TEST REPORT

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1. Client

- Name : DREAMUS COMPANY
- Address : 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Republic of Korea
- Date of Receipt : 2019-04-11

2. Use of Report : -

3. Name of Product and Model : SP2000 / PPF33

4. Manufacturer and Country of Origin : DREAMUS COMPANY / Korea

5. FCC ID : QDMPPF33

6. Date of Test : 2019-05-14 to 2019-05-25

7. Test Standards : IEEE 1528-2013, ANSI/IEEE C95.1, KDB Publication

8. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Kyounghoo Min (Signature)	Technical Manager Name : Jongwon Ma (Signature)

2019-06-11

KCTL Inc.

Report revision history

Date	Revision	Page No
2019-05-31	Initial report	-
2019-06-07	Revised Bluetooth Average Conducted Output Power Revised Simultaneous Transmission Configurations	21 26
2019-06-11	Revised SAR Test Exclusions Applied table	22

Please note: Report KR19-SPF00011-B issued on 2019-06-11 supersedes previously issued report KR19-SPF00011-A issued on 2019-06-07.

This test report is a general report that does not use the KOLAS accreditation mark and is not related to KOLAS accreditation.

CONTENTS

1. General information

Client	:	DREAMUS COMPANY
Address	:	5, Bangbae-ro 18gil, Seocho-gu, Seoul, Republic of Korea
Manufacturer	:	DREAMUS COMPANY
Address	:	5, Bangbae-ro 18gil, Seocho-gu, Seoul, Republic of Korea
Contact Person		Yewon.Jeong / yewon.jeong@iriver.com
Laboratory	:	KCTL Inc.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-3327, G-198, C-3706, T-1849 Industry Canada Registration No. : 8035A KOLAS No.: KT231

2. Device information

2.1 Basic description

EUT Type	SP2000
Brand Name	DREAMUS COMPANY
Mode of Operation	WLAN 2.4 ㎓ / 5 ㎓, Bluetooth
Model Number	PPF33
Serial Number	57
Tx Freq. Range	WLAN 2.4 ㎓: 2 412 ㎒ ~ 2 462 ㎒ WLAN 5.2 ㎓: 5 180 ㎒ ~ 5 240 ㎒ WLAN 5.8 ㎓: 5 745 ㎒ ~ 5 825 ㎒ Bluetooth: 2 402 ㎒ ~ 2 480 ㎒

2.2 Summary of SAR Test Results

Band	Equipment Class	Highest Reported
		1g Body (W/㎏)
802.11b	DTS	0.05
U-II-1	NII	1.29
U-NII-3	NII	0.22
Simultaneous SAR per KDB 690783 D01v01r03		N/A

3. Report Overview

This report details the results of testing carried out on the samples listed in section 2, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this test report is used in any configuration other than that detailed in the test report, the manufacturer must ensure the new configuration complies with all relevant standards and certification requirements. Any mention of KCTL Inc. Wireless lab or testing done by KCTL Inc. Wireless lab made in connection with the distribution or use of the tested product must be approved in writing by KCTL Inc. Wireless lab.

4. Test Lab Declaration or Comments

None

5. Applicant Declaration or Comments

None

6. SAR Test Methods and Procedures

The tests documented in this report were performed in accordance with IEEE Standard 1528-2003 & IEEE 1528a-2005 and the following published KDB procedures:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 447498 D03 Supplement C Cross-Reference v01
- 865664 D01 SAR measurement 100 ㎒ to 6 ㎓ v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D06 Hotspot Mode v02r01
- October 2016 TCB Workshop Notes (Bluetooth Duty Factor)
- April 2019 TCB Workshop Notes (Tissue Simulating Liquids)

7. Measurement Uncertainty

Per KDB 865664 D01 SAR measurement 100 ㎒ to 6 ㎓, when the highest measured 1-g SAR within a frequency band is < 1.5 W/㎏ and the measured 10-g SAR within a frequency band is < 3.75 W/㎏. 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 IEEE Standard 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/㎏ and highest measured 10-g SAR is less 3.75W/㎏. Therefore, the measurement uncertainty table is not required in this report.

8. Specific Absorption Rate

8.1 Introduction

The SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational / controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

8.2 SAR Definition

The SAR definition is 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). The equation description is as below:

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

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

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathrm{SAR} = C\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength. However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

8.3 SAR Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (''SAR'') in Section 4.2 of ''IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 ㎓,'' ANSI/IEEE C95.3–2003, Copyright 2003 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements

(NCRP) in ''Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields,'' NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. 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. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100 kHz to 6 ㎓. Portable devices that transmit at frequencies above 6 ㎓ are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter. Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 ㎓ should be made at a minimum distance of 5 cm from the radiating source.

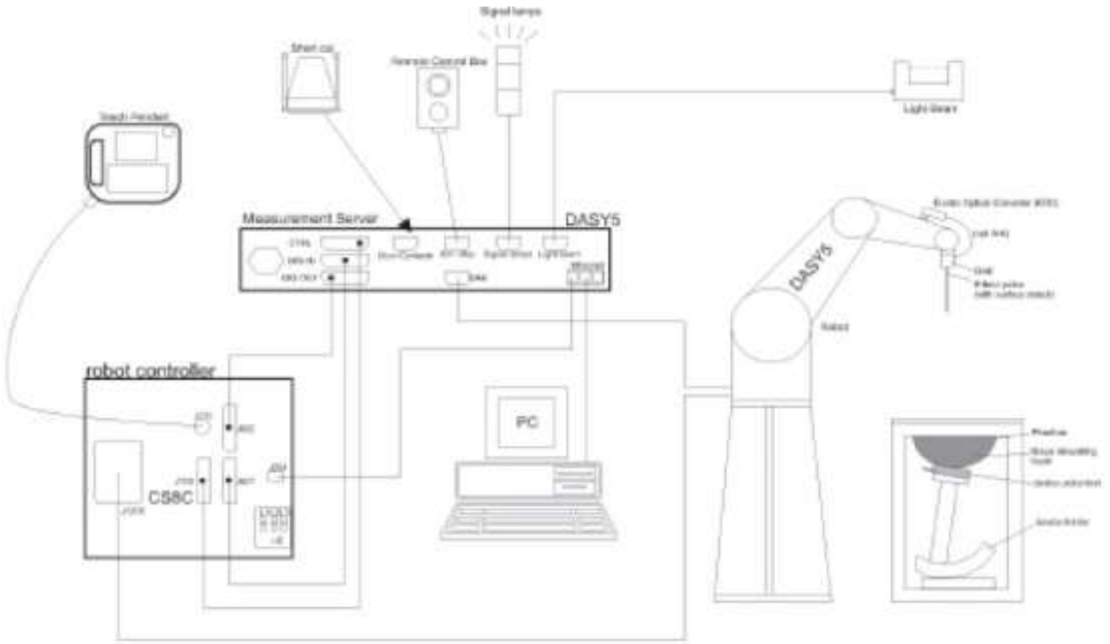
(1) Limits for Occupational/Controlled exposure: 0.4 W/㎏as averaged over the whole-body and spatial peak SAR not exceeding 8 W/㎏ as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/㎏, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube). Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.

(2) Limits for General Population/Uncontrolled exposure: 0.08 W/㎏ as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/㎏ as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/㎏, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section.

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Partial Peak SAR 1) (Partial)	1.60 m W/g	8.00 m W/g
Partial Average SAR 2) (Whole Body)	0.08 m W/g	0.40 m W/g
Partial Peak SAR 3) (Hands/Feet/Ankle/Wrist)	4.00 m W/g	20.00 m W/g

1) The spatial Peak value of the SAR averaged over any 1g 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.

9. The SAR Measurement System



<SAR System Configuration>

- 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 Windows XP or Windows 7 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.

9.1 Data Acquisition Electronics

Type	DAE3, DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Calibration	ISO/IEC 17025 calibration (Annual)
Measurement Mange	−100 – +300 mV (16 bit resolution and two range settings: 4 mV, 400 mV)
Input Offset Voltage	< 5 ㎶ (with auto zero)
Input Resistance	200 Mohm
Input Bias Current	< 50 fA

9.2 Isotropic E-field Probe

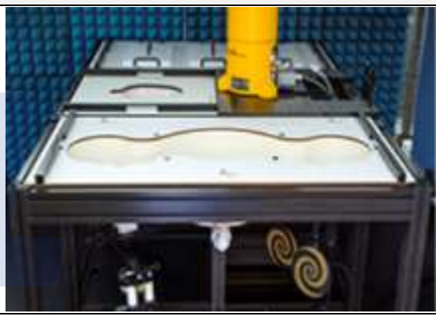
Type	EX3DV4
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material(resistant to organic solvents)
Calibration	ISO/IEC 17025 calibration (Annual)
Frequency	10 ㎒ to 6 ㎓ Linearity: ± 0.2 dB (30 ㎒ to 6 ㎓)
Directivity	± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 ㎼/g to > 100 ㎽/g Linearity: ± 0.2 dB (noise: typically < 1 ㎼/g)
Dimensions	Overall length: 337 ㎜ (Tip: 20 ㎜) Tip diameter: 2.5 ㎜ (Body: 12 ㎜) Typical distance from probe tip to dipole centers: 1 ㎜

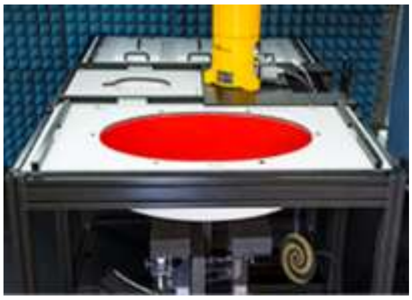
Type	ES3DV3
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material(resistant to organic solvents)
Calibration	ISO/IEC 17025 calibration (Annual)
Frequency	10 ㎒ to 4 ㎓ Linearity: ± 0.2 dB (30 ㎒ to 4 ㎓)
Directivity	± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 ㎼/g to > 100 ㎽/g Linearity: ± 0.2 dB (noise: typically < 1 ㎼/g)
Dimensions	Overall length: 337 ㎜ (Tip: 20 ㎜) Tip diameter: 3.9 ㎜ (Body: 12 ㎜) Typical distance from probe tip to dipole centers: 2 ㎜

9.3 System Validation Dipoles

Type	Dipole Antenna	
Construction	Symmetrical dipole with λ/4 balun. Enables measurement of feed point impedance with network analyzers (NWA) Matched for use near flat phantoms filled with tissue simulating liquids	
Calibration	ISO/IEC 17025 calibration (Biennial)	
Frequency	300 ㎒ to 6 ㎓	
Return Loss	> 20 dB at specified validation position	
Power Capability	>100 W (*f* <1 ㎓); >40 W (*f* >1 ㎓)	

9.4 Phantom

Type	Twin SAM	
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. 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 teaching three points with the robot.	
Material	Vinyl ester, fiberglass reinforced (VE-GF)	
Shell Thickness	2 ± 0.2 ㎜ (6 ± 0.2 ㎜ at ear point)	
Dimensions	Length: 1000 ㎜ Width: 500 ㎜ Height: adjustable feet	
Filling Volume	approx. 25 liters	

Type	ELI	
Construction	The ELI phantom is used for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 ㎒ to 6 ㎓. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids by teaching three points with the robot.	
Material	Vinyl ester, fiberglass reinforced (VE-GF)	
Shell Thickness	2 ± 0.2 ㎜ (bottom plate)	
Dimensions	Major axis: 600 ㎜ / Minor axis: 400 ㎜	
Filling Volume	approx. 300 liters	

9.5 Device Holder for Transmitters

Construction	In combination with the Twin SAM or ELI phantoms, the Mounting Device for Hand-held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to Standard or other specifications. The device holder can be locked for positioning at different phantom sections	
Type	MD4HHTV5	MD4LAPV5
Photo		
Material	Polyoxymethylene(POM)	Polyoxymethylene(POM), PET-G, Foam

10. Test Equipment Information

Test Platform	SPEAG DASY5 System			
Version	DASY5 : Version 52.10.2.1495 SEMCAD : Version 14.6.12 (7450)			
Location	KCTL Inc.			
Manufacture	SPEAG			
Hardware Reference				
Equipment	Model	Serial Number	Date of Calibration	Due date of next Calibration
Shield Room	Shield Room	8F - #1	N/A	N/A
Shield Room	Shield Room	8F - #2	N/A	N/A
DASY5 Robot	TX90XL Speag	F07/554JA1/A/01	N/A	N/A
DASY5 Controller	TX90XL Speag	F07/554JA1/C/01	N/A	N/A
DASY5 Robot	TX90XL Speag	F12/5L7FA1/A/01	N/A	N/A
DASY5 Controller	TX90XL Speag	F12/5L7FA1/C/01	N/A	N/A
Phantom	Twin SAM Phantom	1363	N/A	N/A
Phantom	Twin SAM Phantom	1728	N/A	N/A
Mounting Device	Mounting Device	None	N/A	N/A
DAE	DAE4	666	2019-01-25	2020-01-25
DAE	DAE4	1567	2019-02-05	2020-02-05
Probe	EX3DV4	3865	2018-08-29	2019-08-29
Probe	EX3DV4	3928	2019-01-31	2020-01-31
Signal Generator	E4438C	MY42080486	2019-05-13	2020-05-13
Dual Power Meter	E4419B	GB43312301	2019-05-13	2020-05-13
Power Sensor	8481H	3318A19377	2019-05-13	2020-05-13
Power Sensor	8481H	3318A19379	2019-05-13	2020-05-13
Attenuator	8491B 3dB	17387	2019-05-13	2020-05-13
Attenuator	8491B-6dB	MY39270294	2019-05-13	2020-05-13
Attenuator	8491B 10dB	29425	2019-05-13	2020-05-13
Power Amplifier	2055-BBS3Q7E9I	1005D/C0521	2019-03-08	2020-03-08
Power Amplifier	5190FE	1012	2019-05-14	2020-05-14
Dual Directional Coupler	772D	2839A00719	2019-05-13	2020-05-13
Low Pass Filter	LA-30N	40058	2019-05-13	2020-05-13
Low Pass Filter	LA-60N	40059	2019-05-13	2020-05-13
Dipole Validation Kits	D2450V2	895	2018-07-24	2020-07-24
Dipole Validation Kits	D5㎓V2	1130	2018-05-25	2020-05-25
Network Analyzer	E5071B	MY42403524	2019-01-04	2020-01-04
Dielectric Assessment kit	DAK-3.5	1078	2018-08-22	2019-08-22
Humidity/Temp.	MHB-382SD	23107	2018-06-14	2019-06-14
Humidity/Temp.	MHB-382SD	46307	2019-04-10	2020-04-10

11. System Verification

11.1 Tissue Verification

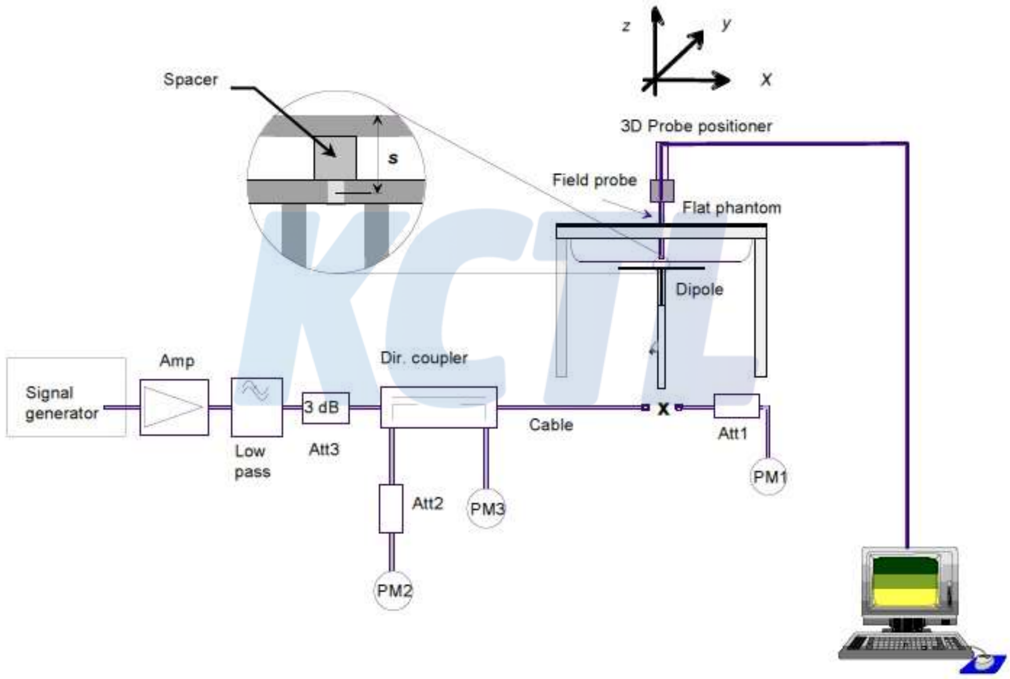
The dielectric properties for this Tissue Simulant Liquids were measured by using the SPEAG Model DAK3.5 Dielectric Probe in conjunction with Agilent E5071B Network Analyzer (300 kHz – 8 500 ㎒). The Conductivity (σ) and Permittivity (ρ) are listed in Table 1.For the SAR measurement given in this report. The temperature variation of the Tissue Simulant Liquids was (22 ± 2) ℃.

Freq. (㎒)	Tissue Type	Limit/Measured	Permittivity (ρ)	Conductivity (σ)	Temp (℃)
2 450	HSL	Recommended Limit	39.20 ± 5 % (37.24 ~ 41.16)	1.80 ± 5 % (1.71 ~ 1.89)	22 ± 2
		Measured, 2019-05-25	39.46	1.82	20.27
5 200	HSL	Recommended Limit	36.00 ± 5 % (34.20 ~ 37.80)	4.66 ± 5 % (4.43 ~ 4.89)	22 ± 2
		Measured, 2019-05-14	35.72	4.62	20.68
5 800	HSL	Recommended Limit	35.30 ± 5 % (33.54 ~ 37.07)	5.27 ± 5 % (5.01 ~ 5.53)	22 ± 2
		Measured, 2019-05-22	35.79	5.46	20.56

<Table 1.Measurement result of Tissue electric parameters>

11.2 Test System Verification

The microwave circuit arrangement for system verification is sketched below picture. The daily system accuracy verification occurs within the flat section of the SAM phant om. A SAR measurement was performed to see if the measured SAR was within ± 1 0% from the target SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the Table 2. During the tests, the ambient temperature of the laboratory was in the range (22 ± 2) ℃, the relative humidity was in the range(50 ± 20)% and the liquid depth Above the ear/grid reference points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the re sults are within acceptable tolerance of the reference values.



Validation Kit	Dipole Ant. S/N	Frequency (㎒)	Tissue Type	Limit/Measurement (Normalized to 1 W)	
				1 g	
D2450V2	895	2 450	HSL	Recommended Limit (Normalized)	51.30 ± 10 % (46.17 ~ 56.43)
				Measured, 2019-05-25	50.80
D5GHzV2	1130	5 200	HSL	Recommended Limit (Normalized)	77.50 ± 10 % (69.75 ~ 85.25)
				Measured, 2019-05-14	79.10
D5GHzV2	1130	5 800	HSL	Recommended Limit (Normalized)	83.00 ± 10 % (74.70 ~ 91.30)
				Measured, 2019-05-22	80.90

<Table 2.Test System Verification Result>

12. SAR Measurement Procedures

12.1 SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 1.4 ㎜. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan & Zoom 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 and Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing1 g and 10 g of simulated tissue. 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 & Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 ㎒ to 6 ㎓ v01r04.

			≤ 3 ㎓	> 3 ㎓
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ㎜ ± 1 ㎜	½·δ·ln(2) ㎜ 0.5 ㎜
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: ΔxArea, ΔyArea			≤ 2 ㎓: ≤ 15 ㎜ 2 – 3 ㎓: ≤ 12 ㎜	3 – 4 ㎓: ≤ 12 ㎜ 4 – 6 ㎓: ≤ 10 ㎜
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: ΔxZoom, ΔyZoom			≤ 2 ㎓: ≤ 8 ㎜ 2 – 3 ㎓: ≤ 5 ㎜*	3 – 4 ㎓: ≤ 5 ㎜* 4 – 6 ㎓: ≤ 4 ㎜*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: ΔzZoom(n)		≤ 5 ㎜	3 – 4 ㎓: ≤ 4 ㎜ 4 – 5 ㎓: ≤ 3 ㎜ 5 – 6 ㎓: ≤ 2 ㎜
	graded grid	ΔzZoom(1): between 1st two points closest to phantom surface	≤ 4 ㎜	3 – 4 ㎓: ≤ 3 ㎜ 4 – 5 ㎓: ≤ 2.5 ㎜ 5 – 6 ㎓: ≤ 2 ㎜
		ΔzZoom(n>1): between subsequent points	≤ 1.5·ΔzZoom(n-1) ㎜	
Minimum zoom scan volume	x, y, z		≥ 30 ㎜	3 – 4 ㎓: ≥ 28 ㎜ 4 – 5 ㎓: ≥ 25 ㎜ 5 – 6 ㎓: ≥ 22 ㎜
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/㎏, ≤ 8 ㎜, ≤ 7 ㎜ and ≤ 5 ㎜ zoom scan resolution may be applied, respectively, for 2 ㎓ to 3 ㎓, 3 ㎓ to 4 ㎓ and 4 ㎓ to 6 ㎓.				

Step 3: 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.

13. WLAN Measured Procedures

13.1 General Device Setup

The normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable.

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.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 – 96％ is typically achievable in most test mode configurations. A minimum transmission duty factor of 85％ is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100％ transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

13.2 U-NII-1 and U-NII-2A

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is > 1.2 W/kg. When different maximum output powers is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is > 1.2 W/kg.

13.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 ㎒ (5.47 – 5.85 ㎓), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements.

When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 ㎓ in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification.

Unless band gap channels are permanently disabled, SAR must be considered for these channels.

When band gap channels are disabled, each band is tested independently according to the normally required OFDM SAR measurement and probe calibration frequency point requirements.

13.4 2.4 ㎓ SAR Test Requirement

SAR is measured for 2.4 ㎓ 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following.

1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
2) When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel; i.e., all channels require testing.

2.4 ㎓ 802.11g/n OFDM are additionally evaluated for SAR if highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 ㎓ band, the Initial Test Configuration Procedures should be followed.

13.5 OFDM Transmission Mode and SAR Test Channel Selection

For the 2.4 ㎓ and 5 ㎓ band, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a, 802.11n and 802.11ac or 802.11g and 802.11n with the same channel band width, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 802.11n and 802.11ac or 802.11g then 802.11n, is used for SAR measurement. When maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

13.6 Initial Test Configuration Procedure

For OFDM, in both 2.4 and 5 ㎓ bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, and lowest data rate. If the average RF output powers of the highest identical transmission modes are within 0.25 dB of each other, mid channel of the transmission mode with highest average RF output power is the initial test channel. Otherwise, the channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration. When the reported SAR is ≤ 0.8 W/㎏, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/㎏ or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements.

13.7 Subsequent Test Configuration Procedures

For OFDM configurations in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure. When the highest reported SAR (for the initial test configuration), adjusted by the ratio of the specified maximum output power of the subsequent test configuration to initial test configuration, is ≤ 1.2 W/㎏, no additional SAR tests for the subsequent test configurations are required.

14. RF Average Conducted Output Power

14.1 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. Test highest reported SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

14.1.1 Maximum Tune-up power

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

Band	Ant	Mode	Channel	Output Power (㏈m)		
				Target	Max. Allowed	SAR Test
WLAN 2.4 ㎓	Ant 0	802.11b	All Channel	12.50	**14.00**	**Yes**
		802.11g	All Channel	11.50	**13.00**	No
		802.11n(HT20)	All Channel	11.50	**13.00**	No
		802.11n(HT40)	All Channel	11.50	**13.00**	No
WLAN 5.2 ㎓	Ant 0	802.11a	All Channel	13.00	**14.50**	**Yes**
		802.11n(HT20)	All Channel	12.50	**14.00**	No
		802.11n(HT40)	All Channel	12.50	**14.00**	No
		802.11ac(VHT80)	All Channel	12.50	**14.00**	No
WLAN 5.8 ㎓	Ant 0	802.11a	All Channel	11.50	**13.00**	**Yes**
		802.11n(HT20)	All Channel	10.50	**12.00**	No
		802.11n(HT40)	All Channel	10.50	**12.00**	No
		802.11ac(VHT80)	All Channel	10.50	**12.00**	No
Bluetooth	Ant 0	BDR(GFSK)	All Channel	0.50	**2.00**	No
		EDR (π/4DQPSK)	All Channel	-3.50	**-2.00**	No
		EDR(8DPSK)	All Channel	-3.50	**-2.00**	No

14.1.2 WLAN Average Conducted Output Power

Band	Ant	Mode	Conducted Powers (dBm)		
			Low	Mid.	High
WLAN 2.4 GHz	Ant 0	802.11b	13.13	13.30	13.24
WLAN 5.2 GHz	Ant 0	802.11a	14.23	14.29	14.02
WLAN 5.8 GHz	Ant 0	802.11a	12.67	12.72	12.75

14.1.3 Bluetooth Average Conducted Output Power

Mode	Ant	Conducted Powers (dBm)		
		Low	Mid.	High
BDR(GFSK)	Ant 0	-0.88	0.64	1.58
EDR (π/4DQPSK)	Ant 0	-3.39	-2.56	-2.33
EDR(8DPSK)	Ant 0	-3.35	-2.50	-2.28

15. SAR Test Exclusions Applied

Per FCC KDB 447498 D01v06, The SAR exclusion threshold for distance < 50 ㎜ is defined by the following equation:

$$\frac{\text{Max Power of Channel (mW)}}{\text{Test Separation Distance (mm)}} * \sqrt{\text{Frequency(GHz)}} \leq 3.0$$

For 100 ㎒ to 6 ㎓ and test separation distances > 50 ㎜, SAR exclusion threshold are determined by the following:

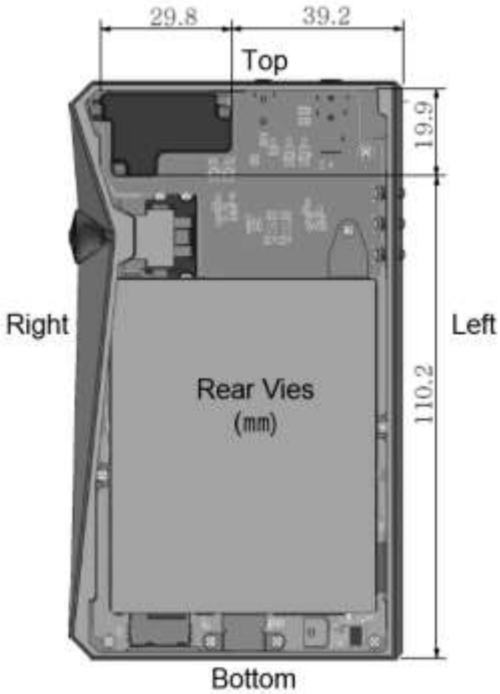
[(Threshold at 50 ㎜ in step 1) + (test separation distance - 50 ㎜) * (f(MHz)/150)] ㎽
at 100 ㎒ to 1500 ㎒

[(Threshold at 50 ㎜ in step 1) + (test separation distance - 50 ㎜) * 10] ㎽
at > 1500 MHz and ≤ 6 GHz

Separation distances (㎜)					
Front	Rear	Left	Right	Top	Bottom
5	5	39	5	5	110

Mode	Frequency (㎒)	Maximum Allowed Power (dBm)	Maximum Allowed Power (㎽)	SAR Exemption Front	SAR Exemption Rear	SAR Exemption Left	SAR Exemption Right	SAR Exemption Top	SAR Exemption Bottom
Bluetooth	2 480	**2.00**	2	0.63 Exempt	0.63 Exempt	0.08 Exempt	0.63 Exempt	0.63 Exempt	N/A
WLAN	2 437	**14.00**	25	7.81 Measure	7.81 Measure	1.00 Exempt	7.81 Measure	7.81 Measure	N/A
	5 200	**14.50**	28	12.77 Measure	12.77 Measure	1.64 Exempt	12.77 Measure	12.77 Measure	N/A
	5 825	**13.00**	20	9.65 Measure	9.65 Measure	1.24 Exempt	9.65 Measure	9.65 Measure	N/A

Note: Formulas round separation distance to nearest ㎜ and power to nearest ㎽ before calculating thresholds or exemption values.



16. SAR Test Results

16.1 WLAN 2.4 ㎓ Body SAR Test Results

802.11b Ant 0

EUT Position	Distance (㎜)	Frequency (㎒)	Measured Conducted Power (dB m)	Max. Tune-up Power (dB m)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1 g SAR (W/㎏)	Scaled 1 g SAR (W/㎏)	Plot No.
Front	5	2 437	13.30	14.00	1.175	1.010	0.000	0.000	
Rear	5	2 437	13.30	14.00	1.175	1.010	0.038	**0.045**	#1
Right	5	2 437	13.30	14.00	1.175	1.010	0.000	0.000	
Top	5	2 437	13.30	14.00	1.175	1.010	0.000	0.000	

16.2 WLAN 5.3 ㎓ Body SAR Test Results

802.11a Ant 0

EUT Position	Distance (㎜)	Frequency (㎒)	Measured Conducted Power (dB m)	Max. Tune-up Power (dB m)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1 g SAR (W/㎏)	Scaled 1 g SAR (W/㎏)	Plot No.
Front	5	5 200	14.29	14.50	1.050	1.075	0.044	0.049	
Rear	5	5 200	14.29	14.50	1.050	1.075	1.140	**1.287**	#2
Right	5	5 200	14.29	14.50	1.050	1.075	0.033	0.037	
Top	5	5 200	14.29	14.50	1.050	1.075	0.116	0.131	
Rear	5	5 180	14.23	14.50	1.064	1.075	1.060	1.213	
Rear	5	5 240	14.02	14.50	1.117	1.075	0.891	1.070	
Rear-ear	5	5 200	14.29	14.50	1.050	1.075	0.925	1.044	
Repeated (See Section 16)									
Rear	5	5 200	14.29	14.50	1.050	1.075	1.090	1.230	

16.3 WLAN 5.8 ㎓ Body SAR Test Results

802.11a Ant 0

EUT Position	Distance (㎜)	Frequency (㎒)	Measured Conducted Power (dB m)	Max. Tune-up Power (dB m)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1 g SAR (W/㎏)	Scaled 1 g SAR (W/㎏)	Plot No.
Front	5	5 825	12.75	13.00	1.059	1.075	0.000	0.000	
Rear	5	5 825	12.75	13.00	1.059	1.075	0.189	**0.215**	#3
Right	5	5 825	12.75	13.00	1.059	1.075	0.008	0.009	
Top	5	5 825	12.75	13.00	1.059	1.075	0.011	0.012	

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in FCC KDB Publication 447498 D01v06.
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings and the standard batteries are the only options.
4. Liquid tissue depth was at least 15 cm.
5. The EUT is tested 2nd hot-spot peak, if it is less than 2 dB below the highest peak.
6. 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.
7. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.

WLAN & Bluetooth Notes:

1. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 ㎓ WIFI operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4㎓ 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 ㎓ WIFI operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2W/㎏.
3. When the maximum reported 1g averaged SAR is ≤ 0.8 W/㎏, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/㎏ or all test channels were measured.
4. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance.
5. 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.
6. When the highest reported SAR for the initial test configuration (when applicable, include subsequent highest output channels), according to the initial test position or fixed exposure requirements, is adjusted by the ratio of the subsequent test configuration to the initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/㎏, SAR is not required for that subsequent test configuration.
7. WLAN & Bluetooth transmission was verified using a spectrum analyzer.

17. SAR Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg.
2) **When the original highest measured SAR is ≥ 0.80 W/㎏, the measurement was repeated once**.
3) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/㎏ (~ 10% from the 1-g SAR limit).
4) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/㎏ and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Band	Frequency (㎒)	EUT Position	Separation Distance (㎜)	Measured 1 g SAR (W/㎏)	Repeated 1g SAR (W/㎏)	Ratio
WLAN 5.2 ㎓	5 200	Rear	5	1.14	1.09	0.96

18. Simultaneous Transmission

18.1 Simultaneous Transmission Configurations

No	Scenario	Operation
1	WLAN 2.4 ㎓ + Bluetooth	No
2	WLAN 5 ㎓ + Bluetooth	No
3	WLAN 2.4 ㎓ + WLAN 5 ㎓	No

This device does not have simultaneous transmission.

18. Test System Verification Results

Date: 2019-05-25

Test Laboratory: KCTL Inc.
File Name: Head_D2450(190525).da5:0

DUT: Dipole 2450 MHz D2450V2, Type: D2450V2, Serial: D2450V2 - SN:895

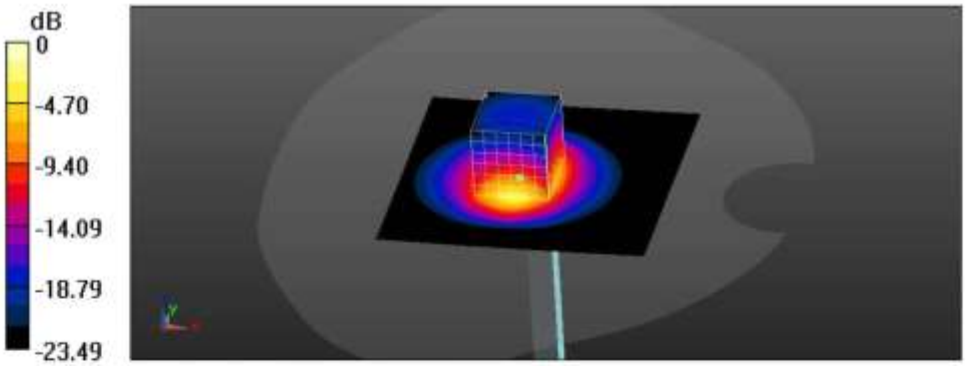
Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.819 S/m; ε_r = 39.459; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3865;ConvF(7.72, 7.72, 7.72) @ 2450 MHz; Calibrated: 2018-08-29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn666; Calibrated: 2019-01-25
- Phantom: Twin-SAM V4.0 (30deg probe tilt)_1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/d=10 mm, Pin=250 mW, dist=1.4 mm (EX-Probe)/Area Scan (91x91x1):
Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 19.4 W/kg

Configuration/d=10 mm, Pin=250 mW, dist=1.4 mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 86.89 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 27.0 W/kg
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.73 W/kg
Maximum value of SAR (measured) = 21.6 W/kg



0 dB = 21.6 W/kg = 13.34 dBW/kg

Date: 2019-05-14

Test Laboratory: KCTL Inc.
File Name: Head_D5.2GHz(190514).da52:0

DUT: Dipole D5GHzV2, Type: D5GHzV2, Serial: D5GHzV2 - SN:1130

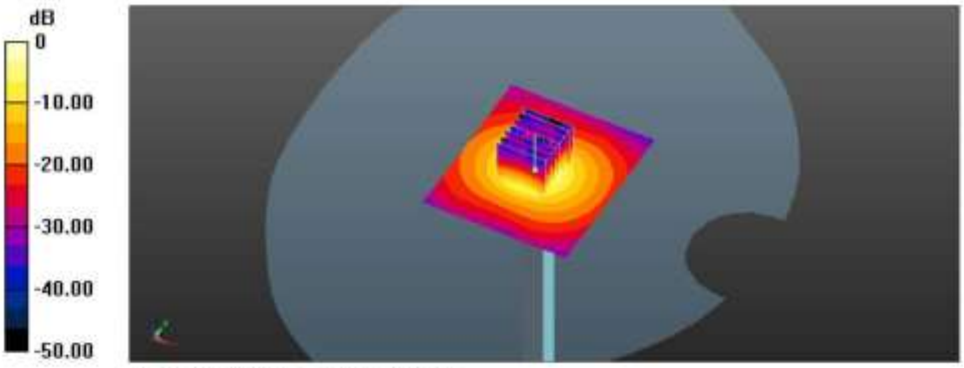
Communication System: UID 0, CW (0); Communication System Channel Number: 0;
Frequency: 5200 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 4.624 S/m; ε_r = 35.723; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3865; ConvF(4.88, 4.88, 4.88) @ 5200 MHz;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn666; Calibrated: 2019-01-25
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.8 (4);

Configuration/d=10mm, Pin=100mW, f=5200MHz/Area Scan (71x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.5 W/kg

Configuration/d=10mm, Pin=100mW, f=5200MHz/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.85 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 34.1 W/kg
SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 20.8 W/kg



0 dB = 20.8 W/kg = 13.18 dBW/kg

Date: 2019-05-22

Test Laboratory: KCTL Inc.
File Name: Head_D5.8GHz(190522).da52:0

DUT: Dipole D5GHzV2, Type: D5GHzV2, Serial: D5GHzV2 - SN:1130

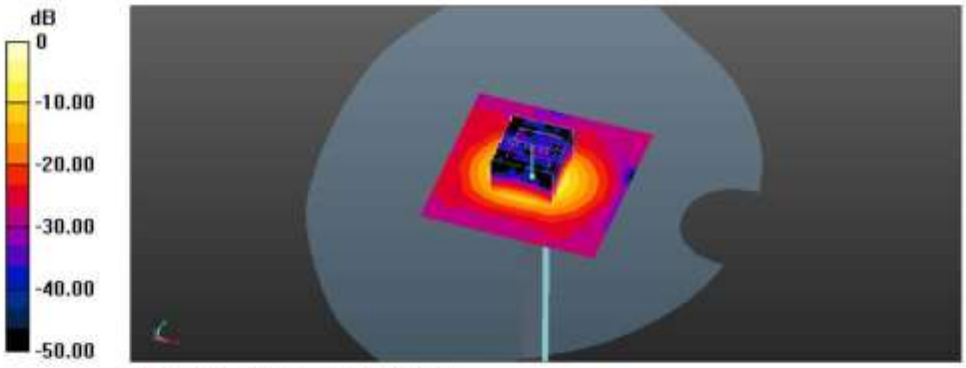
Communication System: UID 0, CW (0); Communication System Channel Number: 4;
Frequency: 5800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.457 S/m; ε_r = 35.788; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.7, 4.7, 4.7) @ 5800 MHz;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/d=10mm, Pin=100mW, f=5800MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 22.4 W/kg

Configuration/d=10mm, Pin=100mW, f=5800MHz/Zoom Scan (9x9x7)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.70 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 41.7 W/kg
SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.29 W/kg
Maximum value of SAR (measured) = 22.4 W/kg



0 dB = 22.4 W/kg = 13.50 dBW/kg

19. Test Results

#1

Date: 2019-05-25

Test Laboratory: KCTL Inc.
File Name: 2.802.11b_f.2 437_Rear_5 mm.da53:0

DUT: PPF33, Type: SP2000, Serial: 57

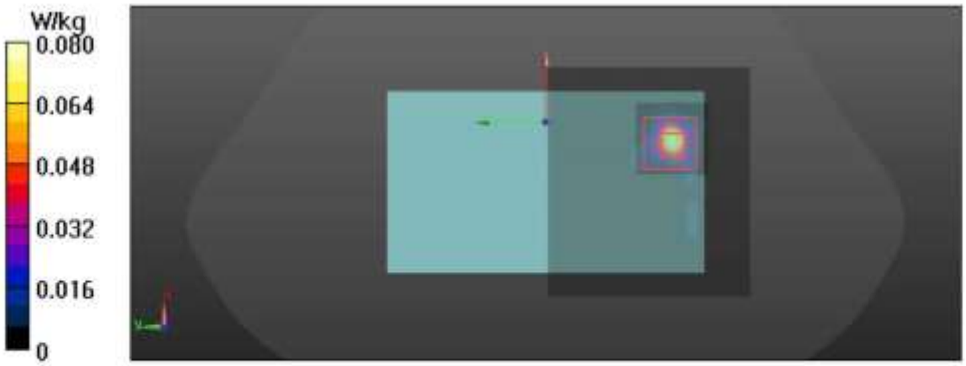
Communication System: UID 0, 2.4GWLAN (0); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2437 MHz; σ = 1.804 S/m; ε_r = 39.464; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3865;ConvF(7.72, 7.72, 7.72) @ 2437 MHz; Calibrated: 2018-08-29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn666; Calibrated: 2019-01-25
- Phantom: Twin-SAM V4.0 (30deg probe tilt)_1_20180808; Type: QD 000 P40 CC; Serial: 1363
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11b_f.2 437_Rear_5 mm/Area Scan (81x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.126 W/kg

Configuration/802.11b_f.2 437_Rear_5 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.150 W/kg
SAR(1 g) = 0.038 W/kg; SAR(10 g) = 0.0087 W/kg
Maximum value of SAR (measured) = 0.0803 W/kg



#2

Date: 2019-05-14

Test Laboratory: KCTL Inc.
File Name: 2.802.11a_f.5 200_Rear_5 mm.da53:0

DUT: PPF33, Type: SP2000, Serial: 57

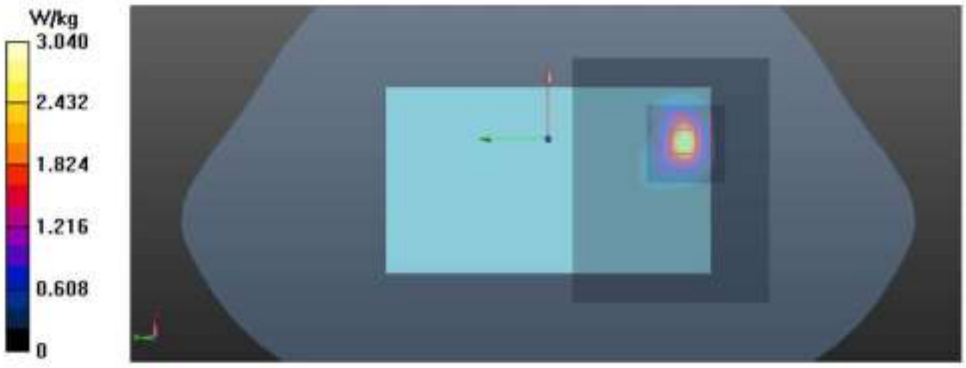
Communication System: UID 0, 5GWLAN; Communication System Channel Number: 40;
Frequency: 5200 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 4.624 S/m; ε_r = 35.723; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3865; ConvF(4.88, 4.88, 4.88) @ 5200 MHz;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn666; Calibrated: 2019-01-25
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11a_f.5 200_Rear_5 mm/Area Scan (101x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 3.15 W/kg

Configuration/802.11a_f.5 200_Rear_5 mm/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 5.037 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 5.47 W/kg
SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.301 W/kg
Maximum value of SAR (measured) = 3.04 W/kg



#3

Date: 2019-05-22

Test Laboratory: KCTL Inc.
File Name: 2.802.11a_f.5 825_Rear_5 mm.da53:0

DUT: PPF33, Type: SP2000, Serial: 57

Communication System: UID 0, 5GWLAN (0); Communication System Channel Number: 165; Frequency: 5825 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5825 MHz; σ = 5.479 S/m; ε_r = 35.781; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.7, 4.7, 4.7) @ 5825 MHz;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1567; Calibrated: 2019-02-05
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.10 (2);

Configuration/802.11n20_f.5 825_Rear_5 mm/Area Scan (101x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.559 W/kg

Configuration/802.11n20_f.5 825_Rear_5 mm/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 1.514 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 1.10 W/kg
SAR(1 g) = 0.189 W/kg; SAR(10 g) = 0.038 W/kg
Maximum value of SAR (measured) = 0.616 W/kg