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

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

Accredited by the Swiss Accreditation Service (SAS)
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Accreditation No.: SCS 0108

Client **Sporton**

Certificate No: CD835V3-1045_Sep21

CALIBRATION CERTIFICATE

Object	CD835V3 - SN: 1045
Calibration procedure(s)	QA CAL-20.v7 Calibration Procedure for Validation Sources in air
Calibration date:	September 27, 2021

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Probe EF3DV3	SN: 4013	28-Dec-20 (No. EF3-4013_Dec20)	Dec-21
DAE4	SN: 781	23-Dec-20 (No. DAE4-781_Dec20)	Dec-21

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
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
RF generator R&S SMT-06	SN: 837633/005	10-Jan-19 (in house check Oct-20)	In house check: Oct-23
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 27, 2021

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%.

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	835 MHz ± 1 MHz	
Input power drift	< 0.05 dB	

Maximum Field values at 835 MHz

E-field 15 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured above high end	100 mW input power	108.2 V/m = 40.68 dBV/m
Maximum measured above low end	100 mW input power	105.4 V/m = 40.46 dBV/m
Averaged maximum above arm	100 mW input power	**106.8 V/m ± 12.8 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

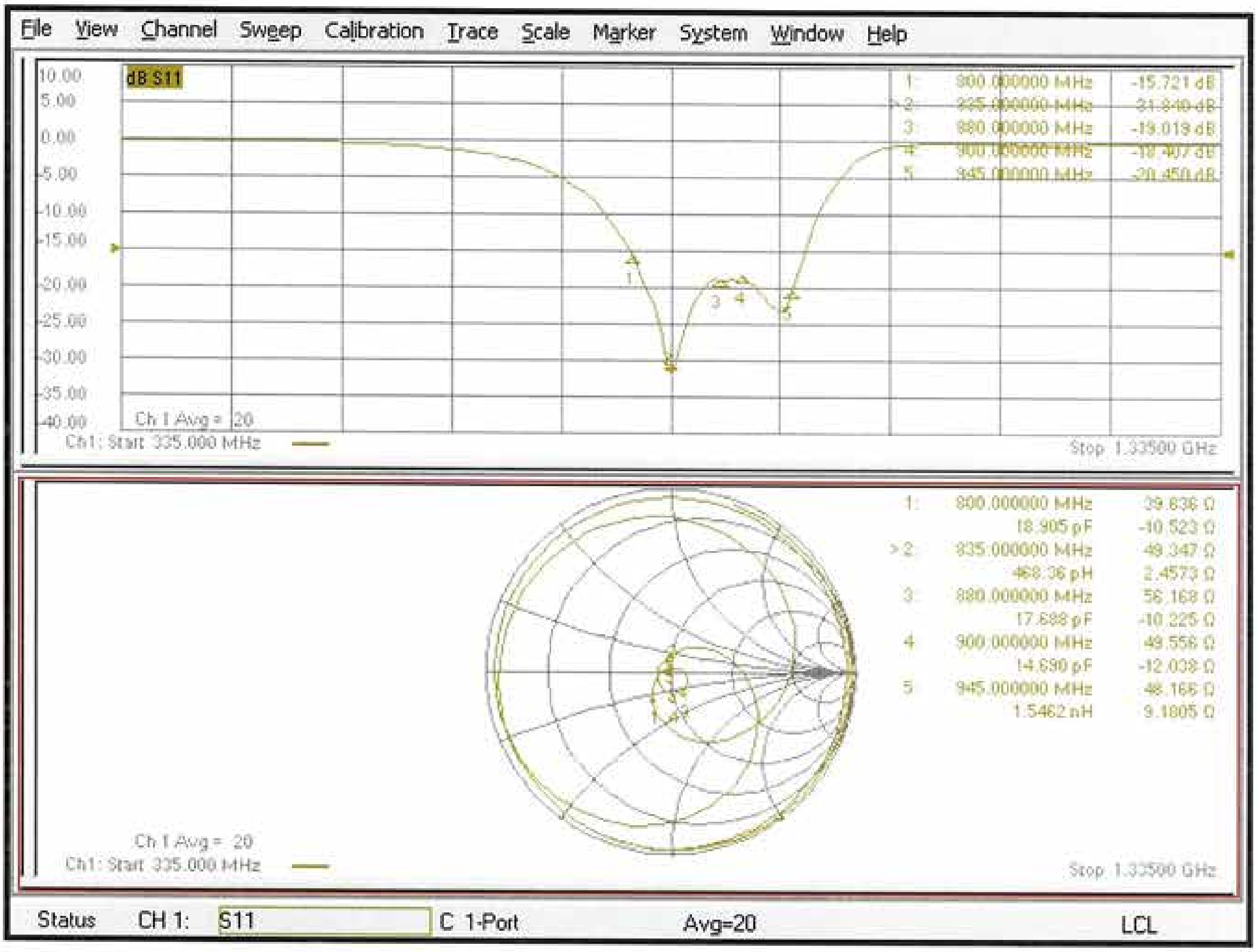
Frequency	**Return Loss**	**Impedance**
800 MHz	15.7 dB	39.6 Ω - 10.5 jΩ
835 MHz	31.8 dB	49.3 Ω + 2.5 jΩ
880 MHz	19.0 dB	56.2 Ω - 10.2 jΩ
900 MHz	18.4 dB	49.6 Ω - 12.0 jΩ
945 MHz	20.4 dB	48.2 Ω + 9.2 jΩ

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.

Impedance Measurement Plot



DASY5 E-field Result

Date: 27.09.2021

Test Laboratory: SPEAG Lab2

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1045

Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

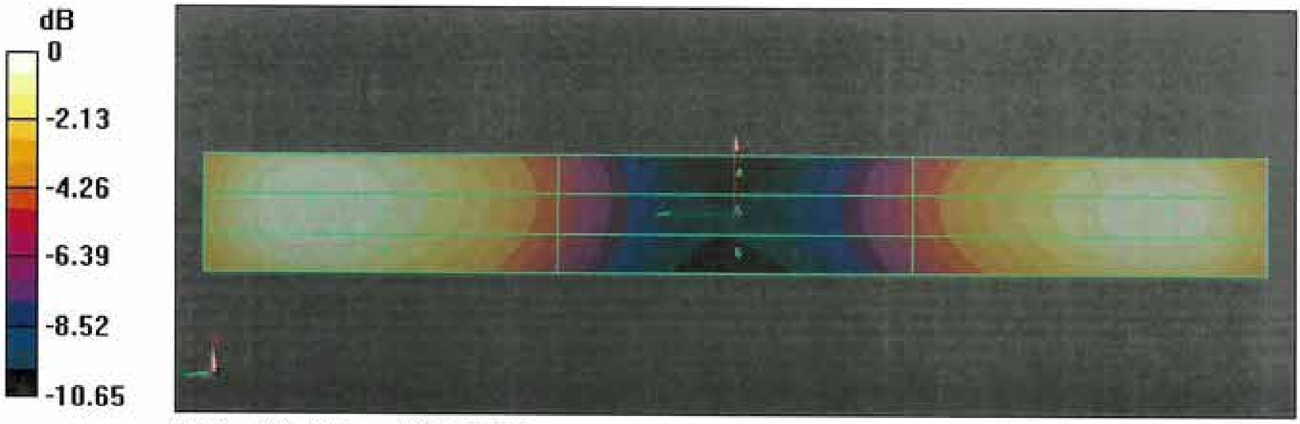
DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 835 MHz; Calibrated: 28.12.2020
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 23.12.2020
- 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 @ 835MHz/E-Scan - 835MHz d=15mm/Hearing Aid Compatibility Test (41x361x1):
Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 127.6 V/m; Power Drift = 0.01 dB
Applied MIF = 0.00 dB
RF audio interference level = 40.69 dBV/m
Emission category: M3

MIF scaled E-field

Grid 1 **M3** **40.39 dBV/m**	Grid 2 **M3** **40.46 dBV/m**	Grid 3 **M3** **40.17 dBV/m**
Grid 4 **M4** **35.69 dBV/m**	Grid 5 **M4** **35.69 dBV/m**	Grid 6 **M4** **35.38 dBV/m**
Grid 7 **M3** **40.64 dBV/m**	Grid 8 **M3** **40.68 dBV/m**	Grid 9 **M3** **40.31 dBV/m**



0 dB = 108.2 V/m = 40.68 dBV/m

CD835V3, serial no. 1045 Extended Dipole Calibrations

Referring to KDB 450824, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

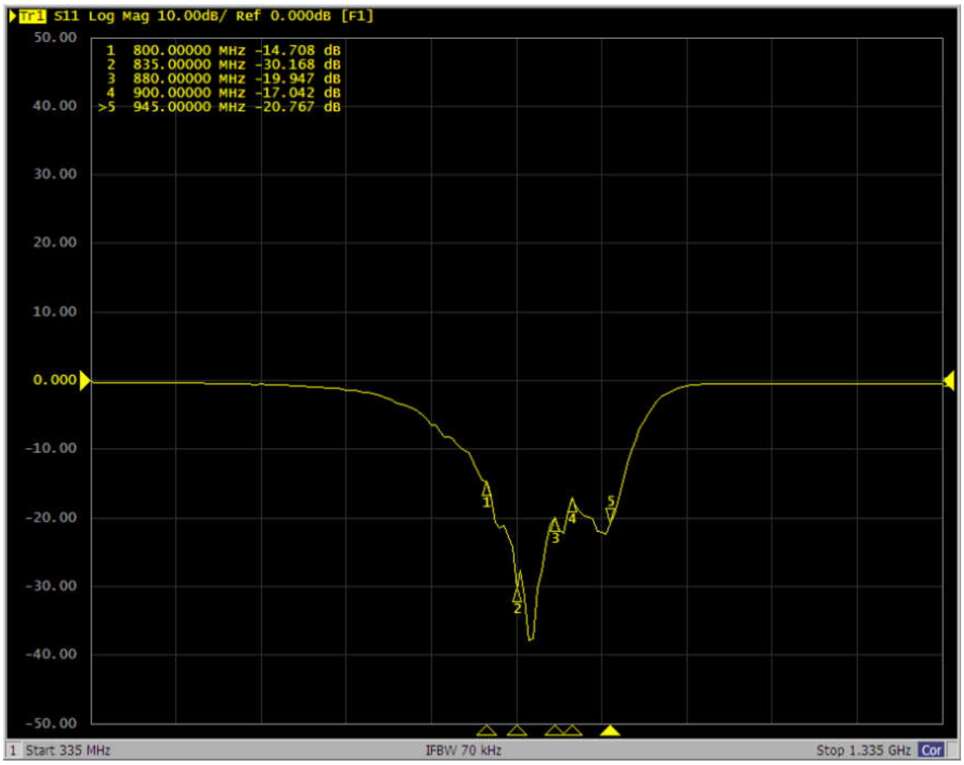
<Justification of the extended calibration>

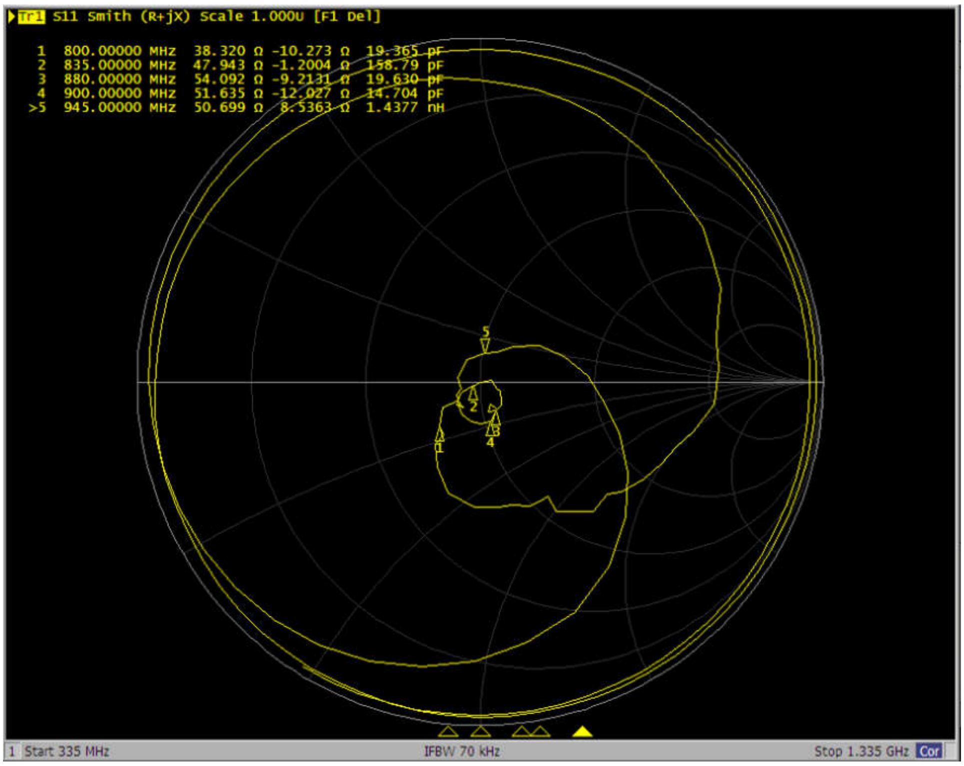
CD**835**V3 – serial no. **1045**						
	835MHZ					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
09.27.2021	-31.8		49.3		2.5	
09.26.2022	-30.168	-5.13	47.943	1.357	-1.2004	3.7004

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

<Dipole Verification Data> - CD835 V3, serial no. 1045 (Data of Measurement : 9.26.2022)

835 MHz - Head





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Accreditation No.: SCS 0108

Client **Sporton**

Certificate No: CD1880V3-1038_Sep21

CALIBRATION CERTIFICATE

Object	CD1880V3 - SN: 1038
Calibration procedure(s)	QA CAL-20.v7 Calibration Procedure for Validation Sources in air
Calibration date:	September 27, 2021

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
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Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Probe EF3DV3	SN: 4013	28-Dec-20 (No. EF3-4013_Dec20)	Dec-21
DAE4	SN: 781	23-Dec-20 (No. DAE4-781_Dec20)	Dec-21

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
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
RF generator R&S SMT-06	SN: 837633/005	10-Jan-19 (in house check Oct-20)	In house check: Oct-23
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 27, 2021

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.
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  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%.

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	86.3 V/m = 38.72 dBV/m
Maximum measured above low end	100 mW input power	84.7 V/m = 38.56 dBV/m
Averaged maximum above arm	100 mW input power	**85.5 V/m ± 12.8 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

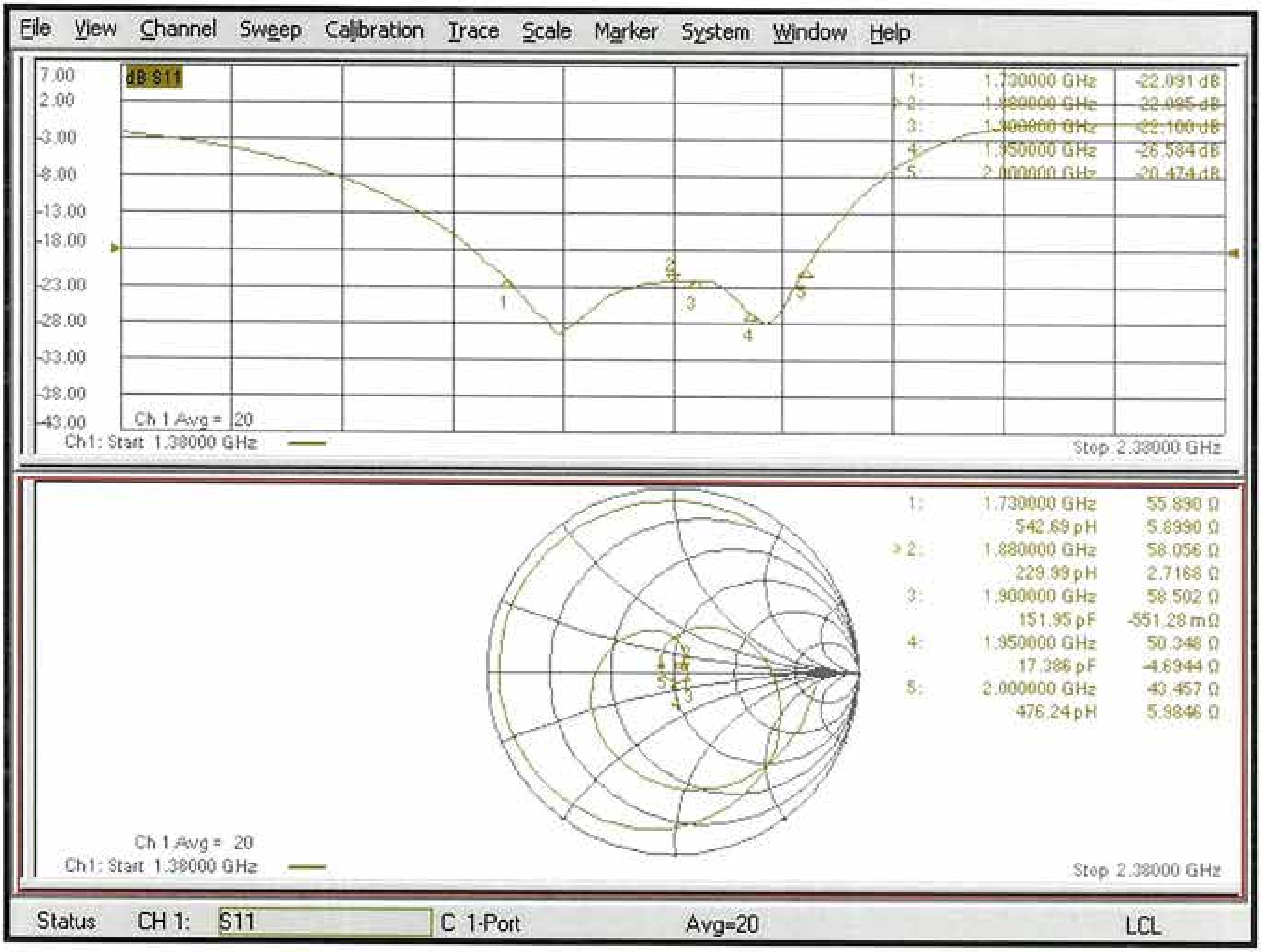
Frequency	**Return Loss**	**Impedance**
1730 MHz	22.1 dB	55.9 Ω + 5.9 jΩ
1880 MHz	22.1 dB	58.1 Ω + 2.7 jΩ
1900 MHz	22.1 dB	58.5 Ω - 0.6 jΩ
1950 MHz	26.6 dB	50.3 Ω - 4.7 jΩ
2000 MHz	20.5 dB	43.5 Ω + 6.0 jΩ

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.

Impedance Measurement Plot



DASY5 E-field Result

Date: 27.09.2021

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1038

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

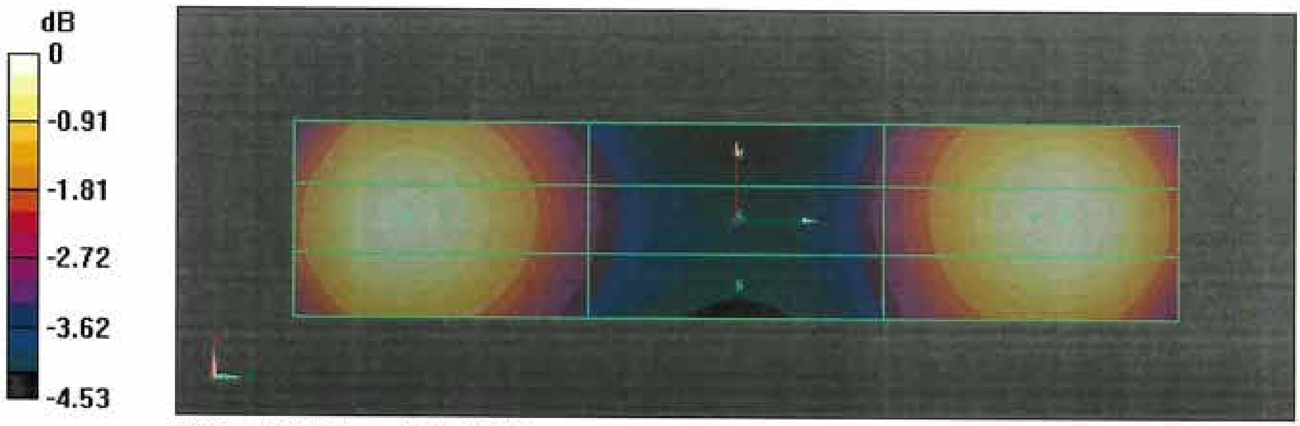
DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 1880 MHz; Calibrated: 28.12.2020
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 23.12.2020
- 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 = 151.4 V/m; Power Drift = -0.00 dB
Applied MIF = 0.00 dB
RF audio interference level = 38.72 dBV/m
Emission category: M2

MIF scaled E-field

Grid 1 **M2** **38.39 dBV/m**	Grid 2 **M2** **38.56 dBV/m**	Grid 3 **M2** **38.37 dBV/m**
Grid 4 **M2** **35.91 dBV/m**	Grid 5 **M2** **35.93 dBV/m**	Grid 6 **M2** **35.8 dBV/m**
Grid 7 **M2** **38.61 dBV/m**	Grid 8 **M2** **38.72 dBV/m**	Grid 9 **M2** **38.45 dBV/m**



0 dB = 86.34 V/m = 38.72 dBV/m

CD1880V3, serial no. 1038 Extended Dipole Calibrations

Referring to KDB 450824, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

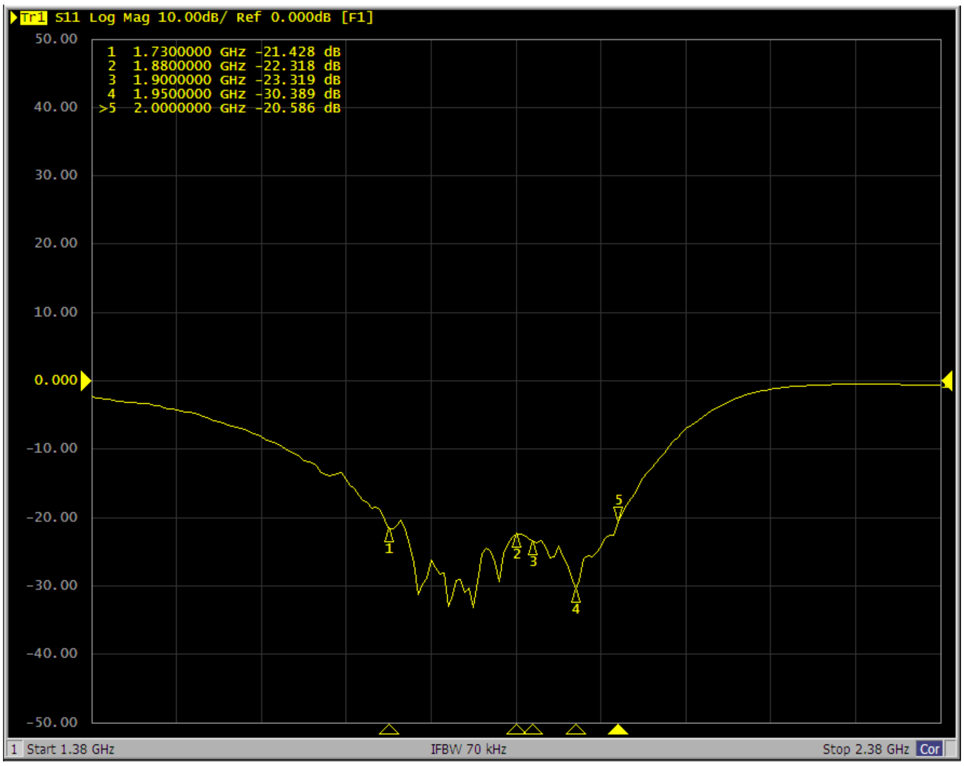
<Justification of the extended calibration>

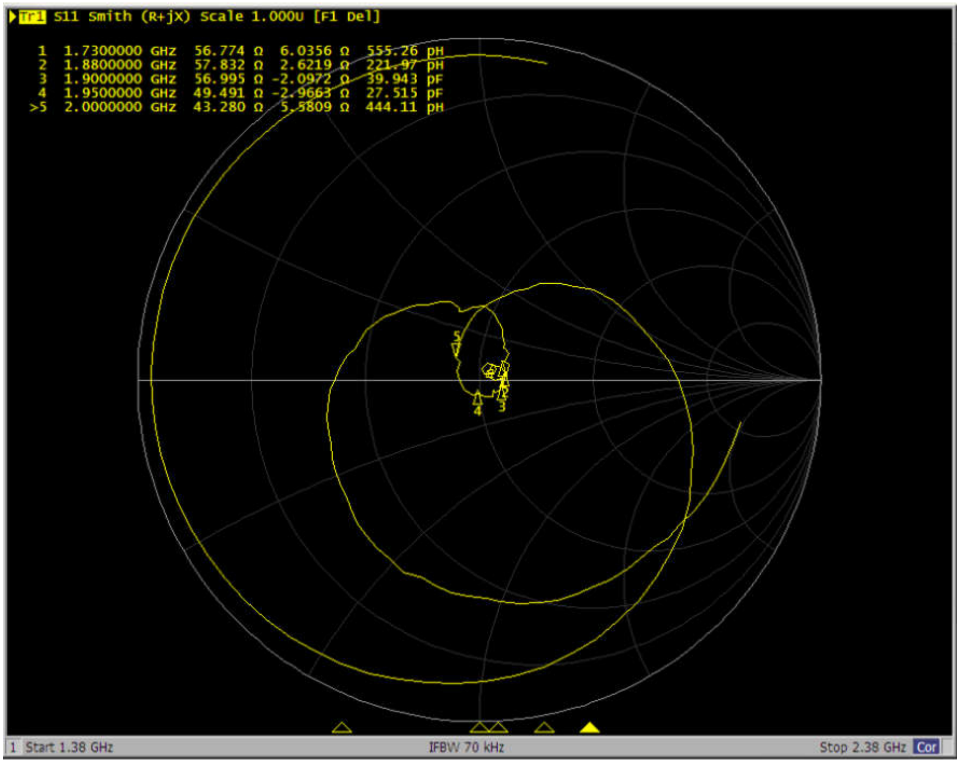
CD**1880**V3 – serial no. **1038**						
	1730MHZ					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
09.27.2021 (Cal. Report)	-22.1		55.9		5.9	
09.26.2022 (extended)	-21.428	-3.04	56.774	-0.874	6.0356	-0.1356
CD**1880**V3 – serial no. **1038**						
	1880MHZ					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
09.27.2021 (Cal. Report)	-22.1		58.1		2.7	
09.26.2022 (extended)	-22.318	0.99	57.832	0.268	2.6219	0.0781

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

<Dipole Verification Data> - CD1880 V3, serial no. 1038 (Data of Measurement : 9.26.2022)

1880 MHz - Head





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Accreditation No.: **SCS 0108**

Client **Sporton**

Certificate No: **CD2450V3-1186_Jan22**

CALIBRATION CERTIFICATE

Object	CD2450V3 - SN: 1186
Calibration procedure(s)	QA CAL-20.v7 Calibration Procedure for Validation Sources in air
Calibration date:	January 25, 2022

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
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Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
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

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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
RF generator R&S SMT-06	SN: 837633/005	10-Jan-19 (in house check Oct-20)	In house check: Oct-23
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	
Approved by:	Sven Kühn	Deputy Manager	

Issued: January 25, 2022

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- *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%.

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	85.2 V/m = 38.61 dBV/m
Maximum measured above low end	100 mW input power	84.3 V/m = 38.51 dBV/m
Averaged maximum above arm	100 mW input power	**84.7 V/m ± 12.8 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

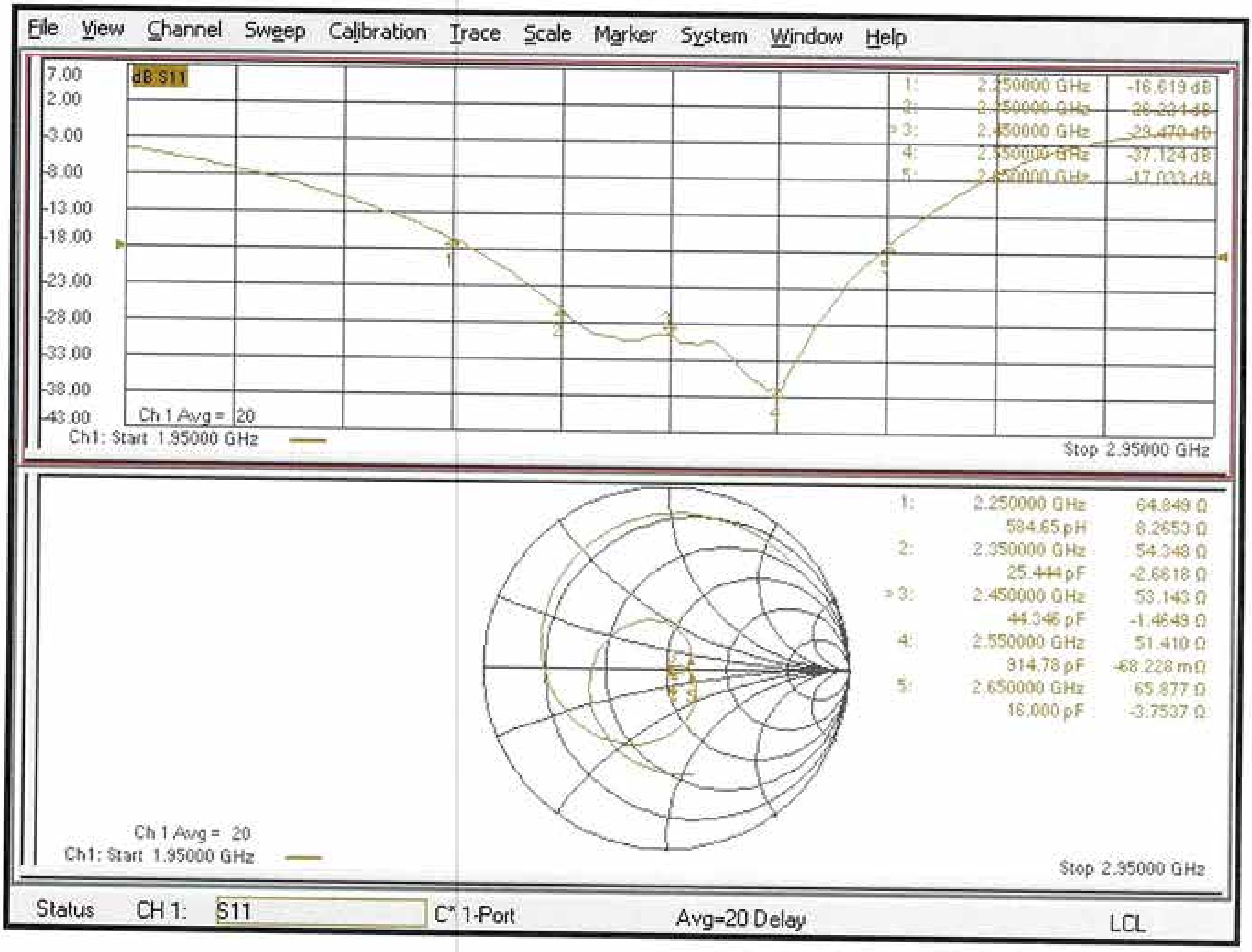
Frequency	**Return Loss**	**Impedance**
2250 MHz	16.6 dB	64.8 Ω + 8.3 jΩ
2350 MHz	26.2 dB	54.3 Ω - 2.7 jΩ
2450 MHz	29.5 dB	53.1 Ω - 1.5 jΩ
2550 MHz	37.1 dB	51.4 Ω - 0.1 jΩ
2650 MHz	17.0 dB	65.9 Ω - 3.8 jΩ

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.

Impedance Measurement Plot



DASY5 E-field Result

Date: 25.01.2022

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 2450 MHz; Type: CD2450V3; Serial: CD2450V3 - SN: 1186

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

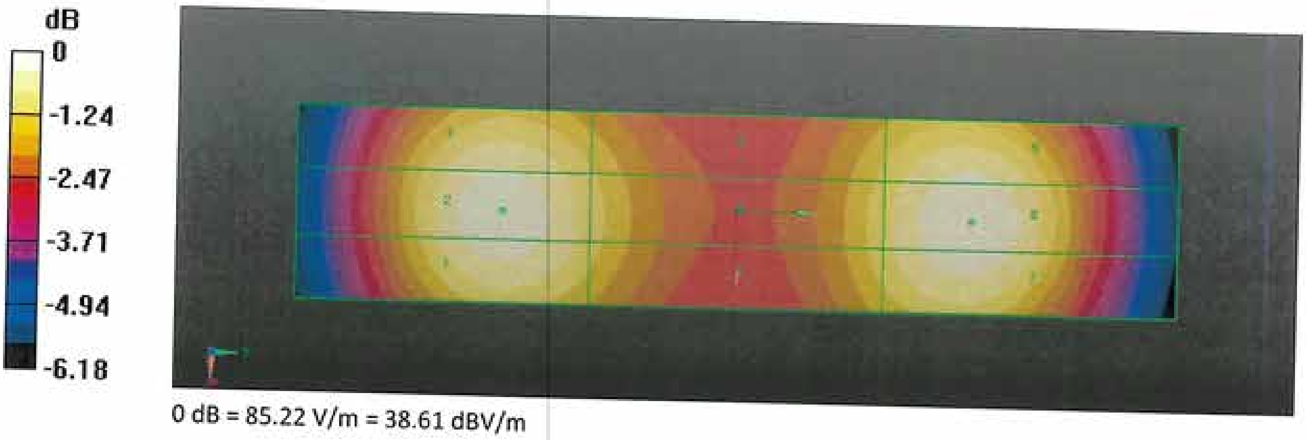
DASY52 Configuration:

- 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 = 76.03 V/m; Power Drift = 0.01 dB
Applied MIF = 0.00 dB
RF audio interference level = 38.61 dBV/m
Emission category: M2

MIF scaled E-field

Grid 1 **M2** **38.41 dBV/m**	Grid 2 **M2** **38.51 dBV/m**	Grid 3 **M2** **38.24 dBV/m**
Grid 4 **M2** **37.64 dBV/m**	Grid 5 **M2** **37.69 dBV/m**	Grid 6 **M2** **37.53 dBV/m**
Grid 7 **M2** **38.5 dBV/m**	Grid 8 **M2** **38.61 dBV/m**	Grid 9 **M2** **38.36 dBV/m**



0 dB = 85.22 V/m = 38.61 dBV/m

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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 **Sporton**

Certificate No: **CD2600V3-1018_Aug21**

CALIBRATION CERTIFICATE

Object: CD2600V3 - SN: 1018

Calibration procedure(s): QA CAL-20.v7
Calibration Procedure for Validation Sources in air

Calibration date: August 24, 2021

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Probe EF3DV3	SN: 4013	28-Dec-20 (No. EF3-4013_Dec20)	Dec-21
DAE4	SN: 781	23-Dec-20 (No. DAE4-781_Dec20)	Dec-21

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
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
RF generator R&S SMT-06	SN: 837633/005	10-Jan-19 (in house check Oct-20)	In house check: Oct-23
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 27, 2021

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%.

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	86.7 V/m = 38.76 dBV/m
Maximum measured above low end	100 mW input power	85.6 V/m = 38.65 dBV/m
Averaged maximum above arm	100 mW input power	**86.1 V/m ± 12.8 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

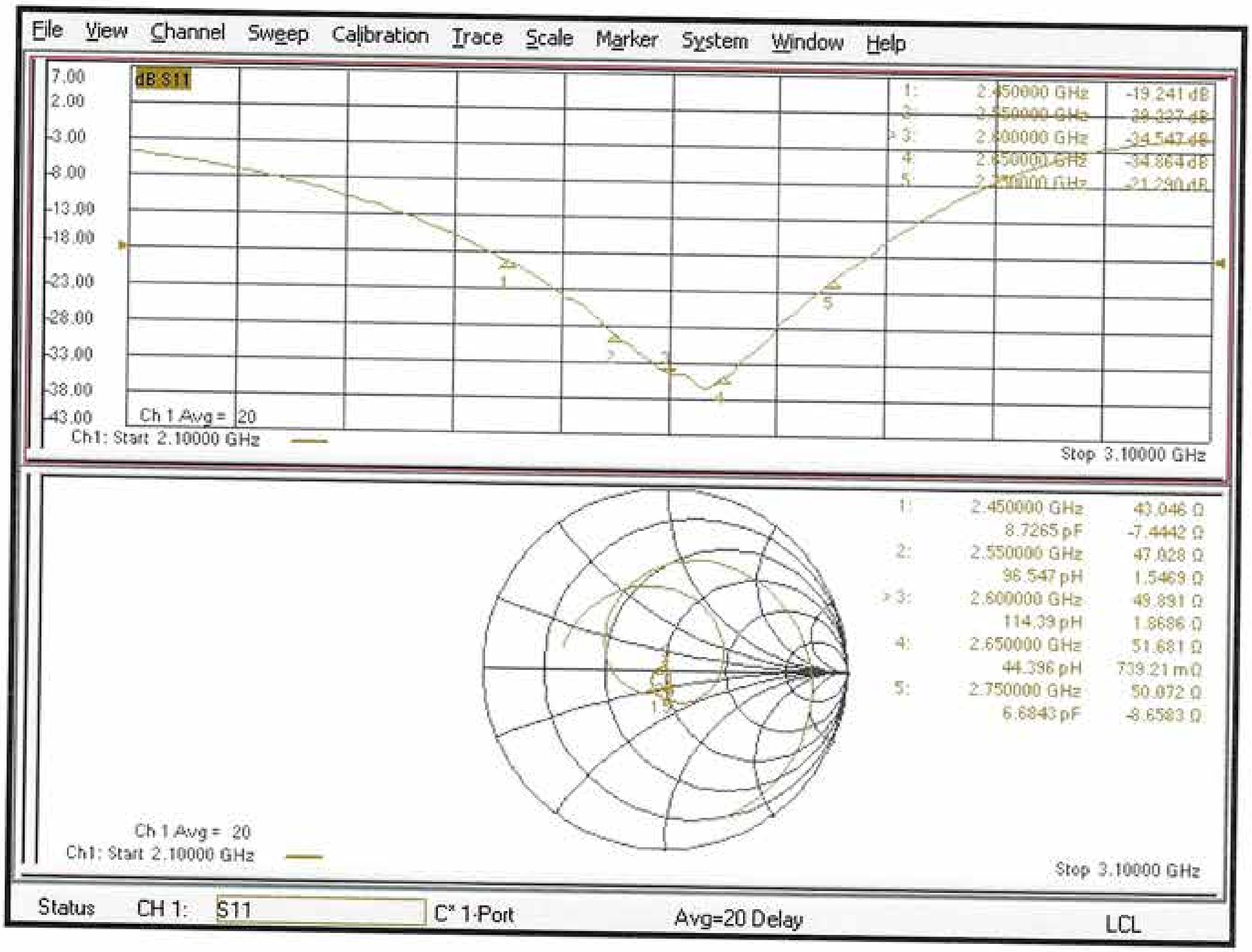
Frequency	**Return Loss**	**Impedance**
2450 MHz	19.2 dB	43.0 Ω - 7.4 jΩ
2550 MHz	29.2 dB	47.0 Ω + 1.5 jΩ
2600 MHz	34.5 dB	49.9 Ω + 1.9 jΩ
2650 MHz	34.9 dB	51.7 Ω + 0.7 jΩ
2750 MHz	21.3 dB	50.1 Ω - 8.7 jΩ

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.

Impedance Measurement Plot



DASY5 E-field Result

Date: 24.08.2021

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 2600 MHz; Type: CD2600V3; Serial: CD2600V3 - SN: 1018

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

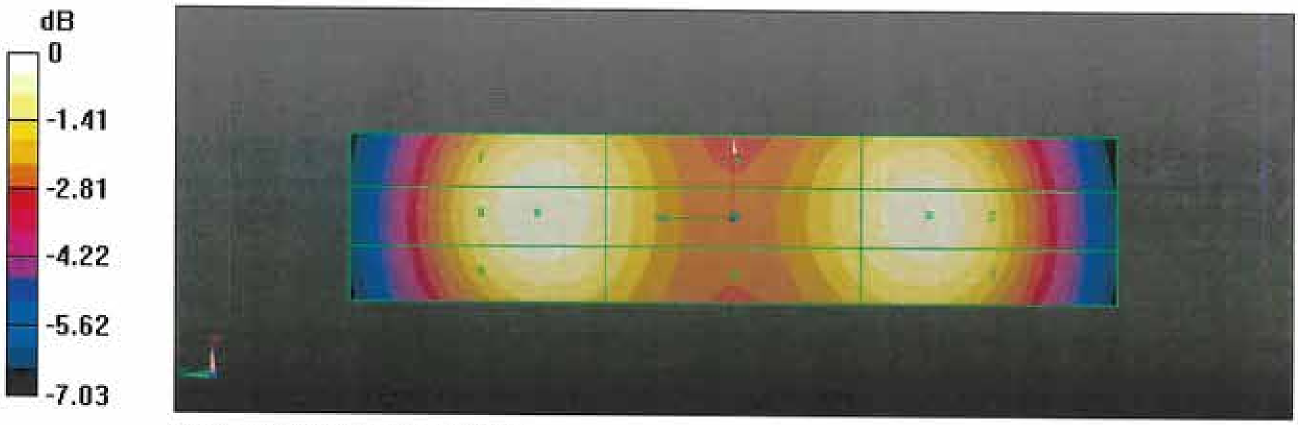
DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 2600 MHz; Calibrated: 28.12.2020
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 23.12.2020
- 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 = 68.33 V/m; Power Drift = -0.01 dB
Applied MIF = 0.00 dB
RF audio interference level = 38.76 dBV/m
Emission category: M2

MIF scaled E-field

Grid 1 **M2** **38.51 dBV/m**	Grid 2 **M2** **38.65 dBV/m**	Grid 3 **M2** **38.44 dBV/m**
Grid 4 **M2** **37.95 dBV/m**	Grid 5 **M2** **37.99 dBV/m**	Grid 6 **M2** **37.82 dBV/m**
Grid 7 **M2** **38.65 dBV/m**	Grid 8 **M2** **38.76 dBV/m**	Grid 9 **M2** **38.51 dBV/m**



0 dB = 86.65 V/m = 38.76 dBV/m

CD2600V3, serial no. 1018 Extended Dipole Calibrations

Referring to KDB 450824, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

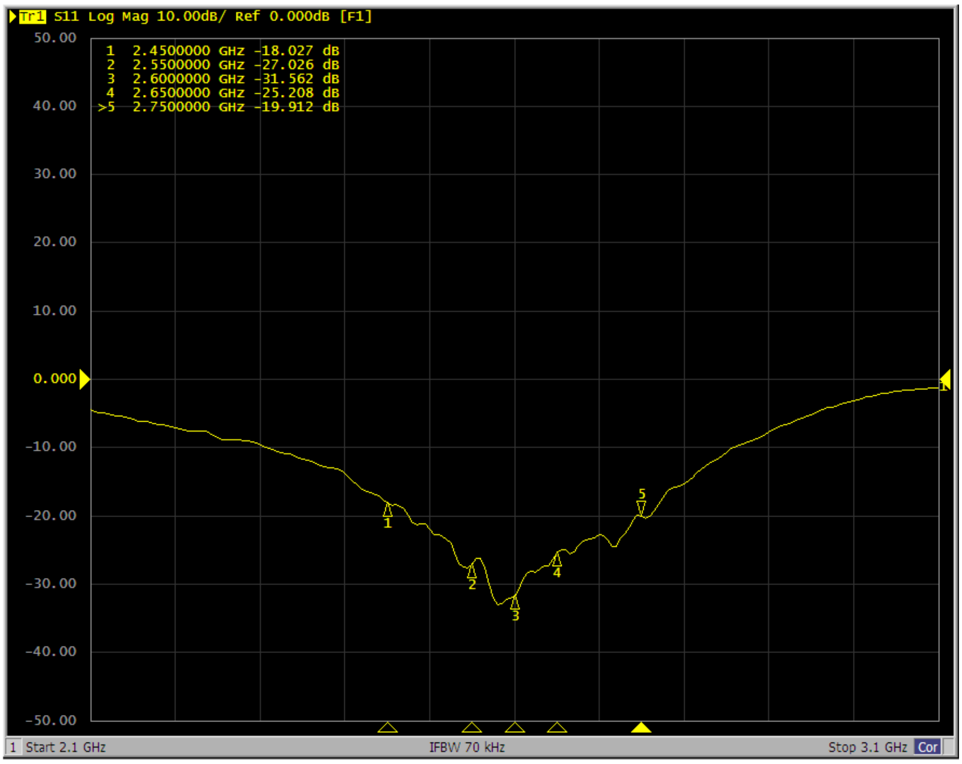
<Justification of the extended calibration>

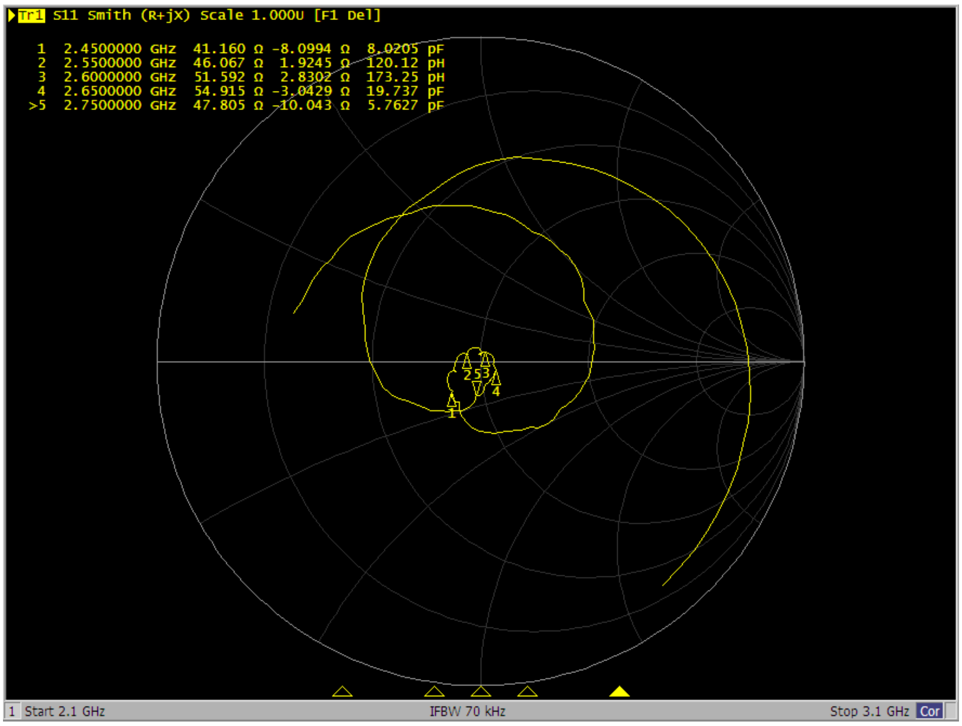
CD**2600**V3 – serial no. **1018**						
	2600MHZ					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
08.24.2021 (Cal. Report)	-34.547		49.891		1.8686	
08.23.2022 (extended)	-31.562	-8.64	51.592	-1.701	2.8302	-0.9616

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

<Dipole Verification Data> - CD2600 V3, serial no. 1018 (Data of Measurement : 8.23.2022)

2600 MHz - Head





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Accreditation No.: SCS 0108

Client Sporton

Certificate No: CD3500V3-1009_Mar22

CALIBRATION CERTIFICATE

Object	CD3500V3 - SN: 1009
Calibration procedure(s)	QA CAL-20.v7 Calibration Procedure for Validation Sources in air
Calibration date:	March 03, 2022

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
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
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
RF generator R&S SMT-06	SN: 837633/005	10-Jan-19 (in house check Oct-20)	In house check: Oct-23
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	
Approved by:	Niels Kuster	Quality Manager	

Issued: March 3, 2022

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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

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%.

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	3500 MHz ± 1 MHz	
Input power drift	< 0.05 dB	

Maximum Field values at 3500 MHz

E-field 15 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured above high end	100 mW input power	84.1 V/m = 38.50 dBV/m
Maximum measured above low end	100 mW input power	82.8 V/m = 38.36 dBV/m
Averaged maximum above arm	100 mW input power	**83.4 V/m ± 12.8 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

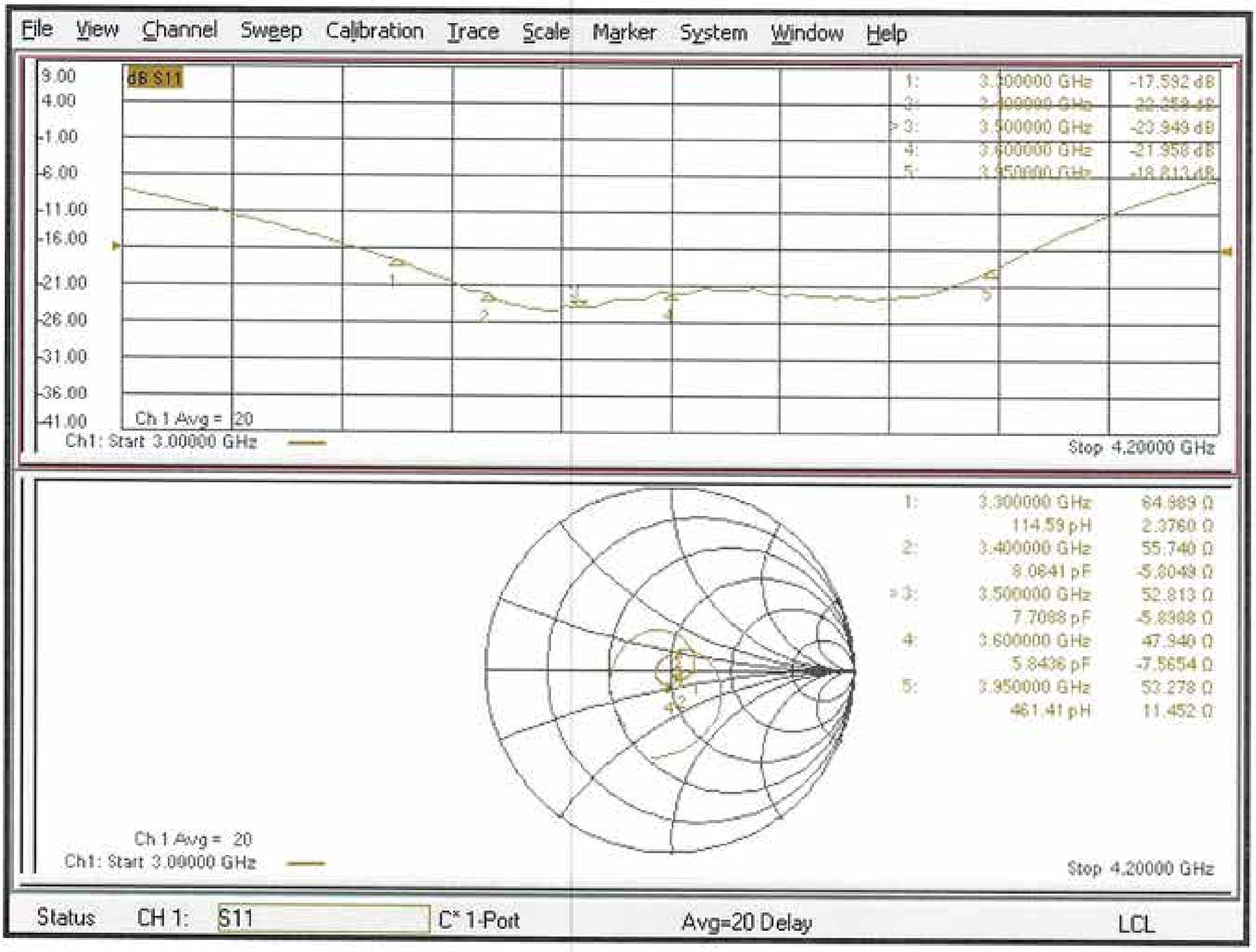
Frequency	**Return Loss**	**Impedance**
3300 MHz	17.6 dB	65.0 Ω + 2.4 jΩ
3400 MHz	22.3 dB	55.7 Ω - 5.8 jΩ
3500 MHz	23.9 dB	52.8 Ω - 5.9 jΩ
3600 MHz	22.0 dB	47.9 Ω - 7.6 jΩ
3700 MHz	21.7 dB	42.8 Ω - 2.5 jΩ

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.

Impedance Measurement Plot



DASY5 E-field Result

Date: 03.03.2022

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 3500 MHz; Type: CD3500V3; Serial: CD3500V3 - SN: 1009

Communication System: UID 0 - CW ; Frequency: 3500 MHz
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

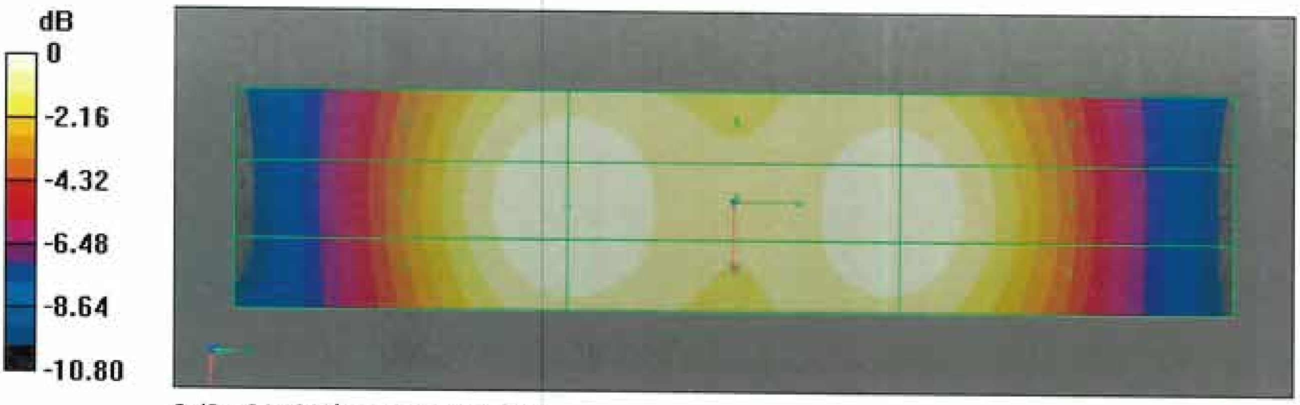
DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 3500 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 @ 3500MHz/E-Scan - 3500MHz 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 = 35.66 V/m; Power Drift = 0.03 dB
Applied MIF = 0.00 dB
RF audio interference level = 38.50 dBV/m
Emission category: M2

MIF scaled E-field

Grid 1 **M2** **38.4 dBV/m**	Grid 2 **M2** **38.5 dBV/m**	Grid 3 **M2** **38.31 dBV/m**
Grid 4 **M2** **38.4 dBV/m**	Grid 5 **M2** **38.5 dBV/m**	Grid 6 **M2** **38.31 dBV/m**
Grid 7 **M2** **38.28 dBV/m**	Grid 8 **M2** **38.36 dBV/m**	Grid 9 **M2** **38.14 dBV/m**



0 dB = 84.12 V/m = 38.50 dBV/m

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Accreditation No.: SCS 0108

Client Sporton

Certificate No: DAE4-376_Nov21

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BJ - SN: 376
Calibration procedure(s)	QA CAL-06.v30 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	November 22, 2021

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-21 (No:31368)	Aug-22
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-21 (in house check)	In house check: Jan-22
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-21 (in house check)	In house check: Jan-22

	Name	Function	Signature
Calibrated by:	Adrian Gehring	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: November 22, 2021

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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 = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

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

Calibration Factors	X	Y	Z
High Range	403.841 ± 0.02% (k=2)	403.327 ± 0.02% (k=2)	403.398 ± 0.02% (k=2)
Low Range	3.95988 ± 1.50% (k=2)	3.93897 ± 1.50% (k=2)	3.95314 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	216.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199995.66	0.36	0.00
Channel X	+ Input	20004.23	2.18	0.01
Channel X	- Input	-19996.96	4.72	-0.02
Channel Y	+ Input	199996.51	1.54	0.00
Channel Y	+ Input	20003.58	1.46	0.01
Channel Y	- Input	-19999.79	1.89	-0.01
Channel Z	+ Input	199993.37	-2.12	-0.00
Channel Z	+ Input	20001.66	-0.30	-0.00
Channel Z	- Input	-20001.76	0.05	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.25	-0.15	-0.01
Channel X	+ Input	201.77	0.18	0.09
Channel X	- Input	-198.82	-0.68	0.34
Channel Y	+ Input	2001.45	0.09	0.00
Channel Y	+ Input	200.89	-0.71	-0.35
Channel Y	- Input	-199.79	-1.62	0.82
Channel Z	+ Input	2001.08	-0.18	-0.01
Channel Z	+ Input	200.87	-0.62	-0.31
Channel Z	- Input	-199.29	-1.05	0.53

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	6.28	4.80
	- 200	-4.21	-5.51
Channel Y	200	-1.39	-1.84
	- 200	-0.90	-1.03
Channel Z	200	1.30	1.97
	- 200	-3.91	-3.94

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	-	3.12	-1.41
Channel Y	200	9.76	-	4.22
Channel Z	200	10.06	6.37	-

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	15929	16173
Channel Y	16002	15505
Channel Z	16054	14005

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	0.68	-0.27	1.30	0.32
Channel Y	-0.42	-2.55	1.16	0.48
Channel Z	-0.95	-2.26	0.47	0.52

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	−0.01	-8	-9

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IMPORTANT NOTICE

USAGE OF THE DAE4

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

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

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

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

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

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

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

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

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

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Accreditation No.: SCS 0108

Client **Sporton**

Certificate No: DAE4-1512_Mar22

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1512
Calibration procedure(s)	QA CAL-06.v30 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	March 29, 2022

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-21 (No:31368)	Aug-22
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	24-Jan-22 (in house check)	In house check: Jan-23
Calibrator Box V2.1	SE UMS 006 AA 1002	24-Jan-22 (in house check)	In house check: Jan-23

	Name	Function	Signature
Calibrated by:	Adrian Gehring	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: March 29, 2022

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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 = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

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

Calibration Factors	X	Y	Z
High Range	404.617 ± 0.02% (k=2)	405.013 ± 0.02% (k=2)	405.294 ± 0.02% (k=2)
Low Range	3.97396 ± 1.50% (k=2)	3.97796 ± 1.50% (k=2)	3.99009 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	11.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199992.42	1.06	0.00
Channel X	+ Input	19999.92	-1.91	-0.01
Channel X	- Input	-19999.19	2.26	-0.01
Channel Y	+ Input	199991.37	-0.16	-0.00
Channel Y	+ Input	19997.67	-4.08	-0.02
Channel Y	- Input	-20002.31	-0.79	0.00
Channel Z	+ Input	199990.88	-0.75	-0.00
Channel Z	+ Input	20000.74	-0.96	-0.00
Channel Z	- Input	-20001.89	-0.27	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.20	0.17	0.01
Channel X	+ Input	202.00	0.75	0.37
Channel X	- Input	-198.30	0.24	-0.12
Channel Y	+ Input	2000.61	-0.20	-0.01
Channel Y	+ Input	201.73	0.68	0.34
Channel Y	- Input	-198.59	-0.00	0.00
Channel Z	+ Input	2001.19	0.31	0.02
Channel Z	+ Input	200.42	-0.58	-0.29
Channel Z	- Input	-200.02	-1.36	0.69

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	-16.50	-17.84
	- 200	19.39	17.94
Channel Y	200	0.47	-0.10
	- 200	-0.41	-0.99
Channel Z	200	-15.03	-15.12
	- 200	13.91	14.02

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-0.36	0.05
Channel Y	200	3.71	-	0.77
Channel Z	200	10.76	1.37	-

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	16340	17346
Channel Y	16365	15675
Channel Z	16138	14890

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	1.15	-0.18	2.01	0.39
Channel Y	-0.06	-1.04	1.87	0.42
Channel Z	-0.28	-1.53	0.69	0.40

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

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DAE
1512
Sporton

IMPORTANT NOTICE

USAGE OF THE DAE4

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

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

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

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

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

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

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

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

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

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Accreditation No.: SCS 0108

Client **Sporton**

Certificate No: EF3-4047_Jan22

CALIBRATION CERTIFICATE

Object	EF3DV3- SN:4047
Calibration procedure(s)	QA CAL-02.v9, QA CAL-25.v7 Calibration procedure for E-field probes optimized for close near field evaluations in air
Calibration date:	January 24, 2022

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: CC2552 (20x)	09-Apr-21 (No. 217-03343)	Apr-22
DAE4	SN: 789	24-Dec-21 (No. DAE4-789_Dec21)	Dec-22
Reference Probe ER3DV6	SN: 2328	08-Oct-21 (No. ER3-2328_Oct21)	Oct-22
Secondary Standards	**ID**	**Check Date (in house)**	**Scheduled Check**
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: January 26, 2022

Glossary:

NORMx,y,z	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
En	incident E-field orientation normal to probe axis
Ep	incident E-field orientation parallel to probe axis
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1309-2005, " IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005
b) CTIA Test Plan for Hearing Aid Compatibility, Rev 3.1.1, May 2017

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 for XY sensors and ϑ = 90 for Z sensor (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart).
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *Spherical isotropy (3D deviation from isotropy)*: in a locally homogeneous field realized using an open waveguide setup.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

DASY/EASY - Parameters of Probe: EF3DV3 - SN:4047

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)²)	0.84	0.68	1.19	± 10.1 %
DCP (mV)[B]	98.6	99.8	98.0	

Calibration results for Frequency Response (30 MHz – 6 GHz)

Frequency MHz	Target E-Field V/m	Measured E-field (En) V/m	Deviation E-normal in %	Measured E-field (Ep) V/m	Deviation E-normal in %	Unc (k=2) %
30	77.2	77.4	0.3%	77.3	0.2%	± 5.1 %
100	77.1	77.8	0.9%	77.7	0.8%	± 5.1 %
450	77.1	77.9	1.0%	78.1	1.2%	± 5.1 %
600	77.1	77.6	0.6%	77.7	0.8%	± 5.1 %
750	77.1	77.4	0.4%	77.6	0.7%	± 5.1 %
1800	143.3	139.6	-2.6%	140.0	-2.3%	± 5.1 %
2000	135.1	131.6	-2.6%	132.0	-2.3%	± 5.1 %
2200	127.7	123.6	-3.2%	124.8	-2.2%	± 5.1 %
2500	125.6	122.6	-2.3%	123.9	-1.3%	± 5.1 %
3000	79.5	75.9	-4.5%	77.0	-3.1%	± 5.1 %
3500	256.9	248.8	-3.1%	245.7	-4.4%	± 5.1 %
3700	249.5	239.8	-3.9%	237.9	-4.6%	± 5.1 %
5200	50.7	51.3	1.1%	51.6	1.7%	± 5.1 %
5500	49.6	49.3	-0.6%	48.2	-2.7%	± 5.1 %
5800	48.9	48.5	-0.9%	49.6	1.5%	± 5.1 %

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%.

[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EF3DV3 - SN:4047

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max dev.	Max Unc[E] (k=2)
0	CW	X	0.00	0.00	1.00	0.00	175.5	± 3.5 %	± 4.7 %
		Y	0.00	0.00	1.00		153.1		
		Z	0.00	0.00	1.00		169.8		
10352-AAA	Pulse Waveform (200Hz, 10%)	X	5.65	73.94	15.07	10.00	60.0	± 2.1 %	± 9.6 %
		Y	6.48	75.80	16.15		60.0		
		Z	6.02	74.99	15.16		60.0		
10353-AAA	Pulse Waveform (200Hz, 20%)	X	5.68	75.85	14.59	6.99	80.0	± 0.8 %	± 9.6 %
		Y	7.40	78.90	16.01		80.0		
		Z	11.04	82.90	16.56		80.0		
10354-AAA	Pulse Waveform (200Hz, 40%)	X	20.00	88.88	17.04	3.98	95.0	± 0.8 %	± 9.6 %
		Y	20.00	89.65	17.66		95.0		
		Z	20.00	88.80	16.67		95.0		
10355-AAA	Pulse Waveform (200Hz, 60%)	X	20.00	89.78	16.24	2.22	120.0	± 0.8 %	± 9.6 %
		Y	20.00	90.26	16.67		120.0		
		Z	20.00	88.43	15.24		120.0		
10387-AAA	QPSK Waveform, 1 MHz	X	2.09	68.95	17.16	1.00	150.0	± 1.9 %	± 9.6 %
		Y	2.00	68.34	16.60		150.0		
		Z	1.96	69.29	16.91		150.0		
10388-AAA	QPSK Waveform, 10 MHz	X	2.87	71.97	17.85	0.00	150.0	± 0.9 %	± 9.6 %
		Y	2.65	70.70	17.12		150.0		
		Z	2.72	71.72	17.75		150.0		
10396-AAA	64-QAM Waveform, 100 kHz	X	1.75	65.51	17.08	3.01	150.0	± 8.6 %	± 9.6 %
		Y	3.61	73.61	20.18		150.0		
		Z	3.14	72.64	20.00		150.0		
10399-AAA	64-QAM Waveform, 40 MHz	X	3.73	68.12	16.54	0.00	150.0	± 1.4 %	± 9.6 %
		Y	3.62	67.68	16.20		150.0		
		Z	3.69	68.19	16.57		150.0		
10414-AAA	WLAN CCDF, 64-QAM, 40MHz	X	5.03	65.79	15.82	0.00	150.0	± 2.9 %	± 9.6 %
		Y	4.96	65.65	15.66		150.0		
		Z	5.01	66.16	16.04		150.0		

Note: For details on UID parameters see Appendix

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%.

[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EF3DV3 - SN:4047

Sensor Frequency Model Parameters

	Sensor X	Sensor Y	Sensor Z
Frequency Corr. (LF)	-0.34	-0.20	5.90
Frequency Corr. (HF)	2.82	2.82	2.82

Sensor Model Parameters

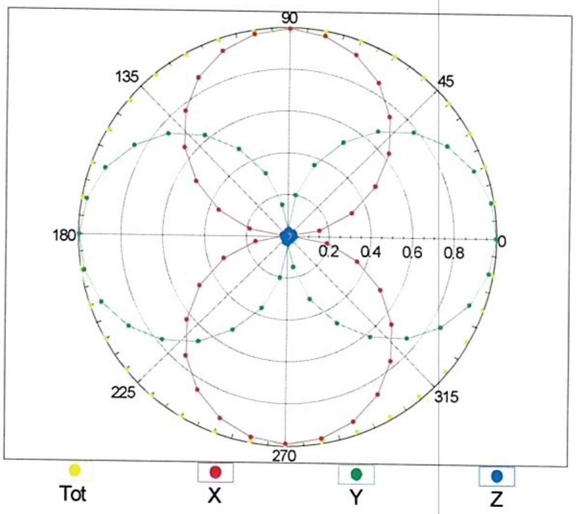
	C1 fF	C2 fF	α V^{-1}	T1 $ms.V^{-2}$	T2 $ms.V^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	69.7	459.14	36.77	12.98	0.88	4.99	0.00	0.00	1.00
Y	65.8	429.68	36.14	14.23	1.01	5.00	0.55	0.45	1.01
Z	54.9	365.02	37.34	10.96	0.61	5.02	0.74	0.30	1.00

Other Probe Parameters

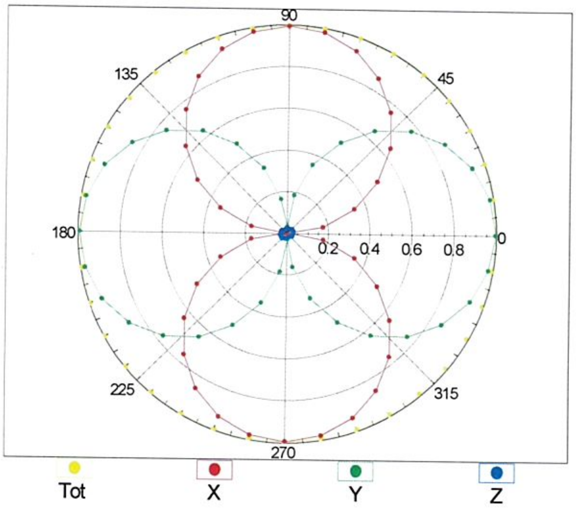
Sensor Arrangement	Rectangular
Connector Angle (°)	150.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	12 mm
Tip Length	25 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	1.5 mm
Probe Tip to Sensor Y Calibration Point	1.5 mm
Probe Tip to Sensor Z Calibration Point	1.5 mm

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM,0°

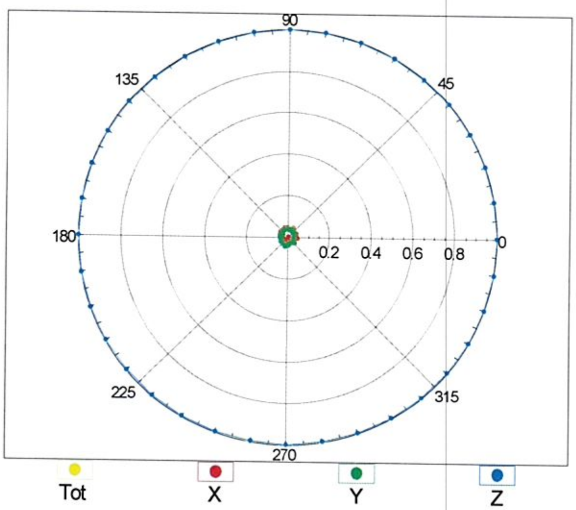


f=1800 MHz,R22,0°



Receiving Pattern (ϕ), ϑ = 90°

f=600 MHz,TEM,90°



f=1800 MHz,R22,90°