Test Report

Test Report Identifier:

SC-1402-516-03

Tested Device:

Wireless Bodypack Transmitter –
dBtechnologies MOVING ONE-B

According to the standard(s):

FCC KDB 447498 D01 v06

Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies - General RF Exposure Guidance

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	A.E.B. Industriale s.r.l. a socio unico
V.A.T. number	IT02685631208
Address	Via G.Brodolini 8
City	Valsamoggia Loc. Crespellano (BO)
Postal Code	40053
Country	Italy
Telephone number	+39 051 969870
Contact person name	Andrea Molinari
Contact person e-mail	a.molinari@dbtechnologies-aeb.com

Product Identification	
Device type (brief description)	Wireless Bodypack Transmitter
Trademark / Brand	dBtechnologies
Model name	MOVING ONE-B
Hardware version	1
Software / Firmware version(s)	1
Antenna informations	fixed, not removable, semi-rigid linear antenna; lenght 85 mm
Accessories informations	non conductive belt clip microphone with MINI XLR 4P connector
Power Source	3V (2 x Alkaline battery size AA)
Battery data	Duracell ultra power 1,5V LR6 AA
FCC ID	2ADDV-MOVINGONEB
RF exposure environment	general public

Test Standard: KDB 447498 D01 v06 10/23/2015 - *Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies - General RF Exposure Guidance*

Technical Standards: KDB 865664 D01 v01r04 08/07/2015 - *SAR Measurement for 100 MHz to 6 GHz*

IEEE1528: 2013 - *IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques*

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

Tested Device:

Sample A: dBtechnologies MOVING ONE-B

IMEI / Serial number: sample 1

Supported mode: FM analog (Peak deviation = ±35 kHz max)

Supported band: 518-542 MHz (frequency range 518.150 to 541.900 MHz)

Type of antenna: fixed, not removable, semi-rigid linear antenna; lenght 85 mm

Power: 26.9 mW at 541.900 MHz (max conducted).

Date of Report: 07 December 2015

Test headquarters: Sicom test s.r.l - Via dell'Industria 9 (Loc. Begliano)

I-34075 San Canzian d'Isonzo Gorizia GO Italy

Test site: Sicom test s.r.l - AREA Science Park

Padriciano 99 - I-34149 Trieste Italy

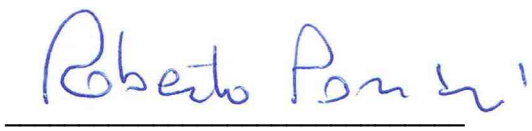
Total number of pages: 59

This test report includes the following sections:

1. General information
2. Photographs
3. Test description
4. Test equipment and test conditions
5. System validation check data
6. Test results
7. Evaluation
8. Uncertainty evaluation
9. System validation check uncertainty
10. Annex A: Electric field probe calibration reports
11. Annex B: dipoles reference SAR value and calibration

Test Operator: Antonio Dieni

Technical responsible: Roberto Passini



2. Photographs

Figure 1 – The tested device, front view

Figure 2 – The tested device, rear view

Figure 3 – The tested device, top view

Figure 4 – The tested device, label

Figure 5 – The tested device with its receiver

Figure 6 – The tested device during test

Figure 7 – The tested device during test

Figure 8 – Tested Device position: with the back side against the phantom

Figure 9 – Tested Device position: with the back side against the phantom (detail)

Note1: DUT antenna tip distance from the shell: 13 mm

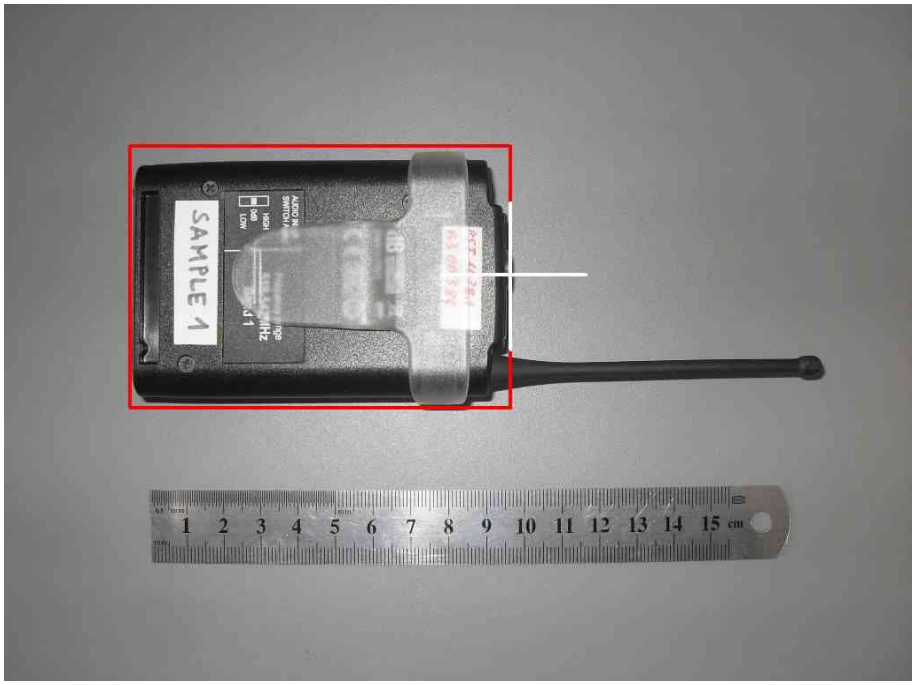


Figure 10 – Device positioning for peak SAR locations

Note2: DUT rectangle dimensions: 91 mm x 59 mm; Antenna length 85 mm
Note3: DUT cross coincides with the center of the shell in all measurements

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, head and/or other configurations included in the Test Standard.
The Test Standard generally require SAR evaluation for devices that have a radiating element normally operating at or below 6 GHz, with a separation distance of up to 20 cm between the user and the device and specifies measurement methods in accordance with the latest version of IEEE 1528 and/or IEC EN 62209 series technical standards. A list of accepted FCC KDB procedures and/or IC Notices for SAR measurements details for specific families of devices is also given in Technical Standard(s) paragraph.
The exposure limits are specified in the Test Condiction section and are generally referred in the Test Standard for General Public / Uncontrolled Environment exposure or in general references such as Health Canada's RF exposure guideline or European Council Recommendation 1999/519/EC.
The results of Specific Absorption Rate (SAR) measurements are compared directly to the limit and the DUT is declared to fulfill the requirements of the standard if the measured values are less than or equal to the limit.

The Dosimetric Assessment System
The SAR Dosimetric Assessment System used is able to determine the SAR distribution inside a phantom conforming to the European, Canadian 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.

Figure 11 - 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 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 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 ± 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 ± 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 1 g (or 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 ± 10% of the target value, determined during the system validation.
During all the tests is monitored ambient temperature of the laboratory and liquid, relative humidity and that 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 except those required for normal operating conditions (defined by the manufacturer or by the intended use of the tested device).
The output power and frequency are controlled using a network emulator when applicable. In any case the tested device is set to transmit at its highest output peak power level on the required frequencies of each transmitting band.
For “head” measurements the device is tested in the “cheek” and “tilt” positions on left and right sides of the phantom at the required test conditions and test frequencies of each transmitting band (tipically following the IEC EN 62209-1 or IEEE 1528 provisions). If the mobile phone has a retractable antenna, all of the tests are performed both with the antenna fully extended and fully retracted.

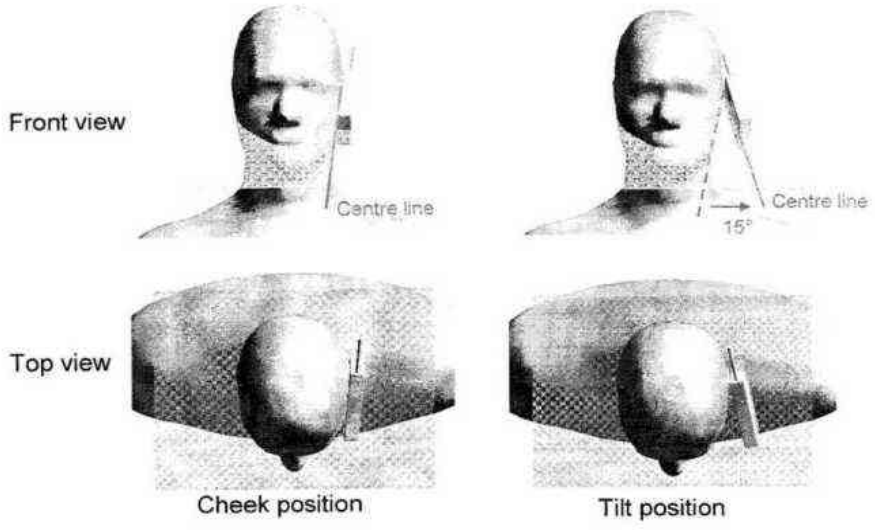


Figure 12 - “cheek” and “tilt” positions of the mobile phone on the left side

For “body” measurements the device is tested in the body operating configurations (tipically following the IEC EN 62209-2 or FCC KDB or IC DRS Notices provisions), 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 also.
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 stated by the standards. If the mobile phone has a retractable antenna, all of the tests are performed both with the antenna fully extended and fully retracted. Any measurement detail related to bands, channels, and configurations is enumerated in Test Condictions section.

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 30mm³ (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.

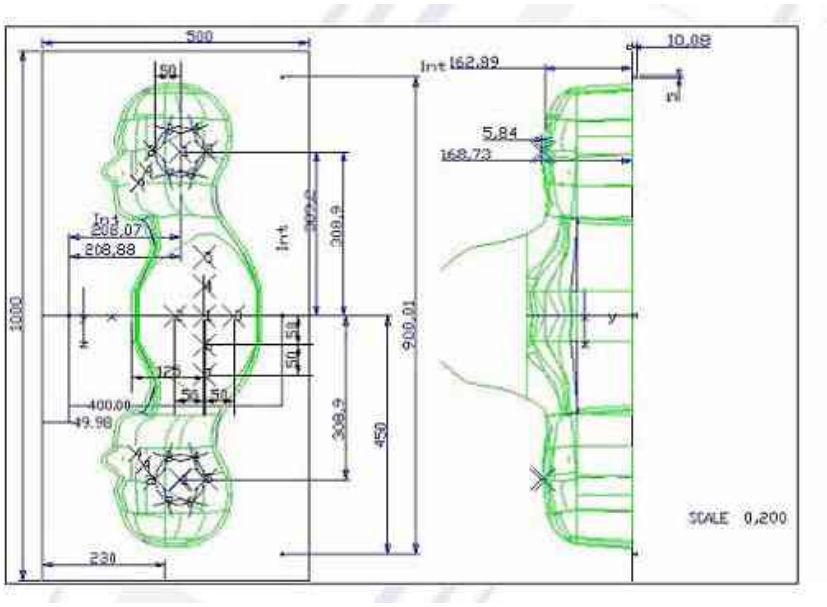


Figure 13 - SAM and ellipsoidal shell

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, EN 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.

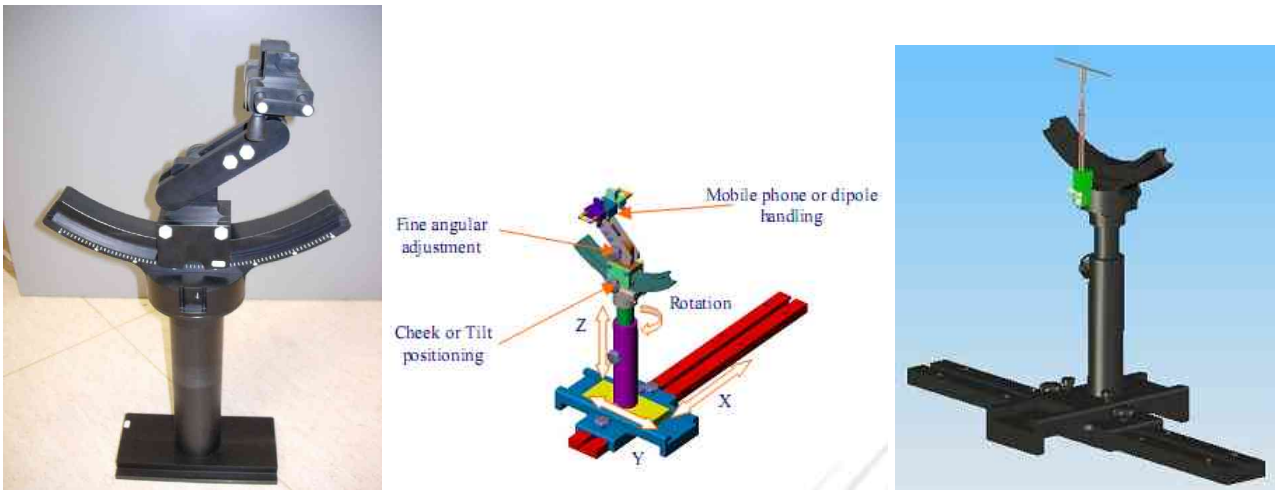


Figure 14 - positioning holder overview

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.

Figure 15 - 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, 750, 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

Test Equipment:

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	15 months	27/02/2015
Dipole	450 MHz	Satimo	SN 39/05 DIPB26	24 months	21/02/2014
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	26/02/2014
Tissue-simulating liquid	450 MHz 750 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	24 months	19/02/2014
Power amplifier	RF 4002000-2	RFPA	52627	N.S.	-
Signal Generator	SMIQ03B	Rohde & Schwarz	831389/028	24 months	11/03/2014
Power meter	NRVS	Rohde & Schwarz	827023/049	24 months	11/03/2014
Sensor head	NRV-Z51	Rohde & Schwarz	829759/003	24 months	11/03/2014
Directional coupler	ZFDC-20-5	Minicircuits	--	24 months	11/03/2014
Directional coupler	R433563000	Radiall	--	24 months	11/03/2014
Attenuator 20 dB	HP8941A	HP	2708A44001	24 months	11/03/2014
Vector Network Analyser	MS4622B	Anritsu	984502	24 months	24/02/2014
Digital Spectrum Analyzer / Radio Transmitter Tester	MS8609A	Anritsu	6200456808	24 months	12/03/2014
Test Fixture / Antenna Coupler	4916	Willtek	LX717852	24 months	12/01/2015

N.S. = no perioc calibration required

Test Conditions:

The testing has been performed within the period:

From: 01 December 2015

To: 01 December 2015

Ambient Conditions:

Temperature: +22°C ± 2°C

Tested device conditions:

DUT Use: Portable bodypack transmitter.
DUT Sample: Supplied from the manufacturer as production units.
DUT Mode: FM analog (Peak deviation = ±35 kHz max).
Band: 518-542 MHz (frequency range 518.150 to 541.900 MHz).
Power Source: Two alkaline battery (2 x 1,5V AA).
DUT Antenna: Fixed, not removable, semi-rigid linear antenna; lenght 85 mm.
DUT Accessories: Microphone with MINI XLR 4P connector. Device can only operate with the accessory connected.
DUT fixings: Device marketed with a not removable belt clip built in plastic material and positioned on the back side of the DUT.

Test mode conditions:

Test signal: The tested device transmit continuously.
Duty factor: CW (a 100% duty factor were used in the test).
RF power: DUT power setting selected for highest level: “50 mW”. Antenna port is not available on the supplied device and is not possible arrange an RF antenna connector to support conducted power measurements. Power level verified separately, basing on the test report with the code FCCTR_151063B-0 (date 19/10/2015) supplied from the Customer, and also verified with spectrum analyzer and precalibrated test fixture.
Battery drift: To minimize the battery influence the battery were changed with new and full charge battery every SAR measurement. Also the battery drift was evalued, with a radiated E-field comparation between the first and the last measurement, and recorded. If the power deviation more than 5% occurred, the test was repeated.
Distance: Separation distance between the device and the phantom = **0.0 mm**
Positioning: The device is tested in the body-worn operating configuration with a separation distance of 0.0 mm between the device and the flat phantom with the back side (belt clip) against the phantom. When necessary a foam spacer were used to keep the tested device antenna straight.
Test channels/frequencies: 3, according to KDB 447498, high channel with the highest output power tested first.
1. lowest channel 518.150 MHz (device channel N0, conducted power 11.0 mW);
2. middle channel 529.650 MHz (device channel A4, conducted power 18.6 mW);
3. highest channel 541.900 MHz (device channel F7, conducted power 26.9 mW).

SAR test reduction considerations: none.

Tested Configurations: Body-worn with cable/microphone connected (the operational configuration).

Exposure limit applied:

FCC Limit for General population/Uncontrolled exposure
Spatial Peak (averaged over any 1g of tissue) limit: **1.6 W/Kg**

5. System validation check data

Measurement for Tissue Simulant Liquid

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 DUT.

Figure 16 - Open coaxial probe with the bottle cap

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

Date of measurement: 01 December 2015;

Temperature: 22.6°C.

Band	Tissue Type	Frequency**	Values*	ε'r relative permittivity	σ conductivity (S/m)
518-542 MHz	Body	450.000 MHz	Target value	56.7	0.94
			± 5% range	53.865 - 59.535	0.893 - 0.987
			Measured	**56.52**	**0.944**
518-542 MHz	Body	518.150 MHz	Target value	56.43	0.945
			± 5% range	53.609 - 59.252	0.898 - 0.992
			Measured	**56.19**	**0.948**
518-542 MHz	Body	529.650 MHz	Target value	56.39	0.946
			± 5% range	53.571- 59.209	0.899 - 0.993
			Measured	**56.15**	**0.950**
518-542 MHz	Body	541.900 MHz	Target value	56.34	0.947
			± 5% range	53.523- 59.157	0.900 - 0.994
			Measured	**56.13**	**0.952**

* target values from KDB 865664, linear interpolated.
** test frequencies from KDB 447498 § 4.1.

Tissue simulant theoretical composition of ingredients (in % by weight):

Tissue-simulating liquid body 450 MHz 750 MHz	Water: 51.18 % Sucrose: 46.76 % NaCl salt:1.48 % Hydroxyethil cellulose: 0.51 % Bactericide: 0.05% DGBE: Diethylenglykol-monobutylether: 0.01 %

SAR system verification

SAR measurement system verification procedure

The microwave circuit arrangement for system verification is showed in the bottom figure. 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 DUT. 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.

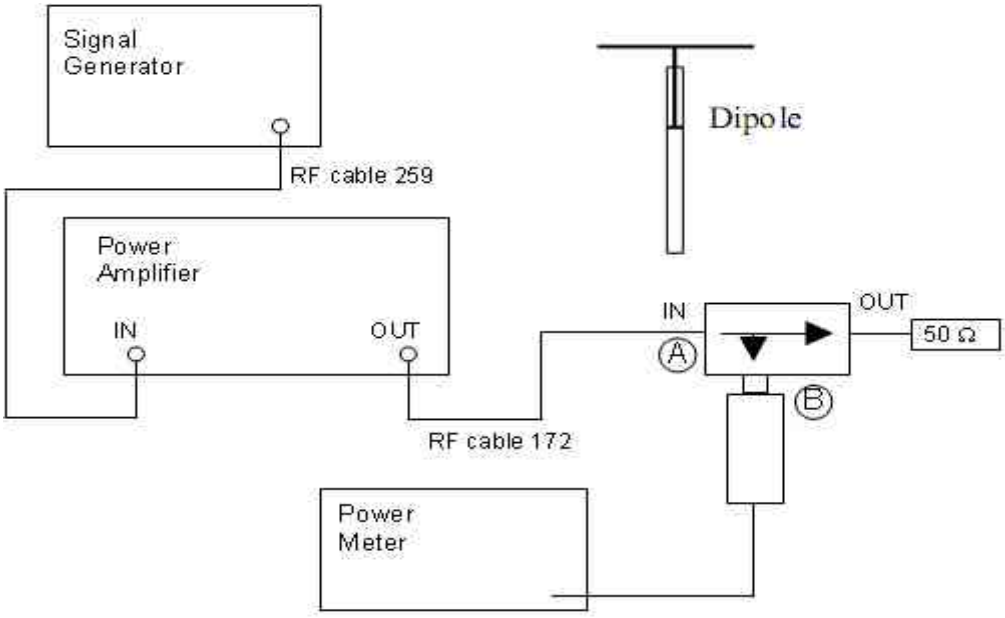


Figure 17 - System verification scheme

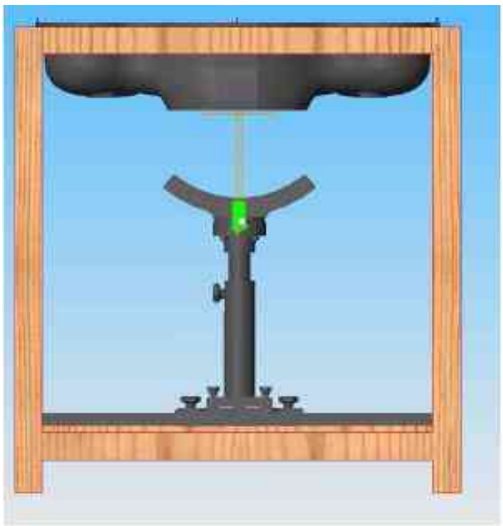


Figure 18 - Reference dipole position for system verification

VALIDATION 1

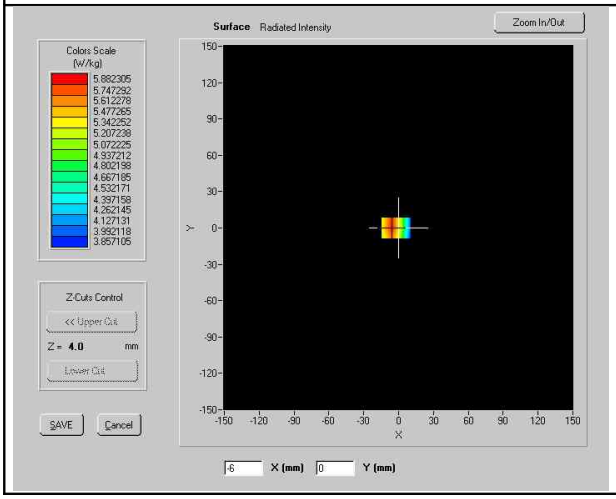
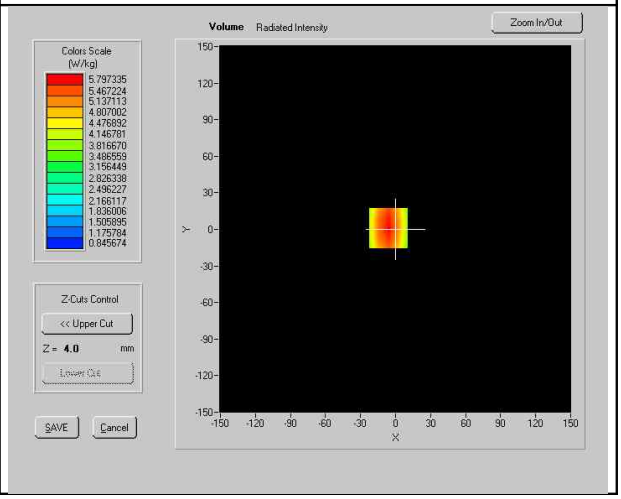
Type: Dipole measurement (Complete)
Date of measurement: 01/12/2015

A. Experimental conditions.

Phantom	Flat ellipsoidal shell
Device Position	Dipole
Band	450
Channel	Middle
Signal	CW (Duty Cycle: 1:1)
Dipole input power	1 W
Probe	EP60
Probe Path	Adaptative 1 max
Liquid Temperature	22.6 °C

B. SAR Measurement Results

Frequency (MHz)	450.0
Relative permittivity (real part)	56.52
Conductivity (S/m)	0.944
Maximum location	X=-6.00, Y=0.00

SURFACE SAR	VOLUME SAR
	

SAR	SAR (W/kg)	Target value* (W/kg)	Variation (%)
SAR 1g	5.186	5.05	+2.7

* target value from manufacturer calibration dipole reference SAR.

6. Test results

MEASUREMENT 1

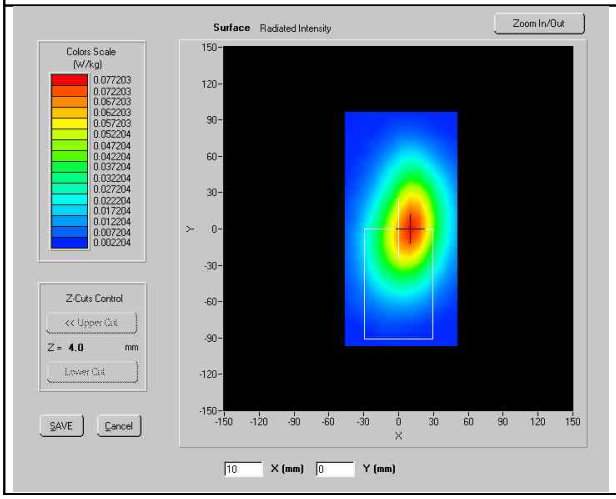
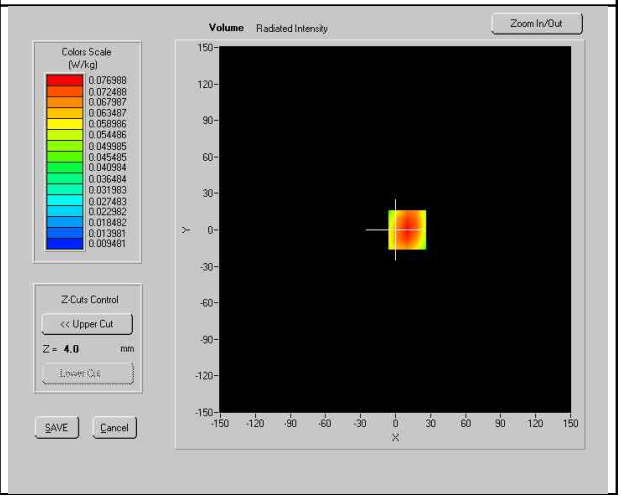
Type: Phone measurement (Complete)
Date of measurement: 01/12/2015
Tested device / Serial number / IMEI: sample 1

A. Experimental conditions.

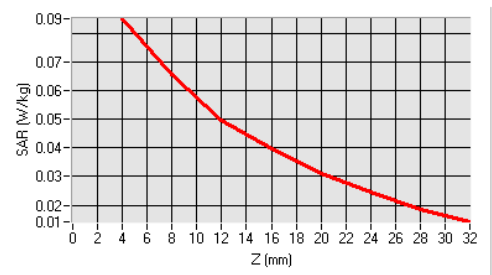
Phantom	Flat ellipsoidal shell SN 46/07 ELLI13
Device Use	Body-worn
DUT Position	With the back side against the phantom
Antenna Position	Fixed
Accessories	Belt clip Cable/microphone connected
Band	518-542 MHz
Channel	HIGH (F7)
Frequency	541.900 MHz
Transmission modulation	FM analog
Signal	CW (Duty Cycle: 1:1)
Probe Path	Flat (-46<=X<=50, -96<=Y<=96) mm
Distance	d=0 mm
Probe	EP60
Liquid temperature	22.5°C ÷ 22.6°C

B. SAR Measurement Results

Frequency (MHz)	541.900
Relative permittivity (real part)	56.13
Conductivity (S/m)	0.952
Battery Power drift	-0.24 %
Peak SAR location	X=10, Y=0

SURFACE SAR	VOLUME SAR
	

Z-scan



SAR	Measured SAR (W/kg)	Limit (W/kg)	Result
SAR 1g	0.082	1.6	**PASS**

MEASUREMENT 2

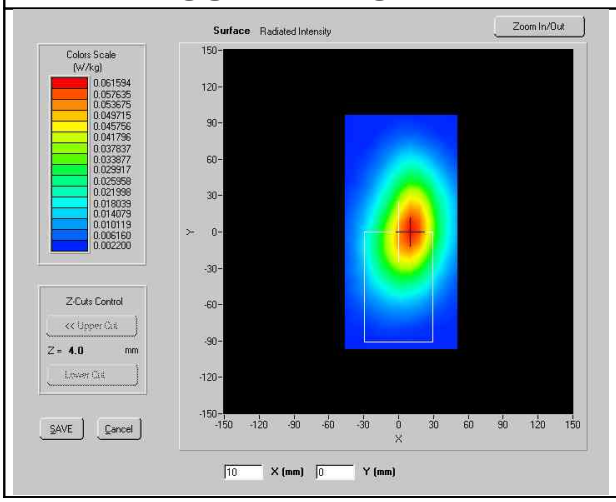
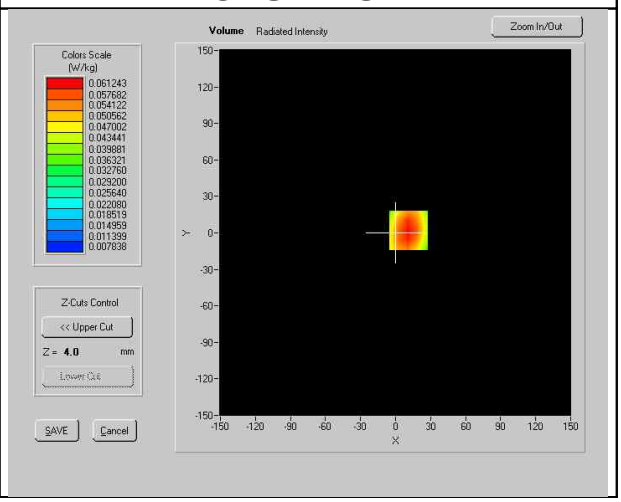
Type: Phone measurement (Complete)
Date of measurement: 01/12/2015
Tested device / Serial number / IMEI: sample 1

A. Experimental conditions.

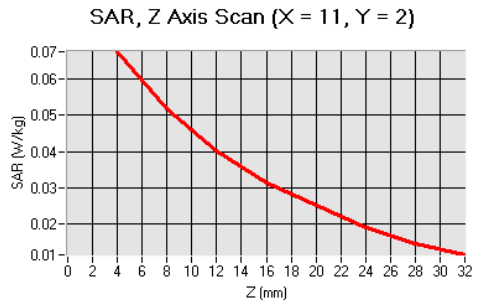
Phantom	Flat ellipsoidal shell SN 46/07 ELLI13
Device Use	Body-worn
DUT Position	With the back side against the phantom
Antenna Position	Fixed
Accessories	Belt clip Cable/microphone connected
Band	518-542 MHz
Channel	MIDDLE (A4)
Frequency	529.650 MHz
Transmission modulation	FM analog
Signal	CW (Duty Cycle: 1:1)
Probe Path	Flat (-46<=X<=50, -96<=Y<=96) mm
Distance	d=0 mm
Probe	EP60
Liquid temperature	22.5°C ÷ 22.6°C

B. SAR Measurement Results

Frequency (MHz)	529.650
Relative permittivity (real part)	56.15
Conductivity (S/m)	0.950
Battery Power drift	-0.13 %
Peak SAR location	X=10, Y=0

SURFACE SAR	VOLUME SAR
	

Z-scan



SAR	Measured SAR (W/kg)	Limit (W/kg)	Result
SAR 1g	0.066	1.6	**PASS**

MEASUREMENT 3

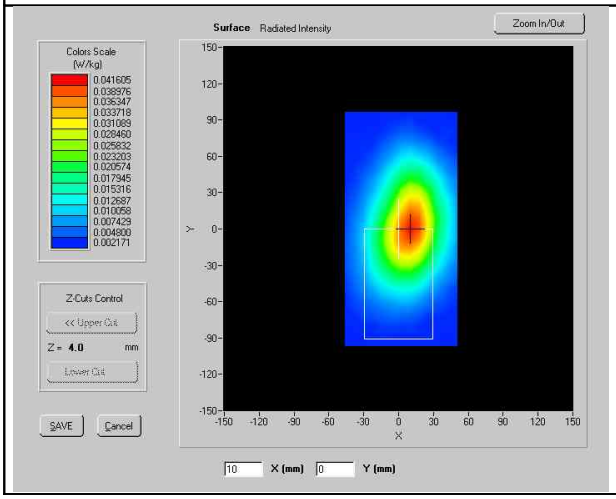
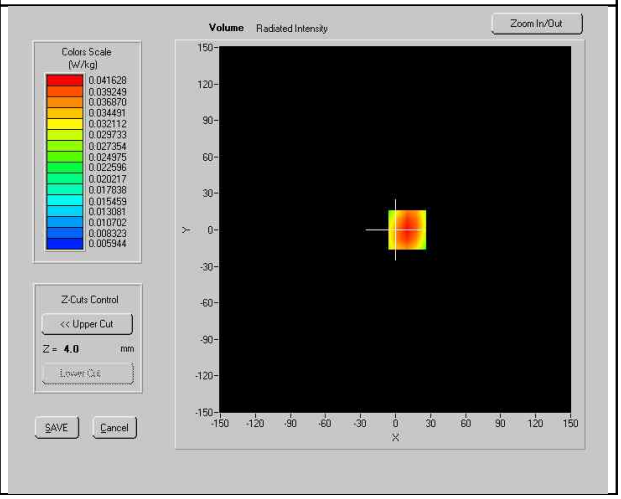
Type: Phone measurement (Complete)
Date of measurement: 01/12/2015
Tested device / Serial number / IMEI: sample 1

A. Experimental conditions.

Phantom	Flat ellipsoidal shell SN 46/07 ELLI13
Device Use	Body-worn
DUT Position	With the back side against the phantom
Antenna Position	Fixed
Accessories	Belt clip Cable/microphone connected
Band	518-542 MHz
Channel	LOW (N0)
Frequency	518.150 MHz
Transmission modulation	FM analog
Signal	CW (Duty Cycle: 1:1)
Probe Path	Flat (-46<=X<=50, -96<=Y<=96) mm
Distance	d=0 mm
Probe	EP60
Liquid temperature	22.5°C ÷ 22.6°C

B. SAR Measurement Results

Frequency (MHz)	518.150
Relative permittivity (real part)	56.19
Conductivity (S/m)	0.948
Battery Power drift	0.49 %
Peak SAR location	X=10, Y=0

SURFACE SAR	VOLUME SAR
	

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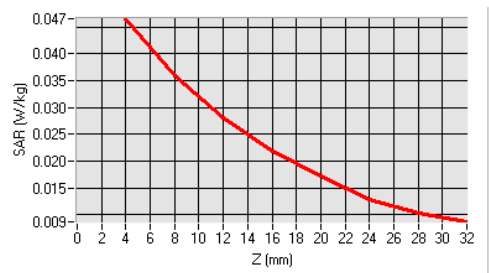


SAR	Measured SAR (W/kg)	Limit (W/kg)	Result
SAR 1g	0.045	1.6	**PASS**

7. Evaluation

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

Meas. #	Band	Frequency	Mode	Phantom	DUT side against the phantom	Antenna	Measured SAR 1g (W/kg)	Limit SAR 1g (W/kg)	Result
1	518-542 MHz	541.900 MHz	FM Max power setting 50 mW	flat ellipsoidal	back (belt clip)	fixed	**0.082**	1.6	Pass
2	518-542 MHz	529.650 MHz	FM Max power setting 50 mW	flat ellipsoidal	back (belt clip)	fixed	0.066	1.6	Pass
3	518-542 MHz	518.150 MHz	FM Max power setting 50 mW	flat ellipsoidal	back (belt clip)	fixed	0.045	1.6	Pass

The maximum Specific Absorption Rate (SAR) averaged over 1g, determined at 541.900 MHz frequency in FM mode, of the Wireless Bodypack Transmitter – dBtechnologies MOVING ONE-B portable unit, is **0.082 W/kg**.

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

The SAR 1g exposure limit applied, as detailed in the FCC KDB 447498 D01 v06 “Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies - General RF Exposure Guidance” for General population/Uncontrolled exposure - Spatial Peak (averaged over any 1g of tissue)

is equal to **1.6 W/Kg.**

This unit as tested is found to be **COMPLIANT** with this requirement.

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.

The following table includes the uncertainty table of the IEEE 1528:2013.
The values are determined by the manufacturer of SAR System.

UNCERTAINTY EVALUATION FOR HANDSET SAR TEST

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	E.2.1	7.0	N	1	1	1	7.00	7.00	∞
Axial Isotropy	E.2.2	1.5	R	$\sqrt{3}$	$(1\text{-}Cp)^{1/2}$	$(1\text{-}Cp)^{1/2}$	0.61	0.61	∞
Hemispherical Isotropy	E.2.2	1.7	R	$\sqrt{3}$	$\sqrt{Cp}$	$\sqrt{Cp}$	0.69	0.69	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	E.2.4	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	E.2.5	2.4	R	$\sqrt{3}$	1	1	1.39	1.39	∞
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.02	∞
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
RF ambient Conditions - noise	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient Conditions - reflections	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	E.5	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Test sample Related									
SAR scaling / Power scaling	E.6.5	0.0	R	$\sqrt{3}$	1	1	0.0	0.0	∞
Test sample positioning	E.4.2	0.03	N	1	1	1	0.03	0.03	N-1
Device Holder Uncertainty	E.4.1	5.00	N	1	1	1	5.00	5.00	N-1
Output power Variation - SAR drift measurement	E.2.9	3.0	R	$\sqrt{3}$	1	1	1,7320	1,7320	∞

Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Liquid conductivity - deviation from target value	E.3.2	1.54	R	$\sqrt{3}$	0.64	0.43	0.57	0.38	∞
Liquid conductivity - measurement uncertainty	E.3.3	5.00	N	1	0.64	0.43	3.20	2.15	M
Liquid permitivity - deviation from target value	E.3.2	1.12	R	$\sqrt{3}$	0.6	0.49	0.39	0.32	∞
Liquid permitivity - measurement uncertainty	E.3.3	10.00	N	1	0.6	0.49	6.00	4.90	M
Temp. unc. - Conductivity	E.3.4	1.7	R	$\sqrt{3}$	0.78	0.71	0.8	0.7	∞
Temp. unc. - Permittivity	E.3.4	0.4	R	$\sqrt{3}$	0.23	0.26	0.05	0.06	∞
Combined Standard Uncertainty			RSS				11.90	11.42	
Expanded Uncertainty (95% Confidence interval)			k = 2				23.80	22.64	

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.

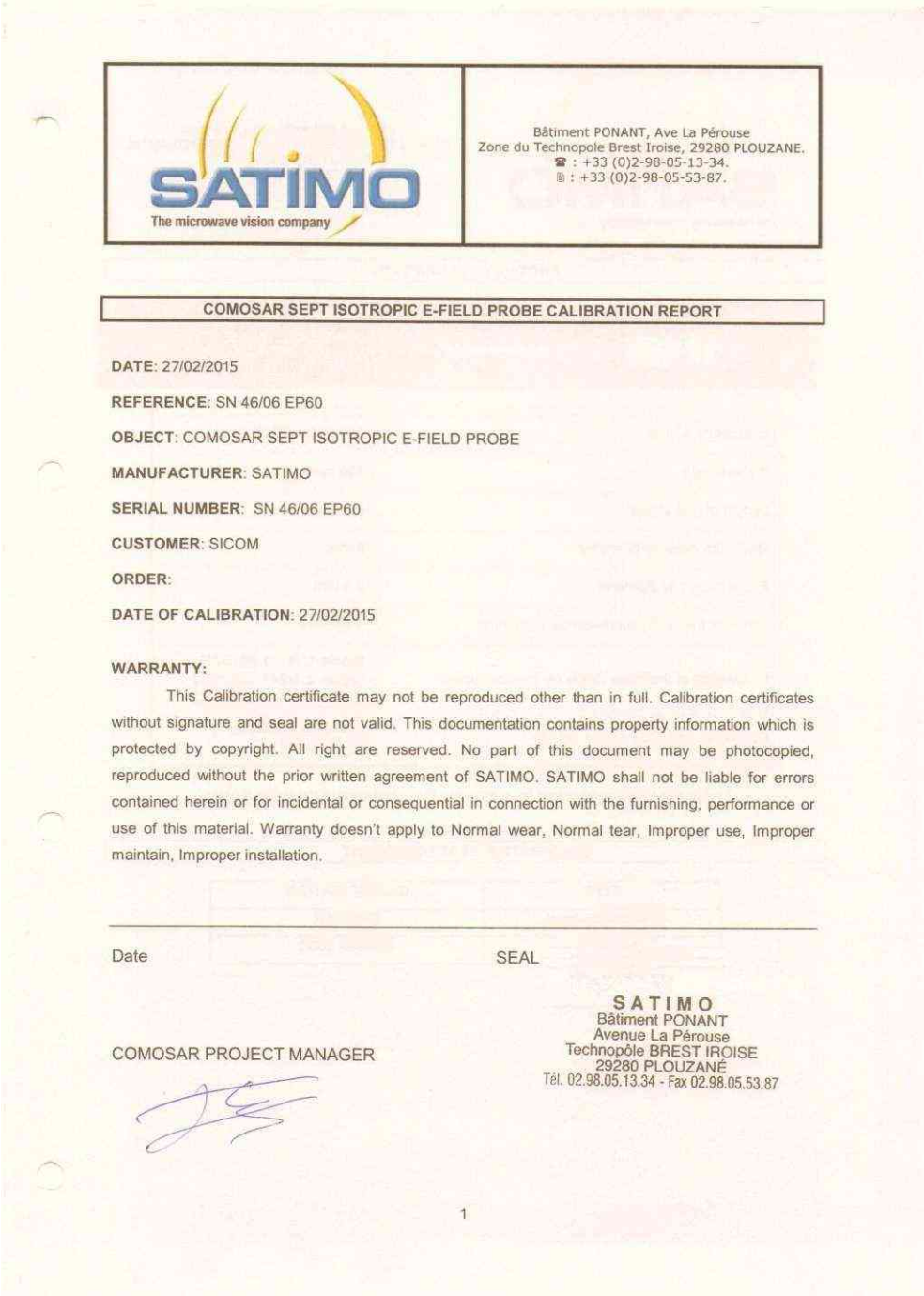
The following table includes the uncertainty table of the IEEE 1528:2013.
The values are determined by the manufacturer of SAR System.

UNCERTAINTY FOR SYSTEM PERFORMANCE CHECK

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	E.2.1	7.0	N	1	1	1	7.00	7.00	∞
Axial Isotropy	E.2.2	1.5	R	$\sqrt{3}$	$(1\text{-}Cp)^{1/2}$	$(1\text{-}Cp)^{1/2}$	0.61	0.61	∞
Hemispherical Isotropy	E.2.2	1.7	R	$\sqrt{3}$	$\sqrt{Cp}$	$\sqrt{Cp}$	0.69	0.69	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	E.2.4	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	E.2.5	0	R	$\sqrt{3}$	1	1	0.0	0.0	∞
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.02	∞
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
RF ambient Conditions - noise	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient Conditions - reflections	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	E.5	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole									
Deviation of experimental dipole from numerical dipole	E.6.4	5.0	N	1	1	1	5.0	5.0	∞
Dipole axis to liquid Distance	8,E.6.6	1.00	N	$\sqrt{3}$	1	1	0.58	0.58	N-1
Input power and SAR drift measurement	8,6.6.4	2.00	R	$\sqrt{3}$	1	1	1.1547	1,1547	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R		1	1	0.03	0.03	∞

Liquid conductivity - deviation from target value	E.3.2	1.54	R	$\sqrt{3}$	0.64	0.43	0.57	0.38	∞
Liquid conductivity - measurement uncertainty	E.3.3	5.00	N	1	0.64	0.43	3.20	2.15	M
Liquid permitivity - deviation from target value	E.3.2	1.12	R	$\sqrt{3}$	0.6	0.49	0.39	0.32	∞
Liquid permitivity - measurement uncertainty	E.3.3	10.00	N	1	0.6	0.49	6.00	4.90	M
Temp. unc. - Conductivity	E.3.4	1.7	R	$\sqrt{3}$	0.78	0.71	0.8	0.7	∞
Temp. unc. - Permittivity	E.3.4	0.4	R	$\sqrt{3}$	0.23	0.26	0.05	0.06	∞
Combined Standard Uncertainty			RSS				10.005	9.985	
Expanded Uncertainty (95% Confidence interval)			k = 2				20.01	19.97	

10. Annex A: Electric field probe calibration reports



SATIMO
The microwave vision company

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COMOSAR SEPT ISOTROPIC E-FIELD PROBE CALIBRATION REPORT

DATE: 27/02/2015

REFERENCE: SN 46/06 EP60

OBJECT: COMOSAR SEPT ISOTROPIC E-FIELD PROBE

MANUFACTURER: SATIMO

SERIAL NUMBER: SN 46/06 EP60

CUSTOMER: SICOM

ORDER:

DATE OF CALIBRATION: 27/02/2015

WARRANTY:

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Date

SEAL

SATIMO
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Avenue La Pérouse
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29280 PLOUZANÉ
Tél. 02.98.05.13.34 - Fax 02.98.05.53.87

COMOSAR PROJECT MANAGER

1

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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
Calibration bench	CALISAR
Multimeter	Keithley 2000

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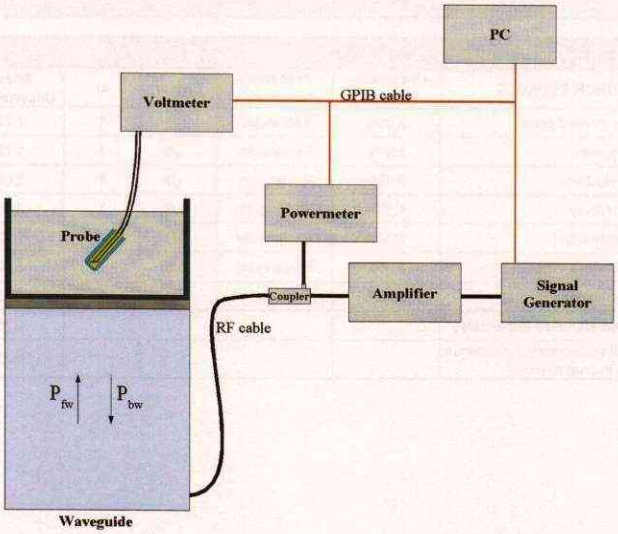
MEASUREMENT PROCEDURE

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.



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

Where :

P_{fw}	= Forward Power
P_{bw}	= Backward Power
a and b	= Waveguide dimensions
δ	= 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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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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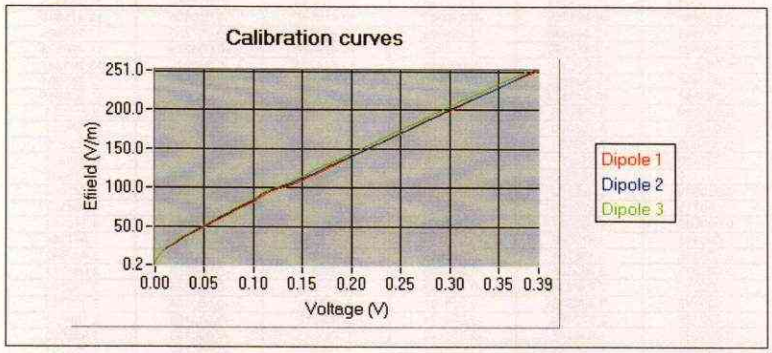
1. Calibration at 450.00 MHz

A. Calibration parameters.

Label	GSM450
Epsilon	43.33
Sigma	0.84 S/m
Temperature	21°C
Antenna gain	2.03 dB
Antenna S11	-10.50 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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Calibration coefficients for the three dipoles in CW:

v1	e1	v2	e2	v3	e3
0.390027	251.001230	-0.386042	250.695400	-0.376740	250.105988
0.366258	237.736292	-0.363554	236.787975	-0.354679	236.787975
0.339500	222.072445	-0.337008	221.186610	-0.328598	221.186610
0.311463	205.295068	-0.308712	204.712502	-0.300644	204.476157
0.283636	188.692124	-0.280417	187.939442	-0.273013	187.939442
0.256654	172.433067	-0.252967	171.745241	-0.245920	171.745241
0.230715	156.667434	-0.226695	156.042496	-0.220370	156.222813
0.206445	142.343234	-0.202087	141.775434	-0.196303	141.775434
0.183645	129.030238	-0.179221	128.367222	-0.173929	128.515544
0.162409	116.557803	-0.158001	116.092860	-0.153202	116.092860
0.142655	105.047888	-0.138513	104.628858	-0.134233	104.628858
0.114926	94.238168	-0.111965	93.862257	-0.110685	93.862257
0.104027	84.638434	-0.101130	84.300816	-0.099583	84.398340
0.092836	75.928948	-0.089992	75.626072	-0.087196	75.713499
0.080253	68.036895	-0.077392	67.765500	-0.074788	67.843957
0.068634	60.894908	-0.066076	60.652001	-0.063785	60.722110
0.058285	54.439678	-0.056065	54.222521	-0.054067	54.222521
0.049187	48.556435	-0.047203	48.362746	-0.045499	48.362746
0.041377	43.358902	-0.039629	43.235904	-0.038172	43.235904
0.034626	38.762659	-0.033080	38.608037	-0.031847	38.608037
0.028813	34.573630	-0.027466	34.435717	-0.026410	34.475417
0.023824	30.837228	-0.022664	30.714220	-0.021789	30.749598
0.019633	27.536241	-0.018631	27.426401	-0.017892	27.426401
0.016008	24.503942	-0.015174	24.406197	-0.014559	24.406197
0.013042	21.855528	-0.012358	21.768348	-0.011849	21.768348
0.010587	19.493705	-0.010024	19.415946	-0.009606	19.415946
0.008546	17.346896	-0.008093	17.297985	-0.007756	17.297985
0.006893	15.472199	-0.006525	15.428528	-0.006253	15.428528
0.005551	13.816360	-0.005245	13.744774	-0.005028	13.761247
0.004448	12.308602	-0.004220	12.259504	-0.004044	12.259504
0.003547	10.940343	-0.003371	10.909905	-0.003230	10.909905
0.002829	9.758078	-0.002696	9.719153	-0.002584	9.719153
0.002257	8.703900	-0.002159	8.658517	-0.002071	8.669181
0.001800	7.753551	-0.001731	7.731915	-0.001662	7.722622
0.001430	6.916527	-0.001386	6.888937	-0.001330	6.888937
0.001139	6.161560	-0.001110	6.130303	-0.001070	6.136982
0.000899	5.469502	-0.000886	5.447684	-0.000850	5.447684
0.000711	4.879656	-0.000707	4.870699	-0.000681	4.864397
0.000560	4.352907	-0.000568	4.335543	-0.000548	4.340254
0.000443	3.877568	-0.000464	3.867384	-0.000441	3.867384
0.000345	3.456781	-0.000369	3.442992	-0.000360	3.442992
0.000273	3.069309	-0.000298	3.060398	-0.000288	3.063727
0.000212	2.736734	-0.000242	2.725818	-0.000235	2.733280
0.000157	2.439318	-0.000197	2.433773	-0.000194	2.433773
0.000125	2.172484	-0.000171	2.168512	-0.000160	2.168512
0.000089	1.938165	-0.000142	1.930433	-0.000133	1.935690
0.000074	1.725784	-0.000111	1.718900	-0.000112	1.724797
0.000054	1.537689	-0.000095	1.524916	-0.000094	1.524916
0.000039	1.368867	-0.000080	1.363407	-0.000081	1.363407
0.000025	1.218869	-0.000069	1.214007	-0.000072	1.214007
0.000014	1.086023	-0.000067	1.081691	-0.000062	1.081691
0.000005	0.966789	-0.000055	0.962933	-0.000053	0.962933

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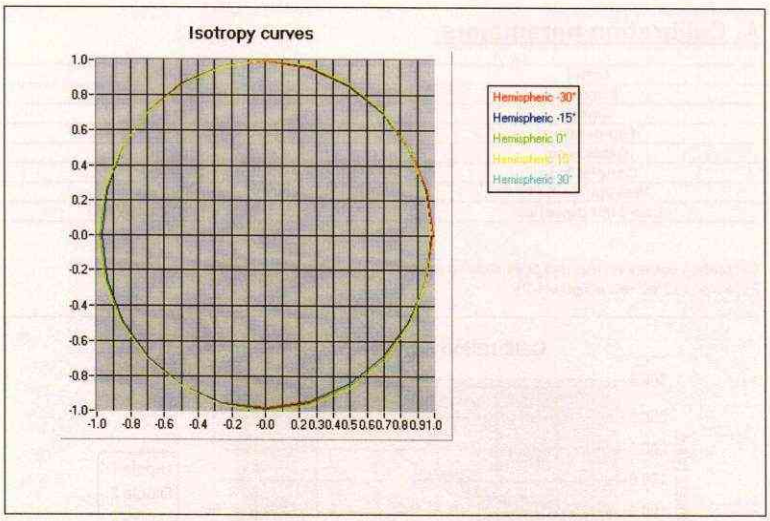
B. Isotropy.

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.08 dB



E-field E (V/m)= f (phi, theta)

7

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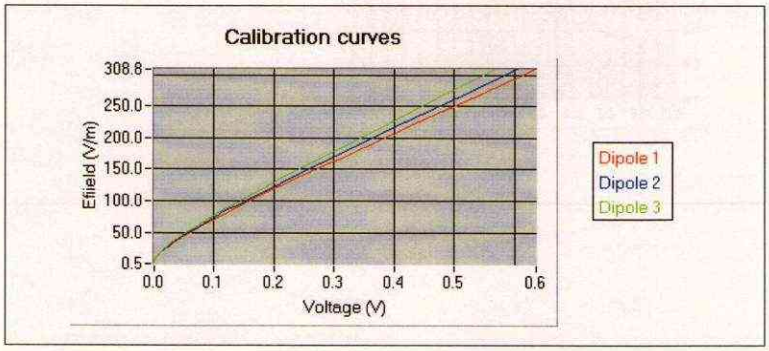
2. Calibration at 835.00 MHz

A. Calibration parameters.

Label	GSM850
Epsilon	43.72
Sigma	0.90 S/m
Temperature	21°C
Cable loss	0.00 dB
Coupler loss	20.50 dB
Waveguide S11	-13.91 dB
Low limit detection	0.96 V/m (0.84 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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Calibration coefficients for the three dipoles in CW:

v1	e1	v2	e2	v3	e3
0.635587	308.082146	-0.604183	308.789236	-0.565402	306.584464
0.529656	262.201294	-0.503486	262.612528	-0.471169	261.045773
0.441380	223.967252	-0.419571	224.131937	-0.392640	223.096863
0.306514	165.119244	-0.291369	164.929254	-0.272667	164.739481
0.290555	159.146719	-0.276427	158.963600	-0.258259	158.597995
0.268411	149.209919	-0.255467	149.038233	-0.238392	148.695455
0.244835	138.610998	-0.233209	138.451509	-0.217240	138.133080
0.220829	127.731407	-0.210592	127.584435	-0.195765	127.144533
0.196961	116.626621	-0.187954	116.492427	-0.174452	116.090770
0.173928	105.876040	-0.166016	105.632534	-0.153977	105.389584
0.151847	95.235242	-0.145092	95.125662	-0.134330	94.797676
0.130863	85.074164	-0.116894	84.976276	-0.113424	84.683284
0.110829	75.213828	-0.103844	75.127284	-0.097728	74.782106
0.086907	62.776585	-0.083093	62.704353	-0.076637	62.560137
0.074182	56.207943	-0.070921	56.078668	-0.065266	56.014143
0.063386	50.442627	-0.060565	50.384586	-0.055632	50.268705
0.054223	45.373021	-0.051774	45.373021	-0.047474	45.268666
0.046364	40.954129	-0.044245	40.954129	-0.040448	40.859937
0.039475	36.965594	-0.037645	36.923061	-0.034382	36.838139
0.033397	33.288765	-0.031834	33.250463	-0.028981	33.173988
0.027920	29.839922	-0.026578	29.839922	-0.024144	29.737036
0.022982	26.594859	-0.021858	26.594859	-0.019775	26.503163
0.018501	23.458362	-0.017588	23.431370	-0.015876	23.350580
0.013825	19.874568	-0.013101	19.851699	-0.011833	19.806042
0.011273	17.774512	-0.010688	17.754059	-0.009633	17.713227
0.009222	15.951359	-0.008761	15.933005	-0.007862	15.896361
0.007562	14.348209	-0.007180	14.331699	-0.006464	14.315209
0.006215	12.950833	-0.005899	12.935931	-0.005323	12.906178
0.005101	11.676097	-0.004850	11.662663	-0.004328	11.635839
0.004155	10.502620	-0.003953	10.490535	-0.003545	10.478466
0.003354	9.414510	-0.003197	9.403675	-0.002891	9.382049
0.002660	8.371392	-0.002539	8.371392	-0.002271	8.352139
0.002061	7.375607	-0.001985	7.367119	-0.001806	7.350176
0.001439	6.127703	-0.001390	6.120652	-0.001217	6.113610
0.001137	5.480216	-0.001117	5.473911	-0.001022	5.467612
0.000918	4.923769	-0.000902	4.918103	-0.000835	4.912446
0.000734	4.428918	-0.000732	4.428918	-0.000651	4.418732
0.000591	3.997585	-0.000601	3.992985	-0.000565	3.988391
0.000475	3.599959	-0.000499	3.595818	-0.000424	3.591681
0.000389	3.238156	-0.000421	3.234430	-0.000388	3.230709
0.000295	2.892662	-0.000318	2.889334	-0.000319	2.886009
0.000226	2.566242	-0.000286	2.566242	-0.000249	2.560339
0.000167	2.250597	-0.000204	2.248006	-0.000215	2.242836
0.000115	1.946694	-0.000163	1.944454	-0.000132	1.942217
0.000096	1.743001	-0.000139	1.740997	-0.000129	1.738992
0.000068	1.567825	-0.000121	1.564218	-0.000115	1.562420
0.000044	1.410256	-0.000114	1.407012	-0.000087	1.407012
0.000036	1.268522	-0.000088	1.271445	-0.000066	1.269982
0.000023	1.142346	-0.000071	0.959949	-0.000045	1.132954
0.000005	0.501457	-0.000054	0.597334	-0.000024	0.561644

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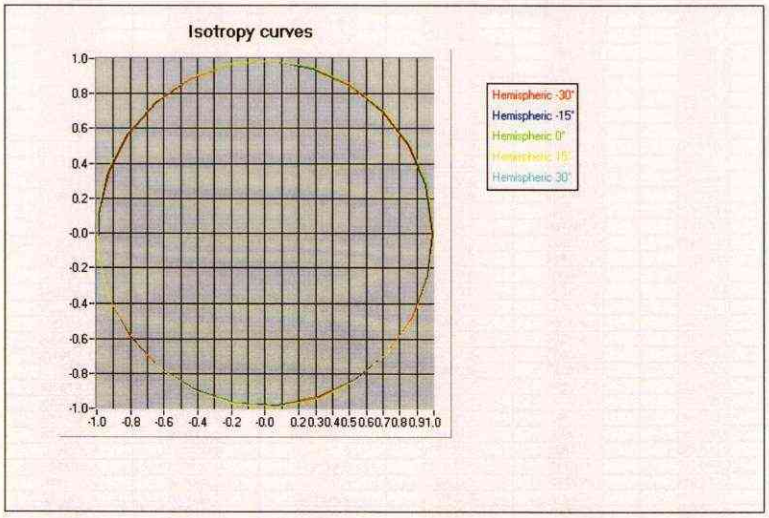
B. Isotropy.

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



E-field E (V/m)= f (phi, theta)

C. Linearity.

- Linearity: 0.19 dB

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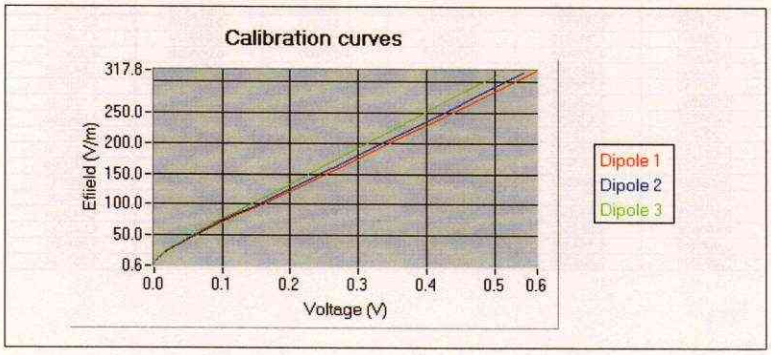
3. Calibration at 900.00 MHz

A. Calibration parameters.

Label	GSM900
Epsilon	43.04
Sigma	0.98 S/m
Temperature	21°C
Cable loss	0.00 dB
Coupler loss	20.30 dB
Waveguide S11	-13.94 dB
Low limit detection	1.26 V/m (1.57 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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Calibration coefficients for the three dipoles in CW:

v1	e1	v2	e2	v3	e3
0.562646	317.801076	-0.542112	313.053898	-0.505287	311.994322
0.468872	266.592145	-0.451760	263.347651	-0.421072	262.612228
0.390727	223.918036	-0.376466	221.925779	-0.350893	221.460484
0.271338	158.889567	-0.261435	158.706743	-0.243676	158.706743
0.253080	148.626202	-0.243021	148.455189	-0.226314	148.284371
0.232479	137.276242	-0.222726	137.276242	-0.207208	137.118287
0.210674	125.775305	-0.201577	125.775305	-0.187307	125.630584
0.188759	114.708442	-0.180478	114.576454	-0.167510	114.312937
0.167251	103.895176	-0.159872	103.775631	-0.148239	103.656224
0.146965	93.776794	-0.140482	93.668892	-0.130117	93.561113
0.127724	84.157995	-0.122159	84.061160	-0.112968	83.867826
0.108227	74.919588	-0.103052	74.833383	-0.096736	74.747278
0.092300	66.007819	-0.088290	65.931868	-0.081313	65.856004
0.071260	54.650655	-0.068090	54.524963	-0.062542	54.462225
0.060603	48.875969	-0.057889	48.819730	-0.053034	48.763558
0.051606	43.862701	-0.049262	43.812232	-0.045010	43.761820
0.043938	39.499843	-0.041926	39.454395	-0.038211	39.363651
0.037401	35.652943	-0.035651	35.611920	-0.032430	35.570943
0.031672	32.143664	-0.030156	32.106679	-0.027355	32.069736
0.026638	28.946455	-0.025333	28.913148	-0.022968	28.846650
0.022129	25.977381	-0.021035	25.917636	-0.018986	25.887814
0.018094	23.125727	-0.017164	23.099118	-0.015492	23.045990
0.014437	20.351450	-0.013691	20.328034	-0.012319	20.304644
0.010878	17.381826	-0.010300	17.341849	-0.009246	17.321893
0.008843	15.545166	-0.008371	15.509414	-0.007494	15.491568
0.007210	13.950680	-0.006832	13.934629	-0.006114	13.918594
0.005895	12.548603	-0.005586	12.534165	-0.005027	12.519742
0.004835	11.326491	-0.004587	11.313458	-0.004105	11.300440
0.003944	10.211637	-0.003749	10.199887	-0.003367	10.188151
0.003220	9.185343	-0.003068	9.174773	-0.002727	9.164218
0.002589	8.233707	-0.002482	8.224232	-0.002211	8.214769
0.002056	7.329855	-0.001974	7.321421	-0.001765	7.312996
0.001594	6.450529	-0.001556	6.443107	-0.001388	6.435694
0.001078	5.322251	-0.001056	5.310011	-0.000938	5.310011
0.000857	4.759873	-0.000870	4.754396	-0.000778	4.748925
0.000686	4.276568	-0.000690	4.271647	-0.000629	4.266732
0.000560	3.851194	-0.000566	3.846763	-0.000528	3.842336
0.000445	3.476125	-0.000481	3.472125	-0.000405	3.468130
0.000355	3.130368	-0.000377	3.126766	-0.000348	3.123168
0.000277	2.812518	-0.000324	2.809282	-0.000306	2.806050
0.000214	2.512439	-0.000245	2.512439	-0.000253	2.509547
0.000165	2.228925	-0.000202	2.226360	-0.000169	2.223798
0.000122	1.952519	-0.000183	1.950273	-0.000168	1.948029
0.000084	1.686924	-0.000118	1.684983	-0.000133	1.683043
0.000059	1.510412	-0.000089	1.508674	-0.000098	1.506938
0.000041	1.357048	-0.000045	1.363478	-0.000063	1.443934
0.000025	1.222068	-0.000023	1.240128	-0.000028	1.240128
0.000019	1.104320	-0.000015	1.021952	-0.000017	1.084302
0.000008	0.605325	-0.000006	0.803439	-0.000007	0.757194

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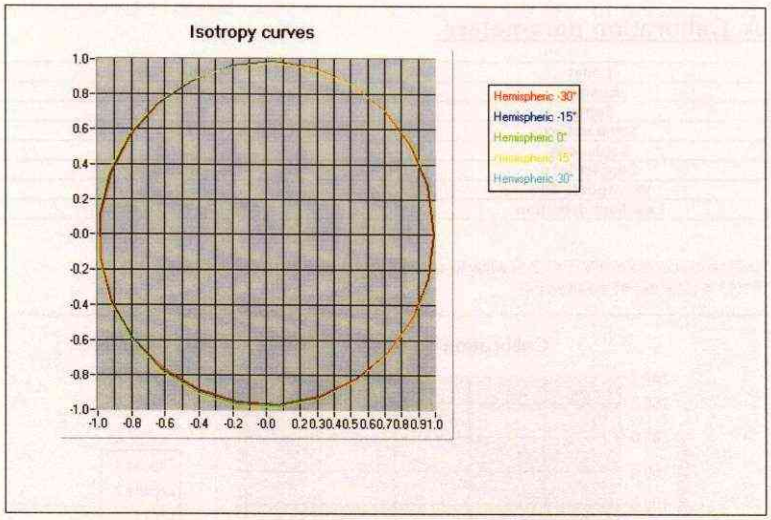
B. Isotropy.

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.06 dB



E-field E (V/m)= f (phi, theta)

C. Linearity.

- Linearity: 0.18 dB

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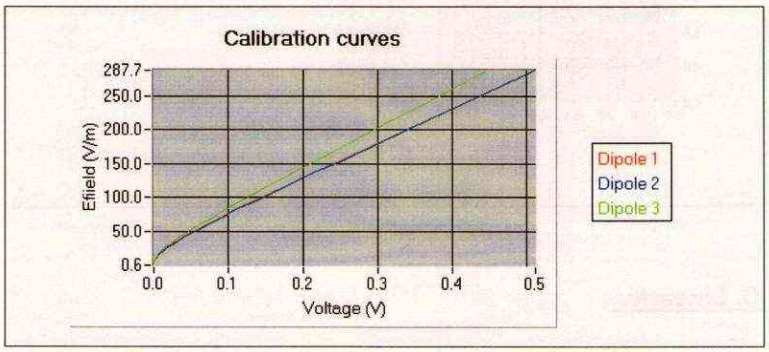
4. Calibration at 1747.00 MHz

A. Calibration parameters.

Label	GSM1800
Epsilon	39.10
Sigma	1.36 S/m
Temperature	21°C
Cable loss	0.00 dB
Coupler loss	20.18 dB
Waveguide S11	-13.10 dB
Low limit detection	1.05 V/m (1.50 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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Calibration coefficients for the three dipoles in CW:

v1	e1	v2	e2	v3	e3
0.510721	286.851496	-0.510995	287.693425	-0.443939	286.309825
0.425601	243.350716	-0.425829	243.900692	-0.369949	243.053215
0.354668	207.100067	-0.354858	207.406747	-0.308291	207.006040
0.246297	151.644785	-0.246429	151.644785	-0.214091	151.819474
0.219264	137.983603	-0.219592	137.824835	-0.190283	138.142555
0.192454	124.258893	-0.193001	124.258893	-0.166831	124.402035
0.167259	111.257035	-0.167958	111.257035	-0.144922	111.385198
0.144913	99.615629	-0.145778	99.615629	-0.125520	99.732447
0.125258	89.295070	-0.126254	89.295070	-0.107824	89.397934
0.106977	80.135967	-0.106266	80.135967	-0.093715	80.228280
0.093604	72.082109	-0.094642	71.999169	-0.080896	72.165144
0.080853	64.912373	-0.081878	64.912373	-0.069798	64.987148
0.069882	58.590537	-0.070823	58.590537	-0.060179	58.725602
0.059202	52.339248	-0.060092	52.339248	-0.050784	52.399541
0.048472	45.795993	-0.049268	45.795993	-0.041401	45.848748
0.039793	40.302082	-0.040486	40.302082	-0.033855	40.348509
0.032772	35.672003	-0.033401	35.713095	-0.027786	35.754234
0.027117	31.792705	-0.027629	31.792705	-0.022876	31.829328
0.022403	28.400598	-0.022872	28.400598	-0.018844	28.433314
0.018563	25.458188	-0.018968	25.458188	-0.015557	25.516875
0.015394	22.873229	-0.015716	22.873229	-0.012846	22.925957
0.012741	20.621844	-0.013045	20.621844	-0.010627	20.645598
0.010592	18.613477	-0.010825	18.613477	-0.008803	18.634918
0.008587	16.646675	-0.008809	16.646675	-0.007132	16.665850
0.006690	14.565570	-0.006860	14.565570	-0.005540	14.582317
0.005237	12.818214	-0.005410	12.818214	-0.004342	12.832979
0.004144	11.345601	-0.004259	11.345601	-0.003442	11.358670
0.003298	10.100142	-0.003432	10.100142	-0.002748	10.111777
0.002640	9.022513	-0.002740	9.022513	-0.002205	9.032906
0.002126	8.087745	-0.002209	8.087745	-0.001783	8.097063
0.001712	7.258176	-0.001791	7.258176	-0.001445	7.274820
0.001391	6.543762	-0.001478	6.536232	-0.001178	6.551300
0.001132	5.906462	-0.001223	5.899667	-0.000970	5.913267
0.000859	5.156173	-0.000921	5.150241	-0.000749	5.162112
0.000667	4.511568	-0.000735	4.511568	-0.000578	4.516765
0.000509	3.974912	-0.000572	3.974912	-0.000456	3.979490
0.000390	3.522309	-0.000463	3.522309	-0.000366	3.526366
0.000322	3.135649	-0.000360	3.135649	-0.000285	3.139262
0.000211	2.801093	-0.000286	2.801093	-0.000240	2.807550
0.000192	2.510888	-0.000251	2.510888	-0.000198	2.513781
0.000159	2.255939	-0.000205	2.255939	-0.000171	2.260171
0.000123	2.031550	-0.000158	2.031550	-0.000140	2.036558
0.000101	1.835809	-0.000132	1.833696	-0.000119	1.840042
0.000035	1.450434	-0.000124	1.628649	-0.000098	1.630525
0.000022	1.075120	-0.000095	1.426683	-0.000078	1.429972
0.000006	0.613424	-0.000079	1.258425	-0.000072	1.258217
		-0.000066	1.116420	-0.000064	1.117705
		-0.000060	0.993866	-0.000053	0.993182
		-0.000056	0.888848	-0.000042	0.862972
		-0.000046	0.794928	-0.000031	0.718691
		-0.000036	0.622424	-0.000020	0.580812

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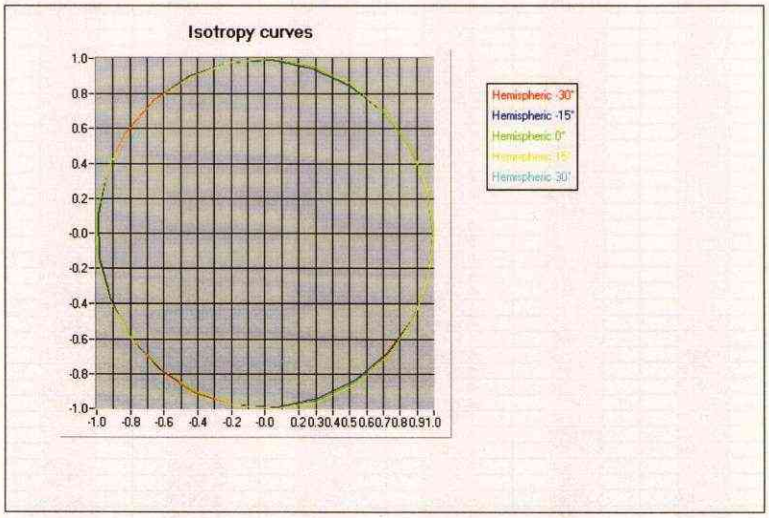
B. Isotropy.

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



E-field E (V/m)= f (phi, theta)

C. Linearity.

- Linearity: 0.19 dB

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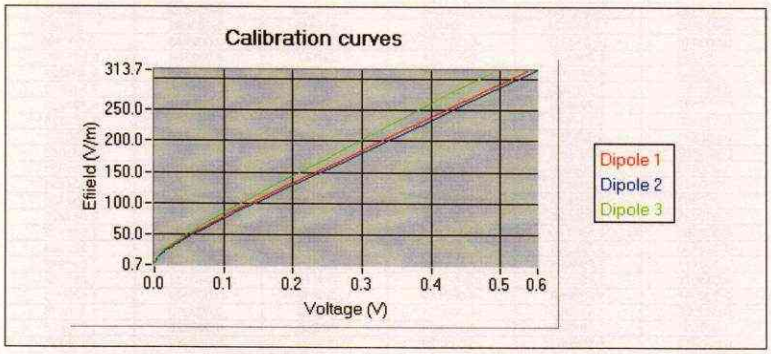
5. Calibration at 1950.00 MHz

A. Calibration parameters.

Label	IMT2000
Epsilon	39.43
Sigma	1.40 S/m
Temperature	21°C
Cable loss	0.00 dB
Coupler loss	20.07 dB
Waveguide S11	-36.66 dB
Low limit detection	1.27 V/m (2.30 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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Calibration coefficients for the three dipoles in CW:

v1	e1	v2	e2	v3	e3
0.538560	311.624390	-0.553261	313.722699	-0.486674	310.530862
0.448800	264.027659	-0.461051	265.427130	-0.405562	263.294326
0.374000	224.363717	-0.384209	225.180822	-0.337968	223.930545
0.259722	163.676878	-0.266812	163.676878	-0.234700	163.676878
0.228065	147.057552	-0.234742	146.888343	-0.205692	147.057552
0.198097	131.216163	-0.204667	131.216163	-0.178433	131.065182
0.171141	116.677559	-0.177391	116.811965	-0.153946	116.677559
0.147777	104.108774	-0.153689	104.108774	-0.132662	103.988984
0.127488	92.893929	-0.132975	93.000939	-0.114181	92.893929
0.108273	83.269764	-0.115177	83.269764	-0.098330	83.173952
0.095107	74.642699	-0.099090	74.642699	-0.084669	74.642699
0.082157	67.140927	-0.086401	67.218270	-0.072924	67.140927
0.070984	60.602052	-0.074821	60.602052	-0.062842	60.532323
0.060312	54.136146	-0.063747	54.136146	-0.053232	54.136146
0.049369	47.368249	-0.052337	47.368249	-0.043407	47.313746
0.040527	41.685722	-0.043073	41.685722	-0.035485	41.637757
0.033371	36.896683	-0.035550	36.854230	-0.029113	36.854230
0.027567	32.808573	-0.029424	32.808573	-0.023965	32.808573
0.022785	29.308078	-0.024373	29.308078	-0.019748	29.274355
0.018872	26.271649	-0.020203	26.271649	-0.016302	26.241420
0.015625	23.576934	-0.016768	23.576934	-0.013460	23.549805
0.012951	21.231825	-0.013913	21.231825	-0.011131	21.231825
0.010739	19.164052	-0.011576	19.164052	-0.009212	19.164052
0.008971	17.397519	-0.009676	17.397519	-0.007705	17.397519
0.006970	15.222547	-0.007534	15.205032	-0.005982	15.205032
0.005454	13.380961	-0.005908	13.365565	-0.004673	13.365565
0.004298	11.830071	-0.004690	11.816458	-0.003690	11.816458
0.003418	10.519312	-0.003733	10.519312	-0.002948	10.507209
0.002733	9.386147	-0.003014	9.386147	-0.002366	9.375348
0.002203	8.413707	-0.002423	8.413707	-0.001915	8.404026
0.001783	7.550702	-0.001966	7.550702	-0.001546	7.542013
0.001437	6.799663	-0.001604	6.799663	-0.001262	6.791839
0.001163	6.137441	-0.001316	6.130380	-0.001040	6.123325
0.000871	5.327057	-0.001003	5.327057	-0.000779	5.320927
0.000662	4.661088	-0.000780	4.661088	-0.000618	4.661088
0.000499	4.106646	-0.000609	4.106646	-0.000483	4.101921
0.000384	3.634858	-0.000487	3.634858	-0.000381	3.634858
0.000303	3.235843	-0.000391	3.235843	-0.000307	3.232120
0.000239	2.890596	-0.000316	2.887270	-0.000253	2.887270
0.000182	2.591119	-0.000265	2.588136	-0.000208	2.588136
0.000140	2.325345	-0.000217	2.325345	-0.000173	2.322669
0.000117	2.094051	-0.000191	2.094051	-0.000143	2.091642
0.000079	1.890112	-0.000150	1.890112	-0.000132	1.887936
0.000057	1.680689	-0.000137	1.680689	-0.000104	1.678755
0.000029	1.473966	-0.000101	1.472269	-0.000090	1.470575
0.000021	1.298636	-0.000084	1.298636	-0.000075	1.298636
0.000017	1.152093	-0.000080	1.152093	-0.000072	1.148120
0.000012	1.025622	-0.000069	1.025622	-0.000060	1.024442
0.000008	0.915140	-0.000064	0.914087	-0.000051	0.914087
0.000004	0.804656	-0.000051	0.818440	-0.000048	0.819383
		-0.000049	0.735338	-0.000045	0.734492
				-0.000036	0.659154

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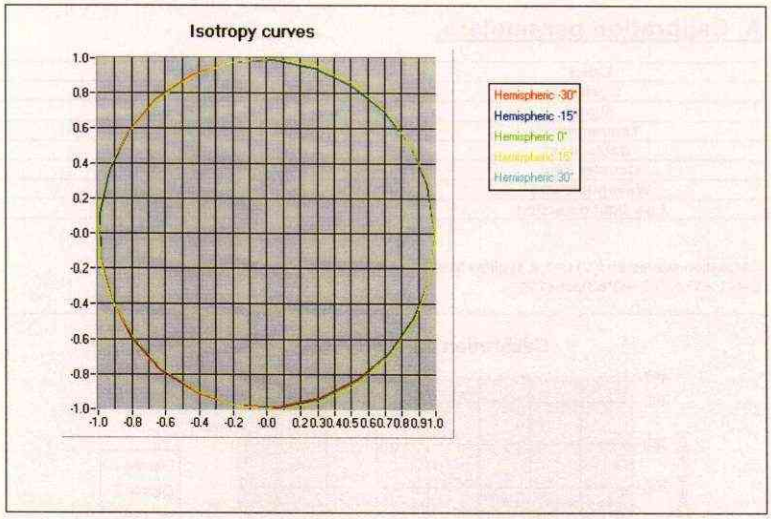
B. Isotropy.

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



E-field E (V/m)= f (phi, theta)

C. Linearity.

- Linearity: 0.17 dB

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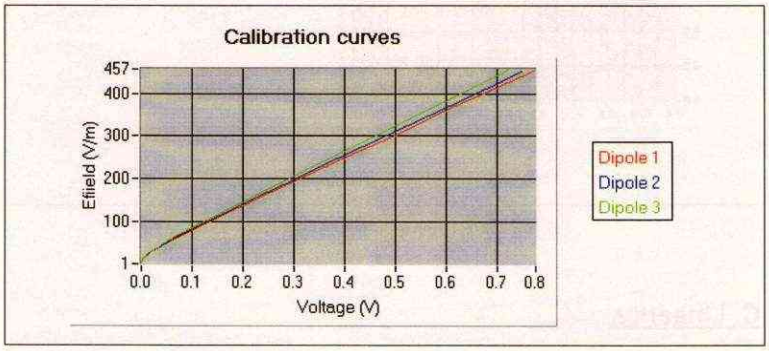
6. Calibration at 2450.00 MHz

A. Calibration parameters.

Label	Bluetooth
Epsilon	37.79
Sigma	1.85 S/m
Temperature	21°C
Cable loss	0.00 dB
Coupler loss	21.50 dB
Waveguide S11	-15.00 dB
Low limit detection	0.92 V/m (1.51 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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Calibration coefficients for the three dipoles in CW:

v1	e1	v2	e2	v3	e3
0.775885	454.454927	-0.748460	450.440543	-0.725597	456.774143
0.620606	368.804659	-0.606912	370.466546	-0.580020	370.842348
0.499623	301.991331	-0.482063	299.834178	-0.465640	303.231159
0.396761	245.082582	-0.386170	245.475034	-0.374743	249.392407
0.319389	202.162943	-0.311188	202.849779	-0.297735	203.642804
0.257308	167.598066	-0.249926	167.884910	-0.239781	169.064921
0.207152	139.527842	-0.198963	138.629007	-0.192512	140.694550
0.168348	117.658041	-0.158939	115.463102	-0.155199	118.116132
0.135618	99.035731	-0.127146	96.856391	-0.123856	98.937582
0.108916	83.645541	-0.101857	81.836550	-0.098522	83.195036
0.086939	70.755962	-0.082444	70.088170	-0.079125	70.899915
0.070561	60.938992	-0.066997	60.524608	-0.063011	60.424288
0.044971	44.928910	-0.042854	44.877214	-0.040169	44.825576
0.039748	41.497877	-0.037893	41.497877	-0.035485	41.450130
0.032394	36.477569	-0.030815	36.477569	-0.028813	36.435596
0.026448	32.212608	-0.025118	32.212608	-0.023444	32.175543
0.021679	28.643487	-0.020566	28.643487	-0.019158	28.610529
0.017778	25.557942	-0.016851	25.557942	-0.015687	25.499160
0.014629	22.883681	-0.013855	22.857350	-0.012869	22.831050
0.012058	20.536475	-0.011390	20.536475	-0.010563	20.512844
0.009929	18.472509	-0.009400	18.472509	-0.008694	18.451255
0.008208	16.673465	-0.007749	16.654282	-0.007181	16.635118
0.006421	14.605819	-0.006052	14.605819	-0.005596	14.589013
0.005301	13.213743	-0.005014	13.213743	-0.004624	13.198540
0.004097	11.601814	-0.003904	11.601814	-0.003606	11.588464
0.003229	10.245328	-0.003075	10.245328	-0.002831	10.233540
0.002561	9.099674	-0.002432	9.099674	-0.002253	9.089205
0.002029	8.110095	-0.001946	8.110095	-0.001810	8.100763
0.001647	7.253138	-0.001577	7.253138	-0.001453	7.244792
0.001305	6.509174	-0.001289	6.509174	-0.001171	6.485386
0.001041	5.854985	-0.001043	5.848249	-0.000945	5.810292
0.000861	5.273301	-0.000842	5.278687	-0.000787	5.287375
0.000672	4.678586	-0.000677	4.645430	-0.000618	4.663597
0.000540	4.213738	-0.000541	4.197841	-0.000510	4.216921
0.000396	3.639535	-0.000442	3.724311	-0.000399	3.702094
0.000295	3.175437	-0.000334	3.208253	-0.000309	3.224887
0.000257	2.982186	-0.000267	2.841382	-0.000262	2.945105
0.000166	2.458408	-0.000224	2.578572	-0.000197	2.507241
0.000151	2.360940	-0.000169	2.197068	-0.000172	2.316902
0.000104	2.025398	-0.000158	2.112516	-0.000141	2.056560
0.000072	1.760726	-0.000131	1.889000	-0.000122	1.879253
0.000062	1.669433	-0.000106	1.655346	-0.000105	1.705051
0.000037	1.415672	-0.000087	1.452851	-0.000076	1.357225
0.000032	1.359248	-0.000081	1.382758	-0.000059	1.103480
0.000032	1.359248	-0.000061	1.117810	-0.000051	0.955439
-0.000001	0.902308	-0.000050	0.940804	-0.000044	0.810758
-0.000008	0.767889	-0.000046	0.867531	-0.000039	0.698043
-0.000013	0.658095	-0.000041	0.766146	-0.000036	0.602865
-0.000017	0.561131	-0.000034	0.595901	-0.000033	0.516890
		-0.000031	0.513790		

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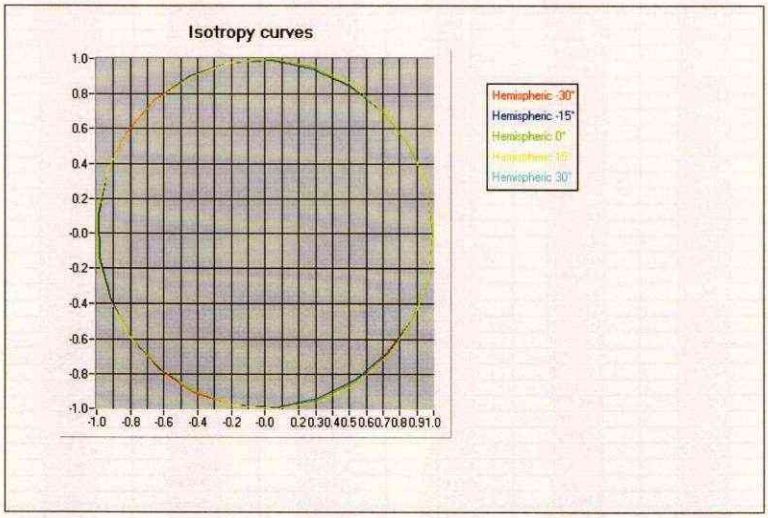
B. Isotropy.

- Axial isotropy: 0.07 dB
- Hemispherical isotropy: 0.06 dB



E-field E (V/m)= f (phi, theta)

C. Linearity.

- Linearity: 0.20 dB

11. Annex B: dipoles reference SAR value and calibration

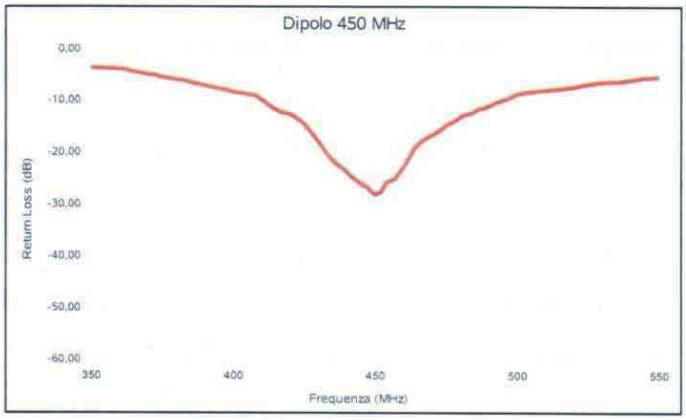
Sicom

Verification of measuring instrument

Instrument checked : REFERENCE DIPOLE
Manufacturer : ANTENNESSA / SATIMO
Model : 450 MHz
Serial number : SN 39/05 DIPB26
Date of inspection : 20/02/2014
Measured quantity (unit) : RETURN LOSS (dB)

Measurements

Return loss at the frequency of use : -28,32 dB



Instrumentation used for verification:

Instrument : VECTOR NETWORK ANALYZER
Manufacturer : ANRITSU
Model : MS4622B
Serial Number : 984502

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

Test Operator : Antonio Sirigu

Pag. 1 of 1

Sicom

Dipole historical data

Instrument checked	:	REFERENCE DIPOLE
Manufacturer	:	AUTENNOSSA / SATINO
Model	:	450 MHz
Serial number	:	SN 39/05 DIPB26
Date of inspection	:	21/02/2014
Measured quantity (unit)	:	SAR

Pag. 1 of 3

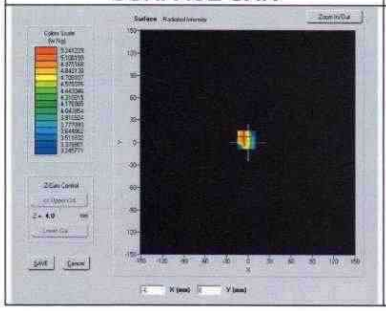
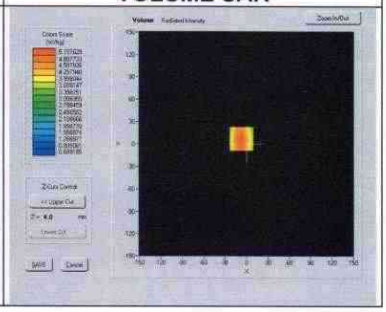
Date of measurement: 21/02/2014

A. Experimental conditions.

Phantom	Validation plane
Device Position	Dipole
Band	450 MHz
Channel	Middle
Signal	CW
Probe Path	Adaptative 1 max
Probe	EP_60

B. SAR Measurement Results:

Frequency (MHz)	450.0
Relative permittivity (real part)	56.74
Conductivity (S/m)	0.942

SURFACE SAR	VOLUME SAR
	

SAR	SAR (W/kg)	Reference value (W/kg)	Variation (%)	RESULT
SAR 1g	**5.14**	5.05	+1.78	PASS
SAR 10g	**3.51**	3.47	+1.15	PASS

Sicom

	SAR (W/Kg)	SAR REFERENCE MANUFACTURER VALUE (W/Kg)	VARIATON (%)	VERDICT
SAR 10g	3,51	3,47	+ 1,15 %	PASS
SAR 1g	5,14	5,05	+ 1,78 %	PASS

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

Test Operator : .....

Pag. 3 of 3