SAR TEST REPORT

for

Sony Group Corporation

Wireless Noise Canceling Gaming Headset

Model No.: YY2987

IC: 409B-YY2987

FCC ID: AK8YY2987

The MAX Report SAR(1g)	
Head SAR	0.150W/Kg

Test distance: 0mm

Prepared for : Sony Group Corporation
1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan

Prepared By : Audix Technology (Shenzhen) Co., Ltd.
No. 6, Kefeng Road, Science &Technology Park,
Nanshan District, Shenzhen, Guangdong, China

Tel: (0755) 26639496
Fax: (0755) 26632877

Report No. : ACS-SF25005
Date of Test : Mar.12, 2025
Date of Report : Apr.15, 2025

TABLE OF CONTENTS

Description Page

SAR TEST REPORT

Applicant	:	Sony Group Corporation
Product	:	Wireless Noise Canceling Gaming Headset
Model No.	:	YY2987
FCC ID	:	AK8YY2987
IC	:	409B-YY2987
Test Voltage	:	DC 3.85V

Measurement Standard Used:

- FCC 47 CFR Part 2 (2.1093)
- IEEE C95.1-1999
- IEC/IEEE 62209-1528: 2020
- IEC62209-2:2010
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- RSS-102 ISSUE 6 (Dec 15, 2023)
- FCC KDB 447498 D04 v01
- FCC KDB 865664 D01/D02

The device described above is tested by Audix Technology (Shenzhen) Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The test results are contained in this test report and Audix Technology (Shenzhen) Co., Ltd. is assumed full responsibility for the accuracy and completeness of test. This report contains data that are not covered by the NVLAP accreditation.Also, this report shows that the EUT is technically compliant with the RSS-102 test requirements.

This report applies to single evaluation of one sample of above mentioned product and shall not be reproduced in part without written approval of Audix Technology (Shenzhen) Co., Ltd..

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

Date of Test : Mar.12, 2025 Report of date: Apr.15, 2025

Prepared by : Jasmine Ning
Jasmine Ning / Assistant

Reviewed by : Thomas Chen
Thomas Chen / Assistant Manager

AUDIX® 信華科技（深圳）有限公司
Audix Technology (Shenzhen) Co., Ltd.
EMC 部門報告專用章
Stamp only for EMC Dept. Report
Signature:

Approved & Authorized Signer :
Sunny Lu/ Manager

1. GENERAL INFORMATION

1.1. Description of Equipment Under Test

Applicant	Sony Group Corporation
Applicant Address	1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan
Product	Wireless Noise Canceling Gaming Headset
Model No.	YY2987
IC	409B-YY2987
FCC ID	AK8YY2987
Dongle	Manufacturer: SONY; Model: YY2988
USB Cable	Shielded, Detachable, 2.0m
Audio Cable	Unshielded, Detachable, 2.0m
BoomMIC	-
Soft pouch	-
Sample Type	Prototype production
Date of Receipt	Feb.12, 2025
Date of Test	Mar.12, 2025

Product consist two parts as below:

Part	Name
Wireless Noise Canceling Gaming Headset	YY2987(Headset)
USB Type-C transceiver	YY2988(Dongle)

1.2.Feature of Equipment under Test

Product Feature & Specification		
Product	Wireless Noise Canceling Gaming Headset	
Model No.	YY2987	
Power Source	☐ Commercial Power	AC V
	☒ External Power Source	DC 5V
	☒ Li-ion polymer Battery	DC 3.85V
	☐ UM battery	DC V

Radio				
Support Category/ Frequency Range	BT: Article 2-1-19 /2402MHz ~ 2480MHz SRD: Article 2-1-19 /2402MHz ~ 2480MHz			
Specification	☒ BDR	☒ EDR	☒ BLE	☒ General 2.4GHz
Type of Modulation	☐ Direct Spreading (DS) ☐ Orthogonal frequency-division multiplexing (OFDM) ☒ Frequency Hopping (FH) ☒ Bluetooth: GFSK, π/4 DQPSK, 8-DPSK ☒ General 2.4GHz: GFSK			
Antenna Information	Antenna Type: BT: PCB Antenna SRD: FPC Antenna			
	BT Peak Gain: 2.64dBi SRD Peak Gain: 3.63dBi			

2. GENERAL DESCRIPTION

2.1.Product Description For EUT

Please refer to section 1.1

2.2.Applied Standards

The Specific Absorption Rate (SAR) testing specification, method and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- IEEE C95.1-1999
- IEC/IEEE 62209-1528: 2020
- IEC62209-2:2010
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- RSS-102 ISSUE 6 (Dec 15, 2023)
- FCC KDB 447498 D04 v01
- FCC KDB 865664 D01/D02

2.3.Device Description and SAR Limits

This device is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

2.4.Test Conditions

2.4.1. **Ambient Condition**

Ambient Temperature	30 to 70 ℃
Humidity	＜20% to25 %

2.4.2.**Test Configuration**

The EUT was set to radiate maximum output power during all tests.

2.5.Exposure Positions Consideration

Exposure Positions Consideration please refer to Appendix E.

Sides for SAR tests							
Band	Body						
	Back	Front	Top	Bottom	Left	Right	Cochlea
BLE 1M	×	✓	×	×	✓	✓	✓
BLE 2M	×	✓	×	×	✓	✓	✓
BT 3.0	×	✓	×	×	✓	✓	✓
ULL 1M	×	✓	×	×	✓	✓	✓
ULL 2M	×	✓	×	×	✓	✓	✓

2.6.Standalone SAR Test Exclusion Considerations

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th}\ (\mathrm{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \mathrm{cm})^{x} & d \leq 20\ \mathrm{cm} \\ ERP_{20\ cm} & 20\ \mathrm{cm} < d \leq 40\ \mathrm{cm} \end{cases} \qquad (B.2)$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right)$$

and f is in GHz, d is the separation distance (cm), and ERP_{20cm} is per Formula (B.1) in KDB447498 D04 V01, The example values shown in Table B.2 are for illustration only.

According to the KDB447498 Table B.2, the SAR test exclusion threshold for 2450MHz at 5mm test separation distances is 3mW

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

RSS-102 issue 6 Section 6.3 table 11:

Devices operating at or below the applicable output power levels (adjusted for tune-up tolerance) specified in table 11, based on the separation distance, are exempt from SAR evaluation. The separation distance, defined as the distance between the user and/or bystander and the antenna and/or radiating element of the device or the outer surface of the device, shall be less than or equal to 20 cm for these exemption limits to apply.

Table 11: Power limits for exemption from routine SAR evaluation based on the separation distance

Frequency (MHz)	≤ 5 mm(mW)	10 mm (mW)	15 mm(mW)	20 mm(mW)	25 mm(mW)	30 mm(mW)	35 mm(mW)	40 mm(mW)	45 mm(mW)	> 50 mm(mW)
≤ 300	45	116	139	163	189	216	246	280	319	362
450	32	71	87	104	124	147	175	208	248	296
835	21	32	41	54	72	96	129	172	228	298
1900	6	10	18	33	57	92	138	194	257	323
2450	3	7	16	32	56	89	128	170	209	245
3500	2	6	15	29	50	72	94	114	134	158
5800	1	5	13	23	32	41	54	74	102	128

The exemption limits in table 11 Table 11 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 50 mm from a iat phantom, which provides a SAR value of approximately 0.4 W/kg for 1 g of tissue.

2.7.EUT Configuration and operation conditions for test.

EUT

(EUT: Wireless Noise Canceling Gaming Headset**)**

2.8.Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date	Calibration Body
1.	DASY5 SAR Test System	Speag	TX60 L speag	F09/5B1H1/01	NCR	NCR	NCR
2.	Power Meter	Anritsu	ML2487A	6K00003262	2024.06.19	2025.06.18	CCIC
3.	Power Sensor	Anritsu	MA2491A	032516	2024.06.19	2025.06.18	CCIC
4.	Dipole Validation Kits	Speag	D2450V2	862	2023.05.18	2026.05.17	CTTL
5.	Attenuator	MCL	VAT-20W2-2W	1527-001	2024.09.15	2025.09.14	CCIC
6.	ENA SERIES NETWORK ANALYZER	Agilent	E5071C	MY46316760	2024.09.15	2025.09.14	CCIC
7.	Date Acquisition Electronics	Speag	DAE4	899	2024.06.06	2025.06.05	CTTL
8.	E-Field Probe	Speag	EX3DV4	3767	2024.08.01	2025.07.31	CTTL
9.	Signal Generator	Rohde & Schwarz	SMB100A	181375	2024.03.16	2025.03.15	CCIC
10.	Attenuator	MCL	VAT-20W2-2W	1527-002	2024.09.15	2025.09.14	CCIC
11.	Test Software	Schmid&Partner Englinnering AG	DASY5	52.8.7.1137	NCR	NCR	NCR
Note: NCR means no calibration required (calibrated with system).							

2.9.Laboratory Environment

Temperature	Min:20℃,Max.25℃
Relative humidity	Min. = 30%, Max. = 70%
Note: Ambient noise is checked and found very low and in compliance with requirement of standards.	

2.10.Measurement Uncertainty

Test Item	Uncertainty
Uncertainty for SAR test	1g: ±21.1
	10g: ±20.6
Uncertainty for SAR tissue fluid	Conductivity: ±21.1
	Dielectric properties: ±20.6
Uncertainty for test site temperature and humidity	±0.6℃, ±3%

Source	Type	Uncertainly Value (%)	Probability Distribution	K	C1(1g)	C1(10g)	Standard uncertaint y uI(%)1g	Standard uncertaint y uI(%)10g	Degree of freedom Veff or Vi
Measurement system repetivity	A	0.5	N	1		1	0.5	0.5	9
Probe calibration	B	5.9	N	1	1	1	5.9	5.9	∞
Isotropy	B	4.7	R	√3	1	1	2.7	2.7	∞
Linearity	B	4.7	R	√3	1	1	2.7	2.7	∞
Probe modulation response	B	0	R	√3	1	1	0	0	∞
Detection limits	B	1.0	R	√3	1	1	0.6	0.6	∞
Boundary effect	B	1.9	R	√3	1	1	1.1	1.1	∞
Readout electronics	B	1.0	N	1	1	1	1.0	1.0	∞
Response time	B	0	R	√3	1	1	0	0	∞
Integration time	B	4.32	R	√3	1	1	2.5	2.5	∞
RF ambient conditions – noise	B	0	R	√3	1	1	0	0	∞
RF ambient conditions – reflections	B	3	R	√3	1	1	1.73	1.73	∞
Probe positioner mech. Restrictions	B	0.4	R	√3	1	1	0.2	0.2	∞
Probe positioning with respect to phantom shell	B	2.9	R	√3	1	1	1.7	1.7	∞
Post-processing	B	0	R	√3	1	1	0	0	∞
Test sample related									
Device holder uncertainty	A	2.94	N	1	1	1	2.94	2.94	M-1
Test sample positioning	A	4.1	N	1	1	1	4.1	4.1	M-1
Power scaling	B	5.0	R	√3	1	1	2.9	2.9	∞
Drift of output power (measured SAR drift)	B	5.0	R	√3	1	1	2.9	2.9	∞
Phantom and set-up									
Phantom uncertainty (shape and thickness tolerances)	B	4.0	R	√3	1	1	2.3	2.1	∞
Algorithm for correcting SAR for deviations in permittivity and conductivity	B	1.9	N	1	1	0,84	1,9	1,6	∞
Liquid conductivity (meas.)	A	0.55	N	1	0.78	0.71	0.24	0.21	M-1
Liquid permittivity (meas.)	A	0.19	N	1	0.23	0.26	0.09	0.06	M
Liquid permittivity – temperature uncertainty	A	5.0	R	√3	0,78	0,71	1.4	1.1	∞
Liquid conductivity – temperature uncertainty	A	5.0	R	√3	0.23	0,26	1.2	0.8	∞
Combined standard uncertainty	$u_c' = \sqrt{\sum_{i=1}^{23} c_i^2 u_i^2}$						**10.57**	**10.32**	
Expanded uncertainty (95 % conf. interval)	$u_e = 2u_c$		N	K=2			**21.14**	**20.64**	

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99+% Pure Sodium Chloride
Sugar: 98+% Pure Sucrose
Water: De-ionized, 16 MΩ+ resistivity
HEC: Hydroxyethyl Cellulose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

3. MEASURE PROCEDURES

3.1.General description of test procedures

This device support GFSK, Choose the channel which has the maximum power as the priority test channel. The top, front, bottom, back side was tested separately use the primary channel the other channel was verified with the worse case side. The measured result was adjusted with maximum tune-up power and duty cycle then get the final result.

Please apply the following guidance for SAR testing:

1. Please use a 0 mm (touching) test separation distance on the flat phantom during SAR testing of this device. This separation distance is based on the guidance found in FCC KDB Publication 447498 D04)
2. Please utilize a body tissue simulating liquid (TSL) of the appropriate frequency during SAR testing.
3. Please use the guidance found in FCC KDB Publication 447498 D04 to determine which sides of the device need to be tested for SAR.

4. SAR MEASUREMENTS SYSTEM

4.1.SAR Measurement Set-up

DASY5 system for performing compliance tests consists of the following items:

(1) A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).

(2) A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage It issue simulating liquid. The probe is equipped with an optical surface detector system.

(3) A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

(4) A unit to operate the optical surface detector which is connected to the EOC.

(5) The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

(6) The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.

(7) DASY5 software and SEMCAD data evaluation software.

(8) Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

(9) The generic twin phantom enabling the testing of left-hand and right-hand usage.

(10) The device holder for handheld mobile phones.

(11) Tissue simulating liquid mixed according to the given recipes.

(12) System validation dipoles allowing to validate the proper functioning of the system.

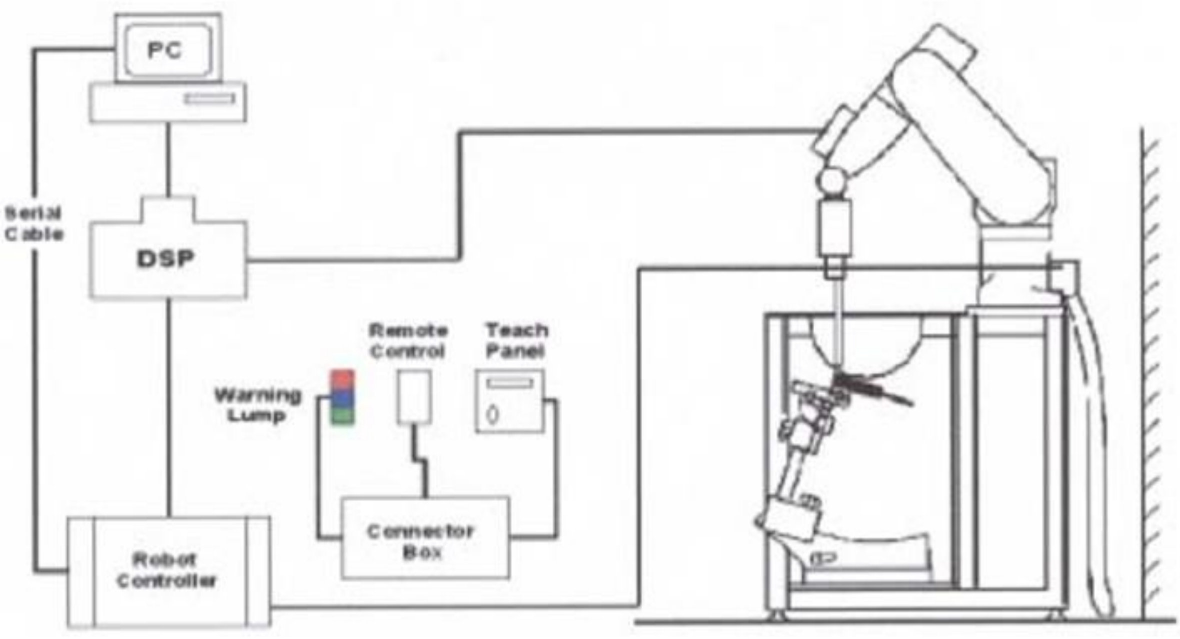
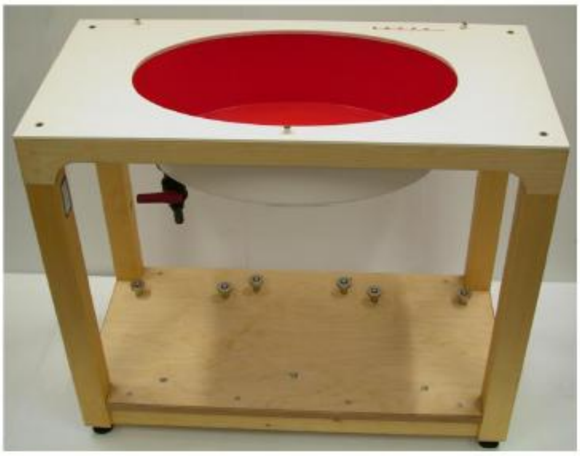


Figure 4.1 SAR Lab Test Measurement Set-up

4.2.ELI Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.



Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters
Wooden Support	SPEAG standard phantom table

The bottom plate contains three pair of bolts for locking the device holder. The device holderpositions are adjusted to the standard measurement positions in the three sections.

Figure 6.2Top View of Twin Phantom

A white cover is provided to tap the phantom during off-periods to prevent water evaporation andchanges in the liquid parameters.

On the phantom top, three reference markers are provided to identify the phantom position withrespect to the robot.

The phantom can be used with the following tissue simulating liquids:

*Water-sugar based liquid
*Glycol based liquids

4.3.Device Holder for SAM Twin Phantom

The SAR in the Phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5 mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ± 20%. An accurate device position is therefore crucial for accurate and repeatable measurement. The position in which the devices must be measured, are defined by the standards.

The DASY5 device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (EPR).

Thus the device needs no repositioning when changing the angles.

The DASY5 device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε_r=3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

Figure 4.3Device Holder

4.4.DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangul -ar configuration and optimized for dosimetric evaluation.

Figure 4.4EX3DV4 E-field Probe

4.4.1. EX3DV4 Probe Specification

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2dB (noise: typically < 1 µW/g)
Dimensions	Overall length: PRS-T2 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

4.5.E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than ±10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C\frac{\Delta T}{\Delta t}$$

Where: Δt = Exposure time (30 seconds),
C = Heat capacity of tissue (brain or muscle),
ΔT = Temperature increase due to RF exposure.
Or

$$SAR = \frac{|E|^2 \sigma}{\rho}$$

Where:
σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m3).

4.6.Scanning procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The ”reference“ and ”drift“ measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure.The indicated drift is mainly the variation of the EUT’s output power and should vary max. ± 5 %.

The ”surface check“ measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles.

The difference between the optical surface detection and the actual surface depends on the Probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field valuesbefore running a detailed measurement around the hot spot. Before starting the area scan a gridspacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remainsunchanged.

After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

Zoom Scan

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

· maximum search
· extrapolation
· boundary correction
· peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on theevaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

5. DATA STORAGE AND EVALUATION

5.1.Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for thedata evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

5.2.Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters: - SensitivityNormi, ai0, ai1, ai2
- Conversion factorConvFi
- Diode compression pointDcpi

Device parameters: - Frequency f
- Crest factor cf

Media parameters: - Conductivity
- Density

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

With ***Vi*** = compensated signal of channel i(i = x, y, z)

Ui = input signal of channel i(i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

dcpi = diode compression point(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: ***Ei = (Vi / Normi ·ConvF)1/2***

H-field probes: ***Hi = (Vi)1/2 ·(ai0 + ai1 f + ai2f2) / f***

With ***Vi***= compensated signal of channel i(i = x, y, z)

Normi= sensor sensitivity of channel i(i = x, y, z)

ConvF= sensitivity enhancement in solution

aij= sensor sensitivity factors for H-field probes

f= carrier frequency [GHz]

Ei= electric field strength of channel i in V/m

Hi= magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

Etot = (Ex2+ EY2+ Ez2)1/2

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

SAR= local specific absorption rate in mW/g

Etot= total field strength in V/m

= conductivity in [mho/m] or [Siemens/m]

= equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

Ppwe = *Etot2 / 3770* or ***Ppwe = Htot2 ·37.7***

with ***Ppwe*** = equivalent power density of a plane wave in mW/cm2

Etot = total electric field strength in V/m

Htot = total magnetic field strength in A/m

6. SYSTEM CHECK

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates weremeasured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulates, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the ANNEX A.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.

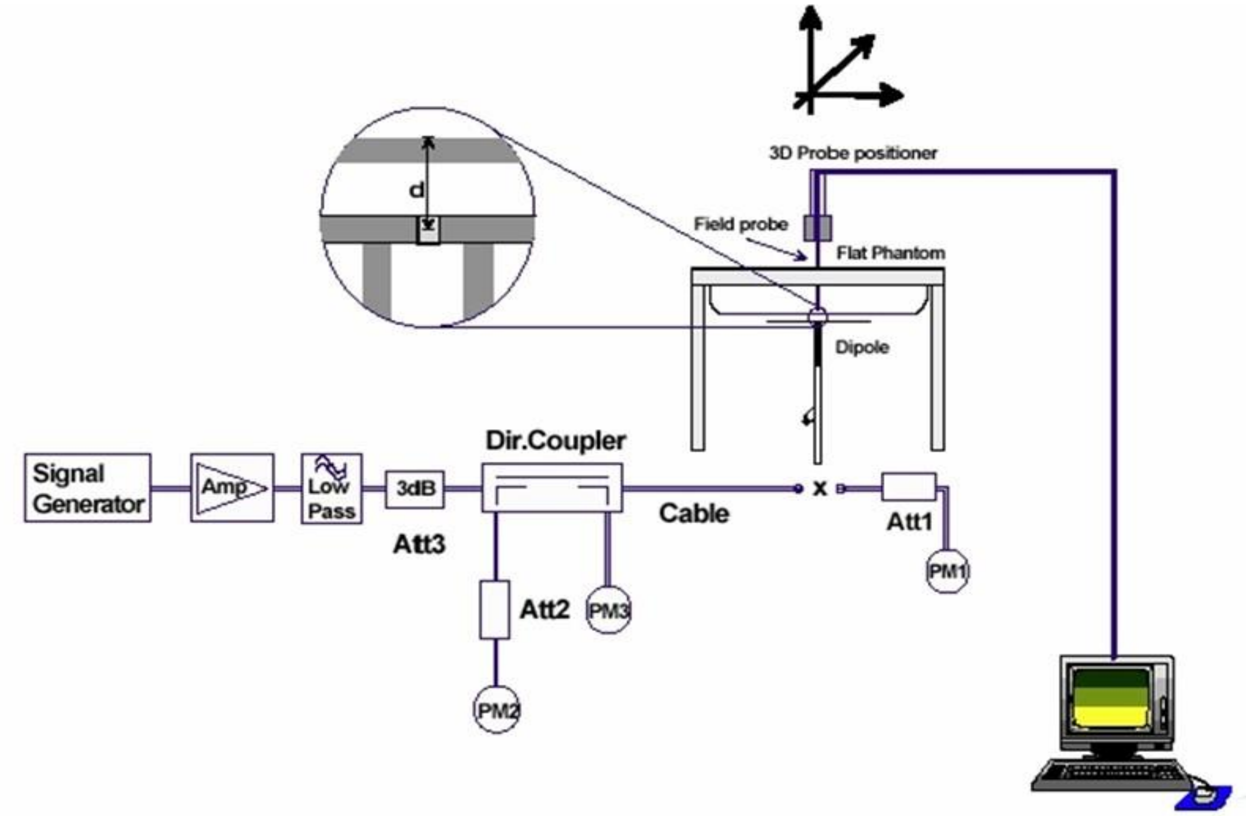


Figure 6.1: System Check Set-up

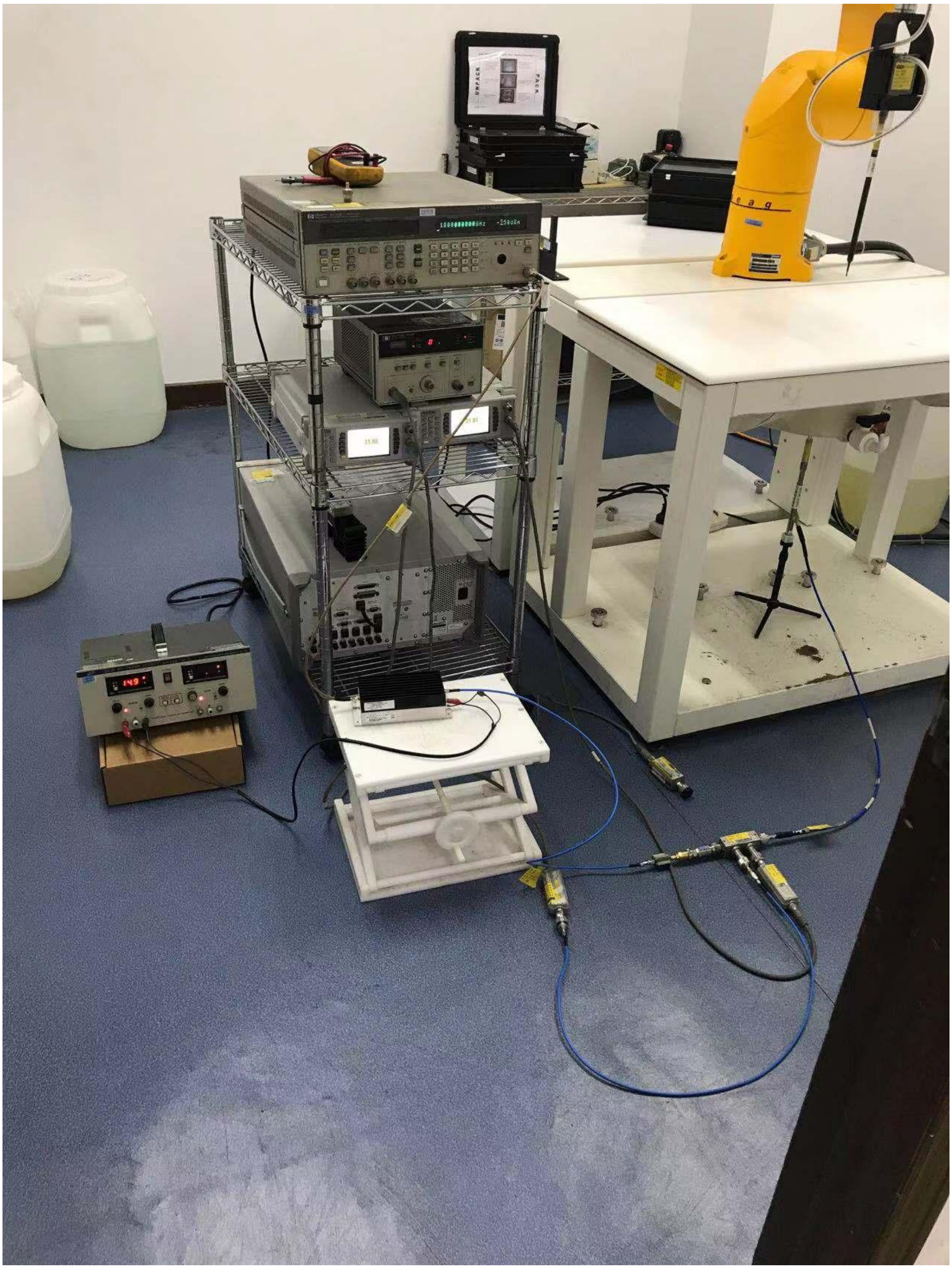


Figure 6.3: photos of system

7. TEST RESULTS

7.1.Output power

Mode: BT GFSK | Data Rate: DH5 | Directional Gain (dBi): 2.64

Channel	Frequency (MHz)	Power Setting	Chain0 Gain: 2.64 Avg (dBm)	Chain0 Gain: 2.64 Peak (dBm)	Total Power Avg (dBm)	Total Power Peak (dBm)	Limit Peak (dBm)	Limit PASS / FAIL	Worst Emission Freq. (MHz)	Worst Emission Margin (dB)	Bottleneck
0	2402	46	3.77	4.62	3.77	4.62	21.00	PASS			
39	2441	46	3.80	4.57	3.80	4.57	21.00	PASS			
78	2480	46	4.16	4.37	4.16	4.37	21.00	PASS			

Mode: BT 8DPSK | Data Rate: 3DH5 | Directional Gain (dBi): 2.64

Channel	Frequency (MHz)	Power Setting	Chain0 Avg (dBm)	Chain0 Peak (dBm)	Total Power Avg (dBm)	Total Power Peak (dBm)	Limit Peak (dBm)	PASS / FAIL	Freq. (MHz)	Margin (dB)	Bottleneck
0	2402	47	2.08	5.29	2.08	5.29	21.00	PASS			
39	2441	47	2.11	5.25	2.11	5.25	21.00	PASS			
78	2480	47	1.94	5.05	1.94	5.05	21.00	PASS			

Mode: BT LE-GFSK | Data Rate: 1Mbps | #REF!

Channel	Frequency (MHz)	Power Setting	Chain0 Avg (dBm)	Chain0 Peak (dBm)	Total Power Avg (dBm)	Total Power Peak (dBm)	Limit Peak (dBm)	PASS / FAIL	Freq. (MHz)	Margin (dB)	Bottleneck
0	2402	46	4.15	4.67	4.15	4.67	30.00	PASS			
19	2440	46	4.27	4.62	4.27	4.62	30.00	PASS			
39	2480	46	3.99	4.41	3.99	4.41	30.00	PASS			

Mode: BT LE-GFSK | Data Rate: 2Mbps

Channel	Frequency (MHz)	Power Setting	Chain0 Avg (dBm)	Chain0 Peak (dBm)	Total Power Avg (dBm)	Total Power Peak (dBm)	Limit Peak (dBm)	PASS / FAIL	Freq. (MHz)	Margin (dB)	Bottleneck
1	2404	46	4.11	4.64	4.11	4.64	30.00	PASS			
19	2440	46	4.22	4.58	4.22	4.58	30.00	PASS			
38	2478	46	4.93	4.35	4.93	4.35	30.00	PASS			

Mode: ULL 1M | Data Rate: 1Mbps | Directional Gain (dBi): 3.63

Channel	Frequency (MHz)	Power Setting	Chain0 Gain: 3.63 Avg (dBm)	Chain0 Gain: 3.63 Peak (dBm)	Total Power Avg (dBm)	Total Power Peak (dBm)	Limit Peak (dBm)	Limit PASS / FAIL	Worst Emission Freq. (MHz)	Worst Emission Margin (dB)	Bottleneck
0	2402	47	3.88	4.24	3.88	4.24	21.00	PASS			
19	2440	47	4.06	4.50	4.06	4.50	21.00	PASS			
39	2480	47	4.36	4.71	4.36	4.71	21.00	PASS			

Mode: ULL 2M | Data Rate: 2Mbps | Directional Gain (dBi): 3.63

Channel	Frequency (MHz)	Power Setting	Chain0 Avg (dBm)	Chain0 Peak (dBm)	Total Power Avg (dBm)	Total Power Peak (dBm)	Limit Peak (dBm)	PASS / FAIL	Freq. (MHz)	Margin (dB)	Bottleneck
1	2404	47	3.83	4.20	3.83	4.20	21.00	PASS			
19	2440	47	4.00	4.46	4.00	4.46	21.00	PASS			
38	2478	47	4.28	4.65	4.28	4.65	21.00	PASS			

7.2.System Check for Head Tissue simulating liquid

Frequency	Description	SAR(W/kg)		Dielectric Parameters (±10% window)		Temp
		1g	10g	εr	σ(s/m)	℃
2450MHz	Recommended value	13.5 10.962-16.038	6.29 5.11377-7.46623	39.2 35.28-43.12	1.80 1.62-1.98	/
	Measurement value **2025-03-12**	13.94	6.32	39.2	1.8	**21.05**

7.3.Dielectric Performance for Tissue simulating liquid

Frequency		Description	Dielectric Parameters (±10% window)		Temp
			εr	σ(s/m)	℃
BDR	2402MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.913	1.828	**21.05**
	2441MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.734	1.878	**21.05**
	2480MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.579	1.917	**21.05**
BLE 1M	2402MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.913	1.828	**21.05**
	2440MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.738	1.876	**21.05**
	2480MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.579	1.917	**21.05**
BLE 2M	2404MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.738	1.876	**21.05**
	2440MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.738	1.876	**21.05**
	2478MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.59	1.915	**21.05**
ULL 1M	2402MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.913	1.828	**21.05**
	2440MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.738	1.876	**21.05**
	2480MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.579	1.917	**21.05**

ULL 2M	**2404MHz**	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.892	1.83	**21.05**
	2440MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.738	1.876	**21.05**
	2478MHz	Recommended value	39.2 35.28-43.12	1.80 1.62-1.98	/
		Measurement value **2025-03-12**	38.59	1.915	**21.05**

7.4.Test Results

PASS

SAR Test Record For wireless													
	Test Position	Test CH	Duty Cycle	Measure SAR 1g(W/kg)	Measure SAR 10g (W/kg)	GAIN	AV power	Conducted Power (dBm)	Tune up Power (dBm)	Factor	Scaled Final SAR 1g	Scaled Final SAR 10g	power drift
BLE1M	Front	2440	0.8472	0.026	0.011	2.64	4.22	6.8600	8.8600	1.584893	0.049	0.021	0.15
	Left	2440	0.8472	0.012	0.0025	2.64	4.22	6.8600	8.8600	1.584893	0.022	0.005	-0.17
	Right	2440	0.8472	0.000511	0.000211	2.64	4.22	6.8600	8.8600	1.584893	0.001	0.000	-0.06
	Cochlea Side	2440	0.8472	0.000223	0.000121	2.64	4.22	6.8600	8.8600	1.584893	0.000	0.000	0.17
	Front	2402	0.8472	0.027	0.011	2.64	4.15	6.7900	8.7900	1.584893	0.051	0.021	-0.14
	Front	2480	0.8472	0.028	0.012	2.64	3.99	6.6300	8.6300	1.584893	0.052	0.022	-0.07
BLE2M	Front	2478	0.4242	0.016	0.00473	2.64	4.93	7.5700	9.5700	1.584893	0.060	0.018	0.1
	Left	2478	0.4242	0.000755	0.000421	2.64	4.93	7.5700	9.5700	1.584893	0.003	0.002	0.03
	Right	2478	0.4242	0.000433	0.000211	2.64	4.93	7.5700	9.5700	1.584893	0.002	0.001	-0.04
	Cochlea Side	2478	0.4242	0.000788	0.000512	2.64	4.93	7.5700	9.5700	1.584893	0.003	0.002	-0.09
	Front	2404	0.4242	0.014	0.00339	2.64	4.11	6.7500	8.7500	1.584893	0.052	0.013	-0.11
	Front	2440	0.4242	0.011	0.00218	2.64	4.22	6.8600	8.8600	1.584893	0.041	0.008	0.16
BT 3.0	Front	2480	0.7659	0.027	0.011	2.64	4.16	6.8000	8.8000	1.584893	0.056	0.023	-0.18
	Left	2480	0.7659	0.016	0.00395	2.64	4.16	6.8000	8.8000	1.584893	0.033	0.008	0.17
	Right	2480	0.7659	0.000187	0.0001	2.64	4.16	6.8000	8.8000	1.584893	0.000	0.000	0.15
	Cochlea Side	2480	0.7659	0.00263	0.00133	2.64	4.16	6.8000	8.8000	1.584893	0.005	0.003	-0.12
	Front	2402	0.7659	0.022	0.00914	2.64	3.77	6.4100	8.4100	1.584893	0.046	0.019	-0.16
	Front	2441	0.7659	0.027	0.011	2.64	3.8	6.4400	8.4400	1.584893	0.056	0.023	-0.11
ULL1M	Front	2480	0.3074	0.028	0.011	3.63	4.36	7.9900	9.9900	1.584893	0.144	0.057	-0.15
	Left	2480	0.3074	0.019	0.0074	3.63	4.36	7.9900	9.9900	1.584893	0.098	0.038	0.18
	Right	2480	0.3074	0.000125	0.000073	3.63	4.36	7.9900	9.9900	1.584893	0.001	0.000	-0.12
	Cochlea Side	2480	0.3074	0.000964	0.000118	3.63	4.36	7.9900	9.9900	1.584893	0.005	0.001	-0.12
	Front	2402	0.3074	0.027	0.011	3.63	3.88	7.5100	9.5100	1.584893	0.139	0.057	-0.17
	Front	2440	0.3074	0.029	0.011	3.63	4.06	7.6900	9.6900	1.584893	0.150	0.057	0.18
ULL2M	Front	2478	0.4238	0.018	0.00571	3.63	4.28	7.9100	9.9100	1.584893	0.067	0.021	0.12
	Left	2478	0.4238	0.00254	0.000312	3.63	4.28	7.9100	9.9100	1.584893	0.009	0.001	0.16
	Right	2478	0.4238	0.000987	0.000477	3.63	4.28	7.9100	9.9100	1.584893	0.004	0.002	0.19
	Cochlea Side	2478	0.4238	0.000746	0.000315	3.63	4.28	7.9100	9.9100	1.584893	0.003	0.001	0.03
	Front	2404	0.4238	0.016	0.00449	3.63	3.83	7.4600	9.4600	1.584893	0.060	0.017	-0.19
	Front	2440	0.4238	0.017	0.00528	3.63	4.28	7.9100	9.9100	1.584893	0.064	0.020	-0.1