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Accreditation No.: **SCS 0108**

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Client **UL CCS USA**

Certificate No: **D2600V2-1036\_Mar17**

## CALIBRATION CERTIFICATE

Object **D2600V2 - SN:1036**

Calibration procedure(s) **QA CAL-05.v9  
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **March 10, 2017**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	31-Dec-16 (No. EX3-7349_Dec16)	Dec-17
DAE4	SN: 601	04-Jan-17 (No. DAE4-601_Jan17)	Jan-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

Calibrated by:	Name <b>Leif Klysner</b>	Function <b>Laboratory Technician</b>	Signature 
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Approved by:	Name <b>Katja Pokovic</b>	Technical Manager <b>Technical Manager</b>	
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Issued: March 14, 2017

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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### Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power.
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

## Measurement Conditions

DASY system configuration, as far as not given on page 1.

<b>DASY Version</b>	DASY5	V52.8.8
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	2600 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	39.0	1.96 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	37.2 $\pm$ 6 %	2.04 mho/m $\pm$ 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	14.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>57.5 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	6.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>25.6 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	52.5	2.16 mho/m
<b>Measured Body TSL parameters</b>	(22.0 $\pm$ 0.2) °C	52.3 $\pm$ 6 %	2.21 mho/m $\pm$ 6 %
<b>Body TSL temperature change during test</b>	< 0.5 °C	----	----

## SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	13.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>54.6 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	250 mW input power	6.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>24.5 W/kg <math>\pm</math> 16.5 % (k=2)</b>

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.3 $\Omega$ - 6.0 $j\Omega$
Return Loss	- 24.4 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.1 $\Omega$ - 4.6 $j\Omega$
Return Loss	- 24.1 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.147 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 03, 2009

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1036**

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.04$  S/m;  $\epsilon_r = 37.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.56, 7.56, 7.56); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.01.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

## Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

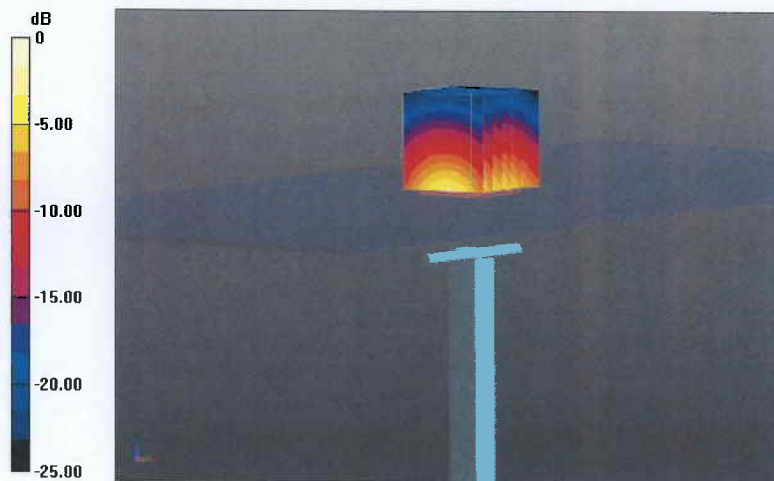
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 117.4 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 32.0 W/kg

**SAR(1 g) = 14.8 W/kg; SAR(10 g) = 6.5 W/kg**

Maximum value of SAR (measured) = 25.0 W/kg



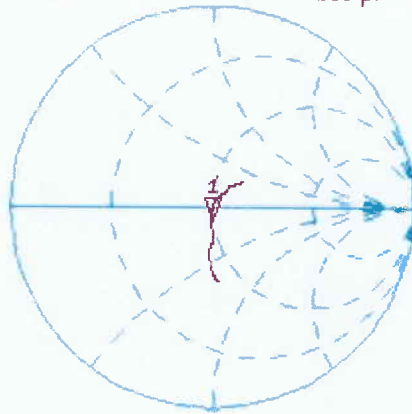
0 dB = 25.0 W/kg = 13.98 dBW/kg

# Impedance Measurement Plot for Head TSL

10 Mar 2017 13:57:06

CH1 S11 1 U FS 1: 49.285  $\Omega$  -5.9668  $\Omega$  10.259 pF 2 600.000 000 MHz

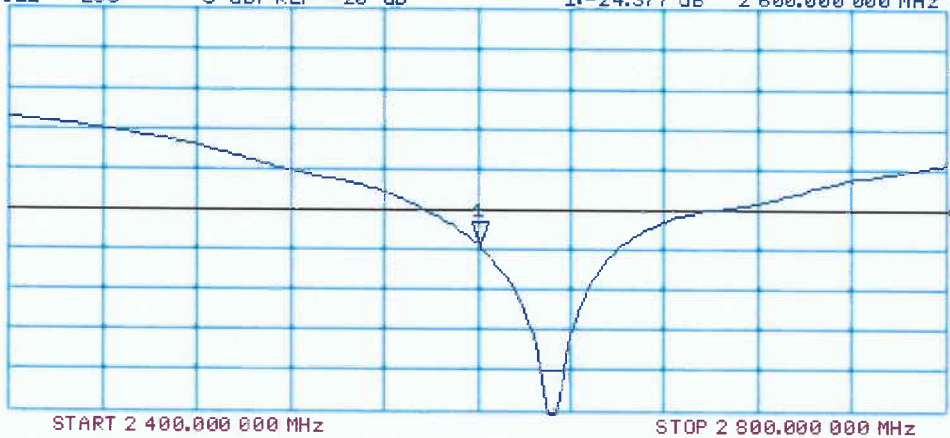
\*  
De1  
CA



Avg  
16  
H1 d

CH2 S11 LOG 5 dB/REF -20 dB 1: -24.377 dB 2 600.000 000 MHz

CA  
Avg  
16  
H1 d



Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1036**

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.21$  S/m;  $\epsilon_r = 52.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.48, 7.48, 7.48); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.01.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

## Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.7 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 27.8 W/kg

**SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.15 W/kg**

Maximum value of SAR (measured) = 22.2 W/kg



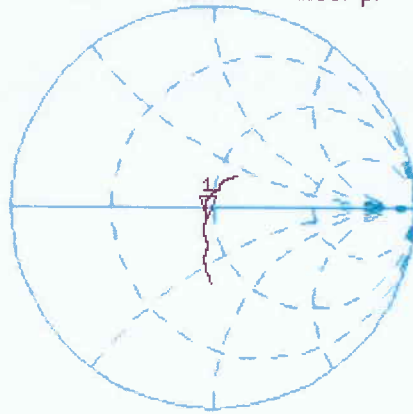
0 dB = 22.2 W/kg = 13.46 dBW/kg

# Impedance Measurement Plot for Body TSL

10 Mar 2017 13:56:24

CH1 S11 1 U FS 1: 46.098  $\Omega$  -4.5898  $\Omega$  13.337 pF 2 600.000 000 MHz

\*  
De1  
CA



Avg  
16  
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-24.063 dB 2 600.000 000 MHz

CA  
Avg  
16  
H1d





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DATE OF ISSUE: 30/Nov/2017      CERTIFICATE NUMBER : 11903932JD01F



5248

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Page 1 of 16

APPROVED SIGNATORY

.....  
Naseer Mirza

## Customer :

UL VS Inc  
47173 Benicia Street  
Fremont, CA 94538, USA

## Equipment Details:

Description:	Dipole Validation Kit	Date of Receipt:	20/Nov/2017
Manufacturer:	Speag		
Type/Model Number:	D5GHzv2		
Serial Number:	1168		
Calibration Date:	23/Nov/2017		
Calibrated By:	Chanthu Thevarajah Laboratory Engineer		

Signature:

.....

All Calibration have been conducted in the closed laboratory facility: Lab Temperature (22±3) °C and humidity < 70%

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Use of the UKAS mark demonstrates that compliance with the requirements of BS/EN/ISO/IEC 17025 has been independently assessed.

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Page 2 of 16

The calibration methods and procedures used were as detailed in:

1. **IEC 62209-1:2005**: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)
2. **IEC 62209-2:2010**: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)
3. **IEEE 1528: 2013**: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques
4. FCC KDB Publication Number: **"KDB865664 D01 SAR Measurement 100 MHz to 6 GHz"**
5. **SPEAG DASY4/ DASY5 System Handbook**

The measuring equipment used to perform the calibration, documented in this certificate has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A2546	Data Acquisition Electronics	SPEAG	DAE4	1435	10 Feb 2017	12
A2545	Probe	SPEAG	ES3DV4	3395	04 May 2017	12
A1377	Dipole	SPEAG	D5GHzV2	1016	16 Feb 2017	12
PRE0151451	Power Monitoring Kit	Art-Fi	ART 100850-01	0001	Cal as part of System	12
M1855	Power Sensor	Rhode & Schwarz	NRP-Z51	103246	08 Nov 2017	12
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	10 Oct 2017	12
PRE0151154	Network Analyser	Rhode & Schwarz	ZND8	100151	22 Nov 2016	24
PRE0151877	Calibration Kit	Rhode & Schwarz	Z135	102947-Bt	02 Dec 2016	12
M1838	Signal Generator	Rhode & Schwarz	SME06	831377/005	30 Mars 2017	12

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Page 3 of 16

## SAR System Specification

Robot System Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Robot Serial Number:	F14/5T5ZA1/A/01
DASY Version:	DASY 52 (v52.8.8.1258)
Phantom:	Flat section of SAM Twin Phantom
Distance Dipole Centre:	10 mm (with spacer)

## Frequency: 5250 MHz

### Dielectric Property Measurements – Head Simulating Liquid (HSL)

Simulant Liquid	Frequency (MHz)	Room Temp		Liquid Temp		Parameters	Target Value	Measured Value	Uncertainty (%)
		Start	End	Start	End				
Head	5250	21.0 °C	21.0 °C	21.0°C	21.0°C	$\epsilon_r$	35.9	36.445	± 5%
						$\sigma$	4.71	4.578	± 5%

### SAR Results – Head Simulating Liquid (HSL)

Simulant Liquid	SAR Measured	100 mW input Power	Normalised to 1.00 W	Uncertainty (%)
Head	SAR averaged over 1g	8.09 W/Kg	<b>80.9 W/Kg</b>	± 18.75%
	SAR averaged over 10g	2.28 W/Kg	<b>22.8 W/Kg</b>	± 18.63%

### Antenna Parameters – Head Simulating Liquid (HSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Head	Impedance	62.365 $\Omega$ 2.721 j $\Omega$	± 0.28 $\Omega$ ± 0.044 j $\Omega$
	Return Loss	19.18	± 1.48 dB

## Frequency: 5600 MHz

### Dielectric Property Measurements – Head Simulating Liquid (HSL)

Simulant Liquid	Frequency (MHz)	Room Temp		Liquid Temp		Parameters	Target Value	Measured Value	Uncertainty (%)
		Start	End	Start	End				
Head	5600	21.0 °C	21.0 °C	21.0°C	21.0°C	$\epsilon_r$	35.5	36.195	± 5%
						$\sigma$	5.07	5.011	± 5%

### SAR Results – Head Simulating Liquid (HSL)

Simulant Liquid	SAR Measured	100 mW input Power	Normalised to 1.00 W	Uncertainty (%)
Head	SAR averaged over 1g	8.72 W/Kg	<b>87.2 W/Kg</b>	± 18.75%
	SAR averaged over 10g	2.44 W/Kg	<b>24.4 W/Kg</b>	± 18.63%

### Antenna Parameters – Head Simulating Liquid (HSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Head	Impedance	47.404 $\Omega$ 4.886 j $\Omega$	± 0.28 $\Omega$ ± 0.044 j $\Omega$
	Return Loss	25.69	± 1.48 dB

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CERTIFICATE  
NUMBER :  
11903932JD01F

Page 4 of 16

**Frequency: 5750 MHz**

## Dielectric Property Measurements – Head Simulating Liquid (HSL)

Simulant Liquid	Frequency (MHz)	Room Temp		Liquid Temp		Parameters	Target Value	Measured Value	Uncertainty (%)
		Start	End	Start	End				
Head	5750	21.0 °C	21.0 °C	21.0°C	21.0°C	$\epsilon_r$	35.4	35.945	± 5%
						$\sigma$	5.22	5.214	± 5%

## SAR Results – Head Simulating Liquid (HSL)

Simulant Liquid	SAR Measured	100 mW input Power	Normalised to 1.00 W	Uncertainty (%)
Head	SAR averaged over 1g	7.91 W/Kg	<b>79.1 W/Kg</b>	± 18.75%
	SAR averaged over 10g	2.21 W/Kg	<b>22.1 W/Kg</b>	± 18.63%

## Antenna Parameters – Head Simulating Liquid (HSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Head	Impedance	58.626 $\Omega$ -3.403 j $\Omega$	± 0.28 $\Omega$ ± 0.044 j $\Omega$
	Return Loss	20.65	± 1.48 dB

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CERTIFICATE  
NUMBER :  
11903932JD01F

Page 5 of 16

**Frequency: 5250 MHz**

## Dielectric Property Measurements – Body Simulating Liquid (MSL)

Simulant Liquid	Frequency (MHz)	Room Temp		Liquid Temp		Parameters	Target Value	Measured Value	Uncertainty (%)
		Start	End	Start	End				
Body	5250	22.0 °C	21.0 °C	21.0°C	21.0°C	$\epsilon_r$	48.9	47.644	± 5%
						$\sigma$	5.36	5.312	± 5%

## SAR Results – Body Simulating Liquid (MSL)

Simulant Liquid	SAR Measured	100 mW input Power	Normalised to 1.00 W	Uncertainty (%)
Body	SAR averaged over 1g	7.07 W/Kg	<b>70.7 W/Kg</b>	± 18.53%
	SAR averaged over 10g	1.97 W/Kg	<b>19.7 W/Kg</b>	± 18.61%

## Antenna Parameters – Body Simulating Liquid (MSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Body	Impedance	60.697 $\Omega$ 2.711 $j\Omega$	± 0.28 $\Omega$ ± 0.044 $j\Omega$
	Return Loss	20.08	± 1.48 dB

**Frequency: 5600 MHz**

## Dielectric Property Measurements – Body Simulating Liquid (MSL)

Simulant Liquid	Frequency (MHz)	Room Temp		Liquid Temp		Parameters	Target Value	Measured Value	Uncertainty (%)
		Start	End	Start	End				
Body	5600	22.0 °C	21.0 °C	21.0°C	21.0°C	$\epsilon_r$	48.5	46.782	± 5%
						$\sigma$	5.77	5.777	± 5%

## SAR Results – Body Simulating Liquid (MSL)

Simulant Liquid	SAR Measured	100 mW input Power	Normalised to 1.00 W	Uncertainty (%)
Body	SAR averaged over 1g	7.56 W/Kg	<b>75.6 W/Kg</b>	± 18.53%
	SAR averaged over 10g	2.08 W/Kg	<b>20.8 W/Kg</b>	± 18.61%

## Antenna Parameters – Body Simulating Liquid (MSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Body	Impedance	46.92 $\Omega$ 4.017 $j\Omega$	± 0.28 $\Omega$ ± 0.044 $j\Omega$
	Return Loss	25.70	± 1.48 dB

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CERTIFICATE  
NUMBER :  
11903932JD01F

Page 6 of 16

**Frequency: 5750 MHz**

## Dielectric Property Measurements – Body Simulating Liquid (MSL)

Simulant Liquid	Frequency (MHz)	Room Temp		Liquid Temp		Parameters	Target Value	Measured Value	Uncertainty (%)
		Start	End	Start	End				
Body	5750	22.0 °C	21.0 °C	21.0°C	21.0°C	$\epsilon_r$	48.3	46.523	± 5%
						$\sigma$	5.94	5.968	± 5%

## SAR Results – Body Simulating Liquid (MSL)

Simulant Liquid	SAR Measured	100 mW input Power	Normalised to 1.00 W	Uncertainty (%)
Body	SAR averaged over 1g	6.53 W/Kg	<b>65.3 W/Kg</b>	± 18.53%
	SAR averaged over 10g	1.82 W/Kg	<b>18.2 W/Kg</b>	± 18.61%

## Antenna Parameters – Body Simulating Liquid (MSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Body	Impedance	59.977 $\Omega$ -2.829 j $\Omega$	± 0.28 $\Omega$ ± 0.044 j $\Omega$
	Return Loss	20.34	± 1.48 dB

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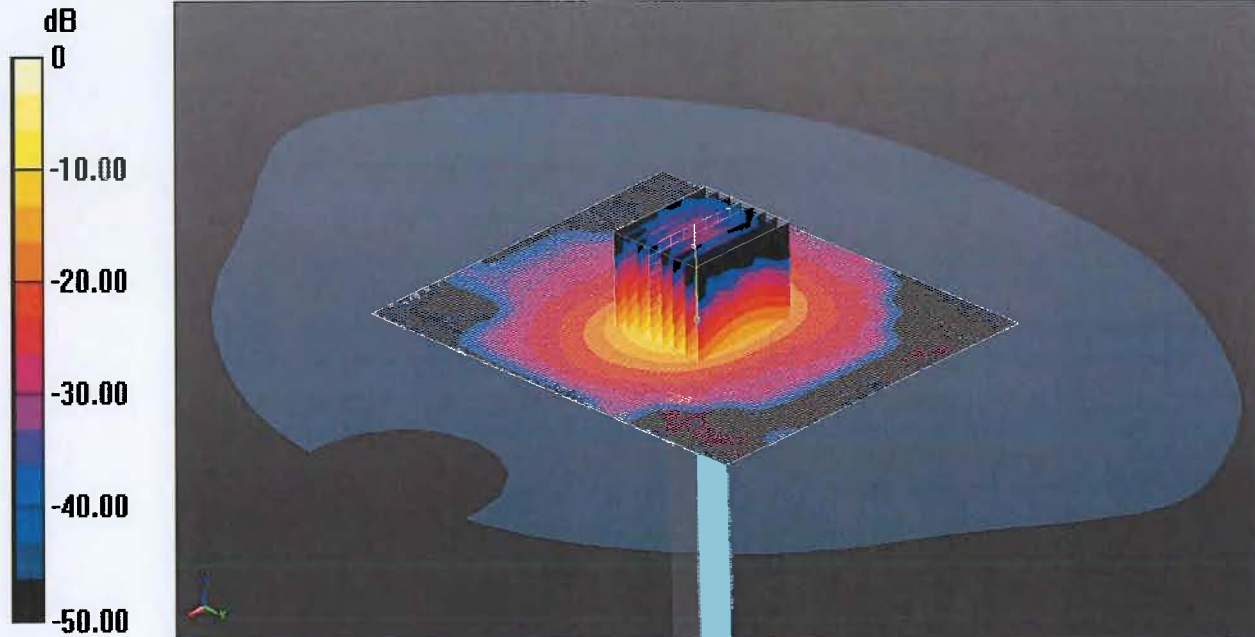
CERTIFICATE  
NUMBER :  
11903932JD01F

UKAS Accredited Calibration Laboratory No. 5248

Page 7 of 16

### DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D5GHzV2 - SN1168; Type: D5GHzV2; Serial: SN1168



0 dB = 16.9 W/kg = 12.28 dBW/kg

Communication System: UID 0, CW (0); Frequency: 5250 MHz; Duty Cycle: 1:1

Medium: 5GHz MSL Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.578$  S/m;  $\epsilon_r = 36.445$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3995; ConvF(5.38, 5.38, 5.38); Calibrated: 04/05/2017;

- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn1435; Calibrated: 10/02/2017

- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:xxxx

- ; SEMCAD X Version 14.6.10 (7372)

**Configuration/d=10mm, Pin=250mW 2 2/Area Scan (101x121x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 12.4 W/kg

**Configuration/d=10mm, Pin=250mW 2 2/Zoom Scan 2 (9x8x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 53.68 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 33.8 W/kg

**SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.28 W/kg**

Maximum value of SAR (measured) = 16.9 W/kg

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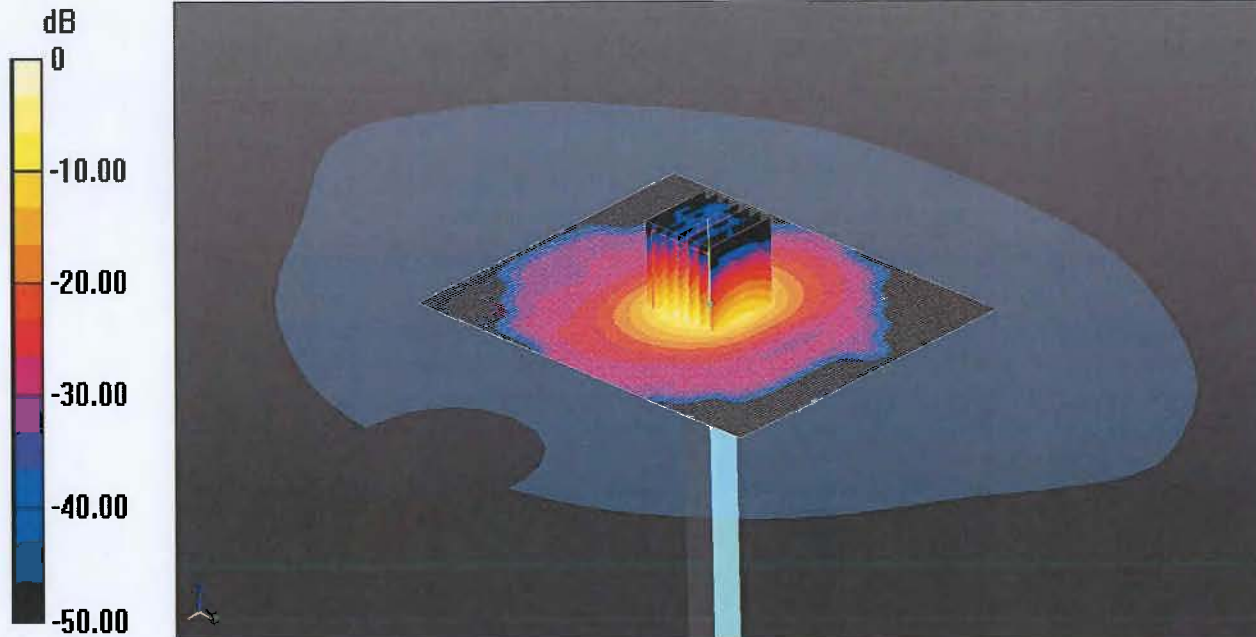
CERTIFICATE  
NUMBER :  
11903932JD01F

UKAS Accredited Calibration Laboratory No. 5248

Page 8 of 16

### DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D5GHzV2 - SN1168; Type: D5GHzV2; Serial: SN1168



0 dB = 18.6 W/kg = 12.70 dBW/kg

Communication System: UID 0, CW (0); Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5GHz MSL Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.011$  S/m;  $\epsilon_r = 36.195$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3995; ConvF(5.02, 5.02, 5.02); Calibrated: 04/05/2017;
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1435; Calibrated: 10/02/2017
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:xxxx
- ; SEMCAD X Version 14.6.10 (7372)

**Configuration/d=10mm, Pin=250mW/Area Scan (101x121x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 13.2 W/kg

**Configuration/d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 53.28 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 38.9 W/kg

**SAR(1 g) = 8.72 W/kg; SAR(10 g) = 2.44 W/kg**

Maximum value of SAR (measured) = 18.6 W/kg



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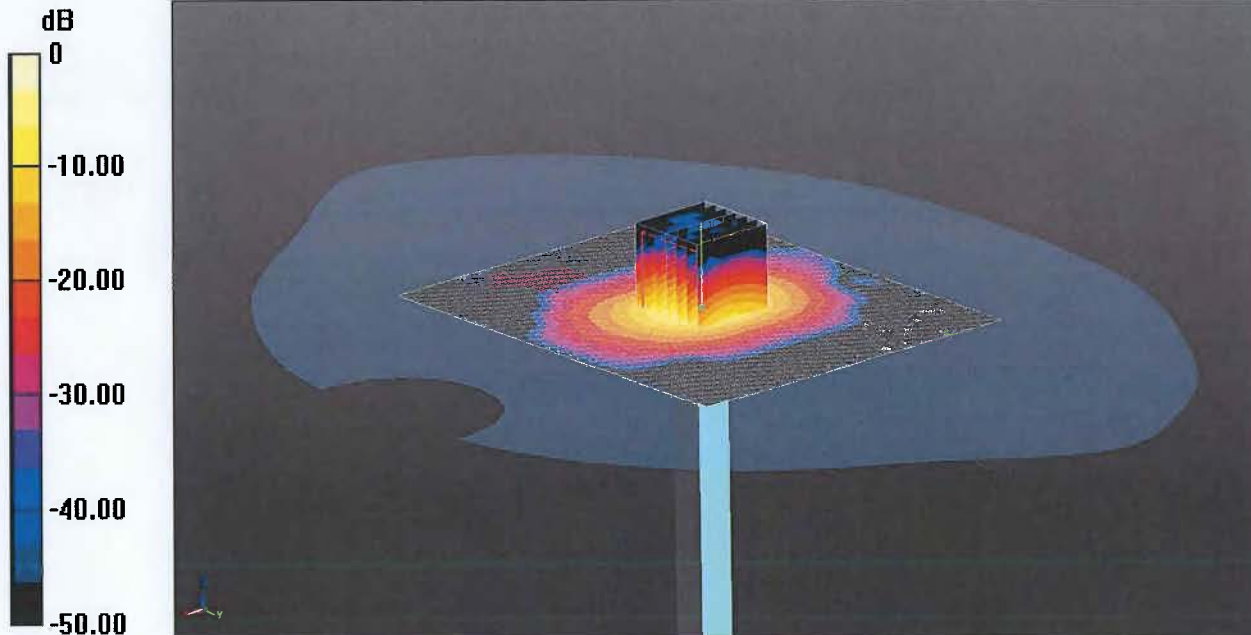
CERTIFICATE  
NUMBER :  
11903932JD01F

UKAS Accredited Calibration Laboratory No. 5248

Page 9 of 16

### DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D5GHzV2 - SN1168; Type: D5GHzV2; Serial: SN1168



Communication System: UID 0, CW (0); Frequency: 5750 MHz; Duty Cycle: 1:1  
Medium: 5GHz MSL Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.214$  S/m;  $\epsilon_r = 35.945$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section  
DASY 5 Configuration:  
- Probe: EX3DV4 - SN3995; ConvF(5.3, 5.3, 5.3); Calibrated: 04/05/2017;  
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn1435; Calibrated: 10/02/2017  
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:xxxx  
- ; SEMCAD X Version 14.6.10 (7372)

**Configuration/d=10mm, Pin=250mW/Area Scan (101x121x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 11.8 W/kg

**Configuration/d=10mm, Pin=250mW/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 49.29 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 36.5 W/kg

**SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.21 W/kg**

Maximum value of SAR (measured) = 16.9 W/kg

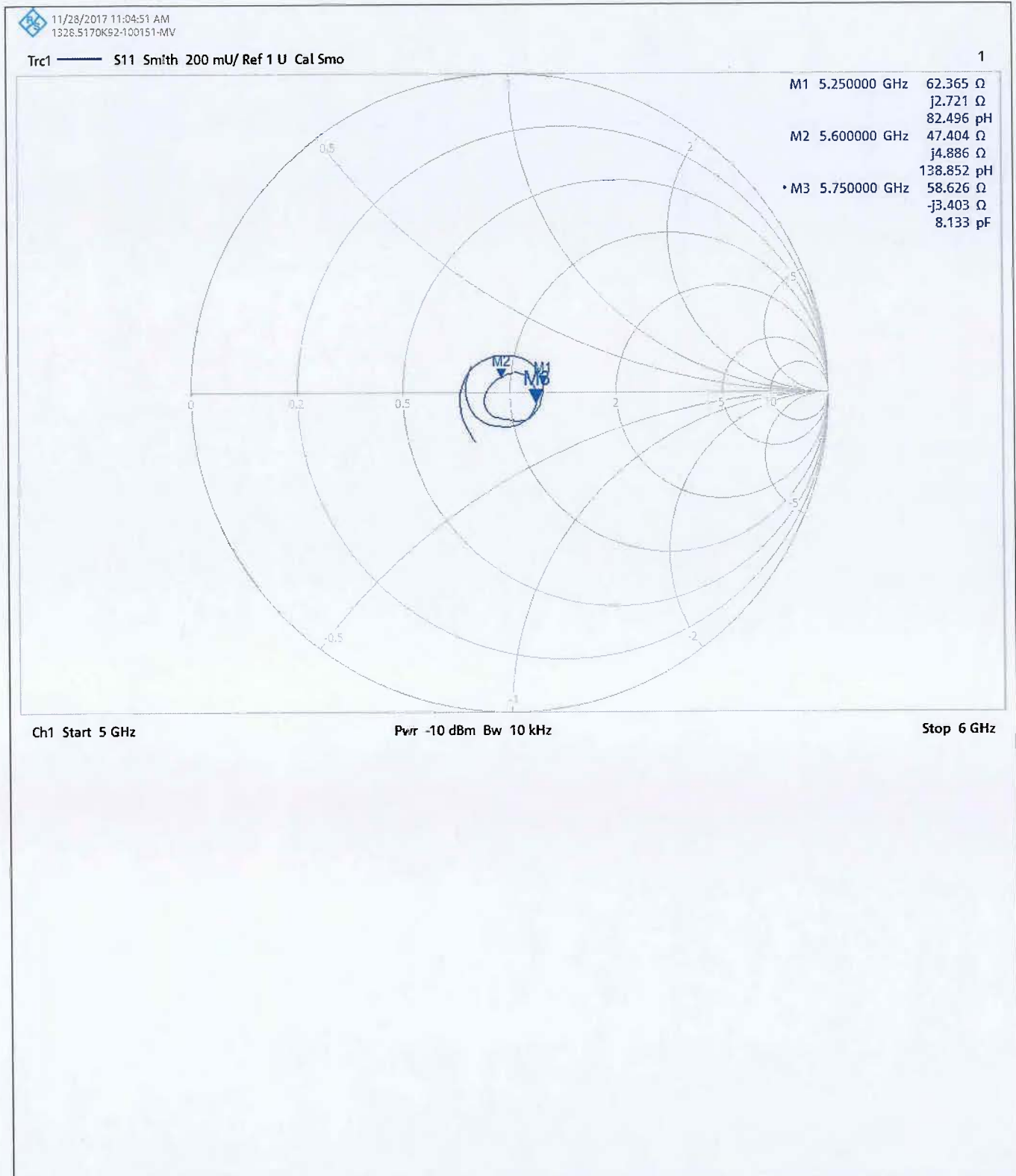
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UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE  
NUMBER :  
11903932JD01F

Page 10 of 16

## Impedance Measurement Plot for Head Stimulating Liquid (HSL)



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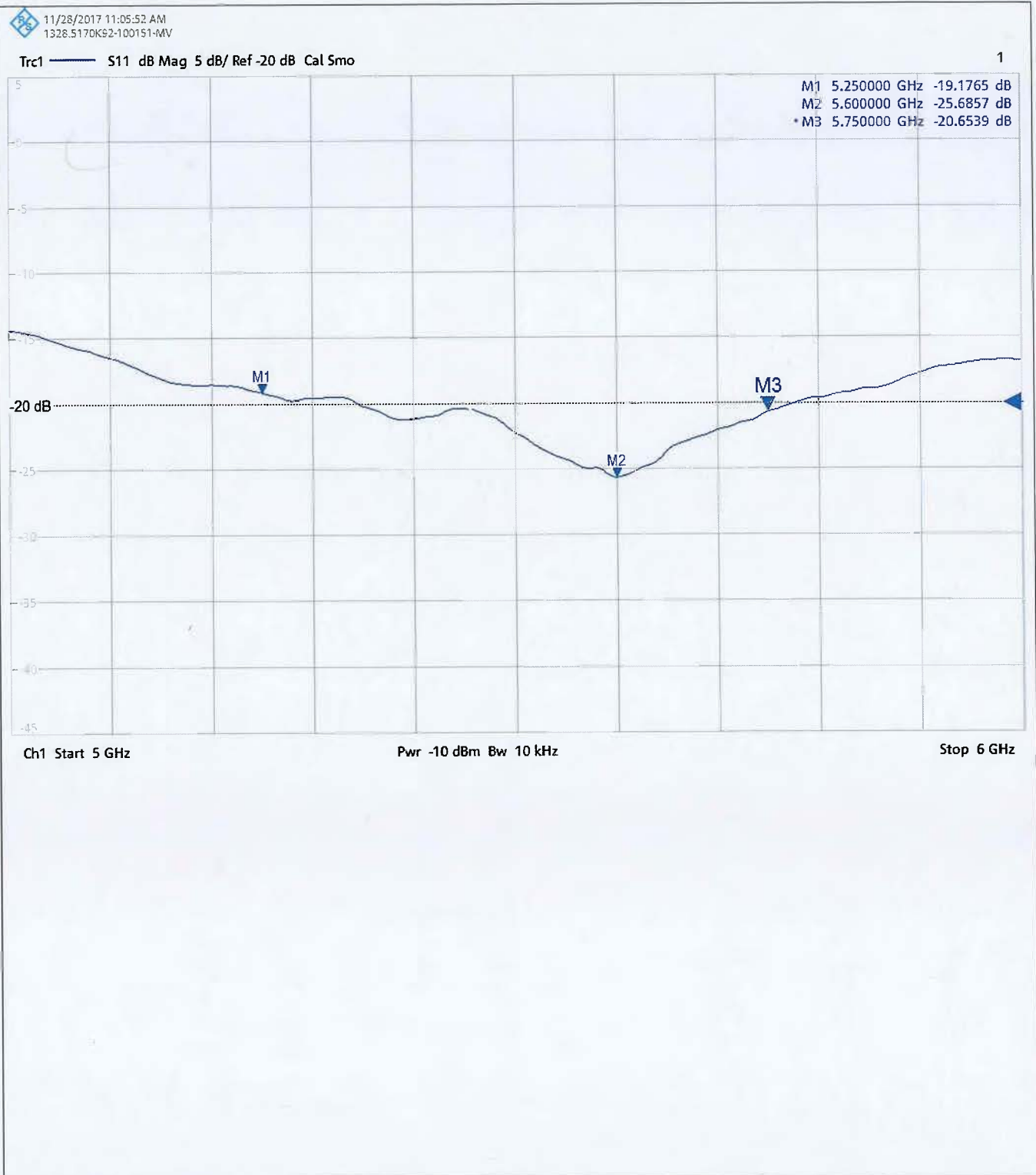
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NUMBER :  
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Page 11 of 16

### Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



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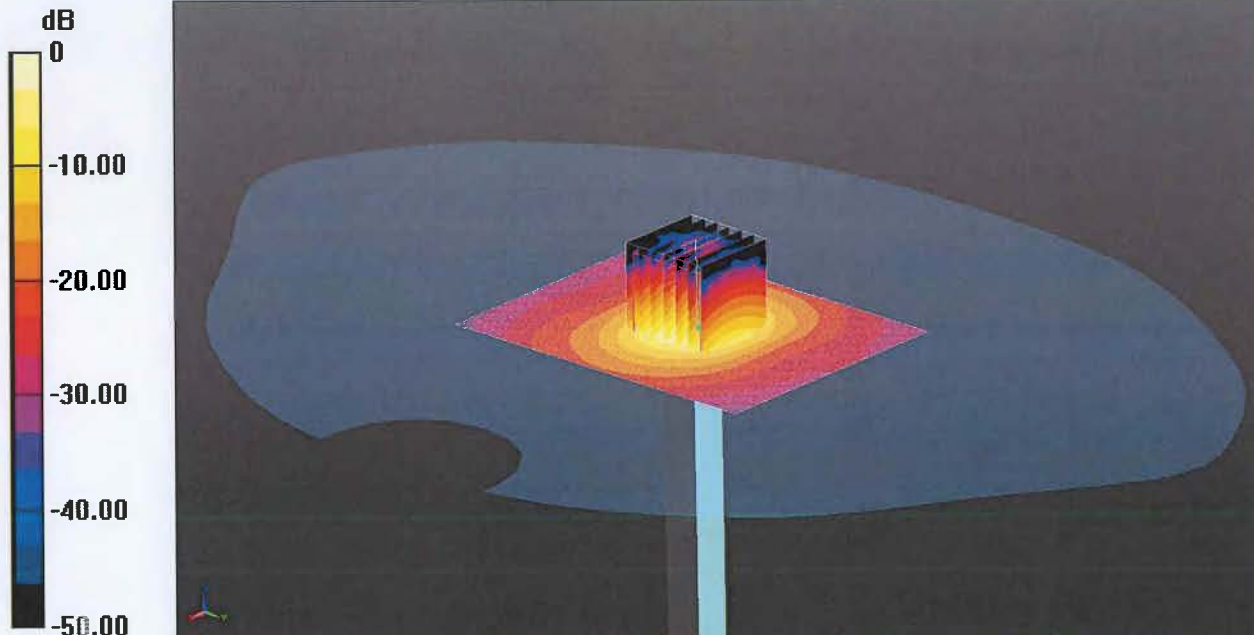
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CERTIFICATE  
NUMBER :  
11903932JD01F

Page 12 of 16

### DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: 5GHz Dipole SN:1016; Type: D5GHzV2; Serial: SN 1016



0 dB = 14.8 W/kg = 11.70 dBW/kg

Communication System: UID 0, CW (0); Frequency: 5250 MHz; Duty Cycle: 1:1  
Medium: MSL 5G Medium parameters used:  $f = 5250$  MHz;  $\sigma = 5.312$  S/m;  $\epsilon_r = 47.644$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3995; ConvF(4.97, 4.97, 4.97); Calibrated: 04/05/2017;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1435; Calibrated: 10/02/2017
- Phantom: SAM (20deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: TP:xxxx
- ; SEMCAD X Version 14.6.10 (7372)

**Configuration/d=10mm, Pin=100mW 2 2/Area Scan (71x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 15.3 W/kg

**Configuration/d=10mm, Pin=100mW 2 2/Zoom Scan (7x7x12) (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 40.03 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 29.5 W/kg

**SAR(1 g) = 7.07 W/kg; SAR(10 g) = 1.97 W/kg**

Maximum value of SAR (measured) = 14.8 W/kg

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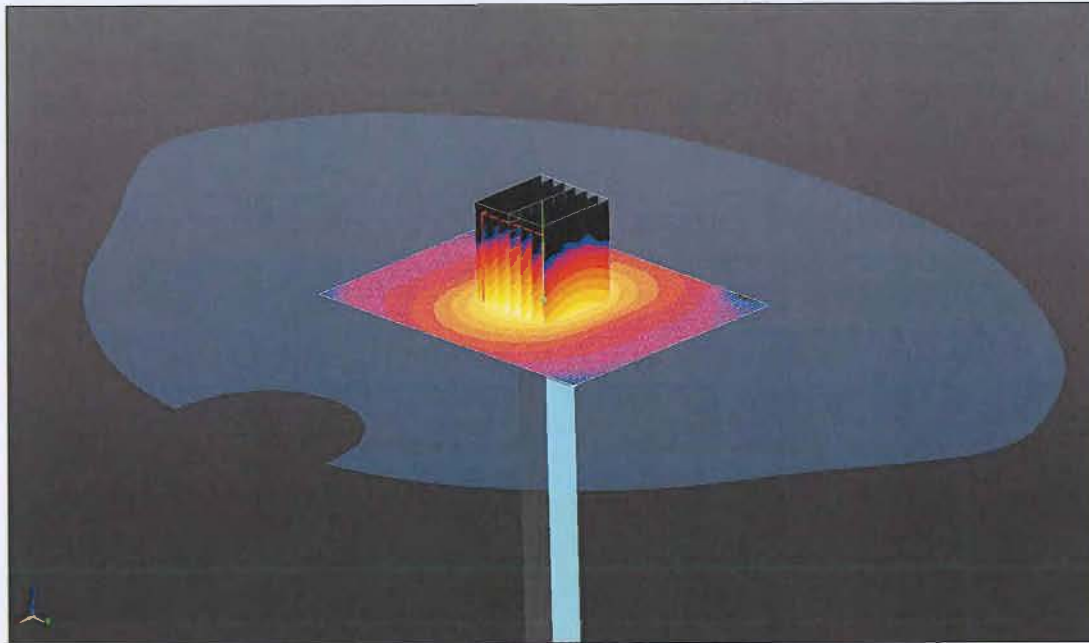
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NUMBER :  
11903932JD01F

UKAS Accredited Calibration Laboratory No. 5248

Page 13 of 16

### DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: 5GHz Dipole SN:1168; Type: D5GHzV2; Serial: SN 1168



0 dB = 16.2 W/kg = 12.10 dBW/kg

Communication System: UID 0, CW (0); Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: MSL 5G Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.777$  S/m;  $\epsilon_r = 46.782$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3995; ConvF(4.4, 4.4, 4.4); Calibrated: 04/05/2017;

- Sensor-Surface: 2mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn1435; Calibrated: 10/02/2017

- Phantom: SAM (20deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: TP:xxxx

- ; SEMCAD X Version 14.6.10 (7372)

**Configuration/d=10mm, Pin=100mW 2/Area Scan (71x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 17.1 W/kg

**Configuration/d=10mm, Pin=100mW 2/Zoom Scan (7x7x12) (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 39.49 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 33.7 W/kg

**SAR(1 g) = 7.56 W/kg; SAR(10 g) = 2.08 W/kg**

Maximum value of SAR (measured) = 16.2 W/kg

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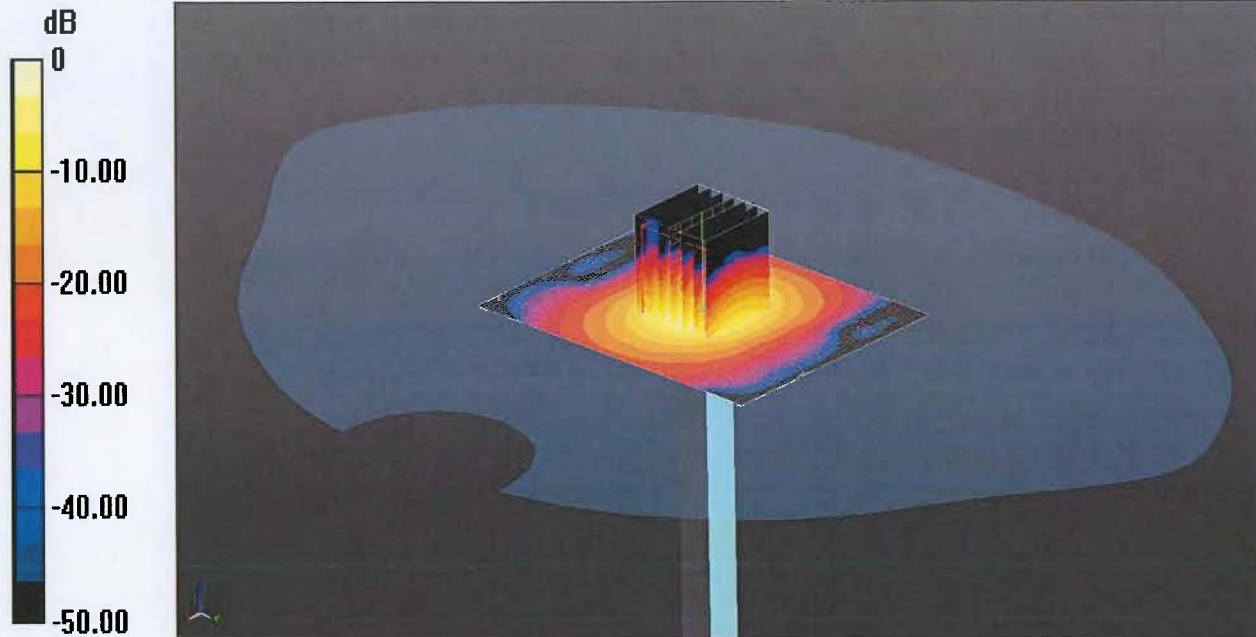
UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE  
NUMBER :  
11903932JD01F

Page 14 of 16

### DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: 5GHz Dipole SN:1168; Type: D5GHzV2; Serial: SN 1168



0 dB = 14.1 W/kg = 11.49 dBW/kg

Communication System: UID 0, CW (0); Frequency: 5750 MHz; Duty Cycle: 1:1  
Medium: MS 5G Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.968$  S/m;  $\epsilon_r = 46.523$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section  
DASY 5 Configuration:  
- Probe: EX3DV4 - SN3995; ConvF(4.59, 4.59, 4.59); Calibrated: 04/05/2017;  
- Sensor-Surface: 2mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn1435; Calibrated: 10/02/2017  
- Phantom: SAM (20deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: TP:xxxx  
- ; SEMCAD X Version 14.6.10 (7372)

**Configuration/d=10mm, Pin=100mW 2 2 /Area Scan (71x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 14.4 W/kg

**Configuration/d=10mm, Pin=100mW 2 2 /Zoom Scan (7x7x12) (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 36.07 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 29.2 W/kg

**SAR(1 g) = 6.53 W/kg; SAR(10 g) = 1.82 W/kg**

Maximum value of SAR (measured) = 14.1 W/kg

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CERTIFICATE  
NUMBER :  
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Page 15 of 16

## Impedance Measurement Plot for Body Stimulating Liquid (MSL)

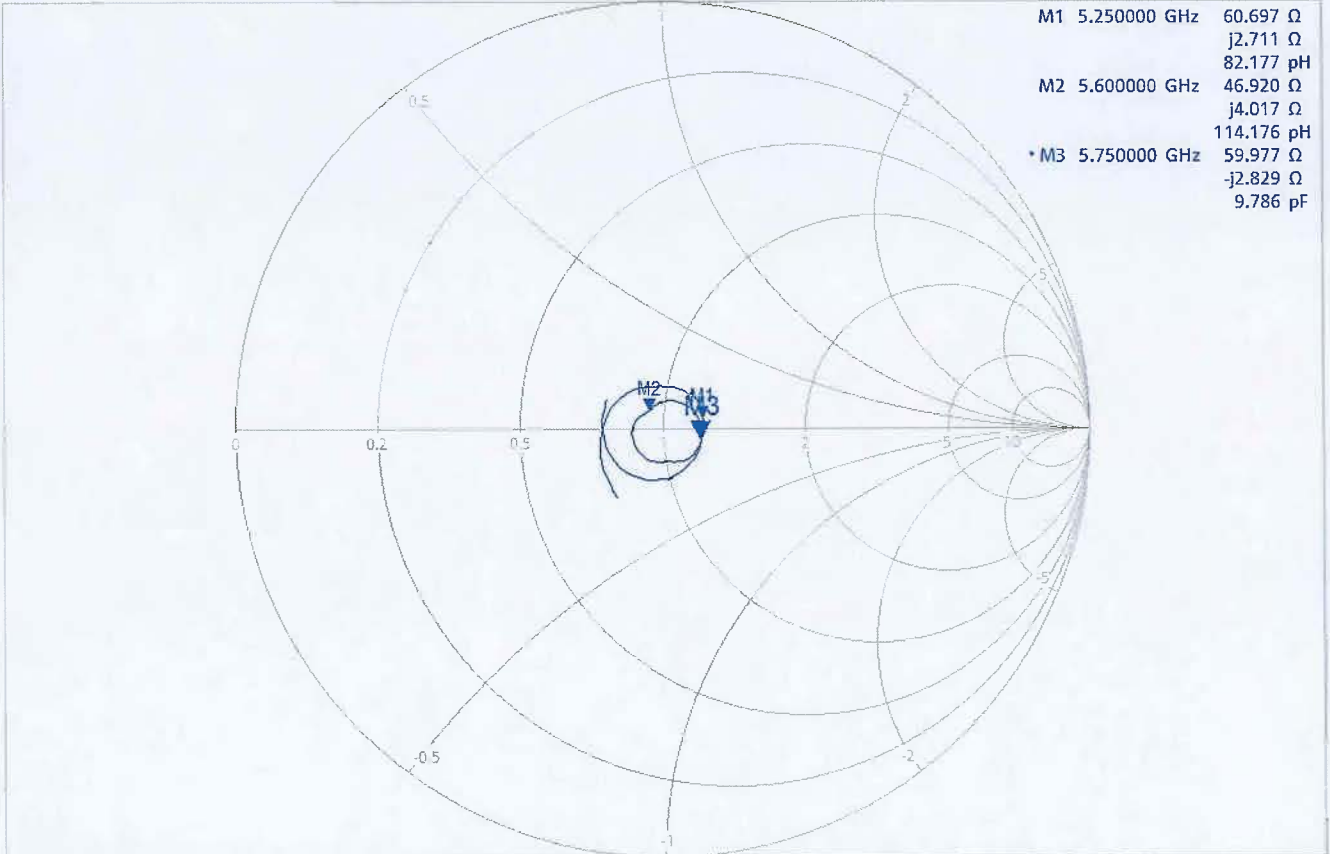


11/28/2017 10:48:30 AM  
1328.5170K92-100151-MV

Trc1 — S11 Smith 200 mU/ Ref 1 U Cal Smo

1

M1	5.250000 GHz	60.697 $\Omega$
		j2.711 $\Omega$
		82.177 pF
M2	5.600000 GHz	46.920 $\Omega$
		j4.017 $\Omega$
		114.176 pF
* M3	5.750000 GHz	59.977 $\Omega$
		-j2.829 $\Omega$
		9.786 pF



Ch1 Start 5 GHz

Pwr -10 dBm Bw 10 kHz

Stop 6 GHz

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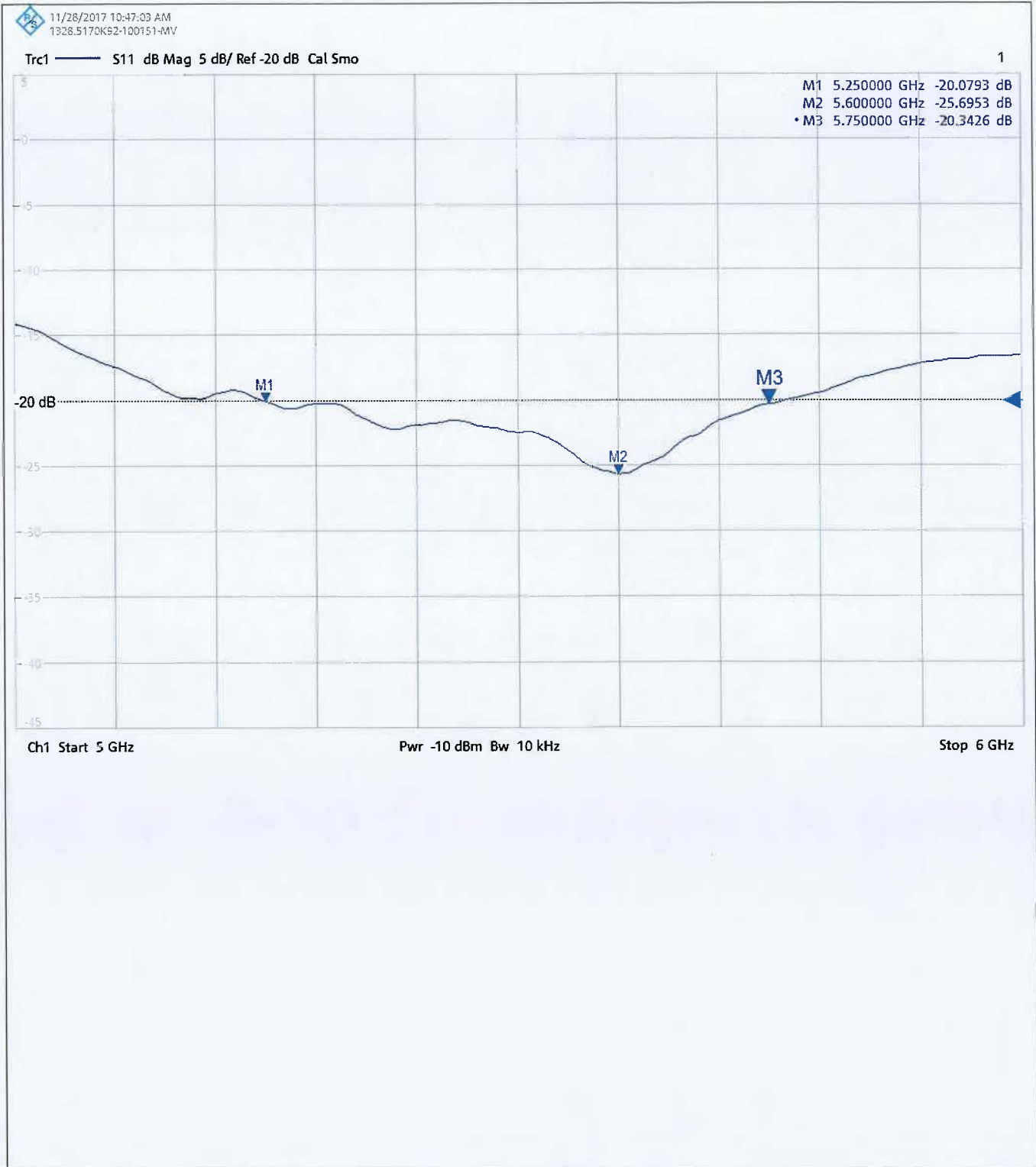
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CERTIFICATE  
NUMBER :  
11903932JD01F


Page 16 of 16


### Return Loss Measurement Plot for Body Stimulating Liquid (MSL)






**Calibration Certificate Label:**

 <p>UKAS CALIBRATION 5248</p>	<p><b>UL VS LTD - Tel: +44 (0) 1256312000</b></p> <p>Certificate Number: 11903932JD01F</p> <p>Instrument ID: 1168</p> <p>Calibration Date: 23/Nov/2017</p> <p>Calibration Due Date:</p>
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