

Measurement Conditions

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

DASY Version	DASY5	V52.10.0
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	15 mm	
Scan resolution	dx, dy = 5 mm	
Frequency	2600 MHz \pm 1 MHz	
Input power drift	< 0.05 dB	

Maximum Field values at 2600 MHz

E-field 15 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW input power	86.5 V/m = 38.74 dBV/m
Maximum measured above low end	100 mW input power	85.1 V/m = 38.60 dBV/m
Averaged maximum above arm	100 mW input power	85.8 V/m \pm 12.8 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

Frequency	Return Loss	Impedance
2450 MHz	22.4 dB	44.6 Ω - 4.8 j Ω
2550 MHz	28.7 dB	51.4 Ω + 3.5 j Ω
2600 MHz	26.8 dB	54.8 Ω + 0.6 j Ω
2650 MHz	24.9 dB	54.9 Ω - 3.5 j Ω
2750 MHz	18.8 dB	47.9 Ω - 11.1 j Ω

3.2 Antenna Design and Handling

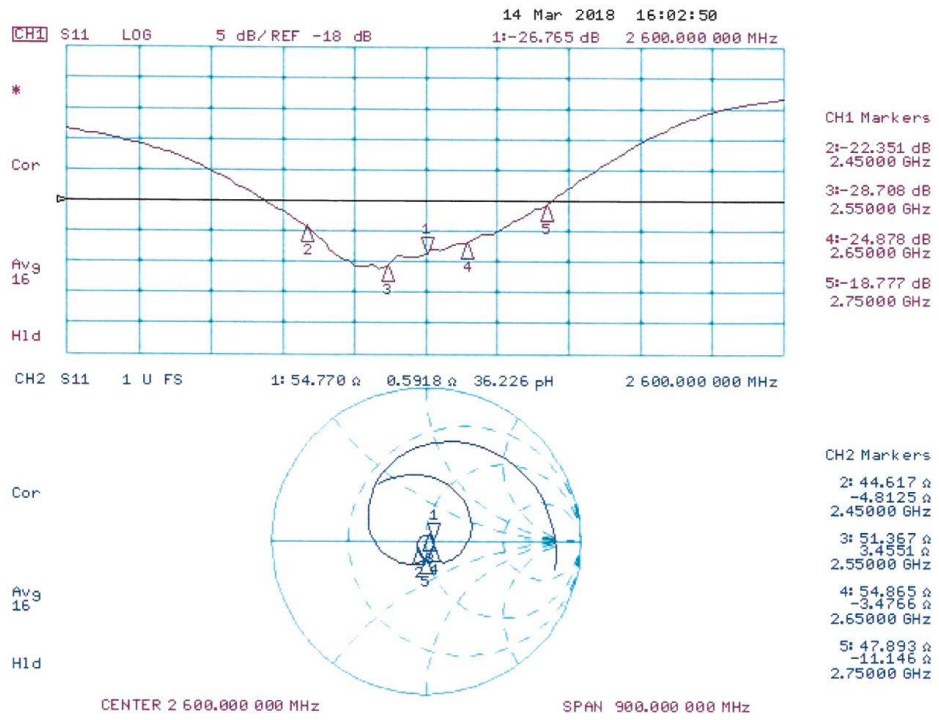
The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

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



DASY5 E-field Result

Date: 14.03.2018

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 2600 MHz; Type: CD2600V3; Serial: CD2600V3 - SN: 1005

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

Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: RF Section

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

DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1); Calibrated: 05.03.2018;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 17.01.2018
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole E-Field measurement/E-Scan - 2600MHz d=15mm/Hearing Aid Compatibility Test (41x181x1): Interpolated grid:

dx=0.5000 mm, dy=0.5000 mm

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 63.21 V/m; Power Drift = -0.00 dB

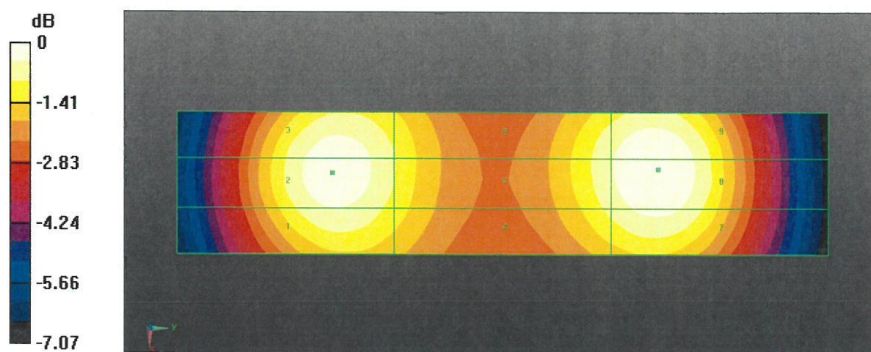
Applied MIF = 0.00 dB

RF audio interference level = 38.74 dBV/m

Emission category: M2

MIF scaled E-field

Grid 1 M2 38.27 dBV/m	Grid 2 M2 38.6 dBV/m	Grid 3 M2 38.56 dBV/m
Grid 4 M2 37.94 dBV/m	Grid 5 M2 38.24 dBV/m	Grid 6 M2 38.22 dBV/m
Grid 7 M2 38.41 dBV/m	Grid 8 M2 38.74 dBV/m	Grid 9 M2 38.71 dBV/m



ANNEX F DAE CALIBRATION CERTIFICATE

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



S Schweizerischer Kalibrierdienst
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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 **CTTL (Auden)**

Certificate No: **DAE4-777_Sep17**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 777**

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

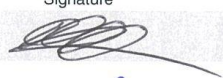

Calibration date: **September 08, 2017**

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	31-Aug-17 (No:21092)	Aug-18
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	05-Jan-17 (in house check)	In house check: Jan-18
Calibrator Box V2.1	SE UMS 006 AA 1002	05-Jan-17 (in house check)	In house check: Jan-18

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: September 8, 2017

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

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Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: **SCS 0108**

Glossary

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

Methods Applied and Interpretation of Parameters

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



DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 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	405.400 \pm 0.02% (k=2)	405.869 \pm 0.02% (k=2)	405.579 \pm 0.02% (k=2)
Low Range	3.96640 \pm 1.50% (k=2)	3.96264 \pm 1.50% (k=2)	4.00499 \pm 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	97.0 $^{\circ}$ \pm 1 $^{\circ}$
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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	200022.73	-12.42	-0.01
Channel X + Input	20003.49	-1.25	-0.01
Channel X - Input	-19998.82	6.77	-0.03
Channel Y + Input	200025.10	-10.04	-0.01
Channel Y + Input	20007.22	2.54	0.01
Channel Y - Input	-20002.34	3.30	-0.02
Channel Z + Input	200028.10	-6.82	-0.00
Channel Z + Input	20002.36	-2.19	-0.01
Channel Z - Input	-20003.64	2.12	-0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2000.54	-0.37	-0.02
Channel X + Input	201.37	0.50	0.25
Channel X - Input	-199.19	-0.20	0.10
Channel Y + Input	1999.95	-0.89	-0.04
Channel Y + Input	200.04	-0.75	-0.37
Channel Y - Input	-199.96	-0.85	0.43
Channel Z + Input	2001.05	0.20	0.01
Channel Z + Input	199.88	-0.86	-0.43
Channel Z - Input	-200.02	-0.88	0.44

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	5.45	3.79
	- 200	3.93	0.83
Channel Y	200	7.70	7.39
	- 200	-9.52	-8.90
Channel Z	200	7.51	6.49
	- 200	-9.21	-8.71

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	-	-1.61	-2.84
Channel Y	200	8.30	-	0.46
Channel Z	200	6.69	5.02	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15919	14652
Channel Y	16343	14477
Channel Z	16033	14911

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.50	-2.04	0.95	0.51
Channel Y	1.56	0.40	2.80	0.48
Channel Z	0.26	-0.78	1.16	0.42

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



The photos of HAC test are presented in the additional document:

Appendix to test report No.I18Z60880-SEM03/04

The photos of HAC test