TEST REPORT

Report Reference No. .... :	**TRE17050227**	R/C..........:	57146
FCC ID .... :	**Q5EDP990**		
Applicant's name .... :	**Kirisun Communications Co., Ltd**		
Address..:	3-6F ROBETA Building, No. 1, QiMin Road,Song PingShan Area, Science & Industry Park,Nanshan District,Shenzhen518057,China		
Manufacturer....................................:	Kirisun Communications Co., Ltd		
Address..:	3-6F ROBETA Building, No. 1, QiMin Road,Song PingShan Area, Science & Industry Park,Nanshan District,Shenzhen518057,China		
Test item description .... :	**DMR Two Way Radio**		
Trade Mark ....:	KIRISUN		
Model/Type reference.......................:	DP990		
Listed Model(s) ....:	DP995		
Standard .... :	**FCC 47 CFR Part2.1093** **ANSI/IEEE C95.1: 1999** **IEEE 1528: 2013**		
Date of receipt of test sample..........:	May 25, 2017		
Date of testing..............................:	May 26, 2017 –June 21, 2017		
Date of issue...............................:	June 24, 2017		
Result.................. ....:	**PASS**		

Compiled by (position+printedname+signature)...:	File administrators: Candy Liu		Candy Liu
Supervised by (position+printedname+signature)...:	Test Engineer:	SiyuanRao	Siyuan Rao
Approved by (position+printedname+signature)...:	Manager:	Hans Hu	Hans Hu

Testing Laboratory Name .... :	**Shenzhen Huatongwei International Inspection Co., Ltd**
Address..:	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1 . Test Standards and Report version

1.1. Test Standards

The tests were performed according to following standards:

IEEE Std C95.1, 1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz.

IEEE Std 1528™-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

KDB 447498 D01:General RF Exposure Guidance v06: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

KDB 643646 D01:SAR Test for PTT Radios v01r03 :SAR Test Reduction Considerations for Occupational PTT Radios

1.2. Report version

Version No.	Date of issue	Description
00	June 24, 2017	Original

2. Summary

2.1. Client Information

Applicant:	Kirisun Communications Co., Ltd
Address:	3-6F ROBETA Building, No. 1, QiMin Road,Song PingShan Area, Science & Industry Park,Nanshan District,Shenzhen518057,China
Manufacturer:	Kirisun Communications Co., Ltd
Address:	3-6F ROBETA Building, No. 1, QiMin Road,Song PingShan Area, Science & Industry Park,Nanshan District,Shenzhen518057,China

2.2. Product Description

Name of EUT:	DMR Two Way Radio			
Trade mark:	KIRISUN			
Model/Type reference:	DP990			
Listed mode(s):	DP995			
Accessories	Belt Clip			
Device Category:	Portable			
RF Exposure Environment:	Occupational / Controlled			
Power supply:	7.4V from Internal battery			
Maximum SAR Value				
Separation Distance:	Front to Face:	25mm		
	Body:	0mm		
Max Report SAR Value (1g):	Test location:	TNF	DSS	Simultaneous TX
	Front to Face:	2.77 W/kg	0.01 W/kg	2.78 W/kg
	Body:	3.70 W/kg	0.04 W/kg	3.74 W/kg
PMR				
Operation Frequency Range:	From 406.1MHz to 470MHz			
Rated Output Power:	☒ High Power: 4W (36.00dBm)	☒ Low Power 1W (30.00dBm)		
Modulation Type:	Analog	FM		
	Digital:	4FSK		
Channel Separation:	Analog:	☒ 12.5kHz	☐ 20kHz	☐ 25kHz
	Digital:	☐ 6.25kHz	☒ 12.5kHz	
Digital Type:	DMR			
Bluetooth				
Version:	Supported BT3.0+EDR			
Modulation:	GFSK, π/4DQPSK, 8DPSK			
Operation frequency:	2402MHz~2483.5MHz			
Channel number:	79			
Channel separation:	1MHz			
Antenna type:	Integral Antenna			

2.3. Test frequency list

When the frequency channels required for SAR testing are not specified in the published RF exposure KDB procedures, the following should be applied to determine the number of required test channels. The test channels should be evenly spread across the transmission frequency band of each wireless mode:

$$N_c = 2 * \text{roundup}\ [10* (f_{high} - f_{low})/f_c] + 1$$

fc: is the centre frequency of the band in hertz;
fhigh: is the highest frequency in the band in hertz;
flow: is the lowest frequency in the band in hertz;
Nc: is the number of channels;
f: is the width of the transmit frequency band in hertz.

ModulationType	Channel Separation	Test Channel	Test Frequency (MHz)	
			TX	RX
Analog	12.5kHz	CH_1	406.15	406.15
		CH_2	418.05	418.05
		CH_3	435.05	435.05
		CH_4	453.05	453.05
		CH_5	469.95	469.95
Digital	12.5kHz	CH_1	406.15	406.15
		CH_2	418.05	418.05
		CH_3	435.05	435.05
		CH_4	453.05	453.05
		CH_5	469.95	469.95

3. Test Environment

3.1. Address of the test laboratory

Laboratory:Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China
Phone: 86-755-26748019 Fax: 86-755-26748089

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 317478

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 317478.

IC-Registration No.: 5377B

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	18-25 ° C
Humidity:	40-65 %
Atmospheric pressure:	950-1050mbar

4. Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Calibration	Calibration Interval
Data Acquisition Electronics DAEx	SPEAG	DAE4	1315	2016/07/26	1
E-field Probe	SPEAG	ES3DV3	3292	2016/09/02	1
System Validation Dipole D450V3	SPEAG	D450V3	1079	2016/02/28	3
Dielectric Probe Kit	Agilent	85070E	US44020288	/	/
Power meter	Agilent	E4417A	GB41292254	2016/10/25	1
Power sensor	Agilent	8481H	MY41095360	2016/10/25	1
Power sensor	Agilent	E9327A	US40441621	2016/10/25	1
Network analyzer	Agilent	8753E	US37390562	2016/10/24	1
Signal Generator	ROHDE & SCHWARZ	SMBV100A	258525	2016/10/22	1
Power Divider	ARRA	A3200-2	N/A	N/A	N/A
Dual Directional Coupler	Agilent	778D	50783	Note	
Attenuator 1	PE	PE7005-10	N/A	Note	
Attenuator 2	PE	PE7005-10	N/A	Note	
Attenuator 3	PE	PE7005-3	N/A	Note	
Power Amplifier	AR	5S1G4M2	0328798	Note	

Note:

1. The Probe,Dipole and DAE calibration reference to the Appendix A.

5. Measurement Uncertainty

No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.0%	N	1	1	1	6.0%	6.0%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.90%	3.90%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.70%	2.70%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
7	RF ambient conditions-noise	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
8	RF ambient conditions-reflection	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
9	Response time	B	0.80%	R	$\sqrt{3}$	1	1	0.50%	0.50%	∞
10	Integration time	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
11	RF ambient	B	3.00%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
12	Probe positioned mech. restrictions	B	0.40%	R	$\sqrt{3}$	1	1	0.20%	0.20%	∞
13	Probe positioning with respect to phantom shell	B	2.90%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
14	Max.SAR evalation	B	3.90%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
Test Sample Related										
15	Test sample positioning	A	1.86%	N	1	1	1	1.86%	1.86%	∞
16	Device holder uncertainty	A	1.70%	N	1	1	1	1.70%	1.70%	∞
17	Drift of output power	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
Phantom and Set-up										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
19	Liquid conductivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.80%	1.20%	∞
20	Liquid conductivity (meas.)	A	0.50%	N	1	0.64	0.43	0.32%	0.26%	∞
21	Liquid permittivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.80%	1.20%	∞
22	Liquid cpermittivity (meas.)	A	0.16%	N	1	0.64	0.43	0.10%	0.07%	∞
Combined standard uncertainty		$u_c=\sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$		/	/	/	/	9.79%	9.67%	∞
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		R	K=2	/	/	19.57%	19.34%	∞

6. SAR Measurements System Configuration

6.1. SAR Measurement Set-up

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

A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).

A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

A data acquisition electronic (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.

A unit to operate the optical surface detector which is connected to the EOC.

The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.

DASY5 software and SEMCAD data evaluation software.

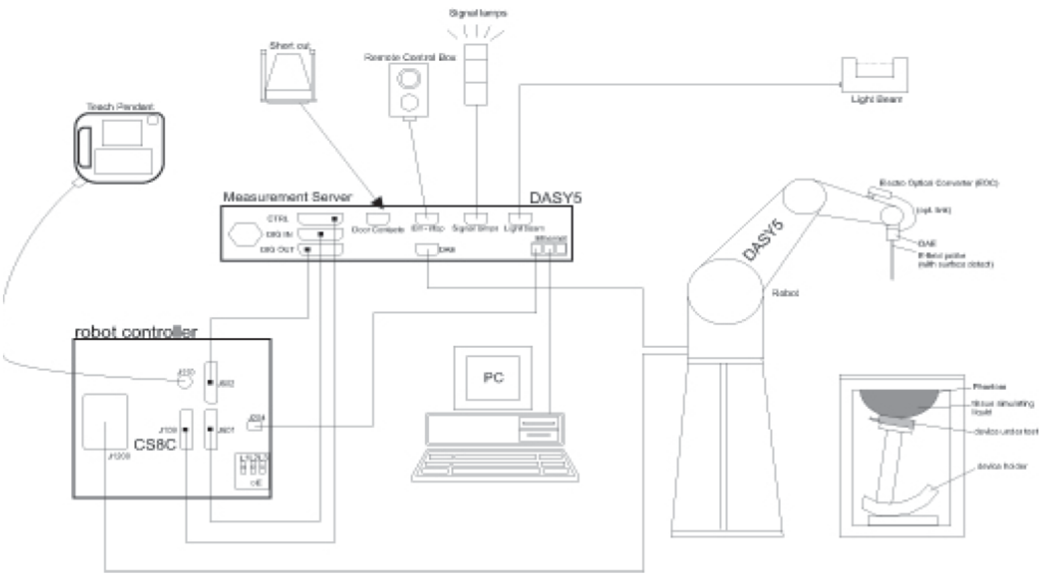
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

The generic twin phantom enabling the testing of left-hand and right-hand usage.

The device holder for handheld Mobile Phones.

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles allowing to validate the proper functioning of the system.



6.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

- **Probe Specification**

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

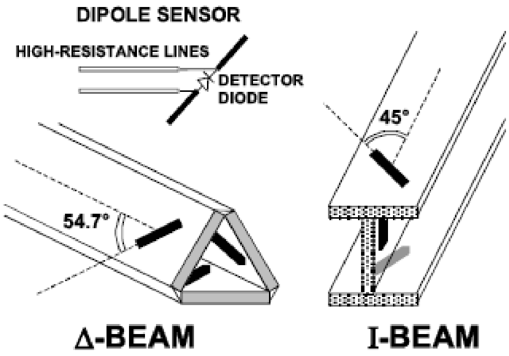
CalibrationISO/IEC 17025 calibration service available.

Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (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

- **Isotropic E-Field Probe**

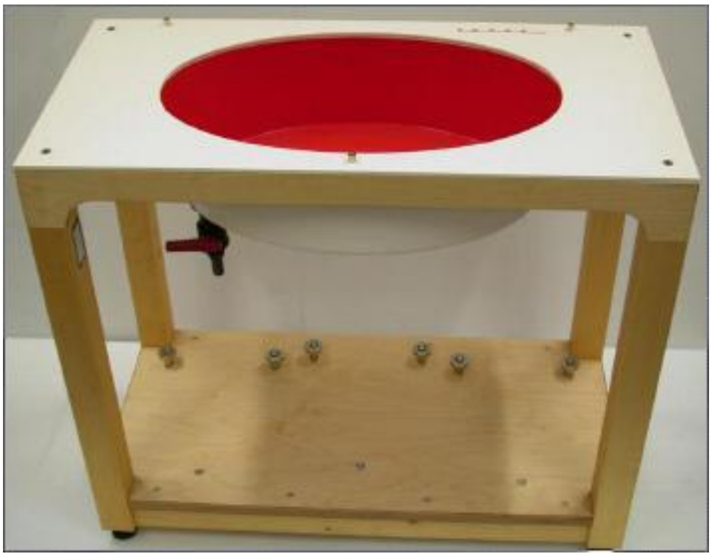
The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



6.3. Phantoms

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI isfully compatible with the IEC 62209-2 standard and all known tissuesimulating liquids. ELI has been optimized regarding its performance and can beintegrated into our standard phantom tables. A cover prevents evaporation ofthe liquid. Reference markings on the phantom allow installation of thecomplete setup, including all predefined phantom positions and measurementgrids, by teaching three points. The phantom is compatible with all SPEAGdosimetric probes and dipoles.



ELI4 Phantom

6.4. Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

Device holder supplied by SPEAG

7. SAR Test Procedure

7.1. Scanning Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 5 %.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot.Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

Zoom Scan

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x5 points within a cube whose base is centered around the maxima found in the preceding area scan.

Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses.The DASY5 system allows evaluations that combine measured data and robot positions, such as: • maximum search • extrapolation • boundary correction • peak search for averaged SAR During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard’s method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

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. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard’s method for extrapolation. For a grid using 7x7x5 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x5 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

7.2. Data Storage and Evaluation

Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	Sensitivity:	Normi, ai0, ai1, ai2
	Conversion factor:	ConvFi
	Diode compression point:	Dcpi
Device parameters:	Frequency:	f
	Crest factor:	cf
Media parameters:	Conductivity:	σ
	Density:	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

Vi: compensated signal of channel (i = x, y, z)
Ui: input signal of channel (i = x, y, z)
cf: crest factor of exciting field (DASY parameter)
dcpi: diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E} - \text{fieldprobes :} \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H} - \text{fieldprobes :} \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

Vi: compensated signal of channel (i = x, y, z)
Normi: sensor sensitivity of channel (i = x, y, z), [mV/(V/m)2] for E-field Probes
ConvF: sensitivity enhancement in solution
aij: sensor sensitivity factors for H-field probes
f: carrier frequency [GHz]
Ei: electric field strength of channel i in V/m
Hi: magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

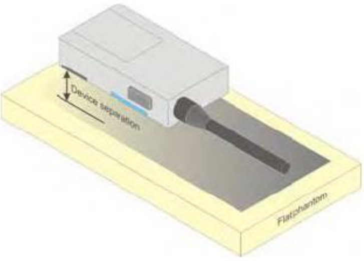
SAR: local specific absorption rate in mW/g
Etot: total field strength in V/m
σ: conductivity in [mho/m] or [Siemens/m]
ρ: equivalent tissue density in g/cm3

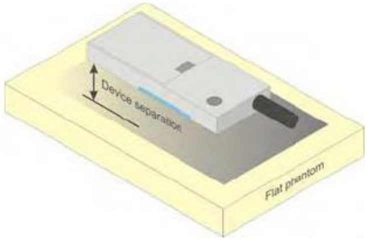
Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

8. Position of the wireless device in relation to the phantom

8.1. Front-of-face

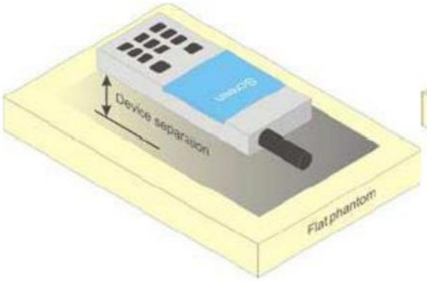
A typical example of a front-of-face device is a two-way radio that is held at a distance from the face of the user when transmitting. In these cases the device under test shall be positioned at the distance to the phantom surface that corresponds to the intended use as specified by the manufacturer in the user instructions. If the intended use is not specified, a separation distance of 25 mm between the phantom surface and the device shall be used.

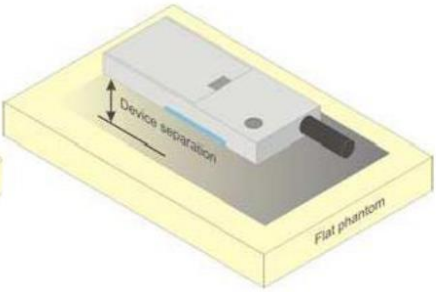




8.2. Body Position

A typical example of a body-worn device is a mobile phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person’s body using a carry accessory approved by the wireless device manufacturer.





9. SAR System Validation

Per FCC KDB 865664 D02,SAR system validadion status should be documented to confirm measurement accuracy.The SAR systems (including SAR probes,system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements.Reference dipoles were used with the required tissue-equivalent media for system validation,according to the procedures outlined in FCC KDB 865664 D01 and IEEE 1528-2013.Since SAR probe calibrations are frequency dependent,each probe calibration point,using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s),measurement frequencies, SAR probes and tissue dielectric parameters has been included.

SAR System Validation Summary

Probe	Probe type	Probe Calibration Point		Dielectric Parameters		CW Validation			Modulation Validation		
				Conductivity	Permittivity	Sensitivity	Probe linearity	Probe Isotropy	Moduation type	Duty factor	PAR
3292	ES3DV3	450	Head	0.89	43.64	PASS	PASS	PASS	4FSK/FM	PASS	N/A
3292	ES3DV3	450	Body	0.95	56.50	PASS	PASS	PASS	4FSK/FM	PASS	N/A

NOTE:
While the probes have been calibrated for both CW and modulated signals,all measurements were performed using communication systems calibrated for CW signals only.Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01 for scenarios when CW probe calibrations are used with other signal types.

10. System Verification

10.1. Tissue Dielectric Parameters

The liquid used for the frequency consisted of water, sugar, salt and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table 1 and 2 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB865664 D01.

Table 1.Composition of the Head Tissue Equivalent Matter

Mixture %	Frequency (Brain) 450MHz
Water	38.56
Sugar	56.32
Salt	3.95
Preventol	0.10
Cellulose	1.07
Dielectric Parameters Target Value	f=450MHz ε_r=43.5 σ=0.87

Table 2.Composition of the Body Tissue Equivalent Matter

Mixture %	Frequency (Brain) 450MHz
Water	56.16
Sugar	46.78
Salt	1.49
Preventol	0.10
Cellulose	0.47
Dielectric Parameters Target Value	f=450MHz ε_r=56.7 σ=0.94

CheckResult:

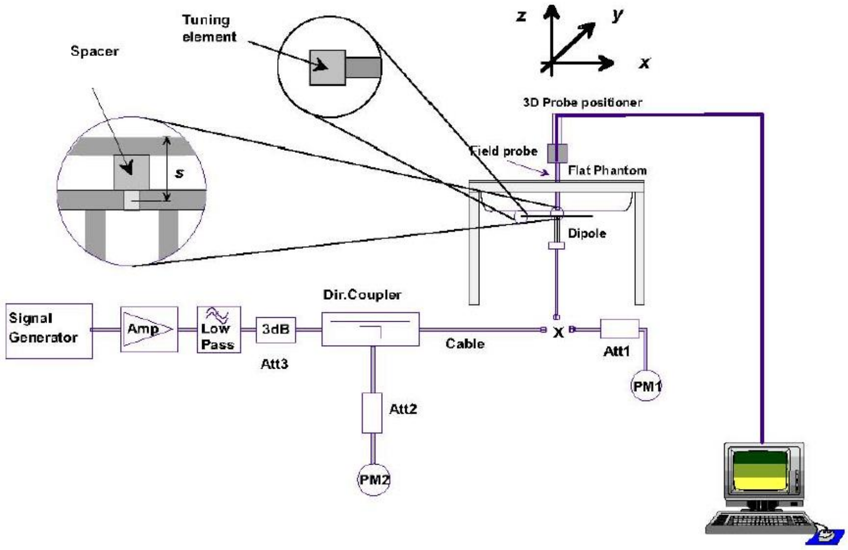
Dielectric performance of Head tissue simulating liquid				
Frequency (MHz)	Description	DielectricParameters		Temp
		εr	σ(s/m)	℃
450	Recommended result ±5% window	43.50 41.32 - 45.67	0.87 0.83–0.91	/
	Measurement value 2017-06-06	43.64	0.89	21

Dielectric performance of Body tissue simulating liquid				
Frequency (MHz)	Description	DielectricParameters		Temp
		εr	σ(s/m)	℃
450	Recommended result ±5% window	56.7 53.87 - 59.53	0.94 0.89–0.98	/
	Measurement value 2017-06-07	56.50	0.95	21

10.2. SAR System Verification

The purpose of the system check is to verify that the system operates within its specifications at the decice test frequency.The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).
System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



The output power on dipole port must be calibrated to 26 dBm (398mW) before dipole is connected.

Check Result:

System Validation Result for Head				
Frequency (MHz)	Description	SAR(W/kg)		Temp
		1g	10g	℃
450	Recommended result ±10% window	1.81 1.63 – 1.99	1.21 1.09 - 1.33	/
	Measurement value 2017-06-06	1.78	1.17	21

System Validation Result for Body				
Frequency (MHz)	Description	SAR(W/kg)		Temp
		1g	10g	℃
450	Recommended result ±10% window	1.74 1.57 – 1.91	1.16 1.04 - 1.27	/
	Measurement value 2017-06-07	1.69	1.12	21

Note:

1. *the graph results see follow.*
2. *Recommended Values used derive from the calibration certificate and 398mW is used asfeeding power to the calibrated dipole.*

System Performance Check at 450 MHz Head

DUT: Dipole 450 MHz; Type: D450V3; Serial: 4d134

Date:2017-06-06
Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 450 MHz; σ = 0.89 S/m; ε_r = 43.64; ρ = 1000 kg/m^3

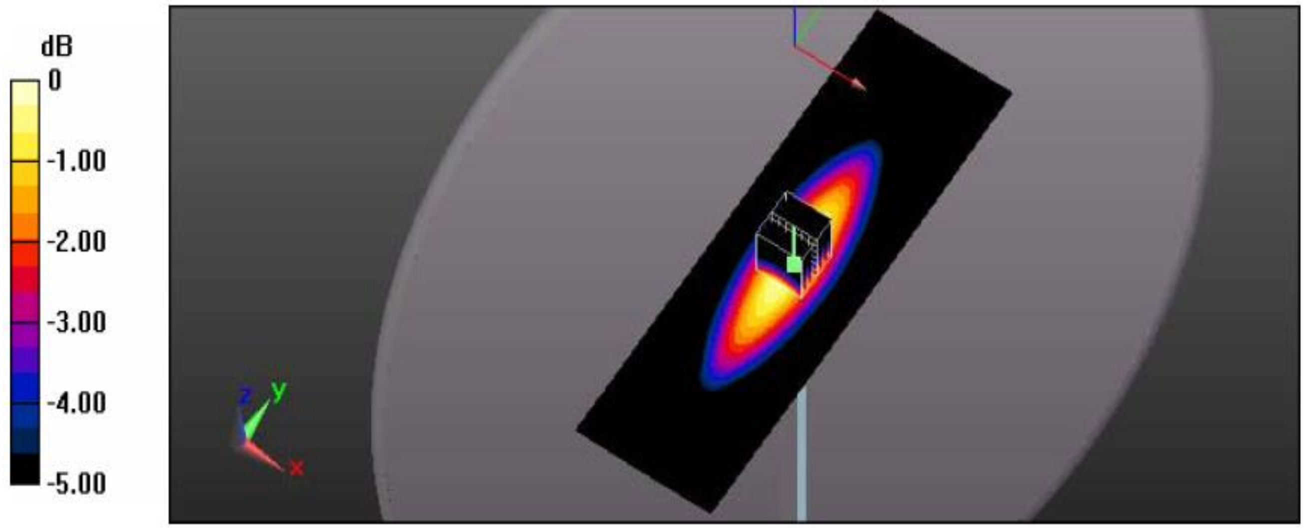
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV3 - SN3292; ConvF(7.12, 7.12, 7.12); Calibrated: 02/09/2016;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 26/07/2016
Phantom: ELI v4.0; Type: QDOVA001BB;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)
Area Scan (61x171x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 2.58 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.994 V/m; Power Drift = 0.082 dB
Peak SAR (extrapolated) = 3.542 W/kg

SAR(1 g) = 1.78 mW/gSAR(10 g) = 1.17 mW/g

Maximum value of SAR (measured) = 2.59 mW/g



System Performance Check 450MHz 398mW

System Performance Check at 450 MHz Body

DUT: Dipole 450 MHz; Type: D450V3; Serial: 4d134

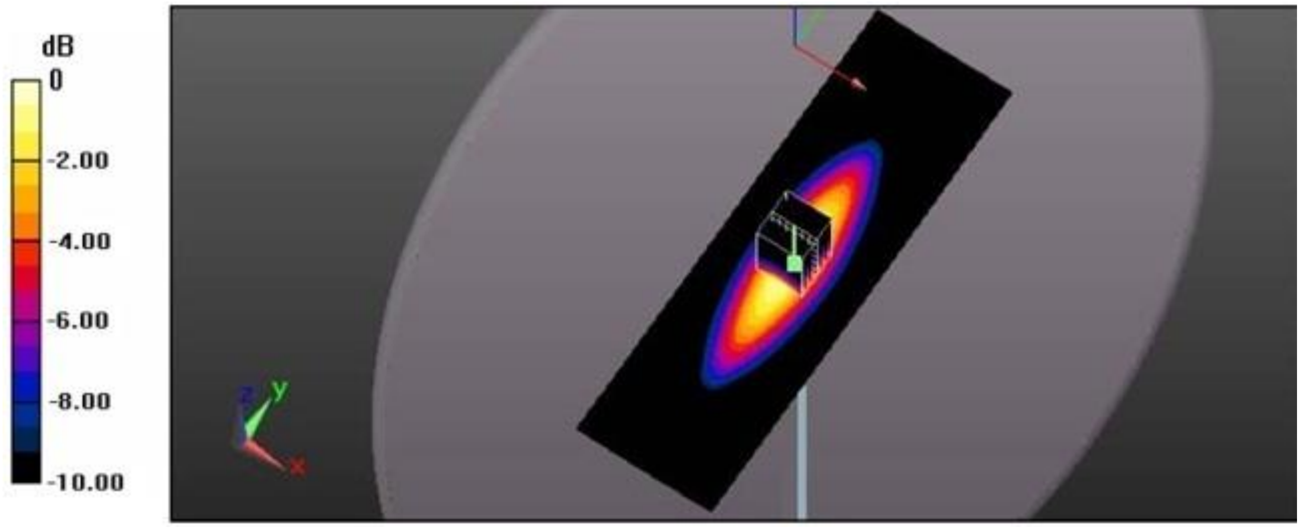
Date:2017-06-07
Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 450 MHz; σ = 0.95 S/m; ε_r = 56.50; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV3 - SN3292; ConvF(7.33, 7.33, 7.33); Calibrated: 02/09/2016;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 26/07/2016

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.5 (6469)
Area Scan (61x171x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 2.15 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 46.528 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.262 W/kg

SAR(1 g) = 1.69 mW/gSAR(10 g) = 1.12 mW/g

Maximum value of SAR (measured) = 3.24 mW/g



System Performance Check 450MHz Body 398mW

11. SAR Exposure Limits

Type Exposure	Limit (W/kg)	
	General Population / Uncontrolled Exposure Environment	Occupational / Controlled Exposure Environment
Spatial Average SAR (whole body)	0.08	0.4
Spatial Peak SAR (1g cube tissue for head and trunk)	1.60	8.0
Spatial Peak SAR (10g for limb)	4.0	20.0

Population/Uncontrolled Environments: are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments: are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

12. Conducted Power Measurement Results

Mode	Channel	Frequency (MHz)	Conducted power (dBm)
Analog / 12.5KHz	CH_1	406.15	36.50
	CH_2	418.05	36.60
	CH_3	435.05	36.50
	CH_4	453.05	36.50
	CH_5	469.95	36.60
Digital / 12.5KHz	CH_1	406.15	36.39
	CH_2	418.05	36.51
	CH_3	435.05	36.45
	CH_4	453.05	36.46
	CH_5	469.95	36.54

Bluetooth			
Mode	Channel	Frequency (MHz)	Conducted power (dBm)
GFSK	00	2402	-0.24
	39	2441	2.14
	78	2480	2.13
π/4QPSK	00	2402	-4.64
	39	2441	-1.95
	78	2480	-2.20
8DPSK	00	2402	-3.61
	39	2441	-1.05
	78	2480	-1.72

13. Maximum Tune-up Limit

This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB publication 447498 D01

Mode	Channel Separation (KHz)	Operation Frequency Range	Tune up power
Analog / Digtial	12.5	406.1MHz~470MHz	36.80 dBm

Bluetooth			
Mode	Channel	Frequency (MHz)	Conducted power (dBm)
GFSK	0	2402	0.00
	39	2441	3.00
	78	2480	3.00
π/4QPSK	0	2402	-4.00
	39	2441	-2.00
	78	2480	-2.00
8DPSK	0	2402	-3.00
	39	2441	-1.00
	78	2480	-1.00

Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances ≦50mm are determined by:

[(max. Power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)] ≦15.0 for 1-g SAR

Band/Mode	F(GHz)	Position	separation distance	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
					dBm	mW	
Bluetooth	2.45	Front of Face	25	240	3	2.00	Yes
		Body with Belt Clip	0	50	3	2.00	Yes

Per KDB 447498 D01, when the minimum test separation distance is <5mm, a distance of 5mm is applied to determine SAR test exclusion.

14. SAR Measurement Results

Front of Face										
Test Position	Frequency		Conducted Power (dBm)	Tune-up limit	Power Drift(dB)	Tune-up Scaling factor	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	SAR 50% duty (W/kg)	Test Plot
	CH	MHz								
Analog mode										
Front of Face	CH_1	406.15	36.50	36.80	-0.11	1.07	4.32	4.63	2.32	-
	CH_2	418.05	36.60	36.80	-	-	-	-	-	-
	CH_3	435.05	36.50	36.80	-0.10	1.07	4.72	5.06	2.53	AF
	CH_4	453.05	36.50	36.80	-	-	-	-	-	-
	CH_5	469.95	36.60	36.80	-0.08	1.05	4.46	4.67	2.34	-
Diatigal mode										
Front of Face	CH_1	406.15	36.39	36.80	-0.11	1.10	4.67	5.13	2.57	-
	CH_2	418.05	36.51	36.80	-	-	-	-	-	-
	CH_3	435.05	36.45	36.80	-0.02	1.08	5.10	5.53	2.77	DF
	CH_4	453.05	36.46	36.80	-	-	-	-	-	-
	CH_5	469.95	36.54	36.80	-0.12	1.06	4.71	5.00	2.50	-

Worst case mode for DP995

Front of Face										
Test Position	Frequency		Conducted Power (dBm)	Tune-up limit	Power Drift(dB)	Tune-up Scaling factor	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	SAR 50% duty (W/kg)	Test Plot
	CH	MHz								
Analog mode										
Front of Face	CH_3	435.05	36.50	36.80	-0.19	1.07	4.66	4.99	2.50	-
Diatigal mode										
Front of Face	CH_3	435.05	36.45	36.80	-0.13	1.08	4.93	5.34	2.67	-

Note:

1. *The value with blue color is the maximum SAR Value of each test band.*
2. *Batteries are fully charged at the beginning of the SAR measurements*
3. *The EUT was tested for face-held SAR with a 2.5cm separation distance between the front of the EUT and the outer surface of the planer phantom*
4. *When the SAR for all antennas tested using the default battery is ≤ 3.5 W/kg (50% PTT duty factor), testing of all other required channels is not necessary.*
5. *When the SAR of an antenna tested on the highest output power using the default battery is > 3.5 W/Kg and ≤ 4.0 W/Kg (50% PTT duty factor), testing of the immediately adjacent channel(s) is not necessary, but testing of other required channels may still be required.*
6. *When the SAR for all antennas tested using the default battery ≤ 4.0 W/kg(50% PTT duty factor), test additional batteries using the antenna and channel configuration that resulted in the highest SAR.*

Body-worn										
Test Position	Frequency		Conducted Power (dBm)	Tune-up limit	Power Drift(dB)	Tune-up Scaling factor	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	SAR 50% duty (W/kg)	Test Plot
	CH	MHz								
Analog mode										
Rear	CH_1	406.15	36.50	36.80	-0.06	1.07	6.15	6.59	3.30	-
	CH_2	418.05	36.60	36.80	-	-	-	-	-	-
	CH_3	435.05	36.50	36.80	-0.12	1.07	6.51	6.98	3.49	AB
	CH_4	453.05	36.50	36.80	-	-	-	-	-	-
	CH_5	469.95	36.60	36.80	-0.10	1.05	6.36	6.66	3.33	-
Diatigal mode										
Rear	CH_1	406.15	36.39	36.80	-0.16	1.10	6.30	6.92	3.46	-
	CH_2	418.05	36.51	36.80	-	-	-	-	-	-
	CH_3	435.05	36.45	36.80	-0.11	1.08	6.82	7.39	3.70	DB
	CH_4	453.05	36.46	36.80	-	-	-	-	-	-
	CH_5	469.95	36.54	36.80	-0.09	1.06	6.45	6.85	3.43	-

Worst case mode for DP995

Body-worn										
Test Position	Frequency		Conducted Power (dBm)	Tune-up limit	Power Drift(dB)	Tune-up Scaling factor	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	SAR 50% duty (W/kg)	Test Plot
	CH	MHz								
Analog mode										
Rear	CH_3	435.05	36.50	37.00	-0.08	1.07	6.47	6.93	3.47	-
Diatigal mode										
Rear	CH_3	435.05	36.45	37.00	-0.19	1.08	6.79	7.36	3.68	-

Note:

1. *The value with blue color is the maximum SAR Value of each test band.*
2. *Batteries are fully charged at the beginning of the SAR measurements*
3. *The Body-worn SAR evaluation was performed with the Leather Case body-worn accessory attached to the DUT and touching the outer surface of the planar phantom*
4. *When the SAR for all antennas tested using the default battery is ≤ 3.5 W/kg (50% PTT duty factor), testing of all other required channels is not necessary.*
5. *When the SAR of an antenna tested on the highest output power using the default battery is > 3.5 W/Kg and ≤ 4.0 W/Kg (50% PTT duty factor), testing of the immediately adjacent channel(s) is not necessary, but testing of other required channels may still be required.*
6. *When the SAR for all antennas tested using the default battery ≤ 4.0 W/kg(50% PTT duty factor), test additional batteries using the antenna and channel configuration that resulted in the highest SAR.*

SAR Test Data Plots

Test Plot:	AF	Test Position:	Front of Face

Date:2017-06-06

Communication System: Customer System; Frequency: 435.05 MHz;
Medium parameters used (interpolated): f = 435.05 MHz; σ = 0.86 S/m; εr = 44.05; ρ=1000 kg/m3

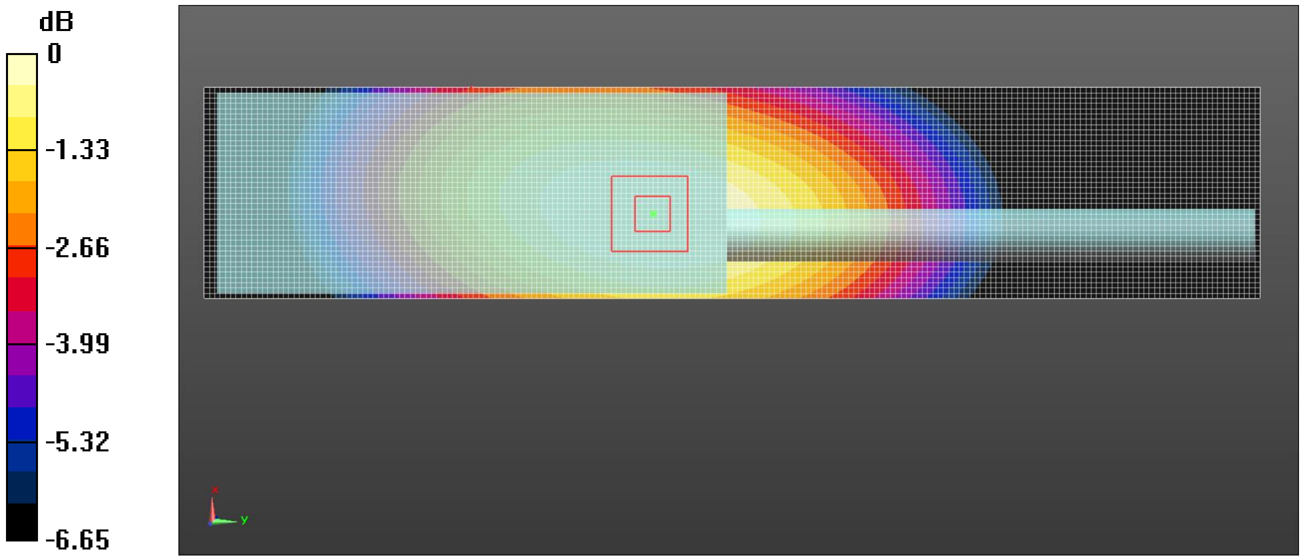
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(7.12, 7.12, 7.12); Calibrated: 02/09/2016;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 26/07/2016
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x151x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) =5.58 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 78.56 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 7.511 mW/g

SAR(1 g) = 4.72 mW/g; SAR(10 g) = 3.58 mW/g

Maximum value of SAR (measured) = 5.55 W/kg



Test Plot:	DF	Test Position:	Front of Face

Date:2017-06-06

Communication System: Customer System; Frequency: 435.05 MHz;
Medium parameters used (interpolated): f = 435.05 MHz; σ = 0.86 S/m; εr = 44.05; ρ=1000 kg/m3

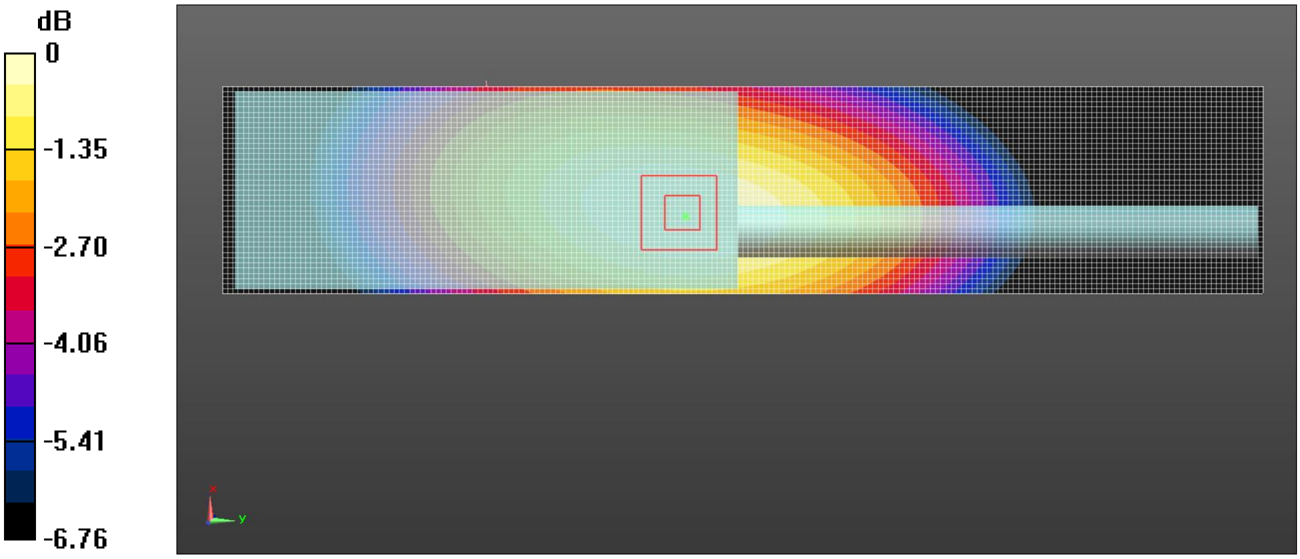
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(7.12, 7.12, 7.12); Calibrated: 02/09/2016;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 26/07/2016
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x151x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) =5.27 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =81.12 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 6.42 mW/g

SAR(1 g) = 5.10 mW/g; SAR(10 g) = 3.86 mW/g

Maximum value of SAR (measured) = 5.25 W/kg



Test Plot:	AB	Test Position:	Body-worn

Date:2017-06-07

Communication System: Customer System; Frequency: 435.05 MHz;
Medium parameters used (interpolated): f = 435.05 MHz; σ = 0.94 S/m; εr = 56.95; ρ=1000 kg/m3

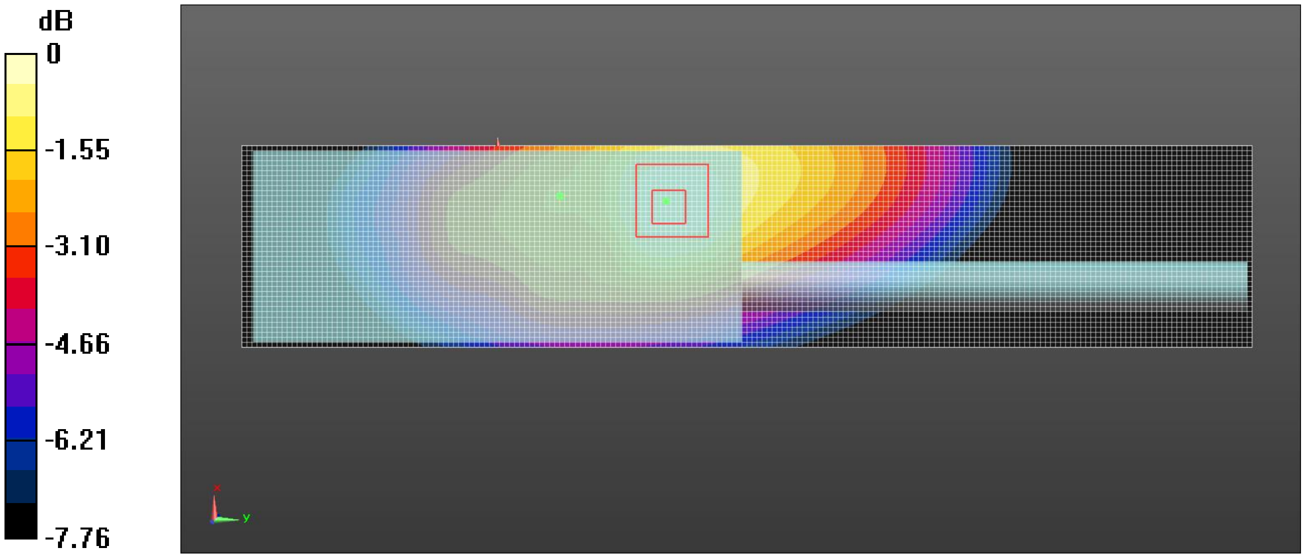
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(7.12, 7.12, 7.12); Calibrated: 02/09/2016;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 26/07/2016
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x151x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) =6.93 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =91.76 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 8.60 mW/g

SAR(1 g) = 6.51 mW/g; SAR(10 g) = 4.59 mW/g

Maximum value of SAR (measured) =6.91 W/kg



Test Plot:	DB	Test Position:	Body-worn

Date:2017-06-07

Communication System: Customer System; Frequency: 435.05 MHz;
Medium parameters used (interpolated): f = 435.05 MHz; σ = 0.94 S/m; εr = 56.95; ρ=1000 kg/m3

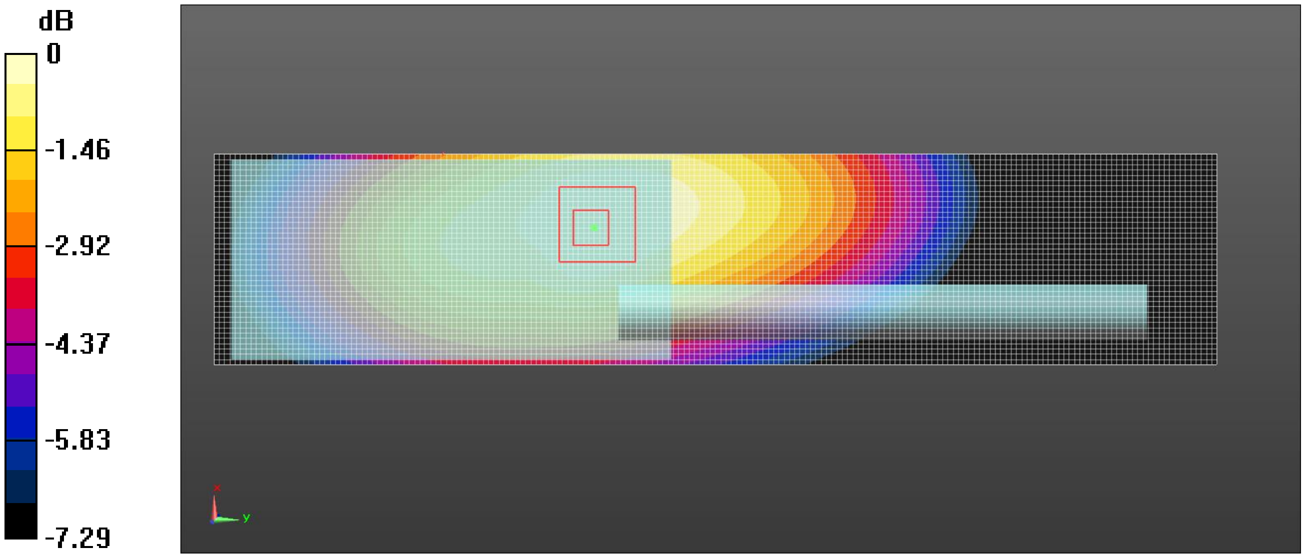
DASY5 Configuration:
•Probe: ES3DV3 - SN3292; ConvF(7.12, 7.12, 7.12); Calibrated: 02/09/2016;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 26/07/2016
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan(41x151x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) =7.29 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.845 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 13.71 mW/g

SAR(1 g) = 6.82 mW/g; SAR(10 g) =4.39 mW/g

Maximum value of SAR (measured) = 7.27 W/kg



15. Simultaneous Transmission analysis

No.	Simultaneous Transmission Configurations	Face	Body-worn	Note
1	PTT + Bluetooth (data)	Yes	Yes	

General note:

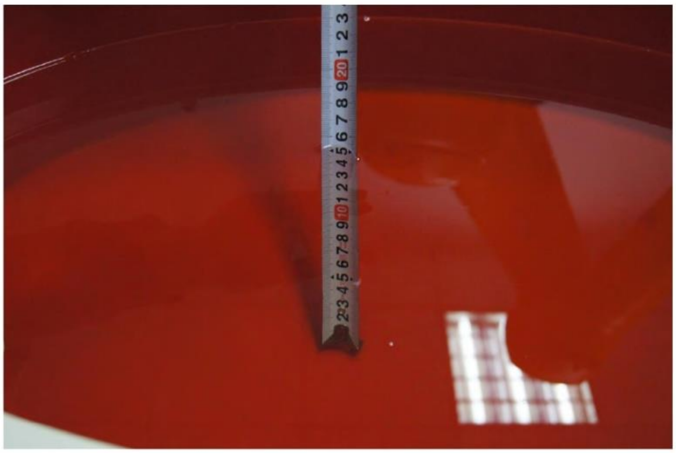
1. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
2. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 based on the formula below
   a) [(max. Power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)/x]W/kg for test separation distances ≦50mm; whetn x=7.5 for 1-g SAR, and x=18.75 for 10-g SAR.
   b) When the minimum separation distance is <5mm, the distance is used 5mm to determine SAR test exclusion
   c) 0.4 W/kg for 1-g SAR and 1.0W/kg for 10-g SAR, when the test separation distances is >50mm.

Bluetooth Max power	Exposure position	Face	Body worn
	Test separation	25mm	0mm
3.0 dBm	Estimated SAR (W/kg)	0.01W/kg	0.04 W/kg

Maximum reported SAR value

PMR TNF + Bluetooth DSS					
Mode		Exposure Position	Max SAR (W/kg)		Summed SAR (W/kg)
			PMR TNF	Bleutooth DSS	
PTT	Analog mode	Front of Face	2.53	0.01	2.54
		Body	3.49	0.04	3.53
	Diatigal mode	Front of Face	2.77	0.01	2.78
		Body	3.70	0.04	3.74

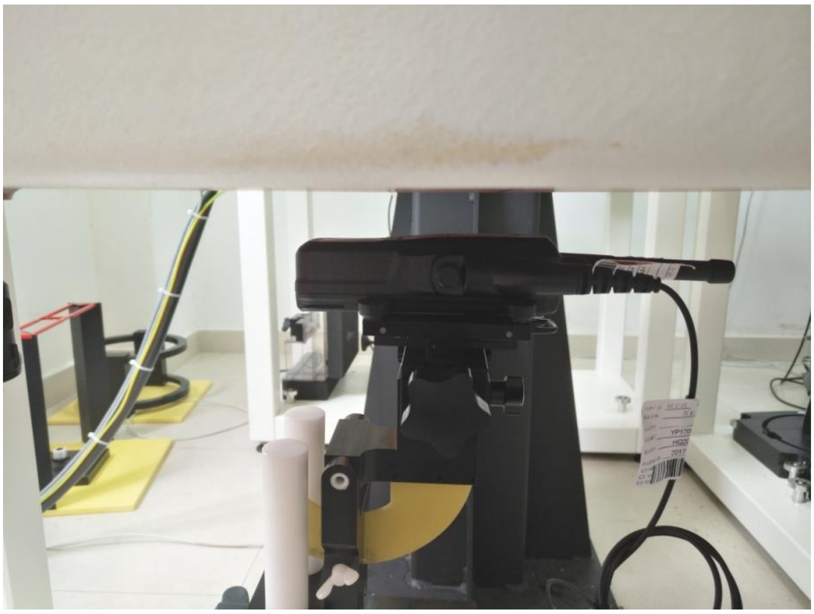
16. Test Setup Photos



Liquid depth in the flat Phantom (450MHz) (15.3cm deep)

DP990

Body with headset (0mm)



Face (25mm)

DP995


Body with headset (0mm)


Face (25mm)

17. Photos of the EUT

Please reference to the test report No.: TRE1705023101.

---------End of Report---------