SAR TEST REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

for

E-note device

Model: USMUK4

Prepared for:

AIMobile Co., Ltd.
6F., No. 166, Sec.4, Chengde Rd., Shilin Dist., Taipei City 11167 , Taiwan

Prepared by

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New Taipei City, Taiwan. (R.O.C.)
Issue Date: September 27, 2022

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	September 2, 2022	Initial Issue	ALL	Allison Chen
01	September 16, 2022	See the following Note Rev.(01)	P.19, 29	Allison Chen
02	September 27, 2022	See the following Note Rev.(02)	P.7	Allison Chen

Note:
Rev.(01)
1. Modify date and description.
Rev.(02)
1. Added notes description in section 3.2.

Table of Contents

1 Attestation of Test Results

Applicant Name	AIMobile Co., Ltd.		
Model Name	USMUK4		
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013		
Exposure Category	SAR Limits (W/Kg)		
	Peak spatial-average (1g of tissue)		
General population	1.6		
RF Exposure Conditions	Equipment Class - Highest Reported SAR (W/kg)		
	DTS	NII	DSS
Body	0.79	1.181	0.148
Simultaneous TX	1.089		
Receive EUT Date:	July 19, 2022		
Date Tested	July 30~August 12, 2022		
Test Results	Pass		

Compliance Certification Services Inc. , tested the above equipment in accordance with the requirements set forth in the above standards. Determination of compliance is based on the results of the compliance measurement,not taking into account measurement instrumentation uncertainy.All indications of Pass/Fail in this report are opinions expressed by Compliance Certification Services Inc, based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved & Released By:	Tested by:
	
Sky Zhou Asst. Section Manager Compliance Certification Services Inc.	Jack Yang Engineer Compliance Certification Services Inc.

2 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528- 2013, the following FCC Published RF exposure KDB procedures:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D04 Interim General RF Exposure Guidance v01
- 616217 D04 SAR for laptop and tablets v01r02
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02

In addition to the above, the following information was used:

- TCB workshop October, 2016; Page 7, RF Exposure Procedures (Bluetooth Duty Factor)

3 Device Under Test (DUT) Information

3.1 DUT Description

Applicant Name	AIMobile Co., Ltd.
Applicant Address	6F., No. 166, Sec.4, Chengde Rd., Shilin Dist., Taipei City 11167 , Taiwan
Manufacturer Name	AIMobile Co., Ltd.
Manufacturer Address	6F., No. 166, Sec.4, Chengde Rd., Shilin Dist., Taipei City 11167 , Taiwan
Product	E-note device
Trade Name	ITOCHU
Model No.	USMUK4
Device Dimension	Overall (Length x Width): 300 mm x 222 mm Overall Diagonal: 373 mm Display Diagonal: 337 mm
Back Cover	☐ Normal Battery Cover ☐ Normal Battery Cover with NFC ☐ Wireless Charger Battery Cover ☐ Wireless Charger Battery Cover with NFC ☒ The Back Cover is not removable.
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.7Vdc, 7.4Wh ☐ Extended (large capacity) ☐ The rechargeable battery is not user accessible.
Hardware Version	A01
Software Version	V0.0.111.1
Sample Stage	PVT

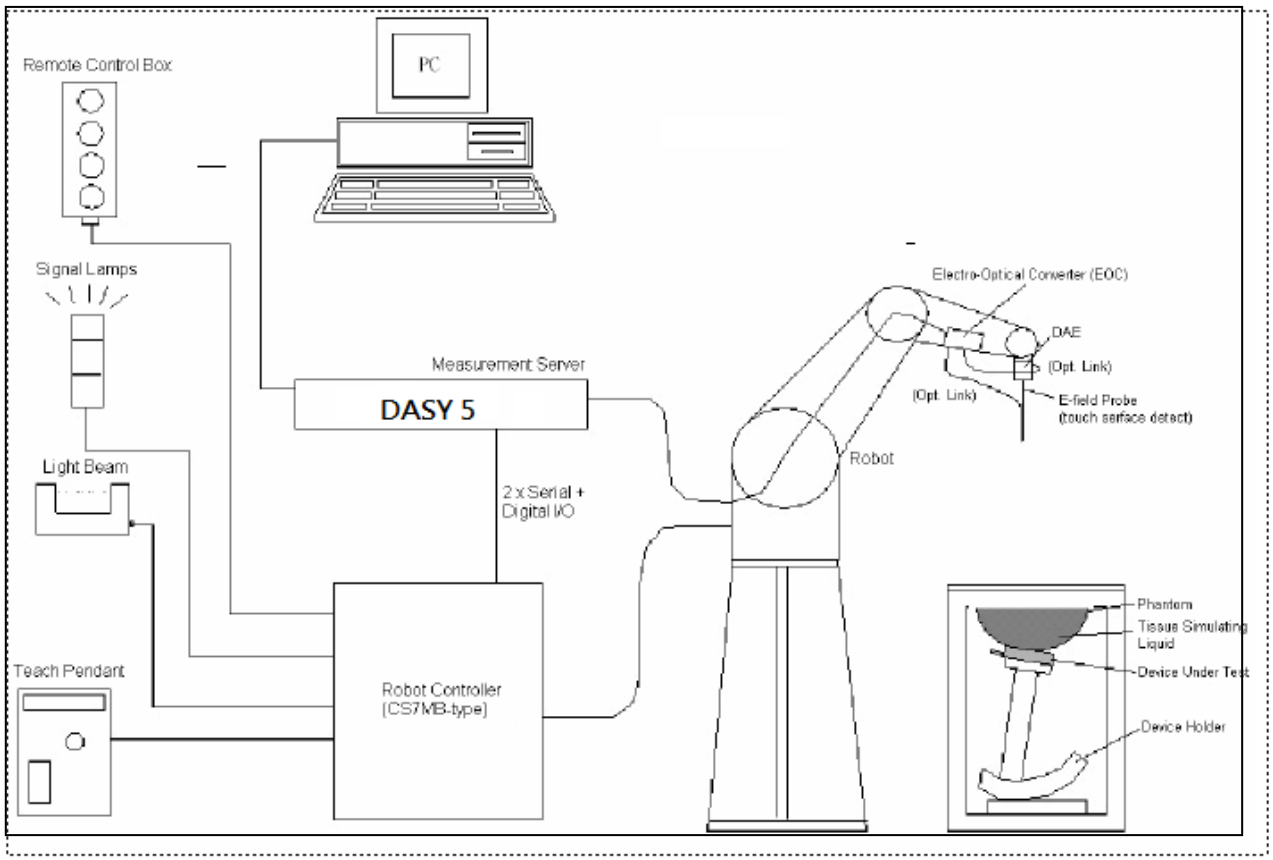
3.2 Wireless Technologies

Wireless technologies	Frequency bands	Peak Antenna Gain (dBi)	Operating mode	Duty Cycle used for SAR testing
Wi-Fi (Main)	2.4 GHz[1]	2.6	802.11b 802.11g 802.11n (HT20)	100% (802.11b) 100% (802.11g/n 20MHz BW)
	5 GHz[1]	3.93	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT80)	100% (802.11a) 100% (802.11n 20MHz BW) 100% (802.11n 40MHz BW) 100% (802.11ac 80MHz BW)
			Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No	
			Does this device support Band gap channel? ☐ Yes ☒ No	
Antenna Specification	Brand Name	YAGEO		
	Type	PIFA		
	Parts Number	ANTA0ZV1421124553		
Wi-Fi (Aux)	2.4 GHz[1]	2.58	802.11b 802.11g 802.11n (HT20)	100% (802.11b) 100% (802.11g/n 20MHz BW)
	5 GHz[1]	2.69	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT80)	100% (802.11a) 100% (802.11n 20MHz BW) 100% (802.11n 40MHz BW) 100% (802.11ac 80MHz BW)
			Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No	
			Does this device support Band gap channel? ☐ Yes ☒ No	
Bluetooth	2.4 GHz[1]	2.58		76.8%
Antenna Specification	Brand Name	YAGEO		
	Type	PIFA		
	Parts Number	ANTA0ZV1421124554		
NFC	13.56MHz			N/A[5]

Notes:

1. Duty cycle for Wi-Fi and BT is referenced from the DTS and U-NII and BT reports.
2. The sample selected for test was prototype that representative to production product and was provided by manufacturer
3. Variant information between/among model numbers / trademarks is provided by the applicant, test results of this report are applicable to the sample EUT received of main test model name.
4. Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received
5. Measured Duty Cycle is not required due to SAR test exemption.
6. For IEEE 802.11 a/b/g function, it supports SISO mode only

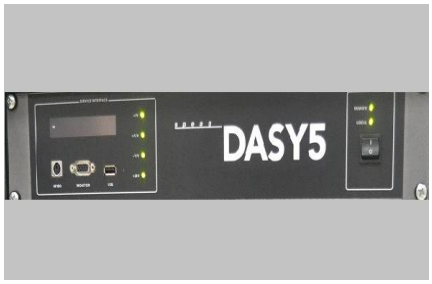
4 SAR Measurement System



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

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A 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 between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7 or Windows XP.
- DASY software version: NEO52 D10.3 S14.6.13.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

4.1 System Components

DASY5 Measurement Server	
	The DASY5 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE4 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.
	The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

Data Acquisition Electronics (DAE)	
	The data acquisition electronics (DAE4) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements

Construction: Symmetrical design with triangular core
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration: Basic Broad Band Calibration in air: 10-3000 MHz. Conversion Factors (CF) for HSL 900 and HSL 1800 CF-Calibration for other liquids and frequencies upon request.

Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in HSL (rotation normal to probe axis)

Dynamic Range: 10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)

Dimensions: Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 1 mm

Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

SAM Phantom

Construction: The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE1528: 2013. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness: 2 ±0.2 mm

Filling Volume: Approx. 25 liters

Dimensions: Height: 810mm; Length: 1000mm; Width: 500mm

ELI Phantom

Construction: Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEEE1528: 2013 and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY5 and higher and is compatible with all SPEAG dosimetric probes and dipoles

Shell Thickness: 2.0 ± 0.2 mm (sagging: <1%)

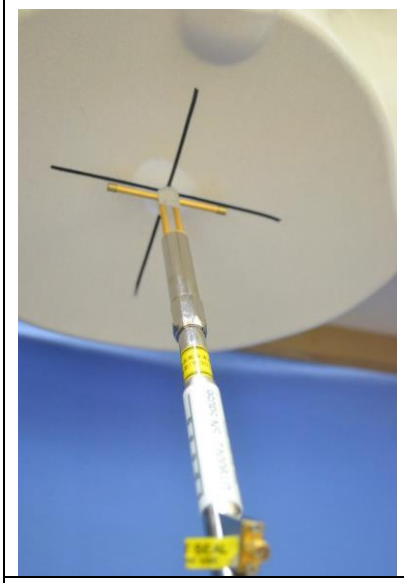
Filling Volume: Approx. 25 liters

Dimensions: Major ellipse axis: 600 mm
Minor axis: 400 mm 500mm

Device Holder for SAM Twin Phantom

Construction: In combination with the Twin SAM Phantom V4.0 or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

System Validation Kits for SAM Phantom



Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

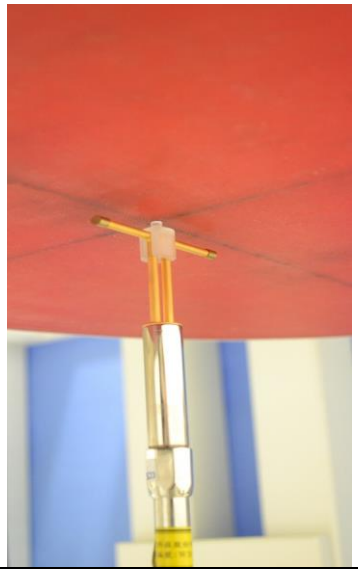
Frequency: 2450, 5300, 5600, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions: D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm

System Validation Kits for ELI phantom



Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 2450, 5300, 5600, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions: D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm

4.2 SAR Scan Procedures

Step 1: Power Reference Measurement

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE1528 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

<table>
<tr><th></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe abgle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: ΔxZoom, ΔyZoom</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
</table>

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

- Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm</td><td>3 – 4 GHz: ≤ 5 mm
4 – 6 GHz: ≤ 4 mm</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">Uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$:between 1st two points losest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Maximum zoom scan volume</td><td>x, y, z</td><td>≥ 30 mm</td><td colspan="2">3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
</table>

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction

5 Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE1528: 2013 is not required in SAR reports submitted for equipment approval.

Therefore, the measurement uncertainty is not required.

6 RF Exposure Conditions (Test Configurations)

Refer to Appendixes 1 for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

6.1 Standalone SAR Test Exclusion Considerations

Since the Dedicated Host Approach is applied, the SAR-based exemption in Appendix B of KDB 447498 is applied together with KDB 616217 § 4.3 to determine the minimum test separation distance:

- When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
- When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.

SAR Test Exclusion Calculations for 1.5 GHz ≤ f ≤ 6 GHz

Tx Interface	Frequency (GHz)	Output Power		Antenna Gain	ERP	ERP Threshold	Separation Distances (cm)					P_{th}(mW)					Exemption result				
		dBm	mW	(dBi)	(dBm)	(mW)	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
1.5GHz ≤ f ≤ 6GHz																					
WiFi 2.4GHz(Main)	2.462	12.00	16	2.6	12.45	17.58	0.5	5.49	0.5	14.49	28.74	3	261	3	1657	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.2GHz(Main)	5.24	8.00	6	3.93	9.78	9.51	0.5	5.49	0.5	14.49	28.74	1	211	1	1572	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.3GHz(Main)	5.32	8.00	6	3.93	9.78	9.51	0.5	5.49	0.5	14.49	28.74	1	210	1	1570	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.5GHz(Main)	5.7	8.00	6	3.93	9.78	9.51	0.5	5.49	0.5	14.49	28.74	1	206	1	1563	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.8GHz(Main)	5.825	8.00	6	3.93	9.78	9.51	0.5	5.49	0.5	14.49	28.74	1	205	1	1560	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 2.4GHz(Aux)	2.462	12.00	16	2.58	12.43	17.50	0.5	13.16	0.5	7.12	28.78	3	1380	3	429	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.2GHz(Aux)	5.24	8.00	6	2.69	8.54	7.14	0.5	13.16	0.5	7.12	28.78	1	1288	1	362	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.3GHz(Aux)	5.32	8.00	6	2.69	8.54	7.14	0.5	13.16	0.5	7.12	28.78	1	1286	1	361	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.5GHz(Aux)	5.7	8.00	6	2.69	8.54	7.14	0.5	13.16	0.5	7.12	28.78	1	1278	1	355	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.8GHz(Aux)	5.825	8.00	6	2.69	8.54	7.14	0.5	13.16	0.5	7.12	28.78	1	1276	1	353	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
BT	2.48	4.00	3	2.58	4.43	2.77	0.5	13.16	0.5	7.12	28.78	3	1379	3	428	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 2.4GHz(MIMO)	2.462	14.00	25	2.6	14.45	27.86	0.5	5.49	0.5	7.12	28.74	3	261	3	429	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.2GHz(MIMO)	5.24	9.00	8	3.93	10.78	11.97	0.5	5.49	0.5	7.12	28.74	1	211	1	362	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.3GHz(MIMO)	5.32	9.00	8	3.93	10.78	11.97	0.5	5.49	0.5	7.12	28.74	1	210	1	361	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.5GHz(MIMO)	5.7	9.00	8	3.93	10.78	11.97	0.5	5.49	0.5	7.12	28.74	1	206	1	355	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-
WiFi 5.8GHz(MIMO)	5.825	10.50	11	3.93	12.28	16.90	0.5	5.49	0.5	7.12	28.74	1	205	1	353	3060	-MEASURE-	-EXEMPT-	-MEASURE-	-EXEMPT-	-EXEMPT-

Required Test Configurations

The table below identifies the standalone test configurations required for this device according to the findings in Section 6.1:

Test Configurations	Rear	Edge1	Edge2	Edge3	Edge4
WiFi 2.4GHz(Main)	Yes	No	Yes	No	No
WiFi 5.2GHz(Main)	Yes	No	Yes	No	No
WiFi 5.3GHz(Main)	Yes	No	Yes	No	No
WiFi 5.5GHz(Main)	Yes	No	Yes	No	No
WiFi 5.8GHz(Main)	Yes	No	Yes	No	No
WiFi 2.4GHz(Aux)	Yes	No	Yes	No	No
WiFi 5.2GHz(Aux)	Yes	No	Yes	No	No
WiFi 5.3GHz(Aux)	Yes	No	Yes	No	No
WiFi 5.5GHz(Aux)	Yes	No	Yes	No	No
WiFi 5.8GHz(Aux)	Yes	No	Yes	No	No
BT	Yes	No	Yes	No	No
WiFi 2.4GHz(MIMO)	Yes	No	Yes	No	No
WiFi 5.2GHz(MIMO)	Yes	No	Yes	No	No
WiFi 5.3GHz(MIMO)	Yes	No	Yes	No	No
WiFi 5.5GHz(MIMO)	Yes	No	Yes	No	No
WiFi 5.8GHz(MIMO)	Yes	No	Yes	No	No

Note(s):

Yes = Testing is required.

No = Testing is not required.

7 Dielectric Property Measurements & System Check

7.1 Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

The dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

Typical Composition of Ingredients for Liquid Tissue Phantoms

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

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

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

Simulating Liquids for 5 GHz, Manufactured by SPEAG

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

Dielectric Property Measurements Results:

Date	Tissue Type	Frequency (MHz)	Relative Permittivity (εr)			Conductivity (σ)		
			Measured	Target	Delta (%)	Measured	Target	Delta (%)
2022/8/4	Head	2400	40.59	39.30	3.28	1.73	1.76	-1.31
		2450	40.36	39.20	2.96	1.80	1.80	-0.22
		2480	40.24	39.16	2.76	1.84	1.83	0.16
2022/8/8	Head	2400	38.64	39.30	-1.68	1.84	1.76	4.72
		2450	38.55	39.20	-1.66	1.88	1.80	4.50
		2480	38.51	39.16	-1.66	1.90	1.83	3.93
2022/8/12	Head	2400	39.45	39.30	0.38	1.80	1.76	2.22
		2450	39.37	39.20	0.43	1.84	1.80	2.06
		2480	39.35	39.16	0.49	1.87	1.83	1.91
2022/8/8	Head	5250	34.63	35.95	-3.67	4.57	4.71	-3.01
		5300	34.59	35.90	-3.65	4.67	4.76	-1.95
		5350	34.52	35.85	-3.71	4.73	4.81	-1.75
2022/8/10	Head	5250	34.94	35.95	-2.81	4.66	4.71	-0.98
		5300	34.86	35.90	-2.90	4.71	4.76	-1.13
		5350	34.69	35.85	-3.24	4.78	4.81	-0.62
2022/8/11	Head	5250	37.19	35.95	3.45	4.75	4.71	0.83
		5300	37.33	35.90	3.98	4.92	4.76	3.38
		5350	37.09	35.85	3.46	5.01	4.81	4.07
2022/8/5	Head	5500	35.58	35.65	-0.20	5.02	4.97	1.01
		5600	35.25	35.50	-0.70	5.06	5.07	-0.16
		5720	34.99	35.38	-1.10	5.27	5.19	1.46
2022/8/8	Head	5500	34.58	35.65	-3.00	4.85	4.97	-2.38
		5600	34.17	35.50	-3.75	4.91	5.07	-3.10
		5720	34.01	35.38	-3.87	5.16	5.19	-0.67
2022/8/9	Head	5500	36.36	35.65	1.99	5.03	4.97	1.25
		5600	36.19	35.50	1.94	5.11	5.07	0.71
		5720	35.94	35.38	1.58	5.34	5.19	2.81
2022/8/11	Head	5500	36.88	35.65	3.45	5.10	4.97	2.66
		5600	36.71	35.50	3.41	5.18	5.07	2.07
		5720	36.46	35.38	3.05	5.41	5.19	4.24
2022/8/5	Head	5720	34.99	35.38	-1.10	5.27	5.19	1.46
		5750	35.09	35.35	-0.74	5.28	5.22	1.11
		5850	34.87	35.25	-1.08	5.28	5.32	-0.83
2022/8/8	Head	5720	34.01	35.38	-3.87	5.16	5.19	-0.67
		5750	33.88	35.35	-4.16	5.14	5.22	-1.59
		5850	33.73	35.25	-4.31	5.15	5.32	-3.34
2022/8/11	Head	5720	36.46	35.38	3.05	5.41	5.19	4.24
		5750	36.49	35.35	3.22	5.39	5.22	3.20
		5850	36.27	35.25	2.89	5.41	5.32	1.67

7.2 System Check

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

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 mm (below 1 GHz) and 10 mm (above 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube
- Distance between probe sensors and phantom surface was set to 2 mm.
- The dipole input power (forward power) was 250 mW (below 2GHz) and 100 mW
- The results are normalized to 1 W input power.

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within ±10% of the manufacturer calibrated dipole SAR target. Refer to Appendix 2 for the SAR System Check Plots.

Date	Tissue Type	Dipole S/N	Input Power (mW)	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Delta 1g ±10 (%)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Delta 10g ±10 (%)	Plot No.
2022/8/4	Head	D2450V2-727	250	13.50	52.80	54	2.27	6.23	25.00	24.92	-0.32	1
2022/8/8	Head	D2450V2-727	250	13.10	52.80	52.4	-0.76	6.03	25.00	24.12	-3.52	2
2022/8/12	Head	D2450V2-727	250	12.90	52.80	51.6	-2.27	5.96	25.00	23.84	-4.64	3
2022/8/8	Head	D5GHzV2-1023-5250	100	8.59	81.00	85.9	6.05	2.48	23.10	24.8	7.36	4
2022/8/10	Head	D5GHzV2-1023-5250	100	8.39	81.00	83.9	3.58	2.41	23.10	24.1	4.33	5
2022/8/11	Head	D5GHzV2-1023-5250	100	8.60	81.00	86	6.17	2.48	23.10	24.8	7.36	6
2022/8/5	Head	D5GHzV2-1023-5600	100	8.99	84.40	89.9	6.52	2.54	23.80	25.4	6.72	7
2022/8/8	Head	D5GHzV2-1023-5600	100	8.40	84.40	84	-0.47	2.38	23.80	23.8	0.00	8
2022/8/9	Head	D5GHzV2-1023-5600	100	8.38	84.40	83.8	-0.71	2.37	23.80	23.7	-0.42	9
2022/8/11	Head	D5GHzV2-1023-5600	100	8.52	84.40	85.2	0.95	2.42	23.80	24.2	1.68	10
2022/8/5	Head	D5GHzV2-1023-5750	100	7.92	81.00	79.2	-2.22	2.25	22.90	22.5	-1.75	11
2022/8/8	Head	D5GHzV2-1023-5750	100	8.43	81.00	84.3	4.07	2.40	22.90	24	4.80	12
2022/8/11	Head	D5GHzV2-1023-5750	100	8.28	81.00	82.8	2.22	2.37	22.90	23.7	3.49	13

8 Conducted Output Power Measurements

8.1 Wi-Fi 2.4GHz (DTS Band)

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11g/n/ac/ax mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

SAR testing is not required for OFDM mode(s) when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Measured Results

Band	Mode	Data Rate	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)			Tune-up Limit (dBm)			SAR Test (Yes/No)		
					Chain 0	Chain 1	Total	Chain 0	Chain 1	MIMO	Chain 0	Chain 1	MIMO
2.4GHz (DTS)	802.11b	1 Mbps	1	2412	11.82	11.75		12.0	12.0		Yes	Yes	
			6	2437	11.23	11.41							
			11	2462	11.61	11.57							
	802.11g	6 Mbps	1	2412	11.69	11.67		12.0	12.0		No	No	
			6	2437	11.13	11.36							
			11	2462	11.46	11.40							
	802.11n (HT20)	MCS0	1	2412	10.91	10.79	13.86	11.0	11.0	14.00	No	No	Yes
			6	2437	10.36	10.61	13.50						
			11	2462	10.67	10.75	13.72						

8.2 Wi-Fi 5GHz (U-NII Bands)

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n then ac) is selected.

SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output powermeasurements were not deemed necessary.

Measured Results

Band	Mode	Data Rate	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)			Tune-up Limit (dBm)			SAR Test (Yes/No)		
					Chain 0	Chain 1	Total	Chain 0	Chain 1	MIMO	Chain 0	Chain 1	MIMO
5.2GHz (U-NII 1)	802.11a	6 Mbps	36	5180	7.27	7.58		8.0	8.0		Yes	Yes	
			40	5200	7.38	6.87							
			44	5220	7.42	6.91							
			48	5240	7.61	7.20							
	802.11n (HT20)	MCS0	36	5180	5.47	5.91	8.71	6.0	6.0	9.00	No	No	No
			40	5200	5.56	5.17	8.38						
			44	5220	5.64	5.21	8.44						
			48	5240	5.83	5.51	8.68						
	802.11n (HT40)	MCS0	38	5190	5.36	4.74	8.07	6.0	6.0	9.00	No	No	No
			46	5230	5.13	5.94	8.56						
	802.11ac (VHT80)	MCS0	42	5210	5.27	4.78	8.04	6.0	6.0	9.00	No	No	Yes
5.3GHz (U-NII 2A)	802.11a	6 Mbps	52	5260	7.51	7.23		8.0	8.0		Yes	Yes	
			56	5280	7.48	7.19							
			60	5300	7.61	7.53							
			64	5320	6.98	6.86							
	802.11n (HT20)	MCS0	52	5260	5.74	5.58	8.67	6.0	6.0	9.00	No	No	No
			56	5280	6.10	5.78	8.95						
			60	5300	5.91	5.84	8.89						
			64	5320	5.92	5.85	8.90						
	802.11n (HT40)	MCS0	54	5270	5.06	5.90	8.51	6.0	6.0	9.00	No	No	No
			62	5310	4.51	5.57	8.08						
	802.11ac (VHT80)	MCS0	58	5290	4.51	5.46	8.02	6.0	6.0	9.00	No	No	Yes

Measured Results (continued)

Band	Mode	Data Rate	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)			Tune-up Limit (dBm)			SAR Test (Yes/No)		
					Chain 0	Chain 1	Total	Chain 0	Chain 1	MIMO	Chain 0	Chain 1	MIMO
5.5GHz (U-NII 2C)	802.11a	6 Mbps	100	5500	6.84	7.18		8.0	8.0		Yes	Yes	
			116	5580	6.72	7.48							
			124	5620	6.68	7.32							
			132	5660	6.56	7.38							
			140	5700	6.36	7.46							
			144	5720	6.42	7.54							
	802.11n (HT20)	MCS0	100	5500	4.80	5.92	8.41	6.0	6.0	9.00	No	No	No
			116	5580	5.62	5.89	8.77						
			124	5620	5.53	5.68	8.62						
			132	5660	5.47	5.64	8.57						
			140	5700	5.11	5.48	8.31						
			144	5720	5.23	5.52	8.39						
	802.11n (HT40)	MCS0	102	5510	4.85	5.81	8.37	6.0	6.0	9.00	No	No	No
			110	5550	3.75	5.12	7.50						
			118	5590	4.36	5.17	7.79						
			126	5630	4.53	5.35	7.97						
			134	5670	4.98	5.26	8.13						
			142	5710	4.71	5.42	8.09						
	802.11ac (VHT80)	MCS0	106	5530	4.48	5.43	7.99	6.0	6.0	9.00	No	No	Yes
			122	5610	4.84	5.03	7.95						
			138	5690	4.78	5.21	8.01						
5.8GHz (U-NII 3)	802.11a	6 Mbps	149	5745	6.49	6.36		8.0	8.0		Yes	Yes	
			157	5785	6.96	6.89							
			165	5825	6.83	6.92							
	802.11n (HT20)	MCS0	149	5745	6.01	7.68	9.94	8.0	8.0	10.50	No	No	Yes
			157	5785	5.43	7.28	9.46						
			165	5825	5.31	7.26	9.40						
	802.11n (HT40)	MCS0	151	5755	5.11	6.64	8.95	7.0	7.0	10.00	No	No	No
			159	5795	5.46	6.81	9.20						
	802.11ac (VHT80)	MCS0	155	5775	4.82	6.40	8.69	7.0	7.0	10.00	No	No	No

8.3 Bluetooth.

Average Power Measured Results

Band (GHz)	Mode	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)	Meas. Avg Pwr (mW)	Tune-up Limit (dBm)	SAR Test (Yes/No)
2.4	GFSK	0	2402	3.57	2.28	4.0	Yes
		39	2441	3.49	2.23		
		78	2480	3.71	2.35		
	EDR, π/4 DQPSK	0	2402	3.36	2.17	4.0	No
		39	2441	3.17	2.07		
		78	2480	3.57	2.28		
	EDR, 8-DPSK	0	2402	3.30	2.14	4.0	No
		39	2441	3.12	2.05		
		78	2480	3.51	2.24		
	LE, GFSK	0	2402	3.62	2.30	4.0	No
		19	2440	3.49	2.23		
		39	2480	3.45	2.21		

Duty Factor Measured Results

Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
GFSK	DH5	2.88	3.75	76.80%	1.15

Duty Cycle plots

GFSK

9 Measured and Reported (Scaled) SAR Results

9.1 Wi-Fi (DTS Band)

Mode	Antenna	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up Limit	Meas.	Meas.	Scaled	
802.11b	Chain 0	0	Rear	1	2412	100.0%	12.0	11.82	0.378	**0.394**	1
			Edge 2	1	2412	100.0%	12.0	11.82	0.178	0.186	
802.11b	Chain 1	0	Rear	1	2412	100.0%	12.0	11.75	0.746	**0.790**	2
			Edge 2	1	2412	100.0%	12.0	11.75	0.289	0.306	
802.11n (HT20)	MIMO	0	Rear	1	2412	100.0%	14.0	13.86	0.512	**0.529**	3
			Edge 2	1	2412	100.0%	14.0	13.86	0.220	0.227	

9.2 Wi-Fi (U-NII Band)

Frequency Band	Mode	Antenna	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up Limit	Meas.	Meas.	Scaled	
5.3 (U-NII 2A)	802.11a	Chain 0	0	Rear	60	5300	100.0%	8.0	7.61	0.309	0.338	
				Edge 2	60	5300	100.0%	8.0	7.61	0.349	**0.382**	4
5.3 (U-NII 2A)	802.11a	Chain 1	0	Rear	52	5260	100.0%	8.0	7.23	0.907	1.083	
				Rear	56	5280	100.0%	8.0	7.19	0.974	1.174	
				Rear	60	5300	100.0%	8.0	7.53	0.744	0.829	
				Rear	64	5320	100.0%	8.0	6.86	0.908	**1.181**	5
				Edge 2	52	5260	100.0%	8.0	7.23	0.701	0.837	
				Edge 2	56	5280	100.0%	8.0	7.19	0.712	0.858	
				Edge 2	60	5300	100.0%	8.0	7.53	0.638	0.711	
				Edge 2	64	5320	100.0%	8.0	6.86	0.659	0.857	
5.5 (U-NII 2C)	802.11a	Chain 0	0	Rear	100	5500	100.0%	8.0	6.84	0.227	**0.297**	6
				Edge 2	100	5500	100.0%	8.0	6.84	0.061	0.080	
5.5 (U-NII 2C)	802.11a	Chain 1	0	Rear	100	5500	100.0%	8.0	7.18	0.953	1.151	
				Rear	116	5580	100.0%	8.0	7.48	1.010	1.138	
				Rear	124	5620	100.0%	8.0	7.32	0.988	1.155	
				Rear	132	5660	100.0%	8.0	7.38	1.020	**1.177**	7
				Rear	140	5700	100.0%	8.0	7.46	0.897	1.016	
				Rear	144	5720	100.0%	8.0	7.54	1.040	1.156	
				Edge 2	100	5500	100.0%	8.0	7.18	0.763	0.922	
				Edge 2	116	5580	100.0%	8.0	7.48	0.856	0.965	
				Edge 2	124	5620	100.0%	8.0	7.32	0.856	1.001	
				Edge 2	132	5660	100.0%	8.0	7.38	0.892	1.029	
				Edge 2	140	5700	100.0%	8.0	7.46	0.665	0.753	
				Edge 2	144	5720	100.0%	8.0	7.54	0.760	0.845	
5.8 (U-NII 3)	802.11a	Chain 0	0	Rear	157	5785	100.0%	8.0	6.96	0.265	**0.337**	8
				Edge 2	157	5785	100.0%	8.0	6.96	0.256	0.325	
5.8 (U-NII 3)	802.11a	Chain 1	0	Rear	149	5745	100.0%	8.0	6.36	0.727	**1.061**	9
				Rear	157	5785	100.0%	8.0	6.89	0.689	0.890	
				Rear	165	5825	100.0%	8.0	6.92	0.654	0.839	
				Edge 2	165	5825	100.0%	8.0	6.92	0.538	0.690	
5.3 (U-NII 2A)	802.11ac (VHT80)	MIMO	0	Rear	58	5290	100.0%	9.0	8.02	0.751	**0.941**	10
				Edge 2	58	5290	100.0%	9.0	8.02	0.569	0.713	
5.5 (U-NII 2C)	802.11ac (VHT80)	MIMO	0	Rear	138	5690	100.0%	9.0	8.01	0.578	**0.726**	11
				Edge 2	138	5690	100.0%	9.0	8.01	0.459	0.576	
5.8 (U-NII 3)	802.11n (HT20)	MIMO	0	Rear	149	5745	100.0%	10.5	9.94	0.748	**0.852**	12
				Rear	157	5785	100.0%	10.5	9.46	0.577	0.733	
				Edge 2	149	5745	100.0%	10.5	9.94	0.617	0.703	

9.3 Bluetooth

Mode	Antenna	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up Limit	Meas.	Meas.	Scaled	
GFSK_1M	Chain 1	0	Rear	78	2480	76.80%	4.0	3.71	0.106	**0.148**	13
			Edge 2	78	2480	76.80%	4.0	3.71	0.050	0.070	

10 SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

W i-Fi (U-NII Band)

RF Exposure Conditions	Mode	Antenna	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	**Delta Target ≤ 5%**
								Original	Repeated		
5.3 (U-NII 2A)	802.11a	Chain 1	0	Rear	56	5280	100.0%	0.974	0.932	1.05	-4%
5.5 (U-NII 2C)	802.11a	Chain 1	0	Rear	144	5720	100.0%	1.040	1.040	1.00	0%

Note(s):
Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is < 1.20.

11 Simultaneous Transmission SAR Analysis

KDB 447498 D04 General RF Exposure Guidance provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

Sum of SAR

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

SAR to Peak Location Ratio (SPLSR)

KDB 447498 D01 General RF Exposure Guidance explains how to calculate the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$\mathbf{SPLSR = (SAR_1 + SAR_2)^{1.5} /Ri}$$

Where:

$\mathbf{SAR_1}$ is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

$\mathbf{SAR_2}$ is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $\mathbf{[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]}$

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$\mathbf{(SAR_1 + SAR_2)^{1.5} /Ri \leq 0.04}$$

When an individual antenna transmits at on two bands simultaneously, the sum of the highest reported SAR for the frequency bands should be used to determine SAR1.or SAR2. When SPLSR is necessary, the smallest distance between the peak SAR locations for the antenna pair with respect to the peaks from each antenna should be used.

The antennas in all antenna pairs that do not qualify for simultaneous transmission SAR test exclusion must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
Standalone	1	DTS_Main	+	BT_Aux
	2	DTS_MIMO	+	BT_Aux
	3	U-NII_Main	+	BT_Aux
	4	U-NII_MIMO	+	BT_Aux

Estimated SAR for Simultaneous Transmission SAR Analysis
Considerations for SAR estimation

1. When standalone SAR test exclusion applies, standalone SAR must also be estimated to determine simultaneous transmission SAR test exclusion.
2. Please refer to Estimated SAR Tables to see which test positions are inherently compliant as they consist of only estimated SAR values for all applicable transmitters and consequently will always have sum of SAR values < 1.2 W/kg. Simultaneous transmission SAR analysis was therefore not performed for these test positions.
3. Refer to Appendix C of KDB 447498 D01 and multiply the corresponding ratio by the 1-g SAR limit of 1.6 W/kg SAR.

Estimated SAR for 1.5 GHz ≤ *f* ≤ 6 GHz

Tx Interface	Frequency (GHz)	Output Power dBm	Output Power mW	Antenna Gain (dBi)	ERP (dBm)	ERP Threshold (mW)	Separation Distances (cm) Rear	Edge1	Edge2	Edge3	Edge4	P_{th}(mW) Rear	Edge1	Edge2	Edge3	Edge4	Exemption result Rear	Edge1	Edge2	Edge3	Edge4
WiFi 2.4GHz(Main)	2.462	12.00	16	2.6	12.45	17.58	0.5	5.49	0.5	14.49	28.74	3	261	3	1657	3060	-MEASURE-	0.108	-MEASURE-	0.017	0.009
WiFi 5.2GHz(Main)	5.24	8.00	6	3.93	9.78	9.51	0.5	5.49	0.5	14.49	28.74	1	211	1	1572	3060	-MEASURE-	0.072	-MEASURE-	0.010	0.005
WiFi 5.3GHz(Main)	5.32	8.00	6	3.93	9.78	9.51	0.5	5.49	0.5	14.49	28.74	1	210	1	1570	3060	-MEASURE-	0.072	-MEASURE-	0.010	0.005
WiFi 5.5GHz(Main)	5.7	8.00	6	3.93	9.78	9.51	0.5	5.49	0.5	14.49	28.74	1	206	1	1563	3060	-MEASURE-	0.074	-MEASURE-	0.010	0.005
WiFi 5.8GHz(Main)	5.825	8.00	6	3.93	9.78	9.51	0.5	5.49	0.5	14.49	28.74	1	205	1	1560	3060	-MEASURE-	0.074	-MEASURE-	0.010	0.005
WiFi 2.4GHz(Aux)	2.462	12.00	16	2.58	12.43	17.50	0.5	13.16	0.5	7.12	28.78	3	1380	3	429	3060	-MEASURE-	0.020	-MEASURE-	0.065	0.009
WiFi 5.2GHz(Aux)	5.24	8.00	6	2.69	8.54	7.14	0.5	13.16	0.5	7.12	28.78	1	1288	1	362	3060	-MEASURE-	0.009	-MEASURE-	0.032	0.004
WiFi 5.3GHz(Aux)	5.32	8.00	6	2.69	8.54	7.14	0.5	13.16	0.5	7.12	28.78	1	1286	1	361	3060	-MEASURE-	0.009	-MEASURE-	0.032	0.004
WiFi 5.5GHz(Aux)	5.7	8.00	6	2.69	8.54	7.14	0.5	13.16	0.5	7.12	28.78	1	1278	1	355	3060	-MEASURE-	0.009	-MEASURE-	0.032	0.004
WiFi 5.8GHz(Aux)	5.825	8.00	6	2.69	8.54	7.14	0.5	13.16	0.5	7.12	28.78	1	1276	1	353	3060	-MEASURE-	0.009	-MEASURE-	0.032	0.004
BT	2.48	4.00	3	2.58	4.43	2.77	0.5	13.16	0.5	7.12	28.78	3	1379	3	428	3060	-MEASURE-	0.003	-MEASURE-	0.011	0.002
WiFi 2.4GHz(MIMO)	2.462	14.00	25	2.6	14.45	27.86	0.5	5.49	0.5	7.12	28.74	3	261	3	429	3060	-MEASURE-	0.171	-MEASURE-	0.104	0.015
WiFi 5.2GHz(MIMO)	5.24	9.00	8	3.93	10.78	11.97	0.5	5.49	0.5	7.12	28.74	1	211	1	362	3060	-MEASURE-	0.091	-MEASURE-	0.053	0.006
WiFi 5.3GHz(MIMO)	5.32	9.00	8	3.93	10.78	11.97	0.5	5.49	0.5	7.12	28.74	1	210	1	361	3060	-MEASURE-	0.091	-MEASURE-	0.053	0.006
WiFi 5.5GHz(MIMO)	5.7	9.00	8	3.93	10.78	11.97	0.5	5.49	0.5	7.12	28.74	1	206	1	355	3060	-MEASURE-	0.093	-MEASURE-	0.054	0.006
WiFi 5.8GHz(MIMO)	5.825	10.50	11	3.93	12.28	16.90	0.5	5.49	0.5	7.12	28.74	1	205	1	353	3060	-MEASURE-	0.132	-MEASURE-	0.077	0.009

11.1 Sum of the SAR for Wi-Fi & BT

Test Position	Standalone SAR (W/kg) DTS Chain 0 ①	DTS Chain 1 ②	DTS MIMO ③	U-NII Chain 0 ④	U-NII Chain 1 ⑤	U-NII MIMO ⑥	BT Chain 1 ⑦	∑ 1-g SAR (W/kg) DTS + BT ① + ⑦	DTS + BT ③ + ⑦	U-NII + BT ④ + ⑦	U-NII + BT ⑥ + ⑦
Rear	0.394	0.790	0.529	0.338	1.181	0.941	0.148	0.542	0.677	0.486	1.089
Edge 2	0.186	0.306	0.227	0.382	1.029	0.713	0.070	0.256	0.297	0.452	0.783

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because either the sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

12 Equipment List & Calibration Status

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	SPEAG	DAKS_VNA R140	0140417	2023/1/24
Dielectric Assessment Kit	SPEAG	DAKS-3.5	1001	2023/1/26
Thermometer	TES	TES-1306	210801061	2022/10/21

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Signal Generator	Agilent	N5181A	MY50141235	2023/7/22
Power Meter	Anritsu	ML2496A	2136002	2022/12/5
Power Sensor	Anritsu	MA2411B	1911386	2022/10/24
Power Sensor	Anritsu	MA2411B	1911387	2022/8/18
Dual Directional Coupler	Agilent	772D	MY46151242	2022/9/10
Amplifier	EMCI	ZHL-42	S1900976	N/A
Amplifier	EMCI	ZVE-8G	S1900977	N/A
Data Acquisition Electronice	SPEAG	DAE4	1260	2022/9/19
Dosimetric E-Field Probe	SPEAG	EX3DV4	3665	2022/8/24
Dosimetric E-Field Probe	SPEAG	EX3DV4	7642	2023/3/2
System Validation Dipole	SPEAG	D2450V2	727	2023/4/24
System Validation Dipole	SPEAG	D5GHzV2	1023	2023/1/26
Humidity/Temp meter	TECPEL	DTM-303A	TP130075	2023/1/13
Thermometer	TES	TES-1306	210801061	2022/10/21

Software Version
DASY NEO52 D10.3 S14.6.13
SEMCAD-X-PostPro

13 Facilities

All measurement facilities used to collect the measurement data are located at

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan. (R.O.C.)

14 Appendixes

Exhibit	Content
1	SAR Setup Photos
2	SAR System Check Plots
3	Highest SAR Test Plots
4	SAR DAE and Probe Calibration Certificates
5	SAR Dipole Calibration Certificates

END OF REPORT