

Measurement Conditions

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

DASY Version	DASY5	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	10mm 15mm	
Scan resolution	dx, dy = 5 mm	
Frequency	835 MHz \pm 1 MHz	
Input power drift	< 0.05 dB	

Maximum Field values at 835 MHz

H-field 10 mm above dipole surface	condition	interpolated maximum
Maximum measured	100 mW input power	0.456 A / m \pm 8.2 % (k=2)

E-field 10 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW input power	167.7 V / m
Maximum measured above low end	100 mW input power	166.0 V / m
Averaged maximum above arm	100 mW input power	166.9 V / m \pm 12.8 % (k=2)

E-field 15 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW input power	107.5 V / m
Maximum measured above low end	100 mW input power	105.8 V / m
Averaged maximum above arm	100 mW input power	106.7 V / m \pm 12.8 % (k=2)

Appendix

Antenna Parameters

Frequency	Return Loss	Impedance
800 MHz	16.4 dB	44.3 Ω - 13.3 j Ω
835 MHz	31.1 dB	50.5 Ω + 2.8 j Ω
900 MHz	15.6 dB	56.5 Ω - 16.8 j Ω
950 MHz	20.8 dB	42.4 Ω + 3.7 j Ω
960 MHz	18.5 dB	47.9 Ω + 11.6 j Ω

3.2 Antenna Design and Handling

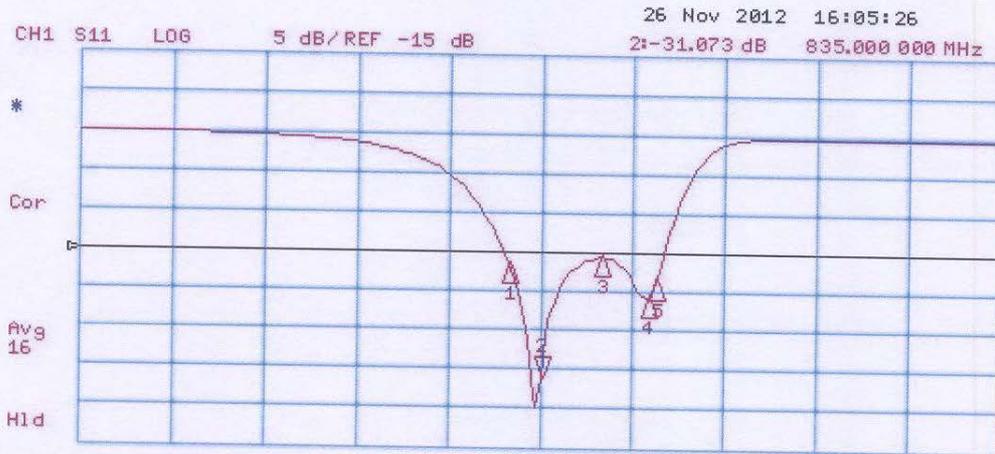
The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

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.

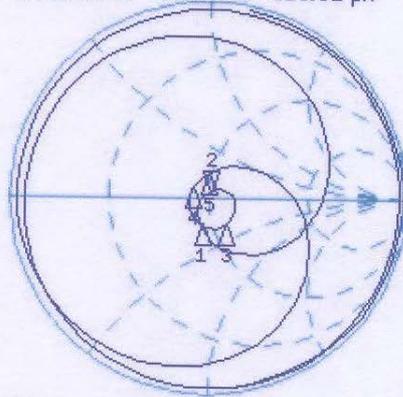
After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Impedance Measurement Plot



CH2 S11 1 U FS 2: 50.520 Ω 2.7598 Ω 526.02 μ H 835.000 000 MHz

De1
Cor
Avg 16
H1d



CH2 Markers

1:	44.297 Ω	-13.285 Ω	800.000 MHz
3:	56.510 Ω	-16.778 Ω	900.000 MHz
4:	42.371 Ω	3.7012 Ω	950.000 MHz
5:	47.926 Ω	11.600 Ω	960.000 MHz

START 335.000 000 MHz

STOP 1 335.000 000 MHz

DASY5 H-field Result

Date: 26.11.2012

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, $\epsilon_r = 1$; $\rho = 1$ kg/m³
 Phantom section: RF Section
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

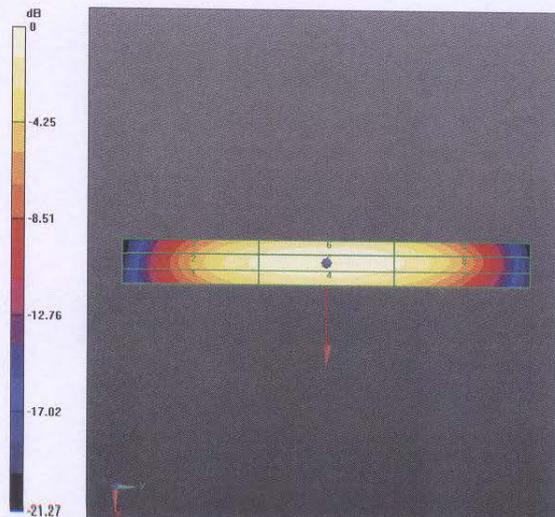
- Probe: H3DV6 - SN6065; ; Calibrated: 29.12.2011
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 29.05.2012
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

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



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

DASY5 E-field Result

Date: 26.11.2012

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, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

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

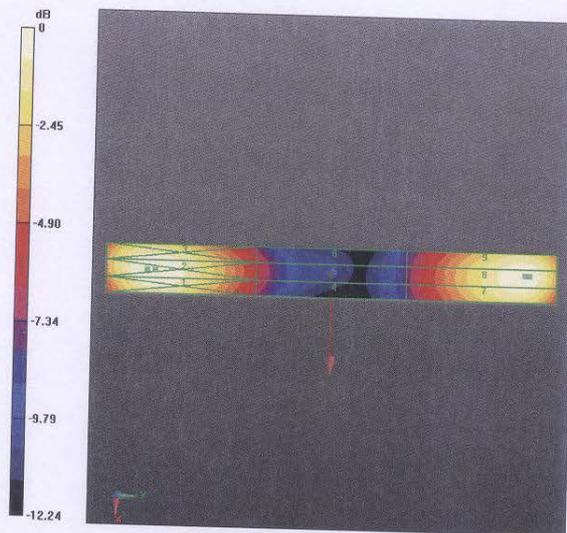
PMR not calibrated. PMF = 1.000 is applied.

E-field emissions = 105.8 V/m

Near-field category: M4 (AWF 0 dB)

PMF scaled E-field

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



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

Accreditation No.: **SCS 108**

Client **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

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



Accredited by the Swiss Accreditation Service (SAS)

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

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 μ 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	405.128 \pm 0.1% (k=2)	405.158 \pm 0.1% (k=2)	403.945 \pm 0.1% (k=2)
Low Range	3.95723 \pm 0.7% (k=2)	3.98771 \pm 0.7% (k=2)	3.95537 \pm 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	158.5 $^{\circ}$ \pm 1 $^{\circ}$
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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	-