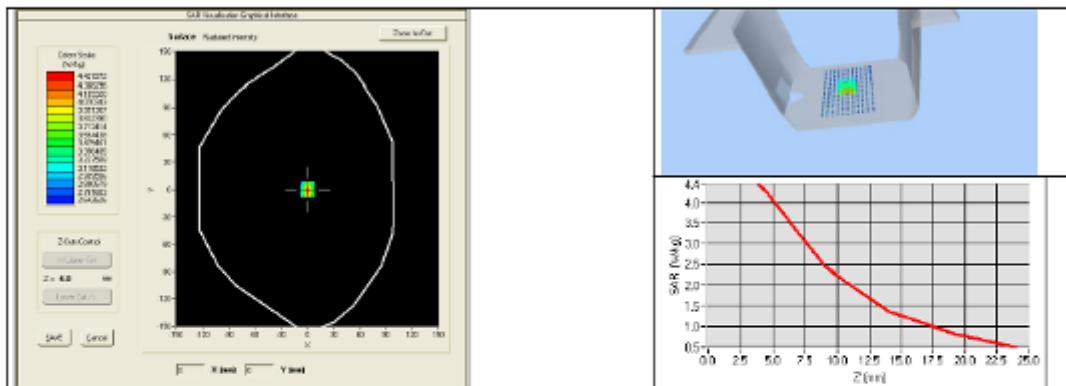




SAR REFERENCE DIPOLE CALIBRATION REPORT

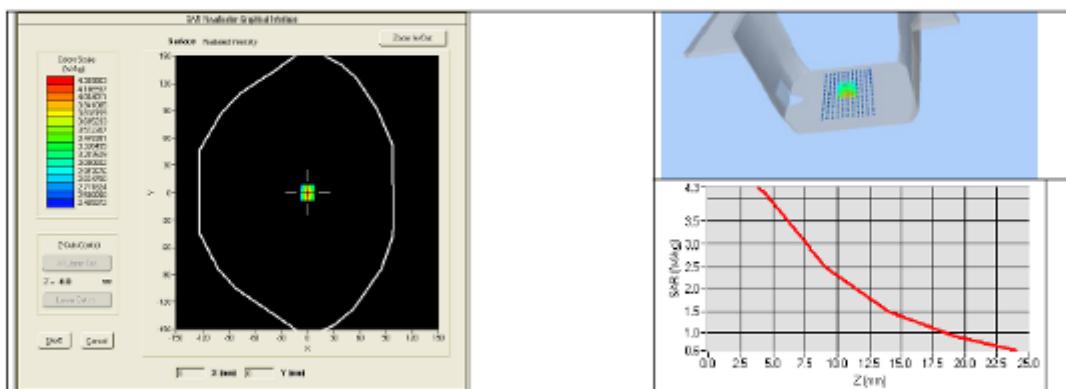
Ref ACR.96.6.13.SATU.A



7.4 BODY MEASUREMENT RESULT

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_s : 52.5 sigma : 1.50
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8\text{mm}/dy=8\text{mm}$
Zoon Scan Resolution	$dx=8\text{mm}/dy=8\text{mm}/dz=5\text{mm}$
Frequency	1900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	
	measured	measured
1900	40.29 (4.03)	21.10 (2.11)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM 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
Calipers	Carrera	CALIPER-01	12/2010	12/2013
Reference Probe	Satimo	EPG122 SN 18/11	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Multimeter	Keithley 2000	1188656	11/2010	11/2013
Signal Generator	Agilent E4438C	MY49070581	12/2010	12/2013
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2010	11/2013
Power Sensor	HP ECP-E26A	US37181460	11/2010	11/2013
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	3/2012	3/2014

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SID2450 Dipole Calibration Certificate



SAR Reference Dipole Calibration Report

Ref: ACR.96.8.13.SATU.A

**CCIC SOUTHERN ELECTRONIC PRODUCT TESTING
(SHENZHEN) CO.,LTD**

**ELECTRONIC TESTING BUILDING, SHAHE ROAD, XILI
TOWN SHENZHEN, P.R.CHINA**

**SATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 2450 MHZ**

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144



04/05/13

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref ACR.96.8.13.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	4/5/2013	
Checked by :	Jérôme LUC	Product Manager	4/5/2013	
Approved by :	Kim RUTKOWSKI	Quality Manager	4/5/2013	Kim RUTKOWSKI

	Customer Name
Distribution :	Shenzhen EMC-united Co., Ltd

Issue	Date	Modifications
A	4/5/2013	Initial release

Page: 2/10

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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 09/13 DIP2G450-220
Product Condition (new / used)	new

A yearly calibration interval is recommended.

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 constructed 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 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	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

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 %

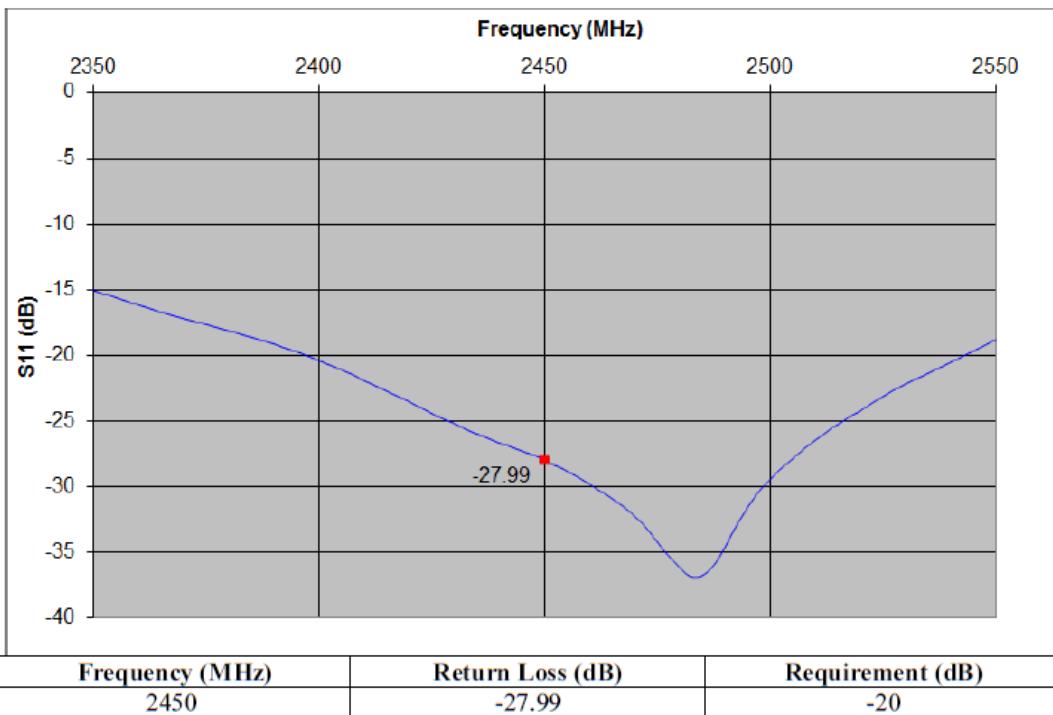
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6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 \pm 1 %.		250.0 \pm 1 %.		6.35 \pm 1 %.	
450	290.0 \pm 1 %.		166.7 \pm 1 %.		6.35 \pm 1 %.	
750	176.0 \pm 1 %.		100.0 \pm 1 %.		6.35 \pm 1 %.	
835	161.0 \pm 1 %.		89.8 \pm 1 %.		3.6 \pm 1 %.	
900	149.0 \pm 1 %.		83.3 \pm 1 %.		3.6 \pm 1 %.	
1450	89.1 \pm 1 %.		51.7 \pm 1 %.		3.6 \pm 1 %.	
1500	80.5 \pm 1 %.		50.0 \pm 1 %.		3.6 \pm 1 %.	
1640	79.0 \pm 1 %.		45.7 \pm 1 %.		3.6 \pm 1 %.	
1750	75.2 \pm 1 %.		42.9 \pm 1 %.		3.6 \pm 1 %.	
1800	72.0 \pm 1 %.		41.7 \pm 1 %.		3.6 \pm 1 %.	
1900	68.0 \pm 1 %.		39.5 \pm 1 %.		3.6 \pm 1 %.	
1950	66.3 \pm 1 %.		38.5 \pm 1 %.		3.6 \pm 1 %.	
2000	64.5 \pm 1 %.		37.5 \pm 1 %.		3.6 \pm 1 %.	
2100	61.0 \pm 1 %.		35.7 \pm 1 %.		3.6 \pm 1 %.	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref ACR.96.8.13.SATU.A

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 %.	

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 MEASUREMENT CONDITION

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_r' : 38.6 sigma : 1.82
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	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

7.2 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±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 %	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref ACR.96.8.13.SATU.A

2000	40.0 \pm 5 %		1.40 \pm 5 %	
2100	39.8 \pm 5 %		1.49 \pm 5 %	
2300	39.5 \pm 5 %		1.67 \pm 5 %	
2450	39.2 \pm 5 %	PASS	1.80 \pm 5 %	PASS
2600	39.0 \pm 5 %		1.96 \pm 5 %	
3000	38.5 \pm 5 %		2.40 \pm 5 %	
3500	37.9 \pm 5 %		2.91 \pm 5 %	

7.3 MEASUREMENT RESULT

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.

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		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	53.33 (5.33)	24	24.23 (2.42)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	

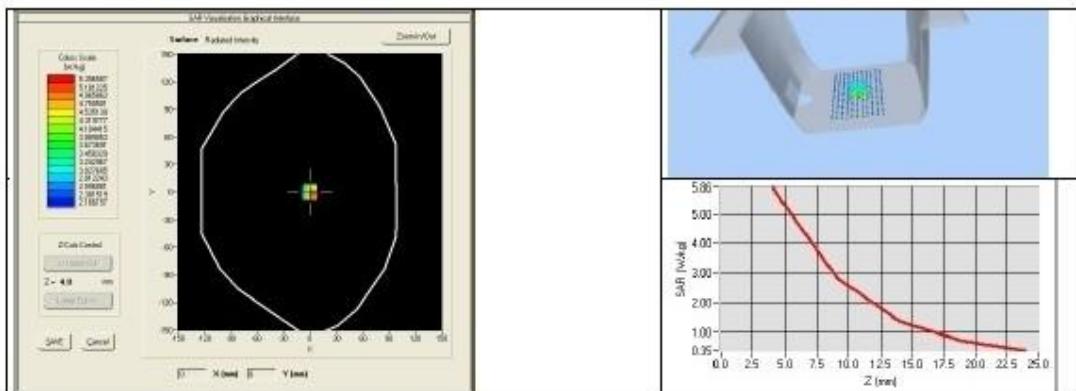
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SAR REFERENCE DIPOLE CALIBRATION REPORT

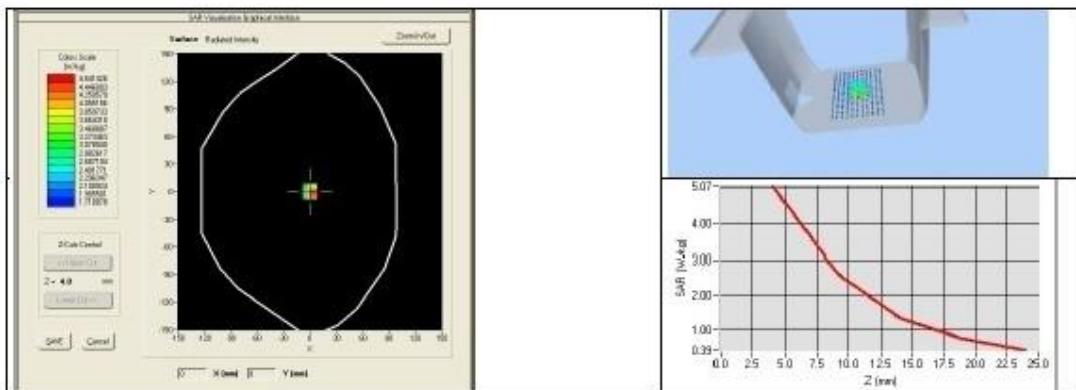
Ref: ACR 96.8.13.SATU.A



7.4 BODY MEASUREMENT RESULT

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: $\epsilon_s' : 52.0$ $\sigma : 1.94$
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8\text{mm}/dy=8\text{mm}$
Zoon Scan Resolution	$dx=8\text{mm}/dy=8\text{mm}/dz=5\text{mm}$
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2450	51.99 (5.20)	23.96 (2.40)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM 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
Calipers	Carrera	CALIPER-01	12/2010	12/2013
Reference Probe	Satimo	EPG122 SN 18/11	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Multimeter	Keithley 2000	1188656	11/2010	11/2013
Signal Generator	Agilent E4438C	MY49070581	12/2010	12/2013
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2010	11/2013
Power Sensor	HP ECP-E26A	US37181460	11/2010	11/2013
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	3/2012	3/2014

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SID5G Dipole Calibration Ceriticate



SAR Reference Waveguide Calibration Report

Ref: ACR.170.8.14.SATU.A

SIEMIC TESTING AND CERTIFICATION SERVICES

ZONE A,FLOOR 1,BUILDING 2,WAN YE LONG
TECHNOLOGY PARK,SOUTH SIDE OF ZHOU SHI ROAD,
SHIYAN STREET, BAO'AN DISTRICT, SHENZHEN 518108 ,
GUANGDONG , P.R.C.

SATIMO COMOSAR REFERENCE WAVEGUIDE

FREQUENCY: 5000-6000 MHZ

SERIAL NO.: SN 24/11 WGA16

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144



06/18/2014

Summary:

This document presents the method and results from an accredited SAR reference waveguide calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.1708.14.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	6/19/2014	
Checked by :	Jérôme LUC	Product Manager	6/19/2014	
Approved by :	Kim RUTKOWSKI	Quality Manager	6/19/2014	

	Customer Name
Distribution :	SIEMIC Testing and Certification Services

Issue	Date	Modifications
A	6/19/2014	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528 and CEI/IEC 62209 standards for reference waveguides 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 5000-6000 MHz REFERENCE WAVEGUIDE
Manufacturer	Satimo
Model	SWG5500
Serial Number	SN 24/11 WGA16
Product Condition (new / used)	used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Waveguides are built in accordance to the IEEE 1528 and CEI/IEC 62209 standards.

4 MEASUREMENT METHOD

The IEEE 1528 and CEI/IEC 62209 standards provide requirements for reference waveguides 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 waveguide used for SAR system validation measurements and checks must have a return loss of -8 dB or better. The return loss measurement shall be performed with matching layer placed in the open end of the waveguide, with the waveguide and matching layer in direct contact with the phantom shell as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE 1528 and CEI/IEC 62209 standards specify the mechanical dimensions of the validation waveguide, the specified dimensions are as shown in Section 6.2. Figure 1 shows how the dimensions relate to the physical construction of the waveguide.

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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	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

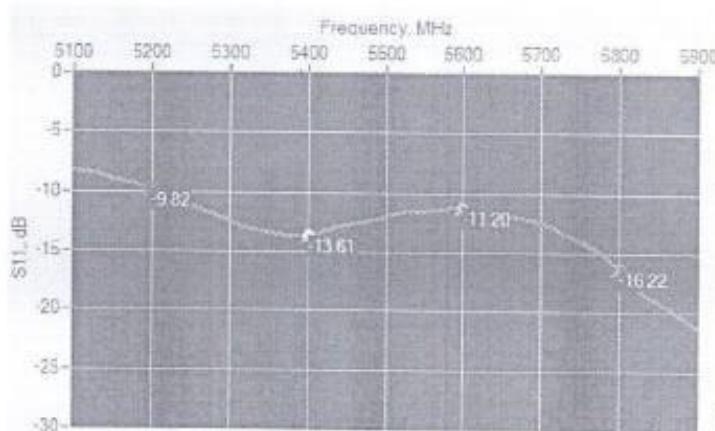
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Return Loss (dB)	Requirement (dB)
5000-6000	< -8.18	-8

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6.2 MECHANICAL DIMENSIONS

Frequency (MHz)	L (mm)		W (mm)		L _f (mm)		W _f (mm)		T (mm)	
	Require d	Measure d	Require d	Measure d	Require d	Measure d	Require d	Measure d	Require d	Measure d
5200	40.39 ± 0.13	PASS	20.19 ± 0.13	PASS	81.03 ± 0.13	PASS	61.98 ± 0.13	PASS	5.3*	PASS
5800	40.39 ± 0.13	PASS	20.19 ± 0.13	PASS	81.03 ± 0.13	PASS	61.98 ± 0.13	PASS	4.3*	PASS

* The tolerance for the matching layer is included in the return loss measurement.

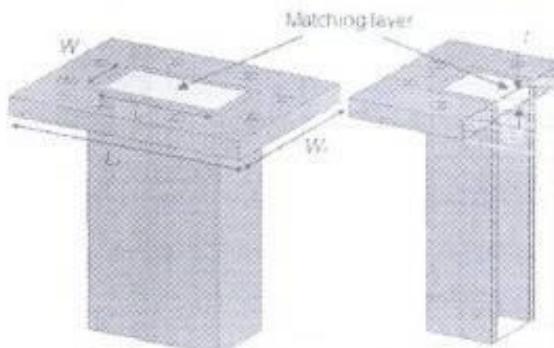


Figure 1: Validation Waveguide Dimensions

7 VALIDATION MEASUREMENT

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference waveguide meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed with the matching layer placed in the open end of the waveguide, with the waveguide and matching layer in direct contact with the phantom shell.

Measurement Condition

Software	OPEN SAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values 5200 MHz: $\epsilon_{\text{pr}}' = 36.47$ sigma: 4.91 Head Liquid Values 5400 MHz: $\epsilon_{\text{pr}}' = 36.83$ sigma: 5.02 Head Liquid Values 5600 MHz: $\epsilon_{\text{pr}}' = 35.39$ sigma: 5.49 Head Liquid Values 5800 MHz: $\epsilon_{\text{pr}}' = 34.91$ sigma: 5.76
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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7.1 HEAD LIQUID MEASUREMENT

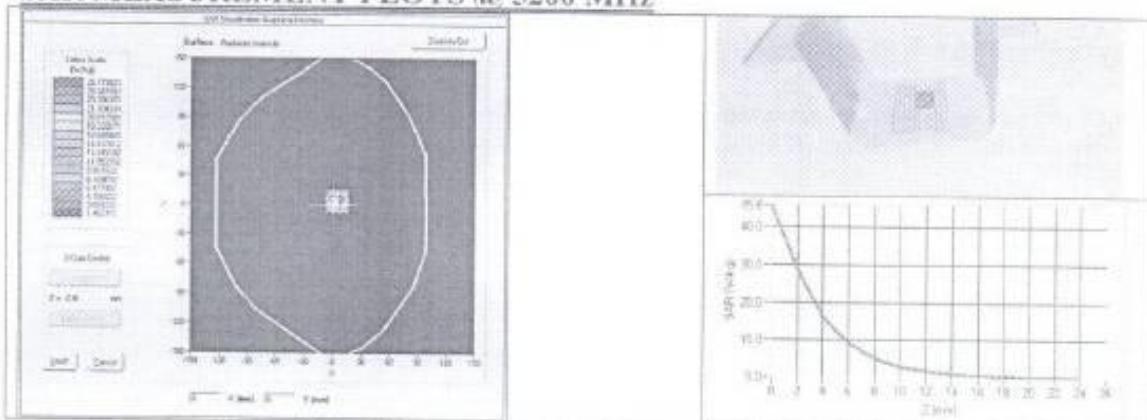
Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
5000	$36.2 \pm 10\%$		$4.45 \pm 10\%$	
5100	$36.1 \pm 10\%$		$4.56 \pm 10\%$	
5200	$36.0 \pm 10\%$	PASS	$4.66 \pm 10\%$	PASS
5300	$35.9 \pm 10\%$		$4.76 \pm 10\%$	
5400	$35.8 \pm 10\%$	PASS	$4.86 \pm 10\%$	PASS
5500	$35.6 \pm 10\%$		$4.97 \pm 10\%$	
5600	$35.5 \pm 10\%$	PASS	$5.07 \pm 10\%$	PASS
5700	$35.4 \pm 10\%$		$5.17 \pm 10\%$	
5800	$35.3 \pm 10\%$	PASS	$5.27 \pm 10\%$	PASS
5900	$35.2 \pm 10\%$		$5.38 \pm 10\%$	
6000	$35.1 \pm 10\%$		$5.48 \pm 10\%$	

7.2 MEASUREMENT RESULT

At those frequencies, the target SAR value can not be generic. Hereunder is the target SAR value defined by Satimo, within the uncertainty for the system validation. All SAR values are normalized to 1 W net power. In bracket, the measured SAR is given with the used input power.

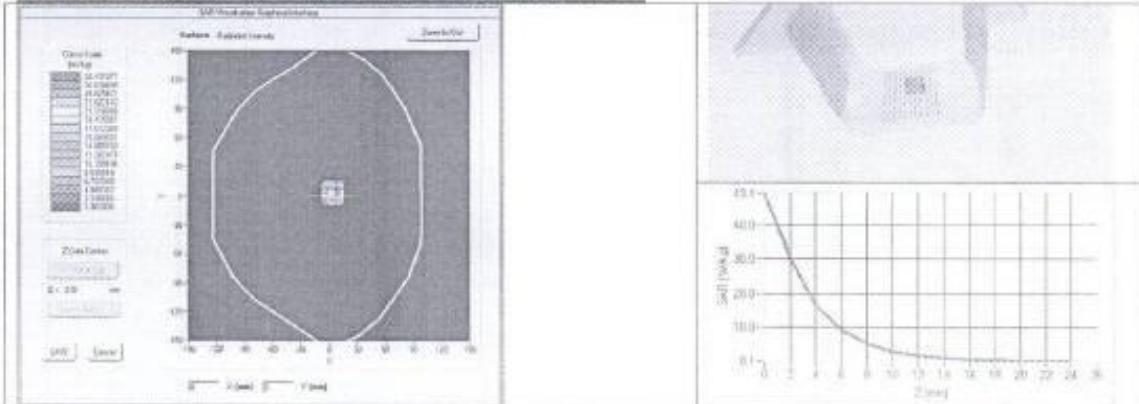
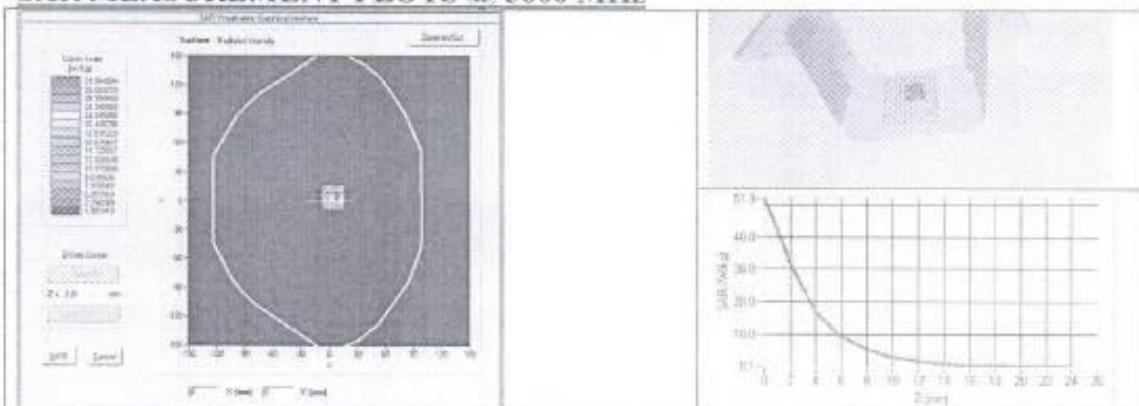
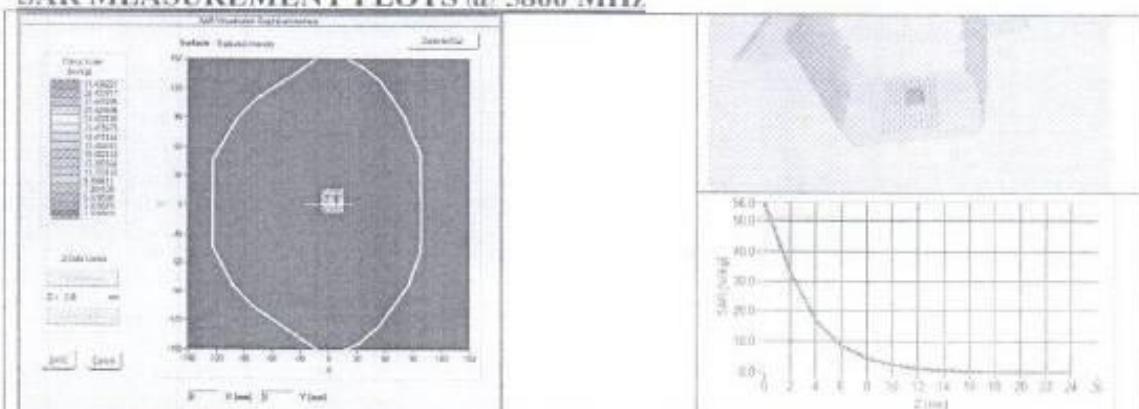
Frequency (MHz)	1 g SAR (W/kg)		10 g SAR (W/kg)	
	required	measured	required	measured
5200	159.00	163.32 (16.33)	56.90	57.02 (5.70)
5400	166.40	170.07 (17.01)	58.43	58.55 (5.85)
5600	173.80	176.88 (17.69)	59.97	60.45 (6.04)
5800	181.20	182.74 (18.27)	61.50	61.72 (6.17)

SAR MEASUREMENT PLOTS @ 5200 MHz



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**SAR MEASUREMENT PLOTS @ 5400 MHz****SAR MEASUREMENT PLOTS @ 5600 MHz****SAR MEASUREMENT PLOTS @ 5800 MHz**

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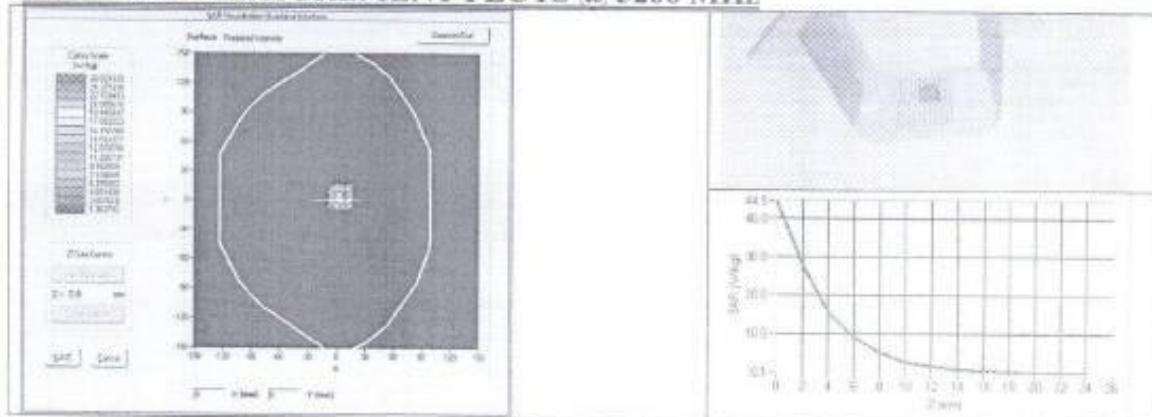


7.3 BODY MEASUREMENT RESULT

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values 5200 MHz: eps': 51.18 sigma : 4.84 Body Liquid Values 5400 MHz: eps': 48.35 sigma : 5.81 Body Liquid Values 5600 MHz: eps': 49.03 sigma : 6.17 Body Liquid Values 5800 MHz: eps': 47.18 sigma : 6.32
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

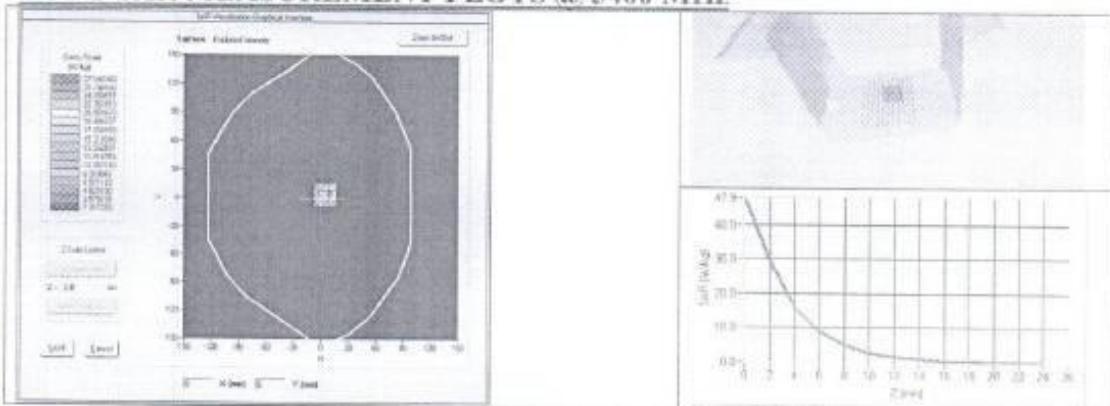
Frequency (MHz)	1 g SAR (W/kg)	10 g SAR (W/kg)
	measured	measured
5200	158.88 (15.89)	55.44 (5.54)
5400	165.05 (16.51)	56.94 (5.69)
5600	171.26 (17.13)	58.30 (5.83)
5800	176.93 (17.69)	59.66 (5.97)

BODY SAR MEASUREMENT PLOTS @ 5200 MHz

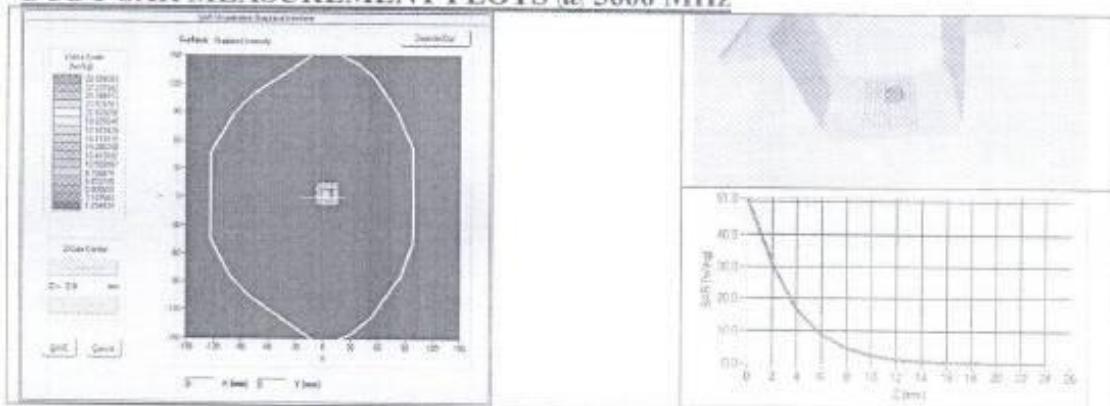




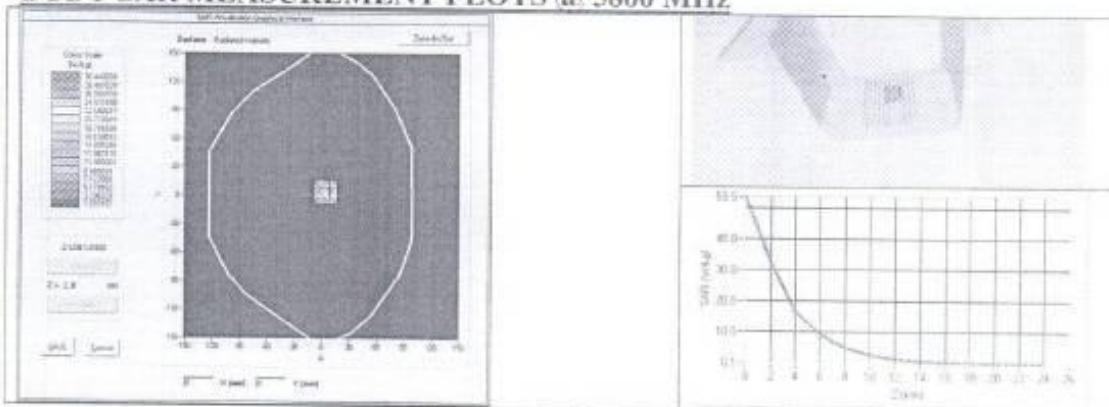
BODY SAR MEASUREMENT PLOTS @ 5400 MHz



BODY SAR MEASUREMENT PLOTS @ 5600 MHz



BODY SAR MEASUREMENT PLOTS @ 5800 MHz





8 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
Calipers	Carrera	CALIPER-01	12/2013	12/2016
Reference Probe	Satimo	EPG122 SN 18/11	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
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.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

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<Justification of the extended calibration>

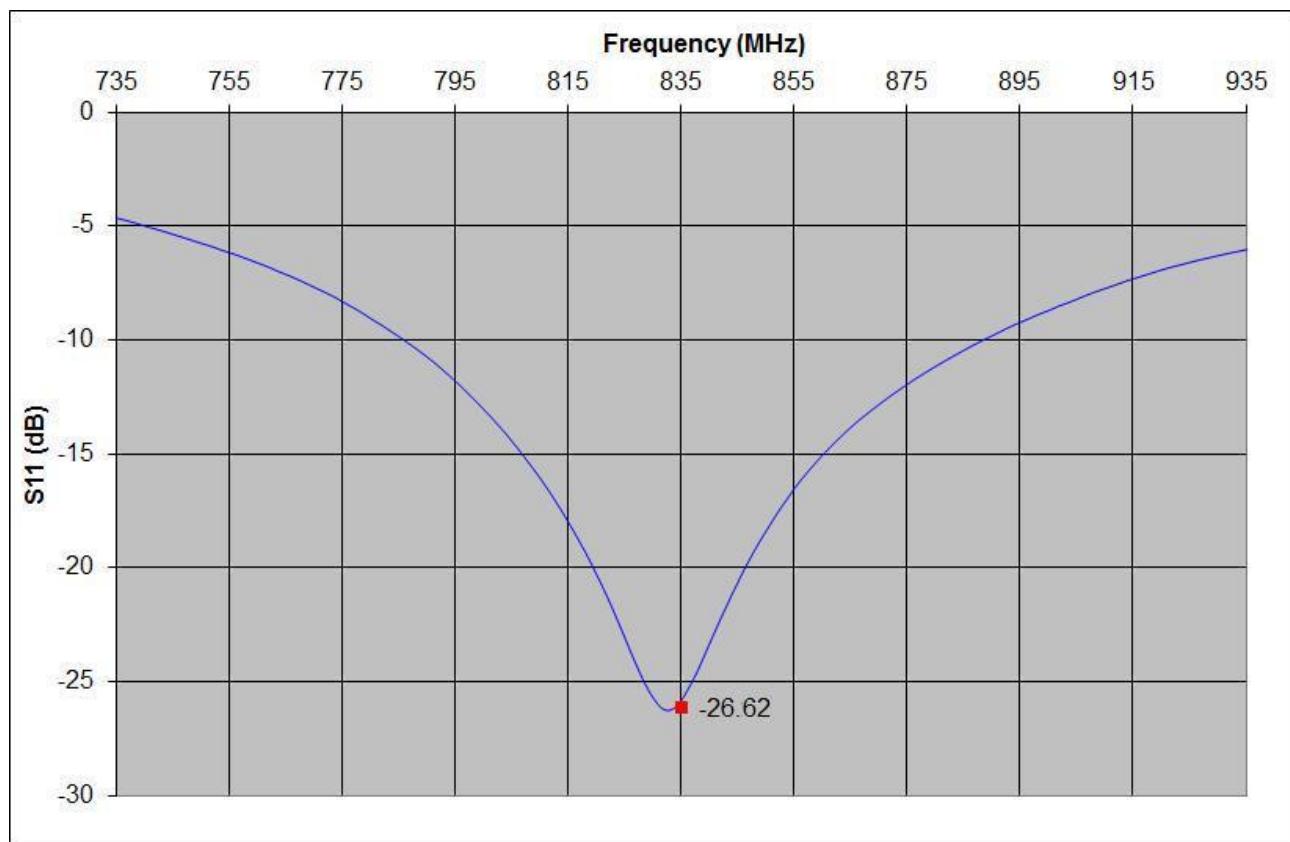
Referring to KDB 450824, if dipoles are verified in return loss(<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

835MHz				
Date of Measurement	Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)
2013.04.05	-26.15	-	49.25	-
2014.04.02	-26.62	1.8	48.37	0.88

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

<Dipole Verification Data>

835MHz

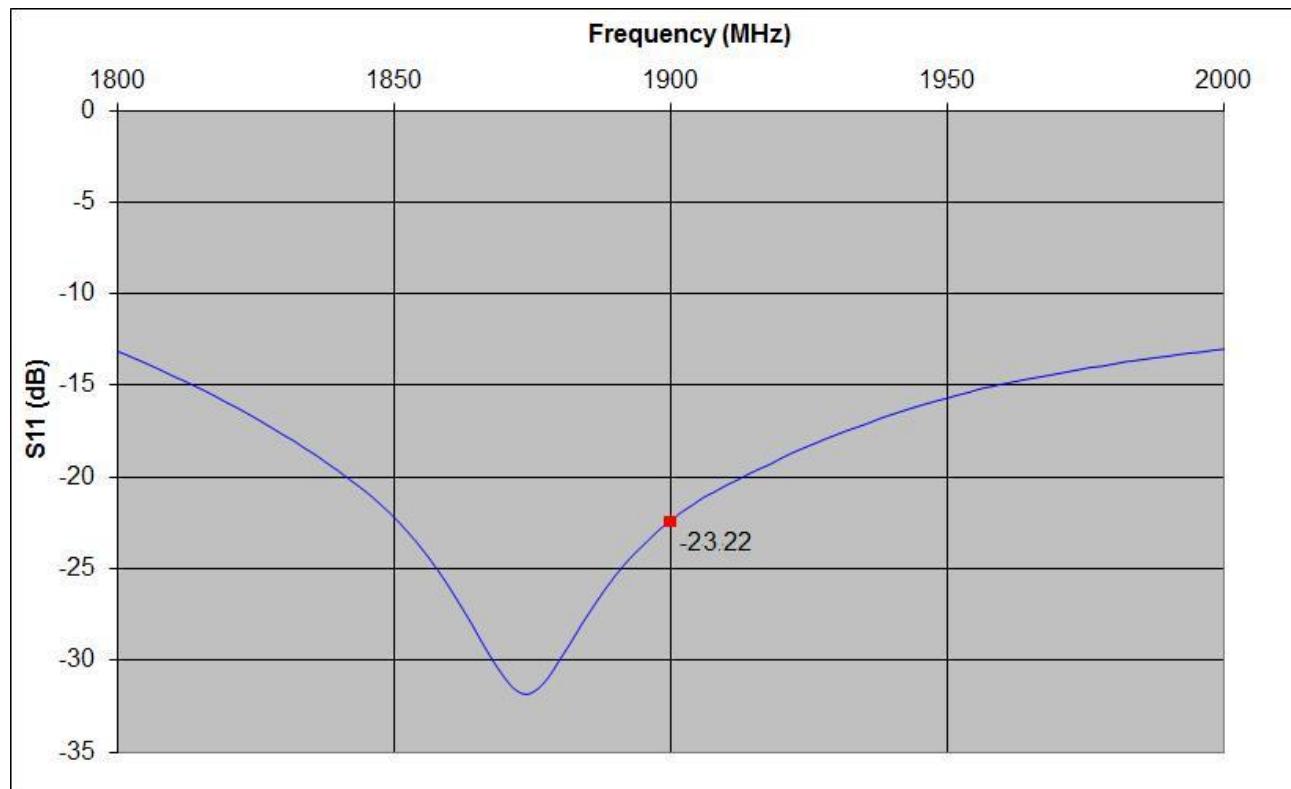


1900MHz				
Date of Measurement	Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)
2013.04.05	-22.43	-	50.21	-
2014.04.02	-23.22	3.5	51.08	-0.87

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

<Dipole Verification Data>

1900MHz

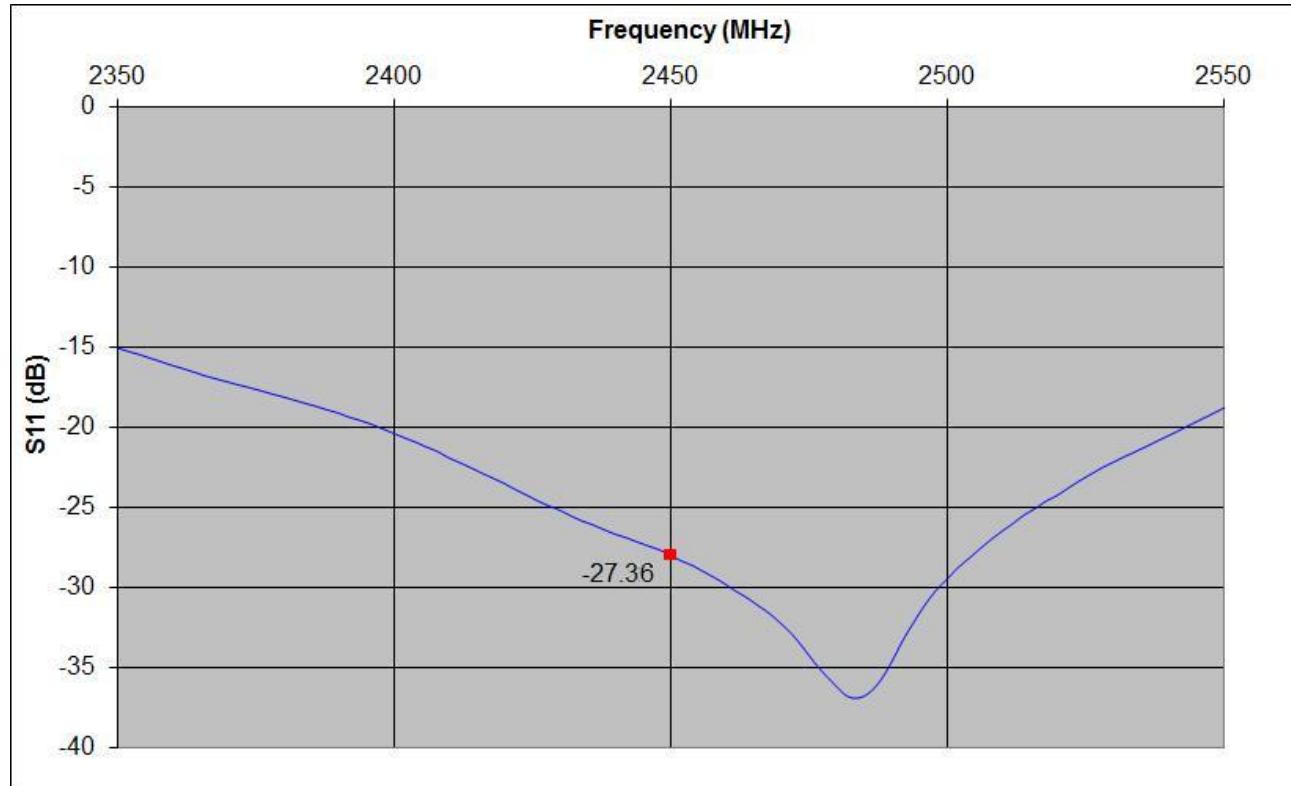


2450MHz				
Date of Measurement	Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)
2013.04.05	-27.99	-	51.37	-
2014.04.02	-27.36	2.3	50.46	0.91

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

<Dipole Verification Data>

2450MHz



Calibration Certificate of Keithley 2000 Multimeter

KEITHLEY

A Tektronix Company

A Greater Measure of Confidence

TRACEABLE CALIBRATION

2000, 4014020
Cal Date: 30-JAN-2013
Cal Due: Lab: Kei

KEITHLEY

KEITHLEY INSTRUMENTS, INC. • 28775 AURORA RD, CLEVELAND, OHIO - USA • 440-248-0400 • Fax: 440-248-6168 • 1-888-KEITHLEY • www.Keithley.com

Calibration Facility: This product was calibrated for Keithley Instruments by
Tektronix (China) Co. Ltd., 1227 Chuan Qiao Road, Pudong New District, Shanghai, China 201206

Calibration Certificate

Certificate No: PCXPTG6FZX

Revision: 00

Manufacturer: Keithley

Model: 2000

Serial No: 4014020

Description: Multimeter, 6 1/2 digit

Temperature: 23.0 °C

Humidity: 46 %

Calibration Date: 30-JAN-2013

Date Placed In Service: _____ * Due Date: _____ *

* Optional customer entry fields. The due date may be established by adding the Keithley recommended cal interval stated in the product manual to the "Date placed in service"

Initial Condition: Not applicable, new product

Final Condition: In Tolerance

- Keithley Instruments, Inc. certifies that the above instrument meets its published measurement specifications.
- This instrument has been calibrated using measurement standards traceable to the International System of Units (SI) through the PRC National Institute of Metrology (NIM), or other National Metrology Institutes (such as NIST, NPL, PTB, etc.).
- The policies and procedures used for the calibration of this product are based upon ANSI/NCSL Z540.1-1994 (R2002).
- The quality system used by the calibration facility is ISO 9001 registered.
- This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.
- This calibration certificate shall not be reproduced, except in full, without the written approval of Keithley Instruments, Inc.

Calibration Procedure Used: MANIFEST:Product_Dmm_KeithleyDMM_Full VERSION:107

Calibration Standards Used:

Manufacturer/Model	Model Description	ID Number	Due Date
Fluke 5720A	Calibrator	KI10138	18-Nov-2013
Fluke 5725A	Power Amplifier	KI5554	09-Jan-2014
Keithley 3390	Function/Arbitrary Waveform Gen	KI10261	16-Nov-2013

Issued By:

Certified By: Lin Qing Zhu

Quality Director:

Cui, Hu Wa

Date Issued: 30-JAN-2013

2000 4014020

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PA-1061A



SAR System Validation

Per FCC KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D 01 v01 and IEEE 1528-2003. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Freq. MHz	Date	probe	position	COND	PERM	CW validation			Mod validation		
				σ	ϵ	Sensitivity	Probe linearity	Probe isotropy	Mod type	Duty factor	PAR
835	20140712	SN09/13 EP169	Head	0.91	41.21	PASS	PASS	PASS	GMSK	PASS	N/A
1750	20140823	SN09/13 EP169	Head	1.39	39.93	PASS	PASS	PASS	N/A	N/A	N/A
1900	20140824	SN09/13 EP169	Head	1.41	39.95	PASS	PASS	PASS	GMSK	PASS	N/A
2450	20140827	SN09/13 EP169	Head	1.78	39.18	PASS	PASS	PASS	GMSK	PASS	N/A
5200	20140828	SN09/13 EP169	Head	5.23	35.22	PASS	PASS	PASS	OFDM	N/A	PASS
5300	20140829	SN09/13 EP169	Head	5.23	35.26	PASS	PASS	PASS	OFDM	N/A	PASS
5500	20140905	SN09/13 EP169	Head	5.24	35.28	PASS	PASS	PASS	OFDM	N/A	PASS
5600	20140906	SN07/14 EPG211	Head	5.26	35.31	PASS	PASS	PASS	OFDM	N/A	PASS
5800	20140908	SN07/14 EPG211	Head	5.25	35.29	PASS	PASS	PASS	OFDM	N/A	PASS
835	20140712	SN07/14 EPG211	Body	0.95	55.12	PASS	PASS	PASS	GMSK	PASS	N/A
1750	20140823	SN09/13 EP169	Body	1.49	53.25	PASS	PASS	PASS	N/A	N/A	N/A
1900	20140824	SN09/13 EP169	Body	1.52	53.28	PASS	PASS	PASS	GMSK	PASS	N/A
2450	20140827	SN09/13 EP169	Body	1.93	52.46	PASS	PASS	PASS	GMSK	PASS	N/A
5200	20140828	SN09/13 EP169	Body	5.89	48.13	PASS	PASS	PASS	OFDM	N/A	PASS
5300	20140829	SN09/13 EP169	Body	5.92	48.15	PASS	PASS	PASS	OFDM	N/A	PASS
5500	20140905	SN09/13 EP169	Body	5.93	48.16	PASS	PASS	PASS	OFDM	N/A	PASS
5600	20140906	SN09/13 EP169	Body	5.93	48.18	PASS	PASS	PASS	OFDM	N/A	PASS
5800	20140908	SN07/14 EPG211	Body	5.95	48.17	PASS	PASS	PASS	OFDM	N/A	PASS

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB publication 865664 D01v01 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664

—————End of the Report—————