TEST REPORT

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1. Client

- Name : IRIVER LIMITED
- Address : Iriverhouse, 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Korea
- Date of Receipt : 2019-02-18

2. Use of Report : -

3. Product Name : KANN CUBE / PPM42

4. Host Product Name : IRIVER LIMITED / Korea

5. FCC ID : QDMPPM42

6. Date of Test : 2019-03-25

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 : Gyuhyun Shim (Signature)

2019-04-12

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
2019-04-03	Initial Report	-
2019-04-12	Revised Plot	22

Please note: Report KR19-SPF0008-A issued on 2019-04-12 supersedes previously issued report KR19-SPF0008 issued on 2019-04-03.

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	:	IRIVER LIMITED
Address	:	Iriverhouse, 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Korea
Manufacturer	:	IRIVER LIMITED
Address	:	Iriverhouse, 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Korea
Contact Person	:	Jeong Ye-Won / 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	KANN CUBE
Brand Name	IRIVER LIMITED
Mode of Operation	WLAN 802.11b/g/n, Bluetooth
Model Number	PPM42
Serial Number	-
Tx Freq. Range	WLAN 2.4 GHz: 2 412 ~ 2 462 MHz Bluetooth: 2 400 ~ 2 480 MHz
H/W Version	ES
S/W Version	1.0

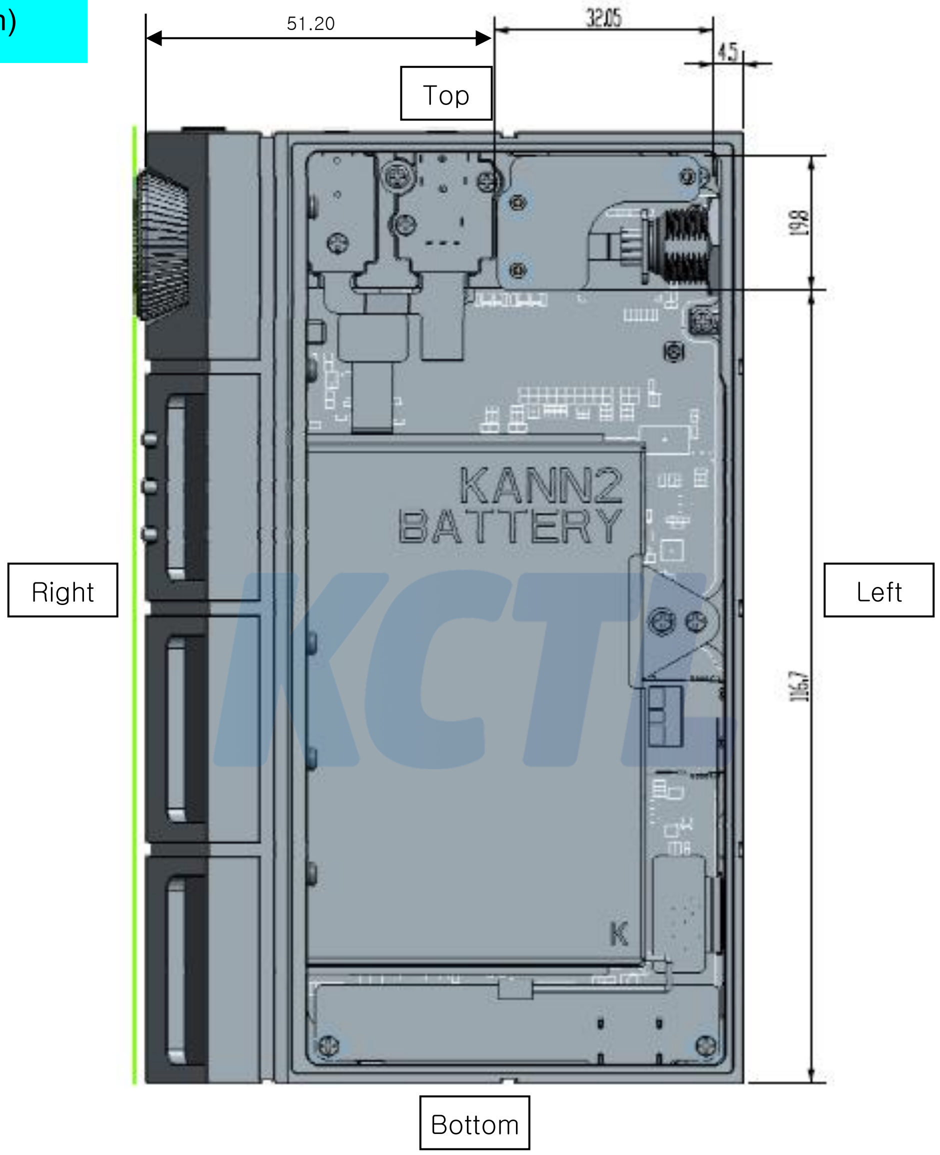
2.2 RF power setting in TEST SW

WLAN 2.4 GHz (2 412 MHz ~ 2 462 MHz)

Mode	Lowest Channel	Middle Channel	Highest Channel
802.11b	17	17	17

2.3 Antenna Diagram

Rear View
(Unit: mm)



3. Summary of tests

3.1 SAR Test Results

Band	Body SAR (W/kg)
WLAN 2.4 GHz	**0.240**

<Note>
* SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.
* When battery operating of this device is worst case mode.
* 1 g SAR Limit 1.6 W/kg

4. 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.

5. Test Lab Declaration or Comments

None

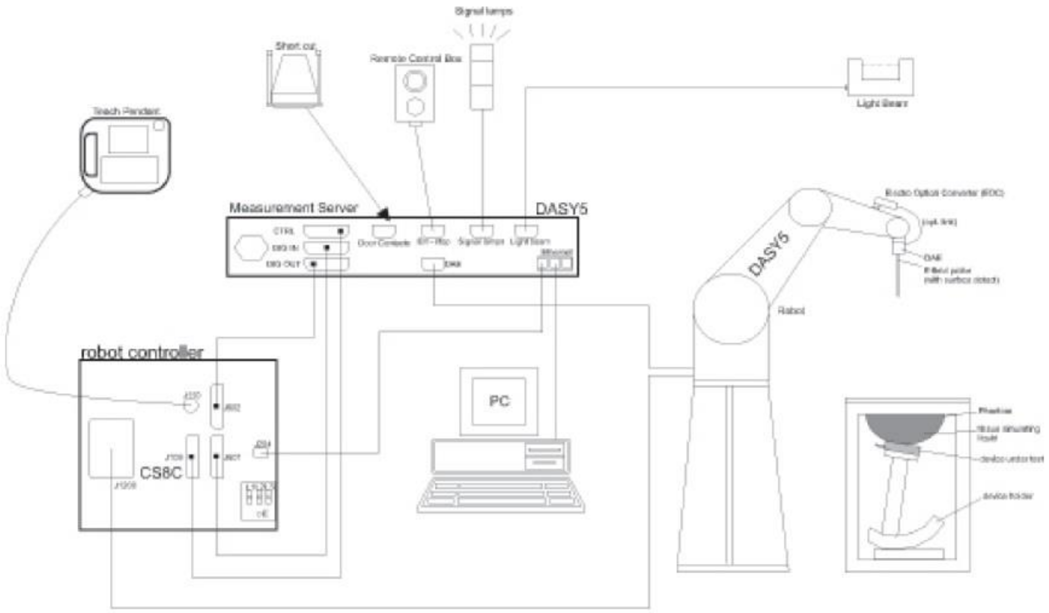
6. Applicant Declaration or Comments

None

7. Measurement Uncertainty

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 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/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

8. The SAR Measurement System

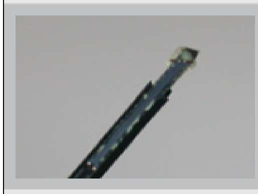


<SAR System Configuration>

- 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

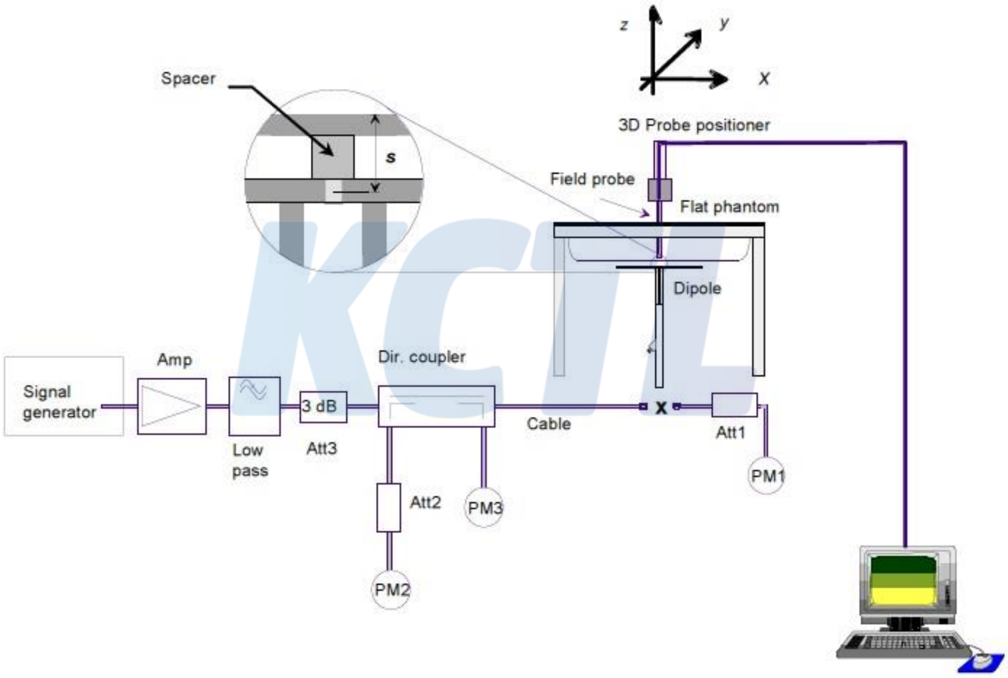
The dielectric properties for this Tissue Simulant Liquids were measured by using the SPEAG Model DAK3.5 Dielectric Probe in conjunction with Agilent E5071B Network Analyzer (300 kHz – 8 500 MHz). The Conductivity (σ) and Permittivity (ρ) are listed in Table 1.For the SAR measurement given in this report. 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, 2019-03-25	52.52	2.00	20.56

<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 phantom. 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 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 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)	50.60 ± 10 % (45.54 ~ 55.66)
				Measured, 2019-03-25	52.80

<Table 2.Test System Verification Result>

10. Operation Configurations

Measurements were performed at 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 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 2 mm. 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

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz 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 scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 mm ± 1 mm	$\frac{1}{2}\cdot\delta\cdot\ln(2)$ mm 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: ΔxArea, ΔyArea			≤ 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.	
Maximum zoom scan spatial resolution: ΔxZoom, ΔyZoom			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: ΔzZoom(n)		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	ΔzZoom(1): between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		ΔzZoom(n>1): between subsequent points	≤ 1.5·ΔzZoom(n-1) mm	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
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.				

Step 4: Power drift measurement

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

Step 5: Z-Scan

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

* 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	8F - #2	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	2mm Oval Phantom ELI5	1178	N/A	N/A
Mounting Device	Mounting Device	None	N/A	N/A
DAE	DAE4	1342	2018-07-24	2019-07-24
Probe	EX3DV4	3928	2019-01-31	2020-01-31
Signal Generator	E4438C	MY42080486	2019-01-04	2020-01-04
Dual Power Meter	E4419B	GB43312301	2018-05-15	2019-05-15
Power Sensor	8481H	3318A19377	2018-05-15	2019-05-15
Power Sensor	8481H	3318A19379	2018-05-15	2019-05-15
Attenuator	8491B 3dB	17387	2018-05-14	2019-05-14
Attenuator	8491B-6dB	MY39270294	2018-05-14	2019-05-14
Attenuator	8491B 10dB	29425	2018-05-14	2019-05-14
Power Amplifier	2055-BBS3Q7E9I	1005D/C0521	2019-03-08	2020-03-08
Dual Directional Coupler	772D	2839A00719	2018-05-15	2019-05-15
Low Pass Filter	LA-30N	40058	2018-05-14	2019-05-14
Dipole Validation Kits	D2450V2	895	2018-07-24	2020-07-24
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. Data Recorder	MHB-382SD	73871	2018-07-12	2019-07-12
Usb Rf Power Sensor	RPR3006W	13I00030SNO76	2018-08-02	2019-08-02
Power Divider	1580-1	RM986	2019-01-08	2020-01-08

13. RF Average Conducted Output Power

13.1 Max. tune up power

WLAN 2.4 GHz (2 412 MHz ~ 2 462 MHz)

Mode	Channel	Target Power (dBm)	Max. Allowed Power (dBm)
802.11b	All	14.00	15.50
802.11g	All	12.00	13.50
802.11n(HT-20)	All	12.00	13.50

Bluetooth (2 402 MHz ~ 2 480 MHz)

Mode	Max. Allowed Power (including tune-up tolerance) (dBm)
BDR(GFSK)	6.00
EDR (π/4DQPSK)	2.00
EDR(8DPSK)	2.00

13.2 Average Conducted Output Power

WLAN 2.4 GHz (2 412 MHz ~ 2 462 MHz)

Mode	Conducted Powers (dBm)		
	Low	Mid.	High
802.11b_1 Mbps	14.48	14.58	14.42
802.11g_6 Mbps	12.93	12.92	12.66
802.11n(HT-20)_MCS 0	12.78	12.72	12.48

Bluetooth (2 402 MHz ~ 2 480 MHz)

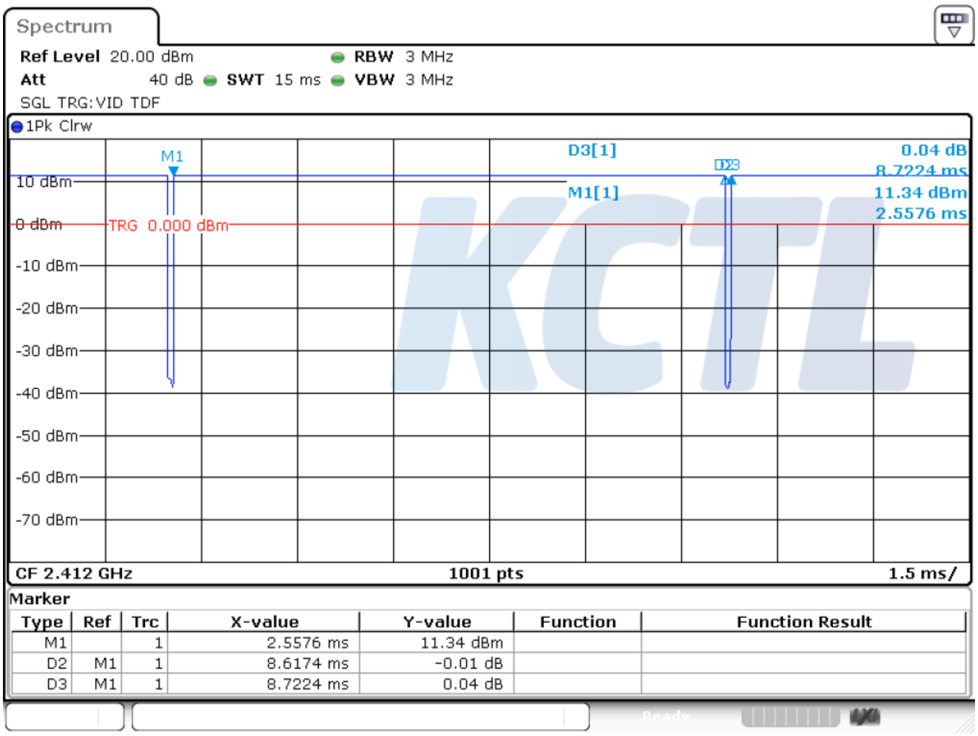
Mode	Conducted Powers (dBm)		
	Low	Mid.	High
BDR(GFSK)	4.91	3.96	4.51
EDR (π/4DQPSK)	-0.62	-0.83	0.28
EDR(8DPSK)	-0.61	-0.84	0.28

WLAN Duty Cycle

Mode		Duty Cycle [%]	Duty Cycle Compensate Factor
WLAN 2.4 GHz	802.11b	0.988	1.01

Power Measurement Setup

WLAN Transmission Plot



Note1) : Period : 8.72 ms, On time : 8.62 ms

Note2) : DCCF = 10log(1/x) = 10log(1/0.988) = 0.053 dB, x = 8.62/8.72 = 0.988

Note3) : 802.11 b is a continuous transmission (duty cycle >= 98%)

Duty Factor	
On Time	8.62
Period	8.72
Duty Cycle	0.988
Duty Factor	0.053

14. SAR Test Results

KDB 447498 D01, General RF Exposure Guidance

Testing of other required channels within the operating mode of a frequency band is not required when the reported SAR for the mid-band or highest output power channel is:

(1) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz

(2) ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz

(3) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

KDB 248227 D01 SAR meas for 802.11:

DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures. The initial test position procedure is described in the following:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the *initial test position* to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the *reported* SAR is ≤ 0.8 W/kg or all required test positions are tested.
  - □ For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - □ When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the *initial test position* and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required test channels are considered.
  - □ The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.

14.1 WLAN 2.4 GHz Body SAR Test Results

RF Exposure Conditions	Mode	EUT Position	Distance (mm)	Frequency (MHz)	Measured Conducted Power (dBm)	Max. Tune-up Power (dBm)	Power Scaling Factor	Duty Cycle Compensate Factor	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	Plot No.
Body	802.11b	Front	5	2 437	14.58	15.50	1.24	1.01	0.000	0.000	
		Rear	5	2 437	14.58	15.50	1.24	1.01	0.192	**0.240**	#1
		Left	5	2 437	14.58	15.50	1.24	1.01	0.016	0.020	
		Top	5	2 437	14.58	15.50	1.24	1.01	0.044	0.055	

* KDB Publication 248227 D01v02r02, 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.
* When the original highest measured SAR is >= 0.80 W/kg, repeat that measurement once.
* Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is >= 1.45 W/kg

14.2 SAR Test Exclusions Applied(Bluetooth Body SAR)

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

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

Mode	Frequency (MHz)	Maximum Allowed Power (mW)	Separation Distance (mm)	≤ 3.0
Bluetooth	2 480	3.98	5	1.25

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 ≤ 1.6W/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	2 480	3.98	5	0.167

14.3 Simultaneous Transmission

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 + BT	Rear	5	0.240	0.167	**0.407**	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.

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14. Test System Verification Results

2 450 MHz (2019-03-25)

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

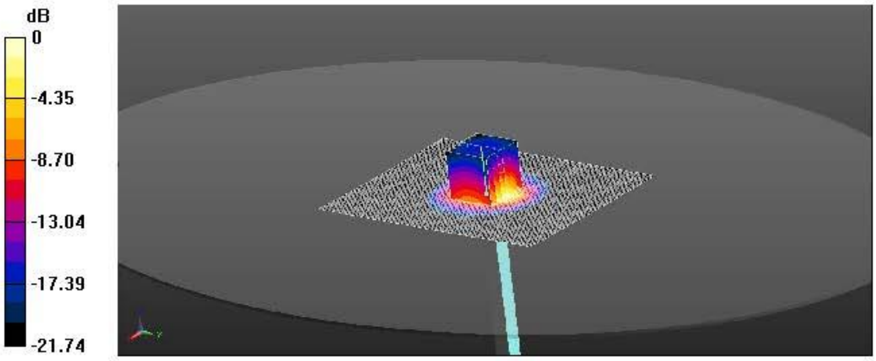
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 2.004 S/m; ε_r = 52.524; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(7.22, 7.22, 7.22); Calibrated: 2019-01-31;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2018-07-24
- 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) = 20.9 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 = 101.4 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.17 W/kg
Maximum value of SAR (measured) = 20.2 W/kg



0 dB = 20.2 W/kg = 13.05 dBW/kg

15. Test Results

#1

Procedure Name: 802.11b_f.2 437_Rear_5 mm

Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2437 MHz; σ = 1.989 S/m; ε_r = 52.554; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(7.22, 7.22, 7.22); Calibrated: 2019-01-31;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2018-07-24
- Phantom: ELI v5.0 sn1178; Type: QDOVA002AA; Serial: TP:1178
- Measurement SW: DASY52, Version 52.8 (8);

Configuration/802.11b_f.2 437_Rear_5 mm/Area Scan (81x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.239 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 = 4.268 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.383 W/kg
SAR(1 g) = 0.192 W/kg; SAR(10 g) = 0.080 W/kg
Maximum value of SAR (measured) = 0.276 W/kg