DASY5 H-field Result

Test Laboratory: SPEAG Lab2

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1114

Communication System: CW; Frequency: 835 MHz
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
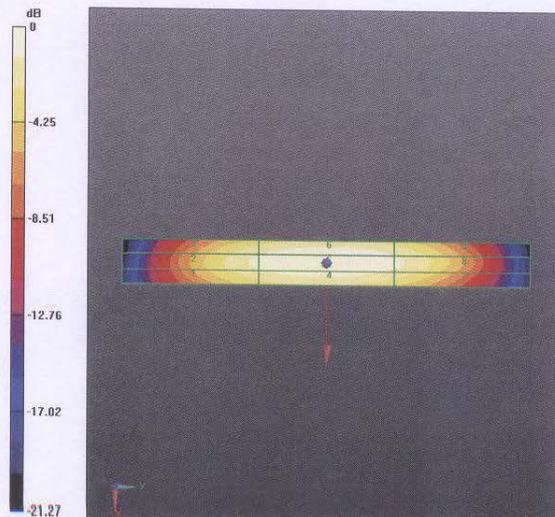
DASY52 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 29.12.2011
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 29.05.2012
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole H-Field measurement @ 835MHz/H-Scan - 835MHz d=10mm/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 = 0.4850 A/m; Power Drift = -0.01 dB
PMR not calibrated. PMF = 1.000 is applied.
H-field emissions = 0.4560 A/m
Near-field category: M4 (AWF 0 dB)

PMF scaled H-field

Grid 1 **M4**	Grid 2 **M4**	Grid 3 **M4**
0.381 A/m	0.405 A/m	0.386 A/m
Grid 4 **M4**	Grid 5 **M4**	Grid 6 **M4**
0.422 A/m	0.456 A/m	0.441 A/m
Grid 7 **M4**	Grid 8 **M4**	Grid 9 **M4**
0.369 A/m	0.405 A/m	0.393 A/m

0 dB = 0.4560 A/m = -6.82 dBA/m

DASY5 E-field Result

Test Laboratory: SPEAG Lab2

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1114

Communication System: CW; Frequency: 835 MHz
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 29.12.2011;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 29.05.2012
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole E-Field measurement @ 835MHz/E-Scan - 835MHz d=10mm/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 = 107.6 V/m; Power Drift = -0.00 dB
PMR not calibrated. PMF = 1.000 is applied.
E-field emissions = 167.7 V/m
Near-field category: M4 (AWF 0 dB)

PMF scaled E-field

Grid 1 **M4**	Grid 2 **M4**	Grid 3 **M4**
164.0 V/m	167.7 V/m	159.7 V/m
Grid 4 **M4**	Grid 5 **M4**	Grid 6 **M4**
87.01 V/m	89.21 V/m	86.38 V/m
Grid 7 **M4**	Grid 8 **M4**	Grid 9 **M4**
156.3 V/m	166.0 V/m	163.7 V/m

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
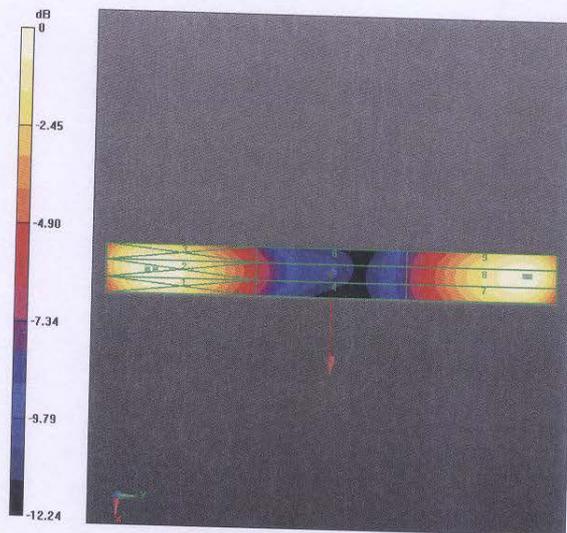Reference Value = 107.2 V/m; Power Drift = -0.04 dB
PMR not calibrated. PMF = 1.000 is applied.
E-field emissions = 105.8 V/m
Near-field category: M4 (AWF 0 dB)

PMF scaled E-field

Grid 1 M4	Grid 2 M4	Grid 3 M4
106.1 V/m	107.5 V/m	105.2 V/m
Grid 4 M4	Grid 5 M4	Grid 6 M4
62.58 V/m	63.50 V/m	62.48 V/m
Grid 7 M4	Grid 8 M4	Grid 9 M4
103.2 V/m	105.8 V/m	104.5 V/m

0 dB = 167.7 V/m = 44.49 dBV/m

IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

> **Important Note:**
> **Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.**

> **Important Note:**
> **Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.**

> **Important Note:**
> **To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.**

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Accreditation No.: **SCS 108**

Client   **Huawei-SZ (Auden)**

Certificate No: **DAE4-852_Nov12**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BJ - SN: 852
Calibration procedure(s)	QA CAL-06.v25 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	November 22, 2012

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	02-Oct-12 (No:12728)	Oct-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V2.1	SE UWS 053 AA 1001	05-Jan-12 (in house check)	In house check: Jan-13

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: November 22, 2012

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Glossary

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

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.

- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.

- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.

  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.

  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.

  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.

  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage

  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.

  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.

  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.

  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.

  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1µV ,	full range =	-100…+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1…….+3mV

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

Calibration Factors	X	Y	Z
High Range	405.128 ± 0.1% (k=2)	405.158 ± 0.1% (k=2)	403.945 ± 0.1% (k=2)
Low Range	3.95723 ± 0.7% (k=2)	3.98771 ± 0.7% (k=2)	3.95537 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	158.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	199997.15	1.18	0.00
Channel X	+ Input	20003.11	2.88	0.01
Channel X	- Input	-19996.03	4.83	-0.02
Channel Y	+ Input	199995.79	-0.59	-0.00
Channel Y	+ Input	20000.73	0.58	0.00
Channel Y	- Input	-20002.32	-1.46	0.01
Channel Z	+ Input	199995.69	-0.49	-0.00
Channel Z	+ Input	19998.85	-1.34	-0.01
Channel Z	- Input	-20001.40	-0.37	0.00

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2000.51	0.03	0.00
Channel X	+ Input	200.96	-0.03	-0.02
Channel X	- Input	-198.24	0.68	-0.34
Channel Y	+ Input	2000.37	-0.03	-0.00
Channel Y	+ Input	200.31	-0.65	-0.32
Channel Y	- Input	-199.25	-0.28	0.14
Channel Z	+ Input	2000.13	-0.36	-0.02
Channel Z	+ Input	200.54	-0.36	-0.18
Channel Z	- Input	-200.46	-1.43	0.72

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 (µV)	Low Range Average Reading (µV)
Channel X	200	4.83	3.10
	- 200	-1.58	-2.70
Channel Y	200	-10.83	-11.44
	- 200	10.00	9.75
Channel Z	200	-6.54	-6.44
	- 200	5.17	5.04

3. Channel separation

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

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	-0.02	-1.97
Channel Y	200	6.36	-	1.16
Channel Z	200	9.36	3.59	-

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	15477	16088
Channel Y	15885	16031
Channel Z	16754	17744

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (µV)	min. Offset (µV)	max. Offset (µV)	Std. Deviation (µV)
Channel X	1.06	-0.25	2.41	0.50
Channel Y	-0.70	-2.21	0.88	0.61
Channel Z	-0.41	-1.74	1.88	0.60

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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Accreditation No.: **SCS 108**

Client   **Huawei-SZ (Auden)**   Certificate No: **ER3-2441_Nov12**

CALIBRATION CERTIFICATE

Object	ER3DV6 - SN:2441
Calibration procedure(s)	QA CAL-02.v6, QA CAL-25.v4 Calibration procedure for E-field probes optimized for close near field evaluations in air
Calibration date:	November 26, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ER3DV6	SN: 2328	12-Oct-12 (No. ER3-2328_Oct12)	Oct-13
DAE4	SN: 789	18-Sep-12 (No. DAE4-789_Sep12)	Sep-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 26, 2012

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Accreditation No.: SCS 108

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	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, April 2010.

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 for XY sensors and ϑ = 90 for Z sensor (f ≤ 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, VRx,y,z:* A, B, C 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:2441

Manufactured: November 27, 2007
Calibrated: November 26, 2012

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

DASY/EASY - Parameters of Probe: ER3DV6 - SN:2441

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)	1.39	1.57	1.78	± 10.1 %
DCP (mV)^B	91.8	99.0	98.6	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc^E (k=2)
0	CW	0.00	X	0.0	0.0	1.0	175.9	±2.7 %
			Y	0.0	0.0	1.0	153.6	
			Z	0.0	0.0	1.0	197.0	
10011	UMTS-FDD (WCDMA)	2.91	X	3.39	67.1	18.9	142.4	±1.7 %
			Y	3.21	66.4	18.5	122.6	
			Z	3.10	65.5	17.7	115.3	
10021	GSM-FDD (TDMA, GMSK)	9.39	X	18.89	99.8	29.2	149.1	±1.7 %
			Y	17.24	99.7	28.6	116.3	
			Z	24.19	99.4	28.8	142.4	
10039	CDMA2000 (1xRTT, RC1)	4.57	X	5.01	67.3	19.7	142.0	±1.2 %
			Y	4.80	66.8	19.4	121.2	
			Z	4.54	65.5	18.4	113.3	
10081	CDMA2000 (1xRTT, RC3)	3.97	X	4.05	66.2	18.9	138.5	±0.7 %
			Y	3.93	66.0	18.8	119.5	
			Z	3.77	65.0	18.0	110.8	
10100	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	5.67	X	6.41	67.1	19.9	112.7	±1.7 %
			Y	6.67	68.6	20.7	136.3	
			Z	6.38	67.2	19.7	125.9	
10101	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	6.42	X	7.60	67.8	20.6	121.6	±2.7 %
			Y	7.86	69.2	21.3	147.0	
			Z	7.56	67.9	20.3	136.2	
10108	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	5.80	X	6.31	66.8	19.9	111.4	±1.9 %
			Y	6.58	68.2	20.6	134.7	
			Z	6.28	66.9	19.6	124.4	
10109	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	6.43	X	7.36	67.5	20.5	119.0	±2.7 %
			Y	7.61	68.9	21.2	143.9	
			Z	7.27	67.5	20.2	132.7	
10110	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	5.75	X	5.97	66.1	19.5	109.5	±1.7 %
			Y	6.20	67.5	20.2	131.7	
			Z	5.94	66.3	19.3	121.7	