



DASY5 E-field Result

Date: 24.08.2021

Test Laboratory: SPEAG Lab2

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

Communication System: UID 0 - CW; Frequency: 1880 MHz Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m³ Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

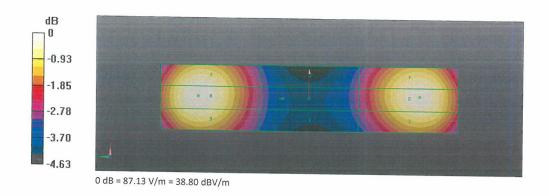
- Probe: EF3DV3 SN4013; ConvF(1, 1, 1) @ 1880 MHz; Calibrated: 28.12.2020
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 23.12.2020
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 155.6 V/m; Power Drift = 0.00 dB Applied MIF = 0.00 dB RF audio interference level = 38.80 dBV/m Emission category: M2

MIF scaled E-field

Grid 1 M2	Grid 2 M2	Grid 3 M2
38.62 dBV/m	38.7 dBV/m	38.43 dBV/m
Grid 4 M2	Grid 5 M2	Grid 6 M2
35.91 dBV/m	35.94 dBV/m	35.82 dBV/m
Grid 7 M2	Grid 8 M2	Grid 9 M2
38.69 dBV/m	38.8 dBV/m	38.53 dBV/m



Certificate No: CD1880V3-1018_Aug21

Page 5 of 5





Dipole 2450 MHz

ccredited by the Swiss Accreditatio		S S S S	Swiss Calibration Service
he Swiss Accreditation Service is lultilateral Agreement for the rec	s one of the signatories	s to the EA	ccreditation No.: SCS 0108
lient CTTL (Auden)		Certificate No	»: CD2450V3-1021_Aug2
CALIBRATION C	ERTIFICATI	E	
Object	CD2450V3 - SN:	1021	
Calibration procedure(s)	QA CAL-20.v7 Calibration Proce	edure for Validation Sources in ai	r
Calibration date:	August 24, 2021		
All calibrations have been conducte	ed in the closed laborator	y facility: environment temperature $(22 \pm 3)^{\circ}$	C and humidity < 70%.
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards	ed in the closed laborator E critical for calibration)	y facility: environment temperature (22 ± 3)°r Cal Date (Certificate No.)	C and humidity < 70%. Scheduled Calibration
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP	ed in the closed laborator = critical for calibration) ID # SN: 104778	y facility: environment temperature (22 ± 3)° Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292)	Scheduled Calibration Apr-22
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244	y facility: environment temperature (22 ± 3)° <u>Cal Date (Certificate No.)</u> 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291)	Scheduled Calibration Apr-22 Apr-22
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	y facility: environment temperature (22 ± 3)° Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292)	Scheduled Calibration Apr-22 Apr-22 Apr-22
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	ed in the closed laborator Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	y facility: environment temperature (22 ± 3)° Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	ed in the closed laborator Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327	y facility: environment temperature (22 ± 3)% Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3	ed in the closed laborator Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	y facility: environment temperature (22 ± 3)° Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013	y facility: environment temperature (22 ± 3)° Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. EF3-4013_Dec20)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID # ID # SN: GB42420191	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. DAE4-781_Dec20) 23-Dec-20 (No. DAE4-781_Dec20)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Dec-21
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID # ID # SN: GB42420191 SN: US38485102	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-20 (No. 217-03344) 28-Dec-20 (No. EF3-4013_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Dec-21 Scheduled Check
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID # SN: GB42420191 SN: US38485102 SN: US37295597	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. EF3-4013_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Dec-21 Scheduled Check In house check: Oct-23
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 03245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID # SN: GB42420191 SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005	y facility: environment temperature (22 ± 3)°(Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. EF3-4013_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23
All calibrations have been conducte Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID # SN: GB42420191 SN: US38485102 SN: US37295597	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. EF3-4013_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
All calibrations have been conducte Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP E4412A Power sensor HP E442A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID # ID # SN: GB42420191 SN: US38485102 SN: US37295597 SN: US37295597 SN: US37033/005 SN: US41080477 Name	y facility: environment temperature (22 ± 3)° Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. DEF3-4013_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
All calibrations have been conducte Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP E4412A Power sensor HP E442A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID # SN: GB42420191 SN: US38485102 SN: US37295597 SN: US37295597 SN: US41080477	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. EF3-4013_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23
The measurements and the uncerta All calibrations have been conducte Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID # ID # SN: GB42420191 SN: US38485102 SN: US37295597 SN: US37295597 SN: US37033/005 SN: US41080477 Name	y facility: environment temperature (22 ± 3)° Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. DEF3-4013_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23
All calibrations have been conducte Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	ed in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH3934 (20k) SN: 310982 / 06327 SN: 4013 SN: 781 ID # SN: GB42420191 SN: US38485102 SN: US3729597 SN: 837633/005 SN: US41080477 Name Leif Klysner	y facility: environment temperature (22 ± 3)° Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. DEF3-4013_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) 23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23

Certificate No: CD2450V3-1021_Aug21

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

S

С

S

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

References

- [1] ANSI-C63.19-2019 (ANSI-C63.19-2011)
- American National Standard, Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

Methods Applied and Interpretation of Parameters:

- Coordinate System: y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with the standards [1], the measurement planes (probe sensor center) are selected to be at a distance of 15 mm above the top metal edge of the dipole arms.
- Measurement Conditions: Further details are available from the hardcopies at the end of the certificate. All
 figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector
 is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a
 directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- Antenna Positioning: The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections. It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY5 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- Feed Point Impedance and Return Loss: These parameters are measured using a Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- E-field distribution: E field is measured in the x-y-plane with an isotropic E-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 15 mm (in z) above the metal top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, in the plane above the dipole surface.

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

Certificate No: CD2450V3-1021_Aug21

Page 2 of 5





Measurement Conditions

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

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

Maximum Field values at 2450 MHz

E-field 15 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW input power	85.9 V/m = 38.68 dBV/m
Maximum measured above low end	100 mW input power	84.5 V/m = 38.54 dBV/m
Averaged maximum above arm	100 mW input power	85.2 V/m ± 12.8 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

Frequency	Return Loss	Impedance
2250 MHz	18.3 dB	63.1 Ω + 4.0 jΩ
2350 MHz	29.5 dB	52.5 Ω - 2.4 jΩ
2450 MHz	29.8 dB	53.2 Ω - 1.1 jΩ
2550 MHz	31.8 dB	50.7 Ω - 2.5 jΩ
2650 MHz	18.6 dB	61.1 Ω - 6.8 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.

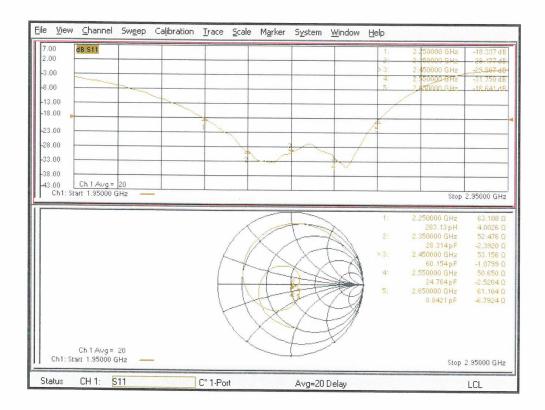
Certificate No: CD2450V3-1021_Aug21

Page 3 of 5





Impedance Measurement Plot



Page 4 of 5





DASY5 E-field Result

Date: 24.08.2021

Test Laboratory: SPEAG Lab2

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

Communication System: UID 0 - CW ; Frequency: 2450 MHz Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 0$ kg/m³ Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

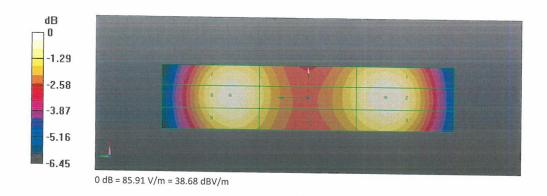
DASY52 Configuration:

- Probe: EF3DV3 SN4013; ConvF(1, 1, 1) @ 2450 MHz; Calibrated: 28.12.2020
- 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 @ 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 = 74.90 V/m; Power Drift = -0.00 dB Applied MIF = 0.00 dB RF audio interference level = 38.68 dBV/m Emission category: M2

MIF scaled E-fi		
		Grid 3 M2 38.44 dBV/m
Grid 4 M2 37.64 dBV/m		Grid 6 M2 37.55 dBV/m
Grid 7 M2 38.42 dBV/m		Grid 9 M2 38.3 dBV/m



Certificate No: CD2450V3-1021_Aug21

Page 5 of 5





Dipole 2600 MHz

eulted by the office i teer earlier	Service (SAS)		editation No.: SCS 0108
Swiss Accreditation Service is o tilateral Agreement for the recog	ne of the signatories to nition of calibration ce	o the EA rtificates	
nt CTTL (Auden)		Certificate No: C	CD2600V3-1017_Aug21
ALIBRATION CE	RTIFICATE		
bject	CD2600V3 - SN: 1	1017	
alibration procedure(s)	QA CAL-20.v7 Calibration Procee	dure for Validation Sources in air	
alibration date:	August 24, 2021		
bis calibration certificate document	s the traceability to natio	onal standards, which realize the physical units	of measurements (SI).
he measurements and the uncerta	inties with confidence pr	obability are given on the following pages and	are part of the certificate.
1	d in the alaced laborator	y facility: environment temperature $(22 \pm 3)^{\circ}C$	and humidity < 70%.
All calibrations have been conducte	a in the closed laborator	j raomy. on the other	
Calibration Equipment used (M&TE	critical for calibration)		o i i i o l'hadion
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration Apr-22
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22 Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03243)	Apr-22
	SN: BH9394 (20k) SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference 20 dB Attenuator			D 01
Type-N mismatch combination	and a second	28-Dec-20 (No. EF3-4013_Dec20)	Dec-21
Type-N mismatch combination Probe EF3DV3	SN: 3103027 00027 SN: 4013 SN: 781	28-Dec-20 (No. EF3-4013_Dec20) 23-Dec-20 (No. DAE4-781_Dec20)	Dec-21 Dec-21
Type-N mismatch combination Probe EF3DV3 DAE4	SN: 4013 SN: 781	23-Dec-20 (No. DAE4-781_Dec20)	
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards	SN: 4013 SN: 781 ID #	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house)	Dec-21 Scheduled Check In house check: Oct-23
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B	SN: 4013 SN: 781	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20)	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A	SN: 4013 SN: 781	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20)	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A	SN: 4013 SN: 781	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20)	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: 4013 SN: 781 ID # SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20)	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A	SN: 4013 SN: 781 SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005 SN: US41080477	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 4013 SN: 781 ID # SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20)	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-21
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06	SN: 4013 SN: 781 SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005 SN: US41080477 Name	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-21
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 4013 SN: 781 SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005 SN: US41080477 Name	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-21
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: 4013 SN: 781 SN: 781 SN: GB42420191 SN: US38485102 SN: US37295597 SN: 837633/005 SN: US41080477 Name Leif Klysner	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Laboratory Technician	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-21 Signature
Type-N mismatch combination Probe EF3DV3 DAE4 Secondary Standards Power meter Agilent 4419B Power sensor HP E4412A Power sensor HP 8482A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by: Approved by:	SN: 4013 SN: 781 SN: 781 SN: GB42420191 SN: US38485102 SN: US37295597 SN: US37295597 SN: US37295597 SN: US41080477 Name Leif Klysner Katja Pokovic	23-Dec-20 (No. DAE4-781_Dec20) Check Date (in house) 09-Oct-09 (in house check Oct-20) 05-Jan-10 (in house check Oct-20) 09-Oct-09 (in house check Oct-20) 10-Jan-19 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Laboratory Technician	Dec-21 Scheduled Check In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-23 In house check: Oct-21 Signature





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



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

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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

References

- ANSI-C63.19-2019 (ANSI-C63.19-2011) [1]
- American National Standard, Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids

Methods Applied and Interpretation of Parameters:

- Coordinate System: y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with the standards [1], the measurement planes (probe sensor center) are selected to be at a distance of 15 mm above the top metal edge of the dipole arms.
- Measurement Conditions: Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- Antenna Positioning: The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections. It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY5 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- Feed Point Impedance and Return Loss: These parameters are measured using a Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- E-field distribution: E field is measured in the x-y-plane with an isotropic E-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 15 mm (in z) above the metal top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any nonparallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, in the plane above the dipole surface.

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

Page 2 of 5

Certificate No: CD2600V3-1017_Aug21

©Copyright. All rights reserved by CTTL.





Measurement Conditions

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

Jii page 1.	
DASY5	V52.10.4
HAC Test Arch	
15 mm	
dx, dy = 5 mm	
2600 MHz ± 1 MHz	
< 0.05 dB	
	DASY5 HAC Test Arch 15 mm dx, dy = 5 mm 2600 MHz ± 1 MHz

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	85.5 V/m = 38.64 dBV/m
Maximum measured above low end	100 mW input power	85.0 V/m = 38.59 dBV/m
Averaged maximum above arm	100 mW input power	85.2 V/m ± 12.8 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

Frequency	Return Loss	Impedance
2450 MHz	24.2 dB	44.3 Ω + 1.2 jΩ
2550 MHz	22.5 dB	57.0 Ω + 3.9 jΩ
2600 MHz	20.8 dB	59.5 Ω - 3.2 jΩ
2650 MHz	19.6 dB	55.3 Ω - 9.7 jΩ
2750 MHz	15.3 dB	41.0 Ω - 12.9 jΩ

3.2 Antenna Design and Handling

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

The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

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

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

Certificate No: CD2600V3-1017_Aug21

Page 3 of 5





Impedance Measurement Plot

7.00	dB \$11	Sw <u>e</u> ep	T		1	1		1:	2.450000 GHz	-24.215 dE
2.00	08 511							20	2.550000 GHz	22 522 45
								> 3;	2.600000 GHz	-20.760 dE
-3.00							-	4:	2.650000 GHz	-19.626 dE
8.00		-						5		-15.346.dF
-13.00								-		
-18.00							-5			
-10.00	•	-			-					
23.00						4				
-28.00				2	2					
-33.00										
-38.00										
43.00	Ch 1 Avg =									
Ch1:	Start 2.10000	GHz —							Stop	3.10000 GH
								1.		
							7	1:	2.450000 GHz	44.316 0
					\sim	E	A	1:		44.316 G 1.1823 G
				/		F	A	2:	2.450000 GHz 76.801 pH 2.550000 GHz 240.74 pH	44.316 (1.1823 (57.002 (3.8571 (
						F			2.450000 GHz 76.801pH 2.550000 GHz 240.74pH 2.600000 GHz	44.316 (1.1823 (57.002 (3.8571 (59.518 (
					X	Ę		2: >3:	2.450000 GHz 76.801 pH 2.550000 GHz 240.74 pH 2.600000 GHz 13.190 pF	44.316 (1.1823 (57.002 (3.8571 (59.518 (-3.1898 (
				4	X	F A		2:	2.450000 GHz 76.801 pH 2.550000 GHz 240.74 pH 2.600000 GHz 15.190 pF 2.650000 GHz	44.316 (1.1823 (57.002 (3.8571 (59.518 (-3.1898 (55.331 (
				6	X			2: >3: 4:	2.450000 GHz 76.801 pH 2.550000 GHz 240.74 pH 2.600000 GHz 13.190 pF 2.650000 GHz 6.2104 pF	44.316 0 1.1823 0 57.002 0 3.8571 0 59.518 0 -3.1898 0 55.331 0 -9.6706 0
				6	X			2: >3:	2.450000 GHz 76.801 pH 2.550000 GHz 2.40,74 pH 2.800000 GHz 19.190 pF 2.850000 GHz 6.2104 pF 2.750000 GHz	44.316 (1.1823 (57.002 (3.8571 (59.518 (-3.1898 (55.331 (-9.6706 (40.981 (
				É	X			2: >3: 4:	2.450000 GHz 76.801 pH 2.550000 GHz 240.74 pH 2.600000 GHz 13.190 pF 2.650000 GHz 6.2104 pF	44.316 (1.1823 (57.002 (3.8571 (59.518 (-3.1898 (55.331 (-9.6706 (40.981 (
					X			2: >3: 4:	2.450000 GHz 76.801 pH 2.550000 GHz 2.40,74 pH 2.800000 GHz 19.190 pF 2.850000 GHz 6.2104 pF 2.750000 GHz	44.316 (1.1823 (57.002 (3.8571 (59.518 (-3.1898 (55.331 (-9.6706 (40.981 (
								2: >3: 4:	2.450000 GHz 76.801 pH 2.550000 GHz 2.40,74 pH 2.800000 GHz 19.190 pF 2.850000 GHz 6.2104 pF 2.750000 GHz	44.316 (1.1823 (57.002 (3.8571 (59.518 (-3.1898 (55.331 (-9.6706 (40.981 (
					X			2: >3: 4:	2.450000 GHz 76.801 pH 2.550000 GHz 2.40,74 pH 2.800000 GHz 19.190 pF 2.850000 GHz 6.2104 pF 2.750000 GHz	44.316 (1.1823 (57.002 (3.8571 (59.518 (-3.1898 (55.331 (-9.6706 (40.981 (
	Ch 1 Avg =				X			2: >3: 4:	2.450000 GHz 76.801 pH 2.550000 GHz 2.40,74 pH 2.800000 GHz 19.190 pF 2.850000 GHz 6.2104 pF 2.750000 GHz	44.316 (1.1823 (57.002 (3.8571 (59.518 (-3.1898 (55.331 (-9.6706 (40.981 (
Ch1:	Ch 1 Avg = Start 2.10000		_		X			2: >3: 4:	2,450000 GHz 76.801 pH 2,550000 GHz 240,74 pH 2,650000 GHz 19,190 pF 2,650000 GHz 6,2104 pF 2,750000 GHz 4,5028 pF	44.316 C 1.1822 C 57.002 C 3.8571 C 58.518 C -3.1888 C -3.1888 C -3.1888 C -3.1888 C -3.1888 C -3.1888 C -3.1888 C -12.853 C 3.10000 GHt

Certificate No: CD2600V3-1017_Aug21

Page 4 of 5





DASY5 E-field Result

Date: 24.08.2021

Test Laboratory: SPEAG Lab2

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

Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m³ Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

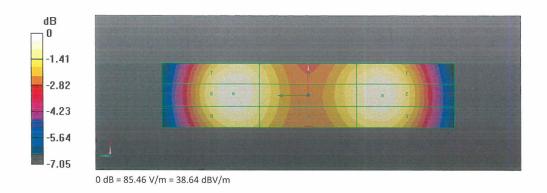
- Probe: EF3DV3 SN4013; ConvF(1, 1, 1) @ 2600 MHz; Calibrated: 28.12.2020
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 23.12.2020
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 67.89 V/m; Power Drift = 0.01 dB Applied MIF = 0.00 dB RF audio interference level = 38.64 dBV/m Emission category: M2

MIF scaled E-field

Grid 1 M2	Grid 2 M2	Grid 3 M2
38.44 dBV/m	38.59 dBV/m	38.37 dBV/m
Grid 4 M2	Grid 5 M2	Grid 6 M2
37.84 dBV/m	37.9 dBV/m	37.76 dBV/m
Grid 7 M2	Grid 8 M2	Grid 9 M2
38.53 dBV/m	38.64 dBV/m	38.39 dBV/m



Certificate No: CD2600V3-1017_Aug21

Page 5 of 5





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

Appendix to test report No.I21Z62273-SEM01/02

The photos of HAC test