Test Report No.: R2003A0142-H1

EF3DV3 - SN:4048

February 27, 2020

10870	AAC	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2	5.86	± 9.6 %
10871	AAC	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2	5.75	± 9.6 %
10872	AAC	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	TDD 5G NR FR2	6.52	± 9.6 %
10873	AAC	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	TDD 5G NR FR2	6.61	± 9.6 %
10874	AAC	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	TDD		
10875	AAC		5G NR FR2 TDD	6.65	± 9.6 %
		5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	7.78	± 9.6 %
10876	AAC	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2	8.39	± 9.6 %
10877	AAC	5G NR (CP-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2	7.95	± 9.6 %
10878	AAC	5G NR (CP-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2	8.41	± 9.6 %
10879	AAC	5G NR (CP-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2	8.12	± 9.6 %
10880	AAC	5G NR (CP-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.38	± 9.6 %
10881	AAC	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2	5.75	± 9.6 %
10882	AAC	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2	5.96	± 9.6 %
10883	AAC	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2	6.57	± 9.6 %
10884	AAC	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2	6.53	± 9.6 %
10885	AAC	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2	6.61	± 9.6 %
10886	AAC	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2	6.65	± 9.6 %
10887	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2	7.78	± 9.6 %
10888	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2	8.35	± 9.6 %
10889	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2	8.02	± 9.6 %
10890	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2	8.40	± 9.6 %
10891	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2	8.13	± 9.6 %
10892	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.41	± 9.6 %

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Certificate No: EF3-4048_Feb20



ANNEX D: CD835V3 Dipole Calibration Certificate

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

Client

TA-SH (Auden)

Certificate No: CD835V3-1133_Nov17

Object	CD835V3 - SN: 1	133	
Calibration procedure(s)	QA CAL-20.v6 Calibration proce	dure for dipoles in air	
Calibration date:	November 22, 20	017	
This calibration certificate document	ents the traceability to nati	onal standards, which realize the physical uni	ts of measurements (SI).
The measurements and the unce	rtainties with confidence p	robability are given on the following pages and	d are part of the certificate.
All calibrations have been conduc	cted in the closed laborator	ry 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	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Probe ER3DV6	SN: 2336	30-Dec-16 (No. ER3-2336_Dec16)	Dec-17
DAE4	SN: 781	13-Jul-17 (No. DAE4-781_Jul17)	Jul-18
	ID#	Check Date (in house)	Scheduled Check
Secondary Standards	SN: GB42420191	09-Oct-09 (in house check Oct-17)	In house check: Oct-20
		05-Jan-10 (in house check Oct-17)	In house check: Oct-20
Power meter Agilent 4419B	SN: US38485102	US-Jan-10 (in house check Oct-17)	
Power meter Agilent 4419B Power sensor HP E4412A	SN: US38485102 SN: US37295597	09-Oct-09 (in house check Oct-17)	In house check: Oct-20
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A	Company of the Compan		In house check: Oct-20 In house check: Oct-20
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: US37295597	09-Oct-09 (in house check Oct-17)	
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: US37295597 SN: 832283/011	09-Oct-09 (in house check Oct-17) 27-Aug-12 (in house check Oct-17)	In house check: Oct-20
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: US37295597 SN: 832283/011 SN: US37390585	09-Oct-09 (in house check Oct-17) 27-Aug-12 (in house check Oct-17) 18-Oct-01 (in house check Oct-17)	In house check: Oct-20 In house check: Oct-18
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer HP 8753E	SN: US37295597 SN: 832283/011 SN: US37390585 Name	09-Oct-09 (in house check Oct-17) 27-Aug-12 (in house check Oct-17) 18-Oct-01 (in house check Oct-17) Function	In house check: Oct-20 In house check: Oct-18

Certificate No: CD835V3-1133_Nov17

Page 1 of 5



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

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-C63.19-2011 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 HP 8753E 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 ER3D-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: CD835V3-1133_Nov17

Page 2 of 5



Measurement Conditions

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

DASY Version	DASY5	V52.10.0
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	15 mm	
Scan resolution	dx, dy = 5 mm	
Frequency	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	106.6 V/m = 40.56 dBV/m
Maximum measured above low end	100 mW input power	104.9 V/m = 40.42 dBV/m
Averaged maximum above arm	100 mW input power	105.8 V/m ± 12.8 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

Frequency	Return Loss	Impedance
800 MHz	16.1 dB	40.1 Ω - 10.1 jΩ
835 MHz	28.4 dB	$52.7 \Omega + 2.8 j\Omega$
900 MHz	17.0 dB	48.5 Ω - 14.0 jΩ
950 MHz	20.0 dB	49.4 Ω + 10.0 jΩ
960 MHz	15.0 dB	61.5 Ω + 16.3 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.

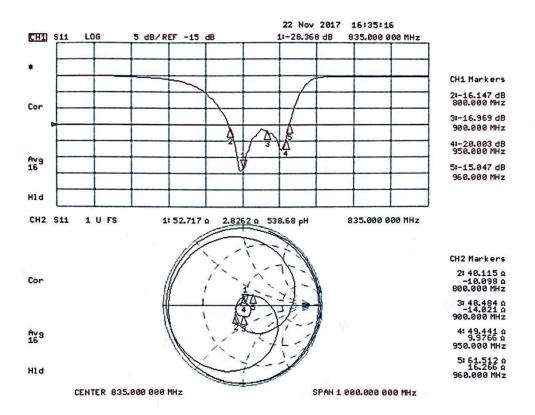
Certificate No: CD835V3-1133_Nov17

Page 3 of 5





Impedance Measurement Plot



Report No.: R2003A0142-H1

DASY5 E-field Result

Date: 22.11.2017

Test Laboratory: SPEAG Lab2

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1133

Communication System: UID 0 - CW; Frequency: 835 MHz Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: RF Section

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

DASY52 Configuration:

- Probe: ER3DV6 SN2336; ConvF(1, 1, 1); Calibrated: 30.12.2016;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 13.07.2017
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole E-Field measurement @ 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 = 109.1 V/m; Power Drift = -0.00 dB

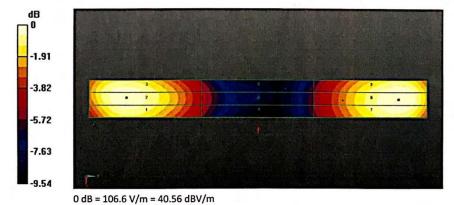
Applied MIF = 0.00 dB

RF audio interference level = 40.56 dBV/m

Emission category: M3

MIF scaled E-field

Grid 1 M3	Grid 2 M3	Grid 3 M3
40.18 dBV/m	40.42 dBV/m	40.33 dBV/m
Grid 4 M4	Grid 5 M4	Grid 6 M4
35.75 dBV/m	35.91 dBV/m	35.79 dBV/m
Grid 7 M3	Grid 8 M3	Grid 9 M3
40.44 dBV/m	40.56 dBV/m	40.39 dBV/m



Certificate No: CD835V3-1133_Nov17

Page 5 of 5



ANNEX E: CD1880V3 Dipole Calibration Certificate

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

TA-SH (Auden)

Certificate No: CD1880V3-1115_Nov17

Power meter NRP SN: 104778 04-Apr-17 (No. 217-02521/02522) Apr-18 Power sensor NRP-Z91 SN: 103244 04-Apr-17 (No. 217-02521) Apr-18 Power sensor NRP-Z91 SN: 103245 04-Apr-17 (No. 217-02522) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) 07-Apr-17 (No. 217-02528) Apr-18 Type-N mismatch combination SN: 5047.2 / 06327 07-Apr-17 (No. 217-02529) Apr-18 Probe ER3DV6 SN: 2336 30-Dec-16 (No. ER3-2336_Dec16) Dec-17 DAE4 SN: 781 13-Jul-17 (No. DAE4-781_Jul17) Jul-18 Secondary Standards ID # Check Date (in house) Scheduled Check Power meter Agilent 4419B SN: GB42420191 09-Oct-09 (in house check Oct-17) In house check: 05-Jan-10 (in house check Oct-17) In hou	Object	CD1880V3 - SN:	1115	
Calibration date: November 22, 2017 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certifical for 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) Prower meter NRP Power meter NRP SN: 104778 04-Apr-17 (No. 217-02521/02522) Apr-18 Power sensor NRP-Z91 SN: 103244 04-Apr-17 (No. 217-02521) Apr-18 Power sensor NRP-Z91 SN: 103245 04-Apr-17 (No. 217-02522) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) 07-Apr-17 (No. 217-02528) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) 07-Apr-17 (No. 217-02529) Apr-18 Frobe ER3DV6 SN: 2336 30-Dec-16 (No. ER3-2336_Dec16) Dec-17 DAE4 SN: 781 13-Jul-17 (No. DAE4-781_Jul17) Jul-18 Secondary Standards ID # Check Date (in house) Scheduled Check Power sensor HP 8482A SN: US38485102 05-Jan-10 (in house check Oct-17) In house check: Network Analyzer HP 8753E SN: US37390585 18-Oct-09 (in house check Oct-17) In house check: Network Analyzer HP 8753E SN: US37390585 18-Oct-01 (in house check Oct-17) In house check: Leif Klysner Leif Klysner Leif Klysner Laboratory Technician	Calibration procedure(s)	QA CAL-20.v6	and the first was deleted by the second of the	
Calibration date: November 22, 2017 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certifical for 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) Prower meter NRP Power meter NRP SN: 104778 04-Apr-17 (No. 217-02521/02522) Apr-18 Power sensor NRP-291 SN: 103244 04-Apr-17 (No. 217-02521) Apr-18 Power sensor NRP-291 SN: 103245 04-Apr-17 (No. 217-02522) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) 07-Apr-17 (No. 217-02528) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) 07-Apr-17 (No. 217-02529) Apr-18 Probe ER3DV6 SN: 2336 30-Dec-16 (No. ER3-2336_Dec16) Dec-17 DAE4 SN: 781 13-Jul-17 (No. DAE4-781_Jul17) Jul-18 Secondary Standards ID # Check Date (in house) Scheduled Check Power sensor HP 8482A SN: US38485102 05-Jan-10 (in house check Oct-17) In house check: Nework Analyzer HP 8753E SN: US37390585 18-Oct-09 (in house check Oct-17) In house check: Network Analyzer HP 8753E SN: US37390585 18-Oct-01 (in house check Oct-17) In house check: Leif Klysner Leif Klysner Leif Klysner Laboratory Technician		Calibration proce	dure for dipoles in air	
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 certifical 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 (No. 217-02521/02522) Apr-18 Power meter NRP SN: 104778 SN: 104778 O4-Apr-17 (No. 217-02521) Apr-18 Power sensor NRP-Z91 SN: 103244 O4-Apr-17 (No. 217-02521) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) O7-Apr-17 (No. 217-02529) Apr-18 Type-N mismatch combination SN: 5047.2 / 06327 O7-Apr-17 (No. 217-02529) Apr-18 Probe ER3DV6 SN: 2336 30-Dec-16 (No. ER3-2336_Dec16) Dec-17 DAE4 SN: 781 13-Jul-17 (No. DAE4-781_Jul17) Jul-18 Secondary Standards ID # Check Date (in house) Scheduled Check Power meter Agilent 4419B SN: GB42420191 O9-Oct-09 (in house check Oct-17) In house check: 10 house check Oct-17 In house check: 10 house check Oct-17 RF generator R&S SMT-06 SN: 832283/011 SN: US38495102 O5-Jan-10 (in house check Oct-17) In house check: 10 house check Oct-17 In house check: 10 house check Oct-17 Network Analyzer HP 8753E SN: US37390585 SN: US37390585 SN: US37390585 SN: US37390585 Refunction Signature Calibrated by:				
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 certifical for 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 (No. 217-02521/02522) Apr-18 Power meter NRP SN: 104778 SN: 104778 O4-Apr-17 (No. 217-02521) Apr-18 Power sensor NRP-Z91 SN: 103244 O4-Apr-17 (No. 217-02521) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) O7-Apr-17 (No. 217-02529) Apr-18 Probe ER3DV6 SN: 2336 SN: 2336 30-Dec-16 (No. ER3-2336_Dec16) Dec-17 DAE4 SN: 781 13-Jul-17 (No. DAE4-781_Jul17) Jul-18 Secondary Standards ID # Check Date (in house) Scheduled Check Power sensor HP E4412A SN: US38485102 O5-Jan-10 (in house check Oct-17) In house check: 10 house check Oct-17 In house check: 10 house check Oct-17 In house check: 11 house check: 11 house check Oct-17 Network Analyzer HP 8753E Network Analyzer HP 8753E Name Function Signature Calibrated by:				
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificat NI 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 Shippers of the Calibration Shippers of Calibra	Calibration date:	November 22, 20	017	
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificat 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 #			The second secon	
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) Prower meter NRP SN: 104778 04-Apr-17 (No. 217-02521/02522) Apr-18 Prower sensor NRP-Z91 SN: 103244 04-Apr-17 (No. 217-02521) Apr-18 Prower sensor NRP-Z91 SN: 103245 04-Apr-17 (No. 217-02522) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) 07-Apr-17 (No. 217-02528) Apr-18 Type-N mismatch combination SN: 5047.2 / 06327 07-Apr-17 (No. 217-02529) Apr-18 Probe ER3DV6 SN: 2336 30-Dec-16 (No. ER3-2336_Dec16) Dec-17 DAE4 SN: 781 13-Jul-17 (No. DAE4-781_Jul17) Jul-18 Secondary Standards ID # Check Date (in house) Scheduled Check Secondary Standards Prower sensor HP E4412A SN: US38485102 05-Jan-10 (in house check Oct-17) In house check: Not-17 Prower sensor HP 8482A SN: US37295597 09-Oct-09 (in house check Oct-17) In house check: Not-17 Network Analyzer HP 8753E SN: US37390585 18-Oct-01 (in house check Oct-17) In house check: Not-17 Name Function Signature Calibrated by:	his calibration certificate docum	ents the traceability to nation	onal standards, which realize the physical un	ts of measurements (SI).
Calibration Equipment used (M&TE critical for calibration) ID # Cal Date (Certificate No.) Scheduled Calibration	he measurements and the unce	ertainties with confidence p	robability are given on the following pages an	d are part of the certificate.
Calibration Equipment used (M&TE critical for calibration) ID #				
D # Cal Date (Certificate No.) Scheduled Calibration	ul calibrations have been condu	cted in the closed laborator	ry facility: environment temperature (22 ± 3)°C	and humidity < 70%.
D # Cal Date (Certificate No.) Scheduled Calibration				
Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 SN: 103244 O4-Apr-17 (No. 217-02521) Apr-18 Power sensor NRP-Z91 SN: 103245 O4-Apr-17 (No. 217-02521) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) O7-Apr-17 (No. 217-02528) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) SN: 5058 (20k) SN: 5047.2 / 06327 O7-Apr-17 (No. 217-02529) Apr-18 Probe ER3DV6 DAE4 SN: 2336 SO-Dec-16 (No. ER3-2336_Dec16) Dec-17 DAE4 SN: 781 D# Check Date (in house) Scheduled Check Power meter Agilent 4419B SN: GB42420191 SN: GB42420191 SN: US38485102 SN: US38485102 SN: US38485102 SN: US37295597 O9-Oct-09 (in house check Oct-17) Newer sensor HP 8482A SN: US37295597 O9-Oct-09 (in house check Oct-17) Network Analyzer HP 8753E SN: US37390585				
Power sensor NRP-Z91				Scheduled Calibration
Power sensor NRP-Z91 SN: 103245 04-Apr-17 (No. 217-02522) Apr-18 Reference 20 dB Attenuator SN: 5058 (20k) 07-Apr-17 (No. 217-02528) Apr-18 Type-N mismatch combination SN: 5047.2 / 06327 07-Apr-17 (No. 217-02529) Apr-18 Probe ER3DV6 SN: 2336 30-Dec-16 (No. ER3-2336_Dec16) Dec-17 DAE4 SN: 781 13-Jul-17 (No. DAE4-781_Jul17) Jul-18 Secondary Standards ID # Check Date (in house) Scheduled Check: Power meter Agilent 4419B SN: GB42420191 09-Oct-09 (in house check Oct-17) In house check: Nower sensor HP E4412A SN: US33485102 05-Jan-10 (in house check Oct-17) In house check: Nower Sensor HP 8482A SN: US37295597 09-Oct-09 (in house check Oct-17) In house check: Network Analyzer HP 8753E SN: US37390585 18-Oct-01 (in house check Oct-17) In house check: Name Function Signature Calibrated by: Leif Klysner Laboratory Technician	horacean communication		04-Apr-17 (No. 217-02521/02522)	Apr-18
Reference 20 dB Attenuator			04-Apr-17 (No. 217-02521)	Apr-18
Secondary Standards ID # Check Date (in house) Sover sensor HP E4412A Sover sensor HP 8482A Signature Signature Calibrated by: Signature	ower sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
SN: 2336 30-Dec-16 (No. ER3-2336_Dec16) Dec-17 SN: 781 13-Jul-17 (No. DAE4-781_Jul17) Jul-18 Secondary Standards ID # Check Date (in house) Scheduled Check Power meter Agilent 4419B SN: GB42420191 09-Oct-09 (in house check Oct-17) In house check: 000 Source sensor HP E4412A SN: US38485102 05-Jan-10 (in house check Oct-17) In house check: 000 SN: US37295597 09-Oct-09 (in house check Oct-17) In house check: 000 SN: 832283/011 27-Aug-12 (in house check Oct-17) In house check: 000 SN: 832283/011 27-Aug-12 (in house check Oct-17) In house check: 000 SN: WS37390585 18-Oct-01 (in house check Oct-17) In house check: 000 SN: WS37390585 18-Oct-01 (in house check Oct-17) In house check: 000 SN: WS37390585 18-Oct-01 (in house check Oct-17) In house check: 000 SN: WS37390585 18-Oct-01 (in house check Oct-17) In house check: 000 SN: WS37390585 18-Oct-01 (in house check Oct-17) In house check: 000 SN: WS37390585 18-Oct-01 (in house check Oct-17) In house check: 000 SN: WS37390585 18-Oct-01 (in house check Oct-17) In house check: 000 SN: WS37390585 18-Oct-01 (in house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS37390585 In house check Oct-17) In house check: 000 SN: WS3739058	leference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Secondary Standards ID # Check Date (in house) Scheduled Check Power meter Agilent 4419B SN: GB42420191 SN: US38485102 SS-Jan-10 (in house check Oct-17) In house check: Oct-17) In house ch	ype-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Secondary Standards ID # Check Date (in house) Scheduled Check Power meter Agilent 4419B Power sensor HP E4412A SN: US38485102 SN: US37295597 SN: US37390585 IB-Oct-01 (in house check Oct-17) In house check: Network Analyzer HP 8753E Name Function Signature Calibrated by: Leif Klysner Laboratory Technician	Probe ER3DV6	SN: 2336	30-Dec-16 (No. ER3-2336_Dec16)	Dec-17
Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A SN: US38485102 SN: US37295597 SN: US37390585 SN: US3739	DAE4	SN: 781	13-Jul-17 (No. DAE4-781_Jul17)	Jul-18
Power meter Agilent 4419B SN: GB42420191 O9-Oct-09 (in house check Oct-17) In house check: SN: US38485102 O5-Jan-10 (in house check Oct-17) In house check: Power sensor HP 8482A SN: US37295597 O9-Oct-09 (in house check Oct-17) In house check: In hous	Secondary Standards	lın#	Chack Data (in house)	0.1.1.1.0
Power sensor HP E4412A Power sensor HP 8482A SN: US38485102 O5-Jan-10 (in house check Oct-17) In house check: SN: US37295597 O9-Oct-09 (in house check Oct-17) In house check:				
Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer HP 8753E Name SN: US37295597 O9-Oct-09 (in house check Oct-17) In house check: Ott-17) In house check: Ott-17 In		10.00.000 to 0.000 to		
RF generator R&S SMT-06 Network Analyzer HP 8753E Name SN: 832283/011 27-Aug-12 (in house check Oct-17) In house check: In	OHE SCHOOL IN LATIZA			
Network Analyzer HP 8753E SN: US37390585 18-Oct-01 (in house check Oct-17) In house check: Name Function Signature Calibrated by: Laboratory Technician	Power sensor HP 9/92A			
Name Function Signature Calibrated by: Leif Klysner Laboratory Technician		The second consequence of the second consequ	- ''' (1) - ''' (1) - ''' (1) - ''' (1) - ''' (1) - ''' (1) - ''' (1) - ''' (1) - ''' (1) - ''' (1) - ''' (1) - '''' (1) - ''' (1) - ''' (1) - '' (1) - '' (1) - ''' (1) - ''' (1) - ''' (1) - ''' (1) - ''' (1) - '	In house check: Oct-20
Calibrated by: Leif Klysner Laboratory Technician Signature Laboratory Technician	RF generator R&S SMT-06	I SN: US3/390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18
Seffly	RF generator R&S SMT-06			Signature
Approved by: Katja Pokovic Technical Manager	RF generator R&S SMT-06	4	Function	
Approved by: Katja Pokovic Technical Manager	RF generator R&S SMT-06 Network Analyzer HP 8753E	Name		2:060
Approved by: Technical Manager	RF generator R&S SMT-06 Network Analyzer HP 8753E	Name		Si Mer
	RF generator R&S SMT-06 Network Analyzer HP 8753E	Name		Sel My
	RF generator R&S SMT-06 Network Analyzer HP 8753E Calibrated by:	Name Leif Klysner	Laboratory Technician	Sel Mar
	RF generator R&S SMT-06 Network Analyzer HP 8753E Calibrated by:	Name Leif Klysner	Laboratory Technician	Sel My
Issued: Novembe	RF generator R&S SMT-06 Network Analyzer HP 8753E Calibrated by:	Name Leif Klysner	Laboratory Technician	Seller-

Certificate No: CD1880V3-1115_Nov17

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

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

References

 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 HP 8753E 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 ER3D-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: CD1880V3-1115_Nov17 Page 2 of 5

TA Technology (Shanghai) Co., Ltd.

TA-MB-04-001H

Page 66 of 74



Measurement Conditions

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

DASY Version	DASY5	V52.10.0
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	15 mm	
Scan resolution	dx, dy = 5 mm	
Frequency	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	90.5 V/m = 39.13 dBV/m
Maximum measured above low end	100 mW input power	87.8 V/m = 38.87 dBV/m
Averaged maximum above arm	100 mW input power	89.2 V/m ± 12.8 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

Frequency	Return Loss	Impedance
1730 MHz	31.0 dB	52.8 Ω - 0.7 jΩ
1880 MHz	21.1 dB	$51.9 \Omega + 8.8 j\Omega$
1900 MHz	21.6 dB	$54.2 \Omega + 7.6 j\Omega$
1950 MHz	29.7 dB	$52.3 \Omega + 2.4 j\Omega$
2000 MHz	18.9 dB	46.8 Ω + 10.6 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.

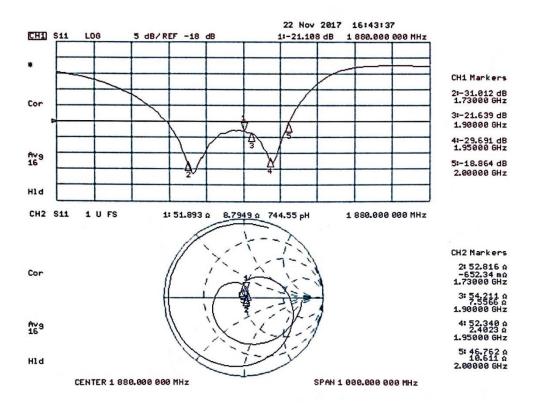
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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

Certificate No: CD1880V3-1115_Nov17 Page 3 of 5



Impedance Measurement Plot



Certificate No: CD1880V3-1115_Nov17

Page 4 of 5



DASY5 E-field Result

Date: 22.11.2017

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1115

Communication System: UID 0 - CW ; Frequency: 1880 MHz Medium parameters used: σ = 0 S/m, ϵ_r = 1; ρ = 1000 kg/m³

Phantom section: RF Section

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

DASY52 Configuration:

- Probe: ER3DV6 SN2336; ConvF(1, 1, 1); Calibrated: 30.12.2016;
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 13.07.2017
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

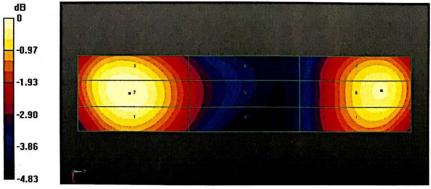
Dipole E-Field measurement @ 1880MHz/E-Scan - 1880MHz d=15mm/Hearing Aid Compatibility Test (41x181x1):

Interpolated grid: dx=0.5000 mm, dy=0.5000 mm Device Reference Point: 0, 0, -6.3 mm Reference Value = 155.7 V/m; Power Drift = -0.01 dB Applied MIF = 0.00 dB RF audio interference level = 39.13 dBV/m

Emission category: M2

MIF scaled E-field

Grid 1 M2	Grid 2 M2	Grid 3 M2
38.94 dBV/m	39.13 dBV/m	39.02 dBV/m
Grid 4 M2	Grid 5 M2	Grid 6 M2
36.82 dBV/m	36.95 dBV/m	36.82 dBV/m
Grid 7 M2	Grid 8 M2	Grid 9 M2
38.67 dBV/m	38.87 dBV/m	38.79 dBV/m



0 dB = 90.50 V/m = 39.13 dBV/m

Certificate No: CD1880V3-1115_Nov17

Page 5 of 5



Report No.: R2003A0142-H1

ANNEX F: DAE4 Calibration Certificate



Tel: +86-10-62304633-2512 E-mail: cttl@chinattl.com

Fax: +86-10-62304633-2504 Http://www.chinattl.cn

Client :

TA(Shanghai)

Certificate No: Z20-60078

CALIBRATION CERTIFICATE

Object

DAE4 - SN: 1291

Calibration Procedure(s)

FF-Z11-002-01

Calibration Procedure for the Data Acquisition Electronics

Calibration date:

February 24, 2020

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)

Lin Hao

Qi Dianyuan

Primary Standards	ID#	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration	
Process Calibrator 753	1971018	24-Jun-19 (CTTL, No.J19X05126)	Jun-20	

SAR Test Engineer

Calibrated by:

Name **Function** SAR Test Engineer Yu Zongying

Reviewed by:

Approved by:

SAR Project Leader

Issued: February 26, 2020

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

Certificate No: Z20-60078

Page 1 of 3





Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504 E-mail: cttl@chinattl.com Http://www.chinattl.cn

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 report provide only calibration results for DAE, it does not contain other performance test results.

Certificate No: Z20-60078

Page 2 of 3



Test Report No.: R2003A0142-H1



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: ettl@chinattl.com Http://www.chinattl.cn

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: $1LSB = 6.1 \mu V$, full range = -100...+300 mVLow Range: 1LSB = 61 nV, full range = -1......+3 mVDASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	х	Y 403.248 ± 0.15% (k=2)	z	
High Range	402.573 ± 0.15% (k=2)		403.162 ± 0.15% (k=2)	
Low Range	3.97616 ± 0.7% (k=2)	3.98005 ± 0.7% (k=2)	3.97509 ± 0.7% (k=2)	

Connector Angle

Connector Angle to be used in DASY system	166.5° ± 1 °
---	--------------

Certificate No: Z20-60078



ANNEX G: The EUT Appearances and Test Configuration



Picture 1: Constituents of EUT



Report No.: R2003A0142-H1



Picture 2: Test Setup