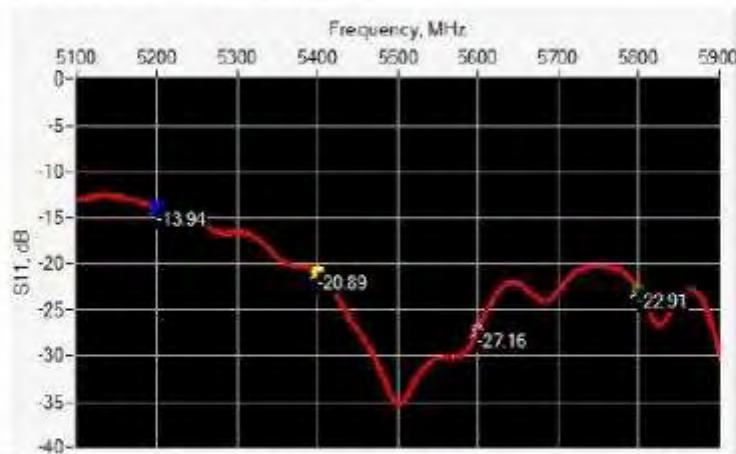




SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.262.12.14.SATU.A

6.2 RETURN LOSS IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)
5000-6000	< -13.94	-8

6.3 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.

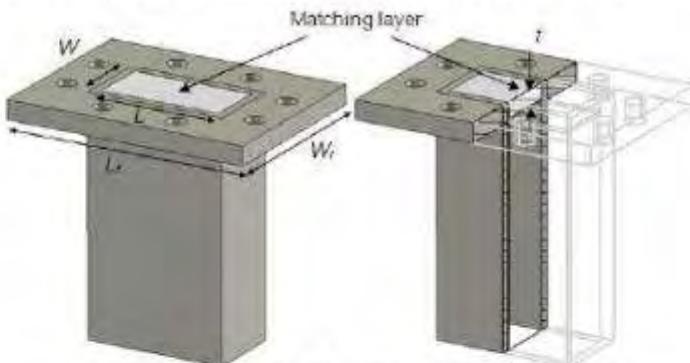


Figure 1: Validation Waveguide Dimensions

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.

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SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.262.12.14.SATU.A

7.1 HEAD LIQUID MEASUREMENT

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

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values 5200 MHz: ϵ_r' :36.62 sigma : 4.93 Head Liquid Values 5400 MHz: ϵ_r' :35.95 sigma : 5.18 Head Liquid Values 5600 MHz: ϵ_r' :36.08 sigma : 5.60 Head Liquid Values 5800 MHz: ϵ_r' :34.73 sigma : 5.74
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 %

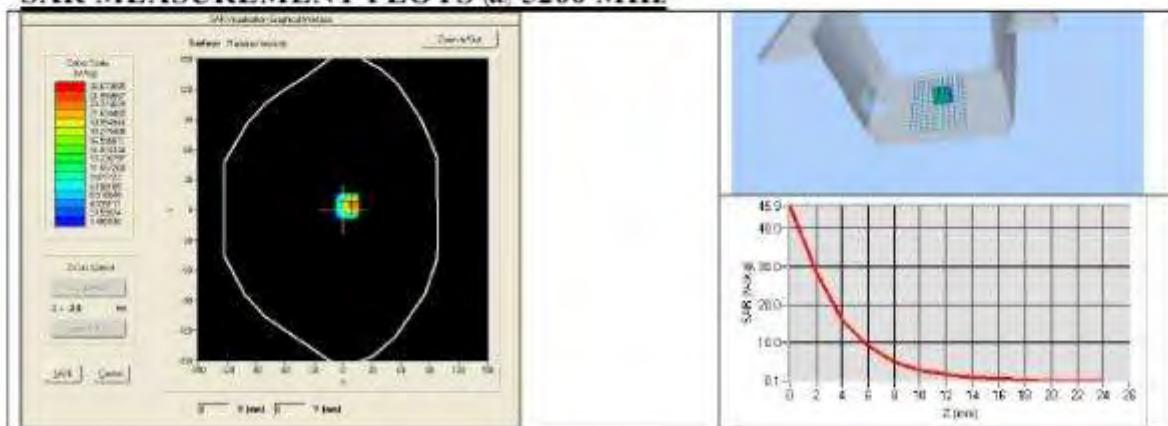


SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

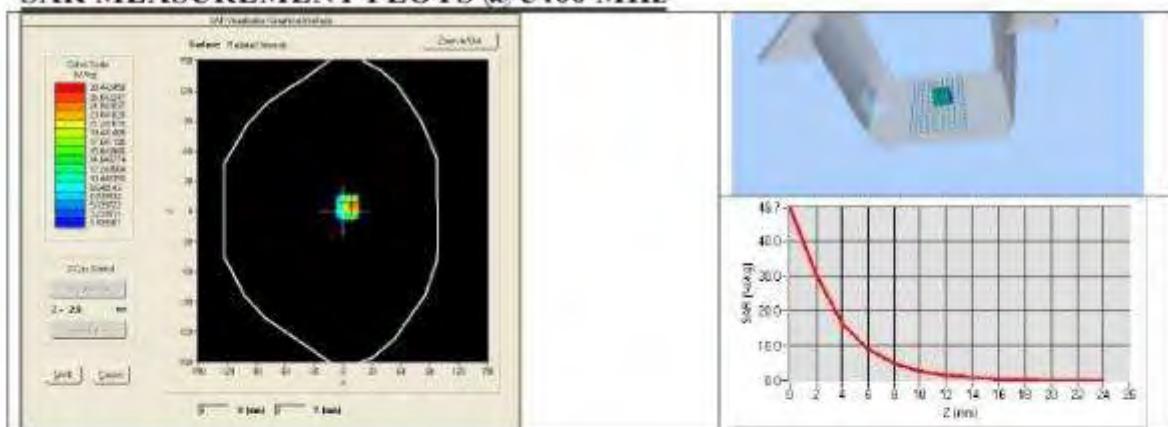
Ref: ACR.262.12.14.SATU.A

Frequency (MHz)	1 g SAR (W/kg)		10 g SAR (W/kg)	
	required	measured	required	measured
5200	159.00	163.88 (16.39)	56.90	57.29 (5.73)
5400	166.40	172.23 (17.22)	58.43	59.16 (5.92)
5600	173.80	181.28 (18.13)	59.97	61.57 (6.16)
5800	181.20	188.95 (18.90)	61.50	63.45 (6.35)

SAR MEASUREMENT PLOTS @ 5200 MHz



SAR MEASUREMENT PLOTS @ 5400 MHz

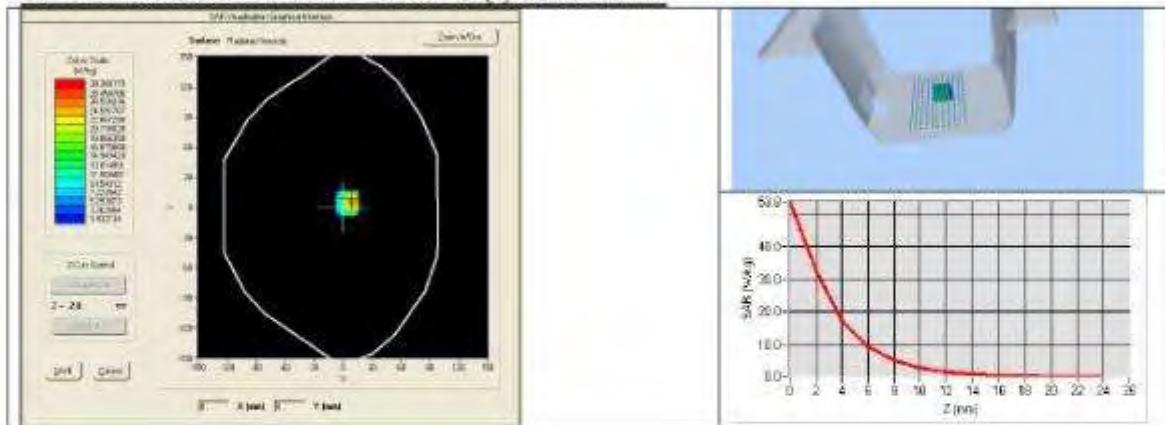




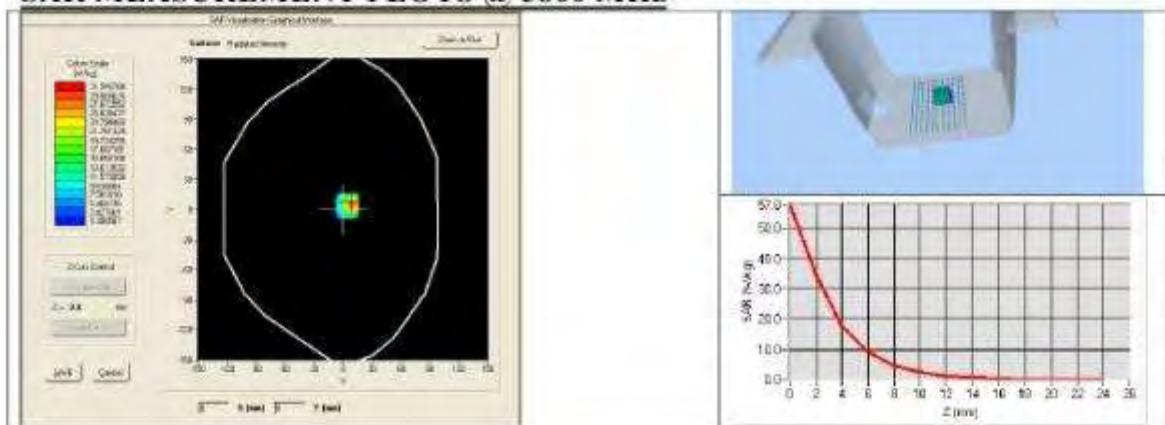
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.262.12.14.SATU.A

SAR MEASUREMENT PLOTS @ 5600 MHz



SAR MEASUREMENT PLOTS @ 5800 MHz





SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.262.12.14.SATU.A

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
5200	49.0 \pm 10 %	PASS	5.30 \pm 10 %	PASS
5300	48.9 \pm 10 %		5.42 \pm 10 %	
5400	48.7 \pm 10 %	PASS	5.53 \pm 10 %	PASS
5500	48.6 \pm 10 %		5.65 \pm 10 %	
5600	48.5 \pm 10 %	PASS	5.77 \pm 10 %	PASS
5800	48.2 \pm 10 %	PASS	6.00 \pm 10 %	PASS

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values 5200 MHz: ϵ_r :50.69 sigma : 4.98 Body Liquid Values 5400 MHz: ϵ_r :48.45 sigma : 5.82 Body Liquid Values 5600 MHz: ϵ_r :50.57 sigma : 6.37 Body Liquid Values 5800 MHz: ϵ_r :48.19 sigma : 6.45
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 %

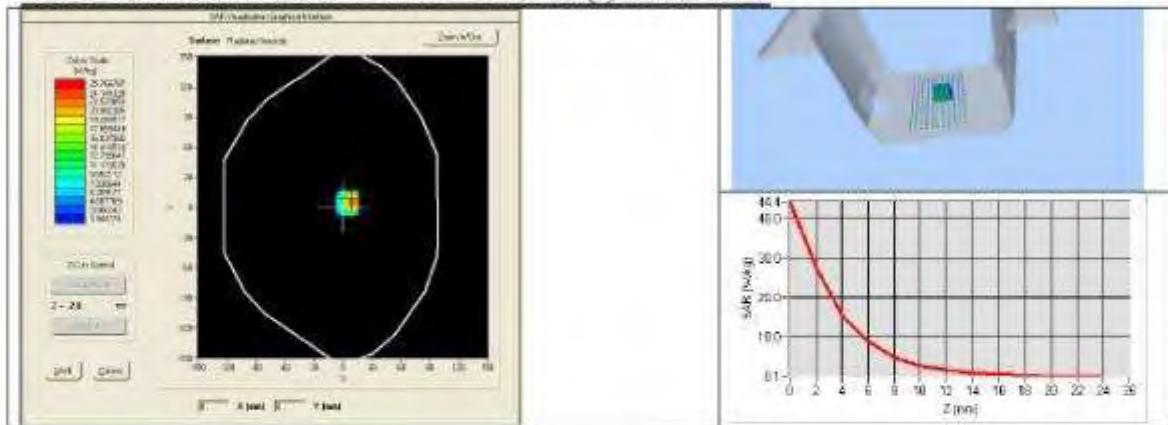
Frequency (MHz)	1 g SAR (W/kg)	10 g SAR (W/kg)
	measured	measured
5200	158.49 (15.85)	55.40 (5.54)
5400	167.20 (16.72)	57.39 (5.74)
5600	175.65 (17.57)	59.48 (5.95)
5800	183.06 (18.31)	61.62 (6.16)



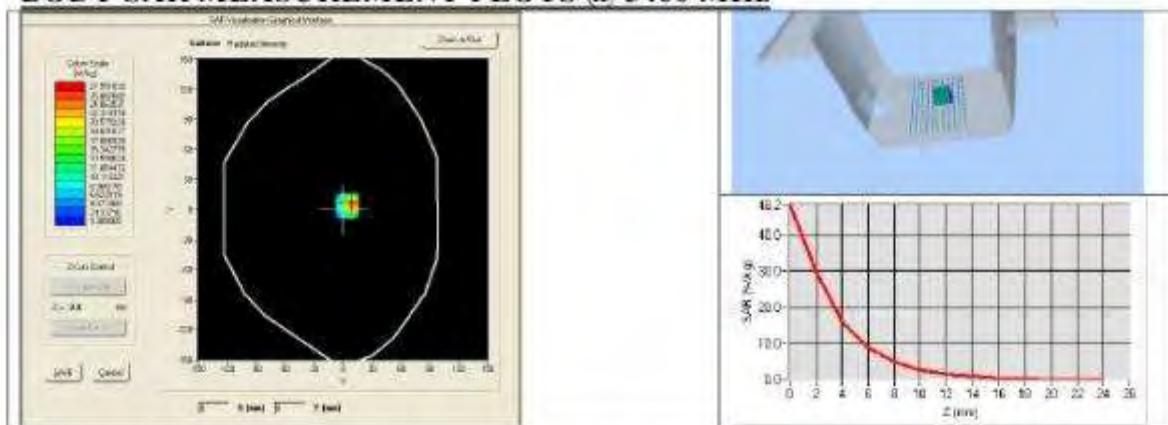
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.262.12.14.SATU.A

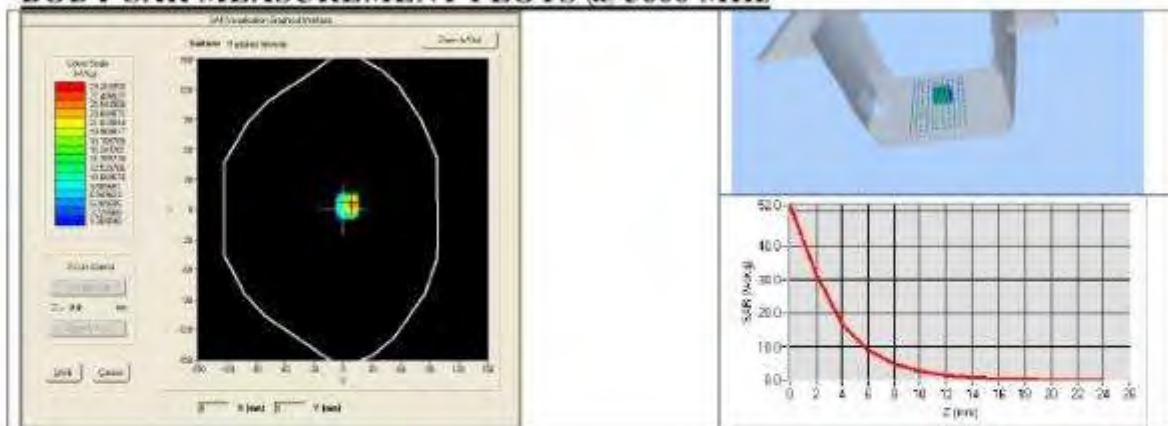
BODY SAR MEASUREMENT PLOTS @ 5200 MHz



BODY SAR MEASUREMENT PLOTS @ 5400 MHz



BODY SAR MEASUREMENT PLOTS @ 5600 MHz

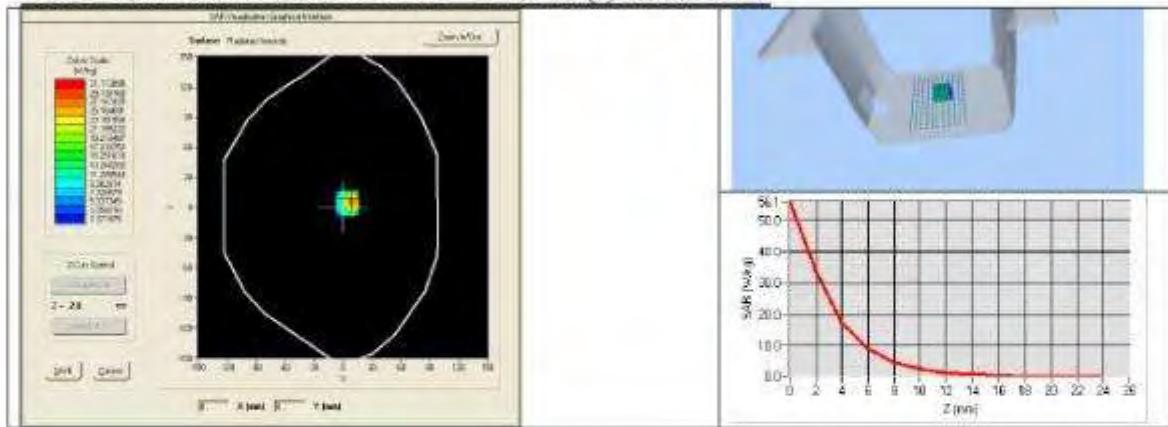




SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.262.12.14.SATU.A

BODY SAR MEASUREMENT PLOTS @ 5800 MHz



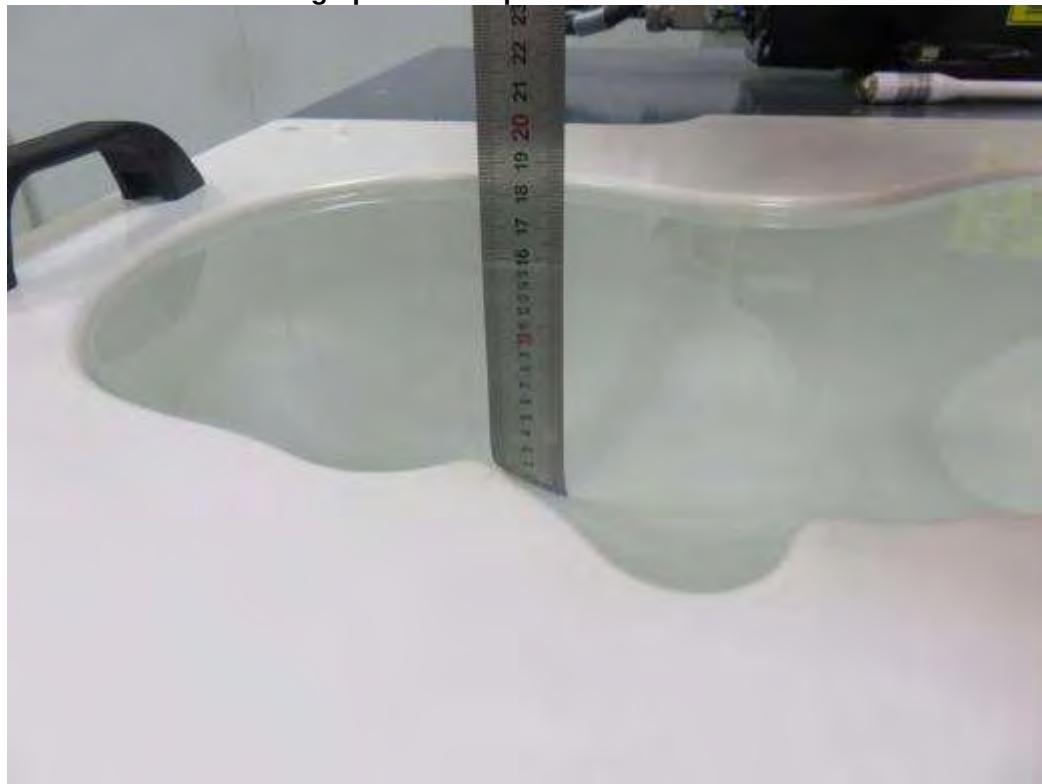


8 LIST OF EQUIPMENT

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	02/2014	02/2017
Calipers	Carrera	CALIPER-01	12/2013	12/2016
Reference Probe	Satimo	EPG122 SN 18/11	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.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

6. EUT TEST PHOTOGRAPHS

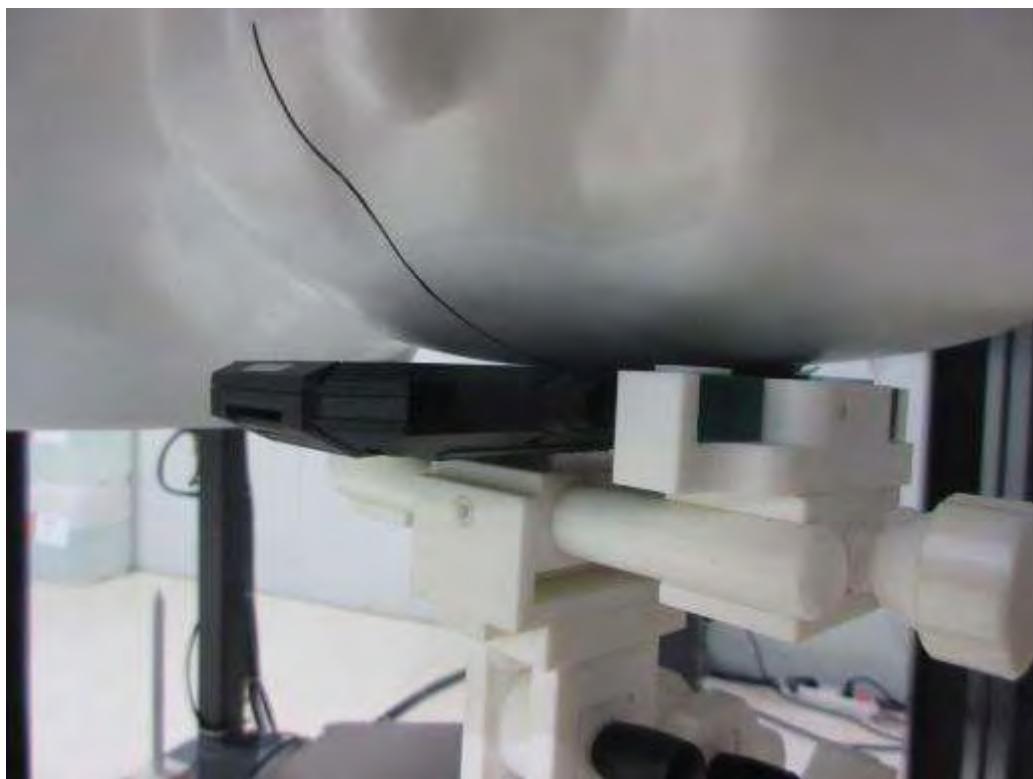
Photograph of the depth in the Head Phantom



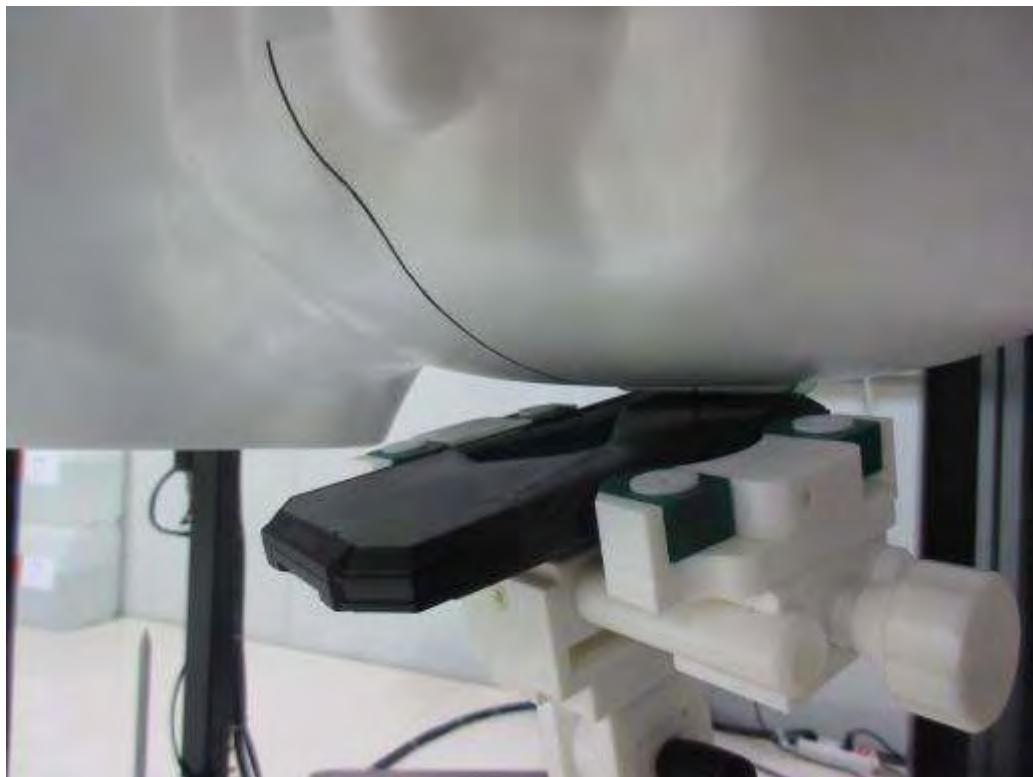
Photograph of the depth in the Body Phantom



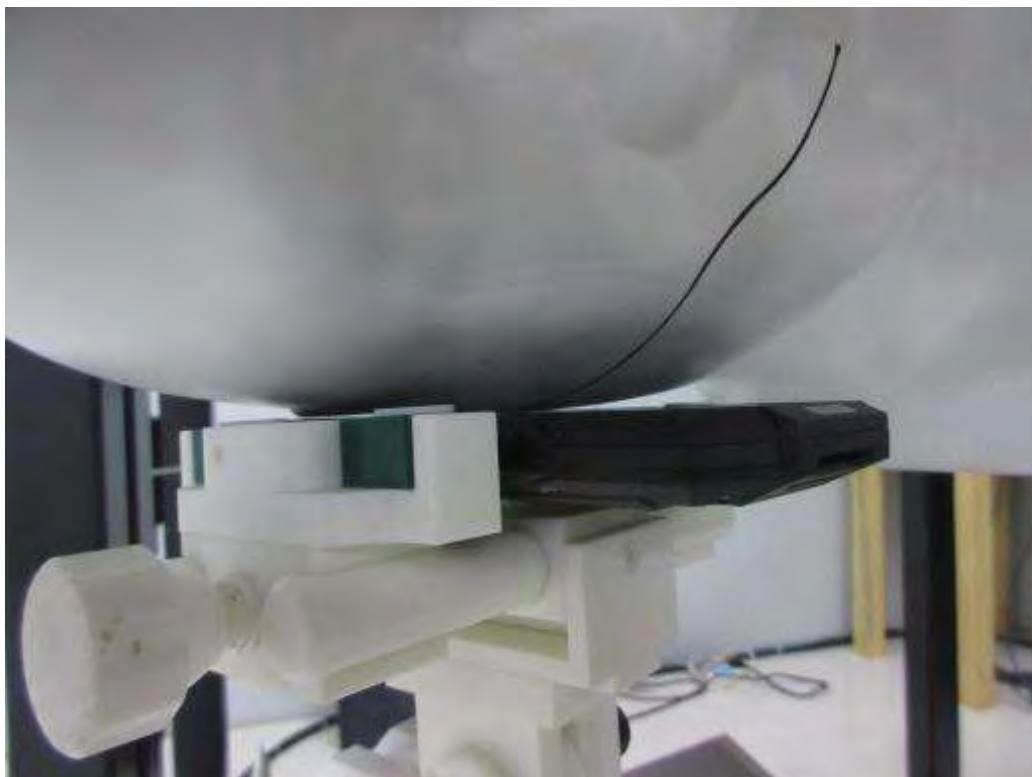
Head Setup Photo(Left cheek)



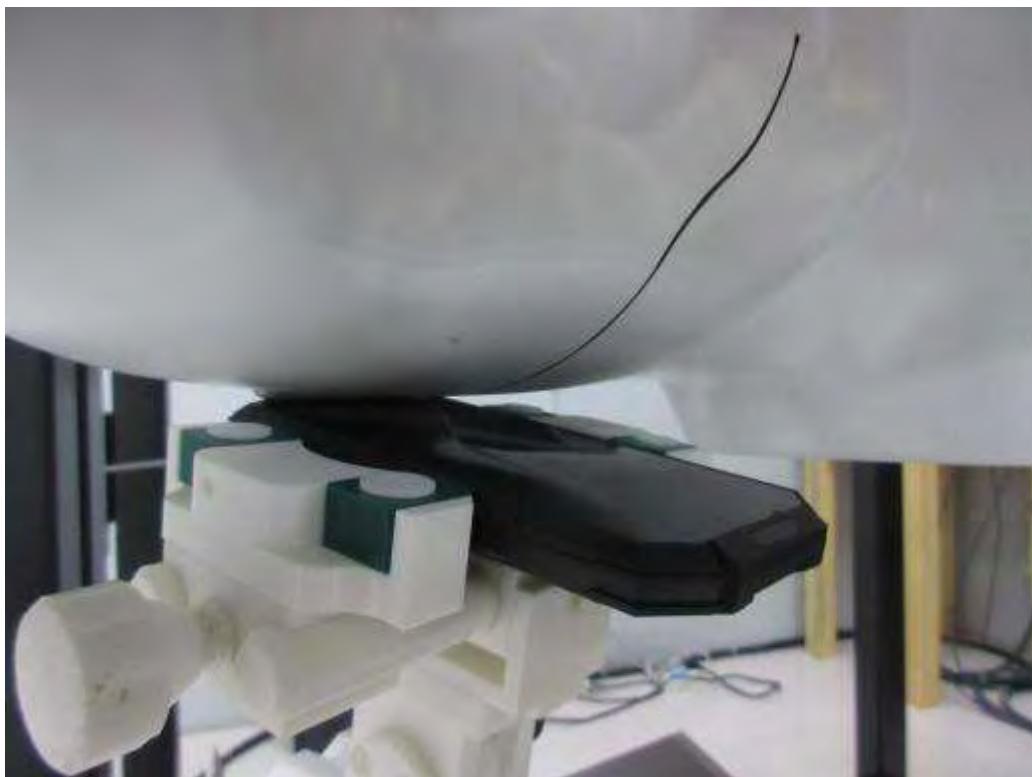
Head Setup Photo(Left Tilt)



Head Setup Photo(Right Cheek)



Head Setup Photo(Right Tilt)



10mm body-worn Back Side Setup Photo(hotspot)



10mm body-worn Front Side Setup Photo(hotspot)

