

# CERTIFICATE OF CALIBRATION

ISSUED BY **UL VS LTD**

DATE OF ISSUE: 10/Oct/2017

CERTIFICATE NUMBER : 11903941JD01E



5248

UL VS LTD  
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**APPROVED SIGNATORY**

.....  
Naseer Mirza

**Customer :**

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

**Equipment Details:**

Description:	Dipole Validation Kit	Date of Receipt:	29/Sep/2017
Manufacturer:	Speag		
Type/Model Number:	D2600V2		
Serial Number:	1006		
Calibration Date:	05/Oct/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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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
A2587	Probe	SPEAG	ES3DV3	3341	14 Aug 2017	12
A2767	Dipole	SPEAG	D2600V2	1109	13 Feb 2017	12
PRE0151451	Power Monitoring Kit	Art-Fi	ART 100850-01	0001	Cal as part of System	12
PRE0151441	Power Sensor	Rhode & Schwarz	NRP8S	102481	16 Nov 2016	12
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	26 Sept 2016	12
PRE0151154	Network Analyser	Rhode & Schwarz	ZND8	100151	22 Nov 2016	12
PRE0151877	Calibration Kit	Rhode & Schwarz	Z135	102947-Bt	02 Dec 2016	12
M1908	Signal Generator	Rhode & Schwarz	SMIQ 03B	1125.555.03	08 Nov 2016	12

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### 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:	2600 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	2600	23.0 °C	22.0 °C	20.0°C	22.0°C	$\epsilon_r$	39.00	37.06	± 5%
						$\sigma$	1.96	1.97	± 5%

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

Simulant Liquid	SAR Measured	250 mW input Power	Normalised to 1.00 W	Uncertainty (%)
Head	SAR averaged over 1g	14.00 W/Kg	<b>55.73 W/Kg</b>	± 17.57%
	SAR averaged over 10g	6.30 W/Kg	<b>25.08 W/Kg</b>	± 17.32%

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

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Head	Impedance	50.38 $\Omega$ 6.70 j $\Omega$	± 0.28 $\Omega$ ± 0.044 j $\Omega$
	Return Loss	23.52	± 1.27 dB

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### 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	2600	22.0 °C	22.0 °C	22.0°C	22.0°C	$\epsilon_r$	52.50	51.39	± 5%
						$\sigma$	2.16	2.19	± 5%

### SAR Results – Body Simulating Liquid (MSL)

Simulant Liquid	SAR Measured	250 mW input Power	Normalised to 1.00 W	Uncertainty (%)
Body	SAR averaged over 1g	14.10 W/Kg	56.13 W/Kg	± 18.06%
	SAR averaged over 10g	6.28 W/Kg	25.00 W/Kg	± 17.44%

### Antenna Parameters – Body Simulating Liquid (MSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Body	Impedance	48.51 $\Omega$ -2.73 j $\Omega$	± 0.28 $\Omega$ ± 0.044 j $\Omega$
	Return Loss	30.37	± 1.27 dB

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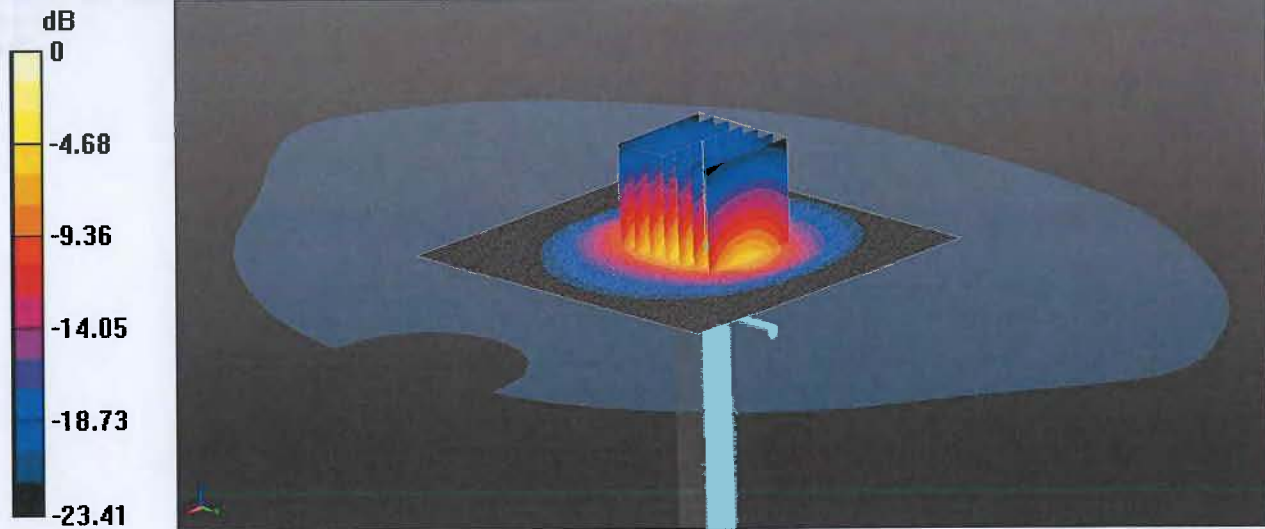
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### DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1006



0 dB = 21.7 W/kg = 13.36 dBW/kg

Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1

Medium: 2600 MHz HSL Medium parameters used:  $f = 2600$  MHz;  $\sigma = 1.971$  S/m;  $\epsilon_r = 37.058$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3341; ConvF(4.5, 4.5, 4.5); Calibrated: 14/08/2017;

- Sensor-Surface: 4mm (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/Area Scan (81x81x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 15.9 W/kg

**Configuration/d=10mm, Pin=250mW 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.28 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 29.9 W/kg

**SAR(1 g) = 14 W/kg; SAR(10 g) = 6.3 W/kg**

Maximum value of SAR (measured) = 21.7 W/kg

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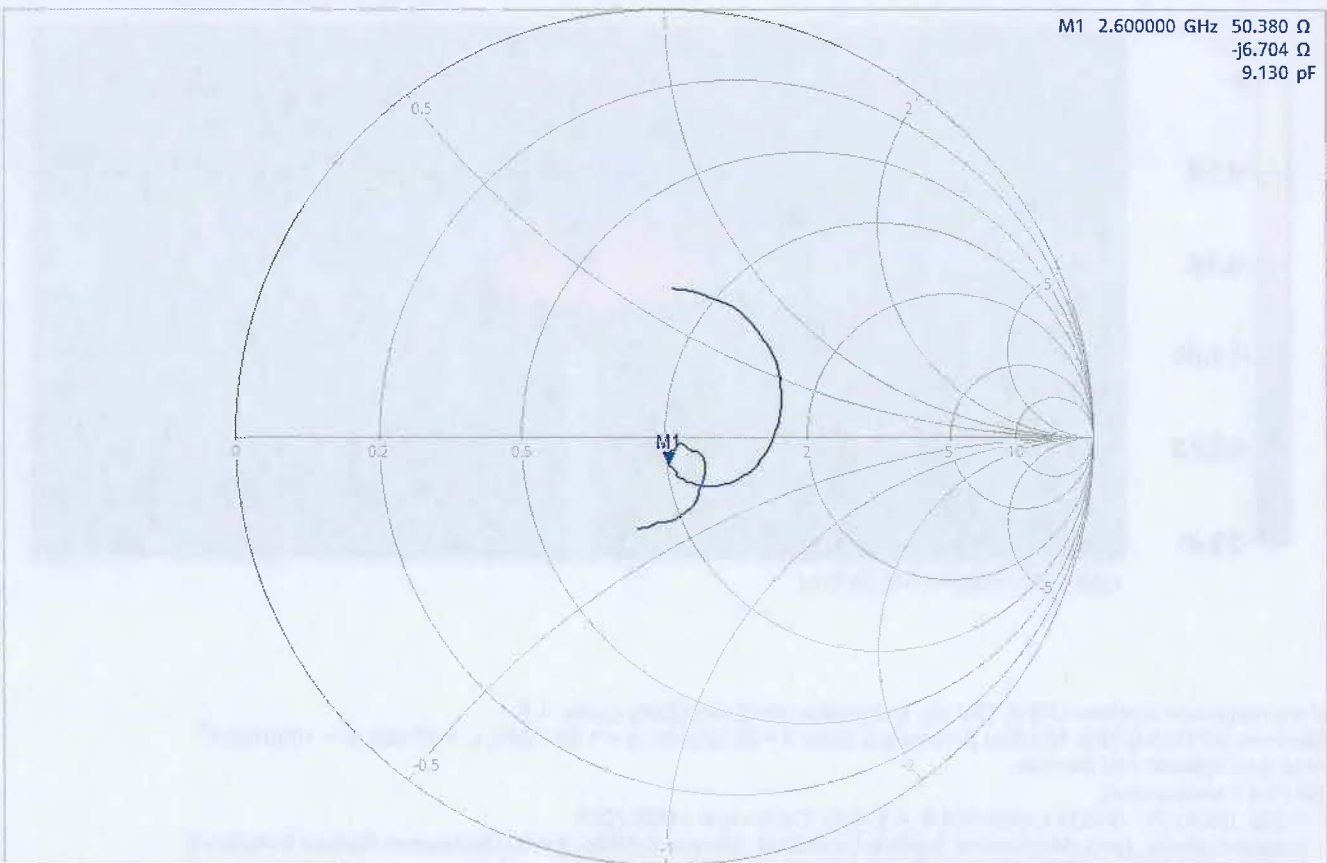
### Impedance Measurement Plot for Head Stimulating Liquid (HSL)

10/10/2017 1:17:37 PM  
1328.5170K92-100151-MV

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

1

M1 2.600000 GHz 50.380  $\Omega$   
-j6.704  $\Omega$   
9.130 pF



Ch1 Start 2.4 GHz

Pwr -10 dBm Bw 10 kHz

Stop 2.8 GHz

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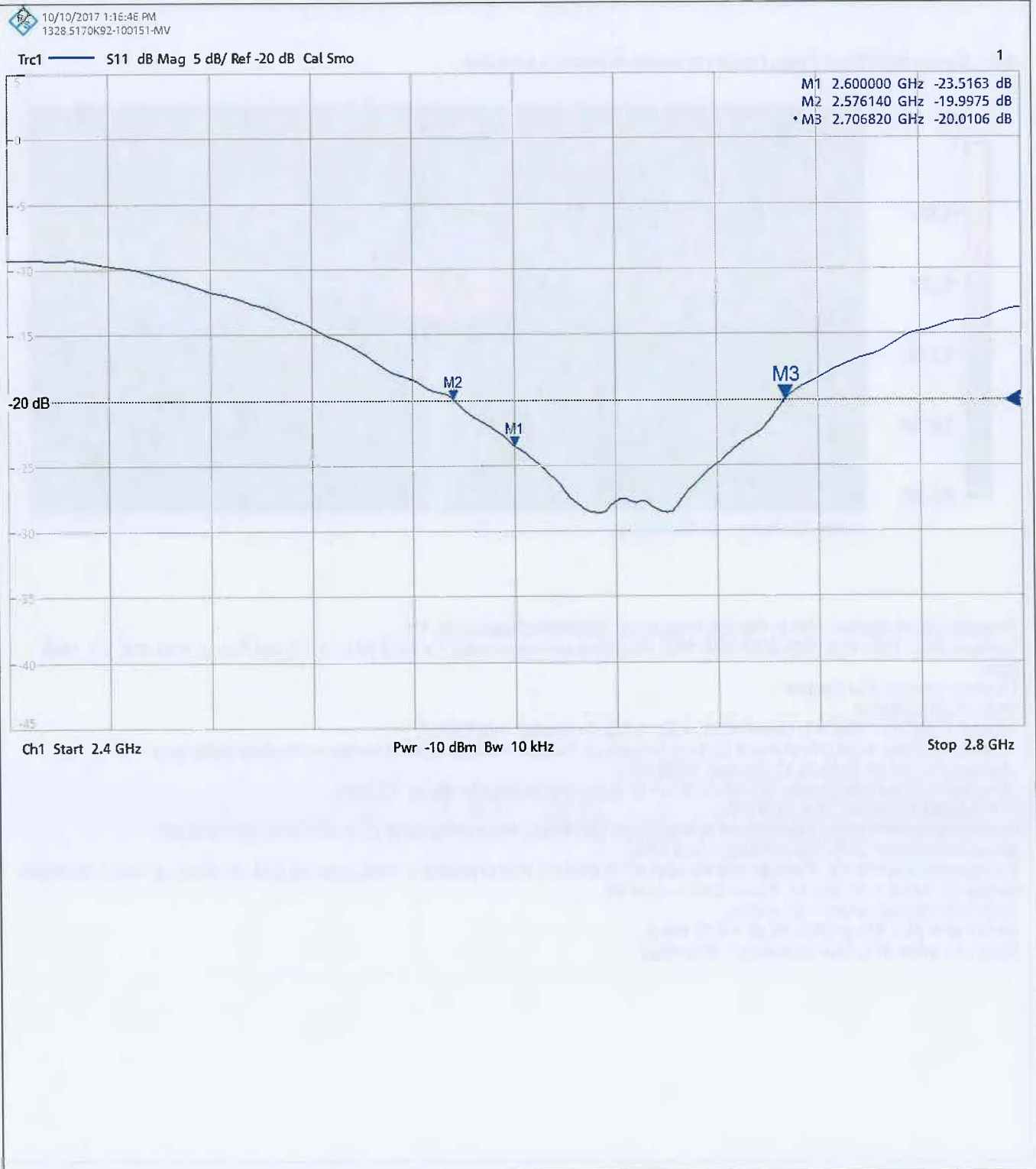
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### Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



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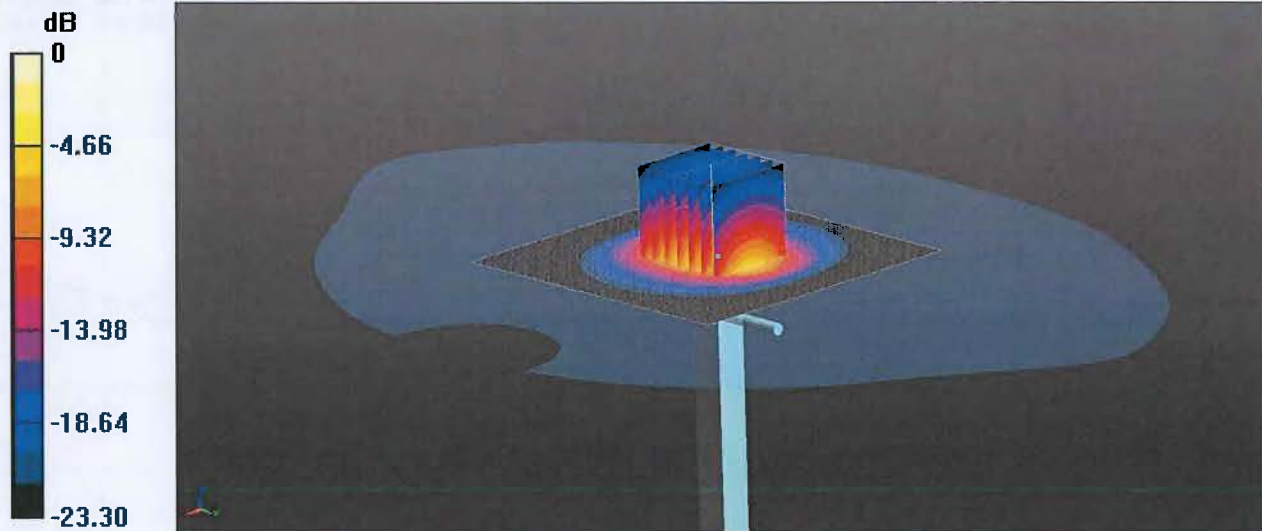
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### DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1006



0 dB = 22.3 W/kg = 13.48 dBW/kg

Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1  
Medium: 900,1750,1800,1900,2600 MHz MSL Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.189$  S/m;  $\epsilon_r = 51.388$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3341; ConvF(4.32, 4.32, 4.32); Calibrated: 14/08/2017;
- Sensor-Surface: 4mm (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/Area Scan (81x81x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

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

**Configuration/d=10mm, Pin=250mW 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.50 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 31.4 W/kg

**SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.28 W/kg**

Maximum value of SAR (measured) = 22.3 W/kg



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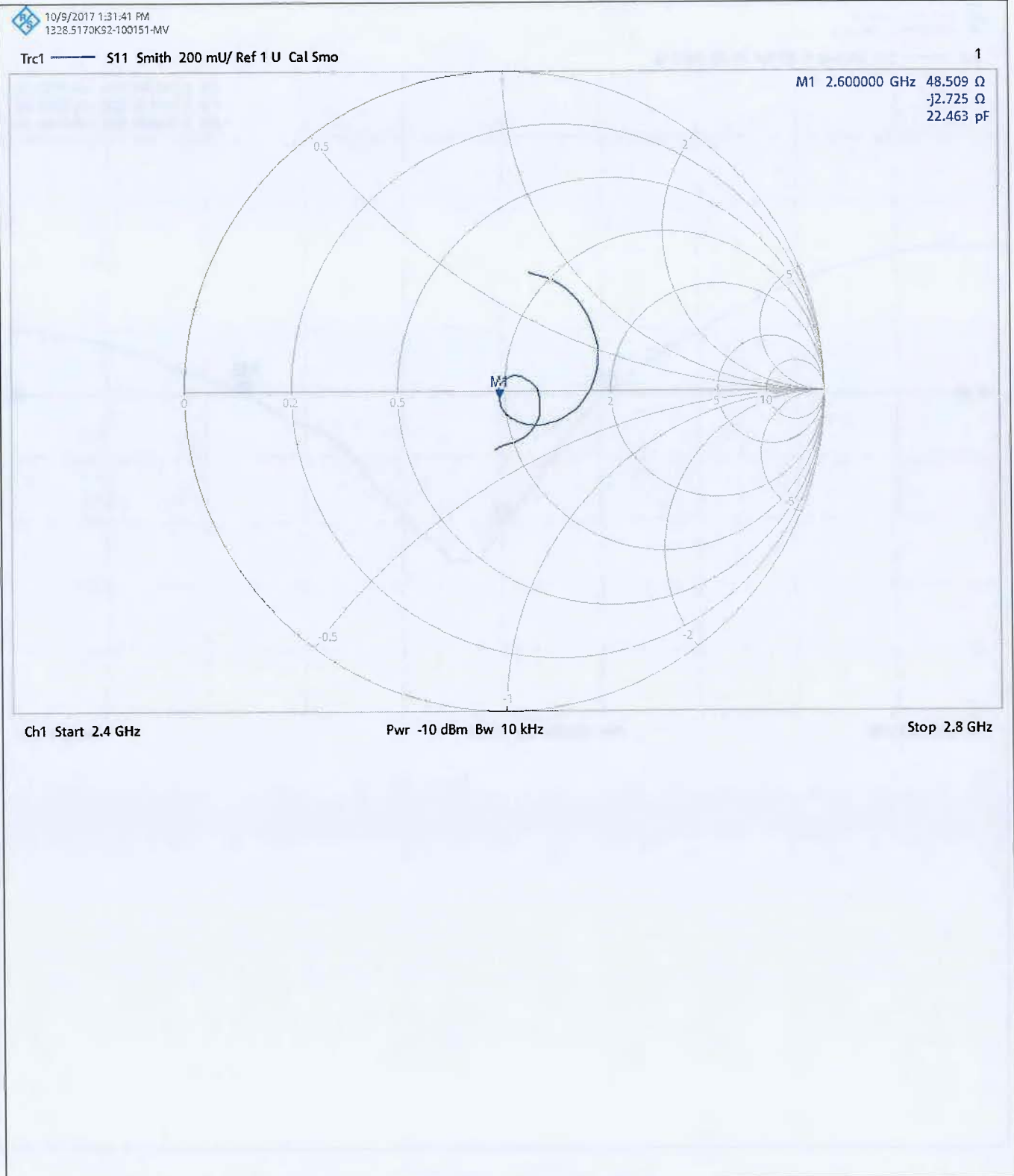
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### Impedance Measurement Plot for Body Stimulating Liquid (MSL)



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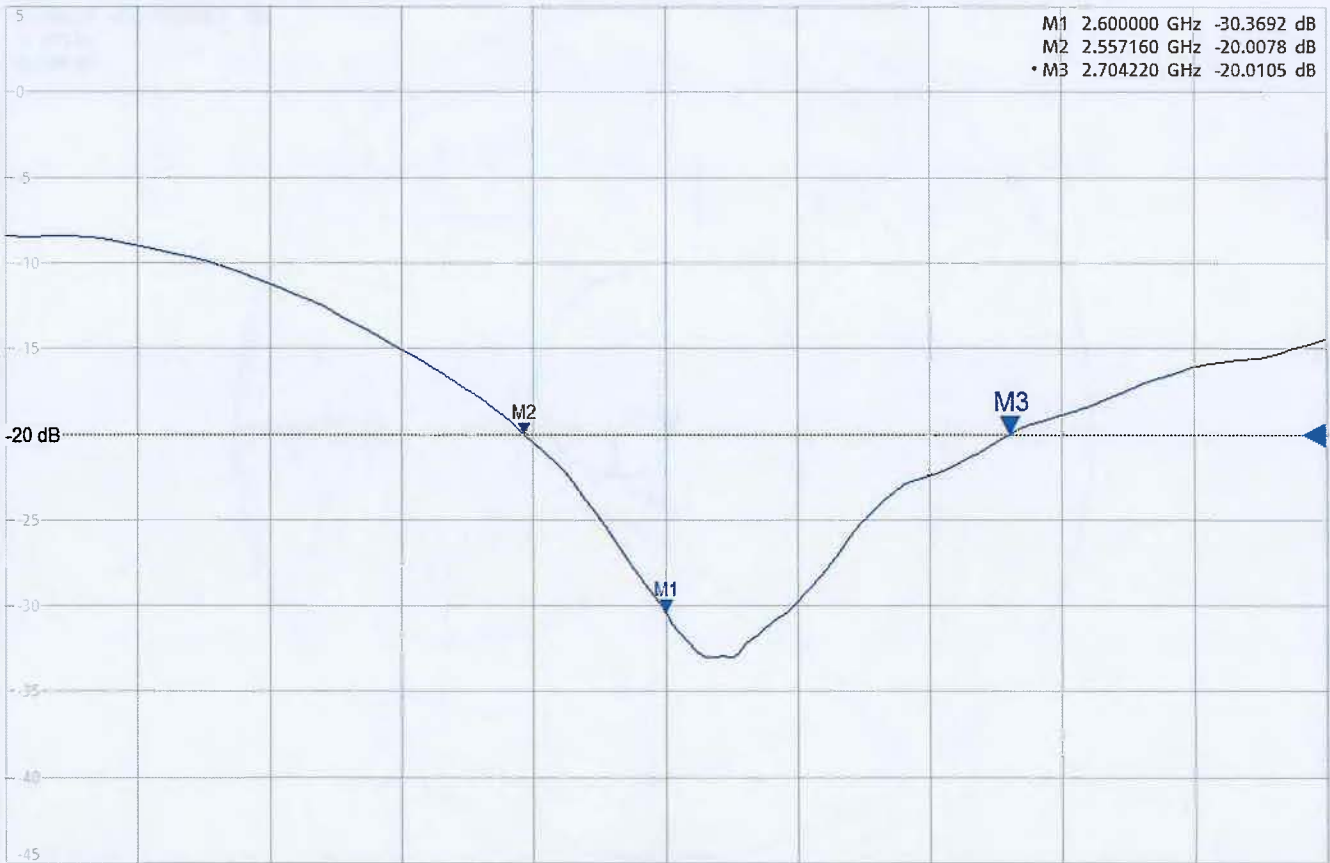
### Return Loss Measurement Plot for Body Stimulating Liquid (MSL)

10/9/2017 1:30:54 PM  
1326.5170K92-100151-MV

Trc1 — S11 dB Mag 5 dB/ Ref -20 dB Cal Smo

1

M1 2.600000 GHz -30.3692 dB  
M2 2.557160 GHz -20.0078 dB  
• M3 2.704220 GHz -20.0105 dB





Ch1 Start 2.4 GHz

Pwr -10 dBm Bw 10 kHz

Stop 2.8 GHz

Calibration Certificate Label:

 <p>UKAS CALIBRATION 5248</p>	<p><b>UL VS LTD - Tel: +44 (0) 1256312000</b></p> <p>Certificate Number: 11903941JD01E</p> <p>Instrument ID: 1006</p> <p>Calibration Date: 05/Oct/2017</p> <p>Calibration Due Date:</p>
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# CERTIFICATE OF CALIBRATION

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



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PAVILION A  
ASHWOOD PARK, ASHWOOD WAY  
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Email: LST.UK.Calibration@ul.com



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APPROVED SIGNATORY

A handwritten signature in black ink, appearing to read 'M. Naseer'.

.....  
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:

A handwritten signature in black ink, appearing to read 'Chanthu Thevarajah'.

.....  
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.

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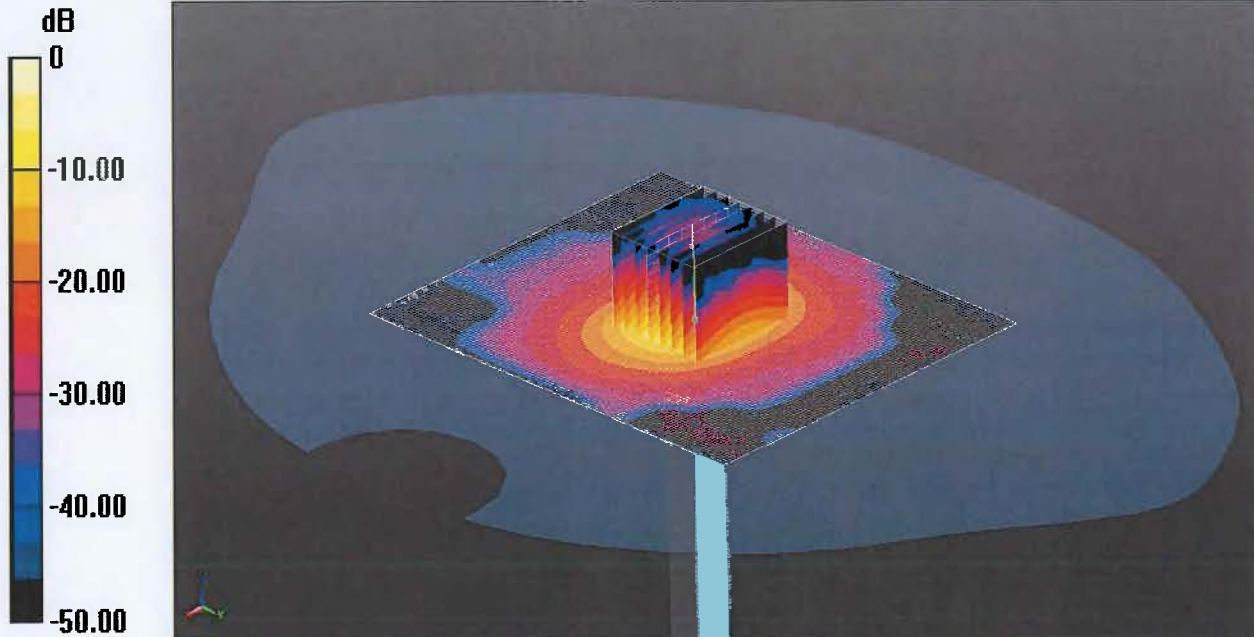
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### DASY Validation Scan for Head Stimulating Liquid (HSL)

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

# CERTIFICATE OF CALIBRATION

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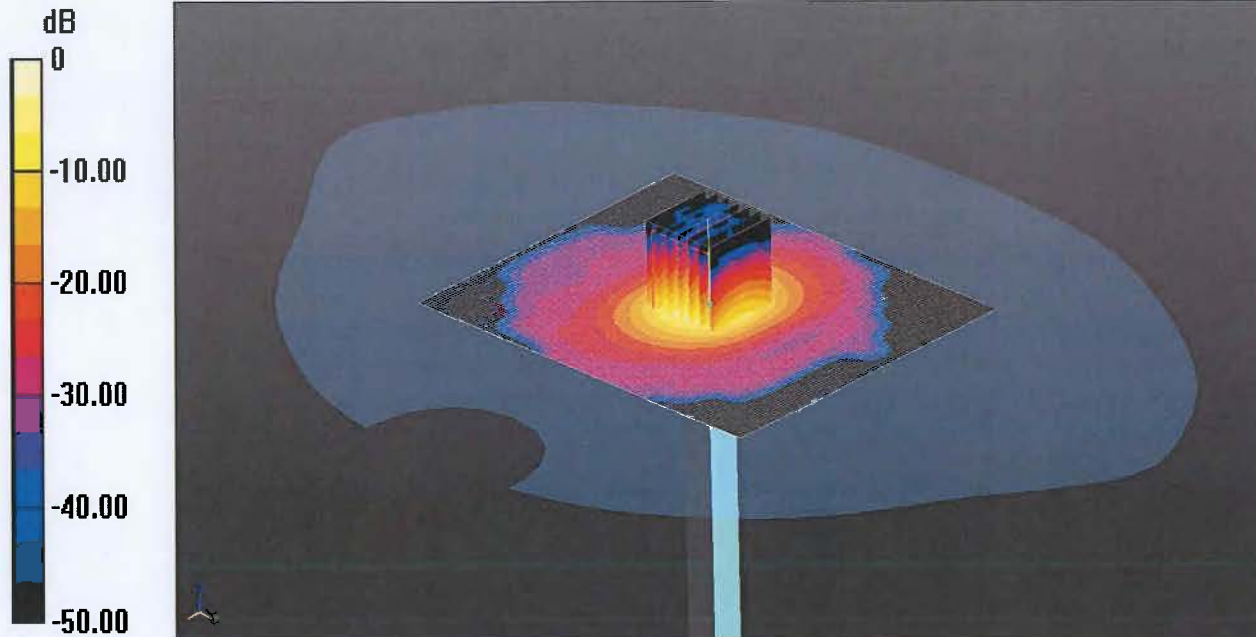
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11903932JD01F

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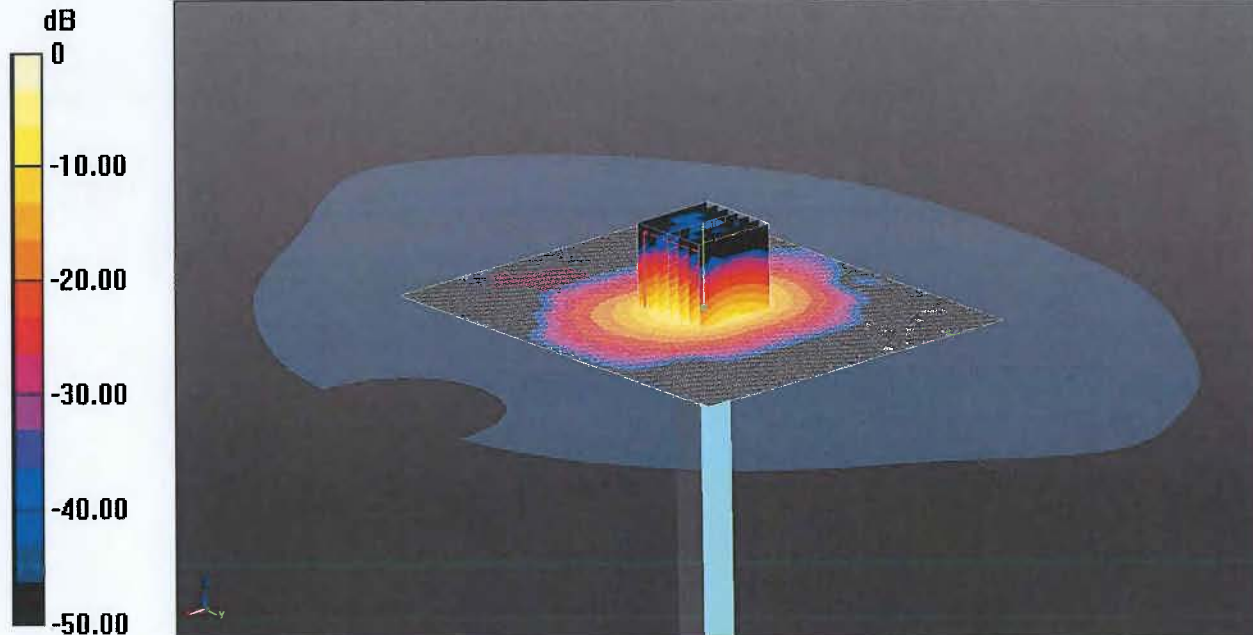
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### DASY Validation Scan for Head Stimulating Liquid (HSL)

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

# CERTIFICATE OF CALIBRATION

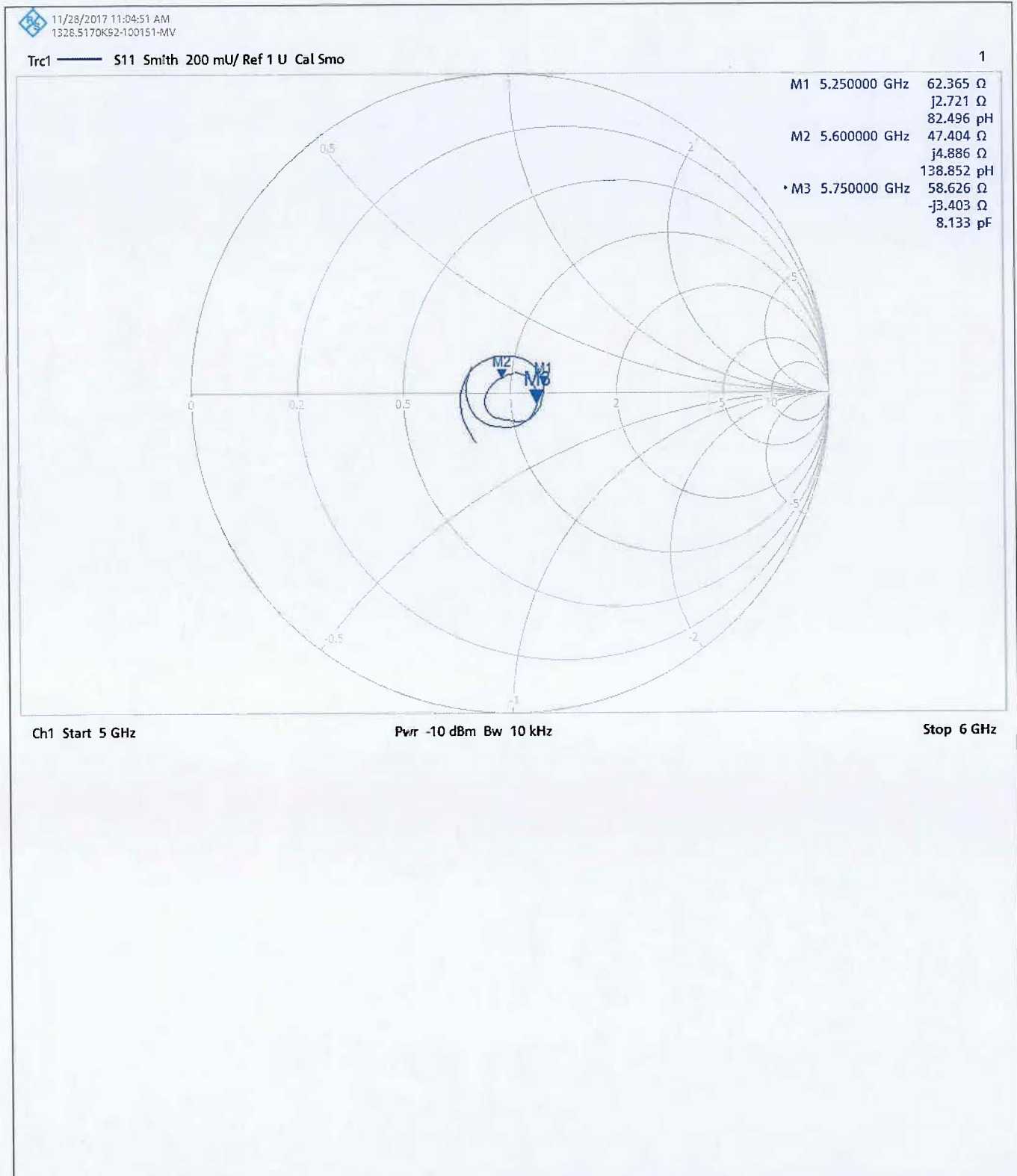
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### Impedance Measurement Plot for Head Stimulating Liquid (HSL)



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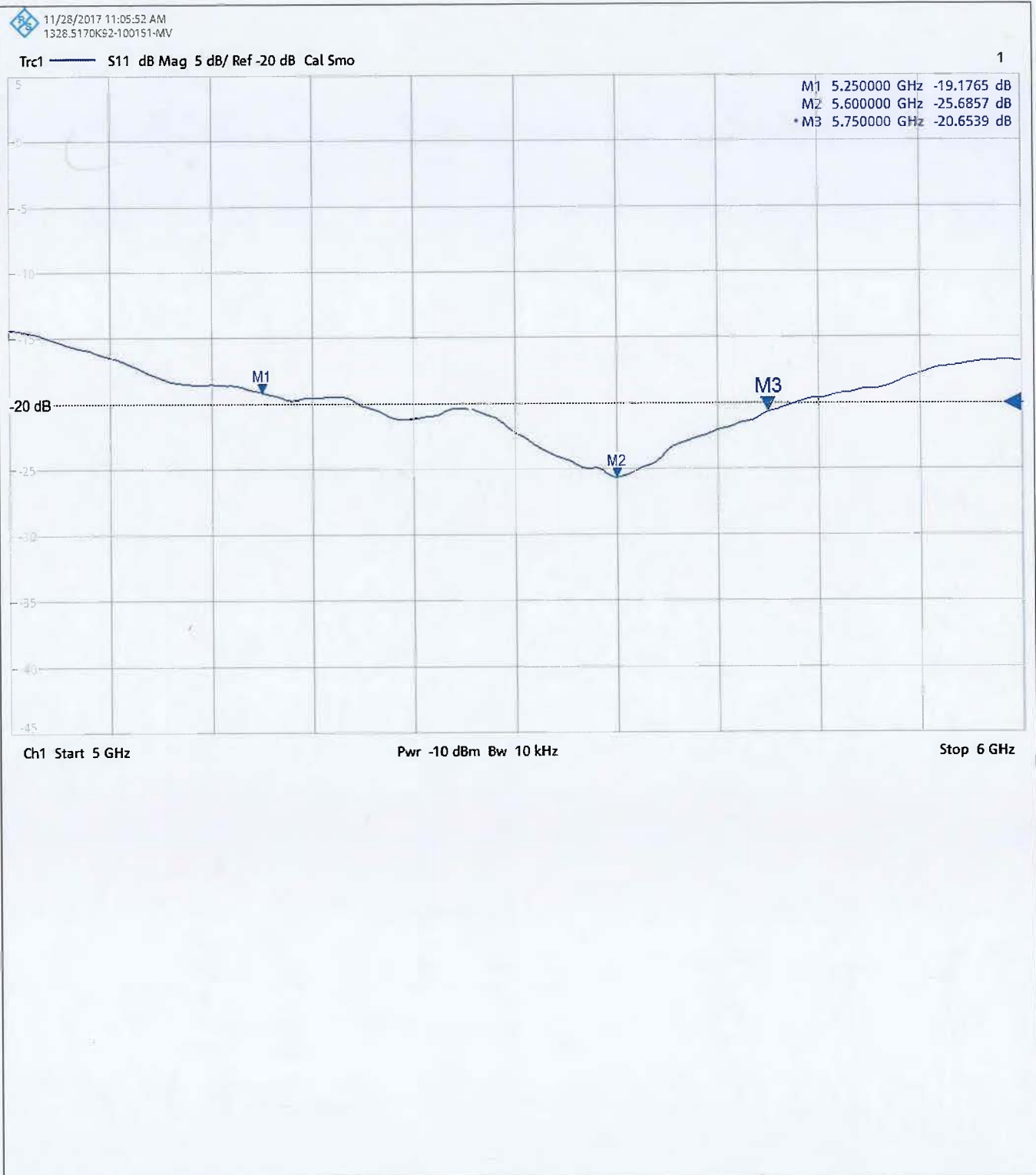
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### Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



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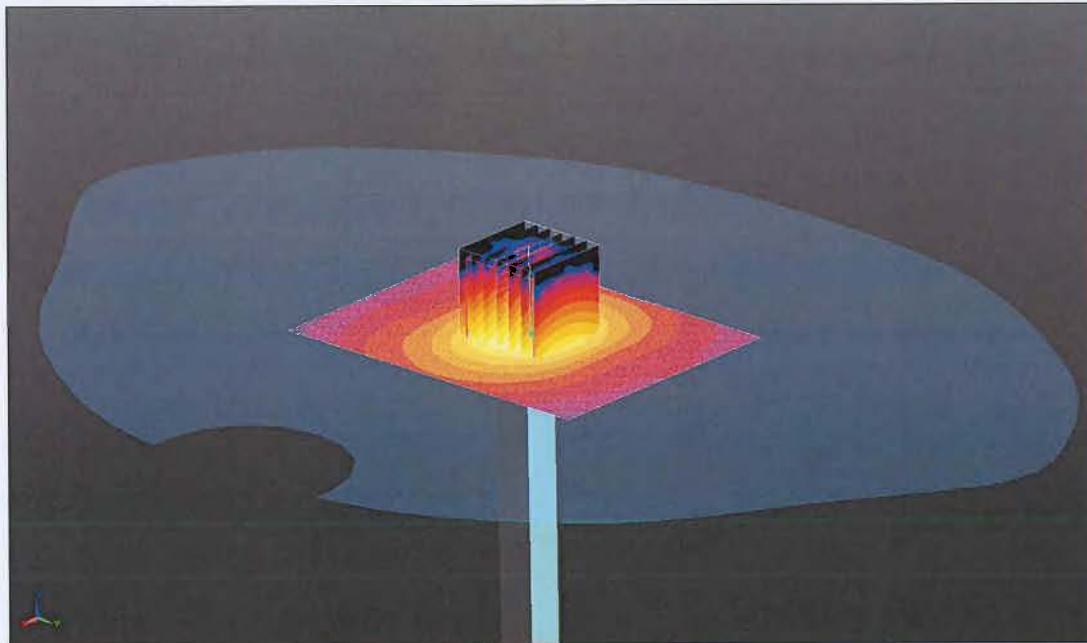
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11903932JD01F

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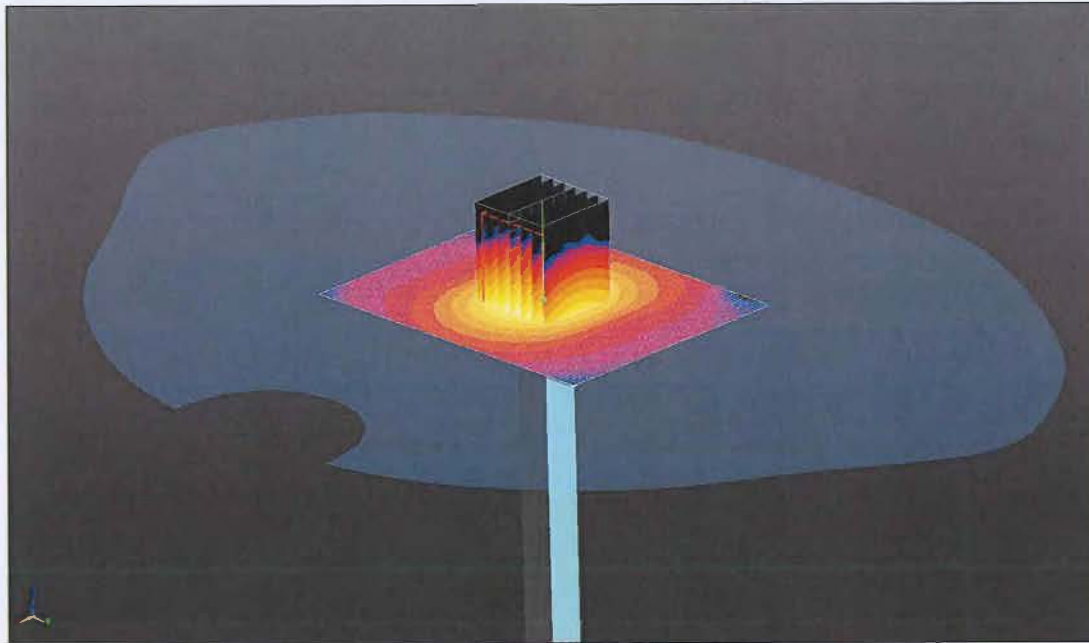
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### DASY Validation Scan for Body Stimulating Liquid (MSL)

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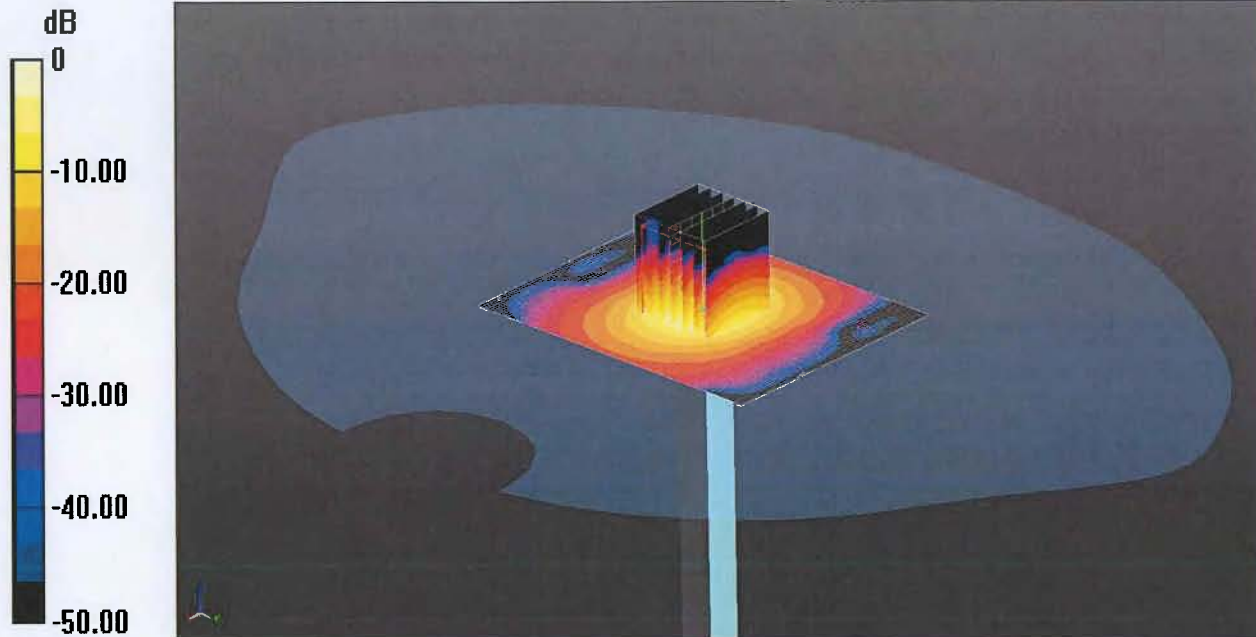
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### DASY Validation Scan for Body Stimulating Liquid (MSL)

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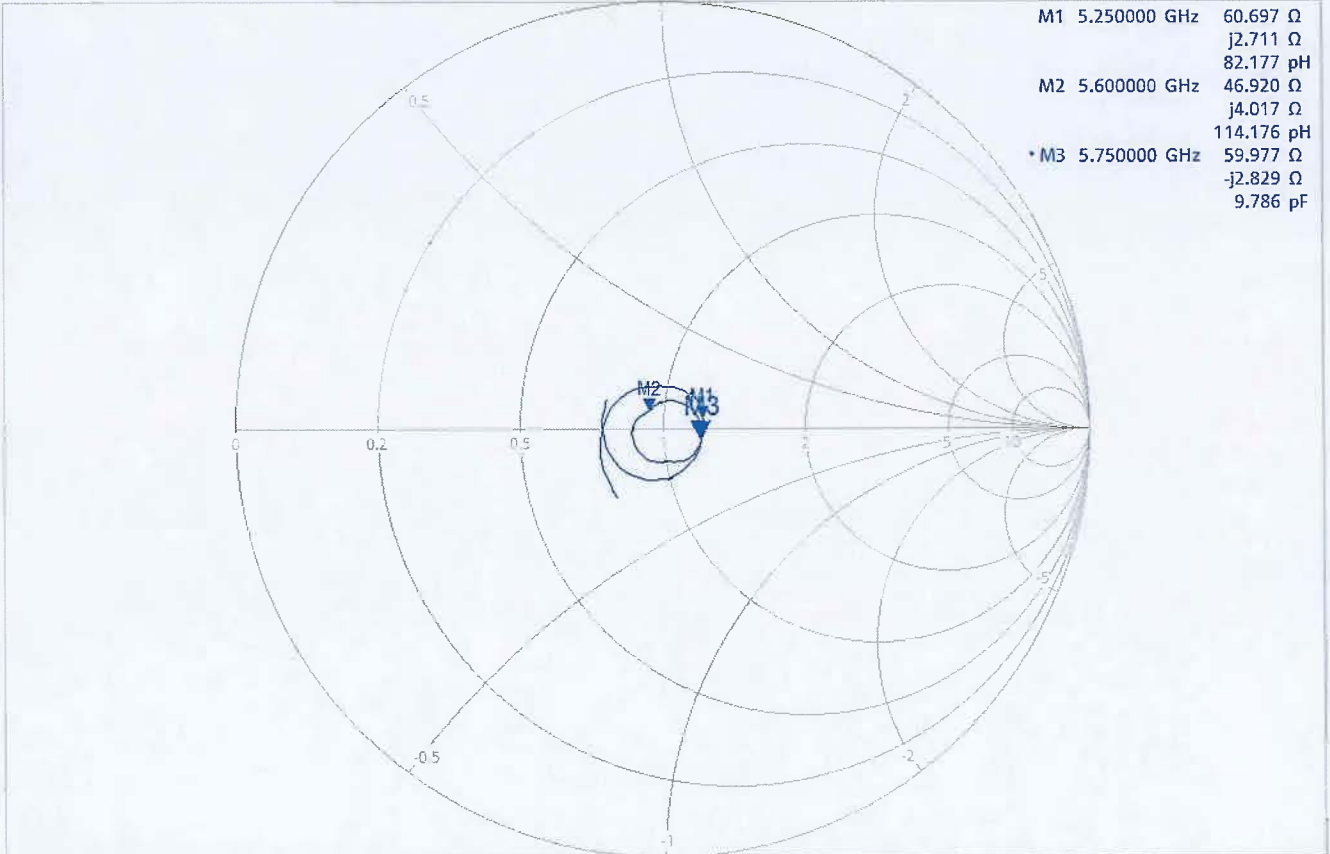
## Impedance Measurement Plot for Body Stimulating Liquid (MSL)

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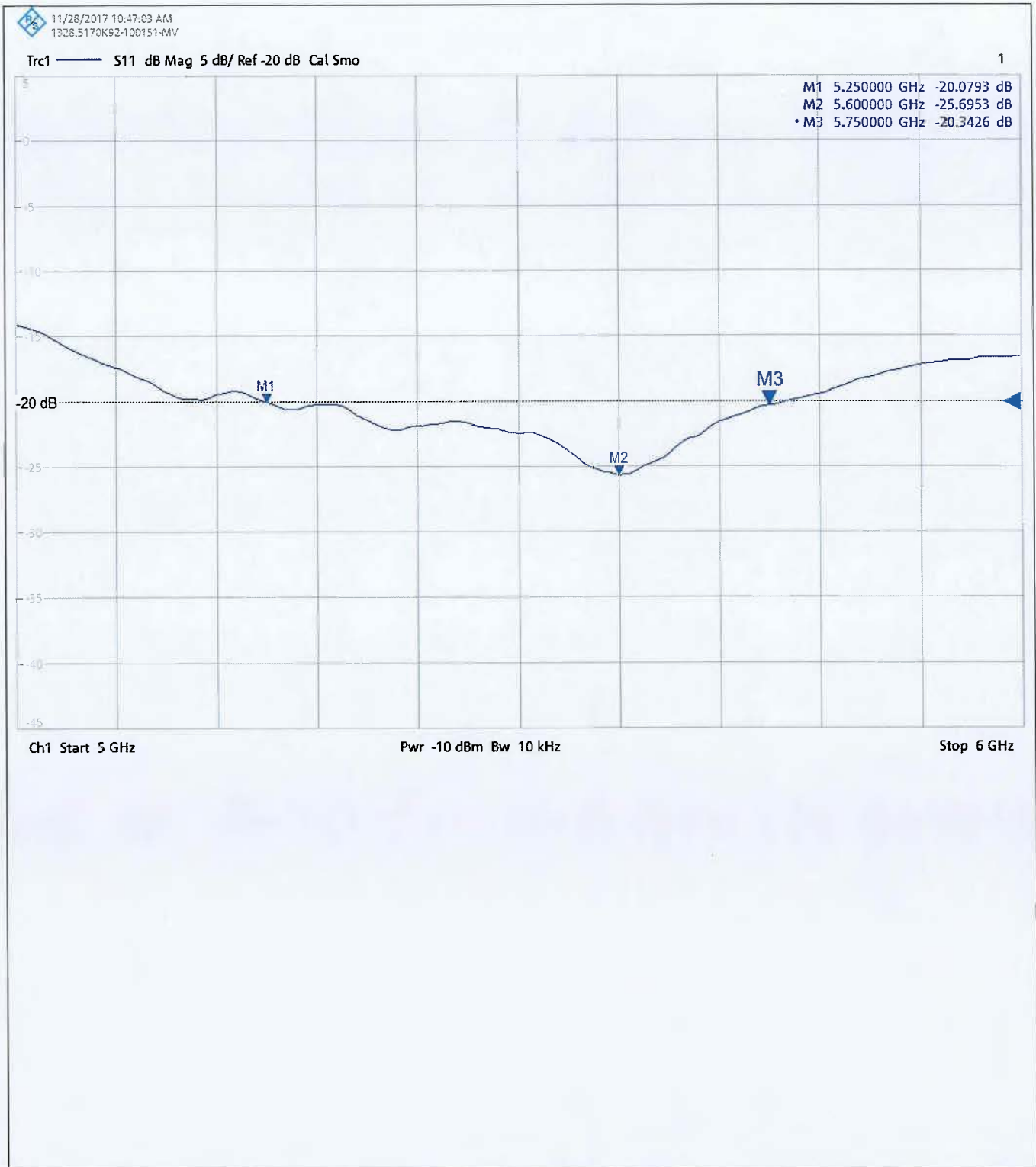
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### Return Loss Measurement Plot for Body Stimulating Liquid (MSL)



Calibration Certificate Label:

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