



## Dipole 1880 MHz

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



S Schweizerischer Kalibrierdienst Service suisse d'étalonnage 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

ent CTTL (Auden)			CD1880V3-1018_Aug2
ALIBRATION CE	ERTIFICATE		
Dbject	CD1880V3 - SN:	1018	
alibration procedure(s)	QA CAL-20.v7 Calibration Proces	dure for Validation Sources in air	
Calibration date:	August 25, 2022		
	to the traceability to patir	onal standards, which realize the physical unit	s of measurements (SI).
This calibration certificate document	inties with confidence pr	obability are given on the following pages and	are part of the certificate.
ne measurements and the uncerta	anties war connuctice pr		•
All colibrations have been conducted	d in the closed laborator	y facility: environment temperature (22 $\pm$ 3)°C	and humidity < 70%.
All calibrations have been conducte	d in the closed laborator	y lacinty. on the internation (in a set of a	
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
Power sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Type-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
Probe EF3DV3	SN: 4013	28-Dec-21 (No. EF3-4013_Dec21)	Dec-22
DAE4	SN: 781	22-Dec-21 (No. DAE4-781_Dec21)	Dec-22
	Les -		Calculat Charle
,	ID #	Check Date (in house)	Scheduled Check
Power meter Agilent 4419B	SN: GB42420191	09-Oct-09 (in house check Oct-20)	In house check: Oct-23
Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A	SN: GB42420191 SN: US38485102	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20)	In house check: Oct-23 In house check: Oct-23
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A	SN: GB42420191 SN: US38485102 SN: US37295597	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20)	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20)	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
Power meter Agilent 4419B Power sensor HP E4412A	SN: GB42420191 SN: US38485102 SN: US37295597	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20)	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20)	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005 SN: US41080477	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-22
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005 SN: US41080477 Name	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-22
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005 SN: US41080477 Name Leif Klysner	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Laboratory Technician	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-22
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005 SN: US41080477 Name	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-22
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005 SN: US41080477 Name Leif Klysner	09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Laboratory Technician	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-22

Certificate No: CD1880V3-1018\_Aug22

Page 1 of 5

.





## Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S S S

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

Accreditation No.: SCS 0108

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

#### References

- [1] ANSI-C63.19-2019 (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 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 E-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 nonparallelity 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%.

Certificate No: CD1880V3-1018\_Aug22

Page 2 of 5





#### **Measurement Conditions**

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

DASY Version	DASY5	V52.10.4
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	100 mW input power	86.9 V/m = 38.78 dBV/m
Maximum measured above low end	100 mW input power	86.5 V/m = 38.74 dBV/m
Averaged maximum above arm	100 mW input power	86.7 V/m ± 12.8 % (k=2)

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

#### Antenna Parameters

Frequency	Return Loss	Impedance
1730 MHz	27.8 dB	54.2 Ω + 0.7 jΩ
1880 MHz	22.1 dB	54.7 Ω + 6.7 jΩ
1900 MHz	23.0 dB	55.8 Ω + 4.8 jΩ
1950 MHz	32.4 dB	52.4 Ω + 0.1 jΩ
2000 MHz	19.5 dB	47.5 Ω + 10.0 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.

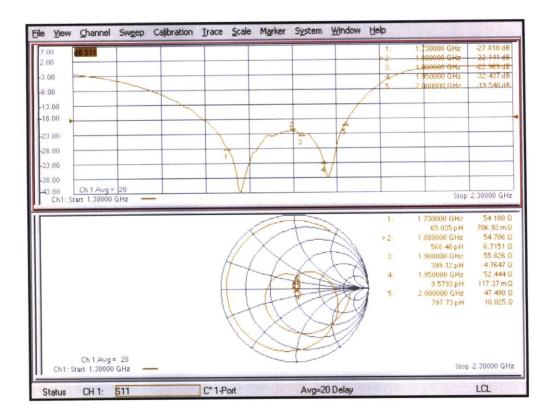
Certificate No: CD1880V3-1018\_Aug22

Page 3 of 5





### Impedance Measurement Plot



Certificate No: CD1880V3-1018\_Aug22

Page 4 of 5





### **DASY5 E-field Result**

Date: 25.08.2022

Test Laboratory: SPEAG Lab2

#### DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1018

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

DASY52 Configuration:

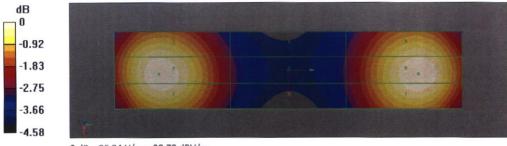
- Probe: EF3DV3 SN4013; ConvF(1, 1, 1) @ 1880 MHz; Calibrated: 28.12.2021
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 22.12.2021
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

#### 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 = 157.1 V/m; Power Drift = 0.01 dB Applied MIF = 0.00 dB RF audio interference level = 38.78 dBV/m Emission category: M2

MIF scaled E-field		
Grid 1 M2	Grid 2 M2	Grid 3 M2

38.66 dBV/m	38.74 dBV/m	38.45 dBV/m
Grid 4 M2 36.05 dBV/m		Grid 6 M2 35.87 dBV/m
Grid 7 M2	Grid 8 M2	Grid 9 <b>M2</b>
38.7 dBV/m	38.78 dBV/m	38.49 dBV/m



0 dB = 86.94 V/m = 38.78 dBV/m

Certificate No: CD1880V3-1018\_Aug22

Page 5 of 5





## Dipole 2450 MHz

chmid & Partner Engineering AG rughausstrasse 43, 8004 Zurich, S	of Switzerland	S S S	Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service
ccredited by the Swiss Accreditation ne Swiss Accreditation Service is ultilateral Agreement for the reco	one of the signatories	to the EA	creditation No.: SCS 0108
lient CTTL (Auden)	<b>3</b>		: CD2450V3-1021_Aug22
CALIBRATION CI			
CALIDRATION CI			
Object	CD2450V3 - SN:	1021	
Calibration procedure(s)	QA CAL-20.v7 Calibration Proce	dure for Validation Sources in ai	r
Calibration date:	August 25, 2022		
	ainties with confidence pr	onal standards, which realize the physical un obability are given on the following pages ar y facility: environment temperature (22 ± 3)°(	ad are part of the certificate.
The measurements and the uncerta	ainties with confidence pr	obability are given on the following pages an	d are part of the certificate. C and humidity < 70%. Scheduled Calibration
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE	ainties with confidence pr ad in the closed laborator critical for calibration)	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91	ainties with confidence provide in the closed laborator critical for calibration) D # SN: 104778 SN: 103244	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03525/03524)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03525)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	obability are given on the following pages ar         y facility: environment temperature (22 ± 3)°(         Cal Date (Certificate No.)         04-Apr-22 (No. 217-03525/03524)         04-Apr-22 (No. 217-03524)         04-Apr-22 (No. 217-03525)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327	obability are given on the following pages ar         y facility: environment temperature (22 ± 3)°(         Cal Date (Certificate No.)         04-Apr-22 (No. 217-03525/03524)         04-Apr-22 (No. 217-03524)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03528)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Apr-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013	obability are given on the following pages ar         y facility: environment temperature (22 ± 3)°(         Cal Date (Certificate No.)         04-Apr-22 (No. 217-03525/03524)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03528)         28-Dec-21 (No. EF3-4013_Dec21)	Id are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327	obability are given on the following pages ar         y facility: environment temperature (22 ± 3)°(         Cal Date (Certificate No.)         04-Apr-22 (No. 217-03525/03524)         04-Apr-22 (No. 217-03524)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03528)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Apr-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013	obability are given on the following pages ar         y facility: environment temperature (22 ± 3)°(         Cal Date (Certificate No.)         04-Apr-22 (No. 217-03525/03524)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03528)         28-Dec-21 (No. EF3-4013_Dec21)	Id are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE <u>Primary Standards</u> Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4	Ainties with confidence provide in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781	obability are given on the following pages ar         y facility: environment temperature (22 ± 3)°(         Cal Date (Certificate No.)         04-Apr-22 (No. 217-03525/03524)         04-Apr-22 (No. 217-03524)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03525)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03527)         04-Apr-22 (No. 217-03528)         28-Dec-21 (No. EF3-4013_Dec21)         22-Dec-21 (No. DAE4-781_Dec21)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Dec-22 Dec-22 Scheduled Check In house check: Oct-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards	Ainties with confidence provide in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID #	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           28-Dec-21 (No. EF3-4013_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           Check Date (in house)           09-Oct-09 (in house check Oct-20)           05-Jan-10 (in house check Oct-20)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Dec-22 Scheduled Check In house check: Oct-23 In house check: Oct-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A	Inities with confidence predimension           ad in the closed laborator           critical for calibration)           ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 4013           SN: 781           ID #           SN: GB42420191	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           28-Dec-21 (No. EF3-4013_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           Check Date (in house)           09-Oct-09 (in house check Oct-20)           05-Jan-10 (in house check Oct-20)           09-Oct-09 (in house check Oct-20)	Id are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Dec-22 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	Inities with confidence predimension           in the closed laborator           icritical for calibration)           ID #           SN: 104778           SN: 103244           SN: 103245           SN: BH9394 (20k)           SN: 310982 / 06327           SN: 4013           SN: 781           ID #           SN: GB42420191           SN: US38485102           SN: US37295597           SN: 837633/005	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03528)           28-Dec-21 (No. EF3-4013_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           Check Date (in house)           09-Oct-09 (in house check Oct-20)           05-Jan-10 (in house check Oct-20)           09-Oct-09 (in house check Oct-20)	Id are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Dec-22 Scheduled Check In house check: Oct-23 In house check: Oct-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A	Inities with confidence predimension           ad in the closed laborator           critical for calibration)           ID #           SN: 104778           SN: 103244           SN: 103245           SN: BH9394 (20k)           SN: 310982 / 06327           SN: 4013           SN: 781           ID #           SN: GB42420191           SN: US38485102           SN: US37295597	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           28-Dec-21 (No. EF3-4013_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           Check Date (in house)           09-Oct-09 (in house check Oct-20)           05-Jan-10 (in house check Oct-20)           09-Oct-09 (in house check Oct-20)	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	Inities with confidence predimension           in the closed laborator           icritical for calibration)           ID #           SN: 104778           SN: 103244           SN: 103245           SN: BH9394 (20k)           SN: 310982 / 06327           SN: 4013           SN: 781           ID #           SN: GB42420191           SN: US38485102           SN: US37295597           SN: 837633/005	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03528)           28-Dec-21 (No. EF3-4013_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           Check Date (in house)           09-Oct-09 (in house check Oct-20)           05-Jan-10 (in house check Oct-20)           09-Oct-09 (in house check Oct-20)	Id are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Dec-22 Scheduled Check In house check: Oct-23 In house check: Oct-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP E4412A RF generator R&S SMT-06	ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 781           ID #	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           28-Dec-21 (No. EF3-4013_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           09-Oct-09 (in house check Oct-20)           05-Jan-10 (in house check Oct-20)           09-Oct-09 (in house check Oct-20)           01-Jan-19 (in house check Oct-20)           31-Mar-14 (in house check Oct-20)	In house check: Oct-23 In house check: Oct-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power sensor HP E4412A Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	Inities with confidence predimension           in the closed laborator           critical for calibration)           ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 4013           SN: 781           ID #           SN: 6B42420191           SN: US38485102           SN: US37295597           SN: 837633/005           SN: US41080477           Name	Obability are given on the following pages an           y facility: environment temperature (22 ± 3)°(           Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           28-Dec-21 (No. DF3-4013_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           Check Date (in house)           09-Oct-09 (in house check Oct-20)           05-Jan-10 (in house check Oct-20)           09-Oct-09 (in house check Oct-20)           10-Jan-19 (in house check Oct-20)           10-Jan-19 (in house check Oct-20)           Function           Laboratory Technician	In house check: Oct-23 In house check: Oct-23
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power sensor HP E4412A Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	Inities with confidence predimension           in the closed laborator           critical for calibration)           ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 4013           SN: 781           ID #           SN: 6B42420191           SN: US38485102           SN: US37295597           SN: 837633/005           SN: US41080477           Name	Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           28-Dec-21 (No. EF3-4013_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           22-Dec-21 (No. DAE4-781_Dec21)           09-Oct-09 (in house check Oct-20)           05-Jan-10 (in house check Oct-20)           09-Oct-09 (in house check Oct-20)           10-Jan-19 (in house check Oct-20)           31-Mar-14 (in house check Oct-20)	In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23

Certificate No: CD2450V3-1021\_Aug22

Page 1 of 5





## Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Sc C Se S Se S Sw

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

Accreditation No.: SCS 0108

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

#### References

- [1] ANSI-C63.19-2019 (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 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 E-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%.

Certificate No: CD2450V3-1021\_Aug22

Page 2 of 5





## **Measurement Conditions**

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

DASY Version	DASY5	V52.10.4
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	15 mm	
Scan resolution	dx, dy = 5 mm	
Frequency	2450 MHz ± 1 MHz	
Input power drift	< 0.05 dB	

#### Maximum Field values at 2450 MHz

E-field 15 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW input power	86.0 V/m = 38.69 dBV/m
Maximum measured above low end	100 mW input power	85.8 V/m = 38.67 dBV/m
Averaged maximum above arm	100 mW input power	85.9 V/m ± 12.8 % (k=2)

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

#### Antenna Parameters

Frequency	Return Loss	Impedance
2250 MHz	18.3 dB	63.2 Ω + 4.0 jΩ
2350 MHz	30.3 dB	52.1 Ω - 2.3 jΩ
2450 MHz	29.4 dB	53.1 Ω - 1.6 jΩ
2550 MHz	33.5 dB	51.0 Ω - 1.9 jΩ
2650 MHz	18.6 dB	60.7 Ω - 7.5 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.

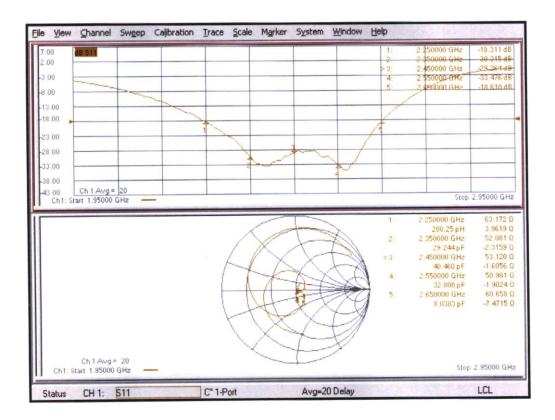
Certificate No: CD2450V3-1021\_Aug22

Page 3 of 5





## Impedance Measurement Plot



Page 4 of 5

©Copyright. All rights reserved by CTTL.





#### **DASY5 E-field Result**

Date: 25.08.2022

Test Laboratory: SPEAG Lab2

## DUT: HAC Dipole 2450 MHz; Type: CD2450V3; Serial: CD2450V3 - SN: 1021

 $\begin{array}{l} Communication \ System: \ UID \ 0 \ - \ CW \ ; \ Frequency: \ 2450 \ MHz \\ Medium \ parameters \ used: \ \sigma = 0 \ S/m, \ \epsilon_r = 1; \ \rho = 0 \ kg/m^3 \\ Phantom \ section: \ RF \ Section \\ Measurement \ Standard: \ DASY5 \ (IEEE/IEC/ANSI \ C63.19-2011) \\ \end{array}$ 

DASY52 Configuration:

- Probe: EF3DV3 SN4013; ConvF(1, 1, 1) @ 2450 MHz; Calibrated: 28.12.2021
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 22.12.2021
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

## Dipole E-Field measurement @ 2450MHz/E-Scan - 2450MHz 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 = 79.61 V/m; Power Drift = 0.02 dB Applied MIF = 0.00 dB RF audio interference level = 38.69 dBV/m Emission category: M2

 Grid 2 M2 38.67 dBV/m	Grid 3 M2 38.39 dBV/m
 Grid 5 M2 37.72 dBV/m	Grid 6 M2 37.53 dBV/m
 Grid 8 M2 38.69 dBV/m	Grid 9 M2 38.45 dBV/m

dB -1.22 -2.45 -3.67 -4.90 -6.12

Certificate No: CD2450V3-1021\_Aug22

Page 5 of 5

## Dipole 2600 MHz

<sup>0</sup> dB = 86.03 V/m = 38.69 dBV/m





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

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA





S

С

S

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

Accreditation No.: SCS 0108

Multilateral Agreement for the recognition of calibration certificates Certificate No: CD2600V3-1017\_Aug22 Client **CTTL** (Auden) **CALIBRATION CERTIFICATE** CD2600V3 - SN: 1017 Object QA CAL-20.v7 Calibration procedure(s) Calibration Procedure for Validation Sources in air August 25, 2022 Calibration date: 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) Scheduled Calibration Cal Date (Certificate No.) Primary Standards ID # SN: 104778 04-Apr-22 (No. 217-03525/03524) Apr-23 Power meter NRP Apr-23 04-Apr-22 (No. 217-03524) Power sensor NRP-Z91 SN: 103244 Power sensor NRP-Z91 SN: 103245 04-Apr-22 (No. 217-03525) Apr-23 04-Apr-22 (No. 217-03527) Apr-23 SN: BH9394 (20k) Reference 20 dB Attenuator 04-Apr-22 (No. 217-03528) Apr-23 SN: 310982 / 06327 Type-N mismatch combination Probe EF3DV3 SN: 4013 28-Dec-21 (No. EF3-4013\_Dec21) Dec-22 DAE4 SN: 781 22-Dec-21 (No. DAE4-781\_Dec21) Dec-22 Scheduled Check ID # Check Date (in house) Secondary Standards SN: GB42420191 In house check: Oct-23 Power meter Agilent 4419B 09-Oct-09 (in house check Oct-20) Power sensor HP E4412A SN: US38485102 05-Jan-10 (in house check Oct-20) In house check: Oct-23 Power sensor HP 8482A SN: US37295597 09-Oct-09 (in house check Oct-20) In house check: Oct-23 SN: 837633/005 10-Jan-19 (in house check Oct-20) In house check: Oct-23 RF generator R&S SMT-06 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-20) In house check: Oct-22 Name Function Signature Calibrated by: Leif Klysner Laboratory Technician Technical Manager Sven Kühn Approved by: Issued: August 25, 2022 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: CD2600V3-1017\_Aug22

Page 1 of 5





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





S

С

S

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

Accreditation No.: SCS 0108

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

#### References

- [1] ANSI-C63.19-2019 (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 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 E-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%.

Certificate No: CD2600V3-1017\_Aug22

Page 2 of 5





### Measurement Conditions

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

DASY Version	DASY5	V52.10.4
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	15 mm	
Scan resolution	dx, dy = 5 mm	
Frequency	2600 MHz ± 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	86.0 V/m = 38.69 dBV/m
Maximum measured above low end	100 mW input power	85.7 V/m = 38.66 dBV/m
Averaged maximum above arm	100 mW input power	85.9 V/m ± 12.8 % (k=2)

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

#### Antenna Parameters

Frequency	Return Loss	Impedance
2450 MHz	24.5 dB	44.6 Ω + 1.5 jΩ
2550 MHz	21.6 dB	57.9 Ω + 4.4 jΩ
2600 MHz	20.7 dB	59.4 Ω - 3.8 jΩ
2650 MHz	19.4 dB	54.9 Ω - 10.2 jΩ
2750 MHz	15.7 dB	41.4 Ω - 12.3 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.

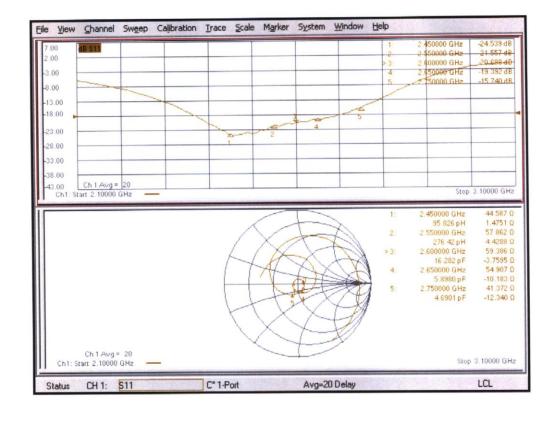
Certificate No: CD2600V3-1017\_Aug22

Page 3 of 5





## **Impedance Measurement Plot**



Certificate No: CD2600V3-1017\_Aug22

Page 4 of 5





#### **DASY5 E-field Result**

Date: 25.08.2022

Test Laboratory: SPEAG Lab2

## DUT: HAC Dipole 2600 MHz; Type: CD2600V3; Serial: CD2600V3 - SN: 1017

Communication System: UID 0 - CW ; Frequency: 2600 MHz Medium parameters used:  $\sigma=0$  S/m,  $\epsilon_r=1$  ;  $\rho=0$  kg/m<sup>3</sup> Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

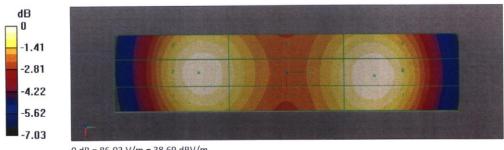
- Probe: EF3DV3 SN4013; ConvF(1, 1, 1) @ 2600 MHz; Calibrated: 28.12.2021
- ٠ Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 22.12.2021 .
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070 ٠
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

## Dipole E-Field measurement @ 2600MHz/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 = 69.34 V/m; Power Drift = -0.03 dB Applied MIF = 0.00 dBRF audio interference level = 38.69 dBV/m Emission category: M2

MIF scaled E-field

Grid 1 <b>M2</b>		Grid 3 <b>M2</b>
38.49 dBV/m	38.66 dBV/m	38.46 dBV/m
Grid 4 M2	Grid 5 M2	Grid 6 M2
37.89 dBV/m	37.97 dBV/m	37.83 dBV/m
Grid 7 M2	Grid 8 M2	Grid 9 M2
38.62 dBV/m	38.69 dBV/m	38.42 dBV/m



0 dB = 86.03 V/m = 38.69 dBV/m

Certificate No: CD2600V3-1017\_Aug22

Page 5 of 5





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

Appendix to test report No.I23Z60212-SEM08/09

The photos of HAC test