



TEST REPORT

Report No. : CHTEW20040011 Report verification: 

Project No..... : SHT2001005812EW

FCC ID..... : 2ASNSRB18

Applicant's name : Shenzhen Retevis Technology Co., Ltd.

Address..... : Room 700, 7/F, 13-C, Zhonghaixin Science&Technology Park, No.12 Ganli 6th Road, Jihua Street, Longgang District, Shenzhen, China

Manufacturer..... : Shenzhen Retevis Technology Co., Ltd.

Address..... : Room 700, 7/F, 13-C, Zhonghaixin Science&Technology Park, No.12 Ganli 6th Road, Jihua Street, Longgang District, Shenzhen, China

Test item description : Two Way Radio

Trade Mark : RETEVIS

Model/Type reference..... : RB18

Listed Model(s) : -

Standard : FCC 47 CFR Part2.1093
IEEE Std C95.1, 1999 Edition
IEEE 1528: 2013

Date of receipt of test sample..... : Mar.17, 2020

Date of testing..... : Mar.18, 2020- Apr.01, 2020

Date of issue..... : Apr.02, 2020

Result..... : PASS

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The test report merely correspond to the test sample.

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1 . Test Standards and Report version

1.1. Test Standards

The tests were performed according to following standards:

[FCC 47 Part 2.1093](#): Radiofrequency Radiation Exposure Evaluation:Portable Devices

[IEEE Std C95.1, 1999 Edition](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

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

FCC published RF exposure KDB procedures:

[KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04](#): SAR Measurement Requirements for 100 MHz to 6 GHz

[KDB 865664 D02 RF Exposure Reporting v01r02](#): RF Exposure Compliance Reporting and Documentation Considerations

[KDB 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

[TCB workshop](#): April, 2019; Page 19, Tissue Simulating Liquids (TSL)

1.2. Report version

| Revision No. | Date of issue | Description |
|--------------|---------------|-------------|
| N/A | 2020-04-02 | Original |
| | | |
| | | |
| | | |
| | | |

2. Summary

2.1. Client Information

| | |
|---------------|--|
| Applicant: | Shenzhen Retevis Technology Co., Ltd. |
| Address: | Room 700, 7/F, 13-C, Zhonghaixin Science&Technology Park, No.12 Ganli 6th Road, Jihua Street, Longgang District, Shenzhen, China |
| Manufacturer: | Shenzhen Retevis Technology Co., Ltd. |
| Address: | Room 700, 7/F, 13-C, Zhonghaixin Science&Technology Park, No.12 Ganli 6th Road, Jihua Street, Longgang District, Shenzhen, China |

2.2. Product Description

| | |
|--------------------------|--|
| Name of EUT: | Two Way Radio |
| Trade mark: | RETEVIS |
| Model/Type reference: | RB18 |
| Listed model(s): | - |
| Accessories: | Belt Clip |
| Device Category: | Portable |
| RF Exposure Environment: | General Population/Uncontrolled |
| Test sample No.: | YPHT20010058018 |
| Power supply: | DC 3.7V |
| Device Dimension: | Overall (Length x Width x Thickness): 100x56x26mm Antenna(Length): 42mm |
| Hardware version: | BF_T18_A21-V1.1 |
| Software version: | 1.0.8 |

2.3. Maximum SAR Value

| | |
|------------------------|---------------------------|
| Separation Distance: | Front-of-face: 25mm |
| | Body-worn: 0mm |
| Maximum SAR Value(1g): | Front-of-face: 0.643 W/kg |
| | Body-worn: 1.345 W/kg |

2.4. Radio Specification Description

| | | |
|----------------------------|--|---|
| Operation Frequency Range: | 462.5500~462.7250MHz 467.5625~467.7125MHz | |
| Rated Output Power: | <input checked="" type="checkbox"/> High Power: 2W | <input checked="" type="checkbox"/> Low Power: 0.5W |
| Modulation Type: | FM(Analog) | |
| Channel Bandwidth: | 12.5kHz | |
| Antenna Type: | Integral | |
| Remark: | <p>1. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power.</p> <p>2. EUT supports VOX functionality.</p> | |

2.5. Test frequency list

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

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

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.

| Modulation Type | Channel Bandwidth | Test Channel | Test Frequency(MHz) |
|-----------------|-------------------|--------------|---------------------|
| | | | TX |
| Analog | 12.5kHz | CH4 | 462.6375 |
| | | CH11 | 467.6375 |

3. Test Environment

3.1. Testing Laboratory Information

| | | |
|---------------------|--|----------------------|
| Laboratory Name | Shenzhen Huatongwei International Inspection Co., Ltd. | |
| Laboratory Location | 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China | |
| Qualifications | Type | Accreditation Number |
| | CNAS | L1225 |
| | A2LA | 3902.01 |
| | FCC | 762235 |
| | Canada | 5377A |

3.2. Environmental conditions

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

| | |
|---------------------|----------------|
| Ambient temperature | 18 °C to 25 °C |
| Ambient humidity | 30%RH to 70%RH |
| Air Pressure | 950-1050mbar |

4. Equipments Used during the Test

| Used | Test Equipment | Manufacturer | Model No. | Serial No. | Cal. date (YY-MM-DD) | Due date (YY-MM-DD) |
|---|--------------------------------------|---------------|---------------|------------|----------------------|---------------------|
| ● | Data Acquisition Electronics DAEx | SPEAG | DAE4 | 876 | 2020/03/03 | 2020/03/02 |
| ● | E-field Probe | SPEAG | EX3DV4 | 3842 | 2020/01/30 | 2021/01/29 |
| ○ | Universal Radio Communication Tester | R&S | CMW500 | 137681 | 2019/06/27 | 2020/06/26 |
| ● Tissue-equivalent liquids Validation | | | | | | |
| ● | Dielectric Assessment Kit | SPEAG | DAK-3.5 | 1267 | N/A | N/A |
| ○ | Dielectric Assessment Kit | SPEAG | DAK-12 | 1130 | N/A | N/A |
| ● | Network analyzer | Keysight | E5071C | MY46733048 | 2019/10/19 | 2020/10/18 |
| ● System Validation | | | | | | |
| ○ | System Validation Antenna | SPEAG | CLA-150 | 4024 | 2018/02/21 | 2021/02/20 |
| ● | System Validation Dipole | SPEAG | D450V3 | 1102 | 2018/02/23 | 2021/02/22 |
| ○ | System Validation Dipole | SPEAG | D750V3 | 1180 | 2018/02/07 | 2021/02/06 |
| ○ | System Validation Dipole | SPEAG | D835V2 | 4d238 | 2018/02/19 | 2021/02/18 |
| ○ | System Validation Dipole | SPEAG | D1750V2 | 1164 | 2018/02/06 | 2021/02/05 |
| ○ | System Validation Dipole | SPEAG | D1900V2 | 5d226 | 2018/02/22 | 2021/02/21 |
| ○ | System Validation Dipole | SPEAG | D2450V2 | 1009 | 2018/02/05 | 2021/02/04 |
| ○ | System Validation Dipole | SPEAG | D2600V2 | 1150 | 2018/02/05 | 2021/02/04 |
| ○ | System Validation Dipole | SPEAG | D5GHzV2 | 1273 | 2018/02/21 | 2021/02/20 |
| ● | Signal Generator | R&S | SMB100A | 114360 | 2019/08/15 | 2020/08/14 |
| ● | Power Viewer for Windows | R&S | N/A | N/A | N/A | N/A |
| ● | Power sensor | R&S | NRP18A | 101010 | 2019/08/15 | 2020/08/14 |
| ● | Power sensor | R&S | NRP18A | 101011 | 2019/08/15 | 2020/08/14 |
| ● | Power Amplifier | BONN | BLWA 0160-2M | 1811887 | 2019/11/14 | 2020/11/13 |
| ● | Dual Directional Coupler | Mini-Circuits | ZHDC-10-62-S+ | F975001814 | 2019/11/14 | 2020/11/13 |
| ● | Attenuator | Mini-Circuits | VAT-3W2+ | 1819 | 2019/11/14 | 2020/11/13 |
| ● | Attenuator | Mini-Circuits | VAT-10W2+ | 1741 | 2019/11/14 | 2020/11/13 |

Note:

1. The Probe, Dipole and DAE calibration reference to the Appendix B and C.
2. Referring to KDB865664 D01, the dipole calibration interval can be extended to 3 years with justification. The dipole are also not physically damaged or repaired during the interval.

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg. The expanded SAR measurement uncertainty must be $\leq 30\%$, for a confidence interval of $k = 2$. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

6. SAR Measurements System Configuration

6.1. SAR Measurement Set-up

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

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

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

A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

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

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

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

DASY5 software and SEMCAD data evaluation software.

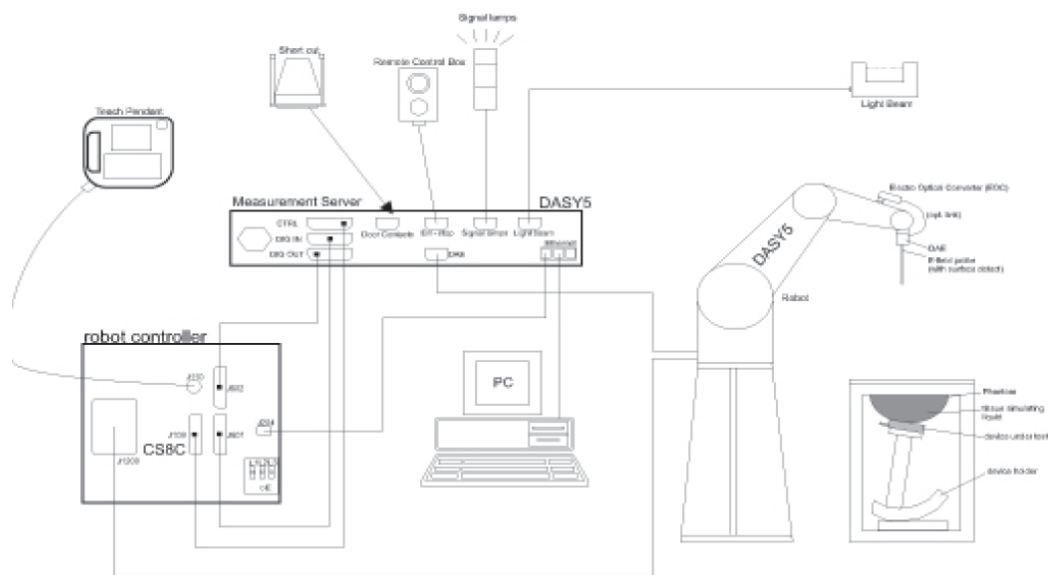
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

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

The device holder for handheld Mobile Phones.

Tissue simulating liquid mixed according to the given recipes.

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



6.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

● Probe Specification

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

Calibration ISO/IEC 17025 calibration service available.

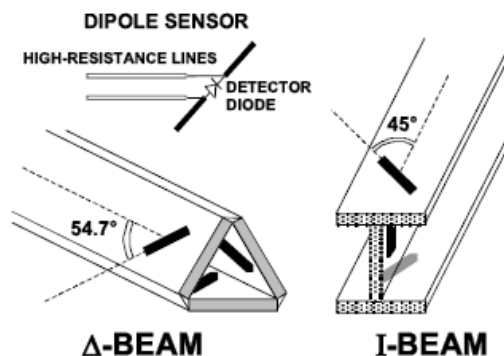
| | |
|---------------|--|
| Frequency | 10 MHz to 10 GHz; Linearity: ± 0.2 dB (30 MHz to 10 GHz) |
| Directivity | ± 0.1 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (rotation normal to probe axis) |
| Dynamic Range | 10 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB |
| Dimensions | Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm |
| Application | General dosimetry up to 10 GHz Dosimetry in strong gradient fields Compliance tests of Mobile Phones |
| Compatibility | DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI |



● Isotropic E-Field Probe

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

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



6.3. Phantoms

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with standard and all known tissue-simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.



ELI4 Phantom

6.4. Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.

The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.



Device holder supplied by SPEAG

7. SAR Test Procedure

7.1. Scanning Procedure

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

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

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

Area Scan

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

Zoom Scan

After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard’s method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.

They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard’s method for extrapolation.

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

Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v04

| | | ≤ 3 GHz | > 3 GHz | |
|--|------------------------------------|--|---|--|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | | 5 mm \pm 1 mm | $\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm \pm 0.5 mm | |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | | 30° \pm 1° | 20° \pm 1° | |
| Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area} | | ≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm | |
| | | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device. | | |
| Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom} | | ≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm* | 3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm* | |
| Maximum zoom scan spatial resolution, normal to phantom surface | uniform grid: $\Delta z_{Zoom}(n)$ | ≤ 5 mm | 3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm | |
| | graded grid | $\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface | ≤ 4 mm | 3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm |
| | | $\Delta z_{Zoom}(n>1)$: between subsequent points | $\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm | |
| Minimum zoom scan volume | x, y, z | ≥ 30 mm | 3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm | |
| <p>Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.</p> <p>* When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</p> | | | | |

7.2. Data Storage and Evaluation

Data Storage

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

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

Data Evaluation

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

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

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

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

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

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

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

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

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

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

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

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

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

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

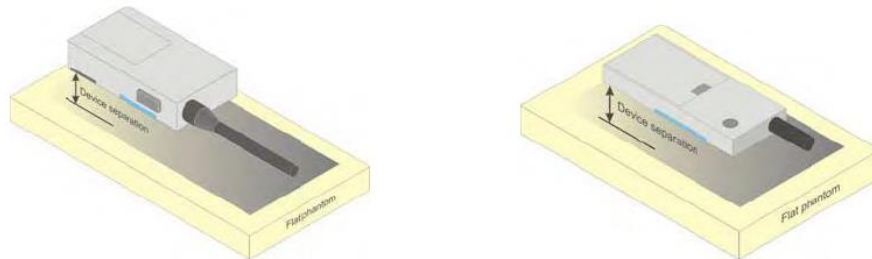
SAR: local specific absorption rate in mW/g
Etot: total field strength in V/m
 σ : conductivity in [mho/m] or [Siemens/m]
 ρ : equivalent tissue density in g/cm³

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

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

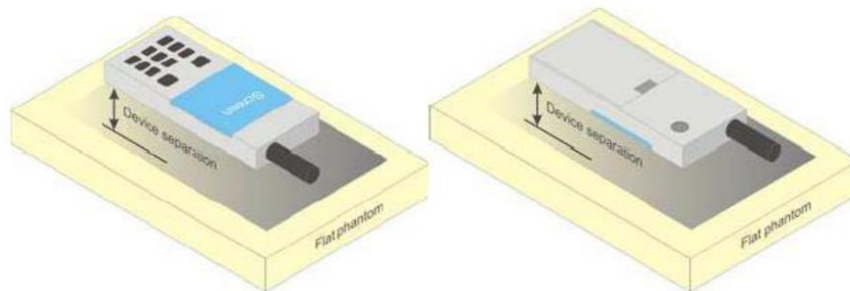
8.1. Front-of-face

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



8.2. Body Position

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



9. Dielectric Property Measurements & System Check

9.1. Tissue Dielectric Parameters

It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB865664 D01.

Targets for tissue simulating liquid

| Tissue dielectric parameters for head and body | | | | |
|--|--------------|----------------|--------------|----------------|
| Target Frequency (MHz) | Head | | Body | |
| | ϵ_r | σ (s/m) | ϵ_r | σ (s/m) |
| 450 | 43.50 | 0.87 | 56.70 | 0.94 |

CheckResult:

| Dielectric performance of Head tissue simulating liquid | | | | | | | | | |
|---|--------------|----------|----------------|----------|---------------------------|-----------------------|-------|--------------|-----------|
| Frequency (MHz) | ϵ_r | | σ (s/m) | | Delta (ϵ_r) | Delta (σ) | Limit | Temp (°C) | Date |
| | Target | Measured | Target | Measured | | | | | |
| 450 | 43.50 | 44.62 | 0.870 | 0.849 | 2.57% | -2.37% | ±5% | 22.5 | 2020/3/26 |

9.2. SAR System Validation

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

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

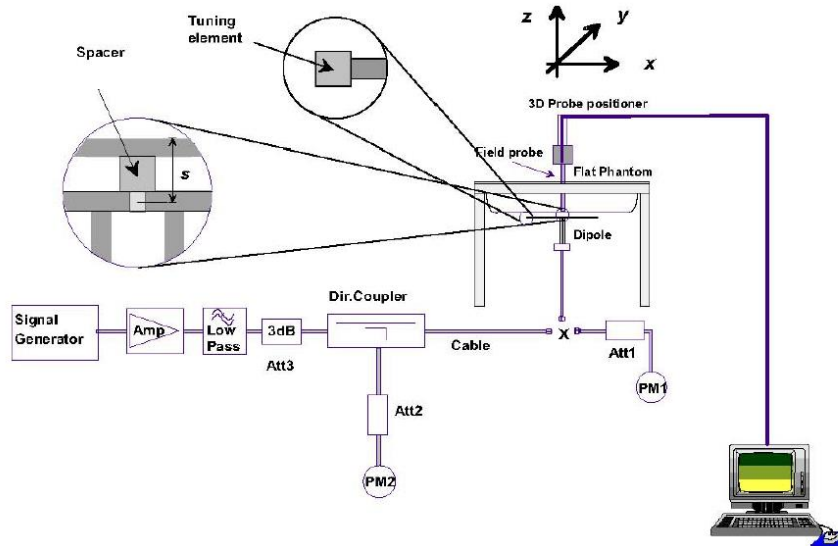
| Test Date | Probe S/N | Calibration Point | | Dielectric Parameters | | CW Validation | | | Modulation Validation | | |
|------------|-----------|-------------------|-----|-----------------------|--------------|---------------|-----------------|----------------|-----------------------|-------------|------|
| | | | | Conductivity | Permittivity | Sensitivity | Probe linearity | Probe Isotropy | Modulation type | Duty factor | PAR |
| 2019-04-01 | 3842 | Head | 450 | 0.88 | 43.15 | PASS | PASS | PASS | FM | PASS | PASS |

9.3. SAR System Verification

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

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ($\pm 10\%$).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



System Performance Check Setup



Photo of Dipole Setup

Check Result:

| Head | | | | | | | | | | | |
|-----------------|-----------|-----------------|----------------|-----------|-----------------|----------------|------------|-------------|-------|-----------|-----------|
| Frequency (MHz) | 1g SAR | | | 10g SAR | | | Delta (1g) | Delta (10g) | Limit | Temp (°C) | Date |
| | Target 1W | Normalize to 1W | Measured 250mW | Target 1W | Normalize to 1W | Measured 250mW | | | | | |
| 450 | 4.48 | 4.88 | 1.22 | 3.00 | 3.25 | 0.812 | 8.93% | 8.27% | ±10% | 22.5 | 2020/3/26 |

Note:

1. the graph results see follow.

Plots of System Performance Check

System Performance Check-Head 450MHz

DUT: D450V3; Type: D450V3; Serial: 1102

Date: 2020-03-26

Communication System: UID 0, A-CW (0); Frequency: 450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 450$ MHz; $\sigma = 0.849$ S/m; $\epsilon_r = 44.618$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.2°C; Liquid Temperature: 22.0°C;

DASY5 Configuration:

- Probe: EX3DV4 - SN3842; ConvF(9.96, 9.96, 9.96) @ 450 MHz; Calibrated: 1/30/2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn876; Calibrated: 3/3/2020
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Head/d=15mm, Pin=250mW, dist=1.4mm/Area Scan (51x101x1): Interpolated grid:

$dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.75 W/kg

Head/d=15mm, Pin=250mW, dist=1.4mm/Zoom Scan (7x7x7)/Cube 0:

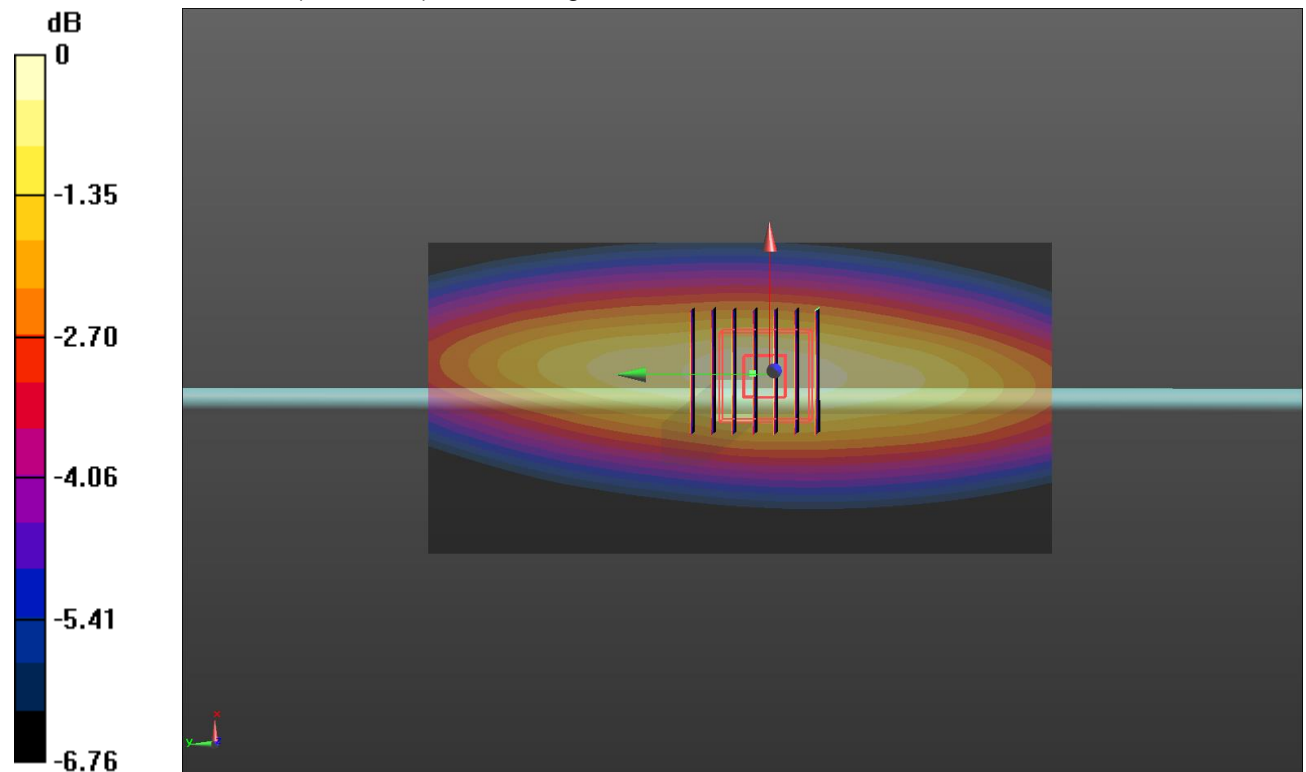
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 43.99 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 2.07 W/kg

SAR(1 g) = 1.22 W/kg; SAR(10 g) = 0.812 W/kg

Maximum value of SAR (measured) = 1.75 W/kg



0 dB = 1.75 W/kg = 2.43 dBW/kg

10. SAR Exposure Limits

SAR assessments have been made in line with the requirements of FCC 47 CFR § 2.1093.

| Type Exposure | Limit (W/kg) | |
|---|---|---|
| | General Population / Uncontrolled Exposure Environment | Occupational / Controlled Exposure Environment |
| Spatial Average SAR (whole body) | 0.08 | 0.4 |
| Spatial Peak SAR (1g cube tissue for head and trunk) | 1.6 | 8.0 |
| Spatial Peak SAR (10g for limb) | 4.0 | 20.0 |

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

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

11. Radiated Power Measurement Results

| FRS | | | | |
|--------|-------------------|-----------|----------|----------------------|
| Mode | Channel Bandwidth | Frequency | | Radiated power (dBm) |
| | | Channel | MHz | |
| Analog | 12.5kHz | CH4 | 462.6375 | 31.50 |
| | | CH11 | 467.6375 | 26.95 |

12. Maximum Tune-up Limit

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

| FRS | | | |
|--------|-------------------|---------------------------------|-----------------------------|
| Mode | Channel Bandwidth | Operation Frequency Range (MHz) | Maximum tune-up power (dBm) |
| Analog | 12.5kHz | 462.5500~462.7250MHz | 33.00 |
| | | 467.5625~467.7125MHz | 27.00 |

13. SAR Measurement Results

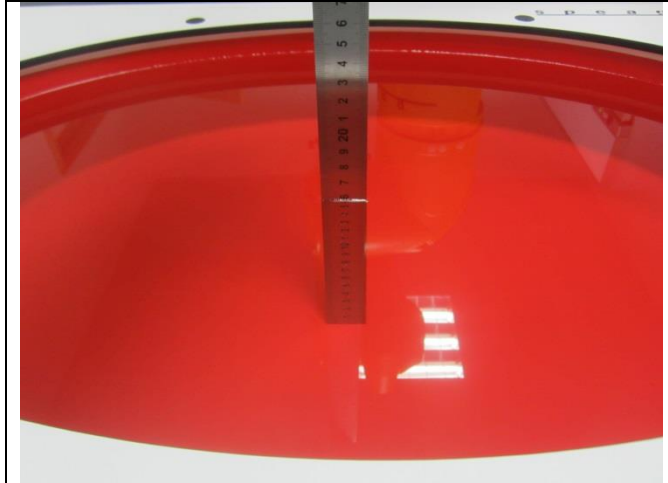
| Front-of-face | | | | | | | | | | | |
|----------------|---------------|-----------|----------|-----------|---------------------|------------------------|------------------|------------------|----------------|---------------------|----------|
| Mode | Test Position | Frequency | | ERP (dBm) | Tune-up limit (dBm) | Tune-up scaling factor | Power Drift(dB) | Measured SAR(1g) | Report SAR(1g) | 75% Duty factor SAR | Plot No. |
| | | CH | MHz | | | | | (W/kg) | (W/kg) | (W/kg) | |
| Analog 12.5kHz | Front | CH4 | 462.6375 | 31.50 | 33.00 | 1.413 | -0.13 | 0.598 | 0.845 | 0.634 | 1 |
| | | CH11 | 467.6375 | 26.95 | 27.00 | 1.012 | -0.12 | 0.177 | 0.179 | 0.134 | - |

| Body-worn | | | | | | | | | | | |
|----------------|---------------|-----------|----------|-----------|---------------------|------------------------|-----------------|------------------|----------------|---------------------|----------|
| Mode | Test Position | Frequency | | ERP (dBm) | Tune-up limit (dBm) | Tune-up scaling factor | Power Drift(dB) | Measured SAR(1g) | Report SAR(1g) | 75% Duty factor SAR | Plot No. |
| | | CH | MHz | | | | | (W/kg) | (W/kg) | (W/kg) | |
| Analog 12.5kHz | Rear | CH4 | 462.6375 | 31.50 | 33.00 | 1.413 | -0.13 | 1.270 | 1.794 | 1.345 | 2 |
| | | CH11 | 467.6375 | 26.95 | 27.00 | 1.012 | -0.15 | 0.359 | 0.363 | 0.272 | - |

Note:

1. The distance of the front-of-face test is 25mm, the distance of the Body-worn test is 0mm.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. The Body-worn SAR evaluation was performed with the Leather Case body-worn accessory attached to the DUT and touching the outer surface of the planar phantom.
4. SAR Test Data Plots to the Appendix A.

14. Test Setup Photos



Liquid depth in the ELI Phantom



Front-of-face(25mm)



Body-worn(0mm)

15. External and Internal Photos of the EUT

Please refer to the test report No.: CHTEW20040001

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