SAR TEST REPORT
FOR
FUTABA Corporation
Radio Control
Model Name: T3PV
Brand: Futaba

Prepared for : FUTABA Corporation
1080 YabutsukaChosei-son Chosei-gun
Chiba, 299-4395 Japan.

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Date of Test ： 2016. 05. 16
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Description Page

TEST REPORT VERIFICATION

Applicant	:	FUTABA Corporation
Manufacturer	:	FUTABA Corporation
EUT Description	:	Radio Control
(A) Model Name	:	T3PV
(B) Serial Number	:	N/A
(C) Brand Name	:	Futaba
(D) Power Supply	:	DC 6.0V

Measurement Standards Used:

FCC 47 CFR Part 2 (§2.1093)
IEEE 1528-2013
KDB 865664 D01 SAR Measurement 100MHz to 6GHz v01r04
KDB 447498 D01 General RF Exposure Guidance v06

The device described above was tested by AUDIX Technology Corporation. The measurement results were contained in this test report and AUDIX Technology Corporation was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with FCC OET Bulletin 65 Supplement C & IEEE 1528 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of AUDIX Technology Corporation.

Date of Test: 2016. 05. 16 Date of Report: 2016. 05. 23

Producer: ______________
(Annie Yu/Administrator)

Signatory: ______________
(Ben Cheng/Manager)

1. DESCRIPTION OF REVISION HISTORY

Edition No.	Date of Revision	Revision Summary	Report Number
0	2016. 05. 23	Original Report.	EM-SR160006

2. REPORTED SAR VALUE

Measured SAR Body SAR $_{1g}$	Maximum tune-up tolerance (dB)	Reported SAR Body SAR $_{1g}$
0.284 (W/kg)	**0**	**0.284 (W/kg)**
Remark: Reported SAR is scaled to the maximum tune-up tolerance limit according to the power applied to the l channel tested to determine compliance.		

3. GENERAL INFORMATION

3.1. Description of Device (EUT)

Product	Radio Control
Model Name	T3PV
Serial Number	N/A
Brand Name	Futaba
Applicant	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.
Manufacture	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.
SAR Evaluation (Total SAR 1g)	**0.284W/kg**
Fundamental Range	T-FHSS: 2407.5MHz ~ 2467.5MHz S-FHSS: 2403.25MHz ~ 2447.502480MHz
Frequency Channel	T-FHSS: 31 channels S-FHSS: 60 channels
Radio Technology	FSK
Data Transfer Rate	T-FHSS: 128 kbps S-FHSS: 128 kbps
Date of Receipt of Sample	2016. 02. 26

3.2. Antenna Information

Manufacture	Antenna Type	Frequency	Max Gain (dBi)
WAN SHIH ELECTRONIC (H.K) CO.,LTD	1/2λ Print Pattern Type	2.4GHz	2.14

3.3. Test Environment

Ambient conditions in the laboratory:

Item	Require	Actual
Temperature (℃)	18-25	22 ± 2
Humidity (%RH)	30-70	48 ± 2

3.4. Description of Test Facility

Name of Firm	：	**AUDIX Technology Corporation** **EMC Department** No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan, R.O.C.
Test Site	：	No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan, R.O.C.
NVLAP Lab. Code	：	200077-0
TAF Accreditation No	：	1724

3.5. Measurement Uncertainty

DASY5 Uncertainty
Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram / 10 gram.

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Setup								
Phantom Uncertainty	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Liquid Conductivity (target)	±5.0%	R	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
Liquid Conductivity (meas.)	±2.5%	N	1	0.64	0.43	±1.6%	±1.1%	∞
Liquid Permittivity (target)	±5.0%	R	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
Liquid Permittivity (meas.)	±2.5%	N	1	0.6	0.49	±1.5%	±1.2%	∞
Combined Std. Uncertainty						±11%	±10.8%	387
Expanded STD Uncertainty						±22%	±21.5%	

4. TEST EQUIPMENT

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Stäubli Robot TX90 XL	Stäubli	TX90	F12/5K9SA1/A 101	N/A	N/A
2.	Controller	SPEAG	CS8c	N/A	N/A	N/A
3.	SAM Twin Phantom	SPEAG	N/A	1706	N/A	N/A
4.	ELI5 Phantom	SPEAG	N/A	1170	N/A	N/A
5.	Device Holder	SPEAG	N/A	N/A	N/A	N/A
6.	Data Acquisition Electronic	SPEAG	DAE4	1337	2015. 09. 24	1 Year
7.	E-Field Probe	SPEAG	EX3DV4	3855	2015. 09. 29	1 Year
8.	SAR Software	SPEAG	DASY52	V.52.8.8.1222	N.C.R.	N.C.R.
9.	ENA Network Analyzer	Agilent	E5071C-480	Y46214331	2015. 09. 11	1 Year
10.	Signal Generator	Aglient	N5181A	MY50143917	2015. 09. 09	1 Year
11.	Dual Channel PK Power Meter	Aglient	N1912A	MY52180007	2015. 09. 14	1 Year
12.	Power Sensor	Aglient	N8481H	MY52080006	2015. 09. 14	1 Year
13.	Dipole Antenna	SPEAG	D2450V2	888	2015. 09. 28	3 Years

5. SAR MEASUREMENT SYSTEM

5.1. Definition of Specific Absorption Rate (SAR)

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.

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:

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

SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

5.2. SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

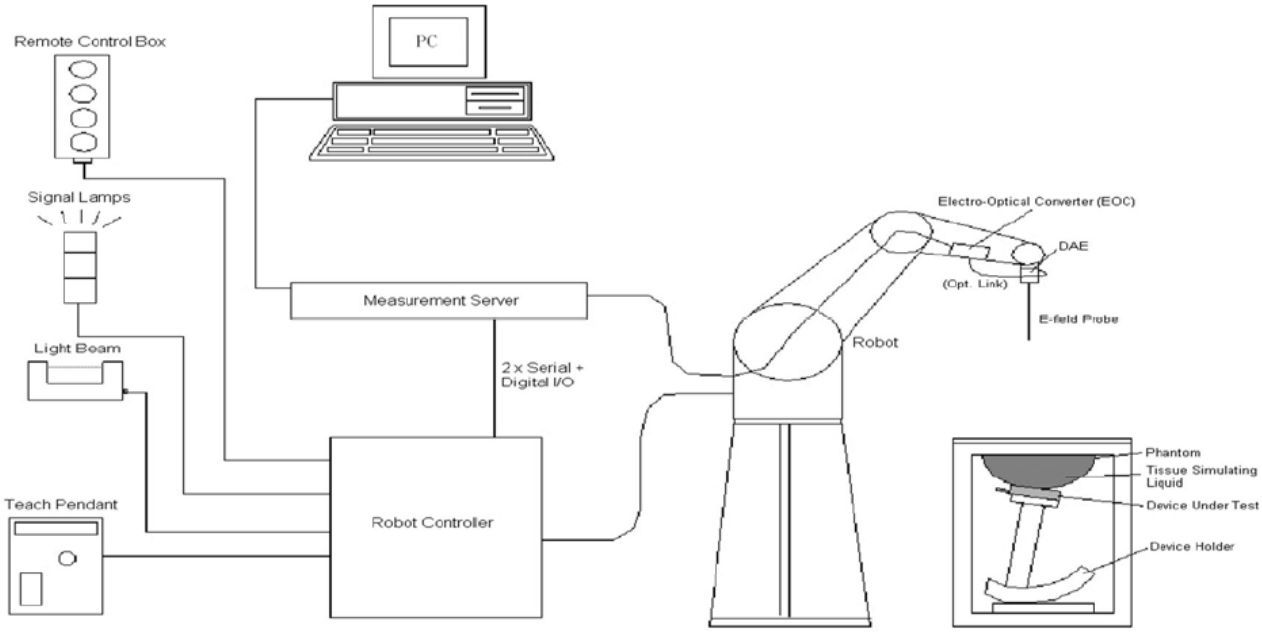


Fig-3.1 DASY System Setup

5.2.1. Robot

The DASY system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

5.2.2. Probes

Model	Ex3DV4
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (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

5.2.3. Data Acquisition Electronics (DAE)

Model	DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY4/5 embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset Voltage	< 5μV (with auto zero)
Input Bias Current	< 50 fA
Dimensions	60 x 60 x 68 mm

5.2.4. Phantoms

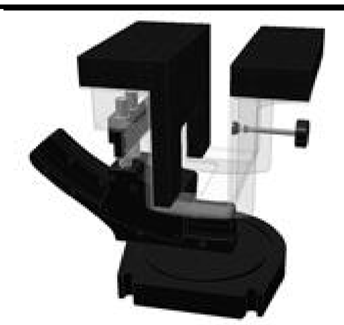
Model	Twin SAM	
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover 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	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)	
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet	
Filling Volume	approx. 25 liters	

Model	ELI	
Construction	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.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2.0 ± 0.2 mm (bottom plate)	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	
Filling Volume	approx. 30 liters	

5.2.5. Device Holder

Model	Mounting Device
Construction	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).
Material	POM

Model	Laptop Extensions Kit
Construction	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.
Material	POM, Acrylic glass, Foam



5.2.6. Device Holder

Model	System Validation Dipoles
Construction	Symmetrical dipole with l/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.
Frequency	750 MHz to 5800 MHz
Return Loss	> 20 dB
Power Capability	> 100 W (f < 1GHz), > 40 W (f > 1GHz)

5.2.7. Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in Table-5.1.

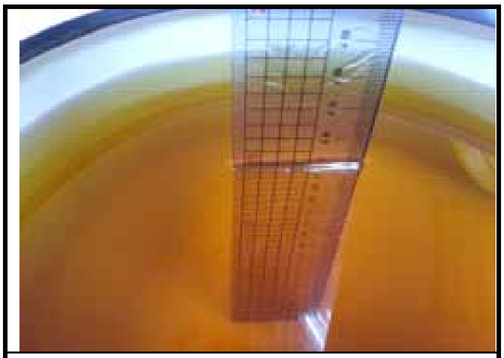


Photo of Liquid Height

The dielectric properties of the head tissue simulating liquids are defined in IEEE 1528 and KDB 865664 Appendix A. For the body tissue simulating liquids, the dielectric properties are defined in KDB 865664 Appendix A. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using an Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

Table-5.1 Targets of Tissue Simulating Liquid

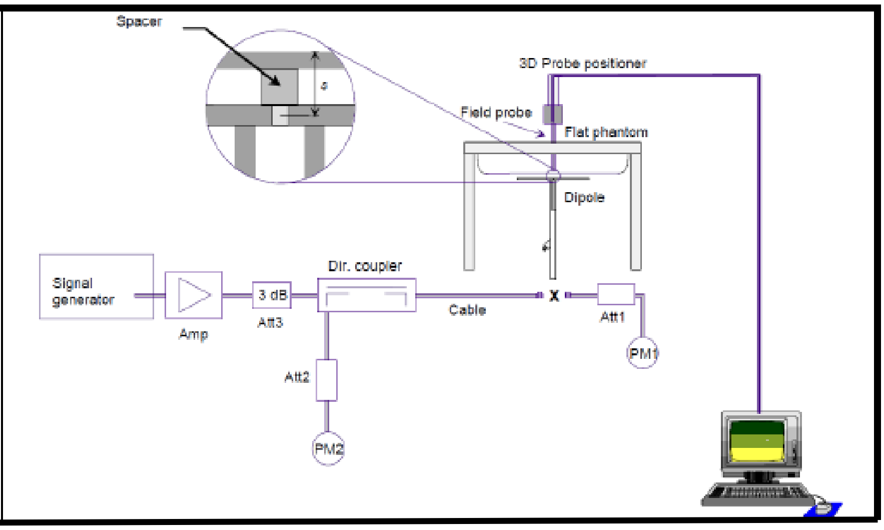
Target Frequency [MHz]	Target Permittivity (εr)	Range of ± 5%	Target Conductivity σ [s/m]	Range of ± 5%
For Head				
750	41.9	39.8 ~ 44.0	0.89	0.85 ~ 0.93
835	41.5	39.4 ~ 43.6	0.90	0.86 ~ 0.95
900	41.5	39.4 ~ 43.6	0.97	0.92 ~ 1.02
1450	40.5	38.5 ~ 42.5	1.20	1.14 ~ 1.26
1640	40.3	38.3 ~ 42.3	1.29	1.23 ~ 1.35
1750	40.1	38.1 ~ 42.1	1.37	1.30 ~ 1.44
1800	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
1900	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2000	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2300	39.5	37.5 ~ 41.5	1.67	1.59 ~ 1.75
2450	39.2	37.2 ~ 41.2	1.80	1.71 ~ 1.89
2600	39.0	37.1 ~ 41.0	1.96	1.86 ~ 2.06
3500	37.9	36.0 ~ 39.8	2.91	2.76 ~ 3.06
5200	36.0	34.2 ~ 37.8	4.66	4.43 ~ 4.89
5300	35.9	34.1 ~ 37.7	4.76	4.52 ~ 5.00
5500	35.6	33.8 ~ 37.4	4.96	4.71 ~ 5.21
5600	35.5	33.7 ~ 37.3	5.07	4.82 ~ 5.32
5800	35.3	33.5 ~ 37.1	5.27	5.01 ~ 5.53
For Body				
750	55.5	52.7 ~ 58.3	0.96	0.91 ~ 1.01
835	55.2	52.4 ~ 58.0	0.97	0.92 ~ 1.02
900	55.0	52.3 ~ 57.8	1.05	1.00 ~ 1.10
1450	54.0	51.3 ~ 56.7	1.30	1.24 ~ 1.37
1640	53.8	51.1 ~ 56.5	1.40	1.33 ~ 1.47
1750	53.4	50.7 ~ 56.1	1.49	1.42 ~ 1.56
1800	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
1900	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
2000	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
2300	52.9	50.3 ~ 55.5	1.81	1.72 ~ 1.90
2450	52.7	50.1 ~ 55.3	1.95	1.85 ~ 2.05
2600	52.5	49.9 ~ 55.1	2.16	2.05 ~ 2.27
3500	51.3	48.7 ~ 53.9	3.31	3.14 ~ 3.48
5200	49.0	46.6 ~ 51.5	5.30	5.04 ~ 5.57
5300	48.9	46.5 ~ 51.3	5.42	5.15 ~ 5.69
5500	48.6	46.2 ~ 51.0	5.65	5.37 ~ 5.93
5600	48.5	46.1 ~ 50.9	5.77	5.48 ~ 6.06
5800	48.2	45.8 ~ 50.6	6.00	5.70 ~ 6.30

Table-5.2 Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCI	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
For Head								
H750	0.2	-	0.2	1.5	56.0	-	42.1	-
H835	0.2	-	0.2	1.5	57.0	-	41.1	-
H900	0.2	-	0.2	1.4	58.0	-	40.2	-
H1450	-	43.3	-	0.6	-	-	56.1	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	47.0	-	0.4	-	-	52.6	-
H1800	-	44.5	-	0.3	-	-	55.2	-
H1900	-	44.5	-	0.2	-	-	55.3	-
H2000	-	44.5	-	0.1	-	-	55.4	-
H2300	-	44.9	-	0.1	-	-	55.0	-
H2450	-	45.0	-	0.1	-	-	54.9	-
H2600	-	45.1	-	0.1	-	-	54.8	-
H3500	-	8.0	-	0.2	-	20.0	71.8	-
H5G	-		-	-	-	17.2	65.5	17.3
For Body								
B750	0.2	-	0.2	0.8	48.8	-	50.0	-
B835	0.2	-	0.2	0.9	48.5	-	50.2	-
B900	0.2	-	0.2	0.9	48.2	-	50.5	-
B1450	-	34.0	-	0.3	-	-	65.7	-
B1640	-	32.5	-	0.3	-	-	67.2	-
B1750	-	31.0	-	0.2	-	-	68.8	-
B1800	-	29.5	-	0.4	-	-	70.1	-
B1900	-	29.5	-	0.3	-	-	70.2	-
B2000	-	30.0	-	0.2	-	-	69.8	-
B2300	-	31.0	-	0.1	-	-	68.9	
B2450	-	31.4	-	0.1	-	-	68.5	
B2600	-	31.8	-	0.1	-	-	68.1	
B3500	-	28.8	-	0.1	-	-	71.1	
B5G	-	-	-	-	-	10.7	78.6	10.7

5.3. SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.



The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The power meter PM1 measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz, 100 mW is used for 3.5 GHz to 6 GHz) at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

5.3.1. SAR System Verification Result

System Performance Check Dipole Kit: D2450V2				
Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
2450	Reference result ± 10% window	12.9 11.610 to 14.190	6.00 5.400 to 6.600	N/A
	2016. 05. 16	**12.4**	**5.7**	**22.4**
Note: All SAR values are normalized to 250mW forward power.				

5.3.2. SAR System Check Data

Date: 5/16/2016

Test Laboratory: Audix_SAR Lab

System Check_B2450

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:888

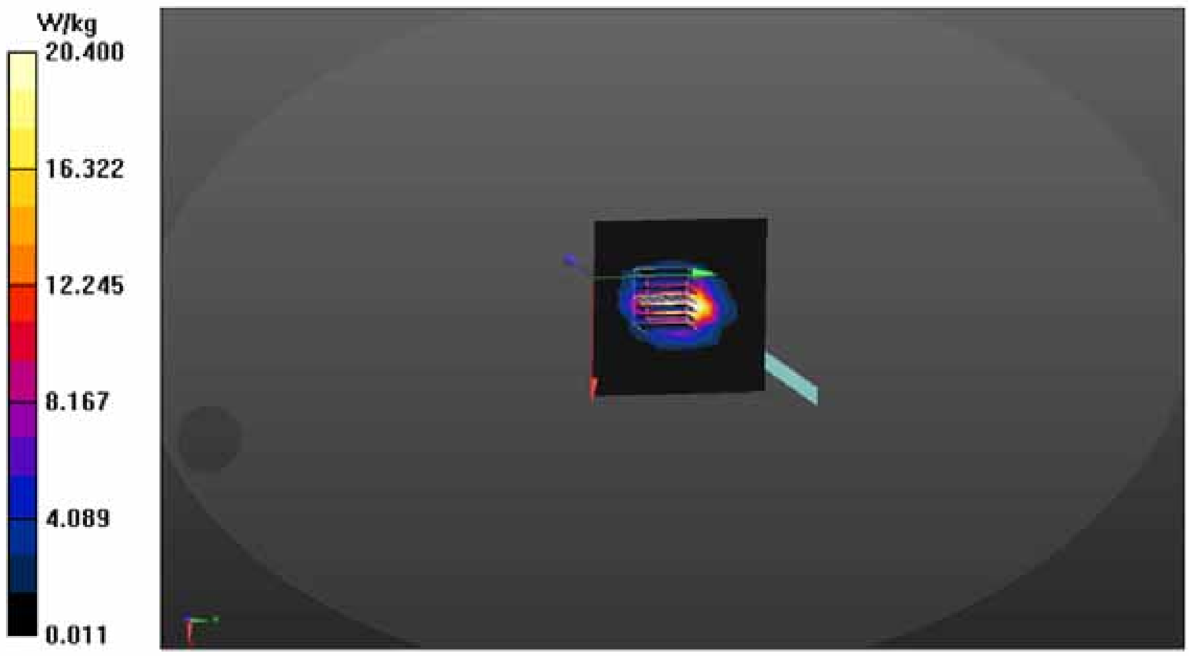
Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle:1:1
Medium parameters used: f = 2450 MHz; σ = 2.021 S/m; ε_r = 54.184; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3855; ConvF(7.55, 7.55, 7.55); Calibrated: 9/29/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1337; Calibrated: 9/24/2015
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1170
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Area Scan (9x9x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 20.4 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 102.7 V/m; Power Drift = 0.24 dB
Peak SAR (extrapolated) = 23.9 W/kg
SAR(1 g) = 12.4 W/kg; SAR(10 g) = 5.7 W/kg
Maximum value of SAR (measured) = 20.1 W/kg



5.4. SAR Measurement Procedure

According to the SAR test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transmit maximum output power
(b) Measure conducted output power through RF cable
(c) Place the EUT in the specific position of phantom
(d) Perform SAR testing steps on the DASY system
(e) Record the SAR value

5.4.1. Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. According to KDB 865664 D01 v01r03, the resolution for Area and Zoom scan is specified in the table below.

Items	<= 2 GHz	2-3 GHz	3-4 GHz	4-5 GHz	5-6 GHz
Area Scan (Δx, Δy)	<= 15mm	<= 12mm	<= 12mm	<= 10mm	<= 10mm
Zoom Scan (Δx, Δy)	<= 8mm	<= 5mm	<= 5mm	<= 4mm	<= 4mm
Zoom Scan (Δz)	<= 5mm	<= 5mm	<= 4mm	<= 3mm	<= 2mm
Zoom Scan Volume	>= 30mm	>= 30mm	>= 28mm	>= 25mm	>= 22mm

Note:
When zoom scan is required and report SAR is <= 1.4 W/kg, the zoom scan resolution of Δx / Δy (2-3GHz: <= 8 mm, 3-4GHz: <= 7 mm, 4-6GHz: <= 5 mm) may be applied.

5.4.2. Volume Scan Procedure

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

5.4.3. Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

5.4.4. Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

5.4.5. SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard’s method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

6. SAR MEASUREMENT EVALUATION

6.1. EUT Configuration and Setting

Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB 447498 D01 are used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics. All body-worn accessories containing metallic components are tested in conjunction with the host device.

Body-worn accessory SAR compliance is based on a single minimum test separation distance for all wireless and operating modes applicable to each body-worn accessory used by the host, and according to the relevant voice and/or data mode transmissions and operations. If a body-worn accessory supports voice only operations in its normal and expected use conditions, testing of data mode for body-worn compliance is not required.

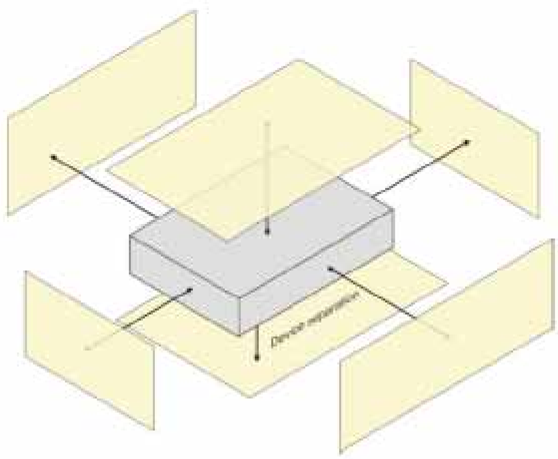
A conservative minimum test separation distance for supporting off-the-shelf body-worn accessories that may be acquired by users of consumer handsets is used to test for body-worn accessory SAR compliance. This distance is determined by the handset manufacturer, according to the requirements of Supplement C 01-01. Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body-worn accessories, will be tested using a conservative minimum test separation distance ≤ 5 mm to support compliance.

6.2. EUT Testing Position

The wireless router device is tested for SAR compliance in body configurations described in the following subsections.

6.2.1. Hotspot Mode Exposure conditions

A test separation of 10 mm is required. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25 mm from that surface or edge, for the data modes, wireless technologies and frequency bands supporting hotspot mode. The standalone SAR results in each device test orientation must be analyzed for the applicable hotspot mode simultaneous transmission configurations to determine SAR test exclusion and volume scan requirements. The simultaneous transmission configurations must be clearly described in the SAR report to support the analyses or test results. When the device form factor is smaller than 9 cm x 5 cm, unless a test separation distance of 5 mm or less is used a KDB inquiry is required to determine the acceptable test distance.



The SAR testing required for hotspot mode is listed as below.

Antenna	Front Face	Rear Face	Top Side	Bottom Side	Left Side	Right Side
1/2λ Print Pattern Type	√					

6.3. Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using Aligent Dielectric Probe Kit and Aligent E5071C Vector Network Analyzer.

Tissue Simulate Measurement				
Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ε_r	σ [s/m]	
2450MHz	Reference result	52.70	1.95	N/A
	± 5% window	50.065 to 55.335	1.853 to 2.048	
	2016. 05. 16	**54.184**	**2.021**	**22.4**

6.4. SAR Exposure Limits

SAR assessments have been made in line with the requirements of IEEE-1528, KDB 865664, and comply with ANSI/IEEE C95.1-1992 "Uncontrolled Environments" limits. These limits apply to a location which is deemed as "Uncontrolled Environment" which can be described as a situation where the general public may be exposed to an RF source with no prior knowledge or control over their exposure.

Limits for General Population/Uncontrolled Exposure (W/kg)

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for brain or body)	1.60 W/kg
Spatial Average SAR (whole body)	0.08 W/kg
Spatial Peak SAR (10g for hands, feet, ankles and wrist)	4.00 W/kg

6.5. Conducted Power Measurement

Type of Network	Channel	Frequency (MHz)	**Output Power (dBm)**	Maximum Power (dBm)
T-FHSS	CH 1	2407.50	**14.775**	14.771
	CH 15	2435.50	**14.618**	
	CH 31	2467.50	**14.781**	
S-FHSS	CH 1	2403.25	**13.564**	
	CH 30	2425.00	**13.820**	
	CH 60	2447.50	**13.751**	

Remark: The maximum power is declared by the applicant in operation description.

6.6. Exposure Positions Consideration

6.7. SAR Test Result

Test Date: 2016. 05. 16 Temperature : 23℃ Humidity : 25%

Liquid Temperature : 22.2℃					Depth of Liquid: > 15cm		
Test Position: Body	Antenna Position	Separation Distance (cm)	Frequency		Conducted power (dBm)	SAR 1g (W/kg)	Limit (W/kg)
			Channel	MHz			
T-FHSS							
Vertical-Front	Fixed	0	1	2407.50	14.775	**0.284**	1.6
Vertical-Front	Fixed	0	15	2435.50	14.618	0.255	1.6
Vertical-Front	Fixed	0	31	2467.50	14.781	0.221	1.6

Date: 5/16/2016

Test Laboratory: Audix_SAR Lab

P9 T-FHSS CH1 2407.5MHz Front

DUT: T3PV

Communication System: UID 0, T-FHSS (0); Frequency: 2407.5 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 2407.5 MHz; σ = 1.966 S/m; ε_r = 54.305; ρ = 1000 kg/m^3

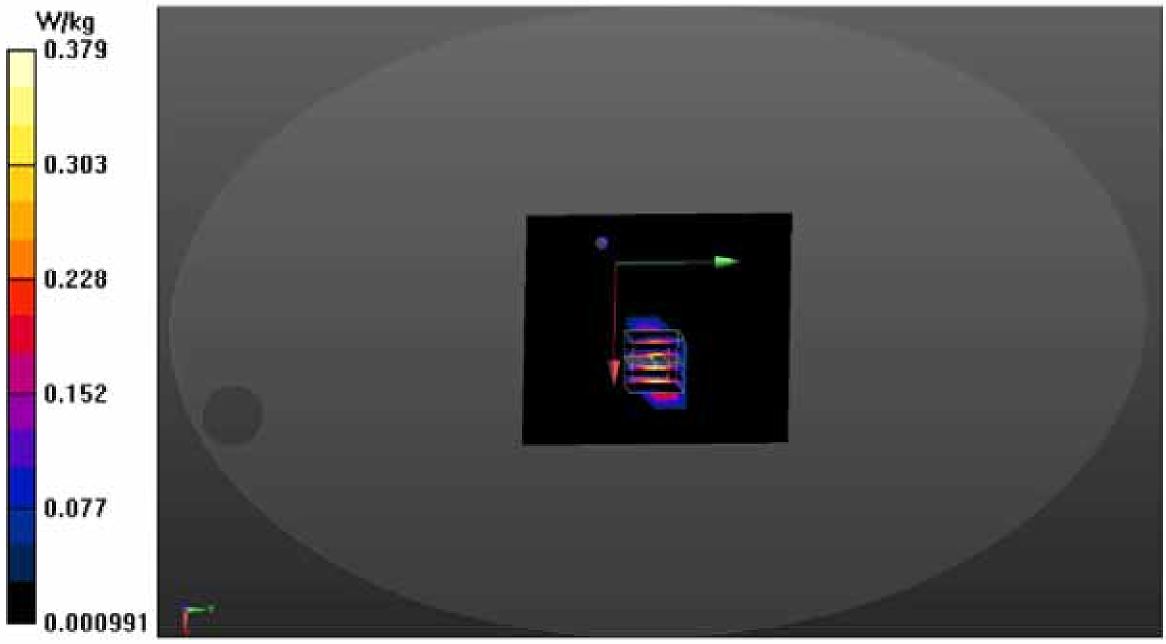
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3855; ConvF(7.55, 7.55, 7.55); Calibrated: 9/29/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1337; Calibrated: 9/24/2015
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1170
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Area Scan (8x9x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 0.379 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.694 V/m; Power Drift = -1.41 dB
Peak SAR (extrapolated) = 0.716 W/kg
SAR(1 g) = 0.284 W/kg; SAR(10 g) = 0.114 W/kg
Maximum value of SAR (measured) = 0.295 W/kg



Date: 5/16/2016

Test Laboratory: Audix_SAR Lab

P8 T-FHSS CH15 2435.5MHz Front

DUT: T3PV

Communication System: UID 0, T-FHSS (0); Frequency: 2435.5 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 2435.5 MHz; σ = 2.002 S/m; ε_r = 54.221; ρ = 1000 kg/m^3

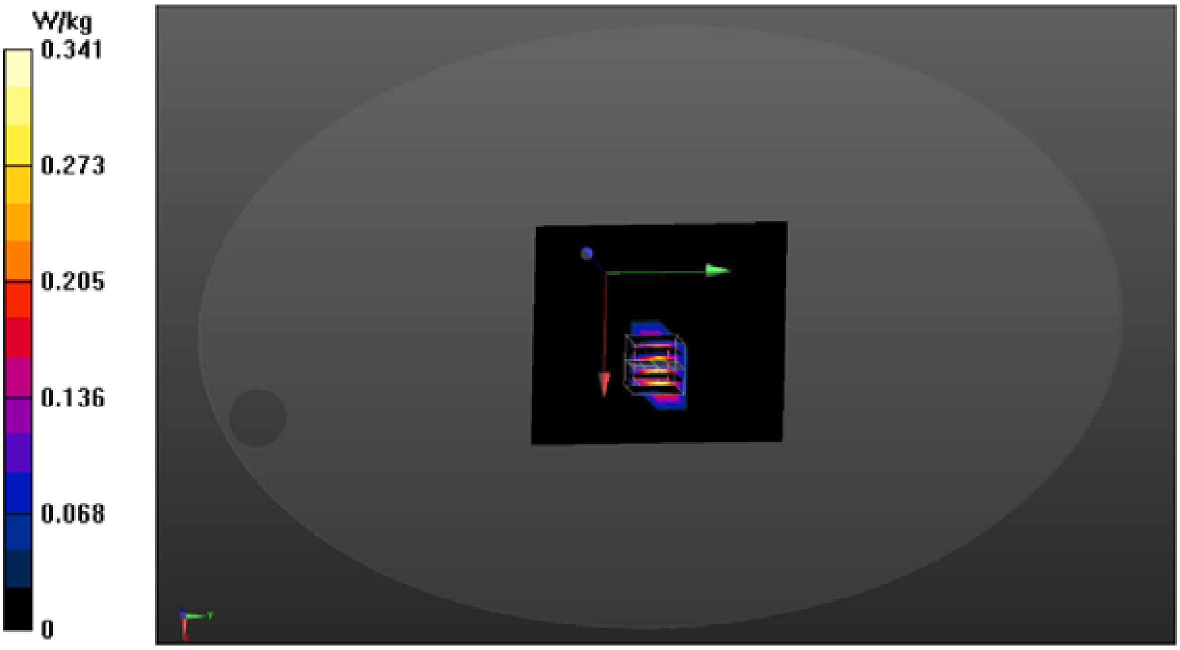
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3855; ConvF(7.55, 7.55, 7.55); Calibrated: 9/29/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1337; Calibrated: 9/24/2015
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1170
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Area Scan (8x9x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 0.341 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.418 V/m; Power Drift = -0.50 dB
Peak SAR (extrapolated) = 0.641 W/kg
SAR(1 g) = 0.255 W/kg; SAR(10 g) = 0.103 W/kg
Maximum value of SAR (measured) = 0.265 W/kg



Date: 5/16/2016

Test Laboratory: Audix_SAR Lab

P7 T-FHSS CH31 2467.5MHz Front

DUT: T3PV

Communication System: UID 0, T-FHSS (0); Frequency: 2467.5 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 2467.5 MHz; σ = 2.043 S/m; ε_r = 54.136; ρ = 1000 kg/m^3

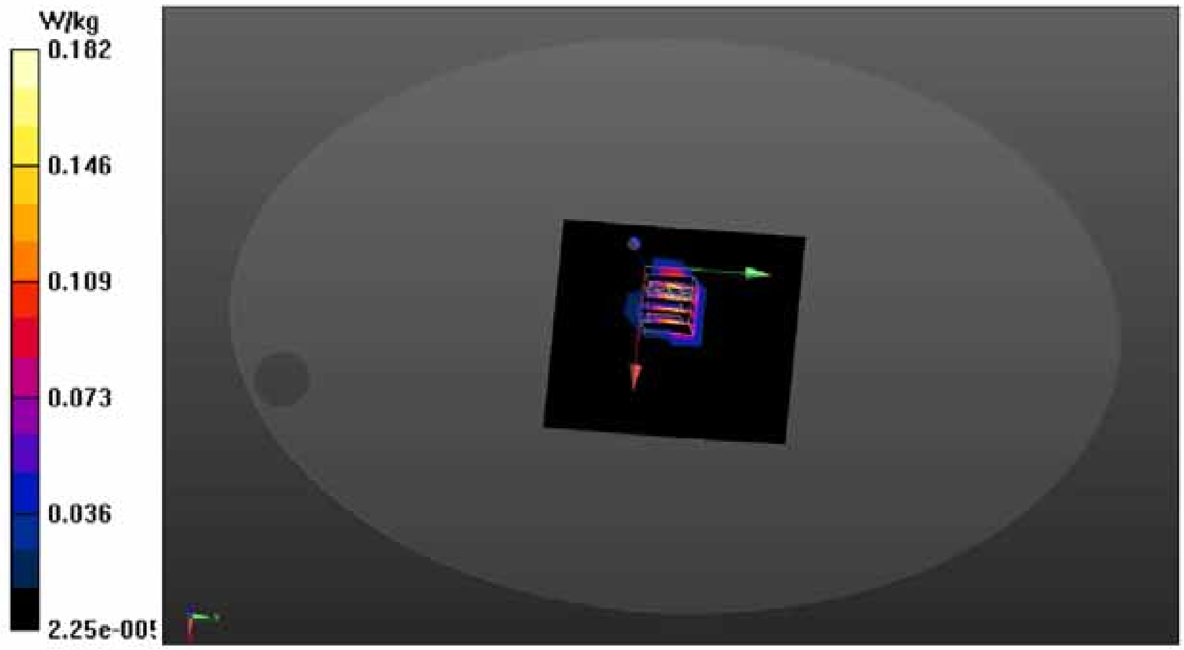
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3855; ConvF(7.55, 7.55, 7.55); Calibrated: 9/29/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1337; Calibrated: 9/24/2015
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1170
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Area Scan (8x9x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 0.182 W/kg

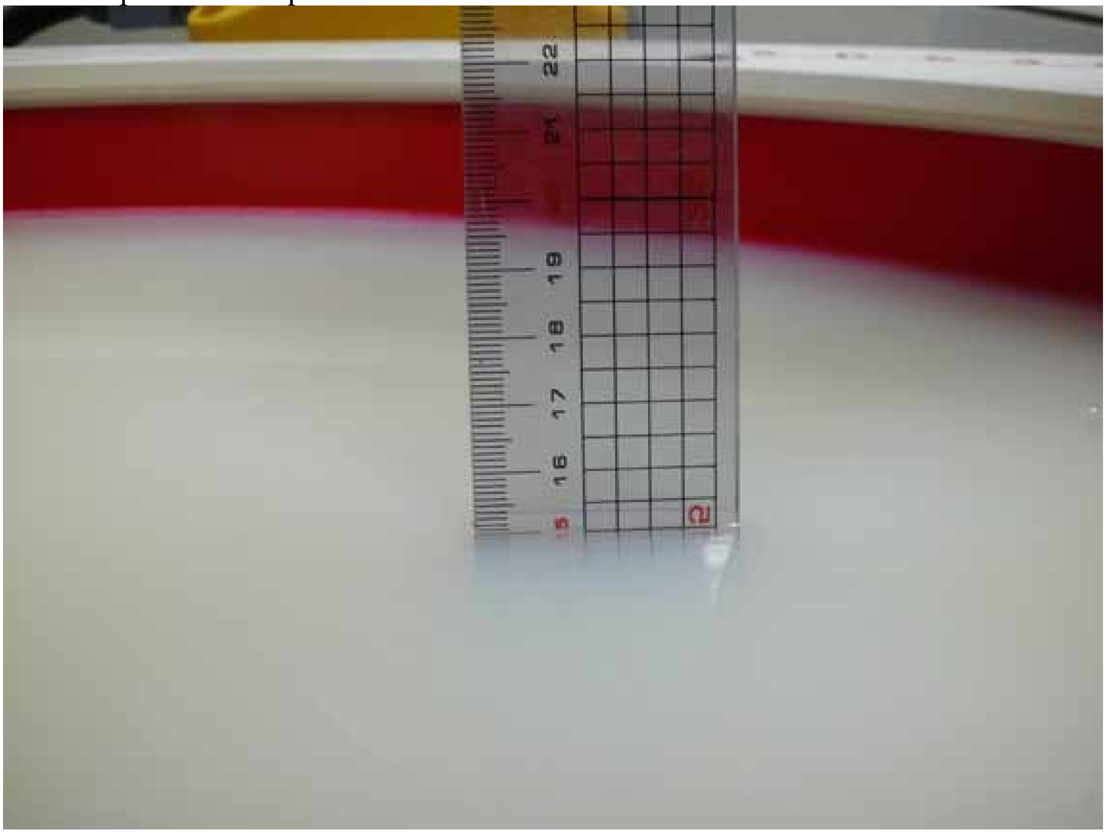
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.682 V/m; Power Drift = -1.03 dB
Peak SAR (extrapolated) = 0.527 W/kg
SAR(1 g) = 0.221 W/kg; SAR(10 g) = 0.091 W/kg
Maximum value of SAR (measured) = 0.239 W/kg



7. PHOTOGRAPHS OF MEASUREMENT

Test Position: Front

Depth of the Liquid in the Phantom-Zoom In



APPENDIX I

Test Equipment Calibration Data