# FCC Hearing Aid Compatibility (HAC) RF Emission Test Report

Product Name ： Smart Phone
Model No. ： PH4002

Applicant ： Shenzhen Topwell Wireless Communication Co Ltd
Address ： 5F, 10Building,Changyuan New Material Port,No.2,Middle Road 1, High Tech Park, Nanshan District,Shenzhen, China

Date of Receipt ： 2016/06/02
Issued Date ： 2016/07/25
Report No. ： 1660131R-SAUSP01V00
Report Version ： V1.0

ilac-MRA TAF Testing Laboratory 3023

# Test Report

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| Product Name | : | Smart Phone |
| Applicant | : | Shenzhen Topwell Wireless Communication Co Ltd |
| Address | : | 5F, 10Building,Changyuan New Material Port,No.2,Middle Road 1, High Tech Park, Nanshan District,Shenzhen, China |
| Manufacturer | : | Shenzhen Topwell Wireless Communication Co Ltd |
| Model No. | : | PH4002 |
| FCC ID | : | 2AHDDPCDPH4002 |
| Applicable Standard | : | 47CFR § 20.19<br>ANSI C63.19 2011<br>KDB 285076 D01 |
| M Category | : | M3 |
| Application Type | : | Certification |

Documented By : Anny Chou

(Senior Adm. Specialist / Anny Chou)

Tested By : Vorana Chen

(Senior Engineer / Vorana Chen)

Approved By :

( Director / Vincent Lin )

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# 1. General Information

## 1.1 EUT Description

| | |
|---|---|
| Product Name | Smart Phone |
| Model No. | PH4002 |
| FCC ID | 2AHDDPCDPH4002 |
| TX Frequency | GSM 850: 824.2 MHz ~ 848.8 MHz<br>PCS 1900: 1850.2 MHz ~ 1909.8MHz<br>WCDMA Band 2: 1852.4 MHz ~ 1907.6 MHz<br>WCDMA Band 4: 1712.4 MHz ~ 1752.6 MHz<br>WCDMA Band 5: 826.4 MHz ~846.6 MHz |
| RX Frequency | GSM 850: 869.2 MHz ~ 893.8 MHz<br>PCS 1900: 1930.2 MHz ~ 1989.8 MHz<br>WCDMA Band 2: 1932.4 MHz ~ 1987.6 MHz<br>WCDMA Band 4: 2112.4 MHz ~ 2152.6 MHz<br>WCDMA Band 5: 871.4 MHz ~ 891.6 MHz |
| Device Category | Portable |
| RF Exposure Environment | Uncontrolled |
| Max. Output Power (Conducted) | GSM 850: 32.27dBm; PCS 1900: 29.03dBm<br>WCDMA Band II: 21.42dBm; WCDMA Band IV: 18.8dBm<br>WCDMA Band V: 22.08dBm |

Note: Air interface as below

| Air interface | frequency | Type | C63.19 | Simultaneous | VoIP | VoLTE | Additional GSM power Reduction |
|---|---|---|---|---|---|---|---|
| GSM | 850 | VO | Yes (2011) | WLAN/BT | N/A | N/A | N/A |
| GSM | 1900 | VO | Yes (2011) | WLAN/BT | N/A | N/A | N/A |
| GPRS/EDGE | 850/1900 | DT | NO | WLAN/BT | Yes | N/A | N/A |
| WCDMA | 850 (Band V) | VO | Yes (2011)[1] | WLAN/BT | N/A | N/A | N/A |
| WCDMA | 1700 (Band IV) | VO | Yes (2011)[1] | WLAN/BT | N/A | N/A | N/A |
| WCDMA | 1900 (Band II) | VO | Yes (2011)[1] | WLAN/BT | N/A | N/A | N/A |
| HSPA | 850/1700/1900 | DT | NO | WLAN/BT | Yes | N/A | N/A |
| BT | 2.4G | DT | NO | WWAN | N/A | N/A | N/A |
| WLAN | 2.4G | DT | NO | WWAN | Yes | N/A | N/A |

Type:
VO – CMRS Voice Service
DT – Digital Transport
VD – CMRS IP Voice Service and Digital Transport

Note:
1. Evaluated for MIF and low-power exemption.

## 1.2 Test Environment

Ambient conditions in the laboratory:

| Items | Required | Actual |
|---|---|---|
| Temperature (°C) | 18-25 | 22.4± 2 |
| Humidity (%RH) | 30-70 | 54 |

Site Description:

Accredited by TAF
Accredited Number: 3023
Effective through: December 12, 2017

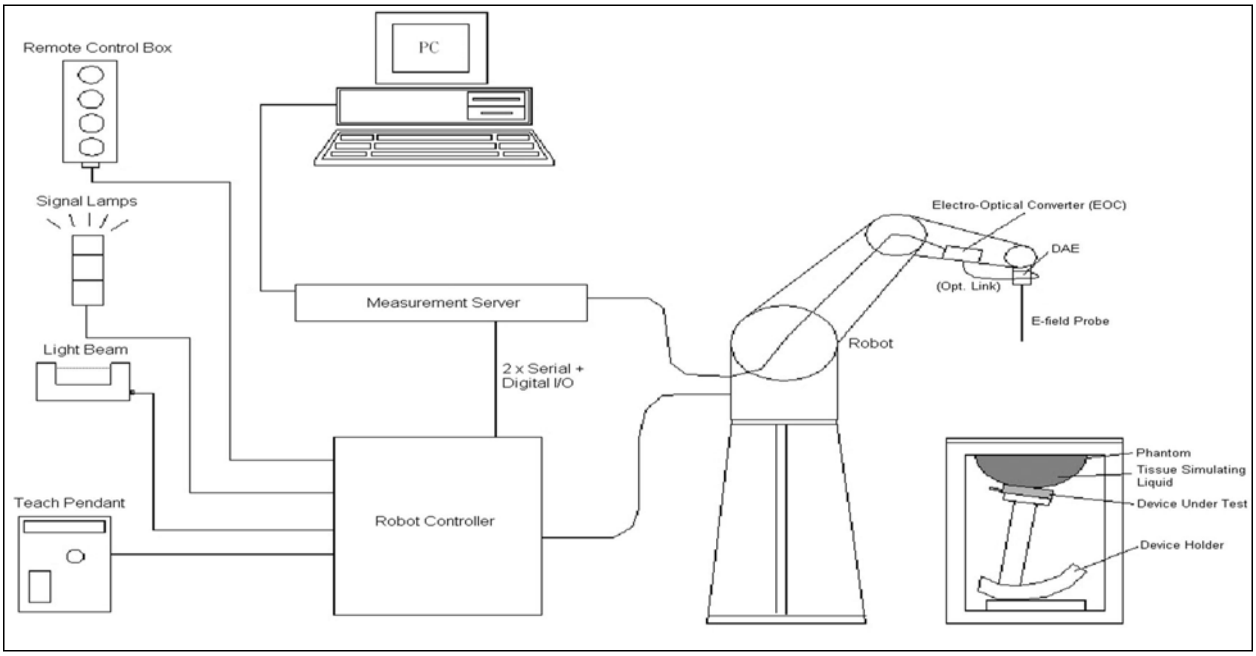
Site Name: Quietek Corporation

Site Address: No.5-22, Ruishukeng, Linkou Dist.,
New Taipei City 24451,
Taiwan. R.O.C.
TEL: 886-2-8601-3788 / FAX: 886-2-8601-3789
E-Mail: service@quietek.com

# 2. HAC Measurement System

## 2.1 DASY5 System Description

The purpose of the Hearing Aid Compatibility extension is to enable measurements of the near electric and magnetic fields generated by wireless communication devices in the region controlled for use by a hearing aid in accordance with ANSI C63.19-2011 and magnetic fields of a wireless device are scanned with free-space probes (e.g., ER3DVX ) in a 5 by 5 cm area parallel above the acoustic point. The scanning distance from the device surface depends on the standard version (for ANSI C63.19-2011 15mm from the probe sensor center). The maximum field values in 9 sub-grids of the electrical and a magnetic field scan are evaluated automatically according to the rules defined in the standard and result in a specific “M-class”.




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

- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- 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 from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The Arch phantom, the device holder and other accessories according to the targeted measurement.

### 2.2 HAC Probe

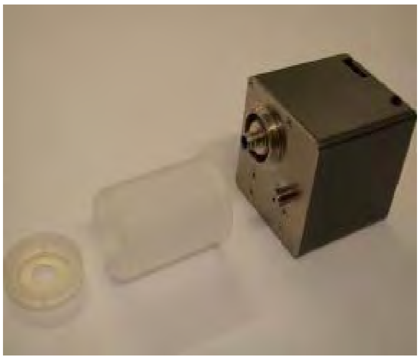
The E-field free space probe (ER3DV6) needs to be calibrated for the respective signal such that the true time-average RMS value is obtained independent of the field strength. The calibration data are in Appendix D**.**

#### 2.2.1 HAC E-Field Probe Specification

| **Model** | ER3DV6 | |
|---|---|---|
| **Construction** | One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges | |
| **Frequency** | 100MHz to 6GHz;<br>Linearity: ± 0.2dB (100MHz to 3GHz) |  |
| **Directivity** | ± 0.2dB in air (rotation around probe axis)<br>± 0.4dB in air (rotation normal to probe axis) | |
| **Dynamic Range** | 2V/m to 1000V/m (M3 or better device readings fall well below diode compression point) Linearity: ± 0.2dB | |
| **Dimensions** | Overall length: 330mm (Tip: 16mm)<br>Tip diameter: 8mm (Body: 12mm)<br>Distance from probe tip to dipole centers: 2.5mm | |

## 2.3 Boundary Detection Unit and Probe Mounting Device

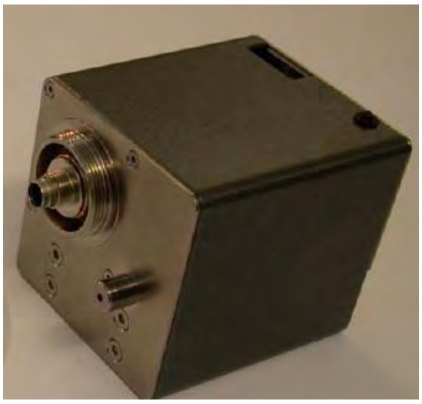
The DASY probes use a precise connector and an additional holder for the probe, consisting of a plastic tube and a flexible silicon ring to center the probe. The connector at the DAE is flexibly mounted and held in the default position with magnets and springs. Two switching systems in the connector mount detect frontal and lateral probe collisions and trigger the necessary software response.



## 2.4 DATA Acquisition Electronics (DAE) and Measurement Server

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.



The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chipdisk and 128MB RAM. The necessary circuits for communication with the DAE electronics box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY5 I/O board, which is directly connected to the PC/104 bus of the CPU board.

## 2.5 Robot

The DASY5 system uses the high precision robots TX60L type out of the newer series from Stäubli SA (France). For the 6-axis controller DASY5 system, the CS8C robot controller version from Stäubli is used.

The XL robot series have many features that are important for our application:

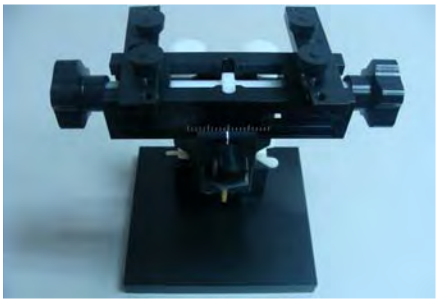
- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

## 2.6 Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.

The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

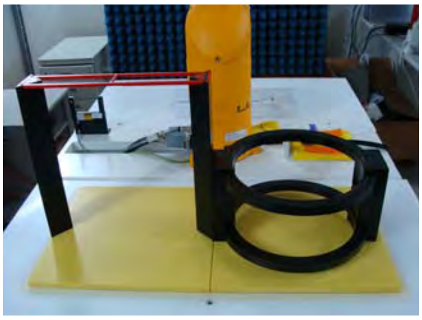
## 2.7 Device Holder



The HAC device holder is made from SPEAG. The holder supports accurate and reliable positioning of any phone effect on near field <+/- 0.5dB. It is used to adjust DUT to suitable position.

## 2.8 Test Arch Phantom

The HAC Test Arch phantom is used with several sections, each considering the different vertical distances of the DUT or the dipole as well as the different sensor offsets of the E- and H-Field probes. The Test Arch phantom V4.8 includes a single predefined RF phantom section (V4.9 also a TCoil section).



| | |
|---|---|
| **Model** | Arch Phantom V 4.9 |
| **Dimensions** | 370 x 370 x 370mm |

## 2.9 Audio Interference Analyzer (AIA)

The Audio Interference Analyzer measures the Modulation Interference Factor (MIF) and the Probe Modulation Factor (PMF) of modulated radiofrequency (RF) signals as required to meet the new hearing-aid-compatibility (HAC) standard. It is also perfectly suited for establishing the connection between base-station emulator and the device under test (DUT). It is compact, i.e., it fits on any emulator, and covers the entire mobile frequency band .

# 3. System Check

## 3.1 Dipole Kit

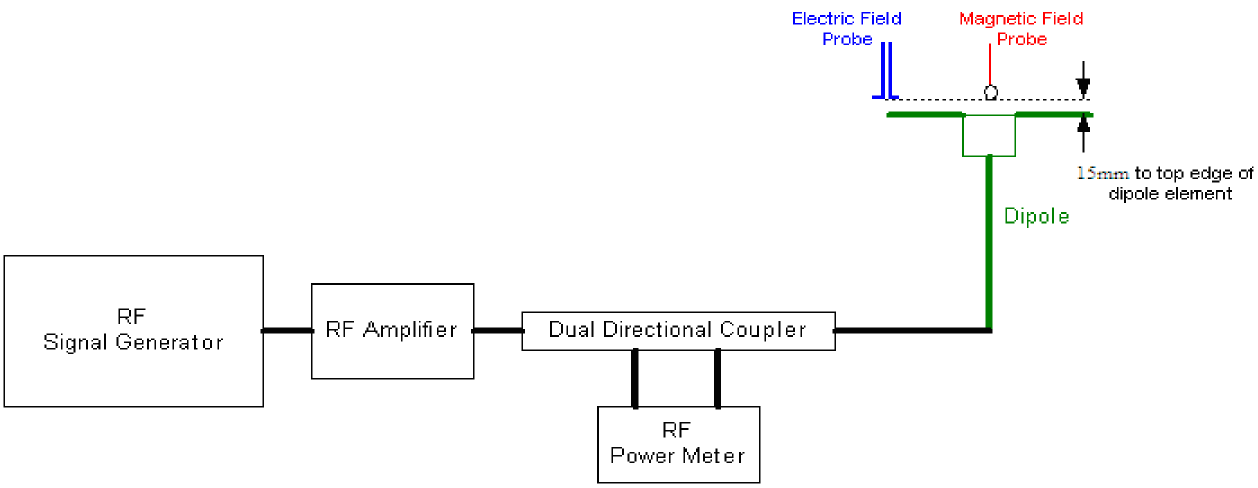
| Model | CD835V3 |  |
|---|---|---|
| Frequency Band | 800 ~ 960MHz (free space) | |
| Return Loss | > 15dB | |
| Calibration | 835MHz (Appendix E) | |
| Power Capability | 50W continuous | |
| Dimensions | Length: 166mm<br>Height: 330mm | |

| Model | CD1880V3 |  |
|---|---|---|
| Frequency Band | 1710 ~ 2000MHz (free space) | |
| Return Loss | > 18dB | |
| Calibration | 1880MHz (Appendix E) | |
| Power Capability | 50W continuous | |
| Dimensions | Length: 80.8mm<br>Height: 330mm | |

| Model | CD2450V3 |  |
|---|---|---|
| Frequency Band | 2250 ~ 2650MHz (free space) | |
| Return Loss | > 18dB | |
| Calibration | 2450MHz (Appendix E) | |
| Power Capability | 50W continuous | |
| Dimensions | Length: 59.9mm<br>Height: 330mm | |

### 3.2 System Check

The manufacturer calibrates the probes annually. The HAC measurements of the device were done within 24 hours of system accuracy verification, which was done using calibration dipoles. Unmodulated continuous wave of power level of 20dBm was supplied to a dipole antenna placed under Test Arch. The measurement probes are positioned over the illuminated dipole at 15mm distance from the top surface of the dipole element to the calibration reference point of the sensor, defined by the probe manufacturer.




### 3.3 System Check Results

| HAC System Check | | | | | | |
|---|---|---|---|---|---|---|
| Frequency [MHz] | Input Power (dBm) | Target E-Field (V/m) | Measured E-Field (V/m) | | Deviation (%) | Date |
| | | | E-Field 1 | E-Field 2 | | |
| 835 | 20 | 105.8 | 103.9 | 94.12 | -6.4 | 2016/06/22 |
| 1880 | 20 | 89.1 | 87.44 | 85.71 | -2.8 | 2016/06/22 |

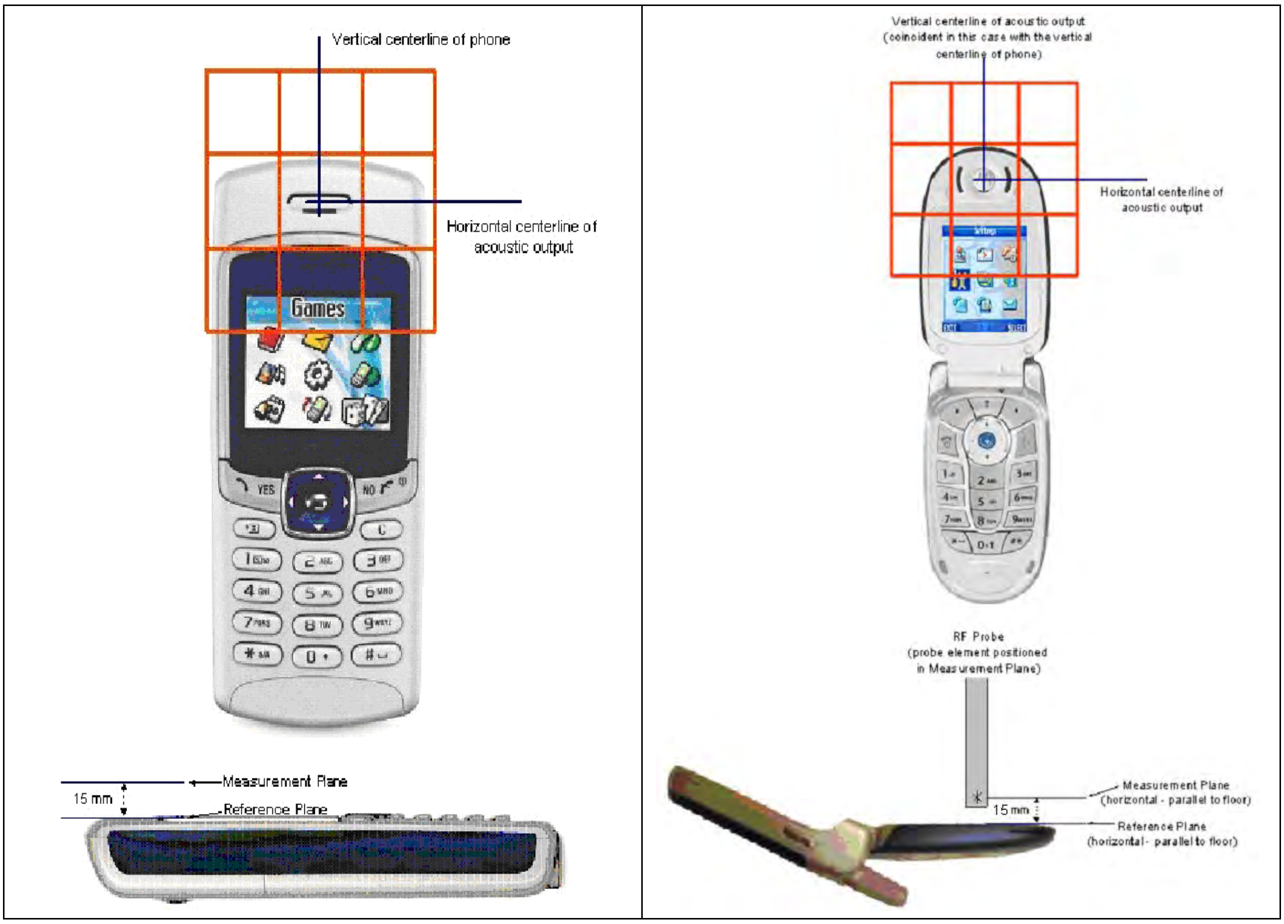
1. The measured values were compared with the values provided by the probe manufacturer and must within the allowed tolerance of 25%
2. The deviation is ((E-Field 1+ E-Field 2)/2-Target E-Field))/ Target E-Field * 100%

# 4. Measurement Description

## 4.1 RF Emission Measurements Reference and Plane

The figure as below illustrates the references and reference plane that shall be used in the EUT emissions measurement:

- The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.
- The grid is centered on the audio frequency output transducer (speaker) of the EUT.
- The grid is in a reference plane, which is defined as the planar area that contains the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver of the EUT and is defined by the points of the receiver-end of the EUT, which, in normal handset use, rest against the ear.
- The measurement plane is parallel to, and 1.5 cm in front of, the reference plane.



## 4.2 Near-Field Emission Automated Test Flowchart

♦ Confirm proper operation of probes and instrumentation
♦ Position WD
♦ Configure WD Tx operation

Per ANSI C63.19-2011 Section 5.5.1.2 (1-3)

↓

♦ Initialize field probe
♦ Scan area

Per ANSI C63.19-2011 Section 5.5.1.2 (4-6)

↓

♦ Identify exclusion area
♦ Rescan or reanalyze open area to determine maximum
♦ Indirect Method: Add the MIF to the maximum steady state RMS field strength and record RF Audio Interference Level in dBV/m

Per ANSI C63.19-2011 Section 5.5.1.2 (7-9)

↓

♦ Identify and record the category

Per ANSI C63.19-2011 Section 5.5.1.2 (9-10)

### 4.3 Test Procedure Description

The following illustrate a typical RF emission test scan over a wireless communication device:

1. Proper operation of the field probe, probe measurement system, other instrumentation, and the positioning system was confirmed.
2. Position the WD 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. Ensure battery is 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 arch.
6. The measurement system measured the field strength at the reference location.
7. Measurements at 2mm or 5mm increments in the 5x 5cm region were performed at a distance 15 mm from the center point of the probe measurement element to the WD. 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.

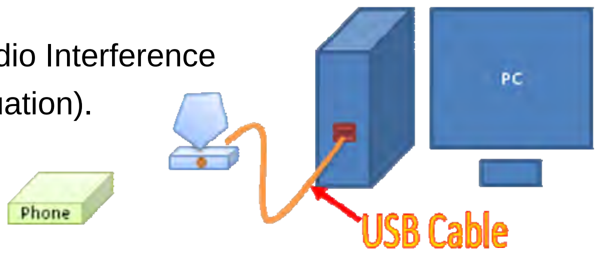
### 4.4 Modulation interference factor

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, a conducted RF signal, or in a preliminary stage, a mathematical analysis of a modeled RF signal:

a) 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.
b) 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 × log(step f))/step c)).

The following procedure was used to measure the MIF using SPEAG Audio interference Analyzer(AIA)




a) Couple the RF signal to be evaluated to an Audio Interference Analyzer (AIA). Set the coupling factor (RF attenuation).
b) Connect the AIA via USB to the DASY5 PC.
c) Generate and run a MIF measurement job with a reference signal. Adjust the configuration of the AIA (MIF scaling based on an 80% AM 1 kHz sine signal) for correct reference reading.
d) Generate and run a MIF measurement job for the unknown signal.
e) The device was placed into a simulated call using a base station simulator or set to transmit using test software for a given mode.
f) Set to continuously transmit a maximum power.
g) Using a coupler if needed, the device output signal was connected to the RF in port of the AIA, which was connected to as desktop computer. Altematively a radiated RF signal may be used with the AIA’s built-in antenna
h) The MIF measurement procedure in the DASY software was run, and the resulting MIF Value was recorded.

| Mode | GSM850 | | | GSM1900 | | |
|---|---|---|---|---|---|---|
| Channel | 128 | 190 | 251 | 512 | 661 | 810 |
| GSM | 3.48 | 3.47 | 3.40 | 3.50 | 3.60 | 3.01 |

| Mode | | UMTS II | | | UMTS IV | | | UMTS V | | |
|---|---|---|---|---|---|---|---|---|---|---|
| UMTS | Channel | 9262 | 9400 | 9538 | 1312 | 1412 | 1513 | 4132 | 4183 | 4233 |
| | RMC | -24.01 | -22.72 | -22.56 | -23.03 | -22.63 | -22.83 | -19.52 | -17.00 | -21.33 |
| | AMR | -14.21 | -14.19 | -14.19 | -14.17 | -14.40 | -14.42 | -14.42 | -13.79 | -14.01 |

Low Power Exemption

| Mode | Maximum Power(dBm) | Maximum MIF | Power + MIF | C63.19 |
|---|---|---|---|---|
| GSM 850 | 32.27 | 3.48 | 35.75 | Yes |
| GSM 1900 | 29.03 | 3.60 | 32.63 | Yes |
| UMTS II | 21.42 | -14.19 | 7.23 | No |
| UMTS IV | 18.80 | -14.17 | 4.63 | No |
| UMTS V | 22.08 | -13.79 | 8.29 | No |

Note: According to ANSI C63.19 2011-version.An RF air interface technology of a device is exempt from testing when it’s a average antenna input power plus its MIF is ≤17 dBm for any of its operating mods.

## 5. HAC RF Emission Limits

The ANSI Standard presents performance requirements for acceptable interoperability of hearing aids with wireless communications devices. When these parameters are met, a hearing aid operates acceptably in close proximity to a wireless communications device.

| **TELEPHONE RF PARAMETERS < 960MHz** | |
|---|---|
| **CATEGORY NEAR FIELD** | **E-FIELD EMISSION CW** |
| | **(dBV/m)** |
| M1 | 50.0 to 66.0 |
| M2 | 45.0 to 50.0 |
| M3 | 40.0 to 45 |
| M4 | < 40 |
| **TELEPHONE RF PARAMETERS >960MHz** | |
| M1 | 40.0 to 45.0 |
| M2 | 35.0 to 40.0 |
| M3 | 30.0 to 35.0 |
| M4 | < 30.0 |

# 6. Test Equipment List

| Instrument | Manufacturer | Model No. | Serial No. | Last Calibration | Next Calibration |
|---|---|---|---|---|---|
| Stäubli Robot TX60L | Stäubli | TX60L | F09/5BL1A1/A06 | 2009/05/18 | only once |
| Controller | Speag | CS8c | N/A | 2009/05/18 | only once |
| Test Arch Phantom | Speag | SD HAC P01 BB | 1118 | N/A | N/A |
| Speaq Reference Dipole 835MHz | Speaq | CD835V3 | 1135 | 2015/05/26 | 2017/05/24 |
| Speaq Reference Dipole 1900MHz | Speaq | CD1880V3 | 1117 | 2015/05/26 | 2017/05/24 |
| SAM Twin Phantom | Speag | QD000 P40 CA | Tp 1515 | N/A | N/A |
| Device Holder | Speag | N/A | N/A | N/A | N/A |
| Data Acquisition Electronic | Speag | DAE4 | 1207 | 2015/11/20 | 2016/11/19 |
| E-Field Probe | Speag | ER3DV6 | 2466 | 2016/05/27 | 2017/05/26 |
| SAR Software | Speag | DASY52 | Version 52.8 (8) | N/A | N/A |
| Aprel Dipole Spaccer | Aprel | ALS-DS-U | QTK-295 | N/A | N/A |
| Power Amplifier | Mini-Circuit | ZHL-42 | D051404-20 | N/A | N/A |
| Directional Coupler | Agilent | 778D-012 | 50550 | N/A | N/A |
| Universal Radio Communication Tester | R&S | CMU200 | 104846 | 2016/07/07 | 2017/07/06 |
| Vector Network | Agilent | E5071C | MY46108013 | 2015/12/02 | 2016/11/30 |
| Signal Generator | Anritsu | MG3694A | 041902 | 2015/08/14 | 2016/08/12 |
| Power Meter | Anritsu | ML2487A | 6K00001447 | 2015/09/17 | 2016/09/15 |
| Wide Bandwidth Sensor | Anritsu | MA2411B | 1339194 | 2015/09/17 | 2016/09/15 |

# 7. Measurement Uncertainty

| HAC Uncertainty Budget<br>According to ANSI C63.19 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Error Description | Uncert. value | Prob. Dist. | Div. | ($c_i$) E | ($c_i$) H | Std. Unc. E | Std. Unc. H |
| **Measurement System** | | | | | | | |
| Probe Calibration | ±5.1% | N | 1 | 1 | 1 | ±5.1% | ±5.1% |
| Axial Isotropy | ±4.7% | R | $\sqrt{3}$ | 1 | 1 | ±2.7% | ±2.7% |
| Sensor Displacement | ±16.5% | R | $\sqrt{3}$ | 1 | 0.145 | ±9.5% | ±1.4% |
| Boundary Effects | ±2.4% | R | $\sqrt{3}$ | 1 | 1 | ±1.4% | ±1.4% |
| Phantom Boundary Effect | ±7.2% | R | $\sqrt{3}$ | 1 | 0 | ±4.1% | ±0.0% |
| Linearity | ±4.7% | R | $\sqrt{3}$ | 1 | 1 | ±2.7% | ±2.7% |
| Modulation Interference Factor | ±10.0% | R | $\sqrt{3}$ | 1 | 1 | ±5.8% | ±5.8% |
| System Detection Limit | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% |
| Readout Electronics | ±0.3% | N | $\sqrt{3}$ | 1 | 1 | ±0.3% | ±0.3% |
| Response Time | ±0.8% | R | $\sqrt{3}$ | 1 | 1 | ±0.5% | ±0.5% |
| Integration Time | ±2.6% | R | $\sqrt{3}$ | 1 | 1 | ±1.5% | ±1.5% |
| RF Ambient Conditions | ±3.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% |
| RF Reflections | ±12.0% | R | $\sqrt{3}$ | 1 | 1 | ±6.9% | ±6.9% |
| Probe Positioner | ±1.2% | R | $\sqrt{3}$ | 1 | 0.67 | ±0.7% | ±0.5% |
| Probe Positioning | ±4.7% | R | $\sqrt{3}$ | 1 | 0.67 | ±2.7% | ±1.8% |
| Extrap. and Interpolation | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% |
| **Test Sample Related** | | | | | | | |
| Device Positioning Vertical | ±4.7% | R | $\sqrt{3}$ | 1 | 0.67 | ±2.7% | ±1.8% |
| Device Positioning Lateral | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% |
| Device Holder and Phantom | ±2.4% | R | $\sqrt{3}$ | 1 | 1 | ±1.4% | ±1.4% |
| Power Drift | ±5.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.9% | ±2.9% |
| **Phantom and Setup Related** | | | | | | | |
| Phantom Thickness | ±2.4% | R | $\sqrt{3}$ | 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% |

# 8. Test Results

## 8.1 HAC RF Emission Test Results Summary

| HAC Measurement | | | | | | |
|---|---|---|---|---|---|---|
| Product: Smart phone | | | | | | |
| Test Mode: E-Field | | | | | | |
| Test Band | Antenna Position | Frequency | | Conducted Power (dBm) | Peak E-Field(dBV/m) | Rating |
| | | Channel | MHz | | | |
| 850 | Fixed | 128 | 824.2 | 32.32 | 38.15 | M4 |
| | Fixed | 190 | 836.6 | 32.27 | 38.05 | M4 |
| | Fixed | 251 | 848.8 | 32.15 | 37.67 | M4 |
| 1900 | Fixed | 512 | 1850.2 | 29.03 | 31.77 | M3 |
| | Fixed | 661 | 1880 | 29.02 | 31.65 | M3 |
| | Fixed | 810 | 1909.8 | 28.96 | 30.52 | M3 |
| | | | | | | |

**Appendix**

**Appendix A. HAC System Check Data**

**Appendix B. HAC RF Emission Measurement Data**

**Appendix C. Test Setup Photographs & EUT Photographs**

**Appendix D. HAC Probe Calibration Data**

**Appendix E. HAC Dipole Calibration Data**

## Appendix A. HAC System Check Data

Test Laboratory: QuieTek-a DEKRA    Date/Time: 2016/06/22

**HAC Correction 850**
**DUT: HAC Dipole 835MHz; Type: CD835V3**
Communication System: UID 0, CW; Frequency: 835 MHz;
Communication System PAR: 0 dB
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: RF Section
Ambient Temperature (°C) : 22.4, Humidity (%RH) : 54
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

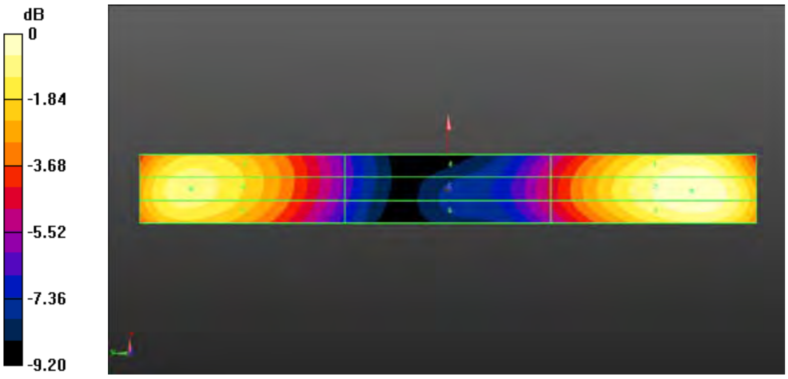
- Probe: ER3DV6 - SN2466; ConvF(1, 1, 1); Calibrated: 2016/05/27;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1207; Calibrated: 2015/11/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Dipole E-Field measurement (E-field scan for ANSI C63.19-2007 & -2011 compliance)/E Scan - measurement distance from the probe sensor center to CD835 = 15mm/Hearing Aid Compatibility Test at 15mm distance (41x361x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 93.80 V/m; Power Drift = -0.02 dB
PMR not calibrated. PMF = 1.000 is applied.
E-field emissions = 103.9 V/m
**Near-field category: M4 (AWF 0 dB)**

PMF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **101.3 V/m** | Grid 2 **M4** **103.9 V/m** | Grid 3 **M4** **102.7 V/m** |
| Grid 4 **M4** **59.79 V/m** | Grid 5 **M4** **60.64 V/m** | Grid 6 **M4** **60.10 V/m** |
| Grid 7 **M4** **92.83 V/m** | Grid 8 **M4** **94.12 V/m** | Grid 9 **M4** **92.72 V/m** |

**Cursor:**
Total = 103.9 V/m
E Category: M4
Location: -0.5, -71, 9.7 mm




0 dB = 103.9 V/m = 40.33 dBV/m

Test Laboratory: QuieTek-a DEKRA Date/Time: 2016/06/22

**HAC Correction 1900**
**DUT: HAC Dipole 1880 MHz; Type: CD1880V3**
Communication System: UID 0, CW; Frequency: 1880 MHz;
Communication System PAR: 0 dB
Medium parameters used: $\sigma$ = 0 S/m, $\varepsilon_r$ = 1; $\rho$ = 1000 kg/$m^3$
Phantom section: RF Section
Ambient Temperature (°C) : 22.4, Humidity (%RH) : 54
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

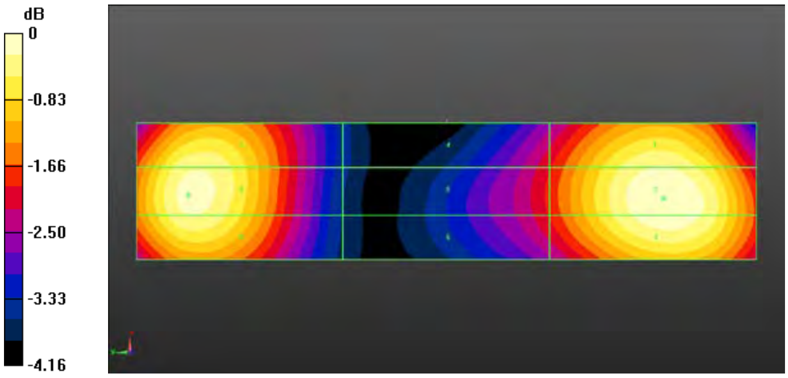
- Probe: ER3DV6 - SN2466; ConvF(1, 1, 1); Calibrated: 2016/05/27;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1207; Calibrated: 2015/11/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Dipole E-Field measurement (E-field scan for ANSI C63.19-2007 & -2011 compliance)/E Scan - measurement distance from the probe sensor center to CD1880 = 15mm/Hearing Aid Compatibility Test at 15mm distance (41x181x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 148.7 V/m; Power Drift = 0.00 dB
PMR not calibrated. PMF = 1.000 is applied.
E-field emissions = 87.44 V/m
**Near-field category: M3 (AWF 0 dB)**

PMF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M3** **84.92 V/m** | Grid 2 **M3** **87.44 V/m** | Grid 3 **M3** **86.77 V/m** |
| Grid 4 **M3** **69.78 V/m** | Grid 5 **M3** **70.86 V/m** | Grid 6 **M3** **70.24 V/m** |
| Grid 7 **M3** **84.40 V/m** | Grid 8 **M3** **85.71 V/m** | Grid 9 **M3** **84.65 V/m** |

**Cursor:**
Total = 87.44 V/m
E Category: M3
Location: -1, -31.5, 9.7 mm




0 dB = 87.44 V/m = 38.83 dBV/m

## Appendix B. HAC RF Emission Measurement Data

Test Laboratory: QuieTek-a DEKRA Date/Time: 2016/06/22

**GSM 850 CH 128**
**DUT: Smart Phone; Type: PH4002**
Communication System: UID 0, FCC GSM_850MHz; Frequency: 824.2 MHz;
Communication System PAR: 0 dB
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: RF Section
Ambient Temperature (°C) : 22.4, Humidity (%RH) : 54
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY5 Configuration:

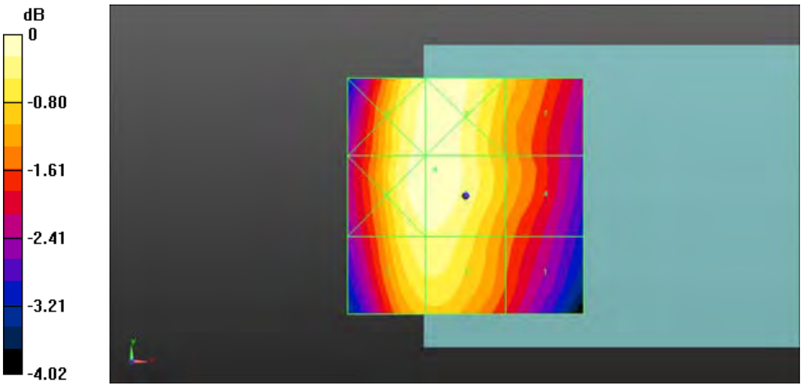
- Probe: ER3DV6 - SN2466; ConvF(1, 1, 1); Calibrated: 2016/05/27;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1207; Calibrated: 2015/11/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Device E-Field measurement (E-field scan for ANSI C63.19-2007 & -2011 compliance)/E Scan - ER3D: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 63.53 V/m; Power Drift = -0.03 dB
Applied MIF = 3.48 dB
RF audio interference level = 38.15 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **36.73 dBV/m** | Grid 2 **M4** **37.86 dBV/m** | Grid 3 **M4** **37.85 dBV/m** |
| Grid 4 **M4** **37.12 dBV/m** | Grid 5 **M4** **38.15 dBV/m** | Grid 6 **M4** **38.13 dBV/m** |
| Grid 7 **M4** **37.29 dBV/m** | Grid 8 **M4** **38.15 dBV/m** | Grid 9 **M4** **38.08 dBV/m** |

**Cursor:**
Total = 38.15 dBV/m
E Category: M4
Location: -6.5, 5.5, 8.7 mm




0 dB = 80.83 V/m = 38.15 dBV/m

Test Laboratory: QuieTek-a DEKRA Date/Time: 2016/06/22

**GSM 850 CH 190**
**DUT: Smart Phone; Type: PH4002**
Communication System: UID 0, FCC GSM_850MHz; Frequency: 836.6 MHz;
Communication System PAR: 0 dB
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: RF Section
Ambient Temperature (°C) : 22.4, Humidity (%RH) : 54
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY5 Configuration:

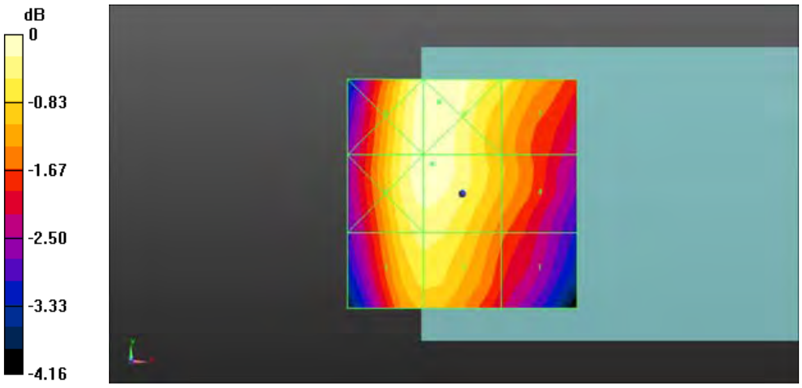
- Probe: ER3DV6 - SN2466; ConvF(1, 1, 1); Calibrated: 2016/05/27;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1207; Calibrated: 2015/11/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Device E-Field measurement (E-field scan for ANSI C63.19-2007 & -2011 compliance)/E Scan - ER3D: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 63.27 V/m; Power Drift = -0.09 dB
Applied MIF = 3.47 dB
RF audio interference level = 38.01 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **36.5 dBV/m** | Grid 2 **M4** **37.62 dBV/m** | Grid 3 **M4** **37.62 dBV/m** |
| Grid 4 **M4** **37 dBV/m** | Grid 5 **M4** **38.01 dBV/m** | Grid 6 **M4** **37.98 dBV/m** |
| Grid 7 **M4** **37.38 dBV/m** | Grid 8 **M4** **38.05 dBV/m** | Grid 9 **M4** **37.96 dBV/m** |

**Cursor:**
Total = 38.05 dBV/m
E Category: M4
Location: -5, 20, 8.7 mm




0 dB = 79.91 V/m = 38.05 dBV/m

Test Laboratory: QuieTek-a DEKRA Date/Time: 2016/06/22

**GSM 850 CH 251**
**DUT: Smart Phone; Type: PH4002**
Communication System: UID 0, FCC GSM_850MHz; Frequency: 848.8 MHz;
Communication System PAR: 0 dB
Medium parameters used: σ = 0 S/m, $\varepsilon_r$ = 1; ρ = 1000 kg/m$^3$
Phantom section: RF Section
Ambient Temperature (°C) : 22.4, Humidity (%RH) : 54
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY5 Configuration:

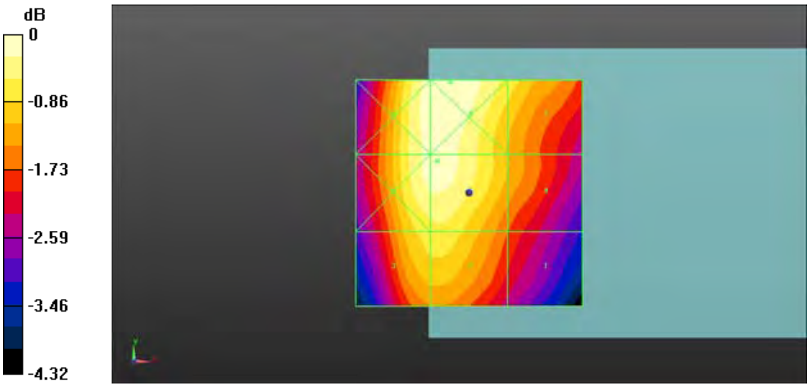
- Probe: ER3DV6 - SN2466; ConvF(1, 1, 1); Calibrated: 2016/05/27;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1207; Calibrated: 2015/11/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Device E-Field measurement (E-field scan for ANSI C63.19-2007 & -2011 compliance)/E Scan - ER3D: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 60.11 V/m; Power Drift = -0.10 dB
Applied MIF = 3.40 dB
RF audio interference level = 37.51 dBV/m
**Emission category: M4**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M4** **35.96 dBV/m** | Grid 2 **M4** **37.02 dBV/m** | Grid 3 **M4** **37 dBV/m** |
| Grid 4 **M4** **36.54 dBV/m** | Grid 5 **M4** **37.51 dBV/m** | Grid 6 **M4** **37.5 dBV/m** |
| Grid 7 **M4** **37 dBV/m** | Grid 8 **M4** **37.67 dBV/m** | Grid 9 **M4** **37.59 dBV/m** |

**Cursor:**
Total = 37.67 dBV/m
E Category: M4
Location: -4, 24.5, 8.7 mm




0 dB = 76.45 V/m = 37.67 dBV/m

Test Laboratory: QuieTek-a DEKRA Date/Time: 2016/06/22

**PCS 1900 CH 512**
**DUT: Smart Phone; Type: PH4002**
Communication System: UID 0, FCC PCS_1900MHz; Frequency: 1850.2 MHz;
Communication System PAR: 0 dB
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: RF Section
Ambient Temperature (°C) : 22.4, Humidity (%RH) : 54
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY5 Configuration:

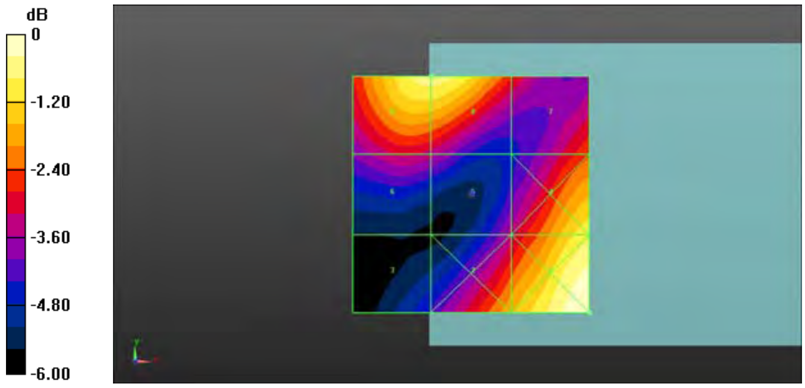
- Probe: ER3DV6 - SN2466; ConvF(1, 1, 1); Calibrated: 2016/05/27;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1207; Calibrated: 2015/11/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Device E-Field measurement (E-field scan for ANSI C63.19-2007 & -2011 compliance)/E Scan - ER3D: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 14.19 V/m; Power Drift = 0.02 dB
Applied MIF = 3.50 dB
RF audio interference level = 31.20 dBV/m
**Emission category: M3**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M3** **31.77 dBV/m** | Grid 2 **M3** **30.11 dBV/m** | Grid 3 **M4** **27.48 dBV/m** |
| Grid 4 **M3** **30.87 dBV/m** | Grid 5 **M4** **28.4 dBV/m** | Grid 6 **M4** **28.67 dBV/m** |
| Grid 7 **M4** **29.34 dBV/m** | Grid 8 **M3** **31.2 dBV/m** | Grid 9 **M3** **31.2 dBV/m** |

**Cursor:**
Total = 31.77 dBV/m
E Category: M3
Location: 25, -25, 8.7 mm




0 dB = 38.79 V/m = 31.77 dBV/m

Test Laboratory: QuieTek-a DEKRA Date/Time: 2016/06/22

**PCS 1900 CH 661**
**DUT: Smart Phone; Type: PH4002**
Communication System: UID 0, FCC PCS_1900MHz; Frequency: 1880 MHz;
Communication System PAR: 0 dB
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: RF Section
Ambient Temperature (°C) : 22.4, Humidity (%RH) : 54
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY5 Configuration:

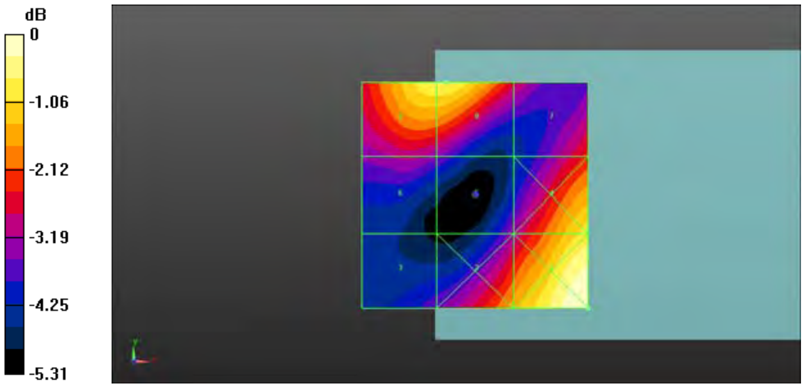
- Probe: ER3DV6 - SN2466; ConvF(1, 1, 1); Calibrated: 2016/05/27;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1207; Calibrated: 2015/11/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Device E-Field measurement (E-field scan for ANSI C63.19-2007 & -2011 compliance)/E Scan - ER3D: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 14.76 V/m; Power Drift = -0.01 dB
Applied MIF = 3.60 dB
RF audio interference level = 31.02 dBV/m
**Emission category: M3**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M3** **31.65 dBV/m** | Grid 2 **M3** **30.1 dBV/m** | Grid 3 **M4** **28.06 dBV/m** |
| Grid 4 **M3** **30.78 dBV/m** | Grid 5 **M4** **28.43 dBV/m** | Grid 6 **M4** **28.61 dBV/m** |
| Grid 7 **M4** **29.33 dBV/m** | Grid 8 **M3** **31.02 dBV/m** | Grid 9 **M3** **30.97 dBV/m** |

**Cursor:**
Total = 31.65 dBV/m
E Category: M3
Location: 25, -25, 8.7 mm




0 dB = 38.25 V/m = 31.65 dBV/m

Test Laboratory: QuieTek-a DEKRA Date/Time: 2016/06/22

**PCS 1900 CH 810**
**DUT: Smart Phone; Type: PH4002**
Communication System: UID 0, FCC PCS_1900MHz; Frequency: 1909.8 MHz;
Communication System PAR: 0 dB
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: RF Section
Ambient Temperature (°C) : 22.4, Humidity (%RH) : 54
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY5 Configuration:

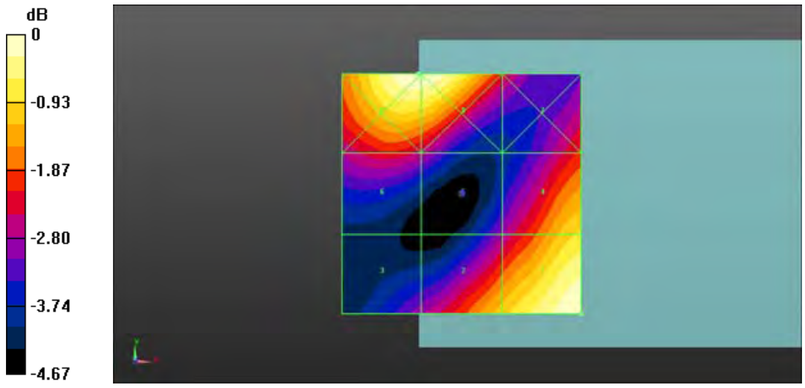
- Probe: ER3DV6 - SN2466; ConvF(1, 1, 1); Calibrated: 2016/05/27;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn1207; Calibrated: 2015/11/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Device E-Field measurement (E-field scan for ANSI C63.19-2007 & -2011 compliance)/E Scan - ER3D: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 14.64 V/m; Power Drift = -0.14 dB
Applied MIF = 3.01 dB
RF audio interference level = 30.46 dBV/m
**Emission category: M3**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M3** **30.46 dBV/m** | Grid 2 **M4** **29.47 dBV/m** | Grid 3 **M4** **27.65 dBV/m** |
| Grid 4 **M4** **29.67 dBV/m** | Grid 5 **M4** **27.89 dBV/m** | Grid 6 **M4** **28.28 dBV/m** |
| Grid 7 **M4** **28.47 dBV/m** | Grid 8 **M3** **30.52 dBV/m** | Grid 9 **M3** **30.52 dBV/m** |

**Cursor:**
Total = 30.52 dBV/m
E Category: M3
Location: -9, 25, 8.7 mm

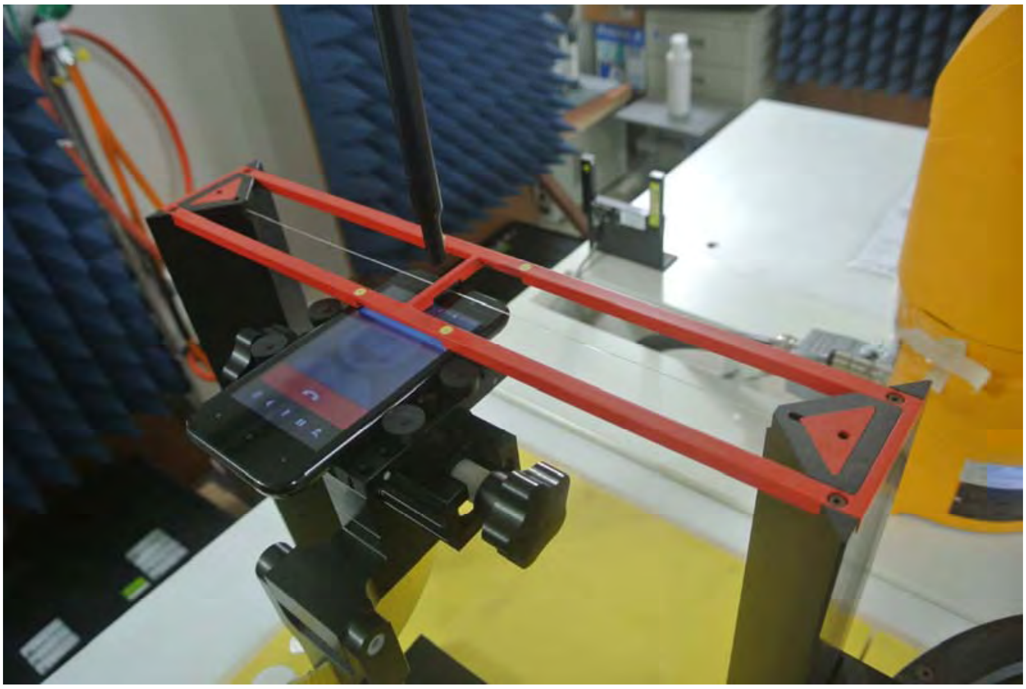



0 dB = 33.59 V/m = 30.52 dBV/m

## Appendix C. Test Setup Photographs & EUT Photographs
## Test Setup Photographs

**HAC Front View**

**HAC Side View**



## EUT Photographs

QuieTek a DEKRA company

# Appendix D. HAC Probe Calibration Data

## Object: ER3DV6- SN: 2466

1130H

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

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

Accredited by the Swiss Accreditation Service (SAS)
**The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates**

**Accreditation No.: SCS 0108**

**Client** **Quietek-TW (Auden)**

**Certificate No: ER3-2466_May16**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | ER3DV6 - SN:2466 |
| Calibration procedure(s) | QA CAL-02.v8, QA CAL-25.v6<br>Calibration procedure for E-field probes optimized for close near field evaluations in air |
| Calibration date: | May 27, 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. 217-02288/02289) | 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: S5277 (20x) | 05-Apr-16 (No. 217-02293) | Apr-17 |
| Reference Probe ER3DV6 | SN: 2328 | 12-Oct-15 (No. ER3-2328_Oct15) | Oct-16 |
| DAE4 | SN: 789 | 31-Mar-16 (No. DAE4-789_Mar16) | Mar-17 |
| | | | |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (No. 217-02285/02284) | In house check: Jun-16 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (No. 217-02285) | In house check: Jun-16 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (No. 217-02284) | In house check: Jun-16 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Apr-13) | In house check: Jun-16 |
| Network Analyzer HP 8753E | SN: US37390585 | 18-Oct-01 (in house check Oct-15) | In house check: Oct-16 |

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

Issued: May 30, 2016

## Glossary:

| | |
|---|---|
| NORMx,y,z | 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 φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 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:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ for XY sensors and $\vartheta = 90$ for Z sensor ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart).
- *DCPx,y,z:* 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
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: *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 *NORMx* (no uncertainty required).

# Probe ER3DV6

# SN:2466

Manufactured: March 31, 2009
Calibrated: May 27, 2016

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

# DASY/EASY - Parameters of Probe: ER3DV6 - SN:2466

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|---|---|---|---|
| Norm ($\mu V/(V/m)^2$) | 1.77 | 1.68 | 1.62 | ± 10.1 % |
| DCP (mV)[B] | 99.4 | 99.8 | 101.1 | |

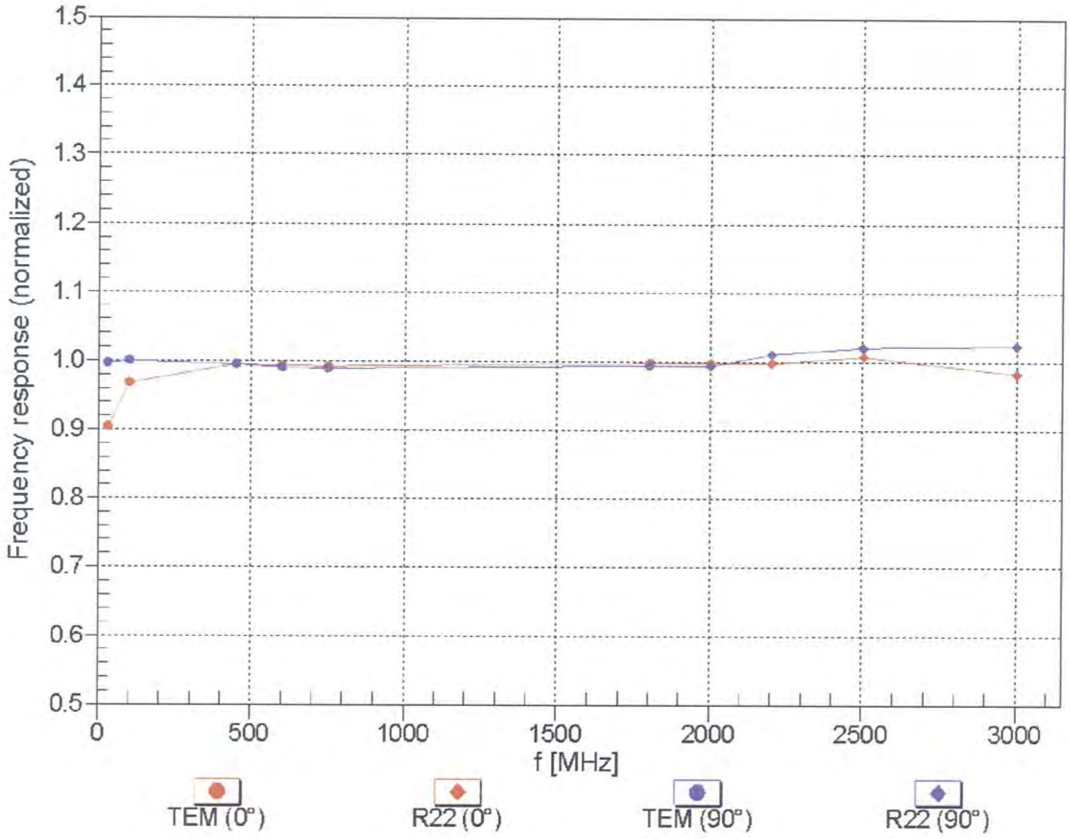
## Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB$\sqrt{\mu V}$ | C | D dB | VR mV | Unc[E] (k=2) |
|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 154.1 | ±3.5 % |
| | | Y | 0.0 | 0.0 | 1.0 | | 160.5 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 174.2 | |
| 10011-CAB | UMTS-FDD (WCDMA) | X | 3.23 | 66.5 | 18.6 | 2.91 | 123.2 | ±1.2 % |
| | | Y | 3.33 | 67.3 | 19.1 | | 128.5 | |
| | | Z | 3.32 | 67.0 | 18.4 | | 139.3 | |
| 10021-DAB | GSM-FDD (TDMA, GMSK) | X | 22.69 | 100.0 | 28.8 | 9.39 | 140.1 | ±1.7 % |
| | | Y | 20.88 | 99.9 | 28.6 | | 135.0 | |
| | | Z | 13.00 | 90.4 | 25.3 | | 104.4 | |

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%.

[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

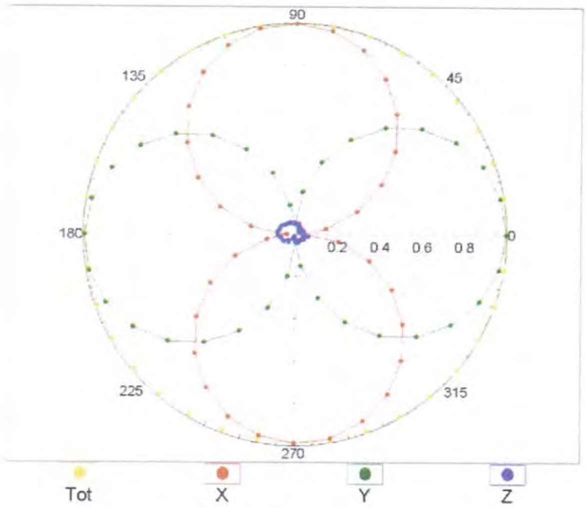
# Frequency Response of E-Field
**(TEM-Cell:ifi110 EXX, Waveguide: R22)**



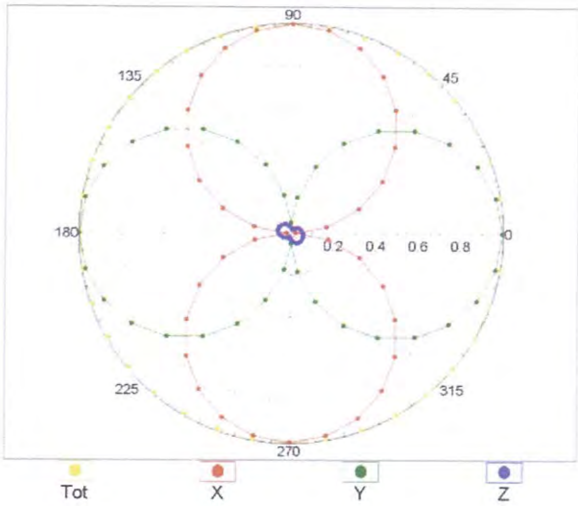

**Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)**

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

f=600 MHz,TEM,0°

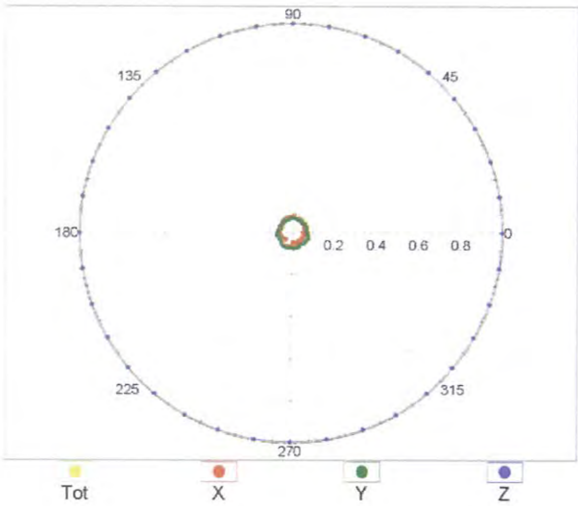



f=2500 MHz,R22,0°

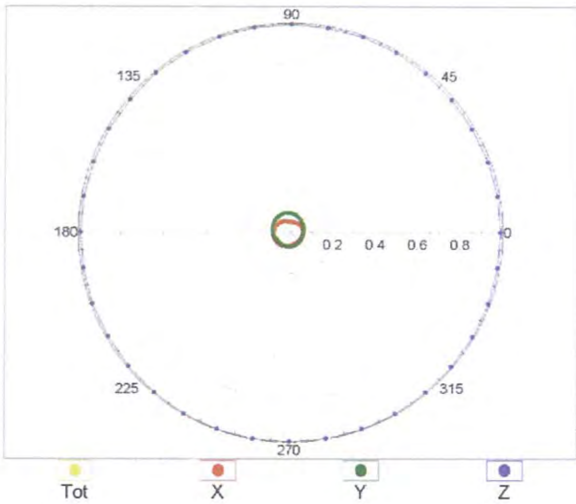



## Receiving Pattern ($\phi$), $\vartheta = 90°$

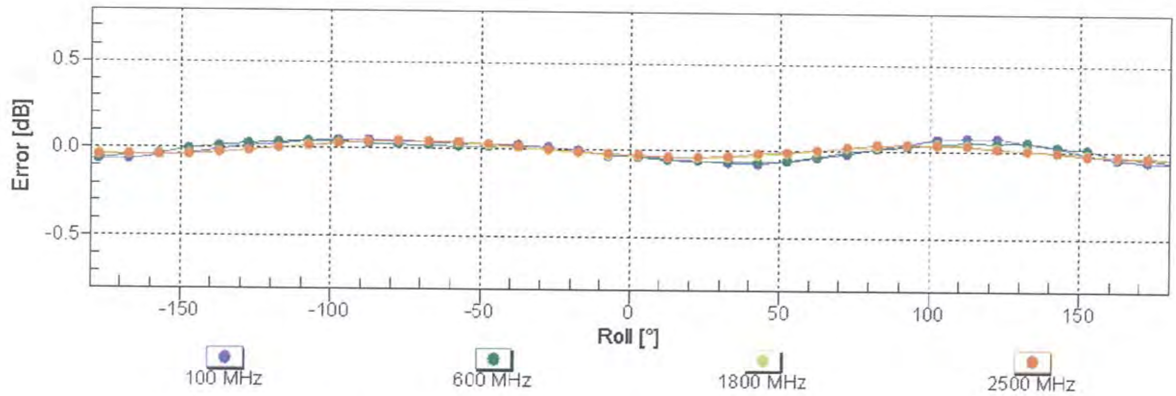
f=600 MHz,TEM,90°




f=2500 MHz,R22,90°

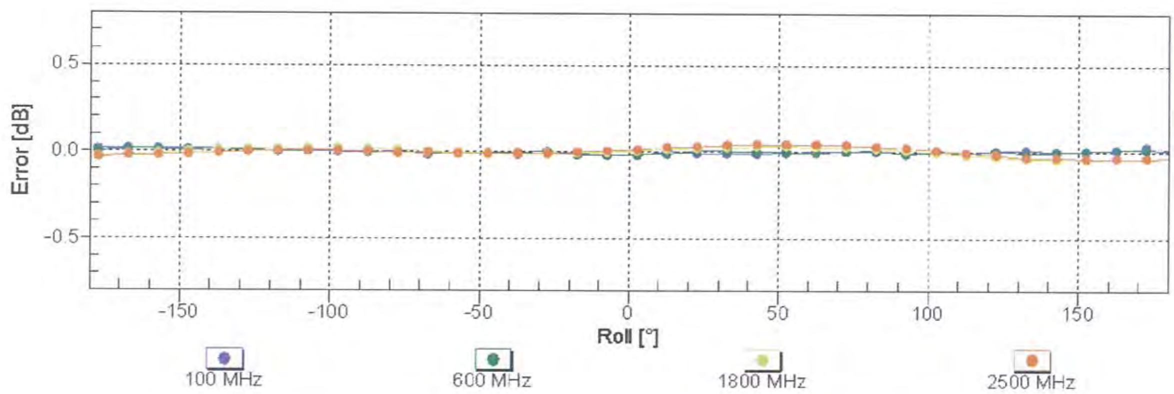


# Receiving Pattern (ϕ), ϑ = 0°



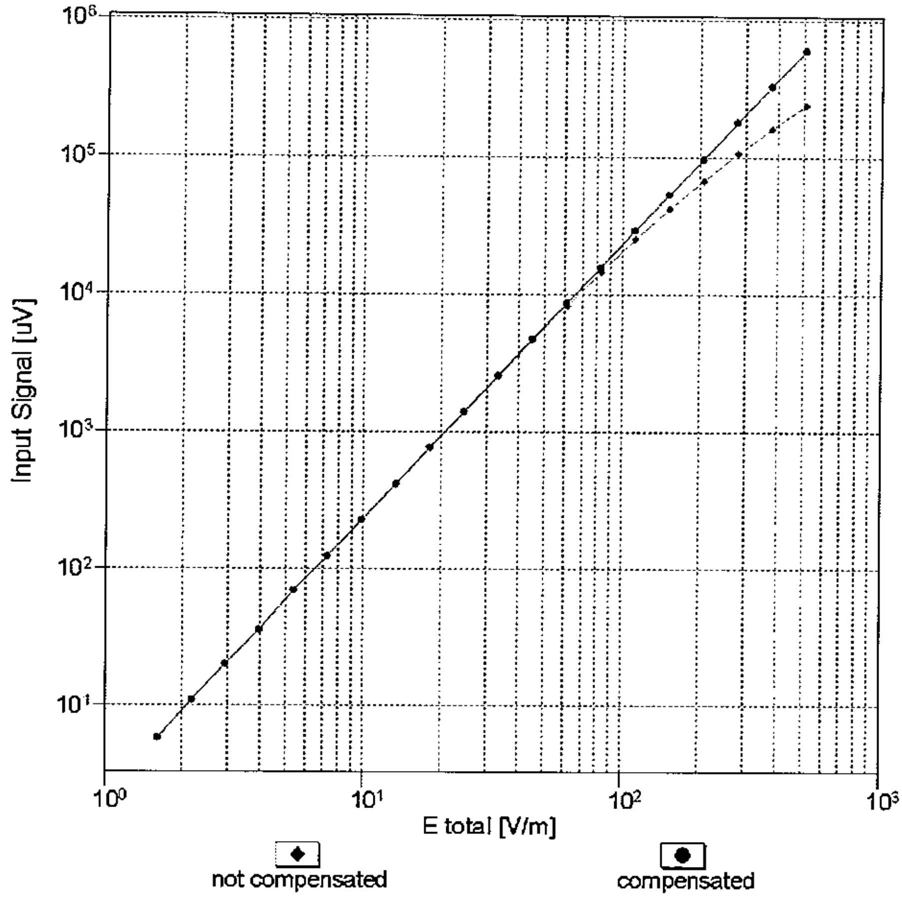

**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

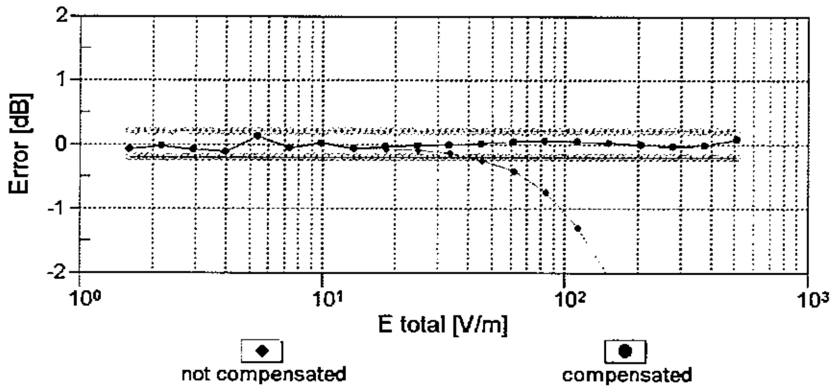
# Receiving Pattern (ϕ), ϑ = 90°




**Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)**

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

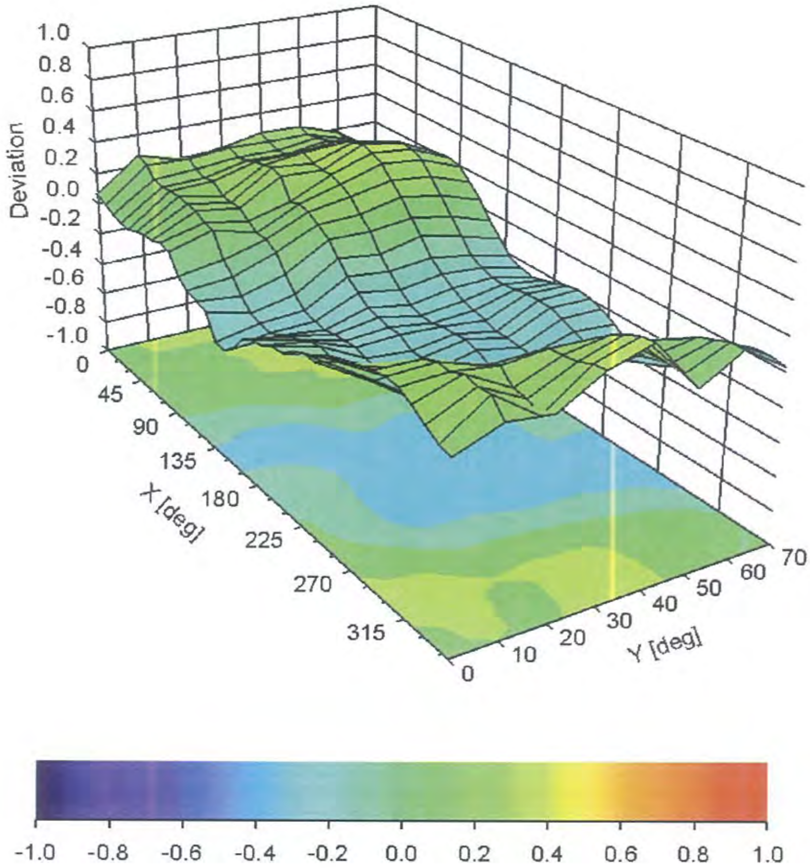



**Uncertainty of Linearity Assessment: ± 0.6% (k=2)**

# Deviation from Isotropy in Air

**Error (ϕ, ϑ), f = 900 MHz**




**Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)**

# DASY/EASY - Parameters of Probe: ER3DV6 - SN:2466

## Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Rectangular |
| Connector Angle (°) | 142.5 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disabled |
| Probe Overall Length | 337 mm |
| Probe Body Diameter | 10 mm |
| Tip Length | 10 mm |
| Tip Diameter | 8 mm |
| Probe Tip to Sensor X Calibration Point | 2.5 mm |
| Probe Tip to Sensor Y Calibration Point | 2.5 mm |
| Probe Tip to Sensor Z Calibration Point | 2.5 mm |

# Appendix E. HAC Dipole Calibration

## Validation Dipole 835MHz

**M/N: CD835V3**

**S/N: 1135**

## Validation Dipole 1900MHz

**M/N: CD1880V3**

**S/N: 1117**

1154
HP

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

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

Accredited by the Swiss Accreditation Service (SAS)
**The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates**

**Accreditation No.: SCS 0108**

**Client** **Quietek-TW (Auden)**

**Certificate No: CD835V3-1135_May15**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | CD835V3 - SN: 1135 |
| Calibration procedure(s) | QA CAL-20.v6<br>Calibration procedure for dipoles in air |
| Calibration date: | May 26, 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 EPM-442A | GB37480704 | 07-Oct-14 (No. 217-02020) | Oct-15 |
| Power sensor HP 8481A | US37292783 | 07-Oct-14 (No. 217-02020) | Oct-15 |
| Power sensor HP 8481A | MY41092317 | 07-Oct-14 (No. 217-02021) | Oct-15 |
| Reference 10 dB Attenuator | SN: 5047.2 / 06327 | 01-Apr-15 (No. 217-02130) | Mar-16 |
| Probe ER3DV6 | SN: 2336 | 31-Dec-14 (No. ER3-2336_Dec14) | Dec-15 |
| Probe H3DV6 | SN: 6065 | 31-Dec-14 (No. H3-6065_Dec14) | Dec-15 |
| DAE4 | SN: 781 | 12-Sep-14 (No. DAE4-781_Sep14) | Sep-15 |

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

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Israe Elnaouq | Laboratory Technician | Israe Elnaouq |
| Approved by: | Fin Bomholt | Deputy Technical Manager | F. Bomholt |

Issued: May 27, 2015

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

## References

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

## Methods Applied and Interpretation of Parameters:

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

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

## Measurement Conditions

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

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

## Maximum Field values at 835 MHz

| **E-field 15 mm above dipole surface** | condition | **Interpolated maximum** |
|---|---|---|
| Maximum measured above high end | 100mW input power | 105.8V/m = 40.49 dBV/m |
| Maximum measured above low end | 100mW input power | 105.7V/m = 40.48 dBV/m |
| Averaged maximum above arm | 100mW input power | **105.8V/m ± 12.8 % (k=2)** |

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

## Antenna Parameters

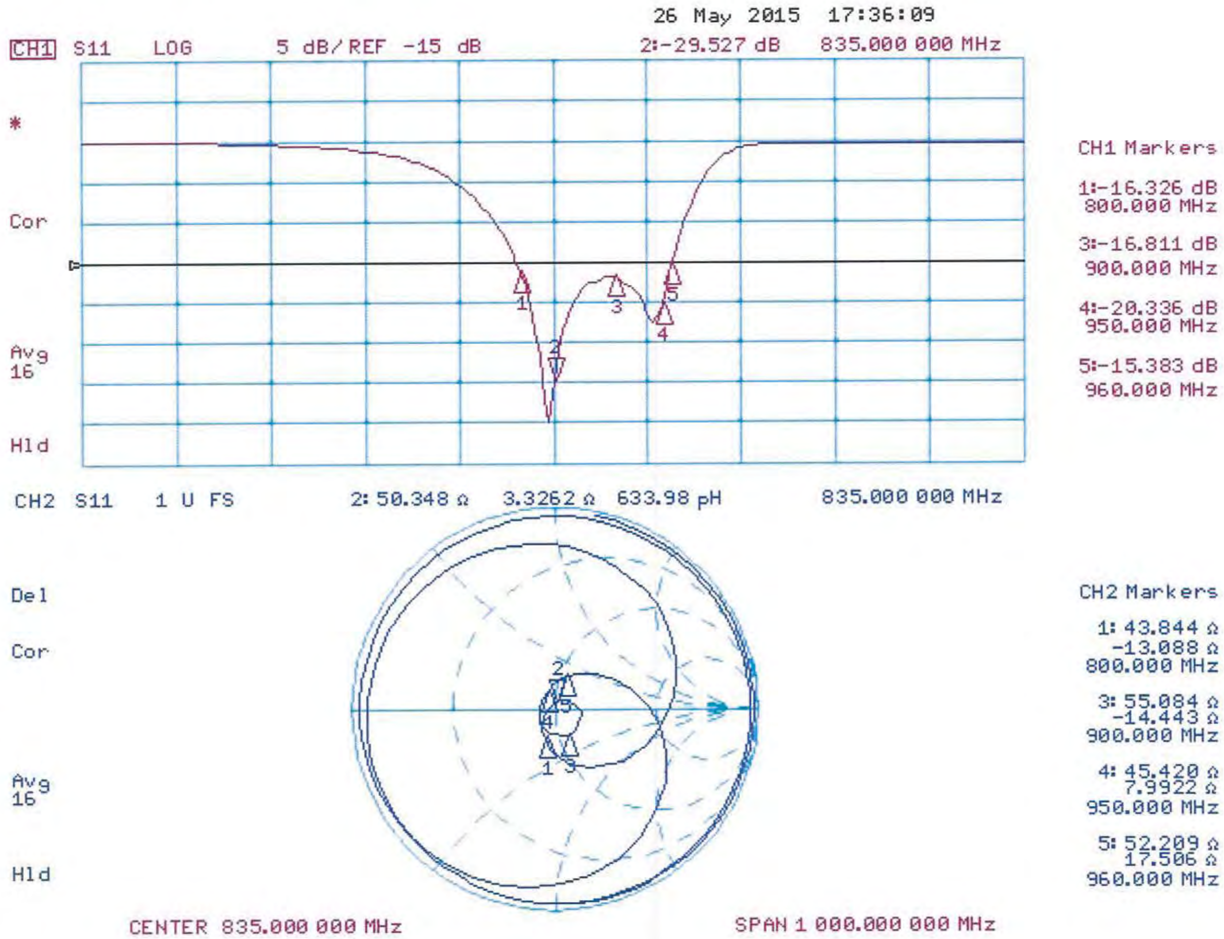
| **Frequency** | **Return Loss** | **Impedance** |
|---|---|---|
| 800 MHz | 16.3 dB | 43.8 Ω - 13.1 jΩ |
| 835 MHz | 29.5 dB | 50.3 Ω + 3.3 jΩ |
| 900 MHz | 16.8 dB | 55.1 Ω - 14.4 jΩ |
| 950 MHz | 20.3 dB | 45.4 Ω + 8.0 jΩ |
| 960 MHz | 15.4 dB | 52.2 Ω + 17.5 jΩ |

### 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: 26.05.2015

Test Laboratory: SPEAG Lab2

**DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1135**

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

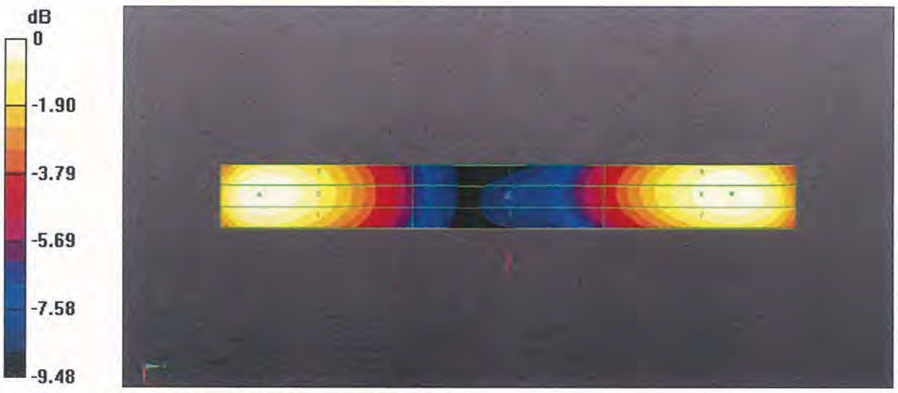
DASY52 Configuration:

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

**Reference 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 = 122.3 V/m; Power Drift = -0.02 dB
Applied MIF = 0.00 dB
RF audio interference level = 40.49 dBV/m
**Emission category: M3**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M3** **40.24 dBV/m** | Grid 2 **M3** **40.48 dBV/m** | Grid 3 **M3** **40.37 dBV/m** |
| Grid 4 **M4** **35.79 dBV/m** | Grid 5 **M4** **36.04 dBV/m** | Grid 6 **M4** **36 dBV/m** |
| Grid 7 **M3** **40.23 dBV/m** | Grid 8 **M3** **40.49 dBV/m** | Grid 9 **M3** **40.42 dBV/m** |




0 dB = 105.8 V/m = 40.49 dBV/m

11 33 HP

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Engineering AG
**Zeughausstrasse 43, 8004 Zurich, Switzerland**

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

Accredited by the Swiss Accreditation Service (SAS)
**The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates**

**Accreditation No.: SCS 0108**

**Client** **Quietek-TW (Auden)**

**Certificate No: CD1880V3-1117_May15**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | CD1880V3 - SN: 1117 |
| Calibration procedure(s) | QA CAL-20.v6<br>Calibration procedure for dipoles in air |
| Calibration date: | May 26, 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 EPM-442A | GB37480704 | 07-Oct-14 (No. 217-02020) | Oct-15 |
| Power sensor HP 8481A | US37292783 | 07-Oct-14 (No. 217-02020) | Oct-15 |
| Power sensor HP 8481A | MY41092317 | 07-Oct-14 (No. 217-02021) | Oct-15 |
| Reference 10 dB Attenuator | SN: 5047.2 / 06327 | 01-Apr-15 (No. 217-02130) | Mar-16 |
| Probe ER3DV6 | SN: 2336 | 31-Dec-14 (No. ER3-2336_Dec14) | Dec-15 |
| Probe H3DV6 | SN: 6065 | 31-Dec-14 (No. H3-6065_Dec14) | Dec-15 |
| DAE4 | SN: 781 | 12-Sep-14 (No. DAE4-781_Sep14) | Sep-15 |

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

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Israe Elnaouq | Laboratory Technician | Israe Elnaouq |
| Approved by: | Fin Bomholt | Deputy Technical Manager | F. Bomholt |

Issued: May 27, 2015

## References

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

## Methods Applied and Interpretation of Parameters:

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

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

## Measurement Conditions

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

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

## Maximum Field values at 1880 MHz

| **E-field 15 mm above dipole surface** | condition | **Interpolated maximum** |
|---|---|---|
| Maximum measured above high end | 100mW input power | 89.2V/m = 39.01 dBV/m |
| Maximum measured above low end | 100mW input power | 89.0V/m = 38.98 dBV/m |
| Averaged maximum above arm | 100mW input power | **89.1V/m ± 12.8 % (k=2)** |

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

## Antenna Parameters

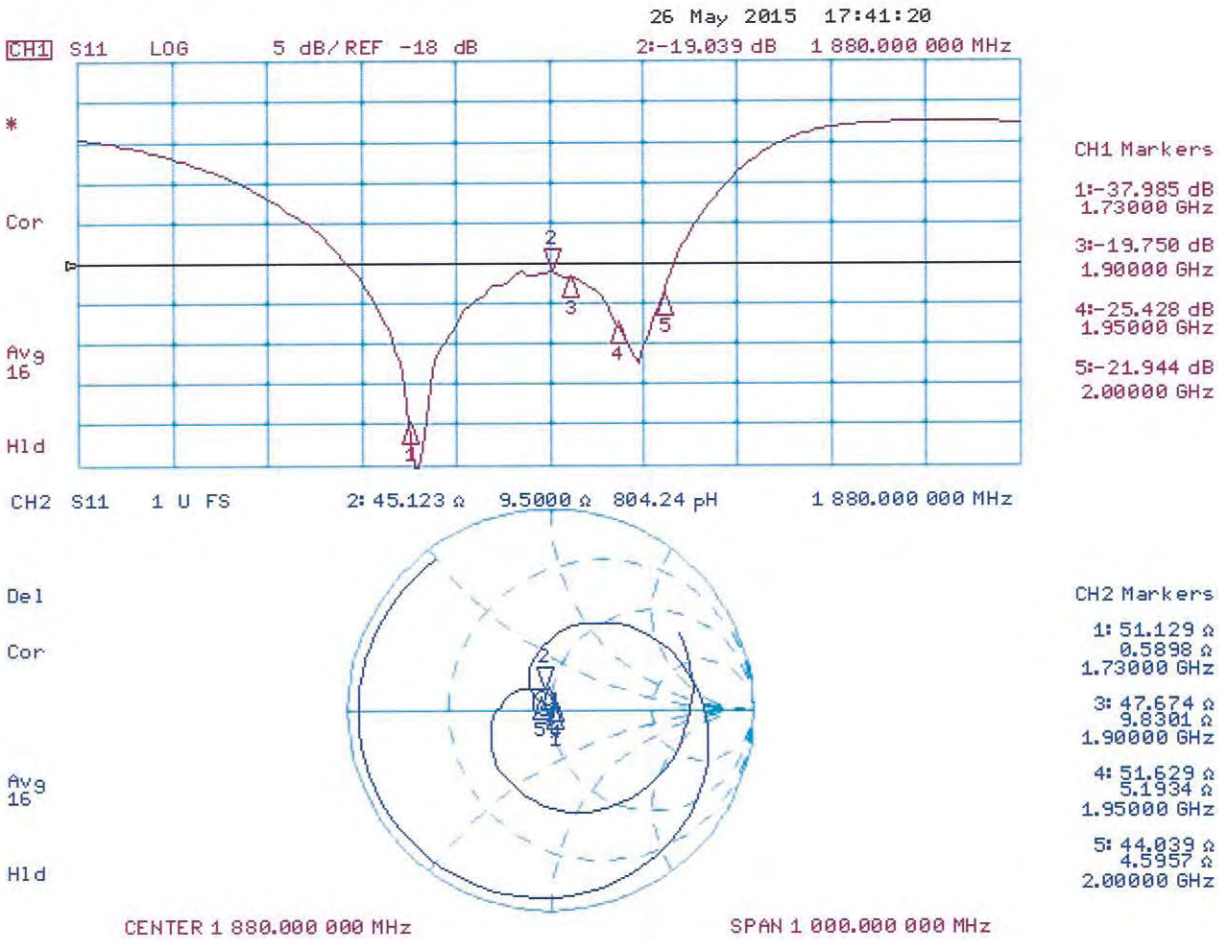
| **Frequency** | **Return Loss** | **Impedance** |
|---|---|---|
| 1730 MHz | 38.0 dB | 51.1 Ω + 0.6 jΩ |
| 1880 MHz | 19.0 dB | 45.1 Ω + 9.5 jΩ |
| 1900 MHz | 19.8 dB | 47.7 Ω + 9.8 jΩ |
| 1950 MHz | 25.4 dB | 51.6 Ω + 5.2 jΩ |
| 2000 MHz | 21.9 dB | 44.0 Ω + 4.6 jΩ |

### 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: 26.05.2015

Test Laboratory: SPEAG Lab2

**DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1117**

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

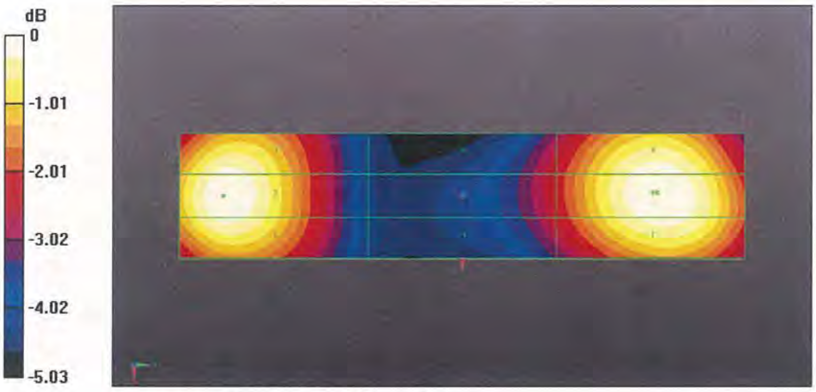
DASY52 Configuration:

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

**Reference 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 = 138.7 V/m; Power Drift = 0.02 dB
Applied MIF = 0.00 dB
RF audio interference level = 39.01 dBV/m
**Emission category: M2**

MIF scaled E-field

| | | |
|---|---|---|
| Grid 1 **M2** **38.79 dBV/m** | Grid 2 **M2** **38.98 dBV/m** | Grid 3 **M2** **38.83 dBV/m** |
| Grid 4 **M2** **36.58 dBV/m** | Grid 5 **M2** **36.76 dBV/m** | Grid 6 **M2** **36.71 dBV/m** |
| Grid 7 **M2** **38.84 dBV/m** | Grid 8 **M2** **39.01 dBV/m** | Grid 9 **M2** **38.9 dBV/m** |




0 dB = 89.24 V/m = 39.01 dBV/m