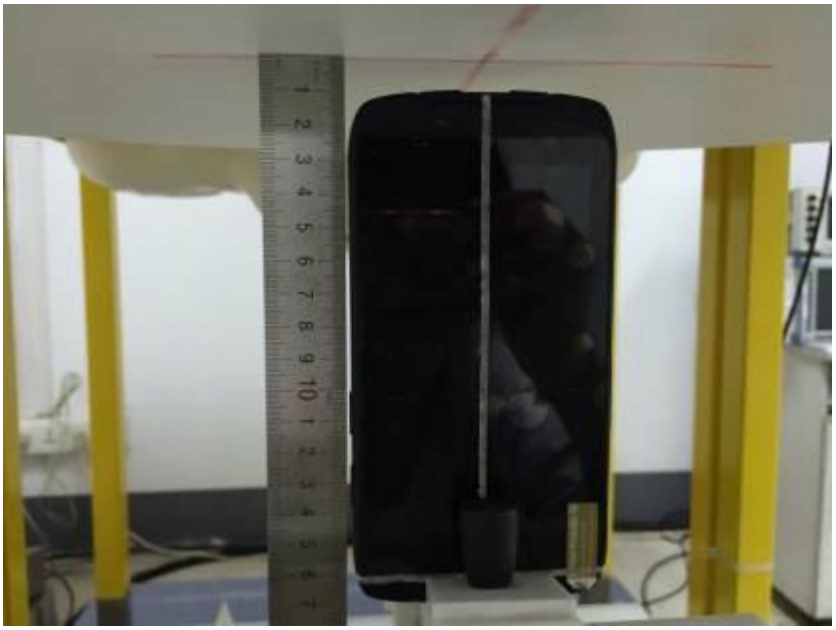
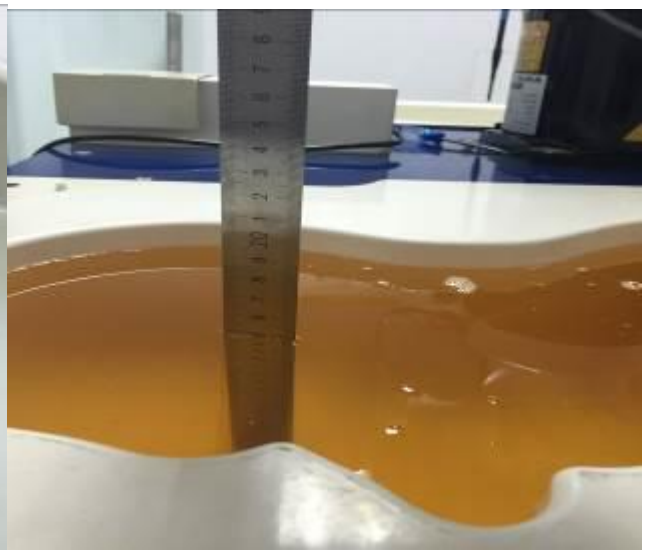


BODY-BOTTOM

BODY LIQUID DEPTH



HEAD LIQUID DEPTH

APPENDIX C: PROBE CALIBRATION CERTIFICATE

COMOSAR E-Field Probe Calibration Report

Ref : ACR.266.2.14.SATU.A

INVENTEC APPLIANCES (JIANGNING) CORPORATION
133 JIANG-JUN ROAD, JIANGNING ECONOMIC AND TECHNOLOGICAL DEVELOPMENT ZONE
NANJING 211153 PR CHINA
SATIMO COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 35/11 EP131

Calibrated at SATIMO US
2105 Barrett Park Dr. - Kennesaw, GA 30144

09/22/2014

Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in SATIMO USA using the CALISAR / CALIBAIR test bench, for use with a SATIMO COMOSAR system only. All calibration results are traceable to national metrology institutions.

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	9/23/2014	
Checked by :	Jérôme LUC	Product Manager	9/23/2014	
Approved by :	Kim RUTKOWSKI	Quality Manager	9/23/2014	

	Customer Name
Distribution :	Inventec Appliances (Jiangning) Corporation

Issue	*Date*	*Modifications*
A	9/23/2014	Initial release

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

TABLE OF CONTENTS

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	Satimo
Model	SSE5
Serial Number	SN 35/11 EP131
Product Condition (new / used)	Used
Frequency Range of Probe	0.7 GHz-3GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.999 MΩ Dipole 2: R2=1.244 MΩ Dipole 3: R3=1.253 MΩ

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

Satimo's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.

Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

Probe Length	330 mm
Length of Individual Dipoles	4.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	5 mm
Distance between dipoles / probe extremity	2.7 mm

3 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.5 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in waveguide					
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%

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

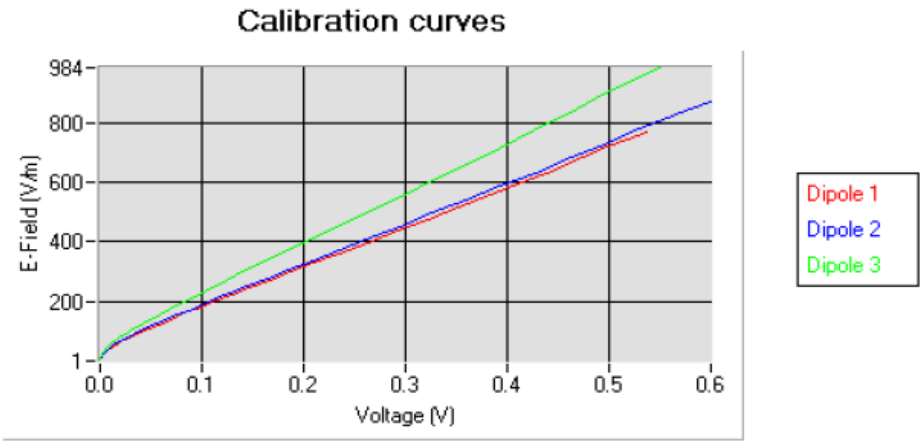
5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
4.98	6.07	5.22

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
96	93	99

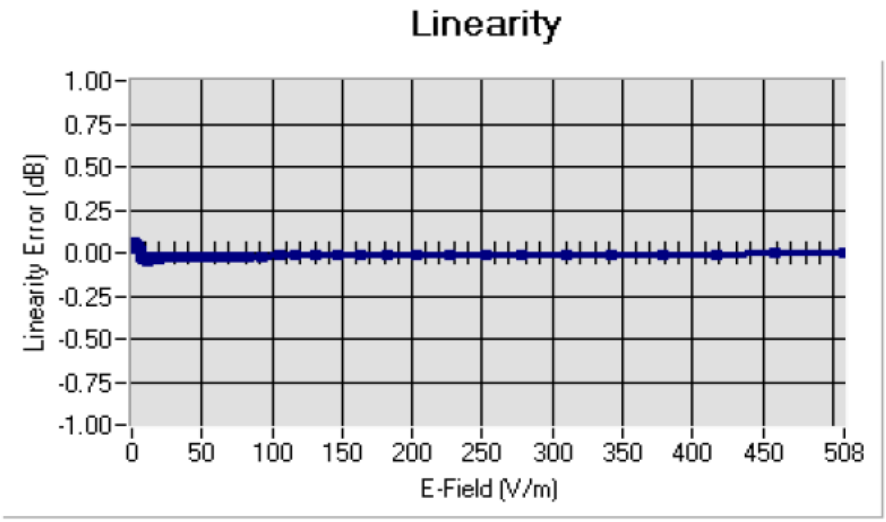
Calibration curves ei=f(V) (i=1,2,3) allow to obtain H-field value using the formula:

$$E = \sqrt{E_1^{\,2} + E_2^{\,2} + E_3^{\,2}}$$



This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

5.2 LINEARITY



Linearity: +/-1.45% (+/-0.06dB)

5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL1800	1800	41.31	1.38	6.99
BL1800	1800	53.27	1.51	7.27
HL1900	1900	41.09	1.42	7.69
BL1900	1900	54.20	1.54	7.95
HL2000	2000	39.72	1.43	7.15
BL2000	2000	53.91	1.53	7.35
HL2000	2000	39.72	1.43	7.30
BL2000	2000	53.91	1.53	7.47
HL2450	2450	39.05	1.77	7.22
BL2450	2450	52.97	1.93	7.46
HL2600	2600	38.35	1.92	7.08
BL2600	2600	51.81	2.19	7.32

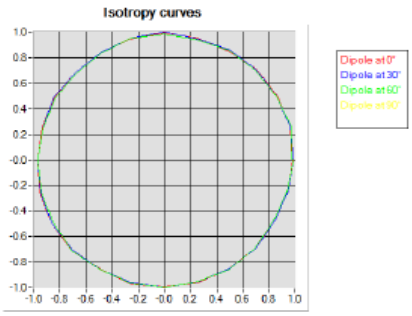
LOWER DETECTION LIMIT: 9mW/kg

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

5.4 ISOTROPY

HL1800 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.07 dB



This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	Satimo	EP 94 SN 37/08	10/2013	10/2014
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

COMOSAR E-Field Probe Calibration Report

Ref : ACR.266.1.14.SATU.A

INVENTEC APPLIANCES (JIANGNING) CORPORATION

133 JIANG-JUN ROAD, JIANGNING ECONOMIC AND TECHNOLOGICAL DEVELOPMENT ZONE

NANJING 211153 PR CHINA

SATIMO COMOSAR DOSIMETRIC E-FIELD PROBE

SERIAL NO.: SN 18/11 EP121

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED

Calibration CERT #2246-02

09/22/2014

Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in SATIMO USA using the CALISAR / CALIBAIR test bench, for use with a SATIMO COMOSAR system only. All calibration results are traceable to national metrology institutions.

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	9/23/2014	
Checked by :	Jérôme LUC	Product Manager	9/23/2014	
Approved by :	Kim RUTKOWSKI	Quality Manager	9/23/2014	

	Customer Name
Distribution :	Inventec Appliances (Jiangning) Corporation

Issue	*Date*	*Modifications*
A	9/23/2014	Initial release

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

TABLE OF CONTENTS

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	Satimo
Model	SSE5
Serial Number	SN 18/11 EP121
Product Condition (new / used)	Used
Frequency Range of Probe	0.7 GHz-3GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=1.399 MΩ Dipole 2: R2=1.338 MΩ Dipole 3: R3=1.165 MΩ

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

Satimo's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.

Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

Probe Length	330 mm
Length of Individual Dipoles	4.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	5 mm
Distance between dipoles / probe extremity	2.7 mm

3 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.5 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in waveguide					
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%

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

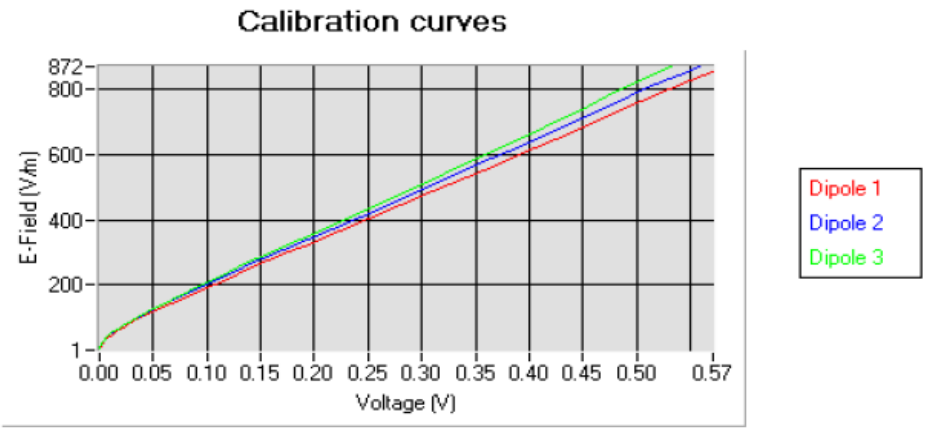
5.1 SENSITIVITY IN AIR

Normx dipole 1 (μV/(V/m)^2)	Normy dipole 2 (μV/(V/m)^2)	Normz dipole 3 (μV/(V/m)^2)
5.55	5.30	4.95

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
96	93	98

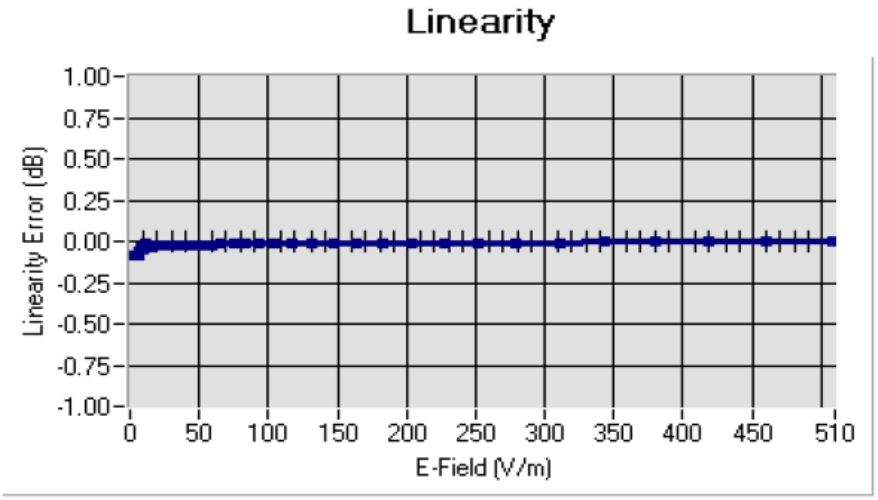
Calibration curves ei=f(V) (i=1,2,3) allow to obtain H-field value using the formula:

$$E = \sqrt{E_1^{\,2} + E_2^{\,2} + E_3^{\,2}}$$



This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

5.2 LINEARITY



Linearity: +/-1.98% (+/-0.09dB)

5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL450	450	43.90	0.87	8.61
BL450	450	58.63	0.98	8.86
HL750	750	42.06	0.89	7.18
BL750	750	56.57	0.99	7.45
HL850	835	42.81	0.89	7.73
BL850	835	53.46	0.96	8.03
HL900	900	42.47	0.96	7.40
BL900	900	56.69	1.08	7.64
HL1450	1450	39.54	1.18	7.23
BL1450	1450	54.74	1.34	7.38

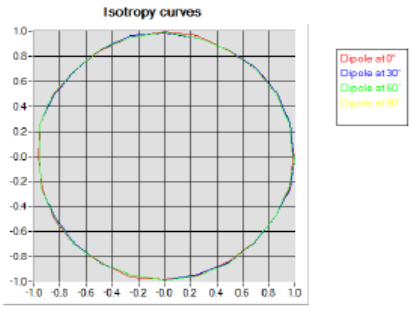
LOWER DETECTION LIMIT: 7mW/kg

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

5.4 ISOTROPY

HL900 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.06 dB



This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	Satimo	EP 94 SN 37/08	10/2013	10/2014
Multimeter	Keithley 2000	1188656	12/2013	12/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

This document shall not be reproduced, except in full or in part, without the written approval of SATIMO. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of SATIMO.

APPENDIX D: DIPOLE CALIBRATION REPORT

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0075

SAR Reference Dipole Calibration Report

FREQUENCY: 835 MHZ

SERIAL NO.:SN 39/09 DIPC117

INVENTEC APPLIANCES (JIANGNING) CORPORATION TESTING LABORATORY **133 JIANG-JUN ROAD, JIANGNING ECONOMIC AND TECHNOLOGICAL DEVELOPMENT ZONE NANJING 211153 PR CHINA**
Calibrated at INVENTEC 07/01/2016

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0075

	Name	Function	Date	Signature
Tested By:	Zhang shuqin	Test Engineer	07/01/2016	Zhang Shuqin
Reviewed By:	Ji jianlin	Manager	07/01/2016	JiJianlin
Approved By:	Xu chunxiu	Quality Manager	07/01/2016	

Issue	Date	Modifications
A	07/01/2016	Initial release

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0075

TABLE OF CONTENTS

1. INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2. DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 835 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID 835
Serial Number	SN 39/09 DIPC117
Product Condition (new / used)	Used

3. PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *Satimo COMOSAR Validation Dipole*

4. MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0075

thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5. MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3-300	0.05mm

5.3 VALIDATION MEASUREMENT

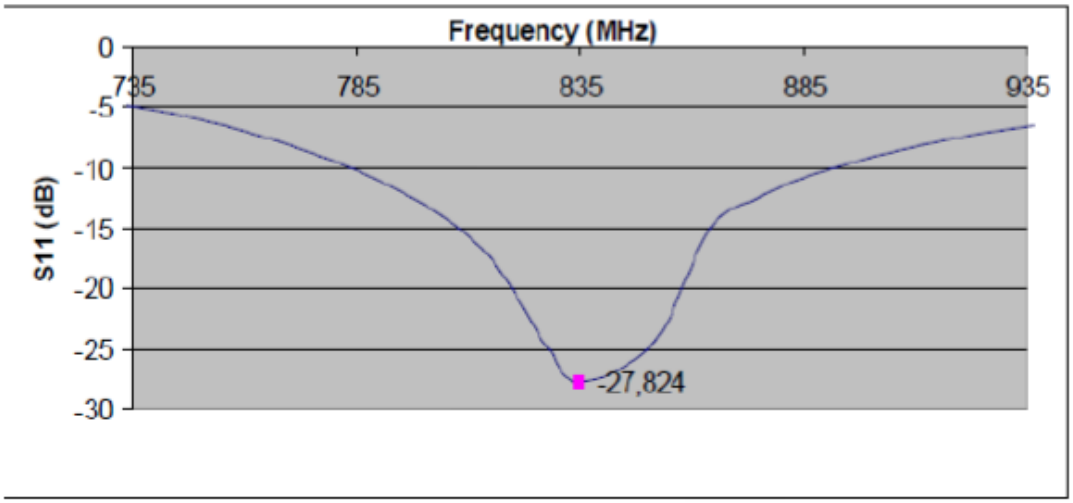
The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	16.19 %
10 g	15.86 %

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0075

6. CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance(Ω)	
			Real	Imaginary part
835	-27.82	-20	49.14	-31.63

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.	Pass	89.8 ±1 %.	Pass	3.6 ±1 %.	Pass
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0075

7. VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	45.3 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %	Pass	0.90 ±5 %	Pass
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

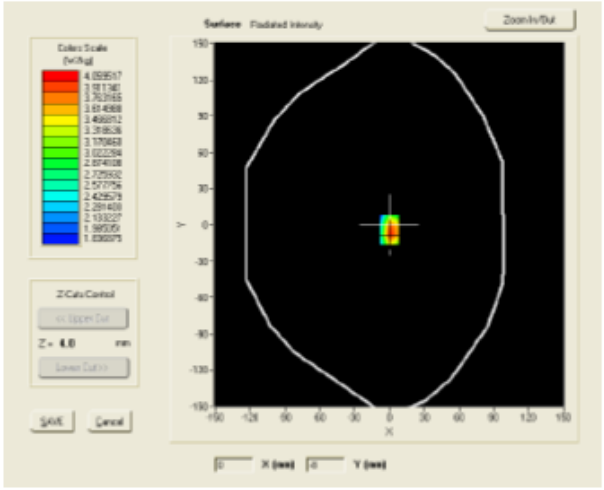
The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

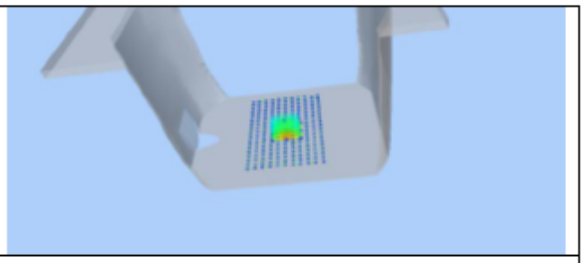
Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Head Liquid Values: eps' : 41.0 sigma : 0.90
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm

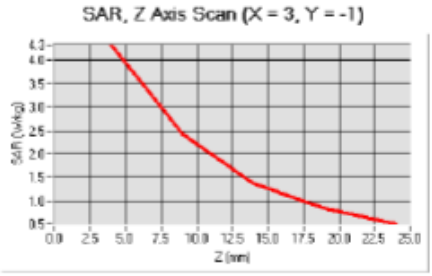
Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0075

Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	22 °C
Lab Temperature	22 °C
Lab Humidity	45%

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.85		3.06	
750	8.49		5.55	
835	9.56	9.82(0.98))	6.22	6.34(0.63))
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	







Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0075

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %	Pass	0.97 ±5 %	Pass
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±5 %		5.30 ±5 %	
5300	48.9 ±5 %		5.42 ±5 %	
5400	48.7 ±5 %		5.53 ±5 %	
5500	48.6 ±5 %		5.65 ±5 %	
5600	48.5 ±5 %		5.77 ±5 %	
5800	48.2 ±5 %		6.00 ±5 %	

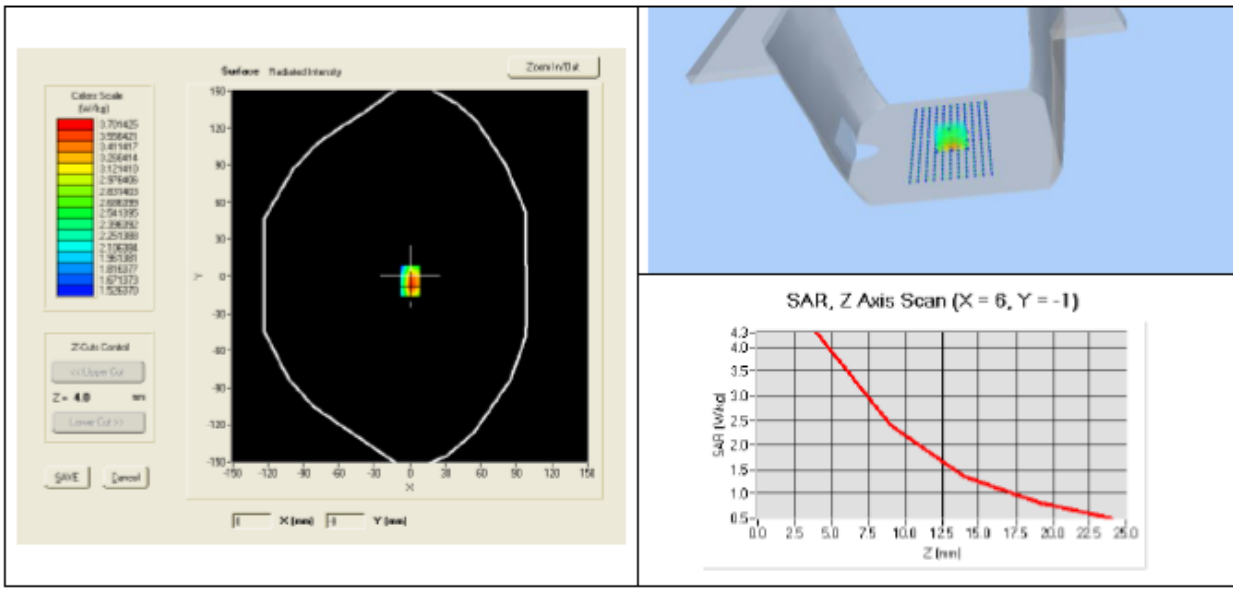
7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Body Liquid Values: eps' :54.1 sigma : 0.99
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	22 °C
Lab Temperature	22 °C
Lab Humidity	45 %

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0075

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
835	10.05(1.01)	6.56(0.66))



Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0075

8. LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN 40/14 SAM117	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Agilent	8753E	2015/11/27	2016/11/28
Reference Probe	Satimo	EP220 SN 17/14	2015/10/01	2016/10/01
Multimeter	Keithley	MiltiMeter2000	2016/02/27	2017/02/28
Signal Generator	Agilent	E4432B	2016/04/09	2017/04/08
Power Meter	R & S	NRP-Z23	2016/06/17	2017/06/16
Power Sensor	R & S	NRP-Z23	2016/06/17	2017/06/16
Temperature and Humidity Sensor	JM	JM222	2016/06/06	2017/06/05

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0076

SAR Reference Dipole Calibration Report

FREQUENCY: 1800 MHZ

SERIAL NO.:SN 39/09 DIPF119

INVENTEC APPLIANCES (JIANGNING) CORPORATION TESTING LABORATORY 133 JIANG-JUN ROAD, JI ANGNING ECONOMIC AND TECHNOLOGICAL DEVELOPMENT ZONE NANJING 211153 PR CHINA
Calibrated at INVENTEC 07/01/2016

Inventec Appliances(Jiangning) Corporation Testing Laboratory **Report NO：JZ-1607-0076**

	Name	Function	Date	Signature
Tested By:	Zhang shuqin	Test Engineer	07/01/2016	Zhang Shuqin
Reviewed By:	Ji jianlin	Manager	07/01/2016	Ji Jianlin
Approved By:	Xu chunxiu	Quality Manager	07/01/2016	

Issue	Date	Modifications
A	07/01/2016	Initial release

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0076

TABLE OF CONTENTS

1. INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2. DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1800
Serial Number	SN 39/09 DIPF119
Product Condition (new / used)	Used

3. PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *Satimo COMOSAR Validation Dipole*

4. MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0076

dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5. MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3-300	0.05mm

5.3 VALIDATION MEASUREMENT

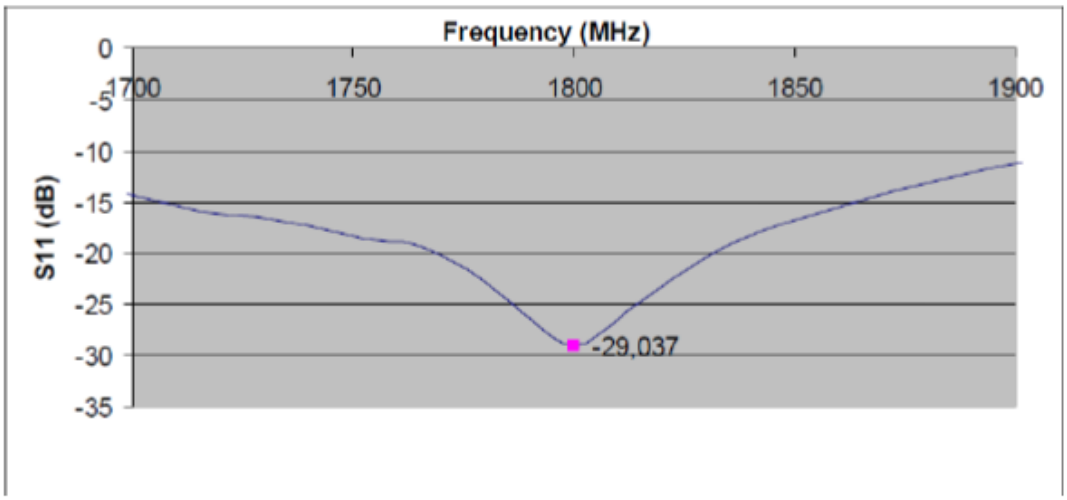
The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	16.19 %
10 g	15.86 %

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0076

6. CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance(Ω)	
			Real	Imaginary part
1800	-29.04	-20	49.22	25.83

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.	pass	41.7 ±1 %.	pass	3.6 ±1 %.	pass
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0076

7. VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	45.3 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %	pass	1.40 ±5 %	pass
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 5 %	

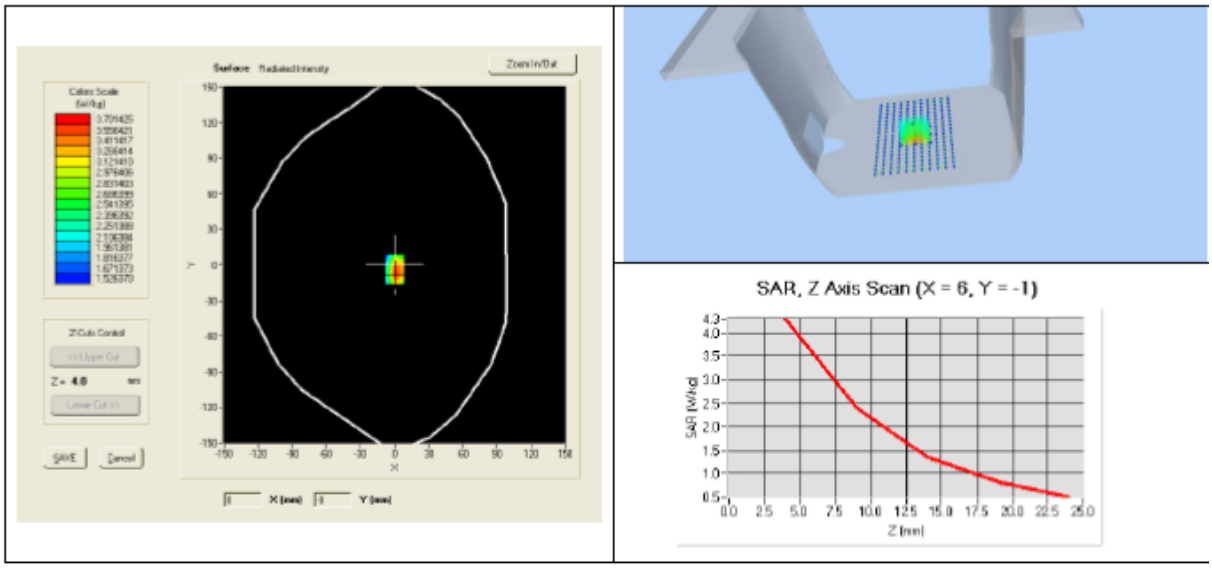
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Head Liquid Values: eps' : 39.4 sigma : 1.39
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0076

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1800	36.86(3.69)	19.69(1.97)



Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0076

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %	Pass	1.52 ±5 %	Pass
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±5 %		5.30 ±5 %	
5300	48.9 ±5 %		5.42 ±5 %	
5400	48.7 ±5 %		5.53 ±5 %	
5500	48.6 ±5 %		5.65 ±5 %	
5600	48.5 ±5 %		5.77 ±5 %	
5800	48.2 ±5 %		6.00 ±5 %	

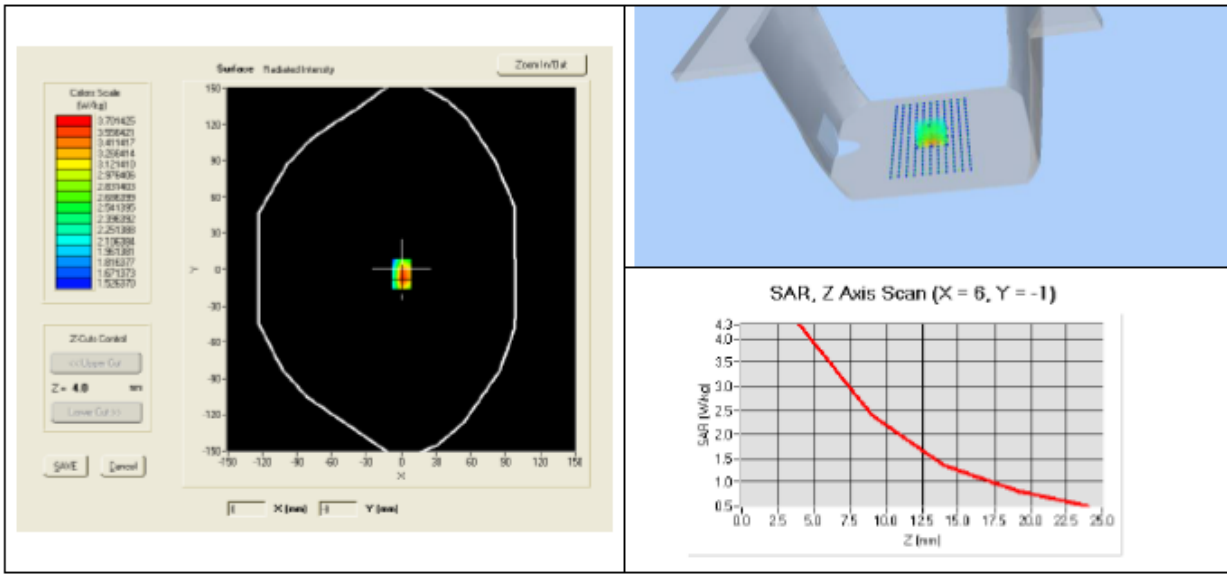
7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Body Liquid Values: eps' :54.1 sigma : 1.50
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	22 °C
Lab Temperature	22 °C
Lab Humidity	45 %

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0076

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1800	36.86(3.69)	19.69(1.97)



Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0076

8. LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN 40/14 SAM117	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Agilent	8753E	2015/11/27	2016/11/28
Reference Probe	Satimo	EP220 SN 17/14	2015/10/01	2016/10/01
Multimeter	Keithley	MiltiMeter2000	2016/02/27	2017/02/28
Signal Generator	Agilent	E4432B	2016/04/09	2017/04/08
Power Meter	R & S	NRP-Z23	2016/06/17	2017/06/16
Power Sensor	R & S	NRP-Z23	2016/06/17	2017/06/16
Temperature and Humidity Sensor	JM	JM222	2016/06/06	2017/06/05

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

SAR Reference Dipole Calibration Report

FREQUENCY: 1900 MHZ

SERIAL NO.:SN 39/09 DIPG120

INVENTEC APPLIANCES (JIANGNING) CORPORATION TESTING LABORATORY 133 JIANG-JUN ROAD, JI ANGNING ECONOMIC AND TECHNOLOGICAL DEVELOPMENT ZONE NANJING 211153 PR CHINA
Calibrated at INVENTEC 07/01/2016

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0077

	Name	Function	Date	Signature
Tested By:	Zhang shuqin	Test Engineer	07/01/2016	Zhang Shuqin
Reviewed By:	Ji jianlin	Manager	07/01/2016	JiJianlin
Approved By:	Xu chunxiu	Quality Manager	07/01/2016	

Issue	Date	Modifications
A	07/01/2016	Initial release

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0077

TABLE OF CONTENTS

1. INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2. DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1900 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1900
Serial Number	SN 39/09 DIPG120
Product Condition (new / used)	Used

3. PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *Satimo COMOSAR Validation Dipole*

4. MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0077

dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5. MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3-300	0.05mm

5.3 VALIDATION MEASUREMENT

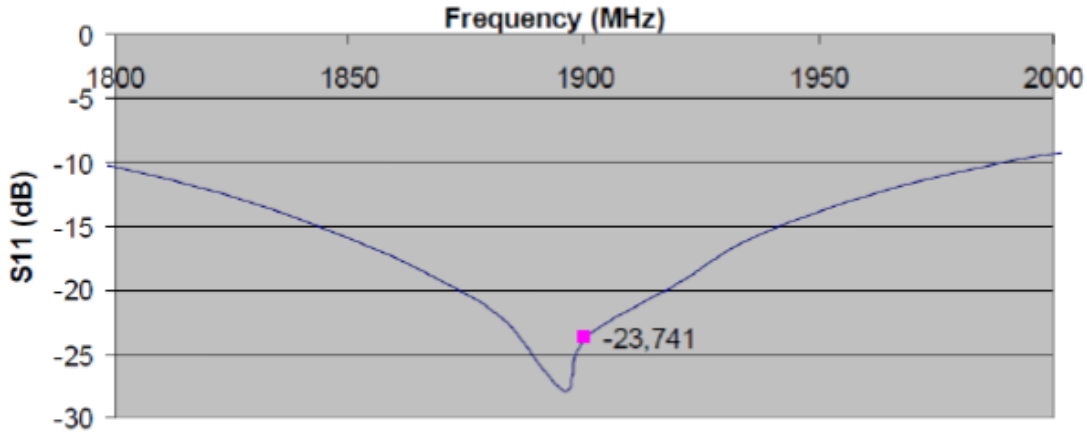
The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	16.19 %
10 g	15.86 %

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0077

6. CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance(Ω)	
			Real	Imaginary part
1900	-23.74	-20	45.66	-15.41

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.	pass	39.5 ±1 %.	pass	3.6 ±1 %.	pass
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0077

7. VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	45.3 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %	pass	1.40 ±5 %	pass
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 5 %	

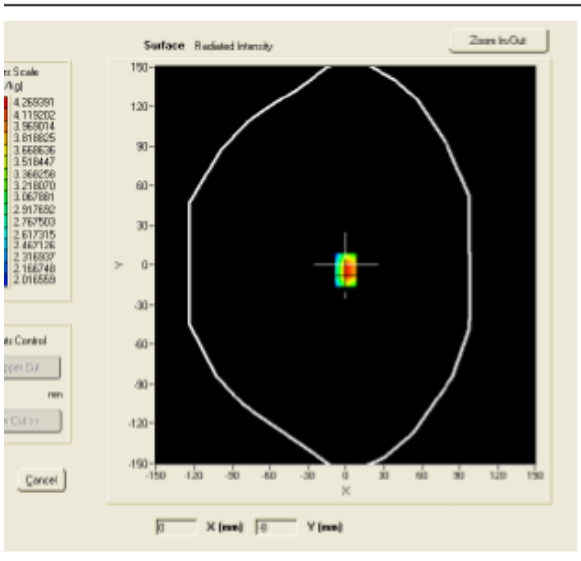
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

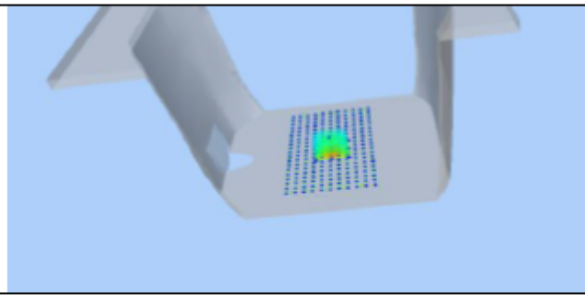
The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

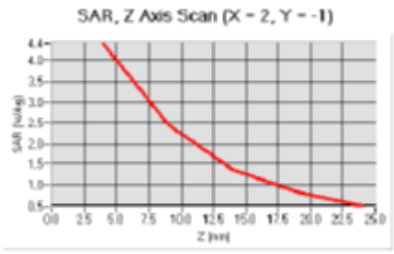
Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Head Liquid Values: eps' : 38.9 sigma : 1.38
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm

Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	1900 MHz
Input power	20 dBm
Liquid Temperature	22 °C
Lab Temperature	22 °C
Lab Humidity	45%

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.85		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7	41.62(4.16)	20.5	21.36(2.14)
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	







Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0077

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %	Pass	1.52 ±5 %	Pass
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±5 %		5.30 ±5 %	
5300	48.9 ±5 %		5.42 ±5 %	
5400	48.7 ±5 %		5.53 ±5 %	
5500	48.6 ±5 %		5.65 ±5 %	
5600	48.5 ±5 %		5.77 ±5 %	
5800	48.2 ±5 %		6.00 ±5 %	

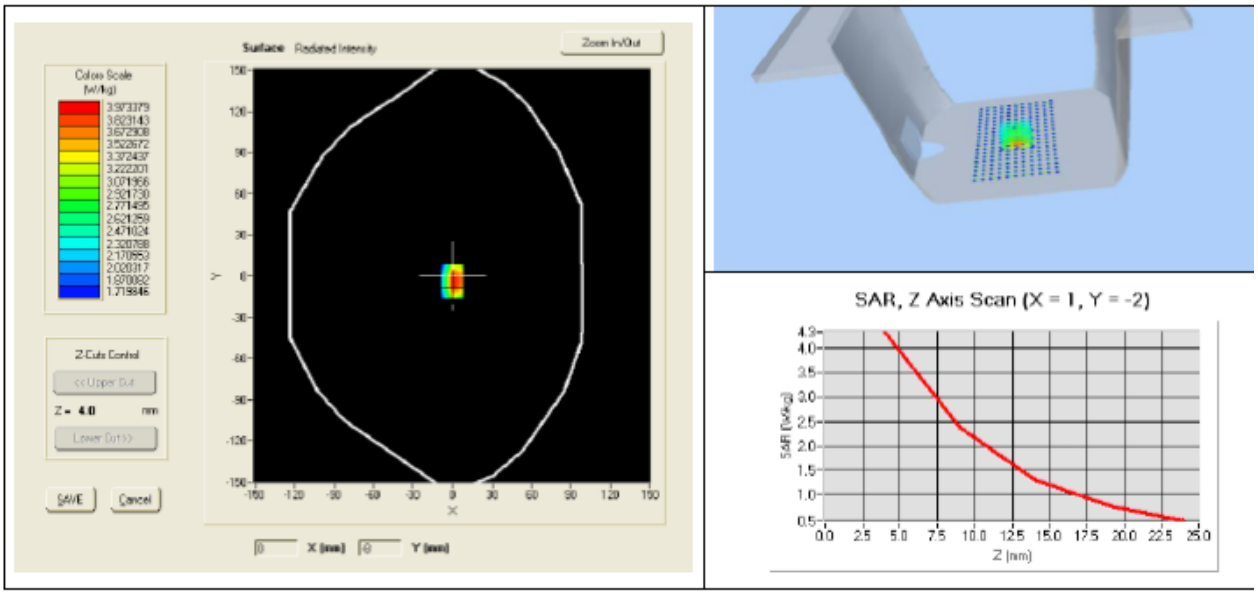
7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Body Liquid Values: eps' :54.0 sigma : 1.53
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	1900 MHz
Input power	20 dBm
Liquid Temperature	22 °C
Lab Temperature	22 °C
Lab Humidity	45 %

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0077

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1900	41.39(4.14)	21.65(2.17)



Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0077

8. LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN 40/14 SAM117	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Agilent	8753E	2015/11/27	2016/11/28
Reference Probe	Satimo	EP220 SN 17/14	2015/10/01	2016/10/01
Multimeter	Keithley	MiltiMeter2000	2016/02/27	2017/02/28
Signal Generator	Agilent	E4432B	2016/04/09	2017/04/08
Power Meter	R & S	NRP-Z23	2016/06/17	2017/06/16
Power Sensor	R & S	NRP-Z23	2016/06/17	2017/06/16
Temperature and Humidity Sensor	JM	JM222	2016/06/06	2017/06/05

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0078

SAR Reference Dipole Calibration Report

FREQUENCY: 2000 MHZ

SERIAL NO.:SN 39/09 DIPI121

INVENTEC APPLIANCES (JIANGNING) CORPORATION TESTING LABORATORY 133 JIANG-JUN ROAD, JI ANGNING ECONOMIC AND TECHNOLOGICAL DEVELOPMENT ZONE NANJING 211153 PR CHINA
Calibrated at INVENTEC 07/01/2016

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0078

	Name	Function	Date	Signature
Tested By:	Zhang shuqin	Test Engineer	07/01/2016	Zhang Shuqin
Reviewed By:	Ji jianlin	Manager	07/01/2016	Ji Jianlin
Approved By:	Xu chunxiu	Quality Manager	07/01/2016	

Issue	Date	Modifications
A	07/01/2016	Initial release

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0078

TABLE OF CONTENTS

Inventec Appliances(Jiangning) Corporation Report NO：JZ-1607-0078
Testing Laboratory

1. INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2. DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2000 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID2000
Serial Number	SN 39/09 DIPI121
Product Condition (new / used)	Used

3. PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *Satimo COMOSAR Validation Dipole*

4. MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0078

dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5. MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3-300	0.05mm

5.3 VALIDATION MEASUREMENT

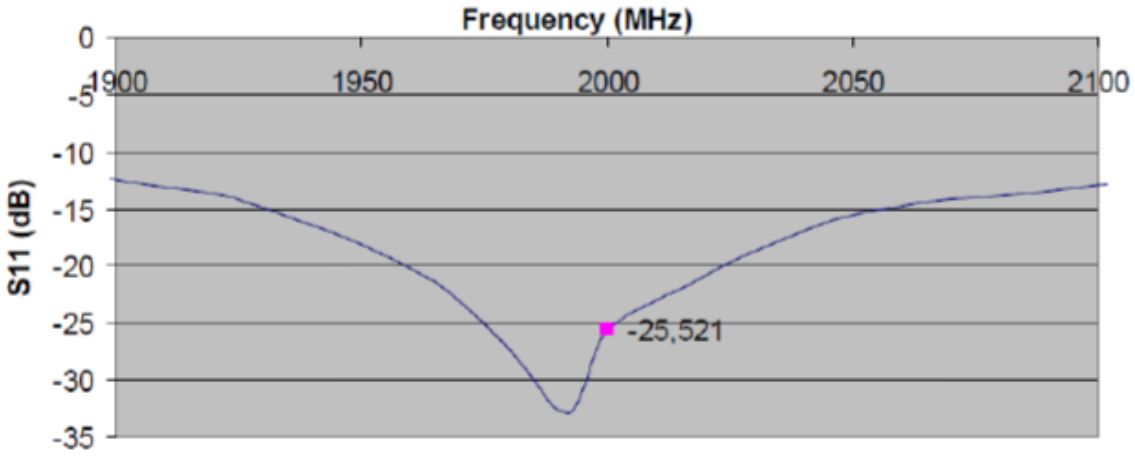
The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	16.19 %
10 g	15.86 %

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0078

6. CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance(Ω)	
			Real	Imaginary part
2000	-25.52	-20	37.19	-17.74

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.	pass	37.5 ±1 %.	pass	3.6 ±1 %.	pass
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0078

7. VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	45.3 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %	pass	1.40 ±5 %	pass
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

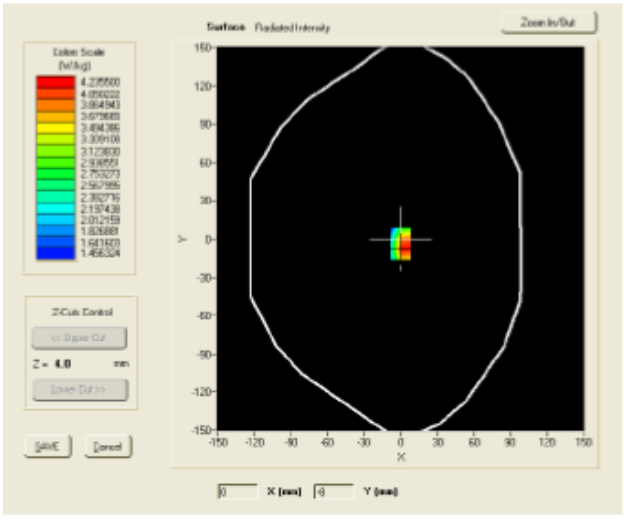
The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

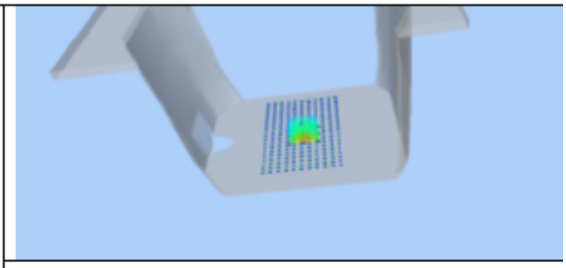
Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Head Liquid Values: eps' : 38.5 sigma : 1.43
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm

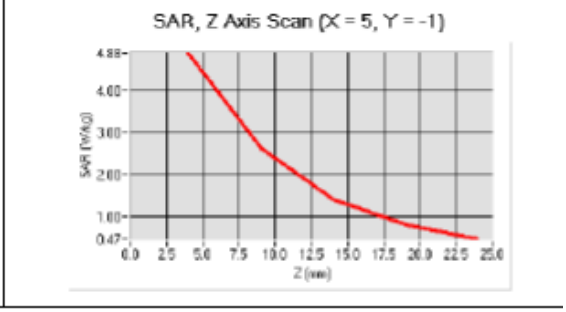
Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0078

Frequency	2000 MHz
Input power	20 dBm
Liquid Temperature	22 °C
Lab Temperature	22 °C
Lab Humidity	45%

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.85		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1	42.32(4.23)	21.1	21.00(2.10)
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	







Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0078

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %	Pass	1.52 ±5 %	Pass
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±5 %		5.30 ±5 %	
5300	48.9 ±5 %		5.42 ±5 %	
5400	48.7 ±5 %		5.53 ±5 %	
5500	48.6 ±5 %		5.65 ±5 %	
5600	48.5 ±5 %		5.77 ±5 %	
5800	48.2 ±5 %		6.00 ±5 %	

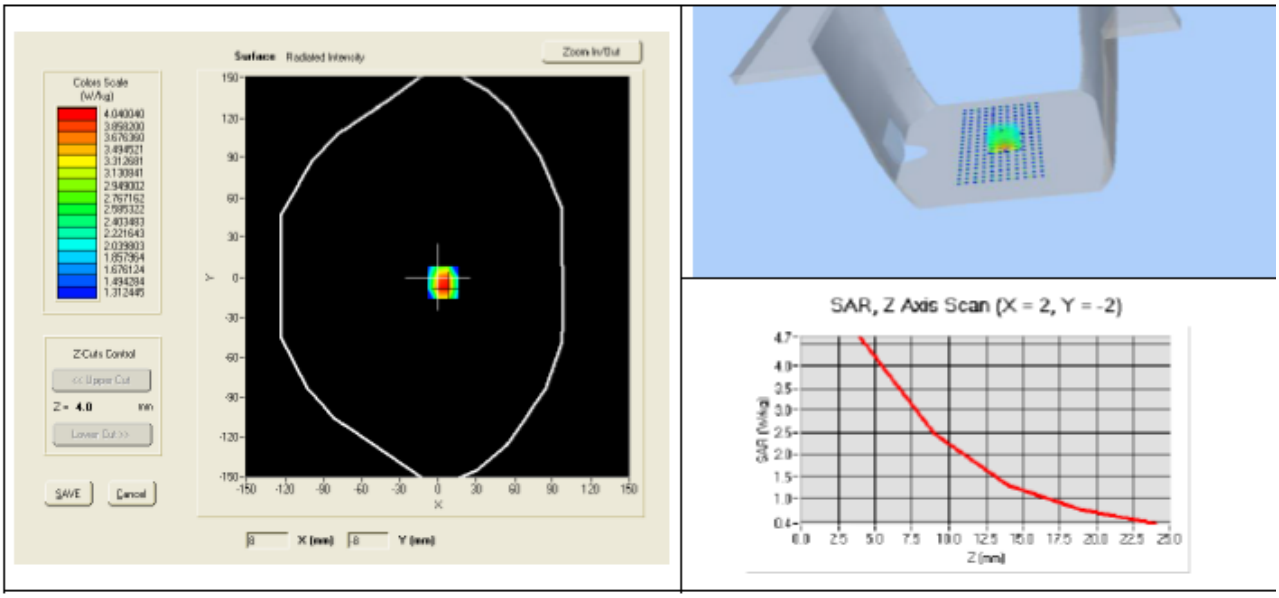
7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Body Liquid Values: eps' :53.3 sigma : 1.57
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2000 MHz
Input power	20 dBm
Liquid Temperature	22 °C
Lab Temperature	22 °C
Lab Humidity	45 %

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0078

Frequency MHz	1 g SAR (W/kg/W) measured	10 g SAR (W/kg/W) measured
2000	42.20(4.22)	21.64(2.16)



Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0078

8. LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN 40/14 SAM117	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Agilent	8753E	2015/11/27	2016/11/28
Reference Probe	Satimo	EP220 SN 17/14	2015/10/01	2016/10/01
Multimeter	Keithley	MiltiMeter2000	2016/02/27	2017/02/28
Signal Generator	Agilent	E4432B	2016/04/09	2017/04/08
Power Meter	R & S	NRP-Z23	2016/06/17	2017/06/16
Power Sensor	R & S	NRP-Z23	2016/06/17	2017/06/16
Temperature and Humidity Sensor	JM	JM222	2016/06/06	2017/06/05

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0079

SAR Reference Dipole Calibration Report

FREQUENCY: 2450 MHZ

SERIAL NO.:SN 39/09 DIPJ122

INVENTEC APPLIANCES (JIANGNING)
CORPORATION TESTING LABORATORY

133 JIANG-JUN ROAD, JI ANGNING ECONOMIC AND
TECHNOLOGICAL DEVELOPMENT ZONE
NANJING 211153 PR CHINA

Calibrated at INVENTEC

07/01/2016

Inventec Appliances(Jiangning) Corporation
Testing Laboratory

Report NO：JZ-1607-0079

	Name	Function	Date	Signature
Tested By:	Zhang shuqin	Test Engineer	07/01/2016	Zhang Shuqin
Reviewed By:	Ji jianlin	Manager	07/01/2016	Ji Jianlin
Approved By:	Xu chunxiu	Quality Manager	07/01/2016	

Issue	Date	Modifications
A	07/01/2016	Initial release

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0079

TABLE OF CONTENTS

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0079

1. INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2. DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2450 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID2450
Serial Number	SN 39/09 DIPJ122
Product Condition (new / used)	Used

3. PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *Satimo COMOSAR Validation Dipole*

4. MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0079

dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5. MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3-300	0.05mm

5.3 VALIDATION MEASUREMENT

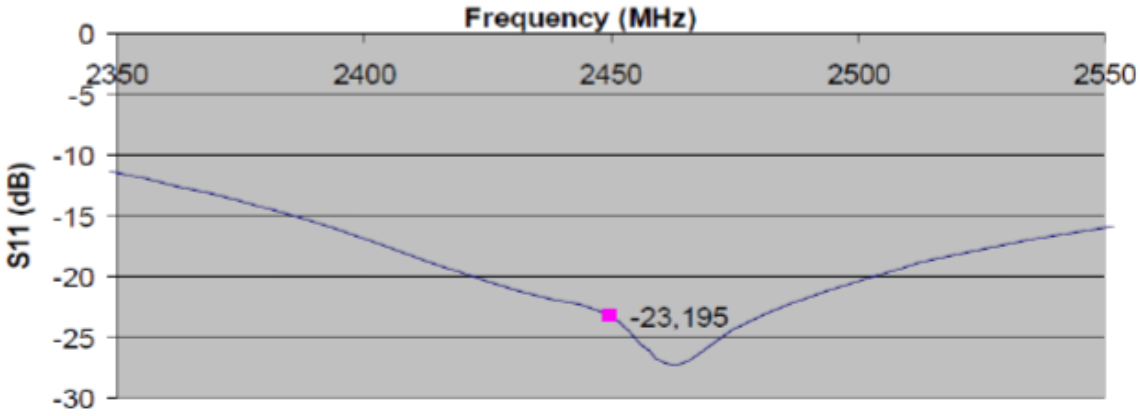
The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	16.19 %
10 g	15.86 %

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0079

6. CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance(Ω)	
			Real	Imaginary part
2450	-23.20	-20	26.20	8.63

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.	pass	30.4 ±1 %.	pass	3.6 ±1 %.	pass
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0079

7. VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	45.3 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %	pass	1.80 ±5 %	pass
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

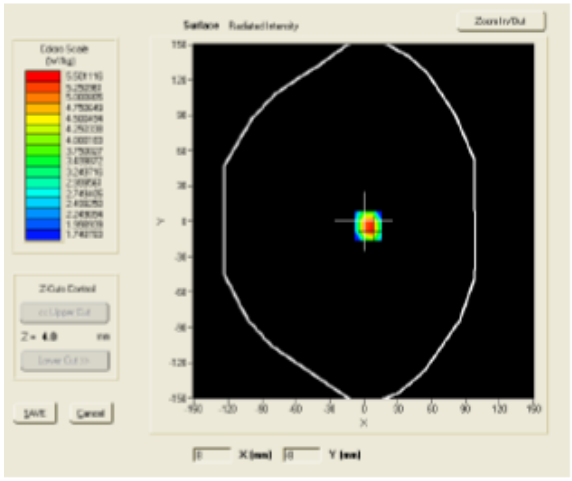
The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

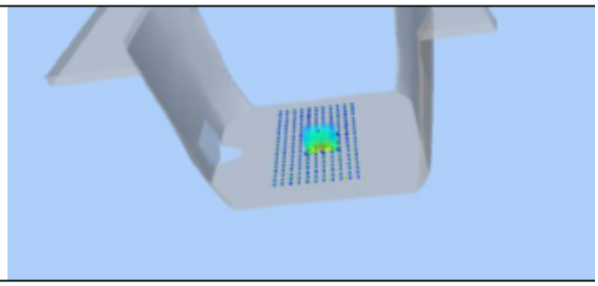
Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Head Liquid Values: eps' : 38.0 sigma : 1.84
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm

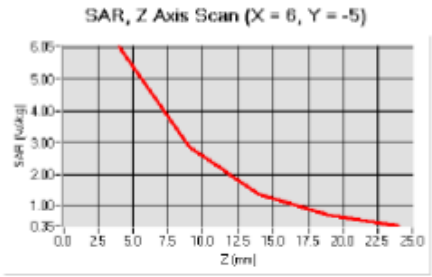
Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0079

Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	22 °C
Lab Temperature	22 °C
Lab Humidity	45%

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.85		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4	55.19(5.52)	24	24.96(2.50)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	







Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0079

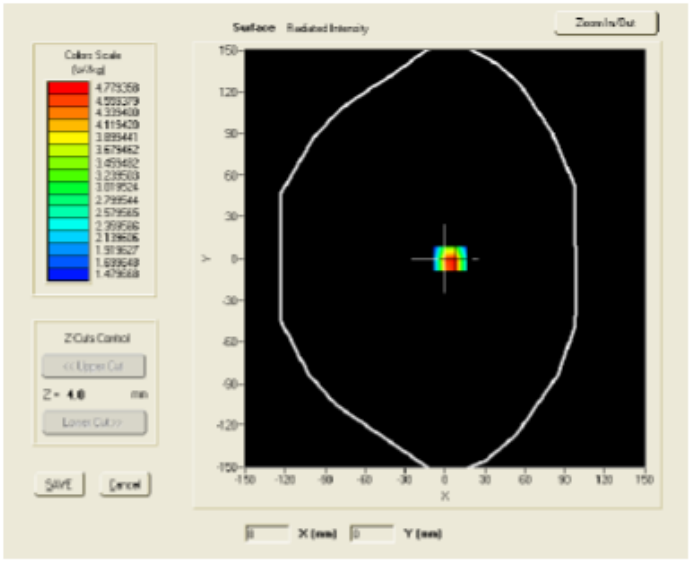
7.3 BODY LIQUID MEASUREMENT

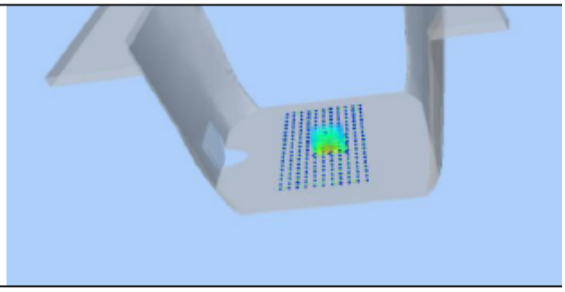
Frequency MHz	Relative permittivity(r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %	Pass	1.95 ±5 %	Pass
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±5 %		5.30 ±5 %	
5300	48.9 ±5 %		5.42 ±5 %	
5400	48.7 ±5 %		5.53 ±5 %	
5500	48.6 ±5 %		5.65 ±5 %	
5600	48.5 ±5 %		5.77 ±5 %	
5800	48.2 ±5 %		6.00 ±5 %	

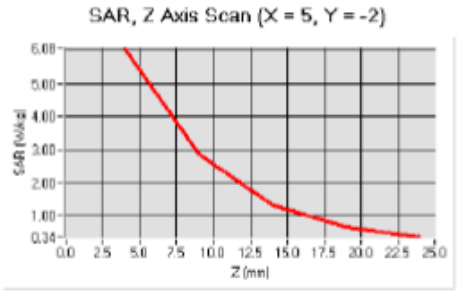
7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 40/14 SAM117
Probe	SN 17/14 EP220
Liquid	Body Liquid Values: eps' :51.7 sigma : 1.93
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	22 °C
Lab Temperature	22 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W) measured	10 g SAR (W/kg/W) measured
2450	52.85(5.29)	24.78(2.48)







Inventec Appliances(Jiangning) Corporation
Testing Laboratory
Report NO：JZ-1607-0079

8. LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN 40/14 SAM117	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Agilent	8753E	2015/11/27	2016/11/28
Reference Probe	Satimo	EP220 SN 17/14	2015/10/01	2016/10/01
Multimeter	Keithley	MiltiMeter2000	2016/02/27	2017/02/28
Signal Generator	Agilent	E4432B	2016/04/09	2017/04/08
Power Meter	R & S	NRP-Z23	2016/06/17	2017/06/16
Power Sensor	R & S	NRP-Z23	2016/06/17	2017/06/16
Temperature and Humidity Sensor	JM	JM222	2016/06/06	2017/06/05