TEST REPORT

KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea Tel : 82-31-285-0894 Fax : 82-505-299-8311 www.kctl.co.kr	Report No.: KR18-SPF0003-B Page (1) of (86)	KCTL

1. Client

- Name : Qualcomm Atheros, Inc.
- Address : 1700 Technology Drive, San Jose, CA 95110
- Date of Receipt : 2018-04-03

2. Use of Report : -

3. Product Name : Single Stream 802.11a/b/g/n/ac + BT 4.1 M.2 1216 Type Card

- Model Number : QCNFA425
- Manufacturer and Country of Origin : Qualcomm Atheros, Inc. / USA

4. Host Product Name : NoteBook PC

- Host Model Number : NP550XTA
- Manufacturer : Samsung Electronics Co., Ltd.

5. FCC ID : PPD-QCNFA425

6. Date of Test : 2018-04-09 to 2018-04-25

7. Test method used : 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 : Cheonsig, Choi (Signature)

2018-04-27

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2018-04-23	Originally issued	-
2018-04-25	Remove the Measurement Uncertainty	-
	Additional TEST SW 802.11ac(VHT80) RF power setting	6
	Additional Tissue Verification	14
	Additional Test System Verification	16
	Additional Test Results 802.11ac(VHT80)	27 ~ 29
	Remove 2.4 GHz WLAN + Bluetooth Simultaneous Transmission	30
	Change Test System Verification Results	31
	Additional Test System Verification Results	33, 35, 37
	Additional Test Results 802.11ac(VHT80)	40 ~ 43
2018-04-27	Additional Duty Cycle Compensate Factor	9
	Update the system verification result	17
	Additional Duty Cycle	25
	Additional Duty Cycle Compensate Factor	27 ~ 30

Please note: Report KR18-SPF0003-B issued on 2018-04-27 supercedes previously issued report KR18-SPF0003-A issued on 2018-04-25.

Contents

1. Client information

Client: Qualcomm Atheros, Inc.

Address: 1700 Technology Drive, San Jose, CA 95110

Telephone number: +1 858 658 3208

Contact person: Mark Ortlieb / mortlieb@qti.qualcomm.com

Manufacturer: Qualcomm Atheros, Inc.

Address: 1700 Technology Drive, San Jose, CA 95110

2. Laboratory information

Address

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea

TEL: 82-31-285-0894 FAX: 82-505-299-8311

Certificate

KOLAS No.: KT231

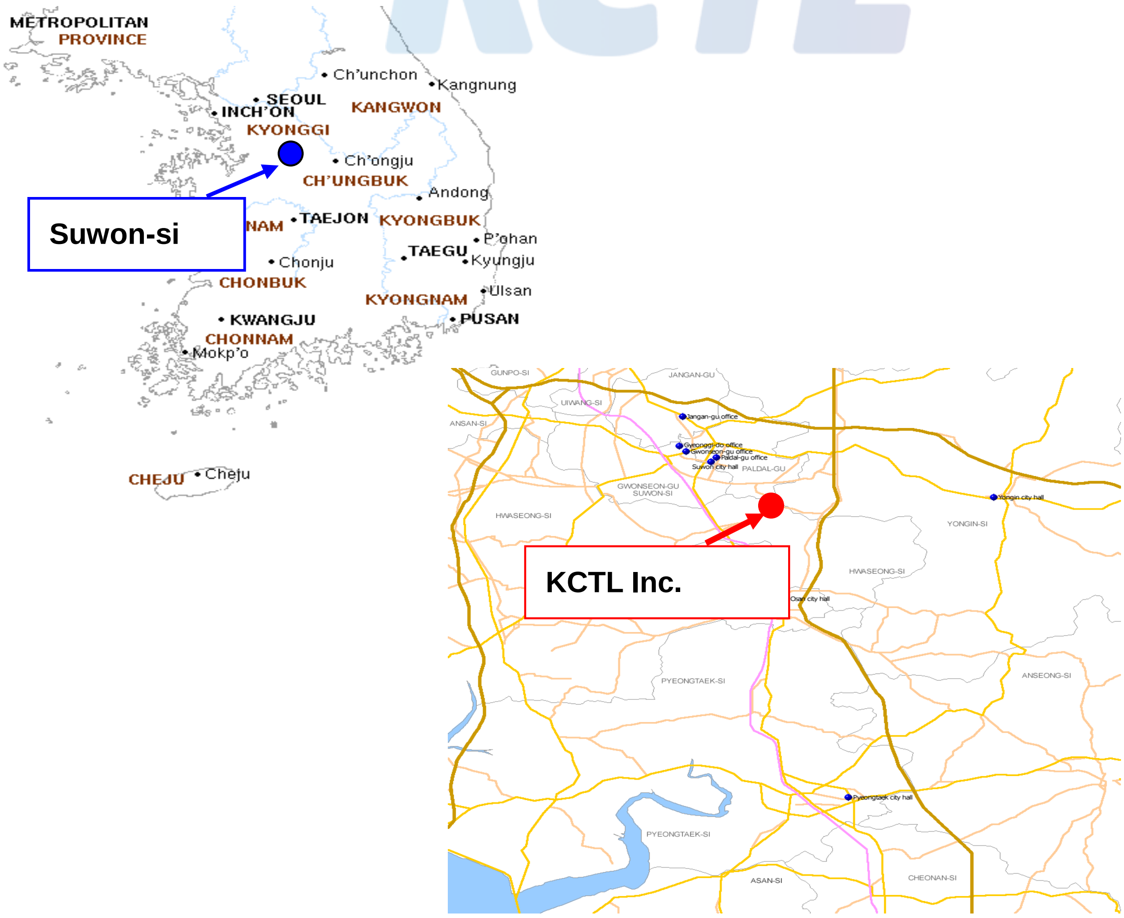
FCC Site Designation No.: KR0040

FCC Site Registration No.: 687132

VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849

IC Site Registration No.: 8035A-2

SITE MAP



3. Identification of Sample

3.1 Basic description

Product Name	Single Stream 802.11a/b/g/n/ac + BT 4.1 M.2 1216 Type Card
Product Model Number	QCNFA425
Product Manufacturer	Qualcomm Atheros, Inc.
Host Product Name	Notebook PC
Host Model Number	NP550XTA
Host Manufacturer	Samsung Electronics Co., Ltd.
Host Serial Number	0W7Q91ZK300015X
Mode of Operation	WLAN 2.4 GHz / 5 GHz, Bluetooth
Max. Power	WLAN 2.4 GHz : 17.00 dBm WLAN 5 GHz : 12.50 dBm
Tx Freq.Range	WLAN 2.4 GHz : 2 412 MHz ~ 2 462 MHz WLAN 5.2 GHz : 5 180 MHz ~ 5 240 MHz WLAN 5.3 GHz : 5 260 MHz ~ 5 320 MHz WLAN 5.6 GHz : 5 500 MHz ~ 5 720 MHz WLAN 5.8 GHz : 5 745 MHz ~ 5 825 MHz
Rx Freq.Range	WLAN 2.4 GHz : 2 412 MHz ~ 2 462 MHz WLAN 5.2 GHz : 5 180 MHz ~ 5 240 MHz WLAN 5.3 GHz : 5 260 MHz ~ 5 320 MHz WLAN 5.6 GHz : 5 500 MHz ~ 5 720 MHz WLAN 5.8 GHz : 5 745 MHz ~ 5 825 MHz
Antenna Type	PIFA Type Antenna
Antenna Size	28.00 mm x 4.50 mm
Normal Voltage	DC 11.4 V

3.2 RF power setting in TEST SW

WLAN 2.4 GHz

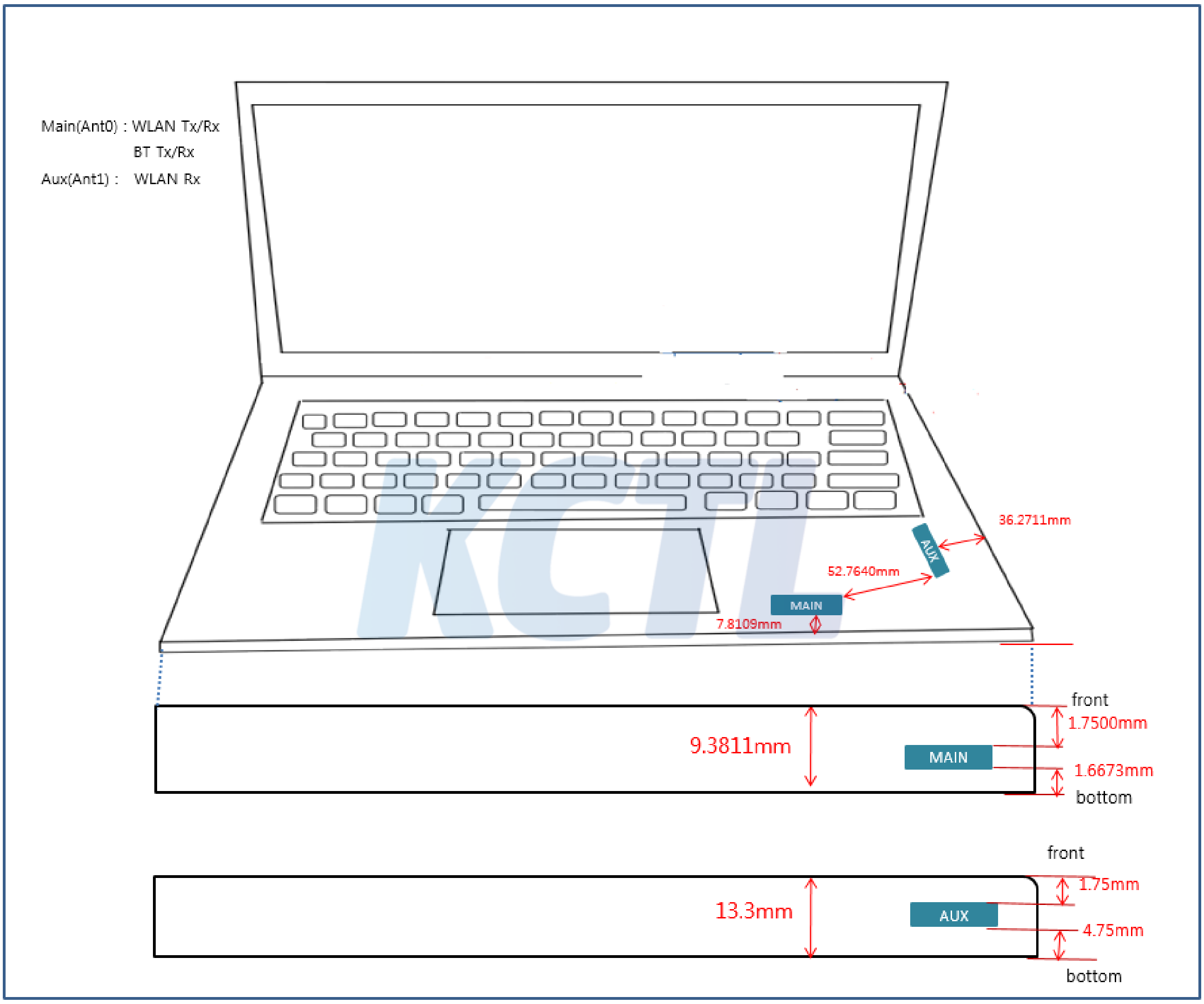
Mode	Lowest Channel	Middle Channel	Highest Channel
802.11b	14	14	14.5
802.11g	10	10	10
802.11n HT20	9.5	9.5	10
802.11n HT40	7.5	7.5	8
802.11ac VHT20	9.5	9.5	10
802.11ac VHT40	7.5	7.5	8

WLAN 5 GHz

Mode	Frequency Band	Lowest Channel	Middle Channel	Highest Channel	Straddle Channel
802.11a	5.2 GHz Band	8.5	8.5	8.5	-
	5.3 GHz Band	8.5	8.5	8.5	-
	5.5 GHz Band	9	9	9	9.5
	5.8 GHz Band	8.5	9	9.5	-
802.11n HT20 & 802.11ac VHT20	5.2 GHz Band	8.5	8.5	8.5	-
	5.3 GHz Band	9	9	9	-
	5.5 GHz Band	9.5	9.5	9.5	10
	5.8 GHz Band	9.5	9.5	10	-
802.11n HT40 & 802.11ac VHT40	5.2 GHz Band	7	-	8.5	-
	5.3 GHz Band	8.5	-	8.5	-
	5.5 GHz Band	9.5	9.5	9.5	9.5
	5.8 GHz Band	9.5	-	9.5	-
802.11ac VHT80	5.2 GHz Band	-	5	-	-
	5.3 GHz Band	-	8	-	-
	5.5 GHz Band	9.5	-	9.5	9.5
	5.8 GHz Band	-	9.5	-	-

3.3 Antenna Diagram

Front View
(Unit: mm)



- Main antenna operate as both of transtmitter and receiver antenna but Aux antenna operate as only receiver antenna.

4. Test Result Summary

4.1 WLAN 2.4 GHz_802.11b Body SAR

802.11b

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
2 412	15.37	17.00	1.455	Rear	0	1.00	0.012	**0.017**

4.2 WLAN 5.8 GHz_802.11ac(VHT-20) Body SAR

802.11ac(VHT-20)

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
5 825	10.71	12.50	1.510	Rear	0	1.01	0.011	**0.017**

<Note>

* SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

* Contain the results of the worst test SAR including battery.

* 1 g SAR Limit 1.6 W/kg

5. Report Overview

This report details the results of testing carried out on the samples listed in section 3, 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.

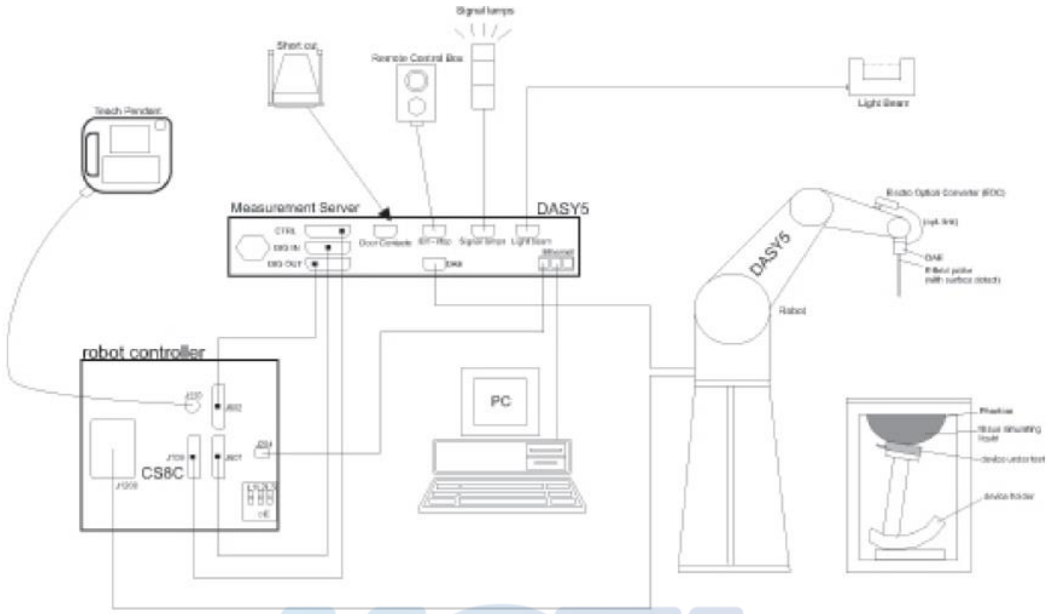
6. Test Lab Declaration or Comments

None

7. Applicant Declaration or Comments

None

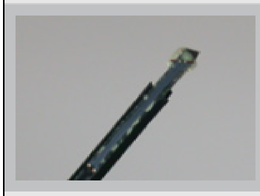
8. The SAR Measurement System



<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 WinXP or Win7 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.

8.1 Isotropic E-field Probe

ES3DV3 **Isotropic E-Field Probe for Dosimetric Measurements**	
	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (rotation normal to probe axis)
Dynamic Range	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

EX3DV4 **Smallest Isotropic E-Field Probe for Dosimetric Measurements** **(Preliminary Specifications)**	
	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (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: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

8.2 Phantom

Twin SAM	
	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. Twin SAM V5.0 has the same shell geometry and is manufactured from the same material as Twin SAM V4.0, but has reinforced top structure.
Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
Dimensions (incl. Wooden Support)	Length: 1000 mm Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters
Wooden Support	SPEAG standard phantom table
Accessories	Mounting Device and Adaptors

ELI	
	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles. ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure. ELI V6.0, released in August 2014, has the same shell geometry as ELI4 but offers increased longterm stability.
Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters
Wooden Support	SPEAG standard phantom table
Accessories	Mounting Device and Adaptors

8.3 Device Holder for Transmitters

Mounting Devices and Adaptors

Mounting Device for Hand-Held Transmitters

MD4HHTV5 - Mounting Device for Hand-Held Transmitters

In combination with the Twin SAM V5.0/V5.0c 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 IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).

Material: Polyoxymethylene (POM)

Mounting Device for Laptops

MD4LAPV5 - Mounting Device for Laptops and other Body-Worn Transmitters

In combination with the Twin SAM V5.0/V5.0c or ELI Phantoms, the Mounting Device (Body-Worn) enables testing of ransmitter devices according to IEC 62209-2 specifications. The device holder can be locked for positioning at flat phantom section.

Material: Polyoxymethylene (POM), PET-G, Foam

9. System Verification

9.1 Tissue Verification

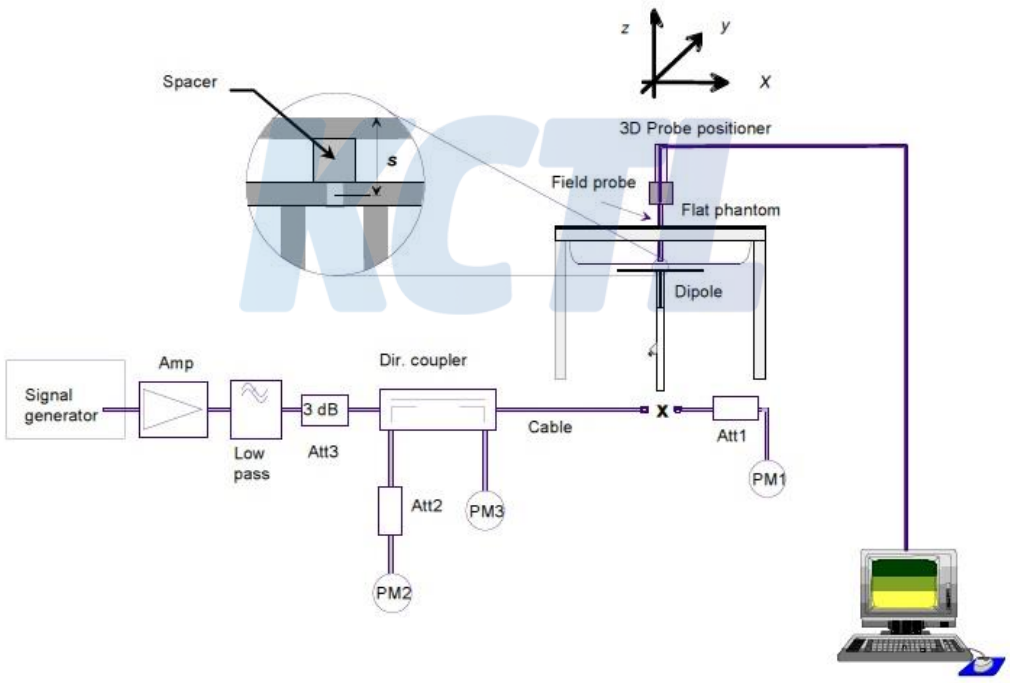
The dielectric properties for this Tissue Simulant Liquids were measured by using the SPEAG Model DAK3.5 Dielectric Probe in conjunction with Agilent E5071B Network Analyzer (300 kHz – 8 500 MHz). The Conductivity (σ) and Permittivity (ρ) are listed in Table 1.For the SAR measurement given in this report.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

Freq. (MHz)	Tissue Type	Limit/Measured	Permittivity (ρ)	Conductivity (σ)	Temp (℃)
2 450	MSL	Recommended Limit	52.70 ± 5 % (50.07 ~ 55.34)	1.95 ± 5 % (1.85 ~ 2.05)	22 ± 2
		Measured, 2018-04-09	51.28	1.96	21.02
5 300	MSL	Recommended Limit	48.88 ± 5 % (46.44 ~ 51.32)	5.42 ± 5 % (5.15 ~ 5.69)	22 ± 2
		Measured, 2018-04-13	47.30	5.52	21.91
5 300	MSL	Recommended Limit	48.88 ± 5 % (46.44 ~ 51.32)	5.42 ± 5 % (5.15 ~ 5.69)	22 ± 2
		Measured, 2018-04-25	49.61	5.63	21.77
5 600	MSL	Recommended Limit	48.47 ± 5 % (46.05 ~ 50.89)	5.77 ± 5 % (5.48 ~ 6.06)	22 ± 2
		Measured, 2018-04-13	48.04	5.69	21.96
5 600	MSL	Recommended Limit	48.47 ± 5 % (46.05 ~ 50.89)	5.77 ± 5 % (5.48 ~ 6.06)	22 ± 2
		Measured, 2018-04-25	47.49	5.85	21.77
5 800	MSL	Recommended Limit	48.20 ± 5 % (45.79 ~ 50.61)	6.00 ± 5 % (5.70 ~ 6.30)	22 ± 2
		Measured, 2018-04-13	47.45	5.96	21.96
5 800	MSL	Recommended Limit	48.20 ± 5 % (45.79 ~ 50.61)	6.00 ± 5 % (5.70 ~ 6.30)	22 ± 2
		Measured, 2018-04-25	47.09	6.18	21.77

<Table 1.Measurement result of Tissue electric parameters>

9.2 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 pha ntom. A SAR measurement was performed to see if the measured SAR was within ± 10% from the target SAR values. The tests were conducted on the samedays as the measurement of the EUT. The obtained results from the system accuracy verific ation 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 i n all the cases. It is seen that the system is operating within its specification, as th e results are within acceptable tolerance of the reference values.



Validation Kit	Dipole Ant. S/N	Frequency (MHz)	Tissue Type	Limit/Measurement (Normalized to 1 W)	
					1 g
D2450V2	895	2 450	MSL	Recommended Limit (Normalized)	50.80 ± 10 % (45.72 ~ 55.88)
				Measured, 2018-04-09	52.80
D5GHzV2	1134	5 300	MSL	Recommended Limit (Normalized)	77.90 ± 10 % (70.11 ~ 85.69)
				Measured, 2018-04-13	82.80
D5GHzV2	1134	5 300	MSL	Recommended Limit (Normalized)	77.90 ± 10 % (70.11 ~ 85.69)
				Measured, 2018-04-25	72.10
D5GHzV2	1134	5 600	MSL	Recommended Limit (Normalized)	80.10 ± 10 % (72.09 ~ 88.11)
				Measured, 2018-04-13	81.60
D5GHzV2	1134	5 600	MSL	Recommended Limit (Normalized)	80.10 ± 10 % (72.09 ~ 88.11)
				Measured, 2018-04-25	83.70
D5GHzV2	1134	5 800	MSL	Recommended Limit (Normalized)	77.20 ± 10 % (69.48 ~ 84.92)
				Measured, 2018-04-13	79.50
D5GHzV2	1134	5 800	MSL	Recommended Limit (Normalized)	77.20 ± 10 % (69.48 ~ 84.92)
				Measured, 2018-04-25	75.20

<Table 2.Test System Verification Result>

9.3 Justification for Extended SAR Dipole Calibrations

Instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements

KDB 865664 D01v01r04 requirements

a) return loss : < - 20 dB, within 20 % of previous measurement

b) impedance : within 5Ω from previous measurement.

Dipole Antenna	Head/Body	Date of Measurement	Return Loss (dB)	∆ %	Impedance (Ω)	∆ Ω
D2450V2 SN 895	Body	2016. 07. 25	-28.0	9.6	49.8	2.3
		2017. 07. 25	-25.3		47.5	

c) extrapolated peak SAR : within 15% of that reported in the calibration data

Dipole Antenna	Head/Body	Date of Measurement	extrapolated peak SAR (W/kg)	∆ %
D2450V2 SN 895	Body	2016. 07. 25	26.0	4.2
		2018. 04. 09	27.1	

10. Operation Configurations

Measurements were performed at the lowest, middle and highest channels of the operating band. The EUT was set to maximum power level during all tests and at the beginning of each test the battery was fully charged.

11. SAR Measurement Procedures

Step 1: Power Reference Measurement
The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift ofthe device under test in the batch process. The Minimum distance of probe sensors to surfacedetermines the closest measurement point to phantom surface. The minimum distance of probe sensorsto surface is 2 mm. This distance cannot be smaller than the Distance of sensor calibration points toprobe tip as defined in the probe properties.

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 doinga fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASYsoftware can find the maximum locations even in relatively coarse grids. When an Area Scan hasmeasured all reachable points, it computes the field maximal found in the scanned area, within a rangeof the global maximum. The range (in dB) is specified in the standards for compliance testing. Forexample, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is arequirement when compliance is assessed in accordance with the ARIB standard (Japan). If only oneZoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. Forcases where multiple maximums are detected, the number of Zoom Scans has to be increasedaccordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measument 100 MHz to 6 GHz v01r04.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing1 g and 10 g of simulated tissue. The Zoom Scan measures 5x5x7 points within a cube whose base faces are centered on the maxima found in a preceding area scanjob within the same procedure. When the measurement is done, the Zoom Scan evaluates theaveraged 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 Measument 100 MHz to 6 GHz v01r04.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 mm ± 1 mm</td><td>½·δ·ln(2) mm 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: ΔxArea, ΔyArea</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>
<tr><td colspan="3">Maximum zoom scan spatial resolution: ΔxZoom, ΔyZoom</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: ΔzZoom(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>ΔzZoom(1): between 1st two points closest 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>ΔzZoom(n>1): between subsequent points</td><td colspan="2">≤ 1.5·ΔzZoom(n-1) mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">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/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

Step 4: Power drift measurement
The Power Drift Measurement measures the field at the same location as the most recent powerreference measurement within the same procedure, and with the same settings. The Power DriftMeasurement gives the field difference in dB from the reading conducted within the last PowerReference Measurement. This allows a user to monitor the power drift of the device under test within abatch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan
The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a onedimensionalgrid. In order to get a reasonable extrapolation, the extrapolated distance should not belarger than the step size in Z-direction.

* Z Scan Report on Liquid Measure the height Appendix C. Liquid Depth photo to replace

12. Test Equipment Information

Test Platform	SPEAG DASY5 System			
Version	DASY5 : Version 52.8.8.1222 SEMCAD : Version 14.6.10 (7331)			
Location	KCTL Inc.			
Manufacture	SPEAG			
Hardware Reference				
Equipment	Model	Serial Number	Date of Calibration	Due date of next Calibration
Shield Room	Shield Room	None	N/A	8F - #2
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	2mm Oval Phantom ELI5	1178	N/A	N/A
Mounting Device	Laptop Holder	None	N/A	N/A
DAE	DAE4	1342	2017-07-21	2018-07-21
Probe	EX3DV4	3928	2018-01-23	2019-01-23
Signal Generator	E4438C	MY42080486	2018-01-05	2019-01-05
Dual Power Meter	E4419B	GB43312301	2017-05-16	2018-05-16
Power Sensor	8481H	3318A19377	2017-05-16	2018-05-16
Power Sensor	8481H	3318A19379	2017-05-16	2018-05-16
Attenuator	8491B 3dB	17387	2017-05-16	2018-05-16
Attenuator	8491B-6dB	MY39270294	2017-05-16	2018-05-16
Attenuator	8491B 10dB	29425	2017-05-16	2018-05-16
Power Amplifier	2055 BBS3Q7E9I	1005D/C0521	2017-05-16	2018-05-16
Power Amplifier	5190FE	1012	2017-05-16	2018-05-16
Dual Directional Coupler	772D	2839A00719	2017-05-16	2018-05-16
Low Pass Filter	LA-30N	40058	2017-05-16	2018-05-16
Low Pass Filter	LA-60N	40059	2017-05-16	2018-05-16
Dipole Validation Kits	D2450V2	895	2016-07-25	2018-07-25
Dipole Validation Kits	D5GHzV2	1134	2017-05-26	2019-05-26
Network Analyzer	E5071B	MY42403524	2018-01-05	2019-01-05
Dielectric Assessment kit	DAK-3.5	1078	2017-08-15	2018-08-15
Humidity/Temp. Data Recorder	MHB-382SD	73871	2017-05-19	2018-05-19

13. RF Average Conducted Output Power

13.1 Max. tune up power

WLAN 2.4 GHz

Mode	Channel	Target Power	Tolerance	Max. Allowed Power
802.11b	All Channel	15.50 dBm	± 1.50 dB	17.00 dBm
802.11g	1, 6	11.50 dBm	± 1.50 dB	13.00 dBm
	11	11.00 dBm	± 1.50 dB	12.50 dBm
802.11n(HT-20)	All Channel	10.50 dBm	± 1.50 dB	12.00 dBm
802.11n(HT-40)	All Channel	9.00 dBm	± 1.50 dB	10.50 dBm
802.11ac(VHT-20)	All Channel	10.50 dBm	± 1.50 dB	12.00 dBm
802.11ac(VHT-40)	All Channel	9.00 dBm	± 1.50 dB	10.50 dBm

WLAN 5 GHz

Mode	Channel	Target Power	Tolerance	Max. Allowed Power
802.11a	All Channel	10.50 dBm	± 2.00 dB	12.50 dBm
802.11n(HT-20)	All Channel	10.50 dBm	± 2.00 dB	12.50 dBm
802.11n(HT-40)	38	9.00 dBm	± 2.00 dB	11.00 dBm
	46	10.00 dBm	± 2.00 dB	12.00 dBm
	All Channel	10.50 dBm	± 2.00 dB	12.50 dBm
802.11ac(VHT-20)	All Channel	10.50 dBm	± 2.00 dB	12.50 dBm
802.11ac(VHT-40)	38	9.00 dBm	± 2.00 dB	11.00 dBm
	46	10.00 dBm	± 2.00 dB	12.00 dBm
	All Channel	10.50 dBm	± 2.00 dB	12.50 dBm
802.11ac(VHT-80)	42	7.00 dBm	± 2.00 dB	9.00 dBm
	58	10.00 dBm	± 2.00 dB	12.00 dBm
	All Channel	10.50 dBm	± 2.00 dB	12.50 dBm

Bluetooth

Mode	Max. Allowed Power (including tune-up tolerance)
BDR(GFSK)	9.00 dBm
EDR(8DPSK)	6.00 dBm
LE(GFSK)	0.0 dBm

13.2 Average Conducted Output Power

WLAN 2.4 GHz

Mode	Conducted Powers (dBm)		
	Low	Mid.	High
802.11b_1 Mbps	15.37	15.30	15.08
802.11g_6 Mbps	11.23	11.04	10.53
802.11n(HT-20)_MCS 0	10.31	10.25	10.18
802.11n(HT-40)_MCS 0	8.67	8.64	8.77
802.11ac(VHT-20)_MCS 0	10.36	10.25	10.14
802.11ac(VHT-40)_MCS 0	8.62	8.56	8.69

<Note>

* The above average output power results are quoted from the RF test report (#KR18-SRF0048-A) without the separately test.

WLAN 5.3 GHz

Mode	Conducted Powers (dBm)		
	Low	Mid.	High
802.11a_6 Mbps	10.80	10.79	10.69
802.11n(HT-20)_MCS 0	10.87	10.85	10.80
802.11n(HT-40)_MCS 0	10.53	-	10.86
802.11ac(VHT-20)_MCS 0	10.88	10.89	10.81
802.11ac(VHT-40)_MCS 0	10.52	-	10.84
802.11ac(VHT-80)_MCS 0	-	10.26	-

WLAN 5.6 GHz

Mode	Conducted Powers (dBm)			
	Low	Mid.	High	High
802.11a_6 Mbps	10.72	10.54	10.58	10.77
802.11n(HT-20)_MCS 0	10.93	10.68	10.78	10.93
802.11n(HT-40)_MCS 0	10.80	10.84	10.68	10.65
802.11ac(VHT-20)_MCS 0	10.92	10.69	10.76	10.92
802.11ac(VHT-40)_MCS 0	10.87	10.95	10.87	10.75
802.11ac(VHT-80)_MCS 0	10.88	10.69	10.72	-

WLAN 5.8 GHz

Mode	Conducted Powers (dBm)		
	Low	Mid.	High
802.11a_6 Mbps	10.60	10.73	10.68
802.11n(HT-20)_MCS 0	10.88	10.58	10.71
802.11n(HT-40)_MCS 0	10.60	-	10.55
802.11ac(VHT-20)_MCS 0	10.92	10.59	10.71
802.11ac(VHT-40)_MCS 0	10.68	-	10.74
802.11ac(VHT-80)_MCS 0	-	10.58	-

<Note>

* The above average output power results are quoted from the RF test report (#KR18-SRF0051-A) without the separately test.

Bluetooth

Mode	Conducted Powers (dBm)		
	Low	Mid.	High
BDR(GFSK)	8.31	8.14	7.65

WLAN 2.4 GHz Duty Cycle

Mode	Duty Cyclem [%]	Duty Cycle Compensate Factor
802.11b_1 Mbps	99.87	1.00
802.11g_6 Mbps	99.16	1.01
802.11n(HT-20)_MCS 0	99.10	1.01
802.11n(HT-40)_MCS 0	97.76	1.02
802.11ac(VHT-20)_MCS 0	99.09	1.01
802.11ac(VHT-40)_MCS 0	97.83	1.02

WLAN 5 GHz Duty Cycle

Mode	Duty Cycle [%]	Duty Cycle Compensate Factor
802.11a_6 Mbps	99.20	1.01
802.11n(HT-20)_MCS 0	99.15	1.01
802.11n(HT-40)_MCS 0	97.94	1.02
802.11ac(VHT-20)_MCS 0	99.15	1.01
802.11ac(VHT-40)_MCS 0	97.93	1.02
802.11ac(VHT-80)_MCS 0	95.41	1.05

14. SAR Test Exclusions Applied

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

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

Mode	Frequency (MHz)	Maximum Allowed Power (mW)	Separation Distance (mm)	≤ 3.0
Bluetooth	2 402	7.94	5	2.46

Based on the maximum conducted power of Bluetooth and antenna to use separation distance, Bluetooth SAR was not required.

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v06, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6 W/kg. When standalone SAR is not required to be measured per FCC KDB 447498 D01v06, the following equation must be used to estimate the standalone 1-g SAR for simultaneous transmission assessment involving that transmitter.

$$Estimated\ SAR = \frac{\sqrt{f\ (GHz)}}{7.5} * \frac{(Max\ Power\ of\ Channel\ mW)}{Min\ Separation\ Distance}$$

Mode	Frequency (MHz)	Maximum Allowed Power (mW)	Separation Distance (Body) (mm)	Estimated SAR (Body) (W/kg)
Bluetooth	2 402	7.94	5	0.328

15. SAR Test Results

15.1 WLAN 2.4 GHz Body SAR Test Results

802.11b

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
2 437	15.30	17.00	1.479	Rear	0	1.00	0.010	0.015
2 412	15.37	17.00	1.455	Rear	0	1.00	0.012	**0.017**
2 462	15.08	17.00	1.556	Rear	0	1.00	0.009	0.014

<Note>

* SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg per KDB Publication 248227 D01v02r02.
* 1 g SAR Limit 1.6 W/kg

15.2 WLAN 5.3 GHz Body SAR Test Results

802.11ac(VHT-20)

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
5 300	10.89	12.50	1.449	Rear	0	1.01	0.000	0.000
5 260	10.88	12.50	1.452	Rear	0	1.01	0.000	0.000
5 320	10.81	12.50	1.476	Rear	0	1.01	0.005	**0.007**

802.11ac(VHT-40)

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
5 310	10.84	12.50	1.466	Rear	0	1.02	0.000	0.000

802.11ac(VHT-80)

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
5 290	10.26	12.00	1.493	Rear	0	1.05	0.000	0.000

<Note>

* SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.
* For WLAN 5 GHz, 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 applicable. 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 position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration per KDB Publication 248227 D01v02r02.
* For WLAN 5 GHz, When the same maximum output power is specified for U-NII-1 and U-NII-2A bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements.
  If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR per KDB Publication 248227 D01v02r02.
* 1 g SAR Limit 1.6 W/kg

15.3 WLAN 5.6 GHz Body SAR Test Results

802.11ac(VHT-40)

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
5 590	10.95	12.50	1.429	Rear	0	1.02	0.003	0.004
5 510	10.87	12.50	1.455	Rear	0	1.02	0.000	0.000
5 670	10.87	12.50	1.455	Rear	0	1.02	0.005	0.007
5 710	10.75	12.50	1.496	Rear	0	1.02	0.008	**0.012**

802.11ac(VHT-80)

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
5 530	10.88	12.50	1.452	Rear	0	1.05	0.000	0.000

<Note>

* SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.
* For WLAN 5 GHz, 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 applicable. 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 position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration per KDB Publication 248227 D01v02r02.
* 1 g SAR Limit 1.6 W/kg

15.4 WLAN 5.8 GHz Body SAR Test Results

802.11ac(VHT-20)

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
5 785	10.59	12.50	1.552	Rear	0	1.01	0.008	0.012
5 745	10.92	12.50	1.439	Rear	0	1.01	0.007	0.010
5 825	10.71	12.50	1.510	Rear	0	1.01	0.011	**0.017**

802.11ac(VHT-80)

Frequency (MHz)	Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Distance (mm)	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)
5 775	10.58	12.50	1.556	Rear	0	1.05	0.000	0.000

<Note>

* SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.
* For WLAN 5 GHz, 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 applicable. 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 position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration per KDB Publication 248227 D01v02r02.
* 1 g SAR Limit 1.6 W/kg

15.5 WLAN + Bluetooth Simultaneous Transmission

Band	EUT Position	Separation Distance (mm)	Scaled 1 g SAR (W/kg)	BT Estimated SAR (W/kg)	Σ 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
WLAN 5.8 GHz + BT	Rear	0	0.017	0.328	**0.345**	1.6

<Note>

* Simultaneous transmission SAR test exclusion considerations

: Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneously transmitting antenna. When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration. Per KDB Publication 447498 D01v06.

* The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit (1.6 W/kg per 1-g). Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit. And therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06.

16. Test System Verification Results

2 450 MHz (2018-04-09)

Procedure Name: d=10 mm, Pin=250 mW, dist=2.0mm (EX-Probe)

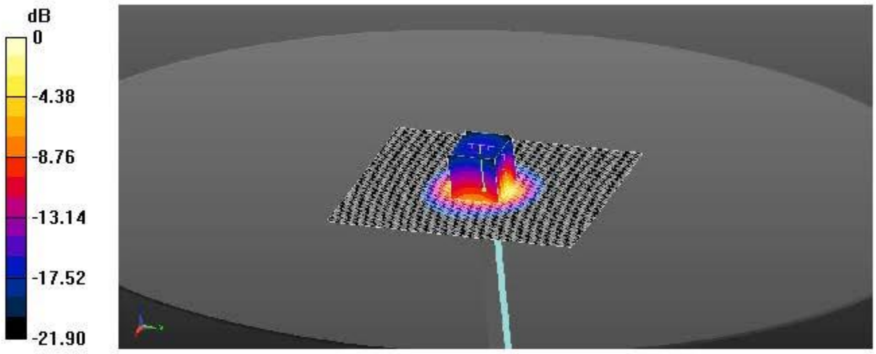
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.955 S/m; ε_r = 51.278; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(7.38, 7.38, 7.38); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

System Performance Check (without Area Scan)/d=10 mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (101x131x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 20.7 W/kg

System Performance Check (without Area Scan)/d=10 mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.8 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.12 W/kg
Maximum value of SAR (measured) = 20.1 W/kg



0 dB = 20.1 W/kg = 13.03 dBW/kg

5 300 MHz (2018-04-13)

Procedure Name: d=10mm, Pin=100mW, f=5300MHz

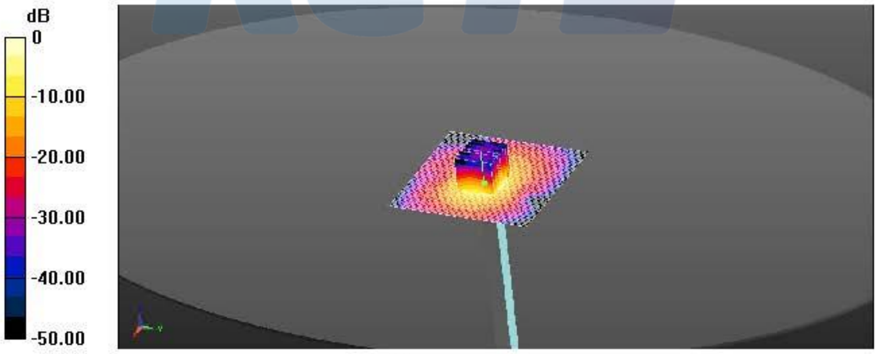
Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.521 S/m; ε_r = 47.296; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.65, 4.65, 4.65); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/d=10mm, Pin=100mW, f=5300MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 17.2 W/kg

Configuration/d=10mm, Pin=100mW, f=5300MHz/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 52.99 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 36.7 W/kg
SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 17.3 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg

5 300 MHz (2018-04-25)

Procedure Name: d=10mm, Pin=100mW, f=5300MHz

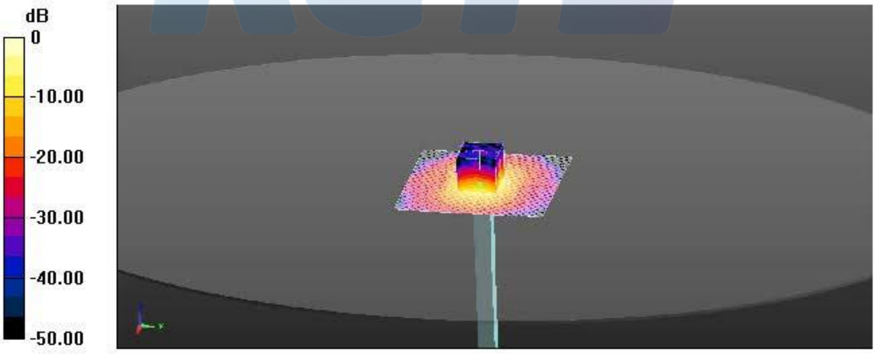
Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.633 S/m; ε_r = 49.605; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.65, 4.65, 4.65); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/d=10mm, Pin=100mW, f=5300MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.4 W/kg

Configuration/d=10mm, Pin=100mW, f=5300MHz/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 55.61 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 35.2 W/kg
SAR(1 g) = 7.21 W/kg; SAR(10 g) = 1.99 W/kg
Maximum value of SAR (measured) = 15.4 W/kg



0 dB = 15.4 W/kg = 11.88 dBW/kg

5 600 MHz (2018-04-13)

Procedure Name: d=10mm, Pin=100mW, f=5600MHz

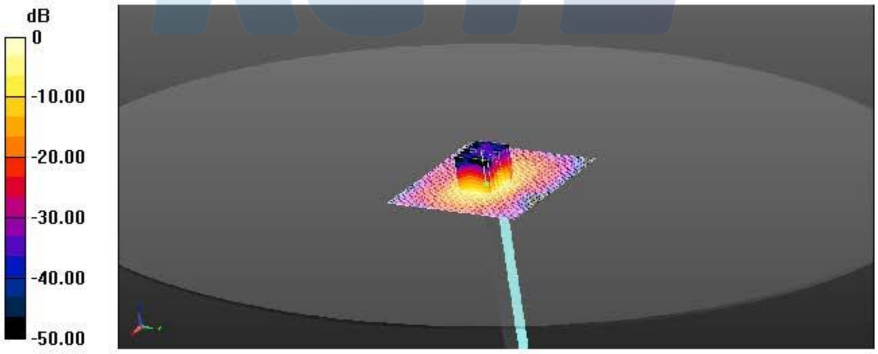
Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.688 S/m; ε_r = 48.041; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.1, 4.1, 4.1); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/d=10mm, Pin=100mW, f=5600MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 18.1 W/kg

Configuration/d=10mm, Pin=100mW, f=5600MHz/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 54.24 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 35.4 W/kg
SAR(1 g) = 8.16 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 17.2 W/kg



0 dB = 17.2 W/kg = 12.36 dBW/kg

5 600 MHz (2018-04-25)

Procedure Name: d=10mm, Pin=100mW, f=5600MHz

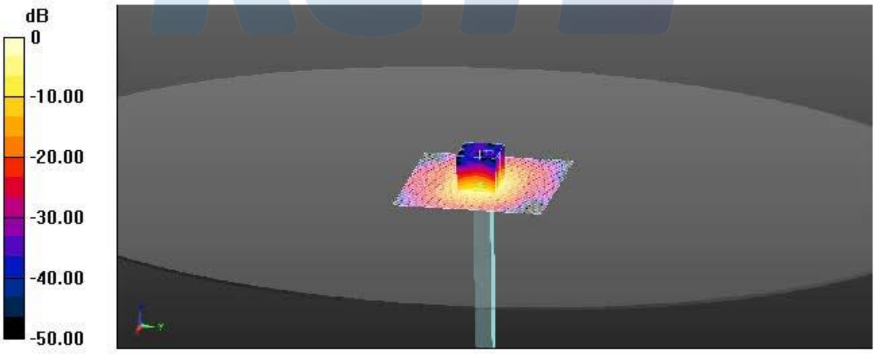
Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.854 S/m; ε_r = 47.489; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.1, 4.1, 4.1); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/d=10mm, Pin=100mW, f=5600MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.1 W/kg

Configuration/d=10mm, Pin=100mW, f=5600MHz/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 62.99 V/m; Power Drift = -0.78 dB
Peak SAR (extrapolated) = 38.4 W/kg
SAR(1 g) = 8.37 W/kg; SAR(10 g) = 2.36 W/kg
Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

5 800 MHz (2018-04-13)

Procedure Name: d=10mm, Pin=100mW, f=5800MHz

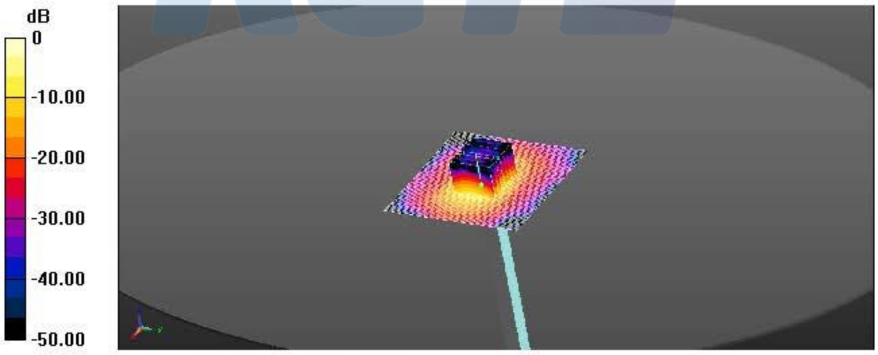
Frequency: 5800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.96 S/m; ε_r = 47.445; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.37, 4.37, 4.37); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

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) = 17.6 W/kg

Configuration/d=10mm, Pin=100mW, f=5800MHz/Zoom Scan (8x8x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 51.35 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 35.0 W/kg
SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.2 W/kg
Maximum value of SAR (measured) = 16.7 W/kg



0 dB = 16.7 W/kg = 12.23 dBW/kg

5 800 MHz (2018-04-25)

Procedure Name: d=10mm, Pin=100mW, f=5800MHz

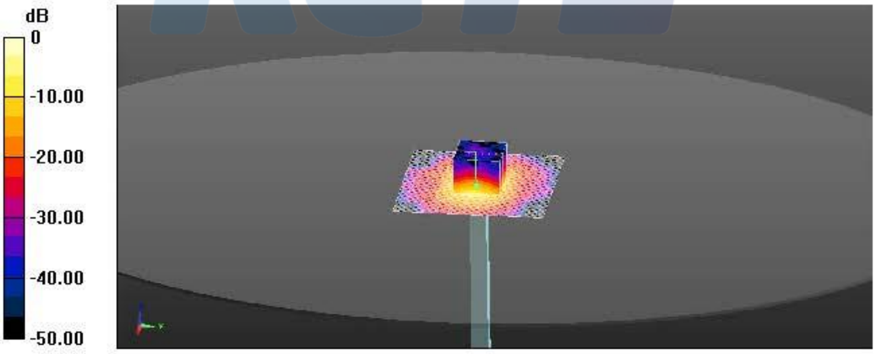
Frequency: 5800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.185 S/m; ε_r = 47.092; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.37, 4.37, 4.37); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

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) = 15.0 W/kg

Configuration/d=10mm, Pin=100mW, f=5800MHz/Zoom Scan (8x8x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 54.06 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 36.1 W/kg
SAR(1 g) = 7.52 W/kg; SAR(10 g) = 2.07 W/kg
Maximum value of SAR (measured) = 16.1 W/kg



0 dB = 16.1 W/kg = 12.07 dBW/kg

17. Test Results

Procedure Name: 802.11b_f.2 412_Rear_0 mm

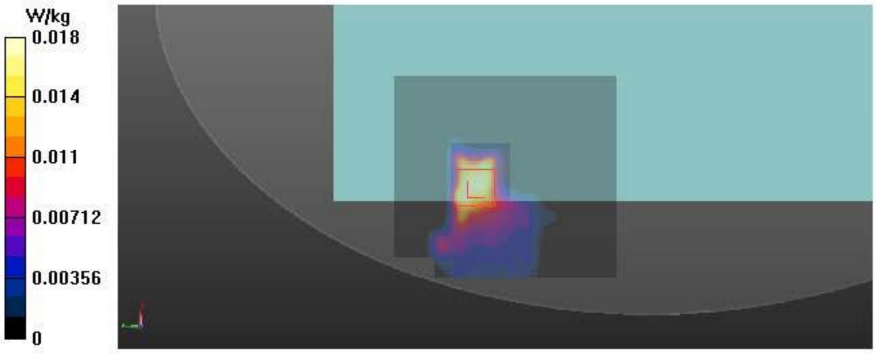
Frequency: 2412 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2412 MHz; σ = 1.932 S/m; ε_r = 51.611; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(7.38, 7.38, 7.38); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/802.11b_f.2 412_Rear_0 mm/Area Scan (101x111x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0213 W/kg

Configuration/802.11b_f.2 412_Rear_0 mm/Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.0600 W/kg
SAR(1 g) = 0.012 W/kg; SAR(10 g) = 0.0054 W/kg
Maximum value of SAR (measured) = 0.0178 W/kg



Procedure Name: 802.11ac20_f.5 825_Rear_0 mm

Frequency: 5825 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5825 MHz; σ = 5.98 S/m; ε_r = 47.435; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.37, 4.37, 4.37); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/802.11ac20_f.5 825_Rear_0 mm/Area Scan (121x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.0389 W/kg

Configuration/802.11ac20_f.5 825_Rear_0 mm/Zoom Scan (9x10x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.145 W/kg
SAR(1 g) = 0.011 W/kg; SAR(10 g) = 0.00238 W/kg
Maximum value of SAR (measured) = 0.0196 W/kg

Procedure Name: 802.11ac40_f.5 310_Rear_0 mm

Frequency: 5310 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5310 MHz; σ = 5.654 S/m; ε_r = 49.508; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.65, 4.65, 4.65); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/802.11ac40_f.5 310_Rear_0 mm/Area Scan (121x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0 W/kg

Procedure Name: 802.11ac80_f.5 290_Rear_0 mm

Frequency: 5290 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5290 MHz; σ = 5.638 S/m; ε_r = 49.496; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.65, 4.65, 4.65); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/802.11ac80_f.5 290_Rear_0 mm/Area Scan (121x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0 W/kg

Procedure Name: 802.11ac80_f.5 530_Rear_0 mm

Frequency: 5530 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5530 MHz; σ = 5.709 S/m; ε_r = 47.435; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.3, 4.3, 4.3); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/802.11ac80_f.5 530_Rear_0 mm/Area Scan (121x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0 W/kg

Procedure Name: 802.11ac80_f.5 775_Rear_0 mm

Frequency: 5775 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5775 MHz; $\sigma = 6.206$ S/m; $\varepsilon_r = 47.08$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.37, 4.37, 4.37); Calibrated: 2018-01-23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2017-07-21
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/802.11ac80_f.5 775_Rear_0 mm/Area Scan (121x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0 W/kg