FCC SAR TEST REPORT

For

Product Name: Multi-mode Advanced Radio
Brand Name: Hytera
Model No.: PDC680 UxB1
Series Model: N/A
FCC ID: YAMPDC680UXB1
Test Report Number:
C190326R01-SF

Issued for

Hytera Communications Corporation Limited
Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, People's Republic of China

Issued by

Compliance Certification Services Inc.
Kun shan Laboratory
No.10 Weiye Rd., Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China
TEL: 86-512-57355888
FAX: 86-512-57370818

TESTING CERT #2541.01

Revision History

Revision	REPORT NO.	Date	Page Revised	Contents
Original	C190326R01-SF	April 29, 2019	N/A	N/A

TABLE OF CONTENTS

1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Product Name:	Multi-mode Advanced Radio
Brand Name:	Hytera
Model Name.:	PDC680 UxB1
Series Model:	N/A
Device Category:	PORTABLE DEVICES
Exposure Category:	OCCUPATIONAL/CONTROLLED EXPOSURE
Date of Test:	February 21,2019 ~ February 22,2019
Applicant:	**Hytera Communications Corporation Limited** Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, People's Republic of China
Manufacturer:	**Hytera Communications Corporation Limited** Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, People's Republic of China
Application Type:	Certification

APPLICABLE STANDARDS AND TEST PROCEDURES

STANDARDS AND TEST PROCEDURES	TEST RESULT
ANSI/IEEE C95.1-1999 FCC 47 CFR Part 2 (2.1093) IEEE 1528-2013 KDB 447498 D01 KDB 643646 D01 KDB 865664 D01 KDB 865664 D02	No non-compliance noted

Deviation from Applicable Standard

None

The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in KDB 865664 The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Eric Lin
RF Manager
Compliance Certification Services Inc.

Tested by:

Kamily Jia
Test Engineer
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product Name:	Multi-mode Advanced Radio
Brand Name:	Hytera
Model Name.:	PDC680 UxB1
Series Model:	N/A
Model Discrepancy:	N/A
FCC ID:	YAMPDC680UXB1
Software version	V2.5.03
Hardware version	C
Device Category:	Production unit
Frequency Range:	350MHz to 527MHz
Number of Channels:	The equipment is able to operate on any designated channel within the specified frequency range.
Modulation Type:	FM for Analog; 4FSK for Digital
Channel Separation:	12.5KHz/25KHz for FM, 12.5KHz for 4FSK
Rated Power:	Digital:1W(30dBm)/4W(36.02dBm) Analog: 1W(30dBm)/3W(34.77dBm)
Antenna Type:	External
Antenna Gain:	0dBi
Power supply:	Characteristics: 7.7V, 2400mAh Model: T4

2.1 MAXIMUM RF OUTPUT POWER WITH TEST CHANNEL

Band / Mode	Channel	High power Tune-up power(dBm)	Low power Tune-up power(dBm)
Digital modulation (12.5KHz)	350.025	36.5	31
	380.975	36.5	31
	405.975	36.5	31
	430.975	36.5	31
	450.025	36.5	31
	459.975	36.5	31
	469.975	36.5	31
	511.975	36.5	31
	526.975	36.5	31

Band / Mode	Channel	High power Tune-up power(dBm)	Low power Tune-up power(dBm)
Analogue modulation (25KHz)	350.025	35	31
	380.975	35	31
	405.975	35	31
	430.975	35	31
	450.025	35	31
	459.975	35	31
	469.975	35	31
	511.975	35	31
	526.975	35	31

Band / Mode	Channel	High power Tune-up power(dBm)	Low power Tune-up power(dBm)
Analogue modulation (12.5KHz)	350.025	35	31
	380.975	35	31
	405.975	35	31
	430.975	35	31
	450.025	35	31
	459.975	35	31
	469.975	35	31
	511.975	35	31
	526.975	35	31

2.2 STATEMENT OF COMPLIANCE

The maximum results of Specific Absorption Rate (SAR) found during testing for **Hytera Communications Corporation Limited, PDC680 UxB1,** are as follows.

Equipment Class	Frequency Band	Highest SAR Summary Body-worn 1g SAR (W/kg)		Highest SAR Summary Face-Held 1g SAR (W/kg)	
		100% duty cycle	50% duty cycle	100% duty cycle	50% duty cycle
FM	450MHz	6.893	3.447	5.276	2.638
4FSK	450MHz	3.168	1.584	2.678	1.339

This device is in compliance with Specific Absorption Rate (SAR) for Occupational/controlled exposure limits (8 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1999, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

3. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 W/Kg for an uncontrolled environment and 8.0 W/Kg for an occupational/controlled environment as recommended by the FCC 47 CFR Part 2 (2.1093).

4. TEST METHODOLOGY

The Specific Absorption Rate (SAR) testing specification, method and procedure for this device is in accordance with the following standards:

☒ FCC 47 CFR Part 2 (2.1093)
☒ ANSI/IEEE C95.1-1999
☒ IEEE 1528-2013
☒ KDB 447498 D01v06 General RF Exposure Guidance
☒ KDB 865664 D01v01r04 Measurement 100 MHz to 6 GHz
☒ KDB 865664 D02 v01r02 RF Exposure Reporting
☒ KDB 643646 D01v01r03 SAR Test for PTT Radios

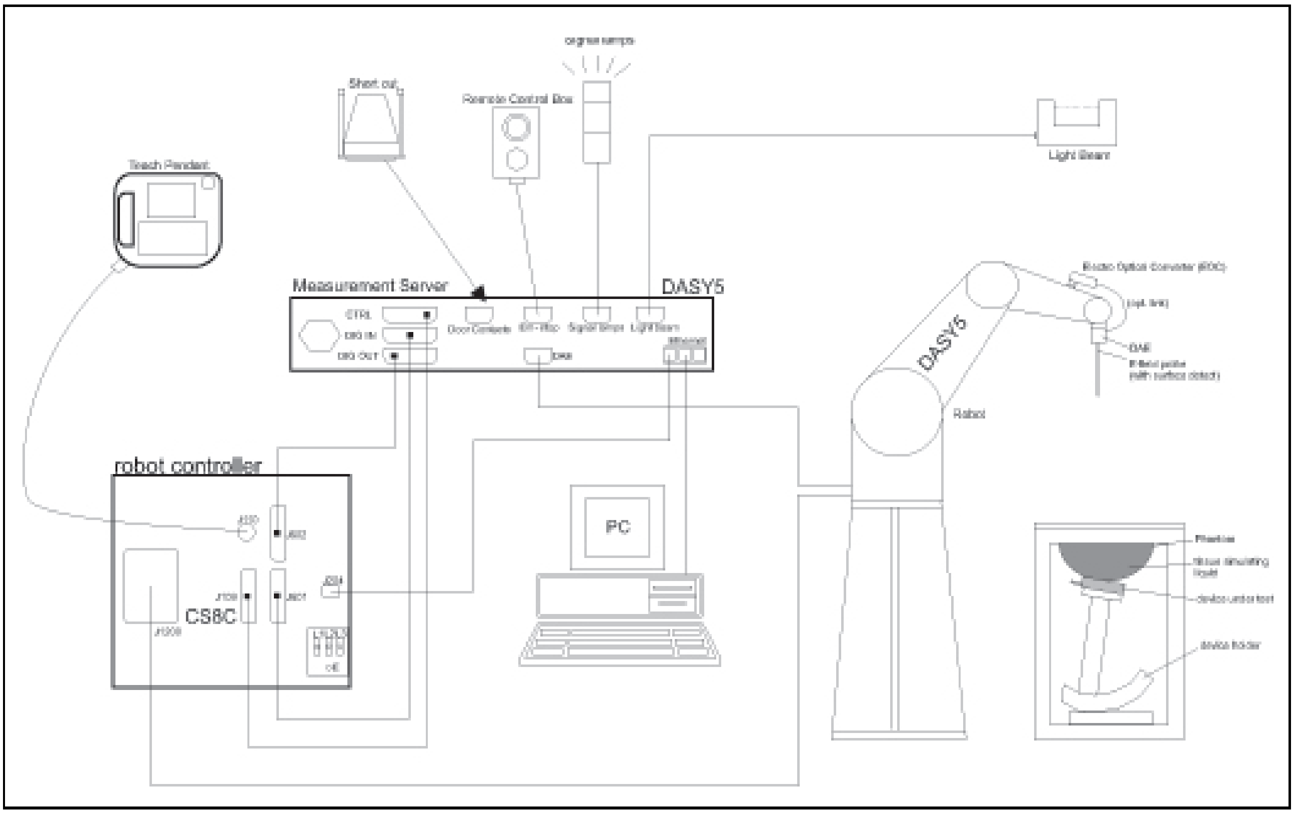
5. DOSIMETRIC ASSESSMENT SETUP

These measurements were performed with the automated near-field scanning system DASY 5 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the E-field PROBE EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than ±0.25 dB. IEEE1528 and CENELEC EN 62209.

The following table gives the recipes for tissue simulating liquids.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	**Head**	**Body**	**Head**	**Body**	**Head**	**Body**	**Head**	**Body**	**Head**	**Body**
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

5.1 MEASUREMENT SYSTEM DIAGRAM



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

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant 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 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 between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

5.2 SYSTEM COMPONENTS

The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV celeron, 128MB chip-disk and 128 MB RAM. The necessary circuits for communication with either the DAE4(or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.

The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE4) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements

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

Calibration: Basic Broad Band Calibration in air: 10-3000 MHz.
Conversion Factors (CF) for HSL 900 and HSL 1800
CF-Calibration for other liquids and frequencies upon request.

Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in HSL (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: 9 mm) Tip diameter: 2.5 mm (Body: 10 mm) Distance from probe tip to dipole centers: 1 mm **Application:** High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	 Interior of probe
SAM Twin Phantom	
Construction: The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50360 and IEC 62209. 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 manually teaching three points with the robot. **Shell Thickness:** 2 ±0.2 mm **Filling Volume:** Approx. 25 liters **Dimensions:** Height: 850mm; Length: 1000mm; Width: 750mm	
SAM Phantom (ELI4 v4.0)	
Description Construction: Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 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 supported by software version DASY4/DASY5.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles **Shell Thickness:** 2.0 ± 0.2 mm (sagging: <1%) **Filling Volume:** Approx. 25 liters **Dimensions:** Major ellipse axis: 600 mm **Minor axis:** 400 mm 500mm	

Device Holder for SAM Twin Phantom

Construction: In combination with the Twin SAM Phantom, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

System Validation Kits for SAM Twin Phantom

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 900,1800,2450,5800 MHz

ReTune loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions:

D835V2: dipole length: 161 mm; overall height: 340 mm
D1800V2: dipole length: 72.5 mm; overall height: 300 mm
D1900V2: dipole length: 67.7 mm; overall height: 300 mm
D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300mm

System Validation Kits for ELI4 phantom

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 900, 1800, 2450, 5800 MHz

ReTune loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions:

D835V2: dipole length: 161 mm; overall height: 340 mm
D1800V2: dipole length: 72.5 mm; overall height: 300 mm
D1900V2: dipole length: 67.7 mm; overall height: 300 mm
D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm

6. EVALUATION PROCEDURES

DATA EVALUATION

The DASY 5 post processing 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	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
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 be imported into the software from the configuration files issued for the DASY 5 components. In the direct measuring mode of the multi-meter 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:

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

with V_i = Compensated signal of channel i (i = x, y, z)
U_i = Input signal of channel i (i = x, y, z)
cf = Crest factor of exciting field (DASY 5 parameter)
dcp_i = Diode compression point (DASY 5 parameter)

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

E-field probes:

$$E_i = \sqrt{\frac{V_i}{Norm_i \bullet ConvF}}$$

H-field probes:

$$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with V_i = Compensated signal of channel i (i = x, y, z)
$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z)
μV/(V/m)² for E0field 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.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

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.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with P_{pwe} = Equivalent power density of a plane wave in mW/cm^2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

SAR EVALUATION PROCEDURES

The procedure for assessing the peak spatial-average SAR value consists of the following steps:

- **Power Reference Measurement**

  The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- **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 finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY 5 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, grid was at to 15 mm by 15 mm and can be edited by a user.

- **Zoom Scan**

  Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

- **Power Drift measurement**

  The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY 5 software stop the measurements if this limit is exceeded.

- **Z-Scan**

  The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

SPATIAL PEAK SAR EVALUATION

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1529 standard. It can be conducted for 1 g and 10 g.

The DASY 5 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 maximum 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

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 Cube 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 5x5x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

Boundary effect

For measurements in the immediate vicinity of a phantom surface, the field coupling effects between the probe and the boundary influence the probe characteristics. Boundary effect errors of different dosimetric probe types have been analyzed by measurements and using a numerical probe model. As expected, both methods showed an enhanced sensitivity in the immediate vicinity of the boundary. The effect strongly depends on the probe dimensions and disappears with increasing distance from the boundary. The sensitivity can be approximately given as:

$$S \approx S_o + S_b exp(-\frac{z}{a})cos(\pi\frac{z}{\lambda})$$

Since the decay of the boundary effect dominates for small probes (a<<λ), the cos-term can be omitted. Factors *Sb* (parameter Alpha in the DASY 5 software) and *a* (parameter Delta in the DASY 5 software) are assessed during probe calibration and used for numerical compensation of the boundary effect. Several simulations and measurements have confirmed that the compensation is valid for different field and boundary configurations.

This simple compensation procedure can largely reduce the probe uncertainty near boundaries. It works well as long as:

- the boundary curvature is small
- the probe axis is angled less than 30_ to the boundary normal
- the distance between probe and boundary is larger than 25% of the probe diameter
- the probe is symmetric (all sensors have the same offset from the probe tip)

Since all of these requirements are fulfilled in a DASY 5 system, the correction of the probe boundary effect in the vicinity of the phantom surface is performed in a fully automated manner via the measurement data extraction during post processing.

7. MEASUREMENT UNCERTAINTY

According to IEEE 1528/2013 and IEC 62209-1/2016(0.3-3GHz range)-1g						
Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\,(1g)}$	Std. Unc. (1-g)	v_i or V_{eff}
Measurement System						
Probe Calibration (k=1)	5.50	Normal	1	1	5.50	∞
Axial Isotropy	4.70	Rectangular	√3	0.7	1.90	∞
Modulation Response	2.40	Rectangular	√3	1	1.39	∞
Hemispherical Isotropy	9.60	Rectangular	√3	0.7	3.88	∞
Boundary Effect	1.00	Rectangular	√3	1	0.58	∞
Linearity	4.70	Rectangular	√3	1	2.71	∞
System Detection Limit	1.00	Rectangular	√3	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	√3	1	0.46	∞
Integration Time	2.60	Rectangular	√3	1	1.50	∞
RF Ambient Noise	3.00	Rectangular	√3	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	√3	1	1.73	∞
Probe Positioner	0.40	Rectangular	√3	1	0.23	∞
Probe Positioning	2.90	Rectangular	√3	1	1.67	∞
Max. SAR Evaluation	1.00	Rectangular	√3	1	0.58	∞
Test sample Related						
Test sample Positioning	2.9	Normal	1	1	2.9	145
Device Holder Uncertainty	3.6	Normal	1	1	3.6	5
Power drift	5	Rectangular	√3	1	2.89	∞
Power Scaling	0	Rectangular	√3	1	0.00	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	4	Rectangular	√3	1	2.31	∞
SAR correction	1.9	Rectangular	√3	1	1.10	∞
Liquid Conductivity (target)	5	Rectangular	√3	0.64	1.85	∞
Liquid Conductivity (meas)	4.04	Rectangular	√3	0.78	1.82	∞
Liquid Permittivity (target)	5	Rectangular	√3	0.6	1.73	∞
Liquid Permittivity (meas)	-4.83	Rectangular	√3	0.26	-0.73	∞
Temp. unc. - Conductivity	1.7	Rectangular	√3	0.78	0.77	∞
Temp. unc. - Permittivity	0.3	Rectangular	√3	0.23	0.04	∞
Combined Std. Uncertainty		RSS			10.85	361
Expanded STD Uncertainty		k=2			21. 70%	

8. EXPOSURE LIMIT

(A). Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Note: Whole-Body SAR is averaged over the entire body, **partial-body SAR** is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. **SAR for hands, wrists, feet and ankles** is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments are defined as locations where there is the exposure of individuals 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).

NOTE OCCUPATION/CONTROLLED EXPOSURE PARTIAL BODY LIMIT 8.0 W/kg

9. MEASUREMENT RESULTS

9.1 TEST LIQUIDS CONFIRMATION

SIMULATED TISSUE LIQUID PARAMETER CONFIRMATION

The dielectric parameters were checked prior to assessment using the SPEAG DAK3.5 dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

IEEE SCC-34/SC-2 P1528 RECOMMENDED TISSUE DIELECTRIC PARAMETERS

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in P1528

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

9.2 LIQUID MEASUREMENT RESULTS

The following table show the measuring results for simulating liquid:

Liquid Type	Liquid Temp. (℃)	Parameters	Target	Measured	Deviation (%)	Limited (%)	Measured Date
Head450	21.5	Permitivity(ε)	43.50	44.03	1.22	± 5	2019/2/22
		Conductivity(σ)	0.87	0.87	0.46	± 5	

Liquid Type	Liquid Temp. (℃)	Parameters	Target	Measured	Deviation (%)	Limited (%)	Measured Date
Body450	21.5	Permitivity(ε)	56.70	53.96	-4.83	± 5	2019/2/21
		Conductivity(σ)	0.94	0.98	4.04	± 5	

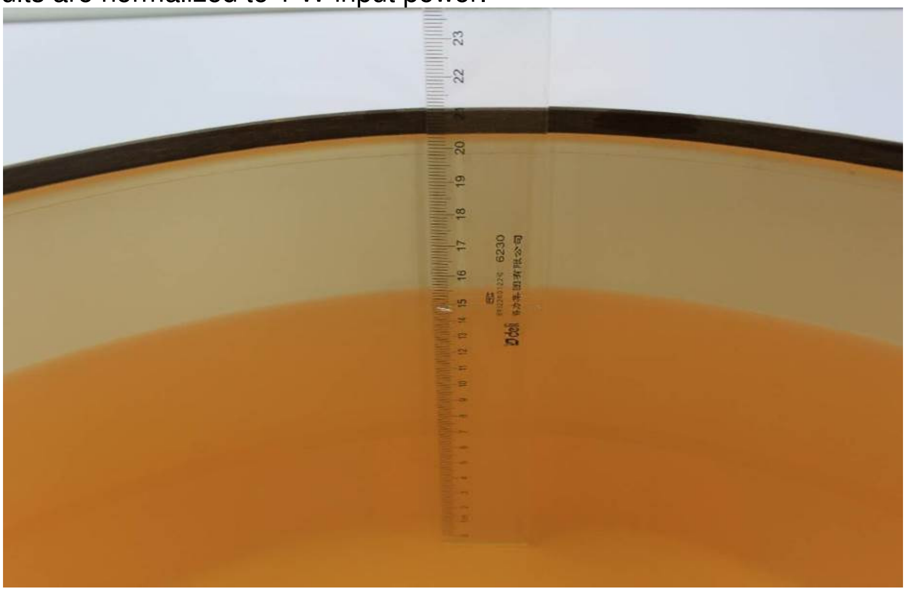
Note: Since the maximum deviation of dielectric properties of the tissue simulating liquid is within 5%, SAR correction is evaluated in the measurement uncertainty shown on section 7 of this report.

9.3 SYSTEM PERFORMANCE CHECK

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of ±10%. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

SYSTEM PERFORMANCE CHECK MEASUREMENT CONDITIONS

- The measurements were performed in the flat section of the SAM twin phantom filled with head and body simulating liquid of the following parameters.
- The DASY5 system withan E-fileld probe EX3DV4 SN: 3798 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 cm from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration (dx= 5 mm, dy= 5 mm, dz= 5 mm).
- Distance between probe sensors and phantom surface was set to 2 mm.
- The dipole less than 3G input power was 250mW±3%.
- The dipole above than 3G input power was 100mW±3%.
- The results are normalized to 1 W input power.



Note: For SAR testing, the liquid depth is 15cm shown above

SYSTEM PERFORMANCE CHECK RESULTS

Liquid Type	Ambient Temp. (°C)	Liquid Temp. (℃)	Input Power (W)	Measured SAR_{1g} (W/Kg)	1W Target SAR_{1g}(W/Kg)	1W Normalized SAR_{1g}(W/Kg)	Deviation (%)	Limited (%)	Date
Head450	22	21.5	0.25	1.11	4.53	4.44	-1.99	± 10	2019/2/22

Liquid Type	Ambient Temp. (°C)	Liquid Temp. (℃)	Input Power (W)	Measured SAR_{1g} (W/Kg)	1W Target SAR_{1g}(W/Kg)	1W Normalized SAR_{1g}(W/Kg)	Deviation (%)	Limited (%)	Date
Body450	22	21.5	0.25	1.08	4.47	4.32	-3.36	± 10	2019/2/21

9.4 EUT TUNE-UP PROCEDURES AND TEST MODE

Conducted output power(dBm):
450MHz

Average Power for Digital modulation(12.5KHz):

Frequency (MHz)	Channel	Average power (High Power)		Average power (Low Power)	
		dBm	W	dBm	W
350.025	1	36.36	4.33	30.33	1.08
380.975	2	36.32	4.29	30.14	1.03
405.975	3	36.37	4.34	30.55	1.14
430.975	4	36.35	4.32	30.75	1.19
450.025	5	36.47	4.44	30.71	1.18
459.975	6	36.41	4.38	30.76	1.19
469.975	7	36.41	4.38	30.62	1.15
511.975	8	36.36	4.33	30.33	1.08
526.975	9	36.32	4.29	30.14	1.03

Average Power for Analogue modulation(25KHz):

Frequency (MHz)	Channel	Average power (High Power)		Average power (Low Power)	
		dBm	W	dBm	W
350.025	1	33.98	2.50	30.08	1.02
380.975	2	33.89	2.45	30.05	1.01
405.975	3	33.82	2.41	29.74	0.94
430.975	4	33.80	2.40	30.44	1.11
450.025	5	34.20	2.63	30.40	1.10
459.975	6	34.21	2.64	30.45	1.11
469.975	7	34.28	2.68	30.46	1.11
511.975	8	33.89	2.45	30.19	1.04
526.975	9	33.91	2.46	30.08	1.02

Average Power for Analogue modulation(12.5KHz):

Frequency (MHz)	Channel	Average power (High Power)		Average power (Low Power)	
		dBm	W	dBm	W
350.025	1	34.01	2.52	30.07	1.02
380.975	2	34.07	2.55	30.00	1.00
405.975	3	34.81	3.03	30.05	1.01
430.975	4	34.27	2.67	30.00	1.00
450.025	5	34.74	2.98	30.43	1.10
459.975	6	34.91	3.10	30.44	1.11
469.975	7	34.17	2.61	30.39	1.09
511.975	8	34.55	2.85	30.35	1.08
526.975	9	34.19	2.62	30.27	1.06

9.5 SAR TEST CONFIGURATIONS

Please refer to IEEE 1528-2013 illustration below.

9.6 EUT TESTING POSITION

This EUT was tested in Two different positions. They are Face-Held Configuration and Body-worn Configuration.

Face-Held Configuration

Face-held Configuration- per IEEE 1528-2013: “If the user instructions provided by the manufacturer specify an intended use with an appropriate accessory at a certain separation distance to the body, the device shall be positioned as intended at the distance to the outer surface of the phantom that corresponds to the specified distance . When evaluating device SAR without a specific carry accessory, the separation distance shall not exceed 25 mm”

Body-worn Configuration

Body-worn measurements-per IEEE 1528-2013: The surface of the device pointing towards the flat phantom should be parallel to the surface of the phantom. However, all devices do not have a flat surface. Therefore the details of the device position, e.g. the definition of the distance and the physical relationship between the device and the phantom , shall be documented in the measurement report according to the manufacturer instructions

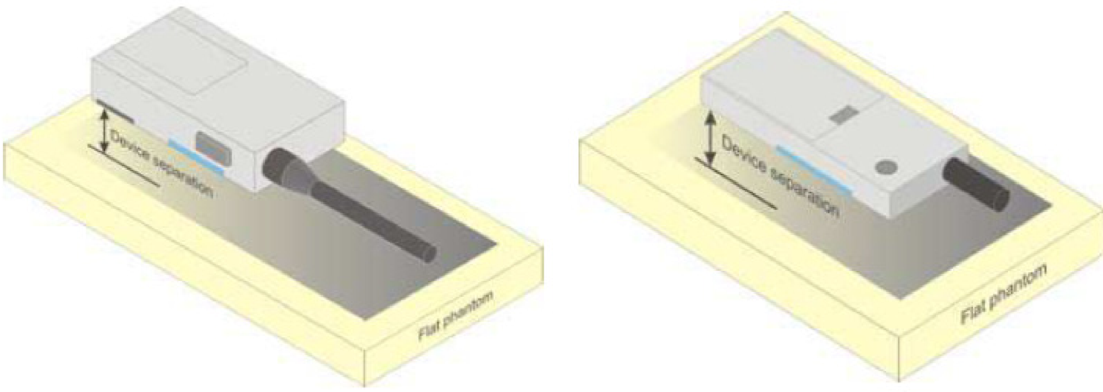


Illustration for Two-way radios

9.7 NUMBER OF TEST CHANNELS

According to KDB447498 D01 4.1 (g)

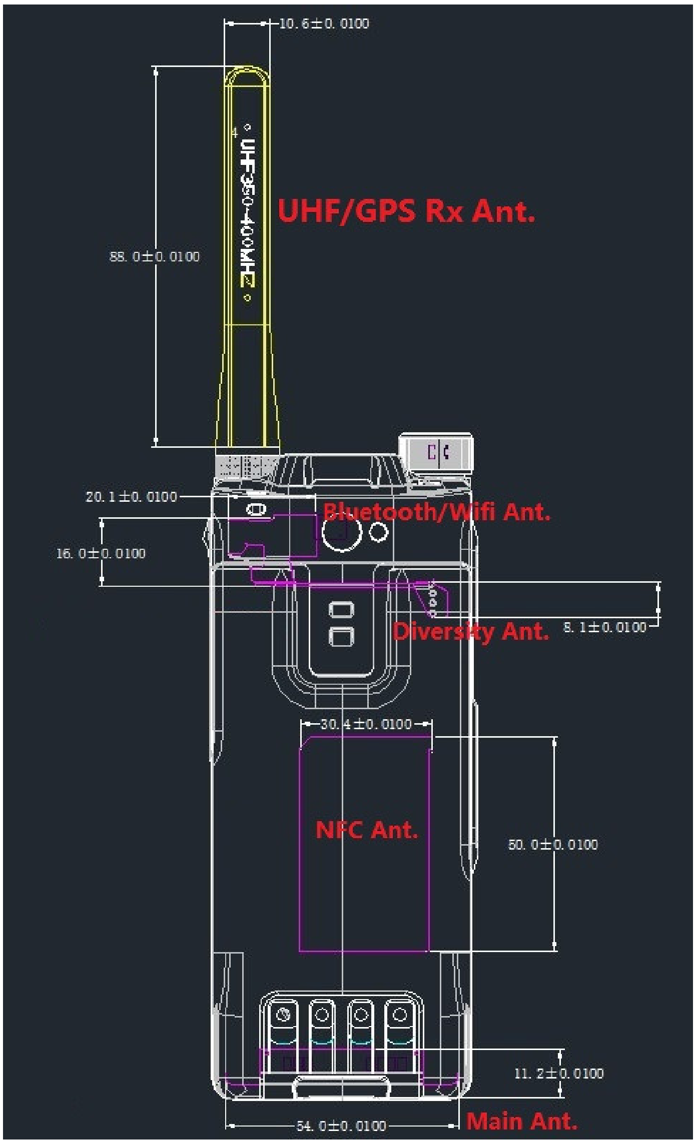
$$N_c = Round\left\{\left[100\left(f_{\text{high}} - f_{\text{low}}\right)/f_c\right]^{0.5} \times \left(f_c/100\right)^{0.2}\right\},$$

where

- N_c is the number of test channels, rounded to the nearest integer,
- f_{high} and f_{low} are the highest and lowest channel frequencies within the transmission band,
- f_c is the mid-band channel frequency,
- all frequencies are in MHz.

F_L	F_H	f_c	N_c	Round
350.025	526.975	450.025	8.4714	9

9.8 ANTENNA LOCATION



Device dimensions for Tablet mode (H x W): 148x 58 mm

Antennas	Wireless Interface
External Antenna	450MHz

Test Mode

Digital modulation	4FSK
Analogue modulation	FM

SAR MEASUREMENT RESULTS

Front To Face(Head SAR):

Mode	Freq. (MHZ)	Ch. Space (KHz)	Modul-ation	Test Position	Dist. (mm)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (W/kg)	Scaled SAR1g (W/kg)	
											100% Duty cycle	50% Duty cycle
Analogue Modulation	450.025	25	FM	Front To Face	25	34.2	35	1.202	-0.12	3.75	4.508	2.254
	459.975	25	FM	Front To Face	25	34.21	35	1.199	-0.16	3.45	4.138	2.069
	469.975	25	FM	Front To Face	25	34.28	35	1.180	-0.12	**4.47**	5.276	2.638
	511.975	25	FM	Front To Face	25	33.89	35	1.177	-0.11	3.37	3.966	1.983
Analogue Modulation*	469.975	25	FM	Front To Face	25	34.28	35	1.178	-0.08	4.42	5.207	2.603
Analogue Modulation	405.975	12.5	FM	Front To Face	25	34.81	35	1.045	-0.08	1.71	1.786	0.893
	450.025	12.5	FM	Front To Face	25	34.74	35	1.062	-0.13	4.21	4.470	2.235
	459.975	12.5	FM	Front To Face	25	34.91	35	1.021	-0.03	3.78	3.859	1.930
Analogue Modulation*	450.025	12.5	FM	Front To Face	25	34.74	35	1.022	-0.18	4.17	4.262	2.131
Analogue Modulation	469.975	25	FM	Front To Face	25	30.46	31	1.132	-0.06	1.65	1.868	0.934
Analogue Modulation	459.975	12.5	FM	Front To Face	25	30.44	31	1.138	-0.01	1.29	1.468	0.734
Digital Modulation	450.025	12.5	4FSK	Front To Face	25	36.47	36.5	1.007	-0.1	2.66	2.678	1.339
	459.975	12.5	4FSK	Front To Face	25	30.76	31	1.057	-0.16	0.79	0.835	0.417

Note: According to KDB 643646 D01 Appendix A1.Head SAR Test Considerations

1)Testing antennas with the default battery:

A) Start by testing a PTT radio with a standard battery (default battery) that is supplied with the radio to measure the head SAR of each antenna on the highest output power channel, according to the test channels required by the number-of-test-channels formula in KDB Publication 447498 D01 and in the frequency range covered by each antenna within the operating frequency bands of the radio. When multiple standard batteries are supplied with a radio, the battery with the highest capacity is considered the default battery for making head SAR measurements.

I)When the head SAR of an antenna tested in A) is:

a)≤3.5 W/kg, testing of all other required channels is not necessary for that antenna

b)>3.5W/kg and ≤4.0W/k, testing of the required immediately adjacent channel(s) is not necessary; testing of the other required channels may still be required

c)>4.0W/kg and≤6.0W/kg, head SAR should be measured for that antenna on the required immediately adjacent channels; testing of the other required channels still needs consideration

d)>6.0W/kg, test all required channels for that antenna

e)for the remaining channels that cannot be excluded in b) and c), which still require consideration, the 3.5 W/kg exclusion in a) and 4.0W/kg exclusion in b) may be applied recursively with respect to the highest output power channel among the remaining channels; measure the SAR for the remaining channels that cannot be excluded

i) if an immediately adjacent channel measured in c) or a remaining channel measured in e) is >6.0W/kg, test all required channels for that antenna

*: Repeat Report.

Body Touch(Body SAR):

Mode	Freq. (MHZ)	Ch. Space (KHz)	Modul-ation	Test Position	Dist. (mm)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (W/kg)	Scaled SAR1g (W/kg)	
											100% Duty cycle	50% Duty cycle
Analogue Modulation	350.025	25	FM	Body Touch	0	33.98	35	1.265	-0.04	4.13	5.223	2.612
	380.975	25	FM	Body Touch	0	33.89	35	1.291	-0.18	3.99	5.152	2.576
	405.975	25	FM	Body Touch	0	33.82	35	1.312	-0.13	3.92	5.144	2.572
	430.975	25	FM	Body Touch	0	33.8	35	1.318	-0.1	4.34	5.721	2.861
	450.025	25	FM	Body Touch	0	34.2	35	1.202	-0.11	4.38	5.266	2.633
	459.975	25	FM	Body Touch	0	34.21	35	1.199	-0.11	4.23	5.074	2.537
	469.975	25	FM	Body Touch	0	34.28	35	1.180	-0.1	**5.84**	6.893	3.447
	511.975	25	FM	Body Touch	0	33.89	35	1.291	-0.01	1.76	2.273	1.136
	526.975	25	FM	Body Touch	0	33.91	35	1.285	-0.11	1.01	1.298	0.649
Analogue Modulation*	469.975	25	FM	Body Touch	0	34.28	35	1.178	-0.12	5.79	6.821	3.410
Analogue Modulation	350.025	12.5	FM	Body Touch	0	34.01	35	1.256	0.07	4.58	5.753	2.876
	380.975	12.5	FM	Body Touch	0	34.07	35	1.239	0.02	4.36	5.401	2.701
	405.975	12.5	FM	Body Touch	0	34.81	35	1.045	-0.06	4.25	4.440	2.220
	430.975	12.5	FM	Body Touch	0	34.27	35	1.183	-0.08	4.26	5.040	2.520
	450.025	12.5	FM	Body Touch	0	34.74	35	1.062	-0.1	4.35	4.618	2.309
	459.975	12.5	FM	Body Touch	0	34.91	35	1.021	-0.1	4.4	4.492	2.246
	469.975	12.5	FM	Body Touch	0	34.17	35	1.211	-0.02	**5.72**	6.925	3.462
	511.975	12.5	FM	Body Touch	0	34.55	35	1.109	-0.16	2.23	2.473	1.237
	526.975	12.5	FM	Body Touch	0	34.19	35	1.205	-0.01	1.48	1.783	0.892
Analogue Modulation*	469.975	12.5	FM	Body Touch	0	34.17	35	1.204	-0.05	5.66	6.815	3.407
Analogue Modulation	469.975	25	FM	Body Touch	0	30.46	31	1.132	-0.04	1.91	2.163	1.081
	459.975	12.5	FM	Body Touch	0	30.44	31	1.138	-0.16	1.47	1.672	0.836
Digital Modulation	350.025	12.5	4FSK	Body Touch	0	36.36	36.5	1.033	-0.05	2.79	2.881	1.441
	380.975	12.5	4FSK	Body Touch	0	36.32	36.5	1.042	-0.06	2.75	2.866	1.433
	405.975	12.5	4FSK	Body Touch	0	36.37	36.5	1.030	-0.07	2.72	2.803	1.401
	430.975	12.5	4FSK	Body Touch	0	36.35	36.5	1.035	0.01	3.06	3.168	1.584
	450.025	12.5	4FSK	Body Touch	0	36.47	36.5	1.007	0.07	3.13	3.152	1.576
	459.975	12.5	4FSK	Body Touch	0	36.41	36.5	1.021	-0.19	1.92	1.960	0.980
	469.975	12.5	4FSK	Body Touch	0	36.41	36.5	1.021	-0.17	1.44	1.470	0.735
	511.975	12.5	4FSK	Body Touch	0	36.36	36.5	1.033	-0.03	0.621	0.641	0.321
	526.975	12.5	4FSK	Body Touch	0	36.32	36.5	1.042	-0.05	0.545	0.568	0.284
Digital Modulation	459.975	12.5	4FSK	Body Touch	0	30.76	31	1.057	-0.05	0.902	0.953	0.477

Note: According to KDB 643646 D01 Appendix A2. Body SAR Test Considerations for Body-worn Accessories
1) Testing antennas with the default battery and body-worn accessory:

A) Start by testing a PTT radio with the thinnest battery and a standard (default) body-worn accessory that are both supplied with the radio and, if applicable, a default audio accessory, to measure the body SAR of each antenna on the highest output power channel, according to the test channels required by the number-of-test-channels formula in KDB Publication 447498 D01 and in the frequency range covered by each antenna within the operating frequency bands of the radio. When multiple default body-worn accessories are supplied with a radio, the standard body-worn accessory expected to result in the highest SAR based on its construction and exposure conditions is considered the default body-worn accessory for making body-worn SAR measurements.

I)When the body SAR of an antenna tested in A) is:

a)≤3.5 W/kg, testing of all other required channels is not necessary for that antenna

b)＞3.5W/kg and ≤4.0W/k, testing of the required immediately adjacent channel(s) is not necessary; testing of the other required channels may still be required

c)＞4.0W/kg and≤6.0W/kg, body SAR should be measured for that antenna on the required immediately adjacent channels; testing of the other required channels still needs consideration

d)＞6.0W/kg, test all required channels for that antenna

e)for the remaining channels that cannot be excluded in b) and c), which still require consideration, the 3.5 W/kg exclusion in a) and 4.0W/kg exclusion in b) may be applied recursively with respect to the highest output power channel among the remaining channels; measure the SAR for the remaining channels that cannot be excluded

i) if an immediately adjacent channel measured in c) or a remaining channel measured in e) is ＞6.0W/kg, test all required channels for that antenna

*: Repeat Report.

10. SAR MULTI XMITER ASSESSMENT

No.	Applicable Simultaneous Transmission Combination
1	N/A

11. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Last Calibration	Calibration Due
P C	HP	Core(rm)3.16G	CZCO48171H	N/A	N/A
Signal Generator	Agilent	E8257C	US37101915	04/26/2018	04/25/2019
S-Parameter Network Analyzer	Agilent	E5071B	MY42301382	04/26/2018	04/25/2019
Power meter	Anritsu	ML2495A	1445010	04/26/2018	04/25/2019
Power sensor	Anritsu	MA2411B	1339220	04/26/2018	04/25/2019
E-field PROBE	SPEAG	EX3DV4	3798	07/27/2018	07/26/2019
DAE	SPEAG	DAE4	1245	07/17/2018	07/16/2019
DIPOLE 450MHZ ANTENNA	SPEAG	D450V3	1103	04/11/2018	04/10/2019
Electro Thermometer	DTM	DTM3000	3030	12/26/2018	12/25/2019
Amplifier	Mini-circuits	ZVE-8G	110405	N/A	N/A
Amplifier	Mini-circuits	ZHL-42	QA1331003	N/A	N/A
3db ATTENUATOR	MINI	MCL BW-S3W5	0533	N/A	N/A
DUMMY PROBE	SPEAG	DP_2	SPDP2001AA	N/A	N/A
Dual Directional Coupler	Woken	20W couple	DOM2BHW1A1	N/A	N/A
SAM PHANTOM (ELI4 v4.0)	SPEAG	QDOVA001BB	1102	N/A	N/A
Twin SAM Phantom	SPEAG	QD000P40CD	1609	N/A	N/A
ROBOT	SPEAG	TX60	F10/5E6AA1/A101	N/A	N/A
ROBOT KRC	SPEAG	CS8C	F10/5E6AA1/C101	N/A	N/A
LIQUID CALIBRATION KIT	ANTENNESSA	41/05 OCP9	00425167	N/A	N/A

12. FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No.10, Weiye Rd., Innovation Park, Eco & Tec. Development Part, Kunshan City, Jiangsu Province, China.

13. REFERENCES

[1] Federal Communications Commission, \Report and order: Guidelines for evaluating the environ-mental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.

[2] David L. Means Kwok Chan, Robert F. Cleveland, \Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commision, O_ce of Engineering & Technology, Washington, DC, 1997.

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, \Automated E-_eld scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105{113, Jan. 1996.

[4] Niels Kuster, Ralph K.astle, and Thomas Schmid, \Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp. 645{652, May 1997.

[5] CENELEC, \Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz – 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.

[6] ANSI, ANSI/IEEE C95.1-1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.

[7] Katja Pokovic, Thomas Schmid, and Niels Kuster, \Robust setup for precise calibration of E-_eld probes in tissue simulating liquids at mobile communications frequencies", in ICECOM _ 97, Dubrovnik, October 15{17, 1997, pp. 120{124.

[8] Katja Pokovic, Thomas Schmid, and Niels Kuster, \E-_eld probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23{25 June, 1996, pp. 172{175.

[9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard K. uhn, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions onMicrowave Theory and Techniques, vol. 44, no. 10, pp. 1865{1873, Oct. 1996.

[10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.

[11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.

[12] W. H. Press, S. A. Teukolsky,W. T. Vetterling, and B. P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992..Dosimetric Evaluation of Sample device, month 1998 9

[13] NIS81 NAMAS, \The treatment of uncertainity in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.

[14] Barry N. Taylor and Christ E. Kuyatt, \Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10

14. LABORATORY ACCREDITATIONS AND LISTING

FCC –Designation Number: CN1172.

Compliance Certification Services Inc. Kun shan 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 and the Designation Number: CN1172.

APPENDIX J: DUT AND SAR TEST SETUP

APPENDIX K: PLOTS OF PERFORMANCE CHECK

The plots are showing as followings.

Test Laboratory: Compliance Certification Services Inc. Date: 2/21/2019

System Performance Check-Body D450

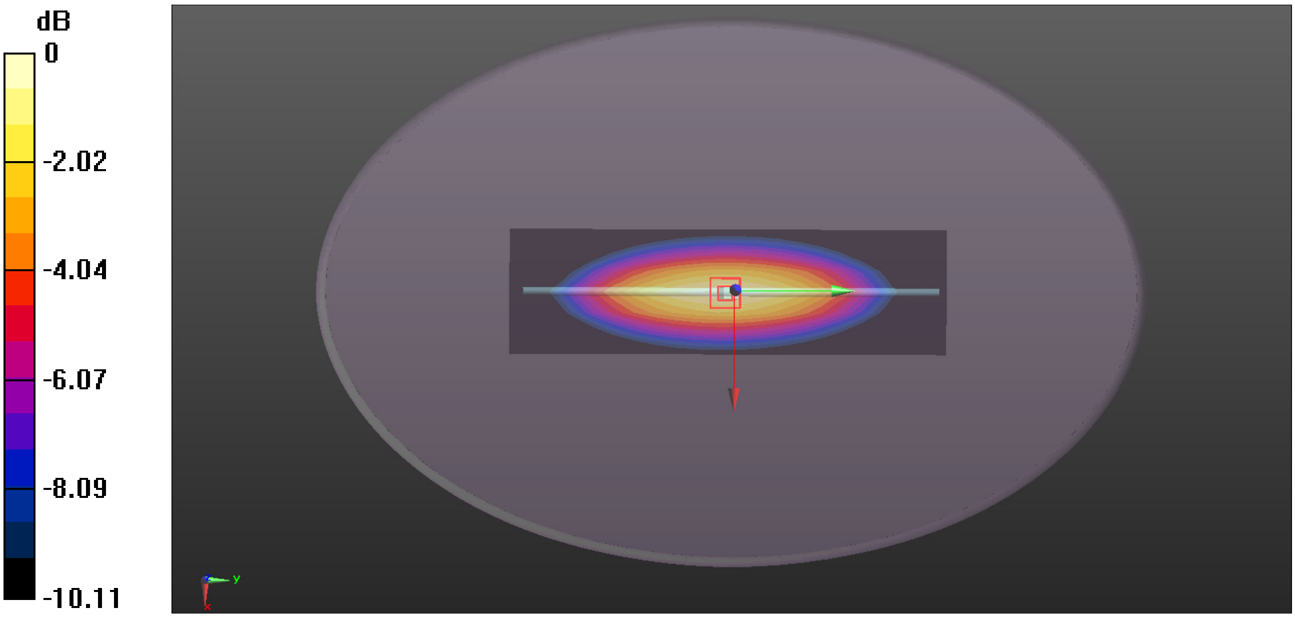
DUT: Dipole 450 MHz ; Type: D450V3; Serial: 1065

Communication System: UID 0, CW (0); Communication System Band: D450 (450.0 MHz); Frequency: 450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.978 S/m; ε_r = 53.962; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(10.41, 10.41, 10.41); Calibrated: 7/27/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/17/2018
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies Low 1 GHz/dist=15mm, Pin=250 mW(EX-Probe)/Area Scan (7x22x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.32 W/kg

System Performance Check at Frequencies Low 1 GHz/dist=15mm, Pin=250 mW(EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 37.19 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.64 W/kg
SAR(1 g) = 1.08 W/kg; SAR(10 g) = 0.734 W/kg
Maximum value of SAR (measured) = 1.34 W/kg



0 dB = 1.34 W/kg = 1.27 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 2/22/2019

System Performance Check-Head D450

DUT: Dipole 450 MHz ; Type: D450V3; Serial: 1065

Communication System: UID 0, CW (0); Communication System Band: D450 (450.0 MHz); Frequency: 450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 450 MHz; σ = 0.874 S/m; ε_r = 44.029; ρ = 1000 kg/m^3

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- P robe: EX3DV4 - SN3798; ConvF(10.16, 10.16, 10.16); Calibrated: 7/27/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/17/2018
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies Low 1 GHz/Pin=250 mW, dist=15 mm (EX-Probe)/Area Scan (7x23x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.41 W/kg

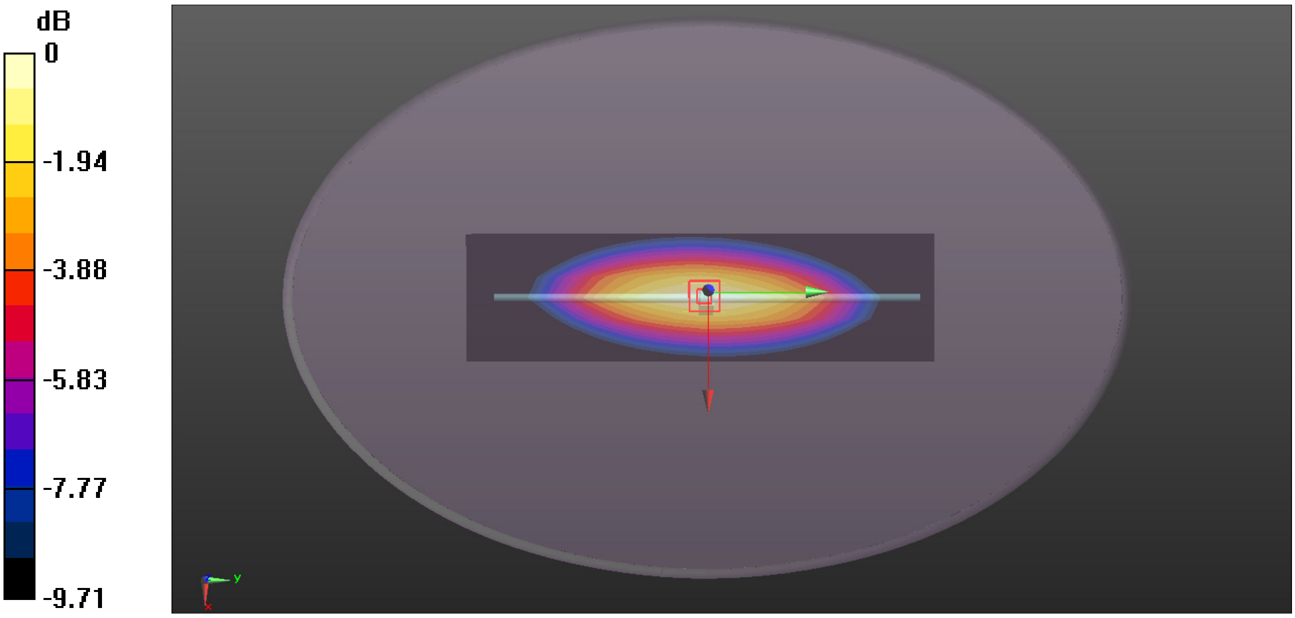
System Performance Check at Frequencies Low 1 GHz/Pin=250 mW, dist=15 mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 40.95 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.68 W/kg

SAR(1 g) = 1.11 W/kg; SAR(10 g) = 0.746 W/kg

Maximum value of SAR (measured) = 1.41 W/kg



0 dB = 1.41 W/kg = 1.49 dBW/kg

APPENDIX L: DASY CALIBRATION CERTIFICATE

The DASY Calibration Certificates are showing in the file named Appendix L DASY Calibration Certificate.

APPENDIX M: PLOTS OF SAR TEST RESULT

The plots of worse case are showing as followings.

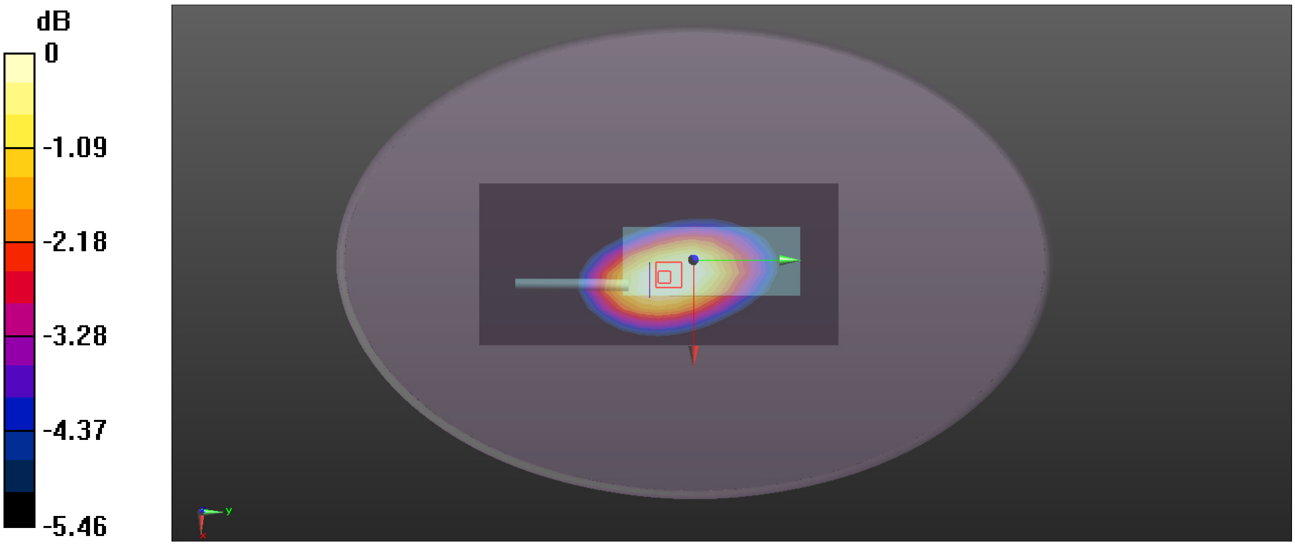
Test Laboratory: Compliance Certification Services Inc. Date: 2/21/2019
450MHz -Body Touch Analogue Modulation 469.975MHz/25KHz
DUT: Multi-mode Advanced Radio; Type: PDC680 UxB1; Serial: N/A
Communication System: UID 0, 450MHz (0); Communication System Band: 450MHz; Frequency: 469.975 MHz;Duty Cycle: 1:1
Medium parameters used: f = 469.975 MHz; σ = 0.96 S/m; εr = 55.184; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(10.41, 10.41, 10.41); Calibrated: 7/27/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/17/2018
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

450MHz/Body Touch CH7 Analogue Modulation 469.975MHz /Area Scan (10x21x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 7.11 W/kg

450MHz/Body Touch CH7 Analogue Modulation 469.975MHz /Zoom Scan (7x7x5)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.41 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 7.42 W/kg
SAR(1 g) = 5.84 W/kg; SAR(10 g) = 4.62 W/kg

Maximum value of SAR (measured) = 6.68 W/kg



0 dB = 6.68 W/kg = 8.25 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 2/22/2019

450MHz -Front to Face Analogue Modulation 469.975MHz/25KHz

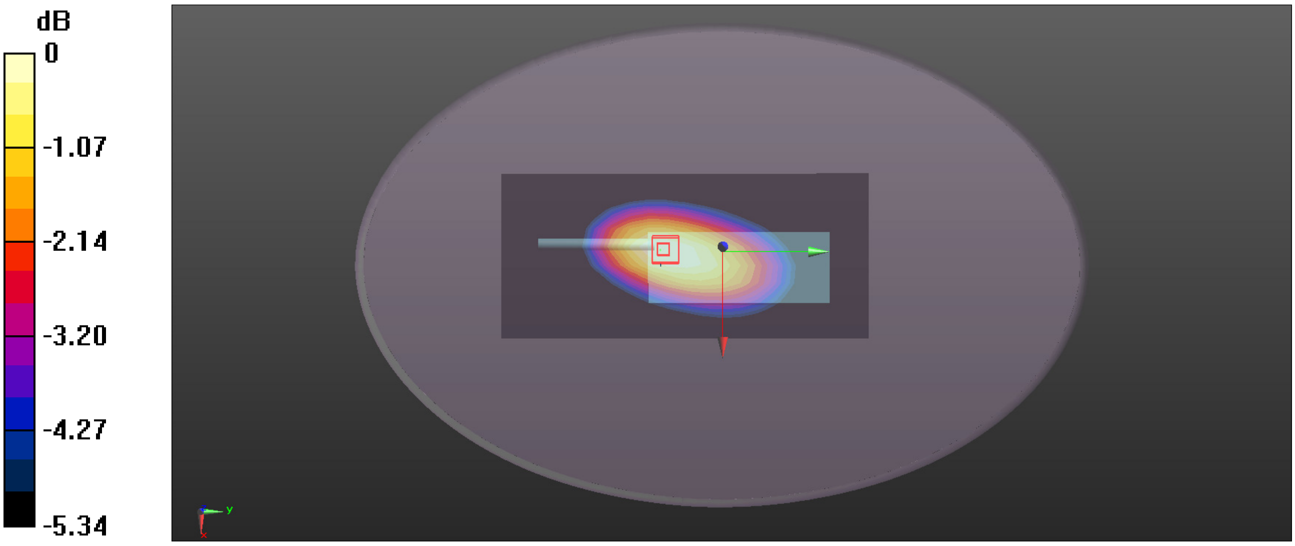
DUT: Multi-mode Advanced Radio; Type: PDC680 UxB1; Serial: N/A

Communication System: UID 0, 450MHz (0); Communication System Band: 450MHz; Frequency: 469.975 MHz;Duty Cycle: 1:1
Medium parameters used: f = 469.975 MHz; σ = 0.891 S/m; ε_r = 44.494; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(10.16, 10.16, 10.16); Calibrated: 7/27/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/17/2018
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

450MHz/Front to Face CH7 Analogue Modulation 469.975MHz /Area Scan (10x21x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.19 W/kg

450MHz/Front to Face CH7 Analogue Modulation 469.975MHz /Zoom Scan (7x7x5)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 71.87 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 5.61 W/kg
SAR(1 g) = 4.47 W/kg; SAR(10 g) = 3.53 W/kg
Maximum value of SAR (measured) = 5.11 W/kg



0 dB = 5.11 W/kg = 7.08 dBW/kg

END REPORT