Test Report

Test Report Identifier:

SC-0871-245-03

Tested Device:

ZigBee USB Dongle - embit EMB-Z2531PA-USB

According to the standards:

IEEE1528-2003

Recommended Practice for Determining the Peak Spatial-Average SAR from Wireless Communications Devices: Measurement Techniques

OET BULLETIN 65 Ed. 97-01 - Supplement C Ed. 01-01

Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions

FCC KDB 447498

SAR Measurement Procedures for USB Dongle Transmitters

Sicom test s.r.l. - AREA Science Park - Padriciano 99 - I-34149 Trieste – Italy
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Accredited by Ministero dello Sviluppo Economico

1. General information

Customer	
Company name	Prima Ricerca & Sviluppo S.r.l.
V.A.T. number	02635860139
Address	Via Campagna, 92
City	Faloppio (CO)
Postal Code	IT- 22020
Country	Italy
Telephone number	+39 031 3500 014
Contact person name	Ing. Vincenzo La Fragola
Contact person e-mail	vlafragola@primaricerca.it

Product Identification	
Device type (brief description)	ZigBee USB Dongle
Trademark / Brand	embit
Model name	EMB-Z2531PA-USB

Test Standard: IEEE 1528-2003 - *IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques*

OET BULLETIN 65 - Supplement C Ed. 01-01 - *Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions*

FCC KDB 447498 D01 v04 11/13/2009 - *Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies*

FCC KDB 447498 D02 v02 11/13/2009 - *SAR Measurement Procedures for USB Dongle Transmitters*

The test results of this report relate only to the tested sample identified in this report.

Tested Device:
Serial number / id: Sample 1
Supported mode(s): ZigBee
Supported band(s): 2450
Type of antenna: fixed embedded
Maximum conducted output power: 20.8 dBm

Date of Report: 13 September 2012

Test site: Sicom test s.r.l - AREA Science Park Padriciano 99 - I-34149 Trieste Italy

Total number of pages: 58

This test report includes the following sections:

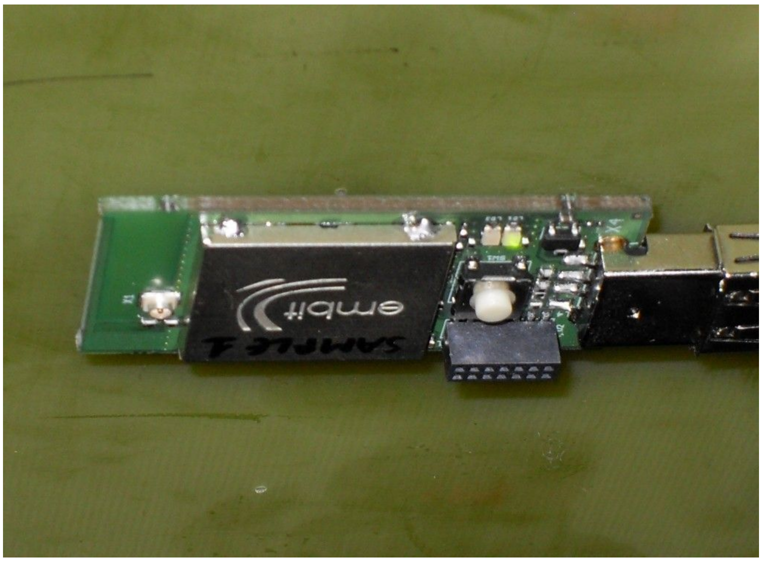
Test Operator: Antonio Dieni

Antonio Dieni

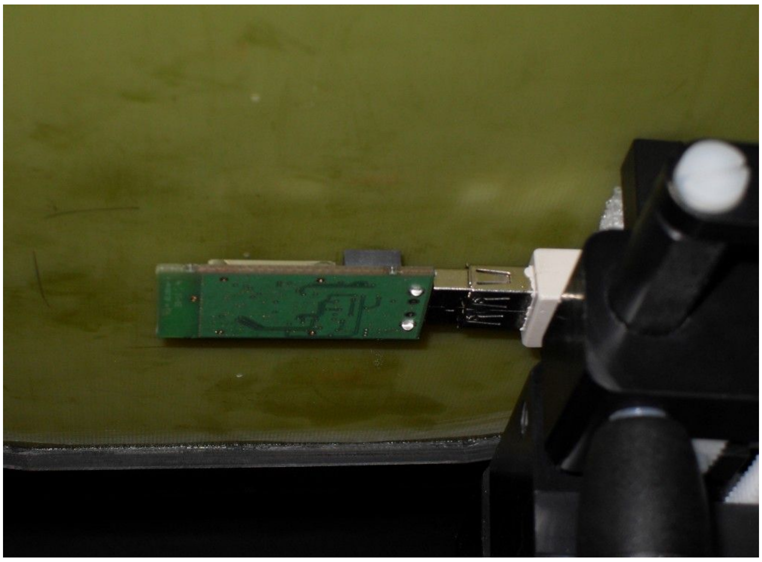
Technical responsible: Roberto Passini

Roberto Passini

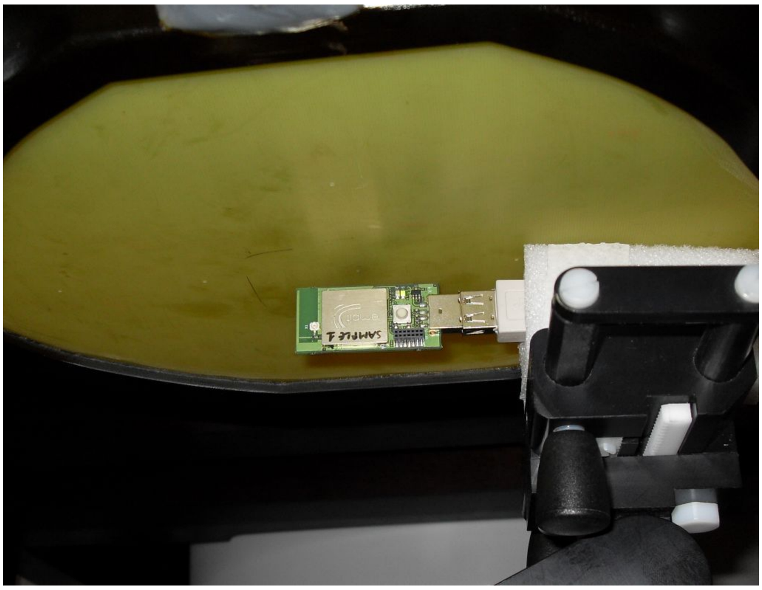
2. Photographs



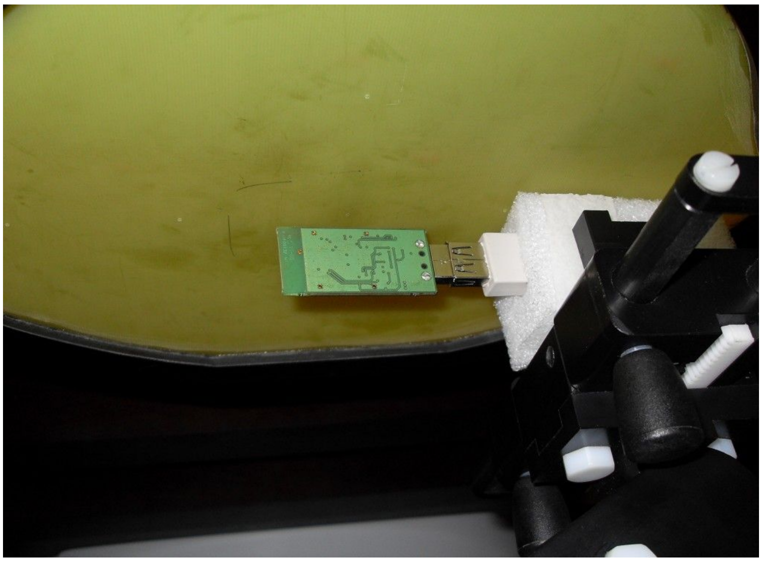
Picture 1 – Tested Device during the test
USB position (A) Horizontal-Up



Picture 2 – Tested Device during the test
USB position (B) Horizontal-Down

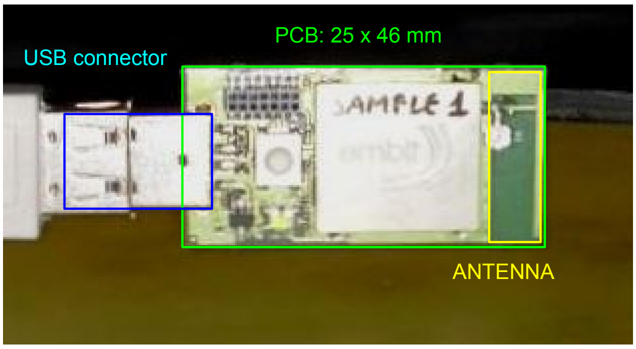


Picture 3 – Tested Device during the test
USB position (C) Vertical-Front



Picture 4 – Tested Device during the test
USB position (D) Vertical-Back

Picture 5 - Tested device during the test



in all positions the center of the PCB coincides with the center of the shell

Picture 6 – device positioning for peak SAR locations

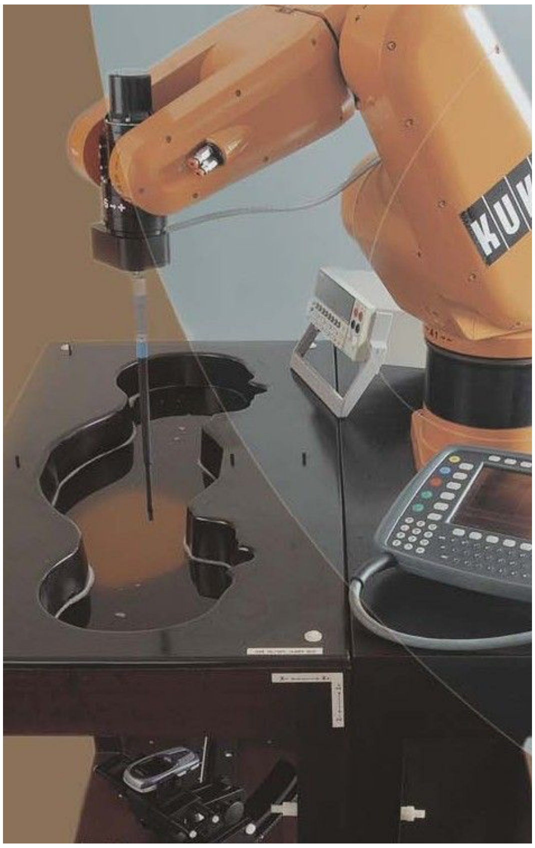
3. Test description

Scope, references and evaluation of compliance to the limits

This report contains the results of the measurements performed on the DUT described in the General Information section in order to evaluate its compliance to the basic restrictions related to human exposure to radio frequency electromagnetic fields, according to the recommended test positions for body worn and other configurations included in the OET BULLETIN 65 Ed. 97-01 - Supplement C Ed. 01-01 “Evaluating Compliance with FCC (Federal Communications Commission) Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields - Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions”.
The exposure limits, applied in U.S., for general population/uncontrolled exposure are specified inside the OET BULLETIN 65 Ed. 97-01 - Supplement C Ed. 01-01, Appendix A. Partial body SAR is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube.
The results of measurements are compared directly to the limits and the DUT is declared to fulfill the requirements of the standard if the measured values are less than or equal to the limits.

The Dosimetric Assessment System

The SAR Dosimetric Assessment System used is able to determine the SAR distribution inside a phantom conforming to the European and U.S. standards. It consists of a robot, a field probe calibrated for use in liquids, a twin phantom, a flat phantom, a flat ellipsoidal phantom, a tissue simulating liquid, a mobile phone holder and software. The software controls the robot and processes the measured data to compare them to the limits.



Picture A - SAR Dosimetric Assessment System

The twin phantom is a shell made with low loss and low permittivity material integrated in a wooden table. The shape of the shell is based on data from an anthropomorphic study and resembles the head and neck of a user, with average size and dimensions . The shell enables the dosimetric evaluation of left and right hand phone usage together with body-worn phone usage through the flat part of the phantom. A fully flat ellipsoidal phantom made with low loss and low permittivity material is used for dosimetric evaluation of body-worn usage of devices with bigger dimensions.
The E-field probe is a 3-axis system made of 3 distinct dipoles. It has a triangular section bar and on each face a dipole and a resistive line are located. The three orthogonal dipoles are linked to special Schottky diodes with low detection thresholds. The probe is designed to fulfill CENELEC and IEEE recommendations for the measurement of electromagnetic fields radiated by mobile phones, base stations and all radiating devices.
The mobile positioning device is made of low-loss and low permittivity material.

SAR measurement procedure
The dielectric properties of the tissue equivalent liquids are measured prior to the SAR measurements and at the same temperature with a tolerance of $\pm$ 2°C. The measured values are the permittivity ε and the electric conductivity σ and they shall comply with the values defined at the specific frequencies into the standard for body simulating tissue liquids with the tolerance of $\pm$ 5%.
A performance check is made before the DUT SAR measurements in order to verify that the system operates within its specifications. It is a 10 g averaged SAR measurement using a simplified set-up with a dipole source. The components and procedures in the simplified performance check are the same as those used for the compliance tests. The result of this check shall be within $\pm$ 10% of the target value, determined during the system validation check.
During all the tests is monitored ambient temperature of the laboratory and liquid, relative humidity and the liquid depth is above 15 cm in all cases.
The tested device uses its internal transmitter; the antenna(s), battery and accessories are those specified by the manufacturer. The battery is fully charged before each measurement and there are no external connections.
The output power and frequency are controlled using a network emulator or proper software. **The device is set to transmit at its highest output peak power level** on the required frequencies of each transmitting band. The device is tested in the body-worn operating configurations, with the belt clips and holsters attached to the device and positioned against a flat phantom in normal use configuration. Devices with a headset output are tested with a headset connected to the device.
Both the physical spacing to the body of the user as dictated by the accessory and the materials used in an accessory affect the SAR produced by the transmitting device.
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 closest space to the body.
When multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contain a unique metallic component. If multiple accessories share an identical metallic component, only the accessory that dictates the closest spacing to the body must be tested.
Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance between the back of the device and the flat phantom is used for testing body-worn SAR compliance under such circumstances.
If the mobile phone has a retractable antenna, all of the tests are performed both with the antenna fully extended and fully retracted.
From measured data the average SAR, in a volume in the shape of a cube and side dimension of a 1g and 10g of tissue, is calculated and compared to the limits.

Spatial Peak SAR, resolution, volume or zoom scan procedure
The system software includes all numerical procedures necessary to evaluate the spatial peak SAR values. The spatial-peak SAR can be computed over any required mass. The base for the evaluation is a “cube” measurement in a volume of $30mm^3$ (7x7x7 points, dx=5mm, dy=5mm, dz=5mm). The measured volume includes the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan. The entire evaluation of the spatial peak values is performed within the post-processing engine. The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. Extraction of the measured data (grid and values) from the Zoom Scan
2. Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. Generation of a high-resolution mesh within the measured volume
4. Interpolation of all measured values from the measurement grid to the high-resolution grid
5. Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. Calculation of the averaged SAR within masses of 1g and 10g

Description of interpolation/extrapolation scheme

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimise measurements errors, but the highest local SAR will occur at the surface of the phantom.

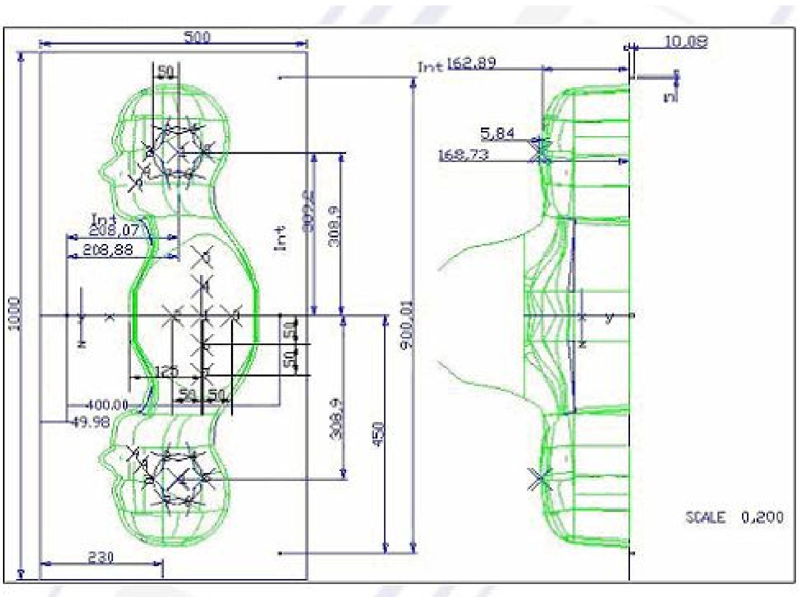
An extrapolation is used to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1 mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10 grams and 1 gram requires a very fine resolution in the three dimensional scanned data array.

An interpolation is used to provide an array of sufficient resolution. The measured and extrapolated SAR values are interpolated on a 1 mm grid with a three dimensional thin plate spline algorithm.

SAR measurement system technical data: phantom description

The SAM phantom is delivered with a CAD CD-ROM including the 3D data of the internal shape of the shell. These data are used by the 6 axis robot control software to define movements relative to its internal surface through 5 additional CAD-linked reference points.



Picture B – SAM and ellipsoidal shell

SAM shell technical data:

Shell thickness	2 mm ± 0.2 mm
Permittivity / loss tangent	3.3 / 0.017
Filling phantom volume/ liquid depth	27 litres / 20 cm

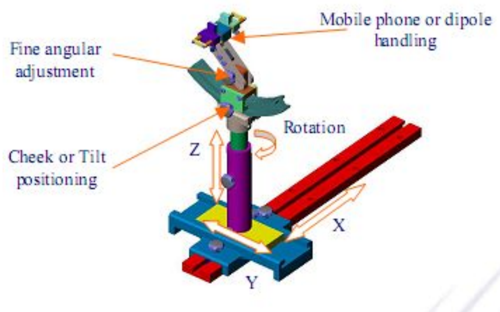
Dimensions	1000 mm (length) x 500 mm (width) x 200 mm (height)
References	IEEE 1528-2003, CENELEC 50361 and IEC 62209-1

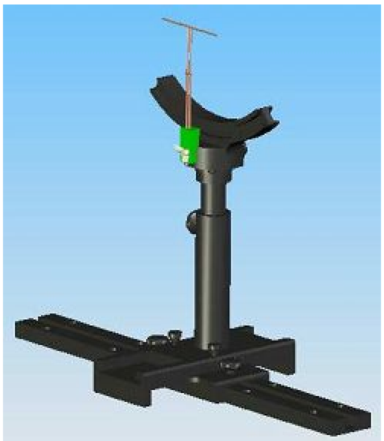
Ellipsoidal shell technical data:

Shell thickness	2 mm ± 0.2 mm
Permittivity / loss tangent	4.4 / 0.017
Filling Volume	35 litres / 20 cm
Dimensions	800 mm (length) x 500 mm (width) x 200 mm (height)
References	IEC 62209-2

SAR measurement system technical data: device holder

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. An accurate device positioning is therefore crucial for accurate and repeatable measurements.





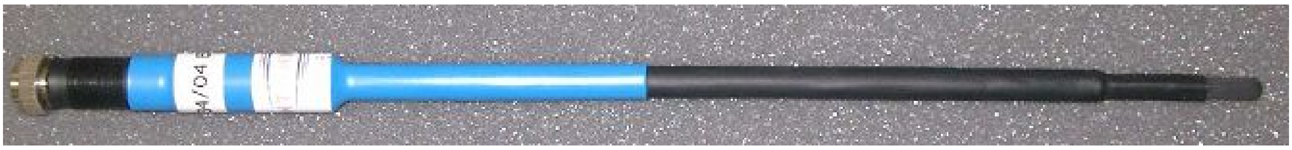
Picture C – positioning holder overview

Device holder system characteristics:

General	Totally metal-free design. Three graduated translation and five rotation point to lock the device under test under the flat part or under the left or right ear. Ensured repeatability with fine angular adjustment. Mobile phone or dipole handling.
Permittivity / loss tangent	3.0 / 0.017
Material	POM
X translation	700 mm
Y translation	250 mm
Z translation	100 mm

SAR measurement system technical data: isotropic E-Field Probe

Probes are constructed with a triangular section bar in alumina. On each face, a dipole and a resistive line are printed. A Schottky diode is placed in the center of each dipole. Symmetrical design with triangular core. These uncoupled dipoles perform the isotropic and wide-band measurements. See Annex A for calibration.



Picture D – isotropic E-Field Probe

isotropic E-Field Probe technical data:

Frequency range	100 MHz - 30 GHz
Length	330 mm
Dipoles Length	4.5 mm
Maximum external diameter	8 mm
Probe tip external diameter	5 mm
Distance between dipoles and the probe tip	<2.7mm
Dipole resistance (in the connector plane)	1MΩ to 2MΩ
Axial isotropy in human-equivalent liquids	± 0.2 dB
Hemispherical Isotropy in human-equivalent liquids	± 0.3 dB
Linearity	± 0.5 dB
Maximum operating SAR	100 Watts/kg
Lower SAR detection threshold	0.0015 Watts/kg
Connectors	6 male wires (Hirose SR30)

SAR measurement system technical data: reference dipoles

The antennas are developed with a $\lambda_0/4$ balun, so that all calibration dipoles are totally symmetrical. Each validation 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. Each dipole has been designed to be plugged in the device holder positioning system. See Annex A for calibration.

Reference dipoles technical data:

Frequencies	450, 900, 1800, 2000, 2450 MHz
Adaptation	S11 < -20dB in specified validation position.
Power	100W
Connectors	SMA
Dimensions	Height : between 200 mm and 300 mm Length : between 25 mm and 83 mm depends on the dipole frequency

4. Test equipment and test conditions

SAR Dosimetric Assessment System - Manufacturer: Satimo Model: COMOSAR TWINS

Instrument Type	Model	Manufacturer	Serial Number	Calibration periodicity	Last Calibration
Robot	KR3	Kuka	846427	N.S.	---
Robot Remote Controller	KRC3	Kuka	599	N.S.	---
Robot Control Panel	KCP2	Kuka	1438	N.S.	---
Isotropic E-field probe	---	Satimo	SN 46/06 EP60	12 months	23/07/2011
Dipole	2450 MHz	Satimo	SN 39/05 DIPJ30	24 months	31/08/2011
SAM shell	Twins phantom	Satimo	SN 39/05 SAM26	N.S.	---
Flat shell	Flat phantom	Satimo	SN 39/05 FVA11	N.S.	---
Flat ellipsoidal shell	Flat shell ellipsoidal	Satimo	SN 46/07 ELLI13	N.S.	---
Positioning system	---	Satimo	SN 39/05 MSH13	N.S.	---
Open coaxial probe	---	Satimo	SN 39/05 OCP8	36 months	31/08/2010
Liquid body	2450 MHz	Satimo	---	every test session	---

N.S. = no perioc calibration required

Supporting test equipment

Instrument Type	Model	Manufacturer	Serial Number	Calibration periodicity	Last Calibration
Multimeter	Mod. 2000	Keithley	1062722	18 months	22/05/2012
Power amplifier	RF 4002000-2	RFPA	52627	N.S.	---
Signal Generator	SMIQ03B	Rohde & Schwarz	831389/028	24 months	10/05/2012
Power meter	NRVS	Rohde & Schwarz	827023/049	24 months	03/05/2012
Sensor head	NRV-Z51	Rohde & Schwarz	829759/003	24 months	03/05/2012
Directional coupler	ZFDC-20-5	Minicircuits	---	24 months	10/05/2012
Directional coupler	R433563000	Radiall	---	24 months	10/05/2012
Vector Network Analyser	MS4622B	Anritsu	984502	24 months	10/05/2012
Digital Spectrum Analyzer / Radio Transmitter Tester	MS8609A	Anritsu	6200456808	12 months	10/05/2012
Test Fixture - Antenna coupler	Antenna Coupler B	Sicom test s.r.l.	AC001	N.S	---
Host computer/laptop	TravelMate 2434 WLMi ZL6	Acer	LXTC305132622 14A332501	N.S	---

N.S. = no perioc calibration required

Test Conditions:

The testing has been performed within the period:

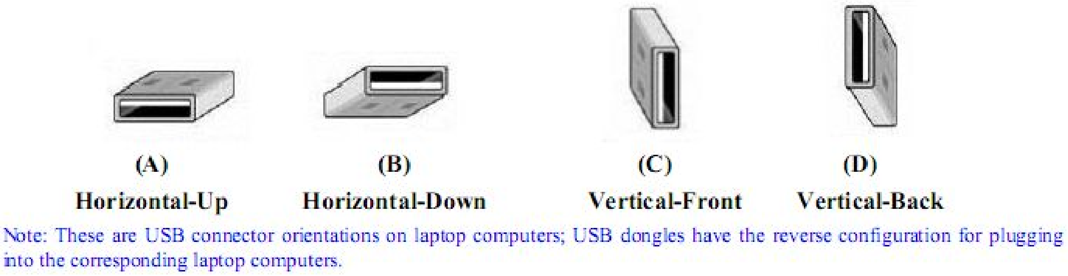
From:	05 June 2012
To:	05 June 2012

Ambient Conditions:

Temperature:	+22°C ± 2°C

Tested device conditions:

Standard:	ZigBee
Antenna:	Fixed embedded.
Accessories:	None, no swivel or rotating connectors.
Power supply:	USB
RF power:	The device is set to transmit at its highest output peak power level with a continuous transmission in test mode on the required frequencies using the software Texas Instruments CC2531 Low-power RF to USB Serial Port DriverVer=05/01/2009,1.1.0.0 supplied by the client and sending via USB serial port the commands: P=high power Q=maximum power (command set Q,A,Z,W,S,X,E,D,C,R,F,V,T,G,B,Y,H,N,U J and M) 1,2,3=transmission frequency 2.405, 2.440 and 2.480 MHz as specified by the client. The correct device highest output peak power transmission condition has been set and verified with a spectrum analyzer in conducted mode.
Positioning:	The device is tested in the body-worn operating configurations, according to FCC KDB Publication 447498 "SAR Measurement Procedures for USB Dongle Transmitters" with *Simple Dongle Procedure* and with a separation **distance of 0.5 cm** between the back of the device and the flat phantom in all required USB orientations (see figure below):



Picture E: KDB Publication 447498 USB orientations

5. System validation check data

Measurement for Tissue Simulant Liquid

Tissue simulant composition of ingredients
2450 MHz liquid (in % by weight) theoretical composition:
DGBE: Diethylenglykol-monobutylether: 26.70 %
Water: 73.26 %
NaCl salt:0.04 %

Tissue dielectric property measurement procedure: contact probe
The measurement is performed using a calibration kit (pre-calibrated open coaxial probe, pre-calibrated cable, and vector network analyzer as detailed in Test Equipment section of this Report) to determinate the S_{11} parameters of the tissue simulant liquid. The system software is able to calculate the complex permittivity (i.e. ε and σ) of the liquid in the frequency band of 300 MHz to 3 GHz. Steps of the permittivity measurement: 1) SOL (Short, Open and Load) calibration at the end of the cable; 2) measurement of the S_{11} parameters of known reference fluid (pure water) at known temperature; 3) measurement of the S_{11} parameters of Tissue Simulant Liquid. The tests were conducted on the same days as the measurement of the EUT.

Picture F: open coaxial probe with the bottle cap

Dielectric parameters of the tissue simulant liquid were verified to be within a tolerance of +-5% from the target values (see below):
Dielectric properties measured:
The conductivity σ and permittivity Ɛr are listed in table below for the SAR measurement given in this report.

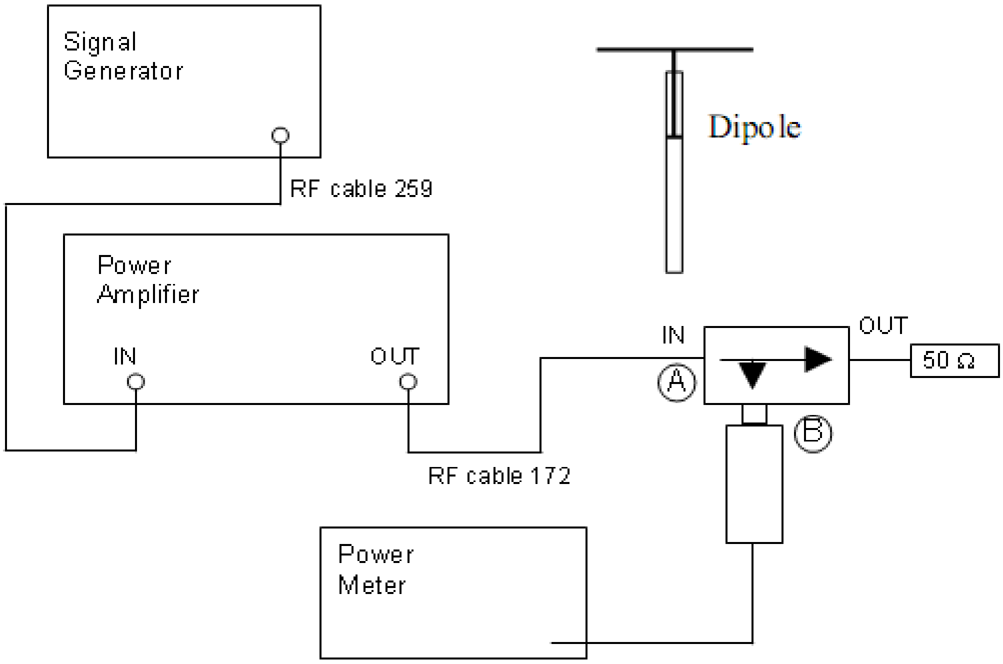
Band	Frequency [MHz]	Recommended Permittivity (Ɛr)	Measured Permittivity (Ɛr)	Recommended Conductivity (σ) [S/m]	Measured Conductivity (σ) [S/m]	Liquid Temperature [°C]	Date
2450	2405	52.7 ± 5% (50.07÷55.34)	52.12	1.95 ± 5% (1.85÷2.05)	1.937	22.4	05/06/2012
	2440		52.28		1.956		05/06/2012
	2480		52.30		1.982		05/06/2012

Frequency [MHz]	Tolerance Ɛr [%]	Verdict Ɛr	Tolerance σ [%]	Verdict σ
2405	-1.10	Pass	-0.67	Pass
2440	-0.80	Pass	+0.31	Pass
2480	-0.76	Pass	+1.64	Pass

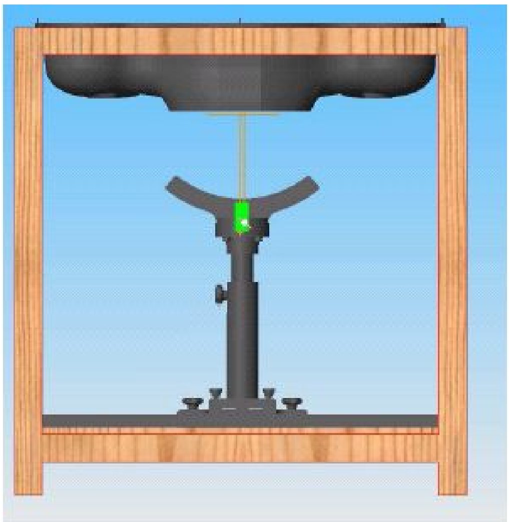
SAR system verification

SAR measurement system verification procedure

The microwave circuit arrangement for system verification is showed in the bottom picture. Instruments and reference dipoles detailed in Test Equipment section of this Report. The tests were conducted daily on the same days as the measurement of the EUT. Steps of the measurement: 1) a CW power level of **1 W** at the same frequency of the reference dipole is measured in the point A; 2) this power level is input to the reference dipole positioned (through a calibrated jig) at the center of the flat section of the SAM phantom (or at the center of ellipsoidal shell) and a SAR measurement was performed to verify if the measured SAR was within +/- 10% from the target reference SAR values.



Picture G: system verification scheme



Picture X: reference dipole position for system verification

VALIDATION 1

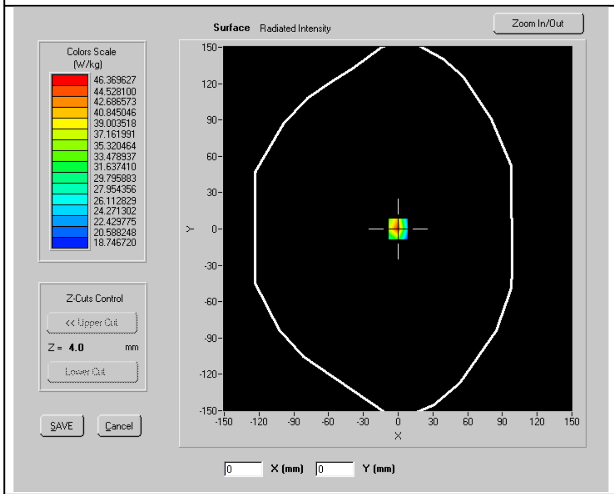
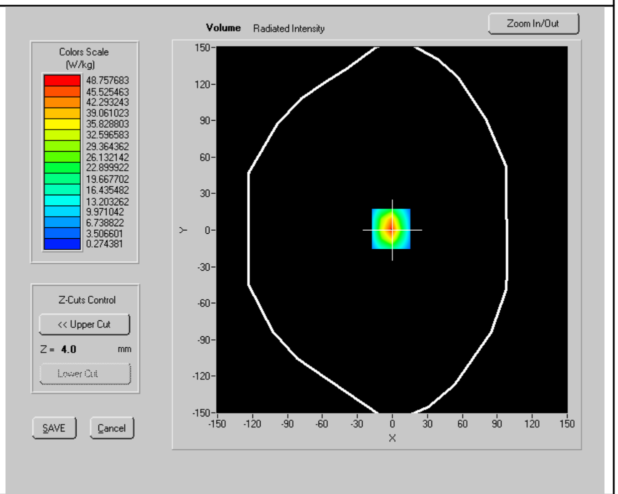
Type: Dipole measurement (Complete)
Date of measurement: 05/06/2012

A. Experimental conditions.

Phantom	FLAT SN 39/05 FVA11
Device Position	Dipole
Band	2450
Channel	Middle
Signal	CW
Dipole input power	1 W
Probe	EP60
Probe Path	Adaptative 1 max
Liquid Temperature	22.4 °C

B. SAR Measurement Results

Frequency (MHz)	2450.0
Relative permittivity (real part)	52.29
Conductivity (S/m)	1.957
Maximum location	X=-1.00, Y=1.00

SURFACE SAR	VOLUME SAR
	

SAR	SAR (W/kg)	Target value (W/kg)	Variation (%)
SAR 1g	51.66	51.20	+0.9

6. Test results

MEASUREMENT 1

Type: Device measurement (Complete)
Date of measurement: 05/06/2012

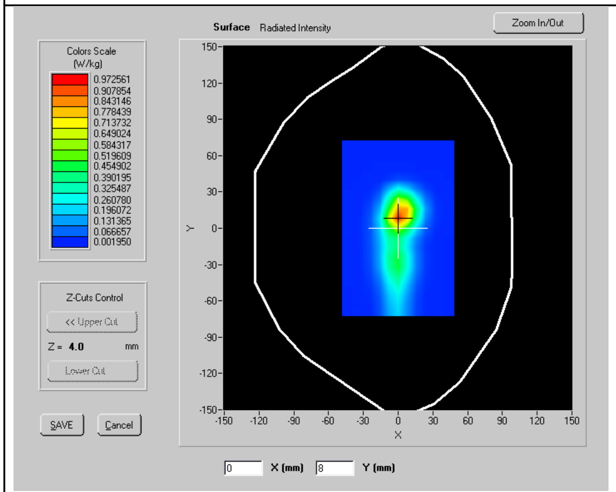
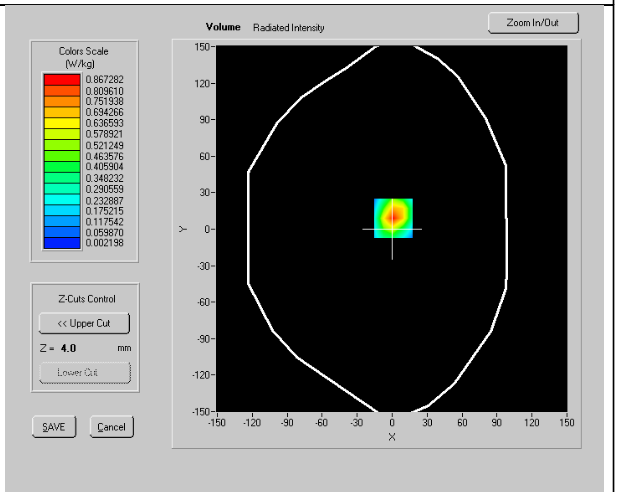
A. Experimental conditions.

Phantom	Flat
Device Position	Body Worn
Antenna Position	Fixed
Band	2450
Channel	Middle
Signal	ZigBee
EUT Position	USB position (A) Horizontal-Up
Probe Path	Flat
Distance	d=0.5 cm
Probe	EP60

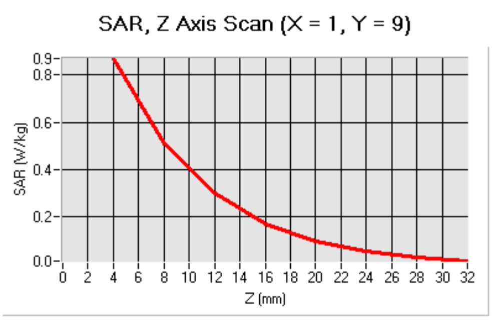
B. SAR Measurement Results

Middle Channel SAR:

Frequency (MHz)	2440.0
Relative permittivity (real part)	52.28
Conductivity (S/m)	1.956
Power drift %	-0.16
Maximum location	X=1.00, Y=9.00

SURFACE SAR	VOLUME SAR
	

Z-scan



SAR	SAR (W/kg)	Limit (W/kg)
SAR 1g	0.898	1.600

Test ID	Test title	Result
SAR_body_ZigBee2450_1g	SAR 1g, body-worn position in the ZigBee 2450 band	**PASS**

MEASUREMENT 2

Type: Device measurement (Complete)
Date of measurement: 05/06/2012

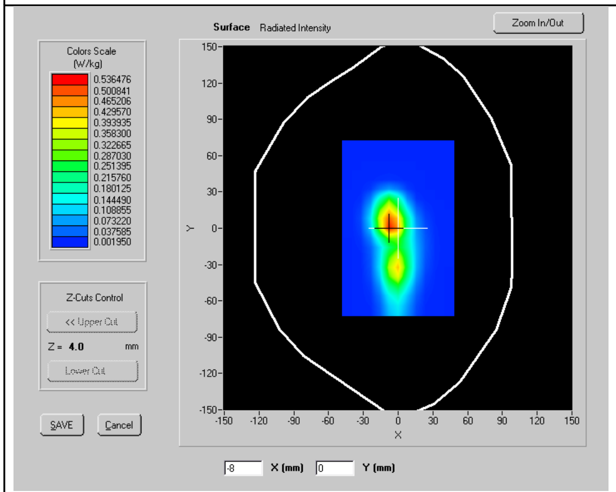
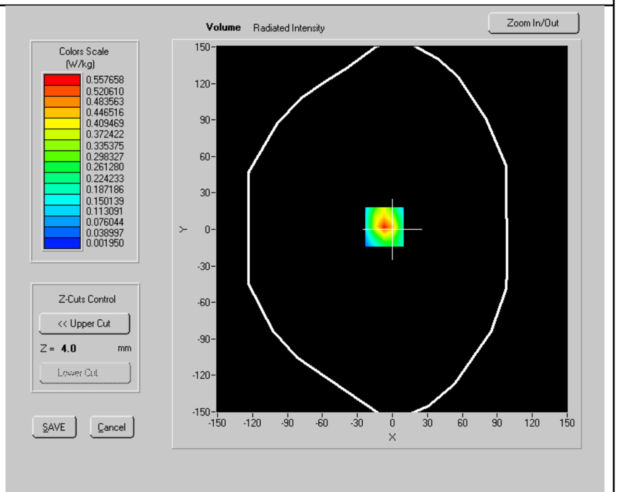
A. Experimental conditions.

Phantom	Flat
Device Position	Body Worn
Antenna Position	Fixed
Band	2450
Channel	Middle
Signal	ZigBee
EUT Position	USB position (B) Horizontal-Down
Probe Path	Flat
Distance	d=0.5 cm
Probe	EP60

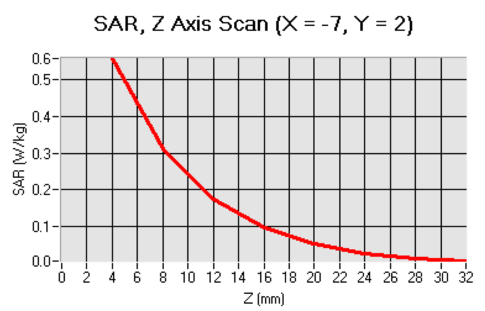
B. SAR Measurement Results

Middle Channel SAR:

Frequency (MHz)	2440.0
Relative permittivity (real part)	52.28
Conductivity (S/m)	1.956
Power drift %	+0.71
Maximum location	X=-7.00, Y=2.00

SURFACE SAR	VOLUME SAR
	

Z-scan



SAR	SAR (W/kg)	Limit (W/kg)
SAR 1g	0.503	1.600

Test ID	Test title	Result
SAR_body_ZigBee2450_1g	SAR 1g, body-worn position in the ZigBee 2450 band	**PASS**

MEASUREMENT 3

Type: Device measurement (Complete)
Date of measurement: 05/06/2012

A. Experimental conditions.

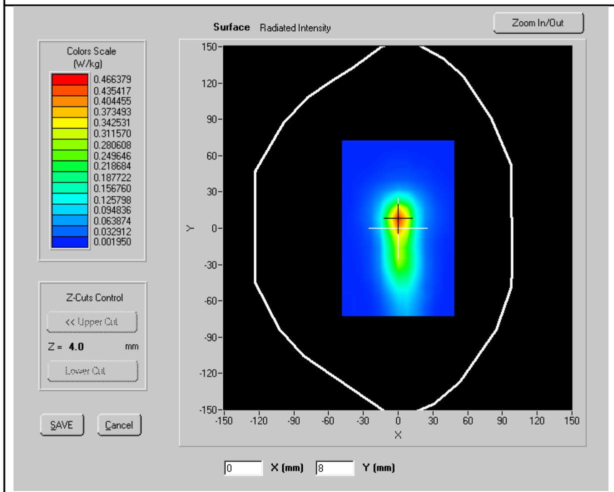
Phantom	Flat
Device Position	Body Worn
Antenna Position	Fixed
Band	2450
Channel	Middle
Signal	ZigBee
EUT Position	USB position (C) Vertical-Front
Probe Path	Flat
Distance	d=0.5 cm
Probe	EP60

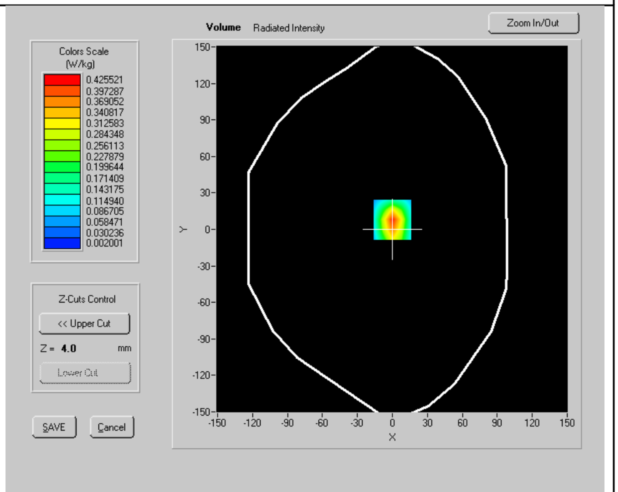
B. SAR Measurement Results

Middle Channel SAR:

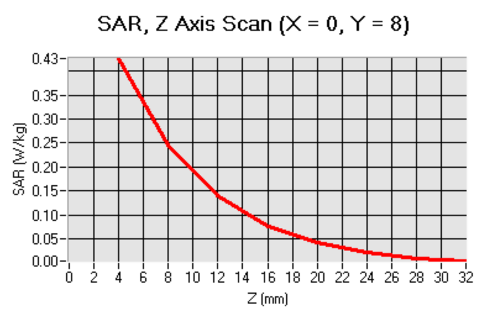
Frequency (MHz)	2440.0
Relative permittivity (real part)	52.28
Conductivity (S/m)	1.956
Power drift %	-0.27
Maximum location	X=0.00, Y=8.00

SURFACE SAR	VOLUME SAR





Z-scan



SAR	SAR (W/kg)	Limit (W/kg)
SAR 1g	0.388	1.600

Test ID	Test title	Result
SAR_body_ZigBee2450_1g	SAR 1g, body-worn position in the ZigBee 2450 band	**PASS**

MEASUREMENT 4

Type: Device measurement (Complete)
Date of measurement: 05/06/2012

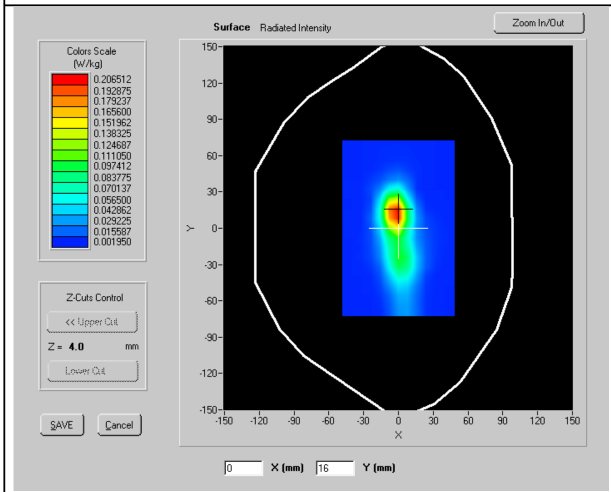
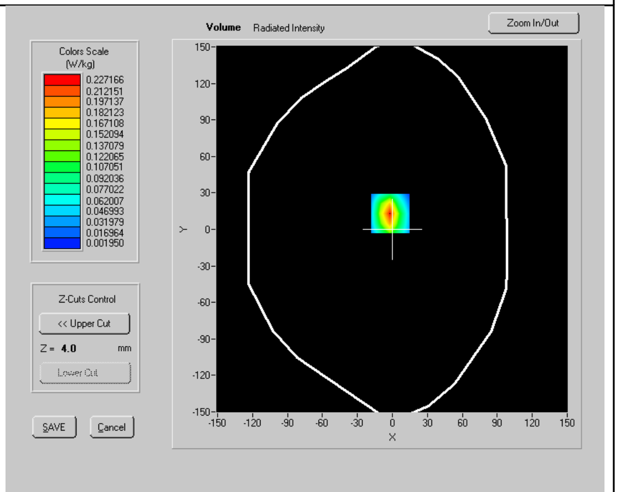
A. Experimental conditions.

Phantom	Flat
Device Position	Body Worn
Antenna Position	Fixed
Band	2450
Channel	Middle
Signal	ZigBee
EUT Position	USB position (D) Vertical-Back
Probe Path	Flat
Distance	d=0.5 cm
Probe	EP60

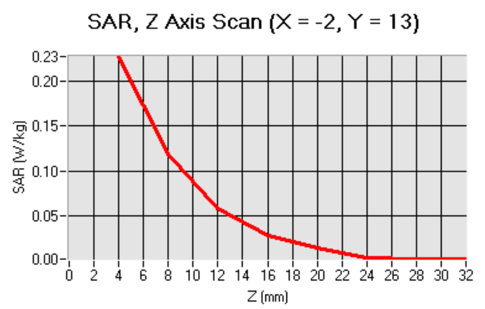
B. SAR Measurement Results

Middle Channel SAR:

Frequency (MHz)	2440.0
Relative permittitivity (real part)	52.28
Conductivity (S/m)	1.956
Power drift %	+0.54
Maximum location	X=-2.00, Y=13.00

SURFACE SAR	VOLUME SAR
	

Z-scan



SAR	SAR (W/kg)	Limit (W/kg)
SAR 1g	0.203	1.600

Test ID	Test title	Result
SAR_body_ZigBee2450_1g	SAR 1g, body-worn position in the ZigBee 2450 band	**PASS**

MEASUREMENT 5

Type: Device measurement (Complete)
Date of measurement: 05/06/2012

A. Experimental conditions.

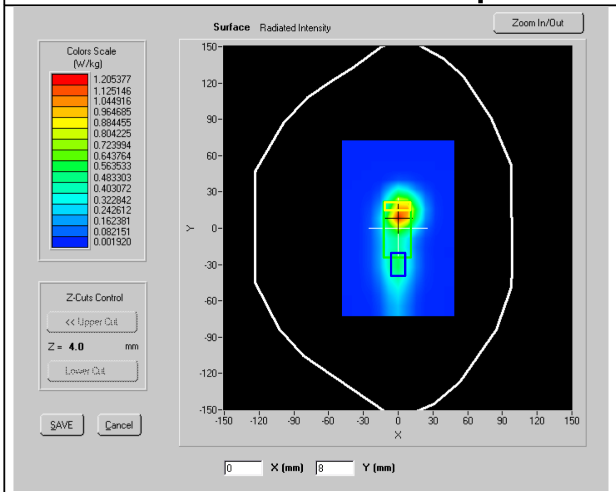
Phantom	Flat
Device Position	Body Worn
Antenna Position	Fixed
Band	2450
Channel	Low
Signal	ZigBee
EUT Position	USB position (A) Horizontal-Up
Probe Path	Flat
Distance	d=0.5 cm
Probe	EP60

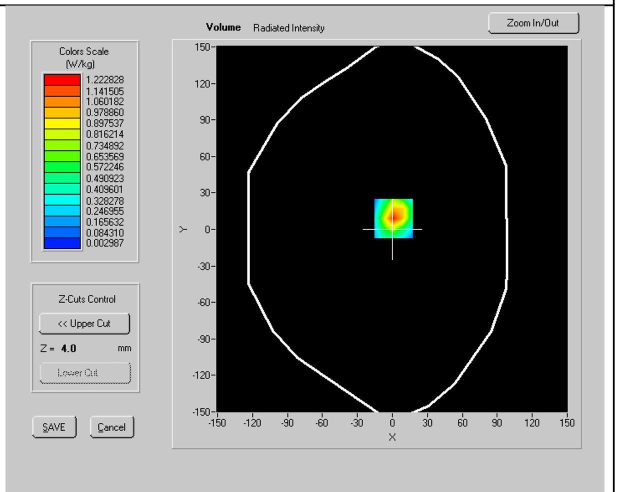
B. SAR Measurement Results

Low Channel SAR:

Frequency (MHz)	2405.0
Relative permittivity (real part)	52.12
Conductivity (S/m)	1.937
Power drift %	+0.48
Maximum location	X=1.00, Y=9.00

SURFACE SAR and device position	VOLUME SAR





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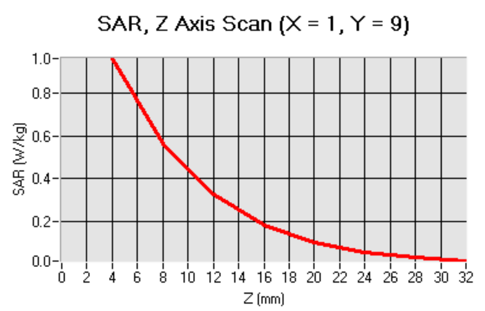


SAR	SAR (W/kg)	Limit (W/kg)
SAR 1g	0.990	1.600

Test ID	Test title	Result
SAR_body_ZigBee2450_1g	SAR 1g, body-worn position in the ZigBee 2450 band	**PASS**

MEASUREMENT 6

Type: Device measurement (Complete)
Date of measurement: 05/06/2012

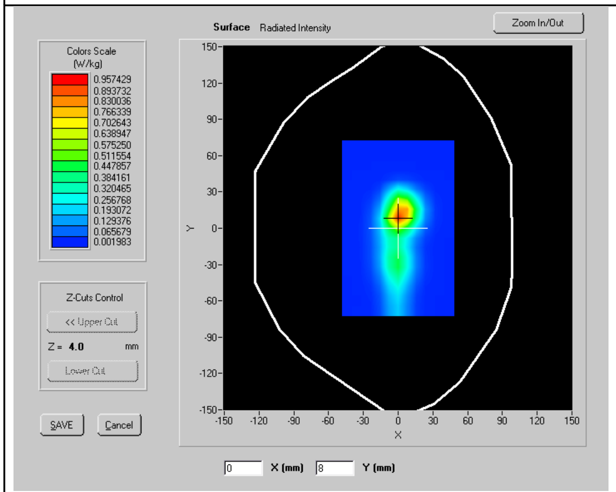
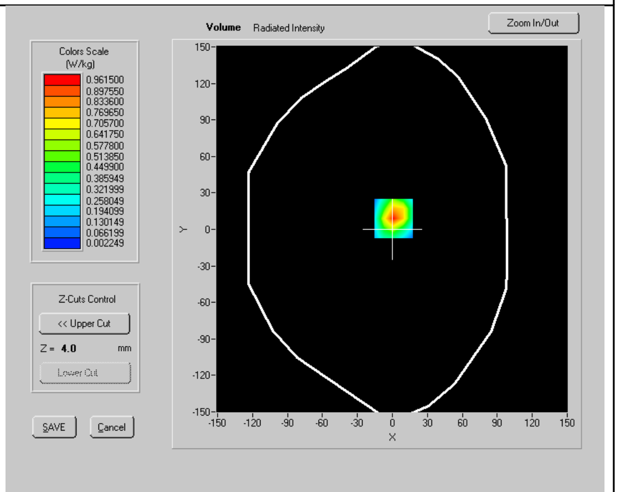
A. Experimental conditions.

Phantom	Flat
Device Position	Body Worn
Antenna Position	Fixed
Band	2450
Channel	High
Signal	ZigBee
EUT Position	USB position (A) Horizontal-Up
Probe Path	Flat
Accessory or distance	d=0.5 cm
Probe	EP60

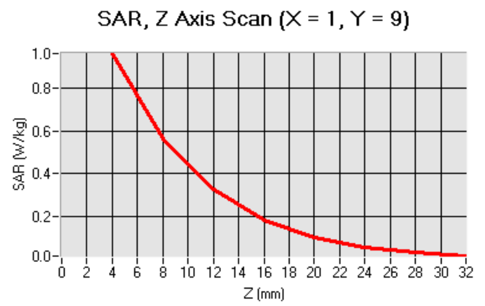
B. SAR Measurement Results

High Channel SAR:

Frequency (MHz)	2480.0
Relative permittivity (real part)	52.30
Conductivity (S/m)	1.982
Power drift %	-0.11
Maximum location	X=1.00, Y=9.00

SURFACE SAR	VOLUME SAR
	

Z-scan



SAR	SAR (W/kg)	Limit (W/kg)
SAR 1g	0.982	1.600

Test ID	Test title	Result
SAR_body_ZigBee2450_1g	SAR 1g, body-worn position in the ZigBee 2450 band	**PASS**

7. Evaluation

In the following table the SAR results for the tested device are summarized.

Band	Frequency	Position	Accessory or distance	EUT position	Antenna	SAR 1g (W/kg)
ZigBee 2450	Middle	body worn	d=0.5 cm	USB position (A) Horizontal-Up	fixed	0.898
ZigBee 2450	Middle	body worn	d=0.5 cm	USB position (B) Horizontal-Down	fixed	0.503
ZigBee 2450	Middle	body worn	d=0.5 cm	USB position (C) Vertical-Front	fixed	0.388
ZigBee 2450	Middle	body worn	d=0.5 cm	USB position (D) Vertical-Back	fixed	0.203
ZigBee 2450	Low	body worn	d=0.5 cm	USB position (A) Horizontal-Up	fixed	0.990
ZigBee 2450	High	body worn	d=0.5 cm	USB position (A) Horizontal-Up	fixed	0.982

The maximum Specific Absorption Rate (SAR) averaged over 1 g, determined at low frequency in ZigBee2450 mode, of the ZigBee USB Dongle - embit EMB-Z2531PA-USB unit, is **0.990** W/kg.

The overall margin of uncertainty for these measurements is given at the Uncertainty evaluation section.

The SAR 1g limit given in the OET BULLETIN 65 Ed. 97-01 - Supplement C Ed. 01-01 for Partial body exposure is 1.6 W/kg.

This unit as tested is found to be **COMPLIANT** with these requirements.

For body worn operation, this device meets the above FCC RF exposure guidelines when used with a part/accessory that contains no metal and that positions the device a minimum of 0.5 cm from the body. Use of other accessories or position other than tested may not ensure compliance.

8. Uncertainty evaluation

Below the contributions of each component of uncertainty is reported together with its name, probability distribution, sensitivity coefficient and uncertainty value. The results are recorded in a table and the combined uncertainty is given, as required by the standards.

UNCERTAINTY EVALUATION FOR HANDSET SAR TEST

a	b	c	d	e= f(d,k)	f	g	h= cxf/e	i= cxg/e	k
Uncertainty Component	Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i (1 g)	c_i (10 g)	1 g u_i (± %)	10 g u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1.	7	N	1	1	1	7	7	∞
Axial Isotropy	E.2.2.	2,5	R	√3	$(1-c_p)^{1/2}$	$(1-c_p)^{1/2}$	1,02062	1,02062	∞
Hemispherical Isotropy	E.2.2.	4	R	√3	$\sqrt{C_p}$	$\sqrt{C_p}$	1,63299	1,63299	∞
Boundary Effect	E.2.3.	1	R	√3	1	1	0,57735	0,57735	∞
Linearity	E.2.4.	5	R	√3	1	1	2,88675	2,88675	∞
System Detection Limits	E.2.5.	1	R	√3	1	1	0,57735	0,57735	∞
Readout Electronics	E.2.6.	0,02	N	1	1	1	0,02	0,02	∞
Response Time	E.2.7.	3	R	√3	1	1	1,73205	1,73205	∞
Integration Time	E.2.8.	2	R	√3	1	1	1,1547	1,1547	∞
RF Ambient Conditions	E.6.1.	3	R	√3	1	1	1,73205	1,73205	∞
Probe Positioner Mechanical Tolerance	E.6.2.	2	R	√3	1	1	1,1547	1,1547	∞
Probe Positioning with respect to Phantom Shell	E.6.3.	0,05	R	√3	1	1	0,02887	0,02887	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5.2.	5	R	√3	1	1	2,88675	2,88675	∞
Test sample Related									
Test Sample Positioning	E.4.2.1.	0,03	N	1	1	1	0,03	0,03	N-1
Device Holder Uncertainty	E.4.1.1.	5	N	1	1	1	5	5	N-1
Output Power Variation - SAR drift measurement	6.6.2.	3	R	√3	1	1	1,73205	1,73205	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1.	0,05	R	√3	1	1	0,02887	0,02887	∞
Liquid Conductivity - deviation from target values	E.3.2.	5	R	√3	0,64	0,43	1,84752	1,2413	∞
Liquid Conductivity - measurement uncertainty	E.3.3.	5	N	1	0,64	0,43	3,2	2,15	M
Liquid Permittivity - deviation from target values	E.3.2.	3	R	√3	0,6	0,49	1,03923	0,8487	∞
Liquid Permittivity - measurement uncertainty	E.3.3.	10	N	1	0,6	0,49	6	4,9	M
Combined Standard Uncertainty			RSS				11,1265	10,5799	
Expanded Uncertainty (95% CONFIDENCE INTERVAL)			k				21,8079	20,7366	

9. System validation check uncertainty

Below the contributions of each component of uncertainty is reported together with its name, probability distribution, sensitivity coefficient and uncertainty value. The results are recorded in a table and the combined uncertainty is given, as required by the standards.

UNCERTAINTY FOR SYSTEM PERFORMANCE CHECK									
a	b	c	d	e= f(d,k)	f	g	h= cxf/e	i= cxg/e	k
Uncertainty Component	Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i (1 g)	c_i (10 g)	1 g u_i (± %)	10 g u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1.	7	N	1	1	1	7	7	∞
Axial Isotropy	E.2.2.	2,5	R	√3	$(1-c_p)^{1/2}$	$(1-c_p)^{1/2}$	1,02062	1,02062	∞
Hemispherical Isotropy	E.2.2.	4	R	√3	$\sqrt{C_p}$	$\sqrt{C_p}$	1,63299	1,63299	∞
Boundary Effect	E.2.3.	1	R	√3	1	1	0,57735	0,57735	∞
Linearity	E.2.4.	5	R	√3	1	1	2,88675	2,88675	∞
System Detection Limits	E.2.5.	1	R	√3	1	1	0,57735	0,57735	∞
Readout Electronics	E.2.6.	0,02	N	1	1	1	0,02	0,02	∞
Response Time	E.2.7.	3	R	√3	1	1	1,73205	1,73205	∞
Integration Time	E.2.8.	2	R	√3	1	1	1,1547	1,1547	∞
RF Ambient Conditions	E.6.1.	3	R	√3	1	1	1,73205	1,73205	∞
Probe Positioner Mechanical Tolerance	E.6.2.	2	R	√3	1	1	1,1547	1,1547	∞
Probe Positioning with respect to Phantom Shell	E.6.3.	0,05	R	√3	1	1	0,02887	0,02887	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5.2.	5	R	√3	1	1	2,88675	2,88675	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2.	1	N	√3	1	1	0,57735	0,57735	N-1
Input Power and SAR drift measurement	8, 6.6.2.	2	R	√3	1	1	1,1547	1,1547	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1.	0,05	R	√3	1	1	0,02887	0,02887	∞
Liquid Conductivity - deviation from target values	E.3.2.	5	R	√3	0,64	0,43	1,84752	1,2413	∞
Liquid Conductivity - measurement uncertainty	E.3.3.	5	N	1	0,64	0,43	3,2	2,15	M
Liquid Permittivity - deviation from target values	E.3.2.	3	R	√3	0,6	0,49	1,03923	0,8487	∞
Liquid Permittivity - measurement uncertainty	E.3.3.	10	N	1	0,6	0,49	6	4,9	M
Combined Standard Uncertainty			RSS				9,87239	9,25204	
Expanded Uncertainty (95% CONFIDENCE INTERVAL)			k				19,3499	18,134	

10. Annex A: Electric field probe and reference dipoles calibration reports

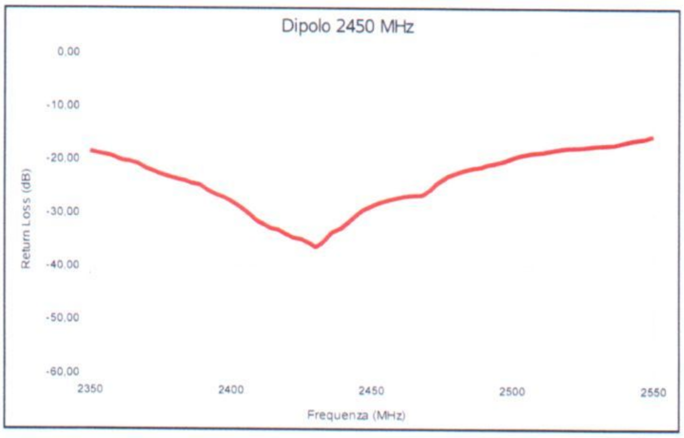
Sicom

Verification of measuring instrument

Instrument checked : REFERENCE DIPOLE
Manufacturer : ANTENNESSA / SATIMO
Model : 2450 MHz
Serial number : SN 39/05 DIPJ30
Date of inspection : 31 - 08 - 2011
Measured quantity (unit) : RETURN LOSS (dB)

Measurements

Return loss at the frequency of use : -29.80 dB



Instrumentation used for verification:

Instrument : VECTOR NETWORK ANALYZER
Manufacturer : ANRITSU
Model : MS4622B
Serial Number : 98 4502

On the basis of measurements carried out the instrument
is ☒ is not ☐
appropriate for the use within the activities of SICOM.

Test Operator : Antonio Dieni

Pag. 1 of 1

COMOSAR E-Field probe Calibration Report	SATIMO		
	Ref: CR-204-1-09-SATB-A		
	Page: 1/19	Issue: A	Date: 2011/07/23

COMOSAR E-FIELD PROBE CALIBRATION REPORT

Prepared By: LUC Jérôme, SATIMO

Project Description: SAR TEST BENCH

Prepared For (End User): SICOM

COMOSAR E-Field probe Calibration Report	SATIMO
	Ref: CR-204-1-09-SATB-A
	Page: 2/19 · Issue: A · Date: 2011/07/23

COMOSAR SEPT ISOTROPIC E-FIELD PROBE CALIBRATION REPORT

DATE: 23/07/2011

OBJECT: COMOSAR SEPT ISOTROPIC E-FIELD PROBE

MANUFACTURER: SATIMO

SERIAL NUMBER: SN 46/06 EP60

CUSTOMER: SICOM

CONTRACT:

DATE OF CALIBRATION: 23/07/2011

WARRANTY:

Date

23-07-11

SAR TEAM MANAGER

SATIMO Bretagne
Technopôle Brest Iroise
Zone du Vernis
225 rue Pierre Rivoalon
29200 BREST

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COMOSAR E-Field probe Calibration Report	SATIMO		
	Ref: CR-204-1-09-SATB-A		
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PRODUCT DESCRIPTION

Frequency Range	100 MHz - 30 GHz
Probe length	330 mm
Length of one dipole	4.5 mm
Maximum external diameter	8 mm
Probe extremity diameter	6.5 mm
Distance between dipoles/probe extremity	< 2.7 mm
Resistance of the three dipole (at the connector)	Dipole 1: R1=1.2306 MΩ Dipole 2: R2=1.0729 MΩ Dipole 3: R3=1.3666 MΩ
Connector (HIROSE series SR30)	6 wire male (Hirose SR30series)

The probe could be checked by measuring the resistance of the three dipoles.

CALIBRATION TEST EQUIPMENT

TYPE	IDENTIFICATION	DATE OF CALIBRATION
Calibration bench	CALISAR CALIBRATION SYSTEM V2.0	
Multimeter	Keithley (2000, SN: 1000572)	Date of calibration: 01-08-2010

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COMOSAR E-Field probe Calibration Report	SATIMO
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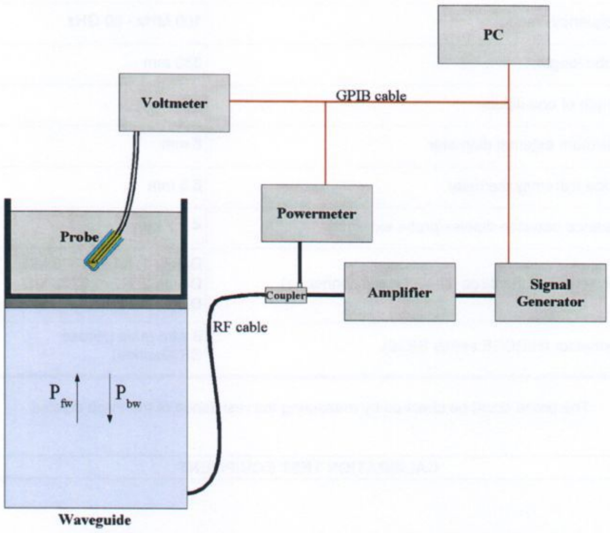
MEASUREMENT PROCEDURE

Probe calibration is realized, in compliance with CENELEC EN 50361 and IEEE 1528 std, with CALISAR, SATIMO proprietary calibration system. The calibration is performed with the EN 50361 annexe technique using reference guide at the five frequencies.



$$SAR = \frac{4\left(P_{fw} - P_{bw}\right)}{ab\delta}\cos^2\left(\pi\frac{y}{a}\right)e^{-(2z/\delta)}$$

Where :

P_{fw} = Forward Power
P_{bw} = Backward Power
a and b = Waveguide dimensions
□ = Skin depth

Keithley configuration:

Rate = Medium; Filter =ON; RDGS=10; FILTER TYPE =MOVING AVERAGE; RANGE AUTO

After each calibration, a SAR measurement is performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

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COMOSAR E-Field probe Calibration Report	SATIMO The microwave vision company		
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PROBE UNCERTAINTIES

Calibration report of dosimetric SATIMO probe

Uncertainty on calibration system

ERROR SOURCES	Uncertainty value (%)	Probability Distribution	Divisor	ci	Standard Uncertainty (%)
Incident or forward power	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Reflected power	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Liquid conductivity	5,00%	Rectangular	$\sqrt{3}$	1	2,887%
Liquid permittivity	4,00%	Rectangular	$\sqrt{3}$	1	2,309%
Field homogeneity	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Field probe positioning	5,00%	Rectangular	$\sqrt{3}$	1	2,887%
Field probe linearity	3,00%	Rectangular	$\sqrt{3}$	1	1,732%
Combined standard uncertainty					4,761%
Expanded uncertainty (confidence interval of 95%)					9,331%

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COMOSAR E-Field probe Calibration Report	SATIMO		
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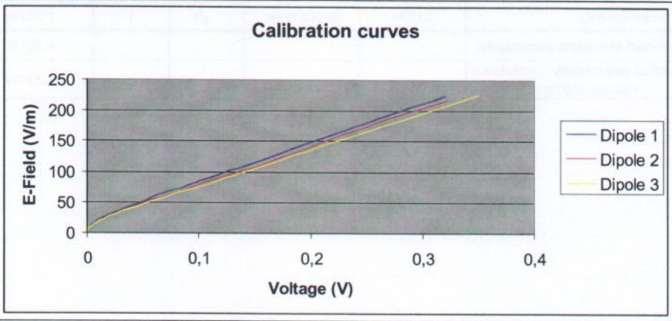
1. Calibration at 435.00 MHz

A. Calibration parameters.

Label	GSM450
Epsilon	43.21
Sigma	0.84 S/m
Temperature	21°C
Antenna gain	2.07 dB
Antenna S11	-11.01 dB
Low limit detection	1.66 V/m (2.31 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:
E=(e1*e1+e2*e2+e3*e3)pow(1/2)



The following tables represent the calibration curves linearization by curve segment in CW signal.

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COMOSAR E-Field probe Calibration Report	SATIMO The microwave vision company		
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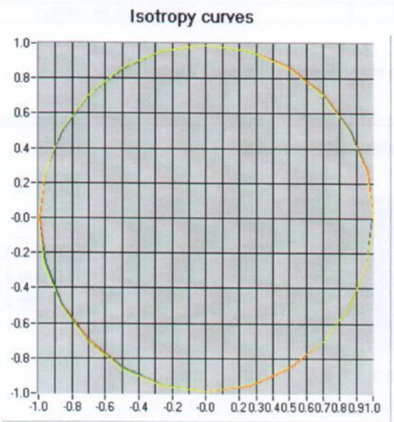
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	43.21	0.84	34.41	31.18	28.74

B. Isotropy.

- Axial isotropy: 0.03 dB
- Hemispherical isotropy: 0.04 dB



C. Linearity.

- Linearity: 0.04 dB

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COMOSAR E-Field probe Calibration Report	SATIMO		
	Ref: CR-204-1-09-SATB-A		
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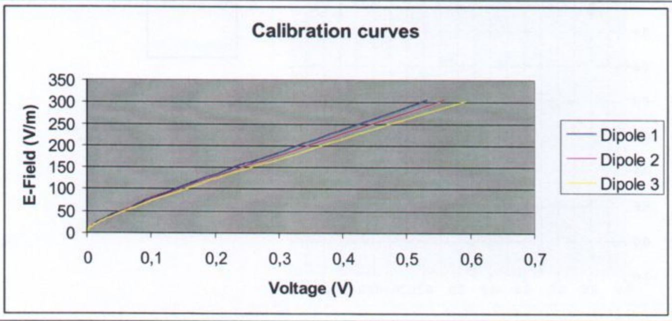
2. Calibration at 835.00 MHz

A. Calibration parameters.

Label	850
Epsilon	41.82
Sigma	0.89 S/m
Temperature	21°C
Cable loss	0.11 dB
Coupler loss	20.50 dB
Waveguide S11	-20.90 dB
Low limit detection	0.83 V/m (0.60 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:
E=(e1*e1+e2*e2+e3*e3)pow(1/2)



The following tables represent the calibration curves linearization by curve segment in CW signal.

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COMOSAR E-Field probe Calibration Report	SATIMO		
	Ref: CR-204-1-09-SATB-A		
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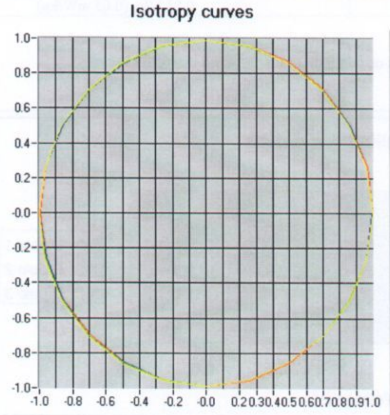
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	41.82	0.89	27.06	26.18	23.10

B. Isotropy.

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.04 dB



C. Linearity.

- Linearity: 0.03 dB

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COMOSAR E-Field probe Calibration Report	SATIMO		
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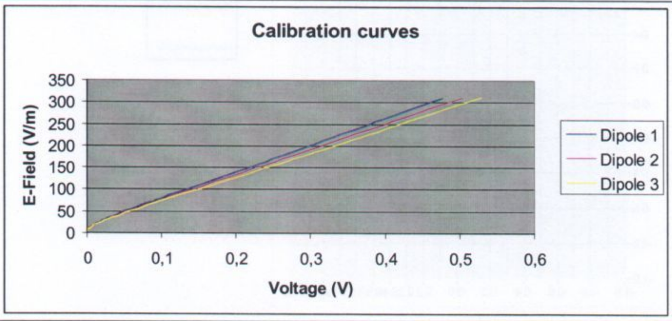
3. Calibration at 897.00 MHz

A. Calibration parameters.

Label	900
Epsilon	41.24
Sigma	0.94 S/m
Temperature	21°C
Cable loss	0.10 dB
Coupler loss	20.27 dB
Waveguide S11	-12.70 dB
Low limit detection	0.83 V/m (0.65 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:
E=(e1*e1+e2*e2+e3*e3)pow(1/2)



The following tables represent the calibration curves linearization by curve segment in CW signal.

10

COMOSAR E-Field probe Calibration Report	SATIMO
	Ref: CR-204-1-09-SATB-A
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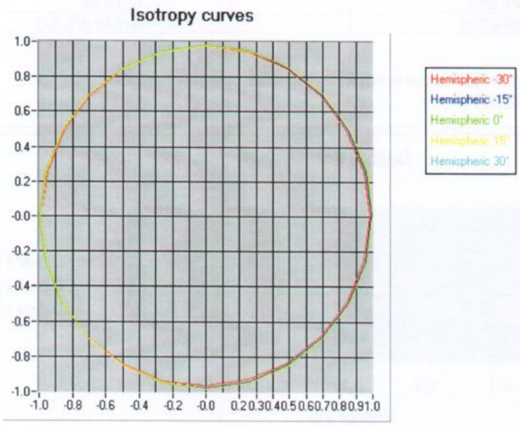
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	41.24	0.94	29.61	27.79	25.25

B. Isotropy.

- Axial isotropy: 0.06 dB
- Hemispherical isotropy: 0.06 dB



C. Linearity.

- Linearity: 0.04 dB

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COMOSAR E-Field probe Calibration Report	SATIMO		
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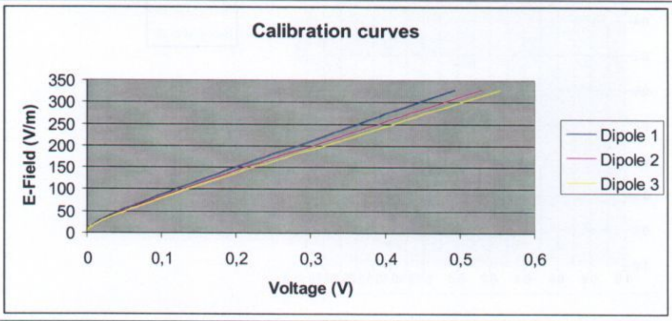
4. Calibration at 1747.00 MHz

A. Calibration parameters.

Label	1800
Epsilon	38.57
Sigma	1.36 S/m
Temperature	21°C
Cable loss	0.14 dB
Coupler loss	20.18 dB
Waveguide S11	-12.70 dB
Low limit detection	0.82 V/m (0.89 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:
E=(e1*e1+e2*e2+e3*e3)pow(1/2)



The following tables represent the calibration curves linearization by curve segment in CW signal.

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COMOSAR E-Field probe Calibration Report	SATIMO The microwave vision company		
	Ref: CR-204-1-09-SATB-A		
	Page: 13/19	Issue: A	Date: 2011/07/23

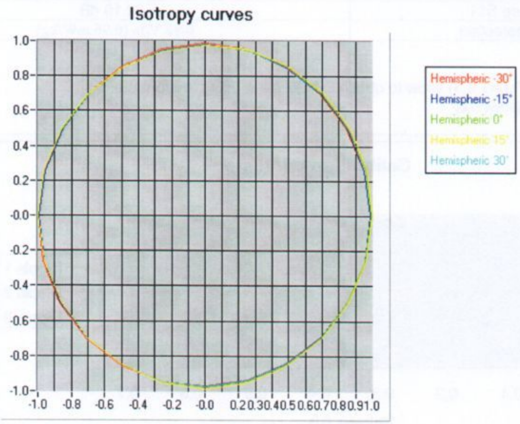
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	38.57	1.36	34.8	31.28	28.97

B. Isotropy.

- Axial isotropy: 0.08 dB
- Hemispherical isotropy: 0.07 dB



C. Linearity.

- Linearity: 0.08 dB

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COMOSAR E-Field probe Calibration Report	SATIMO	
	Ref: CR-204-1-09-SATB-A	
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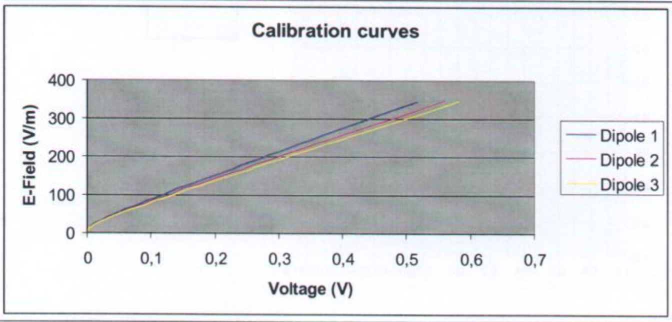
5. Calibration at 1880.00 MHz

A. Calibration parameters.

Label	1900
Epsilon	38.34
Sigma	1.45 S/m
Temperature	21°C
Cable loss	0.15 dB
Coupler loss	20.12 dB
Waveguide S11	-32.10 dB
Low limit detection	0.82 V/m (0.96 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:
E=(e1*e1+e2*e2+e3*e3)pow(1/2)



The following tables represent the calibration curves linearization by curve segment in CW signal.

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COMOSAR E-Field probe Calibration Report	SATIMO The microwave vision company		
	Ref: CR-204-1-09-SATB-A		
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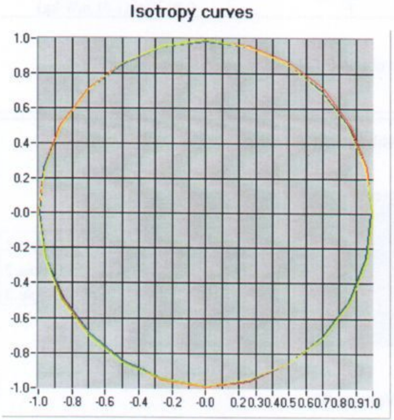
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	38.34	1.45	35.99	32.16	29.82

B. Isotropy.

- Axial isotropy: 0.06 dB
- Hemispherical isotropy: 0.06 dB



C. Linearity.

- Linearity: 0.10 dB

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COMOSAR E-Field probe Calibration Report	SATIMO
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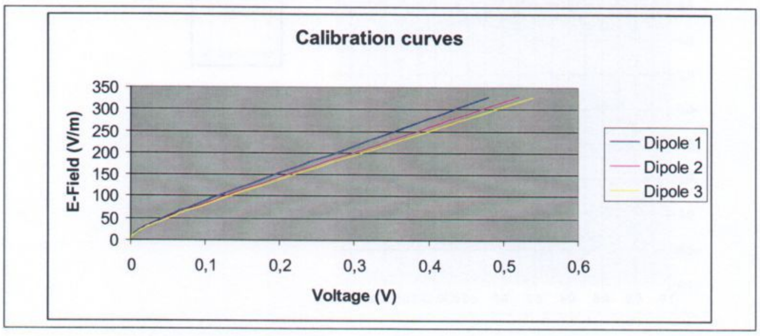
Page: 16/19	Issue: A / Date: 2011/07/23

6. Calibration at 1950.00 MHz

A. Calibration parameters.

Label	2000
Epsilon	38.19
Sigma	1.46 S/m
Temperature	21°C
Cable loss	0.14 dB
Coupler loss	20.12 dB
Waveguide S11	-31.20 dB
Low limit detection	0.83 V/m (1.01 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:
E=(e1*e1+e2*e2+e3*e3)pow(1/2)



The following tables represent the calibration curves linearization by curve segment in CW signal.

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COMOSAR E-Field probe Calibration Report	SATIMO		
	Ref: CR-204-1-09-SATB-A		
	Page: 17/19	Issue: A	Date: 2011/07/23

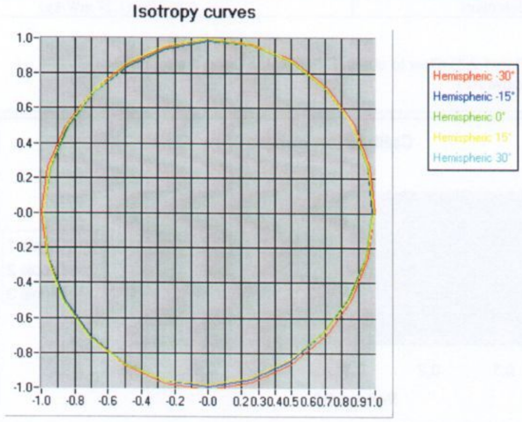
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	38.19	1.46	37.35	33.10	30.55

B. Isotropy.

- Axial isotropy: 0.08 dB
- Hemispherical isotropy: 0.10 dB



C. Linearity.

- Linearity: 0.10 dB

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COMOSAR E-Field probe Calibration Report		
	Ref: CR-204-1-09-SATB-A	
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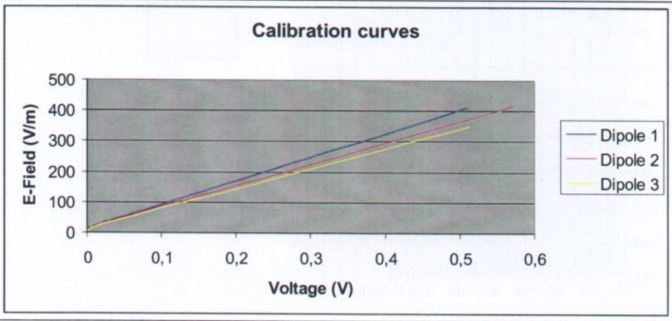
7. Calibration at 2450.00 MHz

A. Calibration parameters.

Label	2450
Epsilon	37.44
Sigma	1.75 S/m
Temperature	21°C
Cable loss	0.13 dB
Coupler loss	21.51 dB
Waveguide S11	-13.20 dB
Low limit detection	0.86 V/m (1.27 mW/kg)

Calibration curves ei=f(V) (i=1,2,3) allow to obtain E-field value using the formula:
E=(e1*e1+e2*e2+e3*e3)pow(1/2)



The following tables represent the calibration curves linearization by curve segment in CW signal.

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COMOSAR E-Field probe Calibration Report	SATIMO
	Ref: CR-204-1-09-SATB-A
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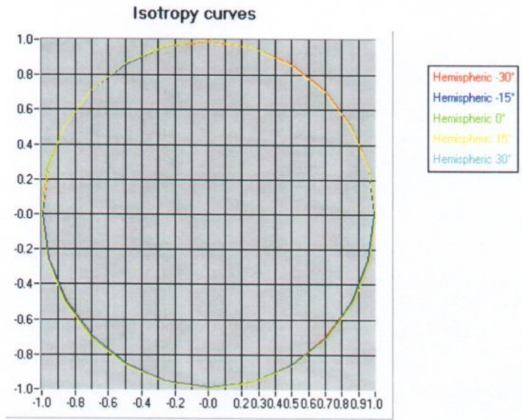
Calibration coefficients for the three dipoles in CW:

Sensitivity in liquid:

Liquid	Epsilon	Sigma (S/m)	CF dipole 1 (W.kg-1 (mV)-1)	CF dipole 2 (W.kg-1 (mV)-1)	CF dipole 3 (W.kg-1 (mV)-1)
Head	37.44	1.75	34.63	29.89	26.55

B. Isotropy.

- Axial isotropy: 0.08 dB
- Hemispherical isotropy: 0.10 dB



C. Linearity.

- Linearity: 0.11 dB

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11. Annex B: dipole reference SAR value

Report for SAR TEST SYSTEM

ANTENNESSA

SA à directoire et conseil de surveillance.
SIRET : 418 022 877 00033 – RCS BREST
Bâtiment Ponant, Avenue La Pérouse, Technopole Brest-Iroise – 29280 PLOUZANE – France.

SAR EVALUATION @ 2450 MHZ

Prepared By:	Mr. LUC Jérôme, ANTENNESSA
Project Description :	SAR TEST BENCH
Prepared For (End User) :	SICOM

1

Report for SAR TEST SYSTEM

SYSTEM VALIDATION

DATE : 17/5/2006

OBJECT : SYSTEM VALIDATION

MANUFACTURER : ANTENNESSA

CUSTOMER : SICOM

ORDER :

DATE OF CALIBRATION : 17/5/2006

WARRANTY :

Date

ANTENNESSA
Bâtiment PONANT
Ave La Perouse
Zone du Technopôle Brest Iroise
29280 PLOUZANE

SAR TEAM MANAGER

PRESIDENT

2

Report for SAR TEST SYSTEM

Date of measurement: 17/5/2006

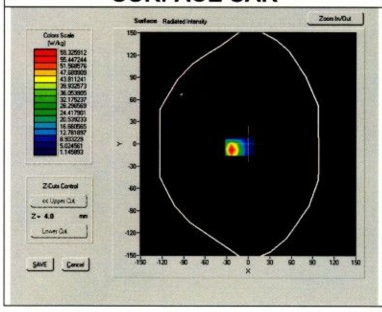
Experimental conditions.

Phantom File	surf_sam_plan.txt, Adaptative 1 max
Phantom	Validation plane
Device Position	Dipole
Band	CUSTOM (Bluetooth)
Channels	--
Signal	Duty Cycle: 1.00

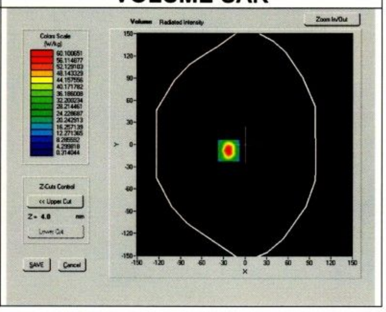
SAR Measurement Results

Frequency (MHz)	2450.000000
Relative permitivity (real part)	52.709999
Relative permitivity (imaginary part)	14.332287
Conductivity (S/m)	1.953444
Variation (%)	0.230000

SURFACE SAR



VOLUME SAR



	SAR (W/kg)	SAR (W/kg/W)
SAR 10g	23.380744	**23.38**
SAR 1g	51.200142	**51.20**

Dipole input power=30 dBm

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12. Annex C: dipole historical data

Sicom

Dipole historical data

Instrument checked	: REFERENCE DIPOLE
Manufacturer	: ANTENNESSA / SATIMO
Model	: 2450 MHz
Serial number	: SN 39/05 DIPJ30
Date of inspection	: 16/09/2011
Measured quantity (unit)	: SAR

Pag. 1 of 3

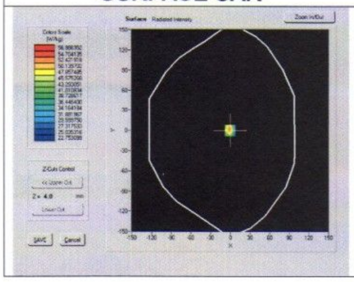
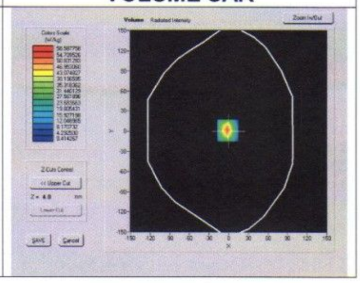
Date of measurement: 16/09/2011

Experimental conditions.

Phantom File	surf_sam_plan.txt, Adaptative 1 max
Phantom	Validation plane
Device Position	Dipole
Band	CUSTOM (Bluetooth)
Channels	--
Signal	Duty Cycle: 1.00

SAR Measurement Results

Frequency (MHz)	2450.000000
Relative permitivity (real part)	52.428000
Relative permitivity (imaginary part)	14.358956
Conductivity (S/m)	1.957079
Variation (%)	0.200000

SURFACE SAR	VOLUME SAR
	

	SAR (W/kg)	SAR (W/kg/W)
SAR 10g	23.569271	**23.57**
SAR 1g	51.570322	**51.57**

Dipole input power = 30 dBm

	SAR (W/Kg)	SAR REFERENCE MANUFACTURER VALUE (W/Kg)	VARIATON (%)	VERDICT
SAR 10g	23,57	23,38	+0,81	PASS
SAR 1g	51,57	51,20	+0,72	PASS

On the basis of measurements carried out the instrument
is ☒ is not ☐
appropriate for the use within the activities of SICOM.

Test Operator : ....