

Appendix D Probe, DAE and Dipole Calibration Certificates

Appendix D.1 Calibration certificate for Probe_SN3986

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

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




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

Accreditation No.: SCS 0108

Client **SGS**
Gyeonggi-do, Republic of Korea

Certificate No. **EX-3986_Jan24**

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3986

Calibration procedure(s) QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6,
QA CAL-25.v8
Calibration procedure for dosimetric E-field probes

Calibration date January 24, 2024

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)


이승우, 영. 11

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104773	30-Mar-23 (No. 217-05804/03905)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-05804)	Mar-24
CCP DAK-3.5 (weighted)	SN: 1249	05-Oct-23 (CCP-DAK3.5-1349, Oct23)	Oct-24
CCP DAK-12	SN: 1018	05-Oct-23 (CCP-DAK12-1018, Oct23)	Oct-24
Reference 20 dB Attenuator	SN: CC2552 (20c)	30-Mar-23 (No. 217-03909)	Mar-24
DAE4	SN: 660	15-Mar-23 (No. DAE4-660, Mar23)	Mar-24
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349, Nov23)	Nov-24

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: G841263874	06-Apr-18 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: M914466367	06-Apr-18 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: 000115210	06-Apr-18 (in house check Jun-22)	In house check: Jun-24
RF generator HP 8548C	SN: US3643U1700	04-Aug-99 (in house check Jun-22)	In house check: Jun-24
Network Analyzer E8360A	SN: US41093477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Calibrated by **Jeton Kastner**
Approved by **Sven Köhn**

Function Laboratory Technician
Technical Manager

Signature
i.v. 


Issued: January 25, 2024

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

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
S 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 0106

Glossary

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
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., $\theta = 0$ 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:

- IEC/IEEE 62209-1528: "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices – Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 885664, "SAR Measurement Requirements for 100 MHz to 8 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM₁(_{x,y,z}) = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. 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.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,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.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 900$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 900$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical Isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- 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 NORM_x (no uncertainty required).

EX3DV4 - SN:3986

January 24, 2024

Parameters of Probe: EX3DV4 - SN:3986

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k = 2)
Norm (μV)/(V/m) ² ^A	0.51	0.54	0.48	±10.1%
DCP (mV) ^B	99.9	99.3	102.5	±4.7%

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB √μV	C	D dB	V _{TH} mV	Max dev.	Max Unc [#] k = 2
0	CW	X	0.00	0.00	1.00	0.00	115.9	±2.9%	±4.7%
		Y	0.00	0.00	1.00		102.1		
		Z	0.00	0.00	1.00		111.6		
10352	Pulse Waveform (200Hz, 10%)	X	20.00	92.64	22.04	10.00	60.0	±2.5%	±9.6%
		Y	20.00	95.27	23.75		60.0		
		Z	20.00	92.26	21.73		60.0		
10353	Pulse Waveform (200Hz, 20%)	X	20.00	93.64	21.67	6.99	60.0	±1.1%	±9.6%
		Y	20.00	96.76	23.37		60.0		
		Z	20.00	95.44	22.45		60.0		
10354	Pulse Waveform (200Hz, 40%)	X	20.00	98.08	22.68	3.98	95.0	±1.4%	±9.6%
		Y	20.00	100.95	23.96		95.0		
		Z	20.00	105.58	26.26		95.0		
10355	Pulse Waveform (200Hz, 60%)	X	20.00	105.27	24.83	2.22	120.0	±1.5%	±9.6%
		Y	20.00	107.61	25.65		120.0		
		Z	20.00	125.17	34.15		120.0		
10387	QPSK Waveform, 1 MHz	X	1.75	66.44	15.40	1.00	150.0	±2.0%	±9.6%
		Y	1.80	68.02	15.36		150.0		
		Z	2.18	71.31	18.20		150.0		
10388	QPSK Waveform, 10 MHz	X	2.33	68.56	16.10	0.00	150.0	±0.9%	±9.6%
		Y	2.40	68.68	16.07		150.0		
		Z	2.93	73.29	18.77		150.0		
10396	64-QAM Waveform, 100 kHz	X	3.04	71.16	19.17	3.01	150.0	±0.7%	±9.6%
		Y	3.25	71.32	19.22		150.0		
		Z	3.56	75.63	21.75		150.0		
10399	64-QAM Waveform, 40 MHz	X	3.58	67.39	15.96	0.00	150.0	±0.9%	±9.6%
		Y	3.84	67.48	15.99		150.0		
		Z	3.82	68.99	17.05		150.0		
10414	WLAN CCDF, 64-QAM, 40 MHz	X	4.94	65.79	15.63	0.00	150.0	±2.1%	±9.6%
		Y	5.05	65.83	15.66		150.0		
		Z	5.04	66.51	16.20		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%.

^A The uncertainties of Norm X,Y,Z do not affect the E₁-field uncertainty inside TSL (see Pages 5 and 6).

^B Linearization parameter uncertainty for maximum specified field strength.

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



EX3DV4 - SN:3986

January 24, 2024

Parameters of Probe: EX3DV4 - SN:3986

Sensor Model Parameters

	C1 fF	C2 fF	α V ⁻¹	T1 mV V ⁻²	T2 mV V ⁻¹	T3 mV	T4 V ⁻²	T5 V ⁻¹	T6
x	48.8	360.34	34.88	24.55	0.09	5.10	1.37	0.22	1.01
y	58.4	436.31	35.65	18.73	0.50	5.10	0.85	0.40	1.01
z	45.4	332.11	34.64	20.85	0.00	5.10	1.58	0.13	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	-50.1°
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Note: Measurement distance from surface can be increased to 3~4 mm for an Area Scan job.

EX3DV4 - SN:3986

January 24, 2024

Parameters of Probe: EX3DV4 - SN:3986

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^E	Conductivity ^F (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k = 2)
600	42.7	0.88	10.92	10.92	10.92	0.10	1.25	±13.3%
750	41.9	0.89	9.57	9.57	10.18	0.42	1.27	±12.0%
835	41.5	0.90	10.14	9.75	9.24	0.37	1.27	±12.0%
900	41.5	0.97	9.55	9.25	9.76	0.38	1.27	±12.0%
1640	40.2	1.31	8.35	7.99	8.56	0.46	1.27	±12.0%
1750	40.1	1.37	8.64	8.22	8.75	0.27	1.27	±12.0%
1900	40.0	1.40	8.32	7.99	8.47	0.28	1.27	±12.0%
1950	40.0	1.40	8.25	7.92	8.41	0.28	1.27	±12.0%
2300	39.5	1.67	7.85	7.54	8.02	0.30	1.27	±12.0%
2450	39.2	1.80	7.54	7.26	7.70	0.30	1.27	±12.0%
2600	39.0	1.96	7.96	7.62	8.14	0.29	1.27	±12.0%
3300	38.2	2.71	7.36	7.07	7.52	0.36	1.27	±14.0%
3500	37.9	2.91	7.20	6.90	7.30	0.35	1.27	±14.0%
3700	37.7	3.12	7.18	6.88	7.30	0.35	1.27	±14.0%
3900	37.5	3.32	6.92	6.61	7.03	0.36	1.27	±14.0%
4100	37.2	3.53	6.84	6.57	6.97	0.36	1.27	±14.0%
4400	36.9	3.84	6.65	6.39	6.77	0.36	1.27	±14.0%
4600	36.7	4.04	6.74	6.26	6.91	0.36	1.27	±14.0%
4800	36.4	4.25	6.66	6.43	6.82	0.37	1.27	±14.0%
4950	36.3	4.40	6.41	6.07	6.47	0.42	1.35	±14.0%
5200	36.0	4.66	5.52	5.24	5.58	0.31	1.66	±14.0%
5300	35.9	4.76	5.24	5.01	5.37	0.33	1.66	±14.0%
5500	35.6	4.96	4.98	4.65	5.15	0.35	1.80	±14.0%
5600	35.5	5.07	4.81	4.66	4.96	0.40	1.67	±14.0%
5800	35.3	5.27	4.70	4.56	4.81	0.38	1.66	±14.0%
5850	35.2	5.32	4.65	4.46	4.77	0.42	1.78	±14.0%

^C Frequency validity above 300 MHz of ±100 MHz only applies for DASY v4.4 and higher (see Page 25), else it is restricted to ±50 MHz. The uncertainty is the RMS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ±10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 156 and 200 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-6 MHz, and ConvF assessed at 13 MHz is 8-19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.

^E The probes are calibrated using tissue simulating liquids (TSL) that deviate for ϵ' and σ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10%. If TSL with deviations from the target of less than ±5% are used, the calibration uncertainties are 11.1% for 0.7 - 3 GHz and 13.1% for 3 - 5 GHz.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz and below ±2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4 - SN:3986

January 24, 2024

Parameters of Probe: EX3DV4 - SN:3986

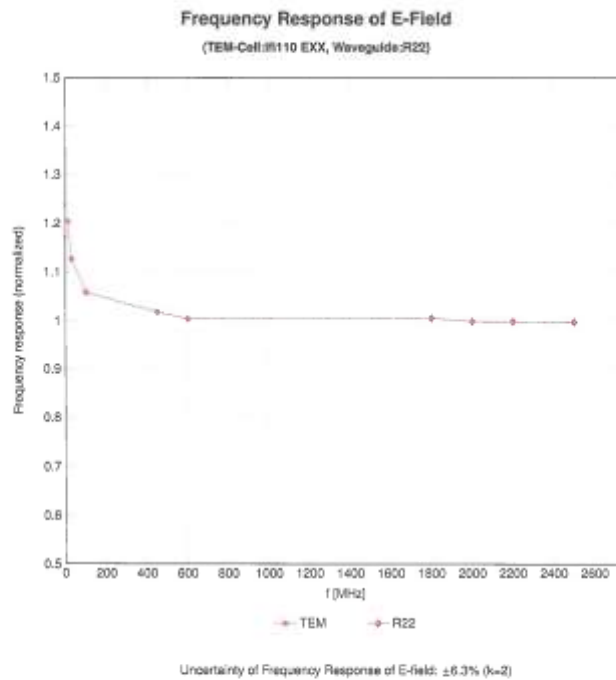
Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity ^F (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
6500	34.5	6.07	5.58	5.70	6.37	0.20	2.50	±18.6%
7000	33.9	6.65	5.80	5.82	6.36	0.20	2.00	±18.6%

^C Frequency validity at 6.5 GHz is -600~700 MHz, and ±700 MHz at or above 7 GHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
^F The probes are calibrated using tissue simulating liquids (TSL) that deviate for ϵ and σ by less than ±10% from the target values (typically better than ±6%) and are valid for TSL with deviations of up to ±10%.
^G Alpha/Depth are determined during calibration. SPEDAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz; below ±2% for frequencies between 3-6 GHz; and below ±4% for frequencies between 6-10 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4 - SN:3986

January 24, 2024

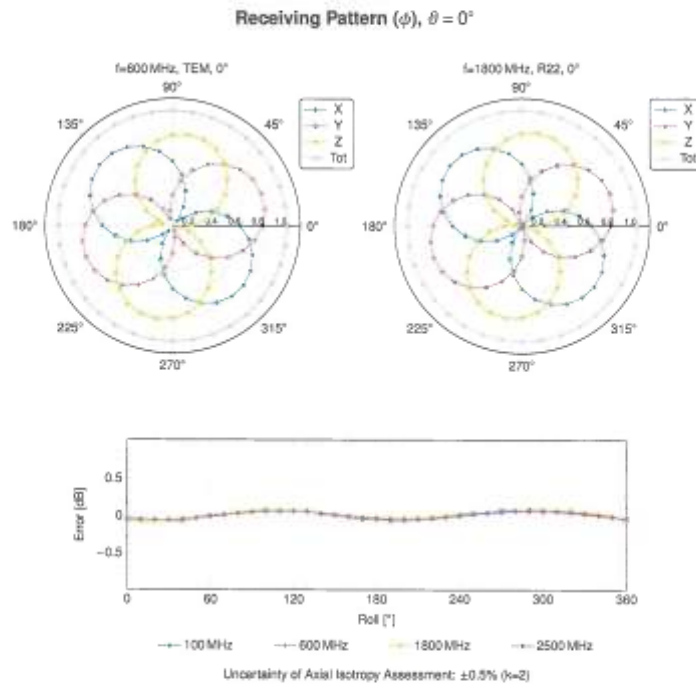


Certificate No: EX-3986_Jan24

Page 7 of 22

EX3D14 - SN:3906

January 24, 2024

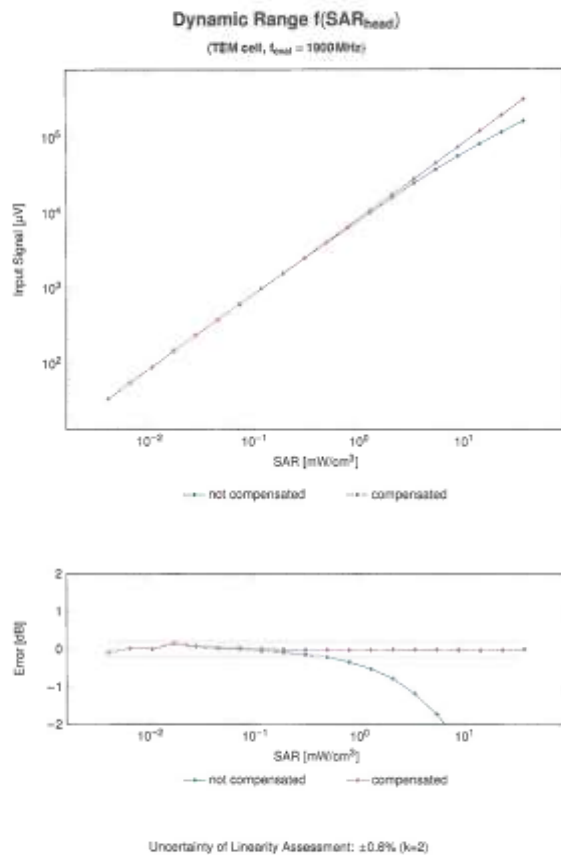


Certificate No: EX-3906_Jan24

Page 8 of 22

EX3DV4 - SN:3905

January 24, 2024



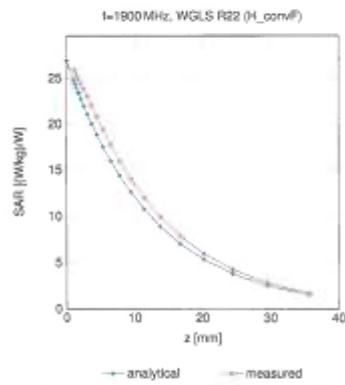
Certificate No: EX-3905_Jan24

Page 9 of 22

EX3DV4 - SN:3988

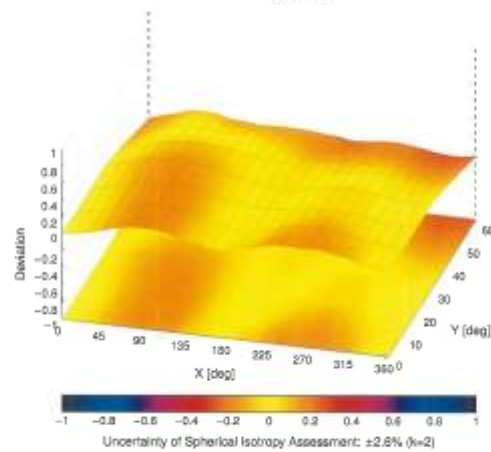
January 24, 2024

Conversion Factor Assessment



Deviation from isotropy in Liquid

Error (ϕ, θ), $f=900\text{MHz}$



Certificate No: EX-3988_Jan24

Page 10 of 22



SGS Korea Co., Ltd.

4, LS-ro 182beon-gil, Gunpo-si Gyeonggi-do, Korea, 15807

Tel. 031-428-5700 / Fax. 031-427-2371

<http://www.sgsgroup.kr>

Page : 11/ 71

EX3DV4 - SN:3986

January 24, 2024

Appendix: Modulation Calibration Parameters

UID	Rev	Communication System Name	Group	PAR (dB)	Unc ¹ k = 2
0		CW	CW	0.06	±4.7
1010	CAB	SAR Validation (Square, 100 ms, 10 ms)	Test	10.00	±0.5
1011	CAC	UMTS-FDD (WCDMA)	WCDMA	2.91	±0.5
1012	CAB	IEEE 802.11b WIF 2.4 GHz (DSSS, 1 Mbps)	WLAN	1.87	±0.5
1013	CAB	IEEE 802.11g WIF 2.4 GHz (DSSS-OFDM, 6 Mbps)	WLAN	8.46	±0.5
1014	DAC	OGM-FDD (TDMA, GMSK)	GSM	9.36	±0.5
1015	DAC	OGM-FDD (TDMA, GMSK, TN 0)	GSM	9.57	±0.5
1016	DAC	OGM-FDD (TDMA, GMSK, TN 0-1)	GSM	6.56	±0.5
1017	DAC	EDGE-FDD (TDMA, GMSK, TN 0)	GSM	12.60	±0.5
1018	DAC	EDGE-FDD (TDMA, GMSK, TN 0-1)	GSM	9.56	±0.5
1019	DAC	OGM-FDD (TDMA, GMSK, TN 0-1-2)	GSM	4.00	±0.5
1020	DAC	OGM-FDD (TDMA, GMSK, TN 0-1-3)	GSM	2.05	±0.5
1021	DAC	EDGE-FDD (TDMA, GMSK, TN 0-1-2)	GSM	7.76	±0.5
1022	CAB	IEEE 802.15.1 Bluetooth (GFSK, DH1)	Bluetooth	5.30	±0.5
1023	CAB	IEEE 802.15.1 Bluetooth (GFSK, DH2)	Bluetooth	1.87	±0.5
1024	CAB	IEEE 802.15.1 Bluetooth (PSK, DH2)	Bluetooth	1.16	±0.5
1025	CAB	IEEE 802.15.1 Bluetooth (FH4-QPSK, DH1)	Bluetooth	7.74	±0.5
1026	CAB	IEEE 802.15.1 Bluetooth (FH4-QPSK, DH2)	Bluetooth	4.55	±0.5
1027	CAB	IEEE 802.15.1 Bluetooth (FH4-QPSK, DH3)	Bluetooth	3.83	±0.5
1028	CAB	IEEE 802.15.1 Bluetooth (FH4-QPSK, DH4)	Bluetooth	0.31	±0.5
1029	CAB	IEEE 802.15.1 Bluetooth (FH4-QPSK, DH5)	Bluetooth	4.77	±0.5
1030	CAB	IEEE 802.15.1 Bluetooth (FH4-QPSK, DH6)	Bluetooth	4.10	±0.5
1031	CAB	CDMA2000 (1xRTT, RCT)	CDMA2000	4.57	±0.5
1032	CAB	IS-94 / IS-136 FDD (TDMA-FDM, FH4-QPSK, Half-rate)	AMPS	7.78	±0.5
1033	CAB	IS-94 / IS-136 FDD (TDMA-FDM, FH4-QPSK, Full-rate)	AMPS	0.00	±0.5
1034	CAB	DECT (TDD, TDMA-FDM, GFSK, Full Slot, 2K)	DECT	13.80	±0.5
1035	CAB	DECT (TDD, TDMA-FDM, GFSK, Double Slot, 12)	DECT	13.79	±0.5
1036	CAB	UMTS-TDD (TD-SCDMA, 1.38 Mbps)	TD-SCDMA	11.67	±0.5
1037	DAC	EDGE-FDD (TDMA, GMSK, TN 0-1-2-3)	GSM	8.52	±0.5
1038	CAB	IEEE 802.11b WIF 2.4 GHz (DSSS, 2 Mbps)	WLAN	2.12	±0.5
1039	CAB	IEEE 802.11b WIF 2.4 GHz (DSSS, 5.5 Mbps)	WLAN	2.83	±0.5
1040	CAB	IEEE 802.11b WIF 2.4 GHz (DSSS, 11 Mbps)	WLAN	3.66	±0.5
1041	CAB	IEEE 802.11a WIF 5 GHz (OFDM, 6 Mbps)	WLAN	8.68	±0.5
1042	CAB	IEEE 802.11a WIF 5 GHz (OFDM, 9 Mbps)	WLAN	8.63	±0.5
1043	CAB	IEEE 802.11a WIF 5 GHz (OFDM, 12 Mbps)	WLAN	8.08	±0.5
1044	CAB	IEEE 802.11a WIF 5 GHz (OFDM, 18 Mbps)	WLAN	9.00	±0.5
1045	CAB	IEEE 802.11a WIF 5 GHz (OFDM, 24 Mbps)	WLAN	9.38	±0.5
1046	CAB	IEEE 802.11a WIF 5 GHz (OFDM, 36 Mbps)	WLAN	10.12	±0.5
1047	CAB	IEEE 802.11a WIF 5 GHz (OFDM, 48 Mbps)	WLAN	10.24	±0.5
1048	CAB	IEEE 802.11a WIF 5 GHz (OFDM, 54 Mbps)	WLAN	10.56	±0.5
1049	CAB	IEEE 802.11g WIF 2.4 GHz (DSSS-OFDM, 9 Mbps)	WLAN	9.83	±0.5
1050	CAB	IEEE 802.11g WIF 2.4 GHz (DSSS-OFDM, 12 Mbps)	WLAN	9.68	±0.5
1051	CAB	IEEE 802.11g WIF 2.4 GHz (DSSS-OFDM, 18 Mbps)	WLAN	9.84	±0.5
1052	CAB	IEEE 802.11g WIF 2.4 GHz (DSSS-OFDM, 24 Mbps)	WLAN	10.30	±0.5
1053	CAB	IEEE 802.11g WIF 2.4 GHz (DSSS-OFDM, 36 Mbps)	WLAN	10.77	±0.5
1054	CAB	IEEE 802.11g WIF 2.4 GHz (DSSS-OFDM, 48 Mbps)	WLAN	10.94	±0.5
1055	CAB	IEEE 802.11g WIF 2.4 GHz (DSSS-OFDM, 54 Mbps)	WLAN	11.00	±0.5
1056	CAB	CDMA2000 (1xRTT, RCT)	CDMA2000	3.07	±0.5
1057	CAB	IS-94 / IS-136 FDD (TDMA-FDM, PSK-QPSK, Full-rate)	AMPS	4.77	±0.5
1058	DAC	OGM-FDD (TDMA, GMSK, TN 0-4)	GSM	6.56	±0.5
1059	CAC	UMTS-FDD (HSPA)	WCDMA	3.06	±0.5
1060	DAC	UMTS-FDD (HSPA, Subclass 2)	WCDMA	3.06	±0.5
1061	DAC	EDGE-FDD (TDMA, GMSK, TN 0-4)	GSM	9.56	±0.5
1062	CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-FDD	5.07	±0.5
1063	CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	±0.5
1064	CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	±0.5
1065	CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-TDD	9.39	±0.5
1066	CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-TDD	9.97	±0.5
1067	CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-TDD	10.01	±0.5
1068	CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-FDD	5.80	±0.5
1069	CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	±0.5
1070	CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-FDD	5.75	±0.5
1071	CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-FDD	6.44	±0.5

Certificate No: EX-3986_Jan24

Page 11 of 22

EXQDV4 - SN:3988

January 24, 2024

UEP	Rev	Communication System Name	Group	PAR (dB)	Unc ² k = 2
10112	CAH	LTE-FDD (SC-FDMA, 100% RB, 18MHz, 64-QAM)	LTE-FDD	6.59	±0.6
10113	CAH	LTE-FDD (SC-FDMA, 100% RB, 5MHz, 64-QAM)	LTE-FDD	6.62	±0.6
10114	CAG	IEEE 802.11n (HT Greenfield, 13.5Mbps, BPSK)	WLAN	8.10	±0.6
10115	CAG	IEEE 802.11n (HT Greenfield, 61Mbps, 16-QAM)	WLAN	8.48	±0.6
10116	CAG	IEEE 802.11n (HT Greenfield, 135Mbps, 64-QAM)	WLAN	8.15	±0.6
10117	CAG	IEEE 802.11n (HT Mixed, 13.5Mbps, BPSK)	WLAN	8.07	±0.6
10118	CAG	IEEE 802.11n (HT Mixed, 61Mbps, 16-QAM)	WLAN	8.59	±0.6
10119	CAG	IEEE 802.11n (HT Mixed, 135Mbps, 64-QAM)	WLAN	8.13	±0.6
10140	CAP	LTE-FDD (SC-FDMA, 100% RB, 15MHz, 16-QAM)	LTE-FDD	6.46	±0.6
10141	CAP	LTE-FDD (SC-FDMA, 100% RB, 15MHz, 64-QAM)	LTE-FDD	6.53	±0.6
10142	CAP	LTE-FDD (SC-FDMA, 100% RB, 3MHz, QPSK)	LTE-FDD	6.73	±0.6
10143	CAP	LTE-FDD (SC-FDMA, 100% RB, 3MHz, 16-QAM)	LTE-FDD	6.36	±0.6
10144	CAP	LTE-FDD (SC-FDMA, 100% RB, 3MHz, 64-QAM)	LTE-FDD	6.05	±0.6
10145	CAG	LTE-FDD (SC-FDMA, 100% RB, 1.4MHz, QPSK)	LTE-FDD	5.76	±0.6
10146	CAG	LTE-FDD (SC-FDMA, 100% RB, 1.4MHz, 16-QAM)	LTE-FDD	6.41	±0.6
10147	CAG	LTE-FDD (SC-FDMA, 100% RB, 1.4MHz, 64-QAM)	LTE-FDD	6.79	±0.6
10148	CAP	LTE-FDD (SC-FDMA, 50% RB, 20MHz, 16-QAM)	LTE-FDD	6.42	±0.6
10150	CAP	LTE-FDD (SC-FDMA, 50% RB, 20MHz, 64-QAM)	LTE-FDD	6.90	±0.6
10151	CAH	LTE-TDD (SC-FDMA, 50% RB, 20MHz, QPSK)	LTE-TDD	9.33	±0.6
10152	CAH	LTE-TDD (SC-FDMA, 50% RB, 20MHz, 16-QAM)	LTE-TDD	9.63	±0.6
10153	CAH	LTE-TDD (SC-FDMA, 50% RB, 20MHz, 64-QAM)	LTE-TDD	10.05	±0.6
10154	CAH	LTE-FDD (SC-FDMA, 50% RB, 10MHz, QPSK)	LTE-FDD	5.73	±0.6
10155	CAH	LTE-FDD (SC-FDMA, 50% RB, 10MHz, 16-QAM)	LTE-FDD	6.43	±0.6
10156	CAH	LTE-FDD (SC-FDMA, 50% RB, 10MHz, 64-QAM)	LTE-FDD	5.79	±0.6
10157	CAH	LTE-FDD (SC-FDMA, 50% RB, 3MHz, 16-QAM)	LTE-FDD	6.48	±0.6
10158	CAH	LTE-FDD (SC-FDMA, 50% RB, 10MHz, 64-QAM)	LTE-FDD	6.69	±0.6
10159	CAH	LTE-FDD (SC-FDMA, 50% RB, 5MHz, 64-QAM)	LTE-FDD	6.56	±0.6
10160	CAP	LTE-FDD (SC-FDMA, 50% RB, 15MHz, QPSK)	LTE-FDD	5.62	±0.6
10161	CAP	LTE-FDD (SC-FDMA, 50% RB, 15MHz, 16-QAM)	LTE-FDD	6.43	±0.6
10162	CAP	LTE-FDD (SC-FDMA, 50% RB, 15MHz, 64-QAM)	LTE-FDD	6.88	±0.6
10164	CAG	LTE-FDD (SC-FDMA, 50% RB, 1.4MHz, QPSK)	LTE-FDD	5.46	±0.6
10167	CAG	LTE-FDD (SC-FDMA, 50% RB, 1.4MHz, 16-QAM)	LTE-FDD	6.21	±0.6
10168	CAG	LTE-FDD (SC-FDMA, 50% RB, 1.4MHz, 64-QAM)	LTE-FDD	6.76	±0.6
10169	CAP	LTE-FDD (SC-FDMA, 1 RB, 20MHz, QPSK)	LTE-FDD	5.75	±0.6
10170	CAP	LTE-FDD (SC-FDMA, 1 RB, 20MHz, 16-QAM)	LTE-FDD	6.52	±0.6
10171	AAF	LTE-FDD (SC-FDMA, 1 RB, 20MHz, 64-QAM)	LTE-FDD	6.49	±0.6
10172	CAH	LTE-TDD (SC-FDMA, 1 RB, 20MHz, QPSK)	LTE-TDD	9.21	±0.6
10173	CAH	LTE-TDD (SC-FDMA, 1 RB, 20MHz, 16-QAM)	LTE-TDD	9.48	±0.6
10174	CAH	LTE-TDD (SC-FDMA, 1 RB, 20MHz, 64-QAM)	LTE-TDD	10.25	±0.6
10175	CAH	LTE-FDD (SC-FDMA, 1 RB, 10MHz, QPSK)	LTE-FDD	6.79	±0.6
10176	CAH	LTE-FDD (SC-FDMA, 1 RB, 10MHz, 16-QAM)	LTE-FDD	6.52	±0.6
10177	CAH	LTE-FDD (SC-FDMA, 1 RB, 5MHz, QPSK)	LTE-FDD	5.73	±0.6
10178	CAH	LTE-FDD (SC-FDMA, 1 RB, 5MHz, 16-QAM)	LTE-FDD	6.52	±0.6
10179	CAH	LTE-FDD (SC-FDMA, 1 RB, 15MHz, 64-QAM)	LTE-FDD	6.90	±0.6
10180	CAH	LTE-FDD (SC-FDMA, 1 RB, 5MHz, 64-QAM)	LTE-FDD	6.60	±0.6
10181	CAP	LTE-FDD (SC-FDMA, 1 RB, 15MHz, QPSK)	LTE-FDD	5.72	±0.6
10182	CAP	LTE-FDD (SC-FDMA, 1 RB, 15MHz, 16-QAM)	LTE-FDD	6.55	±0.6
10183	AMF	LTE-FDD (SC-FDMA, 1 RB, 16MHz, 64-QAM)	LTE-FDD	6.58	±0.6
10184	CAP	LTE-FDD (SC-FDMA, 1 RB, 3MHz, QPSK)	LTE-FDD	5.73	±0.6
10185	CAP	LTE-FDD (SC-FDMA, 1 RB, 3MHz, 16-QAM)	LTE-FDD	6.61	±0.6
10186	AAF	LTE-FDD (SC-FDMA, 1 RB, 3MHz, 64-QAM)	LTE-FDD	6.56	±0.6
10187	CAG	LTE-FDD (SC-FDMA, 1 RB, 1.4MHz, QPSK)	LTE-FDD	5.73	±0.6
10188	CAG	LTE-FDD (SC-FDMA, 1 RB, 1.4MHz, 16-QAM)	LTE-FDD	6.52	±0.6
10189	AMF	LTE-FDD (SC-FDMA, 1 RB, 1.4MHz, 64-QAM)	LTE-FDD	6.56	±0.6
10190	CAG	IEEE 802.11n (HT Greenfield, 6.5Mbps, BPSK)	WLAN	8.06	±0.6
10194	CAG	IEEE 802.11n (HT Greenfield, 39Mbps, 16-QAM)	WLAN	8.12	±0.6
10195	CAG	IEEE 802.11n (HT Greenfield, 65Mbps, 64-QAM)	WLAN	8.21	±0.6
10196	CAG	IEEE 802.11n (HT Mixed, 6.5Mbps, BPSK)	WLAN	8.10	±0.6
10197	CAG	IEEE 802.11n (HT Mixed, 39Mbps, 16-QAM)	WLAN	8.13	±0.6
10198	CAG	IEEE 802.11n (HT Mixed, 65Mbps, 64-QAM)	WLAN	8.27	±0.6
10219	CAG	IEEE 802.11n (HT Mixed, 7.2Mbps, BPSK)	WLAN	8.03	±0.6
10220	CAG	IEEE 802.11n (HT Mixed, 43.3Mbps, 16-QAM)	WLAN	8.13	±0.6
10221	CAG	IEEE 802.11n (HT Mixed, 72.2Mbps, 64-QAM)	WLAN	8.27	±0.6
10222	CAG	IEEE 802.11n (HT Mixed, 15Mbps, BPSK)	WLAN	8.06	±0.6
10223	CAG	IEEE 802.11n (HT Mixed, 90Mbps, 16-QAM)	WLAN	8.48	±0.6
10224	CAG	IEEE 802.11n (HT Mixed, 150Mbps, 64-QAM)	WLAN	8.33	±0.6

Certificate No: EX-3985_Jan24

Page 12 of 22

EX3DV4 - SN-3986

January 24, 2024

UID	Rev	Communication System Name	Group	PAR (dB)	Unc ² k = 2
10225	CAC	UMTS-FDD (HSR+)	WCDMA	5.97	±9.6
10226	CAC	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.40	±9.6
10227	CAC	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.30	±9.6
10228	CAC	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-TDD	9.32	±9.6
10229	CAE	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-TDD	9.48	±9.6
10230	CAE	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-TDD	10.25	±9.6
10231	CAE	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-TDD	9.19	±9.6
10232	CAH	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-TDD	9.40	±9.6
10233	CAH	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-TDD	10.25	±9.6
10234	CAH	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-TDD	9.21	±9.6
10235	CAH	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	±9.6
10236	CAH	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	±9.6
10237	CAH	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	±9.6
10238	CAG	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	±9.6
10239	CAG	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	±9.6
10240	CAG	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	±9.6
10241	CAG	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.82	±9.6
10242	CAG	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-TDD	9.66	±9.6
10243	CAG	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-TDD	9.46	±9.6
10244	CAE	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-TDD	10.06	±9.6
10245	CAE	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-TDD	10.06	±9.6
10246	CAE	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-TDD	9.20	±9.6
10247	CAH	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-TDD	9.91	±9.6
10248	CAH	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-TDD	10.09	±9.6
10249	CAH	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-TDD	9.20	±9.6
10250	CAH	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.91	±9.6
10251	CAH	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.17	±9.6
10252	CAH	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.34	±9.6
10253	CAG	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.90	±9.6
10254	CAG	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.14	±9.6
10255	CAG	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.20	±9.6
10256	CAC	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.90	±9.6
10257	CAC	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.08	±9.6
10258	CAC	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-TDD	9.34	±9.6
10259	CAE	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-TDD	9.95	±9.6
10260	CAE	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-TDD	9.97	±9.6
10261	CAE	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-TDD	9.34	±9.6
10262	CAH	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-TDD	9.83	±9.6
10263	CAH	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-TDD	10.18	±9.6
10264	CAH	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-TDD	9.23	±9.6
10265	CAH	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	9.89	±9.6
10266	CAH	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-TDD	10.07	±9.6
10267	CAH	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.30	±9.6
10268	CAG	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	10.06	±9.6
10269	CAG	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-TDD	10.13	±9.6
10270	CAG	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.28	±9.6
10271	CAC	UMTS-FDD (HSR+, Subnet 5, 3GPP Rel. 6)	WCDMA	4.97	±9.6
10272	CAC	UMTS-FDD (HSR+, Subnet 5, 3GPP Rel. 6)	WCDMA	5.98	±9.6
10273	CAA	PHS (QPSK)	PHS	11.81	±9.6
10274	CAA	PHS (QPSK, BW 884 MHz, Roll-off 0.5)	PHS	11.81	±9.6
10275	CAA	PHS (QPSK, BW 884 MHz, Roll-off 0.58)	PHS	12.18	±9.6
10292	AAB	CDMA2000, RC1, SCSS, Full Rate	CDMA2000	3.91	±9.6
10291	AAB	CDMA2000, RC3, SCSS, Full Rate	CDMA2000	3.46	±9.6
10292	AAB	CDMA2000, RC3, SCSS, Full Rate	CDMA2000	3.96	±9.6
10293	AAB	CDMA2000, RC3, SCSS, Full Rate	CDMA2000	3.50	±9.6
10295	AAB	CDMA2000, RC1, SCSS, 1/8th Rate 25%	CDMA2000	12.49	±9.6
10297	AAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-FDD	5.91	±9.6
10298	AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-FDD	5.72	±9.6
10299	AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-FDD	6.39	±9.6
10300	AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-FDD	6.80	±9.6
10301	AAA	IEEE 802.16e WMAX (29.18, 5 ms, 10 MHz, QPSK, PUSC)	WMAX	12.03	±9.6
10302	AAA	IEEE 802.16e WMAX (29.18, 5 ms, 10 MHz, QPSK, PUSC, 3 CTRLS symbols)	WMAX	12.57	±9.6
10303	AAA	IEEE 802.16e WMAX (31.15, 5 ms, 10 MHz, 64QAM, PUSC)	WMAX	12.52	±9.6
10304	AAA	IEEE 802.16e WMAX (29.18, 5 ms, 10 MHz, 64QAM, PUSC)	WMAX	11.96	±9.6
10305	AAA	IEEE 802.16e WMAX (31.15, 10 ms, 10 MHz, 64QAM, PUSC, 15 symbols)	WMAX	15.34	±9.6
10306	AAA	IEEE 802.16e WMAX (29.18, 10 ms, 10 MHz, 64QAM, PUSC, 15 symbols)	WMAX	14.97	±9.6

Certificate No: EX-3986_Jan24

Page 13 of 22



SGS Korea Co., Ltd.

4, LS-ro 182beon-gil, Gunpo-si Gyeonggi-do, Korea, 15807

Tel. 031-428-5700 / Fax. 031-427-2371

<http://www.sgsgroup.kr>

Page : 14/ 71

EX30V4 - EN3986

January 24, 2024

UID	Rev	Communication System Name	Group	PAR (dB)	U _{me} ² A = 2
10307	AAA	IEEE 802.11a WIMAX (20.18, 10ms, 10 MHz, QPSK, PUSC, 18 symbols)	WIMAX	14.40	±0.6
10308	AAA	IEEE 802.11a WIMAX (20.18, 10ms, 10 MHz, 16QAM, PUSC)	WIMAX	14.40	±0.6
10309	AAA	IEEE 802.11a WIMAX (20.18, 10ms, 10 MHz, 16QAM, AMC 2x3, 18 symbols)	WIMAX	14.50	±0.6
10310	AAA	IEEE 802.11a WIMAX (20.18, 10ms, 10 MHz, QPSK, AMC 2x3, 18 symbols)	WIMAX	14.57	±0.6
10311	AAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-FDD	6.05	±0.6
10313	AAA	IDEN 1.3	IDEN	10.51	±0.6
10314	AAA	IDEN 1.6	IDEN	10.48	±0.6
10315	AAE	IEEE 802.11b WFI 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	WLAN	1.71	±0.6
10316	AAE	IEEE 802.11g WFI 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	WLAN	9.30	±0.6
10317	AAE	IEEE 802.11n WFI 2.4 GHz (OFDM, 6 Mbps, 99pc duty cycle)	WLAN	8.30	±0.6
10352	AAA	Pulse Waveform (200Hz, 10%)	Generic	10.00	±0.6
10353	AAA	Pulse Waveform (200Hz, 20%)	Generic	8.99	±0.6
10354	AAA	Pulse Waveform (200Hz, 40%)	Generic	3.98	±0.6
10355	AAA	Pulse Waveform (200Hz, 50%)	Generic	2.22	±0.6
10356	AAA	Pulse Waveform (200Hz, 80%)	Generic	5.07	±0.6
10387	AAA	QPSK Waveform, 1 MHz	Generic	5.16	±0.6
10388	AAA	QPSK Waveform, 10 MHz	Generic	5.28	±0.6
10389	AAA	64-QAM Waveform, 100 kHz	Generic	6.27	±0.6
10389	AAA	64-QAM Waveform, 40 MHz	Generic	6.27	±0.6
10400	AAE	IEEE 802.11ac WFI (20 MHz, 64-QAM, 99pc duty cycle)	WLAN	8.37	±0.6
10401	AAE	IEEE 802.11ac WFI (40 MHz, 64-QAM, 99pc duty cycle)	WLAN	8.60	±0.6
10402	AAE	IEEE 802.11ac WFI (80 MHz, 64-QAM, 99pc duty cycle)	WLAN	8.55	±0.6
10403	AAE	CDMA2000 (1xEV-DO, Rev. 0)	CDMA2000	3.76	±0.6
10404	AAE	CDMA2000 (1xEV-DO, Rev. 3)	CDMA2000	3.77	±0.6
10406	AAE	CDMA2000 (1xEV-DO, Rev. 3, Full Rate)	CDMA2000	6.32	±0.6
10410	AAE	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9, Subframe=1,6)	LTE-TDD	7.82	±0.6
10414	AAA	WLAN 2.4GHz 802.11n WFI	Generic	8.54	±0.6
10415	AAA	IEEE 802.11b WFI 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	WLAN	1.54	±0.6
10416	AAA	IEEE 802.11g WFI 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	WLAN	9.23	±0.6
10417	AAE	IEEE 802.11n WFI 2.4 GHz (OFDM, 6 Mbps, 99pc duty cycle)	WLAN	8.23	±0.6
10418	AAA	IEEE 802.11g WFI 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preamble)	WLAN	8.14	±0.6
10419	AAA	IEEE 802.11g WFI 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preamble)	WLAN	8.19	±0.6
10422	AAE	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	WLAN	8.32	±0.6
10423	AAE	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	WLAN	8.47	±0.6
10424	AAE	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	WLAN	8.43	±0.6
10425	AAE	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	WLAN	8.41	±0.6
10430	AAE	IEEE 802.11n (HT Greenfield, 30 Mbps, 16-QAM)	WLAN	8.43	±0.6
10431	AAE	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	WLAN	8.41	±0.6
10433	AAE	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	LTE-FDD	8.38	±0.6
10433	AAE	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	LTE-FDD	8.34	±0.6
10433	AAE	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	LTE-FDD	8.34	±0.6
10434	AAE	WCDMA (3G Test Model 1, 64 QPSK)	WCDMA	8.66	±0.6
10435	AAE	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	±0.6
10447	AAE	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.66	±0.6
10448	AAE	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.65	±0.6
10448	AAE	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.51	±0.6
10456	AAE	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.48	±0.6
10457	AAE	WCDMA (3G Test Model 1, 64 QPSK, Clipping 44%)	WCDMA	7.59	±0.6
10458	AAE	Validation (Square, 10ms, 1ms)	Test	10.00	±0.6
10459	AAE	IEEE 802.11ac WFI (160 MHz, 64-QAM, 99pc duty cycle)	WLAN	8.63	±0.6
10457	AAE	UMTS-FDD (DC-HSDPA)	WCDMA	6.62	±0.6
10458	AAA	CDMA2000 (1xEV-DO, Rev. 0, 3 carriers)	CDMA2000	6.95	±0.6
10459	AAA	CDMA2000 (1xEV-DO, Rev. 0, 3 carriers)	CDMA2000	6.35	±0.6
10460	AAE	UMTS-FDD (WCDMA, AMR)	WCDMA	2.39	±0.6
10461	AAE	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	±0.6
10462	AAE	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.33	±0.6
10463	AAE	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.50	±0.6
10464	AAE	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	±0.6
10465	AAE	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	±0.6
10466	AAE	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	±0.6
10467	AAE	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	±0.6
10468	AAE	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.33	±0.6
10469	AAE	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.54	±0.6
10470	AAE	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	±0.6
10471	AAE	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	±0.6

Certificate No: EX-3986_jan24

Page 14 of 22



SGS Korea Co., Ltd.

4, LS-ro 182beon-gil, Gunpo-si Gyeonggi-do, Korea, 15807

Tel. 031-428-5700 / Fax. 031-427-2371

<http://www.sgsgroup.kr>

Page : 15/ 71

EXQDV4 - SN:3986

January 24, 2024

UID	Rev	Communication System Name	Group	PAR (dB)	Unit ² k = 2
10472	AA3	LTE-TDD (SC-FDMA, 1 RB, 15MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	±9.6
10473	AA1	LTE-TDD (SC-FDMA, 1 RB, 15MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	±9.6
10474	AA1	LTE-TDD (SC-FDMA, 1 RB, 15MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.33	±9.6
10475	AA1	LTE-TDD (SC-FDMA, 1 RB, 15MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	±9.6
10477	AA3	LTE-TDD (SC-FDMA, 1 RB, 20MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	±9.6
10478	AA3	LTE-TDD (SC-FDMA, 1 RB, 20MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	±9.6
10479	AA3	LTE-TDD (SC-FDMA, 60% RB, 1.4MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	±9.6
10480	AA3	LTE-TDD (SC-FDMA, 60% RB, 1.4MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.18	±9.6
10481	AA3	LTE-TDD (SC-FDMA, 50% RB, 1.4MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.45	±9.6
10483	AA3	LTE-TDD (SC-FDMA, 50% RB, 3MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.75	±9.6
10483	AA3	LTE-TDD (SC-FDMA, 50% RB, 3MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.38	±9.6
10484	AA3	LTE-TDD (SC-FDMA, 50% RB, 3MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.47	±9.6
10485	AA3	LTE-TDD (SC-FDMA, 50% RB, 5MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.58	±9.6
10486	AA3	LTE-TDD (SC-FDMA, 50% RB, 5MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.38	±9.6
10487	AA3	LTE-TDD (SC-FDMA, 50% RB, 5MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.60	±9.6
10488	AA3	LTE-TDD (SC-FDMA, 50% RB, 10MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.76	±9.6
10489	AA3	LTE-TDD (SC-FDMA, 50% RB, 10MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.31	±9.6
10490	AA3	LTE-TDD (SC-FDMA, 50% RB, 10MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.54	±9.6
10491	AA1	LTE-TDD (SC-FDMA, 50% RB, 15MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	±9.6
10492	AA1	LTE-TDD (SC-FDMA, 50% RB, 15MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.41	±9.6
10493	AA1	LTE-TDD (SC-FDMA, 50% RB, 15MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.65	±9.6
10494	AA3	LTE-TDD (SC-FDMA, 50% RB, 20MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	±9.6
10496	AA3	LTE-TDD (SC-FDMA, 50% RB, 20MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.37	±9.6
10496	AA3	LTE-TDD (SC-FDMA, 50% RB, 20MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.54	±9.6
10497	AA3	LTE-TDD (SC-FDMA, 100% RB, 1.4MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.67	±9.6
10498	AA3	LTE-TDD (SC-FDMA, 100% RB, 1.4MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.40	±9.6
10499	AA3	LTE-TDD (SC-FDMA, 100% RB, 1.4MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.89	±9.6
10500	AA3	LTE-TDD (SC-FDMA, 100% RB, 3MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.67	±9.6
10501	AA3	LTE-TDD (SC-FDMA, 100% RB, 3MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.44	±9.6
10502	AA3	LTE-TDD (SC-FDMA, 100% RB, 3MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.52	±9.6
10503	AA3	LTE-TDD (SC-FDMA, 100% RB, 5MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.72	±9.6
10504	AA3	LTE-TDD (SC-FDMA, 100% RB, 5MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.31	±9.6
10505	AA3	LTE-TDD (SC-FDMA, 100% RB, 5MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.64	±9.6
10506	AA3	LTE-TDD (SC-FDMA, 100% RB, 10MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	±9.6
10507	AA3	LTE-TDD (SC-FDMA, 100% RB, 10MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.36	±9.6
10508	AA3	LTE-TDD (SC-FDMA, 100% RB, 10MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.55	±9.6
10509	AA1	LTE-TDD (SC-FDMA, 100% RB, 15MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.64	±9.6
10510	AA1	LTE-TDD (SC-FDMA, 100% RB, 15MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.48	±9.6
10511	AA1	LTE-TDD (SC-FDMA, 100% RB, 15MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.51	±9.6
10512	AA3	LTE-TDD (SC-FDMA, 100% RB, 20MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	±9.6
10513	AA3	LTE-TDD (SC-FDMA, 100% RB, 20MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.42	±9.6
10514	AA3	LTE-TDD (SC-FDMA, 100% RB, 20MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.45	±9.6
10515	AAA	IEEE 802.11b WiFi (2.4GHz) (DSSS, 2Mbps, 80% duty cycle)	WLAN	1.58	±9.6
10516	AAA	IEEE 802.11b WiFi (2.4GHz) (DSSS, 5.5Mbps, 80% duty cycle)	WLAN	1.67	±9.6
10517	AAA	IEEE 802.11b WiFi (2.4GHz) (DSSS, 11Mbps, 80% duty cycle)	WLAN	1.68	±9.6
10518	AA3	IEEE 802.11a/g WiFi (5GHz) (OFDM, 9Mbps, 80% duty cycle)	WLAN	6.25	±9.6
10519	AA3	IEEE 802.11a/g WiFi (5GHz) (OFDM, 12Mbps, 80% duty cycle)	WLAN	6.39	±9.6
10520	AA3	IEEE 802.11a/g WiFi (5GHz) (OFDM, 18Mbps, 80% duty cycle)	WLAN	6.12	±9.6
10521	AA3	IEEE 802.11a/g WiFi (5GHz) (OFDM, 24Mbps, 80% duty cycle)	WLAN	7.97	±9.6
10522	AA3	IEEE 802.11a/g WiFi (5GHz) (OFDM, 36Mbps, 80% duty cycle)	WLAN	6.45	±9.6
10523	AA3	IEEE 802.11a/g WiFi (5GHz) (OFDM, 48Mbps, 80% duty cycle)	WLAN	6.08	±9.6
10524	AA3	IEEE 802.11a/g WiFi (5GHz) (OFDM, 54Mbps, 80% duty cycle)	WLAN	6.27	±9.6
10525	AA3	IEEE 802.11ac WiFi (20MHz, MCS0, 80% duty cycle)	WLAN	0.36	±9.6
10526	AA3	IEEE 802.11ac WiFi (20MHz, MCS1, 80% duty cycle)	WLAN	0.42	±9.6
10527	AA3	IEEE 802.11ac WiFi (20MHz, MCS2, 80% duty cycle)	WLAN	0.21	±9.6
10528	AA3	IEEE 802.11ac WiFi (20MHz, MCS3, 80% duty cycle)	WLAN	0.36	±9.6
10529	AA3	IEEE 802.11ac WiFi (20MHz, MCS4, 80% duty cycle)	WLAN	0.36	±9.6
10530	AA3	IEEE 802.11ac WiFi (20MHz, MCS5, 80% duty cycle)	WLAN	0.43	±9.6
10531	AA3	IEEE 802.11ac WiFi (20MHz, MCS6, 80% duty cycle)	WLAN	0.23	±9.6
10532	AA3	IEEE 802.11ac WiFi (20MHz, MCS7, 80% duty cycle)	WLAN	0.33	±9.6
10533	AA3	IEEE 802.11ac WiFi (20MHz, MCS8, 80% duty cycle)	WLAN	0.35	±9.6
10534	AA3	IEEE 802.11ac WiFi (40MHz, MCS9, 80% duty cycle)	WLAN	0.45	±9.6
10535	AA3	IEEE 802.11ac WiFi (40MHz, MCS1, 80% duty cycle)	WLAN	0.45	±9.6
10536	AA3	IEEE 802.11ac WiFi (40MHz, MCS3, 80% duty cycle)	WLAN	0.32	±9.6
10537	AA3	IEEE 802.11ac WiFi (40MHz, MCS5, 80% duty cycle)	WLAN	0.44	±9.6
10538	AA3	IEEE 802.11ac WiFi (40MHz, MCS6, 80% duty cycle)	WLAN	0.54	±9.6
10540	AA3	IEEE 802.11ac WiFi (40MHz, MCS8, 80% duty cycle)	WLAN	0.39	±9.6

Certificate No: EX-3986_Jan24

Page 15 of 22

EX3DV4 - SN:3986

January 24, 2024

UID	Rev	Communication System Name	Group	PAR (dB)	Un ^o k = 2
10541	AAD	IEEE 802.11ac WiFi (40 MHz, MCS7, 96pc duty cycle)	WLAN	8.46	±0.6
10542	AAD	IEEE 802.11ac WiFi (40 MHz, MCS8, 96pc duty cycle)	WLAN	8.95	±0.6
10543	AAD	IEEE 802.11ac WiFi (40 MHz, MCS9, 96pc duty cycle)	WLAN	8.85	±0.6
10544	AAD	IEEE 802.11ac WiFi (80 MHz, MCS9, 96pc duty cycle)	WLAN	8.47	±0.6
10545	AAD	IEEE 802.11ac WiFi (80 MHz, MCS1, 96pc duty cycle)	WLAN	8.55	±0.6
10546	AAD	IEEE 802.11ac WiFi (80 MHz, MCS2, 96pc duty cycle)	WLAN	8.38	±0.6
10547	AAD	IEEE 802.11ac WiFi (80 MHz, MCS3, 96pc duty cycle)	WLAN	8.49	±0.6
10548	AAD	IEEE 802.11ac WiFi (80 MHz, MCS4, 96pc duty cycle)	WLAN	8.37	±0.6
10550	AAD	IEEE 802.11ac WiFi (80 MHz, MCS5, 96pc duty cycle)	WLAN	8.38	±0.6
10551	AAD	IEEE 802.11ac WiFi (80 MHz, MCS7, 96pc duty cycle)	WLAN	8.56	±0.6
10563	AAD	IEEE 802.11ac WiFi (80 MHz, MCS8, 96pc duty cycle)	WLAN	8.42	±0.6
10563	AAD	IEEE 802.11ac WiFi (80 MHz, MCS8, 96pc duty cycle)	WLAN	8.45	±0.6
10554	AAD	IEEE 802.11ac WiFi (160 MHz, MCS9, 96pc duty cycle)	WLAN	8.48	±0.6
10555	AAD	IEEE 802.11ac WiFi (160 MHz, MCS1, 96pc duty cycle)	WLAN	8.47	±0.6
10556	AAD	IEEE 802.11ac WiFi (160 MHz, MCS2, 96pc duty cycle)	WLAN	8.50	±0.6
10567	AAD	IEEE 802.11ac WiFi (160 MHz, MCS3, 96pc duty cycle)	WLAN	8.52	±0.6
10568	AAD	IEEE 802.11ac WiFi (160 MHz, MCS4, 96pc duty cycle)	WLAN	8.61	±0.6
10569	AAD	IEEE 802.11ac WiFi (160 MHz, MCS5, 96pc duty cycle)	WLAN	8.73	±0.6
10561	AAD	IEEE 802.11ac WiFi (160 MHz, MCS7, 96pc duty cycle)	WLAN	8.56	±0.6
10562	AAD	IEEE 802.11ac WiFi (160 MHz, MCS8, 96pc duty cycle)	WLAN	8.69	±0.6
10563	AAD	IEEE 802.11ac WiFi (160 MHz, MCS8, 96pc duty cycle)	WLAN	8.77	±0.6
10564	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 96pc duty cycle)	WLAN	8.25	±0.6
10568	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 96pc duty cycle)	WLAN	8.45	±0.6
10568	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 96pc duty cycle)	WLAN	8.12	±0.6
10567	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 96pc duty cycle)	WLAN	8.00	±0.6
10568	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 96pc duty cycle)	WLAN	8.37	±0.6
10569	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 96pc duty cycle)	WLAN	8.10	±0.6
10570	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 96pc duty cycle)	WLAN	8.30	±0.6
10571	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	WLAN	1.99	±0.6
10572	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 96pc duty cycle)	WLAN	1.99	±0.6
10573	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 96pc duty cycle)	WLAN	1.99	±0.6
10574	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 96pc duty cycle)	WLAN	1.99	±0.6
10575	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 96pc duty cycle)	WLAN	8.59	±0.6
10576	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 96pc duty cycle)	WLAN	8.60	±0.6
10577	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 96pc duty cycle)	WLAN	8.73	±0.6
10578	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 96pc duty cycle)	WLAN	8.41	±0.6
10579	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 96pc duty cycle)	WLAN	8.36	±0.6
10580	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 96pc duty cycle)	WLAN	8.78	±0.6
10581	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 96pc duty cycle)	WLAN	8.35	±0.6
10582	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 96pc duty cycle)	WLAN	8.67	±0.6
10583	AAD	IEEE 802.11ah WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	WLAN	8.59	±0.6
10584	AAD	IEEE 802.11ah WiFi 5 GHz (OFDM, 9 Mbps, 96pc duty cycle)	WLAN	8.66	±0.6
10585	AAD	IEEE 802.11ah WiFi 5 GHz (OFDM, 12 Mbps, 96pc duty cycle)	WLAN	8.76	±0.6
10586	AAD	IEEE 802.11ah WiFi 5 GHz (OFDM, 18 Mbps, 96pc duty cycle)	WLAN	8.48	±0.6
10587	AAD	IEEE 802.11ah WiFi 5 GHz (OFDM, 24 Mbps, 96pc duty cycle)	WLAN	8.36	±0.6
10588	AAD	IEEE 802.11ah WiFi 5 GHz (OFDM, 36 Mbps, 96pc duty cycle)	WLAN	8.78	±0.6
10589	AAD	IEEE 802.11ah WiFi 5 GHz (OFDM, 48 Mbps, 96pc duty cycle)	WLAN	8.38	±0.6
10590	AAD	IEEE 802.11ah WiFi 5 GHz (OFDM, 54 Mbps, 96pc duty cycle)	WLAN	8.67	±0.6
10591	AAD	IEEE 802.11n (HT Mixed, 20 MHz, MCS6, 96pc duty cycle)	WLAN	8.63	±0.6
10592	AAD	IEEE 802.11n (HT Mixed, 20 MHz, MCS1, 96pc duty cycle)	WLAN	8.79	±0.6
10593	AAD	IEEE 802.11n (HT Mixed, 20 MHz, MCS2, 96pc duty cycle)	WLAN	8.64	±0.6
10594	AAD	IEEE 802.11n (HT Mixed, 20 MHz, MCS3, 96pc duty cycle)	WLAN	8.74	±0.6
10595	AAD	IEEE 802.11n (HT Mixed, 20 MHz, MCS4, 96pc duty cycle)	WLAN	8.74	±0.6
10596	AAD	IEEE 802.11n (HT Mixed, 20 MHz, MCS5, 96pc duty cycle)	WLAN	8.71	±0.6
10597	AAD	IEEE 802.11n (HT Mixed, 20 MHz, MCS6, 96pc duty cycle)	WLAN	8.72	±0.6
10598	AAD	IEEE 802.11n (HT Mixed, 20 MHz, MCS7, 96pc duty cycle)	WLAN	8.50	±0.6
10599	AAD	IEEE 802.11n (HT Mixed, 40 MHz, MCS0, 96pc duty cycle)	WLAN	8.79	±0.6
10600	AAD	IEEE 802.11n (HT Mixed, 40 MHz, MCS1, 96pc duty cycle)	WLAN	8.68	±0.6
10601	AAD	IEEE 802.11n (HT Mixed, 40 MHz, MCS2, 96pc duty cycle)	WLAN	8.82	±0.6
10602	AAD	IEEE 802.11n (HT Mixed, 40 MHz, MCS3, 96pc duty cycle)	WLAN	8.94	±0.6
10603	AAD	IEEE 802.11n (HT Mixed, 40 MHz, MCS4, 96pc duty cycle)	WLAN	9.03	±0.6
10604	AAD	IEEE 802.11n (HT Mixed, 40 MHz, MCS5, 96pc duty cycle)	WLAN	8.79	±0.6
10605	AAD	IEEE 802.11n (HT Mixed, 40 MHz, MCS6, 96pc duty cycle)	WLAN	8.97	±0.6
10606	AAD	IEEE 802.11n (HT Mixed, 40 MHz, MCS7, 96pc duty cycle)	WLAN	8.82	±0.6
10607	AAD	IEEE 802.11ac WiFi (20 MHz, MCS0, 96pc duty cycle)	WLAN	8.84	±0.6
10608	AAD	IEEE 802.11ac WiFi (20 MHz, MCS1, 96pc duty cycle)	WLAN	8.77	±0.6

Certificate No: EX-3986_Jan24

Page 16 of 22



SGS Korea Co., Ltd.

4, LS-ro 182beon-gil, Gunpo-si Gyeonggi-do, Korea, 15807

Tel. 031-428-5700 / Fax. 031-427-2371

<http://www.sgsgroup.kr>

Page : 17/ 71

EX3DV4 - SN:3986

January 24, 2024

UID	Rev	Communication System Name	Group	PAR (dB)	Unc# A = 2
10609	AAD	IEEE 802.11ac WiFi (20 MHz, MCS2, 90pc duty cycle)	WLAN	8.57	±0.6
10610	AAD	IEEE 802.11ac WiFi (20 MHz, MCS3, 90pc duty cycle)	WLAN	8.78	±0.6
10611	AAD	IEEE 802.11ac WiFi (20 MHz, MCS4, 90pc duty cycle)	WLAN	8.75	±0.6
10612	AAD	IEEE 802.11ac WiFi (20 MHz, MCS5, 90pc duty cycle)	WLAN	8.77	±0.6
10613	AAD	IEEE 802.11ac WiFi (20 MHz, MCS6, 90pc duty cycle)	WLAN	8.94	±0.6
10614	AAD	IEEE 802.11ac WiFi (20 MHz, MCS7, 90pc duty cycle)	WLAN	8.58	±0.6
10615	AAD	IEEE 802.11ac WiFi (20 MHz, MCS8, 90pc duty cycle)	WLAN	8.82	±0.6
10616	AAD	IEEE 802.11ac WiFi (40 MHz, MCS8, 90pc duty cycle)	WLAN	8.02	±0.6
10617	AAD	IEEE 802.11ac WiFi (40 MHz, MCS1, 90pc duty cycle)	WLAN	8.01	±0.6
10618	AAD	IEEE 802.11ac WiFi (40 MHz, MCS2, 90pc duty cycle)	WLAN	8.58	±0.6
10619	AAD	IEEE 802.11ac WiFi (40 MHz, MCS3, 90pc duty cycle)	WLAN	8.06	±0.6
10620	AAD	IEEE 802.11ac WiFi (40 MHz, MCS4, 90pc duty cycle)	WLAN	8.07	±0.6
10621	AAD	IEEE 802.11ac WiFi (40 MHz, MCS5, 90pc duty cycle)	WLAN	8.77	±0.6
10622	AAD	IEEE 802.11ac WiFi (40 MHz, MCS6, 90pc duty cycle)	WLAN	8.08	±0.6
10623	AAD	IEEE 802.11ac WiFi (40 MHz, MCS7, 90pc duty cycle)	WLAN	8.02	±0.6
10624	AAD	IEEE 802.11ac WiFi (40 MHz, MCS8, 90pc duty cycle)	WLAN	8.90	±0.6
10625	AAD	IEEE 802.11ac WiFi (80 MHz, MCS8, 90pc duty cycle)	WLAN	8.90	±0.6
10626	AAD	IEEE 802.11ac WiFi (80 MHz, MCS9, 90pc duty cycle)	WLAN	8.93	±0.6
10627	AAD	IEEE 802.11ac WiFi (80 MHz, MCS1, 90pc duty cycle)	WLAN	8.90	±0.6
10628	AAD	IEEE 802.11ac WiFi (80 MHz, MCS2, 90pc duty cycle)	WLAN	8.71	±0.6
10629	AAD	IEEE 802.11ac WiFi (80 MHz, MCS3, 90pc duty cycle)	WLAN	8.95	±0.6
10630	AAD	IEEE 802.11ac WiFi (80 MHz, MCS4, 90pc duty cycle)	WLAN	8.72	±0.6
10631	AAD	IEEE 802.11ac WiFi (80 MHz, MCS5, 90pc duty cycle)	WLAN	8.81	±0.6
10632	AAD	IEEE 802.11ac WiFi (80 MHz, MCS6, 90pc duty cycle)	WLAN	8.74	±0.6
10633	AAD	IEEE 802.11ac WiFi (80 MHz, MCS7, 90pc duty cycle)	WLAN	8.83	±0.6
10634	AAD	IEEE 802.11ac WiFi (80 MHz, MCS8, 90pc duty cycle)	WLAN	8.90	±0.6
10635	AAD	IEEE 802.11ac WiFi (80 MHz, MCS9, 90pc duty cycle)	WLAN	8.91	±0.6
10636	AAD	IEEE 802.11ac WiFi (160 MHz, MCS9, 90pc duty cycle)	WLAN	8.93	±0.6
10637	AAD	IEEE 802.11ac WiFi (160 MHz, MCS1, 90pc duty cycle)	WLAN	8.70	±0.6
10638	AAD	IEEE 802.11ac WiFi (160 MHz, MCS2, 90pc duty cycle)	WLAN	8.86	±0.6
10639	AAD	IEEE 802.11ac WiFi (160 MHz, MCS3, 90pc duty cycle)	WLAN	8.89	±0.6
10640	AAD	IEEE 802.11ac WiFi (160 MHz, MCS4, 90pc duty cycle)	WLAN	8.99	±0.6
10641	AAD	IEEE 802.11ac WiFi (160 MHz, MCS5, 90pc duty cycle)	WLAN	9.05	±0.6
10642	AAD	IEEE 802.11ac WiFi (160 MHz, MCS6, 90pc duty cycle)	WLAN	9.00	±0.6
10643	AAD	IEEE 802.11ac WiFi (160 MHz, MCS7, 90pc duty cycle)	WLAN	8.89	±0.6
10644	AAD	IEEE 802.11ac WiFi (160 MHz, MCS8, 90pc duty cycle)	WLAN	9.05	±0.6
10645	AAD	IEEE 802.11ac WiFi (160 MHz, MCS9, 90pc duty cycle)	WLAN	9.11	±0.6
10646	AAD	LTE-TDD (SC-FDMA, 1.98, 5 MHz, QPSK, UL Subframe=2,7)	LTE-TDD	11.98	±0.6
10647	AAD	LTE-TDD (SC-FDMA, 1.98, 5 MHz, QPSK, UL Subframe=2,7)	LTE-TDD	11.98	±0.6
10648	AAA	CDMA2000 (1x Advanced)	CDMA2000	3.45	±0.6
10649	AAK	LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.91	±0.6
10650	AAK	LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.43	±0.6
10651	AAE	LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	8.96	±0.6
10652	AAK	LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.21	±0.6
10653	AAK	Pulse Waveform (200Hz, 10%)	Test	10.00	±0.6
10654	AAK	Pulse Waveform (200Hz, 20%)	Test	8.99	±0.6
10655	AAK	Pulse Waveform (200Hz, 40%)	Test	3.98	±0.6
10656	AAK	Pulse Waveform (200Hz, 60%)	Test	3.33	±0.6
10657	AAK	Pulse Waveform (200Hz, 80%)	Test	3.97	±0.6
10658	AAA	Bluetooth Low Energy	Bluetooth	3.19	±0.6
10659	AAD	IEEE 802.11ax (20 MHz, MCS0, 90pc duty cycle)	WLAN	9.09	±0.6
10660	AAD	IEEE 802.11ax (20 MHz, MCS1, 90pc duty cycle)	WLAN	8.57	±0.6
10661	AAD	IEEE 802.11ax (20 MHz, MCS2, 90pc duty cycle)	WLAN	8.78	±0.6
10662	AAD	IEEE 802.11ax (20 MHz, MCS3, 90pc duty cycle)	WLAN	8.74	±0.6
10663	AAD	IEEE 802.11ax (20 MHz, MCS4, 90pc duty cycle)	WLAN	8.90	±0.6
10664	AAD	IEEE 802.11ax (20 MHz, MCS5, 90pc duty cycle)	WLAN	8.77	±0.6
10665	AAD	IEEE 802.11ax (20 MHz, MCS6, 90pc duty cycle)	WLAN	8.73	±0.6
10666	AAD	IEEE 802.11ax (20 MHz, MCS7, 90pc duty cycle)	WLAN	8.78	±0.6
10667	AAD	IEEE 802.11ax (20 MHz, MCS8, 90pc duty cycle)	WLAN	8.88	±0.6
10668	AAD	IEEE 802.11ax (20 MHz, MCS9, 90pc duty cycle)	WLAN	8.85	±0.6
10669	AAD	IEEE 802.11ax (20 MHz, MCS10, 90pc duty cycle)	WLAN	8.62	±0.6
10670	AAD	IEEE 802.11ax (20 MHz, MCS11, 90pc duty cycle)	WLAN	8.83	±0.6
10671	AAD	IEEE 802.11ax (20 MHz, MCS12, 90pc duty cycle)	WLAN	8.42	±0.6
10672	AAD	IEEE 802.11ax (20 MHz, MCS13, 90pc duty cycle)	WLAN	8.26	±0.6
10673	AAD	IEEE 802.11ax (20 MHz, MCS14, 90pc duty cycle)	WLAN	8.33	±0.6
10674	AAD	IEEE 802.11ax (20 MHz, MCS15, 90pc duty cycle)	WLAN	8.28	±0.6

Certificate No: EX-3986_jan24

Page 17 of 22

EX30V4 - 5N3885

January 24, 2024

UID	Rev	Communication System Name	Group	PAIR (dB)	Unc ² & ±2
10687	AAC	IEEE 802.11ax (20MHz, MCS4, 90pc duty cycle)	WLAN	8.45	±0.8
10688	AAC	IEEE 802.11ax (20MHz, MCS4, 90pc duty cycle)	WLAN	8.29	±0.8
10689	AAC	IEEE 802.11ax (20MHz, MCS4, 90pc duty cycle)	WLAN	8.35	±0.8
10690	AAC	IEEE 802.11ax (20MHz, MCS7, 90pc duty cycle)	WLAN	8.39	±0.8
10691	AAC	IEEE 802.11ax (20MHz, MCS8, 90pc duty cycle)	WLAN	8.25	±0.8
10692	AAC	IEEE 802.11ax (20MHz, MCS6, 90pc duty cycle)	WLAN	8.29	±0.8
10693	AAC	IEEE 802.11ax (20MHz, MCS11, 90pc duty cycle)	WLAN	8.28	±0.8
10694	AAC	IEEE 802.11ax (20MHz, MCS11, 90pc duty cycle)	WLAN	8.57	±0.8
10695	AAC	IEEE 802.11ax (40MHz, MCS0, 90pc duty cycle)	WLAN	8.78	±0.8
10696	AAC	IEEE 802.11ax (40MHz, MCS1, 90pc duty cycle)	WLAN	8.81	±0.8
10697	AAC	IEEE 802.11ax (40MHz, MCS2, 90pc duty cycle)	WLAN	8.61	±0.8
10698	AAC	IEEE 802.11ax (40MHz, MCS3, 90pc duty cycle)	WLAN	8.68	±0.8
10699	AAC	IEEE 802.11ax (40MHz, MCS4, 90pc duty cycle)	WLAN	8.82	±0.8
10700	AAC	IEEE 802.11ax (40MHz, MCS5, 90pc duty cycle)	WLAN	8.73	±0.8
10701	AAC	IEEE 802.11ax (40MHz, MCS6, 90pc duty cycle)	WLAN	8.66	±0.8
10702	AAC	IEEE 802.11ax (40MHz, MCS7, 90pc duty cycle)	WLAN	8.70	±0.8
10703	AAC	IEEE 802.11ax (40MHz, MCS8, 90pc duty cycle)	WLAN	8.62	±0.8
10704	AAC	IEEE 802.11ax (40MHz, MCS9, 90pc duty cycle)	WLAN	8.56	±0.8
10705	AAC	IEEE 802.11ax (40MHz, MCS10, 90pc duty cycle)	WLAN	8.69	±0.8
10706	AAC	IEEE 802.11ax (40MHz, MCS11, 90pc duty cycle)	WLAN	8.60	±0.8
10707	AAC	IEEE 802.11ax (40MHz, MCS0, 90pc duty cycle)	WLAN	8.32	±0.8
10708	AAC	IEEE 802.11ax (40MHz, MCS1, 90pc duty cycle)	WLAN	8.55	±0.8
10709	AAC	IEEE 802.11ax (40MHz, MCS2, 90pc duty cycle)	WLAN	8.33	±0.8
10710	AAC	IEEE 802.11ax (40MHz, MCS3, 90pc duty cycle)	WLAN	8.29	±0.8
10711	AAC	IEEE 802.11ax (40MHz, MCS4, 90pc duty cycle)	WLAN	8.39	±0.8
10712	AAC	IEEE 802.11ax (40MHz, MCS5, 90pc duty cycle)	WLAN	8.87	±0.8
10713	AAC	IEEE 802.11ax (40MHz, MCS6, 90pc duty cycle)	WLAN	8.33	±0.8
10714	AAC	IEEE 802.11ax (40MHz, MCS7, 90pc duty cycle)	WLAN	8.28	±0.8
10715	AAC	IEEE 802.11ax (40MHz, MCS8, 90pc duty cycle)	WLAN	8.45	±0.8
10716	AAC	IEEE 802.11ax (40MHz, MCS9, 90pc duty cycle)	WLAN	8.35	±0.8
10717	AAC	IEEE 802.11ax (40MHz, MCS10, 90pc duty cycle)	WLAN	8.48	±0.8
10718	AAC	IEEE 802.11ax (40MHz, MCS11, 90pc duty cycle)	WLAN	8.24	±0.8
10719	AAC	IEEE 802.11ax (80MHz, MCS0, 90pc duty cycle)	WLAN	8.61	±0.8
10720	AAC	IEEE 802.11ax (80MHz, MCS1, 90pc duty cycle)	WLAN	8.67	±0.8
10721	AAC	IEEE 802.11ax (80MHz, MCS2, 90pc duty cycle)	WLAN	8.76	±0.8
10722	AAC	IEEE 802.11ax (80MHz, MCS3, 90pc duty cycle)	WLAN	8.56	±0.8
10723	AAC	IEEE 802.11ax (80MHz, MCS4, 90pc duty cycle)	WLAN	8.70	±0.8
10724	AAC	IEEE 802.11ax (80MHz, MCS5, 90pc duty cycle)	WLAN	8.90	±0.8
10725	AAC	IEEE 802.11ax (80MHz, MCS6, 90pc duty cycle)	WLAN	8.74	±0.8
10726	AAC	IEEE 802.11ax (80MHz, MCS7, 90pc duty cycle)	WLAN	8.79	±0.8
10727	AAC	IEEE 802.11ax (80MHz, MCS8, 90pc duty cycle)	WLAN	8.66	±0.8
10728	AAC	IEEE 802.11ax (80MHz, MCS9, 90pc duty cycle)	WLAN	8.65	±0.8
10729	AAC	IEEE 802.11ax (80MHz, MCS10, 90pc duty cycle)	WLAN	8.64	±0.8
10730	AAC	IEEE 802.11ax (80MHz, MCS11, 90pc duty cycle)	WLAN	8.67	±0.8
10731	AAC	IEEE 802.11ax (80MHz, MCS0, 90pc duty cycle)	WLAN	8.42	±0.8
10732	AAC	IEEE 802.11ax (80MHz, MCS1, 90pc duty cycle)	WLAN	8.40	±0.8
10733	AAC	IEEE 802.11ax (80MHz, MCS2, 90pc duty cycle)	WLAN	8.25	±0.8
10734	AAC	IEEE 802.11ax (80MHz, MCS3, 90pc duty cycle)	WLAN	8.33	±0.8
10735	AAC	IEEE 802.11ax (80MHz, MCS4, 90pc duty cycle)	WLAN	8.27	±0.8
10736	AAC	IEEE 802.11ax (80MHz, MCS5, 90pc duty cycle)	WLAN	8.38	±0.8
10737	AAC	IEEE 802.11ax (80MHz, MCS6, 90pc duty cycle)	WLAN	8.42	±0.8
10738	AAC	IEEE 802.11ax (80MHz, MCS7, 90pc duty cycle)	WLAN	8.28	±0.8
10739	AAC	IEEE 802.11ax (80MHz, MCS8, 90pc duty cycle)	WLAN	8.48	±0.8
10740	AAC	IEEE 802.11ax (80MHz, MCS9, 90pc duty cycle)	WLAN	8.45	±0.8
10741	AAC	IEEE 802.11ax (80MHz, MCS10, 90pc duty cycle)	WLAN	8.43	±0.8
10742	AAC	IEEE 802.11ax (80MHz, MCS11, 90pc duty cycle)	WLAN	8.94	±0.8
10743	AAC	IEEE 802.11ax (160MHz, MCS0, 90pc duty cycle)	WLAN	9.16	±0.8
10744	AAC	IEEE 802.11ax (160MHz, MCS1, 90pc duty cycle)	WLAN	8.93	±0.8
10745	AAC	IEEE 802.11ax (160MHz, MCS2, 90pc duty cycle)	WLAN	9.11	±0.8
10746	AAC	IEEE 802.11ax (160MHz, MCS3, 90pc duty cycle)	WLAN	9.04	±0.8
10747	AAC	IEEE 802.11ax (160MHz, MCS4, 90pc duty cycle)	WLAN	8.93	±0.8
10748	AAC	IEEE 802.11ax (160MHz, MCS5, 90pc duty cycle)	WLAN	8.90	±0.8
10749	AAC	IEEE 802.11ax (160MHz, MCS6, 90pc duty cycle)	WLAN	8.79	±0.8
10750	AAC	IEEE 802.11ax (160MHz, MCS7, 90pc duty cycle)	WLAN	8.82	±0.8
10751	AAC	IEEE 802.11ax (160MHz, MCS8, 90pc duty cycle)	WLAN	8.91	±0.8
10752	AAC	IEEE 802.11ax (160MHz, MCS9, 90pc duty cycle)	WLAN	8.91	±0.8

Certificate No: EX-3885_Jan24

Page 18 of 22



EX30V4 - SN:3986

January 24, 2024

UID	Rev	Communication System Name	Group	PAR (dB)	Unc ² k = 2
10763	AAC	IEEE 802.11ax (180 MHz, MCS10, 90pc duty cycle)	WLAN	9.00	±9.8
10764	AAC	IEEE 802.11ax (180 MHz, MCS11, 90pc duty cycle)	WLAN	8.94	±9.8
10765	AAC	IEEE 802.11ax (180 MHz, MCS3, 90pc duty cycle)	WLAN	8.94	±9.8
10766	AAC	IEEE 802.11ax (180 MHz, MCS1, 90pc duty cycle)	WLAN	8.77	±9.8
10767	AAC	IEEE 802.11ax (180 MHz, MCS2, 90pc duty cycle)	WLAN	8.77	±9.8
10768	AAC	IEEE 802.11ax (180 MHz, MCS4, 90pc duty cycle)	WLAN	8.80	±9.8
10769	AAC	IEEE 802.11ax (180 MHz, MCS4, 90pc duty cycle)	WLAN	8.88	±9.8
10761	AAC	IEEE 802.11ax (180 MHz, MCS8, 90pc duty cycle)	WLAN	8.49	±9.8
10762	AAC	IEEE 802.11ax (180 MHz, MCS8, 90pc duty cycle)	WLAN	8.58	±9.8
10763	AAC	IEEE 802.11ax (180 MHz, MCS8, 90pc duty cycle)	WLAN	8.49	±9.8
10764	AAC	IEEE 802.11ax (180 MHz, MCS8, 90pc duty cycle)	WLAN	8.53	±9.8
10764	AAC	IEEE 802.11ax (180 MHz, MCS8, 90pc duty cycle)	WLAN	8.54	±9.8
10765	AAC	IEEE 802.11ax (180 MHz, MCS10, 90pc duty cycle)	WLAN	8.54	±9.8
10766	AAC	IEEE 802.11ax (180 MHz, MCS11, 90pc duty cycle)	WLAN	8.51	±9.8
10767	AAC	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	7.99	±9.8
10768	AAC	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.01	±9.8
10769	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.01	±9.8
10770	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	±9.8
10771	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	±9.8
10772	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.23	±9.8
10773	AAC	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.03	±9.8
10774	AAC	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	±9.8
10775	AAC	5G NR (CP-OFDM, 50% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.31	±9.8
10776	AAC	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.33	±9.8
10777	AAC	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.33	±9.8
10778	AAC	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.34	±9.8
10779	AAC	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.43	±9.8
10780	AAC	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.38	±9.8
10781	AAC	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.38	±9.8
10782	AAC	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.43	±9.8
10783	AAC	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.31	±9.8
10784	AAC	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.26	±9.8
10785	AAC	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.40	±9.8
10786	AAC	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.36	±9.8
10787	AAC	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.44	±9.8
10788	AAC	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	±9.8
10789	AAC	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.37	±9.8
10790	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	±9.8
10791	AAC	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.83	±9.8
10792	AAC	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.92	±9.8
10793	AAC	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.95	±9.8
10794	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.83	±9.8
10795	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.84	±9.8
10796	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	±9.8
10797	AAC	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.01	±9.8
10798	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.98	±9.8
10799	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.88	±9.8
10800	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.88	±9.8
10801	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.87	±9.8
10802	AAC	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.99	±9.8
10803	AAC	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	±9.8
10804	AAC	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.37	±9.8
10805	AAC	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	±9.8
10806	AAC	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	±9.8
10807	AAC	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	±9.8
10808	AAC	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	±9.8
10809	AAC	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	±9.8
10810	AAC	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.33	±9.8
10811	AAC	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.30	±9.8
10812	AAC	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	±9.8
10813	AAC	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	±9.8
10814	AAC	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.39	±9.8
10815	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	±9.8
10816	AAC	5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.42	±9.8
10817	AAC	5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.43	±9.8

Certificate No: EX-3986_Jan24

Page 19 of 22



SGS Korea Co., Ltd.

4, LS-ro 182beon-gil, Gunpo-si Gyeonggi-do, Korea, 15807

Tel. 031-428-5700 / Fax. 031-427-2371

<http://www.sgsgroup.kr>

Page : 20/ 71

EX30V4 - SN:3986

January 24, 2024

UID	Rev	Communication System Name	Group	RAIR (dB)	Unc ² k = 2
10829	AAE	SG NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	8.43	±0.6
10830	AAE	SG NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.63	±0.6
10831	AAE	SG NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.73	±0.6
10832	AAE	SG NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.74	±0.6
10833	AAE	SG NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.75	±0.6
10834	AAE	SG NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.75	±0.6
10835	AAE	SG NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.75	±0.6
10836	AAE	SG NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.68	±0.6
10837	AAE	SG NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.68	±0.6
10838	AAE	SG NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.75	±0.6
10840	AAE	SG NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.67	±0.6
10841	AAE	SG NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	7.71	±0.6
10843	AAE	SG NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.48	±0.6
10844	AAE	SG NR (CP-OFDM, 50% RB, 25 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.34	±0.6
10846	AAE	SG NR (CP-OFDM, 50% RB, 35 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.41	±0.6
10854	AAE	SG NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.34	±0.6
10855	AAE	SG NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.36	±0.6
10856	AAE	SG NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.37	±0.6
10857	AAE	SG NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.35	±0.6
10858	AAE	SG NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.35	±0.6
10859	AAE	SG NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.34	±0.6
10860	AAE	SG NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.41	±0.6
10861	AAE	SG NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.40	±0.6
10863	AAE	SG NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.41	±0.6
10864	AAE	SG NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.37	±0.6
10865	AAE	SG NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 60 kHz)	SG NR FR1 TDD	8.41	±0.6
10896	AAE	SG NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	8.88	±0.6
10898	AAE	SG NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	8.89	±0.6
10899	AAE	SG NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)	SG NR FR2 TDD	5.75	±0.6
10870	AAE	SG NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	SG NR FR2 TDD	5.86	±0.6
10871	AAE	SG NR (CP-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	SG NR FR2 TDD	5.75	±0.6
10872	AAE	SG NR (CP-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	SG NR FR2 TDD	5.82	±0.6
10873	AAE	SG NR (CP-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	SG NR FR2 TDD	5.81	±0.6
10874	AAE	SG NR (CP-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	SG NR FR2 TDD	5.85	±0.6
10875	AAE	SG NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)	SG NR FR2 TDD	7.78	±0.6
10876	AAE	SG NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	SG NR FR2 TDD	8.39	±0.6
10877	AAE	SG NR (CP-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	SG NR FR2 TDD	7.95	±0.6
10878	AAE	SG NR (CP-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	SG NR FR2 TDD	8.41	±0.6
10879	AAE	SG NR (CP-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	SG NR FR2 TDD	8.12	±0.6
10880	AAE	SG NR (CP-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	SG NR FR2 TDD	8.38	±0.6
10881	AAE	SG NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 120 kHz)	SG NR FR2 TDD	5.78	±0.6
10882	AAE	SG NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 120 kHz)	SG NR FR2 TDD	5.96	±0.6
10883	AAE	SG NR (CP-OFDM, 1 RB, 80 MHz, 16QAM, 120 kHz)	SG NR FR2 TDD	5.87	±0.6
10884	AAE	SG NR (CP-OFDM, 100% RB, 80 MHz, 16QAM, 120 kHz)	SG NR FR2 TDD	6.53	±0.6
10885	AAE	SG NR (CP-OFDM, 1 RB, 80 MHz, 64QAM, 120 kHz)	SG NR FR2 TDD	6.61	±0.6
10886	AAE	SG NR (CP-OFDM, 100% RB, 80 MHz, 64QAM, 120 kHz)	SG NR FR2 TDD	6.68	±0.6
10887	AAE	SG NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 120 kHz)	SG NR FR2 TDD	7.78	±0.6
10888	AAE	SG NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 120 kHz)	SG NR FR2 TDD	8.38	±0.6
10889	AAE	SG NR (CP-OFDM, 1 RB, 80 MHz, 16QAM, 120 kHz)	SG NR FR2 TDD	8.02	±0.6
10890	AAE	SG NR (CP-OFDM, 100% RB, 80 MHz, 16QAM, 120 kHz)	SG NR FR2 TDD	8.40	±0.6
10891	AAE	SG NR (CP-OFDM, 1 RB, 80 MHz, 64QAM, 120 kHz)	SG NR FR2 TDD	6.13	±0.6
10892	AAE	SG NR (CP-OFDM, 100% RB, 80 MHz, 64QAM, 120 kHz)	SG NR FR2 TDD	6.41	±0.6
10893	AAE	SG NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.66	±0.6
10894	AAE	SG NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.67	±0.6
10895	AAE	SG NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.67	±0.6
10896	AAE	SG NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.68	±0.6
10897	AAE	SG NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.68	±0.6
10898	AAE	SG NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.68	±0.6
10899	AAE	SG NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.68	±0.6
10900	AAE	SG NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.68	±0.6
10901	AAE	SG NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.68	±0.6
10902	AAE	SG NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.68	±0.6
10903	AAE	SG NR (CP-OFDM, 50% RB, 5 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.76	±0.6
10904	AAE	SG NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.93	±0.6
10905	AAE	SG NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.96	±0.6
10910	AAE	SG NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 30 kHz)	SG NR FR1 TDD	5.93	±0.6

Certificate No: EX-3986_jan24

Page 20 of 22

EDDV4 - SN:3965

January 24, 2024

ID	Rev	Communication System Name	Group	RA (s)	Unc ² k = 2
12011	AAB	SG NR (DFT+CPDM, 50% RB, 25 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.83	+0.5
12012	AAC	SG NR (DFT+CPDM, 50% RB, 30 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.84	+0.5
12013	AAC	SG NR (DFT+CPDM, 50% RB, 40 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.84	+0.5
12014	AAC	SG NR (DFT+CPDM, 50% RB, 50 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.85	+0.5
12015	AAD	SG NR (DFT+CPDM, 50% RB, 60 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.85	+0.5
12016	AAD	SG NR (DFT+CPDM, 50% RB, 60 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.87	+0.5
12017	AAD	SG NR (DFT+CPDM, 50% RB, 100 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.94	+0.5
12018	AAB	SG NR (DFT+CPDM, 100% RB, 5 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.85	+0.5
12019	AAC	SG NR (DFT+CPDM, 100% RB, 10 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.86	+0.5
12020	AAB	SG NR (DFT+CPDM, 100% RB, 15 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.87	+0.5
12021	AAC	SG NR (DFT+CPDM, 100% RB, 20 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.94	+0.5
12022	AAB	SG NR (DFT+CPDM, 100% RB, 15 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.92	+0.5
12023	AAC	SG NR (DFT+CPDM, 100% RB, 30 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.94	+0.5
12024	AAD	SG NR (DFT+CPDM, 100% RB, 40 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.94	+0.5
12025	AAC	SG NR (DFT+CPDM, 100% RB, 50 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.95	+0.5
12026	AAD	SG NR (DFT+CPDM, 100% RB, 60 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.94	+0.5
12027	AAD	SG NR (DFT+CPDM, 100% RB, 80 MHz, QPSK, 30.0 Hz)	SG NR PR1 TDD	5.94	+0.5
12028	AAD	SG NR (DFT+CPDM, 1 RB, 5 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.92	+0.5
12029	AAD	SG NR (DFT+CPDM, 1 RB, 10 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.92	+0.5
12030	AAC	SG NR (DFT+CPDM, 1 RB, 15 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.92	+0.5
12031	AAC	SG NR (DFT+CPDM, 1 RB, 20 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.91	+0.5
12032	AAD	SG NR (DFT+CPDM, 1 RB, 25 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.91	+0.5
12033	AAD	SG NR (DFT+CPDM, 1 RB, 30 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.91	+0.5
12034	AAC	SG NR (DFT+CPDM, 1 RB, 40 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.91	+0.5
12035	AAD	SG NR (DFT+CPDM, 1 RB, 50 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.91	+0.5
12036	AAD	SG NR (DFT+CPDM, 1 RB, 60 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.91	+0.5
12037	AAD	SG NR (DFT+CPDM, 50% RB, 5 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.92	+0.5
12038	AAD	SG NR (DFT+CPDM, 50% RB, 10 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.92	+0.5
12039	AAC	SG NR (DFT+CPDM, 50% RB, 15 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.92	+0.5
12040	AAC	SG NR (DFT+CPDM, 50% RB, 20 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.92	+0.5
12041	AAC	SG NR (DFT+CPDM, 50% RB, 25 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.95	+0.5
12042	AAC	SG NR (DFT+CPDM, 50% RB, 30 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.93	+0.5
12043	AAC	SG NR (DFT+CPDM, 50% RB, 40 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.95	+0.5
12044	AAD	SG NR (DFT+CPDM, 100% RB, 5 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.91	+0.5
12045	AAD	SG NR (DFT+CPDM, 100% RB, 10 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.92	+0.5
12046	AAD	SG NR (DFT+CPDM, 100% RB, 15 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.91	+0.5
12047	AAC	SG NR (DFT+CPDM, 100% RB, 20 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.97	+0.5
12048	AAD	SG NR (DFT+CPDM, 100% RB, 25 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.94	+0.5
12049	AAC	SG NR (DFT+CPDM, 100% RB, 30 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.97	+0.5
12050	AAC	SG NR (DFT+CPDM, 100% RB, 40 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.94	+0.5
12051	AAC	SG NR (DFT+CPDM, 100% RB, 50 MHz, QPSK, 15 kHz)	SG NR PR1 FDD	5.92	+0.5
12052	AAA	SG NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 15 kHz)	SG NR PR1 FDD	6.25	+0.5
12053	AAA	SG NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 15 kHz)	SG NR PR1 FDD	6.15	+0.5
12054	AAA	SG NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 15 kHz)	SG NR PR1 FDD	6.23	+0.5
12055	AAA	SG NR DL (CP-OFDM, TM 3.1, 30 MHz, 64-QAM, 15 kHz)	SG NR PR1 FDD	6.40	+0.5
12056	AAA	SG NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 30 kHz)	SG NR PR1 FDD	6.14	+0.5
12057	AAA	SG NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 30 kHz)	SG NR PR1 FDD	6.31	+0.5
12058	AAA	SG NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 30 kHz)	SG NR PR1 FDD	6.31	+0.5
12059	AAA	SG NR DL (CP-OFDM, TM 3.1, 30 MHz, 64-QAM, 30 kHz)	SG NR PR1 FDD	6.31	+0.5
12060	AAB	SG NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 15 kHz)	SG NR PR1 TDD	9.32	+0.5
12061	AAC	SG NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 15 kHz)	SG NR PR1 TDD	9.38	+0.5
12062	AAB	SG NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 15 kHz)	SG NR PR1 TDD	9.43	+0.5
12063	AAC	SG NR DL (CP-OFDM, TM 3.1, 30 MHz, 64-QAM, 15 kHz)	SG NR PR1 TDD	9.55	+0.5
12064	AAC	SG NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 30 kHz)	SG NR PR1 TDD	9.29	+0.5
12065	AAC	SG NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 30 kHz)	SG NR PR1 TDD	9.37	+0.5
12066	AAB	SG NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 30 kHz)	SG NR PR1 TDD	9.45	+0.5
12067	AAC	SG NR DL (CP-OFDM, TM 3.1, 30 MHz, 64-QAM, 30 kHz)	SG NR PR1 TDD	9.52	+0.5
12068	AAD	SG NR DL (CP-OFDM, TM 3.1, 100 MHz, 64-QAM, 30 kHz)	SG NR PR1 TDD	9.49	+0.5
12072	AAC	SG NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)	SG NR PR1 TDD	15.58	+0.5
12073	AAD	SG NR (CP+CPDMA, 1 RB, 100 MHz, QPSK, 30 kHz)	SG NR PR1 TDD	9.95	+0.5
12074	AAD	SG NR (CP+CPDMA, 100% RB, 100 MHz, 256-QAM, 30 kHz)	SG NR PR1 TDD	9.95	+0.5
12075	AAA	ULLA BCR	ULLA	1.18	+0.5
12076	AAA	ULLA HCR4	ULLA	8.58	+0.5
12080	AAA	ULLA HCR8	ULLA	19.38	+0.5
12081	AAA	ULLA HCR16	ULLA	3.19	+0.5
12082	AAA	ULLA HCR32	ULLA	3.43	+0.5

Certificate No: EX-3686_Jan24

Page 21 of 22

EX3DV4 - SN:3986

January 24, 2024

SRD	Rev	Communication System Name	Group	PAR (dB)	Unc ² R=2
10982	AAC	SG NR DL (CP-OFDM, TM 3.1, 40 MHz, 64-QAM, 15 MHz)	SG NR FR1 TDD	9.31	±0.6
10984	AAB	SG NR DL (CP-OFDM, TM 3.1, 50 MHz, 64-QAM, 15 MHz)	SG NR FR1 TDD	9.42	±0.6
10985	AAC	SG NR DL (CP-OFDM, TM 3.1, 40 MHz, 64-QAM, 30 MHz)	SG NR FR1 TDD	9.54	±0.6
10986	AAB	SG NR DL (CP-OFDM, TM 3.1, 50 MHz, 64-QAM, 30 MHz)	SG NR FR1 TDD	9.58	±0.6
10987	AAC	SG NR DL (CP-OFDM, TM 3.1, 60 MHz, 64-QAM, 30 MHz)	SG NR FR1 TDD	9.53	±0.6
10988	AAB	SG NR DL (CP-OFDM, TM 3.1, 70 MHz, 64-QAM, 30 MHz)	SG NR FR1 TDD	9.38	±0.6
10989	AAC	SG NR DL (CP-OFDM, TM 3.1, 80 MHz, 64-QAM, 30 MHz)	SG NR FR1 TDD	9.33	±0.6
10990	AAB	SG NR DL (CP-OFDM, TM 3.1, 90 MHz, 64-QAM, 30 MHz)	SG NR FR1 TDD	9.50	±0.6
11000	AAA	SG NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 15 MHz)	SG NR FR1 TDD	10.24	±0.6
11004	AAA	SG NR DL (CP-OFDM, TM 3.1, 25 MHz, 64-QAM, 30 MHz)	SG NR FR1 TDD	10.73	±0.6
11005	AAA	SG NR DL (CP-OFDM, TM 3.1, 25 MHz, 64-QAM, 15 MHz)	SG NR FR1 PDD	8.70	±0.6
11006	AAA	SG NR DL (CP-OFDM, TM 3.1, 30 MHz, 64-QAM, 15 MHz)	SG NR FR1 PDD	8.58	±0.6
11007	AAA	SG NR DL (CP-OFDM, TM 3.1, 40 MHz, 64-QAM, 15 MHz)	SG NR FR1 PDD	8.46	±0.6
11008	AAA	SG NR DL (CP-OFDM, TM 3.1, 50 MHz, 64-QAM, 15 MHz)	SG NR FR1 PDD	8.61	±0.6
11009	AAA	SG NR DL (CP-OFDM, TM 3.1, 25 MHz, 64-QAM, 30 MHz)	SG NR FR1 PDD	8.76	±0.6
11010	AAA	SG NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 30 MHz)	SG NR FR1 PDD	8.05	±0.6
11011	AAA	SG NR DL (CP-OFDM, TM 3.1, 40 MHz, 16-QAM, 30 MHz)	SG NR FR1 PDD	8.96	±0.6
11012	AAA	SG NR DL (CP-OFDM, TM 3.1, 60 MHz, 16-QAM, 30 MHz)	SG NR FR1 PDD	8.66	±0.6
11013	AAB	IEEE 802.11be (320 MHz, MCS1, 99pc duty cycle)	WLAN	8.07	±0.6
11014	AAB	IEEE 802.11be (320 MHz, MCS2, 99pc duty cycle)	WLAN	8.45	±0.6
11015	AAB	IEEE 802.11be (320 MHz, MCS3, 99pc duty cycle)	WLAN	8.44	±0.6
11016	AAB	IEEE 802.11be (320 MHz, MCS4, 99pc duty cycle)	WLAN	8.44	±0.6
11017	AAB	IEEE 802.11be (320 MHz, MCS5, 99pc duty cycle)	WLAN	8.41	±0.6
11018	AAB	IEEE 802.11be (320 MHz, MCS6, 99pc duty cycle)	WLAN	8.40	±0.6
11019	AAB	IEEE 802.11be (320 MHz, MCS7, 99pc duty cycle)	WLAN	8.29	±0.6
11020	AAB	IEEE 802.11be (320 MHz, MCS8, 99pc duty cycle)	WLAN	8.27	±0.6
11021	AAB	IEEE 802.11be (320 MHz, MCS9, 99pc duty cycle)	WLAN	8.40	±0.6
11022	AAB	IEEE 802.11be (320 MHz, MCS10, 99pc duty cycle)	WLAN	8.30	±0.6
11023	AAB	IEEE 802.11be (320 MHz, MCS11, 99pc duty cycle)	WLAN	8.59	±0.6
11024	AAB	IEEE 802.11be (320 MHz, MCS12, 99pc duty cycle)	WLAN	8.42	±0.6
11025	AAB	IEEE 802.11be (320 MHz, MCS13, 99pc duty cycle)	WLAN	8.37	±0.6
11026	AAB	IEEE 802.11be (320 MHz, MCS14, 99pc duty cycle)	WLAN	8.39	±0.6

² Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Appendix D.2 Calibration certificate for DAE_SN567

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

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

Client: **SGS**
Gyeonggi-do, Republic of Korea

Accreditation No.: **SGS 0108**

Certificate No.: **DAE3-567_Feb24**

CALIBRATION CERTIFICATE

Object: **DAES - SD 000 D03 AA - SN: 567**

Calibration procedure(s): **QA CAL-06.v30**
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: **February 16, 2024**

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 closest laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (MATE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Kathley Multimeter Type 2001	SN: 0610278	29-Aug-23 (No:37421)	Aug-24

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	23-Jan-24 (in house check)	In house check: Jan-25
Calibrator Box V2.1	SE UWS 006 AA 1002	23-Jan-24 (in house check)	In house check: Jan-25

Calibrated by: **Dominique Steffen** (Name), **Laboratory Technician** (Function),  (Signature)

Approved by: **Sven Kohn** (Name), **Technical Manager** (Function),  (Signature)

Issued: February 16, 2024

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

Certificate No: DAE3-567_Feb24

Page 1 of 5

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 9004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S 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 0106

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 = 6.1 μ V, 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	404.646 $\pm$ 0.02% (k=2)	404.382 $\pm$ 0.02% (k=2)	404.483 $\pm$ 0.02% (k=2)
Low Range	3.92682 $\pm$ 1.50% (k=2)	3.95906 $\pm$ 1.50% (k=2)	3.94508 $\pm$ 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	7.0 ° $\pm$ 1 °
---	-----------------

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	199997.63	0.16	0.00
Channel X + Input	20008.51	2.97	0.01
Channel X - Input	-19995.08	3.53	-0.02
Channel Y + Input	199994.79	-2.54	-0.00
Channel Y + Input	20005.88	1.05	0.01
Channel Y - Input	-19998.41	2.07	-0.01
Channel Z + Input	199998.48	0.73	0.00
Channel Z + Input	20004.07	-1.57	-0.01
Channel Z - Input	-19995.87	2.61	-0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2004.54	0.11	0.01
Channel X + Input	204.82	0.28	0.14
Channel X - Input	-195.41	0.02	-0.01
Channel Y + Input	2004.05	-0.42	-0.02
Channel Y + Input	204.33	-0.35	-0.17
Channel Y - Input	-195.02	0.24	-0.12
Channel Z + Input	2004.68	0.21	0.01
Channel Z + Input	203.98	-0.49	-0.24
Channel Z - Input	-196.29	-0.94	0.48

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	2.90	1.35
	- 200	-0.35	-2.22
Channel Y	200	-3.28	-3.47
	- 200	2.84	2.26
Channel Z	200	3.63	3.45
	- 200	-4.54	-4.75

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	-	-1.42	-2.72
Channel Y	200	8.21	-	0.13
Channel Z	200	5.89	5.67	-

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	16246	14236
Channel Y	16135	12885
Channel Z	15968	15810

5. Input Offset Measurement

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

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	1.33	-0.17	2.48	0.50
Channel Y	-0.25	-1.66	1.20	0.46
Channel Z	-0.04	-1.66	0.72	0.39

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

	Zeroing (k Ω m)	Measuring (M Ω m)
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	-6	-9

Appendix D.3 Calibration certificate for Dipole_SN1085

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

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



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

Accreditation No.: **SCS 0108**

Client: **SGS Korea**
Gyeonggi-do, Republic of Korea

Certificate No.: **D750V3-1085_Mar23**

CALIBRATION CERTIFICATE

Object: **D750V3 - SN:1085**

Calibration procedure(s): **QA CAL-05.v12
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **March 21, 2023**

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	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
Power sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
Reference 20 dB Attenuator	SN: BH8394 (204)	04-Apr-22 (No. 217-03527)	Apr-23
Type-N mismatch combination	SN: 310882 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
Reference Probe EX3DV4	SN: 7349	10-Jan-23 (No. EX3-7349_Jan23)	Jan-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4416B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP-8481A	SN: U537282783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP-8481A	SN: MY41063315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMW-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Calibrated by: **Michael Weber**

Approved by: **Swen Kühn**

Function: **Laboratory Technician**

Technical Manager

Signature: 



Issued: March 22, 2023

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

Certificate No: D750V3-1085_Mar23

Page 1 of 6

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zauggstrasse 43, 8604 Zurich, Switzerland



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

Glossary:

TSL tissue simulating liquid
ConvF sensitivity in TSL / NORM x,y,z
N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss:** This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.0 $\pm$ 6 %	0.90 mho/m $\pm$ 8 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.49 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.54 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.4 Ω - 1.9 j Ω
Return Loss	- 28.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.032 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 21.03.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1085

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.9$ S/m; $\epsilon_r = 41$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.11, 10.11, 10.11) @ 750 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.31 V/m; Power Drift = -0.05 dB

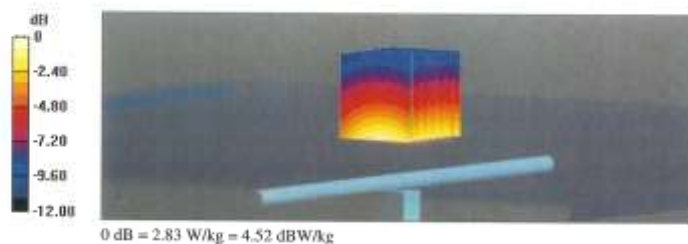
Peak SAR (extrapolated) = 3.24 W/kg

SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.4 W/kg

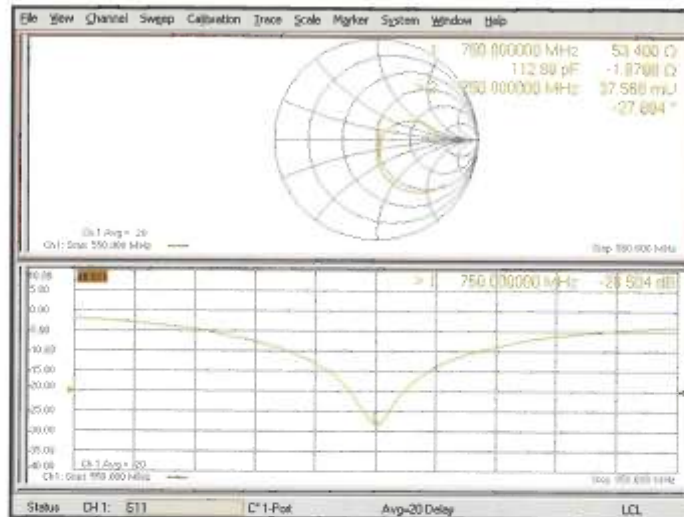
Smallest distance from peaks to all points 3 dB below = 17 mm

Ratio of SAR at M2 to SAR at M1 = 66.5%

Maximum value of SAR (measured) = 2.83 W/kg



Impedance Measurement Plot for Head TSL



Appendix D.4 Calibration certificate for Dipole_SN490

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

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

Client: **SGS**
Gyeonggi-do, Republic of Korea

Certificate No. **D835V2-490_Jun24**

SGS
Schweizerischer Kalibrierdienst
Service suisse d'étalonnage
Servizio svizzero di taratura
Swiss Calibration Service
Accreditation No.: **SCS 0108**

CALIBRATION CERTIFICATE

Object: **D835V2 - SN:490**

Calibration procedure(s): **QA CAL-05.v12**
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: **June 07, 2024**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurement (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 (MATE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04536/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04536)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04537)	Mar-25
Reference 20 dB Attenuator	SN: B18254 (20k)	26-Mar-24 (No. 217-04548)	Mar-25
Type-N mismatch combination	SN: 310882 / 08327	26-Mar-24 (No. 217-04547)	Mar-25
Reference Probe EX30V4	SN: 7349	05-Nov-23 (No. EX3-7348_Nov23)	Nov-24
DAE4	SN: 601	22-May-24 (No. DAE4-601_May24)	May-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: G839512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8441A	SN: U837252783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8441A	SN: MY41063315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMF-26	SN: 100892	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: U541083477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Calibrated by: **Leif Kysner** (Name) **Laboratory Technician** (Function) *[Signature]* (Signature)

Approved by: **Sven Kohn** (Name) **Technical Manager** (Function) *[Signature]* (Signature)

Issued: June 7, 2024

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

Certificate No: D835V2-490_Jun24

Page 1 of 6

Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8604 Zurich, Switzerland

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



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

Accreditation No.: SCS 0108

Glossary:

TSL tissue simulating liquid
ConvF sensitivity in TSL / NORM x,y,z
N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- **Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- **Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- **Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- **Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- **SAR measured:** SAR measured at the stated antenna input power.
- **SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- **SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	42.2 $\pm$ 6 %	0.93 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.64 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.26 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.7 Ω - 5.2 j Ω
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.363 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
 No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 07.06.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:490

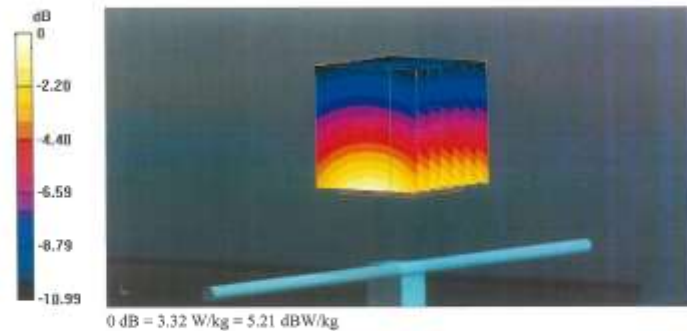
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: $f = 835$ MHz; $\sigma = 0.93$ S/m; $\epsilon_r = 42.2$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/TEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.69, 9.69, 9.69) @ 835 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.05.2024
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

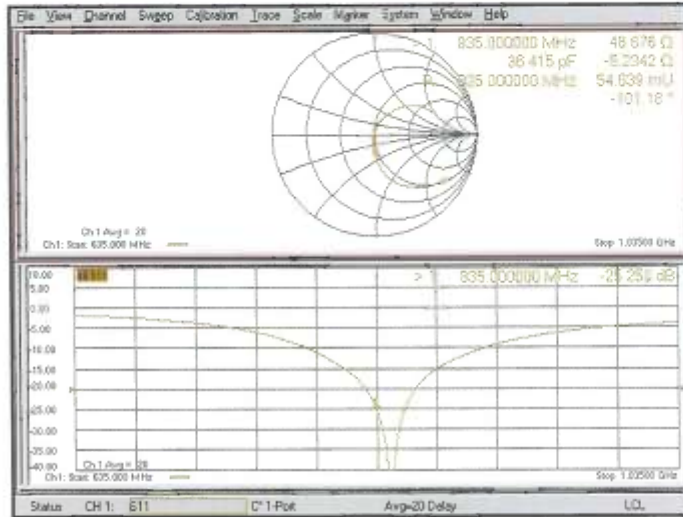
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 63.88 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.75 W/kg
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.60 W/kg
Smallest distance from peaks to all points 3 dB below = 16.1 mm
Ratio of SAR at M2 to SAR at M1 = 65.4%
Maximum value of SAR (measured) = 3.32 W/kg



Certificate No: D835V2-490_Jun24

Page 5 of 5

Impedance Measurement Plot for Head TSL



Appendix D.5 Calibration certificate for Dipole_SN1070

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland	 	S Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura S 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	
Client: SGS Gyeonggi-do, Republic of Korea	Certificate No.: D1750V2-1070_Jul24	

CALIBRATION CERTIFICATE	
Object	D1750V2 - SN: 1070
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7 - 3 GHz
Calibration date	July 11, 2024

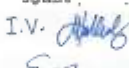
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 5)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-337	SN: 100997	28-Mar-24 (No. 217-04038)	Mar-25
Power Sensor R&S NRP13A	SN: 101099	21-Mar-24 (No. 4030A316557601)	Mar-25
Spectrum Analyzer R&S FSV40	SN: 101832	25-Jan-24 (No. 4030-315007551)	Jan-25
Mismatch: Short [S4188] Attenuator [S4482]	SN: 1102	28-Mar-24 (No. 217-04038)	Mar-25
CCP DAK-12	SN: 1016	05-Oct-23 (No. CCP-DAK12-1016_Oct23)	Oct-24
CCP DAK-3.5	SN: 1249	05-Oct-23 (No. CCP-DAK3.5-1249_Oct23)	Oct-24
Reference Probe EX30V4	SN: 7349	03-Jun-24 (No. EX3-7349_Jun24)	Jun-25
DAE-5p	SN: 1836	10-Jan-24 (No. DAE5p-1836_Jan24)	Jan-25

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Source Box	SN: 1000	28-May-24 (No. 675-ACAD_Source_Box-240528)	May-25
Signal Generator R&S SM5102A	SN: 182081	28-May-24 (No. 0051-300718404)	May-25
Mismatch: SMA	SN: 1102	22-May-24 (No. 675-Mismatch_SMA-240522)	May-25

Calibrated by	Name	Function	Signature
	Paulo Pina	Laboratory Technician	I.V. 
Approved by	Name	Function	Signature
	Evan Kühn	Technical Manager	

Issued: July 11, 2024

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

Certificate No: D1750V2-1070_Jul24

Page 1 of 6

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
S 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 0106

Glossary

TSL tissue simulating liquid
ConvF sensitivity in TSL / NORM x,y,z
N/A not applicable or not measured

Calibration is Performed According to the Following Standards

- IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- DASY System Handbook

Methods Applied and Interpretation of Parameters

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the 1st phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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%.

D1750V2 - SN: 1070

July 11, 2024

Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 6mm, dz = 1.6mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	1750MHz ±1MHz	

Head TSL parameters at 1750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ±0.2)°C	40.6 ±6%	1.35 mho/m ±6%
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 1750 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	24 dBm input power	9.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.9 W/kg ±17.0% (k = 2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	24 dBm input power	4.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.7 W/kg ±16.5% (k = 2)

D1750V2 - SN: 1070

July 11, 2024

Appendix (Additional assessments outside the scope of SCS 0106)

Antenna Parameters with Head TSL at 1750 MHz

Impedance	49.5 Ω - 0.5 jΩ
Return Loss	-42.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.222 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

D1750V2 - SN: 1070

July 11, 2024

System Performance Check Report

Summary

Device	Frequency (MHz)	TSL	Power (dBm)
D1750V2 - SN1070	1750	HBL	24

Exposure Conditions

Platform Position, TSL	Test Distance (mm)	Band	Cross, UID	Frequency (MHz, Channel Number)	Conversion factor	TSL Conductivity (S/m)	TSL Permeability
Flat	18	DW, D--	1750, 0	7.96	1.35	40.6	

Hardware Setup

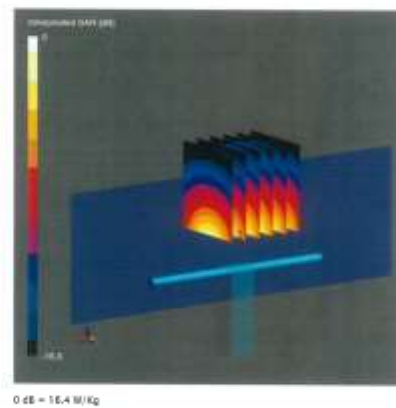
Platform	TSL Measured Date	Probe, Calibration Date	Dist, Calibration Date
HSP VLS Right	HBL, 2024-07-11	EX3066 - 547348, 2024-05-05	DE440 Ser1636, 2024-01-19

Scan Setup

	Zoom Scan
Grid Format (mm)	32 x 80 x 80
Grid Size (mm)	6.8 x 6.8 x 1.3
Sensor Surface (mm)	1.4
Grated G/M	Yes
Grating Rule	1.8
Wish	N/A
Surface Detection	All points
Scan Method	Measured

Measurement Results

	Zoom Scan
Date	2024-07-11
psARL g (W/kg)	9.38
psARL Ep (W/kg)	4.84
Power Grth (dB)	0.80
Power Scaling	Disabled
Scaling Factor (dB)	
TSL Correction	Positive / Negative



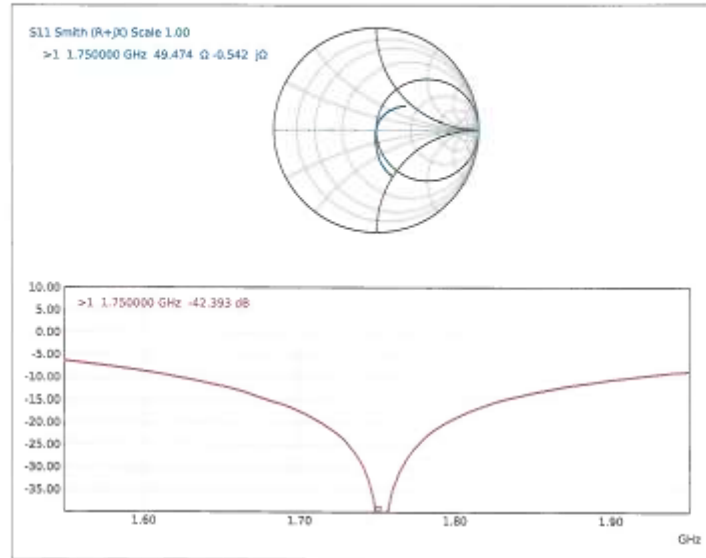
Certificate No: D1750V2-1070_Ju24

Page 5 of 6

D1750V2 - SN: 1070

July 11, 2024

Impedance Measurement Plot for Head TSL



Certificate No: D1750V2-1070_Jul24

Page 6 of 6

Appendix D.6 Calibration certificate for Dipole_SN5d033

Calibration Laboratory of Schmid & Partner Engineering AG Zersgassestrasse 43, 8004 Zurich, Switzerland 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		 	S Schweizerischer Kalibrierdienst S Service suisse d'étalonnage S Servizio svizzero di taratura S Swiss Calibration Service Accreditation No.: SCS 0106
Client SGS Gyeonggi-do, Republic of Korea		Certificate No. D1900V2-5d033_Jun24	

CALIBRATION CERTIFICATE			
Object	D1900V2 - SN:5d033		
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz		
Calibration date:	June 13, 2024		
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 NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: B-9334 (20K)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310662 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Reference Probe EX30V4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 501	22-May-24 (No. DAE4-501_May24)	May-25
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB36512475	30-Oct-14 (in house check Oct-22)	in house check: Oct-24
Power sensor HP 8481A	SN: US37222783	07-Oct-15 (in house check Oct-22)	in house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	in house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	in house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41060477	31-Mar-14 (in house check Oct-22)	in house check: Oct-24
Calibrated by:	Name Kwakmin Park	Function Laboratory Technician	Signature 
Approved by:	Name Sven Kühn	Technical Manager	Signature 
Issued: June 13, 2024 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Certificate No: D1900V2-5d033_Jun24

Page 1 of 6

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
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

Glossary:

TSL tissue simulating liquid
ConvF sensitivity in TSL / NORM x,y,z
N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.2 $\pm$ 6 %	1.40 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.3 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.4 Ω + 6.0 j Ω
Return Loss	- 24.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.206 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 13.06.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d033

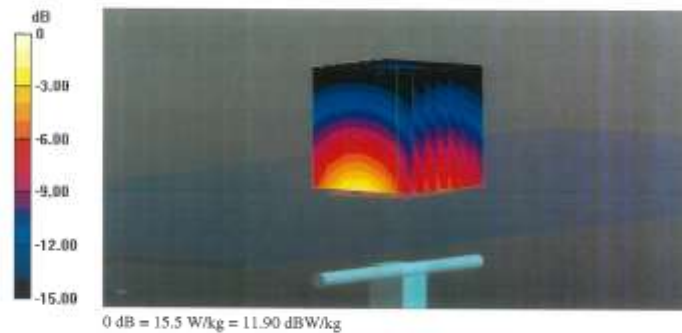
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ S/m; $\epsilon_r = 41.2$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.05.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

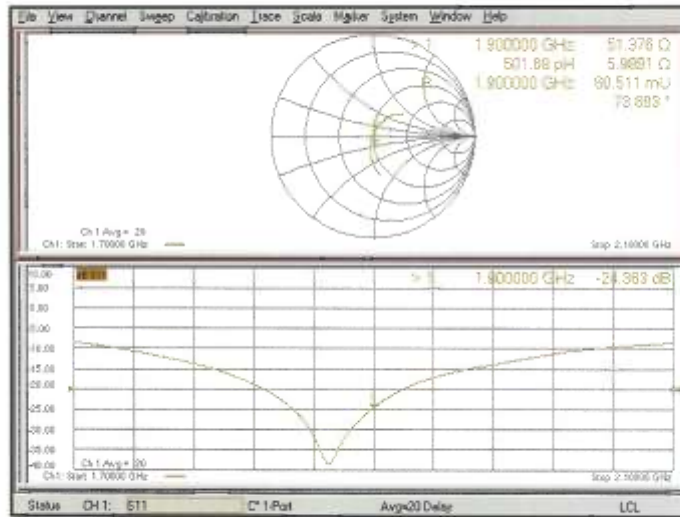
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 111.0 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 18.7 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.29 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 55%
Maximum value of SAR (measured) = 15.5 W/kg



Certificate No: D1900V2-5d033_Jun24

Page 5 of 6

Impedance Measurement Plot for Head TSL



Appendix D.7 Calibration certificate for Dipole_SN1124

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

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

Accreditation No.: SCS 0100

Client: **SGS**
Gyeonggi-do, Republic of Korea

Certificate No.: **D2600V2-1124_Jul24**

CALIBRATION CERTIFICATE

Object: **D2600V2 - SN: 1124**

Calibration procedure(s): **QA CAL-05.v12**
Calibration Procedure for SAR Validation Sources between 0.7 - 3 GHz

Calibration date: **July 22, 2024**

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 ± 5 °C and humidity < 70%).
Calibration Equipment used (M&T/E critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 103967	26-Mar-24 (No. 217-24038)	Mar-25
Power Sensor R&S NRP78A	SN: 101859	21-Mar-24 (No. 4230A315007801)	Mar-25
Spectrum Analyzer R&S FSVA0	SN: 101839	25-Jan-24 (No. 4230-315007801)	Jan-25
Mismatch: Short [S4186] Attenuator [S4423]	SN: 1152	26-Mar-24 (No. 217-24038)	Mar-25
CCP DAK-12	SN: 1018	05-Oct-23 (No. CCP-DAK12-1018_Oct23)	Oct-24
CCP DAK-3.5	SN: 1249	05-Oct-23 (No. CCP-DAK3.5-1249_Oct23)	Oct-24
Reference Probe EX30V4	SN: 7349	03-Jun-24 (No. EX3-7349_Jun24)	Jun-25
DAE4p	SN: 1836	10-Jan-24 (No. DAE4p-1836_Jan24)	Jan-25

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Source Box	SN: 1000	23-May-24 (No. 675-ACAD_Source_Box-240523)	May-25
Signal Generator R&S SMB100A	SN: 182081	23-May-24 (No. 0001-300718404)	May-25
Mismatch: SMA	SN: 1102	22-May-24 (No. 675-Mismatch_SMA-240522)	May-25

Calibrated by: **Knelemin Franje** Function: **Laboratory Technician** Signature: 

Approved by: **Brian Kohn** Function: **Technical Manager** Signature: 

Issued: July 22, 2024

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

Certificate No: D2600V2-1124_Jul24

Page 1 of 6

Calibration Laboratory of
Schmid & Partner
Engineering AG

Zughausstrasse 43, 8004 Zurich, Switzerland



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

Glossary

TSL tissue simulating liquid
ConvF sensitivity in TSL / NORM x,y,z
N/A not applicable or not measured

Calibration is Performed According to the Following Standards

- IECIEEE 62209-1538, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 885664, "SAR Measurement Requirements for 100 MHz to 8 GHz"

Additional Documentation

- DASY System Handbook

Methods Applied and Interpretation of Parameters

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the fat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The Impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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%.

D2600V2 - SN: 1124

July 22, 2024

Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.5mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	2600MHz ±1MHz	

Head TSL parameters at 2600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ±0.2)°C	37.2 ±5%	1.98 mho/m ±5%
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 2600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	24 dBm input power	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	54.5 W/kg ±17.0% (k = 2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	24 dBm input power	6.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ±16.5% (k = 2)

D2600V2 - SN: 1124

July 22, 2024

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 2600 MHz

Impedance	49.9 Ω - 7.3 j Ω
Return Loss	-22.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

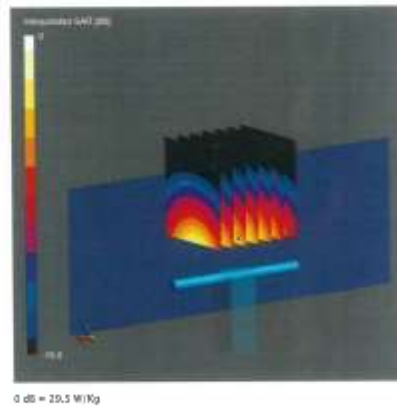
Manufactured by	SPEAG
-----------------	-------

D2600V2 - SN: 1124

July 22, 2024

System Performance Check Report

Summary								
Device	Frequency (MHz)	TSL	Power (dBm)					
D2600V2 - SN: 1124	2608	HSL	24					
Exposure Conditions								
Phantom Section, TSL	Test Distance (mm)	Band	Group, LID	Frequency (MHz)	Channel Number	Conversion Factor	TSL Conductivity (S/m)	TSL Permeability
Flat	10	CM, 0--		2608.0		7.29	1.56	0.72
Hardware Setup								
Phantom	TSL Measured Date	Probe, Calibration Date	OAG, Calibration Date					
MPH VLS Config	HSL 2024-07-22	ED3204 - SN: 7348, 2024-06-03	QAG03 SN: 1836, 2024-01-10					
Scans Setup				Measurement Results				
Zoom Scan				Zoom Scan				
Grid Size (mm)	30 x 10 x 10			Date	2024-07-22			
Grid Steps (mm)	3.0 x 3.0 x 1.5			ptSAR (p W/Kg)	13.7			
Sensor Surface (mm)	1.4			ptSAR (p W/Kg)	6.15			
Cooled Cell	Yes			Power DUT (dB)	-0.01			
Cooling Rate	1.5			Power Scaling	Disabled			
MAIA	N/A			Scaling Factor (dB)				
Surface Detection	VMS - dp			TSL Correction	Positive / Negative			
Scan Method	Measured							



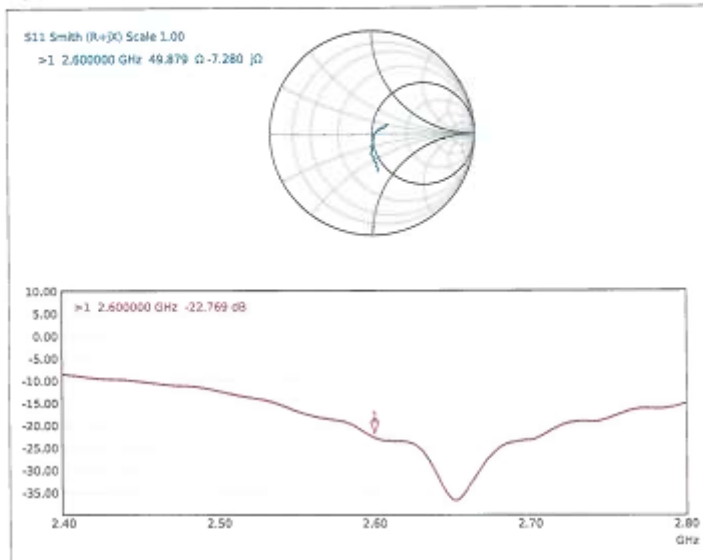
Certificate No: D2600V2-1124_ku24

Page 5 of 6

D2800V2 - SN: 1124

July 22, 2024

Impedance Measurement Plot for Head TSL



Certificate No: D2800V2-1124_Jul24

Page 6 of 6

Appendix D.8 Calibration certificate for Dipole_SN1058

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 45, 8004 Zurich, Switzerland

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: **SGS**
Gyeonggi-do, Republic of Korea

Certificate No.: **D3500V2-1058_Sep23**

CALIBRATION CERTIFICATE

Object: **D3500V2 - SN:1058**

Calibration procedure(s): **QA CAL-22.v7**
Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date: **September 28, 2023**

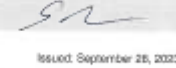
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 5)°C and humidity < 70%.

Calibration Equipment used (MATE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-09804/03905)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-09804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-09805)	Mar-24
Reference 20 dB Attenuator	SN: B48394 (25k)	30-Mar-23 (No. 217-09806)	Mar-24
Type-N mismatch combination	SN: S10982 / 05327	30-Mar-23 (No. 217-09810)	Mar-24
Reference Probe EX30V4	SN: 3500	07-Mar-23 (No. EX3-3503_Mar23)	Mar-24
DAE4	SN: 900	09-Aug-23 (No. DAE4-900_Aug23)	Aug-24

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB35512675	30-Oct-14 (in house check Oct-22)	in house check: Oct-24
Power sensor HP 8481A	SN: US37292763	07-Oct-15 (in house check Oct-22)	in house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	in house check: Oct-24
RF generator R&S SM1-05	SN: 100872	15-Jun-15 (in house check Oct-22)	in house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41093477	21-Mar-14 (in house check Oct-22)	in house check: Oct-24

Name	Function	Signature
Calibrated by: Paulo Pina	Laboratory Technician	
Approved by: Sven Kühn	Technical Manager	

Issued: September 28, 2023

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

Certificate No: D3500V2-1058_Sep23 Page 1 of 7

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 45, 8004 Zurich, Switzerland



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

Glossary:

TSL tissue simulating liquid
ConvF sensitivity in TSL / NORM x,y,z
N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss:** This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3400 MHz ± 1 MHz 3500 MHz ± 1 MHz	

Head TSL parameters at 3400 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	38.0	2.81 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	2.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 3400 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.4 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.6 W/kg ± 19.5 % (k=2)

Head TSL parameters at 3500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.9	2.91 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.6 ± 6 %	2.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 3500 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	65.3 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.49 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.8 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 3400 MHz

Impedance, transformed to feed point	44.1 Ω - 7.3 j Ω
Return Loss	- 20.0 dB

Antenna Parameters with Head TSL at 3500 MHz

Impedance, transformed to feed point	50.8 Ω - 6.1 j Ω
Return Loss	- 24.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.135 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 28.09.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1058

Communication System: UID 0 - CW; Frequency: 3500 MHz, Frequency: 3400 MHz

Medium parameters used: $f = 3500$ MHz; $\sigma = 2.95$ S/m; $\epsilon_r = 37.6$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 3400$ MHz; $\sigma = 2.87$ S/m; $\epsilon_r = 37.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.91, 7.91, 7.91) @ 3500 MHz, ConvF(7.91, 7.91, 7.91) @ 3400 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn900; Calibrated: 09.08.2023
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3500MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 68.22 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 17.5 W/kg

SAR(1 g) = 6.56 W/kg; SAR(10 g) = 2.49 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 74.6%

Maximum value of SAR (measured) = 12.4 W/kg

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3400MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.44 V/m; Power Drift = 0.06 dB

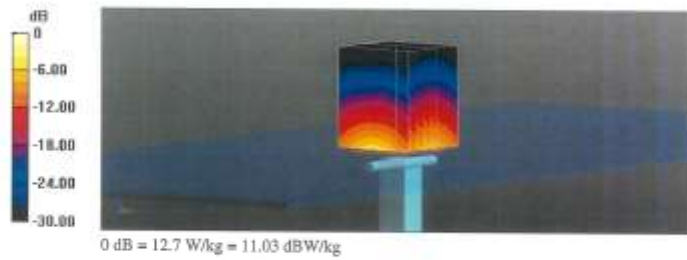
Peak SAR (extrapolated) = 17.9 W/kg

SAR(1 g) = 6.79 W/kg; SAR(10 g) = 2.56 W/kg

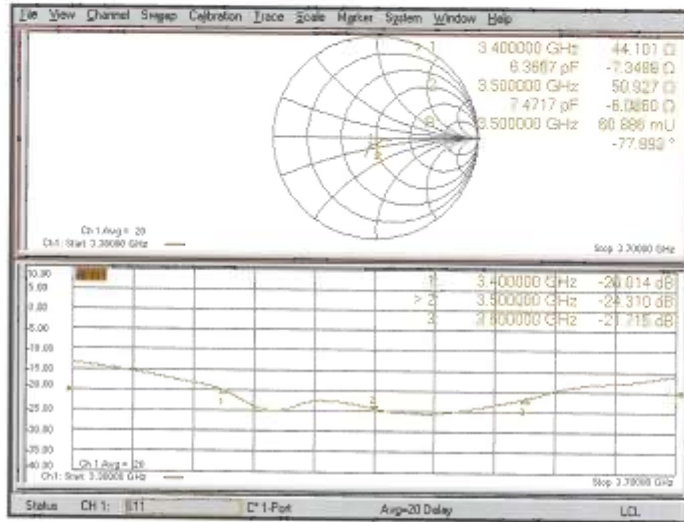
Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 75.3%

Maximum value of SAR (measured) = 12.7 W/kg



Impedance Measurement Plot for Head TSL



Appendix D.9 Calibration certificate for Dipole_SN1036

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

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

Client: **SGS**
Gyeonggi-do, Republic of Korea

Certificate No. **D3900V2-1036_Sep23**

CALIBRATION CERTIFICATE

Object: **D3900V2 - SN:1036**

Calibration procedure(s): **QA_CAL-22.v7**
Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date: **September 27, 2023**

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&E critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103264	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103248	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: 849394 (20k)	30-Mar-23 (No. 217-03806)	Mar-24
Type-N mismatch combination	SN: 310662 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 3553	07-Mar-23 (No. EX3-3503_Mar23)	Mar-24
DAE4	SN: 900	09-Aug-23 (No. DAE4-900_Aug23)	Aug-24

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4118B	SN: G839512476	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41083315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41083477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

Name	Function	Signature
Calibrated by: Kristina Pranjic	Laboratory Technician	
Approved by: Evgen Kohn	Technical Manager	

Issued: September 27, 2023

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

Certificate No: D3900V2-1036_Sep23

Page 1 of 7

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
S 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.: SC5 0108

Glossary:

TSL tissue simulating liquid
ConvF sensitivity in TSL / NORM x,y,z
N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss:** This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3900 MHz $\pm$ 1 MHz 4100 MHz $\pm$ 1 MHz	

Head TSL parameters at 3900 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.5	3.32 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.1 $\pm$ 8 %	3.27 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL at 3900 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.0 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.8 W/kg $\pm$ 19.5 % (k=2)

Head TSL parameters at 4100 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.2	3.53 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	36.9 $\pm$ 6 %	3.45 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL at 4100 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.6 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.6 W/kg $\pm$ 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 3900 MHz

Impedance, transformed to feed point	47.4 Ω - 4.9 j Ω
Return Loss	-24.9 dB

Antenna Parameters with Head TSL at 4100 MHz

Impedance, transformed to feed point	57.3 Ω - 1.1 j Ω
Return Loss	-23.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.104 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 27.09.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN:1036

Communication System: UID 0 - CW; Frequency: 3900 MHz, Frequency: 4100 MHz

Medium parameters used: $f = 3900$ MHz; $\sigma = 3.27$ S/m; $\epsilon_r = 37.1$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 4100$ MHz; $\sigma = 3.45$ S/m; $\epsilon_r = 36.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvP(7.39, 7.39, 7.39) @ 3900 MHz, ConvP(7.26, 7.26, 7.26) @ 4100 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn900; Calibrated: 09.08.2023
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3900MHz/Zoom Scan,
dist=1.4mm (8x8x8)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.20 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 19.2 W/kg

SAR(1 g) = 6.8 W/kg; SAR(10 g) = 2.39 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 73.9%

Maximum value of SAR (measured) = 13.4 W/kg

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=4100MHz/Zoom Scan,
dist=1.4mm (8x8x8)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 68.07 V/m; Power Drift = 0.09 dB

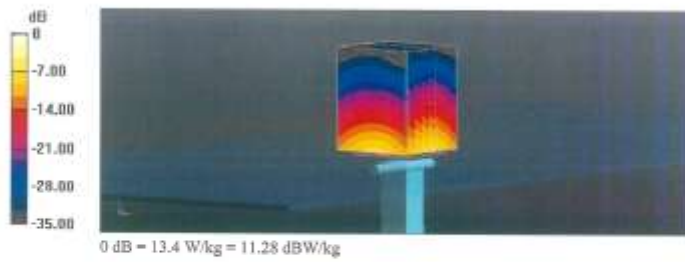
Peak SAR (extrapolated) = 19.1 W/kg

SAR(1 g) = 6.77 W/kg; SAR(10 g) = 2.36 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 74%

Maximum value of SAR (measured) = 13.4 W/kg



Impedance Measurement Plot for Head TSL

