

RF EXPOSURE TEST REPORT

Test Report No. 15951638H-D-R1

Customer	Audio-Technica Corporation
Description of EUT	HANDHELD TRANSMITTER
Model Number of EUT	ATW-DT3202/C510DF2
FCC ID	JFZDT3202DF2
Test Regulation	FCC47CFR 2.1093
Test Result	Complied
Issue Date	January 20, 2026
Remarks	The highest reported SAR 0.25 W/kg (body)

Representative test engineerTomohisa Nakagawa
Engineer**Approved by**Satofumi Matsuyama
Engineer

CERTIFICATE 5107.02

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REVISION HISTORY

Revision	Test report No.	Date	Page Revised Contents
- (Original)	15951638H-D	November 27, 2025	-
1	15951638H-D-R1	January 20, 2026	Appendix: Verification for Impedance and Return-loss -Added minus sign for value of Head (image part) of impedance test results.

Reference: Abbreviations (Including words undescribed in this report)

AAN	Asymmetric Artificial Network	GPS	Global Positioning System
AC	Alternating Current	Hori.	Horizontal
AM	Amplitude Modulation	ICES	Interference-Causing Equipment Standard
AMN	Artificial Mains Network	I/O	Input/Output
Amp, AMP	Amplifier	IEC	International Electrotechnical Commission
ANSI	American National Standards Institute	IEEE	Institute of Electrical and Electronics Engineers
Ant, ANT	Antenna	IF	Intermediate Frequency
AP	Access Point	ILAC	International Laboratory Accreditation Conference
ASK	Amplitude Shift Keying	ISED	Innovation, Science and Economic Development Canada
Atten., ATT	Attenuator	ISN	Impedance Stabilization Network
AV	Average	ISO	International Organization for Standardization
BPSK	Binary Phase-Shift Keying	JAB	Japan Accreditation Board
BR	Bluetooth Basic Rate	LAN	Local Area Network
BT	Bluetooth	LCL	Longitudinal Conversion Loss
BT LE	Bluetooth Low Energy	LIMS	Laboratory Information Management System
BW	BandWidth	LISN	Line Impedance Stabilization Network
C.F	Correction Factor	MRA	Mutual Recognition Arrangement
Cal Int	Calibration Interval	N/A	Not Applicable
CAV	CISPR AV	NIST	National Institute of Standards and Technology
CCK	Complementary Code Keying	NS	No signal detect.
CDN	Coupling Decoupling Network	NSA	Normalized Site Attenuation
Ch., CH	Channel	OBW	Occupied BandWidth
CISPR	Comite International Special des Perturbations Radioelectriques	OFDM	Orthogonal Frequency Division Multiplexing
Corr.	Correction	PER	Packet Error Rate
CPE	Customer premise equipment	PK	Peak
CW	Continuous Wave	P _{LT}	long-term flicker severity
DBPSK	Differential BPSK	POHC(A)	Partial Odd Harmonic Current
DC	Direct Current	Pol., Pola.	Polarization
DET	Detector	PR-ASK	Phase Reversal ASK
D-factor	Distance factor	P _{ST}	short-term flicker severity
Dmax	maximum absolute voltage change during an observation period	QAM	Quadrature Amplitude Modulation
DQPSK	Differential QPSK	QP	Quasi-Peak
DSSS	Direct Sequence Spread Spectrum	QPSK	Quadrature Phase Shift Keying
DUT	Device Under Test	r.m.s., RMS	Root Mean Square
EDR	Enhanced Data Rate	RBW	Resolution BandWidth
e.i.r.p., EIRP	Equivalent Isotropically Radiated Power	RE	Radio Equipment
EM clamp	Electromagnetic clamp	REV	Reverse
EMC	ElectroMagnetic Compatibility	RF	Radio Frequency
EMI	ElectroMagnetic Interference	RFID	Radio Frequency Identifier
EMS	ElectroMagnetic Susceptibility	RNSS	Radio Navigation Satellite Service
EN	European Norm	RSS	Radio Standards Specifications
e.r.p., ERP	Effective Radiated Power	Rx	Receiving
ETSI	European Telecommunications Standards Institute	SINAD	Ratio of (Signal + Noise + Distortion) to (Noise + Distortion)
EU	European Union	S/N	Signal to Noise ratio
EUT	Equipment Under Test	SA, S/A	Spectrum Analyzer
Fac.	Factor	SG	Signal Generator
FCC	Federal Communications Commission	SVSWR	Site-Voltage Standing Wave Ratio
FHSS	Frequency Hopping Spread Spectrum	THC(A)	Total Harmonic Current
FM	Frequency Modulation	THD(%)	Total Harmonic Distortion
Freq.	Frequency	TR, T/R	Test Receiver
FSK	Frequency Shift Keying	Tx	Transmitting
Fund	Fundamental	VBW	Video BandWidth
FWD	Forward	Vert.	Vertical
GFSK	Gaussian Frequency-Shift Keying	WLAN	Wireless LAN
GNSS	Global Navigation Satellite System	xDSL	Generic term for all types of DSL technology
			(DSL: Digital Subscriber Line)

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Section 1 Customer information

Company Name	Audio-Technica Corporation
Address	2-46-1 Nishi-naruse, Machida, Tokyo 194-8666, Japan
Telephone Number	+81-42-739-9121
Contact Person	Hidetomo Ikeda

The information provided by the customer is as follows;

- Customer, Description of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer Information
- SECTION 2: Equipment Under Test (EUT) other than the Receipt Date and Test Date
- Appendix Antenna location

Section 2 Equipment under test (EUT)

2.1 Identification of EUT

Description	HANDHELD TRANSMITTER
Model Number	ATW-DT3202/C510DF2
Serial Number	TP05
Condition	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	October 15, 2025
Test Date	November 5, 2025 and November 6, 2025

2.2 Product description

General Specification

Rating	Battery M/N: LI-320 / DC 3.6V / 3200 mAh / 11.5 Wh
Body-worn option	☒ None ☐ Belt clip ☐ earphone
Battery option	☒ None ☐ ()

Radio Specification

This report contains data provided by the customer which can impact the validity of results. UL Japan, Inc. is only responsible for the validity of results after the integration of the data provided by the customer.
The data provided by the customer is marked "a)" in the table below.

Frequency of operation	470.125 MHz to 607.875 MHz
RF power setting	STD: 1 mW, 10 mW, 20 mW HD: 1 mW
Antenna gain ^{a)}	0.676 dBi max

2.3 Software information

The power value of the EUT was set for testing as follows (setting value might be different from product specification value).

Software: V999.999.012
Power settings: STD 20 mW / HD 1 mW

*This setting of software is the worst case.

Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

2.4 Tune-up tolerance information

If not specified, listed values are maximum power level.

Mode	mW	dBm
STD	25	13.98
HD	1.5	1.76

2.5 Antenna information

Antenna location information is shown in appendix.

2.5.1 Simultaneous transmission combinations

This device does not have a concurrent transmission, only supported single transmission.

2.5.2 Antenna location

Position	[mm]
Front	13.65
Front tilt	3.31
Back tilt	4.38
Back	10.25
Left	8.58
Right	8.58
Top	209.50
Bottom	5.11

Section 3 Definitions

This may contain the definitions which are not used in this report.

Specific Absorption Rate (SAR)	The time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ), as shown in the following equation: $SAR = \frac{d}{dt} \left(\frac{dW}{dm} \right) = \frac{d}{dt} \left(\frac{dW}{\rho dV} \right)$
Power density (PD) or S_{av}	The energy per unit time and unit area crossing a surface of area A characterized by the normal unit vector $\hat{n}$ and averaging time. $S_{av} = \frac{1}{AT} \iint (E \times H) \cdot \hat{n} dA dT$
Absorbed power density (APD)	The APD (absorbed power density) shall be derived from the measured SAR values using the formulas in the Compliance Assessment of the Epithelial. $APD \ 1cm^2(W/m^2) = 10(kg/m^2) \times SAR_{1g}(W/kg)$ $APD \ 4cm^2(W/m^2) = 20(kg/m^2) \times SAR_{8g}(W/kg)$
Reported SAR / PD (IPD or APD)	Measured SAR / PD (IPD or APD) is scaled to the maximum tune-up tolerance limit and the maximum duty by the following formulas. <i>Reported SAR, PD = Measured SAR, or PD × scale factor for power × scaled factor for duty(if needed)</i> Where: $Scaled \ factor \ for \ duty = \frac{1}{Duty}$
Limit reduction for SAR and IPD	If uncertainty is greater than 30%, an additional penalty for the limit is required following the equation below. $L_{lim} \left(\frac{1}{0.7 + \frac{U(L_m)}{L_m}} \right)$ Where: L_m : is the measured value L_{lim} : is the exposure limit $U(L_m)$: is the absolute value of the expanded uncertainty.
Maximum Tune-up tolerance limit, Tune up limit or Tune-up limit	Maximum power including tolerance power specified by customer.

Symbol	Quantity	Unit	Dimensions
E	Electric field	volt per meter	V / m
f	Frequency	hertz	Hz
H	Magnetic field	ampere per meter	A / m
λ	Wavelength	meter	m
S	Local power density	watt per square meter	W / m ²
PD	Spatial-average power density	watt per square meter	W / m ² or mW / cm ²
SAR	Specific Absorption Rate	watt per square meter	W / kg

Section 4 Test standard information

4.1 Test specification

☒ FCC47CFR 2.1093	RF Exposure Procedures and Equipment Authorization Policies for Portable Devices
☐ RSS-102 Issue 6	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

4.2 Published RF exposure KDB procedures and companion procedures

Name of documents	Title
☐ KDB 447498 D01(v06)	RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices
☒ KDB 447498 D04(v01)	Interim General RF Exposure Guidance
☐ KDB 447498 D02(v02r01)	SAR Measurement Procedures for USB Dongle Transmitters
☐ KDB 648474 D04(v01r04)	SAR Evaluation Considerations for Wireless Handsets
☐ KDB 941225 D01(v03r01)	3G SAR Measurement Procedures
☐ KDB 941225 D05(v02r05)	SAR Evaluation Considerations for LTE Devices
☐ KDB 941225 D06(v02r01)	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
☐ KDB 941225 D07(v01r02)	SAR Evaluation Procedures for UMPC Mini-Tablet Devices
☐ KDB 616217 D04(v01r02)	SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers
☒ KDB 865664 D01(v01r04)	SAR Measurement Requirements for 100MHz to 6 GHz
☐ KDB 248227 D01(v02r02)	SAR Guidance for IEEE 802.11 (Wi-Fi) transmitters
☐ KDB 680106 D01(v04)	Equipment authorization of wireless power transfer device
☐ RSS-102.SAR.MEAS Issue 1	Measurement Procedure for Assessing Specific Absorption Rate (SAR) Compliance in Accordance with RSS-102
☐ RSS-102.SAR.MEAS Issue 2	Measurement Procedure for Assessing Specific Absorption Rate (SAR) Compliance in Accordance with RSS-102
☐ Authority inquiry response	Included in the submission document.

4.3 Work Procedures

Name of documents	Title or details
☒ C/N: Work Instructions-ULID-003598	UL Japan, Inc.'s SAR Measurement Equipment Calibration and Inspection Work Procedure
☒ C/N: Work Instructions-ULID-003599	UL Japan, Inc.'s SAR Measurement Work Procedure
☒ IEEE Std 1528-2013	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.
☐ IEC/IEEE 62209-1528 Edition 1.0 2020-10	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 - Human models, instrumentation and procedures (Frequency range of 4 MHz to 10 GHz)
☒ IEC 62209-1	Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1: Devices used next to the ear (Frequency range of 300 MHz to 6 GHz)
☐ C/N: Work Instructions-ULID-003619	UL Japan, Inc.'s Power Density Measurement Procedure
☐ IEC/IEEE 63195-1:2021	Assessment of power density of human exposure to radio frequency fields from wireless devices in close proximity to the head and body (frequency range of 6 GHz to 300 GHz) - Part 1: Measurement procedure
☐ IEC/IEEE 63195-2:2021	Assessment of power density of human exposure to radio frequency fields from wireless devices in close proximity to the head and body (frequency range of 6 GHz to 300 GHz) - Part 2: Computational procedure

4.4 Addition to Standard

No addition, exclusion nor deviation has been made from the standard.

4.5 Reference

Schmid & Partner Engineering AG, DASY Manual
TCB workshop slide decks.

Section 5 Limits

General Population / Uncontrolled Environments limit is applied.

5.1 Exposure limit for SAR (FCC)

(A) Limits for Occupational/Controlled Exposure (W/kg)

Spatial Average (averaged over the whole body)	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.4	8.0	20.0

(B) Limits for General population/Uncontrolled Exposure (W/kg)

Spatial Average (averaged over the whole body)	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.08	1.6	4.0

Occupational/Controlled Environments: are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. because of employment or occupation).

General Population/Uncontrolled Environments: are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

5.2 Exposure limit for PD (FCC)

Frequency Range [MHz]	Power Density [mW/cm ²]	Average Time [Minutes]
(A) Limits For Occupational / Controlled Environments		
1,500 – 100,000	5	6
(B) Limits For General Population / Uncontrolled Environments		
1,500 – 100,000	1	30

Note: 1.0 mW/cm² is 10 W/m²

Section 6 Location

UL Japan, Inc. Ise EMC Lab.
Shielded room for SAR testing.
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Telephone: +81-596-24-8999

A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919
ISED Lab Company Number: 2973C / CAB identifier: JP0002

Section 7 Test result

RF Exposure Conditions		Highest Reported exposure value
Unit of measurement	Position	
Standalone Tx (1 g SAR) (W/kg)	Head	N/A
	Body	0.251 W/kg
	Hotspot	N/A
Standalone Tx (10 g SAR) (W/kg)	Limbs	N/A
Standalone Tx (Power density) (W/m ²)	N/A	N/A

All results are less than the limit: complied
Details are shown in appendix.

7.1 Simultaneous transmission SAR result

Not applicable because of no combination transmitters simultaneously.

Section 8 Uncertainty

Table of uncertainties are listed for ISO/IEC 17025.

8.1 9 MHz – 10 GHz range (SAR)

Error Description	Uncert. value		Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std.Unc. (10g)
Measurement System Errors								
Probe Calibration	± 18.60 %		N	2	1	1	±9.3%	±9.3%
Probe Calibration Drift	± 1.7 %		R	√3	1	1	±1.0%	±1.0%
Probe Linearity	± 4.7 %		R	√3	1	1	±2.7%	±2.7%
Broadband Signal	± 2.6 %		R	√3	1	1	±1.5%	±1.5%
Probe Isotropy	± 7.6 %		R	√3	1	1	±4.4%	±4.4%
Other Probe Electronic	± 2.4 %		N	1	1	1	±2.4%	±2.4%
RF Ambient	± 1.8 %		N	1	1	1	±1.8%	±1.8%
Probe Positioning	± 0.005 mm		N	1	0.5	0.5	±0.3%	±0.3%
Data Processing	± 3.5 %		N	1	1	1	±3.5%	±3.5%
Phantom and Device Errors								
Conductivity (meas.) ^{DAK}	± 5.0 %		N	1	0.78	0.71	±3.9%	±3.6%
Conductivity (temp.) ^{BB}	± 2.4 %		R	√3	0.78	0.71	±1.1%	±1.0%
Phantom Permittivity	± 14.0 %		R	√3	0.5	0.5	±4.1%	±4.1%
Distance DUT - TSL	± 2.0 %		N	1	2	2	±4.0%	±4.0%
Device Positioning (+/- 0.5mm)	± 1.0 %		N	1	1	1	±1.0%	±1.0%
Device Holder	± 3.6 %		N	1	1	1	±3.6%	±3.6%
DUT Modulation ^m	± 2.4 %		R	√3	1	1	±1.4%	±1.4%
Time-average SAR	± 1.7 %		R	√3	1	1	±1.0%	±1.0%
DUT drift	± 2.5 %		N	1	1	1	±2.5%	±2.5%
Val Antenna Unc. ^{val}	± 0.0 %		N	1	1	1	±0.0%	±0.0%
Unc. Input Power ^{val}	± 0.0 %		N	1	1	1	±0.0%	±0.0%
Correction to the SAR results								
Deviation to Target	± 1.9 %		N	1	1	0.84	±1.9%	±1.6%
SAR scaling ^p	± 0.0 %		R	√3	1	1	±0.0%	±0.0%
Combined Std. Uncertainty							±14.6%	±14.5%
Expanded STD Uncertainty (κ=2)							±29.2%	±29.0%

Section 9 RF Exposure Conditions

9.1 SAR-based Exemption - FCC section 1.1307

Exception condition as per section 1.1307 (b)(3)(i)(B)
the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} (mW) = \begin{cases} ERP_{20cm} (d/20 cm)^x & d \leq 20 cm \\ ERP_{20cm} & 20 cm < d \leq 40 cm \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20cm} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

And

$$ERP_{20cm} (mW) = \begin{cases} 2040 f & 0.3 GHz \leq f < 1.5 GHz \\ 3060 & 1.5 GHz \leq f \leq 6 GHz \end{cases}$$

d = the separation distance in cm.

In the table below, when the minimum test separation distance is < 5 mm, a distance, 5 mm, is applied to determine SAR test exclusion¹.

when 10-g extremity SAR applies, SAR test exemption is considered by applying a factor of 2.5 to the SAR-based exemption thresholds.

As per section 1.1307 (b)(2)

Separation distance is the minimum distance in any direction from any part of a radiating structure and any part of the body of a nearby person.

Radiating structure is an unshielded RF current-carrying conductor that generates an RF reactive near electric or magnetic field and/or radiates an RF electromagnetic wave. It is the component of an RF source that transmits, generates, or reradiates an RF fields, such as an antenna, aperture, coil, or plate.

Table: SAR exemption

RAT	Frequency [MHz]	Output Power		Ant Gain dBi	ERP		Separation Distances / Pth / Judge							
		dBm	mW		dBm	mW	Front	Front tilt	Back tilt	Back	Left	Right	Top	Bottom
STD	607.875	13.98	25.00	0.68	12.52	17.85	13.65 mm / 48.53 mW / Excluded	5 mm / 14.44 mW / Required	5 mm / 14.44 mW / Required	10.25 mm / 34.34 mW / Excluded	8.58 mm / 27.70 mW / Excluded	8.58 mm / 27.70 mW / Excluded	209.5 mm / 1240.065 mW / Excluded	5.11 mm / 14.82 mW / Required
							13.65 mm / 48.53 mW / Excluded	5 mm / 14.44 mW / Excluded	5 mm / 14.44 mW / Excluded	10.25 mm / 34.34 mW / Excluded	8.58 mm / 27.70 mW / Excluded	8.58 mm / 27.70 mW / Excluded	209.5 mm / 1240.065 mW / Excluded	5.11 mm / 14.82 mW / Excluded
HD	607.875	1.75	1.50	0.68	0.29	1.07	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded

¹ TCB workshop slide deck October 2021.

9.2 Test position

According to the previous considerations, following position is required.

The test was conservatively performed with test distance 0 mm.

Table Test position

Position	Separation distance	
Front	0 mm	☐
Front tilt	0 mm	☒
Back tilt	0 mm	☒
Back	0 mm	☐
Left	0 mm	☐
Right	0 mm	☐
Top	0 mm	☐
Bottom	0 mm	☒

Section 10 Dielectric Property

10.1 Dielectric Property for SAR

The dielectric parameters were checked prior to assessment using the DAK dielectric probe kit.

+/- 5 % tolerances are required for ϵ_r and σ and below table is the target value of the simulated tissue liquid.

For SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013 or IEC/IEEE 62209-1528, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for ϵ_r and σ may be relaxed to $\pm 10\%$.

The dielectric parameters are linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

Tissue dielectric parameters are typically re-measured every three to four days or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

Measured value is rounded off on the test plot data, so some differences might be observed. However, differences don't affect the result of SAR. Results are listed in appendix.

Table standard parameters on the KDB 865664 D01

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

Table standard parameters on the IEC 62209-1²

Frequency MHz	Relative permittivity ϵ_r	Conductivity S/m	Frequency MHz	Relative permittivity ϵ_r	Conductivity S/m
300	45.3	0.87	2300	39.5	1.67
450	43.5	0.87	2450	39.2	1.80
750	41.9	0.89	2600	39.0	1.96
835	41.5	0.90	3000	38.5	2.40
900	41.5	0.97	3500	37.9	2.91
1450	40.5	1.20	4000	37.4	3.43
1500	40.4	1.23	4500	36.8	3.94
1640	40.2	1.31	5000	36.2	4.45
1750	40.1	1.37	5200	36.0	4.66
1800	40.0	1.40	5400	35.8	4.86
1900	40.0	1.40	5600	35.5	5.07
2000	40.0	1.40	5800	35.3	5.27
2100	39.8	1.49	6000	35.1	5.48

² TCB workshop April 2019, Tissue Simulating Liquids (TSL)

Section 11 SAR Measurements

11.1 Measurement configuration for SAR

11.1.1 SAR evaluation procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the E-field at a fixed location above the ear point, central position of flat phantom or found highest point based on fast scan was used as a reference value for assessing the power drop.

Step 2: The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the antenna of EUT and the horizontal grid spacing was based on standard's grids size.

Step 3: Around this point found in the Step 2 (area scan), zoom scan is conducted based on the standard's grids size.

And for any secondary peaks found in the Step2 which are within 2 dB of maximum peak and not with this Step3 (Zoom scan) is repeated. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

Step 4: Re-measurement of the point of SAR at the same location as in Step 1.

Confirmation after SAR testing

It was checked that the power drift [W/kg] is within +/-5 %. The verification of power drift during the SAR test is that DASY system calculates the power drift by measuring the e-field at the same location at beginning and the end of the scan measurement for each test position.

DASY system calculation power drift value [dB] = $10 \log \left(\frac{W_a}{W_b} \right)$

Before SAR testing : W_b [W/kg]

After SAR testing : W_a [W/kg]

Limit of power drift[W] = +/- 5 %

$X[\text{dB}] = 10\log[P] = 10\log(1.05/1) = 10\log(1.05) - 10\log(1) = 0.212 \text{ dB}$

Table step size.

		≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 mm ± 1 mm	$\frac{1}{2} \delta \ln(2) \text{ mm} \pm 0.5 \text{ mm}$
Maximum probe angle from probe axis to phantom surface normal at the measurement location		$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{Area}, \Delta y_{Area}$		$\leq 2 \text{ GHz: } \leq 15 \text{ mm}$ $2 - 3 \text{ GHz: } \leq 12 \text{ mm}$	$3 - 4 \text{ GHz: } \leq 12 \text{ mm}$ $4 - 6 \text{ GHz: } \leq 10 \text{ mm}$ $6 - 7 \text{ GHz: } \leq 8.57 \text{ mm}$
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device	
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		$\leq 2 \text{ GHz: } \leq 8 \text{ mm}$ $2 - 3 \text{ GHz: } \leq 5 \text{ mm}^1$	$3 - 4 \text{ GHz: } \leq 5 \text{ mm}$ $4 - 6 \text{ GHz: } \leq 4 \text{ mm}$ $6 - 7 \text{ GHz: } \leq 3.4 \text{ mm}$
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	≤ 5 mm	$3 - 4 \text{ GHz: } \leq 4 \text{ mm}$ $4 - 5 \text{ GHz: } \leq 3 \text{ mm}$ $5 - 6 \text{ GHz: } \leq 2 \text{ mm}$ $6 - 7 \text{ GHz: } \leq 1.6 \text{ mm}$
	graded grid	$\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface	$3 - 4 \text{ GHz: } \leq 3 \text{ mm}$ $4 - 5 \text{ GHz: } \leq 2.5 \text{ mm}$ $5 - 6 \text{ GHz: } \leq 2 \text{ mm}$ $6 - 7 \text{ GHz: } \leq 1.7 \text{ mm}$
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1) \text{ mm}$
Minimum zoomscan volume	x, y, z	≥ 30 mm	$3 - 4 \text{ GHz: } \geq 28 \text{ mm}$ $4 - 5 \text{ GHz: } \geq 25 \text{ mm}$ $5 - 7 \text{ GHz: } \geq 22 \text{ mm}$

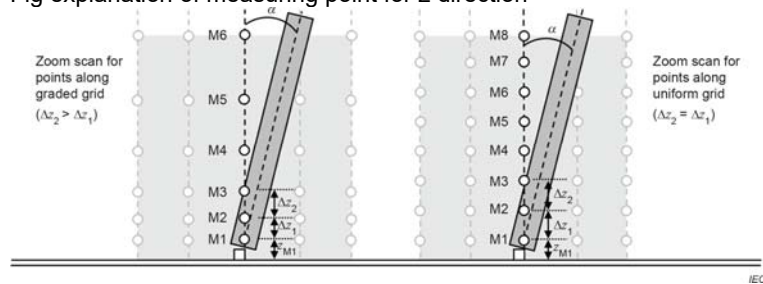
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std1528-2013 for details.

Additional Requirements³

Unless the following criteria are met, zoom-scan measurement shall be successively repeated using smaller increments, at 2 mm or less from phantom surface

- maximum 1 g SAR < **0.1** W/kg, or
- both of the following are met:
 - shortest transverse distances d_x and d_y between SAR peak location and -3 dB points shall be larger than Δx_{Zoom} and Δy_{Zoom} , respectively.
 - at the SAR peak location, the ratio of SAR values from the first two z-axis, M1 to M2 points is ≤ 30 %.

Fig explanation of measuring point for z direction



³ TCB workshop slide deck, November 2019

Section 12 SAR System check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, for FCC typically every three to four days, for ISED every 24 h when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ± 0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.

The depth of tissue-equivalent liquid in a phantom must be $\geq 15.0 \text{ cm} \pm 0.5 \text{ cm}$ for SAR measurements $\leq 3 \text{ GHz}$ and $\geq 10.0 \text{ cm} \pm 0.5 \text{ cm}$ for measurements $> 3 \text{ GHz}$.

The DASY system with an E-Field Probe was used for the measurements.

The reference transmitter was mounted on the small tripod so that the transmitter feed point was positioned below the center marking of the flat phantom section and the transmitter was oriented parallel to the body axis (the long side of the phantom).

Table: The standard measuring distance

Frequency range	Distance between dipole or CLA and phantom
13 MHz	0 mm
0.3 GHz to 1 GHz	15 mm
1 GHz to 6 GHz	10 mm
6 GHz to 10 GHz	5 mm

The scan step was conducted based on the previous section specified.

Distance between probe sensors and phantom surface was set to 1.4 mm.

The transmitter input power (forward power) was listed in the table of SPC. The results are normalized to 1 W input power other than 1 W input power.

The target(reference) SAR values can be obtained from the calibration certificate of system validation dipoles or CLA, refer to appendix. The target SAR values are quoted from "SAR for nominal Head TSL parameters" on calibration record.

The scaled SAR value shall not deviate from the targets by more than $\pm 10 \%$. System check results are listed on appendix.

The 1W Scaled up value is rounded off on the test data, so some differences might be observed. However, differences don't affect the result. Results are listed in appendix.

Section 13 SAR requirement

13.1 Common

This procedure covers every condition, so some conditions are not applicable.

When reported SAR value is exceed 1.2 W/kg (if any), device holder perturbation verification is required; however, since distance between device holder and antenna of EUT is enough, it was not conducted.

The sample calculations are shown in definition.

Next section describes the general RF exposure evaluation requirements and serves as an entry point. If the more specific RF exposure guidance existed, it takes precedence over this.

When 10-g extremity SAR applies, following SAR thresholds are considered by applying a factor of 2.5 to the SAR-based exemption thresholds.

13.2 Channel Selection Requirement

This test reduction process provides for the use of test data for one specific channel, while referencing to those data for demonstrating compliance in other required channels for each test position of an exposure condition, within the operating mode of a frequency band. This is limited specifically to when the reported 1-g or 10-g SAR for the mid-band or highest output power channel meets any of the following conditions:

1. SAR $\leq$ 0.8 W/kg for 1-g, or SAR $\leq$ 2.0 W/kg for 10-g, when the transmission band span is $\leq$ 100 MHz
2. SAR $\leq$ 0.6 W/kg for 1-g, or SAR $\leq$ 1.5 W/kg for 10-g, when the transmission band span is between 100 MHz and 200 MHz
3. SAR $\leq$ 0.4 W/kg for 1-g, or SAR $\leq$ 1.0 W/kg for 10-g, when the transmission band span is $\geq$ 200 MHz

SAR measurement standards such as IEEE Std 1528-2013 requires the middle channel to be tested first. This generally applies to wireless devices that are designed to operate in technologies with tight tolerances for maximum output power variations across channels in the band. When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel must be used.

13.3 Repeated measurement

According to KDB 865664 D01.

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg ($\sim 10\%$ from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

Repeat measurements are not required because of maximum measured SAR value is < 0.8 W/kg.

Section 14 Test instrument

LIMS ID	Description	Manufacturer	Model	Serial	Last Cal Date	Interval
Power measurement						
141244	Attenuator(10dB)	Weinschel - API Technologies Corp	WA8-10-34	A198	2025/02/04	12
208185	Power Sensor	Rohde & Schwarz	NRP8S	110600	2025/06/25	12
141809	Power Meter	Anritsu Corporation	ML2495A	825002	2025/05/15	12
141830	Power sensor	Anritsu Corporation	MA2411B	738285	2025/05/15	12
141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	2025/01/30	12
244706	Thermo-Hygrometer	A & D	AD-5648A	1003	2025/01/19	12
141544	Digital Tester	HIOKI E. E. CORPORATION	3244	030416616	2025/05/13	12
SAR measurement						
141484	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE4	1372	2025/03/11	12
141589	Dosimetric E-Field Probe	Schmid & Partner Engineering AG	EX3DV4	3922	2025/09/11	12
141468	Dipole Antenna	Schmid & Partner Engineering AG	D450V3	1051	2024/09/04	24
141481	Dipole Antenna	Schmid & Partner Engineering AG	D600V3	1003	2025/10/01	12
176484	Head Simulating Liquid	Schmid & Partner Engineering AG	HBBL600-10000V6	SL AAH U16 BC	-	-
141182	Dielectric assessment software	Schmid & Partner Engineering AG	DAK	-	-	-
251453	Analyzer, Network	Rohde & Schwarz	ZNL14	200030	2025/06/20	12
141574	Digital thermometer	LKM electronic	DTM3000	-	2025/07/28	12
142865	Water, distilled	KISHIDA CHEMICAL Co., Ltd.	020-85566	F71047S	-	-
141471	Dielectric assessment kit	Schmid & Partner Engineering AG	DAKS-3.5	0008	2025/04/14	12
173900	Software for MA24106A	Anritsu Corporation	Anritsu PowerXpert	-	-	-
141365	Attenuator	Weinschel Associates	WA54-20	54200103	2025/03/14	12
141808	Dual Power Meter	Keysight Technologies Inc	E4419B	MY45102060	2025/08/25	12
221492	Power sensor	Keysight Technologies Inc	E9300H	MY62080002	2025/08/25	12
141843	Power sensor	Anritsu Corporation	MA24106A	1026164	2025/03/18	12
141844	Power sensor	Anritsu Corporation	MA24106A	1031504	2025/03/18	12
142561	Dual Directional Coupler	Keysight Technologies Inc	778D	MY52180243	-	-
249557	RF Power Source	Schmid & Partner Engineering AG	POWERSOURCE1	4357	2025/05/05	12
141875	Pre Amplifier	R&K	R&K CGA020M602-2633R	B30550	2025/06/25	12
141890	Signal Generator	Keysight Technologies Inc	N5181A	MY47421098	2024/11/25	12
244706	Thermo-Hygrometer	A & D	AD-5648A	1003	2025/01/19	12
142247	SAR robot	Schmid & Partner Engineering AG	TX60 Lspeag	F10/5E3LA1/A/01	2025/04/07	12
142056	2mm Oval Flat Phantom	Schmid & Partner Engineering AG	QDOVA001BB	1045	2025/05/30	12
142489	Device holder	Schmid & Partner Engineering AG	Mounting device for transmitter	-	2024/11/05	12
142064	Ruler	SHINWA	-	-	2025/10/28	12
141181	Dasy5	Schmid & Partner Engineering AG	DASY5	-	-	-

*Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

The expiration date of the calibration is the end of the expired month.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chain of calibrations.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Appendix Dielectric Property result

Date	Tem [deg. C]	Humidity [RH %]	Frequency	Permittivity			Conductivity			Note
				Measured	Target	Delta	Measured	Target	Delta	
			[MHz]	ϵ'	ϵ'	[%]	σ [S/m]	σ [S/m]	[%]	
2025/11/6	23.88	36	450	44.67	43.50	2.68	0.81	0.87	-6.39	SPC
2025/11/6	23.88	36	470.125	44.60	43.39	2.78	0.82	0.87	-5.61	
2025/11/6	23.88	36	539	44.20	43.03	2.72	0.84	0.88	-4.04	
2025/11/6	23.88	36	600	44.09	42.70	3.26	0.86	0.88	-2.00	SPC
2025/11/6	23.88	36	607.875	44.04	42.66	3.24	0.86	0.88	-1.87	

SPC: System performance check

Appendix System performance check result

Date	Freq [MHz]	Liquid Temp [deg. C]	Humid [% RH]	Feed power [mW]	Meas val 1gSAR [W/kg]	Meas val 10gSAR [W/kg]	Norm val 1gSAR [W/kg]	Norm val 10gSAR [W/kg]	Target val 1gSAR [W/kg]	Target val 10gSAR [W/kg]	1g dev	10g dev
2025/11/6	600	23.9	36.0	50.00	0.317	0.208	6.34	4.16	6.41	4.22	-1.09%	-1.42%
2025/11/6	450	23.9	36.0	250.03	1.06	0.697	4.24	2.79	4.61	3.07	-8.05%	-9.19%

Appendix System performance check Plot
Date/Time: 2025/11/06 7:54:11

Probe info:

Probe: EX3DV4 - SN3922 / Calibrated: 2025/09/11
ConvF(10.3, 10.3, 10.3) @ 600 MHz
Medium parameters used: $f = 600 \text{ MHz}$; $\sigma = 0.862 \text{ S/m}$; $\epsilon_r = 44.094$; $\rho = 1000 \text{ kg/m}^3$
Sensor-Surface: 1.4mm (Mechanical Surface Detection)

DAE info:

Electronics: DAE4 Sn1372 / Calibrated: 2025/03/11

Phantom info:

Phantom: ELI V4.0 (20deg probe tilt)/Phantom section: Flat Section
Type: QD OVA 001 BB
Serial: 1045

Software info DASY52 52.10.4(1535) SEMCAD X 14.6.14(7501)

Area Scan (61x61x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$
Maximum value of SAR (interpolated) = 0.433 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: $dx=6\text{mm}$, $dy=6\text{mm}$, $dz=1.5\text{mm}$

Reference Value = 23.11 V/m ; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.547 W/kg

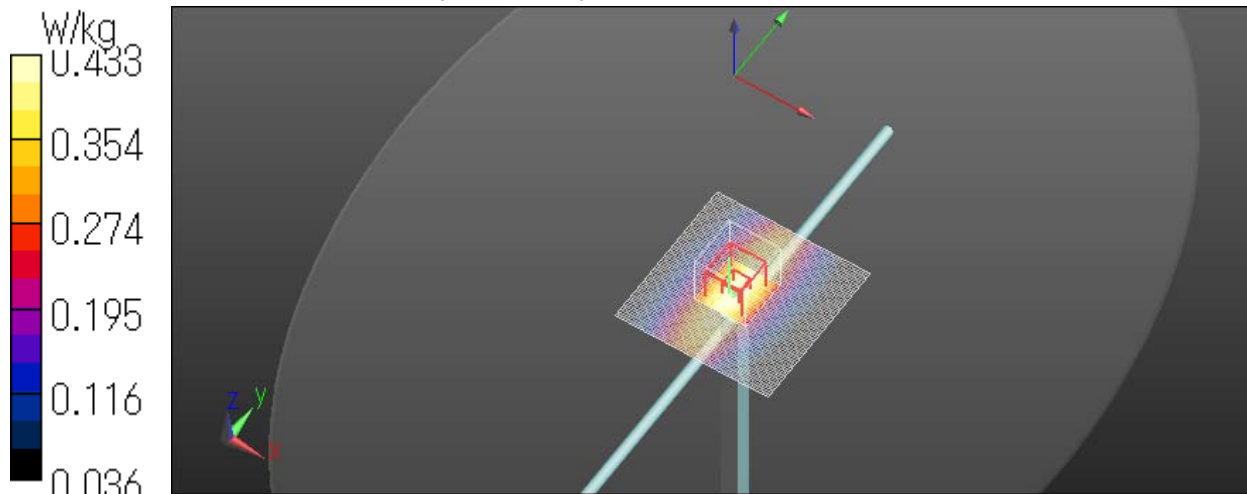
SAR(1 g) = 0.317 W/kg ; SAR(10 g) = 0.208 W/kg

Smallest distance from peaks to all points 3 dB below: Larger than measurement grid ($> 15 \text{ mm}$)

Ratio of SAR at M2 to SAR at M1 = 82.6%

Maximum value of SAR (measured) = 0.433 W/kg

Note: Liquid temp. is kept within the 2 degree.C. during the test.



Date/Time: 2025/11/06 14:22:03

Probe info:

Probe: EX3DV4 - SN3922 / Calibrated: 2025/09/11

ConvF(11.48, 11.48, 11.48) @ 450 MHz

Medium parameters used: $f = 450$ MHz; $\sigma = 0.814$ S/m; $\epsilon_r = 44.665$; $\rho = 1000$ kg/m³

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

DAE info:

Electronics: DAE4 Sn1372 / Calibrated: 2025/03/11

Phantom info:

Phantom: ELI V4.0 (20deg probe tilt)/Phantom section: Flat Section

Type: QD OVA 001 BB

Serial: 1045

Software info DASY52 52.10.4(1535) SEMCAD X 14.6.14(7501)

Area Scan (61x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.38 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: $dx=6$ mm, $dy=6$ mm, $dz=1.5$ mm

Reference Value = 42.18 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 1.65 W/kg

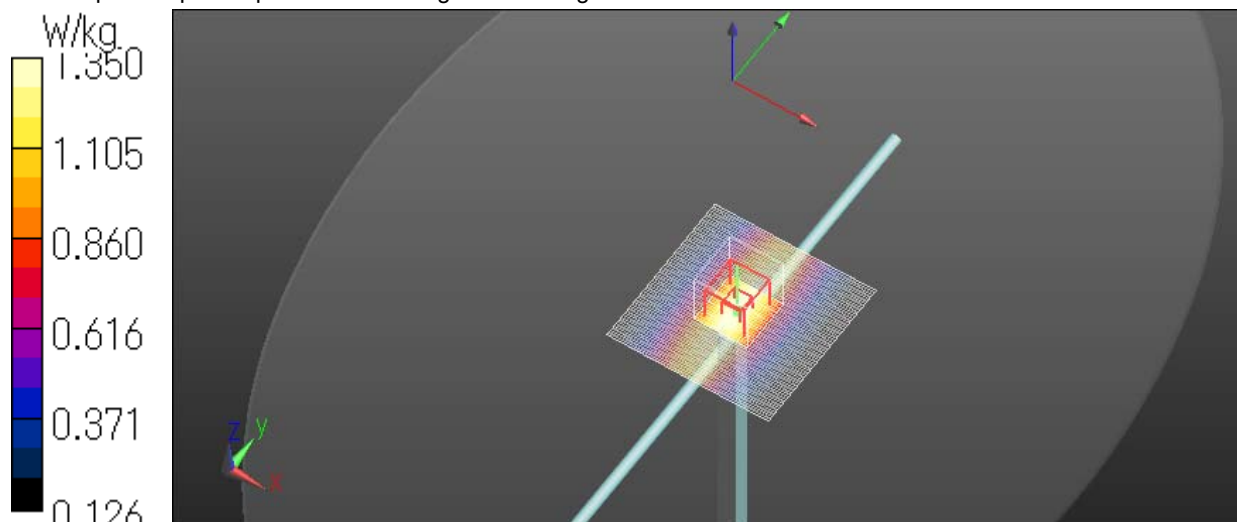
SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.697 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm)

Ratio of SAR at M2 to SAR at M1 = 84.1%

Maximum value of SAR (measured) = 1.35 W/kg

Note: Liquid temp. is kept within the 2 degree.C. during the test.

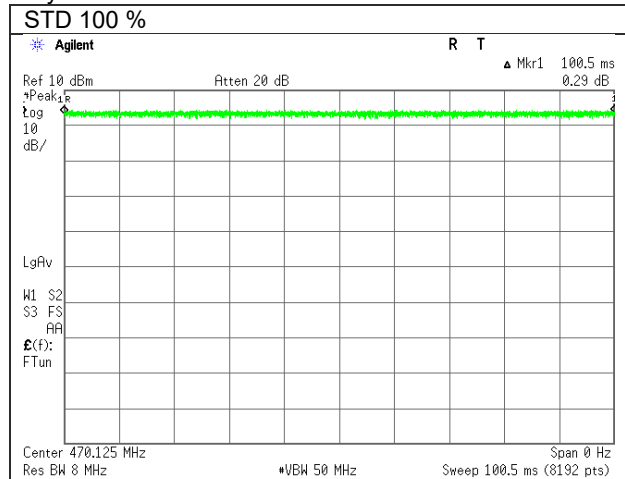


Appendix Power and duty measurement result

Power

Power Setting	Channel	Freq. [MHz]	Reading Average [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result Average		Tune up limit [dBm]	difference [dB]	Remarks
STD 20 mW	Low	470.125	1.99	0.30	9.76	12.05	16.03	13.98	1.93	
STD 20 mW	Mid	539.000	2.15	0.32	9.76	12.23	16.71	13.98	1.75	
STD 20 mW	High	607.875	1.98	0.34	9.77	12.09	16.18	13.98	1.89	

Duty



Appendix SAR measurement result

Test Position	Dist. (mm)	Mode	Freq. (MHz)	Tune-up upper Power(dBm)	Measured average Power(dBm)	Power Scaled factor	Duty (%)	Duty Scaled factor	1g meas. SAR	Reported SAR	Plot No.
Front tilt	0	STD	470.125	13.98	12.05	1.56	100.0	1.00	0.087	0.136	
			539.000	13.98	12.23	1.50	100.0	1.00	0.168	0.251	STD
			607.875	13.98	12.09	1.54	100.0	1.00	0.066	0.102	
Back tilt	0	STD	470.125	13.98	12.05	1.56	100.0	1.00			
			539.000	13.98	12.23	1.50	100.0	1.00	0.168	0.251	
			607.875	13.98	12.09	1.54	100.0	1.00			
Bottom	0	STD	470.125	13.98	12.05	1.56	100.0	1.00			
			539.000	13.98	12.23	1.50	100.0	1.00	0.051	0.076	
			607.875	13.98	12.09	1.54	100.0	1.00			

Appendix Measurement plot

Plot No STD

Front tilt Mch Date/Time: 2025/11/06 8:30:21

Probe info:

Probe: EX3DV4 - SN3922 / Calibrated: 2025/09/11

ConvF(10.3, 10.3, 10.3) @ 539 MHz

Medium parameters used (interpolated): $f = 539$ MHz; $\sigma = 0.841$ S/m; $\epsilon_r = 44.196$; $\rho = 1000$ kg/m³

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

DAE info:

Electronics: DAE4 Sn1372 / Calibrated: 2025/03/11

Phantom info:

Phantom: ELI V4.0 (20deg probe tilt)/Phantom section: Flat Section

Type: QD OVA 001 BB

Serial: 1045

Software info DASY52 52.10.4(1535) SEMCAD X 14.6.14(7501)

Area Scan (61x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.243 W/kg

Zoom Scan 2 2 (13x21x7)/Cube 0: Measurement grid: dx=3mm, dy=3mm, dz=1.5mm

Reference Value = 16.38 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 1.84 W/kg

SAR(1 g) = 0.168 W/kg; SAR(10 g) = 0.056 W/kg

Smallest distance from peaks to all points 3 dB below = 4 mm

Ratio of SAR at M2 to SAR at M1 = 44.6%

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.508 W/kg

Note: Liquid temp. is kept within the 2 degree.C. during the test.

