FCC SAR TEST REPORT

Equipment Under Test	Push-to-Talk
Model Name/Serial No.	ACRO-M/pre-production
Applicant/Client	Insopack Co., Ltd.
Manufacturer/Location	Insopack Co., Ltd. / Korea
FCC ID	RGN-ACRO-M
Laboratory performing the tests	BWS TECH, Inc.
Device of Category	Portable Transmitter
Exposure Category	Occupational/Controlled Exposure
Standards applied	FCC 47 CFR Part 2.1093 / KDB 643646 D01 / KDB 865664 D01 KDB 865664 D02 IEEE 1528,2003 ANSI/IEEE C95.1, C95.3
Data of Test	May 26th – Oct. 02th, 2015
RF Operating Frequency(ies)	LMR:450.015 - 469.915 MHz: Bluetooth: 2402-2480MHz
TX mode(s) tested	TDMA(PTT)
Max. Power output or Tune-up tolerances	3.15 W(LMR); 1.45 ㎽(Bluetooth)
Nominal Power	2.50 W(LMR): 0.91 ㎽(Bluetooth)
Test Result	PASS

In the configuration tested, the DUT clearly complied with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of OET bulletin 65 and the standards specified above.
This test report may be reproduced and distributed in full only and shall not reproduced without written approval from an officially designated representative of the BWS TECH, Inc Laboratory.
All test Data presented in this report is only applicable to presented Test sample.

Based on the test results provided, the undersigned on behalf of BWS TECH, Inc. hereby demonstrates compliance with the FCC Rules and guideline the above.
And This Test Report is issued Under the Authority of;

Yang Jae-Su **Test Engineer**	**Nam Bang-Hyun** **Technical Manager**

23, 480beon-gil, Gokhyeuon-ro, Mohyeon-myeon,Cheoin-gu, Yongin-si, Gyeonggi-do,449-853 Korea

CONTENTS

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4. Executive Summary & DUT Information

The purpose of this test programmed was to demonstrate compliance of the Insopack Co., Ltd. model name ACRO-M against the current Stipulated Standards. The PTT model has shown with FCC 47 CFR Part 2.1093, IEEE 1528 and KDB 447498 D03.
The test has demonstrated this unit complies with stipulated standards.

4.1 DUT Information

Device Under Test	
Device Category	Push-to-Talk
Model Name/Serial No.	ACRO-M/pre-production
DUT Description	Handheld Portable-Frequency bands: LMR 450-470MHz, Bluetooth: 2403-2480MHz
Applicant/Client	Insopack Co., Ltd.
Manufacturer/Location	Insopack Co., Ltd. / Korea
FCC	This report contains results that are immaterial for FCC equipment approval, which are clearly identified with the report
Max. Power output or Tune-up tolerance	3.16 W(450-470MHz); 1.45 ㎽ Bluetooth
Exposure Category	Occupational/Controlled exposure
RF Operating Frequency(ies)	LMR:450.015 - 469.915 MHz Bluetooth: 2402-2480MHz
TX mode(s) tested	CW(PTT), Bluetooth(FHSS)
Type of Modulation	LMR(TDMA), Bluetooth(BDR,EDR)
Test Conditions	- Front-of-face device - Body-Supported device with audio accessory
Models Tested	ACRO-M
Antenna	
Type	Terminal Antenna
Output Range	1/ 2.5 W(Set by S/W)
Radio Frequency	450 MHz
Battery	
Replacement	Removable battery function
Pack	3.7V, 4000mAh

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5. Introduction of SAR

5.1 Introduction

This measurement report shows compliance of the DUT with FCC KDB 447498 D03.

The test procedures, as described in the ANSI C95.1 Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields[2], 3 kHz to 300 GHz and ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields[3] were deployed.

SAR is related to the rate in which energy is absorbed per unit mass in an 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 general population/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

5.2 SAR Definition

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 density (ρ). The equation description is like below;

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{pdv}}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be either related to the temperature elevation in tissue by

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\boldsymbol{\delta}\mathbf{T}}{\boldsymbol{\delta}\mathbf{t}}\right)$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

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;
δ is the conductivity of the tissue in Siemens per meter;
p is the density of the tissue in kilograms per cubic meter;

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

6. SAR Measurement SETUP

These measurements were performed with the automated near-field scanning system OPENSAR from SATIMO. The system is based on a high precision robot, which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E-field and H-field probes have been developed for measurements close to material discontinuity. The sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit.

The SAR measurements were conducted with dosimetric probe(manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation.
The probe has been calibrated according to the procedure described in SAR standard with accuracy of better than ±10%.
The spherical isotropy was evaluated with the procedure described in SAR standard and found to be better than ± 0.25 dB(or, must be ≤± 0.25 dB).
The phantom deployed was the ELLI phantom as described in FCC KDB 447498 D03, IEEE P1528-2013 and CENELEC EN62209-1.

6.1 Measurement System Diagram

SAR measurement system configuration is shown in Figure a.

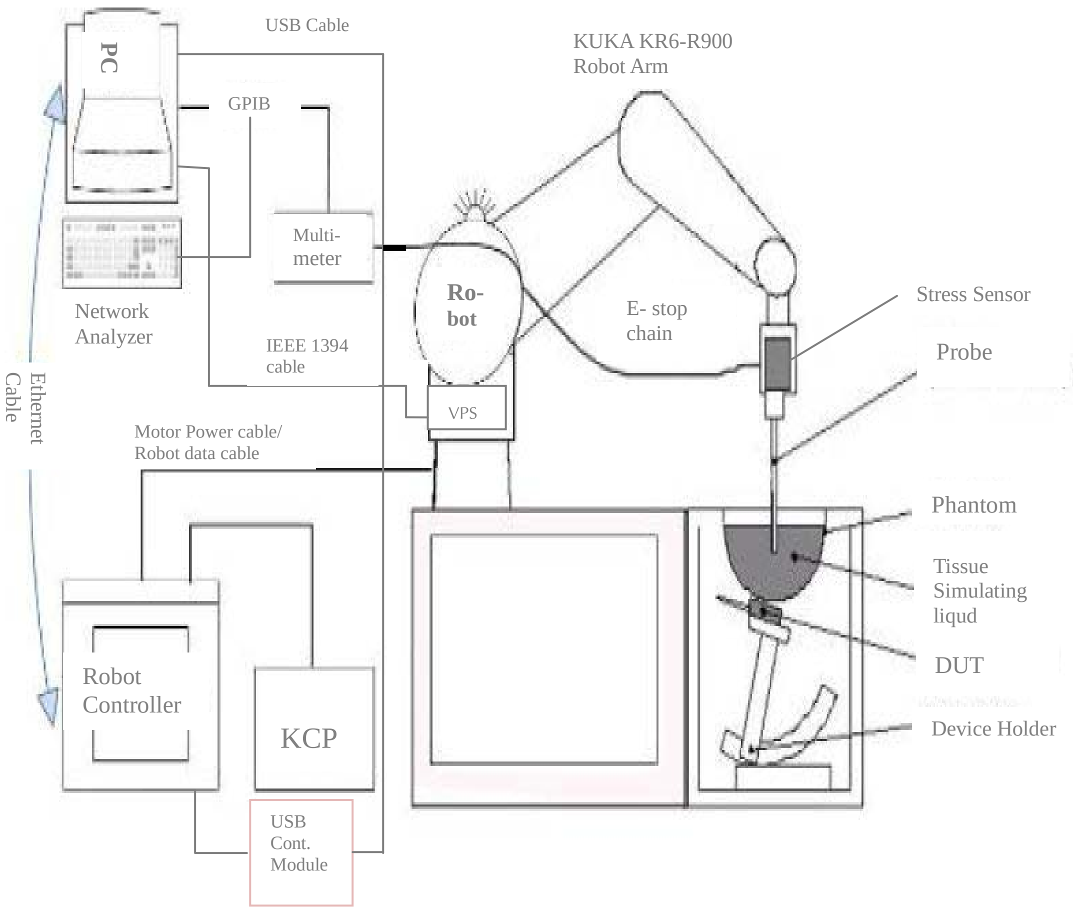


Figure a. SAR Measurement System Configuration

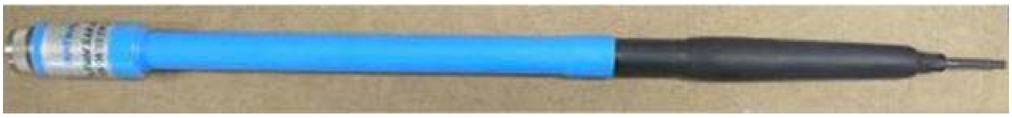
The OPENSAR system for performing compliance tests consist of the following;

1. Standard high precision 6-axis robot (KUKA) with controller and S/W
2. KUKA Control Panel
3. A dosimetric probe, for example, an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
4. The functions of the PC plug-in card are to perform the time critical task such as signal filtering, Surveillance of the robot operation fast movement interrupts.
5. A computer operating system is Window XP.
6. OPENSAR software is deployed.
7. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
8. The ELLI Phantom enabling testing body usage.
9. Device position for in-front-of face & body-worn DUT
10. Tissue simulating liquid mixed following the given recipes (see section 9.2.3)
11. System validation dipoles to validate the proper functioning of the SAR system.

6.2 Probe of EPG 228

6.2.1 General Information

SATIMO's COMOSAR E-field Probes are built in accordance to the IEEE 1528, FCC KDB 447498 And IEC 62209 standards



Device Under Test	
Device Type	COMOSAR DOSIMETRIC E-FIELD PROBE
Manufacturer	SATIMO
Serial Number	SN 27/14 EPG228
Product Condition(new/used)	New
Frequency Range of Probe	0.15 GHz – 6GHz
Probe Length	330 mm
Length of Individual Dipoles	2 mm
Maximum external Diameter	8 mm
Probe Tip External Diameter	2.5 mm
Distance between dipoles/probe extremity	1 mm
Axial isotropy in human-equivalent liquids	± 0.47 dB
Hemispherical Isotropy in human-equivalent liquids	± 0.3 dB
Linearity	± 0.5 dB
Maximum operating SAR	100 Watts/kg
Lower SAR detection threshold	1.5 mWatts/kg
Calibration data(Next:)	Nov. 25, 2014(Nov.5, 2015)
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.218 MΩ Dipole 2: R2=0.220 MΩ Dipole 3: R3=0.218 MΩ

6.2.2 Measurement Methodology

The IEEE 1528, FCC KDB 447498 D03, CENELEC EN50361 and ICE 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations/measurements performed meet the fore mentioned standards.
It is connected to the KRC4 box on the robot arm and provides an automatic detection of the phantom surface. The 3D file of the phantom is include in OPENSAR software. The VPS(Video Positioning System) allows the system to take the automatic reference and to move the probe safely and accurately on the phantom.

6.2.3 E-Field Probe Calibration Process

Each probe is calibrated in accordance with a dosimetric assessment procedure described in SAR standard with must be ≤± 10%. The spherical isotropy was evaluated with the procedure described in SAR standard and must be ≤± 0.25 dB. The sensitivity parameters(X,Y and Z), the diode compression parameter(DCP) and the conversion factor(Con vF) of the probe are tested.
The free-space E-Field from probe output ㄴ are determined in a test chamber. This is performed in a TEM cell for frequencies bellow 0.8 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. E-Field correction calibration is performed in a flat phantom filled with the appropriate simulated brain tissue.

6.3 SAM & ELLI Phantom

6.3.1 General Information

The ELLI Phantom ELLI35 is constructed of a Gelcoat with fiberglass shell integrated in a table.
Its shape is complied with the specification set in IEEE P1528 and CENELEC EN62209-2.
The phantom enables the dosimetric evaluation of flat side DUT usage as well as body-worn usage at the flat phantom region. Its cover prevents the evaporation of the liquid.
Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness	2 ± 0.2 ㎜
Filling Volume	Approx. 27 liters
Dimensions(H*L*W)	810 * 1000 * 500 ㎜
Liquid required	150 ㎜
4 molded plastic points for high precision reference with delivered with 6 nylon screws	
CENELEC 50361 or IEEE 1528 versions	

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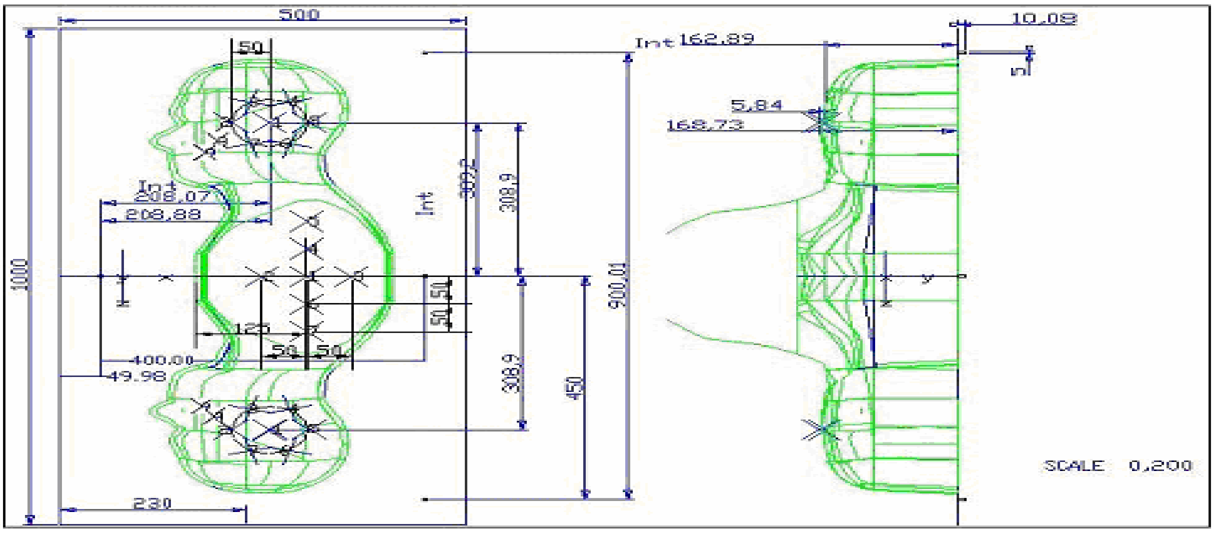
6.3.2 Permittivity & Loss Tangent

Phantom Material	Permittivity	Loss Tangent
Gelcoat with fiberglass	3.4	0.02

6.3.3 Measurement Procedure

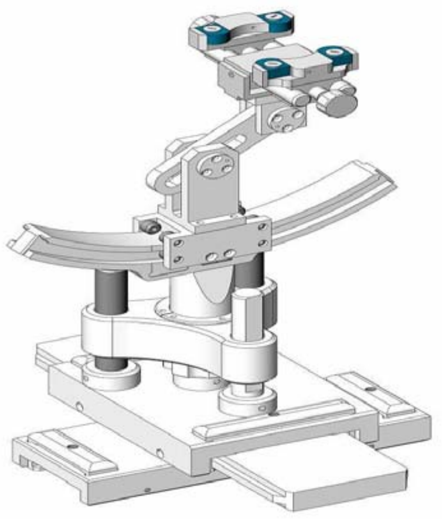
The test, based on ultrasonic system measurement, which allows measuring the thickness with a precision of 10 ㎛

6.3.4 Size of SAM Phantom



6.4 Mobile & Dipole Positioning System Characteristics

6.4.1 General Information



Componet	Totally metal-free desing
Position	Rotation point on ear opening
Adjustment	High repeatability with rotation point external adjustment
Standard	Easy and accurate position according to all Standards
Category	Compliance with mobile phone, PMR or PDA dimensions
Translation	Translation to lock the device under test under the flat part or under the left or right ear

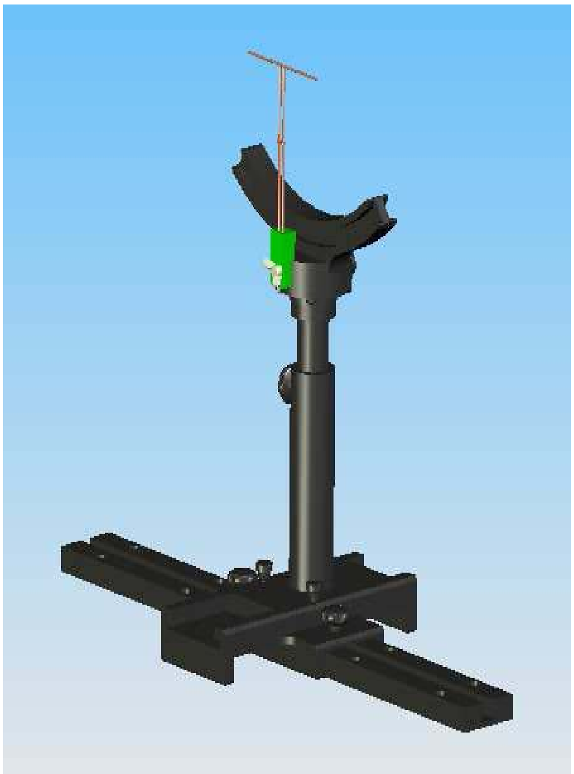
X translation	700 ㎜
Y translation	250 ㎜
Z translation	100 ㎜

The correct position can be easily defined thanks to an additional too with a pointer. With this tool, the top part of the system, above the curved rail, can be fixed definitively, so that the subsequent adjustments just concern the angle or the X, Y or Z axis.

It simplifies the positioning of the acoustic output of the telephone on the cross section of the phantom, before rolling the system underneath the phantom. Moreover, it improves the accuracy and repeatability of the positioning with a tolerance ≤ 0.5 ㎜.

6.5 Validation Dipole Antenna (450MHz) and Positioning System

6.5.1 General Information



Calibration dipoles are developed with a $\lambda_0/4$ balun, so that they are totally symmetrical.
Each dipole is used to check the whole SAR measurement chain in its frequency band. They are especially developed to make SAR measurements near a flat SAM phantom filled with human-equivalent liquid, according to CENELEC and IEEE standards.

Positioning system was also has been designed to be plugged in the SATIMO phone positioning system. Validation measurements are made according to CENELEC and IEEE standards, as the SATIMO phone positioning is totally metal-free.

6.6 Data Evaluation for SAR Computations

The OPENSAR software automatically executes the following procedure to calculate the field units from the microvolt readings at the probe connector. The parameter used in the valuation are stored in the configuration modules of the software:

Probe Parameter	- Sensitivity	$Norm_i$
	- Conversion Factor	ConvFi
	- Diode compression point Dcpi	
Device Parameter	- Frequency	f
	- Crest factor	cf
Media Parameter	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can either be found in the component documents or be imported into the software from the configuration files inssued for the OPENSAR components.

The first step of 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 existing 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

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

Where:

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

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

E-field probes: $$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

H-field probes: $$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

Where

V_i = Compensated signal of channel i(i=x, y, z)
$Norm_i$ = Sensor sensitivity of channel I (i=x, y, z) $\mu W/(V/m)^2$ for E- field Probes
ConvF = Sensitivity enhancement in solution
a_{ij} =Sensor sensitivy factors for H-field probes.

f =Carrier frequency (GHz)
E_i =Electric field strength of channel i in V/m
H_i =Magnetic field strength of channel i in A/m

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

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

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

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

Where

SAR = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m

σ =conductivity in [mho/m] or [Siemens/m]

ρ =equivalent tissue density in g/cm^3

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

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

$$P_{pwe} = \frac{E_{tot}^2}{3770}$$

Where

$\mathbf{P_{pwe}}$ = Equivalent power density of a plane wave in mW/cm^2

$\mathbf{E_{tot}}$ =total electric field strength in V/m

6.7 SAR Scan Procedure

This procedure for assessing the peak Spatial-Average SAR value and following the subsequent steps.

6.7.1 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are monitoring the power drift of the Device Under Test in a batch process. Both tasks measure the field at a specified reference position, at a selectable distance from a phantom surface. The reference position can be either the selected section's grid reference or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

6.7.2 Area Scan Measurement

The Area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines executed in OPENSAR software can find the maximum locations even coarse grids.

The area scan is defined by an editable grid.
This grid is anchored at the grid reference point of the selected in the phantom.
When the area scan's property sheet is brought-up, grid was at to 15 ㎜ by 15 ㎜ and can be edited by a user.
When a measured peak is closer than ½ the zoom scan volume dimension (X,Y) from the edge of the area scan region, unless the entire peak and gram-averaging volume are both captured with the Zoom scan volume, the Area scan must be repeated by shifting and expanding the area scan region to ensure all peaks are away from the area scan boundary.

6.7.3 Zoom Scan Measurement

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1g and 10g of simulated tissue. The default Zoom scan measured 5 × 5 × 7 points within a cube whose basic faces are centered around the maximum found in a preceding Area scan job within the same procedure. The maximum size of cube comes to 30 × 30 × 30 ㎜. If the preceding Area scan job implies more than one maximum, the number of Zoom scans have to be enlarged.

Extrapolation

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurement at different distances are necessary for the extrapolation.
They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the forth order least square polynomial method for extrapolation. For a grid using 5 × 5 × 7 measurement points with 5 ㎜ resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than1% for 1 g and 10g cubes.

6.7.4 Power Drift measurement

The drift task measures the field at the same location as the most recent reference task within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement
Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process.
In the properties of the Drift task, the user can specify a limit for the drift and have OPENSAR software stop the measurements if this limit is exceeded.
This step is for measuring the stable and continuous output power of the Device under Test and it is recommended that the drift be kept within ± 5 %. The drift should always be recorded as the difference between the device initial state with fully charged battery and all subsequent measurement using that battery. The measurement procedure is the same as section 6.7.1
.

6.7.5 SAR Evaluation – Peak SAR

The procedure for spatial peak SAR evaluation has been implemented according to IEEE 1528 Std. It can be conducted for 1g and 10g.
The OPENSAR system allows evaluations that combines measured data and robot positions.
During a maximum search, global and local maximum searches are automatically performed in 2D 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 2dB of the global maxima for all SAR distributions.

<Area and Zoom scan Resolutions per FCC KDB Publication 865664 D01v01r03>

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	½·δ·ln(2) ± 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}			≤ 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 ≤ 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 1st 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	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 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.

6.7.6 Definition of Reference Points

6.7.6.1 Ear Reference Point

Figure 2 shows the front, back and side views of the SAM phantom. The point “M” is the reference point for the center of the mouth, “LE” is the left ear reference point(ERP), and “RE” is the right ERP. The ERPs are 15 ㎜ posterior to the entrance to the ear canal(EEC) along the B-M line(Back-Mouth), as shown Figure 1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F(Neck-Front) is perpendicular to the reference plane and passing through the RE(or LE) is called the reference pivoting line(see Figure 1).
Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning.

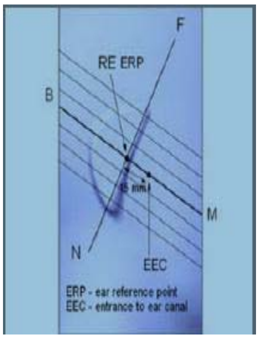


Figure 1
Close-up side view
of ERP’s

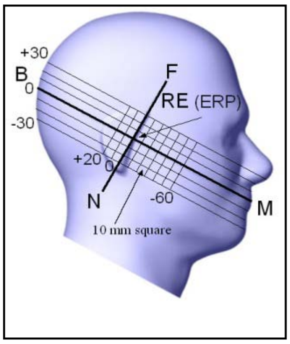


Figure 3
Side view of phantom showing
relevant marking

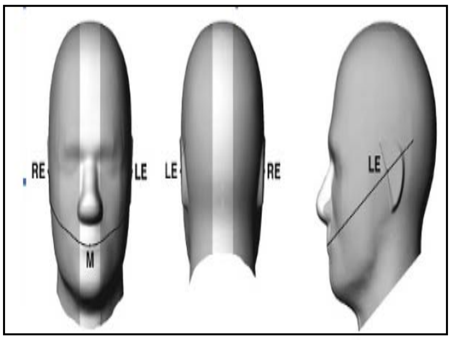


Figure 2 Front, Rear and Side view of SAM

6.7.6.2 Device Reference Point

Two imaginary lines on the device need to be established: the vertical centerline and horizontal line. The test device is placed in a normal operating position with the “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point(see Figure 4). The “test device reference point” is located at the same level as the center of the ear reference point. The test device is positioned so that the “vertical centerline” is bisecting the front surface of the device at its top and bottom edges, positioning the “ear reference point” on the outer surface of both the left and right head phantoms on the ear reference point.

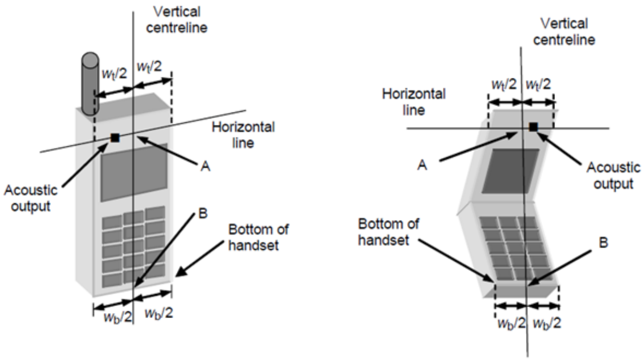


Figure 6 Handset Vertical center & Horizontal Line Reference Points.

6.8 Test Configuration – Positioning for Cheek/Touch

1. Position the device close to the surface of the phantom such that point is on the virtual extension of the line passing through points RE and LE on the phantom (see Figure6), such that the plane defined by the vertical center line and the horizontal line of the device is approximately parallel to the sagittal plane of the phantom.

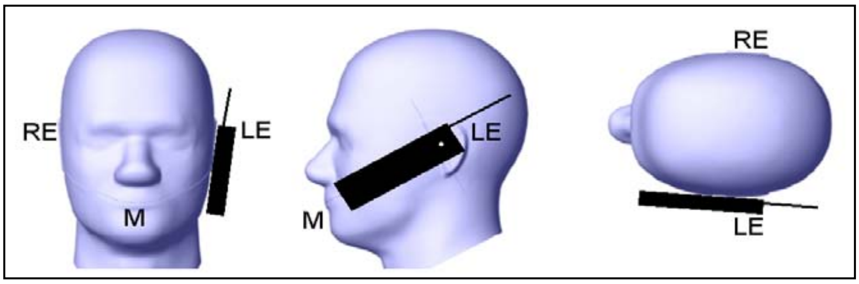


Figure 6 Front, Side and Top View of Cheek/Touch Position

2. Translate the device towards the phantom along the line passing through RE and LE until the device touches the ear.

3. While maintaining the device in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).

4. Rotate the device around the vertical centerline until the device (horizontal line) is symmetrical with respect to the NF line.

5. While maintaining the vertical centerline in the reference plane, keeping point on the line passing through RE and LE and maintain the device contact with the ear, rotate the device about the NF line until any point on the device is in contact with a phantom point below the ear(cheek). (see Figure7)

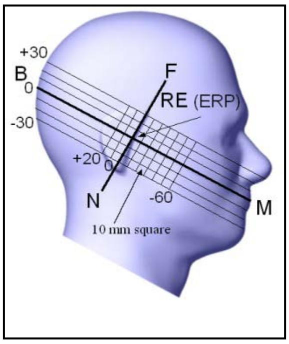


Figure7 Side view of relevant markings

6.9 Test Configuration – Positioning for Ear/15˚ Tilt

With the test device aligned in the "Cheek/Touch Position":

1. While maintaining the orientation of the device, retracted the device parallel to the reference plane for enough to enable a rotation of the delivery by 15 degrees.

2. Rotate the device around the horizontal line by 15 degrees.

3. While maintaining the orientation of the device, move the device parallel to the reference plane until any part of the device touches the head. (In this position, point is located on the line RE-LE). The tilted position is obtained when the contact is on the pinna, the angle of the device shall be reduced. The tilted position is obtained when any part of the device is in contact with the ear as a second part of the device is in contact with the head (see Figure8).

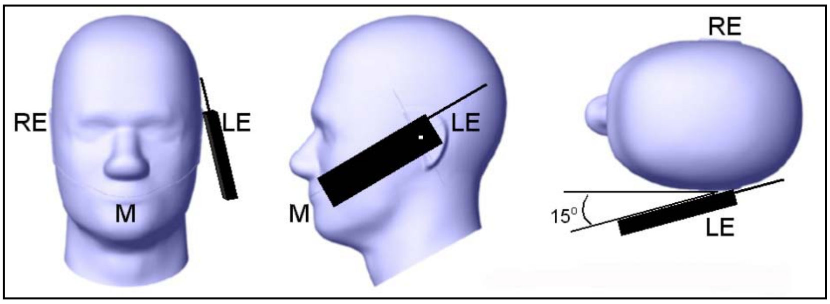


Figure8 Front, Side and Top view of Ear/15˚ Tilt Position

6.10 Test Configuration – Positioning for Body-Worn

Body-worn operating configurations are tested with the accessories attached to the device and positioned against a flat phantom in a normal use configuration. Advice with a mike earset is tested with a mike earset connected to the device. Body dielectric parameters are used.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closet spacing to the body. Then, when multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component, for example, the same metallic belt-clip used with different holster with no other metallic components, only the accessory that dictates the closet spacing to the body is tested.

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 where separation distances between the rear of the device and the flat phantom is used. All test position spacing are 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. For devices that are carried next to body such as shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), including mike earset and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to check the worst-case positioning. Worst-case positioning is then documented and used to perform Body SAR testing.

7. DUT Test Methodology

7.1 Description of DUT

This device operates using Time Division Duplexer used to allocate portions of the RF signal by dividing time into slot. Time allocation enables each unit to transmit its voice information without interference from other transmitting units.

The maximum duty cycle for TDD is 50% and is controlled by software. The modulation signal is continuous.

However, because of hand shaking or Push-To-Talk(PTT) between users and/or base stations a conservative 50% duty cycle is applied.

This device also incorporates Class 3 Bluetooth device which is Frequency Hopping Spread Spectrum(FHSS) technology. The maximum actual transmission duty cycle is imposed by the BT standard. The maximum duty cycle for BT is 75.1%

The DUT represented under this filing uses fixed antenna and an internal chip antenna for BT capable of transmitting in the 450.015-469.915 MHz and 2.402-2.480 GHz(BT) bands respectively. The nominal output powers are 2.5 W(450.015-469.9 MHz) and 0.91 mW(2.402~2.480MHz). The nominal output powers are 2.5 W with maximum output powers of 3.15 W at 450.015~469.9MHz. The nominal BT output power is 0.91 mW and the maximum output power is 1.45 ㎽.

The intended operating positions are "at the body" by means of the offered body-supported audio accessories.

Body-supported operation is executed by means of optional audio accessory that is connected to the radio.

7.2 Measurements

SAR measurements were performed deploying the SATIMO system described in section 6 using zoom scans. An elliptical flat phantom filled with applicable simulated tissue was used for tests at the body.

7.3 DUT Configuration

The DUT is a portable device operational at the body as described in section 7.1.

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7.3.1 Audio Accessory and Battery

The DUT is portable device operational at the body with only an earset and a default battery.

This report was considered when implementing the guidelines specified in KDB 643646 D01.

An audio accessory and a battery used for tests are like below:

Item	Description	Selected for Test	Tested	Model No.
Earset	Default(unique)	Yes	Yes	Proto type pre-production
Battery	Default(unique)	Yes	Yes	KPL954868

7.3.2 Antenna

There is a terminal antenna (stubby) and a BT internal antenna offered for this product.

The below table list shows its descriptions.

Item	Description	Selected for Test	Tested	Model No.
Terminal Ant.	Stubby UHF Ant; 450-470MHz	Yes	Yes	Pre-production
BT Ant.	Internal Chip Antenna; 2402-2480 MHz	Yes	No	Pre-production

7.3.3 DUT Positioning Procedures

The positioning of the device for each body location is the same as below.

7.3.3.1 Body

The DUT was positioned in normal use configuration against the phantom with the offered Body-supported accessory(ies) as well as with and without the offered audio accessories as applicable.

7.3.3.2 Head

Head SAR is measured with the front surface of the radio positioned at 2.5 cm parallel to a flat phantom per KDB 643646 D01 SAR Test for PTT Radios v01r02

7.3.3.3 Face

Not applicable

7.4 DUT Test Channels used.

The number of test channel was determined by using the following KDB 447498.

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

Where:

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

7.5 DUT Test Plan

The guidelines and requirements outlined in "SAR Test Reduction Considerations for Occupational PTT Radios" FCC KDB 643646 D01 were used to assess compliance of this device. All test was performed in 100% CW mode and then 50% duty cycle was applied to the final results.

7.6 DUT Type of Modulation

The DUT employed using TDD modulation and has 0.1MHz channel spacing.
And for Bluetooth, FHSS used.

7.6.1 Assessment at the Bluetooth Band

7.6.1.1 Conducted Power for Bluetooth

In accordance with the requirements of OET Bulletin 65 to determine the stable power during SAR measurement.

Channel	Frequency (MHz)	Averaged Output Power(dBm)	
		BDR	EDR
0	2402	-2.44	-3.52
39	2441	-1.22	-2.22
78	2480	-0.39	-1.28

7.6.1.2 Assessment at Bluetooth Band

Per guidelines in KDB 447498 D01 v05(07/14/2014), the following formula was used to determine the SAR test exclusion for standalone Bluetooth transmitter.

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]

*[√F(GHz)] is **0.3**, which is less than 3 for 1g SAR and ≤ 7.5 for 10g SAR

Where:

- $F_{(GHz)}$ is the RF channel transmit frequency in GHZ
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

Therefore, Max. power is 1.09 mW(1.45mW * 75% duty cycle)
Min. test separation distance is 5 mm for actual test separation < 5 mm
F(GHz) is 2.48 GHz.

Per the result from the calculation above, the standalone SAR assessment was not required for Bluetooth band. Therefore, SAR results for Bluetooth are not reported herein.

8. ANSI/IEEE C95.1-1999 RF Exposure Limit

ANSI C95.1-1999: IEEE Std for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Field, 3 kHz to 300 GHz. It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being deployed within 20 cm of the user in the uncontrolled condition.
Test report documented hereby was performed in compliance with IEEE Std P1528-2013 and complied with published KDB procedures like below;

☒	**KDB 865664 D01v01r04**	**SAR Measurement Requirements for 100 MHz to 6 GHz**
☒	**KDB 865664 D02v01r01**	**RF Exposure Reporting**
☒	**KDB 447498 D01v05r02**	**Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies**
☐	KDB 447498 D02v02	SAR Measurement Procedures for USB Dongle Transmitters
☐	KDB 248227 D01v01r02	SAR Measurement Procedures for 802.11a,b,g Transmitters
☐	KDB 615223 D01v01	802.16e/WiMax SAR Measurement Guidance
☐	KDB 616217 D04v01r01	SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers
☒	**KDB 643646 D01v01r02**	**SAR Test Reduction Considerations for Occupational PTT Radios**
☐	KDB 648474 D03v01r02	Evaluation and Approval Considerations for Handsets with Specific Wireless Charging Battery Covers
☐	KDB 648474 D04v01r02	SAR Evaluation Considerations for Wireless Handsets
☐	KDB 680106 D01v02	RF Exposure Considerations for Low Power Consumer Wireless Power Transfer Applications
☐	KDB 941225 D01v03	3G SAR Measurement Procedures
☐	KDB 941225 D05v02r03	SAR Evaluation Considerations for LTE Devices
☐	KDB 941225 D06v02	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
☐	KDB 941225 D07v01r01	SAR Evaluation Procedures for UMPC Mini-Tablet Devices

In order for user to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and cautions statements are included in the user's manual.

8.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposure or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

8.2 Controlled Environment

Controlled Environments are defined as locations where there is the exposure that mayb be incurred by persons who are aware of the potential for exposure, for example as a result of employment or occupation. In general, occupational/controlled exposure limits are applicable to situation in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

8.3 Limitation for Uncontrolled & Controlled

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Partial Peak SAR[1] (Partial)	1.60 m W/g	8.00 m W/g
Partial Average SAR[2] (Whole Body)	0.08 m W/g	0.40 m W/g
Partial Peak SAR[3] (Hands/Feet/Ankle/Wrist)	4.00 m W/g	20.00 m W/g

1. 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.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube and over the appropriate averaging time.

8.4 Testing Environment

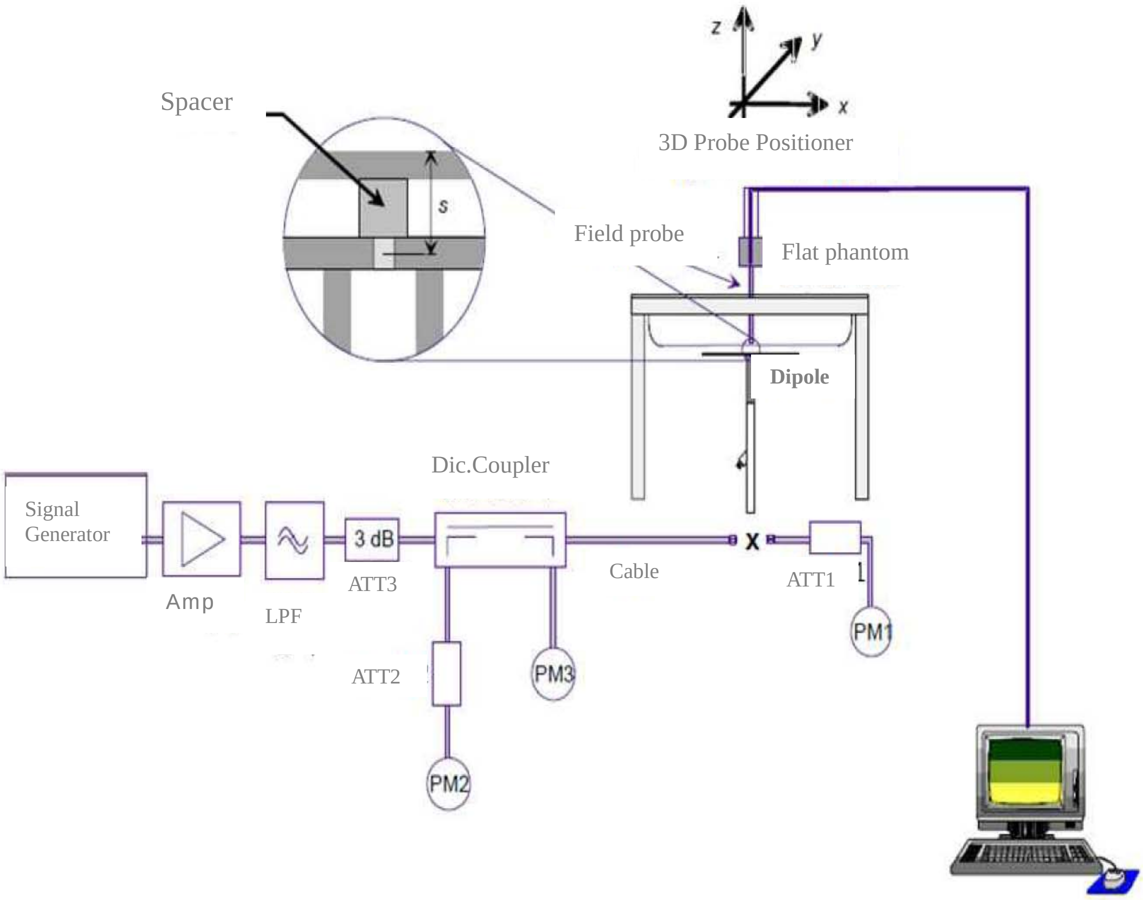
Ambient Temperature	20 °C ~ 26 °C
Relative Humidity	30 % ~ 70 %
Liquid temperature's variation during Test	< ± 2°C

9. System and Liquid Validation

9.1 System Validation and Configuration

FCC KDB 865664 D01v01r03, SAR system validation procedure should be documented to confirm measurement precision. The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected.
The system validation is sketched in Figure9 and this test was done at 450 MHz and also executed on the very same days as the measurement of the DUT.
It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible result. The system performance check uses normal SAR measurements in a streamlined setup with a characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.
In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole antenna and power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom.

SAR measurement was performed to check if the measured SAR was within ±10% from the target SAR values



System Setup for System Validation

The output power on dipole must be calibrated to 1 W(30 dBm) before the dipole is connected.

9.1.1 Measurement Standards

The IEEE Std. 1528 and IEC 62209 standards state the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 ㎜), within the uncertainty for the system validation. All SAR values are normalized to 1000 ㎽ forward power.

Frequency (MHz)	1g SAR	10g SAR
	Required	Required
300	2.85	1.94
450	4.58	3.06
835	9.56	6.22
900	10.9	6.99
1800	38.4	20.1
1900	39.7	20.5
2000	41.1	21.1
2450	52.4	24.0

9.1.2 Target and measured SAR after normalizing

Probe S/N	Frequency (MHz)	Dipole S/N	Tissue	Reference SAR 1g(W/kg)	Measured SAR 1g(W/kg)	Deviation (%)
27/14 EPG 228	450	24/14 Dip 0G450-310	Body	4.58	4.5	-1.75
27/14 EPG 228	450	24/14 Dip 0G450-310	Head	4.58	4.34	-5.24

Equation of Deviation (%) =((Measured value normalized 1 W/Reference SAR value) * 100))-100

❑ Per KDB865664 D01, the test laboratory must ensure that the required supporting information and documentation are included in the SAR report to qualify for the three-year extended calibration interval, otherwise, the IEEE Std 1528-2003 recommended annual calibration applies.

According to the above Standard, the return-loss and impedance measurement of Dipole were performed by our test laboratory to meet the said KDB guideline.

The return-loss and Impedance of 450MHz Dipole antenna complied with the said Standard.
(see Annex D)

9.2 Liquid Validation

The dielectric parameters were checked prior to assessment by using LIMSAR DIELECTRIC Probe (SN 11/14 OCPG70) manufactured by SATIMO. Its probe is built in accordance to the IEEE 1528 and IEC 62209 Standard.

9.2.1 IEEE P1528 recommended Tissue Dielectric Parameters

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

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

WHERE, ε_r is relative permittivity, σ is conductivity and ρ is 1000 kg/m^3

9.2.2 Liquid Confirmation Result

Temperature: 22 ℃		**Humidity: 60 %**			
450 MHz		**Reference**	**Measured**	**Deviation(%)**	**Limit(%)**
BODY	**Permittivity**	**56.7**	**54.61**	**-3.69**	**±5**
	Conductivity	**0.94**	**0.95**	**1.06**	
HEAD	**Permittivity**	**43.5**	**44.06**	**1.29**	**±5**
	Conductivity	**0.87**	**0.88**	**1.15**	

9.2.3 Typical Composition of Ingredients for Tissue

The follow tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

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

Salt: 99^{+}% Pure Sodium Chloride
Sugar: 98^{+}% Pure Sucrose
Water: De-ionized, 16 $M\Omega^{+}$ resistivity
HEC: Hydroxyethyl Cellulose
DGBE: 99^{+}% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

9.2.4 Simulating Tissue for 450 MHz Manufactured by EMF Safety(Head) & HCT(Body) deployed.

Ingredients	% by weight	
	Body	Head
Water	46.21	38.56
Sucrose	51.17	56.32
Nacl	2.34	3.95
HEC	-	0.98
Bactericide	-	0.19
Preventol	0.08	-
Cellulose	0.18	-

10. Conducted Power

In Accordance with the requirements of FCC Report and order OET BULLETIN 65 to determine if device output has been stable during a SAR measurement, conducted power should be measured before and after each SAR test to verify if the output changes are within the tolerance specified for the device. Conducted output power can be measured at a service output port available on most handsets or with an antenna adapter. It is also recommended that the SAR should be checked at a reference location, such as above the ear reference point of the head phantom, immediately before and after each SAR measurement to verify device output and SAR drifts.

10.1 Conducted Power for PTT & Bluetooth

10.1.1 Conducted Power for PTT.

Test frequency(MHz)	Power (dBm)	Power (W)
450.015	33.55	2.26
460.015	33.86	2.43
469.615	33.98	**2.50**

10.1.2 Conducted Power for Bluetooth

Channel	Frequency (MHz)	Averaged Output Power(dBm)	
		BDR(GFSK)	EDR
0	2402	-2.44	-3.52
39	2441	-1.22	-2.22
78	2480	**-0.39**	-1.28

11. SAR Test Result:

Assessment of each of the applicable offered antenna with the default battery(KPL954868-4000mAh), body-supported with audio accessory(insopack) per KDB 643646 D01 SAR Test for PTT Radios v01r01 –Body SAR Test Considerations for Body worn Accessories. For highest output power channel shows in section 10.1

This DUT deployed was used **only one default battery** & only **one audio accessory** therefore, no additional battery & accessory offered and tested.

11.1 Assessment front-of-face at the body with body-supported for 450.015-469.915 MHz band.

Based on the guidelines from KDB 643646, the highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing:

Ant.	Battery	Acce-ssory	Test Freq (MHz)	Init Pwr (W)	Posi tion	Dist-ance (mm)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max. Calc. 1g-SAR (W/kg)	Max. Calc. 10g-SAR (W/kg)
Termin-al	KPL 954868 - 4000mAh	Earset	460.015	2.43	front	25	0.001	1.435	0.991	0.930	0.642
			460.015	2.43	Rear	0	0.06	1.84	1.20	1.19	0.78
			469.615	2.50	front	25	-0.130	1.134	0.787	0.736	0.511
			450.015	2.26	front	25	0.005	0.999	0.696	0.696	0.485

- **Date of Measurement: Oct. 02th, 2015**
- **Reported SAR values have already been scaled and refer to the related formula in section 11.2**

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d).The 10 gram result is not applicable to FCC filing.

11.2 SAR Result Scaling Methodology

The calculated 1-gram and 10-gram averaged SAR results indicated as "Max Calc.1g-SAR to account for power leveling variations and power slump.
Max Calc. 1g-SAR" and "Max Calc. 10g-SAR" are scaled using the following formula;

$$\mathbf{Max\_Calc = SAR\_meas * 10^{\frac{-Drift}{10}} \cdot \frac{P\_max}{P_{int}} \cdot DC}$$

Where;

P_max is Maximum Power (W)
P_int is Initial Power (W)
Drift is SATIMO % Value result converted in dB
SAR_means is Measured 1g or 10g Average SAR (W/kg)
DC is Transmission mode duty cycle in % where applicable
50% duty cycle is applied for PTT operation

Note: for conservative results, the following are applied;
If P_int > P_max, then P_max/P_int =1.
Drift is 1 for positive drift
*formula to convert % into dB

$$\mathbf{dB = 10 \cdot \log 10^{(1+\%/100)}}$$

11.3 KDB &Simultaneous SAR Evaluation

Simultaneous transmission analysis is required under FCC 447498 D01v05r02 (10/24/2012), simultaneous transmission SAR Test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antenna as in a specific a physical test configuration is ≤ 1.6 W/kg. And per guideline in KDB 447498 D01v0512 (02/01/2014), when the sum of 1g or 10g SAR of all Simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration When stand-alone SAR is not required to be measured per FCC KDB 447498 D01v05r02.

This device deployed not to be contained transmitter antenna that operates simultaneously.
Therefore, simultaneous SAR evaluation is not reported herein.

12. Measurement Uncertainty

SAR measurement uncertainties are results of errors due to system instrumentation, field probe response and calibration, and the dielectric parameters of the tissue medium and shows by SCC-34/SC-2.

The measured SAR was < 1.5 W/kg for all frequency bands. Therefore, per KDB 856664 D01v01r03, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

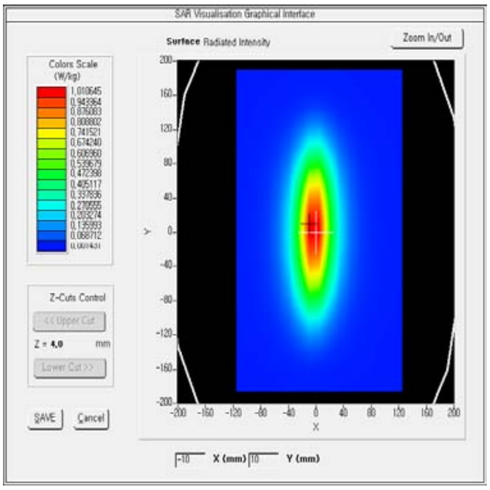
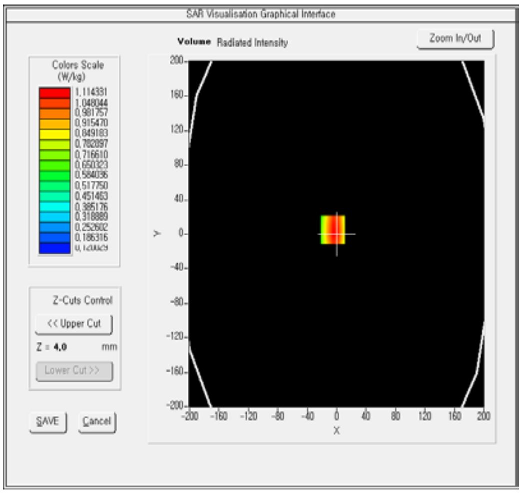
a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System									
Probe calibration	7.2.1	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	7.2.1.1	3.5	R	√3	(1_Cp)^1/2	(1_Cp)^1/2	1.43	1.43	∞
Hemispherical Isotropy	7.2.1.1	5.9	R	√3	(Cp)^1/2	(Cp)^1/2	2.41	2.41	∞
Boundary effect	7.2.1.4	1.0	R	√3	1	1	0.58	0.58	∞
Linearity	7.2.1.2	4.7	R	√3	1	1	2.71	2.71	∞
System detection limits	7.2.1.2	1.0	R	√3	1	1	0.58	0.58	∞
Modulation response	7.2.1.3	3.00	N	1	1	1	3.00	3.00	∞
Readout Electronics	7.2.1.5	0.50	N	1	1	1	0.50	0.50	∞
Reponse Time	7.2.1.6	0.0	R	√3	1	1	0.00	0.00	∞
Integration Time	7.2.1.7	1.4	R	√3	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	7.2.3.7	3.0	R	√3	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	7.2.3.7	3.0	R	√3	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	7.2.2.1	1.4	R	√3	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	7.2.2.3	1.40	R	√3	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	7.2.4	2.3	R	√3	1	1	1.33	1.33	∞
Test sample Related									
Test sample positioning	7.2.2.4.4	2.60	N	1	1	1	2.60	2.60	11
Device Holder Uncertainty	7.2.2.4.3	3.00	N	1	1	1	3.00	3.00	7
Output power Variation - SAR drift measurement	7.2.3.6	5.00	R	√3	1	1	2.89	2.89	∞
SAR scaling	7.2.5	2.00	R	√3	1	1	1.15	1.15	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	7.2.2.2	4.00	R	√3	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviation (in permittivity and conductivity)	7.2.6	2.00	N	1	1	1	2.00	1.68	∞
Liquid conductivity (temperature uncertainty)	7.2.3.5	2.50	N	1	0.78	0.71	1.95	1.77	5
Liquid conductivity - measurement uncertainty	7.2.3.3	4.00	N	1	0.23	0.26	0.92	1.04	5
Liquid permittivity (temperature uncertainty)	7.2.3.5	2.50	N	1	0.78	0.71	1.95	1.77	∞
Liquid permittivity - measurement uncertainty	7.2.3.4	5.00	N	1	0.23	0.26	1.15	1.30	∞
Combined Standard Uncertainty			RSS				10.63	10.54	v_{eff}
Expanded Uncertainty (95% Confidence interval)			K=2				20.73	20.56	

Notes for Uncertainty budget tables
a) Column headings a-k are given for reference
b) Tol.: tolerance in influence quantity.
c) Prob. Dist: Probability distribution
d) N,R: normal, rectangular probability distributions.
e) Div.:divisor used to translate tolerance into normally distributed standard uncertainty
f) c_i : sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR
g) u_i : SAR uncertainty
h) v_i : degrees of freedom for standard uncertainty and effective degrees of freedom for expanded uncertainty.

13. SAR Measurement Plots for validation

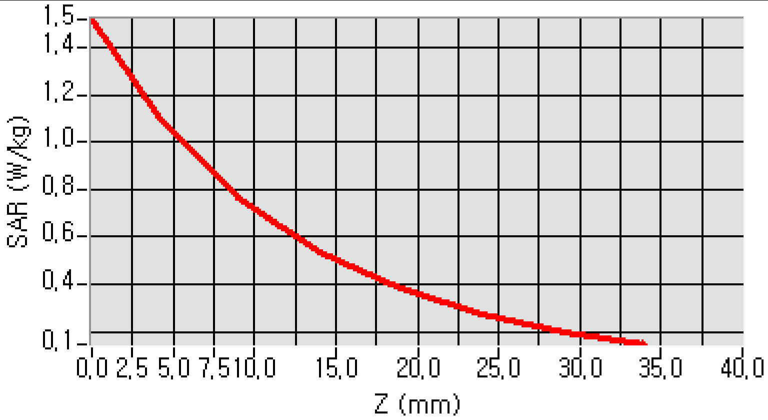
-Test Date : Oct. 02, 2015 **-Wireless mode: TDD**
-Test channel & freq.: Middle&450MHz **-SAR probe S/N: 27/14 EPG228**
-Transmission duty factor: 1.0 **-Conversion factor: 20.22**
-Area and zoom scan measurement resolutions and dimensions: Full path / 8*8*5 mm
-Measurement drift: see the below list(Validation)
-Exposure configuration and test position: Validation
-Product Description : PTT(Push to Talk)
-Model Name : ACRO-M

Relative permittivity (real part)	450.000000
Relative permittivity (imaginary part)	44.058399
Conductivity (S/m)	35.199600
Variation (%)	0.879990
SAR 10g (W/Kg)	0.719698
SAR 1g (W/Kg)	1.085199

SURFACE SAR	VOLUME SAR
	

Maximum Location: X= -5.00 , Y= 5.00 **SAR Peak(extrapolated): 1.54 W/kg**

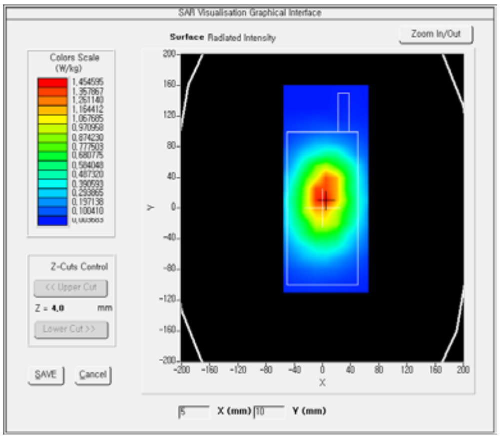
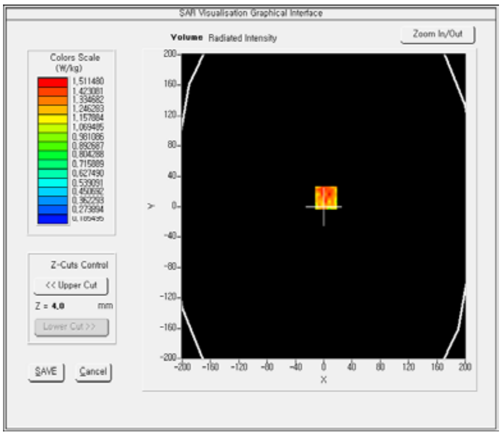
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.5177	1.1143	0.7631	0.5345	0.3806	0.2739	0.1993



13. 1 SAR Measurement for Front-of-Face Plots

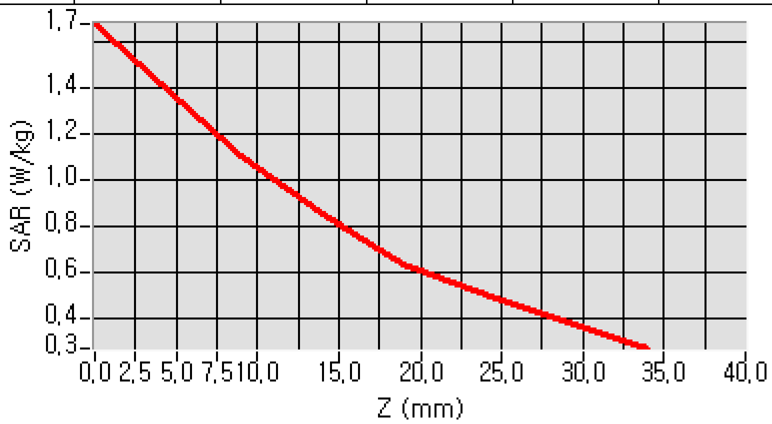
-Test Date : Oct. 02, 2015
-Wireless mode: TDD
-Test channel & freq.: Middle&450MHz
-SAR probe S/N: 27/14 EPG228
-Transmission duty factor: 1.0
-Conversion factor: 20.22
-Area and zoom scan measurement resolutions and dimensions: Full path / 8*8*5 mm
-Measurement drift: see the below list (Validation)
-Exposure configuration and test position: Front-of-Face for Middle Channel
-Product Description : PTT(Push to Talk)
-Model Name : ACRO-M

Frequency (MHz)	460.015015
Relative permittivity (real part)	42.647263
Relative permittivity (imaginary part)	33.961906
Conductivity (S/m)	0.867944
Variation (%)	0.030000
SAR 10g (W/Kg)	0.990810
SAR 1g (W/Kg)	1.434773

SURFACE SAR	VOLUME SAR
	

Maximum Location: X=3.00 , Y= 12.00 **SAR Peak(extrapolated): 2.38 W/kg**

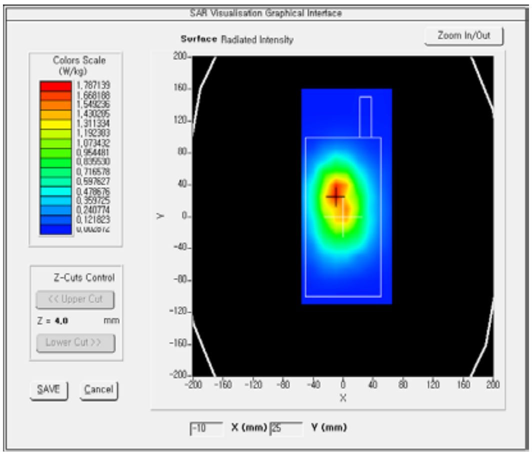
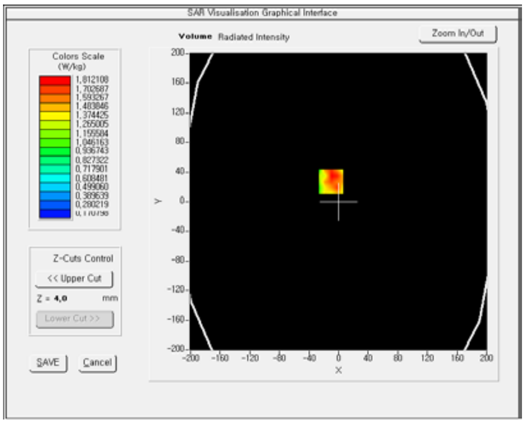
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.6787	1.4156	1.1057	0.8530	0.6392	0.5040	0.3829



13. 2 SAR Measurement for Body-Supported Plots

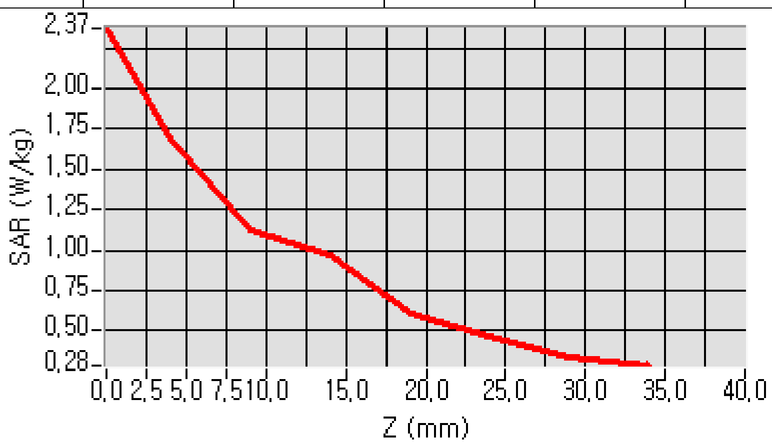
-Test Date : Sept. 14, 2015
-Wireless mode: TDD
-Test channel & freq.: Middle&450MHz
-SAR probe S/N: 27/14 EPG228
-Transmission duty factor: 1.0
-Conversion factor: 21.00
-Area and zoom scan measurement resolutions and dimensions: Full path / 8*8*5 mm
-Measurement drift: see the below list(Validation)
-Exposure configuration and test position: Body-Supported for Middle Channel
-Product Description : PTT(Push to Talk)
-Model Name : ACRO-M

Frequency (㎒)	460.015015
Relative permittivity (real part)	54.092094
Relative permittivity (imaginary part)	37.380695
Conductivity (S/m)	0.955316
Variation (%)	1.330000
SAR 10g (W/Kg)	1.201288
SAR 1g (W/Kg)	***1.843015***

SURFACE SAR	VOLUME SAR
	

Maximum Location: X= -10.00 , Y= 27.00 **SAR Peak(extrapolated): 2.89 W/kg**

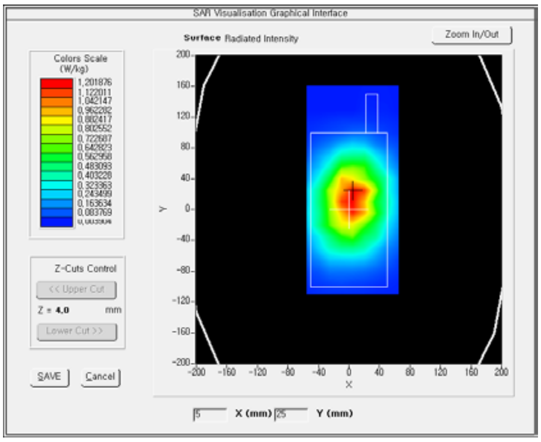
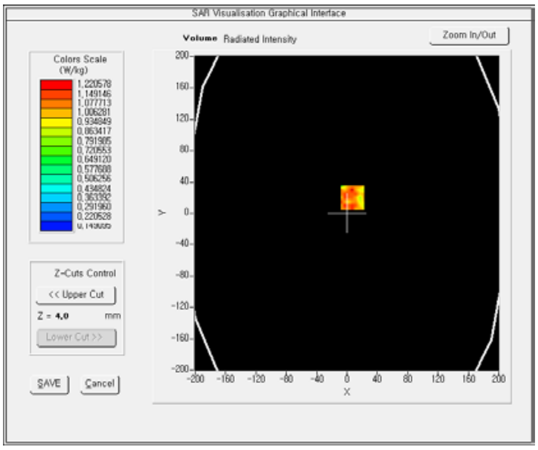
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	2.3735	1.6950	1.1249	0.9661	0.6101	0.4645	0.3353



13. 3 SAR Measurement for Front-of-Face Plots

-Test Date : Oct. 02, 2015
-Wireless mode: TDD
-Test channel & freq.: Middle&450MHz
-SAR probe S/N: 27/14 EPG228
-Transmission duty factor: 1.0
-Conversion factor: 20.22
-Area and zoom scan measurement resolutions and dimensions: Full path / 8*8*5 mm
-Measurement drift: see the below list(Validation)
-Exposure configuration and test position: Front-of-Face for High Channel
-Product Description : PTT(Push to Talk)
-Model Name : ACRO-M

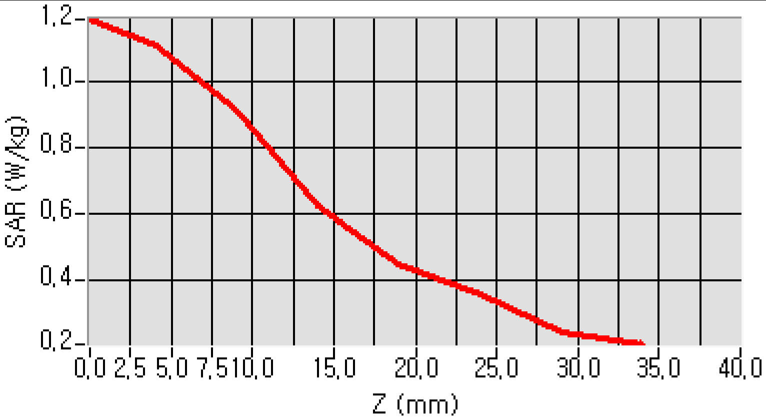
Frequency (MHz)	469.614990
Relative permittivity (real part)	42.596600
Relative permittivity (imaginary part)	33.585602
Conductivity (S/m)	0.876239
Variation (%)	-2.960000
SAR 10g (W/Kg)	0.787386
SAR 1g (W/Kg)	1.133687

SURFACE SAR	VOLUME SAR
	

Maximum Location: X=7.00 , Y= 20.00

SAR Peak(extrapolated): 1.84 W/kg

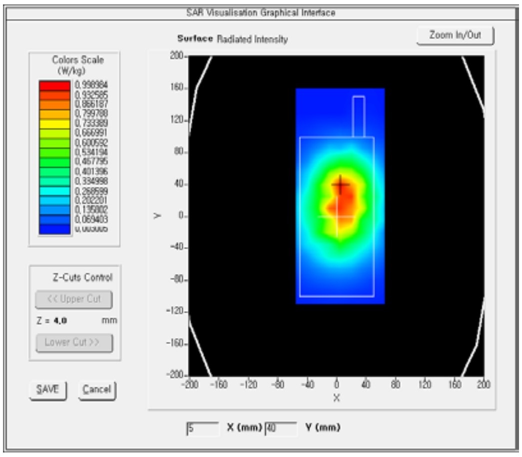
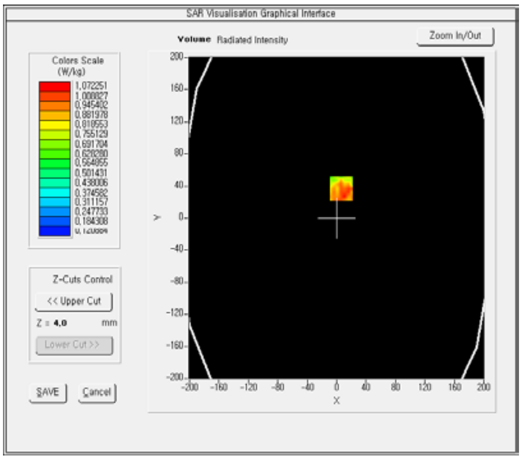
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.1886	1.1105	0.9167	0.6266	0.4464	0.3588	0.2450



13. 4 SAR Measurement for Front-of-Face Plots

-Test Date : Oct. 02, 2015
-Wireless mode: TDD
-Test channel & freq.: Middle&450MHz
-SAR probe S/N: 27/14 EPG228
-Transmission duty factor: 1.0
-Conversion factor: 20.22
-Area and zoom scan measurement resolutions and dimensions: Full path / 8*8*5 mm
-Measurement drift: see the below list(Validation)
-Exposure configuration and test position: Front-of-Face for Low Channel
-Product Description : PTT(Push to Talk)
-Model Name : ACRO-M

Frequency (㎒)	450.015015
Relative permittivity (real part)	43.109840
Relative permittivity (imaginary part)	34.201839
Conductivity (S/m)	0.855074
Variation (%)	0.120000
SAR 10g (W/Kg)	0.695793
SAR 1g (W/Kg)	0.999325

SURFACE SAR	VOLUME SAR
	

Maximum Location: X= 6.00 , Y= 37.00 **SAR Peak(extrapolated): 1.66 W/kg**

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.3586	0.9872	0.7190	0.4923	0.4215	0.3064	0.2172