

# Hearing Aid Compatibility (HAC)

## TEST REPORT

### <For RF-Emission Measurement>

|                      |   |
|----------------------|---|
| Applicant Name       | HP Inc  |
| Address of Applicant | 3390 East Harmony Road Fort Collins, Colorado 80528 United States |
| EUT Name             | Phablet   |
| Brand Name           | HP  |
| Model No.            | HSTNH-F606V   |
| FCC ID               | B94HHF606V  |
| Date of receive      | May. 06, 2016   |
| Date of Test(s)      | May. 13, 2016 , Mar. 03, 2017                                     |
| Date of Issue        | Mar. 16, 2017   |

Standards:

### ANSI C63.19-2011

**FCC RULE PART(S): 47 CFR PART 20.19(B)**

**HAC CATEGORY: M4 (M Category)**

In the configuration tested, the EUT complied with the standards specified above.

**Remarks:**

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

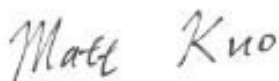
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**Signed on behalf of SGS**

**Engineer**

**Matt Kuo**

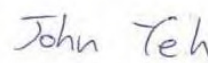
**Date: Mar. 16, 2017**



**Supervisor**

**John Yeh**

**Date: Mar. 16, 2017**





## Revision History

| Report Number | Revision | Description                  | Issue Date    |
|---------------|----------|------------------------------|---------------|
| E5/2017/10013 | Rev.00   | Initial creation of document | Mar. 16, 2017 |
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## 1. Introduction

The purpose of the Hearing Aid Compatibility is to enable measurements of the near electric fields generated by wireless communication devices in the region controlled for use by a hearing aid in accordance with ANSI-C63.19-2011

The purpose of this standard is to establish categories for hearing aids and for WD (wireless communications devices) that can indicate to health care practitioners and hearing aid users which hearing aids are compatible with which WD, and to provide tests that can be used to assess the electromagnetic characteristics of hearing aids and WD and assign them to these categories. The various parameters required, in order to demonstrate compatibility and accessibility are measured. The design of the standard is such that when a hearing aid and WD achieve one of the categories specified, as measured by the methodology of this standard, the indicated performance is realized.

In order to provide for the usability of a hearing aid with a WD, several factors must be coordinated:

a) Radio frequency (RF) measurements of the near-field electric fields emitted by a WD to categorize these emissions for correlation with the RF immunity of a hearing aid.

Hence, the following are measurements made for the WD:  
RF E-Field emissions

The measurement plane is parallel to, and 1.5cm in front of, the reference plane.

Applications for certification of equipment operation under part 20, that a manufacturer is seeking to certify as hearing aid compatible, as set forth in §20.19 of that part, shall include a statement indication compliance with the test requirements of §20.19 and indicating the appropriate U-rating for the equipment. The manufacturer of the equipment shall be responsible for maintaining the test results.

## 2. Testing Laboratory

|                 |  |
|-----------------|--|
| Company Name    | SGS Taiwan Ltd. Electronics & Communication Laboratory                       |
| Company address | No.2, Keji 1st Rd., Guishan Township, Taoyuan County 333,<br>Taiwan (R.O.C.) |
| Telephone       | +886-2-2299-3279   |
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## 3. Details of Applicant

|                   |   |
|-------------------|---|
| Applicant Name    | HP Inc.   |
| Applicant Address | 3390 East Harmony Road Fort Collins, Colorado 80528 United States |

## 4. Description of EUT

|                   |  |   |
|-------------------|--|---|
| EUT Name          | Phablet  |   |
| Brand Name        | HP   |   |
| Model No.         | HSTNH-F606V  |   |
| FCC ID            | B94HHF606V   |   |
| Mode of Operation | <input checked="" type="checkbox"/> GSM <input checked="" type="checkbox"/> GPRS <input checked="" type="checkbox"/> EDGE<br><input checked="" type="checkbox"/> WCDMA <input checked="" type="checkbox"/> HSDPA <input checked="" type="checkbox"/> HSUPA <input checked="" type="checkbox"/> HSPA+<br><input checked="" type="checkbox"/> LTE FDD <input checked="" type="checkbox"/> CDMA 1xRTT <input checked="" type="checkbox"/> CDMA EVDO Rev.0/ Rev.A<br><input checked="" type="checkbox"/> WLAN802.11 a/b/g/n/ac (20M/40M/80M) <input checked="" type="checkbox"/> Bluetooth |   |
| Duty Cycle        | GSM  | 1/8.3   |
|                   | GPRS<br>(support multi class 12 max)   | 1/2 (1Dn4UP)<br>1/2.76 (1Dn3UP)<br>1/4.1 (1Dn2UP)<br>1/8.3 (1Dn1UP) |
|                   | EDGE<br>(support multi class 12 max)   | 1/2 (1Dn4UP)<br>1/2.76 (1Dn3UP)<br>1/4.1 (1Dn2UP)<br>1/8.3 (1Dn1UP) |
|                   | WCDMA  | 1   |
|                   | CDMA 1xRTT /<br>EVDO Rev.0/ Rev. A   | 1   |
|                   | LTE(data only, not support VoLTE)  | 1   |
|                   | WLAN 802.11<br>a/b/g/n/ac(20M/40M/80M)   | 1   |
|                   | Bluetooth  | 1   |

|                             |                                     |      |      |      |
|-----------------------------|-------------------------------------|------|------|------|
| TX Frequency Range (MHz)    | GSM850                              | 824  | —    | 848  |
|                             | GSM1900                             | 1850 | —    | 1910 |
|                             | WCDMA Band II                       | 1850 | —    | 1910 |
|                             | WCDMA Band IV                       | 1710 | —    | 1755 |
|                             | WCDMA Band V                        | 824  | —    | 848  |
|                             | CDMA Cellular (BC0)                 | 824  | —    | 848  |
|                             | CDMA PCS (BC1)                      | 1850 | —    | 1910 |
|                             | LTE FDD Band II                     | 1850 | —    | 1910 |
|                             | LTE FDD Band IV                     | 1710 | —    | 1755 |
|                             | LTE FDD Band V                      | 824  | —    | 849  |
|                             | LTE FDD Band VII                    | 2500 | —    | 2570 |
|                             | LTE FDD Band XII                    | 699  | —    | 716  |
|                             | LTE FDD Band XIII                   | 777  | —    | 787  |
|                             | LTE FDD Band XXX                    | 2305 | —    | 2315 |
|                             | WLAN802.11 b/g/n(20M)               | 2412 | —    | 2462 |
|                             | WLAN802.11 n(40M)                   | 2422 | —    | 2452 |
|                             | WLAN802.11 a/n(20M)/ac(20M)<br>5.2G | 5180 | —    | 5240 |
|                             | WLAN802.11 n(40M)/ac(40M)<br>5.2G   | 5190 | —    | 5230 |
|                             | WLAN802.11 ac(80M) 5.2G             | 5210 |      |      |
|                             | WLAN802.11 a/n(20M)/ac(20M)<br>5.3G | 5260 | —    | 5320 |
|                             | WLAN802.11 n(40M)/ac(40M)<br>5.3G   | 5270 | —    | 5310 |
| WLAN802.11 ac(80M) 5.3G     | 5290                                |      |      |      |
| WLAN802.11 a/n/ac(20M) 5.6G | 5500                                | —    | 5720 |      |
| WLAN802.11 n/ac(40M) 5.6G   | 5510                                | —    | 5710 |      |
| WLAN802.11 ac(80M) 5.6G     | 5530                                | —    | 5690 |      |

|                          |                                  |       |   |       |
|--------------------------|----------------------------------|-------|---|-------|
| TX Frequency Range (MHz) | WLAN802.11 a/n(20M)/ac(20M) 5.8G | 5745  | — | 5825  |
|                          | WLAN802.11 n(40M)/ac(40M) 5.8G   | 5710  | — | 5795  |
|                          | WLAN802.11 ac(80M) 5.8G          | 5775  |   |       |
|                          | Bluetooth                        | 2402  | — | 2480  |
| Channel Number (ARFCN)   | GSM850                           | 128   | — | 251   |
|                          | GSM1900                          | 512   | — | 810   |
|                          | WCDMA Band II                    | 9262  | — | 9538  |
|                          | WCDMA Band IV                    | 1312  | — | 1513  |
|                          | WCDMA Band V                     | 4132  | — | 4233  |
|                          | CDMA Cellular (BC0)              | 1013  | — | 777   |
|                          | CDMA PCS (BC1)                   | 25    | — | 1175  |
|                          | LTE FDD Band II                  | 18607 | — | 19193 |
|                          | LTE FDD Band IV                  | 19957 | — | 20393 |
|                          | LTE FDD Band V                   | 20407 | — | 20643 |
|                          | LTE FDD Band VII                 | 20775 | — | 21425 |
|                          | LTE FDD Band XII                 | 23007 | — | 23173 |
|                          | LTE FDD Band XIII                | 23205 | — | 23255 |
|                          | LTE FDD Band XXX                 | 27685 | — | 27735 |
|                          | WLAN 802.11 b/g/n(20M)           | 1     | — | 11    |
|                          | WLAN802.11 n (40M)               | 3     | — | 9     |
|                          | WLAN802.11a/n(20M)/ac(20M) 5.2G  | 36    | — | 48    |
|                          | WLAN802.11n(40M)/ac(40M) 5.2G    | 38    | — | 46    |
|                          | WLAN802.11 ac(80M) 5.2G          | 42    |   |       |
|                          | WLAN802.11 a/n(20M)/ac(20M) 5.3G | 52    | — | 64    |



|                           |                                     |     |   |     |
|---------------------------|-------------------------------------|-----|---|-----|
| Channel Number<br>(ARFCN) | WLAN802.11 n(40M)/ac(40M)<br>5.3G   | 54  | — | 62  |
|                           | WLAN802.11 ac(80M) 5.3G             | 58  |   |     |
|                           | WLAN802.11 a/n/ac(20M) 5.6G         | 100 | — | 144 |
|                           | WLAN802.11 ac(80M) 5.6G             | 106 | — | 138 |
|                           | WLAN802.11 n/ac(40M) 5.6G           | 102 | — | 142 |
|                           | WLAN802.11 a/n(20M)/ac(20M)<br>5.8G | 149 | — | 165 |
|                           | WLAN802.11 n(40M)/ac(40M)<br>5.8G   | 142 | — | 159 |
|                           | WLAN802.11 ac(80M) 5.8G             | 155 |   |     |
|                           | Bluetooth                           | 0   | — | 78  |

## 5. Air Interfaces and Bands

| Air- Interface  | Band (MHZ) | Type Transport | C63.19 tested | Simultaneous Transmitter but not tested                                | Voice Over Digital Transport OTT capability | Power Reduction |
|---|------------|----------------|---------------|--|---|-----------------|
| GSM   | 850        | VO             | Yes           | Yes, WiFi or Bluetooth   | No  | No              |
|   | 1900       |                |               |  | No  | No              |
| CDMA 1xRTT  | BC0        | VO             | Yes           | Yes, WiFi or Bluetooth   | No  | No              |
|   | BC1        |                |               |  | No  | No              |
| CDMA EVDO Rev.0/ Rev. A   | BC0        | DT             | NA            | Yes, WiFi or Bluetooth   | Yes   | No              |
|   | BC1        |                |               |  | Yes   | No              |
| WCDMA   | II         | VO             | Yes (Note 1)  | Yes, WiFi or Bluetooth   | No  | No              |
|   | IV         |                |               |  | No  | No              |
|   | V          |                |               |  | No  | No              |
| LTE   | II         | DT             | No            | Yes, WiFi or Bluetooth   | Yes   | No              |
|   | IV         |                |               |  | Yes   | No              |
|   | V          |                |               |  | Yes   | No              |
|   | VII        |                |               |  | Yes   | No              |
|   | XII        |                |               |  | Yes   | No              |
|   | XIII       |                |               |  | Yes   | No              |
|   | XXX        |                |               |  | Yes   | No              |
| WiFi  | 2450       | DT             | No            | Yes, WWAN or BT  | Yes   | No              |
| Bluetooth   | 2450       | DT             | No            | Yes, WWAN or BT  | No  | No              |
| VO= CMRS Voice Service<br>DT= Digital Transport<br>VD=CMRS IP Voice Service and Digital Transport |            |                |               | Note<br>1.It applies the low power exemption based on ANSI C63.19-2011 |   |                 |



## 6. Test Environment

|                     |         |
|---------------------|---------|
| Ambient Temperature | 21.7° C |
| Relative Humidity   | <80 %   |

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.  
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

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## 7. Description of test system

### 7.1 Measurement system Diagram for SPEAG Robotic

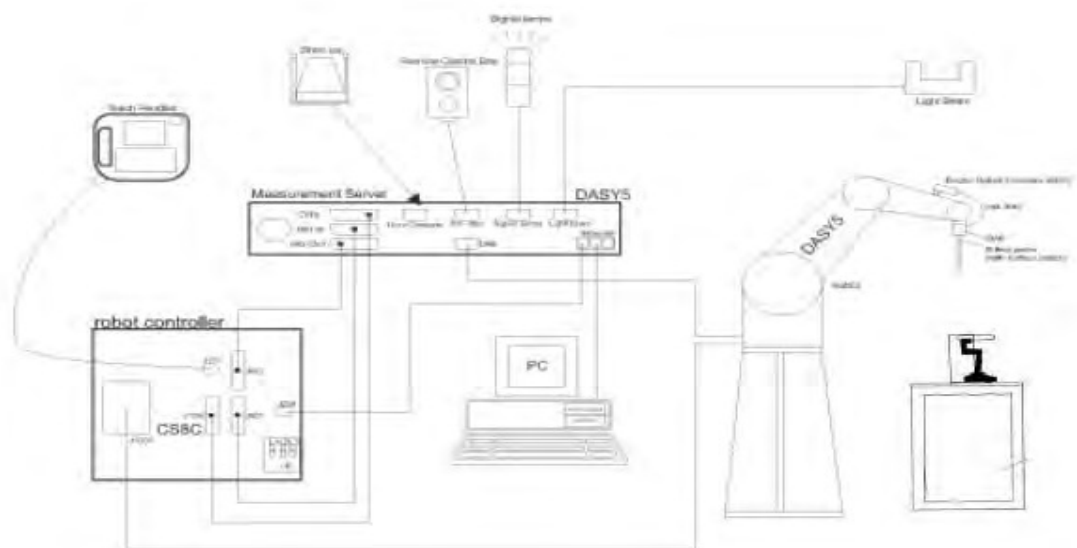



Fig.1 The SPEAG Robotic Diagram

The DASY5 system for performing compliance tests consists of the following items:

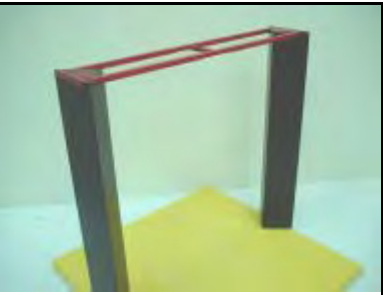
- A standard high precision 6-axis robot (Staubli RX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
- E Field probe.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.

- A computer operating Windows 7.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The Test Arch phantom.
- The device holder for handheld mobile phones.
- Validation dipole kits allowing to validate the proper functioning of the system.


### 7.2 E Field Probe

|               |   |   |
|---------------|---|---|
| Construction  | One dipole parallel, two dipoles normal to probe axis<br>Built-in shielding against static charges<br>PEEK enclosure material |  <p>ER3DV6 E-Field Probe</p> |
| Calibration   | In air from 100 MHz to 3.0 GHz<br>(absolute accuracy $\pm 6.0\%$ , $k=2$ )  |   |
| Frequency     | (extended to 20 MHz for MRI),<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    | Tip diameter: 8 mm<br>Distance from probe tip to dipole centers: 2.5 mm   |   |

### 7.3 Test Arch

|             |  |  |
|-------------|--|--|
| Description | Enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot. |  <p>Test Arch</p> |
| Dimensions  | length: 370 mm<br>width: 370 mm<br>height: 370 mm  |  |

### 7.4 Phone Holder

|             |   |   |
|-------------|---|---|
| Description | Supports accurate and reliable positioning of any phone Effect on near field $< \pm 0.5$ dB |  <p>Phone Holder</p> |
|-------------|---|---|

## 8. Test Procedure

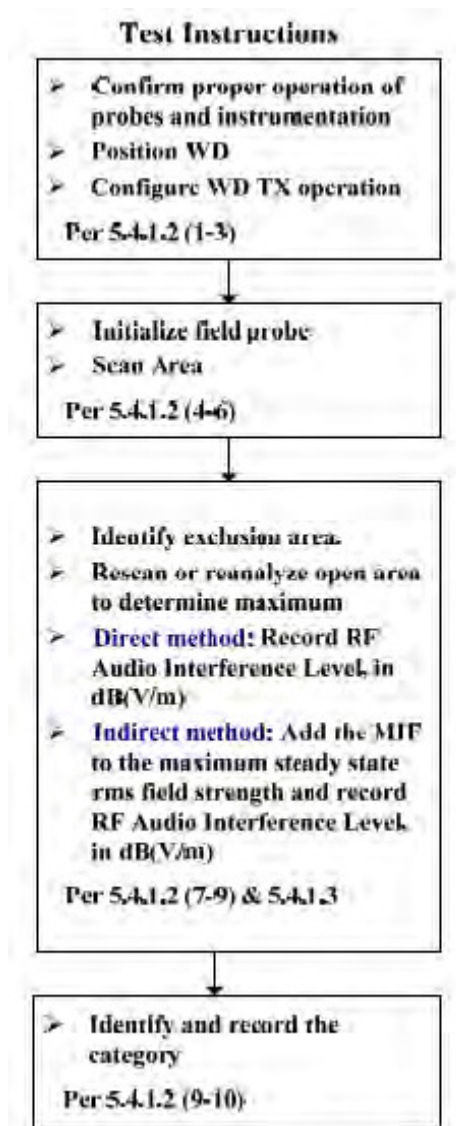


Fig.2 RF emission flow chart

The following illustrate a typical RF emissions test scan over a wireless communications device (Indirect method):

1. Proper operation of the field probe, probe measurement system, other instrumentation, and the positioning system was confirmed.
2. WD is positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.
3. The WD operation for maximum rated RF output power was configured and confirmed with the base station simulator, at the test channel and other normal operating parameters as intended for the test. The battery was ensured to be fully charged before each test.
4. The center sub-grid was centered over the center of the acoustic output (also audio band magnetic output, if applicable). The WD audio output was positioned tangent (as physically possible) to the measurement plane.
5. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the HAC Phantom.
6. The measurement system measured the field strength at the reference location.
7. Measurements at 5mm increments in the 5 × 5 cm region were performed and recorded. A 360° rotation about the azimuth axis at the maximum interpolated position was measured. For the worst-case condition, the peak reading from this rotation was used in re-evaluating the HAC category.
8. The system performed a drift evaluation by measuring the field at the reference location.

**Note.**

Per KDB 285076 D01 v04r01 2.d) 1), handsets that have the ability to support concurrent connections using simultaneous transmissions shall be independently tested for each air interface/band given in ANSI C63.19-2011. At the present time ANSI C63.19 does not provide simultaneous transmission test procedures.



## 9. System Verification

A dipole antenna meeting the requirements given in ANSI C63.19-2011 was placed in the position normally occupied by the WD.

The length of the dipole was scanned by E-field probes and the maximum values for each were recorded.

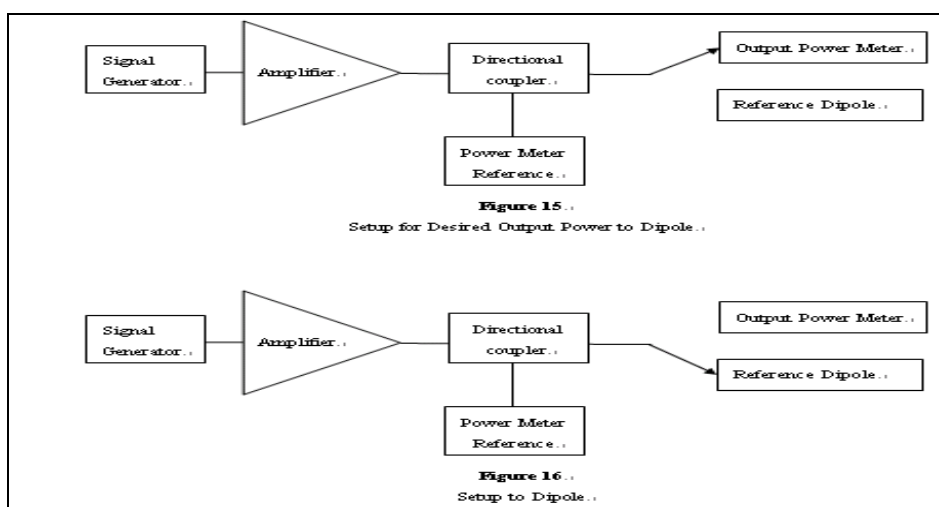


Fig.3 System verification

For E-Field Scan

| Mode | Frequency (MHz) | Input Power(dBm) | E-Field 1 (V/m) | E-Field 2(V/m) | Target Value(V/m) | Deviation | Measured Date |
|------|-----------------|------------------|-----------------|----------------|-------------------|-----------|---------------|
| CW   | 835             | 20               | 114.0           | 106.6          | 108.5             | 1.66%     | May.13, 2016  |
| CW   | 1880            | 20               | 101.4           | 90.46          | 87.8              | 9.25%     | May.13, 2016  |
| CW   | 835             | 20               | 114.0           | 106.5          | 108.5             | 1.61%     | Mar.03, 2017  |
| CW   | 1880            | 20               | 92.98           | 90.45          | 87.8              | 4.46%     | Mar.03, 2017  |

Note:

For E-Field, the deviation is  $[(E\text{-Field } 1 + E\text{-Field } 2) / 2 - \text{Target value}] / \text{Target value} \times 100\%$

## 10. Modulation Interference Factor

For any specific fixed and repeatable modulated signal, a modulation interference factor (MIF, expressed in dB) may be developed that relates its interference potential to its steady-state rms signal level or average power level. This factor is a function only of the audio-frequency amplitude modulation characteristics of the signal and is the same for field-strength and conducted power measurements. It is important to emphasize that the MIF is valid only for a specific repeatable audio-frequency amplitude modulation characteristic. Any change in modulation characteristic requires determination and application of a new MIF

The MIF may be determined using a radiated RF field or a conducted RF signal,

- b) Using RF illumination or conducted coupling, apply the specific modulated signal in question to the measurement system at a level within its confirmed operating dynamic range.
- c) Measure the steady-state rms level at the output of the fast probe or sensor.
- d) Measure the steady-state average level at the weighting output.
- e) Without changing the square-law detector or weighting system, and using RF illumination or conducted coupling, substitute for the specific modulated signal a 1 kHz, 80% amplitude modulated carrier at the same frequency and adjust its strength until the level at the weighting output equals the step d) measurement.
- f) Without changing the carrier level from step e), remove the 1 kHz modulation and again measure the steady-state rms level indicated at the output of the fast probe or sensor.
- g) The MIF for the specific modulation characteristic is provided by the ratio of the step f) measurement to the step c) measurement, expressed in dB ( $20 \times \log(\text{step f})/\text{step c}$ ).

Based on the KDB285076 D01, the handset can also use the MIF values predetermined by the test equipment manufacturer, and the following table lists the MIF values evaluated by DASY manufacturer (SPEAG), and the test result will be calculated with the MIF parameter automatically.

| SPEAG UID | UID version      | Communication system              | MIF(dB) |
|-----------|------------------|-----------------------------------|---------|
| 10021     | DAB (10.14.2015) | GSM-FDD (TDMA, GMSK)              | 3.63    |
| 10011     | CAB (10.14.2015) | UMTS-FDD (WCDMA)                  | -27.23  |
| 10081     | CAB (16.11.2016) | CDMA(SO3; RC3; full frame rate)   | -19.71  |
| 10295     | AAB (10.14.2015) | CDMA(SO3; RC1; 1/8 th frame rate) | 3.26    |

## 11. Measured conducted output power

| Band               | Channel | Average power(dBm) |
|--------------------|---------|--------------------|
| GSM 850<br>(GMSK)  | 128     | 31.62              |
|                    | 190     | 31.69              |
|                    | 251     | 31.72              |
| GSM 1900<br>(GMSK) | 512     | 29.30              |
|                    | 661     | 29.53              |
|                    | 810     | 29.78              |
| WCDMA Band II      | 9262    | 23.45              |
|                    | 9400    | 23.43              |
|                    | 9538    | 23.51              |
| WCDMA Band IV      | 1312    | 23.49              |
|                    | 1412    | 23.24              |
|                    | 1513    | 23.28              |
| WCDMA Band V       | 4132    | 24.05              |
|                    | 4183    | 23.87              |
|                    | 4133    | 24.11              |

| Band                                   | Channel | Average power(dBm) |
|--|---------|--------------------|
| CDMA 1xRTT<br>cellular(BC0)<br>SO3;RC3 | 1013    | 23.33              |
|  | 384     | 23.36              |
|  | 777     | 23.19              |
| CDMA 1xRTT<br>cellular(BC0)<br>SO3;RC1 | 1013    | 23.37              |
|  | 384     | 23.46              |
|  | 777     | 23.26              |
| CDMA 1xRTT<br>PCS(BC1)<br>SO3;RC3      | 25      | 23.41              |
|  | 600     | 23.58              |
|  | 1175    | 23.43              |
| CDMA 1xRTT<br>PCS(BC1)<br>SO3;RC1      | 25      | 23.41              |
|  | 600     | 23.64              |
|  | 1175    | 23.44              |

## 12. Justification of held to ear modes tested

### I. Analysis of RF air interface technologies

a. OTT data services are outside the current definition of a managed CMRS service and are currently not required to be evaluated.

b. Based on ANSI. C63.19-2011. 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. If a device supports multiple RF air interfaces, each RF air interface shall be evaluated individually.

The MIF plus the worst case average power for all modes are investigated below to determine the testing requirements for this device.

## II. Low power exemption

| Air interference   | Maximum power(dB) | MIF(dB) | Power + MIF (dB) | ANSI C63.19 2011 test required |
|--------------------|-------------------|---------|------------------|--------------------------------|
| GSM850             | 31.72             | 3.63    | 35.35            | <b>Yes</b>                     |
| GSM1900            | 29.78             | 3.63    | 33.41            | <b>Yes</b>                     |
| WCDMA B2           | 23.51             | -27.23  | -3.72            | No                             |
| WCDMA B4           | 23.49             | -27.23  | -3.74            | No                             |
| WCDMA B5           | 24.11             | -27.23  | -3.12            | No                             |
| CDMA 1xRTT SO3;RC3 | 23.58             | -19.71  | 3.87             | No                             |
| CDMA 1xRTT SO3;RC1 | 23.64             | 3.26    | 26.90            | <b>Yes</b>                     |

# We used the predetermined MIF to evaluate the low power exemption.

# Based on ANSI. C63.19 2011, RF emission testing for WCDMA / CDMA 1xRTT SO3;RC3 is exempted.

# Based on ANSI. C63.19 2011, WCDMA / CDMA 1xRTT SO3;RC3 that is exempted from testing shall be rated as M4.

### 13. ANSI C63.19-2011 performance and categories

The measurements were performed to ensure compliance to the ANSI C63.19-2011 standard,

| Category | E-Field Emissions dB(V/m) < 960MHz |
|----------|------------------------------------|
| M1       | 50-55                              |
| M2       | 45-50                              |
| M3       | 40-45                              |
| M4       | <40                                |

| Category | E-Field Emissions dB(V/m) > 960MHz |
|----------|------------------------------------|
| M1       | 40-45                              |
| M2       | 35-40                              |
| M3       | 30-35                              |
| M4       | <30                                |

WD RF audio interference level categories in logarithmic units



## 14. Instruments List

| Manufacturer                    | Device                                | Type          | Serial number | Date of last calibration | Date of next calibration |
|---------------------------------|---------------------------------------|---------------|---------------|--------------------------|--------------------------|
| Schmid & Partner Engineering AG | E-Field Probe                         | ER3DV6        | 2306          | Nov.20,2015              | Nov.19,2016              |
|                                 |                                       |               |               | Nov.23,2016              | Nov.22,2017              |
| Schmid & Partner Engineering AG | 835/1880 MHz System Validation Dipole | CD835V3       | 1052          | Mar.17,2016              | Mar.16,2017              |
|                                 |                                       | CD1880V3      | 1044          | Mar.17,2016              | Mar.16,2017              |
| Schmid & Partner Engineering AG | Data acquisition Electronics          | DAE4          | 1374          | Oct.23,2015              | Aug.22,2016              |
|                                 |                                       |               |               | Aug.23,2016              | Aug.22,2017              |
| Schmid & Partner Engineering AG | Software                              | DASY52 52.8.8 | N/A           | Calibration not required | Calibration not required |
| Agilent                         | Dielectric Probe Kit                  | 85070D        | US01440168    | Calibration not required | Calibration not required |
| Agilent                         | Dual-directional coupler              | 778D          | MY48220468    | Jul.16,2015              | Jul.15,2016              |
|                                 |                                       |               |               | Jul.06,2016              | Jul.05,2017              |
| Agilent                         | RF Signal Generator                   | N5181A        | MY50141235    | Dec.24,2015              | Dec.23,2016              |
|                                 |                                       |               | MY50144143    | Mar.01,2017              | Feb.28,2018              |
| R&S                             | Radio Communication Test              | CMU200        | 122498        | Aug.25,2015              | Aug.24,2016              |
|                                 |                                       |               |               | Aug.19,2016              | Aug.18,2017              |
| Schmid & Partner Engineering AG | Test Arch SD HAC                      | P01           | 1047          | Calibration not required | Calibration not required |

| Manufacturer | Device       | Type   | Serial number | Date of last calibration | Date of next calibration |
|--------------|--------------|--------|---------------|--------------------------|--------------------------|
| Agilent      | Power Meter  | E4417A | MY52240003    | Jul.15,2015              | Jul.14,2016              |
|              |              |        |               | Jan.20,2017              | Jan.19,2018              |
| Agilent      | Power Sensor | E9301H | MY51470002    | Jan.07,2016              | Jan.06,2017              |
|              |              |        | MY52200004    | Oct.17,2016              | Oct.16,2017              |

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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## 15. Summary of Results

### E-Field

| E-Field Emission    | Channel | Modulation Interference Factor | Conducted Power (dBm) | Power Drift(dB) | Audio Interference Level dB(V/m) | RESULT | Excl Blocks per 4.3.1.2.2 |
|---------------------|---------|--------------------------------|-----------------------|-----------------|----------------------------------|--------|---------------------------|
| GSM 850             | 128     | 3.63                           | 31.62                 | -0.03           | 37.35                            | M4     | 236                       |
|                     | 190     | 3.63                           | 31.69                 | 0.01            | 38.34                            | M4     | 236                       |
|                     | 251     | 3.63                           | 31.72                 | -0.02           | 38.52                            | M4     | 236                       |
| E-Field Emission    | Channel | Modulation Interference Factor | Conducted Power (dBm) | Power Drift(dB) | Audio Interference Level dB(V/m) | RESULT | Excl Blocks per 4.3.1.2.2 |
| GSM 1900            | 512     | 3.63                           | 29.30                 | 0.09            | 28.97                            | M4     | 789                       |
|                     | 661     | 3.63                           | 29.53                 | 0.08            | 29.25                            | M4     | 789                       |
|                     | 810     | 3.63                           | 29.78                 | 0.14            | 28.97                            | M4     | 689                       |
| E-Field Emission    | Channel | Modulation Interference Factor | Conducted Power (dBm) | Power Drift(dB) | Audio Interference Level dB(V/m) | RESULT | Excl Blocks per 4.3.1.2.2 |
| CDMA Cellular (BC0) | 1013    | 3.26                           | 23.37                 | -0.06           | 30.62                            | M4     | 236                       |
|                     | 384     | 3.26                           | 23.46                 | -0.00           | 31.05                            | M4     | 236                       |
|                     | 777     | 3.26                           | 23.26                 | 0.04            | 31.02                            | M4     | 236                       |
| E-Field Emission    | Channel | Modulation Interference Factor | Conducted Power (dBm) | Power Drift(dB) | Audio Interference Level dB(V/m) | RESULT | Excl Blocks per 4.3.1.2.2 |
| CDMA PCS (BC1)      | 25      | 3.26                           | 23.41                 | 0.15            | 23.06                            | M4     | 789                       |
|                     | 600     | 3.26                           | 23.64                 | 0.16            | 23.79                            | M4     | 689                       |
|                     | 1175    | 3.26                           | 23.44                 | -0.05           | 23.26                            | M4     | 689                       |

## 16. Measurement Data

Date: 2016/5/13

### HAC-E\_GSM 850\_CH 128

Communication System: GSM; Frequency: 824.2 MHz

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

Phantom section: RF Section

DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2015/11/20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 58.28 V/m; Power Drift = -0.03 dB

Applied MIF = 3.63 dB

RF audio interference level = 37.35 dBV/m

**Emission category: M4**

MIF scaled E-field

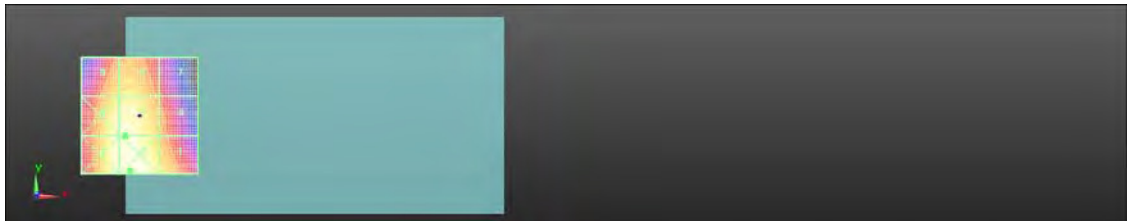
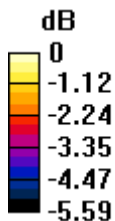
|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>36.67 dBV/m</b> | Grid 2 <b>M4</b><br><b>37.58 dBV/m</b> | Grid 3 <b>M4</b><br><b>37.44 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>35.9 dBV/m</b>  | Grid 5 <b>M4</b><br><b>37.35 dBV/m</b> | Grid 6 <b>M4</b><br><b>37.29 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>35.26 dBV/m</b> | Grid 8 <b>M4</b><br><b>36.64 dBV/m</b> | Grid 9 <b>M4</b><br><b>36.56 dBV/m</b> |

**Cursor:**

Total = 37.58 dBV/m

E Category: M4

Location: -4, -23.5, 8.7 mm



0 dB = 75.68 V/m = 37.58 dBV/m

Date: 2016/5/13

### HAC-E\_GSM 850\_CH 190

Communication System: GSM; Frequency: 836.6 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2015/11/20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm  
Reference Value = 64.51 V/m; Power Drift = 0.01 dB  
Applied MIF = 3.63 dB  
RF audio interference level = 38.34 dBV/m

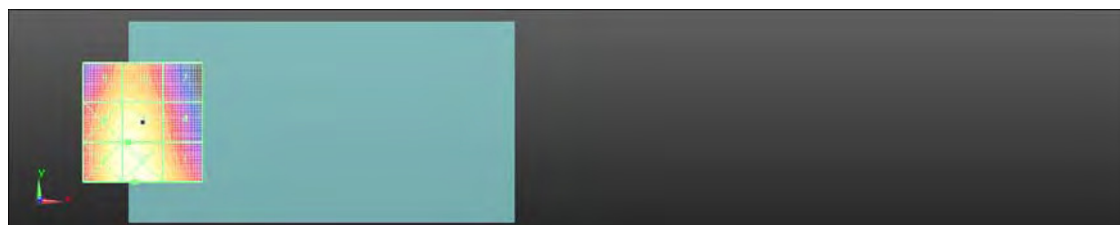
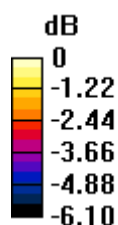
#### Emission category: M4

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>37.7 dBV/m  | Grid 2 M4<br>38.61 dBV/m | Grid 3 M4<br>38.47 dBV/m |
| Grid 4 M4<br>36.83 dBV/m | Grid 5 M4<br>38.34 dBV/m | Grid 6 M4<br>38.29 dBV/m |
| Grid 7 M4<br>36.03 dBV/m | Grid 8 M4<br>37.56 dBV/m | Grid 9 M4<br>37.49 dBV/m |

#### Cursor:

Total = 38.61 dBV/m  
E Category: M4  
Location: -3.5, -25, 8.7 mm



0 dB = 85.24 V/m = 38.61 dBV/m

Date: 2016/5/13

### HAC-E\_GSM 850\_CH 251

Communication System: GSM; Frequency: 848.6 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2015/11/20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 65.58 V/m; Power Drift = -0.02 dB

Applied MIF = 3.63 dB

RF audio interference level = 38.52 dBV/m

**Emission category: M4**

MIF scaled E-field

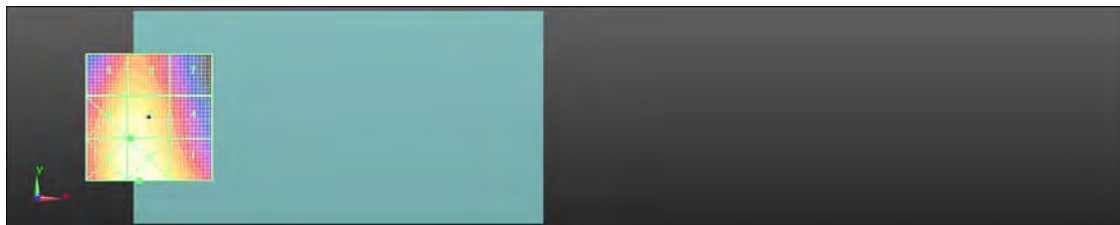
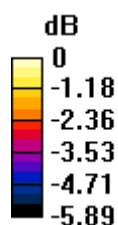
|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>37.95 dBV/m</b> | Grid 2 <b>M4</b><br><b>38.88 dBV/m</b> | Grid 3 <b>M4</b><br><b>38.72 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>37 dBV/m</b>    | Grid 5 <b>M4</b><br><b>38.52 dBV/m</b> | Grid 6 <b>M4</b><br><b>38.5 dBV/m</b>  |
| Grid 7 <b>M4</b><br><b>36.13 dBV/m</b> | Grid 8 <b>M4</b><br><b>37.62 dBV/m</b> | Grid 9 <b>M4</b><br><b>37.58 dBV/m</b> |

#### Cursor:

Total = 38.88 dBV/m

E Category: M4

Location: -4, -25, 8.7 mm



0 dB = 87.87 V/m = 38.88 dBV/m

Date: 2016/5/13

### HAC-E\_GSM 1900\_CH 512

Communication System: GSM; Frequency: 1850.2 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2015/11/20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm  
Reference Value = 16.33 V/m; Power Drift = 0.09 dB  
Applied MIF = 3.63 dB  
RF audio interference level = 28.97 dBV/m

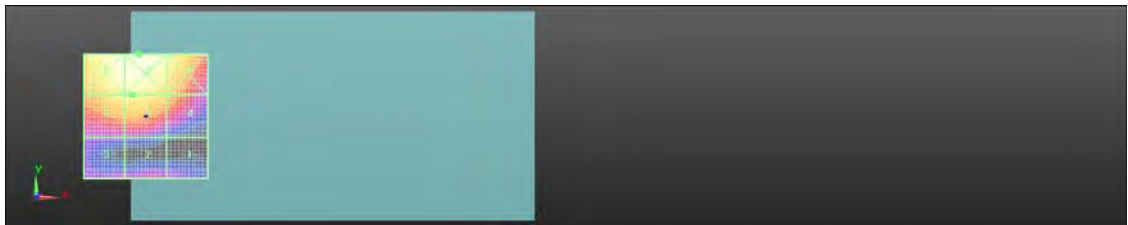
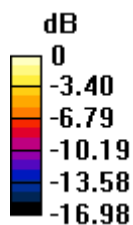
**Emission category: M4**

MIF scaled E-field

|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>21.47 dBV/m</b> | Grid 2 <b>M4</b><br><b>22.17 dBV/m</b> | Grid 3 <b>M4</b><br><b>21.68 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>26.7 dBV/m</b>  | Grid 5 <b>M4</b><br><b>28.97 dBV/m</b> | Grid 6 <b>M4</b><br><b>28.83 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>29.83 dBV/m</b> | Grid 8 <b>M3</b><br><b>31.49 dBV/m</b> | Grid 9 <b>M3</b><br><b>31.19 dBV/m</b> |

#### Cursor:

Total = 31.49 dBV/m  
E Category: M3  
Location: -3, 25, 8.7 mm



0 dB = 37.53 V/m = 31.49 dBV/m

Date: 2016/5/13

### HAC-E\_GSM 1900\_CH 661

Communication System: GSM; Frequency: 1880 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2015/11/20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm  
Reference Value = 17.95 V/m; Power Drift = 0.08 dB  
Applied MIF = 3.63 dB  
RF audio interference level = 29.25 dBV/m

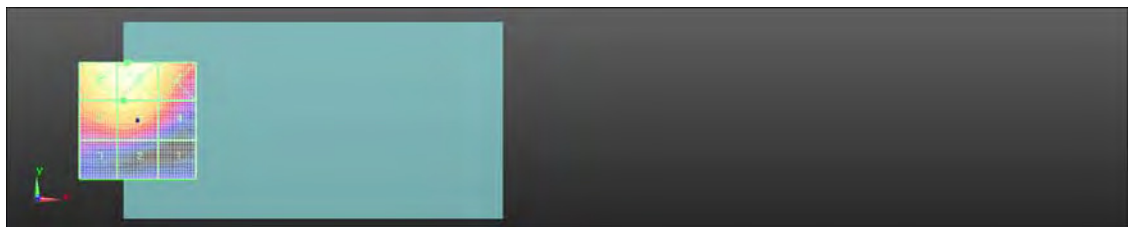
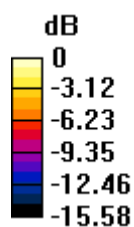
**Emission category: M4**

MIF scaled E-field

|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>20.59 dBV/m</b> | Grid 2 <b>M4</b><br><b>22.33 dBV/m</b> | Grid 3 <b>M4</b><br><b>22.23 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>26.64 dBV/m</b> | Grid 5 <b>M4</b><br><b>29.25 dBV/m</b> | Grid 6 <b>M4</b><br><b>29.15 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>29.42 dBV/m</b> | Grid 8 <b>M3</b><br><b>31.3 dBV/m</b>  | Grid 9 <b>M3</b><br><b>31.1 dBV/m</b>  |

#### Cursor:

Total = 31.30 dBV/m  
E Category: M3  
Location: -4.5, 25, 8.7 mm



0 dB = 36.71 V/m = 31.30 dBV/m



Date: 2016/5/13

### HAC-E\_GSM 1900\_CH 810

Communication System: GSM; Frequency: 1909.8 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2015/11/20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 18.15 V/m; Power Drift = 0.14 dB

Applied MIF = 3.63 dB

RF audio interference level = 28.97 dBV/m

**Emission category: M4**

MIF scaled E-field

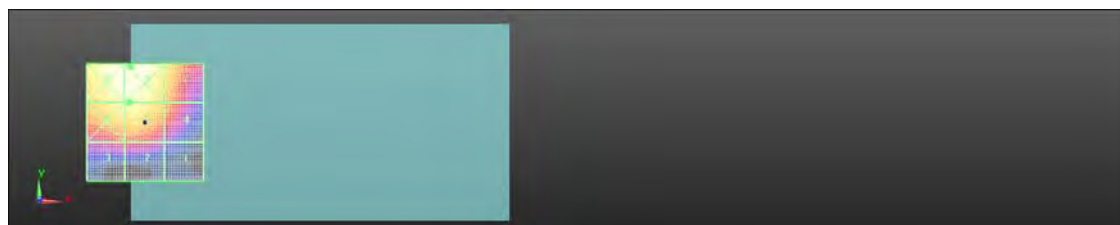
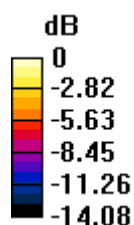
|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>21.2 dBV/m</b>  | Grid 2 <b>M4</b><br><b>23.67 dBV/m</b> | Grid 3 <b>M4</b><br><b>23.63 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>26.05 dBV/m</b> | Grid 5 <b>M4</b><br><b>28.97 dBV/m</b> | Grid 6 <b>M4</b><br><b>28.9 dBV/m</b>  |
| Grid 7 <b>M4</b><br><b>27.76 dBV/m</b> | Grid 8 <b>M3</b><br><b>30.32 dBV/m</b> | Grid 9 <b>M3</b><br><b>30.25 dBV/m</b> |

#### Cursor:

Total = 30.32 dBV/m

E Category: M3

Location: -6, 24, 8.7 mm



0 dB = 32.80 V/m = 30.32 dBV/m

Date: 2017/3/3

### HAC-E CDMA Cellular(BC0) CH 1013

Communication System: CDMA; Frequency: 824.7 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2016/11/23;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: HAC Test Arch with AMCC
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 28.98 V/m; Power Drift = -0.06 dB

Applied MIF = 3.26 dB

RF audio interference level = 30.62 dBV/m

**Emission category: M4**

MIF scaled E-field

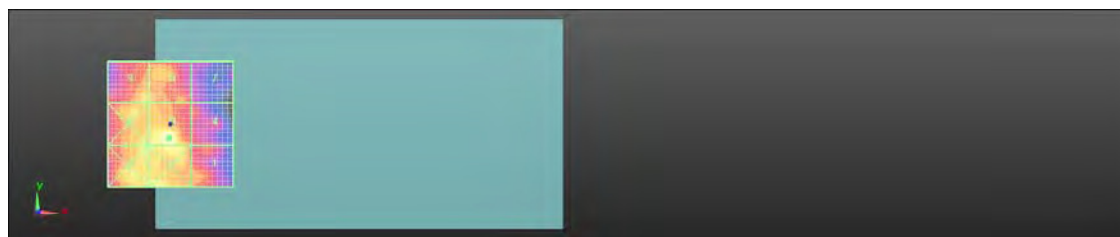
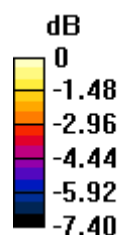
|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>28.15 dBV/m</b> | Grid 2 <b>M4</b><br><b>29.88 dBV/m</b> | Grid 3 <b>M4</b><br><b>29.72 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>27.37 dBV/m</b> | Grid 5 <b>M4</b><br><b>30.62 dBV/m</b> | Grid 6 <b>M4</b><br><b>29.52 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>26.66 dBV/m</b> | Grid 8 <b>M4</b><br><b>28.87 dBV/m</b> | Grid 9 <b>M4</b><br><b>29.1 dBV/m</b>  |

#### Cursor:

Total = 30.62 dBV/m

E Category: M4

Location: -0.5, -5.5, 8.7 mm



0 dB = 33.95 V/m = 30.62 dBV/m

Date: 2017/3/3

### HAC-E\_CDMA Cellular(BC0)\_CH 384

Communication System: CDMA; Frequency: 836.52 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2016/11/23;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: HAC Test Arch with AMCC
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 24.66 V/m; Power Drift = -0.00 dB

Applied MIF = 3.26 dB

RF audio interference level = 31.05 dBV/m

**Emission category: M4**

MIF scaled E-field

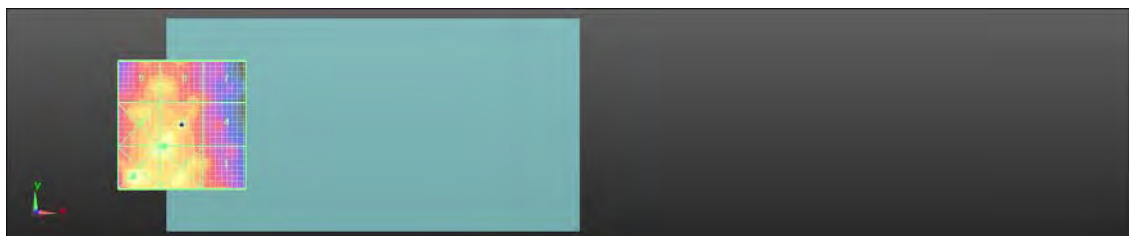
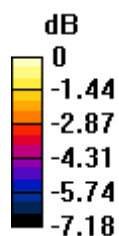
|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M4<br>29.46 dBV/m | Grid 2 M4<br>31.12 dBV/m | Grid 3 M4<br>31.74 dBV/m |
| Grid 4 M4<br>28.56 dBV/m | Grid 5 M4<br>31.05 dBV/m | Grid 6 M4<br>31.02 dBV/m |
| Grid 7 M4<br>28.61 dBV/m | Grid 8 M4<br>30.14 dBV/m | Grid 9 M4<br>30.17 dBV/m |

#### Cursor:

Total = 31.74 dBV/m

E Category: M4

Location: -19, -20, 8.7 mm



0 dB = 38.62 V/m = 31.74 dBV/m

Date: 2017/3/3

### HAC-E\_CDMA Cellular(BC0)\_CH 777

Communication System: CDMA; Frequency: 848.31 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2016/11/23;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: HAC Test Arch with AMCC
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 23.79 V/m; Power Drift = 0.04 dB

Applied MIF = 3.26 dB

RF audio interference level = 31.02 dBV/m

**Emission category: M4**

MIF scaled E-field

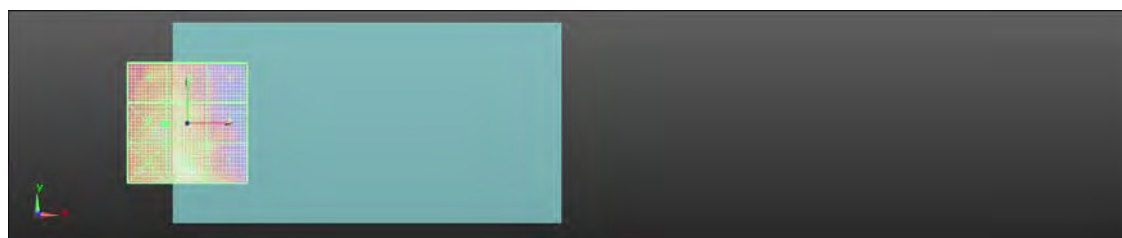
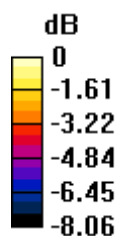
|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>29.03 dBV/m</b> | Grid 2 <b>M4</b><br><b>31.1 dBV/m</b>  | Grid 3 <b>M4</b><br><b>31.23 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>28.74 dBV/m</b> | Grid 5 <b>M4</b><br><b>31.02 dBV/m</b> | Grid 6 <b>M4</b><br><b>31.38 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>27.63 dBV/m</b> | Grid 8 <b>M4</b><br><b>30.26 dBV/m</b> | Grid 9 <b>M4</b><br><b>30.38 dBV/m</b> |

#### Cursor:

Total = 31.38 dBV/m

E Category: M4

Location: -10, -0.5, 8.7 mm



0 dB = 37.09 V/m = 31.39 dBV/m

Date: 2017/3/3

### HAC-E\_CDMA PCS(BC1)\_CH 25

Communication System: CDMA; Frequency: 1851.25 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2016/11/23;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: HAC Test Arch with AMCC
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 8.619 V/m; Power Drift = 0.15 dB

Applied MIF = 3.26 dB

RF audio interference level = 23.06 dBV/m

**Emission category: M4**

MIF scaled E-field

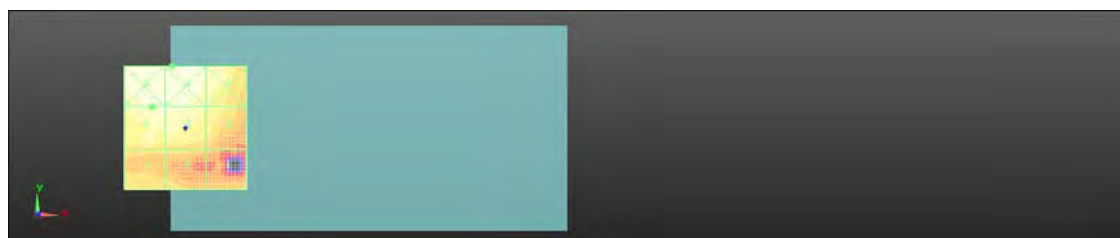
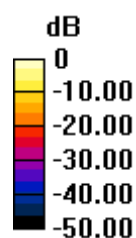
|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>13.07 dBV/m</b> | Grid 2 <b>M4</b><br><b>15.16 dBV/m</b> | Grid 3 <b>M4</b><br><b>16.36 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>19.27 dBV/m</b> | Grid 5 <b>M4</b><br><b>22.95 dBV/m</b> | Grid 6 <b>M4</b><br><b>23.06 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>23.39 dBV/m</b> | Grid 8 <b>M4</b><br><b>25.86 dBV/m</b> | Grid 9 <b>M4</b><br><b>25.05 dBV/m</b> |

#### Cursor:

Total = 25.86 dBV/m

E Category: M4

Location: -5.5, 25, 8.7 mm



0 dB = 19.63 V/m = 25.86 dBV/m

Date: 2017/3/3

### HAC-E\_CDMA PCS(BC1)\_CH 600

Communication System: CDMA; Frequency: 1880 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2016/11/23;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: HAC Test Arch with AMCC
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 9.837 V/m; Power Drift = 0.16 dB

Applied MIF = 3.26 dB

RF audio interference level = 23.79 dBV/m

**Emission category: M4**

MIF scaled E-field

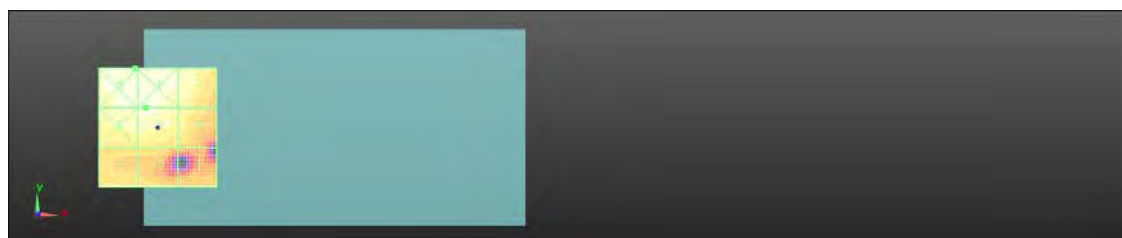
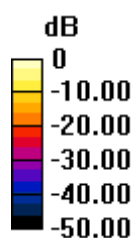
|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>12.88 dBV/m</b> | Grid 2 <b>M4</b><br><b>15.61 dBV/m</b> | Grid 3 <b>M4</b><br><b>16.94 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>19.23 dBV/m</b> | Grid 5 <b>M4</b><br><b>23.79 dBV/m</b> | Grid 6 <b>M4</b><br><b>23.1 dBV/m</b>  |
| Grid 7 <b>M4</b><br><b>22.69 dBV/m</b> | Grid 8 <b>M4</b><br><b>25.67 dBV/m</b> | Grid 9 <b>M4</b><br><b>25.75 dBV/m</b> |

#### Cursor:

Total = 25.75 dBV/m

E Category: M4

Location: -9.5, 25, 8.7 mm



0 dB = 19.39 V/m = 25.75 dBV/m

Date: 2017/3/3

### HAC-E\_CDMA PCS(BC1)\_CH 1175

Communication System: CDMA; Frequency: 1908.75 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

#### DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2016/11/23;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: HAC Test Arch with AMCC
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Device E-Field measurement /E Scan:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 7.316 V/m; Power Drift = -0.05 dB

Applied MIF = 3.26 dB

RF audio interference level = 23.26 dBV/m

**Emission category: M4**

MIF scaled E-field

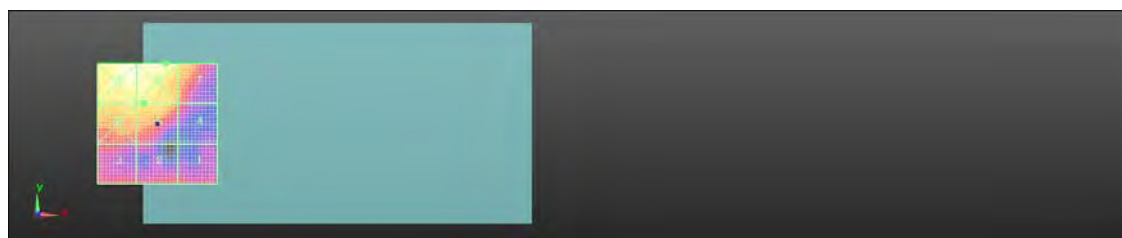
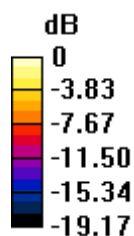
|  |  |  |
|--|--|--|
| Grid 1 <b>M4</b><br><b>17.36 dBV/m</b> | Grid 2 <b>M4</b><br><b>17.62 dBV/m</b> | Grid 3 <b>M4</b><br><b>18.27 dBV/m</b> |
| Grid 4 <b>M4</b><br><b>18.97 dBV/m</b> | Grid 5 <b>M4</b><br><b>23.26 dBV/m</b> | Grid 6 <b>M4</b><br><b>23.08 dBV/m</b> |
| Grid 7 <b>M4</b><br><b>22.47 dBV/m</b> | Grid 8 <b>M4</b><br><b>26.5 dBV/m</b>  | Grid 9 <b>M4</b><br><b>25.9 dBV/m</b>  |

#### Cursor:

Total = 26.50 dBV/m

E Category: M4

Location: 3.5, 25, 8.7 mm



0 dB = 21.13 V/m = 26.50 dBV/m



## 17. System Verification

Date: 2016/5/13

### Dipole CD835\_SN:1052

Communication System: CW; Frequency: 835 MHz

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

Phantom section: RF Section

DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2015/11/20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole E-Field measurement:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 110.7 V/m; Power Drift = -0.01 dB

E-field emissions = 106.6 V/m

**Near-field category: M4 (AWF 0 dB)**

PMF scaled E-field

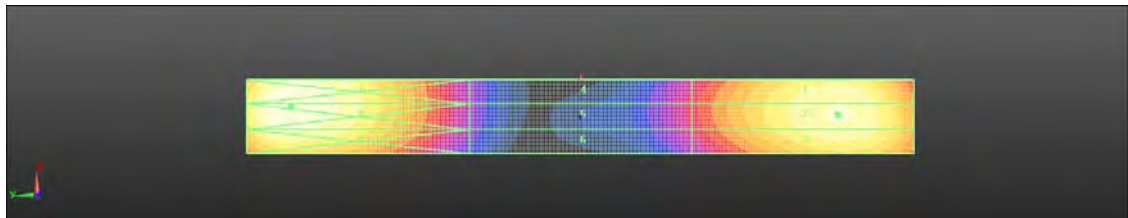
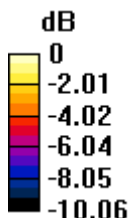
|                                      |                                      |                                      |
|--------------------------------------|--------------------------------------|--------------------------------------|
| Grid 1 <b>M4</b><br><b>105.4 V/m</b> | Grid 2 <b>M4</b><br><b>106.6 V/m</b> | Grid 3 <b>M4</b><br><b>103.9 V/m</b> |
| Grid 4 <b>M4</b><br><b>63.93 V/m</b> | Grid 5 <b>M4</b><br><b>64.09 V/m</b> | Grid 6 <b>M4</b><br><b>61.99 V/m</b> |
| Grid 7 <b>M4</b><br><b>114.0 V/m</b> | Grid 8 <b>M4</b><br><b>114.0 V/m</b> | Grid 9 <b>M4</b><br><b>107.0 V/m</b> |

### Cursor:

Total = 114.0 V/m

E Category: M4

Location: 3, 78, 9.7 mm



0 dB = 114.0 V/m = 41.14 dBV/m



Date: 2016/5/13

**Dipole CD1880\_SN:1044**

Communication System: CW; Frequency: 1880 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2015/11/20;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2015/10/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Dipole E-Field measurement:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm  
Reference Value = 151.8 V/m; Power Drift = 0.00 dB  
E-field emissions = 90.46 V/m

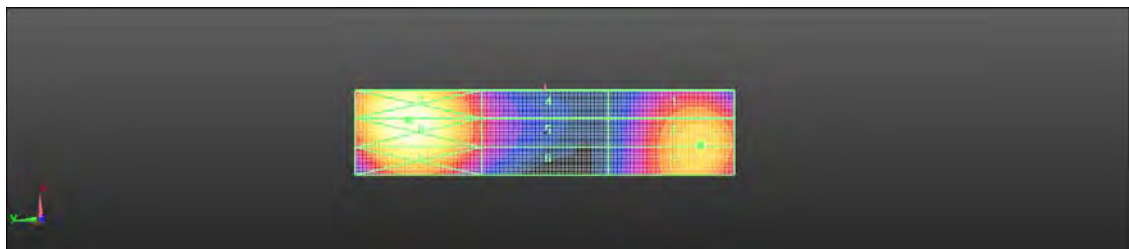
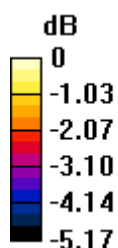
**Near-field category: M3 (AWF 0 dB)**

PMF scaled E-field

|                                      |                                      |                                      |
|--------------------------------------|--------------------------------------|--------------------------------------|
| Grid 1 <b>M3</b><br><b>84.88 V/m</b> | Grid 2 <b>M3</b><br><b>90.46 V/m</b> | Grid 3 <b>M3</b><br><b>90.42 V/m</b> |
| Grid 4 <b>M3</b><br><b>76.16 V/m</b> | Grid 5 <b>M3</b><br><b>76.64 V/m</b> | Grid 6 <b>M3</b><br><b>74.39 V/m</b> |
| Grid 7 <b>M3</b><br><b>101.4 V/m</b> | Grid 8 <b>M3</b><br><b>101.4 V/m</b> | Grid 9 <b>M3</b><br><b>96.03 V/m</b> |

**Cursor:**

Total = 101.4 V/m  
E Category: M3  
Location: 3, 32.5, 9.7 mm



0 dB = 101.4 V/m = 40.12 dBV/m

Date: 2017/3/3

**Dipole CD835 SN:1052**

Communication System: CW; Frequency: 835 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2016/11/23;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Dipole E-Field measurement:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm  
Reference Value = 110.7 V/m; Power Drift = -0.03 dB  
PMR not calibrated. PMF = 1.000 is applied.  
E-field emissions = 106.5 V/m

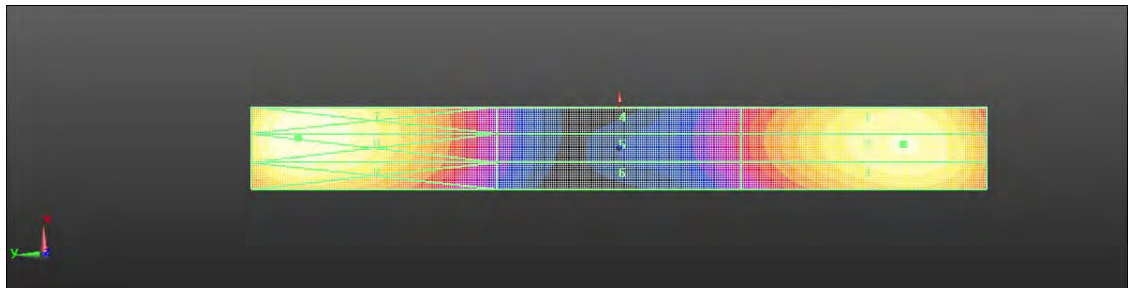
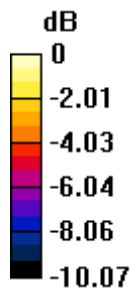
**Near-field category: M4 (AWF 0 dB)**

PMF scaled E-field

|                                      |                                      |                                      |
|--------------------------------------|--------------------------------------|--------------------------------------|
| Grid 1 <b>M4</b><br><b>105.5 V/m</b> | Grid 2 <b>M4</b><br><b>106.5 V/m</b> | Grid 3 <b>M4</b><br><b>103.8 V/m</b> |
| Grid 4 <b>M4</b><br><b>63.99 V/m</b> | Grid 5 <b>M4</b><br><b>64.13 V/m</b> | Grid 6 <b>M4</b><br><b>61.95 V/m</b> |
| Grid 7 <b>M4</b><br><b>113.9 V/m</b> | Grid 8 <b>M4</b><br><b>114.0 V/m</b> | Grid 9 <b>M4</b><br><b>107.2 V/m</b> |

**Cursor:**

Total = 114.0 V/m  
E Category: M4  
Location: 2.5, 78.5, 9.7 mm



0 dB = 114.0 V/m = 41.14 dBV/m

Date: 2017/3/3

**Dipole CD1880\_SN:1044**

Communication System: CW; Frequency: 1880 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section

DASY5 Configuration:

- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2016/11/23;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1374; Calibrated: 2016/8/23
- Phantom: HAC Test Arch
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

**Dipole E-Field measurement:** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm  
Reference Value = 162.3 V/m; Power Drift = -0.01 dB  
PMR not calibrated. PMF = 1.000 is applied.  
E-field emissions = 90.45 V/m

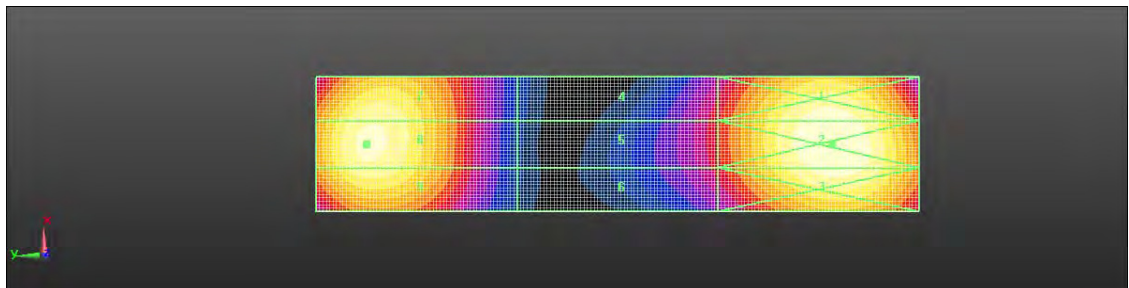
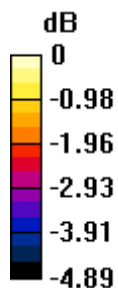
**Near-field category: M3 (AWF 0 dB)**

PMF scaled E-field

|                                      |                                      |                                      |
|--------------------------------------|--------------------------------------|--------------------------------------|
| Grid 1 <b>M3</b><br><b>91.70 V/m</b> | Grid 2 <b>M3</b><br><b>92.98 V/m</b> | Grid 3 <b>M3</b><br><b>91.35 V/m</b> |
| Grid 4 <b>M3</b><br><b>71.20 V/m</b> | Grid 5 <b>M3</b><br><b>71.69 V/m</b> | Grid 6 <b>M3</b><br><b>70.44 V/m</b> |
| Grid 7 <b>M3</b><br><b>89.30 V/m</b> | Grid 8 <b>M3</b><br><b>90.45 V/m</b> | Grid 9 <b>M3</b><br><b>88.78 V/m</b> |

**Cursor:**

Total = 92.98 V/m  
E Category: M3  
Location: 0, -32, 9.7 mm



0 dB = 92.98 V/m = 39.37 dBV/m

## 18. DAE & Probe Calibration Certificate

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zaughausstrasse 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**

Cliënt **SGS - TW (Auden)**

Certificate No: **DAE4-1374\_Oct15**

### CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 1374**

Calibration procedure(s) **QA CAL-06.v29  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **October 23, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards             | ID #               | Cal Date (Certificate No.) | Scheduled Calibration  |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278        | 09-Sep-15 (No:17153)       | Sep-16                 |
| Secondary Standards           | ID #               | Check Date (in house)      | Scheduled Check        |
| Auto DAE Calibration Unit     | SE UWS 053 AA 1001 | 06-Jan-15 (in house check) | In house check: Jan-16 |
| Calibrator Box V2.1           | SE UMS 006 AA 1002 | 06-Jan-15 (in house check) | In house check: Jan-16 |

|                |                                  |   |  |
|----------------|----------------------------------|---|--|
| Calibrated by: | Name<br><b>Dominique Steffen</b> | Function<br><b>Technician</b>               | Signature<br> |
| Approved by:   | Name<br><b>Fin Bornholt</b>      | Function<br><b>Deputy Technical Manager</b> | Signature<br> |

Issued: October 23, 2015

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

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

## 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 = 6.1 $\mu$ V , 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          | 403.597 $\pm$ 0.02% (k=2) | 403.842 $\pm$ 0.02% (k=2) | 404.121 $\pm$ 0.02% (k=2) |
| Low Range           | 3.98111 $\pm$ 1.50% (k=2) | 3.96638 $\pm$ 1.50% (k=2) | 3.98936 $\pm$ 1.50% (k=2) |

### Connector Angle

|   |                                    |
|---|------------------------------------|
| Connector Angle to be used in DASY system | 41.0 $^{\circ}$ $\pm$ 1 $^{\circ}$ |
|---|------------------------------------|

**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 | 200033.09                 | -0.21                        | -0.00     |
| Channel X + Input | 20006.43                  | 2.25                         | 0.01      |
| Channel X - Input | -20003.08                 | 2.09                         | -0.01     |
| Channel Y + Input | 200033.11                 | -0.07                        | -0.00     |
| Channel Y + Input | 20001.24                  | -2.89                        | -0.01     |
| Channel Y - Input | -20006.12                 | -0.87                        | 0.00      |
| Channel Z + Input | 200032.98                 | -0.38                        | -0.00     |
| Channel Z + Input | 20001.71                  | -2.35                        | -0.01     |
| Channel Z - Input | -20007.05                 | -1.72                        | 0.01      |

| Low Range         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2000.72                   | 0.10                         | 0.00      |
| Channel X + Input | 200.90                    | 0.07                         | 0.04      |
| Channel X - Input | -198.32                   | 0.99                         | -0.50     |
| Channel Y + Input | 2000.56                   | -0.00                        | -0.00     |
| Channel Y + Input | 199.87                    | -0.82                        | -0.41     |
| Channel Y - Input | -199.92                   | -0.51                        | 0.26      |
| Channel Z + Input | 2000.72                   | 0.21                         | 0.01      |
| Channel Z + Input | 199.48                    | -1.11                        | -0.56     |
| Channel Z - Input | -200.66                   | -1.13                        | 0.57      |

**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                            | 6.36   | 3.97  |
|           | - 200                          | -2.21  | -4.56                                       |
| Channel Y | 200                            | 7.13   | 6.98  |
|           | - 200                          | -8.29  | -8.73                                       |
| Channel Z | 200                            | 6.37   | 6.35  |
|           | - 200                          | -9.60  | -9.25                                       |

**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                | -                           | -2.02                       | -1.56                       |
| Channel Y | 200                | 4.68                        | -                           | -1.06                       |
| Channel Z | 200                | 11.09                       | 1.58                        | -                           |

#### 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 | 15950            | 15957           |
| Channel Y | 16166            | 15762           |
| Channel Z | 16101            | 16123           |

#### 5. Input Offset Measurement

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

Input 10M $\Omega$

|           | Average ( $\mu$ V) | min. Offset ( $\mu$ V) | max. Offset ( $\mu$ V) | Std. Deviation ( $\mu$ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 0.61               | -0.78                  | 1.59                   | 0.44                      |
| Channel Y | -0.47              | -2.13                  | 0.46                   | 0.39                      |
| Channel Z | -0.68              | -1.72                  | 0.64                   | 0.41                      |

#### 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                |



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **DAE4-1374\_Aug16**

## CALIBRATION CERTIFICATE

Object: **DAE4 - SD 000 D04 BM - SN: 1374**

Calibration procedure(s): **QA CAL-06.v29  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **August 23, 2016**

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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards             | ID #               | Cal Date (Certificate No.) | Scheduled Calibration  |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278        | 09-Sep-15 (No:17153)       | Sep-16                 |
| Secondary Standards           | ID #               | Check Date (in house)      | Scheduled Check        |
| Auto DAE Calibration Unit     | SE UWS 053 AA 1001 | 05-Jan-16 (in house check) | in house check: Jan-17 |
| Calibrator Box V2.1           | SE UMS 005 AA 1002 | 05-Jan-16 (in house check) | in house check: Jan-17 |

|                | Name              | Function                 | Signature |
|----------------|-------------------|--------------------------|-----------|
| Calibrated by: | Dominique Steffen | Technician               |           |
| Approved by:   | Fin Bornholt      | Deputy Technical Manager |           |

Issued: August 23, 2016

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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 = 6.1 $\mu$ V, 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          | 403.637 $\pm$ 0.02% (k=2) | 403.886 $\pm$ 0.02% (k=2) | 404.160 $\pm$ 0.02% (k=2) |
| Low Range           | 3.98275 $\pm$ 1.50% (k=2) | 3.96719 $\pm$ 1.50% (k=2) | 3.99036 $\pm$ 1.50% (k=2) |

### Connector Angle

|   |                                    |
|---|------------------------------------|
| Connector Angle to be used in DASY system | 42.5 $^{\circ}$ $\pm$ 1 $^{\circ}$ |
|---|------------------------------------|

**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 | 200039.11                 | 0.18                         | 0.00      |
| Channel X + Input | 20005.23                  | 0.57                         | 0.00      |
| Channel X - Input | -20004.46                 | 1.52                         | -0.01     |
| Channel Y + Input | 200041.10                 | 3.98                         | 0.00      |
| Channel Y + Input | 20002.96                  | -1.76                        | -0.01     |
| Channel Y - Input | -20007.46                 | -1.38                        | 0.01      |
| Channel Z + Input | 200039.71                 | 2.56                         | 0.00      |
| Channel Z + Input | 20002.57                  | -2.04                        | -0.01     |
| Channel Z - Input | -20008.39                 | -2.20                        | 0.01      |

| Low Range         | Reading ( $\mu\text{V}$ ) | Difference ( $\mu\text{V}$ ) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2001.14                   | 0.37                         | 0.02      |
| Channel X + Input | 200.90                    | 0.07                         | 0.03      |
| Channel X - Input | -198.75                   | 0.41                         | -0.20     |
| Channel Y + Input | 2000.82                   | 0.06                         | 0.00      |
| Channel Y + Input | 200.17                    | -0.51                        | -0.25     |
| Channel Y - Input | -199.47                   | -0.29                        | 0.15      |
| Channel Z + Input | 2000.50                   | -0.29                        | -0.01     |
| Channel Z + Input | 199.36                    | -1.24                        | -0.62     |
| Channel Z - Input | -200.79                   | -1.45                        | 0.73      |

**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                            | 6.08   | 3.93  |
|           | -200                           | -2.69  | -4.73                                       |
| Channel Y | 200                            | 7.56   | 7.12  |
|           | -200                           | -8.69  | -8.88                                       |
| Channel Z | 200                            | 5.83   | 5.98  |
|           | -200                           | -8.94  | -9.16                                       |

**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                | -                           | -2.29                       | -1.91                       |
| Channel Y | 200                | 4.65                        | -                           | -1.13                       |
| Channel Z | 200                | 10.99                       | 2.02                        | -                           |

#### 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 | 15938            | 14709           |
| Channel Y | 16155            | 14646           |
| Channel Z | 16095            | 15566           |

#### 5. Input Offset Measurement

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

Input 10M $\Omega$

|           | Average ( $\mu$ V) | min. Offset ( $\mu$ V) | max. Offset ( $\mu$ V) | Std. Deviation ( $\mu$ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 1.17               | 0.20                   | 1.90                   | 0.33                      |
| Channel Y | 0.61               | -0.17                  | 1.24                   | 0.30                      |
| Channel Z | -1.30              | -2.42                  | -0.33                  | 0.37                      |

#### 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                |



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **ER3-2306\_Nov15**

## CALIBRATION CERTIFICATE

Object: **ER3DV6 - SN:2306**

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

Calibration date: **November 20, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID              | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B         | GB41293874      | 01-Apr-15 (No. 217-02128)         | Mar-16                 |
| Power sensor E4412A        | MY41498087      | 01-Apr-15 (No. 217-02128)         | Mar-16                 |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 01-Apr-15 (No. 217-02129)         | Mar-16                 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 01-Apr-15 (No. 217-02132)         | Mar-16                 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 01-Apr-15 (No. 217-02133)         | Mar-16                 |
| Reference Probe ER3DV6     | SN: 2326        | 12-Oct-15 (No. ER3-2326 Oct15)    | Oct-16                 |
| DAE4                       | SN: 769         | 16-Mar-15 (No. DAE4-789_Mar15)    | Mar-16                 |
| Secondary Standards        | ID              | Check Date (in house)             | Scheduled Check        |
| RF generator HP 8648C      | US3642U01700    | 4-Aug-98 (in house check Apr-13)  | In house check: Apr-15 |
| Network Analyzer HP 8753E  | US37390565      | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |

|                | Name            | Function              | Signature |
|----------------|-----------------|-----------------------|-----------|
| Calibrated by: | Claudio Laubler | Laboratory Technician |           |
| Approved by:   | Katja Pokovic   | Technical Manager     |           |

Issued: November 21, 2015

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**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   |
| Polarization $\phi$   | $\phi$ rotation around probe axis   |
| Polarization $\psi$   | $\psi$ rotation around an axis that is in the plane normal to probe axis (at measurement center),<br>i.e., $\psi = 0$ 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:**

- a) IEEE Std 1309-2005, "IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005.
- b) CTIA Test Plan for Hearing Aid Compatibility, Rev 3.0, November 2013

**Methods Applied and Interpretation of Parameters:**

- **NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\psi = 0$  for XY sensors and  $\psi = 90$  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:2306

November 20, 2015

# Probe ER3DV6

## SN:2306

Manufactured: December 17, 2002  
Calibrated: November 20, 2015

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)



ER3DV6 – SN:2306

November 20, 2015

## DASY/EASY - Parameters of Probe: ER3DV6 - SN:2306

### Basic Calibration Parameters

|  | Sensor X | Sensor Y | Sensor Z | Unc (k=2)    |
|--|----------|----------|----------|--------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) | 1.08     | 1.12     | 1.23     | $\pm 10.1\%$ |
| DCP (mV) <sup>B</sup>                        | 102.8    | 101.2    | 105.2    |              |

### Modulation Calibration Parameters

| UID       | Communication System Name             |   | A<br>dB | B<br>dB $\sqrt{\mu\text{V}}$ | C    | D<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-----------|---------------------------------------|---|---------|------------------------------|------|---------|----------|---------------------------|
| 0         | CW                                    | X | 0.0     | 0.0                          | 1.0  | 0.00    | 155.0    | $\pm 3.0\%$               |
|           |                                       | Y | 0.0     | 0.0                          | 1.0  |         | 166.6    |                           |
|           |                                       | Z | 0.0     | 0.0                          | 1.0  |         | 158.1    |                           |
| 10010-CAA | SAR Validation (Square, 100ms, 10ms)  | X | 0.34    | 50.0                         | 4.4  | 10.00   | 36.4     | $\pm 2.7\%$               |
|           |                                       | Y | 0.43    | 49.8                         | 2.6  |         | 38.0     |                           |
|           |                                       | Z | 0.39    | 49.9                         | 4.1  |         | 37.2     |                           |
| 10011-CAB | UMTS-FDD (WCDMA)                      | X | 3.07    | 66.2                         | 18.2 | 2.91    | 122.1    | $\pm 0.5\%$               |
|           |                                       | Y | 3.08    | 66.1                         | 18.1 |         | 133.0    |                           |
|           |                                       | Z | 3.29    | 67.7                         | 18.9 |         | 124.0    |                           |
| 10021-DAB | GSM-FDD (TDMA, GMSK)                  | X | 2.69    | 71.9                         | 17.0 | 9.39    | 130.8    | $\pm 1.9\%$               |
|           |                                       | Y | 2.34    | 71.2                         | 16.9 |         | 137.4    |                           |
|           |                                       | Z | 2.66    | 69.6                         | 15.3 |         | 131.2    |                           |
| 10081-CAB | CDMA2000 (1xRTT, RC3)                 | X | 3.47    | 64.6                         | 17.8 | 3.97    | 113.7    | $\pm 0.5\%$               |
|           |                                       | Y | 3.60    | 65.3                         | 18.2 |         | 125.9    |                           |
|           |                                       | Z | 3.68    | 66.1                         | 18.6 |         | 117.1    |                           |
| 10295-AAB | CDMA2000, RC1, SO3, 1/8th Rate 25 fr. | X | 5.42    | 70.1                         | 26.7 | 12.49   | 80.7     | $\pm 1.4\%$               |
|           |                                       | Y | 5.56    | 71.3                         | 27.8 |         | 87.9     |                           |
|           |                                       | Z | 5.89    | 71.7                         | 26.9 |         | 84.9     |                           |

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

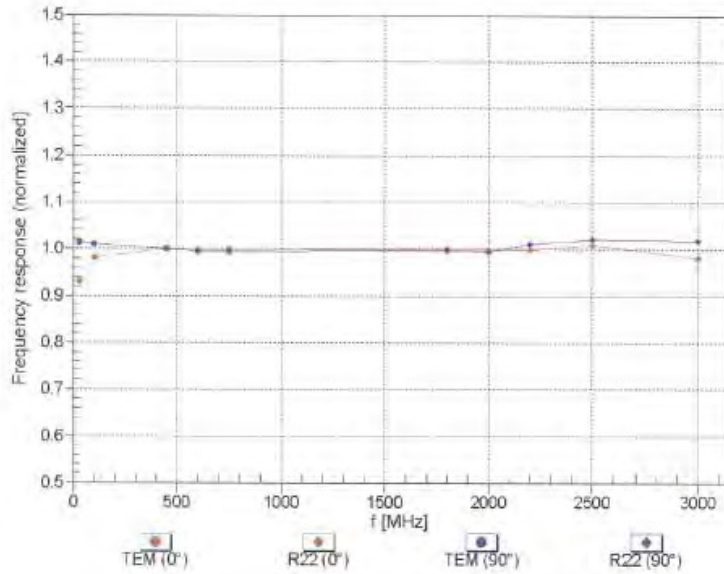
<sup>B</sup> Numerical linearization parameter: uncertainty not required.

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

ER3DV6 – SN:2306

November 20, 2015

### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

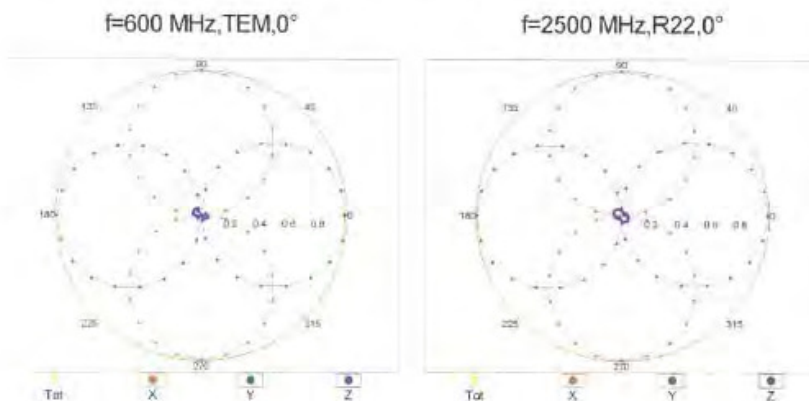


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

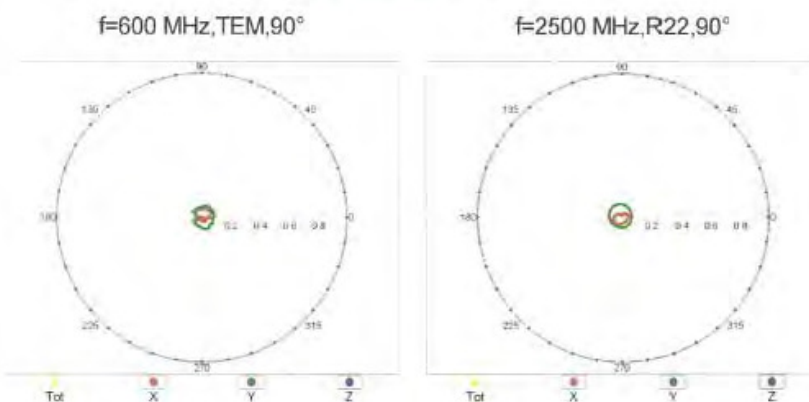
ER3DV6 – SN:2306

November 20, 2015

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



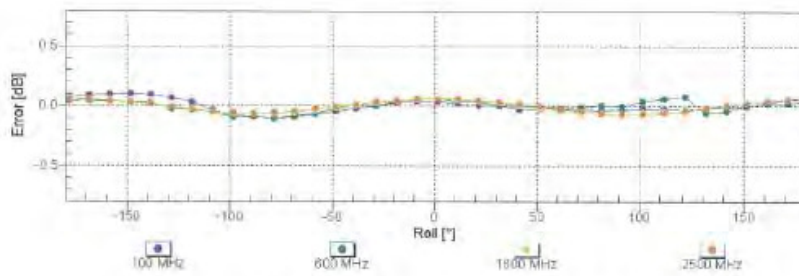
## Receiving Pattern ( $\phi$ ), $\theta = 90^\circ$



ER3DV6 – SN:2306

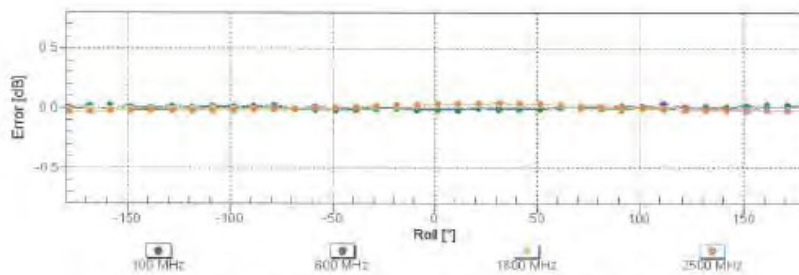
November 20, 2015

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



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

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

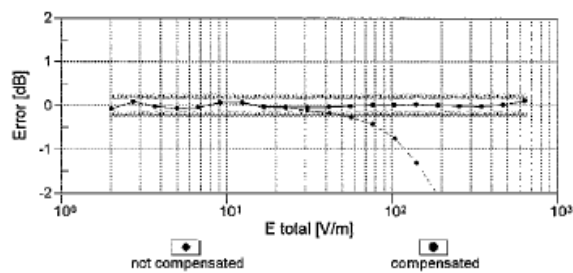
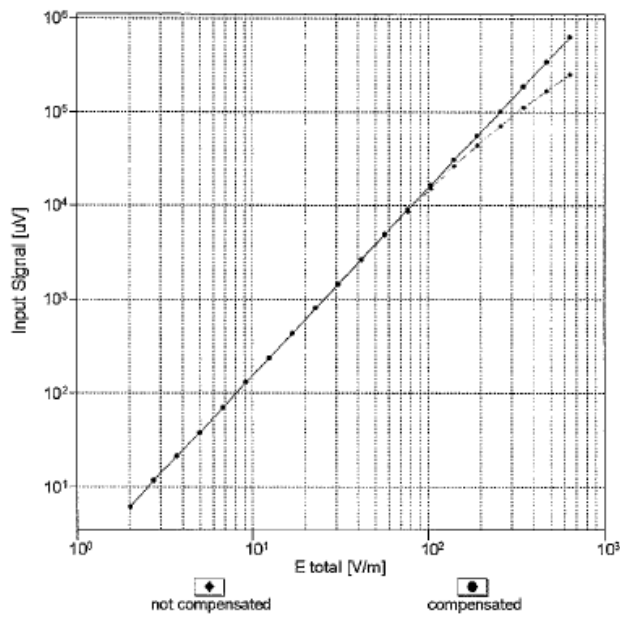


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

ER3DV6 – SN:2306

November 20, 2015

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

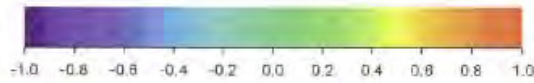
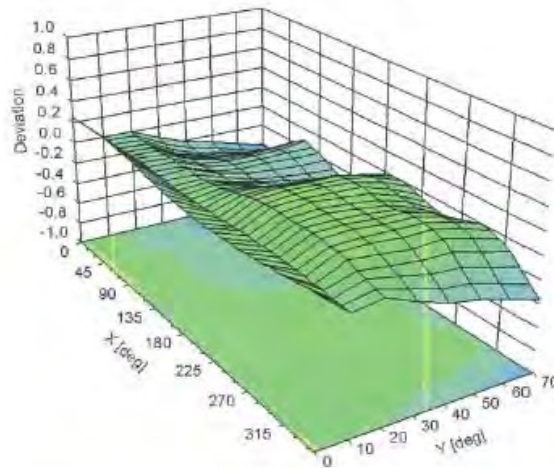


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

ER3DV6 – SN:2306

November 20, 2015

## Deviation from Isotropy in Air Error ( $\phi$ , $\theta$ ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

ER3DV6 – SN:2306

November 20, 2015

## DASY/EASY - Parameters of Probe: ER3DV6 - SN:2306

### Other Probe Parameters

|   |             |
|---|-------------|
| Sensor Arrangement                      | Rectangular |
| Connector Angle (°)                     | 131.6       |
| 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      |



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Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **ER3-2306\_Nov16**

### CALIBRATION CERTIFICATE

Object: **ER3DV6 - SN:2306**

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

Calibration date: **November 23, 2016**

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 ± 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       | 06-Apr-16 (No. 217-02268/02289)   | Apr-17                 |
| Power sensor NRP-Z91       | SN: 103244       | 06-Apr-16 (No. 217-02288)         | Apr-17                 |
| Power sensor NRP-Z91       | SN: 103245       | 06-Apr-16 (No. 217-02289)         | Apr-17                 |
| Reference 20 dB Attenuator | SN: 55277 (20x)  | 05-Apr-16 (No. 217-02293)         | Apr-17                 |
| Reference Probe ER3DV6     | SN: 2328         | 14-Oct-16 (No. ER3-2328_Oct16)    | Oct-17                 |
| DAE4                       | SN: 789          | 11-Nov-16 (No. DAE4-789_Nov16)    | Nov-17                 |
| Secondary Standards        | ID               | Check Date (in house)             | Scheduled Check        |
| Power meter E4419B         | SN: GB41283874   | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A        | SN: MY41498087   | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| Power sensor E4412A        | SN: UD0110210    | 06-Apr-16 (in house check Jun-16) | In house check: Jun-18 |
| RF generator HP 8848C      | SN: US3642UD1700 | 04-Aug-99 (in house check Jun-16) | In house check: Jun-18 |
| Network Analyzer HP 8753E  | SN: US87300686   | 18 Oct 01 (in house check Oct 16) | In house check: Oct-17 |

|                | Name          | Function              | Signature |
|----------------|---------------|-----------------------|-----------|
| Calibrated by: | Michael Weber | Laboratory Technician |           |
| Approved by:   | Kelja Pokovic | Technical Manager     |           |

Issued: November 25, 2016

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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   |
| Polarization $\psi$   | $\psi$ rotation around probe axis   |
| Polarization $\theta$ | $\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center).<br>i.e., $\theta = 0$ 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:**

- a) IEEE Std 1309-2005, "IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005
- b) CTIA Test Plan for Hearing Aid Compatibility, Rev 3.0, November 2013

**Methods Applied and Interpretation of Parameters:**

- **NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\theta = 0$  for XY sensors and  $\theta = 90$  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:2306

November 23, 2016

# Probe ER3DV6

## SN:2306

Manufactured: December 17, 2002  
Calibrated: November 23, 2016

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

ER3DV6 – SN:2306

November 23, 2016

## DASY/EASY - Parameters of Probe: ER3DV6 - SN:2306

### Basic Calibration Parameters

|  | Sensor X | Sensor Y | Sensor Z | Unc (k=2)    |
|--|----------|----------|----------|--------------|
| Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) | 1.05     | 1.08     | 1.19     | $\pm 10.1\%$ |
| DCP (mV) <sup>B</sup>                        | 102.1    | 101.9    | 104.6    |              |

### Modulation Calibration Parameters

| UID           | Communication System Name             |   | A<br>dB | B<br>dB $\sqrt{\mu\text{V}}$ | C    | D<br>dB | VR<br>mV | Unc <sup>C</sup><br>(k=2) |
|---------------|---------------------------------------|---|---------|------------------------------|------|---------|----------|---------------------------|
| 0             | CW                                    | X | 0.0     | 0.0                          | 1.0  | 0.00    | 153.2    | $\pm 3.3\%$               |
|               |                                       | Y | 0.0     | 0.0                          | 1.0  |         | 166.4    |                           |
|               |                                       | Z | 0.0     | 0.0                          | 1.0  |         | 156.4    |                           |
| 10010-<br>CAA | SAR Validation (Square, 100ms, 10ms)  | X | 0.33    | 50.6                         | 4.6  | 10.00   | 36.4     | $\pm 2.7\%$               |
|               |                                       | Y | 0.34    | 40.4                         | 4.6  |         | 37.9     |                           |
|               |                                       | Z | 0.42    | 50.7                         | 4.4  |         | 36.9     |                           |
| 10021-<br>DAC | GSM-FDD (TDMA, GMSK)                  | X | 2.38    | 69.1                         | 15.0 | 9.38    | 131.5    | $\pm 2.5\%$               |
|               |                                       | Y | 3.18    | 76.0                         | 19.5 |         | 139.0    |                           |
|               |                                       | Z | 2.56    | 68.9                         | 15.1 |         | 130.6    |                           |
| 10295-<br>AAB | CDMA2000, RC1, SO3, 1/8th Rate 25 fr. | X | 5.48    | 70.6                         | 26.8 | 12.49   | 80.8     | $\pm 1.4\%$               |
|               |                                       | Y | 5.73    | 72.3                         | 28.6 |         | 87.7     |                           |
|               |                                       | Z | 6.01    | 72.1                         | 27.0 |         | 84.7     |                           |

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%.

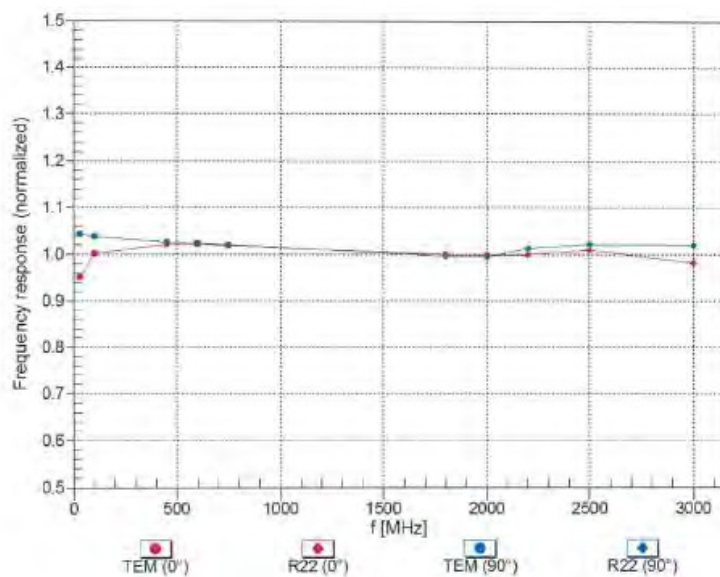
<sup>A</sup> Numerical linearization parameter; uncertainty not required.

<sup>B</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:2306

November 23, 2016

## Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

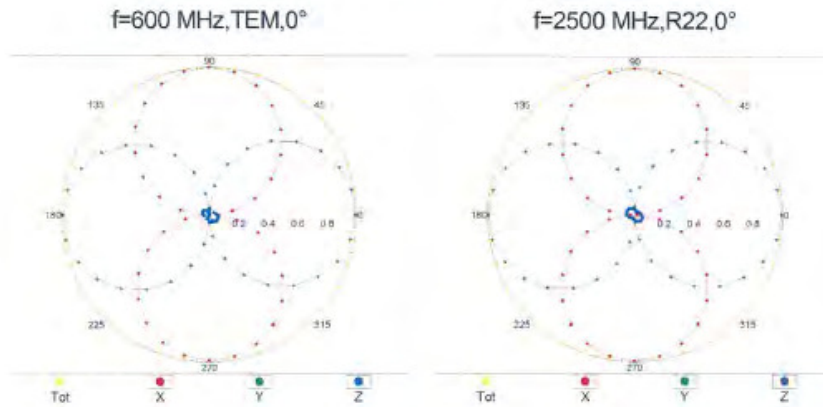


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

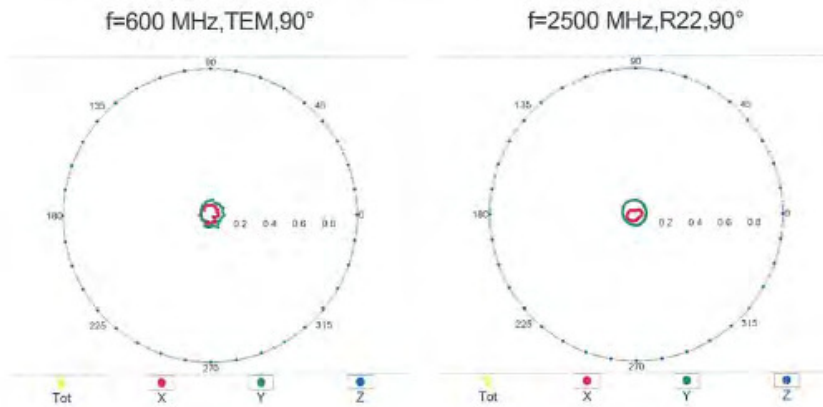
ER3DV6 – SN:2306

November 23, 2016

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



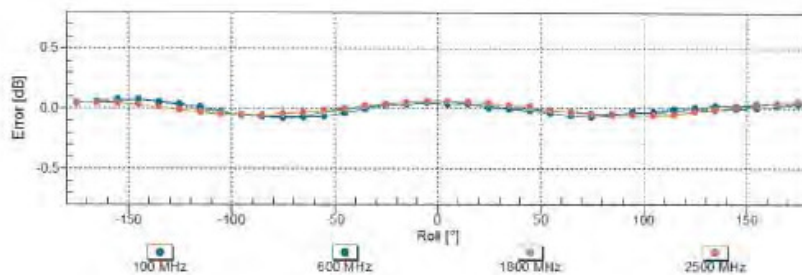
## Receiving Pattern ( $\phi$ ), $\theta = 90^\circ$



ER3DV6 – SN:2306

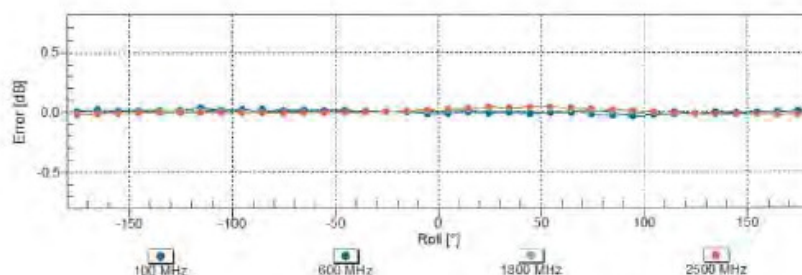
November 23, 2016

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



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

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



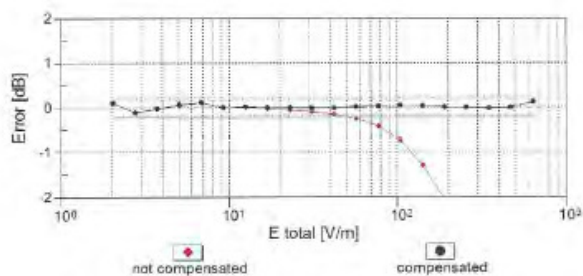
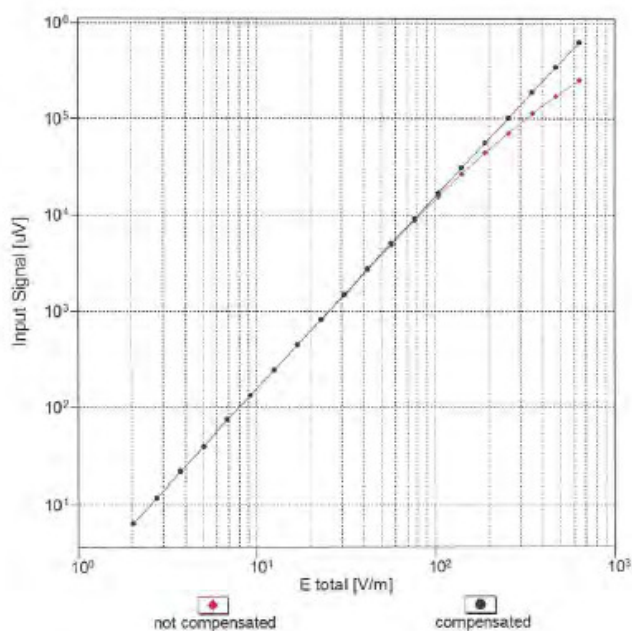
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )



ER3DV6 - SN.2306

November 23, 2016

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

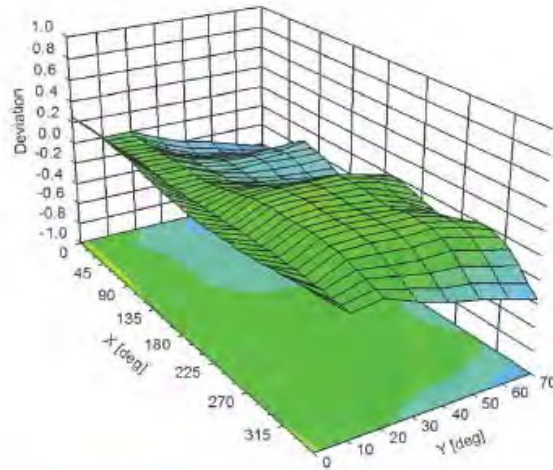


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

ER3DV6 – SN.2306

November 23, 2016

## Deviation from Isotropy in Air Error ( $\phi, \theta$ ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )



ER3DV6 - SN:2306

November 23, 2016

### DASY/EASY - Parameters of Probe: ER3DV6 - SN:2306

#### Other Probe Parameters

|   |             |
|---|-------------|
| Sensor Arrangement                      | Rectangular |
| Connector Angle (°)                     | 134.7       |
| 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      |

## 19. Uncertainty Budget

| HAC Uncertainty Budget<br>According to ANSI C63.19 [1], [2] |               |             |      |                     |                     |             |             |
|---|---------------|-------------|------|---------------------|---------------------|-------------|-------------|
| Error Description   | Uncert. value | Prob. Dist. | Div. | (c <sub>i</sub> ) E | (c <sub>i</sub> ) H | Std. Unc. E | Std. Unc. H |
| <b>Measurement System</b>                                   |               |             |      |                     |                     |             |             |
| Probe Calibration   | ±5.1 %        | N           | 1    | 1                   | 1                   | ±5.1 %      | ±5.1 %      |
| Axial Isotropy  | ±4.7 %        | R           | √3   | 1                   | 1                   | ±2.7 %      | ±2.7 %      |
| Sensor Displacement   | ±16.5 %       | R           | √3   | 1                   | 0.145               | ±9.5 %      | ±1.4 %      |
| Boundary Effects  | ±2.4 %        | R           | √3   | 1                   | 1                   | ±1.4 %      | ±1.4 %      |
| Phantom Boundary Effect                                     | ±7.2 %        | R           | √3   | 1                   | 0                   | ±4.1 %      | ±0.0 %      |
| Linearity   | ±4.7 %        | R           | √3   | 1                   | 1                   | ±2.7 %      | ±2.7 %      |
| Scaling with PMR calibration                                | ±10.0 %       | R           | √3   | 1                   | 1                   | ±5.8 %      | ±5.8 %      |
| System Detection Limit                                      | ±1.0 %        | R           | √3   | 1                   | 1                   | ±0.6 %      | ±0.6 %      |
| Readout Electronics   | ±0.3 %        | N           | 1    | 1                   | 1                   | ±0.3 %      | ±0.3 %      |
| Response Time   | ±0.8 %        | R           | √3   | 1                   | 1                   | ±0.5 %      | ±0.5 %      |
| Integration Time  | ±2.6 %        | R           | √3   | 1                   | 1                   | ±1.5 %      | ±1.5 %      |
| RF Ambient Conditions                                       | ±3.0 %        | R           | √3   | 1                   | 1                   | ±1.7 %      | ±1.7 %      |
| RF Reflections  | ±12.0 %       | R           | √3   | 1                   | 1                   | ±6.9 %      | ±6.9 %      |
| Probe Positioner  | ±1.2 %        | R           | √3   | 1                   | 0.67                | ±0.7 %      | ±0.5 %      |
| Probe Positioning   | ±4.7 %        | R           | √3   | 1                   | 0.67                | ±2.7 %      | ±1.8 %      |
| Extrap. and Interpolation                                   | ±1.0 %        | R           | √3   | 1                   | 1                   | ±0.6 %      | ±0.6 %      |
| <b>Test Sample Related</b>                                  |               |             |      |                     |                     |             |             |
| Device Positioning Vertical                                 | ±4.7 %        | R           | √3   | 1                   | 0.67                | ±2.7 %      | ±1.8 %      |
| Device Positioning Lateral                                  | ±1.0 %        | R           | √3   | 1                   | 1                   | ±0.6 %      | ±0.6 %      |
| Device Holder and Phantom                                   | ±2.4 %        | R           | √3   | 1                   | 1                   | ±1.4 %      | ±1.4 %      |
| Power Drift   | ±5.0 %        | R           | √3   | 1                   | 1                   | ±2.9 %      | ±2.9 %      |
| <b>Phantom and Setup Related</b>                            |               |             |      |                     |                     |             |             |
| Phantom Thickness   | ±2.4 %        | R           | √3   | 1                   | 0.67                | ±1.4 %      | ±0.9 %      |
| Combined Std. Uncertainty                                   |               |             |      |                     |                     | ±16.3 %     | ±12.3 %     |
| Expanded Std. Uncertainty on Power                          |               |             |      |                     |                     | ±32.6 %     | ±24.6 %     |
| Expanded Std. Uncertainty on Field                          |               |             |      |                     |                     | ±16.3 %     | ±12.3 %     |

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.  
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

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## 20. System Validation from Original Equipment Supplier

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Accreditation No.: SCS 0108

Client **SGS-TW (Auden)**

Certificate No: **CD835V3-1052\_Mar16**

| CALIBRATION CERTIFICATE   |  |                                   |   |
|---|--|-----------------------------------|---|
| Object  | CD835V3 - SN: 1052                                       |                                   |   |
| Calibration procedure(s)  | QA CAL-20.v6<br>Calibration procedure for dipoles in air |                                   |   |
| Calibration date:   | March 17, 2016   |                                   |   |
| This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).<br>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 ± 3)°C and humidity < 70%.  |  |                                   |   |
| Calibration Equipment used (M&PE critical for calibration)  |  |                                   |   |
| Primary Standards   | ID #   | Cal Date (Certificate No.)        | Scheduled Calibration   |
| Power meter EPM-442A  | GB37480704   | 07-Oct-15 (No. 217-02222)         | Oct-16  |
| Power sensor HP 8481A   | US37292783   | 07-Oct-15 (No. 217-02222)         | Oct-16  |
| Power sensor HP 8481A   | MY41082317   | 07-Oct-15 (No. 217-02223)         | Oct-16  |
| Reference 10 dB Attenuator  | SN: 5047.2 / 06327                                       | 01-Apr-15 (No. 217-02130)         | Mar-16  |
| Probe ER3DV6  | SN: 2336   | 31-Dec-15 (No. ER3-2336_Dec15)    | Dec-16  |
| Probe H3DV6   | SN: 6065   | 31-Dec-15 (No. H3-6065_Dec15)     | Dec-16  |
| DAE4  | SN: 781  | 04-Sep-15 (No. DAE4-781_Sep15)    | Sep-16  |
| Secondary Standards   | ID #   | Check Date (in house)             | Scheduled Check   |
| Power meter Agilent 4419B   | SN: GB42420191   | 09-Oct-09 (in house check Sep-14) | In house check: Sep-16  |
| Power sensor HP E4412A  | SN: US38485102   | 05-Jan-10 (in house check Sep-14) | In house check: Sep-16  |
| Power sensor HP 8482A   | SN: US37295597   | 09-Oct-09 (in house check Sep-14) | In house check: Sep-16  |
| Network Analyzer HP 8753E   | US37390585   | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16  |
| RF generator R&S SMT-06   | SN: 832283011  | 27-Aug-12 (in house check Oct-15) | In house check: Oct-16  |
| Calibrated by:  | Name<br>Jeton Kastrati                                   | Function<br>Laboratory Technician | Signature<br> |
| Approved by:  | Name<br>Kolja Pokovic                                    | Function<br>Technical Manager     | Signature<br> |
|   |  |                                   | Issued: March 21, 2016  |
| This calibration certificate shall not be reproduced except in full without written approval of this laboratory.  |  |                                   |   |

Certificate No: CD835V3-1052\_Mar16

Page 1 of 5



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## References

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

## Methods Applied and Interpretation of Parameters:

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

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

### Measurement Conditions

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

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

### Maximum Field values at 835 MHz

| <b>E-field 15 mm above dipole surface</b> | <b>condition</b>   | <b>Interpolated maximum</b>                    |
|---|--------------------|--|
| Maximum measured above high end           | 100 mW input power | 110.2 V/m = 40.85 dBV/m                        |
| Maximum measured above low end            | 100 mW input power | 106.8 V/m = 40.57 dBV/m                        |
| Averaged maximum above arm                | 100 mW input power | <b>108.5 V/m <math>\pm</math> 12.8 % (k=2)</b> |

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

#### Antenna Parameters

| <b>Frequency</b> | <b>Return Loss</b> | <b>Impedance</b>                |
|------------------|--------------------|---------------------------------|
| 800 MHz          | 15.9 dB            | 43.2 $\Omega$ - 13.5 j $\Omega$ |
| 835 MHz          | 26.6 dB            | 49.6 $\Omega$ + 4.6 j $\Omega$  |
| 900 MHz          | 16.4 dB            | 57.2 $\Omega$ - 14.7 j $\Omega$ |
| 950 MHz          | 20.4 dB            | 45.6 $\Omega$ + 8.1 j $\Omega$  |
| 960 MHz          | 15.6 dB            | 52.2 $\Omega$ + 17.0 j $\Omega$ |

#### 3.2 Antenna Design and Handling

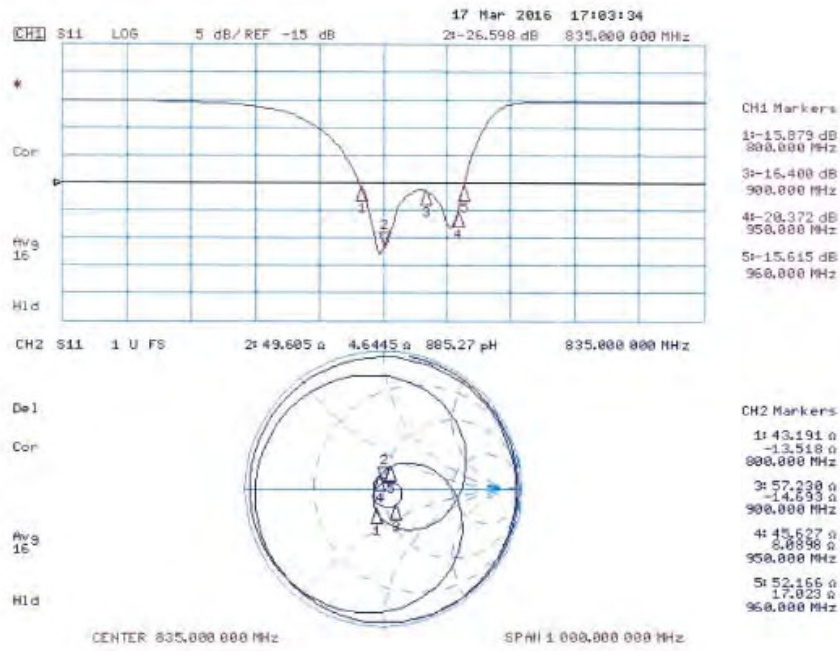
The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

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

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

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

## Impedance Measurement Plot



**DASY5 E-field Result**

Date: 17.03.2016

Test Laboratory: SPEAG Lab2

**DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1052**

Communication System: UID 0 - CW ; Frequency: 835 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ER3DV6 - 5N2336; ConvF(1, 1, 1); Calibrated: 31.12.2015;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 04.09.2015
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

**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 = 113,4 V/m; Power Drift = -0,04 dB  
Applied MIF = 0,00 dB  
RF audio interference level = 40,85 dBV/m  
**Emission category: M3**

MIF scaled E-field

|             |             |             |
|-------------|-------------|-------------|
| Grid 1 M3   | Grid 2 M3   | Grid 3 M3   |
| 40.5 dBV/m  | 40.57 dBV/m | 40.35 dBV/m |
| Grid 4 M4   | Grid 5 M4   | Grid 6 M4   |
| 35.73 dBV/m | 35.8 dBV/m  | 35.6 dBV/m  |
| Grid 7 M3   | Grid 8 M3   | Grid 9 M3   |
| 40.58 dBV/m | 40.85 dBV/m | 40.78 dBV/m |



0 dB = 110.2 V/m = 40.84 dBV/m



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

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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**

Client **SGS-TW (Auden)**

Certificate No: **CD1880V3-1044\_Mar16**

| CALIBRATION CERTIFICATE   |  |                                   |                        |
|---|--|-----------------------------------|------------------------|
| Object  | CD1880V3 - SN: 1044                                      |                                   |                        |
| Calibration procedure(s)  | QA CAL-20.v6<br>Calibration procedure for dipoles in air |                                   |                        |
| Calibration date:   | March 17, 2016   |                                   |                        |
| This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).<br>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 ± 3)°C and humidity < 70%.  |  |                                   |                        |
| Calibration Equipment used (M&TE critical for calibration)  |  |                                   |                        |
| Primary Standards   | ID #   | Cal Date (Certificate No.)        | Scheduled Calibration  |
| Power meter EPM-442A  | GB57480704   | 07-Oct-15 (No. 217-02222)         | Oct-16                 |
| Power sensor HP 8481A   | US37292783   | 07-Oct-15 (No. 217-02222)         | Oct-16                 |
| Power sensor HP 8481A   | MY41092317   | 07-Oct-15 (No. 217-02223)         | Oct-16                 |
| Reference 10 dB Attenuator  | SN: 5047.2 / 06327                                       | 01-Apr-15 (No. 217-02130)         | Mar-16                 |
| Probe ER3DV6  | SN: 2336   | 31-Dec-15 (No. ER3-2336_Dec15)    | Dec-16                 |
| Probe HSDV6   | SN: 6065   | 31-Dec-15 (No. H3-6065_Dec15)     | Dec-16                 |
| DAE4  | SN: 781  | 04-Sep-15 (No. DAE4-781_Sep15)    | Sep-16                 |
| Secondary Standards   | ID #   | Check Date (in house)             | Scheduled Check        |
| Power meter Agilent 4419B   | SN: GB42420191   | 09-Oct-05 (in house check Sep-14) | In house check: Sep-16 |
| Power sensor HP E4412A  | SN: US38485102   | 05-Jan-10 (in house check Sep-14) | In house check: Sep-16 |
| Power sensor HP 8482A   | SN: US37295597   | 09-Oct-09 (in house check Sep-14) | In house check: Sep-16 |
| Network Analyzer HP 8753E   | US37390585   | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |
| RF generator R&S SMT-05   | SN: 832283/011   | 27-Aug-12 (in house check Oct-15) | In house check: Oct-16 |
| Calibrated by:  | Name<br>Jeton Kastrioti                                  | Function<br>Laboratory Technician | Signature<br>          |
| Approved by:  | Name<br>Kajsa Pokovic                                    | Function<br>Technical Manager     | Signature<br>          |
|   |  |                                   | Issued: March 21, 2016 |
| This calibration certificate shall not be reproduced except in full without written approval of the laboratory.   |  |                                   |                        |

Certificate No: CD1880V3-1044\_Mar16

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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 DASY5 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- **Feed Point Impedance and Return Loss:** These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- **E-field distribution:** E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 15 mm (in z) above the metal top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, in the plane above the dipole surface.

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

### Measurement Conditions

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

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

### Maximum Field values at 1880 MHz

| <b>E-field 15 mm above dipole surface</b> | <b>condition</b>   | <b>Interpolated maximum</b>                   |
|---|--------------------|---|
| Maximum measured above high end           | 100 mW input power | 89.3 V/m = 39.01 dBV/m                        |
| Maximum measured above low end            | 100 mW input power | 86.3 V/m = 38.72 dBV/m                        |
| Averaged maximum above arm                | 100 mW input power | <b>87.8 V/m <math>\pm</math> 12.8 % (k=2)</b> |

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

#### Antenna Parameters

| <b>Frequency</b> | <b>Return Loss</b> | <b>Impedance</b>               |
|------------------|--------------------|--------------------------------|
| 1730 MHz         | 23.7 dB            | 49.0 $\Omega$ + 6.4 j $\Omega$ |
| 1880 MHz         | 20.2 dB            | 51.0 $\Omega$ + 9.8 j $\Omega$ |
| 1900 MHz         | 20.3 dB            | 54.2 $\Omega$ + 9.1 j $\Omega$ |
| 1950 MHz         | 28.1 dB            | 54.1 $\Omega$ + 0.5 j $\Omega$ |
| 2000 MHz         | 21.4 dB            | 42.3 $\Omega$ + 1.6 j $\Omega$ |

#### 3.2 Antenna Design and Handling

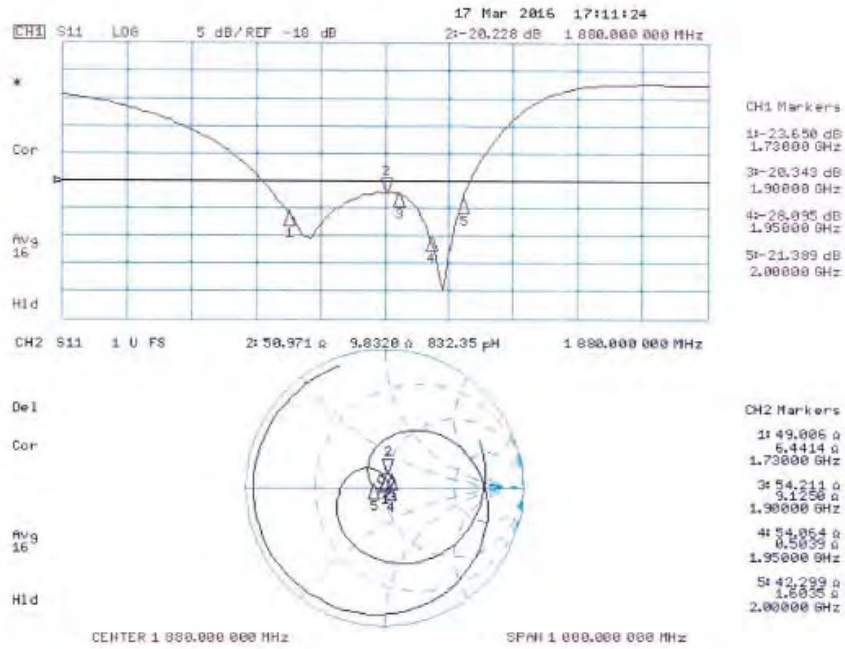
The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

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

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

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

## Impedance Measurement Plot



**DASY5 E-field Result**

Date: 17.03.2016

Test Laboratory: SPEAG Lab2

**DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1044**

Communication System: UID 0 - CW ; Frequency: 1880 MHz  
Medium parameters used:  $\sigma = 0$  S/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: RF Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

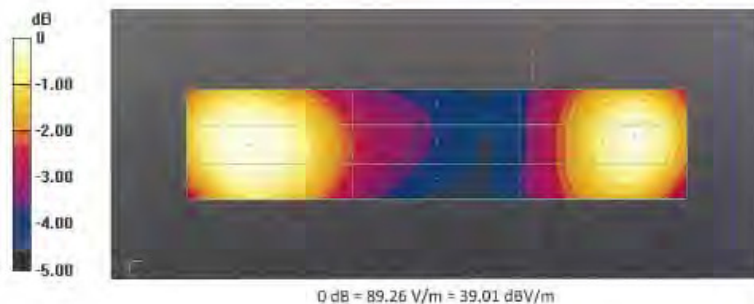
- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 31.12.2015;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 04.09.2015
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

**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 = 147.6 V/m; Power Drift = 0.00 dB  
Applied MIF = 0.00 dB  
RF audio interference level = 39.01 dBV/m  
**Emission category: M2**

MIF scaled E-field

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1 M2<br>38.89 dBV/m | Grid 2 M2<br>39.01 dBV/m | Grid 3 M2<br>38.88 dBV/m |
| Grid 4 M2<br>36.59 dBV/m | Grid 5 M2<br>36.66 dBV/m | Grid 6 M2<br>36.53 dBV/m |
| Grid 7 M2<br>38.52 dBV/m | Grid 8 M2<br>38.72 dBV/m | Grid 9 M2<br>38.65 dBV/m |



**End of 1<sup>st</sup> part of report**