone:    | /                                              |

### 3. Equipment under Test (EUT) and Ancillary Equipment (AE)

#### 3.1. About EUT

|                               |                                                                                                        |
|-------------------------------|--------------------------------------------------------------------------------------------------------|
| Description:                  | Smart Phone                                                                                            |
| Mode Name:                    | Nova                                                                                                   |
| Condition of EUT as received: | No obvious damage in appearance                                                                        |
| Frequency Bands:              | GSM 850/1900,<br>WCDMA Band 2/4/5,<br>LTE Band 2/4/5/12/13/17/41/66/71,<br>Bluetooth, WLAN 2.4GHz/5GHz |

#### 3.2. Internal Identification of EUT used during the test

| EUT ID* | IMEI            | HW Version    | SW Version                           | Receipt Date |
|---------|-----------------|---------------|--------------------------------------|--------------|
| UT01aa  | 867996067151388 | YK583-MB-V0.1 | DILAN_nova_maxsip_v1.0_20230925_1110 | 2023-10-13   |
| UT02aa  | 357949390000085 | YK583-MB-V0.1 | DILAN_nova_maxsip_v1.0_20230925_1110 | 2023-10-13   |

\*EUT ID: is used to identify the test sample in the lab internally.

**Note:** It is performed to test HAC with the UT01aa & UT02aa.

#### 3.3. Internal Identification of AE used during the test

| AE ID* | Description | Model | Manufacturer |
|--------|-------------|-------|--------------|
| /      | /           | /     | /            |

\*AE ID: is used to identify the test sample in the lab internally.

### 3.4. Air Interfaces / Bands Indicating Operating Modes

| Air-interface | Band(MHz)            | Type | C63.19 / tested | Simultaneous Transmissions | Name of Voice Service |
|---------------|----------------------|------|-----------------|----------------------------|-----------------------|
| GSM           | GSM 850/1900         | VO   | Yes             | BT,WLAN                    | CMRS Voice            |
|               | EDGE                 | VD   | Yes             | BT,WLAN                    | Google Meet           |
| WCDMA         | B2/B4/B5             | VO   | No              | BT,WLAN                    | CMRS Voice            |
|               | HSPA                 | VD   | No              | BT,WLAN                    | Google Meet           |
| LTE (FDD)     | 2/4/5/12/13/17/66/71 | VD   | No              | BT,WLAN                    | VoLTE, Google Meet    |
| LTE (TDD)     | 41                   | VD   | Yes             | BT,WLAN                    | VoLTE, Google Meet    |
| WLAN          | 2.4GHz               | VD   | No              | WWAN                       | VoWIFI, Google Meet   |
| WLAN          | 5GHz                 | VD   | No              | WWAN                       | VoWIFI, Google Meet   |
| Bluetooth     | 2.4GHz               | DT   | No              | WWAN                       | NA                    |

VO: Voice CMRS/PSTN Service Only

VD: Voice CMRS/PSTN and Data Service

DT: Digital Transport

#### 4. Reference Documents

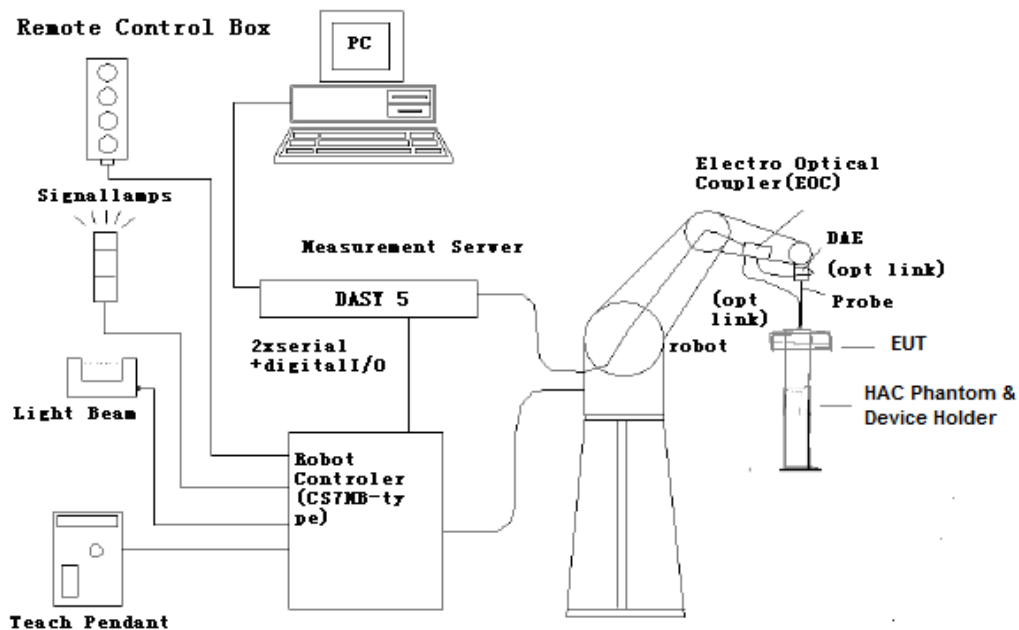
The following document listed in this section is referred for testing.

| Reference        | Title                                                                                                                                          | Version |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| ANSI C63.19-2011 | American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids                 | 2011    |
| KDB 285076 D01   | Equipment Authorization Guidance for Hearing Aid Compatibility                                                                                 | v06r02  |
| KDB 285076 D02   | Guidance for performing T-Coil tests for air interfaces supporting voice over IP (e.g., LTE and WiFi) to support CMRS based telephone services | v04     |
| KDB 285076 D03   | Hearing Aid Compatibility Frequently Asked Questions                                                                                           | v01r06  |

## 5. Operational Conditions During Test

### 5.1. HAC Measurement Set-up

These measurements are performed using the DASY5 NEO automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Stäubli), robot controller, Intel Core2 computer, near-field probe, probe alignment sensor. The robot is a six-axis industrial robot performing precise movements. A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The PC consists of the HP Intel Core2 1.86 GHz computer with Windows XP system and HAC Measurement Software DASY5 NEO, A/D interface card, monitor, mouse, and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.



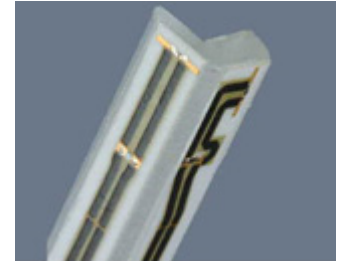
**Fig. 1 HAC Test Measurement Set-up**

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

## 5.2. Probe Specification

### E-Field Probe Description

|               |                                                                                                                               |
|---------------|-------------------------------------------------------------------------------------------------------------------------------|
| Construction  | One dipole parallel, two dipoles normal to probe axis<br>Built-in shielding against static charges<br>PEEK enclosure material |
| Calibration   | In air from 100 MHz to 3.0 GHz (absolute accuracy $\pm 6.0\%$ , $k=2$ )                                                       |
| Frequency     | 40 MHz to > 6 GHz (can be extended to < 20 MHz)<br>Linearity: $\pm 0.2$ dB (100 MHz to 3 GHz)                                 |
| Directivity   | $\pm 0.2$ dB in air (rotation around probe axis)<br>$\pm 0.4$ dB in air (rotation normal to probe axis)                       |
| Dynamic Range | 2 V/m to > 1000 V/m; Linearity: $\pm 0.2$ dB                                                                                  |
| Dimensions    | Overall length: 330 mm (Tip: 16 mm)<br>Tip diameter: 8 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 2.5 mm  |
| Application   | General near-field measurements up to 6 GHz<br>Field component measurements<br>Fast automatic scanning in phantoms            |



**[ER3DV6]**

### 5.3. Test Arch Phantom & Phone Positioner

The Test Arch phantom should be positioned horizontally on a stable surface. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. It enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot (Dimensions: 370 x 370 x 370 mm).

The Phone Positioner supports accurate and reliable positioning of any phone with effect on near field  $< \pm 0.5$  dB.

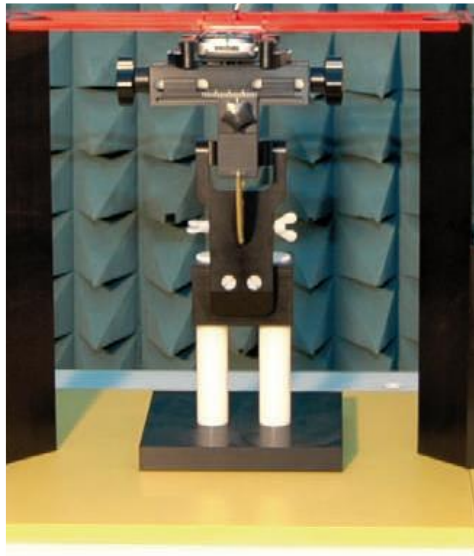


Fig. 2 HAC Phantom & Device Holder

### 5.4. Robotic System Specifications

#### Specifications

**Positioner:** Stäubli Unimation Corp. Robot Model: RX160XL

**Repeatability:**  $\pm 0.02$  mm

**No. of Axis:** 6

#### Data Acquisition Electronic (DAE) System

**Cell Controller**

**Processor:** Intel Core2

**Clock Speed:** 1.86 GHz

**Operating System:** Windows XP

**Data Converter**

**Features:** Signal Amplifier, multiplexer, A/D converter, and control logic

**Software:** DASY5 software

**Connecting Lines:** Optical downlink for data and status info.

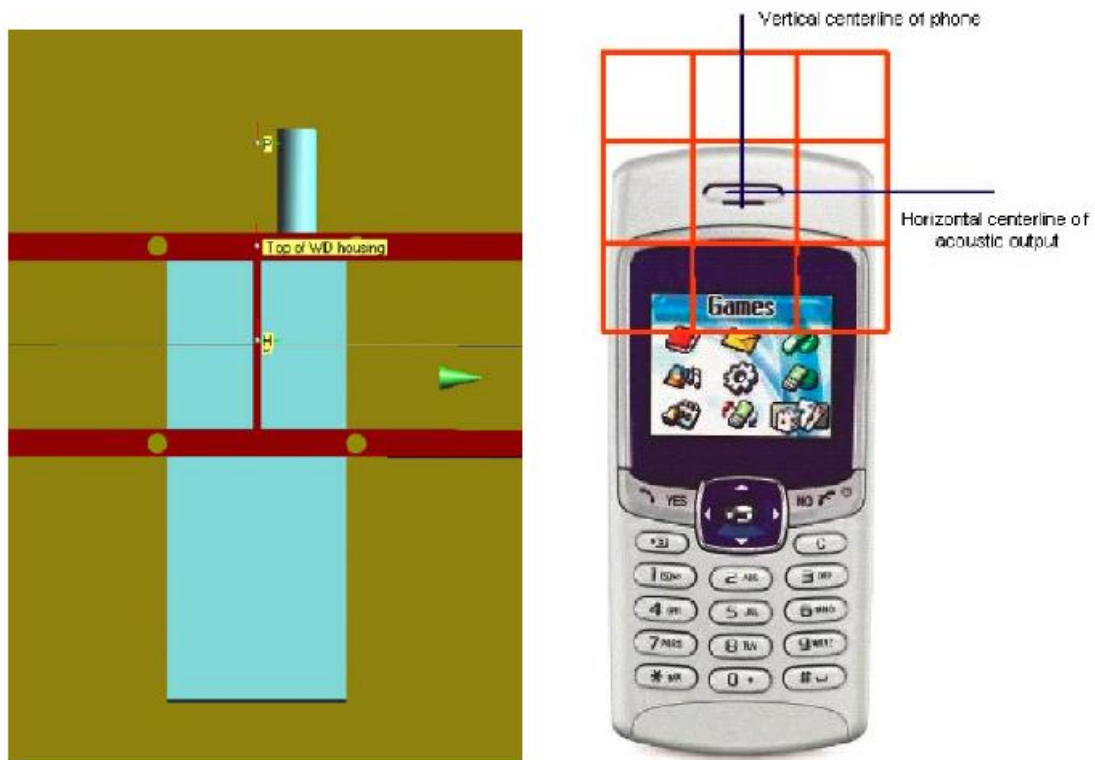
Optical uplink for commands and clock

## 6. EUT Arrangement

### 6.1. WD RF Emission Measurements Reference and Plane

Figure 4 illustrates the references and reference plane that shall be used in the WD emissions measurement.

- The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.
- The grid is centered on the audio frequency output transducer of the WD (speaker or T-coil).
- The grid is located by reference to a reference plane. This reference plane is the planar area that contains the highest point in the area of the WD that normally rests against the user's ear
- The measurement plane is located parallel to the reference plane and 15 mm from it, out from the phone. The grid is located in the measurement plane.



**Fig. 3 WD reference and plane for RF emission measurements**

## 7. System Validation

### 7.1. Validation Procedure

Place a dipole antenna meeting the requirements given in ANSI C63.19 in the position normally occupied by the WD. The dipole antenna serves as a known source for an electrical output. Position the E-field probes so that:

- The probes and their cables are parallel to the coaxial feed of the dipole antenna
- The probe cables and the coaxial feed of the dipole antenna approach the measurement area from opposite directions
- The center point of the probe element(s) are 15 mm from the closest surface of the dipole elements.

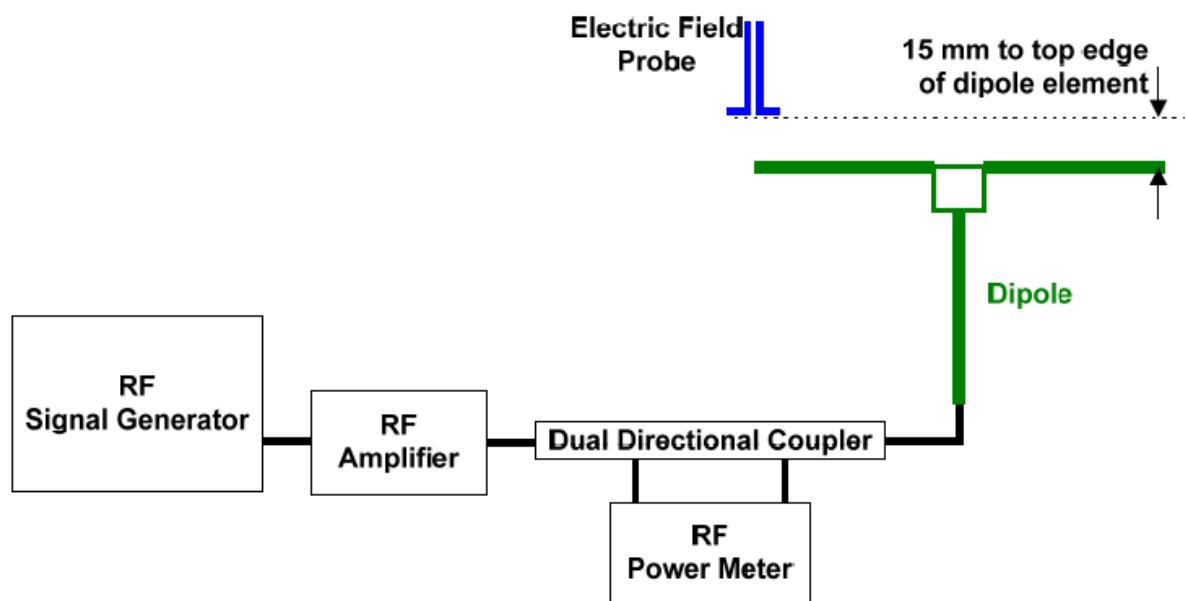


Fig. 4 Dipole Validation Setup

### 7.2. Validation Result

| E-Field Scan |                 |                  |                                    |                                  |                            |                        |
|--------------|-----------------|------------------|------------------------------------|----------------------------------|----------------------------|------------------------|
| Mode         | Frequency (MHz) | Input Power (mW) | Measured <sup>1</sup> Value(dBV/m) | Target <sup>2</sup> Value(dBV/m) | Deviation <sup>3</sup> (%) | Limit <sup>4</sup> (%) |
| CW           | 835             | 100              | 42.36                              | 41.15                            | 2.94                       | ±25                    |
| CW           | 1880            | 100              | 38.55                              | 38.93                            | -0.98                      | ±25                    |
| CW           | 2600            | 100              | 39.71                              | 38.62                            | 2.82                       | ±25                    |

Notes:

1. Please refer to the attachment for detailed measurement data and plot.
2. Target value is provided by SPEAD in the calibration certificate of specific dipoles.
3. Deviation (%) =  $100 * (\text{Measured value minus Target value})$  divided by Target value.
4. ANSI C63.19 requires values within  $\pm 25\%$  are acceptable, of which 12% is deviation and 13% is measurement uncertainty. Values independently validated for the dipole actually used in the measurements should be used, when available.

## 8. Modulation Interference Factor (MIF)

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 level (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 and repetition rates of few 100 Hz have high MIF values and give similar classifications as ANSI C63-2007.

### Definitions

ER3D, E-field probes have a bandwidth <10 kHz and can therefore not evaluate the RF envelope in the full audio band. DASY52 is therefore using the “indirect” measurement method according to ANSI C63.19-2011 which is the primary method. These near field probes read the averaged E-field measurement. Especially for the new high peak-to-average (PAR) signal types, the probes shall be linearized by probe modulation response (PMR) calibration in order to not overestimate the field reading.

The evaluation method or the MIF is defined in ANSI C63.19-2011 section D.7. An RMS demodulated RF signal is fed to a spectral filter (similar to an A weighting filter) and forwarded to a temporal filter acting as a quasi-peak detector. The averaged output of these filtering is called to a 1 kHz 80% AM signal as reference. MIF measurement requires additional instrumentation and is not well suited for evaluation by the end user with reasonable uncertainty. It may alternatively be determined through analysis and simulation, because it is constraint and characteristic for a communication signal. DASY52 uses well defined signals for PMR calibration. The MIF of these signals has been determined by simulation and is automatically applied.

MIF values were not tested by a probe or as specified in the standards but are based on analysis provided by SPEAG for all the air interfaces (GSM, WCDMA, CDMA, LTE). The data included in this report are for the worst case operating modes. The UIDs used are listed below:

| UID   | Communication System Name                      | MIF (dB) |
|-------|------------------------------------------------|----------|
| 10021 | GSM-FDD (TDMA, GMSK)                           | 3.63     |
| 10460 | UMTS-FDD (WCDMA, AMR)                          | -25.43   |
| 10097 | UMTS-FDD (HSDPA)                               | -20.75   |
| 10170 | LTE-FDD(SC-FDMA, 1RB, 20MHz, 16-QAM )          | -9.76    |
| 10176 | LTE-FDD(SC-FDMA, 1RB, 10MHz, 16-QAM )          | -9.76    |
| 10173 | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16QAM)         | -1.44    |
| 10061 | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)      | -2.02    |
| 10077 | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps) | 0.12     |
| 10069 | IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)      | -3.15    |

A PMR calibrated probe is linearized for the selected waveform over the full dynamic range within the uncertainty specified in its calibration certificate. ER3D, EF3D and EU2D E-field probes have a bandwidth <10 kHz and can therefore not evaluate the RF envelope in the full audio band. DASY52 is therefore using the "indirect" measurement method according to ANSI C63.19-2011 which is the primary method. These near field probes read the averaged E-field measurement. 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.

The MIF measurement uncertainty is estimated as follows, for modulation frequencies from slotted waveforms with fundamental frequency and at least 2 harmonics within 10 kHz:

- 0.2 dB for MIF -7 to +5 dB,
- 0.5 dB for MIF -13 to +11 dB
- 1 dB for MIF > -20 dB

## 9. Evaluation for low-power exemption

### 9.1. Product testing threshold

There are two methods for exempting an RF air interface technology from testing. The first method requires evaluation of the MIF for the worst-case operating mode. An RF air interface technology of a device is exempt from testing when its average antenna input power plus its MIF is  $\leq 17$  dBm for any of its operating modes. The second method does not require determination of the MIF. The RF emissions testing exemption shall be applied to an RF air interface technology in a device whose peak antenna input power, averaged over intervals  $\leq 50 \mu s$ , is  $\leq 23$  dBm. An RF air interface technology that is exempted from testing by either method shall be rated as M4.

The first method is used to be exempt from testing for the RF air interface technology in this report.

### 9.2. Average conducted power

| Band                 | Power (dBm) | MIF (dB) | Sum (dBm) | HAC Test |
|----------------------|-------------|----------|-----------|----------|
| GSM 850              | 33.5        | 3.63     | 37.13     | Yes      |
| GSM 1900             | 30.0        | 3.63     | 33.63     | Yes      |
| WCDMA Band 2         | 22.5        | -25.43   | -2.93     | No       |
| WCDMA Band 2 - HSDPA | 21.5        | -20.75   | 0.75      | No       |
| WCDMA Band 4         | 23.5        | -25.43   | -1.93     | No       |
| WCDMA Band 4 - HSDPA | 22.5        | -20.75   | 1.75      | No       |
| WCDMA Band 5         | 23.5        | -25.43   | -1.93     | No       |
| WCDMA Band 5 - HSDPA | 22.5        | -20.75   | 1.75      | No       |
| LTE Band 2           | 24.0        | -9.76    | 14.24     | No       |
| LTE Band 4           | 25.0        | -9.76    | 15.24     | No       |
| LTE Band 5           | 25.0        | -9.76    | 15.24     | No       |
| LTE Band 12          | 24.5        | -9.76    | 14.74     | No       |
| LTE Band 13          | 24.5        | -9.76    | 14.74     | No       |
| LTE Band 17          | 24.5        | -9.76    | 14.74     | No       |
| LTE Band 66          | 25.0        | -9.76    | 15.24     | No       |
| LTE Band 71          | 24.0        | -9.76    | 14.24     | No       |
| LTE Band 41          | 23.5        | -1.44    | 22.06     | Yes      |
| WLAN 2.4GHz 802.11b  | 16.0        | -2.02    | 13.98     | No       |
| WLAN 2.4GHz 802.11g  | 15.0        | 0.12     | 15.12     | No       |
| WLAN 5GHz            | 16.0        | -3.15    | 12.85     | No       |

**Note:** Power = Max tune-up limit

## 10. RF Test Procedures

**The evaluation was performed with the following procedure:**

- 1) Confirm proper operation of the field probe, probe measurement system and other instrumentation and the positioning system.
- 2) Position the WD in its intended test position. The gauge block can simplify this positioning.
- 3) Configure the WD normal operation for maximum rated RF output power, at the desired channel and other operating parameters (e.g., test mode), as intended for the test.
- 4) The center sub-grid shall be centered on the center of the T-Coil mode axial measurement point or the acoustic output, as appropriate. Locate the field probe at the initial test position in the 50 mm by 50 mm grid, which is contained in the measurement plane. If the field alignment method is used, align the probe for maximum field reception.
- 5) Record the reading.
- 6) Scan the entire 50 mm by 50 mm region in equally spaced increments and record the reading at each measurement point. The distance between measurement points shall be sufficient to assure the identification of the maximum reading.
- 7) Identify the five contiguous sub-grids around the center sub-grid whose maximum reading is the lowest of all available choices. This eliminates the three sub-grids with the maximum readings. Thus, the six areas to be used to determine the WD's highest emissions are identified.
- 8) Identify the maximum field reading within the non-excluded sub-grids identified in Step 7)
- 9) Evaluate the MIF and add to the maximum steady-state rms field-strength reading to obtain the RF audio interference level..
- 10) Compare this RF audio interference level with the categories and record the resulting WD category rating.

## 11. Measurement Results (E-Field)

| Frequency   |        | Measured Value<br>(dBV/m) | Power Drift<br>(dB) | Category          |
|-------------|--------|---------------------------|---------------------|-------------------|
| Channel     | MHz    |                           |                     |                   |
| GSM 850     |        |                           |                     |                   |
| 251         | 848.8  | 36.37                     | 0.02                | M4 (see Fig A.1)  |
| 190         | 836.6  | 36.33                     | 0.04                | M4 (see Fig A.2)  |
| 128         | 824.2  | 34.20                     | 0.02                | M4 (see Fig A.3)  |
| GSM 1900    |        |                           |                     |                   |
| 810         | 1909.8 | 34.85                     | 0.01                | M3 (see Fig A.4)  |
| 661         | 1880.0 | 34.41                     | 0.01                | M3 (see Fig A.5)  |
| 512         | 1850.2 | 33.41                     | -0.02               | M3 (see Fig A.6)  |
| LTE Band 41 |        |                           |                     |                   |
| 41490       | 2680.0 | 21.69                     | -0.03               | M4 (see Fig A.7)  |
| 41055       | 2636.5 | 22.42                     | -0.02               | M4 (see Fig A.8)  |
| 40620       | 2593.0 | 22.59                     | -0.05               | M4 (see Fig A.9)  |
| 40185       | 2549.5 | 23.73                     | 0.03                | M4 (see Fig A.10) |
| 39750       | 2506.0 | 26.90                     | -0.04               | M4 (see Fig A.11) |

## 12. ANSI C 63.19-2011 Limits

### WD RF audio interference level categories in logarithmic units

| Emission categories |          |  | < 960 MHz         |  |
|---------------------|----------|--|-------------------|--|
|                     |          |  | E-field emissions |  |
| Category M1         | 50 to 55 |  | dB (V/m)          |  |
| Category M2         | 45 to 50 |  | dB (V/m)          |  |
| Category M3         | 40 to 45 |  | dB (V/m)          |  |
| Category M4         | < 40     |  | dB (V/m)          |  |
| Emission categories |          |  | > 960 MHz         |  |
|                     |          |  | E-field emissions |  |
| Category M1         | 40 to 45 |  | dB (V/m)          |  |
| Category M2         | 35 to 40 |  | dB (V/m)          |  |
| Category M3         | 30 to 35 |  | dB (V/m)          |  |
| Category M4         | < 30     |  | dB (V/m)          |  |

### 13. Measurement Uncertainty

| No.                                                | Error source                   | Type                                       | Uncertainty Value (%) | Prob. Dist. | k   | c <sub>i</sub> | Standard Uncertainty (%) $u_i$ (%) | Degree of freedom $V_{eff}$ or $v_i$ | source       |
|----------------------------------------------------|--------------------------------|--------------------------------------------|-----------------------|-------------|-----|----------------|------------------------------------|--------------------------------------|--------------|
| 1                                                  | System repeatability           | A                                          | 0.24                  | N           | 1   | 1              | 0.24                               | 9                                    | Measurement  |
| <b>Measurement System</b>                          |                                |                                            |                       |             |     |                |                                    |                                      |              |
| 2                                                  | Probe Calibration              | B                                          | 5.1                   | N           | 1   | 1              | 5.1                                | ∞                                    | Manufacturer |
| 3                                                  | Axial Isotropy                 | B                                          | 4.7                   | R           | √3  | 1              | 2.7                                | ∞                                    | Cal report   |
| 4                                                  | Sensor Displacement            | B                                          | 16.5                  | R           | √3  | 1              | 9.5                                | ∞                                    | Manufacturer |
| 5                                                  | Boundary Effects               | B                                          | 2.4                   | R           | √3  | 1              | 1.4                                | ∞                                    | Manufacturer |
| 6                                                  | Linearity                      | B                                          | 4.7                   | R           | √3  | 1              | 2.7                                | ∞                                    | Cal report   |
| 7                                                  | Scaling to Peak Envelope Power | B                                          | 2.0                   | R           | √3  | 1              | 1.2                                | ∞                                    | Standard     |
| 8                                                  | System Detection Limit         | B                                          | 1.0                   | R           | √3  | 1              | 0.6                                | ∞                                    | Manufacturer |
| 9                                                  | Readout Electronics            | B                                          | 0.3                   | N           | 1   | 1              | 0.3                                | ∞                                    | Manufacturer |
| 10                                                 | Response Time                  | B                                          | 0.8                   | R           | √3  | 1              | 0.5                                | ∞                                    | Manufacturer |
| 11                                                 | Integration Time               | B                                          | 2.6                   | R           | √3  | 1              | 1.5                                | ∞                                    | Manufacturer |
| 12                                                 | RF Ambient Conditions          | B                                          | 3.0                   | R           | √3  | 1              | 1.7                                | ∞                                    | Measurement  |
| 13                                                 | RF Reflections                 | B                                          | 12.0                  | R           | √3  | 1              | 6.9                                | ∞                                    | Measurement  |
| 14                                                 | Probe Positioner               | A                                          | 1.2                   | R           | √3  | 1              | 0.7                                | ∞                                    | Manufacturer |
| 15                                                 | Probe Positioning              | A                                          | 4.7                   | R           | √3  | 1              | 2.7                                | ∞                                    | Manufacturer |
| 16                                                 | Extra. And Interpolation       | B                                          | 1.0                   | R           | √3  | 1              | 0.6                                | ∞                                    | Manufacturer |
| <b>Test Sample Related</b>                         |                                |                                            |                       |             |     |                |                                    |                                      |              |
| 17                                                 | Device Positioning Vertical    | B                                          | 4.7                   | R           | √3  | 1              | 2.7                                | ∞                                    | Manufacturer |
| 18                                                 | Device Positioning Lateral     | B                                          | 1.0                   | R           | √3  | 1              | 0.6                                | ∞                                    | Manufacturer |
| 19                                                 | Device Holder and Phantom      | B                                          | 2.4                   | R           | √3  | 1              | 1.4                                | ∞                                    | Manufacturer |
| 20                                                 | Power Drift                    | B                                          | 5.0                   | R           | √3  | 1              | 2.9                                | ∞                                    | Measurement  |
| <b>Phantom and Setup related</b>                   |                                |                                            |                       |             |     |                |                                    |                                      |              |
| 21                                                 | Phantom Thickness              | B                                          | 2.4                   | R           | √3  | 1              | 1.4                                | ∞                                    | Manufacturer |
| <b>MIF related</b>                                 |                                |                                            |                       |             |     |                |                                    |                                      |              |
| 22                                                 | Monitor amplitude              | B                                          | 2.8                   | R           | √3  | 1              | 1.6                                | ∞                                    | Manufacturer |
| 23                                                 | Setup repeatability            | A                                          | 2.7                   | N           | 1   | 1              | 2.7                                | 9                                    | Manufacturer |
| 24                                                 | Sensor amplitude               | B                                          | 11.6                  | R           | √3  | 1              | 6.7                                | ∞                                    | Manufacturer |
| Combined standard uncertainty (%)                  |                                | $u_c = \sqrt{\sum_{i=1}^{24} c_i^2 u_i^2}$ |                       | 18.3        |     |                |                                    |                                      |              |
| Expanded uncertainty (Confidence interval of 95 %) |                                | $u_e = 2u_c$                               |                       | N           | k=2 |                | 36.6                               |                                      |              |

## 14. Main Test Instruments

**Table 14-1: List of Main Instruments**

| No. | Name             | Type     | Serial Number | Calibration Date | Valid Period |
|-----|------------------|----------|---------------|------------------|--------------|
| 01  | Signal Generator | E8257D   | MY47461211    | 2023-01-13       | One year     |
| 02  | Power meter      | NRP      | 102603        | 2022-12-29       | One year     |
| 03  | Power sensor     | NRP-Z51  | 102211        | 2022-12-29       | One year     |
| 04  | Amplifier        | VTL5400  | 0404          | /                | /            |
| 05  | HAC Test Arch    | N/A      | 1150          | /                | /            |
| 06  | DAE              | DAE4     | 1790          | 2023-03-02       | One year     |
| 07  | E-Field Probe    | ER3DV6   | 2424          | 2021-03-04       | Three years  |
| 08  | HAC Dipole       | CD835V3  | 1165          | 2021-05-18       | Three years  |
| 09  | HAC Dipole       | CD1880V3 | 1149          | 2021-05-18       | Three years  |
| 10  | HAC Dipole       | CD2600V3 | 1020          | 2021-05-18       | Three years  |
| 11  | BTS              | CMW500   | 152499        | 2023-07-14       | One year     |
| 12  | Software         | DASY5    | /             | /                | /            |

## ANNEX A: RF Emission Test Plot

### HAC RF E-Field GSM 850 High

Date: 2023-10-18

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, GSM (0) Frequency: 848.8 MHz Duty Cycle: 1:8.3

Probe: ER3DV6 - SN2424 ConvF(1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 51.42 V/m; Power Drift = 0.02 dB

Applied MIF = 3.63 dB

RF audio interference level = 36.37 dBV/m

**Emission category: M4**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>37.27 dBV/m | Grid 2 M4<br>37.33 dBV/m | Grid 3 M4<br>35.79 dBV/m |
| Grid 4 M4<br>36.34 dBV/m | Grid 5 M4<br>36.37 dBV/m | Grid 6 M4<br>34.98 dBV/m |
| Grid 7 M4<br>35.68 dBV/m | Grid 8 M4<br>35.5 dBV/m  | Grid 9 M4<br>34.36 dBV/m |

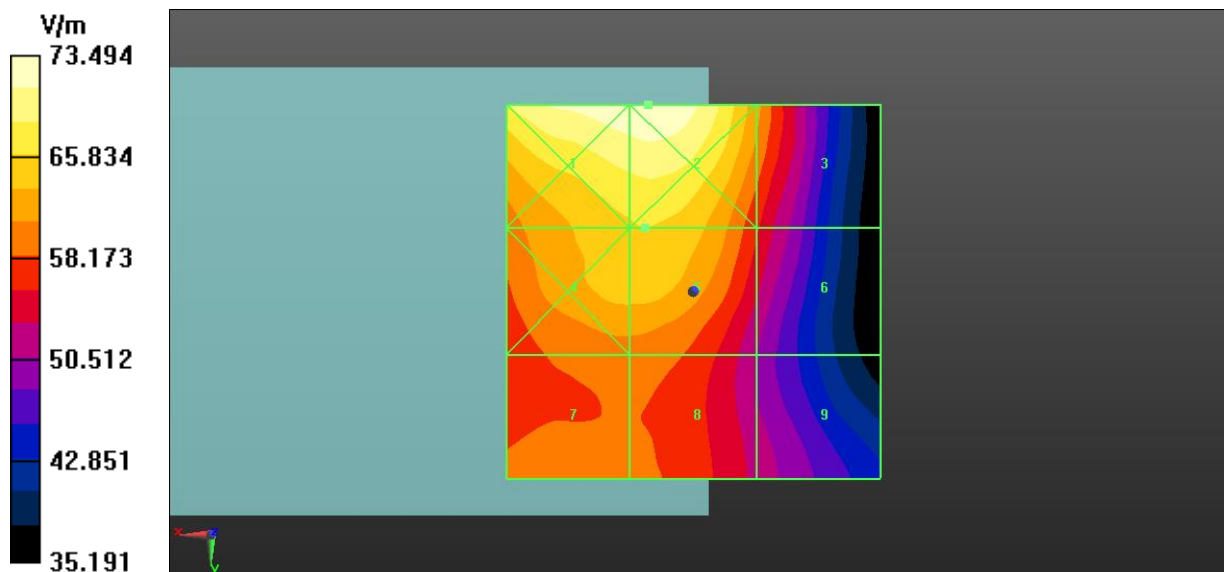


Fig A.1 HAC RF E-Field GSM 850

### HAC RF E-Field GSM 850 Middle

Date: 2023-10-18

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, GSM (0) Frequency: 836.6 MHz Duty Cycle: 1:8.3

Probe: ER3DV6 - SN2424 ConvF(1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 51.14 V/m; Power Drift = 0.04 dB

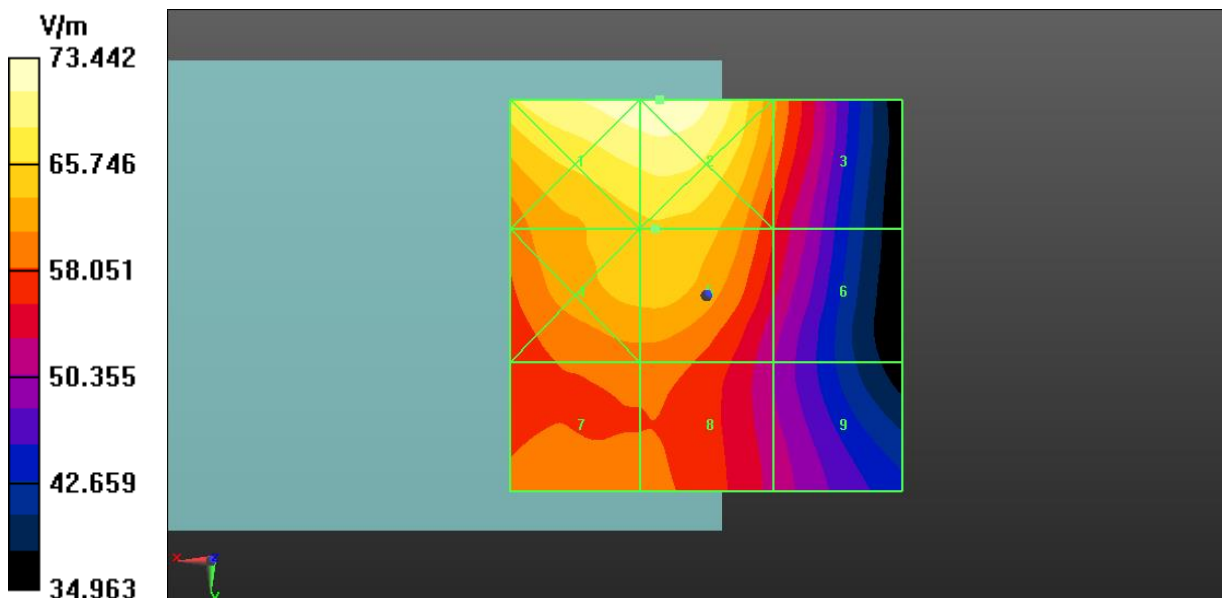
Applied MIF = 3.63 dB

RF audio interference level = 36.33 dBV/m

**Emission category: M4**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>37.27 dBV/m | Grid 2 M4<br>37.32 dBV/m | Grid 3 M4<br>35.78 dBV/m |
| Grid 4 M4<br>36.3 dBV/m  | Grid 5 M4<br>36.33 dBV/m | Grid 6 M4<br>34.95 dBV/m |
| Grid 7 M4<br>35.62 dBV/m | Grid 8 M4<br>35.47 dBV/m | Grid 9 M4<br>34.35 dBV/m |



**Fig A.2 HAC RF E-Field GSM 850**

### HAC RF E-Field GSM 850 Low

Date: 2023-10-18

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, GSM (0) Frequency: 824.2 MHz Duty Cycle: 1:8.3

Probe: ER3DV6 - SN2424 ConvF(1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 40.05 V/m; Power Drift = 0.02 dB

Applied MIF = 3.63 dB

RF audio interference level = 34.20 dBV/m

**Emission category: M4**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>35.06 dBV/m | Grid 2 M4<br>35.12 dBV/m | Grid 3 M4<br>33.55 dBV/m |
| Grid 4 M4<br>34.18 dBV/m | Grid 5 M4<br>34.2 dBV/m  | Grid 6 M4<br>32.81 dBV/m |
| Grid 7 M4<br>33.85 dBV/m | Grid 8 M4<br>33.47 dBV/m | Grid 9 M4<br>32.59 dBV/m |

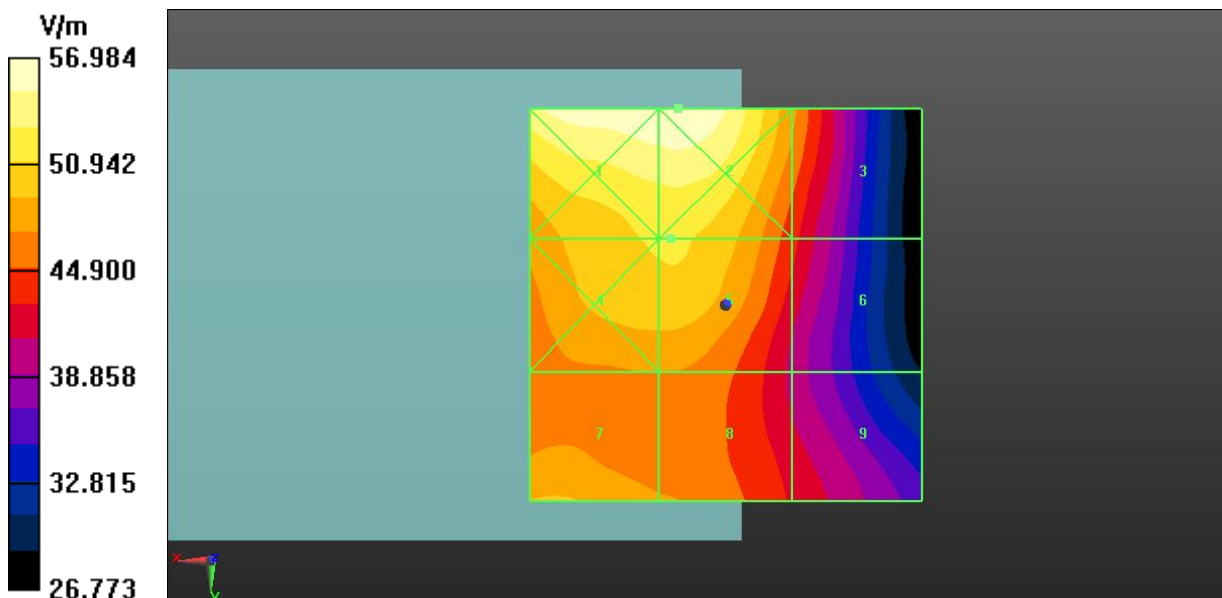


Fig A.3 HAC RF E-Field GSM 850

### HAC RF E-Field GSM 1900 High

Date: 2023-10-18

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, GSM (0) Frequency: 1909.8 MHz Duty Cycle: 1:8.3

Probe: ER3DV6 - SN2424 ConvF(1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 43.93 V/m; Power Drift = 0.01 dB

Applied MIF = 3.63 dB

RF audio interference level = 34.85 dBV/m

**Emission category: M3**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M2<br>37.76 dBV/m | Grid 2 M2<br>37.49 dBV/m | Grid 3 M2<br>35.64 dBV/m |
| Grid 4 M3<br>34.81 dBV/m | Grid 5 M3<br>34.85 dBV/m | Grid 6 M3<br>33.65 dBV/m |
| Grid 7 M3<br>33.84 dBV/m | Grid 8 M3<br>33.8 dBV/m  | Grid 9 M3<br>31.12 dBV/m |

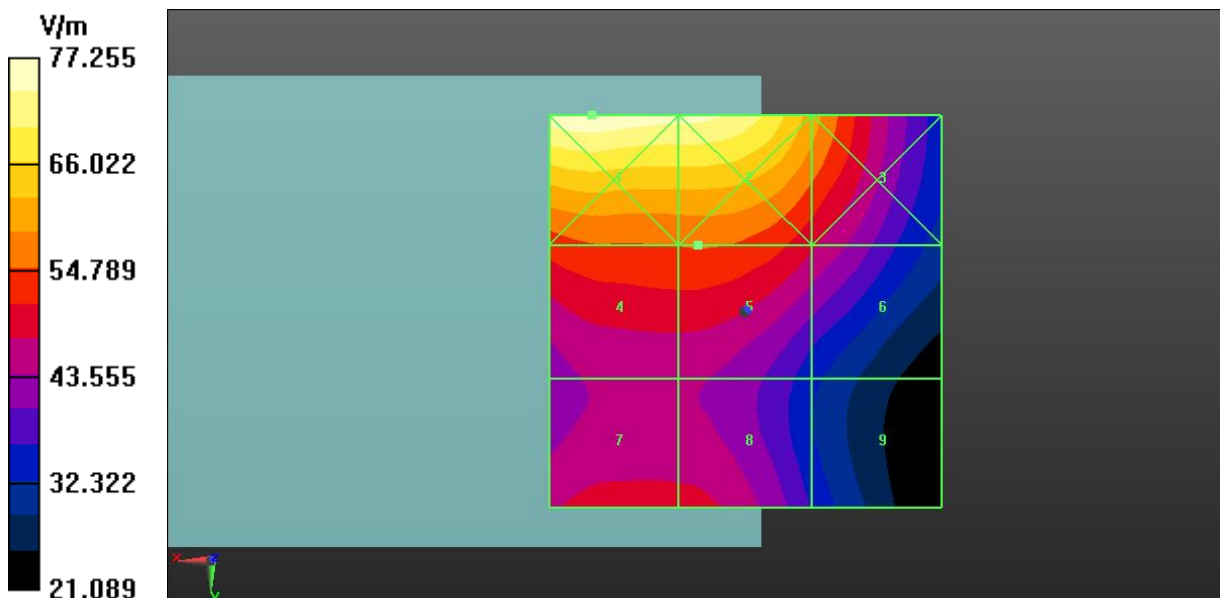


Fig A.4 HAC RF E-Field GSM 1900

### HAC RF E-Field GSM 1900 Middle

Date: 2023-10-18

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, GSM (0) Frequency: 1880 MHz Duty Cycle: 1:8.3

Probe: ER3DV6 - SN2424 ConvF(1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 41.98 V/m; Power Drift = 0.01 dB

Applied MIF = 3.63 dB

RF audio interference level = 34.41 dBV/m

**Emission category: M3**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M2<br>36.92 dBV/m | Grid 2 M2<br>36.68 dBV/m | Grid 3 M3<br>34.57 dBV/m |
| Grid 4 M3<br>34.37 dBV/m | Grid 5 M3<br>34.41 dBV/m | Grid 6 M3<br>33 dBV/m    |
| Grid 7 M3<br>32.26 dBV/m | Grid 8 M3<br>32.28 dBV/m | Grid 9 M3<br>30.04 dBV/m |

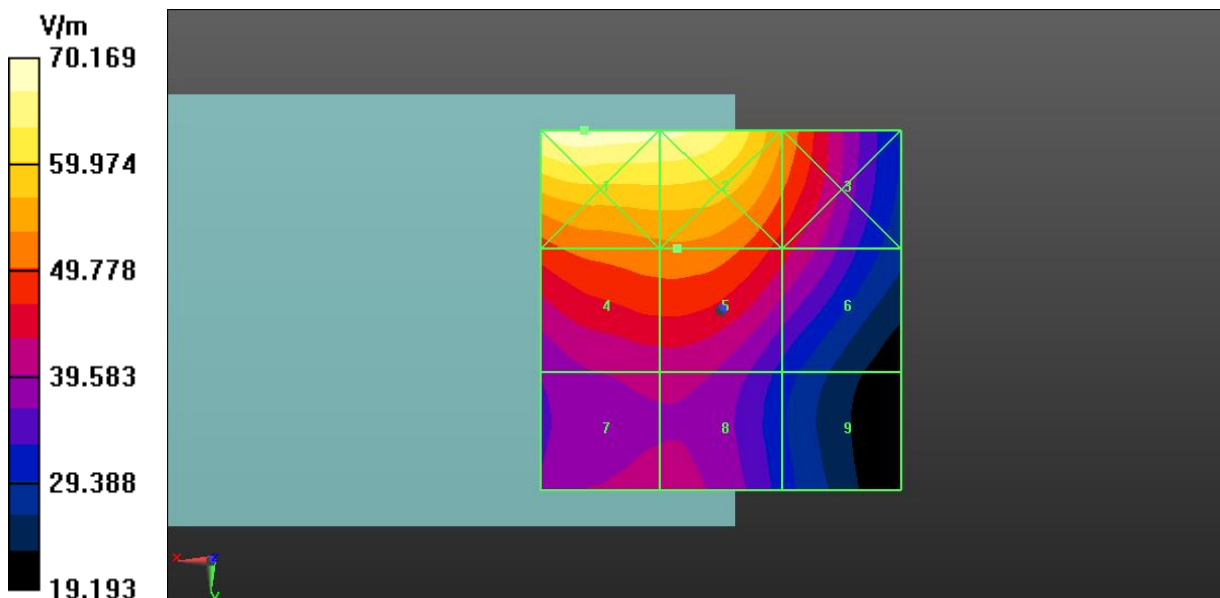


Fig A.5 HAC RF E-Field GSM 1900

### HAC RF E-Field GSM 1900 Low

Date: 2023-10-18

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, GSM (0) Frequency: 1850.2 MHz Duty Cycle: 1:8.3

Probe: ER3DV6 - SN2424 ConvF(1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 36.59 V/m; Power Drift = -0.02 dB

Applied MIF = 3.63 dB

RF audio interference level = 33.41 dBV/m

**Emission category: M3**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M2<br>35.9 dBV/m  | Grid 2 M2<br>35.76 dBV/m | Grid 3 M3<br>33.57 dBV/m |
| Grid 4 M3<br>33.36 dBV/m | Grid 5 M3<br>33.41 dBV/m | Grid 6 M3<br>31.9 dBV/m  |
| Grid 7 M3<br>30.85 dBV/m | Grid 8 M3<br>30.87 dBV/m | Grid 9 M4<br>28.92 dBV/m |

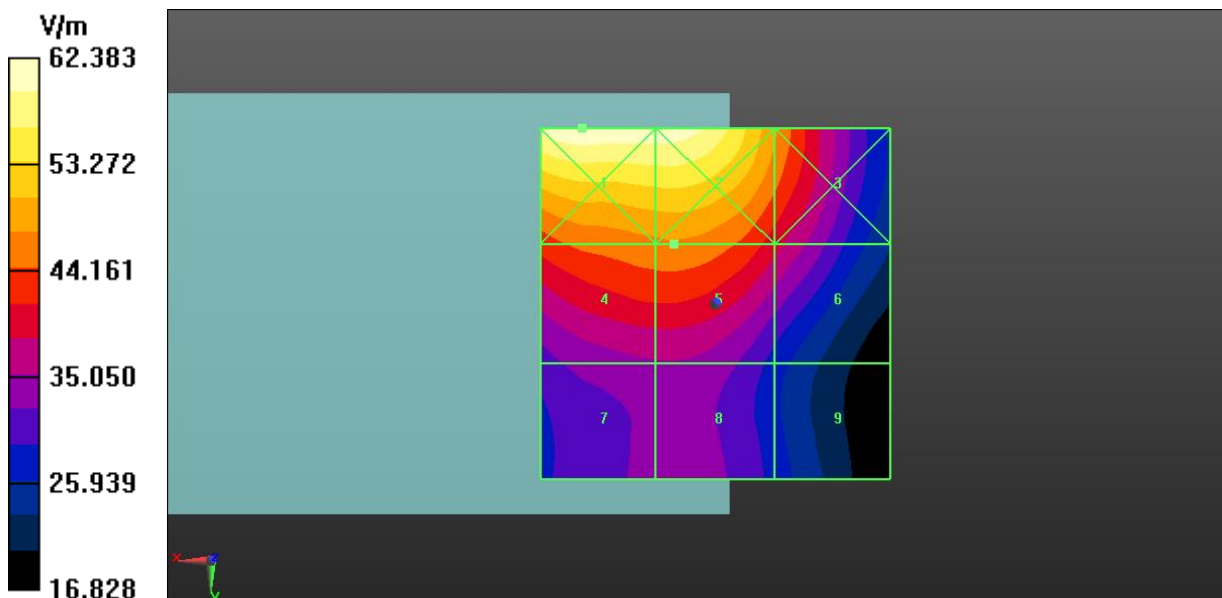


Fig A.6 HAC RF E-Field GSM 1900

# HAC RF E-Field LTE-Band 41 High

Date: 2023-10-29

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, LTE\_TDD Frequency: 2680 MHz Duty Cycle: 1:1.58

Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

## E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 17.00 V/m; Power Drift = -0.03 dB

Applied MIF = -1.44 dB

RF audio interference level = 21.69 dBV/m

**Emission category: M4**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>24.46 dBV/m | Grid 2 M4<br>23.55 dBV/m | Grid 3 M4<br>22.58 dBV/m |
| Grid 4 M4<br>21.19 dBV/m | Grid 5 M4<br>21.69 dBV/m | Grid 6 M4<br>21.4 dBV/m  |
| Grid 7 M4<br>18.8 dBV/m  | Grid 8 M4<br>19.01 dBV/m | Grid 9 M4<br>18.87 dBV/m |

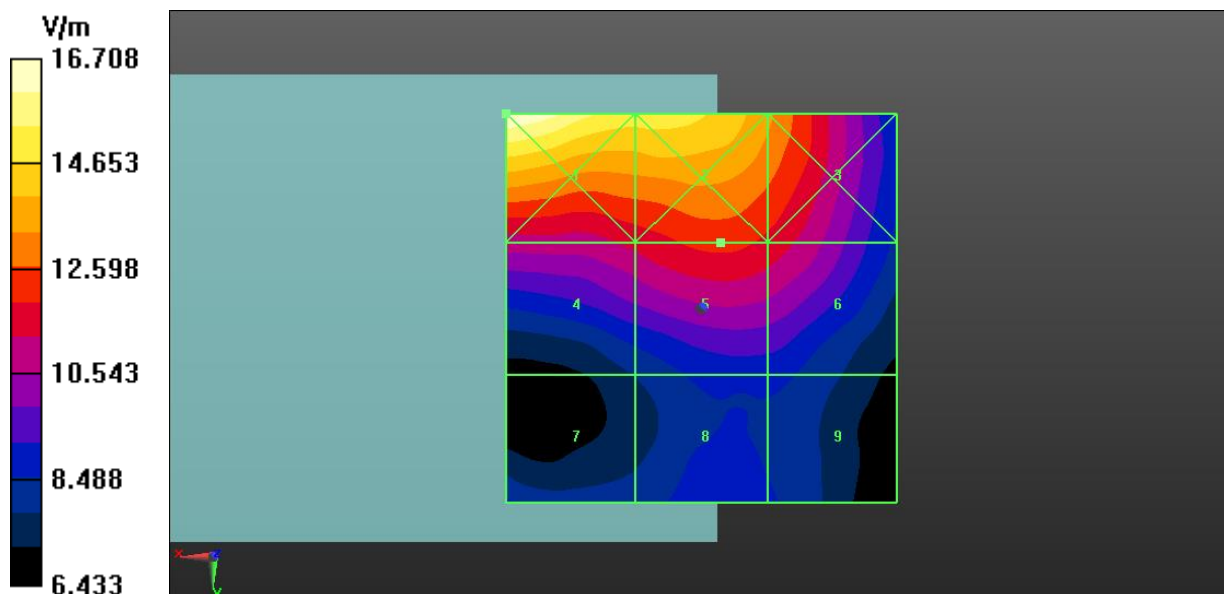


Fig A.7 HAC RF E-Field LTE-Band 41

### HAC RF E-Field LTE-Band 41 Middle-1

Date: 2023-10-29

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, LTE\_TDD Frequency: 2636.5 MHz Duty Cycle: 1:1.58

Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 19.18 V/m; Power Drift = -0.02 dB

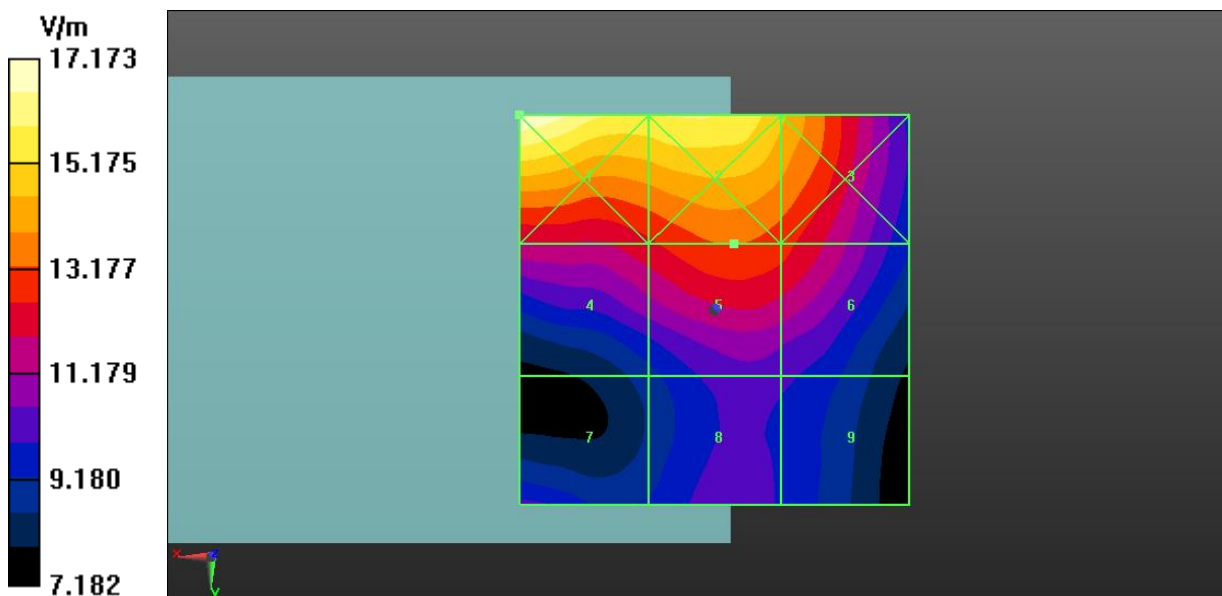
Applied MIF = -1.44 dB

RF audio interference level = 22.42 dBV/m

**Emission category: M4**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>24.7 dBV/m  | Grid 2 M4<br>24.04 dBV/m | Grid 3 M4<br>23.32 dBV/m |
| Grid 4 M4<br>21.85 dBV/m | Grid 5 M4<br>22.42 dBV/m | Grid 6 M4<br>22.15 dBV/m |
| Grid 7 M4<br>20.13 dBV/m | Grid 8 M4<br>20.27 dBV/m | Grid 9 M4<br>20.07 dBV/m |



**Fig A.8 HAC RF E-Field LTE-Band 41**

### HAC RF E-Field LTE-Band 41 Middle-2

Date: 2023-10-29

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, LTE\_TDD Frequency: 2593 MHz Duty Cycle: 1:1.58

Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 19.65 V/m; Power Drift = -0.05 dB

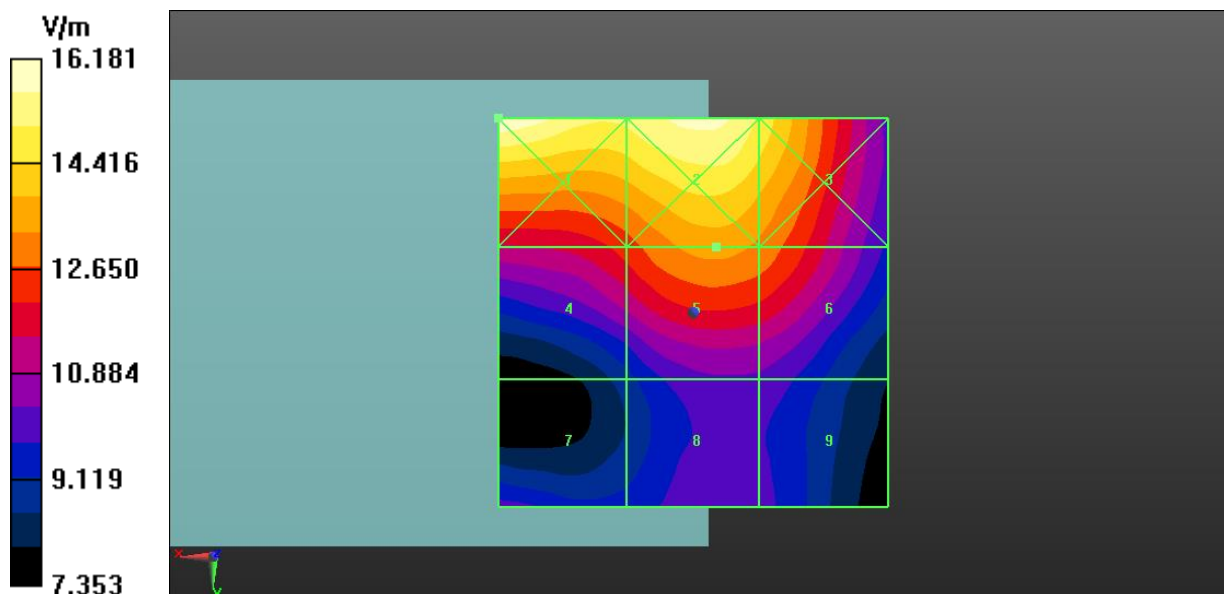
Applied MIF = -1.44 dB

RF audio interference level = 22.59 dBV/m

**Emission category: M4**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>24.18 dBV/m | Grid 2 M4<br>23.94 dBV/m | Grid 3 M4<br>23.45 dBV/m |
| Grid 4 M4<br>21.85 dBV/m | Grid 5 M4<br>22.59 dBV/m | Grid 6 M4<br>22.35 dBV/m |
| Grid 7 M4<br>20.06 dBV/m | Grid 8 M4<br>20.21 dBV/m | Grid 9 M4<br>20.17 dBV/m |



**Fig A.9 HAC RF E-Field LTE-Band 41**

### HAC RF E-Field LTE-Band 41 Middle-3

Date: 2023-10-29

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, LTE\_TDD Frequency: 2549.5 MHz Duty Cycle: 1:1.58

Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 22.63 V/m; Power Drift = 0.03 dB

Applied MIF = -1.44 dB

RF audio interference level = 23.73 dBV/m

**Emission category: M4**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>23.71 dBV/m | Grid 2 M4<br>24.94 dBV/m | Grid 3 M4<br>24.72 dBV/m |
| Grid 4 M4<br>22.28 dBV/m | Grid 5 M4<br>23.73 dBV/m | Grid 6 M4<br>23.61 dBV/m |
| Grid 7 M4<br>21.21 dBV/m | Grid 8 M4<br>21.76 dBV/m | Grid 9 M4<br>21.7 dBV/m  |

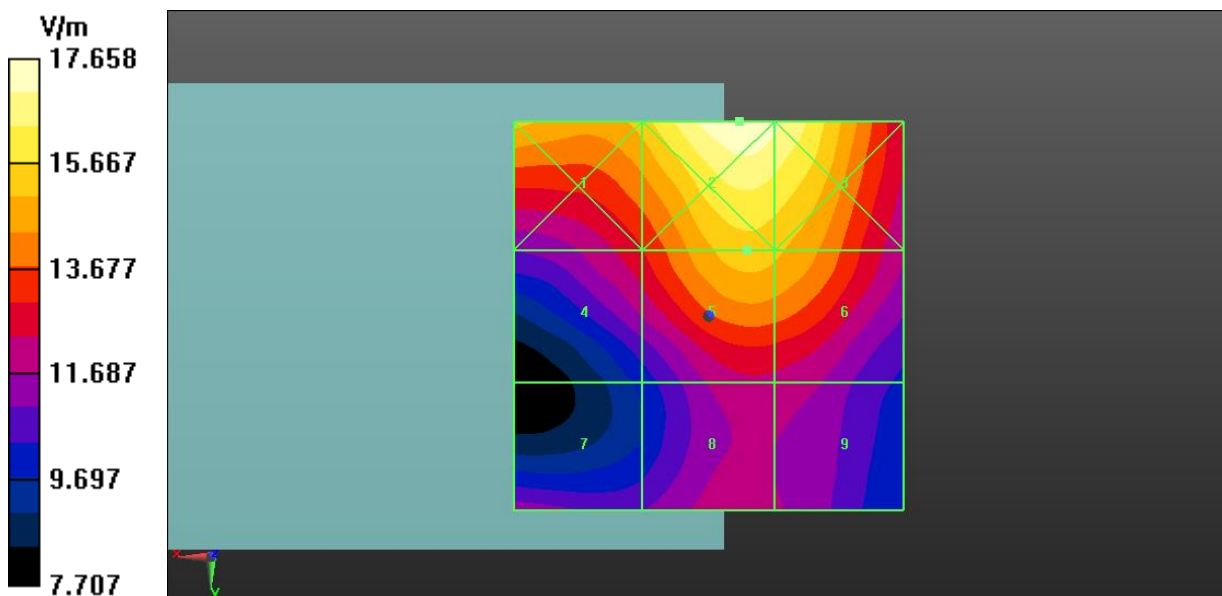


Fig A.10 HAC RF E-Field LTE-Band 41

### HAC RF E-Field LTE-Band 41 Low

Date: 2023-10-29

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: UID 0, LTE\_TDD Frequency: 2506 MHz Duty Cycle: 1:1.58

Probe: ER3DV6 - SN2424 ConvF (1, 1, 1);

### E Scan - ER3DV6 - 2011: 15 mm from Probe Center to the Device /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 = 33.24 V/m; Power Drift = -0.04 dB

Applied MIF = -1.44 dB

RF audio interference level = 26.90 dBV/m

**Emission category: M4**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>25.22 dBV/m | Grid 2 M4<br>28.19 dBV/m | Grid 3 M4<br>28.09 dBV/m |
| Grid 4 M4<br>24.04 dBV/m | Grid 5 M4<br>26.9 dBV/m  | Grid 6 M4<br>26.9 dBV/m  |
| Grid 7 M4<br>23.8 dBV/m  | Grid 8 M4<br>25.39 dBV/m | Grid 9 M4<br>25.39 dBV/m |

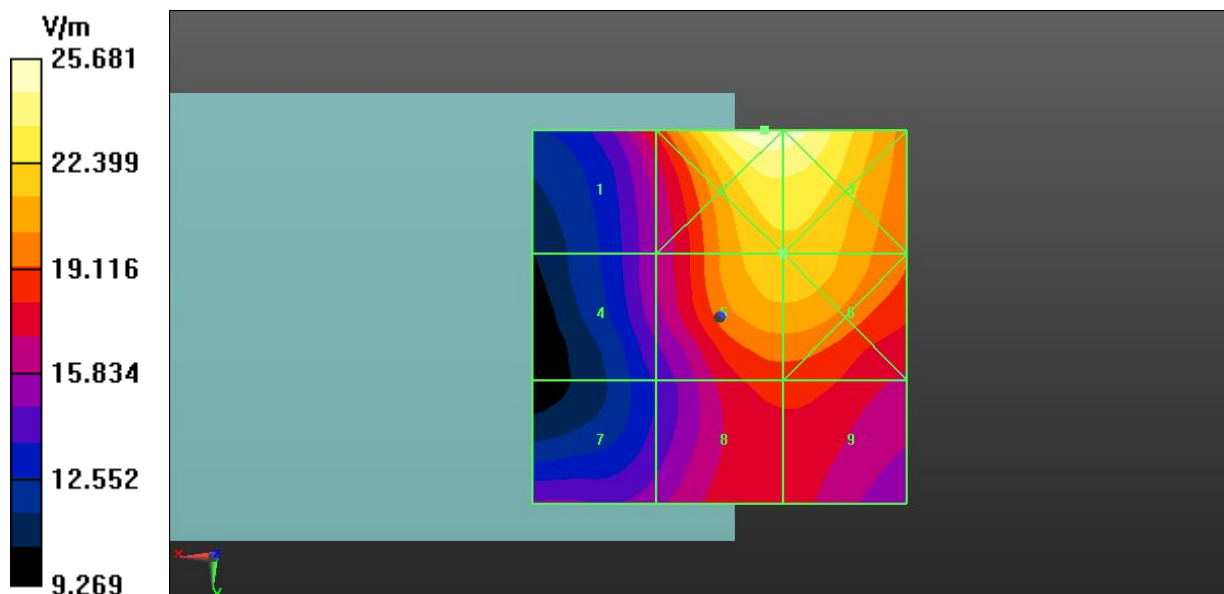


Fig A.11 HAC RF E-Field LTE-Band 41

## ANNEX B: System Validation Result

### 835MHz

Date: 2023-10-18

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Probe: ER3DV6 - SN2424; ConvF (1, 1, 1)

**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 = 114.5 V/m; Power Drift = 0.13 dB

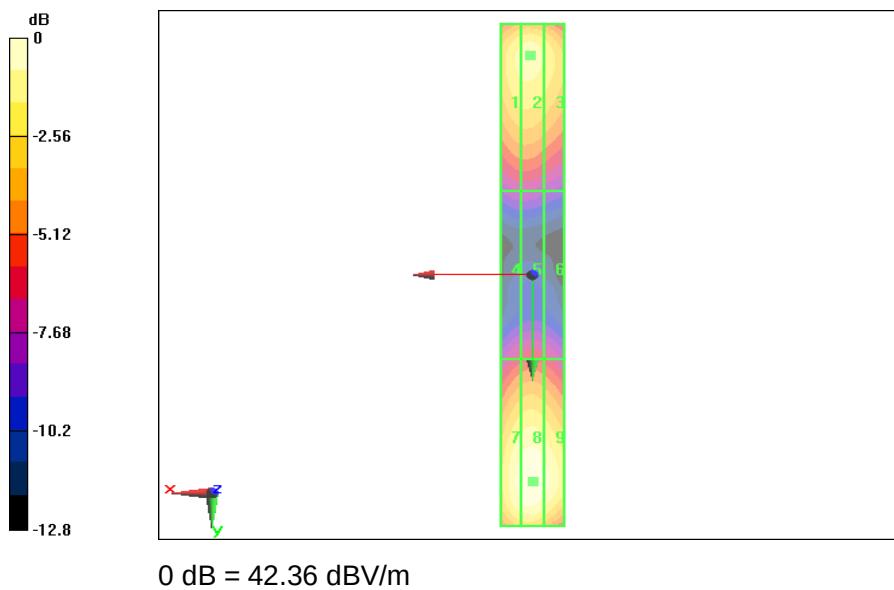
Applied MIF = 0.00 dB

RF audio interference level = 42.36 dBV/m

**Emission category: M3**

MIF scaled E-field

|                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| Grid 1 <b>M3</b><br>41.57 dBV/m | Grid 2 <b>M3</b><br>42.19 dBV/m | Grid 3 <b>M3</b><br>42.02 dBV/m |
| Grid 4 <b>M4</b><br>37.22 dBV/m | Grid 5 <b>M4</b><br>37.57 dBV/m | Grid 6 <b>M4</b><br>37.46 dBV/m |
| Grid 7 <b>M3</b><br>41.68 dBV/m | Grid 8 <b>M3</b><br>42.36 dBV/m | Grid 9 <b>M3</b><br>42.11 dBV/m |



# 1880MHz

Date: 2023-10-18

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1

Probe: ER3DV6 - SN2424; ConvF (1, 1, 1)

**E Scan - measurement distance from the probe sensor center to CD1880 Dipole = 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 = 112.2 V/m; Power Drift = -0.06 dB

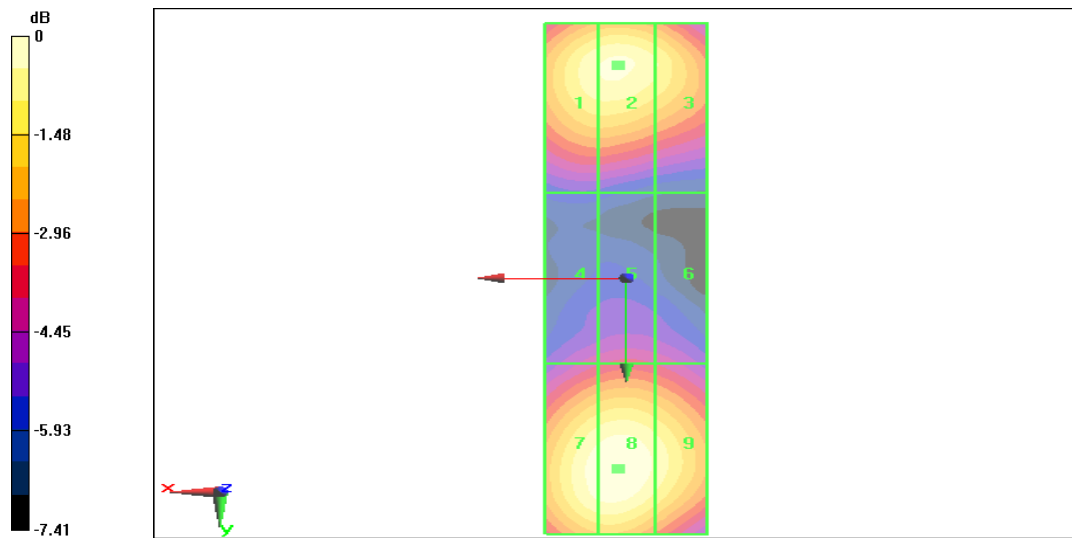
Applied MIF = 0.00 dB

RF audio interference level = 38.55 dBV/m

**Emission category: M2**

MIF scaled E-field

|                          |                           |                          |
|--------------------------|---------------------------|--------------------------|
| Grid 1 M2<br>38.03 dBV/m | Grid 2 M2<br>38.55 dBV/m  | Grid 3 M2<br>38.36 dBV/m |
| Grid 4 M2<br>36.18 dBV/m | Grid 5 M2<br>36.83 dBV/m  | Grid 6 M2<br>36.61 dBV/m |
| Grid 7 M2<br>37.87 dBV/m | Grid 8 M2<br>38.34 dB V/m | Grid 9 M2<br>38.22 dBV/m |



0 dB = 38.55 dBV/m

## 2600MHz

Date: 2023-10-29

Electronics: DAE4 Sn1790

Medium: Air

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

Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Probe: ER3DV6 - SN2424; ConvF (1, 1, 1)

**E Scan - measurement distance from the probe sensor center to CD2600 Dipole = 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 = 81.46 V/m; Power Drift = 0.05 dB

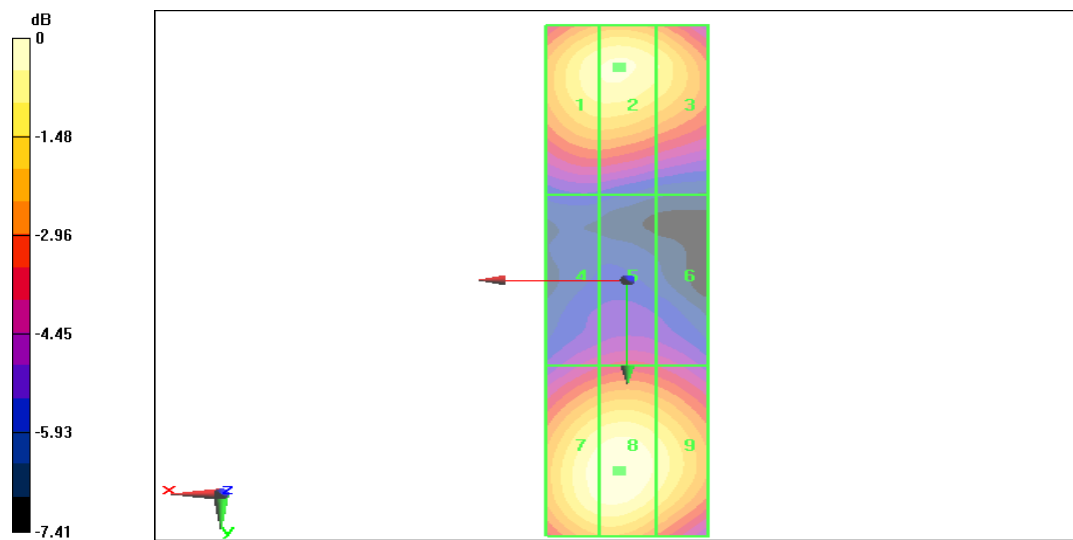
Applied MIF = 0.00 dB

RF audio interference level = 39.71 dBV/m

**Emission category: M2**

MIF scaled E-field

|                          |                           |                          |
|--------------------------|---------------------------|--------------------------|
| Grid 1 M2<br>39.14 dBV/m | Grid 2 M2<br>39.49 dBV/m  | Grid 3 M2<br>39.32 dBV/m |
| Grid 4 M2<br>37.83 dBV/m | Grid 5 M2<br>38.08 dBV/m  | Grid 6 M2<br>37.95 dBV/m |
| Grid 7 M2<br>39.47 dBV/m | Grid 8 M2<br>39.71 dB V/m | Grid 9 M2<br>39.58 dBV/m |



0 dB = 39.71 dBV/m

# ANNEX C: Dipole Calibration Certificate

CD835V3

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



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**C** Service suisse d'étalonnage  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **TMC-SZ (Auden)**

Certificate No: **CD835V3-1165\_May21**

## CALIBRATION CERTIFICATE

Object **CD835V3 - SN: 1165**

Calibration procedure(s) **QA CAL-20.v7  
Calibration Procedure for Validation Sources in air**

Calibration date: **May 18, 2021**

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&amp;TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)      | Scheduled Calibration |
|-----------------------------|--------------------|---------------------------------|-----------------------|
| Power meter NRP             | SN: 104778         | 09-Apr-21 (No. 217-03291/03292) | Apr-22                |
| Power sensor NRP-251        | SN: 103244         | 09-Apr-21 (No. 217-03291)       | Apr-22                |
| Power sensor NRP-231        | SN: 103245         | 09-Apr-21 (No. 217-03292)       | Apr-22                |
| Reference 20 dB Attenuator  | SN: B14394 (20k)   | 09-Apr-21 (No. 217-03343)       | Apr-22                |
| Type-N mismatch combination | SN: 31b382 / 06327 | 09-Apr-21 (No. 217-03344)       | Apr-22                |
| Probe EF3DV3                | SN: 4013           | 28-Dec-20 (No. EF3-4013_Dec20)  | Dec-21                |
| DAE4                        | SN: 781            | 23-Dec-20 (No. DAE4-781_Dec20)  | Dec-21                |

| Secondary Standards             | ID #           | Check Date (in house)             | Scheduled Check        |
|---------------------------------|----------------|-----------------------------------|------------------------|
| Power meter Agilent 4419B       | SN: GB424201B1 | 09-Oct-09 (in house check Oct-20) | In house check: Oct-23 |
| Power sensor HP E4412A          | SN: US38485102 | 05-Jan-10 (in house check Oct-20) | In house check: Oct-23 |
| Power sensor HP 8482A           | SN: US37295597 | 09-Oct-09 (in house check Oct-20) | In house check: Oct-23 |
| RF generator R&S SMT-06         | SN: 837633/005 | 10-Jan-19 (in house check Oct-20) | In house check: Oct-23 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-21 |

|                |               |                       |                                                                                       |
|----------------|---------------|-----------------------|---------------------------------------------------------------------------------------|
|                | Name          | Function              | Signature                                                                             |
| Calibrated by: | Leif Krysner  | Laboratory Technician |  |
| Approved by:   | Katja Pokovic | Technical Manager     |  |

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

Issued: May 18, 2021

Certificate No: CD835V3-1165\_May21

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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 DASYS 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 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 E-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               | V52.10.4 |
| 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    | 100 mW input power | 114.1 V/m = 41.15 dBV/m      |
| Maximum measured above low end     | 100 mW input power | 108.4 V/m = 40.70 dBV/m      |
| Averaged maximum above arm         | 100 mW input power | 111.3 V/m $\pm$ 12.8 % (k=2) |

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

#### Antenna Parameters

| Frequency | Return Loss | Impedance                       |
|-----------|-------------|---------------------------------|
| 800 MHz   | 17.5 dB     | 41.5 $\Omega$ - 8.8 j $\Omega$  |
| 835 MHz   | 27.8 dB     | 53.2 $\Omega$ + 2.7 j $\Omega$  |
| 880 MHz   | 17.0 dB     | 60.4 $\Omega$ - 11.8 j $\Omega$ |
| 900 MHz   | 16.7 dB     | 51.8 $\Omega$ - 14.9 j $\Omega$ |
| 945 MHz   | 24.9 dB     | 46.0 $\Omega$ + 3.7 j $\Omega$  |

#### 3.2 Antenna Design and Handling

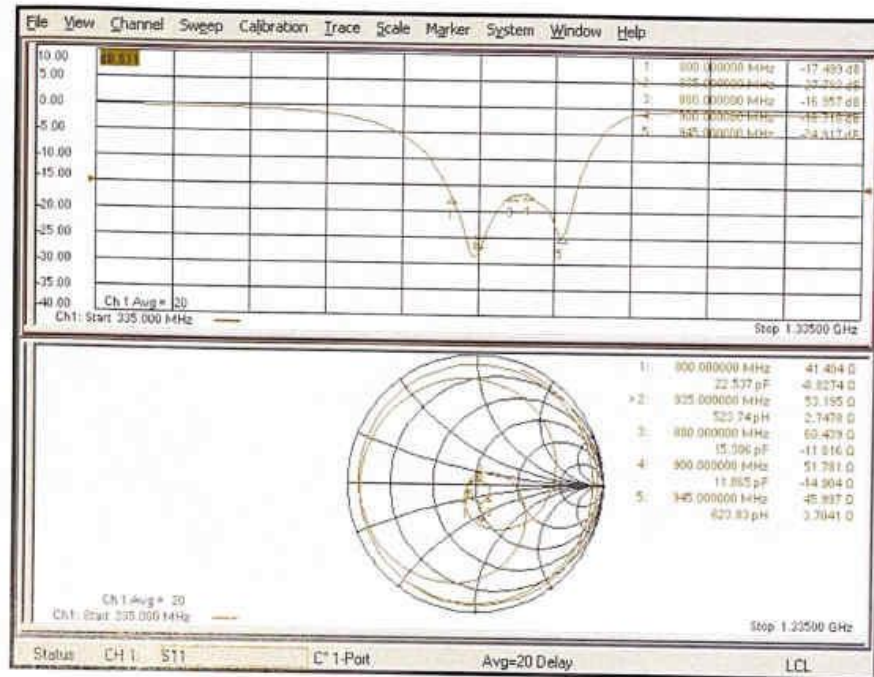
The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

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: 18.05.2021

Test Laboratory: SPEAG Lab2

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1165

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

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

Phantom section: RF Section

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

## DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 835 MHz; Calibrated: 28.12.2020
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 23.12.2020
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 135.0 V/m; Power Drift = 0.01 dB

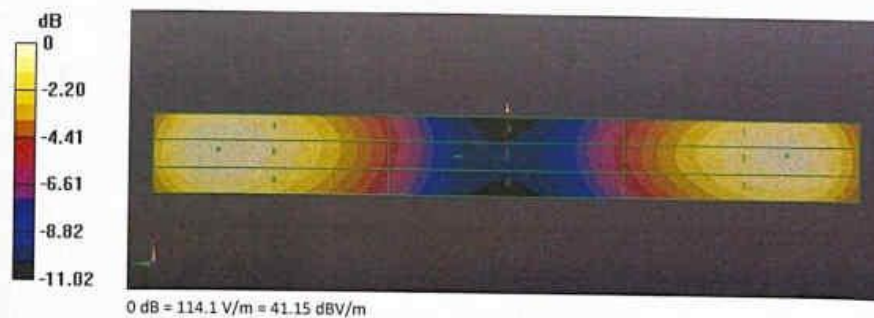
Applied MIF = 0.00 dB

RF audio interference level = 41.15 dBV/m

Emission category: M3

## MIF scaled E-field

|             |             |             |
|-------------|-------------|-------------|
| Grid 1 M3   | Grid 2 M3   | Grid 3 M3   |
| 40.65 dBV/m | 40.7 dBV/m  | 40.35 dBV/m |
| Grid 4 M4   | Grid 5 M4   | Grid 6 M4   |
| 35.83 dBV/m | 35.86 dBV/m | 35.57 dBV/m |
| Grid 7 M3   | Grid 8 M3   | Grid 9 M3   |
| 41.07 dBV/m | 41.15 dBV/m | 40.84 dBV/m |



CD1880V3

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Accreditation No.: **SCS 0108**

Client **TMC-SZ (Auden)**

Certificate No: **CD1880V3-1149\_May21**

## CALIBRATION CERTIFICATE

Object **CD1880V3 - SN: 1149**

Calibration procedure(s) **QA CAL-20.v7  
Calibration Procedure for Validation Sources in air**

Calibration date: **May 18, 2021**

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 NRP             | SN: 104778         | 09-Apr-21 (No. 217-03291/03292) | Apr-22                |
| Power sensor NRP-Z91        | SN: 103244         | 09-Apr-21 (No. 217-03291)       | Apr-22                |
| Power sensor NRP-Z91        | SN: 103245         | 09-Apr-21 (No. 217-03292)       | Apr-22                |
| Reference 20 dB Attenuator  | SN: BH9394 (20k)   | 09-Apr-21 (No. 217-03343)       | Apr-22                |
| Type-N mismatch combination | SN: 310982 / 06327 | 09-Apr-21 (No. 217-03344)       | Apr-22                |
| Probe EF3DV3                | SN: 4013           | 28-Dec-20 (No. EF3-4013_Dec20)  | Dec-21                |
| DAE4                        | SN: 781            | 23-Dec-20 (No. DAE4-781_Dec20)  | Dec-21                |

| Secondary Standards             | ID #           | Check Date (in house)             | Scheduled Check        |
|---------------------------------|----------------|-----------------------------------|------------------------|
| Power meter Agilent 4419B       | SN: GB42420191 | 09-Oct-09 (in house check Oct-20) | In house check: Oct-23 |
| Power sensor HP E4412A          | SN: US38485102 | 05-Jan-10 (in house check Oct-20) | In house check: Oct-23 |
| Power sensor HP 8482A           | SN: US37295597 | 09-Oct-09 (in house check Oct-20) | In house check: Oct-23 |
| RF generator R&S SMT-06         | SN: 837633/005 | 10-Jan-19 (in house check Oct-20) | In house check: Oct-23 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-21 |

| Calibrated by: | Name          | Function              | Signature                                                                             |
|----------------|---------------|-----------------------|---------------------------------------------------------------------------------------|
|                | Leif Klysner  | Laboratory Technician |  |
| Approved by:   | Name          | Function              | Signature                                                                             |
|                | Katja Pokovic | Technical Manager     |  |

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Issued: May 18, 2021

Certificate No: CD1880V3-1149\_May21

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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 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 E-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                | V52.10.4 |
| 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    | 100 mW input power | 88.4 V/m = 38.93 dBV/m      |
| Maximum measured above low end     | 100 mW input power | 86.7 V/m = 38.76 dBV/m      |
| Averaged maximum above arm         | 100 mW input power | 87.5 V/m $\pm$ 12.8 % (k=2) |

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

#### Antenna Parameters

| Frequency | Return Loss | Impedance                      |
|-----------|-------------|--------------------------------|
| 1730 MHz  | 24.1 dB     | 54.4 $\Omega$ + 4.8 j $\Omega$ |
| 1880 MHz  | 22.6 dB     | 54.8 $\Omega$ + 6.2 j $\Omega$ |
| 1900 MHz  | 23.1 dB     | 56.3 $\Omega$ + 3.9 j $\Omega$ |
| 1950 MHz  | 30.8 dB     | 52.7 $\Omega$ - 1.3 j $\Omega$ |
| 2000 MHz  | 21.6 dB     | 44.8 $\Omega$ + 5.9 j $\Omega$ |

#### 3.2 Antenna Design and Handling

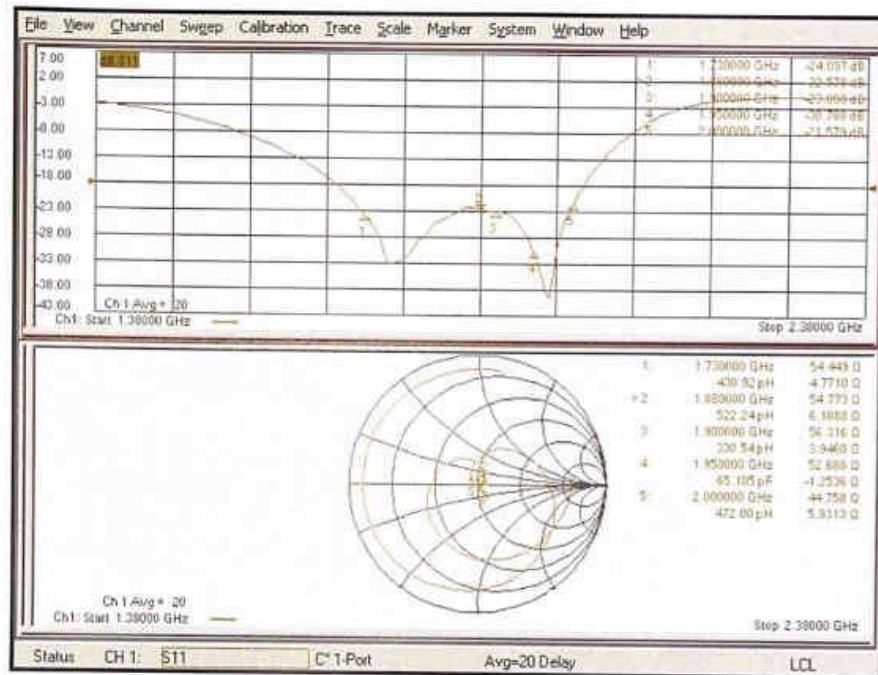
The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

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: 18.05.2021

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1149

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

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

Phantom section: RF Section

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

DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 1880 MHz; Calibrated: 28.12.2020
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 23.12.2020
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 161.6 V/m; Power Drift = -0.01 dB

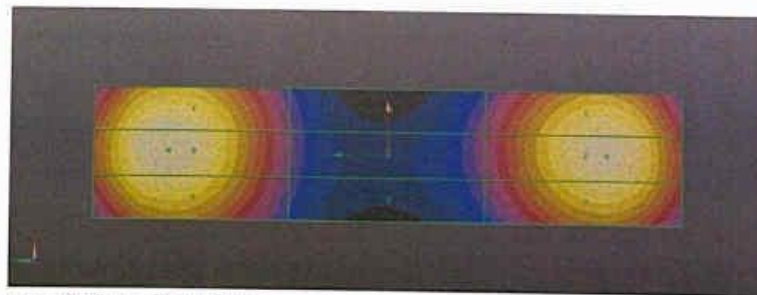
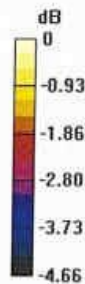
Applied MIF = 0.00 dB

RF audio interference level = 38.93 dBV/m

Emission category: M2

MIF scaled E-field

|             |             |             |
|-------------|-------------|-------------|
| Grid 1 M2   | Grid 2 M2   | Grid 3 M2   |
| 38.66 dBV/m | 38.76 dBV/m | 38.5 dBV/m  |
| Grid 4 M2   | Grid 5 M2   | Grid 6 M2   |
| 36.09 dBV/m | 36.12 dBV/m | 35.97 dBV/m |
| Grid 7 M2   | Grid 8 M2   | Grid 9 M2   |
| 38.83 dBV/m | 38.93 dBV/m | 38.63 dBV/m |



0 dB = 88.38 V/m = 38.93 dBV/m

CD2600V3

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Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: SCS 0108

Client **TMC-SZ (Auden)**

Certificate No: **CD2600V3-1020\_May21**

## CALIBRATION CERTIFICATE

Object **CD2600V3 - SN: 1020**

Calibration procedure(s) **QA CAL-20.v7  
Calibration Procedure for Validation Sources in air**

Calibration date: **May 18, 2021**

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&amp;TE critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)      | Scheduled Calibration |
|-----------------------------|--------------------|---------------------------------|-----------------------|
| Power meter NRP             | SN: 104778         | 09-Apr-21 (No. 217-03291/03292) | Apr-22                |
| Power sensor NRP-Z91        | SN: 103244         | 09-Apr-21 (No. 217-03291)       | Apr-22                |
| Power sensor NRP-Z91        | SN: 103245         | 09-Apr-21 (No. 217-03292)       | Apr-22                |
| Reference 20 dB Attenuator  | SN: BHP394 (20k)   | 09-Apr-21 (No. 217-03343)       | Apr-22                |
| Type-N mismatch combination | SN: 310982 / 06327 | 09-Apr-21 (No. 217-03344)       | Apr-22                |
| Probe EF3DV3                | SN: 4013           | 28-Dec-20 (No. EF3-4013_Dec20)  | Dec-21                |
| DAE4                        | SN: 781            | 23-Dec-20 (No. DAE4-781_Dec20)  | Dec-21                |

| Secondary Standards             | ID #           | Check Date (in house)             | Scheduled Check        |
|---------------------------------|----------------|-----------------------------------|------------------------|
| Power meter Agilent 4419B       | SN: GB42420191 | 09-Oct-09 (in house check Oct-20) | In house check: Oct-23 |
| Power sensor HP E4412A          | SN: US38485102 | 05-Jan-10 (in house check Oct-20) | In house check: Oct-23 |
| Power sensor HP 8482A           | SN: US37295597 | 09-Oct-09 (in house check Oct-20) | In house check: Oct-23 |
| RF generator R&S SMT-06         | SN: 637633/005 | 10-Jan-19 (in house check Oct-20) | In house check: Oct-23 |
| Network Analyzer Agilent E8358A | SN: US41060477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-21 |

|                | Name          | Function              | Signature                                                                             |
|----------------|---------------|-----------------------|---------------------------------------------------------------------------------------|
| Calibrated by: | Leif Klysner  | Laboratory Technician |  |
| Approved by:   | Katja Pokovic | Technical Manager     |  |

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Issued: May 18, 2021

Certificate No: CD2600V3-1020\_May21

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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 DASYS 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 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 E-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                | V52.10.4 |
| Phantom                            | HAC Test Arch        |          |
| Distance Dipole Top - Probe Center | 15 mm                |          |
| Scan resolution                    | dx, dy = 5 mm        |          |
| Frequency                          | 2600 MHz $\pm$ 1 MHz |          |
| Input power drift                  | < 0.05 dB            |          |

### Maximum Field values at 2600 MHz

| E-field 15 mm above dipole surface | condition          | Interpolated maximum        |
|------------------------------------|--------------------|-----------------------------|
| Maximum measured above high end    | 100 mW input power | 85.3 V/m = 38.62 dBV/m      |
| Maximum measured above low end     | 100 mW input power | 83.2 V/m = 38.40 dBV/m      |
| Averaged maximum above arm         | 100 mW input power | 84.3 V/m $\pm$ 12.8 % (k=2) |

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

#### Antenna Parameters

| Frequency | Return Loss | Impedance                       |
|-----------|-------------|---------------------------------|
| 2450 MHz  | 18.0 dB     | 42.7 $\Omega$ - 9.2 j $\Omega$  |
| 2550 MHz  | 26.7 dB     | 45.9 $\Omega$ + 1.6 j $\Omega$  |
| 2600 MHz  | 34.5 dB     | 49.3 $\Omega$ + 1.7 j $\Omega$  |
| 2650 MHz  | 33.6 dB     | 52.1 $\Omega$ + 0.5 j $\Omega$  |
| 2750 MHz  | 19.9 dB     | 50.7 $\Omega$ - 10.2 j $\Omega$ |

#### 3.2 Antenna Design and Handling

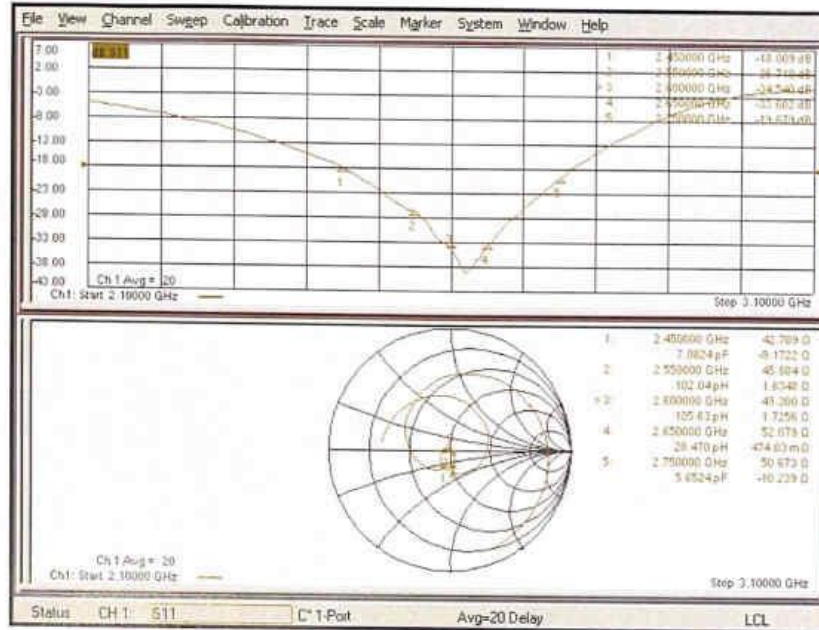
The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

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: 18.05.2021

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 2600 MHz; Type: CD2600V3; Serial: CD2600V3 - SN: 1020

Communication System: UID 0 - CW ; Frequency: 2600 MHz:

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

Phantom section: RF Section

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

DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 2600 MHz; Calibrated: 28.12.2020
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 23.12.2020
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole E-Field measurement @ 2600MHz/E-Scan - 2600MHz 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 = 67.80 V/m; Power Drift = 0.00 dB

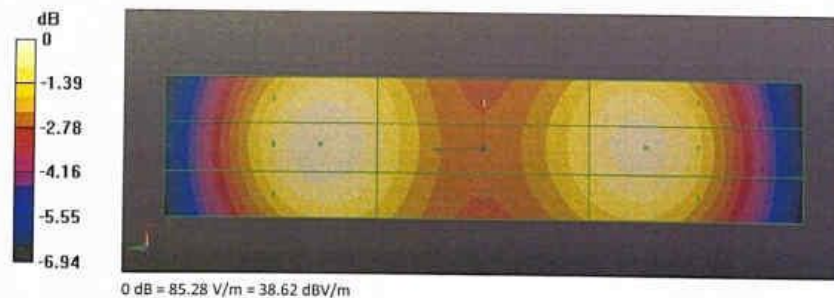
Applied MIF = 0.00 dB

RF audio interference level = 38.62 dBV/m

Emission category: M2

MIF scaled E-field

|             |             |             |
|-------------|-------------|-------------|
| Grid 1 M2   | Grid 2 M2   | Grid 3 M2   |
| 38.28 dBV/m | 38.4 dBV/m  | 38.16 dBV/m |
| Grid 4 M2   | Grid 5 M2   | Grid 6 M2   |
| 37.79 dBV/m | 37.85 dBV/m | 37.68 dBV/m |
| Grid 7 M2   | Grid 8 M2   | Grid 9 M2   |
| 38.51 dBV/m | 38.62 dBV/m | 38.37 dBV/m |



Certificate No: CD2600V3-1020\_May21

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## ANNEX D: Probe Calibration Certificate

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Accreditation No.: SCS 0108

Client **TMC-SZ (Auden)**

Certificate No: **ER3-2424\_Mar21**

### CALIBRATION CERTIFICATE

Object **ER3DV6- SN:2424**

Calibration procedure(s) **QA CAL-02.v9, QA CAL-25.v7**  
Calibration procedure for E-field probes optimized for close near field  
evaluations in air

Calibration date: **March 4, 2021**

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&E critical for calibration)

| Primary Standards          | ID               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|------------------|-----------------------------------|------------------------|
| Power meter NRP            | SN: 104776       | 01-Apr-20 (No. 217-03100/03101)   | Apr-21                 |
| Power sensor NRP-Z91       | SN: 103244       | 01-Apr-20 (No. 217-03100)         | Apr-21                 |
| Power sensor NRP-Z91       | SN: 103245       | 01-Apr-20 (No. 217-03101)         | Apr-21                 |
| Reference 20 dB Attenuator | SN: CC2552 (20x) | 31-Mar-20 (No. 217-03106)         | Apr-21                 |
| DAE4                       | SN: 789          | 23-Dec-20 (No. DAE4-789_Dec20)    | Dec-21                 |
| Reference Probe ER3DV6     | SN: 2328         | 05-Oct-20 (No. ER3-2328_Oct20)    | Oct-21                 |
| Secondary Standards        | ID               | Check Date (in house)             | Scheduled Check        |
| Power meter E4419B         | SN: GB41293874   | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A        | SN: MY41498087   | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A        | SN: 000110210    | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| RF generator HP 8648C      | SN: US3642U01700 | 04-Aug-99 (in house check Jun-20) | In house check: Jun-22 |
| Network Analyzer E8358A    | SN: US41080477   | 31-Mar-14 (in house check Oct-20) | In house check: Oct-21 |

|                                                                                                                 |                       |                                   |                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------|----------------------------------------------------------------------------------------------------|
| Calibrated by:                                                                                                  | Name<br>Michael Weber | Function<br>Laboratory Technician | Signature<br> |
| Approved by:                                                                                                    | Name<br>Katja Pokovic | Function<br>Technical Manager     | Signature<br> |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory. |                       |                                   | Issued: March 4, 2021                                                                              |

Certificate No: ER3-2424\_Mar21

Page 1 of 9

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Accreditation No.: **SCS 0108**

#### Glossary:

|                          |                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| NORM <sub>x,y,z</sub>    | sensitivity in free space                                                                                                                               |
| DCP                      | diode compression point                                                                                                                                 |
| CF                       | crest factor (1/duty_cycle) of the RF signal                                                                                                            |
| A, B, C, D               | modulation dependent linearization parameters                                                                                                           |
| E <sub>n</sub>           | incident E-field orientation normal to probe axis                                                                                                       |
| E <sub>p</sub>           | incident E-field orientation parallel to probe axis                                                                                                     |
| Polarization $\varphi$   | $\varphi$ rotation around probe axis                                                                                                                    |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\vartheta = 0$ is normal to probe axis |
| Connector Angle          | information used in DASY system to align probe sensor X to the robot coordinate system                                                                  |

#### Calibration is Performed According to the Following Standards:

- IEEE Std 1309-2005, "IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005
- CTIA Test Plan for Hearing Aid Compatibility, Rev 3.1.1, May 2017

#### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  for XY sensors and  $\vartheta = 90$  for Z sensor ( $f \leq 900$  MHz in: TEM-cell;  $f > 1800$  MHz: R22 waveguide).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response** (see Frequency Response Chart).
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- Spherical isotropy (3D deviation from isotropy)**: in a locally homogeneous field realized using an open waveguide setup.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).

ER3DV6 – SN:2424

March 4, 2021

## DASY/EASY - Parameters of Probe: ER3DV6 - SN:2424

### Basic Calibration Parameters

|                                       | Sensor X | Sensor Y | Sensor Z | Unc (k=2)    |
|---------------------------------------|----------|----------|----------|--------------|
| Norm ( $\mu\text{V}/(\text{V/m})^2$ ) | 1.53     | 1.55     | 1.83     | $\pm 10.1\%$ |
| DCP (mV) <sup>b</sup>                 | 99.3     | 99.8     | 101.3    |              |

### Calibration results for Frequency Response (30 MHz – 3 GHz)

| Frequency MHz | Target E-Field V/m | Measured E-field (En) V/m | Deviation E-normal in % | Measured E-field (Ep) V/m | Deviation E-normal in % | Unc (k=2) % |
|---------------|--------------------|---------------------------|-------------------------|---------------------------|-------------------------|-------------|
| 30            | 77.1               | 76.6                      | -0.7%                   | 77.4                      | 0.4%                    | $\pm 5.1\%$ |
| 100           | 77.2               | 78.5                      | 1.8%                    | 77.9                      | 0.9%                    | $\pm 5.1\%$ |
| 450           | 77.2               | 78.6                      | 1.9%                    | 77.8                      | 0.8%                    | $\pm 5.1\%$ |
| 600           | 77.0               | 78.2                      | 1.5%                    | 77.5                      | 0.6%                    | $\pm 5.1\%$ |
| 750           | 77.0               | 78.1                      | 1.5%                    | 77.5                      | 0.7%                    | $\pm 5.1\%$ |
| 1800          | 143.0              | 141.7                     | -0.9%                   | 141.1                     | -1.3%                   | $\pm 5.1\%$ |
| 2000          | 135.1              | 134.4                     | -0.5%                   | 133.5                     | -1.2%                   | $\pm 5.1\%$ |
| 2200          | 127.7              | 126.2                     | -1.2%                   | 127.5                     | -0.1%                   | $\pm 5.1\%$ |
| 2500          | 125.5              | 126.0                     | 0.4%                    | 126.8                     | 1.1%                    | $\pm 5.1\%$ |
| 3000          | 79.4               | 78.2                      | -1.6%                   | 81.3                      | 2.4%                    | $\pm 5.1\%$ |

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

ER3DV6 – SN:2424

March 4, 2021

## DASY/EASY - Parameters of Probe: ER3DV6 - SN:2424

### Calibration Results for Modulation Response

| UID       | Communication System Name                      |   | A<br>dB | B<br>dB√μV | C    | D<br>dB | VR<br>mV | Max<br>dev. | Unc <sup>E</sup><br>(k=2) |
|-----------|------------------------------------------------|---|---------|------------|------|---------|----------|-------------|---------------------------|
| 0         | CW                                             | X | 0.0     | 0.0        | 1.0  | 0.00    | 207.1    | ±3.5 %      | ± 4.7 %                   |
|           |                                                | Y | 0.0     | 0.0        | 1.0  |         | 194.8    |             |                           |
|           |                                                | Z | 0.0     | 0.0        | 1.0  |         | 208.5    |             |                           |
| 10021-DAC | GSM-FDD (TDMA, GMSK)                           | X | 13.38   | 91.7       | 25.7 | 9.39    | 127.8    | ±3.0 %      | ± 4.7 %                   |
|           |                                                | Y | 20.31   | 99.9       | 28.1 |         | 115.1    |             |                           |
|           |                                                | Z | 25.39   | 99.9       | 28.1 |         | 145.9    |             |                           |
| 10061-CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)      | X | 4.95    | 75.3       | 21.8 | 3.60    | 114.8    | ±2.2 %      | ± 4.7 %                   |
|           |                                                | Y | 4.11    | 72.3       | 20.5 |         | 106.0    |             |                           |
|           |                                                | Z | 5.66    | 76.6       | 21.8 |         | 117.0    |             |                           |
| 10077-CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps) | X | 12.21   | 74.8       | 27.6 | 11.00   | 104.9    | ±2.2 %      | ± 4.7 %                   |
|           |                                                | Y | 13.33   | 78.3       | 29.7 |         | 144.6    |             |                           |
|           |                                                | Z | 12.02   | 73.8       | 26.5 |         | 107.7    |             |                           |
| 10172-CAG | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)          | X | 10.38   | 84.9       | 32.0 | 9.21    | 140.1    | ±2.5 %      | ± 4.7 %                   |
|           |                                                | Y | 8.50    | 78.8       | 28.9 |         | 126.9    |             |                           |
|           |                                                | Z | 11.14   | 85.0       | 31.1 |         | 148.0    |             |                           |
| 10173-CAG | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)        | X | 10.60   | 84.6       | 31.9 | 9.48    | 139.5    | ±2.5 %      | ± 4.7 %                   |
|           |                                                | Y | 9.11    | 80.2       | 29.6 |         | 127.0    |             |                           |
|           |                                                | Z | 12.00   | 86.6       | 31.9 |         | 148.3    |             |                           |
| 10295-AAB | CDMA2000, RC1, SO3, 1/8th Rate 25 fr.          | X | 16.51   | 99.7       | 40.5 | 12.49   | 113.2    | ±3.5 %      | ± 4.7 %                   |
|           |                                                | Y | 15.91   | 100.0      | 40.9 |         | 101.3    |             |                           |
|           |                                                | Z | 18.42   | 100.0      | 39.2 |         | 126.2    |             |                           |

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>A</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.

ER3DV6 – SN:2424

March 4, 2021

**DASY/EASY - Parameters of Probe: ER3DV6 - SN:2424****Sensor Frequency Model Parameters**

|                      | Sensor X | Sensor Y | Sensor Z |
|----------------------|----------|----------|----------|
| Frequency Corr. (LF) | -1.78    | -1.32    | 0.22     |
| Frequency Corr. (HF) | 0.00     | 0.00     | 0.00     |

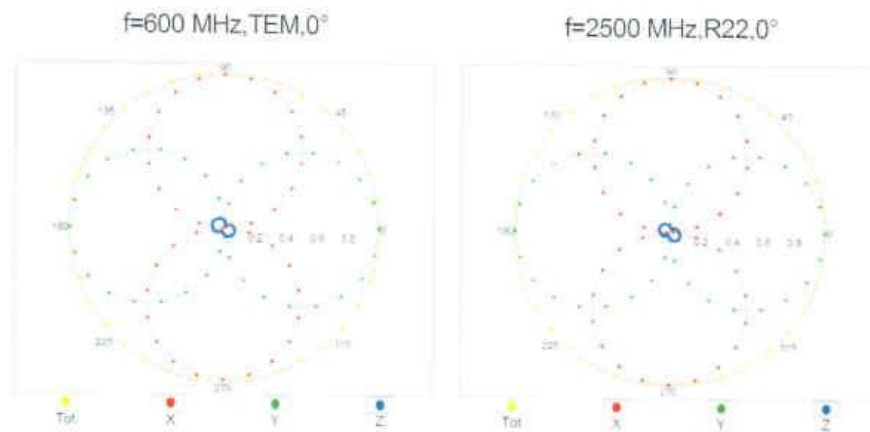
**Other Probe Parameters**

|                                         |             |
|-----------------------------------------|-------------|
| Sensor Arrangement                      | Rectangular |
| Connector Angle (°)                     | 165.5       |
| Mechanical Surface Detection Mode       | enabled     |
| Optical Surface Detection Mode          | disabled    |
| Probe Overall Length                    | 337 mm      |
| Probe Body Diameter                     | 10 mm       |
| Tip Length                              | 10 mm       |
| Tip Diameter                            | 8 mm        |
| Probe Tip to Sensor X Calibration Point | 2.5 mm      |
| Probe Tip to Sensor Y Calibration Point | 2.5 mm      |
| Probe Tip to Sensor Z Calibration Point | 2.5 mm      |

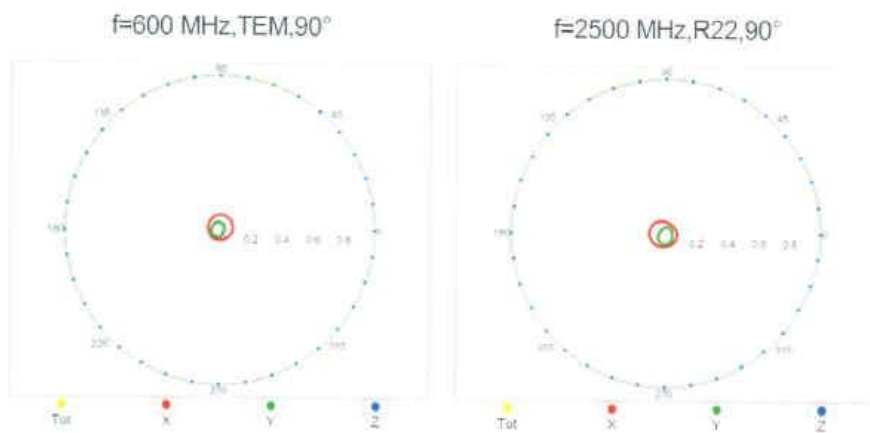
ER3DV6 – SN:2424

March 4, 2021

### Receiving Pattern ( $\phi$ ), $\vartheta = 0^\circ$



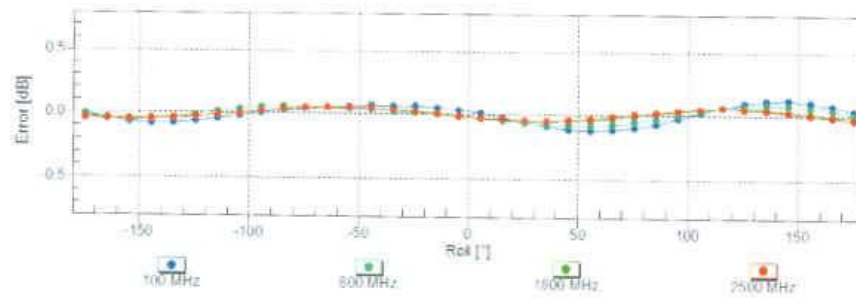
### Receiving Pattern ( $\phi$ ), $\vartheta = 90^\circ$



ER3DV6 – SN:2424

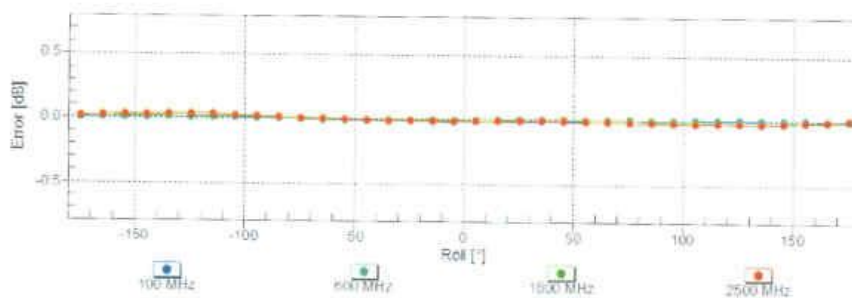
March 4, 2021

### Receiving Pattern ( $\phi$ ), $\vartheta = 0^\circ$



Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

### Receiving Pattern ( $\phi$ ), $\vartheta = 90^\circ$

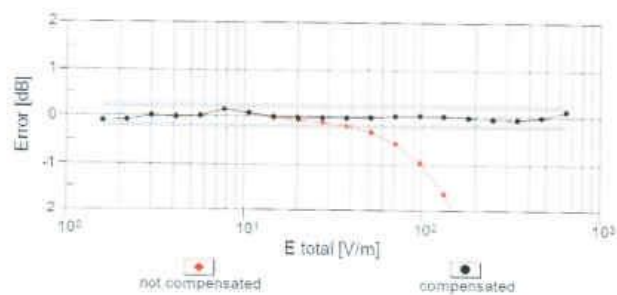
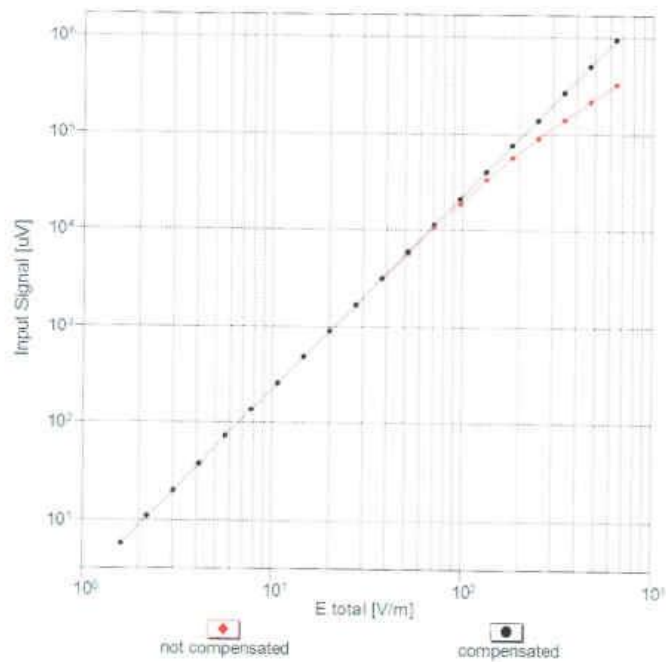


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

ER3DV6 – SN:2424

March 4, 2021

### Dynamic Range f(E-field) (TEM cell, f = 900 MHz)



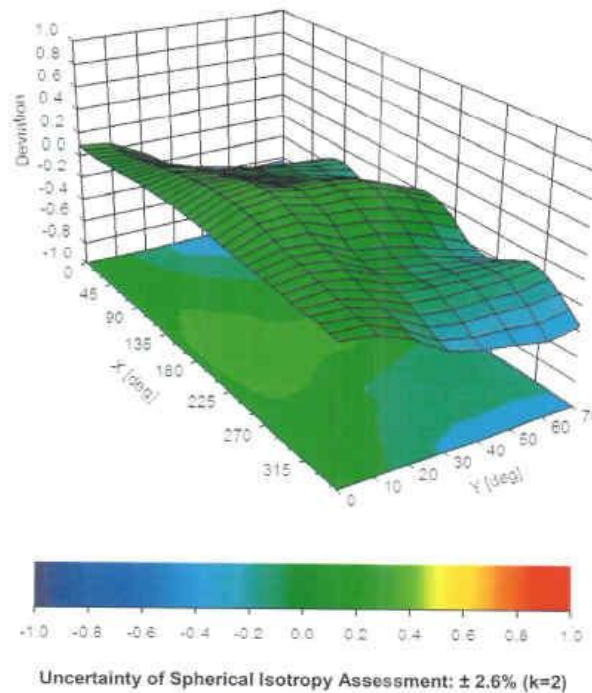
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

ER3DV6 – SN:2424

March 4, 2021

### Deviation from Isotropy in Air

Error ( $\phi, \theta$ ),  $f = 900$  MHz



## ANNEX E: DAE Calibration Certificate

**Calibration Laboratory of**  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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**

Client **SAICT-SZ**

Certificate No: **DAE4-1790\_Mar23**

### CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BP - SN: 1790**

Calibration procedure(s) **QA CAL-06.v30**  
**Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **March 02, 2023**

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  |
|-------------------------------|--------------------|----------------------------|------------------------|
| Kelthley Multimeter Type 2001 | SN: 0810278        | 29-Aug-22 (No:34389)       | Aug-23                 |
| Secondary Standards           | ID #               | Check Date (in house)      | Scheduled Check        |
| Auto DAE Calibration Unit     | SE UWS 053 AA 1001 | 27-Jan-23 (in house check) | In house check: Jan-24 |
| Calibrator Box V2.1           | SE UMS 006 AA 1002 | 27-Jan-23 (in house check) | In house check: Jan-24 |

|                |                              |                                          |                                                                                                    |
|----------------|------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------|
| Calibrated by: | Name<br><b>Eric Hainfeld</b> | Function<br><b>Laboratory Technician</b> | Signature<br> |
| Approved by:   | <b>Sven Kühn</b>             | <b>Technical Manager</b>                 |               |

Issued: March 2, 2023

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

Certificate No: **DAE4-1790\_Mar23**

Page 1 of 5

**Calibration Laboratory of**  
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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**

### Glossary

**DAE** data acquisition electronics  
**Connector angle** information used in DASY system to align probe sensor X to the robot coordinate system.

### Methods Applied and Interpretation of Parameters

- **DC Voltage Measurement:** Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- **Connector angle:** The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - **DC Voltage Measurement Linearity:** Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - **Common mode sensitivity:** Influence of a positive or negative common mode voltage on the differential measurement.
  - **Channel separation:** Influence of a voltage on the neighbor channels not subject to an input voltage.
  - **AD Converter Values with inputs shorted:** Values on the internal AD converter corresponding to zero input voltage
  - **Input Offset Measurement:** Output voltage and statistical results over a large number of zero voltage measurements.
  - **Input Offset Current:** Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - **Input resistance:** Typical value for information; DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - **Low Battery Alarm Voltage:** Typical value for information. Below this voltage, a battery alarm signal is generated.
  - **Power consumption:** Typical value for information. Supply currents in various operating modes.

### DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X                     | Y                     | Z                     |
|---------------------|-----------------------|-----------------------|-----------------------|
| High Range          | 404.604 ± 0.02% (k=2) | 404.331 ± 0.02% (k=2) | 404.468 ± 0.02% (k=2) |
| Low Range           | 4.00255 ± 1.50% (k=2) | 3.99549 ± 1.50% (k=2) | 3.98581 ± 1.50% (k=2) |

### Connector Angle

|                                           |               |
|-------------------------------------------|---------------|
| Connector Angle to be used in DASY system | 306.0 ° ± 1 ° |
|-------------------------------------------|---------------|

## Appendix (Additional assessments outside the scope of SCS0108)

### 1. DC Voltage Linearity

| High Range |         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|------------|---------|---------------------------|------------------------------|-----------|
| Channel X  | + Input | 200033.74                 | -1.44                        | -0.00     |
| Channel X  | + Input | 20005.39                  | -0.74                        | -0.00     |
| Channel X  | - Input | -20004.02                 | 1.76                         | -0.01     |
| Channel Y  | + Input | 200038.50                 | 3.58                         | 0.00      |
| Channel Y  | + Input | 20002.97                  | -3.15                        | -0.02     |
| Channel Y  | - Input | -20007.14                 | -1.18                        | 0.01      |
| Channel Z  | + Input | 200034.20                 | -0.88                        | -0.00     |
| Channel Z  | + Input | 20004.41                  | -1.63                        | -0.01     |
| Channel Z  | - Input | -20005.73                 | 0.32                         | -0.00     |

| Low Range |         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-----------|---------|---------------------------|------------------------------|-----------|
| Channel X | + Input | 2001.40                   | -0.14                        | -0.01     |
| Channel X | + Input | 200.82                    | -0.59                        | -0.29     |
| Channel X | - Input | -198.28                   | 0.23                         | -0.12     |
| Channel Y | + Input | 2001.39                   | -0.05                        | -0.00     |
| Channel Y | + Input | 200.26                    | -1.03                        | -0.51     |
| Channel Y | - Input | -199.92                   | -1.28                        | 0.65      |
| Channel Z | + Input | 2001.20                   | -0.22                        | -0.01     |
| Channel Z | + Input | 200.40                    | -0.89                        | -0.44     |
| Channel Z | - Input | -199.63                   | -1.02                        | 0.51      |

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | Common mode Input Voltage (mV) | High Range Average Reading ( $\mu\text{V}$ ) | Low Range Average Reading ( $\mu\text{V}$ ) |
|-----------|--------------------------------|----------------------------------------------|---------------------------------------------|
| Channel X | 200                            | -18.43                                       | -19.65                                      |
|           | - 200                          | 19.32                                        | 18.11                                       |
| Channel Y | 200                            | -17.38                                       | -18.13                                      |
|           | - 200                          | 16.56                                        | 16.01                                       |
| Channel Z | 200                            | -11.31                                       | -11.64                                      |
|           | - 200                          | 10.03                                        | 9.99                                        |

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | Input Voltage (mV) | Channel X ( $\mu\text{V}$ ) | Channel Y ( $\mu\text{V}$ ) | Channel Z ( $\mu\text{V}$ ) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200                | -                           | 0.84                        | -2.57                       |
| Channel Y | 200                | 4.84                        | -                           | 3.21                        |
| Channel Z | 200                | 7.42                        | 2.89                        | -                           |

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16203            | 15690           |
| Channel Y | 16275            | 16445           |
| Channel Z | 15950            | 16110           |

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10MΩ

|           | Average (μV) | min. Offset (μV) | max. Offset (μV) | Std. Deviation (μV) |
|-----------|--------------|------------------|------------------|---------------------|
| Channel X | 0.10         | -1.05            | 1.63             | 0.45                |
| Channel Y | -0.42        | -2.31            | 0.79             | 0.40                |
| Channel Z | -0.67        | -1.34            | 0.29             | 0.34                |

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

|           | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200            | 200              |
| Channel Y | 200            | 200              |
| Channel Z | 200            | 200              |

#### 8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9              |
| Supply (- Vcc) | -7.6              |

#### 9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01             | +6            | +14               |
| Supply (- Vcc) | -0.01             | -8            | -9                |

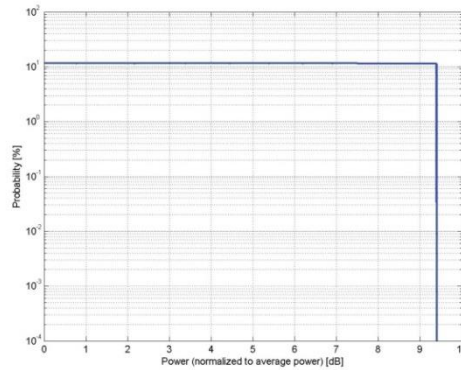
## ANNEX F: UID Specification

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland

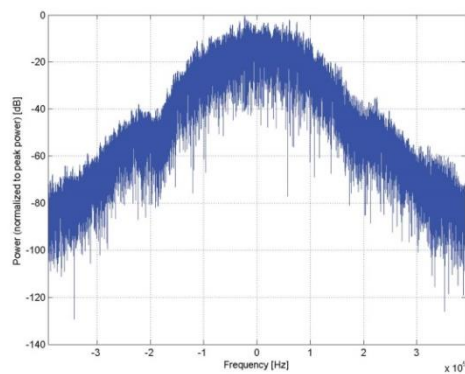
|                         |                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:                   | GSM-FDD (TDMA, GMSK)                                                                                                                                                                                                                                                                                                                                                                                   |
| Group:                  | GSM                                                                                                                                                                                                                                                                                                                                                                                                    |
| UID:                    | 10021-DAC                                                                                                                                                                                                                                                                                                                                                                                              |
| PAR: <sup>1</sup>       | 9.39 dB                                                                                                                                                                                                                                                                                                                                                                                                |
| MIF: <sup>2</sup>       | 3.63 dB                                                                                                                                                                                                                                                                                                                                                                                                |
| Standard Reference:     | ETSI TS 100 909 V8.9.0 (2005-01)<br>FCC OET KDB 941225, D03 and D04<br>Periodic pulsed modulation                                                                                                                                                                                                                                                                                                      |
| Category:               | GMSK                                                                                                                                                                                                                                                                                                                                                                                                   |
| Modulation:             | GSM 450 (450.4 - 457.6 MHz)<br>GSM 480 (478.8 - 486.0 MHz)<br>GSM 710 (698.0 - 716.0 MHz)<br>GSM 750 (747.0 - 763.0 MHz)<br>GSM 850 (824.0 - 849.0 MHz)<br>P-GSM 900 (890.0 - 915.0 MHz)<br>E-GSM 900 (880.0 - 915.0 MHz)<br>R-GSM 900 (876.0 - 915.0 MHz)<br>DCS 1800 (1710.0 - 1785.0 MHz)<br>PCS 1900 (1850.0 - 1910.0 MHz)<br>ER-GSM 900 (873.0 - 915.0 MHz)<br>Validation band (0.0 - 6000.0 MHz) |
| Detailed Specification: | Active Slot: TN0<br>Data: PN9 continuous<br>Frame: composed out of 8 Slots<br>Multiframe: 26th (IDLE) Frame set blank<br>Slottype & -timing: Normal burst for GMSK                                                                                                                                                                                                                                     |
| Bandwidth:              | 0.2 MHz                                                                                                                                                                                                                                                                                                                                                                                                |
| Integration Time:       | 120.0 ms                                                                                                                                                                                                                                                                                                                                                                                               |

<sup>1</sup> PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"  
<sup>2</sup> Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version).

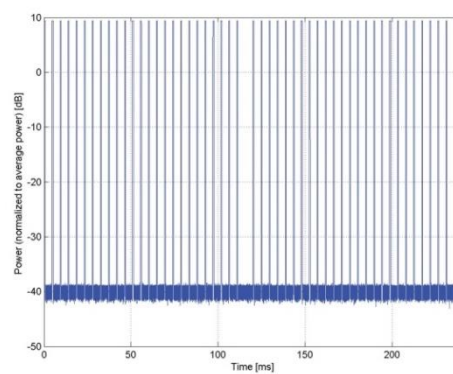
**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



**Complementary Cumulative Distribution Function (CCDF)**



**Frequency Domain**



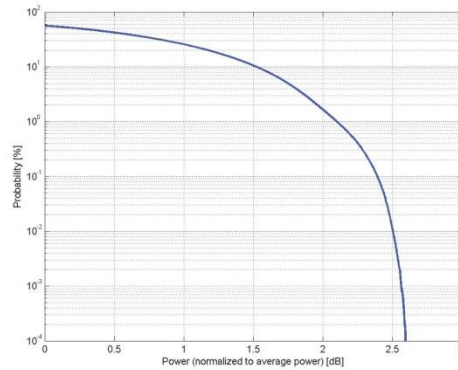
**Time Domain**

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland

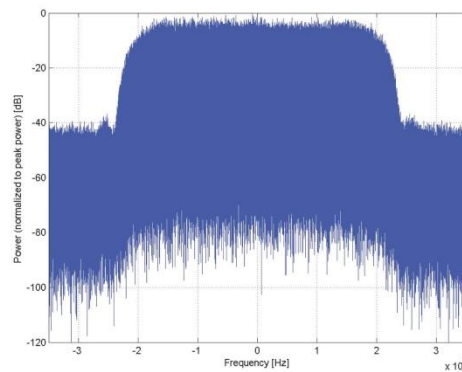
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:                   | UMTS-FDD (WCDMA, AMR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Group:                  | WCDMA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| UID:                    | 10460-AAA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| PAR: <sup>1</sup>       | 2.39 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| MIF: <sup>2</sup>       | -25.43 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Standard Reference:     | FCC OET KDB 941225 D01 SAR test for 3G devices v03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Category:               | Random amplitude modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Modulation:             | QPSK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Frequency Band:         | Band 1, UTRA/FDD (1920.0-1980.0 MHz, 20000)<br>Band 2, UTRA/FDD (1850.0-1910.0 MHz, 20001)<br>Band 3, UTRA/FDD (1710.0-1785.0 MHz, 20002)<br>Band 4, UTRA/FDD (1710.0-1755.0 MHz, 20003)<br>Band 5, UTRA/FDD (824.0-849.0 MHz, 20004)<br>Band 6, UTRA/FDD (830.0-840.0 MHz, 20005)<br>Band 7, UTRA/FDD (2500.0-2570.0 MHz, 20006)<br>Band 8, UTRA/FDD (880.0-915.0 MHz, 20007)<br>Band 9, UTRA/FDD (1749.9-1784.9 MHz, 20008)<br>Band 10, UTRA/FDD (1710.0-1770.0 MHz, 20009)<br>Band 11, UTRA/FDD (1427.9-1452.9 MHz, 20010)<br>Band 12, UTRA/FDD (698.0-716.0 MHz, 20011)<br>Band 13, UTRA/FDD (777.0-787.0 MHz, 20012)<br>Band 14, UTRA/FDD (788.0-798.0 MHz, 20013)<br>Band 19, UTRA/FDD (830.0-845.0 MHz, 20130)<br>Band 20, UTRA/FDD (832.0-862.0 MHz, 20131)<br>Band 21, UTRA/FDD (1447.9-1462.9 MHz, 20132)<br>Band 22, UTRA/FDD (3410.0-3490.0 MHz, 20217)<br>Band 25, UTRA/FDD (1850.0-1915.0 MHz, 20218)<br>Band 26, UTRA/FDD (814.0-849.0 MHz, 20219) |
| Detailed Specification: | Dedicated Channel Type: 12.2 kbps AMR<br>3.4 kbps SRB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Bandwidth:              | 5.0 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Integration Time:       | 100.0 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

<sup>1</sup> PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"  
<sup>2</sup> Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version).

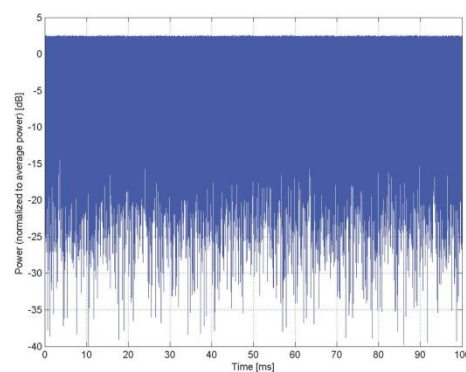
**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



**Complementary Cumulative Distribution Function (CCDF)**



**Frequency Domain**



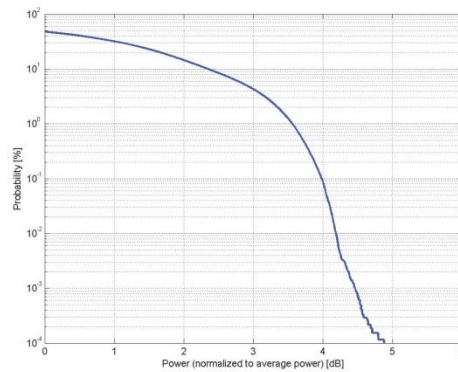
**Time Domain**

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland

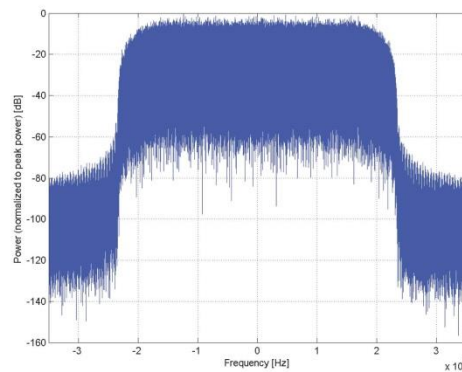
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:                   | UMTS-FDD (HSDPA)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Group:                  | WCDMA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| UID:                    | 10097-CAB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| PAR: <sup>1</sup>       | 3.98 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| MIF: <sup>2</sup>       | -20.75 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Standard Reference:     | ETSI-3GPP TS 134.121 Rel. 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Category:               | FCC OET KDB 941225 D01 SAR test for 3G devices v02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Modulation:             | Random amplitude modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Modulation:             | QPSK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Frequency Band:         | Band 1, UTRA/FDD (1920.0-1980.0 MHz, 20000)<br>Band 2, UTRA/FDD (1850.0-1910.0 MHz, 20001)<br>Band 3, UTRA/FDD (1710.0-1785.0 MHz, 20002)<br>Band 4, UTRA/FDD (1710.0-1755.0 MHz, 20003)<br>Band 5, UTRA/FDD (824.0-849.0 MHz, 20004)<br>Band 6, UTRA/FDD (830.0-840.0 MHz, 20005)<br>Band 7, UTRA/FDD (2500.0-2570.0 MHz, 20006)<br>Band 8, UTRA/FDD (880.0-915.0 MHz, 20007)<br>Band 9, UTRA/FDD (1749.9-1784.9 MHz, 20008)<br>Band 10, UTRA/FDD (1710.0-1770.0 MHz, 20009)<br>Band 11, UTRA/FDD (1427.9-1452.9 MHz, 20010)<br>Band 12, UTRA/FDD (698.0-716.0 MHz, 20011)<br>Band 13, UTRA/FDD (777.0-787.0 MHz, 20012)<br>Band 14, UTRA/FDD (788.0-798.0 MHz, 20013)<br>Band 19, UTRA/FDD (830.0-845.0 MHz, 20130)<br>Band 20, UTRA/FDD (832.0-862.0 MHz, 20131)<br>Band 21, UTRA/FDD (1447.9-1462.9 MHz, 20132)<br>Band 22, UTRA/FDD (3410.0-3490.0 MHz, 20217)<br>Band 25, UTRA/FDD (1850.0-1915.0 MHz, 20218)<br>Band 26, UTRA/FDD (814.0-849.0 MHz, 20219) |
| Detailed Specification: | CQI value: 2<br>Sub-test 2 Conditions:<br>DPCCH gain factor (Beta_c) = 12/15<br>DPDCH gain factor (Beta_d): 15/15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Bandwidth:              | 5.0 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Integration Time:       | 100.0 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

<sup>1</sup> PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"  
<sup>2</sup> Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version).

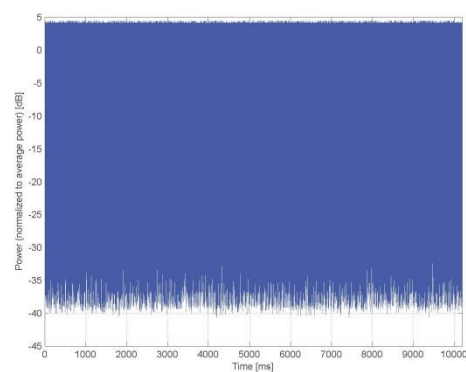
**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



Complementary Cumulative Distribution Function (CCDF)



Frequency Domain



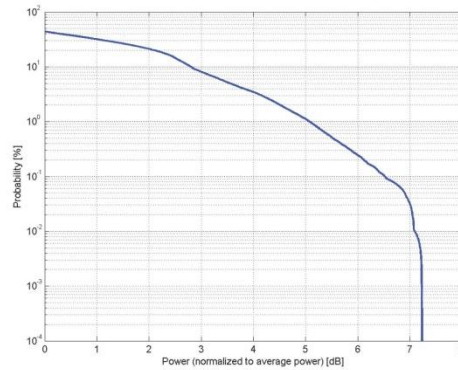
Time Domain

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland

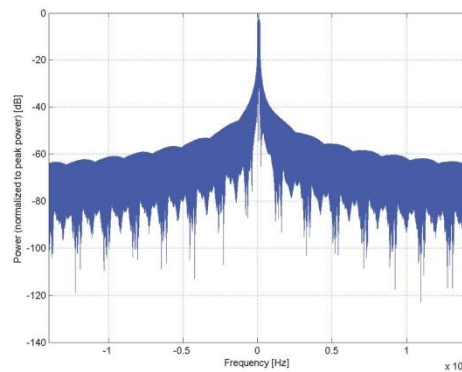
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:                   | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Group:                  | LTE-FDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| UID:                    | 10170-CAE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| PAR: <sup>1</sup>       | 6.52 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| MIF: <sup>2</sup>       | -9.76 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Standard Reference:     | 3GPP / ETSI TS 136.101 V8.4.0<br>3GPP / ETSI TS 136.213 V8.4.0<br>FCC OET KDB 941225 D05 SAR for LTE Devices v01<br>Random amplitude modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Category:               | 16-QAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Modulation:             | Band 1, E-UTRA/FDD (1920.0 - 1980.0 MHz)<br>Band 2, E-UTRA/FDD (1850.0 - 1910.0 MHz)<br>Band 3, E-UTRA/FDD (1710.0 - 1785.0 MHz)<br>Band 4, E-UTRA/FDD (1710.0 - 1755.0 MHz)<br>Band 7, E-UTRA/FDD (2500.0 - 2570.0 MHz)<br>Band 9, E-UTRA/FDD (1749.9 - 1784.9 MHz)<br>Band 10, E-UTRA/FDD (1710.0 - 1770.0 MHz)<br>Band 20, E-UTRA/FDD (832.0 - 862.0 MHz)<br>Band 22, E-UTRA/FDD (3410.0 - 3490.0 MHz)<br>Band 23, E-UTRA/FDD (2000.0 - 2020.0 MHz)<br>Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)<br>Band 28 E-UTRA/FDD (703.0 - 748.0 MHz)<br>Band 65, E-UTRA/FDD (1920.0 - 2010.0 MHz)<br>Band 66, E-UTRA/FDD (1710.0 - 1780.0 MHz)<br>Band 70, E-UTRA/FDD (1695.0 - 1710.0 MHz)<br>Band 71, E-UTRA/FDD (663.0 - 698.0 MHz)<br>Band 74, E-UTRA/FDD (1427.0 - 1470.0 MHz)<br>Validation band (0.0 - 6000.0 MHz) |
| Frequency Band:         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Detailed Specification: | Modulation Scheme: SC-FDMA<br>Number of PUSCHs: 1<br>Settings for Subframe #0 to #9:<br>Modulation Scheme: 16QAM<br>Data Type: UL-SCH<br>Number RB: 1<br>Transport Block Size: 256<br>TBS Index: 14<br>MCS Index: 15<br>Data Type: PN9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Bandwidth:              | 20.0 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Integration Time:       | 10.0 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

<sup>1</sup> PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"  
<sup>2</sup> Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version).

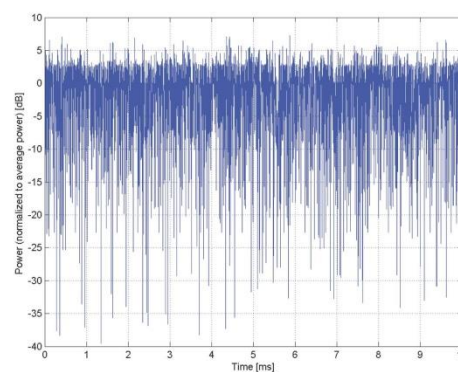
**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**Complementary Cumulative Distribution Function (CCDF)**



**Frequency Domain**



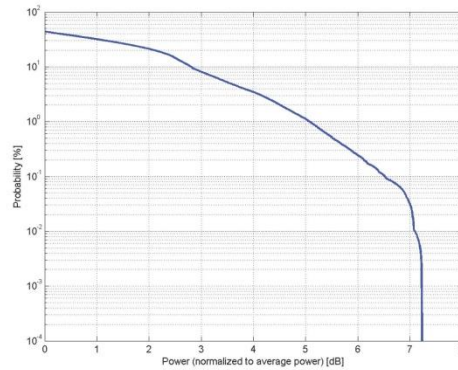
**Time Domain**

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland

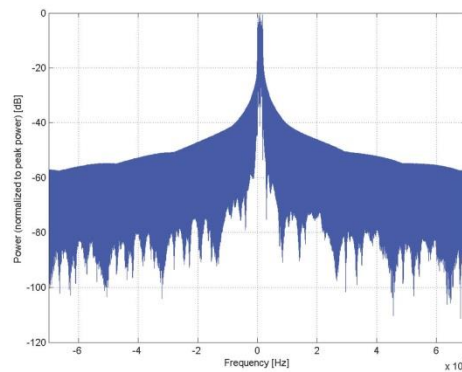
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:                   | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Group:                  | LTE-FDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| UID:                    | 10176-CAG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| PAR: <sup>1</sup>       | 6.52 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| MIF: <sup>2</sup>       | -9.76 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Standard Reference:     | 3GPP / ETSI TS 136.101 V8.4.0<br>3GPP / ETSI TS 136.213 V8.4.0<br>FCC OET KDB 941225 D05 SAR for LTE Devices v01<br>Random amplitude modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Category:               | 16-QAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Modulation:             | Band 1, E-UTRA/FDD (1920.0 - 1980.0 MHz)<br>Band 2, E-UTRA/FDD (1850.0 - 1910.0 MHz)<br>Band 3, E-UTRA/FDD (1710.0 - 1785.0 MHz)<br>Band 4, E-UTRA/FDD (1710.0 - 1755.0 MHz)<br>Band 5, E-UTRA/FDD (824.0 - 849.0 MHz)<br>Band 6, E-UTRA/FDD (830.0 - 840.0 MHz)<br>Band 7, E-UTRA/FDD (2500.0 - 2570.0 MHz)<br>Band 8, E-UTRA/FDD (880.0 - 915.0 MHz)<br>Band 9, E-UTRA/FDD (1749.9 - 1784.9 MHz)<br>Band 10, E-UTRA/FDD (1710.0 - 1770.0 MHz)<br>Band 11, E-UTRA/FDD (1427.9 - 1447.9 MHz)<br>Band 12, E-UTRA/FDD (699.0 - 716.0 MHz)<br>Band 13, E-UTRA/FDD (777.0 - 787.0 MHz)<br>Band 14, E-UTRA/FDD (788.0 - 798.0 MHz)<br>Band 17, E-UTRA/FDD (704.0 - 716.0 MHz)<br>Band 18, E-UTRA/FDD (815.0 - 830.0 MHz)<br>Band 19, E-UTRA/FDD (830.0 - 845.0 MHz)<br>Band 20, E-UTRA/FDD (832.0 - 862.0 MHz)<br>Band 21, E-UTRA/FDD (1447.9 - 1462.9 MHz)<br>Band 22, E-UTRA/FDD (3410.0 - 3490.0 MHz)<br>Band 23, E-UTRA/FDD (2000.0 - 2020.0 MHz)<br>Band 24, E-UTRA/FDD (1626.5 - 1660.5 MHz)<br>Band 25, E-UTRA/FDD (1850.0 - 1915.0 MHz)<br>Band 26 E-UTRA/FDD (814.0 - 849.0 MHz)<br>Band 27 E-UTRA/FDD (807.0 - 824.0 MHz)<br>Band 28 E-UTRA/FDD (703.0 - 748.0 MHz)<br>Band 30, E-UTRA/FDD (2305.0 - 2315.0 MHz)<br>Band 65, E-UTRA/FDD (1920.0 - 2010.0 MHz)<br>Band 66, E-UTRA/FDD (1710.0 - 1780.0 MHz)<br>Band 68, E-UTRA/FDD (698.0 - 728.0 MHz)<br>Band 70, E-UTRA/FDD (1695.0 - 1710.0 MHz)<br>Band 71, E-UTRA/FDD (663.0 - 698.0 MHz)<br>Band 74, E-UTRA/FDD (1427.0 - 1470.0 MHz)<br>Band 85, E-UTRA/FDD (698.0 - 716.0 MHz)<br>Validation band (0.0 - 6000.0 MHz) |
| Frequency Band:         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Detailed Specification: | Modulation Scheme: SC-FDMA<br>Number of PUSCHs: 1<br>Settings for Subframe #0 to #9:<br>Modulation Scheme: QPSK<br>Data Type: UL-SCH<br>Number RB: 1<br>Transport Block Size: 256<br>TBS Index: 14<br>MCS Index: 15<br>Data Type: PN9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Bandwidth:              | 10.0 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Integration Time:       | 10.0 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

<sup>1</sup> PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"  
<sup>2</sup> Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version).

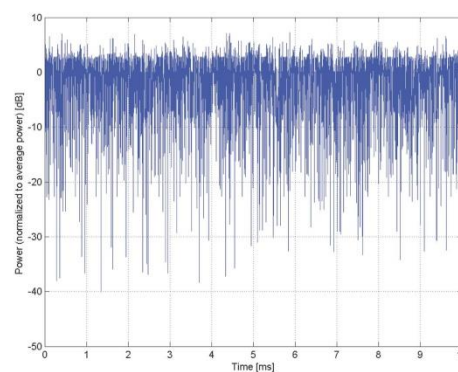
**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**Complementary Cumulative Distribution Function (CCDF)**



**Frequency Domain**



**Time Domain**

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:                   | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Group:                  | LTE-TDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| UID:                    | 10173-CAD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| PAR: <sup>1</sup>       | 9.48 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| MIF: <sup>2</sup>       | -1.44 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Standard Reference:     | 3GPP / ETSI TS 136.101 V8.4.0<br>3GPP / ETSI TS 136.213 V8.4.0<br>FCC OET KDB 941225 D05 SAR for LTE Devices v02<br>Random amplitude modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Category:               | 16-QAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Modulation:             | Band 33, E-UTRA/TDD (1900.0 - 1920.0 MHz)<br>Band 35, E-UTRA/TDD (1850.0 - 1910.0 MHz)<br>Band 36, E-UTRA/TDD (1930.0 - 1990.0 MHz)<br>Band 37, E-UTRA/TDD (1910.0 - 1930.0 MHz)<br>Band 38, E-UTRA/TDD (2570.0 - 2620.0 MHz)<br>Band 39, E-UTRA/TDD (1880.0 - 1920.0 MHz)<br>Band 40, E-UTRA/TDD (2300.0 - 2400.0 MHz)<br>Band 41, E-UTRA/TDD (2496.0 - 2690.0 MHz)<br>Band 42, E-UTRA/TDD (3400.0 - 3600.0 MHz)<br>Band 43, E-UTRA/TDD (3600.0 - 3800.0 MHz)<br>Band 44, E-UTRA/TDD (703.0 - 803.0 MHz)<br>Band 45, E-UTRA/FDD (1447.0 - 1467.0 MHz)<br>Band 46, E-UTRA/FDD (5150.0 - 5925.0 MHz)<br>Band 47, E-UTRA/TDD (5855.0 - 5925.0 MHz)<br>Band 48, E-UTRA/TDD (3550.0 - 3700.0 MHz)<br>Validation band (0.0 - 6000.0 MHz) |
| Frequency Band:         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Detailed Specification: | Modulation Scheme: SC-FDMA<br>Uplink-downlink configuration: 1<br>Special Subframe configuration: 4<br>Number of Frames: 1<br>Settings for UL Subframe 2,3,7,8:<br>Number of PUSCHs: 1<br>Modulation Scheme: 16QAM<br>Allocated RB: 1<br>Start Number of RB: 50<br>Data Type: PN9fix<br>Bandwidth:<br>Integration Time:                                                                                                                                                                                                                                                                                                                                                                                                             |
|                         | 20.0 MHz<br>6.0 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

<sup>1</sup> PAR (0.1%) in accordance with FCC KDB 971168, Section 6.0 "Measurement of the Peak-to-Average Power Ratio (PAPR)"  
<sup>2</sup> Modulation Interference Factor (MIF) value valid only in conjunction with advanced probe response linearization calibration for the same communication system (same UID and version).