

FCC SAR Test Report

Report No. : KES-SR-22T0016
FCC ID : ZNFTONET90Q
Applicant : LG Electronics USA, Inc.
Address : 111 Sylvan Ave, North Building, Englewood Cliffs, New Jersey, United States
Manufacturer : LG Electronics Inc.
Address : 222 LG-ro Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, Korea
DUT Type : Bluetooth Earbud
Model Name : TONE-T90Q
Multiple Model Name: : TONE-UT90Q, TONE-DT90Q
Serial Number : N/A
Date of Testing : 2022.05.31 ~ 2022.06.02
Issued Date : 2022.06.14

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Revision history

Report No.	Reason for Change	Date Issued
KES-SR-22T0016	Initial release	2022.06.14

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1. General Information

Applicant: LG Electronics USA, Inc.
Applicant address: 111 Sylvan Ave, North Building, Englewood Cliffs, New Jersey, United States
Test site: KES Co., Ltd.
Test site address: 3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Test Facility FCC Accreditation Designation No.: KR0100, Registration No.: 4796B
FCC rule part(s): CFR §2.1093
FCC ID: ZNFTONET90Q
Test device serial No.: Production Pre-production Engineering

1.1. Highest SAR Summary

EUT Type	Bluetooth Earbud				
Brand Name(Applicant)	LG Electronics Inc.				
Model Name	TONE-T90Q				
Additional Model Name	TONE-UT90Q, TONE-DT90Q				
Antenna Type	Internal Antenna				
EUT Stage	Identical Prototype				
Equipment Class	Band & Mode	TX Frequency	1g Head (W/Kg)	1g Body (W/Kg)	10g Hands (W/Kg)
DSS	Bluetooth	2 402 ~ 2 480 MHz	0.381	1.155	0.398
Simultaneous SAR per 690783 D01v01r03			N/A	N/A	N/A

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 7 of this report;

1.2. Device Overview

Band & Mode	Operating Modes	Tx Frequency
Bluetooth	Data	2 402 ~ 2 480 MHz

1.3. Power Reduction for SAR

There is no power reduction used for any band/mode implemented in the device for SAR purposes.

1.4. Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

Maximum Bluetooth Output Power

Band / Mode		Modulated Averaged (dBm)
Bluetooth (BDR – 1 Mbps)	Maximum	14.0
	Nominal	12.5
Bluetooth (EDR – 2 Mbps, 3 Mbps)	Maximum	10.5
	Nominal	9.0
Bluetooth (LE – 1 Mbps)	Maximum	8.5
	Nominal	7.0
Bluetooth (LE – 2 Mbps)	Maximum	8.5
	Nominal	7.0

1.5. Simultaneous Transmission Capabilities

This device is supported only Bluetooth. So, simultaneous transmission analysis was not considered.

1.6. DUT Antenna Locations

The DUT antenna locations are included in the filing.

1.7. Near Field Communications (NFC) Antenna

This DUT does not support NFC function.

1.8. Miscellaneous SAR Test Considerations

(A) Bluetooth

This device only supports Bluetooth BDR(1 Mbps), EDR(2 Mbps, 3 Mbps), LE(1 Mbps) and LE (2 Mbps). Bluetooth SAR was measured with hopping disabled with DH5 operation TX Tests test mode type.

1.9. Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 447498 D01v06 (General RF Exposure Guidance)
- FCC KDB Publication 865664 D01v01r04 (SAR Measurement 100 MHz to 6 GHz)
- FCC KDB Publication 865664 D02v01r02 (RF Exposure Reporting)
- FCC KDB Publication 690783 D01v01r03 (SAR Listings on Grants)
- October 2016 TCBC workshop Notes (Bluetooth SAR Testing)
- October 2016 TCBC workshop Notes (DUT Holder perturbations)
- April 2019 TCBC workshop Notes (Tissue Simulating Liquids (TSL))

1.10. Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 8.

2. Introduction

The FCC and Innovation, Science, and Economic Development Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3KHz to 300 GHz and Health Canada RF Exposure Guidelines Safety Code 6. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

2.1. SAR definition

Specific Absorption Rate is defined as 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). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 2-1)

$$\text{SAR} = \frac{d}{dt} \left(\frac{dW}{dm} \right) = \frac{d}{dt} \left(\frac{dW}{\rho dv} \right)$$

Equation 2-1 SAR Mathematical Equation

SAR is expressed in units of Watts per kilogram (W/kg).

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

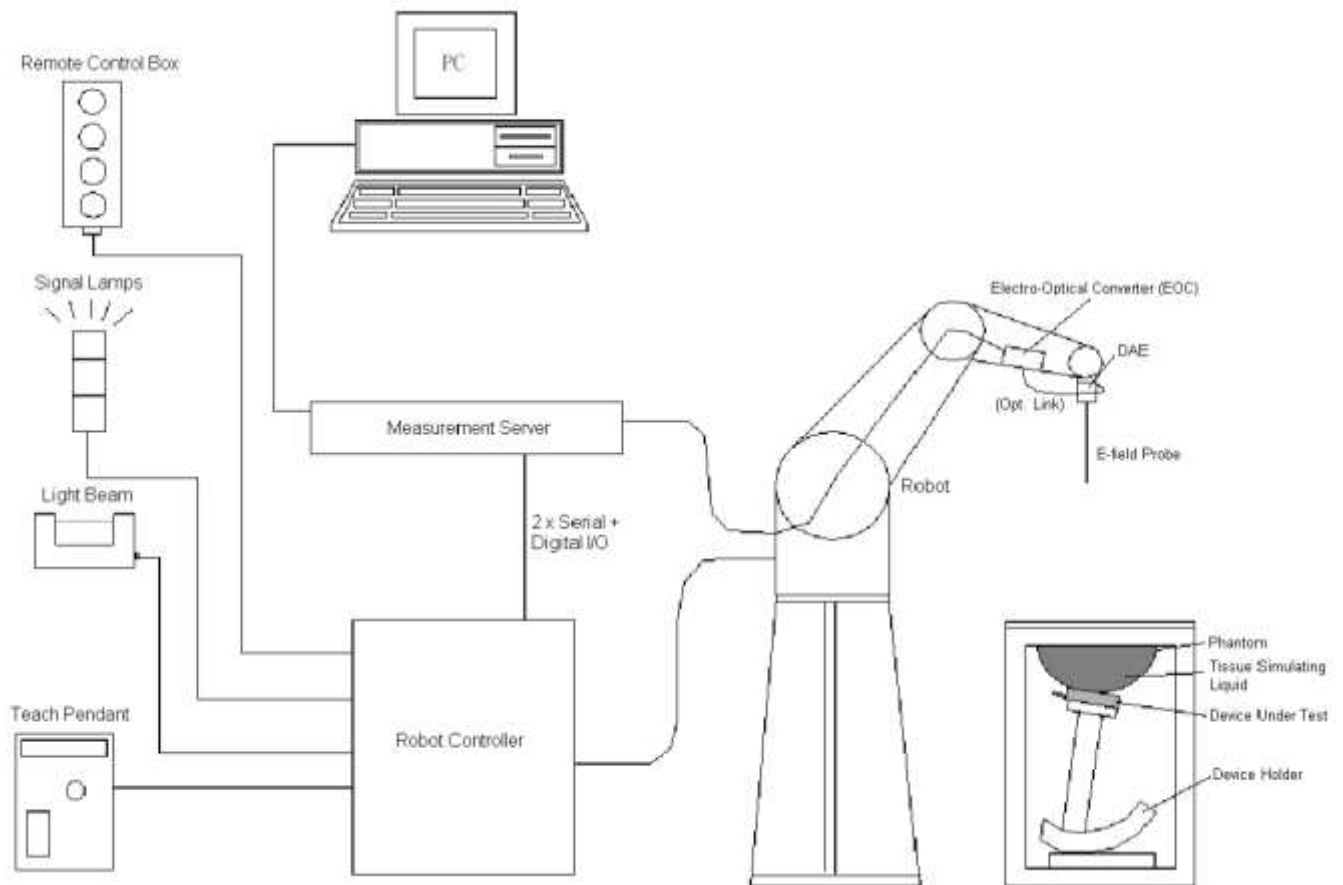
Where: σ = conductivity of the tissue (S/m)
 ρ = mass density of the tissue (kg/m³)
E = rms electrical field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.

2.2. SAR Measurement Setup

A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE). An isotropic Field probe optimized and calibrated for the targeted measurement. Data acquisition electronics (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.

The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts. The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning. A computer running WinXP, Win7 or Win10 and the DASY5 software. Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc. The phantom, the device holder and other accessories according to the targeted measurement.



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3. Dosimetric Assessment

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 4-1) and IEC/IEEE 1528-2013.

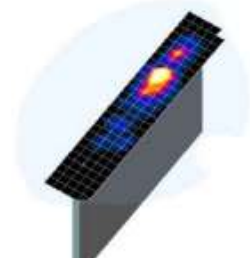


Figure 4-1 Sample SAR Area Scan

2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.

3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 4-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

- a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
- b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
- c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 4-1 Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

Frequency	Maximum Area Scan Resolution (mm) ($\Delta x_{\text{area}}, \Delta y_{\text{area}}$)	Maximum Zoom Scan Resolution (mm) ($\Delta x_{\text{zoom}}, \Delta y_{\text{zoom}}$)	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid $\Delta z_{\text{zoom}}(n)$	Graded Grid		
				$\Delta z_{\text{zoom}}(1)^*$	$\Delta z_{\text{zoom}}(n>1)^*$	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	$\leq 1.5 * \Delta z_{\text{zoom}}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	$\leq 1.5 * \Delta z_{\text{zoom}}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	$\leq 1.5 * \Delta z_{\text{zoom}}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	$\leq 1.5 * \Delta z_{\text{zoom}}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	$\leq 1.5 * \Delta z_{\text{zoom}}(n-1)$	≥ 22

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4. TEST CONFIGURATION POSITIONS

4.1. Device Holder

This device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon = 3$ and loss tangent $\delta = 0.02$.

4.2. Positioning for Testing

Based on FCC guidance and expected exposure conditions, the device was positioned with the outside of the device touching the flat phantom and such that the location of maximum SAR was captured during SAR testing. The SAR test setup photograph is included in Appendix F.

5. RF Exposure Limits

In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, Operating instruction and cautions statements are included in the user's manual.

5.1. Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2. Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 5-1 SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

Human Exposure Limits		
	Uncontrolled Environment General Population (W/kg) or (mW/g)	Controlled Environment Occupational (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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6. FCC Measurement Procedures

Power measurements for licensed transmitters are performed using a base station simulator under digital average power.

6.1. Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

Per KDB Publication 447498 D01v06, testing of other required channels within the operating mode of a frequency band is not required when the reported 1g or 10g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1g or 10g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1g or 10g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1g or 10g respectively, when the transmission band is ≥ 200 MHz

6.2. Procedures Used to Establish RF signal for SAR

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR. Devices under test are evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device is tested throughout the SAR test at maximum output power, the SAR measurement system measures a "point SAR" at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviates by more than 5%, the SAR test and drift measurements are repeated.

As required by §§ 2.1091(d)(2) and 2.1093(d)(5), RF exposure compliance must be determined at the maximum average power level according to source-based time-averaging requirements to determine compliance for general population exposure conditions. Unless it is specified differently in the published RF exposure KDB procedures, these requirements also apply to test reduction and test exclusion considerations. Time-averaged maximum conducted output power applies to SAR and, as required by § 2.1091(c), time-averaged effective radiated power applies to MPE. When an antenna port is not available on the device to support conducted power measurement, such as for FRS (Part 95) devices and certain Part 15 transmitters with built-in integral antennas, the maximum output power and tolerance allowed for production units should be used to determine RF exposure test exclusion and compliance.

7. RF Conducted Powers

7.1. Conducted Powers

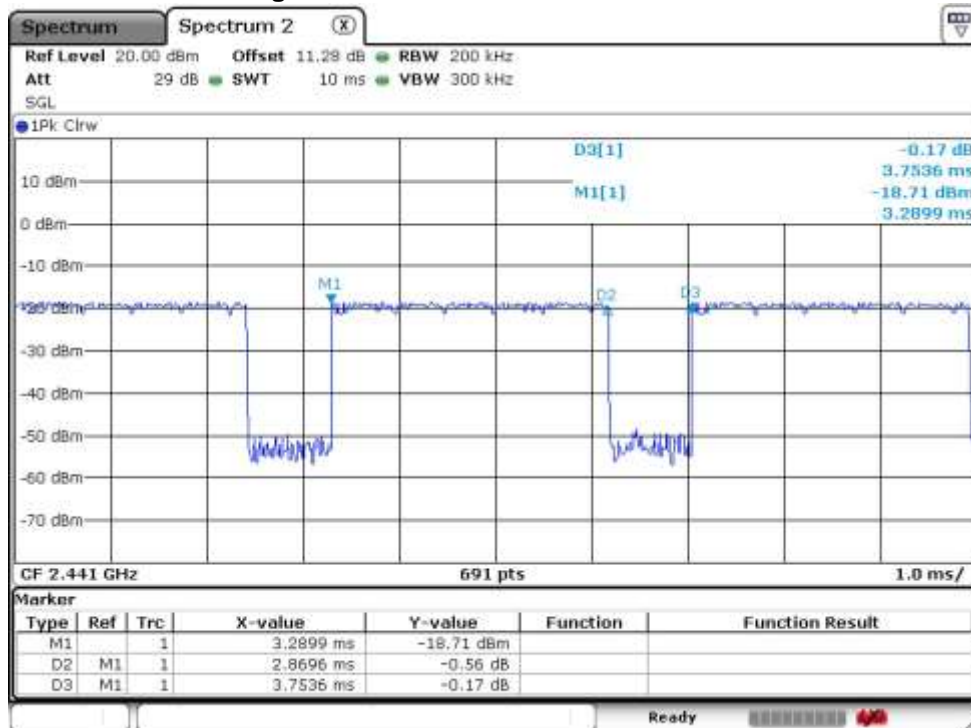
7.1.1. Bluetooth Conducted Power

Table 7-1 Bluetooth Conducted Powers

Mode	Data Rate	Ch.	Frequency	Average Conducted Power	
				dBm	mW
Bluetooth (Right Ear)	1 Mbps	0	2 402	13.87	24.38
		40	2 442	13.91	24.60
		78	2 480	13.78	23.88
	2 Mbps	0	2 402	10.63	11.56
		40	2 442	10.62	11.53
		78	2 480	10.41	10.99
	3 Mbps	0	2 402	10.48	11.17
		40	2 442	10.46	11.12
		78	2 480	10.36	10.86
	LE 1 Mbps	0	2 402	8.87	7.71
		20	2 442	8.94	7.83
		39	2 480	8.91	7.78
	LE 2 Mbps	0	2 402	8.93	7.82
		20	2 442	8.85	7.67
		39	2 480	8.84	7.66

Note: The bolded data rates and channel above were tested for SAR.

Figure 7-1 Bluetooth Transmission Plot



Equation 7-1 Bluetooth Duty Cycle Calculation for Right Ear

Duty Cycle of this device is 76.4 %

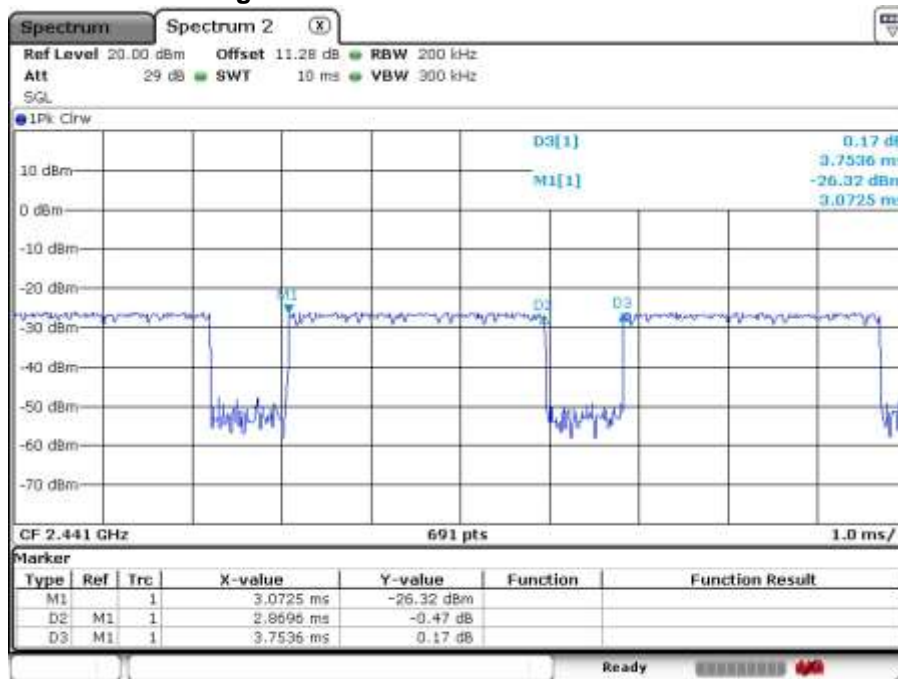
Duty Cycle[%] = (Pulse / Period) X 100 = (2.8696 / 3.7536) X 100 = 76.4 %

Table 7-2 Bluetooth Conducted Powers

Mode	Data Rate	Ch.	Frequency	Average Conducted Power	
				dBm	mW
Bluetooth (Left Ear)	1 Mbps	0	2 402	13.74	23.66
		40	2 442	13.76	23.77
		78	2 480	13.63	23.07
	2 Mbps	0	2 402	10.26	10.62
		40	2 442	10.22	10.52
		78	2 480	10.08	10.19
	3 Mbps	0	2 402	10.33	10.79
		40	2 442	10.27	10.64
		78	2 480	10.26	10.62
	LE 1 Mbps	0	2 402	8.78	7.55
		20	2 442	8.74	7.48
		39	2 480	8.67	7.36
	LE 2 Mbps	0	2 402	8.78	7.55
		20	2 442	8.74	7.48
		39	2 480	8.65	7.33

Note: The bolded data rates and channel above were tested for SAR.

Figure 7-2 Bluetooth Transmission Plot



Equation 7-2 Bluetooth Duty Cycle Calculation for Right Ear

Duty Cycle of this device is 76.4 %

$$\text{Duty Cycle}[\%] = (\text{Pulse} / \text{Period}) \times 100 = (2.8696 / 3.7536) \times 100 = \underline{76.4} \%$$

Note:

- SAR measurement is not required for the QPSK, 8PSK, and BLE. When the secondary mode is $\leq 1/4$ dB higher than the primary mode.

2. System Verification

A. Tissue Verification

Table 8-1 Measured Tissue Properties - Body

Tissue Type	Measured Frequency (MHz)	Tissue Temp (°C)	Measured Conductivity (σ)	Measured Permittivity (ϵ_r)	Target Conductivity (σ)	Target Permittivity (ϵ_r)	Conductivity Deviation (%)	Permittivity Deviation (%)	Test Date
HSL2450	2 450	21.3	1.826	39.157	1.80	39.2	1.44	-0.11	2022.05.31
	2 402		1.778	39.340	1.76	39.3	1.17	0.15	
	2 442		1.814	39.297	1.79	39.2	1.18	0.21	
	2 480		1.854	39.098	1.83	39.2	1.20	-0.16	
HSL2450	2 450	21.2	1.781	39.267	1.80	39.2	-1.06	0.17	2022.06.02
	2 402		1.736	39.279	1.76	39.3	-1.22	-0.01	
	2 442		1.781	39.194	1.79	39.2	-0.66	-0.05	
	2 480		1.818	39.090	1.83	39.2	-0.76	-0.18	

Tissue Verification Notes:

1. The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.
2. Per April 2019 TCBC Workshop Notes, effective February 19, 2019, FCC has permitted the use of single head-tissue simulating liquid specified in IEC 62209-1 for all SAR tests.

B. Tissue Verification

Prior to SAR assessment, the system is verified to $\pm 10\%$ of the SAR measurement on the reference dipole at the time of calibration by the calibration facility.

Table 8-2 System Verification Results – 1 g

SAR System #	Test Date	Tissue Frequency (MHz)	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (mW)	Dipole SN	Probe SN	1W Target SAR-1 g (W/kg)	Measured SAR-1 g (W/kg)	Normalized to 1W SAR-1 g (W/kg)	Deviation (%)
1	2022.05.31	2 450	22.4	21.3	100	896	3879	52.50	5.50	55.00	4.76
1	2022.06.02	2 450	22.2	21.2	100	896	3879	52.50	5.21	52.10	-0.76

Table 8-3 System Verification Results – 10 g

SAR System #	Test Date	Tissue Frequency (MHz)	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (mW)	Dipole SN	Probe SN	1W Target SAR-10 g (W/kg)	Measured SAR-10 g (W/kg)	Normalized to 1W SAR-10 g (W/kg)	Deviation (%)
1	2022.05.31	2 450	22.4	21.3	100	896	3879	24.10	2.49	24.90	3.32
1	2022.06.02	2 450	22.2	21.2	100	896	3879	24.10	2.36	23.60	-2.07

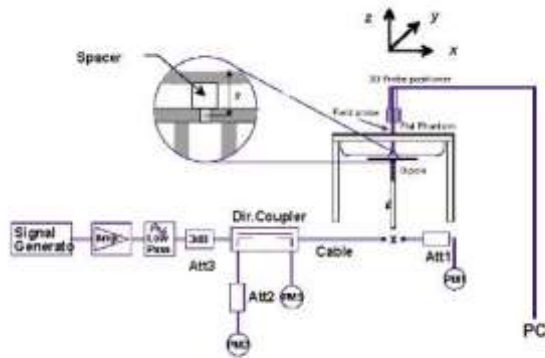


Figure 8-1 System Verification Setup Diagram

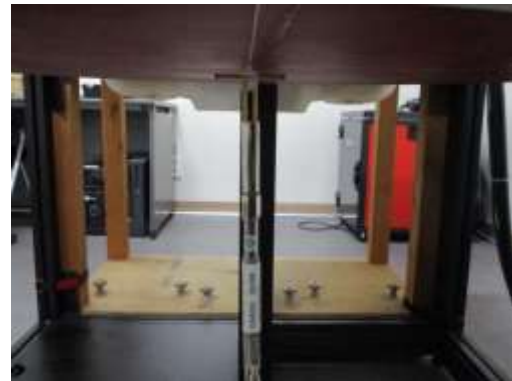


Figure 8-2 System Verification Setup Photo

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3. SAR Data Summary

A. Standalone Head SAR Data

Table 9-1 Bluetooth Head SAR

Plot No.	Device Serial Number	Frequency		Mode	Service	Test Position	Spacing (cm)	Maximum Allowed Power [dBm]	Measured Conducted Power [dBm]	Scaling Factor (Duty Cycle)	Scaling Factor (Power)	Power Drift [dB]	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)
		MHz	Ch.											
8	SAR1	2 480	78	Bluetooth	1 Mbps	Right Ear	0	14.00	13.78	1.309	1.052	-0.080	0.174	0.240
28	SAR1	2 480	78	Bluetooth	1 Mbps	Left Ear	0	14.00	13.63	1.309	1.089	-0.100	0.267	0.381
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population								Head 1.6 W/kg (mW/g) Averaged over 1 gram						

B. Standalone Body/Hands SAR Data

Table 9-2 Bluetooth Body/Hands SAR

Plot No.	Device Serial Number	Earphone Side	Frequency		Mode	Service	Test Position	Spacing (cm)	Maximum Allowed Power [dBm]	Measured Conducted Power [dBm]	Scaling Factor (Duty Cycle)	Scaling Factor (Power)	Power Drift [dB]	Measured SAR 1 g (W/kg)	Reported SAR 1 g (W/kg)	Measured SAR 10 g (W/kg)	Reported SAR 10 g (W/kg)
			MHz	Ch.													
	SAR1	Right Ear	2 442	40	Bluetooth	1 Mbps	Top Side	0	14.00	13.91	1.309	1.021	0.110	0.144	0.192	0.062	0.083
	SAR1		2 442	40	Bluetooth	1 Mbps	Bottom Side	0	14.00	13.91	1.309	1.021	-0.040	0.223	0.298	0.091	0.122
	SAR1		2 442	40	Bluetooth	1 Mbps	Front Side	0	14.00	13.91	1.309	1.021	0.080	0.148	0.198	0.057	0.076
	SAR1		2 442	40	Bluetooth	1 Mbps	Rear Side	0	14.00	13.91	1.309	1.021	0.030	0.774	1.034	0.227	0.303
	SAR1		2 442	40	Bluetooth	1 Mbps	Right Side	0	14.00	13.91	1.309	1.021	-0.030	0.261	0.349	0.096	0.128
	SAR1		2 442	40	Bluetooth	1 Mbps	Left Side	0	14.00	13.91	1.309	1.021	0.100	0.782	1.045	0.269	0.359
	SAR1		2 402	0	Bluetooth	1 Mbps	Front Side	0	14.00	13.87	1.309	1.030	0.090	0.133	0.179	0.054	0.073
	SAR1		2 480	78	Bluetooth	1 Mbps	Front Side	0	14.00	13.78	1.309	1.052	-0.080	0.174	0.240	0.067	0.092
	SAR1		2 402	0	Bluetooth	1 Mbps	Rear Side	0	14.00	13.87	1.309	1.030	0.060	0.749	1.010	0.220	0.297
	SAR1		2 480	78	Bluetooth	1 Mbps	Rear Side	0	14.00	13.78	1.309	1.052	0.010	0.771	1.062	0.224	0.308
	SAR1		2 402	0	Bluetooth	1 Mbps	Left Side	0	14.00	13.87	1.309	1.030	0.090	0.740	0.998	0.256	0.345
12	SAR1		2 402	78	Bluetooth	1 Mbps	Left Side	0	14.00	13.78	1.309	1.052	0.100	0.839	1.155	0.289	0.398
	SAR1		2 480	78	Bluetooth	1 Mbps	Left Side	0	14.00	13.78	1.309	1.052	0.010	0.788	1.085	0.252	0.347
	SAR1		Left Ear	2 442	40	Bluetooth	1 Mbps	Top Side	0	14.00	13.76	1.309	1.057	0.160	0.055	0.076	0.027
	SAR1	2 442		40	Bluetooth	1 Mbps	Bottom Side	0	14.00	13.76	1.309	1.057	0.050	0.213	0.295	0.078	0.108
	SAR1	2 442		40	Bluetooth	1 Mbps	Front Side	0	14.00	13.76	1.309	1.057	-0.160	0.257	0.356	0.092	0.127
	SAR1	2 442		40	Bluetooth	1 Mbps	Rear Side	0	14.00	13.76	1.309	1.057	0.080	0.717	0.992	0.219	0.303
	SAR1	2 442		40	Bluetooth	1 Mbps	Right Side	0	14.00	13.76	1.309	1.057	0.170	0.664	0.918	0.215	0.297
	SAR1	2 442		40	Bluetooth	1 Mbps	Left Side	0	14.00	13.76	1.309	1.057	0.070	0.427	0.591	0.157	0.217
	SAR1	2 402		0	Bluetooth	1 Mbps	Front Side	0	14.00	13.74	1.309	1.062	-0.150	0.235	0.327	0.082	0.114
	SAR1	2 480		78	Bluetooth	1 Mbps	Front Side	0	14.00	13.63	1.309	1.089	-0.100	0.267	0.381	0.095	0.135
	SAR1	2 402		0	Bluetooth	1 Mbps	Rear Side	0	14.00	13.74	1.309	1.062	0.100	0.546	0.759	0.175	0.243
	SAR1	2 480		78	Bluetooth	1 Mbps	Rear Side	0	14.00	13.63	1.309	1.089	0.080	0.600	0.855	0.181	0.258
	SAR1	2 402		0	Bluetooth	1 Mbps	Right Side	0	14.00	13.74	1.309	1.062	-0.010	0.630	0.875	0.205	0.285
32	SAR1	2 480		78	Bluetooth	1 Mbps	Right Side	0	14.00	13.63	1.309	1.089	0.130	0.773	1.102	0.248	0.353
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population									Body 1.6 W/kg (mW/g) Averaged over 1 gram				Limbs (Hands) 4.0 W/kg (mW/g) Averaged over 10 gram				

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C. SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
6. Device was tested using a fixed spacing for body testing. A separation distance of 0 cm was considered because the manufacturer has determined that there will be body available in the marketplace for users to support this separation distance.
7. Unless otherwise noted, when 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds below.
8. Per FCC KDB 865664 D01v01r04, variability SAR tests may be performed when the measured SAR results for a frequency band were greater than or equal to 0.8 W/kg. Since the measured SAR results of this device were less than or equal to 0.8 W/kg, repeated SAR measurements are not required.
9. Per FCC KDB 447498 D01v06, SAR Testing was performed on the Flat Phantom for normal use for Head. Additional SAR Testing was performed on the location closest to the Antenna of similar configuration to demonstrate compliance.
10. Right ear means tested with right earbud.
11. Left ear means tested with left earbud.

Bluetooth Notes:

1. Bluetooth SAR was measured with hopping disabled with DH5 operation and Tx Tests test mode type. Per October 2016 TCBC Workshop Notes, the reported SAR was scaled to the 100 % transmission duty factor to determine compliance. See Section 7.1.1 for the time domain plot and calculation for the duty factor of the device.
2. Per FCC KDB Publication 447498 D01v06, if the reported (Scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> 1/2$ dB, instead of the middle channel, the highest output power channel was used.

4. SAR Measurement Uncertainty

Table 10-1 Uncertainty of SAR equipment for measurement Body 0.3 GHz to 3 GHz

A	b	c		d	e=f(d, k)	f	g	h=c x f/e	l=c x g/e	k
Uncertainty component	Reference	Tol. (± %)		Prob. dist.	Div.	C _i (1 g)	C _i (10 g)	1 g <i>u_i</i> (± %)	10 g <i>u_i</i> (± %)	<i>v_i</i>
Measurement system										
Probe calibration	4	6.65		N	1	1	1	6.65	6.65	∞
Axial isotropy	5	4.7		R	1.732	0.71	0.71	1.93	1.93	∞
Hemispherical isotropy	5	9.6		R	1.732	0.71	0.71	3.94	3.94	∞
Boundary effect	6	1		R	1.732	1	1	0.58	0.58	∞
Linearity	7	4.7		R	1.732	1	1	2.71	2.71	∞
System detection limits	9	0.25		R	1.732	1	1	0.14	0.14	∞
Modulation response	8	2.4		R	1.732	1	1	1.39	1.39	∞
Readout electronics	10	0.3		N	1	1	1	0.30	0.30	∞
Response time	11	0		R	1.732	1	1	0.00	0.00	∞
Integration time	12	2.6		R	1.732	1	1	1.50	1.50	∞
RF ambient conditions—noise	13	3		R	1.732	1	1	1.73	1.73	∞
RF ambient conditions—reflections	13	3		R	1.732	1	1	1.73	1.73	∞
Probe positioner mechanical tolerance	14	0.4		R	1.732	1	1	0.23	0.23	∞
Probe positioning with respect to phantom shell	15	2.9		R	1.732	1	1	1.67	1.67	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	16	2		R	1.732	1	1	1.15	1.15	∞
Test sample related										
Test sample positioning	17	1	1	N	1	1	1	1	1	30
Device holder uncertainty	18	0.9	0.9	N	1	1	1	0.9	0.9	24
Output power variation—SAR drift measurement	20	5		R	1.732	1	1	2.89	2.89	∞
SAR scaling	19	0		R	1.732	1	1	0.00	0.00	∞
Phantom and tissue parameters										
Phantom shell uncertainty—shape, thickness and permittivity	21	6.1		R	1.732	1	1	3.52	3.52	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	22	1.9		N	1	1	0.84	1.90	1.60	∞
Liquid conductivity measurement	22	1.81		N	1	0.78	0.71	1.41	1.29	35
Liquid permittivity measurement	22	1.63		N	1	0.23	0.26	0.37	0.42	35
Liquid conductivity—temperature uncertainty	23	2.37		R	1.732	0.78	0.71	1.07	0.97	∞
Liquid permittivity—temperature uncertainty	23	2.03		R	1.732	0.23	0.26	0.27	0.30	∞
Combined standard uncertainty				RSS				10.80	10.70	<i>v_{eff}</i>
Expanded uncertainty (95% confidence interval)				<i>K</i> = 2				21.60	21.40	

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5. Equipment List

Equipment	Manufacturer	Model	Serial No.	Cal. Date	Next Cal. Date	Cal. Interval
SAR Chamber	Dymstec	N/A	N/A	N/A	N/A	N/A
Thermo-Hygrostat	(주)한국문터스	HK-030-AU1	1506231	N/A	N/A	N/A
Staubli Robot Unit	Staubli	TX60L	F15/5Y7QA1/A/01	N/A	N/A	N/A
Electro Optical Converter	SPEAG	EOC60	1096	N/A	N/A	N/A
2mm Oval Phantom V6.0	SPEAG	QD OVA 003 AA	2036	N/A	N/A	N/A
Device Holder	SPEAG	Mounting Device Upgrade	SD 000 H99 AA	N/A	N/A	N/A
Data Acquisition Electronics	SPEAG	DAE4	1460	2021-11-24	2022-11-24	1 Year
E-Field Probe	SPEAG	EX3DV4	3879	2022-01-27	2023-01-27	1 Year
Dipole Antenna	SPEAG	D2450V2	896	2022-02-11	2024-02-11	2 Years
RF Signal Generator	ANRITSU	68369B	992113	2022-01-13	2023-01-13	1 Year
RF POWER AMPLIFIER	NONE	RFSPA24	001	2021-06-17	2022-06-17	1 Year
DUAL DIRECTIONAL COUPLER	HP	11692D	1212A03523	2021-06-17	2022-06-17	1 Year
EPM Series Power Meter	HP	E4419B	GB40202055	2022-01-13	2023-01-13	1 Year
E-Series AVG Power Sensor	Agilent	E9300H	MY41495967	2022-01-13	2023-01-13	1 Year
E-Series AVG Power Sensor	Agilent	E9300H	US39215405	2022-01-13	2023-01-13	1 Year
POWER METER	ANRITSU	ML2495A	1438001	2022-01-13	2023-01-13	1 Year
Pulse Power Sensor	ANRITSU	MA2411B	1339205	2022-01-13	2023-01-13	1 Year
Attenuator	HP	8491B	22234	2022-01-13	2023-01-13	1 Year
Attenuator	MINI-CIRCUITS	UNAT-10+	VUU38501715	2022-01-13	2023-01-13	1 Year
Low Pass Filter	FILTRON	F-LPCA-KOO1410	1408004S	2022-01-13	2023-01-13	1 Year
DIELECTRIC ASSESSMENT KIT	SPEAG	DAKS-3.5	1065	2022-01-26	2023-01-26	1 Year
HYGRO-THERMOMETER	DAEKWANG	811CE	NONE	2021-06-22	2022-06-22	1 Year
Spectrum Analyzer	R&S	FSQ 40	200045	2021-06-17	2022-06-17	1 Year

Note:

1. CBT (Calibration Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.
2. All equipment was used solely within its calibration period.

6. Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

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Appendix A. SAR Plots for System Verification

The plots for system verification with largest deviation for each SAR system combination are shown as follows.

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Test Laboratory: KES Co., Ltd.

Date: 2022-05-31

System Verification for 2450 MHz

DUT: Dipole D2450V2-SN: 896

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

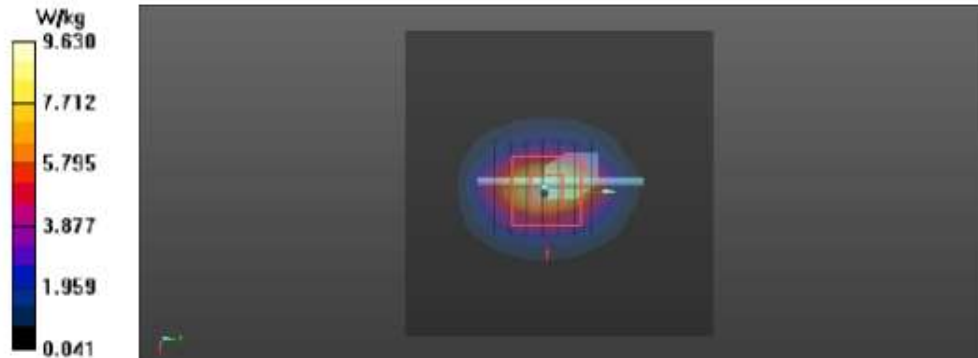
Medium: HSL2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.826$ S/m; $\epsilon_r = 39.157$; $\rho = 1000$ kg/m³
Ambient Temperature 22.4°C; Liquid Temperature 21.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(7.4, 7.4, 7.4) @ 2450 MHz; Calibrated: 2022-01-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1460; Calibrated: 2021-11-23
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2036
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Pin=100 mW/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 9.77 W/kg

Pin=100 mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 73.03 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 12.2 W/kg
SAR(1 g) = 5.5 W/kg; SAR(10 g) = 2.49 W/kg
Smallest distance from peaks to all points 3 dB below = 9.5 mm
Ratio of SAR at M2 to SAR at M1 = 44.4%
Maximum value of SAR (measured) = 9.63 W/kg



Test Laboratory: KES Co., Ltd.

Date: 2022-06-02

System Verification for 2450 MHz

DUT: Dipole D2450V2-SN: 896

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

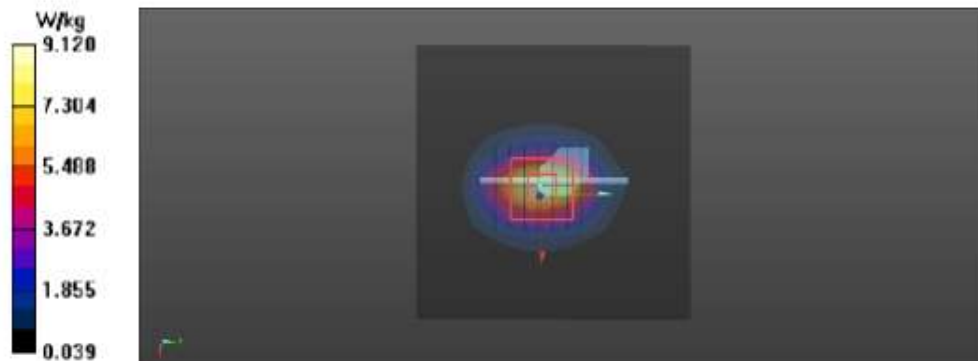
Medium: HSL2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.781$ S/m; $\epsilon_r = 39.267$; $\rho = 1000$ kg/m³
Ambient Temperature 22.2°C; Liquid Temperature 21.2°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(7.4, 7.4, 7.4) @ 2450 MHz; Calibrated: 2022-01-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1460; Calibrated: 2021-11-23
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2036
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Pin=100 mW/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 9.18 W/kg

Pin=100 mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 71.97 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 11.6 W/kg
SAR(1 g) = 5.21 W/kg; SAR(10 g) = 2.36 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 44.4%
Maximum value of SAR (measured) = 9.12 W/kg





Appendix B. SAR Plots for SAR Measurement

The plots for SAR measurement are shown as follows.

Test Laboratory: KES Co., Ltd.

Date: 2022-05-31

P08_Bluetooth_1 Mbps_Right Ear_0 cm_Ch.78_Right Ear

DUT: TONE-T90Q

Communication System: UID 10032 - CAA, IEEE 802.15.1 Bluetooth (GFSK, DH5); Frequency: 2480 MHz; Duty Cycle: 1:1.30557

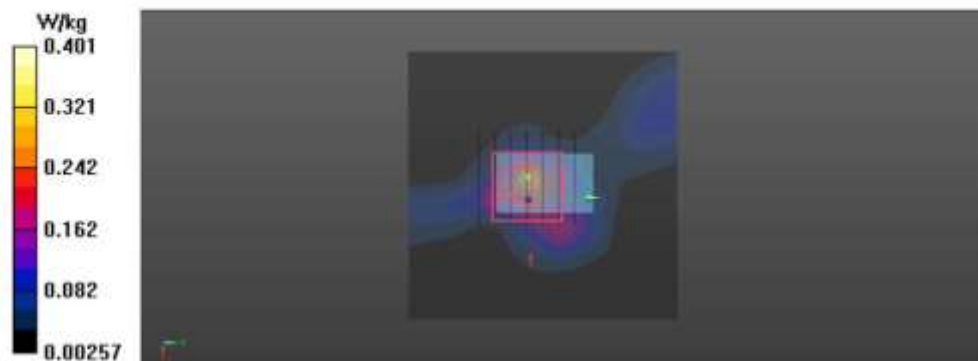
Medium: HSL2450 Medium parameters used: $f = 2480$ MHz; $\sigma = 1.854$ S/m; $\epsilon_r = 39.098$; $\rho = 1000$ kg/m³
Ambient Temperature 22.4°C; Liquid Temperature 21.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(7.4, 7.4, 7.4) @ 2480 MHz; Calibrated: 2022-01-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1460; Calibrated: 2021-11-23
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2036
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- **Area Scan (71x71x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.270 W/kg

- **Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.98 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.699 W/kg
SAR(1 g) = 0.174 W/kg; SAR(10 g) = 0.067 W/kg
Smallest distance from peaks to all points 3 dB below = 5.4 mm
Ratio of SAR at M2 to SAR at M1 = 35.3%
Maximum value of SAR (measured) = 0.401 W/kg



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The authenticity of the test report, contact shchoi@kes.co.kr

Test Laboratory: KES Co., Ltd.

Date: 2022-06-02

P28_Bluetooth_1 Mbps_Left Ear_0 cm_Ch.78_Left Ear

DUT: TONE-T90Q

Communication System: UID 10032 - CAA, IEEE 802.15.1 Bluetooth (GFSK, DH5); Frequency: 2480 MHz; Duty Cycle: 1:1.30557

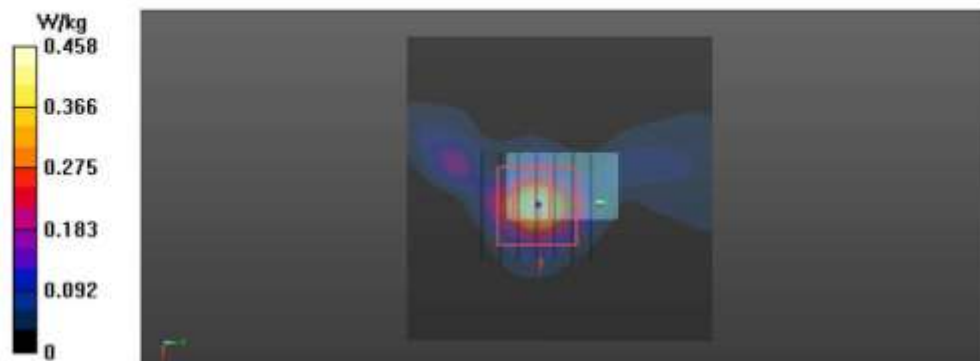
Medium: HSL2450 Medium parameters used: $f = 2480$ MHz; $\sigma = 1.818$ S/m; $\epsilon_r = 39.09$; $\rho = 1000$ kg/m³
Ambient Temperature 22.2°C; Liquid Temperature 21.2°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(7.4, 7.4, 7.4) @ 2480 MHz; Calibrated: 2022-01-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1460; Calibrated: 2021-11-23
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2036
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- **Area Scan (71x71x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.458 W/kg

- **Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.75 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 1.06 W/kg
SAR(1 g) = 0.267 W/kg; SAR(10 g) = 0.095 W/kg
Smallest distance from peaks to all points 3 dB below = 5 mm
Ratio of SAR at M2 to SAR at M1 = 34.9%
Maximum value of SAR (measured) = 0.674 W/kg



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Test Laboratory: KES Co., Ltd.

Date: 2022-05-31

P12_Bluetooth_1 Mbps_Left Side_0 cm_Ch.78_Right Ear

DUT: TONE-T90Q

Communication System: UID 10032 - CAA, IEEE 802.15.1 Bluetooth (GFSK, DH5); Frequency: 2480 MHz; Duty Cycle: 1:1.30557

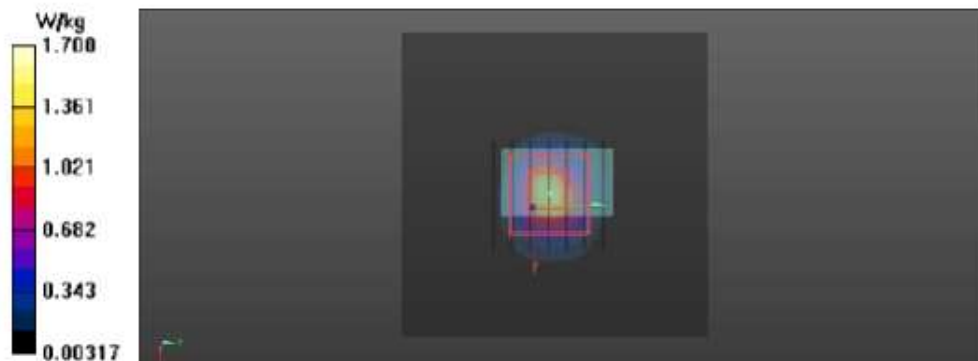
Medium: HSL2450 Medium parameters used: $f = 2480$ MHz; $\sigma = 1.854$ S/m; $\epsilon_r = 39.098$; $\rho = 1000$ kg/m³
 Ambient Temperature 22.4°C; Liquid Temperature 21.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(7.4, 7.4, 7.4) @ 2480 MHz; Calibrated: 2022-01-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1460; Calibrated: 2021-11-23
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2036
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- **Area Scan (71x71x1)**: Interpolated grid: dx=1.200 mm, dy=1.200 mm
 Maximum value of SAR (interpolated) = 1.55 W/kg

- **Zoom Scan (7x7x7)/Cube 0**: Measurement grid: dx=5mm, dy=5mm, dz=5mm
 Reference Value = 31.36 V/m; Power Drift = 0.10 dB
 Peak SAR (extrapolated) = 2.75 W/kg
 SAR(1 g) = 0.839 W/kg; SAR(10 g) = 0.289 W/kg
 Smallest distance from peaks to all points 3 dB below = 6.1 mm
 Ratio of SAR at M2 to SAR at M1 = 34.7%
 Maximum value of SAR (measured) = 1.70 W/kg



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Test Laboratory: KES Co., Ltd.

Date: 2022-06-02

P32_Bluetooth_1 Mbps_Right Side_0 cm_Ch.78_Left Ear

DUT: TONE-T90Q

Communication System: UID 10032 - CAA, IEEE 802.15.1 Bluetooth (GFSK, DH5); Frequency: 2480 MHz; Duty Cycle: 1:1.30557

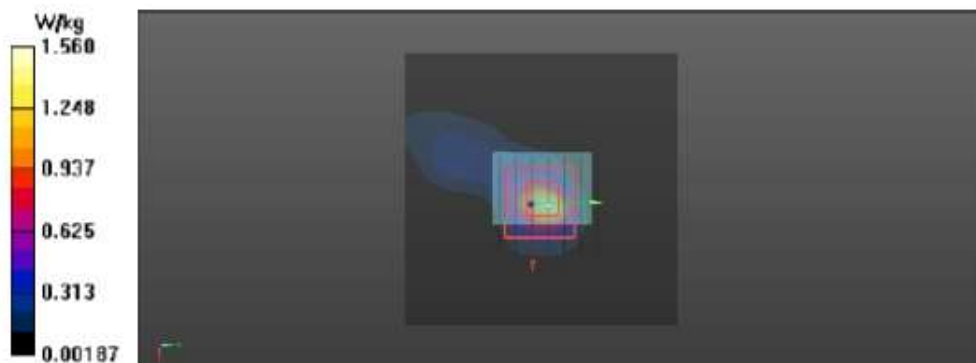
Medium: HSL2450 Medium parameters used: $f = 2480$ MHz; $\sigma = 1.818$ S/m; $\epsilon_r = 39.09$; $\rho = 1000$ kg/m³
Ambient Temperature 22.2°C; Liquid Temperature 21.2°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3879; ConvF(7.4, 7.4, 7.4) @ 2480 MHz; Calibrated: 2022-01-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1460; Calibrated: 2021-11-23
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2036
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- **Area Scan (71x71x1)**: Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.59 W/kg

- **Zoom Scan (7x7x7)/Cube 0**: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.10 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.78 W/kg
SAR(1 g) = 0.773 W/kg; SAR(10 g) = 0.248 W/kg
Smallest distance from peaks to all points 3 dB below = 5 mm
Ratio of SAR at M2 to SAR at M1 = 31.6%
Maximum value of SAR (measured) = 1.56 W/kg





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www.kes.co.kr

Test report No.:
KES-SR-22T0016
Page (32) of (62)

Appendix C. Probe & Dipole Antenna Calibration Certificates

The SPEAG calibration certificates are shown as follows.

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**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 0108**

Client **KES (Dymstec)**

Certificate No: **EX3-3879_Jan22**

CALIBRATION CERTIFICATE

Object: **EX3DV4 - SN:3879**

Calibration procedure(s): **QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v6, QA CAL-23.v5,
 QA CAL-25.v7
 Calibration procedure for dosimetric E-field probes**

Calibration date: **January 27, 2022**

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	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: CC2552 (20x)	09-Apr-21 (No. 217-03343)	Apr-22
DAE4	SN: 660	13-Oct-21 (No. DAE4-660_Oct21)	Oct-22
Reference Probe ES3DV2	SN: 3013	27-Dec-21 (No. ES3-3013_Dec21)	Dec-22
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
RF generator HP B648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer E8358A	SN: US41090477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

Calibrated by:	Name Leif Klysner	Function Laboratory Technician	Signature
Approved by:	Sven Kühn	Deputy Manager	

Issued: February 1, 2022

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**Calibration Laboratory of
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 Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
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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
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DGP	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 β	β rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\beta = 0$ 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:

- 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"

Methods Applied and Interpretation of Parameters:

- **NORM_{x,y,z}:** Assessed for E-field polarization $\beta = 0$ ($f \leq 900$ 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).
- **NORM(f)_{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.
- **DCPx,y,z:** DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). 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 $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ 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:3879

January 27, 2022

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3879

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.29	0.41	0.38	$\pm 10.1\%$
DCP (mV) ^B	103.9	99.9	101.9	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB μV	C	D dB	VR mV	Max dev.	Max Unc ^C (k=2)
0	CW	X	0.00	0.00	1.00	0.00	179.0	$\pm 2.7\%$	$\pm 4.7\%$
		Y	0.00	0.00	1.00		157.6		
		Z	0.00	0.00	1.00		161.9		
10352-AAA	Pulse Waveform (200Hz, 10%)	X	5.81	74.71	14.48	10.00	60.0	$\pm 3.3\%$	$\pm 9.6\%$
		Y	20.00	89.83	20.19		60.0		
		Z	86.00	112.00	27.00		60.0		
10353-AAA	Pulse Waveform (200Hz, 20%)	X	20.00	87.59	17.14	6.99	80.0	$\pm 1.9\%$	$\pm 9.6\%$
		Y	20.00	90.27	19.04		80.0		
		Z	20.00	95.97	22.43		80.0		
10354-AAA	Pulse Waveform (200Hz, 40%)	X	20.00	86.25	15.98	3.98	95.0	$\pm 1.2\%$	$\pm 9.6\%$
		Y	20.00	90.81	17.68		95.0		
		Z	20.00	100.93	23.44		95.0		
10355-AAA	Pulse Waveform (200Hz, 60%)	X	20.00	88.18	14.74	2.22	120.0	$\pm 1.1\%$	$\pm 9.6\%$
		Y	20.00	87.27	14.63		120.0		
		Z	20.00	107.33	24.97		120.0		
10387-AAA	QPSK Waveform, 1 MHz	X	1.74	68.50	15.96	1.00	150.0	$\pm 3.0\%$	$\pm 9.6\%$
		Y	1.48	65.01	14.12		150.0		
		Z	1.67	65.65	14.86		150.0		
10388-AAA	QPSK Waveform, 10 MHz	X	2.30	69.56	16.59	0.00	150.0	$\pm 0.8\%$	$\pm 9.6\%$
		Y	2.17	67.91	15.46		150.0		
		Z	2.22	67.77	15.57		150.0		
10396-AAA	64-QAM Waveform, 100 kHz	X	2.85	71.07	19.04	3.01	150.0	$\pm 1.0\%$	$\pm 9.6\%$
		Y	2.62	68.20	17.66		150.0		
		Z	3.24	71.61	19.22		150.0		
10399-AAA	64-QAM Waveform, 40 MHz	X	3.52	67.76	16.16	0.00	150.0	$\pm 2.2\%$	$\pm 9.6\%$
		Y	3.48	67.17	15.72		150.0		
		Z	3.50	66.99	15.69		150.0		
10414-AAA	WLAN CCDF, 64-QAM, 40MHz	X	4.81	66.05	15.78	0.00	150.0	$\pm 4.0\%$	$\pm 9.6\%$
		Y	4.89	65.87	15.64		150.0		
		Z	4.88	65.53	15.46		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 E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^C 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:3879

January 27, 2022

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3879

Sensor Model Parameters

	C1 fF	C2 fF	α V ⁻¹	T1 ms.V ⁻²	T2 ms.V ⁻¹	T3 ms	T4 V ⁻²	T5 V ⁻¹	T6
X	38.5	283.92	34.85	8.43	0.32	5.03	1.03	0.22	1.01
Y	45.0	340.84	36.43	11.24	0.53	5.07	0.00	0.50	1.01
Z	50.1	373.04	35.34	16.57	0.24	5.10	1.35	0.31	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	165
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:3879

January 27, 2022

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3879

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [Ⓐ]	Relative Permittivity [Ⓕ]	Conductivity (S/m) [Ⓕ]	ConvF X	ConvF Y	ConvF Z	Alpha [Ⓒ]	Depth [Ⓓ] (mm)	Unc (k=2)
450	43.5	0.87	10.16	10.16	10.16	0.16	1.30	± 13.3 %
600	42.7	0.88	10.09	10.09	10.09	0.10	1.25	± 13.3 %
750	41.9	0.89	9.85	9.85	9.85	0.46	0.88	± 12.0 %
835	41.5	0.90	9.49	9.49	9.49	0.34	1.04	± 12.0 %
900	41.5	0.97	9.48	9.48	9.48	0.35	0.94	± 12.0 %
1750	40.1	1.37	8.50	8.50	8.50	0.30	0.86	± 12.0 %
1900	40.0	1.40	8.11	8.11	8.11	0.29	0.86	± 12.0 %
1950	40.0	1.40	7.81	7.81	7.81	0.28	0.86	± 12.0 %
2450	39.2	1.80	7.40	7.40	7.40	0.32	0.90	± 12.0 %
2600	39.0	1.96	7.24	7.24	7.24	0.35	0.90	± 12.0 %
5200	36.0	4.66	5.00	5.00	5.00	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.90	4.90	4.90	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.75	4.75	4.75	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.61	4.61	4.61	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.65	4.65	4.65	0.40	1.80	± 13.1 %

[Ⓐ] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS 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, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-8 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[Ⓕ] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[Ⓒ] 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:3879

January 27, 2022

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3879

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth ^g (mm)	Unc (k=2)
6500	34.5	6.07	5.15	5.15	5.15	0.20	2.50	± 18.6 %

^c Frequency validity above 6GHz is ± 700 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

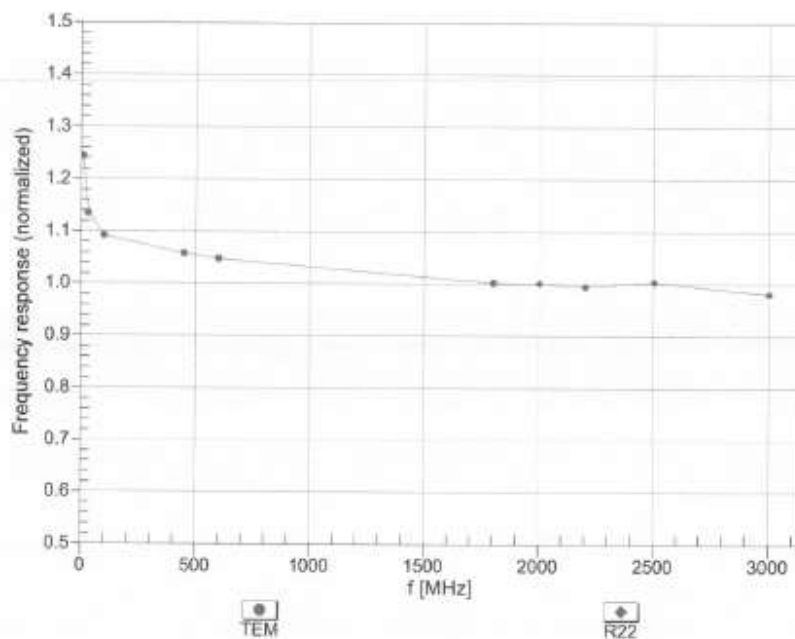
^f At frequencies 6-10 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^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; 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:3879

January 27, 2022

Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

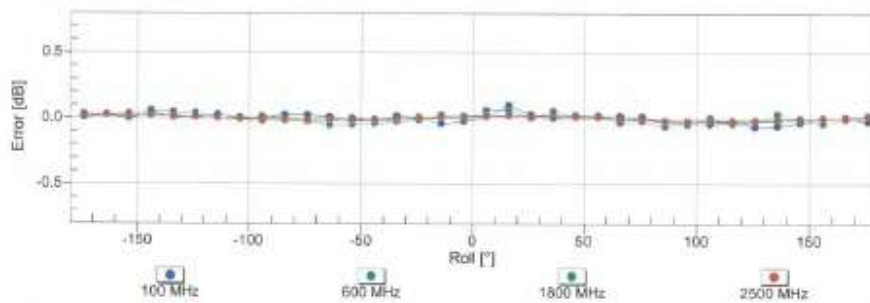
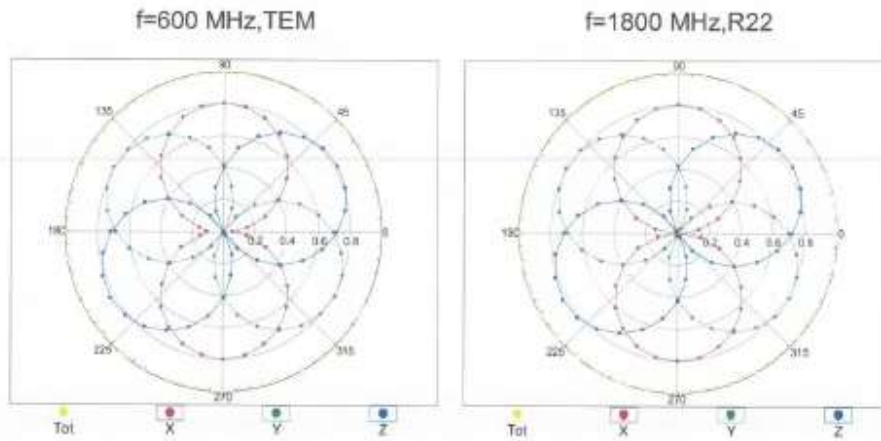


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

EX3DV4- SN:3879

January 27, 2022

Receiving Pattern (ϕ), $\theta = 0^\circ$

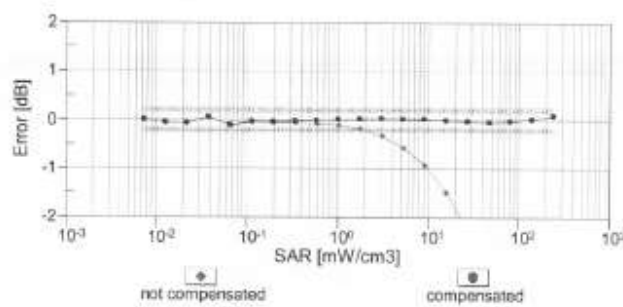
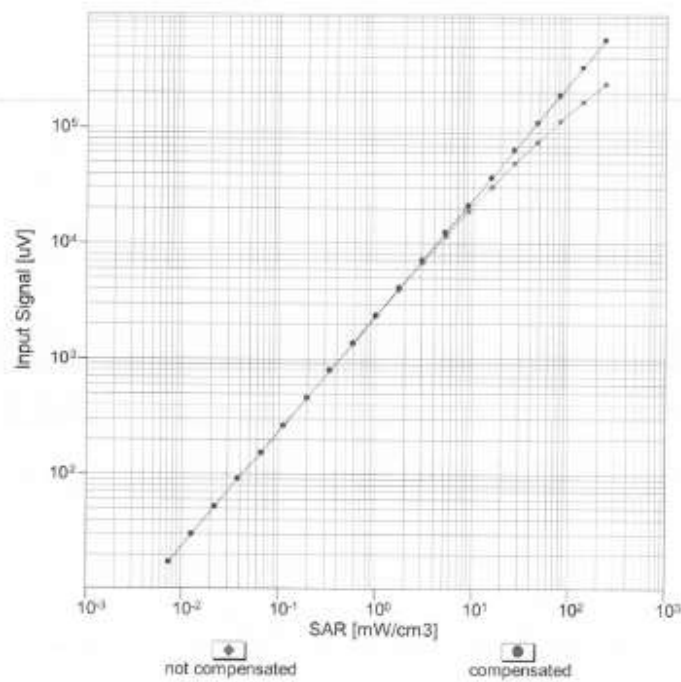


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

EX3DV4- SN-3879

January 27, 2022

Dynamic Range f(SAR_{head}) (TEM cell , f_{eval}= 1900 MHz)



Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

Certificate No: EX3-3879_Jan22

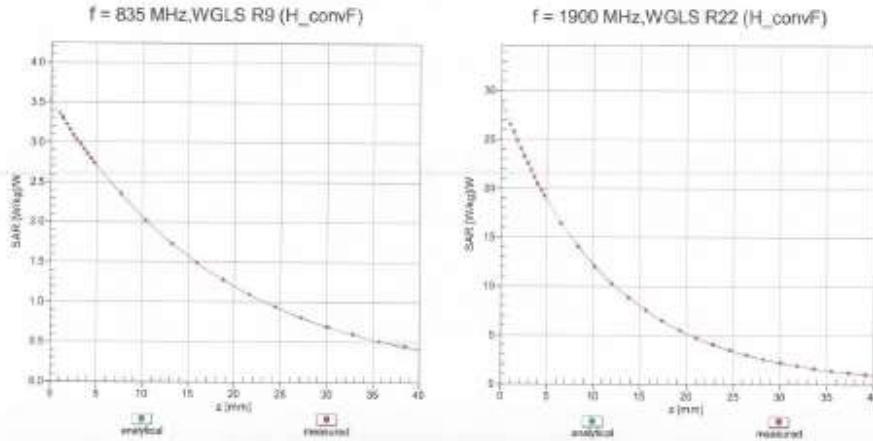
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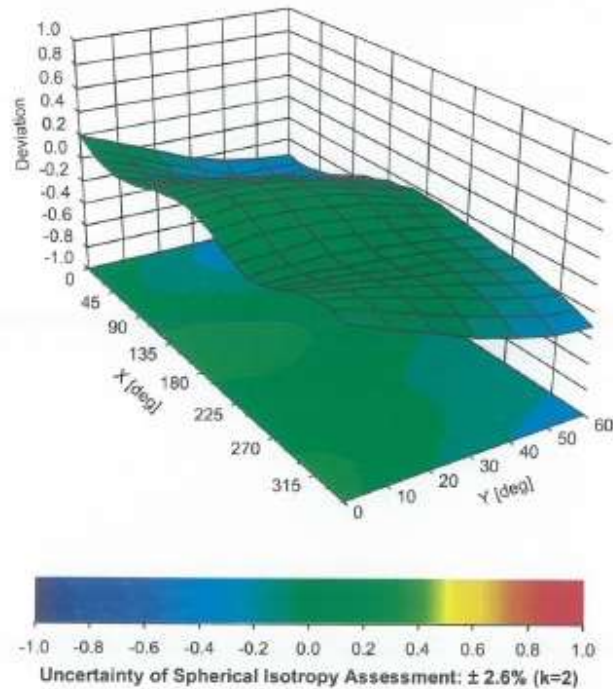
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Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, θ), $f = 900$ MHz



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Appendix: Modulation Calibration Parameters

UID	Rev	Communication System Name	Group	PAR (dB)	Unc ⁵ (k=2)
0	-	CW	CW	0.00	± 4.7 %
10010	CAA	SAR Validation (Square, 100ms, 10ms)	Test	10.00	± 9.6 %
10011	CAB	UMTS-FDD (WCDMA)	WCDMA	2.91	± 9.6 %
10012	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	WLAN	1.87	± 9.6 %
10013	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	WLAN	9.46	± 9.6 %
10021	DAC	GSM-FDD (TDMA, GMSK)	GSM	9.39	± 9.6 %
10023	DAC	GPRS-FDD (TDMA, GMSK, TN 0)	GSM	9.57	± 9.6 %
10024	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	GSM	6.56	± 9.6 %
10025	DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	GSM	12.62	± 9.6 %
10026	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	GSM	9.55	± 9.6 %
10027	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	GSM	4.80	± 9.6 %
10028	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	GSM	3.55	± 9.6 %
10029	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	GSM	7.78	± 9.6 %
10030	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	Bluetooth	5.30	± 9.6 %
10031	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	Bluetooth	1.87	± 9.6 %
10032	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	Bluetooth	1.16	± 9.6 %
10033	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	Bluetooth	7.74	± 9.6 %
10034	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	Bluetooth	4.53	± 9.6 %
10035	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	Bluetooth	3.83	± 9.6 %
10036	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	Bluetooth	8.01	± 9.6 %
10037	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	Bluetooth	4.77	± 9.6 %
10038	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	Bluetooth	4.10	± 9.6 %
10039	CAB	CDMA2000 (1xRTT, RC1)	CDMA2000	4.57	± 9.6 %
10042	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	AMPS	7.78	± 9.6 %
10044	CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	AMPS	0.00	± 9.6 %
10048	CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	DECT	13.80	± 9.6 %
10049	CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	DECT	10.79	± 9.6 %
10056	CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	TD-SCDMA	11.01	± 9.6 %
10058	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	GSM	6.52	± 9.6 %
10059	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	WLAN	2.12	± 9.6 %
10060	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	WLAN	2.83	± 9.6 %
10061	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	WLAN	3.60	± 9.6 %
10062	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	WLAN	8.68	± 9.6 %
10063	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	WLAN	8.63	± 9.6 %
10064	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	WLAN	9.09	± 9.6 %
10065	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	WLAN	9.00	± 9.6 %
10066	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	WLAN	9.38	± 9.6 %
10067	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	WLAN	10.12	± 9.6 %
10068	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	WLAN	10.24	± 9.6 %
10069	CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	WLAN	10.56	± 9.6 %
10071	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	WLAN	9.83	± 9.6 %
10072	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	WLAN	9.62	± 9.6 %
10073	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	WLAN	9.94	± 9.6 %
10074	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	WLAN	10.30	± 9.6 %
10075	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	WLAN	10.77	± 9.6 %
10076	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	WLAN	10.94	± 9.6 %
10077	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	WLAN	11.00	± 9.6 %
10081	CAB	CDMA2000 (1xRTT, RC3)	CDMA2000	3.97	± 9.6 %
10082	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	AMPS	4.77	± 9.6 %
10090	DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	GSM	6.56	± 9.6 %
10097	CAB	UMTS-FDD (HSDPA)	WCDMA	3.98	± 9.6 %
10098	CAB	UMTS-FDD (HSUPA, Subtest 2)	WCDMA	3.98	± 9.6 %
10099	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	GSM	9.55	± 9.6 %

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Table with 6 columns: ID, Category, Modulation, Bandwidth, Modulation, and Error Rate. Rows include various LTE-FDD, LTE-TDD, and IEEE 802.11n configurations with error rates ranging from 5.67% to 10.25%.

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10182	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10183	AAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10184	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10185	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-FDD	6.51	± 9.6 %
10186	AAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10187	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10188	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10189	AAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10193	CAD	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	WLAN	8.09	± 9.6 %
10194	CAD	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	WLAN	8.12	± 9.6 %
10195	CAD	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	WLAN	8.21	± 9.6 %
10196	CAD	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	WLAN	8.10	± 9.6 %
10197	CAD	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10198	CAD	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10219	CAD	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	WLAN	8.03	± 9.6 %
10220	CAD	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10221	CAD	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10222	CAD	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	WLAN	8.06	± 9.6 %
10223	CAD	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	WLAN	8.48	± 9.6 %
10224	CAD	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	WLAN	8.08	± 9.6 %
10225	CAB	UMTS-FDD (HSPA+)	WCDMA	5.97	± 9.6 %
10226	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.49	± 9.6 %
10227	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.26	± 9.6 %
10228	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-TDD	9.22	± 9.6 %
10229	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10230	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10231	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-TDD	9.19	± 9.6 %
10232	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10233	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10234	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10235	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10236	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10237	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10238	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10239	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10240	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10241	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.82	± 9.6 %
10242	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-TDD	9.86	± 9.6 %
10243	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-TDD	9.46	± 9.6 %
10244	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10245	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-TDD	10.06	± 9.6 %
10246	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10247	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-TDD	9.91	± 9.6 %
10248	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-TDD	10.09	± 9.6 %
10249	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10250	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-TDD	9.81	± 9.6 %
10251	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-TDD	10.17	± 9.6 %
10252	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10253	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.90	± 9.6 %
10254	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.14	± 9.6 %
10255	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.20	± 9.6 %
10256	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.96	± 9.6 %
10257	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.08	± 9.6 %
10258	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-TDD	9.34	± 9.6 %
10259	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-TDD	9.98	± 9.6 %
10260	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-TDD	9.97	± 9.6 %

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10261	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10262	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-TDD	9.83	± 9.6 %
10263	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-TDD	10.16	± 9.6 %
10264	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-TDD	9.23	± 9.6 %
10265	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
10266	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-TDD	10.07	± 9.6 %
10267	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10268	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10269	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-TDD	10.13	± 9.6 %
10270	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.58	± 9.6 %
10274	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	WCDMA	4.87	± 9.6 %
10275	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	WCDMA	3.96	± 9.6 %
10277	CAA	PHS (QPSK)	PHS	11.81	± 9.6 %
10278	CAA	PHS (QPSK, BW 884MHz, Roll-off 0.6)	PHS	11.81	± 9.6 %
10279	CAA	PHS (QPSK, BW 884MHz, Roll-off 0.38)	PHS	12.18	± 9.6 %
10290	AAB	CDMA2000, RC1, SO55, Full Rate	CDMA2000	3.91	± 9.6 %
10291	AAB	CDMA2000, RC3, SO55, Full Rate	CDMA2000	3.46	± 9.6 %
10292	AAB	CDMA2000, RC3, SO32, Full Rate	CDMA2000	3.39	± 9.6 %
10293	AAB	CDMA2000, RC3, SO3, Full Rate	CDMA2000	3.50	± 9.6 %
10295	AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	CDMA2000	12.49	± 9.6 %
10297	AAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-FDD	5.81	± 9.6 %
10298	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10299	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-FDD	6.39	± 9.6 %
10300	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10301	AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	WIMAX	12.03	± 9.6 %
10302	AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3CTRL)	WIMAX	12.57	± 9.6 %
10303	AAA	IEEE 802.16e WIMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	WIMAX	12.52	± 9.6 %
10304	AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	WIMAX	11.86	± 9.6 %
10305	AAA	IEEE 802.16e WIMAX (31:15, 10ms, 10MHz, 64QAM, PUSC)	WIMAX	15.24	± 9.6 %
10306	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, 64QAM, PUSC)	WIMAX	14.67	± 9.6 %
10307	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, QPSK, PUSC)	WIMAX	14.49	± 9.6 %
10308	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	WIMAX	14.46	± 9.6 %
10309	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3)	WIMAX	14.58	± 9.6 %
10310	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3)	WIMAX	14.57	± 9.6 %
10311	AAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-FDD	6.06	± 9.6 %
10313	AAA	iDEN 1.3	iDEN	10.51	± 9.6 %
10314	AAA	iDEN 1.6	iDEN	13.48	± 9.6 %
10315	AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc dc)	WLAN	1.71	± 9.6 %
10316	AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc dc)	WLAN	8.36	± 9.6 %
10317	AAD	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc dc)	WLAN	8.36	± 9.6 %
10352	AAA	Pulse Waveform (200Hz, 10%)	Generic	10.00	± 9.6 %
10353	AAA	Pulse Waveform (200Hz, 20%)	Generic	6.99	± 9.6 %
10354	AAA	Pulse Waveform (200Hz, 40%)	Generic	3.98	± 9.6 %
10355	AAA	Pulse Waveform (200Hz, 60%)	Generic	2.22	± 9.6 %
10356	AAA	Pulse Waveform (200Hz, 80%)	Generic	0.97	± 9.6 %
10367	AAA	QPSK Waveform, 1 MHz	Generic	5.10	± 9.6 %
10368	AAA	QPSK Waveform, 10 MHz	Generic	5.22	± 9.6 %
10396	AAA	64-QAM Waveform, 100 kHz	Generic	6.27	± 9.6 %
10399	AAA	64-QAM Waveform, 40 MHz	Generic	6.27	± 9.6 %
10400	AAE	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc dc)	WLAN	8.37	± 9.6 %
10401	AAE	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc dc)	WLAN	8.60	± 9.6 %
10402	AAE	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc dc)	WLAN	8.53	± 9.6 %
10403	AAB	CDMA2000 (1xEV-DO, Rev. 0)	CDMA2000	3.76	± 9.6 %
10404	AAB	CDMA2000 (1xEV-DO, Rev. A)	CDMA2000	3.77	± 9.6 %
10406	AAB	CDMA2000, RC3, SO32, SCHO, Full Rate	CDMA2000	5.22	± 9.6 %
10410	AAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Sub=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %

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10414	AAA	WLAN CCDF, 64-QAM, 40MHz	Generic	8.54	± 9.6 %
10415	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc dc)	WLAN	1.54	± 9.6 %
10416	AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10417	AAC	IEEE 802.11ah WiFi 5 GHz (OFDM, 6 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10418	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Long)	WLAN	8.14	± 9.6 %
10419	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Short)	WLAN	8.19	± 9.6 %
10422	AAC	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	WLAN	8.32	± 9.6 %
10423	AAC	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	WLAN	8.47	± 9.6 %
10424	AAC	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	WLAN	8.40	± 9.6 %
10425	AAC	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	WLAN	8.41	± 9.6 %
10426	AAC	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	WLAN	8.45	± 9.6 %
10427	AAC	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	WLAN	8.41	± 9.6 %
10430	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	LTE-FDD	8.28	± 9.6 %
10431	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	LTE-FDD	8.38	± 9.6 %
10432	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10433	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10434	AAA	W-CDMA (BS Test Model 1, 64 DPCH)	WCDMA	8.60	± 9.6 %
10435	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10447	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.56	± 9.6 %
10448	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.53	± 9.6 %
10449	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.51	± 9.6 %
10450	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.48	± 9.6 %
10451	AAA	W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)	WCDMA	7.59	± 9.6 %
10453	AAD	Validation (Square, 10ms, 1ms)	Test	10.00	± 9.6 %
10456	AAC	IEEE 802.11ac WiFi (180MHz, 64-QAM, 99pc dc)	WLAN	8.63	± 9.6 %
10457	AAA	UMTS-FDD (DC-HSDPA)	WCDMA	8.62	± 9.6 %
10458	AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	CDMA2000	8.55	± 9.6 %
10459	AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	CDMA2000	8.25	± 9.6 %
10460	AAA	UMTS-FDD (WCDMA, AMR)	WCDMA	2.39	± 9.6 %
10461	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10462	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.30	± 9.6 %
10463	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.56	± 9.6 %
10464	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10465	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10466	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	± 9.6 %
10467	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10468	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10469	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Sub)	LTE-TDD	8.56	± 9.6 %
10470	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10471	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10472	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	± 9.6 %
10473	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10474	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10475	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	± 9.6 %
10477	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10478	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	± 9.6 %
10479	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10480	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.18	± 9.6 %
10481	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.45	± 9.6 %
10482	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.71	± 9.6 %
10483	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, Sub)	LTE-TDD	8.39	± 9.6 %
10484	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Sub)	LTE-TDD	8.47	± 9.6 %
10485	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Sub)	LTE-TDD	7.59	± 9.6 %
10486	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Sub)	LTE-TDD	8.38	± 9.6 %
10487	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Sub)	LTE-TDD	8.60	± 9.6 %
10488	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Sub)	LTE-TDD	7.70	± 9.6 %

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10489	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Sub)	LTE-TDD	8.31	± 9.6 %
10490	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.54	± 9.6 %
10491	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10492	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Sub)	LTE-TDD	8.41	± 9.6 %
10493	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.55	± 9.6 %
10494	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10495	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.37	± 9.6 %
10496	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.54	± 9.6 %
10497	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.67	± 9.6 %
10498	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.40	± 9.6 %
10499	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.68	± 9.6 %
10500	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.67	± 9.6 %
10501	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub)	LTE-TDD	8.44	± 9.6 %
10502	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Sub)	LTE-TDD	8.52	± 9.6 %
10503	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Sub)	LTE-TDD	7.72	± 9.6 %
10504	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Sub)	LTE-TDD	8.31	± 9.6 %
10505	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Sub)	LTE-TDD	8.54	± 9.6 %
10506	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10507	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Sub)	LTE-TDD	8.36	± 9.6 %
10508	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.55	± 9.6 %
10509	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Sub)	LTE-TDD	7.99	± 9.6 %
10510	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Sub)	LTE-TDD	8.49	± 9.6 %
10511	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.51	± 9.6 %
10512	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10513	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.42	± 9.6 %
10514	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.45	± 9.6 %
10515	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc dc)	WLAN	1.58	± 9.6 %
10516	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc dc)	WLAN	1.57	± 9.6 %
10517	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc dc)	WLAN	1.58	± 9.6 %
10518	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10519	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc dc)	WLAN	8.39	± 9.6 %
10520	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc dc)	WLAN	8.12	± 9.6 %
10521	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc dc)	WLAN	7.97	± 9.6 %
10522	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc dc)	WLAN	8.45	± 9.6 %
10523	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc dc)	WLAN	8.08	± 9.6 %
10524	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc dc)	WLAN	8.27	± 9.6 %
10525	AAC	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc dc)	WLAN	8.36	± 9.6 %
10526	AAC	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc dc)	WLAN	8.42	± 9.6 %
10527	AAC	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc dc)	WLAN	8.21	± 9.6 %
10528	AAC	IEEE 802.11ac WiFi (20MHz, MCS3, 99pc dc)	WLAN	8.36	± 9.6 %
10529	AAC	IEEE 802.11ac WiFi (20MHz, MCS4, 99pc dc)	WLAN	8.36	± 9.6 %
10531	AAC	IEEE 802.11ac WiFi (20MHz, MCS6, 99pc dc)	WLAN	8.43	± 9.6 %
10532	AAC	IEEE 802.11ac WiFi (20MHz, MCS7, 99pc dc)	WLAN	8.29	± 9.6 %
10533	AAC	IEEE 802.11ac WiFi (20MHz, MCS8, 99pc dc)	WLAN	8.38	± 9.6 %
10534	AAC	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc dc)	WLAN	8.45	± 9.6 %
10535	AAC	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc dc)	WLAN	8.45	± 9.6 %
10536	AAC	IEEE 802.11ac WiFi (40MHz, MCS2, 99pc dc)	WLAN	8.32	± 9.6 %
10537	AAC	IEEE 802.11ac WiFi (40MHz, MCS3, 99pc dc)	WLAN	8.44	± 9.6 %
10538	AAC	IEEE 802.11ac WiFi (40MHz, MCS4, 99pc dc)	WLAN	8.54	± 9.6 %
10540	AAC	IEEE 802.11ac WiFi (40MHz, MCS6, 99pc dc)	WLAN	8.39	± 9.6 %
10541	AAC	IEEE 802.11ac WiFi (40MHz, MCS7, 99pc dc)	WLAN	8.46	± 9.6 %
10542	AAC	IEEE 802.11ac WiFi (40MHz, MCS8, 99pc dc)	WLAN	8.65	± 9.6 %
10543	AAC	IEEE 802.11ac WiFi (40MHz, MCS9, 99pc dc)	WLAN	8.65	± 9.6 %
10544	AAC	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc dc)	WLAN	8.47	± 9.6 %
10545	AAC	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc dc)	WLAN	8.55	± 9.6 %
10546	AAC	IEEE 802.11ac WiFi (80MHz, MCS2, 99pc dc)	WLAN	8.35	± 9.6 %

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10547	AAC	IEEE 802.11ac WiFi (80MHz, MCS3, 99pc dc)	WLAN	8.49	± 9.6 %
10548	AAC	IEEE 802.11ac WiFi (80MHz, MCS4, 99pc dc)	WLAN	8.37	± 9.6 %
10550	AAC	IEEE 802.11ac WiFi (80MHz, MCS6, 99pc dc)	WLAN	8.39	± 9.6 %
10551	AAC	IEEE 802.11ac WiFi (80MHz, MCS7, 99pc dc)	WLAN	8.50	± 9.6 %
10552	AAC	IEEE 802.11ac WiFi (80MHz, MCS8, 99pc dc)	WLAN	8.42	± 9.6 %
10553	AAC	IEEE 802.11ac WiFi (80MHz, MCS9, 99pc dc)	WLAN	8.45	± 9.6 %
10554	AAD	IEEE 802.11ac WiFi (160MHz, MCS0, 99pc dc)	WLAN	8.48	± 9.6 %
10555	AAD	IEEE 802.11ac WiFi (160MHz, MCS1, 99pc dc)	WLAN	8.47	± 9.6 %
10556	AAD	IEEE 802.11ac WiFi (160MHz, MCS2, 99pc dc)	WLAN	8.50	± 9.6 %
10557	AAD	IEEE 802.11ac WiFi (160MHz, MCS3, 99pc dc)	WLAN	8.52	± 9.6 %
10558	AAD	IEEE 802.11ac WiFi (160MHz, MCS4, 99pc dc)	WLAN	8.61	± 9.6 %
10560	AAD	IEEE 802.11ac WiFi (160MHz, MCS6, 99pc dc)	WLAN	8.73	± 9.6 %
10561	AAD	IEEE 802.11ac WiFi (160MHz, MCS7, 99pc dc)	WLAN	8.56	± 9.6 %
10562	AAD	IEEE 802.11ac WiFi (160MHz, MCS8, 99pc dc)	WLAN	8.69	± 9.6 %
10563	AAD	IEEE 802.11ac WiFi (160MHz, MCS9, 99pc dc)	WLAN	8.77	± 9.6 %
10564	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc)	WLAN	8.25	± 9.6 %
10565	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc)	WLAN	8.45	± 9.6 %
10566	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc dc)	WLAN	8.13	± 9.6 %
10567	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc)	WLAN	8.00	± 9.6 %
10568	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc)	WLAN	8.37	± 9.6 %
10569	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc)	WLAN	8.10	± 9.6 %
10570	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc dc)	WLAN	8.30	± 9.6 %
10571	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc)	WLAN	1.99	± 9.6 %
10572	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc dc)	WLAN	1.99	± 9.6 %
10573	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc)	WLAN	1.98	± 9.6 %
10574	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc dc)	WLAN	1.98	± 9.6 %
10575	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc)	WLAN	8.59	± 9.6 %
10576	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc)	WLAN	8.60	± 9.6 %
10577	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc)	WLAN	8.70	± 9.6 %
10578	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc)	WLAN	8.49	± 9.6 %
10579	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc dc)	WLAN	8.36	± 9.6 %
10580	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc)	WLAN	8.76	± 9.6 %
10581	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc)	WLAN	8.35	± 9.6 %
10582	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc)	WLAN	8.67	± 9.6 %
10583	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc)	WLAN	8.59	± 9.6 %
10584	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc)	WLAN	8.60	± 9.6 %
10585	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc)	WLAN	8.70	± 9.6 %
10586	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc)	WLAN	8.49	± 9.6 %
10587	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc)	WLAN	8.36	± 9.6 %
10588	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc)	WLAN	8.76	± 9.6 %
10589	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc)	WLAN	8.35	± 9.6 %
10590	AAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc)	WLAN	8.67	± 9.6 %
10591	AAC	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc dc)	WLAN	8.63	± 9.6 %
10592	AAC	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc dc)	WLAN	8.79	± 9.6 %
10593	AAC	IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc dc)	WLAN	8.64	± 9.6 %
10594	AAC	IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc dc)	WLAN	8.74	± 9.6 %
10595	AAC	IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc dc)	WLAN	8.74	± 9.6 %
10596	AAC	IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc dc)	WLAN	8.71	± 9.6 %
10597	AAC	IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc dc)	WLAN	8.72	± 9.6 %
10598	AAC	IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc dc)	WLAN	8.50	± 9.6 %
10599	AAC	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc dc)	WLAN	8.79	± 9.6 %
10600	AAC	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc dc)	WLAN	8.88	± 9.6 %
10601	AAC	IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc dc)	WLAN	8.82	± 9.6 %
10602	AAC	IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc dc)	WLAN	8.94	± 9.6 %
10603	AAC	IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc dc)	WLAN	9.03	± 9.6 %
10604	AAC	IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc dc)	WLAN	8.76	± 9.6 %

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10605	AAC	IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc dc)	WLAN	8.97	± 9.6 %
10606	AAC	IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc dc)	WLAN	8.82	± 9.6 %
10607	AAC	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc dc)	WLAN	8.64	± 9.6 %
10608	AAC	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc dc)	WLAN	8.77	± 9.6 %
10609	AAC	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc dc)	WLAN	8.57	± 9.6 %
10610	AAC	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc dc)	WLAN	8.78	± 9.6 %
10611	AAC	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc dc)	WLAN	8.70	± 9.6 %
10612	AAC	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc dc)	WLAN	8.77	± 9.6 %
10613	AAC	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc dc)	WLAN	8.94	± 9.6 %
10614	AAC	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc dc)	WLAN	8.59	± 9.6 %
10615	AAC	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc dc)	WLAN	8.82	± 9.6 %
10616	AAC	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc dc)	WLAN	8.82	± 9.6 %
10617	AAC	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc dc)	WLAN	8.81	± 9.6 %
10618	AAC	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc dc)	WLAN	8.58	± 9.6 %
10619	AAC	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc dc)	WLAN	8.86	± 9.6 %
10620	AAC	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc dc)	WLAN	8.87	± 9.6 %
10621	AAC	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc dc)	WLAN	8.77	± 9.6 %
10622	AAC	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc dc)	WLAN	8.68	± 9.6 %
10623	AAC	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc dc)	WLAN	8.82	± 9.6 %
10624	AAC	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc dc)	WLAN	8.96	± 9.6 %
10625	AAC	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc dc)	WLAN	8.96	± 9.6 %
10626	AAC	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc dc)	WLAN	8.83	± 9.6 %
10627	AAC	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc dc)	WLAN	8.88	± 9.6 %
10628	AAC	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc dc)	WLAN	8.71	± 9.6 %
10629	AAC	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc dc)	WLAN	8.85	± 9.6 %
10630	AAC	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc dc)	WLAN	8.72	± 9.6 %
10631	AAC	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc dc)	WLAN	8.81	± 9.6 %
10632	AAC	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc dc)	WLAN	8.74	± 9.6 %
10633	AAC	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc dc)	WLAN	8.83	± 9.6 %
10634	AAC	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc dc)	WLAN	8.80	± 9.6 %
10635	AAC	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc dc)	WLAN	8.81	± 9.6 %
10636	AAD	IEEE 802.11ac WiFi (160MHz, MCS0, 90pc dc)	WLAN	8.83	± 9.6 %
10637	AAD	IEEE 802.11ac WiFi (160MHz, MCS1, 90pc dc)	WLAN	8.79	± 9.6 %
10638	AAD	IEEE 802.11ac WiFi (160MHz, MCS2, 90pc dc)	WLAN	8.86	± 9.6 %
10639	AAD	IEEE 802.11ac WiFi (160MHz, MCS3, 90pc dc)	WLAN	8.85	± 9.6 %
10640	AAD	IEEE 802.11ac WiFi (160MHz, MCS4, 90pc dc)	WLAN	8.98	± 9.6 %
10641	AAD	IEEE 802.11ac WiFi (160MHz, MCS5, 90pc dc)	WLAN	9.06	± 9.6 %
10642	AAD	IEEE 802.11ac WiFi (160MHz, MCS6, 90pc dc)	WLAN	9.06	± 9.6 %
10643	AAD	IEEE 802.11ac WiFi (160MHz, MCS7, 90pc dc)	WLAN	8.89	± 9.6 %
10644	AAD	IEEE 802.11ac WiFi (160MHz, MCS8, 90pc dc)	WLAN	9.05	± 9.6 %
10645	AAD	IEEE 802.11ac WiFi (160MHz, MCS9, 90pc dc)	WLAN	9.11	± 9.6 %
10646	AAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Sub=2,7)	LTE-TDD	11.96	± 9.6 %
10647	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Sub=2,7)	LTE-TDD	11.96	± 9.6 %
10648	AAA	CDMA2000 (1x Advanced)	CDMA2000	3.45	± 9.6 %
10652	AAE	LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.91	± 9.6 %
10653	AAE	LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.42	± 9.6 %
10654	AAD	LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.96	± 9.6 %
10655	AAE	LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.21	± 9.6 %
10658	AAA	Pulse Waveform (200Hz, 10%)	Test	10.00	± 9.6 %
10659	AAA	Pulse Waveform (200Hz, 20%)	Test	6.99	± 9.6 %
10660	AAA	Pulse Waveform (200Hz, 40%)	Test	3.98	± 9.6 %
10661	AAA	Pulse Waveform (200Hz, 60%)	Test	2.22	± 9.6 %
10662	AAA	Pulse Waveform (200Hz, 80%)	Test	0.97	± 9.6 %
10670	AAA	Bluetooth Low Energy	Bluetooth	2.19	± 9.6 %
10671	AAC	IEEE 802.11ax (20MHz, MCS0, 90pc dc)	WLAN	9.09	± 9.6 %
10672	AAC	IEEE 802.11ax (20MHz, MCS1, 90pc dc)	WLAN	8.57	± 9.6 %

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Table with 6 columns: ID, Modulation, Standard, Bandwidth, MCS, and Results. Rows 10673 to 10728.

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10729	AAC	IEEE 802.11ax (80MHz, MCS10, 90pc dc)	WLAN	8.64	±9.6%
10730	AAC	IEEE 802.11ax (80MHz, MCS11, 90pc dc)	WLAN	8.67	±9.6%
10731	AAC	IEEE 802.11ax (80MHz, MCS0, 99pc dc)	WLAN	8.42	±9.6%
10732	AAC	IEEE 802.11ax (80MHz, MCS1, 99pc dc)	WLAN	8.46	±9.6%
10733	AAC	IEEE 802.11ax (80MHz, MCS2, 99pc dc)	WLAN	8.40	±9.6%
10734	AAC	IEEE 802.11ax (80MHz, MCS3, 99pc dc)	WLAN	8.25	±9.6%
10735	AAC	IEEE 802.11ax (80MHz, MCS4, 99pc dc)	WLAN	8.33	±9.6%
10736	AAC	IEEE 802.11ax (80MHz, MCS5, 99pc dc)	WLAN	8.27	±9.6%
10737	AAC	IEEE 802.11ax (80MHz, MCS6, 99pc dc)	WLAN	8.36	±9.6%
10738	AAC	IEEE 802.11ax (80MHz, MCS7, 99pc dc)	WLAN	8.42	±9.6%
10739	AAC	IEEE 802.11ax (80MHz, MCS8, 99pc dc)	WLAN	8.29	±9.6%
10740	AAC	IEEE 802.11ax (80MHz, MCS9, 99pc dc)	WLAN	8.48	±9.6%
10741	AAC	IEEE 802.11ax (80MHz, MCS10, 99pc dc)	WLAN	8.40	±9.6%
10742	AAC	IEEE 802.11ax (80MHz, MCS11, 99pc dc)	WLAN	8.43	±9.6%
10743	AAC	IEEE 802.11ax (160MHz, MCS0, 90pc dc)	WLAN	8.94	±9.6%
10744	AAC	IEEE 802.11ax (160MHz, MCS1, 90pc dc)	WLAN	9.16	±9.6%
10745	AAC	IEEE 802.11ax (160MHz, MCS2, 90pc dc)	WLAN	8.93	±9.6%
10746	AAC	IEEE 802.11ax (160MHz, MCS3, 90pc dc)	WLAN	9.11	±9.6%
10747	AAC	IEEE 802.11ax (160MHz, MCS4, 90pc dc)	WLAN	9.04	±9.6%
10748	AAC	IEEE 802.11ax (160MHz, MCS5, 90pc dc)	WLAN	8.93	±9.6%
10749	AAC	IEEE 802.11ax (160MHz, MCS6, 90pc dc)	WLAN	8.90	±9.6%
10750	AAC	IEEE 802.11ax (160MHz, MCS7, 90pc dc)	WLAN	8.79	±9.6%
10751	AAC	IEEE 802.11ax (160MHz, MCS8, 90pc dc)	WLAN	8.82	±9.6%
10752	AAC	IEEE 802.11ax (160MHz, MCS9, 90pc dc)	WLAN	8.81	±9.6%
10753	AAC	IEEE 802.11ax (160MHz, MCS10, 90pc dc)	WLAN	9.00	±9.6%
10754	AAC	IEEE 802.11ax (160MHz, MCS11, 90pc dc)	WLAN	8.94	±9.6%
10755	AAC	IEEE 802.11ax (160MHz, MCS0, 99pc dc)	WLAN	8.64	±9.6%
10756	AAC	IEEE 802.11ax (160MHz, MCS1, 99pc dc)	WLAN	8.77	±9.6%
10757	AAC	IEEE 802.11ax (160MHz, MCS2, 99pc dc)	WLAN	8.77	±9.6%
10758	AAC	IEEE 802.11ax (160MHz, MCS3, 99pc dc)	WLAN	8.69	±9.6%
10759	AAC	IEEE 802.11ax (160MHz, MCS4, 99pc dc)	WLAN	8.58	±9.6%
10760	AAC	IEEE 802.11ax (160MHz, MCS5, 99pc dc)	WLAN	8.49	±9.6%
10761	AAC	IEEE 802.11ax (160MHz, MCS6, 99pc dc)	WLAN	8.58	±9.6%
10762	AAC	IEEE 802.11ax (160MHz, MCS7, 99pc dc)	WLAN	8.49	±9.6%
10763	AAC	IEEE 802.11ax (160MHz, MCS8, 99pc dc)	WLAN	8.53	±9.6%
10764	AAC	IEEE 802.11ax (160MHz, MCS9, 99pc dc)	WLAN	8.54	±9.6%
10765	AAC	IEEE 802.11ax (160MHz, MCS10, 99pc dc)	WLAN	8.54	±9.6%
10766	AAC	IEEE 802.11ax (160MHz, MCS11, 99pc dc)	WLAN	8.51	±9.6%
10767	AAE	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	7.99	±9.6%
10768	AAD	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.01	±9.6%
10769	AAD	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.01	±9.6%
10770	AAD	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	±9.6%
10771	AAD	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	±9.6%
10772	AAD	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.23	±9.6%
10773	AAD	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.03	±9.6%
10774	AAD	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	±9.6%
10775	AAD	5G NR (CP-OFDM, 50% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.31	±9.6%
10776	AAD	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.30	±9.6%
10777	AAC	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.30	±9.6%
10778	AAD	5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.34	±9.6%
10779	AAC	5G NR (CP-OFDM, 50% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.42	±9.6%
10780	AAD	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.38	±9.6%
10781	AAD	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.38	±9.6%
10782	AAD	5G NR (CP-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.43	±9.6%
10783	AAE	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.31	±9.6%
10784	AAD	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.29	±9.6%

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10785	AAD	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.40	± 9.6 %
10786	AAD	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10787	AAD	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.44	± 9.6 %
10788	AAD	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10789	AAD	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10790	AAD	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10791	AAE	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.83	± 9.6 %
10792	AAD	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.92	± 9.6 %
10793	AAD	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.95	± 9.6 %
10794	AAD	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	± 9.6 %
10795	AAD	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.84	± 9.6 %
10796	AAD	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	± 9.6 %
10797	AAD	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.01	± 9.6 %
10798	AAD	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.89	± 9.6 %
10799	AAD	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.93	± 9.6 %
10801	AAD	5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.89	± 9.6 %
10802	AAD	5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.87	± 9.6 %
10803	AAD	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.93	± 9.6 %
10805	AAD	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10806	AAD	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10809	AAD	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10810	AAD	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10812	AAD	5G NR (CP-OFDM, 50% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10817	AAE	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10818	AAD	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10819	AAD	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.33	± 9.6 %
10820	AAD	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.30	± 9.6 %
10821	AAD	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10822	AAD	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10823	AAD	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.36	± 9.6 %
10824	AAD	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10825	AAD	5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10827	AAD	5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.42	± 9.6 %
10828	AAD	5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.43	± 9.6 %
10829	AAD	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.40	± 9.6 %
10830	AAD	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.63	± 9.6 %
10831	AAD	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.73	± 9.6 %
10832	AAD	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.74	± 9.6 %
10833	AAD	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10834	AAD	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.75	± 9.6 %
10835	AAD	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10836	AAD	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.66	± 9.6 %
10837	AAD	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.68	± 9.6 %
10839	AAD	5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10840	AAD	5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.67	± 9.6 %
10841	AAD	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.71	± 9.6 %
10843	AAD	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.49	± 9.6 %
10844	AAD	5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10846	AAD	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10854	AAD	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10855	AAD	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.36	± 9.6 %
10856	AAD	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10857	AAD	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10858	AAD	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.36	± 9.6 %
10859	AAD	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10860	AAD	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %

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Table with 7 columns: ID, Modulation, Parameters, Modulation, Parameters, Value, Error. Rows 10861 to 10922.

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Table with 7 columns: ID, Modulation, Parameters, Modulation, Modulation, Value, Uncertainty. Rows include various 5G NR configurations like 5G NR (DFT-s-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz) and 5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 15 kHz).

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

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Accreditation No.: **SCS 0108**

Client **KES (Dymstec)**

Certificate No: **D2450V2-896_Feb22**

CALIBRATION CERTIFICATE			
Object	D2450V2 - SN:896		
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz		
Calibration date:	February 11, 2022		
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p>			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	31-Dec-21 (No. EX3-7349_Dec21)	Dec-22
DAE4	SN: 601	01-Nov-21 (No. DAE4-601_Nov21)	Nov-22
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22
Calibrated by:	Name Aldonia Georgiadou	Function Laboratory Technician	Signature
Approved by:	Name Sven Kühn	Function Deputy Manager	Signature
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			Issued: February 23, 2022

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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) DASYS 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	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.1 ± 6 %	1.66 mho/m ± 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	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.5 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.1 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.3 Ω + 5.3 jΩ
Return Loss	- 23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.158 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
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DASY5 Validation Report for Head TSL

Date: 11.02.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 896

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.86$ S/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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 = 121.5 V/m; Power Drift = -0.01 dB

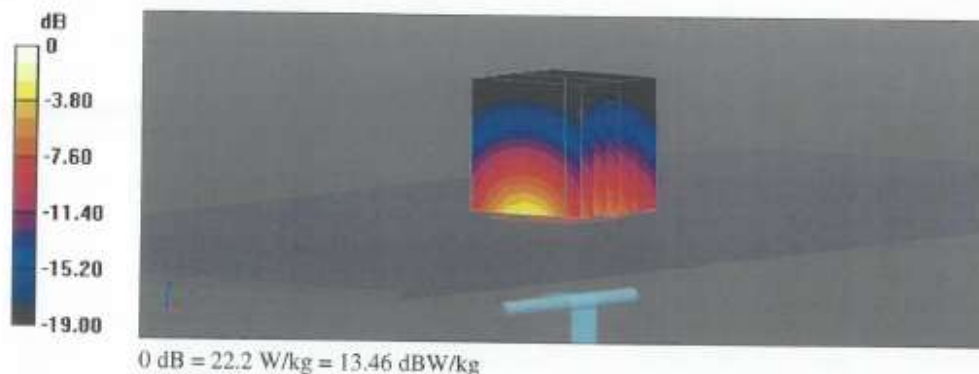
Peak SAR (extrapolated) = 27.1 W/kg

SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.11 W/kg

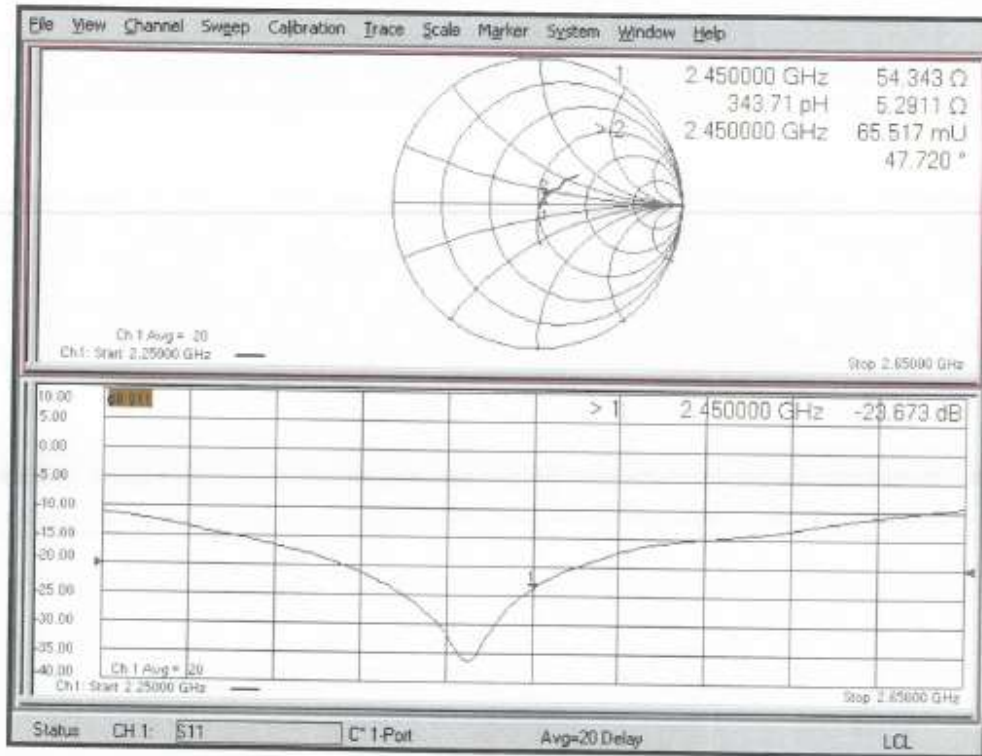
Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 49.3%

Maximum value of SAR (measured) = 22.2 W/kg



Impedance Measurement Plot for Head TSL



Appendix D. SAR Tissue Specifications

Measurement Procedure for Tissue verification:

- 1) The network analyzer and probe system was configured and calibrated.
- 2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
- 3) The complex admittance with respect to the probe aperture was measured.
- 4) The complex relative permittivity ϵ' can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\epsilon_r\epsilon_0}{[\ln(b/a)]^2} \int_a^b \int_a^b \int_0^\pi \cos\phi' \frac{\exp[-j\omega r'(\mu_0\epsilon_r'\epsilon_0)^{1/2}]}{r'} d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

Table D-1 Composition of the Tissue Equivalent Matter - Head

Frequency (MHz)	2 450
Tissue	Head
Ingredients (% by weight)	
Bactericide	-
DGBE	-
HEC	-
Nacl	0.1
Sucrose	-
Tween 20	45.0
Water	54.9

Table D-2 Recommended Tissue Dielectric Parameters (IEC 1528-2013)

Frequency (MHz)	Relative permittivity (ϵ')	Conductivity (σ) (S/m)
300	45.3	0.87
450	43.5	0.87
750	41.9	0.89
835	41.5	0.90
900	41.5	0.97
1450	40.5	1.20
1500	40.4	1.23
1640	40.2	1.31
1750	40.1	1.37
1800	40.0	1.40
1900	40.0	1.40
2000	40.0	1.40
2100	39.8	1.49
2300	39.5	1.67
2450	39.2	1.80
2600	39.0	1.96
3000	38.5	2.40
3500	37.9	2.91
4000	37.4	3.43
4500	36.8	3.94
5000	36.2	4.45
5200	36.0	4.66
5400	35.8	4.86
5600	35.5	5.07
5800	35.3	5.27
6000	35.1	5.45

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