



Dipole 1880 MHz

Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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

Client CTTL (Auden)

Certificate No: CD1880V3-1018_Aug22

		1010	
bject	CD1880V3 - SN:	1018	
alibration procedure(s)	QA CAL-20.v7 Calibration Proce	dure for Validation Sources in air	
calibration date:	August 25, 2022		
his calibration certificate document he measurements and the uncerta	ts the traceability to natio	onal standards, which realize the physical unit obability are given on the following pages and	s of measurements (SI). d are part of the certificate.
		y facility: environment temperature (22 \pm 3)°C	and humidity < 70%.
Calibration Equipment used (M&TE	1		0.1-1.1-1.0-1515
rimary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23
ower sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
ower sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
eference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
ype-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
robe EF3DV3	SN: 4013	28-Dec-21 (No. EF3-4013_Dec21)	Dec-22
AE4	SN: 781	22-Dec-21 (No. DAE4-781_Dec21)	Dec-22
		and the second second	Scheduled Check
condary Standards	ID#	Check Date (in house)	
	ID # SN: GB42420191	Check Date (in house) 09-Oct-09 (in house check Oct-20)	In house check: Oct-23
ower meter Agilent 4419B			In house check: Oct-23 In house check: Oct-23
Power meter Agilent 4419B Power sensor HP E4412A	SN: GB42420191	09-Oct-09 (in house check Oct-20)	
ower meter Agilent 4419B ower sensor HP E4412A ower sensor HP 8482A	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
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	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
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
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	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-22 Signature
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	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-22 Signature
Secondary Standards 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	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-22

Certificate No: CD1880V3-1018_Aug22

Page 1 of 5





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





S Schweizerischer Kalibrierdienst
C 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
- 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: 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	$54.2 \Omega + 0.7 j\Omega$
1880 MHz	22.1 dB	$54.7 \Omega + 6.7 j\Omega$
1900 MHz	23.0 dB	$55.8 \Omega + 4.8 j\Omega$
1950 MHz	32.4 dB	$52.4 \Omega + 0.1 j\Omega$
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.

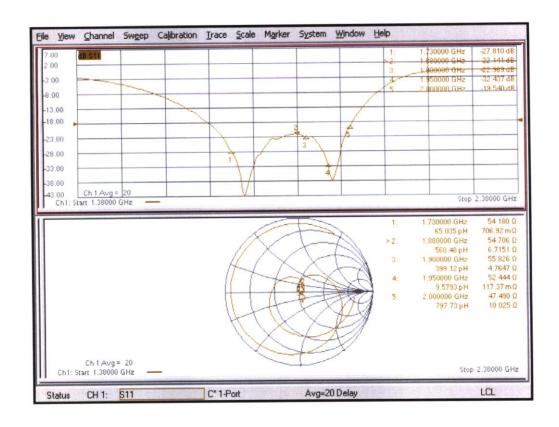
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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



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/m³

Phantom section: RF Section

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

DASY52 Configuration:

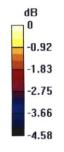
- Probe: EF3DV3 SN4013; ConvF(1, 1, 1) @ 1880 MHz; Calibrated: 28.12.2021
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 22.12.2021
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

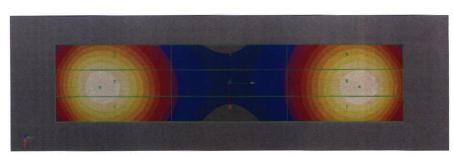
Dipole E-Field measurement @ 1880MHz/E-Scan - 1880MHz d=15mm/Hearing Aid Compatibility Test (41x181x1):

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 38.66 dBV/m		
Grid 4 M2 36.05 dBV/m		
	Grid 8 M2 38.78 dBV/m	





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

Certificate No: CD1880V3-1018_Aug22

Page 5 of 5





Dipole 2450 MHz

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





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

Client

CTTL (Auden)

Certificate No: CD2450V3-1021_Aug22

Object	CD2450V3 - SN:	1021	
Calibration procedure(s)	QA CAL-20.v7 Calibration Proces	dure for Validation Sources in air	
Calibration date:	August 25, 2022		
The measurements and the uncerta	ainties with confidence pro	anal standards, which realize the physical unit obability are given on the following pages and y facility: environment temperature $(22 \pm 3)^{\circ}$ C	d are part of the certificate.
Calibration Equipment used (M&TE	1	Cal Data (Cartificate No.)	Scheduled Calibration
Primary Standards	ID #	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524)	Apr-23
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) 04-Apr-22 (No. 217-03525)	Apr-23
Power sensor NRP-Z91	SN: 103245		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)	Dec-22
Probe EF3DV3	SN: 4013	28-Dec-21 (No. EF3-4013_Dec21) 22-Dec-21 (No. DAE4-781_Dec21)	Dec-22
DAE4	SN: 781	22-060-21 (NO. DALT-701_00021)	
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
	SN: GB42420191	09-Oct-09 (in house check Oct-20)	In house check: Oct-23
	SN: US38485102	05-Jan-10 (in house check Oct-20)	In house check: Oct-23
Power meter Agilent 4419B		09-Oct-09 (in house check Oct-20)	In house check: Oct-23
Power meter Agilent 4419B Power sensor HP E4412A	SN: US37295597	05-OCI-05 (III HOUSE CHECK OCI-20)	In house check: Oct-23
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A	SN: US37295597 SN: 837633/005	10-Jan-19 (in house check Oct-20)	In house check, Oct-23
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06			In house check: Oct-23
Power sensor HP E4412A Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 837633/005 SN: US41080477 Name	10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: 837633/005 SN: US41080477	10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	In house check: Oct-22 Signature
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 837633/005 SN: US41080477 Name	10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	In house check: Oct-22

Certificate No: CD2450V3-1021_Aug22

Page 1 of 5





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





S Schweizerischer Kalibrierdienst
C 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
- 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	$63.2 \Omega + 4.0 j\Omega$
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.

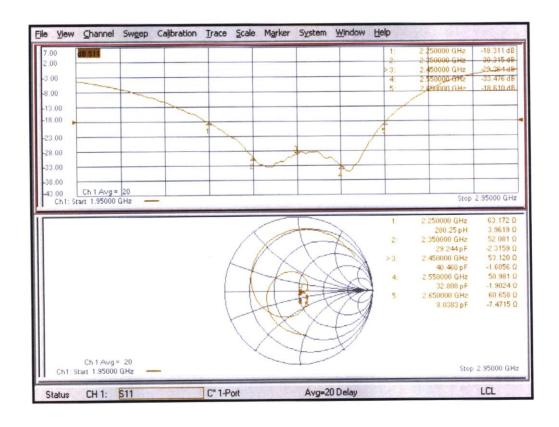
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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	Certificate No: CD2450V3-1021_Aug22 Page 3 of 5	Certificate No: CD2450V3-1021_Aug22 Page 3 of 5			
Certificate No: CD2450V3-1021_Aug22 Page 3 of 5	Certificate No: CD2450V3-1021_Aug22 Page 3 of 5	Certificate No: CD2450V3-1021_Aug22 Page 3 of 5			
			Certificate No: CD2450V3-1021_Aug22	Page 3 of 5	



Impedance Measurement Plot



Certificate No: CD2450V3-1021_Aug22

Page 4 of 5



DASY5 E-field Result

Date: 25.08.2022

Test Laboratory: SPEAG Lab2

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

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)

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

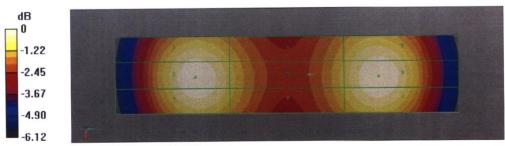
Applied MIF = 0.00 dB

RF audio interference level = 38.69 dBV/m

Emission category: M2

MIF scaled E-field

Grid 1 M2 38.56 dBV/m		
	Grid 5 M2 37.72 dBV/m	Grid 6 M2 37.53 dBV/m
Grid 7 M2 38.58 dBV/m		



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

Certificate No: CD2450V3-1021_Aug22

Page 5 of 5





Dipole 2600 MHz

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





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

Cartificate No. CD2600V3-1017 Aug22

	ERTIFICATE		The same of the sa
Object	CD2600V3 - SN:	1017	
Calibration procedure(s)	QA CAL-20.v7 Calibration Proce	dure for Validation Sources in air	
Calibration date:	August 25, 2022		
This calibration certificate documen	ts the traceability to nation	onal standards, which realize the physical uni	ts of measurements (SI).
The measurements and the uncertain	ainties with confidence pr	obability are given on the following pages an	d are part of the certificate.
All calibrations have been conducted	ed in the closed laborator	y facility: environment temperature (22 \pm 3) $^{\circ}$ C	c and humidity < 70%.
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	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
Secondary Standards	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
ONE MELLINGIE AGION THIS	SN: US38485102	05-Jan-10 (in house check Oct-20)	In house check: Oct-23
-		00 O-t 00 (in house sheet Oct 00)	In house check: Oct-23
Power sensor HP E4412A	SN: US37295597	09-Oct-09 (in house check Oct-20)	In house check: Oct-23
Power sensor HP E4412A Power sensor HP 8482A	SN: US37295597 SN: 837633/005	10-Jan-19 (in house check Oct-20)	III House check. Oct-20
Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06			In house check: Oct-22
Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 837633/005 SN: US41080477 Name	10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	
Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: 837633/005 SN: US41080477	10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	In house check: Oct-22 Signature
Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 837633/005 SN: US41080477 Name	10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	In house check: Oct-22
Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: 837633/005 SN: US41080477 Name Leif Klysner	10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Laboratory Technician	In house check: Oct-22 Signature

Certificate No: CD2600V3-1017_Aug22

Page 1 of 5





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





S Schweizerischer Kalibrierdienst
C 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.

	200	
Certificate No: CD2600V3-1017_Aug22	Page 2 of 5	

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





Measurement Conditions

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

DASY Version	DASY5	V52.10.4
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	$57.9 \Omega + 4.4 j\Omega$
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.

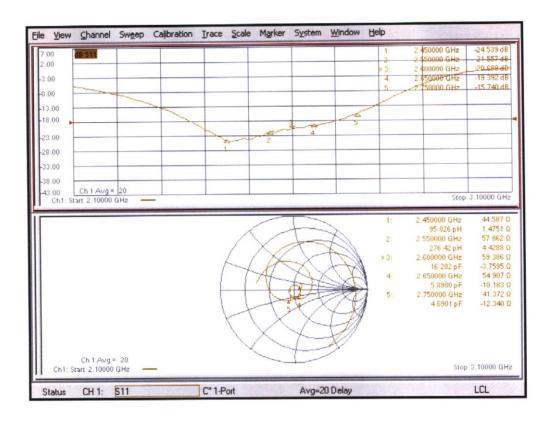
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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: σ = 0 S/m, ϵ_r = 1; ρ = 0 kg/m³

Phantom section: RF Section

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

DASY52 Configuration:

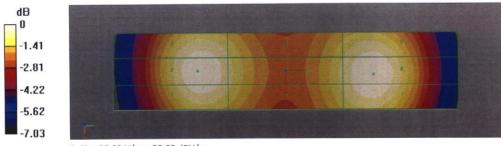
- Probe: EF3DV3 SN4013; ConvF(1, 1, 1) @ 2600 MHz; Calibrated: 28.12.2021
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 22.12.2021
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole E-Field measurement @ 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 dB RF audio interference level = 38.69 dBV/m Emission category: M2

MIF scaled E-field

Grid 1 M2	Grid 2 M2	Grid 3 M2
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. 23T04Z80611-02/03

The photos of HAC test