# FCC SAR TEST REPORT

**For**

**Product Name: Multi-mode Advanced Radio**

**Brand Name: Hytera**

**Model No.: PTC680 FxB1**

**Series Model: N/A**

**FCC ID: YAMPTC680FXB1**

**Application No.:**
**CKSEM1906000172CR**

**Issued for**

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ACCREDITED
TESTING CERT #2541.01

# Revision History

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# 1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

| | |
|---|---|
| **Product Name:** | Multi-mode Advanced Radio |
| **Brand Name:** | Hytera |
| **Model Name.:** | PTC680 FxB1 |
| **Series Model:** | N/A |
| **Device Category:** | PORTABLE DEVICES |
| **Exposure Category:** | OCCUPATIONAL/CONTROLLED EXPOSURE |
| **Date of Test:** | June 26, 2019 |
| **Applicant:** | **Hytera Communications Corporation Limited**<br>Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, People's Republic of China |
| **Manufacturer:** | **Hytera Communications Corporation Limited**<br>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<br>FCC 47 CFR Part 2 ( 2.1093)<br>IEEE 1528-2013<br>KDB 447498 D01<br>KDB 643646 D01<br>KDB 865664 D01<br>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
SAR Manager
Compliance Certification Services Inc.

***Tested by:***

Richard Kong
SAR Engineer
Compliance Certification Services Inc.

# 2. EUT DESCRIPTION

| | |
|---|---|
| **Product Name:** | Multi-mode Advanced Radio |
| **Brand Name:** | Hytera |
| **Model Name.:** | PTC680 FxB1 |
| **Series Model:** | N/A |
| **Model Discrepancy:** | N/A |
| **FCC ID:** | YAMPTC680FXB1 |
| **Software version** | V2.5.03 |
| **Hardware version** | C |
| **Device Category:** | Production unit |
| **Frequency Range:** | 350MHz-475MHz |
| **Number of Channels:** | The equipment is able to operate on any designated channel within the specified frequency range. |
| **Modulation Type:** | π/4-DQPSK |
| **Channel Separation:** | 25KHz |
| **Rated Power:** | 1.8W(32.55dBm) |
| **Antenna Type:** | External |
| **Antenna Gain:** | 0dBi |
| **Power supply:** | Characteristics: 7.7V, 2400mAh<br>Model: T4 |

| | | |
|---|---|---|
| Battery2 Information: | Model: | T4H |
| | Normal Voltage: | 7.7V |
| | Rated capacity: | 4000mAh |
| | Manufacturer: | FPR Connectivity Technology Inc. |

There are two model batteries with similar construction mentioned in this report and only different on the specification of battery. The data of battery T4 in this report based on report no. C190429R01-SF. This report test SAR only with additional battery T4H that is expected to result of battery T4 in the highest SAR.

## 2.1 MAXIMUM RF OUTPUT POWER WITH TEST CHANNEL

| Band / Mode | Channel | Average Tune-up power(dBm) |
|---|---|---|
| π /4-DQPSK modulation (12.5KHz) | 350.025 | 33 |
| | 380.975 | 33 |
| | 405.975 | 33 |
| | 430.975 | 33 |
| | 450.025 | 33 |
| | 459.975 | 33 |
| | 469.975 | 33 |
| | 474.975 | 33 |

## 2.2 STATEMENT OF COMPLIANCE

The maximum results of Specific Absorption Rate (SAR) found during testing for **Hytera Communications Corporation Limited, PTC680 FxB1,** are as follows.

| Equipment Class | Frequency Band | Highest SAR Summary<br>Body-worn 1g SAR (W/kg) | | Highest SAR Summary<br>Face-Held 1g SAR (W/kg) | |
|---|---|---|---|---|---|
| | | 100% duty cycle | 50% duty cycle | 100% duty cycle | 50% duty cycle |
| π/4-DQPSK | 450MHz | 0.160 | 0.080 | 0.375 | 0.188 |

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

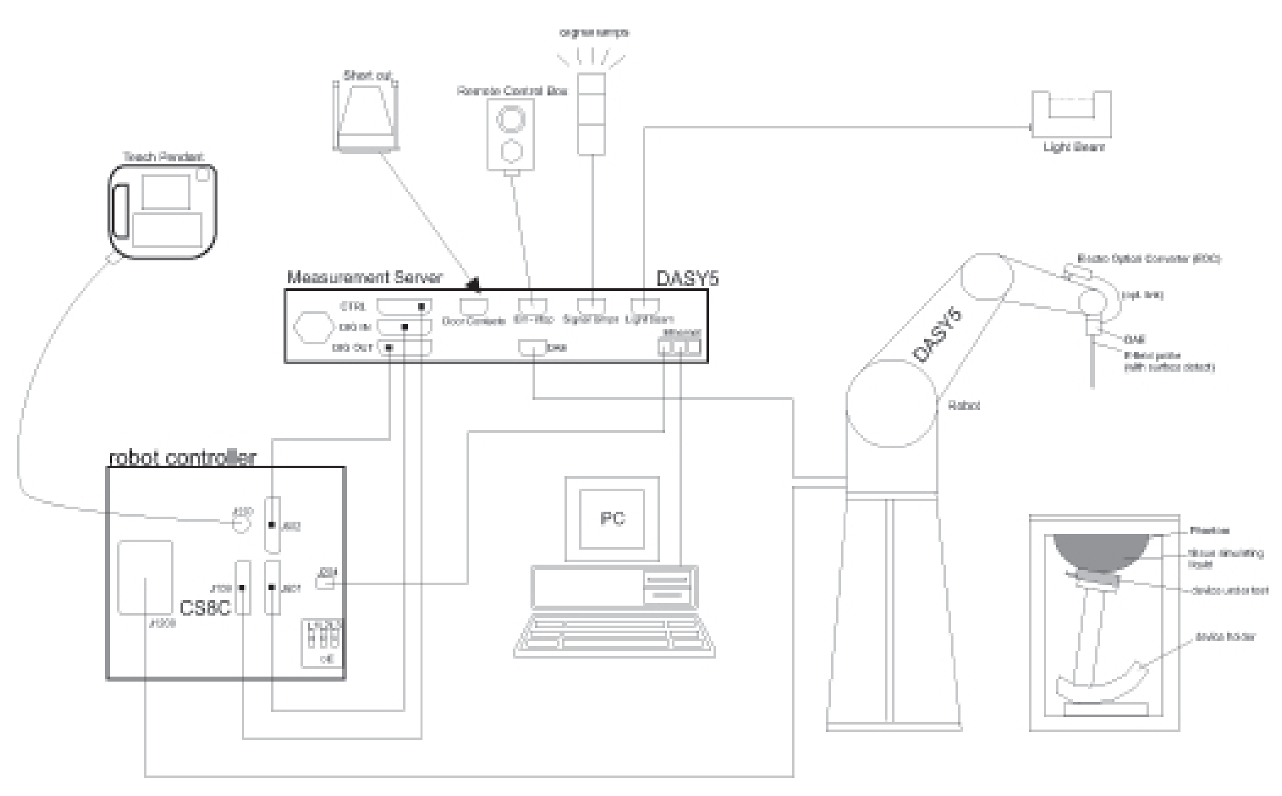
# 5. DOSIMETRIC ASSESSMENT SETUP

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<br>**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%. | <br>Interior of probe |
| **SAM Twin Phantom** | |
| **Construction:**<br>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.<br>**Shell Thickness:** 2 ±0.2 mm<br>**Filling Volume:** Approx. 25 liters<br>**Dimensions:** Height: 850mm; Length: 1000mm; Width: 750mm |  |
| **SAM Phantom (ELI4 v4.0)** | |
| **Description Construction:**<br>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<br>**Shell Thickness:** 2.0 ± 0.2 mm (sagging: <1%)<br>**Filling Volume:** Approx. 25 liters<br>**Dimensions:** Major ellipse axis: 600 mm<br>**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.<br>**Frequency:** 900,1800,2450,5800 MHz<br>**ReTune loss:** > 20 dB at specified validation position<br>**Power capability:** > 100 W (f < 1GHz); > 40 W (f > 1GHz)<br>**Dimensions:**<br>D835V2: dipole length: 161 mm; overall height: 340 mm<br>D1800V2: dipole length: 72.5 mm; overall height: 300 mm<br>D1900V2: dipole length: 67.7 mm; overall height: 300 mm<br>D2450V2: dipole length: 51.5 mm; overall height: 290 mm<br>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.<br>**Frequency:** 900, 1800, 2450, 5800 MHz<br>**ReTune loss:** > 20 dB at specified validation position<br>**Power capability:** > 100 W (f < 1GHz); > 40 W (f > 1GHz)<br>**Dimensions:**<br>D835V2: dipole length: 161 mm; overall height: 340 mm<br>D1800V2: dipole length: 72.5 mm; overall height: 300 mm<br>D1900V2: dipole length: 67.7 mm; overall height: 300 mm<br>D2450V2: dipole length: 51.5 mm; overall height: 290 mm<br>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 | $\sigma$ |
| | - Density | $\rho$ |

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<br>$\mu V/(V/m)^2$ for E0field Probes | (i = x, y, z) |
| | $ConvF$ | | = 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

$\sigma$ = conductivity in [mho/m] or [Siemens/m]

$\rho$ = 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<br>OCCUPATION/CONTROLLED EXPOSURE<br>PARTIAL BODY LIMIT<br>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 | |
|---|---|---|---|---|
| | $\varepsilon_r$ | $\sigma$ (S/m) | $\varepsilon_r$ | $\sigma$ (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 |

($\varepsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$ = 1000 kg/m$^3$)

## 9.2 LIQUID MEASUREMENT RESULTS

**The following table show the measuring results for simulating liquid:**

| Tissue Type | Measured Frequency （MHz） | Target Tissue (±5%) | | Measured Tissue | | Liquid Temp. | Measured Date |
|---|---|---|---|---|---|---|---|
| | | $\varepsilon_r$ | σ(S/m) | $\varepsilon_r$ | σ(S/m) | (℃) | |
| 450 Head | 450 | 43.5 (41.33~45.68) | 0.87 (0.83~0.91) | 42.825 | 0.862 | 22.1 | 2019/6/26 |
| 450 Body | 450 | 56.7 (53.87~59.54) | 0.94 (0.89~0.99) | 53.952 | 0.978 | 22.1 | 2019/6/26 |

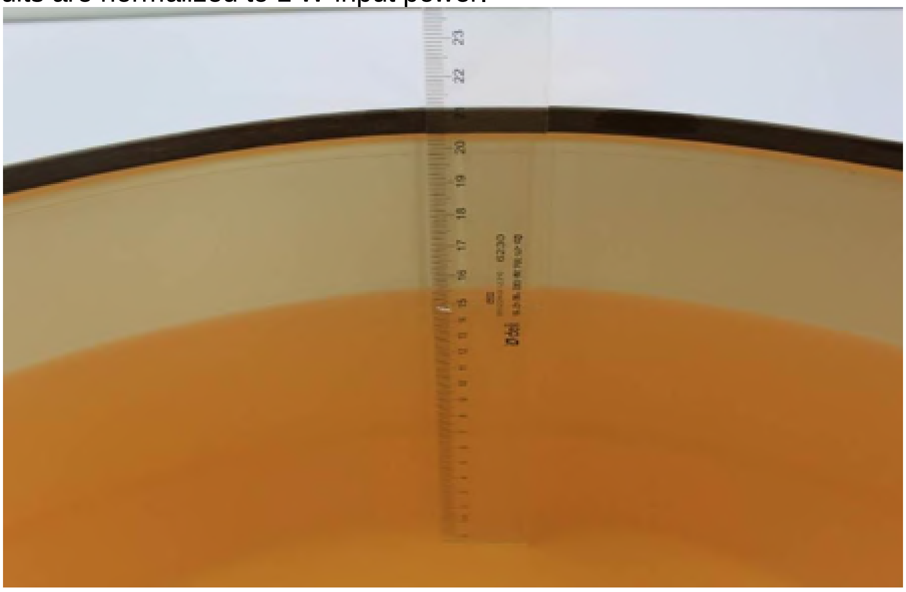
**Note:** Since the maximum deviation of dielectric properties of the tissue simulating liquid is within 5%, SAR correction is evaluated in the measurement uncertainty shown on section 7 of this report.

## 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

| Validation Kit | | Measured SAR 250mW | Measured SAR 250mW | Measured SAR (normalized to 1w) | Measured SAR (normalized to 1w) | Target SAR (normalized to 1w) (±10%) | Target SAR (normalized to 1w) (±10%) | Liquid Temp. (℃) | Measured Date |
|---|---|---|---|---|---|---|---|---|---|
| | | 1g (W/kg) | 10g (W/kg) | 1g (W/kg) | 10g (W/kg) | 1-g(W/kg) | 10-g(W/kg) | | |
| D450V3 | Head | 1.09 | 0.729 | 4.36 | 2.92 | 4.53 (4.08~4.98) | 3.03 (2.73~3.33) | 22.1 | 2019/6/26 |
| | Body | 1.06 | 0.699 | 4.24 | 2.80 | 4.47 (4.02~4.92) | 3.01 (2.71~3.31) | 22.1 | 2019/6/26 |

## 9.4 EUT TUNE-UP PROCEDURES AND TEST MODE

**Conducted output power(dBm):**

**Average Power for π/4-DQPSK modulation:**

| Frequency (MHz) | Channel | Average power | |
|---|---|---|---|
| | | dBm | W |
| 350.025 | 1 | 32.79 | 1.90 |
| 380.975 | 2 | 32.67 | 1.85 |
| 405.975 | 3 | 32.64 | 1.84 |
| 430.975 | 4 | 32.55 | 1.80 |
| 450.025 | 5 | 32.75 | 1.88 |
| 459.975 | 6 | 32.78 | 1.90 |
| 469.975 | 7 | 32.87 | 1.94 |
| 474.975 | 8 | 32.55 | 1.80 |

## 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

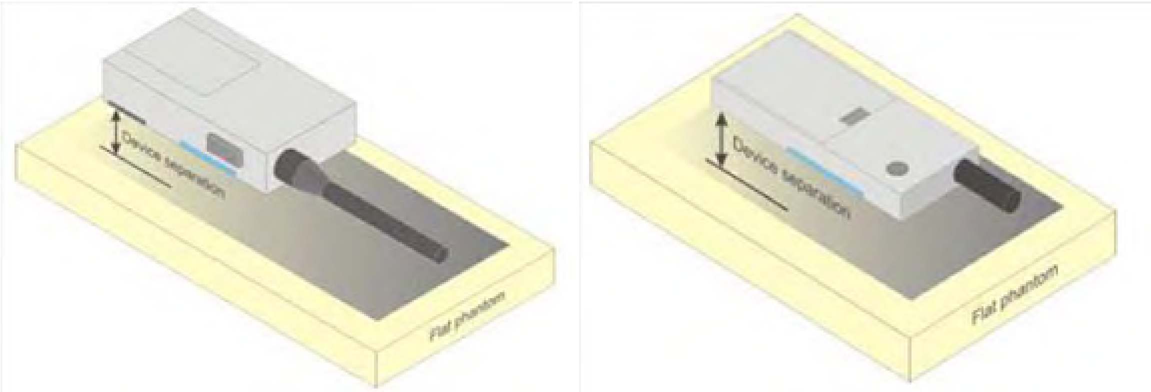



**Illustration for Two-way radios**

## 9.7 NUMBER OF TEST CHANNELS

According to KDB447498 D01 4.1 (g)

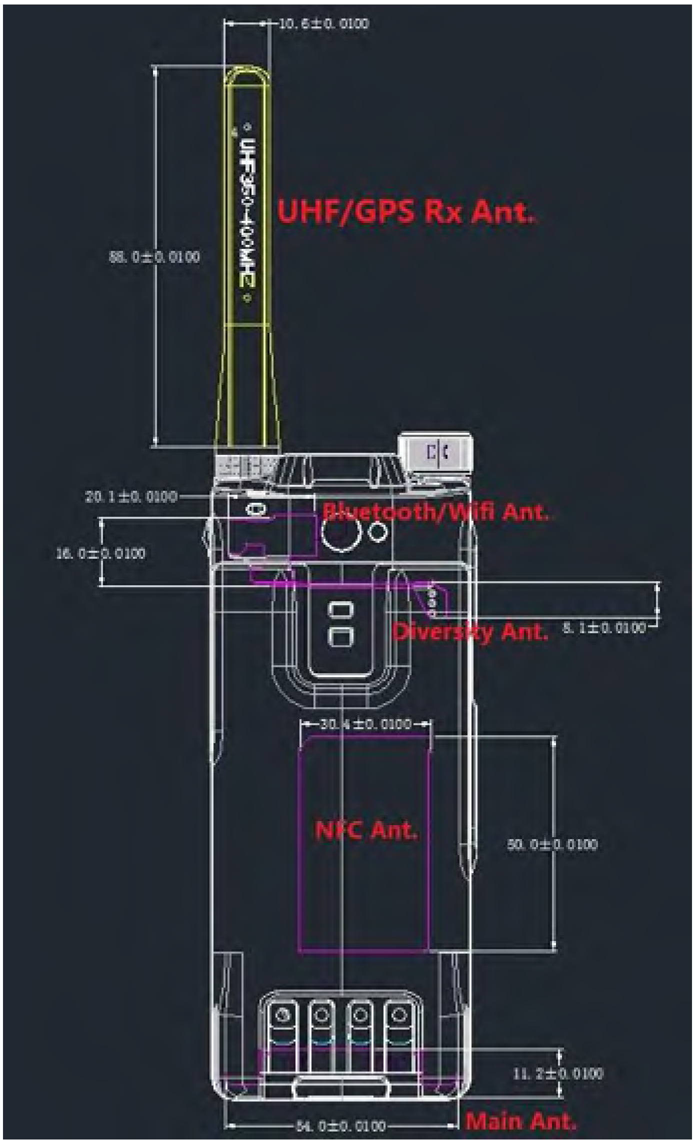
$$N_c = Round\left\{\left[100\left(f_{high} - f_{low}\right)/f_c\right]^{0.5} \times \left(f_c/100\right)^{0.2}\right\},$$

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 | 469.975 | 410 | 7.1726 | 8 |

## 9.8 ANTENNA LOCATION




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

| Antennas | Wireless Interface |
|---|---|
| External Antenna | 450MHz |

**Test Mode**

| | |
|---|---|
| Modulation | π/4-DQPSK |

# 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 |
| π/4-DQPSK Modulation | 350.025 | 25 | π/4-DQPSK | Front To Face | 25 | 32.79 | 33 | 1.050 | -0.03 | 0.411 | 0.431 | 0.216 |
| | 450.025 | 25 | π/4-DQPSK | Front To Face | 25 | 32.75 | 33 | 1.059 | 0.11 | 0.421 | 0.446 | 0.223 |
| | 469.975 | 25 | π/4-DQPSK | Front To Face | 25 | 32.87 | 33 | 1.030 | 0.03 | **0.388** | 0.400 | 0.200 |

Table 1： SAR for Front to Face and Body Touch (Original Report C190429R01-SF).

**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

**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 | Scaled SAR1g (W/kg) 50% Duty cycle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| π/4-DQPSK Modulation | 350.025 | 25 | π/4-DQPSK | Body Touch | 0 | 32.79 | 33 | 1.050 | -0.03 | 0.136 | 0.143 | 0.071 |
| | 380.975 | 25 | π/4-DQPSK | Body Touch | 0 | 32.67 | 33 | 1.079 | -0.17 | 0.114 | 0.123 | 0.061 |
| | 405.975 | 25 | π/4-DQPSK | Body Touch | 0 | 32.64 | 33 | 1.086 | -0.14 | 0.123 | 0.134 | 0.067 |
| | 430.975 | 25 | π/4-DQPSK | Body Touch | 0 | 32.55 | 33 | 1.109 | -0.11 | 0.13 | 0.144 | 0.072 |
| | 450.025 | 25 | π/4-DQPSK | Body Touch | 0 | 32.75 | 33 | 1.059 | 0.03 | 0.131 | 0.139 | 0.069 |
| | 459.975 | 25 | π/4-DQPSK | Body Touch | 0 | 32.78 | 33 | 1.052 | -0.11 | 0.12 | 0.126 | 0.063 |
| | 469.975 | 25 | π/4-DQPSK | Body Touch | 0 | 32.87 | 33 | 1.030 | 0.03 | **0.137** | 0.141 | 0.071 |
| | 474.975 | 25 | π/4-DQPSK | Body Touch | 0 | 32.55 | 33 | 1.109 | -0.02 | 0.13 | 0.144 | 0.072 |

Table 2： SAR for Front to Face and Body Touch (Original Report C190429R01-SF).

**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

| 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 | Scaled SAR1g (W/kg) 50% Duty cycle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| π/4-DQPSK Modulation | Front To Face Test data at the Worst Case with Battery2 | | | | | | | | | | | |
| | 450.025 | 25 | π/4-DQPSK | Front To Face | 25 | 32.75 | 33 | 1.059 | 0.03 | 0.354 | 0.375 | 0.188 |
| **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** | **Scaled SAR1g (W/kg) 50% Duty cycle** |
| π/4-DQPSK Modulation | Body Touch Test data at the Worst Case with Battery2 | | | | | | | | | | | |
| | 430.975 | 25 | π/4-DQPSK | Body Touch | 0 | 32.55 | 33 | 1.109 | 0.03 | 0.144 | 0.160 | 0.080 |

Table 3： SAR for Front to Face and Body Touch (Variant).

# 10. SAR MULTI XMITER ASSESSMENT

| No. | Applicable Simultaneous Transmission Combination |
|---|---|
| 1 | N/A |

# 11. EQUIPMENT LIST & CALIBRATION STATUS

| | |
|---|---|
| Test Platform | SPEAG DASY5 Professional |
| Location | SGS-CCS Standards Technical Services Co., Ltd. Kunshan Branch |
| Description | SAR Test System (Frequency range 300MHz-6GHz) |
| Software Reference | DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331) |

**Hardware Reference**

| | Equipment | Manufacturer | Model | Serial Number | Calibration Date | Due date of calibration |
|---|---|---|---|---|---|---|
| ☒ | P C | HP | Core(rm)3.16 G | CZCO48171H | N/A | N/A |
| ☒ | Signal Generator | Agilent | E8257C | US37101915 | 2019/02/25 | 2020/02/24 |
| ☒ | S-Parameter Network Analyzer | Agilent | E5071B | MY42301382 | 2019/02/25 | 2020/02/24 |
| ☒ | Power sensor | Anritsu | E9327A | Us40441788 | 2019/02/25 | 2020/02/24 |
| ☒ | Power meter | Anritsu | E4416A | GB41292714 | 2019/02/25 | 2020/02/24 |
| ☒ | DAE | SPEAG | DAE4 | 1245 | 2019/05/21 | 2020/05/20 |
| ☒ | E-field PROBE | SPEAG | EX3DV4 | 3798 | 2019/05/24 | 2020/05/23 |
| ☒ | Validation Kits | SPEAG | D450V3 | 1103 | 2018/04/11 | 2021/04/10 |
| ☒ | Electro Thermometer | DTM | DTM3000 | 3030 | 2018/12/8 | 2019/12/7 |
| ☒ | 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/A10 1 | N/A | N/A |
| ☒ | ROBOT KRC | SPEAG | CS8C | F10/5E6AA1/C10 1 | N/A | N/A |
| ☒ | LIQUID CALIBRATION KIT | ANTENNESS A | 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

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[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.

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[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

**Please refer to the report of C190429R01-SF**

## APPENDIX K: PLOTS OF PERFORMANCE CHECK

**The plots are showing as followings.**

Date: 2019-06-26

Test Laboratory: Compliance Certification Services Inc.

**System Performance Check-Head 450MHz**

**DUT: Dipole 450 MHz ; Type: D450V3; Serial: 1103**

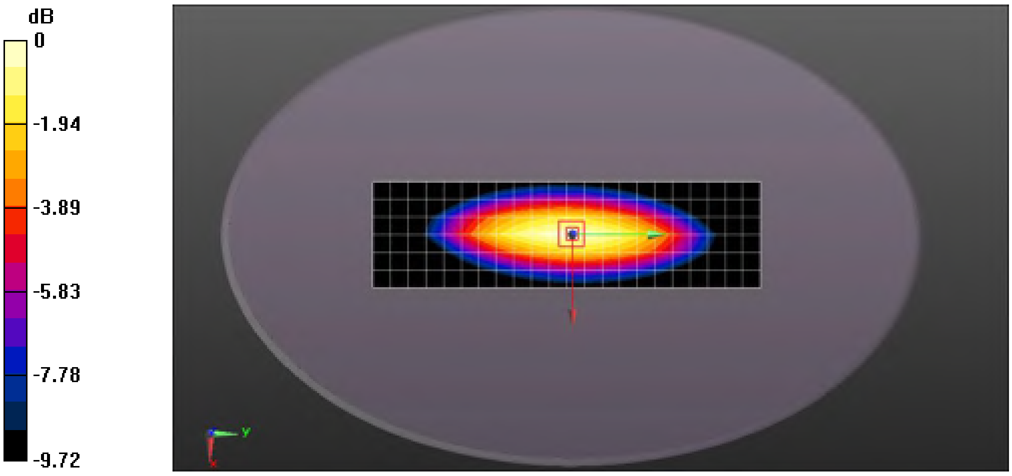
Communication System: UID 0, CW (0); Frequency: 450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; $\sigma$ = 0.862 S/m; $\varepsilon_r$ = 42.825; $\rho$ = 1000 kg/$m^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(10.24, 10.24, 10.24); Calibrated: 2019-05-24;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Body/Pin=250 mW, dist=15 mm (EX-Probe)/Area Scan (7x23x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.37 W/kg

**Body/Pin=250 mW, dist=15 mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 40.64 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.65 W/kg
**SAR(1 g) = 1.09 W/kg; SAR(10 g) = 0.729 W/kg**
Maximum value of SAR (measured) = 1.38 W/kg




0 dB = 1.38 W/kg = 1.40 dBW/kg

Date: 2019-06-26

Test Laboratory: Compliance Certification Services Inc.

**System Performance Check-Body 450MHz**

**DUT: Dipole 450 MHz ; Type: D450V3; Serial: 1103**

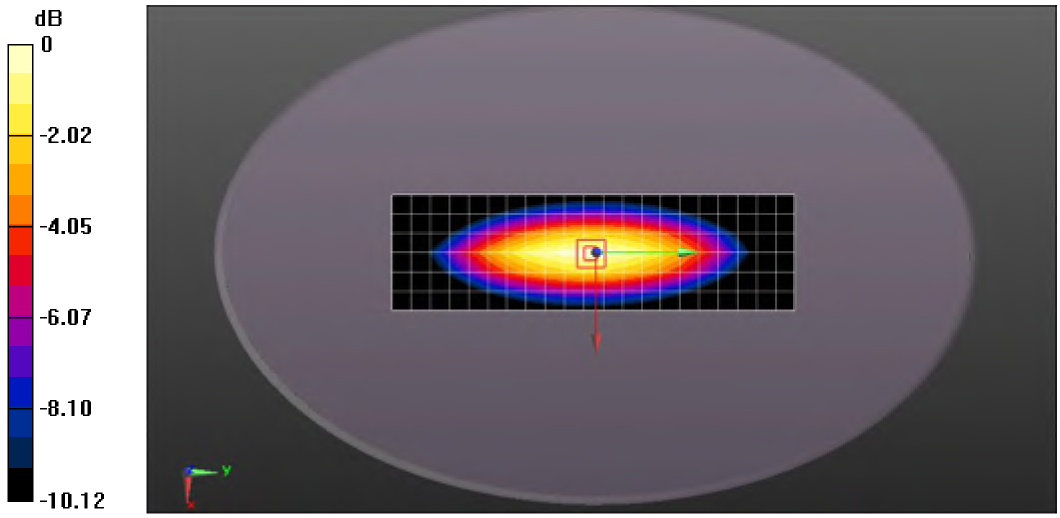
Communication System: UID 0, CW (0); Frequency: 450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; $\sigma$ = 0.978 S/m; $\varepsilon_r$ = 53.952; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(10.21, 10.21, 10.21); Calibrated: 2019-05-24;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Body/dist=15mm, Pin=250 mW(EX-Probe)/Area Scan (7x22x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.35 W/kg

**Body/dist=15mm, Pin=250 mW(EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 37.57 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.68 W/kg
**SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.699 W/kg**
Maximum value of SAR (measured) = 1.37 W/kg




0 dB = 1.37 W/kg = 1.37 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.**

Date: 2019-06-26

Test Laboratory: Compliance Certification Services Inc.

**450MHz -DQPSK Front to Face_Ch450.025_25mm**

**DUT: Multi-Mode Advanced Radio; Type: PDC680 UxB1; Serial: 0607RD1450**

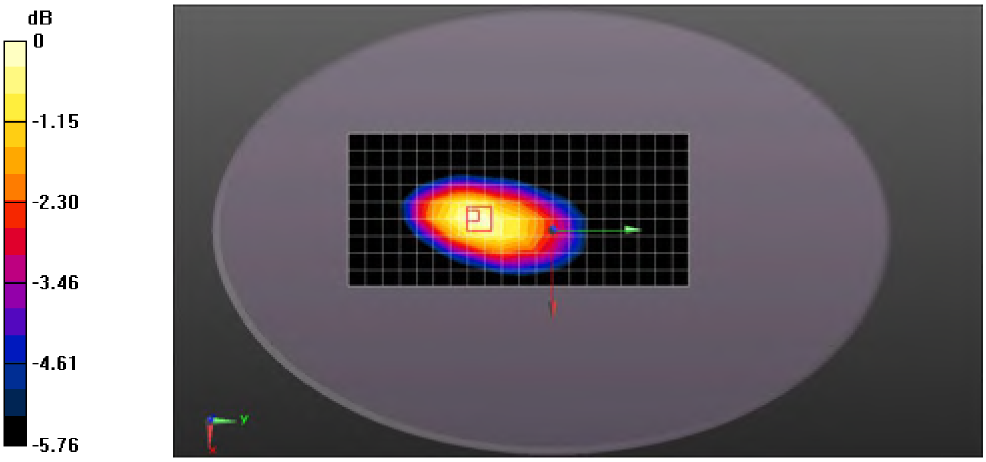
Communication System: UID 0, 450MHz (0); Frequency: 450.025 MHz; Duty Cycle: 1:1
Medium parameters used: f = 450.025 MHz; $\sigma$ = 0.862 S/m; $\varepsilon_r$ = 42.825; $\rho$ = 1000 $kg/m^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(10.24, 10.24, 10.24); Calibrated: 2019-05-24;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**450MHz/Front to Face CH5/Area Scan (10x21x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.408 W/kg

**450MHz/Front to Face CH5/Zoom Scan (7x7x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.60 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.460 W/kg
**SAR(1 g) = 0.354 W/kg; SAR(10 g) = 0.273 W/kg**
Maximum value of SAR (measured) = 0.414 W/kg




0 dB = 0.414 W/kg = -3.83 dBW/kg

Date: 2019-06-26

Test Laboratory: Compliance Certification Services Inc.

**450MHz -DQPSK Body Touch_Ch430.975_0mm**

**DUT: Multi-Mode Advanced Radio; Type: PDC680 UxB1; Serial: 0607RD1450**

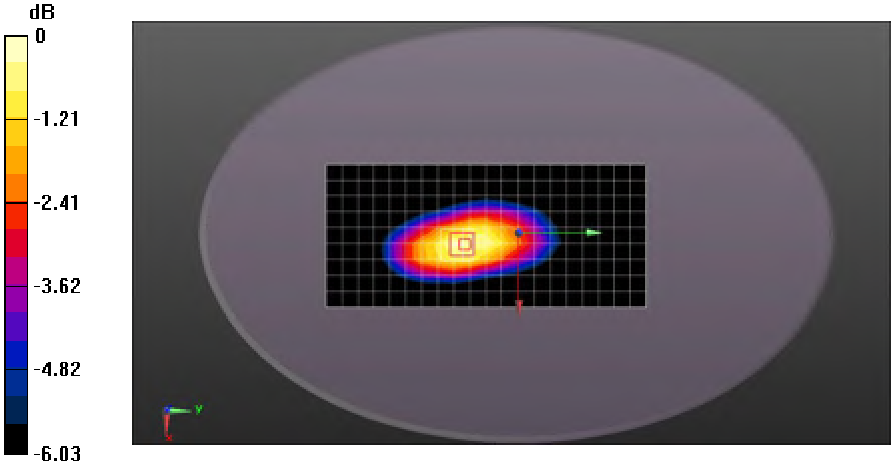
Communication System: UID 0, 450MHz (0); Frequency: 430.975 MHz; Duty Cycle: 1:1
Medium parameters used: f = 431 MHz; $\sigma$ = 0.961 S/m; $\varepsilon_r$ = 54.327; $\rho$ = 1000 kg/$m^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(10.21, 10.21, 10.21); Calibrated: 2019-05-24;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1245; Calibrated: 2019-05-21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**450MHz/Body Touch CH3/Area Scan (10x21x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.159 W/kg

**450MHz/Body Touch CH3/Zoom Scan (7x7x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.34 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.195 W/kg
**SAR(1 g) = 0.144 W/kg; SAR(10 g) = 0.111 W/kg**
Maximum value of SAR (measured) = 0.168 W/kg




0 dB = 0.168 W/kg = -7.75 dBW/kg

**END REPORT**