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TEST REPORT

SPECIFIC ABSORPTION RATE (SAR) EVALUATION REPORT

For Audio Monitor - Parent Unit

Model Number: DM1111 PU
Brand Name: vtech

FCC ID: EW780-1254-01A

Prepared for
VTech Telecommunications Ltd.
23/F., Tai Ping Industrial Centre, Block 1,
57 Ting Kok Road, Tai Po, Hong Kong.

PREPARED AND CHECKED BY:	APPROVED BY:
Signed On File	Siu Yiu Nam Intertek Testing Services Hong Kong Limited
Fengkai Bao, Kaye	Siu Yiu Nam, Edwin
Test Engineer	Senior Lead Engineer
Shenzhen UnionTrust Quality and Technology Co., Ltd.	Intertek Testing Services Hong Kong Ltd.
Date: October 30, 2020	Date: October 30, 2020

TEST REPORT

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TEST REPORT

1. TEST RESULT SUMMARY

Applicant:	VTech Telecommunications Ltd.
Applicant Address:	23/F., Tai Ping Industrial Centre, Block 1, 57 Ting Kok Road, Tai Po, Hong Kong.
Model:	DM1111 PU
Brand Name:	vtech
Serial Number:	N/A
FCC ID:	EW780-1254-01A
Test Device:	Production Unit
Exposure Category:	General Population/Uncontrolled Exposure
Date of Test:	September 12, 2020
Place of Testing:	Shenzhen UnionTrust Quality and Technology Co., Ltd. 16/F., Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China
Environmental Conditions:	Temperature: +18 to 25°C Humidity 25 to 75%
Test Specification:	ANSI/IEEE C95.1 IEEE Std 1528: 2013 FCC KDB Publication 447498 D01 v06 FCC KDB Publication 865664 D01 v01r04 FCC KDB Publication 865664 D02 v01r02

The maximum spatial peak SAR value for the sample device averaged over 1g was found to be:

Band	Operating Mode	TX Frequency (MHz)	Highest Reported SAR
			1 g Body
1.9GHz DECT	Voice	1921.536 – 1928.448	0.0542 W/kg

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment / general population exposure limits specified in ANSI/IEEE C95.1.

TEST REPORT

2. GENERAL INFORMATION

2.1. Description of Equipment under test (EUT)

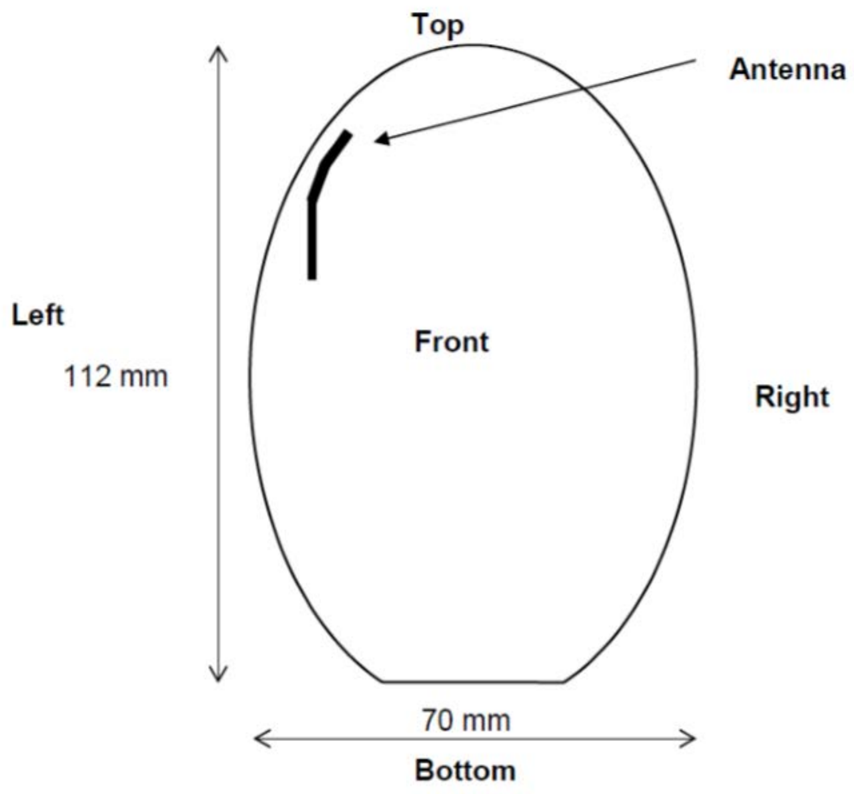
Manufacturer:	VTech (Dongguan) Telecommunications Limited
Manufacturer Address:	VTech Science Park, Xia Ling Bei Management Zone, Liaobu, Dongguan, Guangdong, China.
Device dimension (L x W) :	112 (mm) x 70 (mm)
Device thickness:	45 (mm)
Antenna Gain:	0 dBi
Operating Configuration(s) / mode:	Body (Voice call)
Tx Frequency (MHz):	1921.536MHz to 1928.448MHz
Duty Cycle*:	1/24
H/W Version:	N/A
S/W Version:	N/A
Battery Type:	2.4VDC (1 x 2.4V 400mAh Ni-MH Rechargeable Battery Pack) - Model: Corun BT183342/BT283342 - Model: GP BT183342/BT283342

*Note:

1. DECT has a TDD/TDMA frame structure with a complete frame of 10ms duration with 24 time slots. And under these 24 time slots, the first 12 slots are allocated for the transmission from base station to handsets, and the other 12 slots are for the transmission from handsets to base station. During a call, the handset of this product will use one of 24 time slots to transmit under worst case, which gives a duty cycle of 1/24 (= 4.17%).

TEST REPORT

2.2. EUT Antenna Locations



Details of antenna specification are shown in separate antenna dimension document.

TEST REPORT

2.3. Nominal and Maximum Output Power Specifications

The EUT operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498.

Band	Operating Mode	TX Frequency (MHz)	Output Power Nominal (dBm)	Output Power Maximum (dBm)
1.9GHz DECT	Voice	1921.536 – 1928.448	20.0	21.0

3. SAR MEASUREMENT SYSTEM DESCRIPTION

SAR is related to the rate at which energy is absorbed per unit mass in object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and occupational/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.
The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of given mass density (ρ). The equation description is as below:

$$\mathrm{SAR} = \frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\mathrm{d}W}{\mathrm{d}m}\right) = \frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\mathrm{d}W}{\rho \mathrm{d}V}\right)$$

SAR is expressed in units of Watts per kilogram (W/Kg)
SAR can be obtained using either of the following equations:

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

$$\mathrm{SAR} = c_h \left.\frac{\mathrm{d}T}{\mathrm{d}t}\right|_{t=0}$$

Where

SAR is the specific absorption rate in watts per kilogram;
E is the r.m.s. value of the electric field strength in the tissue in volts per meter;
σ is the conductivity of the tissue in siemens per metre;
ρ is the density of the tissue in kilograms per cubic metre;
c_h is the heat capacity of the tissue in joules per kilogram and Kelvin;

$\frac{\mathbf{dT}}{\mathbf{dt}}|\mathbf{t=0}$ is the initial time derivative of temperature in the tissue in kelvins per second

TEST REPORT

An SAR measurement system usually consists of a small diameter isotropic electric field probe, a multiple axis probe positioning system, a test device holder, one or more phantom models, the field probe instrumentation, a computer and other electronic equipment for controlling the probe and making the measurements. Other supporting equipment, such as a network analyzer, power meters and RF signal generators, are also required to measure the dielectric parameters of the simulated tissue media and to verify the measurement accuracy of the SAR system.

The SAR measurement system being used is DASY4 system, which consists following items for performing compliance tests

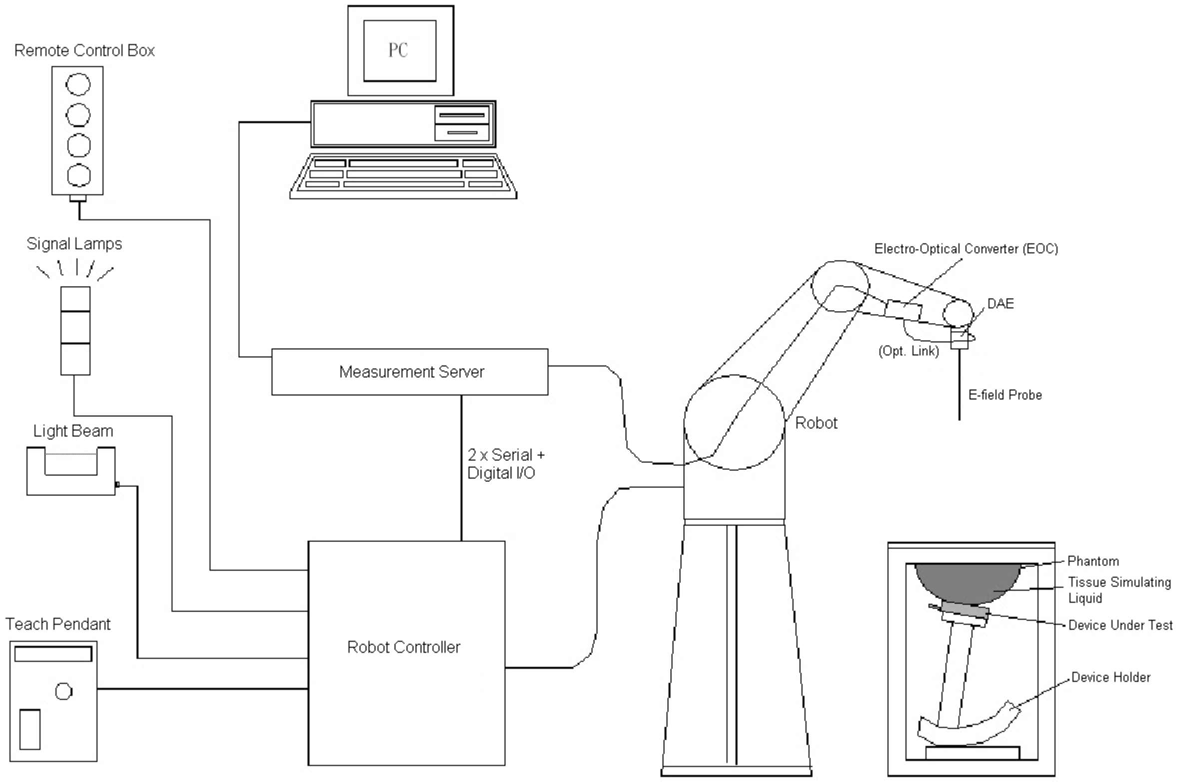


Figure 1: Schematic diagram of the SAR measurement system

- The PC. It controls most of the bench devices and stores measurement data. A computer running WinXP and the Opensar software
- The E-Field probe. The probe is a 3-axis system made of 3 distinct dipoles. Each dipole returns a voltage in function of the ambient electric field.
- The Keithley multimeter measures each probe dipole voltages.
- The SAM phantom simulates a human head. The measurement of the electric field is made inside the phantom.
- The liquids simulate the dielectric properties of the human head tissues
- The network emulator controls the mobile phone under test.
- The validation dipoles are used to measure a reference SAR. They are used to periodically check the bench to make sure that there is no drift of the system characteristics over time.
- The phantom, the device holder and other accessories according to the targeted measurement.

TEST REPORT

ROBOT

The DASY system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

TEST REPORT

E-FIELD PROBE

The SAR measurement is conducted with the dosimetric probe. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

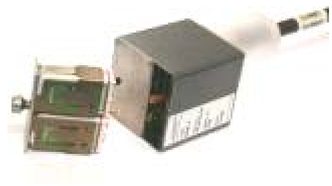
Model	EX3DV4
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

Model	ES3DV3
Construction	Symmetrical design with triangular core. Interleaved sensors. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	10 MHz to 4 GHz Linearity: ± 0.2 dB
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 µW/g to 100 mW/g Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm

TEST REPORT

DATA ACQUISITION ELECTRONICS (DAE)

Model	DAE3, DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset Voltage	< 5µV (with auto zero)
Input Bias Current	< 50 fA
Dimensions	60 x 60 x 68 mm



TEST REPORT

SAM TWIN PHANTOM

Model	Twin SAM
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.
Material	Vinylester, glass fiber reinforced (VE-GF)
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters

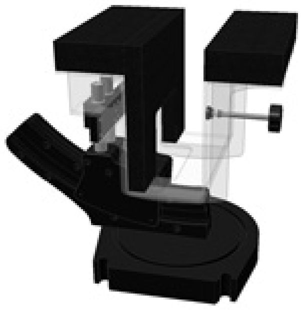
Model	ELI
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.
Material	Vinylester, glass fiber reinforced (VE-GF)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters

TEST REPORT

DEVICE HOLDER

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

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



SYSTEM VALIDATION DIPOLES

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

During measurement, the system first does an area (2D) scan at a fixed depth within the liquid from the inside wall of the phantom scanning area is greater than the projection of EUT and antenna.

Area Scan Parameters extracted from KDB 865664

	$\leq$ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 mm ± 1 mm	$\frac{1}{2}\cdot\delta\cdot\ln(2)$ mm ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	$\leq$ 2 GHz: $\leq$ 15 mm 2 – 3 GHz: $\leq$ 12 mm	3 – 4 GHz: $\leq$ 12 mm 4 – 6 GHz: $\leq$ 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.	

When the maximum SAR point has been found, the system will then carry out a zoom (3D) scan centered at that point to determine volume averaged SAR level.

Zoom Scan Parameters extracted from KDB 865664

Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			$\leq$ 2 GHz: $\leq$ 8 mm 2 – 3 GHz: $\leq$ 5 mm*	3 – 4 GHz: $\leq$ 5 mm* 4 – 6 GHz: $\leq$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq$ 5 mm	3 – 4 GHz: $\leq$ 4 mm 4 – 5 GHz: $\leq$ 3 mm 5 – 6 GHz: $\leq$ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\leq$ 4 mm	3 – 4 GHz: $\leq$ 3 mm 4 – 5 GHz: $\leq$ 2.5 mm 5 – 6 GHz: $\leq$ 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		$\geq$ 30 mm	3 – 4 GHz: $\geq$ 28 mm 4 – 5 GHz: $\geq$ 25 mm 5 – 6 GHz: $\geq$ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB Publication 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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.

4. TISSUE VERIFICATION

For SAR measurement of field distribution inside phantom, homogeneous tissue simulating liquid as below liquid recipes were filled to a depth of 15cm ± 0.5cm for below 3GHz measurement and of 10cm ± 0.5cm for above 3GHz.

HEAD TISSUE RECIPES

Frequency	Ingredients					
	De-ionized Water	Salt	1,2 propanediol	DGBE	DGMH	Triton X100
450 MHz	33.5%	3.4%	63.1%			
750 MHz	34.2%	1.4%	64.4%			
900 MHz	35.3%	1.0%	63.7%			
1800 MHz	55.2%	0.6%		13.8%		30.4%
1900 MHz	55.3%	0.5%		13.8%		30.4%
2000 MHz	55.3%	0.4%		13.8%		30.5%
2450 MHz	55.7%	0.3%		18.7%		25.3%
5000 MHz	65.3%				17.2%	17.5%

BODY TISSUE RECIPES

Frequency	Ingredients					
	De-ionized Water	Salt	1,2 propanediol	DGBE	DGMH	Triton X100
450 MHz	52.4%	1.9%	45.7%			
750 MHz	55.4%	1.3%	43.3%			
900 MHz	52.9%	1.0%	46.1%			
1800 MHz	70.8%	0.5%		8.7%		20.0%
1900 MHz	70.1%	0.4%		8.9%		20.6%
2000 MHz	70.2%	0.3%		8.6%		20.9%
2450 MHz	70.8%	0.3%		8.7%		20.2%
5000 MHz	77.8%				11.7%	11.5%

TEST REPORT

The head tissue dielectric parameters recommended by the IEEE Std 1528 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. For other head and body tissue parameters, they are recommended by KDB 865664.

Target Frequency (MHz)	head		body	
	εr	σ (S/m)	εr	σ (S/m)
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	1.01	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

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)

When a transmission band overlaps with one of the target frequencies, the tissue dielectric parameters of the tissue medium at the middle of a device transmission band should be within ±5% of the parameters specified at that target frequency.

TEST REPORT

The dielectric parameters of the liquids were verified prior to the SAR evaluation using SATIMO Dielectric Probe Kit and R&S Network Analyzer ZVL6.

The dielectric parameters were:

Head Liquid

Freq. (MHz)	Temp. (˚C)	ε_r / Relative Permittivity			σ / Conductivity			ρ **(kg/m³)
		measured	Target*	Δ (±5%)	measured	Target*	Δ (±5%)	
2000	22.5	39.40	40	-1.50	1.426	1.4	1.86	1000

**   Target values refer to KDB 865664*

*** Worst-case assumption*

Note:

1. Date of tissue verification measurement: September 12, 2020

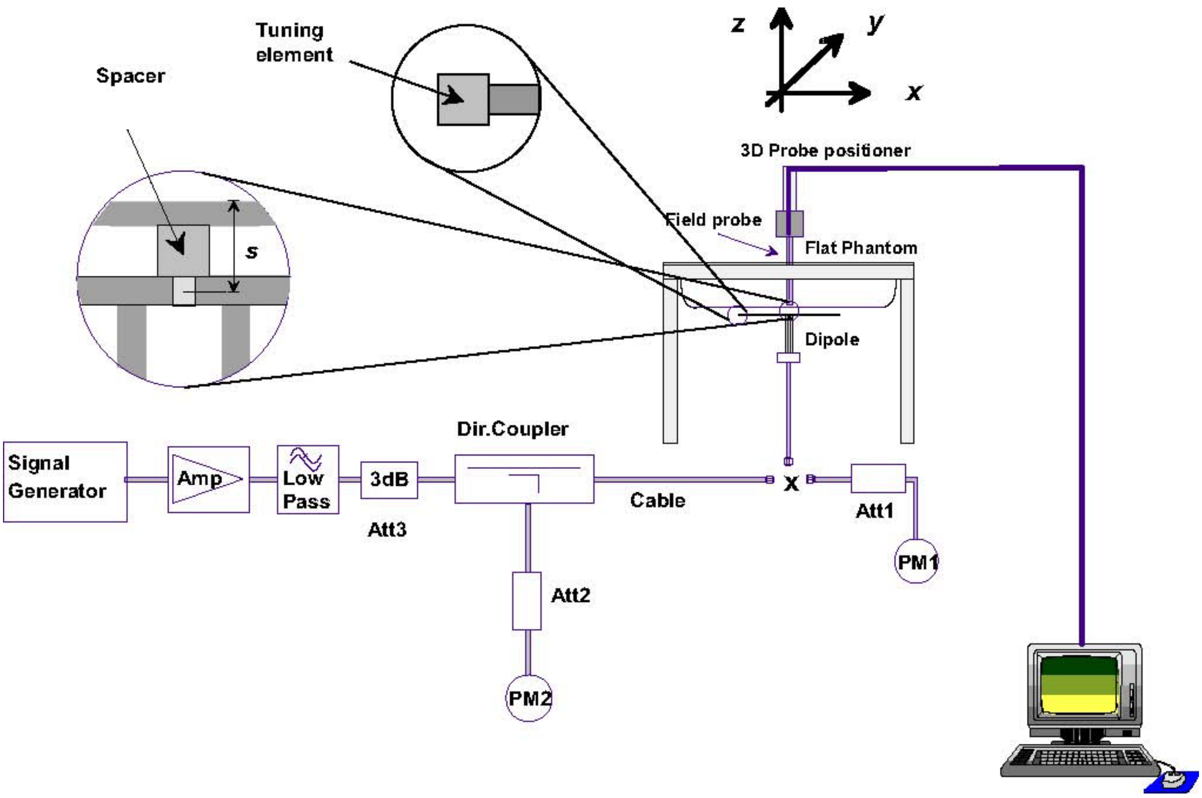
2. Ambient temperature: 22.5 deg C

3. The temperature condition is within +/- 2 deg. C during the SAR measurements.

5. SAR MEASUREMENT SYSTEM VERIFICATION

Each DASY system is equipped with one or more system check kits. These units, together with the predefined measurement procedures within the DASY software, enable user to conduct the system check. System kit includes a dipole, and dipole device holder.

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



TEST REPORT

VALIDATION DIPOLE

The dipoles used is based on the IEEE Std 1528, and is complied with mechanical and electrical specifications in line with the requirements of both FCC and KDB requirement.

SYSTEM CHECK RESULTS

System Verification								
Date	Freq. (MHz)	Liquid Type	System Diople	Serial No.	Target SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	Normalized SAR_{1g} (W/kg)	Deviation (±10%)
Sep 12, 2020	2000	Head	2000MHz	1042	40.3	0.442	44.20	9.68%

* the target was quoted from dipole calibration report
* Input power level = 10dBm (10mW)

SAR_{1g} ambient measured value < 12 mW/kg

Details of System Verification plot is shown in the Appendix A - plot 1.

TEST REPORT

6. SAR EVALUATION

6.1. Device test positions relative to the head

This practice specifies two handset test positions against the head phantom—the “cheek” position and the “tilt” position. These two test positions are defined in the following subclauses. The handset should be tested in both positions on left and right sides of the SAM phantom. If handset construction is such that the handset positioning procedures described below to represent normal use conditions cannot be used, e.g., some asymmetric handsets, alternative alignment procedures should be adapted with all details provided in the test report. These alternative procedures should replicate intended use conditions as closely as possible according to the intent of the procedures described in this subclause.

TEST REPORT

DEFINITION OF THE CHEEK POSITION

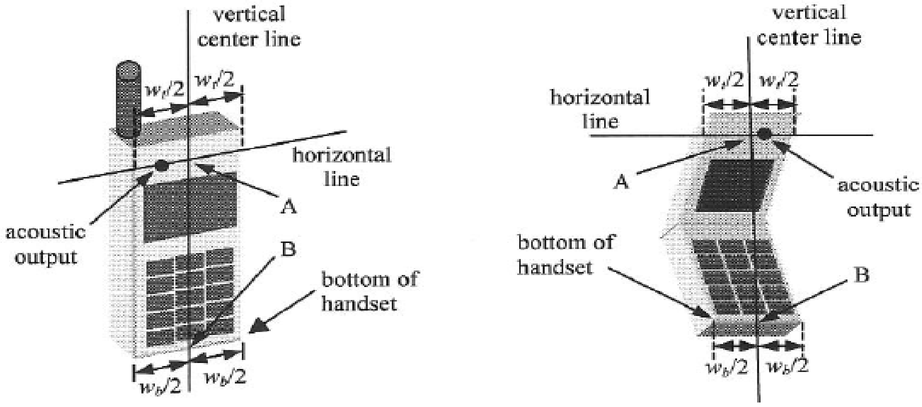
The cheek position is established as follows:

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.

2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in below figure), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see below left figure). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see right figure), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.

3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see the figure as next page), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.

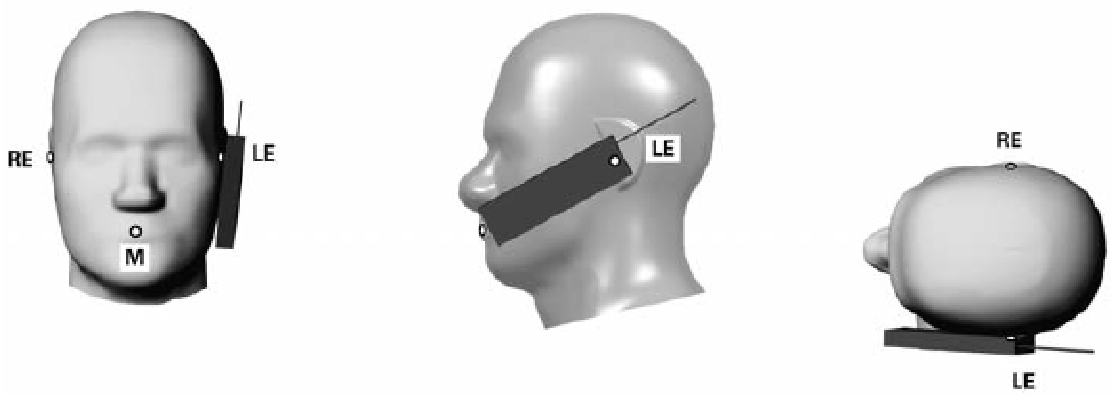
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.



5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.

6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.

7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek.



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DEFINITION OF THE TILT POSITION

The tilt position is established as follows:

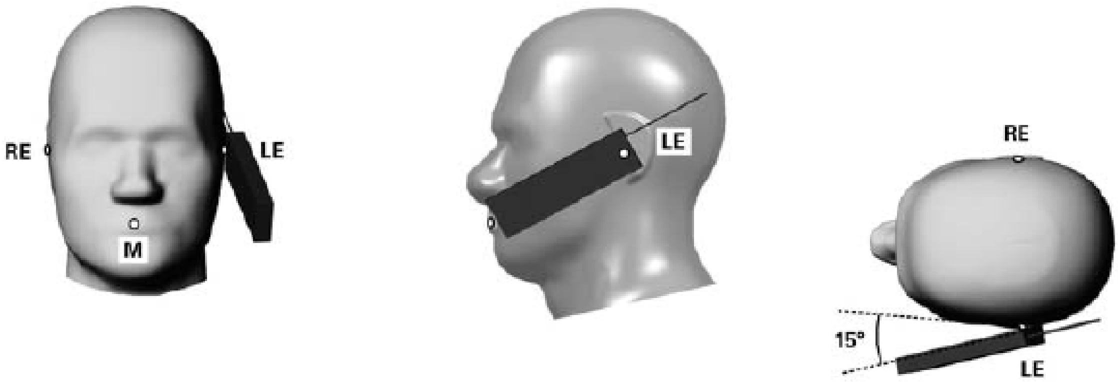
1. Repeat steps to place the device in the cheek position.

2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.

3. Rotate the handset around the horizontal line by 15°.

4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See the figure as below. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced.

5. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point on the handset is in contact with the phantom, e.g., the antenna with the back of the head.



6.2. Device test positions relative to body-worn accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. Per FCC KDB Publication 648474, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is >1.2W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be reported for that body-worn accessory with a headset attached to the handset.

SAR evaluation is required for body-worn accessories supplied with the host device. The test configurations must be conservative for supporting the body-worn accessory use conditions expected by users. Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics. All body-worn accessories containing metallic components, either supplied with the product or available as an option from the device manufacturer, must be tested in conjunction with the host device to demonstrate compliance

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid.

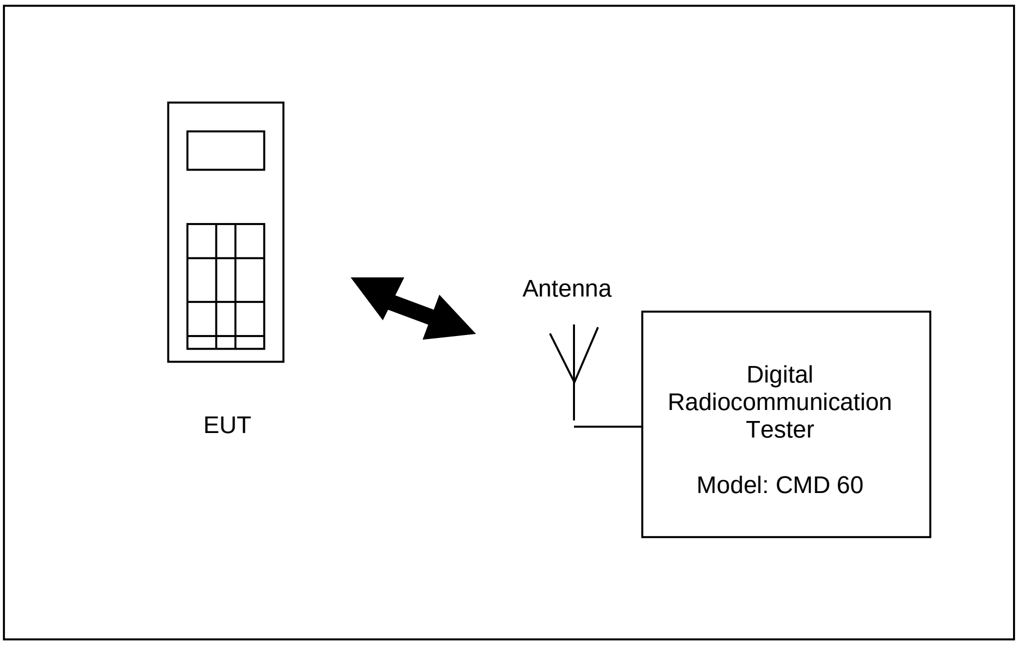
TEST REPORT

6.3. General Device Setup

The device was first charged on a charger over a duration defined by the applicant to make sure the installed battery was fully charged.

The device was then placed into TBR6 test mode to simulate the worst case voice call configuration through highest power channel, where the operating parameters established in this TBR6 test mode is identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequency is corresponded to actual channel frequencies defined for domestic use.

During testing, the device was evaluated with a fully charged battery, power saving function disabled and was configured to operate at maximum output power. A receive antenna and a base station simulator – Digital Radiocommunication Tester, model: CMD60 were placed with a distance > 50cm away from the device to established the voice call communication and monitor the transmission states.



TEST REPORT

6.4. RF Output Power Measurements

Frequency	Channel	Duty Cycle	Maximum tune-up power (dBm)	Measured Conducted Power (Peak) (dBm)	Measured Conducted Power (Time average) (dBm)
1.9GHz DECT	Low – 4	1/24	21.0	19.02	5.62
	Middle – 2			19.10	5.78
	High – 0			19.05	6.19

Note:

1. Time Average power (dBm) = Peak power (dBm) + Time Average factor.

2. Time Average factor = 10*log(duty cycle)

3. Per KDB 447498, the tested device was within the specified tune-up tolerances range, but not more than 2dB lower than the maximum tune-up tolerance limit.

4. Per KDB 447498, when antenna port was not available on the device to support conducted power measurement and test software was used to establish transmitter power levels, the power level was verified separately according to design and component specifications and product development information specified by the manufacturer.

TEST REPORT

6.5. Exposure Conditions

Body Exposure Conditions

Test Configurations	Operation Mode	SAR Required	Note
Front Face 0mm	Voice	Yes	Corun rechargeable battery pack
Rear Face 0mm	Voice	Yes	Corun rechargeable battery pack
Left Side 0mm	Voice	Yes	Corun rechargeable battery pack
Right Side 0mm	Voice	Yes	Corun rechargeable battery pack
Top Side 0mm	Voice	Yes	Corun rechargeable battery pack
Bottom Side 0mm	Voice	Yes	Corun rechargeable battery pack
Front Face 0mm	Voice	Yes	GP rechargeable battery pack

Note:
1. Highest reported SAR test configuration was repeated for additional supported batteries.

TEST REPORT

6.6. Test Result

The results on the following page(s) were obtained when the device was tested in the condition described in this report. Detailed measurement data and plots, which reveal information about the location of the maximum SAR with respect to the device, are reported in Appendix B.

Body SAR

					Measurement Result						
Chan	**Freq. (MHz)**	**Battery**	**Mode**	**Test Position**	**Maximum Allowed Power (dBm)**	**Measured Power (dBm)**	**SAR Drift (%)**	**Measured SAR_{1g} (W/kg)**	**Scaling factor**	**Reported SAR_{1g} (W/kg)**	**Plot**
2	1924.992	1	Voice	Front Face	21.0	19.10	0.10	0.035	1.55	0.0542	1
2	1924.992	1	Voice	Rear Face	21.0	19.10	-0.05	0.016	1.55	0.0248	
2	1924.992	1	Voice	Left Side	21.0	19.10	0.04	0.031	1.55	0.0480	
2	1924.992	1	Voice	Right Side	21.0	19.10	0.05	0.016	1.55	0.0248	
2	1924.992	1	Voice	Top Side	21.0	19.10	0.04	0.002	1.55	0.0031	
2	1924.992	1	Voice	Bottom Side	21.0	19.10	-0.11	0.012	1.55	0.0186	
0	1928.448	1	Voice	Front Face	21.0	19.02	-0.02	0.029	1.58	0.0458	
4	1921.536	1	Voice	Front Face	21.0	19.05	0.03	0.029	1.57	0.0454	
2	1924.992	2	Voice	Front Face	21.0	19.10	0.09	0.029	1.55	0.0449	

Note:

1. Fully charged batteries were used at the beginning of each SAR measurement.

2. There was no power reduction used for any band/mode implemented in this device.

3. Reported SAR results were scaled to the maximum allowed power with the scaling factor equation -10^[(Maximum power – measured power) / 10].

4. Per KDB 447498 D01, when the maximum output power variation across the required test channels was < 0.5 dB, measurement on middle channel was required.

5. Per KDB 865664 D01, repeated measurement was not required when the original highest measured SAR was < 0.8W/kg.

6. Per KDB 865664 D02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.

6.7. SAR Limits

The following FCC limits (Std. C95.1-1992) for SAR apply to devices operate in General Population/Uncontrolled Exposure and Controlled environment:

GENERAL POPULATION / UNCONTROLLED ENVIRONMENTS:
Defined as location where there is the exposure of individuals who have no knowledge or control of their exposure.

EXPOSURE (General Population/Uncontrolled Exposure environment)	SAR (W/kg)
Spatial Peak SAR (Head)*	1.60
Spatial Peak SAR (Partial Body)*	1.60
Spatial Peak SAR (Whole Body)*	0.08
Spatial Peak SAR (Hands / Wrists / Feet / Ankles)**	4.00

OCCUPATIONAL / CONTROLLED ENVIRONMENTS:
Defined as location where there is the exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation)

EXPOSURE (Occupational/Controlled Exposure environment)	SAR (W/kg)
Spatial Peak SAR (Head)*	8.00
Spatial Peak SAR (Partial Body)*	8.00
Spatial Peak SAR (Whole Body)*	0.40
Spatial Peak SAR (Hands / Wrists / Feet / Ankles)**	20.00

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Peak value of the SAR averaged over any 10 gram of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

7. TEST EQUIPMENT LIST

Equipment	Registration No.	Manufacturer	Model No.	Calibration Date	Calibration Due Date
System Validation Dipole	1042	SPEAG	D2000V2	May 18, 2018	3 years
Dosimetric E-Field Probe	3090	SPEAG	ES3DV3	May 09, 2020	1 Year
Data Acquisition Electronics	662	SPEAG	DAE4	May 06, 2020	1 year
Twins Phantom	TP-1376	SPEAG	SAM	N/A	N/A
Digital RadioCommunication tester	82567310046	R&S	CMD60	November 24, 2019	1 Year
Signal Generator	100796	R&S	SMT06	May 14, 2020	1 Year
ENA Series Network Analyzer	US39170317	Agilent	8753ES	November 24, 2019	1 Year
Dielectric Assessment Kit	1056	SPEAG	DAK-3.5	N/A	N/A
USB/GPIB Interface	N10149	Agilent	82357B	N/A	
Signal Generator	103718	R&S	SMB100A	November 24, 2019	1 Year
POWER METER	101293	R&S	NRP	November 24, 2019	1 Year
Thermometer	7E3419002	ZHITUO	i100-TH	July 09, 2020	1 Year
Coupler	161221001	REBES	TC-05180-10S	N/A	N/A
Amplifier	QA1252001	Mini-Circuit	ZHL42	N/A	N/A
DC Source	MY43000795	Agilent	66319B	N/A	N/A

TEST REPORT

8. MEASUREMENT UNCERTAINTY

Per FCC KDB 865884, the extensive SAR measurement uncertainty analysis was not required when the highest measured SAR was < 1.5W/kg for all frequency band.

9. E-FIELD PROBE AND DIPOLE ANTENNA CALIBRATION

Probe calibration factors and dipole antenna calibration are included in Appendix C.

Total Quality. Assured.

TEST REPORT

APPENDIX A – SYSTEM CHECK DATA

Test Laboratory: UnionTrust Date/Time: 2020/9/12

System Check_H2000_10dBm_SAM2

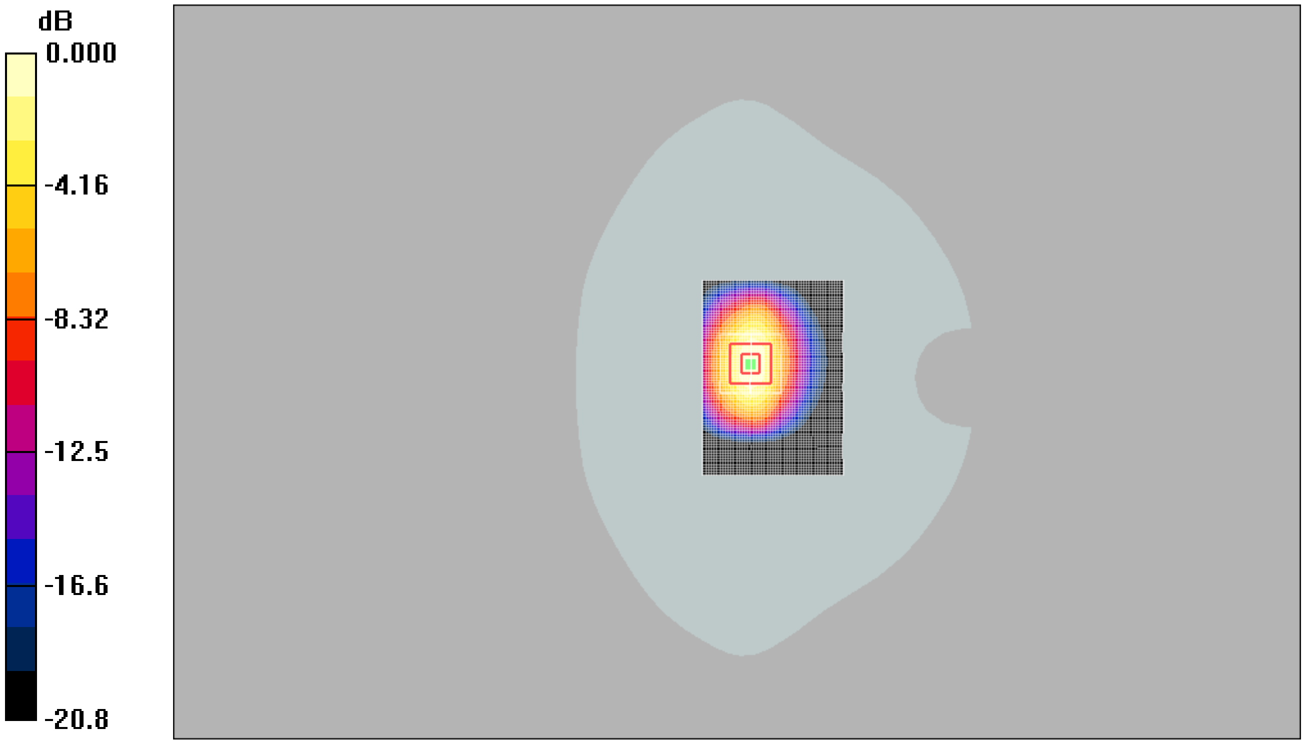
DUT: Dipole 2000 MHz

Communication System: CW; Frequency: 2000 MHz;Duty Cycle: 1:1
Medium: H2000 Medium parameters used: f = 2000 MHz; σ = 1.43 mho/m; ε_r = 39.4; ρ = 1000 kg/m^3

DASY4 Configuration:
- Probe: ES3DV3 - SN3090; ConvF(5.1, 5.1, 5.1); Calibrated: 2020/5/9
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn662; Calibrated: 2020/5/6
- Phantom: SAM 2; Type: QD 000 P40 CB; Serial: TP-1376
- ; Postprocessing SW: SEMCAD, V1.8 Build 186

system check/Area Scan (51x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.566 mW/g

system check/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.9 V/m; Power Drift = 0.015 dB
Peak SAR (extrapolated) = 0.904 W/kg
SAR(1 g) = 0.442 mW/g; SAR(10 g) = 0.216 mW/g
Maximum value of SAR (measured) = 0.578 mW/g



0 dB = 0.578mW/g

Total Quality. Assured.

TEST REPORT

APPENDIX B – SAR EVALUATION DATA

Test Laboratory: UnionTrust Date/Time: 2020/9/12

P01_DECT_Front Face 0mm 2CH

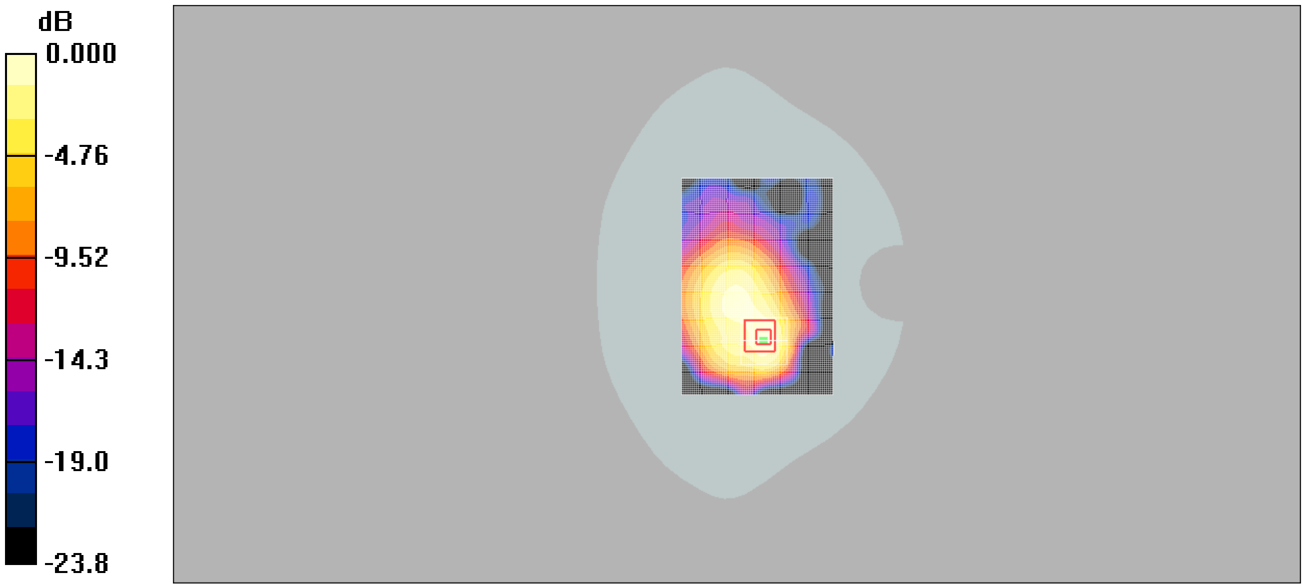
DUT: EUT

Communication System: DECT; Frequency: 1924.99 MHz;Duty Cycle: 1:24
Medium: H1900 Medium parameters used (extrapolated): f = 1924.99 MHz; σ = 1.46 mho/m; ε_r = 40.9; ρ = 1000 kg/m^3

DASY4 Configuration:
- Probe: ES3DV3 - SN3090; ConvF(5.1, 5.1, 5.1); Calibrated: 2020/5/9
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn662; Calibrated: 2020/5/6
- Phantom: SAM 2; Type: QD 000 P40 CB; Serial: TP-1376
- Postprocessing SW: SEMCAD, V1.8 Build 186

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.045 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.33 V/m; Power Drift = 0.101 dB
Peak SAR (extrapolated) = 0.069 W/kg
SAR(1 g) = 0.034 mW/g; SAR(10 g) = 0.018 mW/g
Maximum value of SAR (measured) = 0.044 mW/g



0 dB = 0.044mW/g

TEST REPORT

APPENDIX C – E-FIELD PROBE AND DIPOLE ANTENNA CALIBRATION

Total Quality. Assured.

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CNAS L0570

Client UnionTrust Certificate No: Z20-60141

CALIBRATION CERTIFICAT

Object	ES3DV3 - SN : 3090
Calibration Procedure(s)	FF-Z11-004-01 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	May 09, 2020

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	18-Jun-19(CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101547	18-Jun-19(CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101548	18-Jun-19(CTTL, No.J19X05125)	Jun-20
Reference 10dBAttenuator	18N50W-10dB	10-Feb-20(CTTL, No.J20X00525)	Feb-22
Reference 20dBAttenuator	18N50W-20dB	10-Feb-20(CTTL, No.J20X00526)	Feb-22
Reference Probe EX3DV4	SN 3617	30-Jan-20(SPEAG, No.EX3-3617_Jan20/2)	Jan-21
DAE4	SN 1556	4-Feb-20(SPEAG, No.DAE4-1556_Feb20)	Feb-21

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator MG3700A	6201052605	18-Jun-19(CTTL, No.J19X05127)	Jun-20
Network Analyzer E5071C	MY46110673	10-Feb-20(CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: May 11, 2020

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i θ=0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f＞1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- *NORM(f)x,y,z = NORMx,y,z* frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- *Ax,y,z; Bx,y,z; Cx,y,z;VRx,y,z:*A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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DASY/EASY – Parameters of Probe: ES3DV3 – SN:3090

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(µV/(V/m)²)[A]	1.23	1.34	1.35	±10.0%
DCP(mV)[B]	103.6	103.3	104.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	255.1	±2.6%
		Y	0.0	0.0	1.0		270.4	
		Z	0.0	0.0	1.0		276.1	

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 4 and Page 5).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY – Parameters of Probe: ES3DV3 – SN:3090

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	6.24	6.24	6.24	0.40	1.40	±12.1%
835	41.5	0.90	6.13	6.13	6.13	0.31	1.67	±12.1%
1750	40.1	1.37	5.38	5.38	5.38	0.71	1.18	±12.1%
1900	40.0	1.40	5.10	5.10	5.10	0.63	1.28	±12.1%
2300	39.5	1.67	4.83	4.83	4.83	0.90	1.20	±12.1%
2450	39.2	1.80	4.61	4.61	4.61	0.90	1.20	±12.1%
2600	39.0	1.96	4.51	4.51	4.51	0.90	1.15	±12.1%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY – Parameters of Probe: ES3DV3 – SN:3090

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (*k*=2)
750	55.5	0.96	6.34	6.34	6.34	0.40	1.45	±12.1%
835	55.2	0.97	6.12	6.12	6.12	0.75	1.23	±12.1%
1750	53.4	1.49	5.00	5.00	5.00	0.64	1.33	±12.1%
1900	53.3	1.52	4.80	4.80	4.80	0.63	1.34	±12.1%
2300	52.9	1.81	4.55	4.55	4.55	0.90	1.15	±12.1%
2450	52.7	1.95	4.48	4.48	4.48	0.90	1.11	±12.1%
2600	52.5	2.16	4.26	4.26	4.26	0.90	1.12	±12.1%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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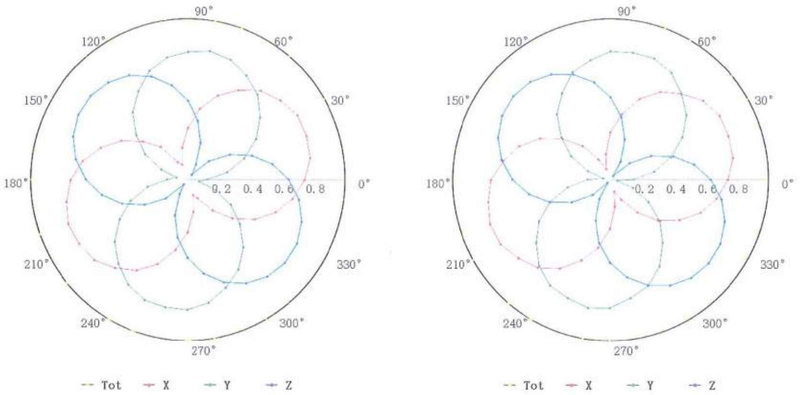
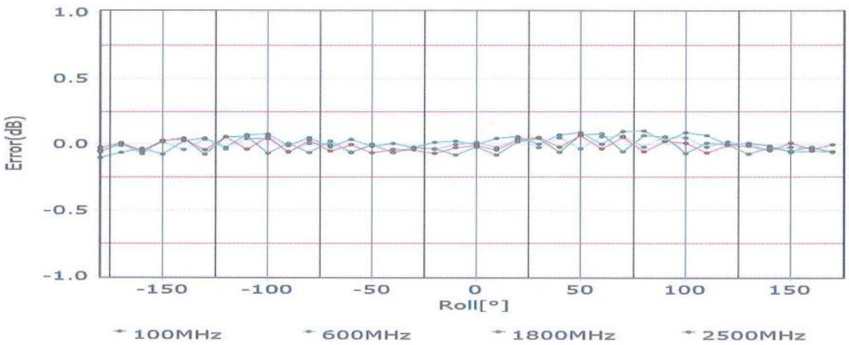
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM **f=1800 MHz, R22**





Uncertainty of Axial Isotropy Assessment: ±1.2% (k=2)

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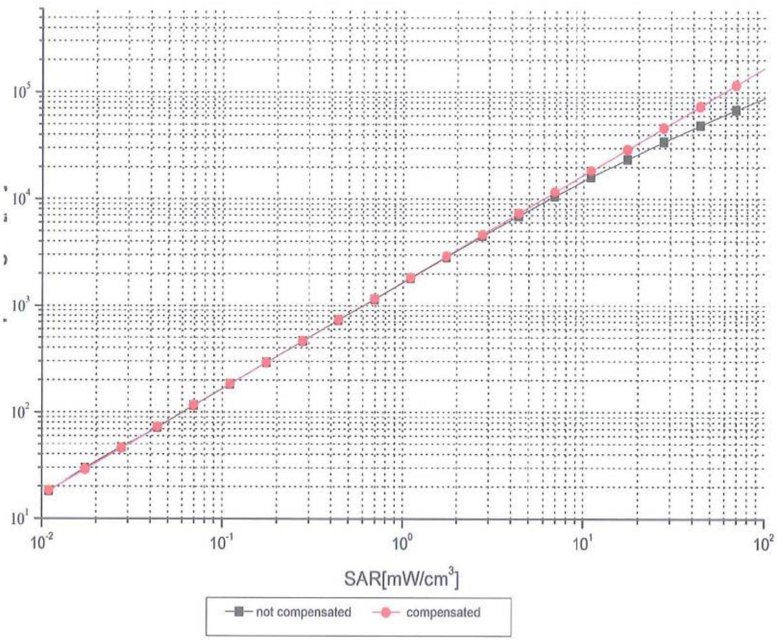
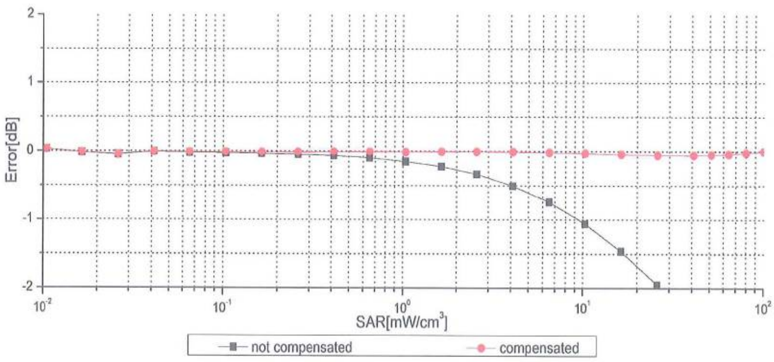
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)





Uncertainty of Linearity Assessment: ±0.9% (*k*=2)

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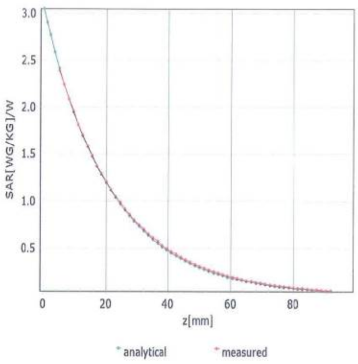
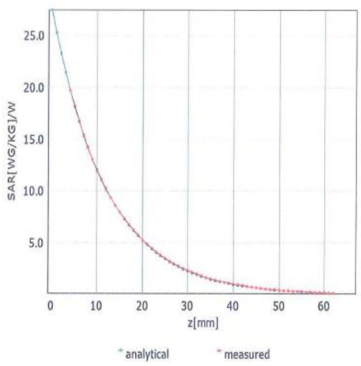
Conversion Factor Assessment

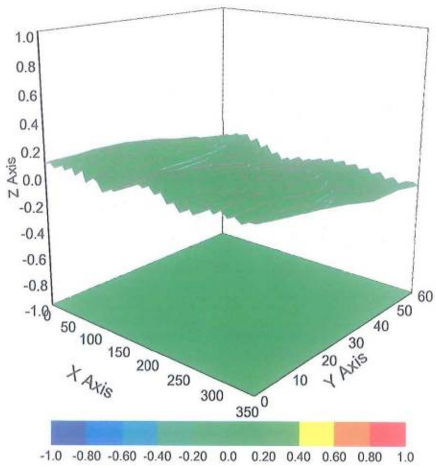
f=750 MHz,WGLS R9(H_convF)



f=1750 MHz,WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (*k*=2)

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DASY/EASY – Parameters of Probe: ES3DV3 – SN:3090

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	0.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	4mm
Probe Tip to Sensor X Calibration Point	2mm
Probe Tip to Sensor Y Calibration Point	2mm
Probe Tip to Sensor Z Calibration Point	2mm
Recommended Measurement Distance from Surface	3mm

TEST REPORT

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校准
CALIBRATION
CNAS L0570

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E-mail: cttl@chinattl.com http://www.chinattl.cn

Client Hydsoft Testing Co., Ltd Certificate No: Z18-60121

CALIBRATION CERTIFICATE

Object	D2000V2 - SN: 1042
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	May 18, 2018

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1525	02-Oct-17(SPEAG,No.DAE4-1525_Oct17)	Oct-18
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
Network Analyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: May 20, 2018

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.10.0.1446
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2000 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.44 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.3 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**40.3 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.14 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.3 mW /g ± 18.7 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.8 ± 6 %	1.56 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.5 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**41.1 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.23 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.6 mW /g ± 18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0Ω+ 0.90jΩ
Return Loss	- 40.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.6Ω- 2.29jΩ
Return Loss	- 24.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.047 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

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DASY5 Validation Report for Head TSL Date: 05.17.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2000 MHz; Type: D2000V2; Serial: D2000V2 - SN: 1042

Communication System: UID 0, CW; Frequency: 2000 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2000 MHz; σ = 1.441 S/m; εr = 38.94; ρ = 1000 kg/m3

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.39, 8.39, 8.39); Calibrated: 9/12/2017,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 10/2/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

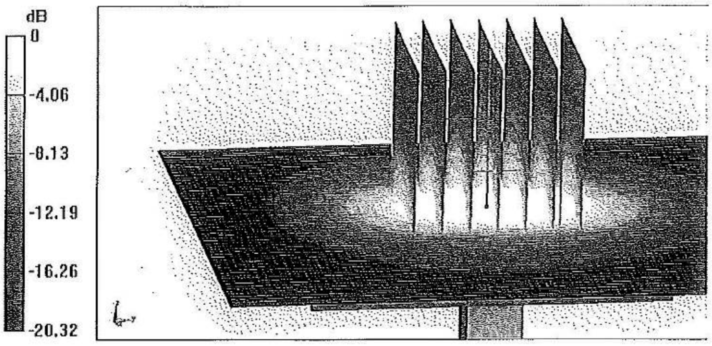
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.2 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 20.8 W/kg

SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.14 W/kg

Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 12.28 dBW/kg

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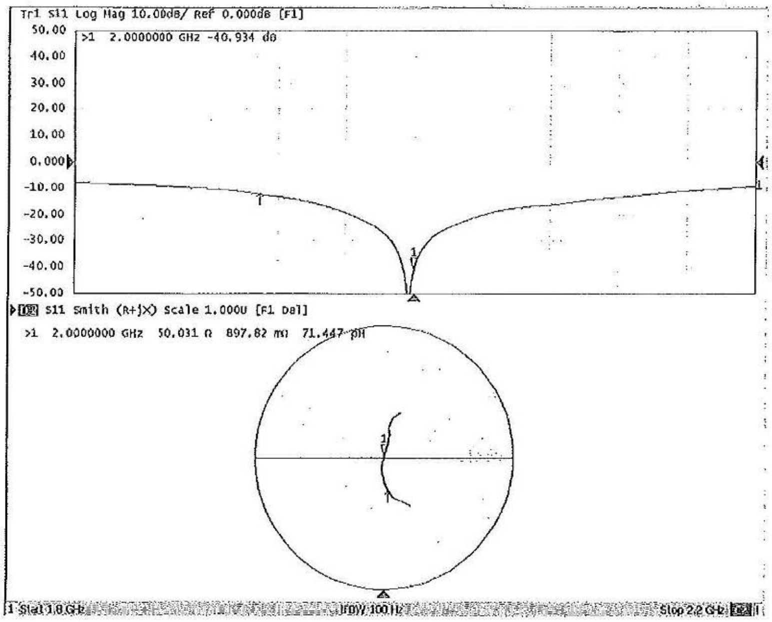
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 05.16.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2000 MHz; Type: D2000V2; Serial: D2000V2 - SN: 1042

Communication System: UID 0, CW; Frequency: 2000 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2000 MHz; σ = 1.561 S/m; ε_r = 54.77; ρ = 1000 kg/m^3

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.24,8.24,8.24); Calibrated: 9/12/2017,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 10/2/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

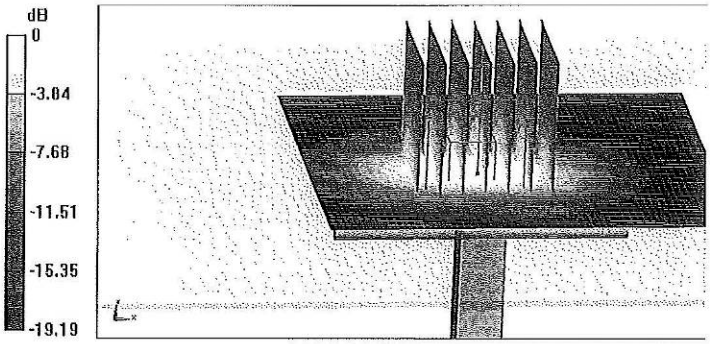
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 80.13 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 20.2 W/kg

SAR(1 g) = 10.5 W/kg; SAR(10 g) = 5.23 W/kg

Maximum value of SAR (measured) = 16.7 W/kg



0 dB = 16.7 W/kg = 12.23 dBW/kg

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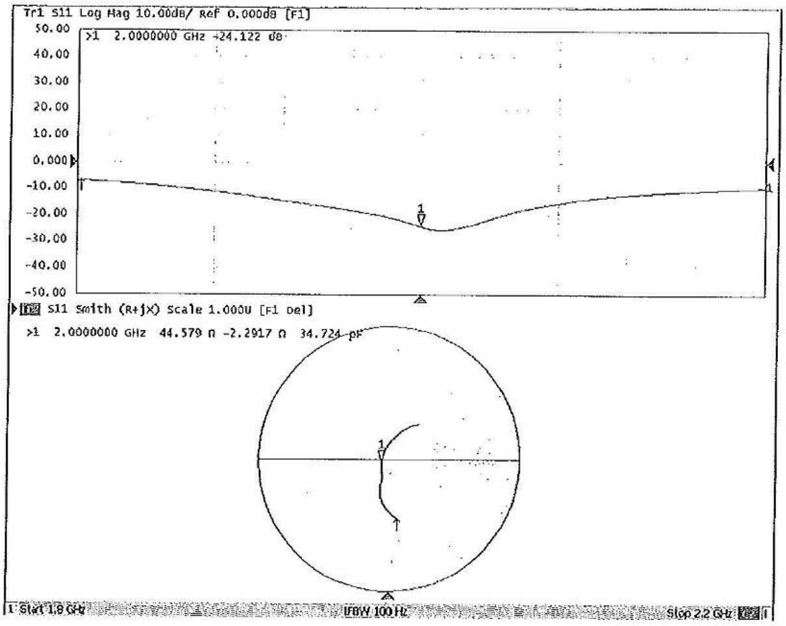
Impedance Measurement Plot for Body TSL



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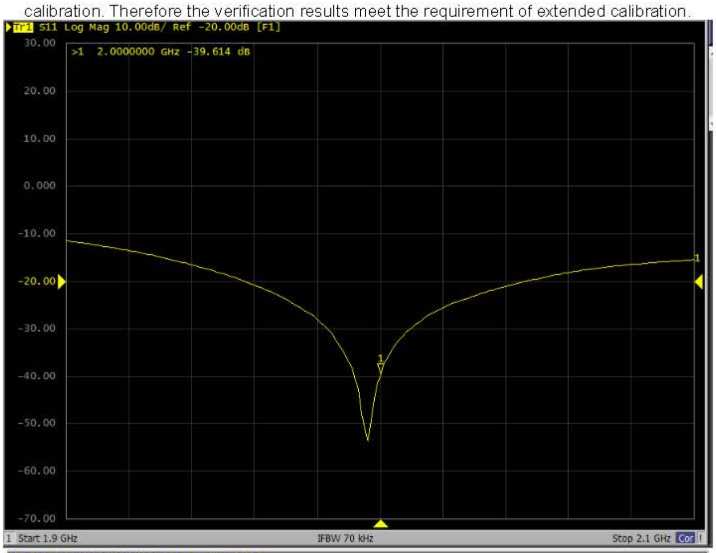
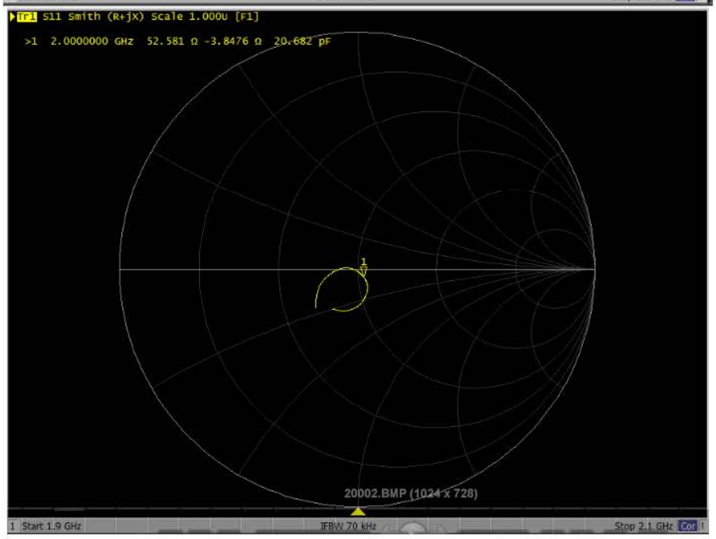
TEST REPORT

Justification for Extended SAR Dipole Calibrations

Dipole	Date of Measurement	Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)
Head 2000 MHz	May 18, 2018	-40.9	-	50	-
	Apr. 17, 2019	-39.6	-3.18	52.6	2.6

Note: The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification results meet the requirement of extended calibration.





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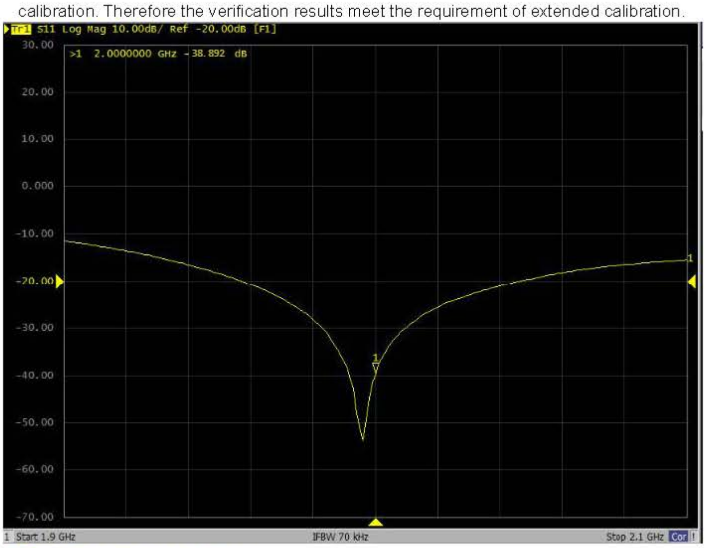
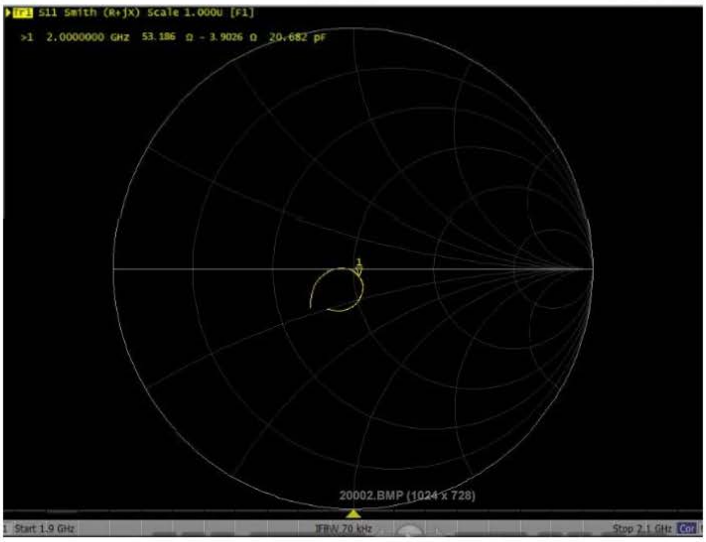
TEST REPORT

Justification for Extended SAR Dipole Calibrations

Dipole	Date of Measurement	Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)
Head 2000 MHz	May 18, 2018	-40.9	-	50	-
	May.16, 2020	-38.9	-4.89	53.2	3.2

Note: The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification results meet the requirement of extended calibration.





TEST REPORT

APPENDIX D – SAR SYSTEM VALIDATION

Per KDB 865664, SAR system validation status should be documented to confirm measurement accuracy. SAR measurement systems are validated according to procedures in KDB 865664. The validation status is documented according to the validation date(s), measurement frequencies, SAR probe and tissue dielectric parameters. When multiple SAR system is used, the validation status of each SAR system is needed to be documented separately according to the associated system components.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probe and tissue dielectric parameters are shown as below.

						CW Validation			Mod. Validation		
Date	Probe S/N	Tested Freq. (MHz)	Tissue Type	Perm	Cond	Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	Peak to average power ratio
21/07/2020	3090	2000	Head	40.051	1.339	PASS	PASS	PASS	GFSK	PASS	PASS