

CERTIFICATE OF CALIBRATION

ISSUED BY **UL VS LTD**

DATE OF ISSUE: 30/Nov/2017 CERTIFICATE NUMBER : 11903932JD01A



5248

UL VS LTD
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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: | D750V3 | | |
| Serial Number: | 1071 | | |
| Calibration Date: | 21/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 |
| A2765 | Dipole | SPEAG | D750V3 | 1147 | 21 Sep 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: | 15 mm (with spacer) |
| Frequency: | 750 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 | 750 | 21.0 °C | 21.0 °C | 20.5°C | 21.0°C | ϵ_r | 41.96 | 41.94 | ± 5% |
| | | | | | | σ | 0.89 | 0.91 | ± 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 | 2.16 W/Kg | 8.59 W/Kg | ± 17.57% |
| | SAR averaged over 10g | 1.44 W/Kg | 5.73 W/Kg | ± 17.32% |

Antenna Parameters – Head Simulating Liquid (HSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|---------------------------------|------------------------------------|
| Head | Impedance | 46.312 Ω 2.22 j Ω | ± 0.28 Ω ± 0.044 j Ω |
| | Return Loss | 26.76 | ± 2.03 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 | 750 | 21.0 °C | 21.0 °C | 21.0°C | 21.0°C | ϵ_r | 55.55 | 54.53 | ± 5% |
| | | | | | | σ | 0.96 | 0.96 | ± 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 | 2.14 W/Kg | 8.52 W/Kg | ± 18.06% |
| | SAR averaged over 10g | 1.43 W/Kg | 5.69 W/Kg | ± 17.44% |

Antenna Parameters – Body Simulating Liquid (MSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|--------------------------------|------------------------------------|
| Body | Impedance | 52.11 Ω 4.88 j Ω | ± 0.28 Ω ± 0.044 j Ω |
| | Return Loss | 26.35 | ± 2.03 dB |

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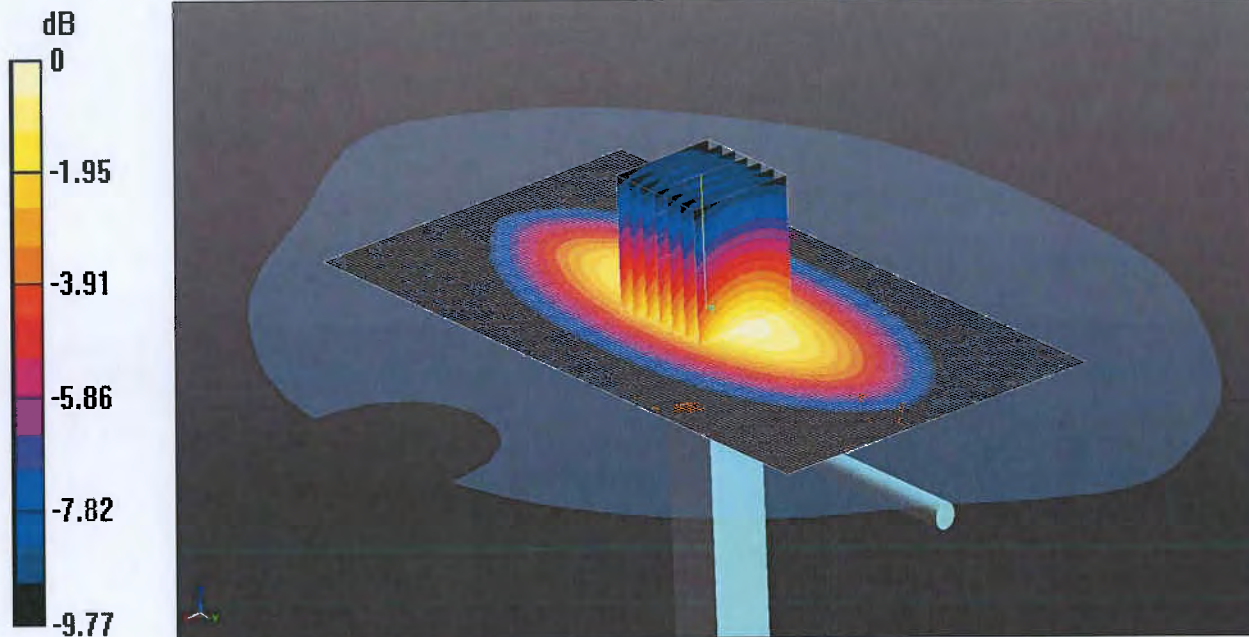
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DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: Dipole 750 MHz SN:1047; Type: D750V3; Serial: D750V3 - SN:1071



0 dB = 2.50 W/kg = 3.98 dBW/kg

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 750,835,900,1800,1900 MHz HSL Medium parameters used: $f = 750$ MHz; $\sigma = 0.914$ S/m; $\epsilon_r = 41.936$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3995; ConvF(10.57, 10.57, 10.57); Calibrated: 04/05/2017;

- Sensor-Surface: 3mm (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=15mm, Pin=250mW 2 2 2 2 2/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 2.50 W/kg

Configuration/d=15mm, Pin=250mW 2 2 2 2 2/Zoom Scan (5x5x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.49 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.18 W/kg

SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.44 W/kg

Maximum value of SAR (measured) = 2.50 W/kg

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Impedance Measurement Plot for Head Stimulating Liquid (HSL)

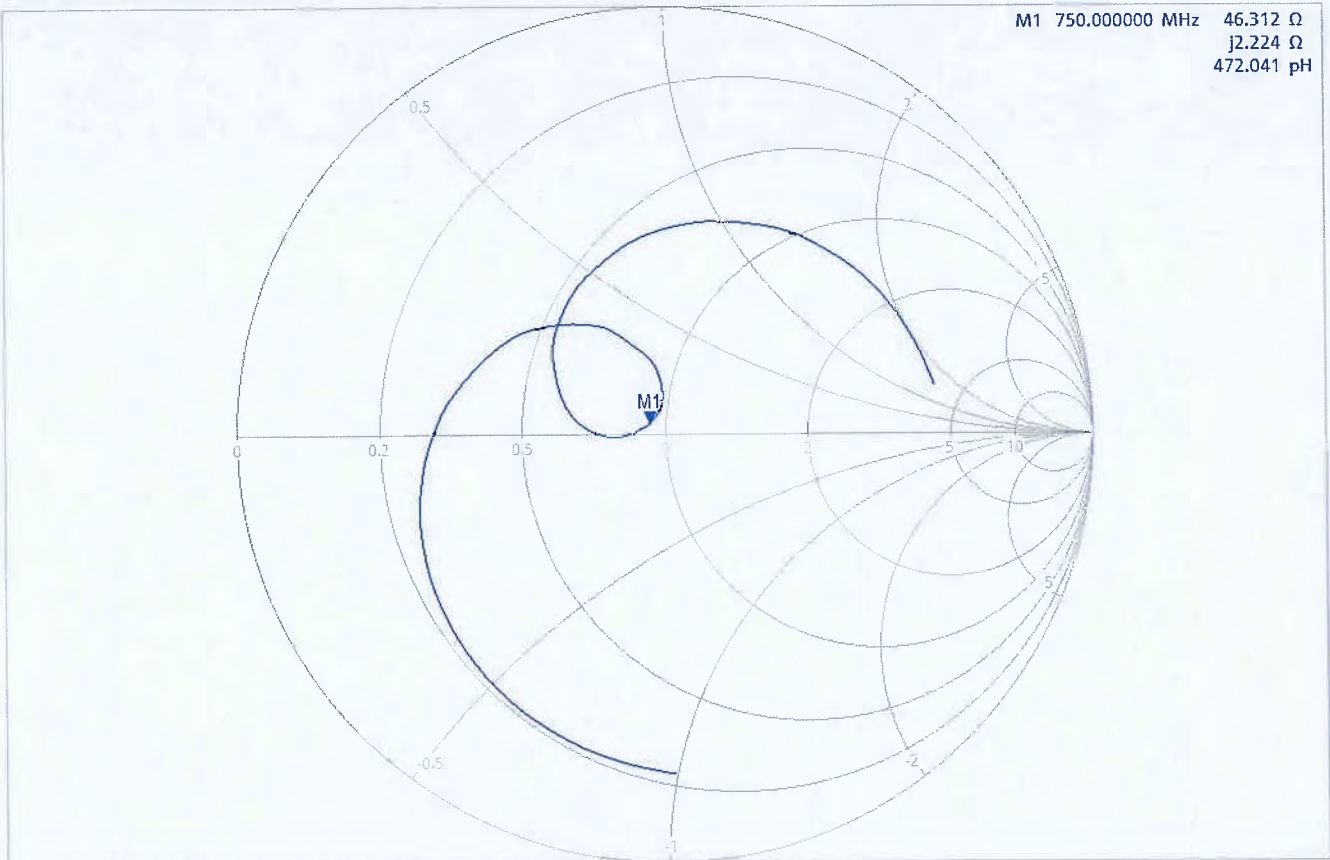


11/28/2017 3:29:06 PM
1326.5170K92-100151-MV

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

1

M1 750.000000 MHz 46.312 Ω
j2.224 Ω
472.041 pF



Ch1 Start 550 MHz

Pwr -10 dBm Bw 10 kHz

Stop 950 MHz

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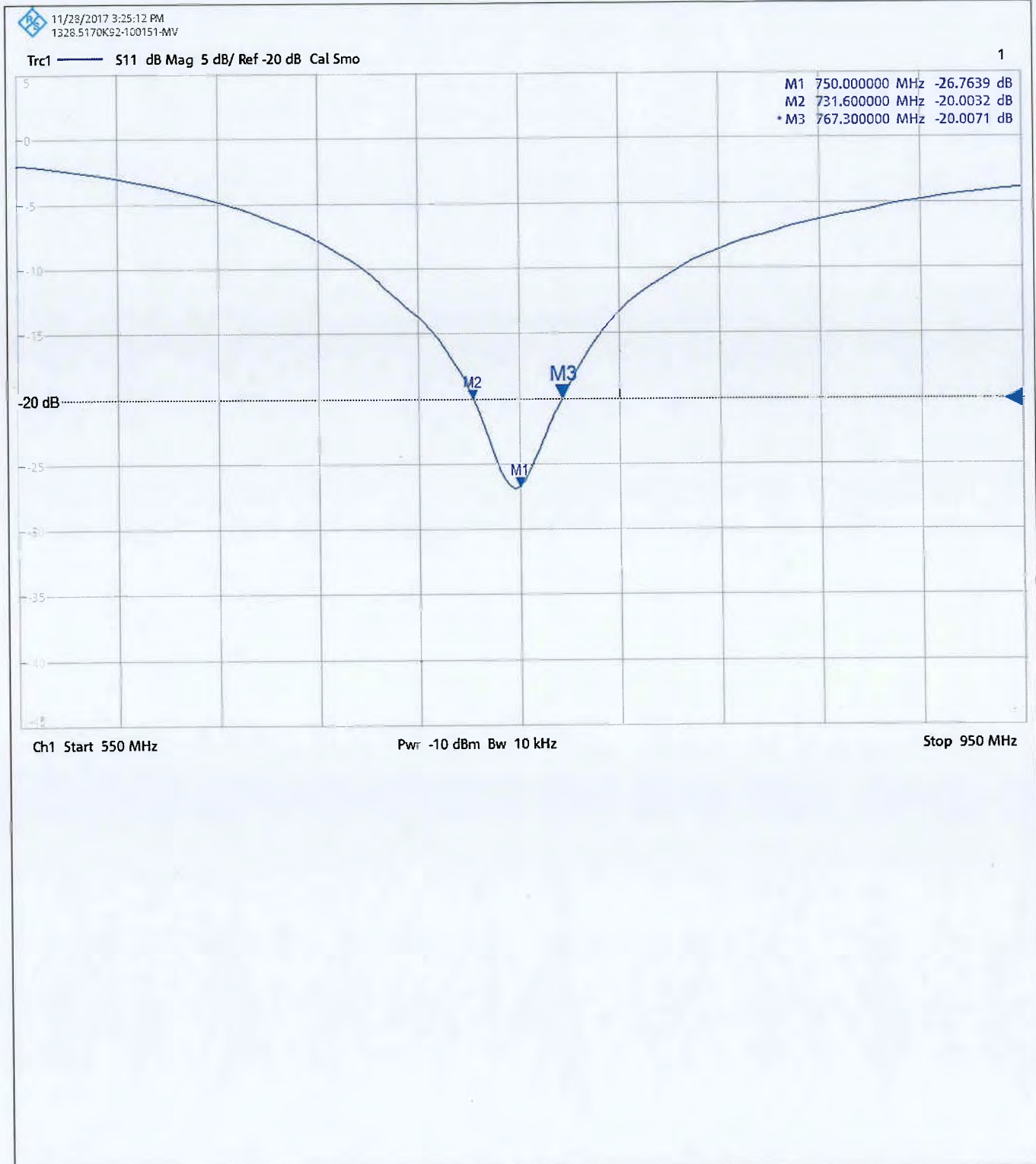
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Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



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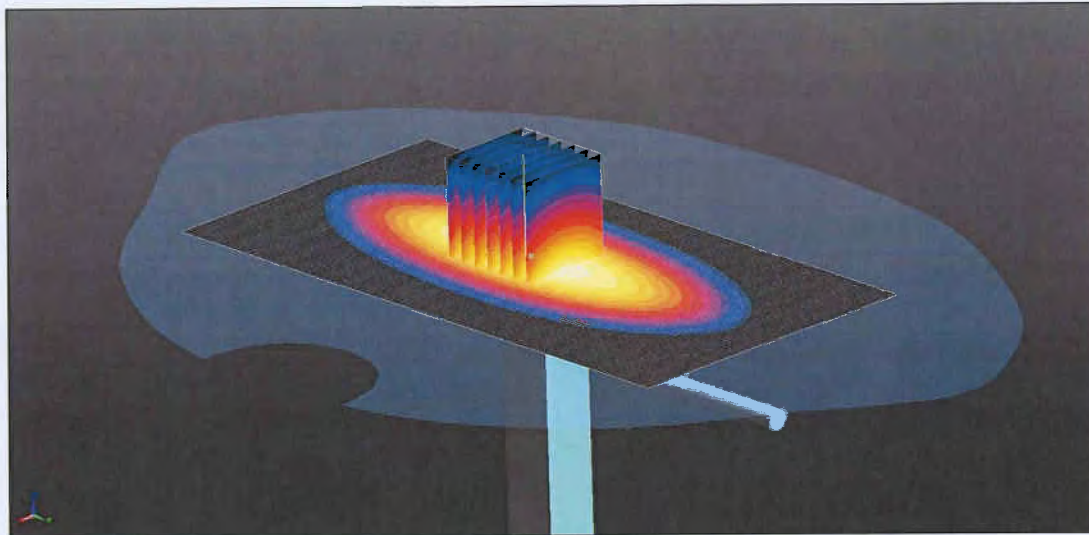
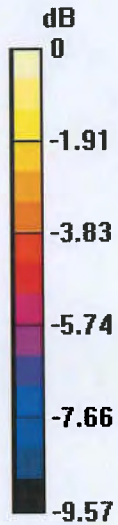
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DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1011



0 dB = 2.29 W/kg = 3.60 dBW/kg

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: MSL(750,835,900,1800,1900,5G) Medium parameters used: $f = 750$ MHz; $\sigma = 0.96$ S/m; $\epsilon_r = 54.527$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3995; ConvF(10.33, 10.33, 10.33); Calibrated: 04/05/2017;
- Sensor-Surface: 4mm (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=15mm, Pin=250mW 2/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 2.29 W/kg

Configuration/d=15mm, Pin=250mW 2/Zoom Scan (5x5x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 48.67 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.12 W/kg

SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.43 W/kg

Maximum value of SAR (measured) = 2.29 W/kg

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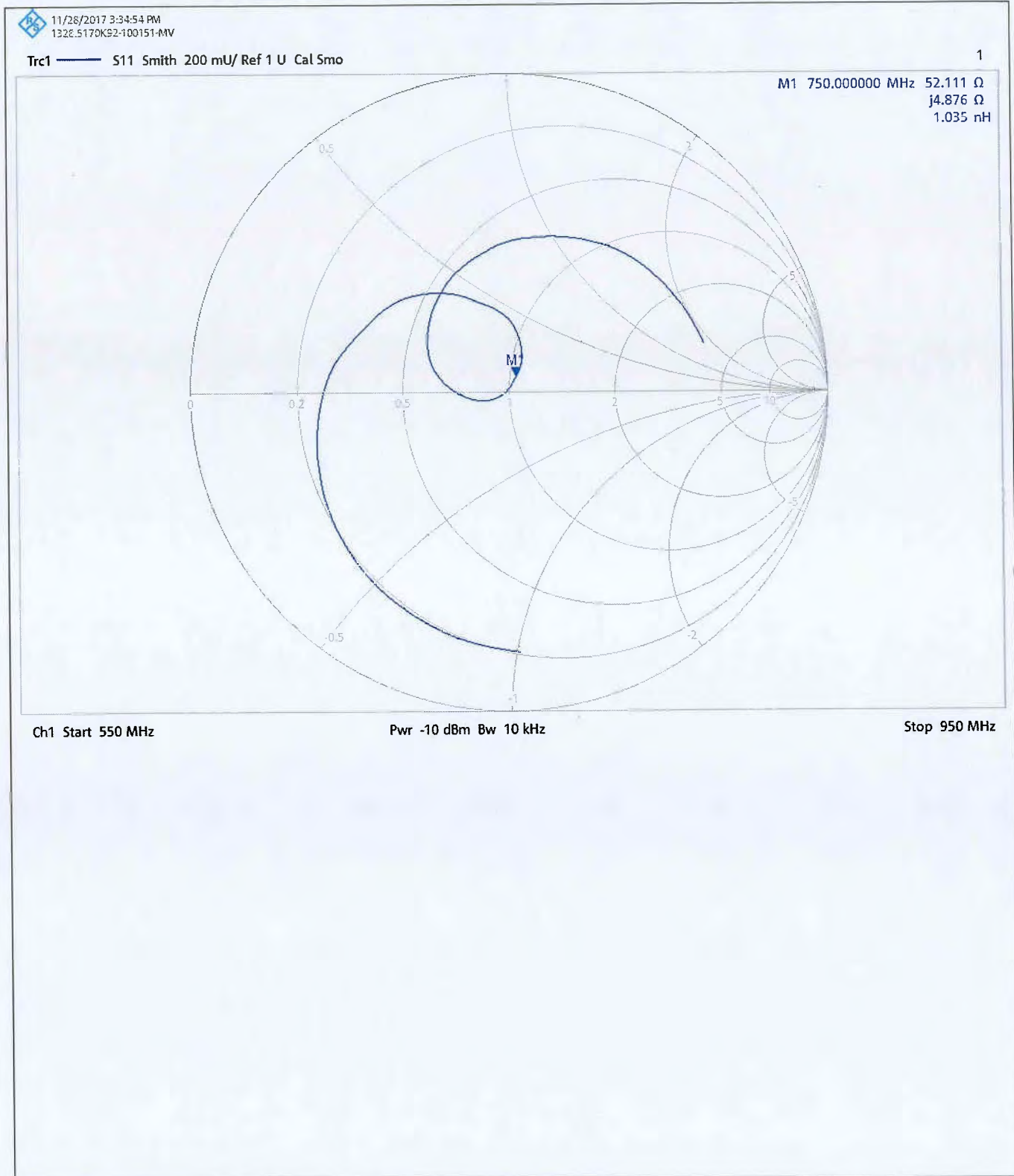
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Impedance Measurement Plot for Body Stimulating Liquid (MSL)



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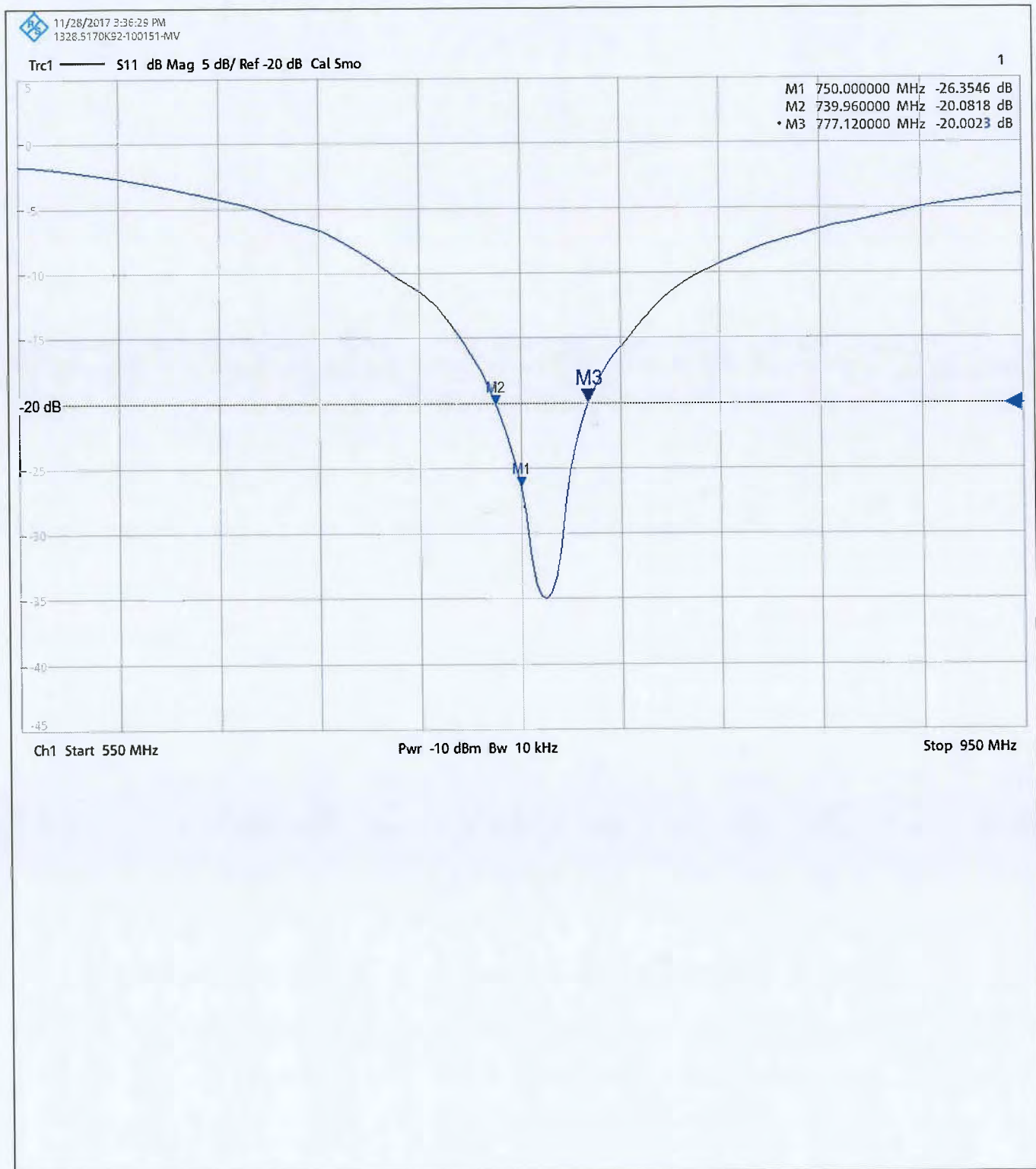
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Return Loss Measurement Plot for Body Stimulating Liquid (MSL)



Calibration Certificate Label:

| | |
|---|--|
|  5248 | UL VS LTD - Tel: +44 (0) 1256312000 |
| | Certificate Number: 11903932JD01A |
| | Instrument ID: 1071 |
| | Calibration Date: 21/Nov/2017 |
| | Calibration Due Date: |

| | |
|---|--|
|  5248 | UL VS LTD - Tel: +44 (0) 1256312000 |
| | Certificate Number: 11903932JD01A |
| | Instrument ID: 1071 |
| | Calibration Date: 21/Nov/2017 |
| | Calibration Due Date: |

| | |
|---|--|
|  5248 | UL VS LTD - Tel: +44 (0) 1256312000 |
| | Certificate Number: 11903932JD01A |
| | Instrument ID: 1071 |
| | Calibration Date: 21/Nov/2017 |
| | Calibration Due Date: |



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Accreditation No.: **SCS 0108**

Client **UL CCS USA**

Certificate No: **D835V2-4d142_Oct17**

CALIBRATION CERTIFICATE

Object **D835V2 - SN:4d142**

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

Calibration date: **October 12, 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 | 04-Apr-17 (No. 217-02521/02522) | Apr-18 |
| Power sensor NRP-Z91 | SN: 103244 | 04-Apr-17 (No. 217-02521) | Apr-18 |
| Power sensor NRP-Z91 | SN: 103245 | 04-Apr-17 (No. 217-02522) | Apr-18 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 07-Apr-17 (No. 217-02528) | Apr-18 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 07-Apr-17 (No. 217-02529) | Apr-18 |
| Reference Probe EX3DV4 | SN: 7349 | 31-May-17 (No. EX3-7349_May17) | May-18 |
| DAE4 | SN: 601 | 28-Mar-17 (No. DAE4-601_Mar17) | Mar-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-17) | In house check: Oct-18 |

| | Name | Function | Signature |
|----------------|---------------|-----------------------|-----------|
| Calibrated by: | Leif Klysner | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: October 13, 2017

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Accredited by the Swiss Accreditation Service (SAS)

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Multilateral Agreement for the recognition of calibration certificates

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- 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.

| | | |
|-------------------------------------|------------------------|-------------|
| DASY Version | DASY5 | V52.10.0 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 15 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 835 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 41.5 | 0.90 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 40.7 \pm 6 % | 0.92 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm³ (1 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 2.46 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 9.64 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 1.58 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 6.22 W/kg \pm 16.5 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|--|---------------------|----------------|----------------------|
| Nominal Body TSL parameters | 22.0 °C | 55.2 | 0.97 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 54.4 \pm 6 % | 1.01 mho/m \pm 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm³ (1 g) of Body TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 2.49 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 9.63 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 1.61 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 6.27 W/kg \pm 16.5 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

| | |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | 50.8 Ω - 3.4 $j\Omega$ |
| Return Loss | - 29.3 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | 47.1 Ω - 6.0 $j\Omega$ |
| Return Loss | - 23.3 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.392 ns |
|----------------------------------|----------|

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 27, 2012 |

DASY5 Validation Report for Head TSL

Date: 12.10.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d142

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.92 \text{ S/m}$; $\epsilon_r = 40.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.07, 10.07, 10.07); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

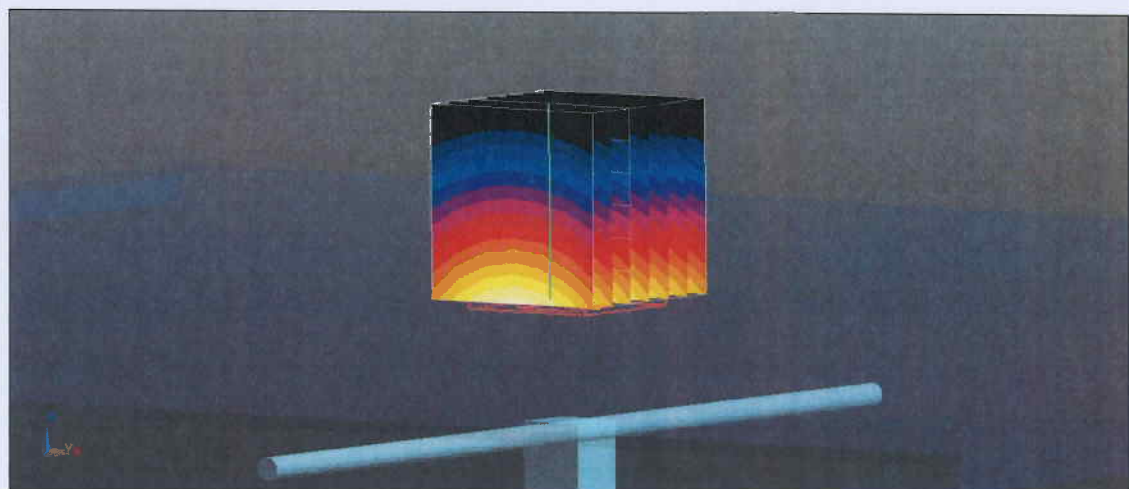
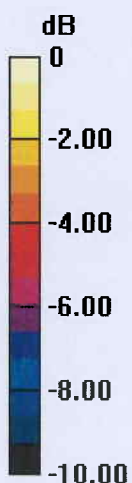
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 63.04 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.87 W/kg

SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.58 W/kg

Maximum value of SAR (measured) = 3.37 W/kg



0 dB = 3.37 W/kg = 5.28 dBW/kg

Impedance Measurement Plot for Head TSL

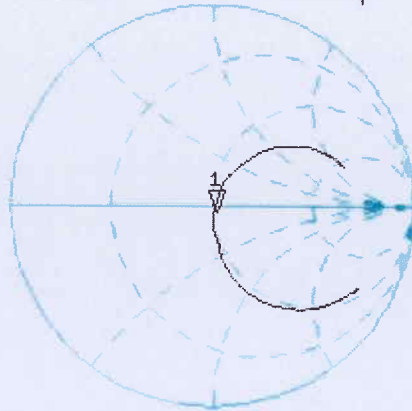
12 Oct 2017 14:25:42

CH1 S11 1 U FS

1: 50.820 Ω -3.3574 Ω 56.771 pF

835.000 000 MHz

*
Del
CA



Avg
16

H1d

CH2 S11 LOG

5 dB/REF -20 dB

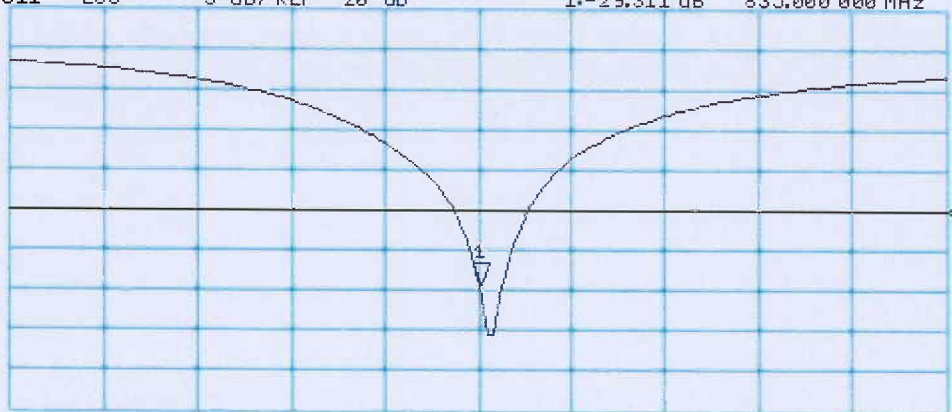
1: -29.311 dB

835.000 000 MHz

CA

Avg
16

H1d



START 635.000 000 MHz

STOP 1 035.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 12.10.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d142

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 1.01 \text{ S/m}$; $\epsilon_r = 54.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.2, 10.2, 10.2); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

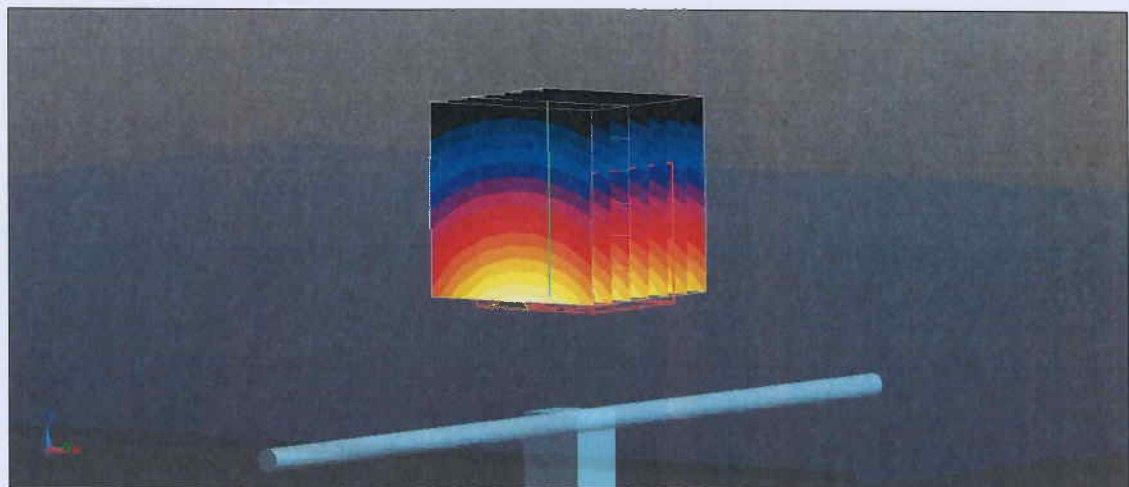
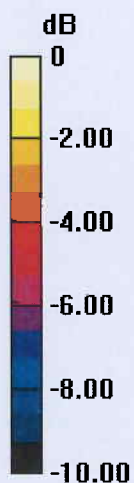
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 60.44 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.83 W/kg

SAR(1 g) = 2.49 W/kg; SAR(10 g) = 1.61 W/kg

Maximum value of SAR (measured) = 3.33 W/kg



0 dB = 3.33 W/kg = 5.22 dBW/kg

Impedance Measurement Plot for Body TSL

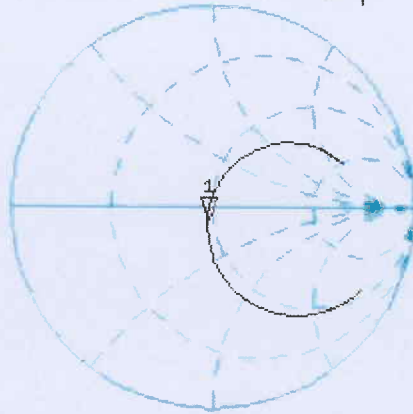
12 Oct 2017 13:06:15
CH1 S11 1 U FS 1: 47.109 Ω -5.9531 Ω 32.018 μF 835.000 000 MHz

*
Del

CΔ

Avg
16

H1d

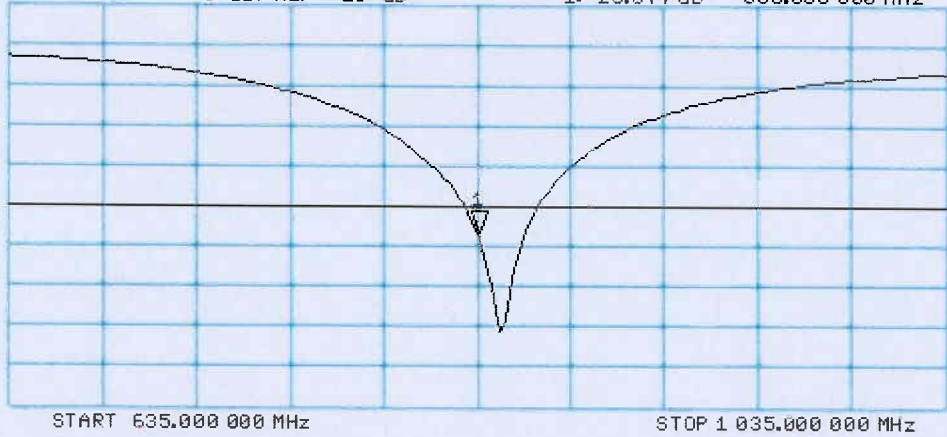


CH2 S11 LOG 5 dB/REF -20 dB 1: -23.344 dB 835.000 000 MHz

CΔ

Avg
16

H1d



Appendix (Additional assessments outside the scope of SCS 0108)

Evaluation Condition

| | | |
|---------|------------------|-----------------------------|
| Phantom | SAM Head Phantom | For usage with cSAR3DV2-R/L |
|---------|------------------|-----------------------------|

SAR result with SAM Head (Top)

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR (average measured) | 250 mW input power | 2.34 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 9.05 W/kg ± 17.5 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|---------------------------------|
| SAR measured | 250 mW input power | 1.53 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 5.97 W/kg ± 16.9 % (k=2) |

SAR result with SAM Head (Mouth)

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR (average measured) | 250 mW input power | 2.45 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 9.50 W/kg ± 17.5 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|---------------------------------|
| SAR (average measured) | 250 mW input power | 1.63 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 6.36 W/kg ± 16.9 % (k=2) |

SAR result with SAM Head (Neck)

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR (average measured) | 250 mW input power | 2.32 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 9.03 W/kg ± 17.5 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|---------------------------------|
| SAR (average measured) | 250 mW input power | 1.55 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 6.08 W/kg ± 16.9 % (k=2) |

SAR result with SAM Head (Ear)

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|---------------------------------|
| SAR (average measured) | 250 mW input power | 1.99 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 7.73 W/kg ± 17.5 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|---------------------------------|
| SAR (average measured) | 250 mW input power | 1.33 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 5.18 W/kg ± 16.9 % (k=2) |

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DATE OF ISSUE: 10/Oct/2017

CERTIFICATE NUMBER : 11903941JD01B



5248

UL VS LTD
PAVILION A
ASHWOOD PARK, ASHWOOD WAY
BASINGSTOKE, HAMPSHIRE
RG23 8BG, UK
TEL: +44 (0) 1256 312000
FAX: +44 (0) 1256 312001
Email: LST.UK.Calibration@ul.com



Page 1 of 10

APPROVED SIGNATORY

.....
Naseer Mirza

Customer :

UL VS Ltd
Pavilion A, Ashwood Park, Ashwood Way
Basingstoke, RG23 8BG, England

Equipment Details:

| | | | |
|--------------------|---|------------------|-------------|
| Description: | Dipole Validation Kit | Date of Receipt: | 29/Sep/2017 |
| Manufacturer: | Speag | | |
| Type/Model Number: | D1750V2 | | |
| Serial Number: | 1077 | | |
| 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.

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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 |
| A1236 | Dipole | SPEAG | D1800V2 | 2d009 | 09 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: | 1750 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 | 1750 | 23.0 °C | 23.0 °C | 20.0°C | 20.0°C | ϵ_r | 40.10 | 40.38 | ± 5% |
| | | | | | | σ | 1.37 | 1.39 | ± 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 | 9.11 W/Kg | 36.26 W/Kg | ± 17.57% |
| | SAR averaged over 10g | 4.86 W/Kg | 19.34 W/Kg | ± 17.32% |

Antenna Parameters – Head Simulating Liquid (HSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|---------------------------------|------------------------------------|
| Head | Impedance | 49.21 Ω -0.63 j Ω | ± 0.28 Ω ± 0.044 j Ω |
| | Return Loss | -36.48 | ± 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 | 1750 | 22.0 °C | 22.0 °C | 22.0°C | 22.0°C | ϵ_r | 53.40 | 52.41 | ± 5% |
| | | | | | | σ | 1.49 | 1.47 | ± 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 | 9.38 W/Kg | 37.34 W/Kg | ± 18.06% |
| | SAR averaged over 10g | 5.02 W/Kg | 19.98 W/Kg | ± 17.44% |

Antenna Parameters – Body Simulating Liquid (MSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|-------------------------------|-----------------------------------|
| Body | Impedance | 49.29 Ω 3.26 $j\Omega$ | ± 0.28 Ω ± 0.044 $j\Omega$ |
| | Return Loss | -29.63 | ± 2.03 dB |

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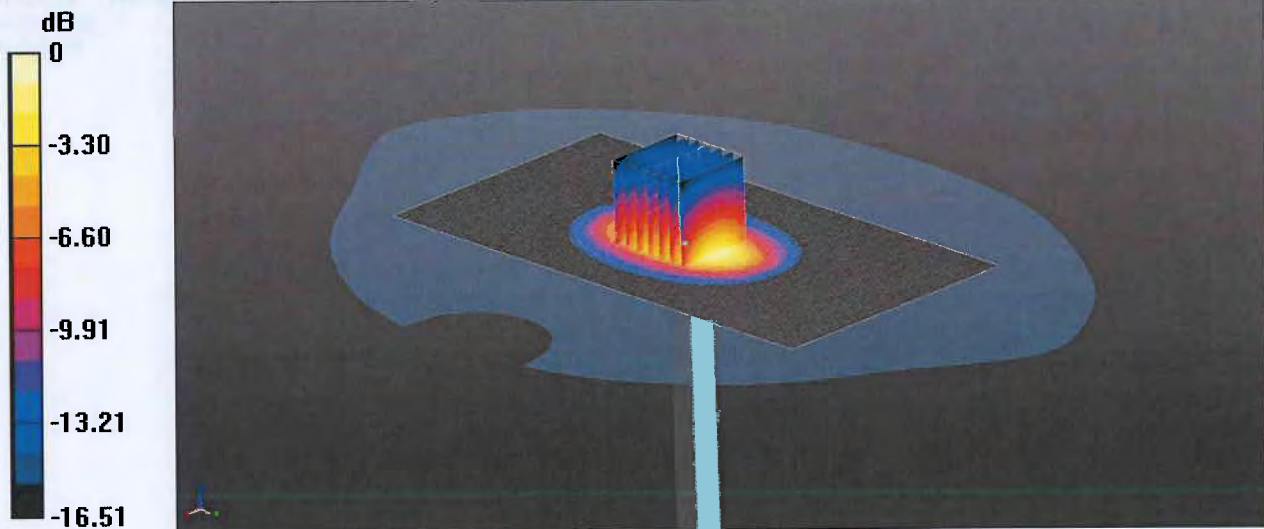
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NUMBER :
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DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D1750V2 - SN1077; Type: D1750V2; Serial: SN1077



0 dB = 11.4 W/kg = 10.57 dBW/kg

Communication System: UID 0, CW (0); Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 1800 MHz HSL Medium parameters used: $f = 1750$ MHz; $\sigma = 1.393$ S/m; $\epsilon_r = 40.378$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3341; ConvF(5.47, 5.47, 5.47); Calibrated: 14/08/2017;

- Sensor-Surface: 3mm (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 (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 11.7 W/kg

Configuration/d=10mm, Pin=250mW 2/Zoom Scan (5x5x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.81 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 16.3 W/kg

SAR(1 g) = 9.11 W/kg; SAR(10 g) = 4.86 W/kg

Maximum value of SAR (measured) = 11.4 W/kg

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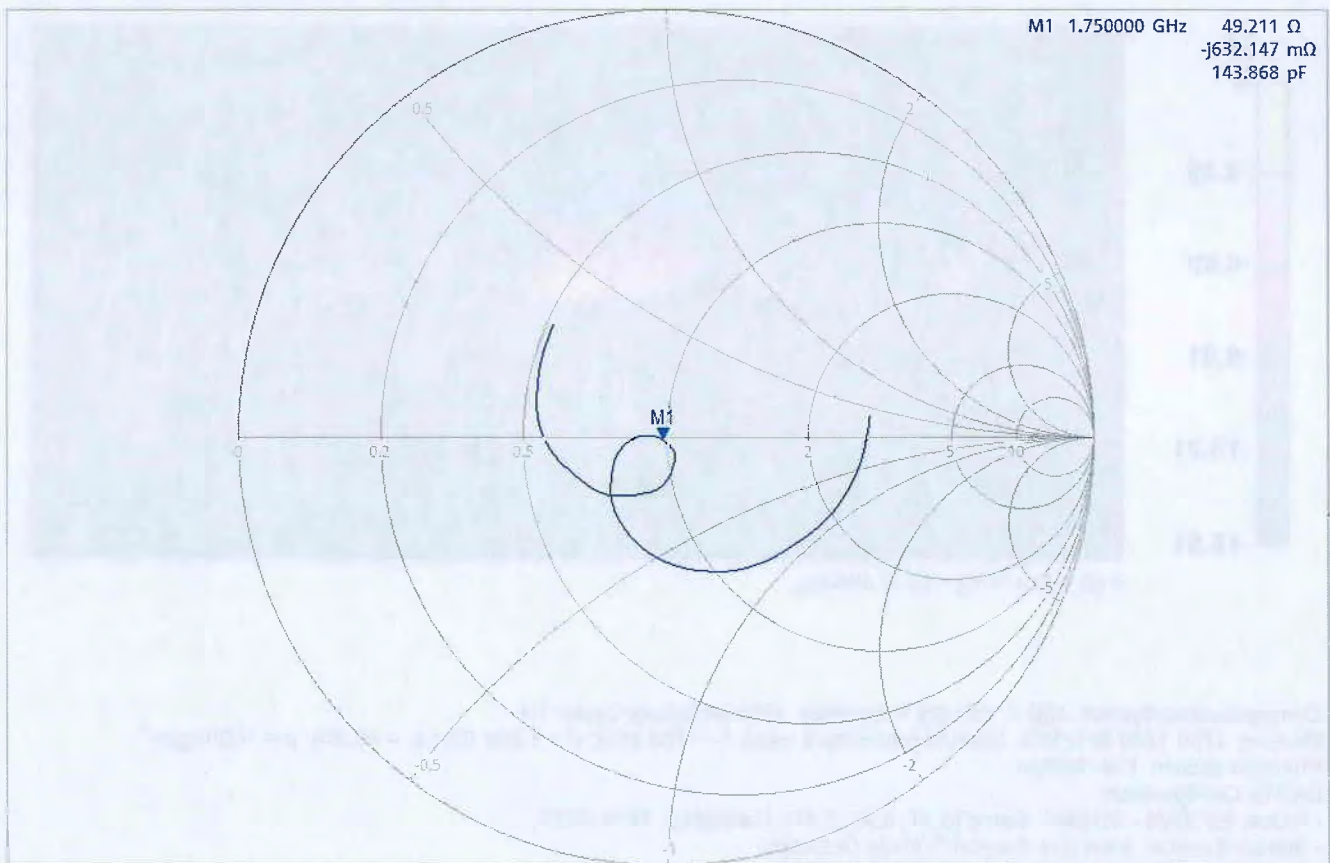
Page 6 of 10

Impedance Measurement Plot for Head Stimulating Liquid (HSL)

10/10/2017 9:09:15 AM
1326.5170K92-100151-MV

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

1



Ch1 Start 1.55 GHz

Pwr -10 dBm Bw 10 kHz

Stop 1.95 GHz

CERTIFICATE OF CALIBRATION

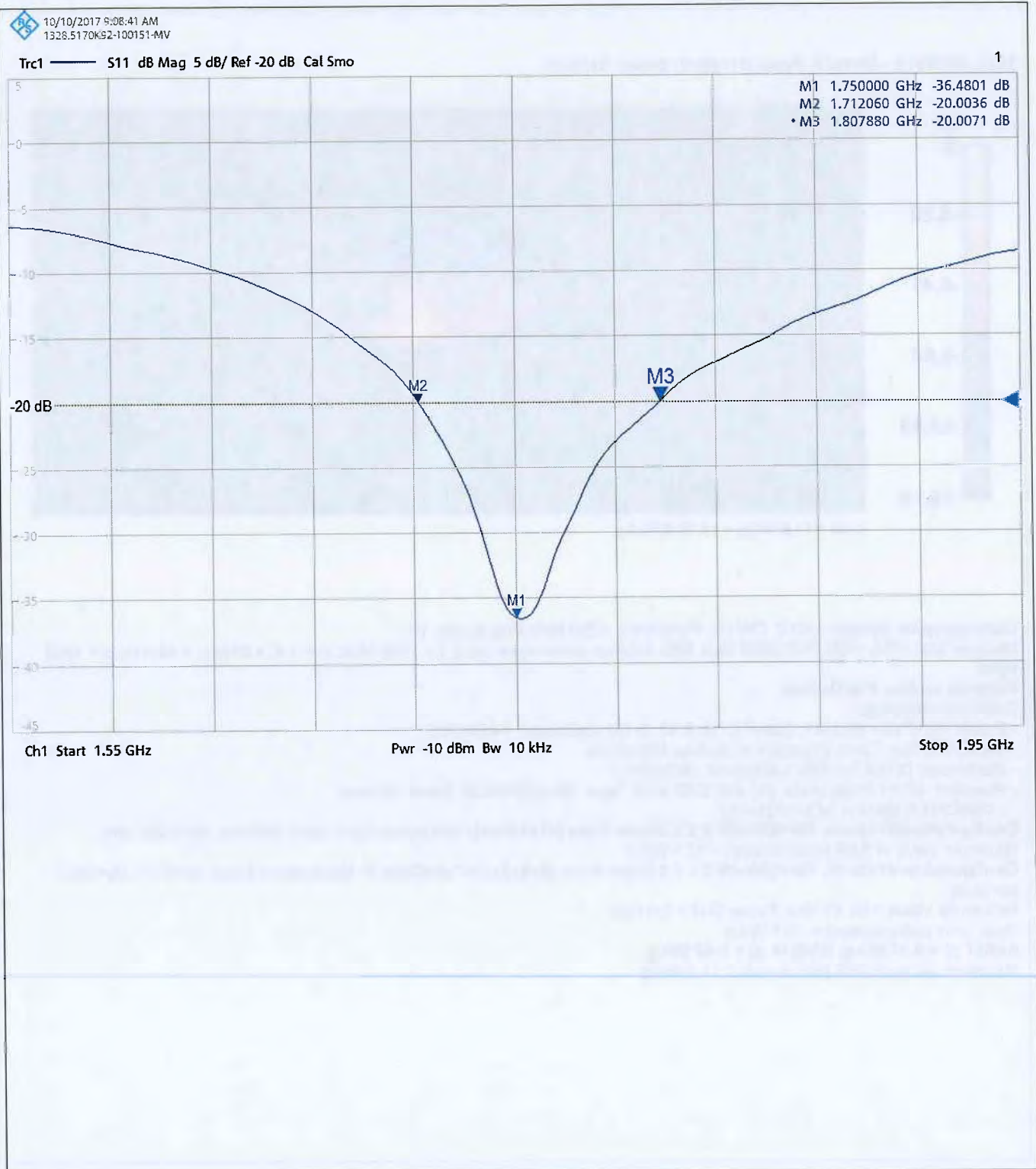
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11903941JD01B

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Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



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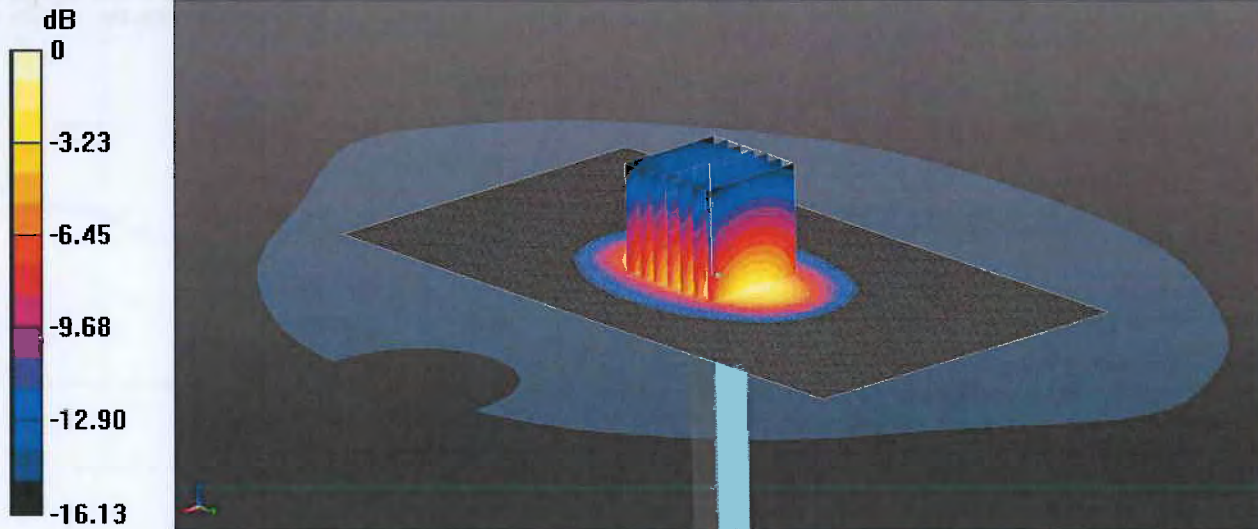
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NUMBER :
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DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: D1750V2 - SN1077; Type: D1750V2; Serial: SN1077



0 dB = 11.8 W/kg = 10.72 dBW/kg

Communication System: UID 0, CW (0); Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 900,1750,1800,1900,2600 MHz MSL Medium parameters used: $f = 1750$ MHz; $\sigma = 1.474$ S/m; $\epsilon_r = 52.411$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3341; ConvF(5.12, 5.12, 5.12); Calibrated: 14/08/2017;
- Sensor-Surface: 3mm (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 2 /Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 12.1 W/kg

Configuration/d=10mm, Pin=250mW 2 2 2 /Zoom Scan (5x5x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.81 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 16.5 W/kg

SAR(1 g) = 9.38 W/kg; SAR(10 g) = 5.02 W/kg

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

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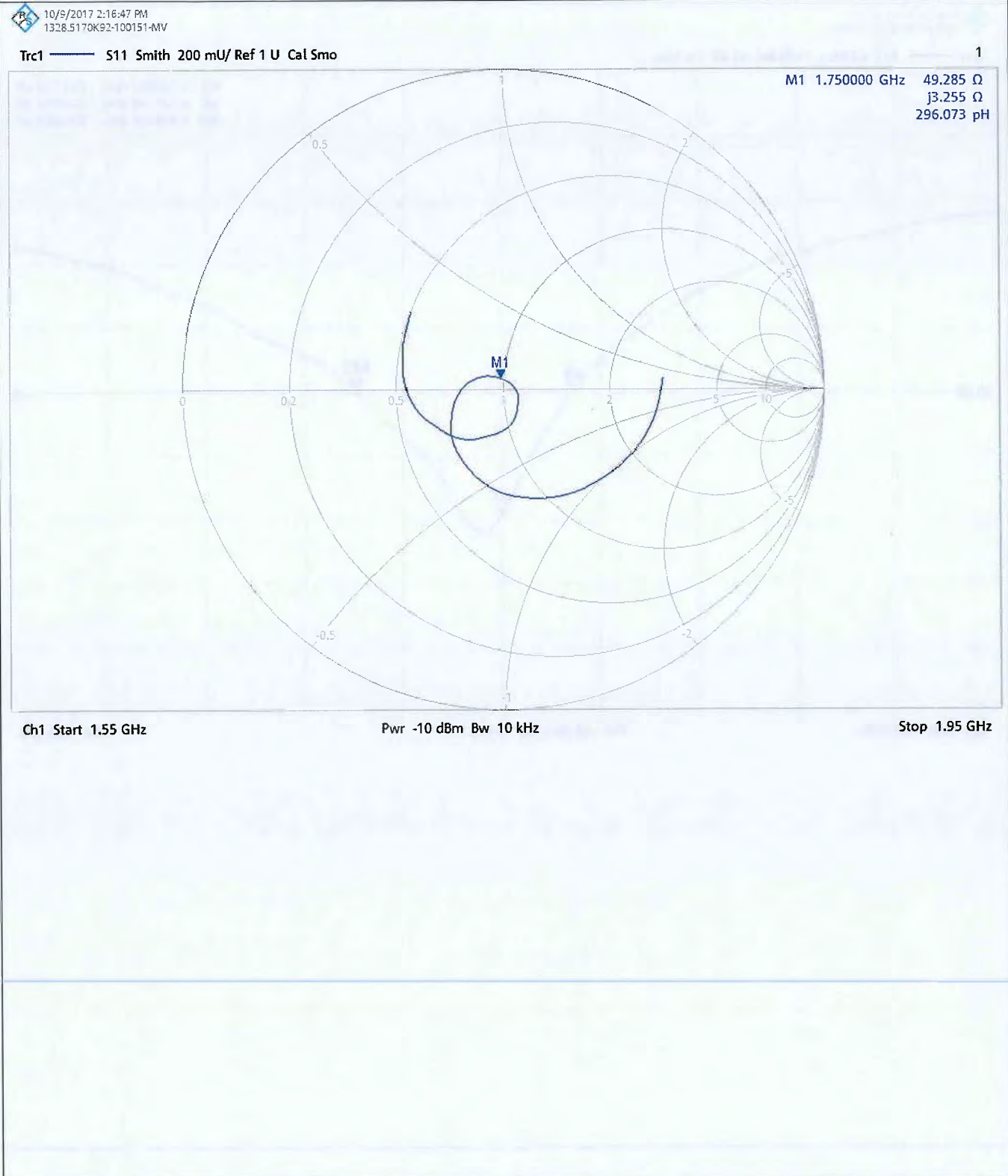
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Impedance Measurement Plot for Body Stimulating Liquid (MSL)



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Return Loss Measurement Plot for Body Stimulating Liquid (MSL)

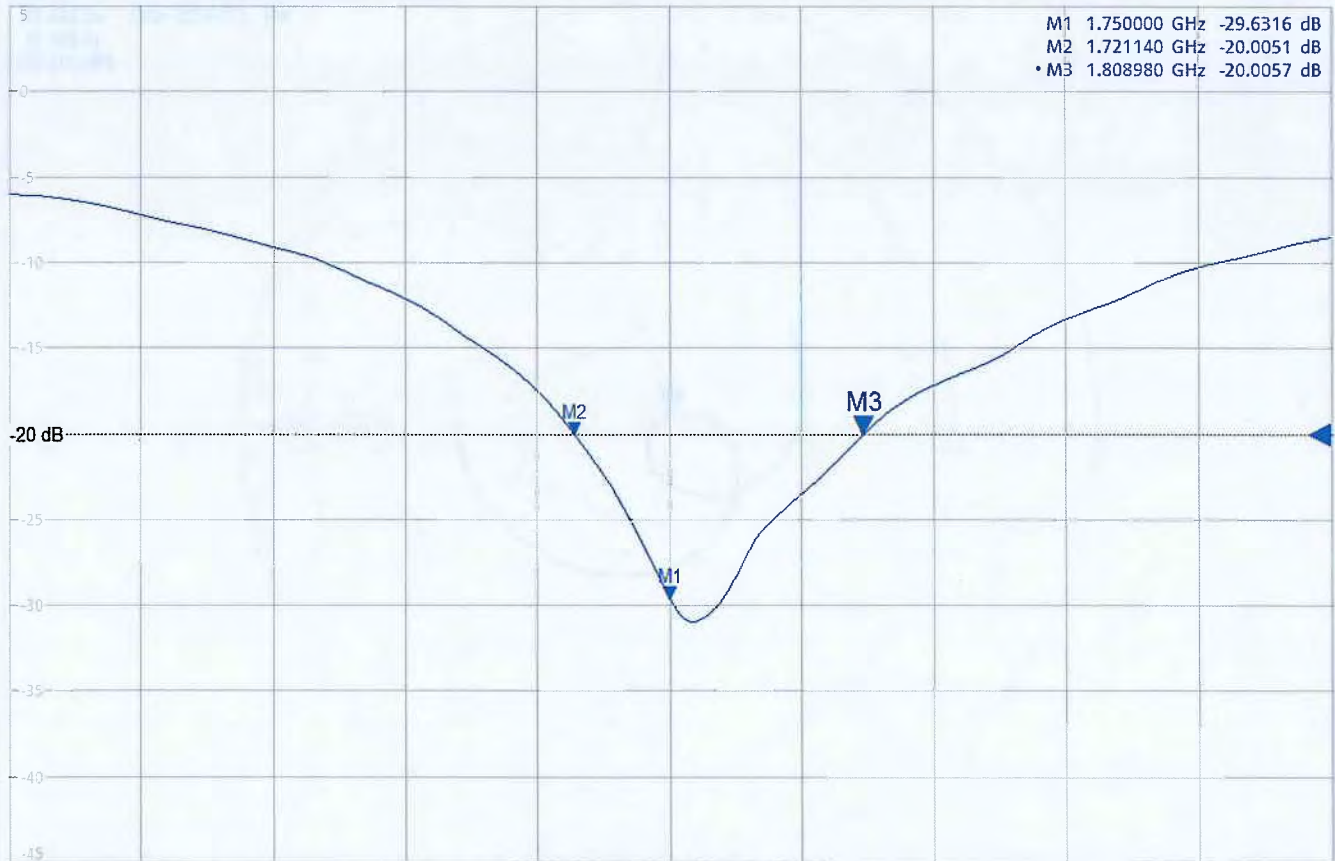


10/9/2017 2:15:13 PM
1326.5170K92-100151-MV

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

1

M1 1.750000 GHz -29.6316 dB
M2 1.721140 GHz -20.0051 dB
• M3 1.808980 GHz -20.0057 dB





Ch1 Start 1.55 GHz


Pwr -10 dBm Bw 10 kHz

Stop 1.95 GHz

Calibration Certificate Label:

| | |
|--|---|
|  <p>UKAS CALIBRATION 5248</p> | <p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 11903941JD01B</p> <p>Instrument ID: 1077</p> <p>Calibration Date: 05/Oct/2017</p> <p>Calibration Due Date:</p> |
|--|---|

| | |
|--|---|
|  <p>UKAS CALIBRATION 5248</p> | <p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 11903941JD01B</p> <p>Instrument ID: 1077</p> <p>Calibration Date: 05/Oct/2017</p> <p>Calibration Due Date:</p> |
|--|---|

| | |
|---|---|
|  <p>UKAS CALIBRATION 5248</p> | <p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 11903941JD01B</p> <p>Instrument ID: 1077</p> <p>Calibration Date: 05/Oct/2017</p> <p>Calibration Due Date:</p> |
|---|---|

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ISSUED BY **UL VS LTD**

DATE OF ISSUE: 29/Nov/2017 CERTIFICATE NUMBER : 11903932JD01E



5248

UL VS LTD
PAVILION A
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BASINGSTOKE, HAMPSHIRE
RG23 8BG, UK
TEL: +44 (0) 1256 312000
FAX: +44 (0) 1256 312001
Email: LST.UK.Calibration@ul.com



Page 1 of 10

APPROVED SIGNATORY

A handwritten signature in black ink, appearing to read 'N. Mirza'.

.....
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: | D1900V2 | | |
| Serial Number: | 5d043 | | |
| Calibration Date: | 22/Nov/2017 | | |
| Calibrated By: | Chanthu Thevarajah Laboratory Engineer | | |

Signature:

A handwritten signature in blue 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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Page 2 of 10

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 |
| A2200 | Dipole | SPEAG | D1900V2 | 537 | 09 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: | 1900 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 | 1900 | 21.0 °C | 21.0 °C | 20.5°C | 21.0°C | ϵ_r | 40.00 | 39.91 | ± 5% |
| | | | | | | σ | 1.40 | 1.44 | ± 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 | 10.80 W/Kg | 42.99 W/Kg | ± 17.57% |
| | SAR averaged over 10g | 5.57 W/Kg | 22.17 W/Kg | ± 17.32% |

Antenna Parameters – Head Simulating Liquid (HSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|----------------------------------|------------------------------------|
| Head | Impedance | 52.432 Ω -3.49 j Ω | ± 0.28 Ω ± 0.044 j Ω |
| | Return Loss | 27.60 | ± 2.03 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 | 1900 | 21.0 °C | 21.0 °C | 21.0°C | 21.0°C | ϵ_r | 53.30 | 52.87 | ± 5% |
| | | | | | | σ | 1.52 | 1.56 | ± 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 | 10.30 W/Kg | 41.00 W/Kg | ± 18.06% |
| | SAR averaged over 10g | 5.25 W/Kg | 20.90 W/Kg | ± 17.44% |

Antenna Parameters – Body Simulating Liquid (MSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|---------------------------------|------------------------------------|
| Body | Impedance | 55.43 Ω -4.69 j Ω | ± 0.28 Ω ± 0.044 j Ω |
| | Return Loss | 23.18 | ± 2.03 dB |

CERTIFICATE OF CALIBRATION

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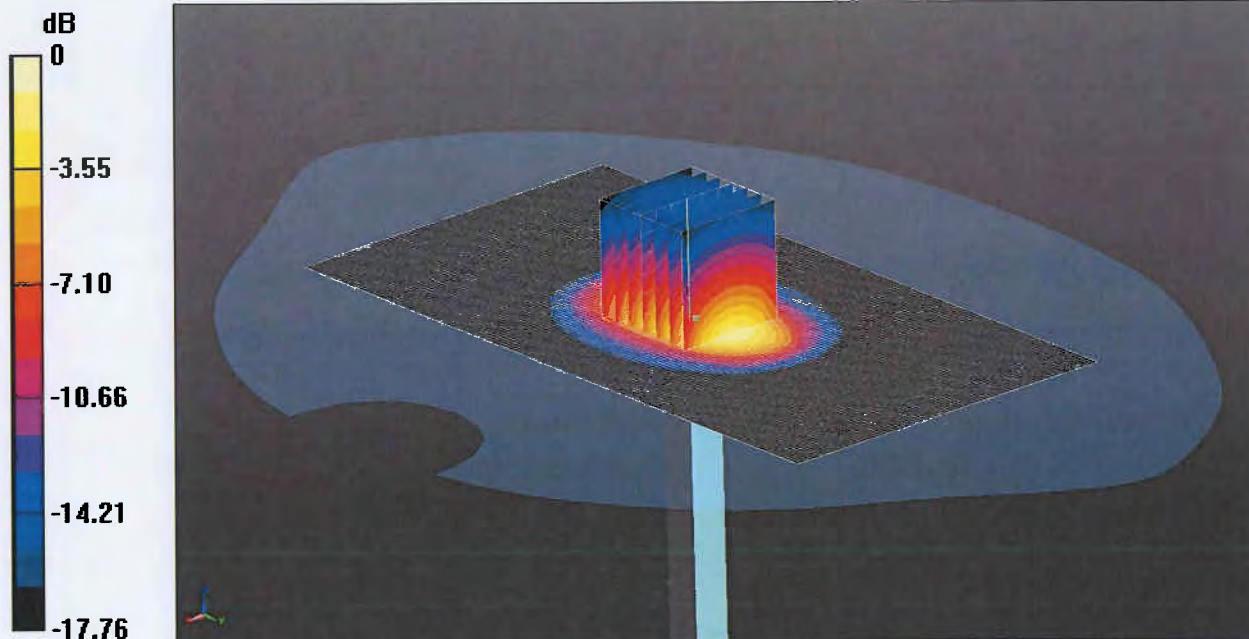
CERTIFICATE
NUMBER :
11903932JD01E

UKAS Accredited Calibration Laboratory No. 5248

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DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D1900V2 - SN: 5D043; Type: D1900V2; Serial: SN: 5D043



0 dB = 13.6 W/kg = 11.34 dBW/kg

Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 750,835,900,1800,1900 MHz HSL Medium parameters used: $f = 1900$ MHz; $\sigma = 1.438$ S/m; $\epsilon_r = 39.91$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3995; ConvF(8.37, 8.37, 8.37); Calibrated: 04/05/2017;
- Sensor-Surface: 3mm (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 (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

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

Configuration/d=10mm, Pin=250mW/Zoom Scan (5x5x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.92 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 20.2 W/kg

SAR(1 g) = 10.8 W/kg; SAR(10 g) = 5.57 W/kg

Maximum value of SAR (measured) = 13.6 W/kg

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Page 6 of 10

Impedance Measurement Plot for Head Stimulating Liquid (HSL)

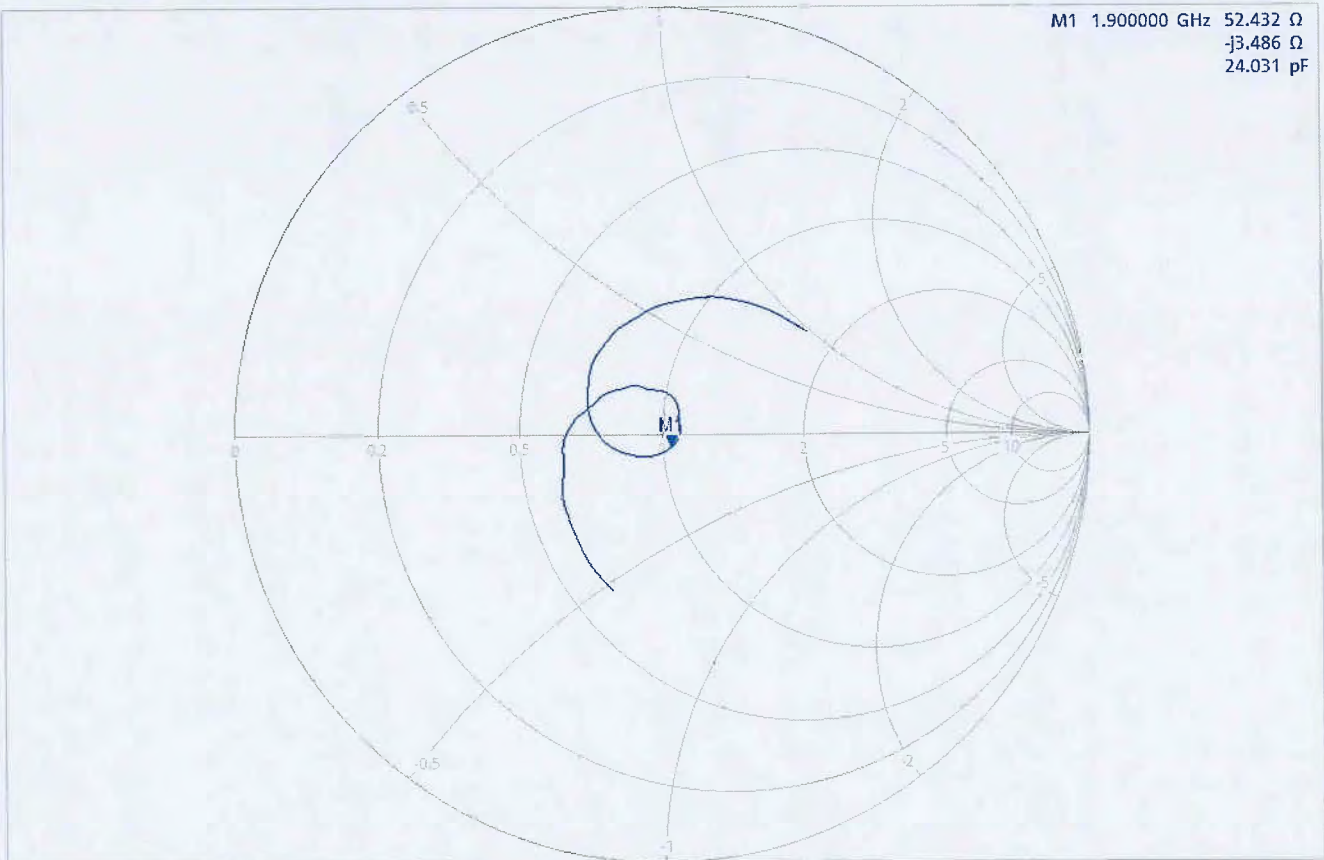


11/28/2017 11:24:05 AM
1326.5170K92-100151-MV

Trc1 — S11 Smith 200 mU/ Ref 1 U Cal 5mo

1

M1 1.900000 GHz 52.432 Ω
-j3.486 Ω
24.031 pF



Ch1 Start 1.7 GHz

Pwr -10 dBm Bw 10 kHz

Stop 2.1 GHz

CERTIFICATE OF CALIBRATION

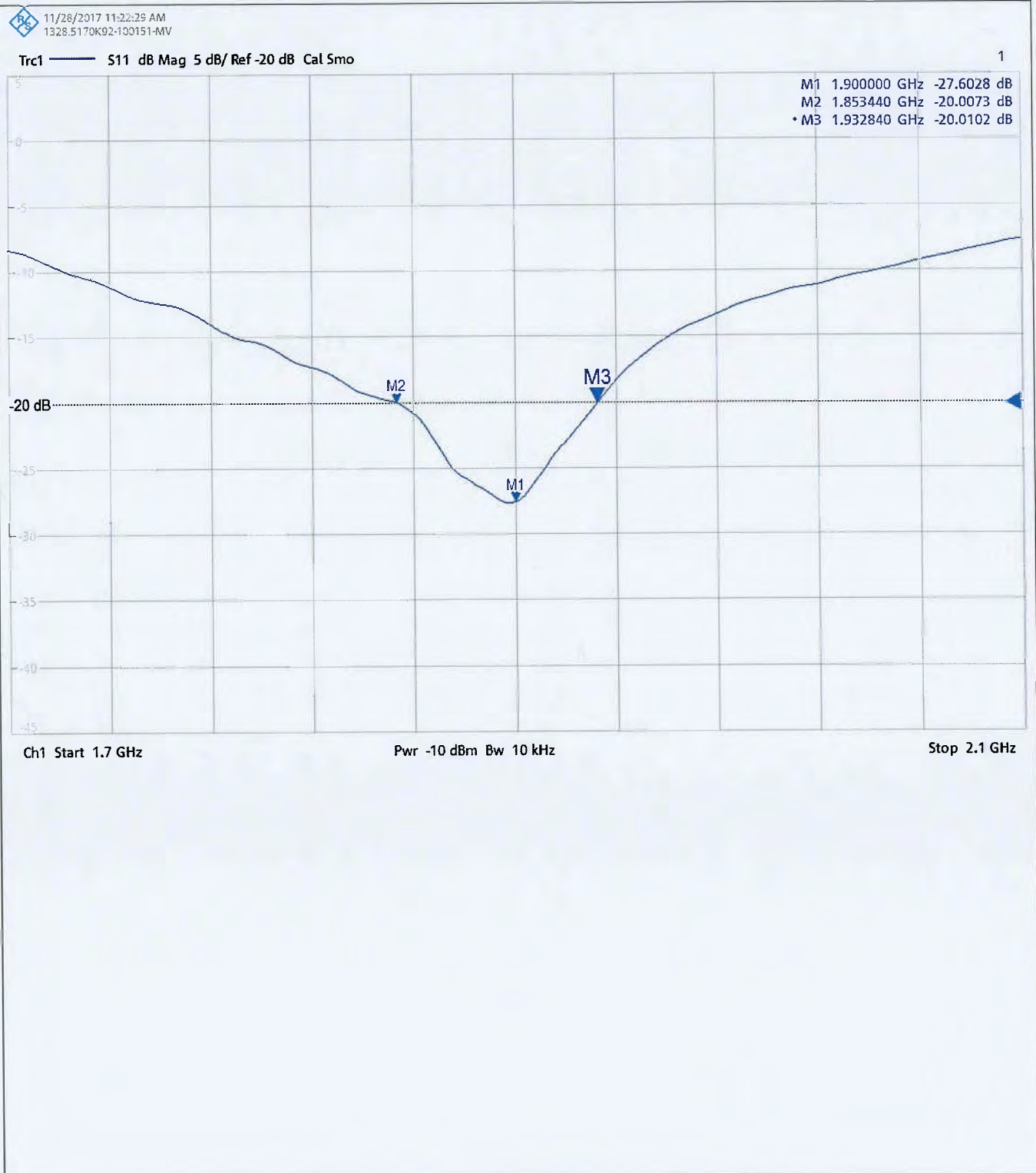
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NUMBER :
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Page 7 of 10

Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



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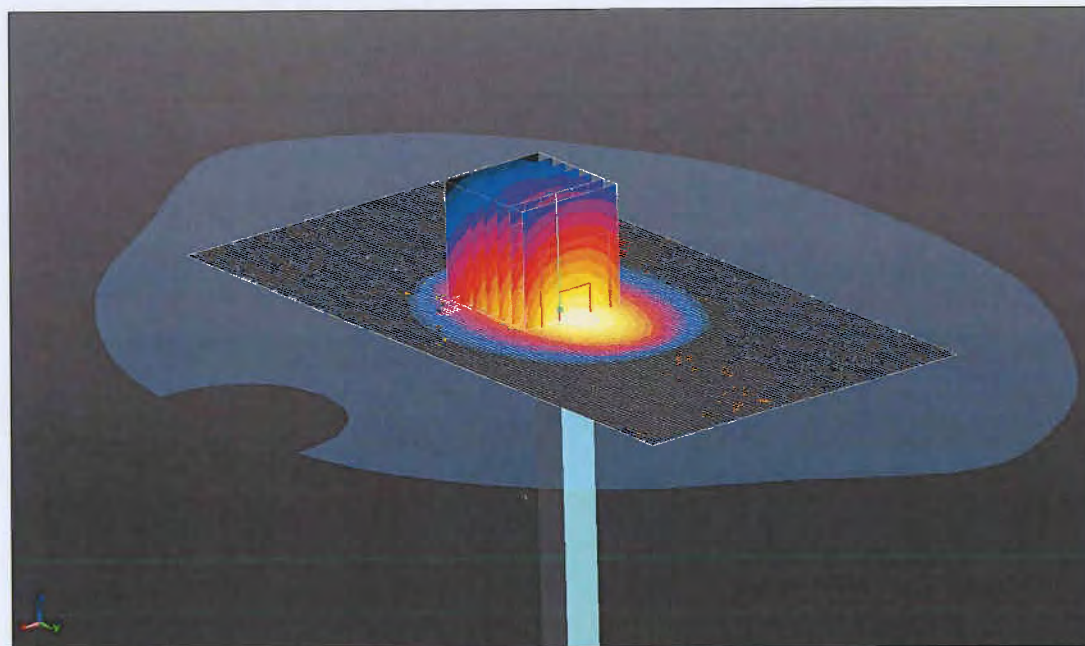
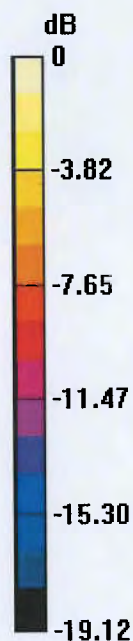
CERTIFICATE
NUMBER :
11903932JD01E

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DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: SN5d043



0 dB = 13.0 W/kg = 11.14 dBW/kg

Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL(750,835,900,1800,1900,5G) Medium parameters used: $f = 1900$ MHz; $\sigma = 1.564$ S/m; $\epsilon_r = 52.87$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3995; ConvF(8.04, 8.04, 8.04); Calibrated: 04/05/2017;

- Sensor-Surface: 3mm (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)

SAR/d=10mm, Pin=250mW/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 13.4 W/kg

SAR/d=10mm, Pin=250mW/Zoom Scan (5x5x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.38 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.25 W/kg

Maximum value of SAR (measured) = 13.0 W/kg

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UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903932JD01E

Page 9 of 10

Impedance Measurement Plot for Body Stimulating Liquid (MSL)

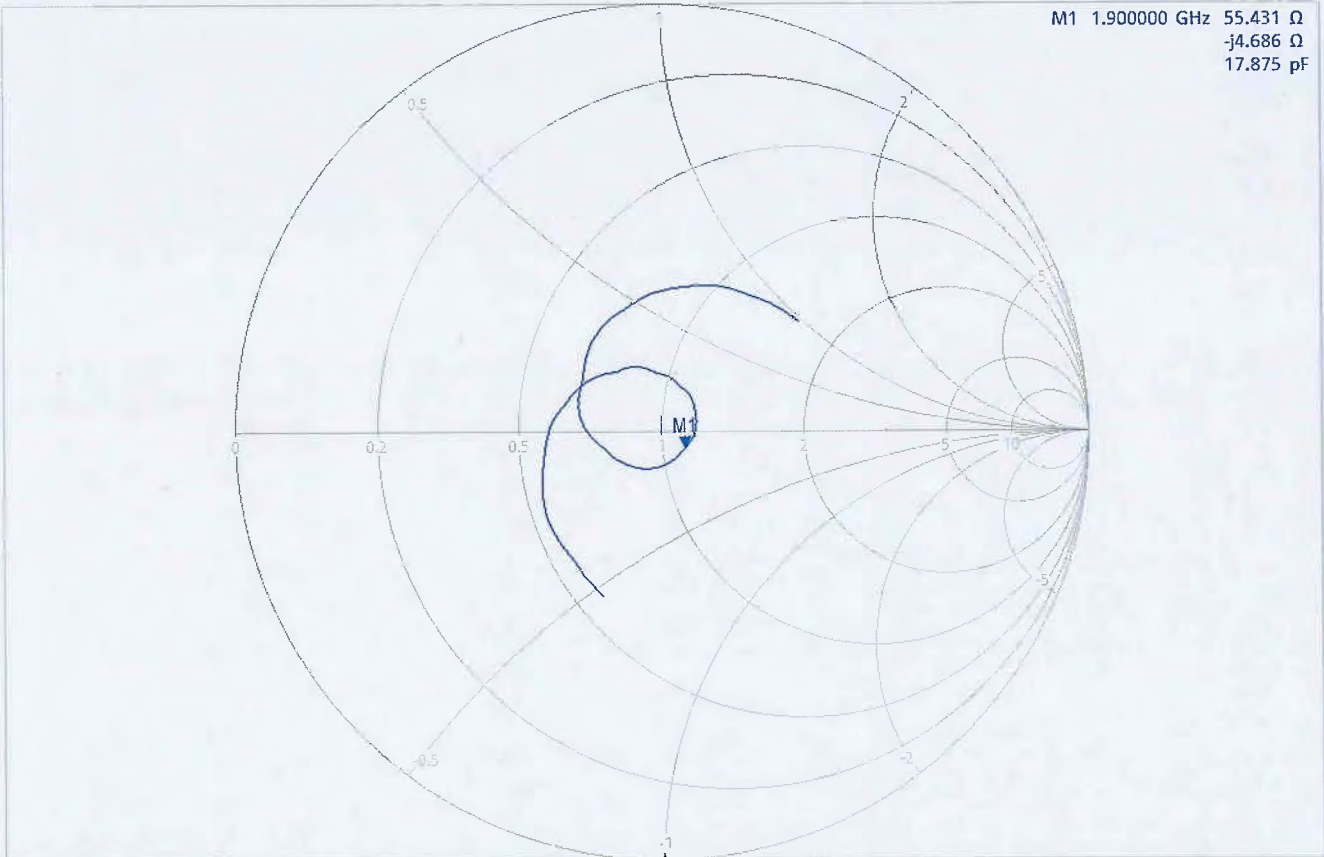


11/28/2017 11:30:05 AM
1328.5170K92-100151-MV

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

1

M1 1.900000 GHz 55.431 Ω
-j4.686 Ω
17.875 pF



Ch1 Start 1.7 GHz

Pwr -10 dBm Bw 10 kHz

Stop 2.1 GHz

CERTIFICATE OF CALIBRATION

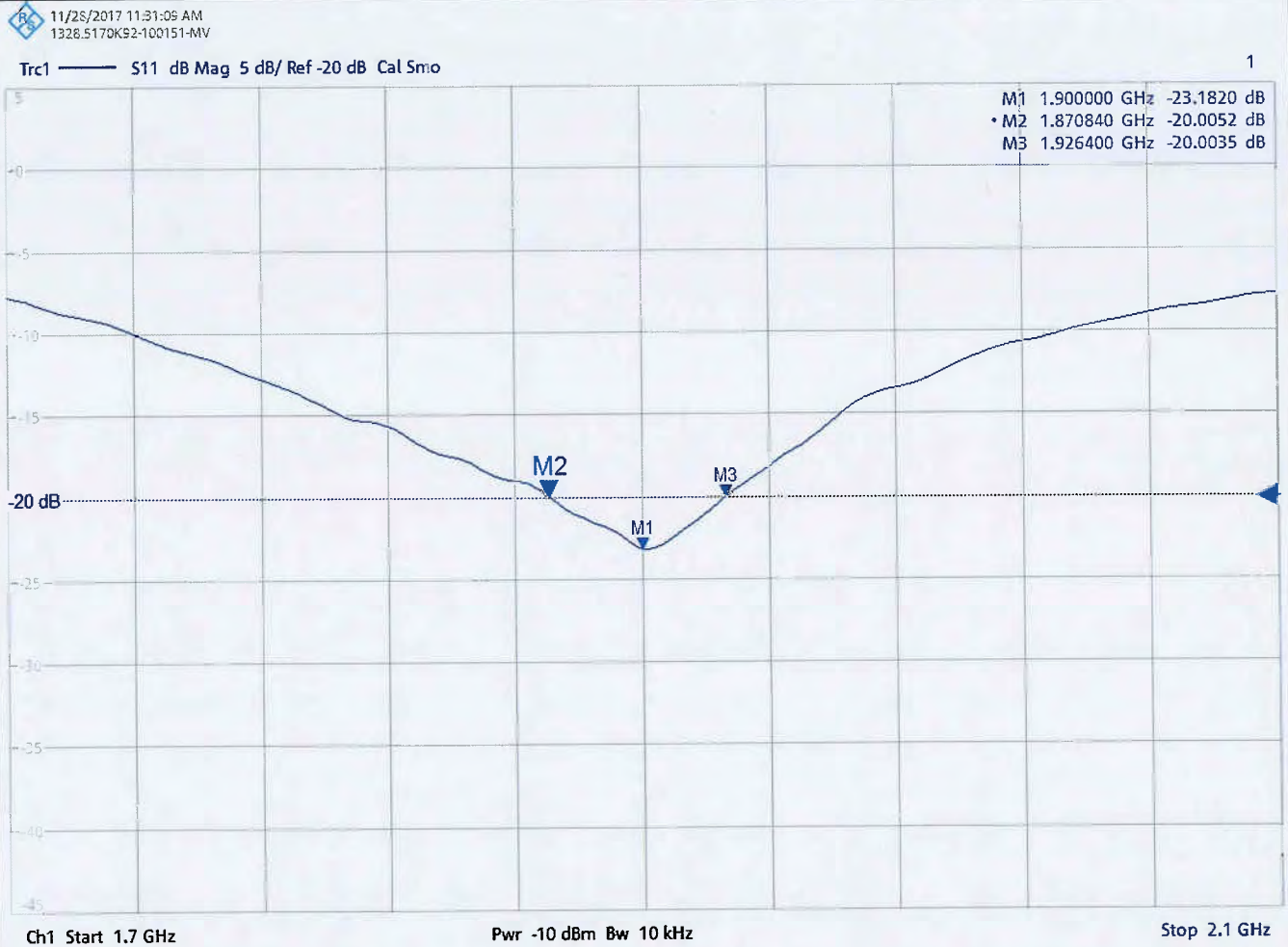
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Return Loss Measurement Plot for Body Stimulating Liquid (MSL)



Calibration Certificate Label:

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|  <p>UKAS CALIBRATION 5248</p> | <p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 11903932JD01E</p> <p>Instrument ID: 5d043</p> <p>Calibration Date: 22/Nov/2017</p> <p>Calibration Due Date:</p> |
|--|--|

| | |
|--|--|
|  <p>UKAS CALIBRATION 5248</p> | <p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 11903932JD01E</p> <p>Instrument ID: 5d043</p> <p>Calibration Date: 22/Nov/2017</p> <p>Calibration Due Date:</p> |
|--|--|

| | |
|---|--|
|  <p>UKAS CALIBRATION 5248</p> | <p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 11903932JD01E</p> <p>Instrument ID: 5d043</p> <p>Calibration Date: 22/Nov/2017</p> <p>Calibration Due Date:</p> |
|---|--|

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DATE OF ISSUE: 19/Feb/2018 CERTIFICATE NUMBER : 12129912JD01A



5248

UL VS LTD
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ASHWOOD PARK, ASHWOOD WAY
BASINGSTOKE, HAMPSHIRE
RG23 8BG, UK
TEL: +44 (0) 1256 312000
FAX: +44 (0) 1256 312001
Email: LST.UK.Calibration@ul.com



Page 1 of 10

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: | 09/Feb/2018 |
| Manufacturer: | Speag | | |
| Type/Model Number: | D2450V2 | | |
| Serial Number: | 748 | | |
| Calibration Date: | 14/Feb/2018 | | |
| Calibrated By: | Chanthu Thevarajah Laboratory Engineer | | |

Signature:

A handwritten signature in black ink, appearing to be a stylized 'C' followed by 'T'.

.....

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

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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) |
|------------|------------------------------|----------------------|---------------|------------|-----------------------|------------------------|
| A2110 | Data Acquisition Electronics | SPEAG | DAE4 | 431 | 08 Nov 2017 | 12 |
| A2077 | Probe | SPEAG | EX3DV4 | 3814 | 28 Sep 2017 | 12 |
| A1322 | Dipole | SPEAG | D2450V2 | 725 | 19 Sep 2017 | 12 |
| PRE0151451 | Power Monitoring Kit | Art-Fi | ART 100850-01 | 0001 | Cal as part of System | 12 |
| PRE0176448 | Power Sensor | Rhode & Schwarz | NRP-Z51 | 103459 | 20 June 2017 | 12 |
| M1015 | Network Analyser | Agilent Technologies | 8753ES | US39172406 | 10 Oct 2017 | 12 |
| PRE0151154 | Network Analyser | Rhode & Schwarz | ZND8 | 100151 | 14 Dec 2016 | 24 |
| PRE0151877 | Calibration Kit | Rhode & Schwarz | Z135 | 102947-Bt | 09 May 2016 | 12 |
| M1838 | Signal Generator | Rhode & Schwarz | SME06 | 831377/005 | 30 March 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: | 2450 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 | 2450 | 22.0 °C | 22.0 °C | 21.6°C | 22.0°C | ϵ_r | 39.20 | 38.11 | ± 5% |
| | | | | | | σ | 1.80 | 1.78 | ± 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 | 13.30 W/Kg | 52.94 W/Kg | ± 17.57% |
| | SAR averaged over 10g | 6.18 W/Kg | 24.60 W/Kg | ± 17.32% |

Antenna Parameters – Head Simulating Liquid (HSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|--------------------------------|-----------------------------------|
| Head | Impedance | 52.358 Ω 3.89 $j\Omega$ | ± 0.28 Ω ± 0.044 $j\Omega$ |
| | Return Loss | 27.52 | ± 2.03 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 | 2450 | 22.0 °C | 22.0 °C | 21.6°C | 22.0°C | ϵ_r | 52.70 | 50.63 | ± 5% |
| | | | | | | σ | 1.95 | 2.02 | ± 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 | 12.80 W/Kg | 50.95 W/Kg | ± 18.06% |
| | SAR averaged over 10g | 5.98 W/Kg | 23.80 W/Kg | ± 17.44% |

Antenna Parameters – Body Simulating Liquid (MSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|---------------------------------|------------------------------------|
| Body | Impedance | 52.47 Ω -1.10 j Ω | ± 0.28 Ω ± 0.044 j Ω |
| | Return Loss | 30.00 | ± 2.03 dB |

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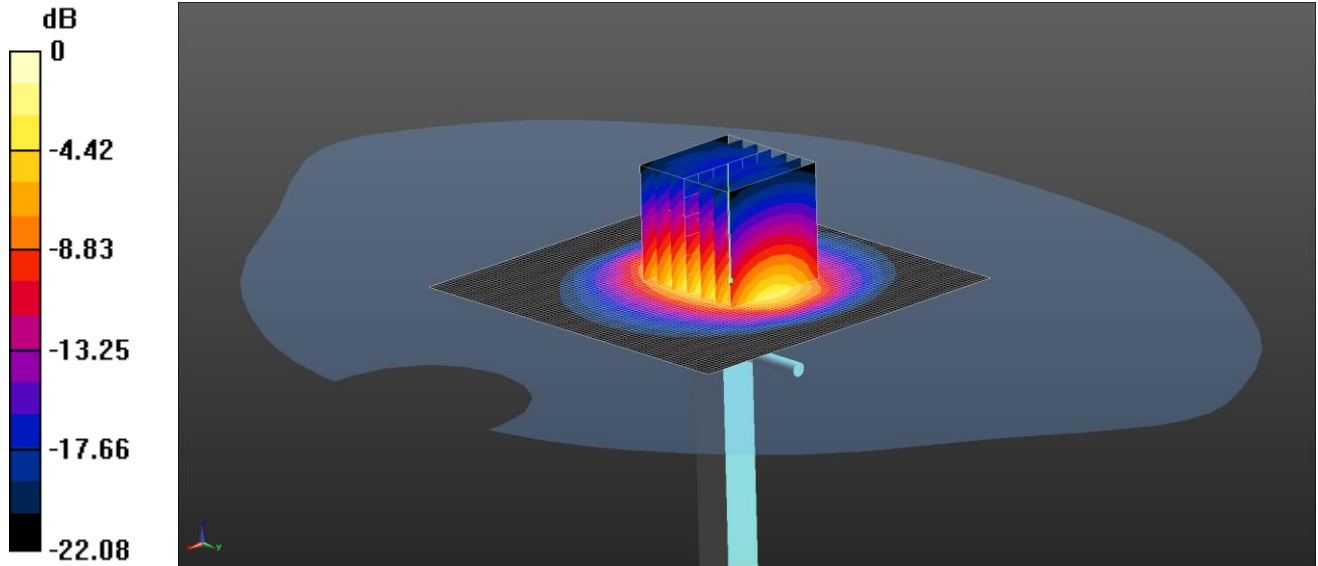
UKAS Accredited Calibration Laboratory No. 5248

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NUMBER :
12129912JD01A

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DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D2450V2 - SN748; Type: D2450V2; Serial: SN748



0 dB = 17.6 W/kg = 12.46 dBW/kg

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 MHz HSL Medium parameters used: $f = 2450$ MHz; $\sigma = 1.779$ S/m; $\epsilon_r = 38.111$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3814; ConvF(7.04, 7.04, 7.04); Calibrated: 28/09/2017;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn431; Calibrated: 08/11/2017
- Phantom: SAM (20deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: TP:1818
- ; SEMCAD X Version 14.6.10 (7372)

Configuration/d=10mm, Pin=250mW /Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 17.9 W/kg

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

Reference Value = 97.54 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 27.6 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.18 W/kg

Maximum value of SAR (measured) = 17.6 W/kg

CERTIFICATE OF CALIBRATION

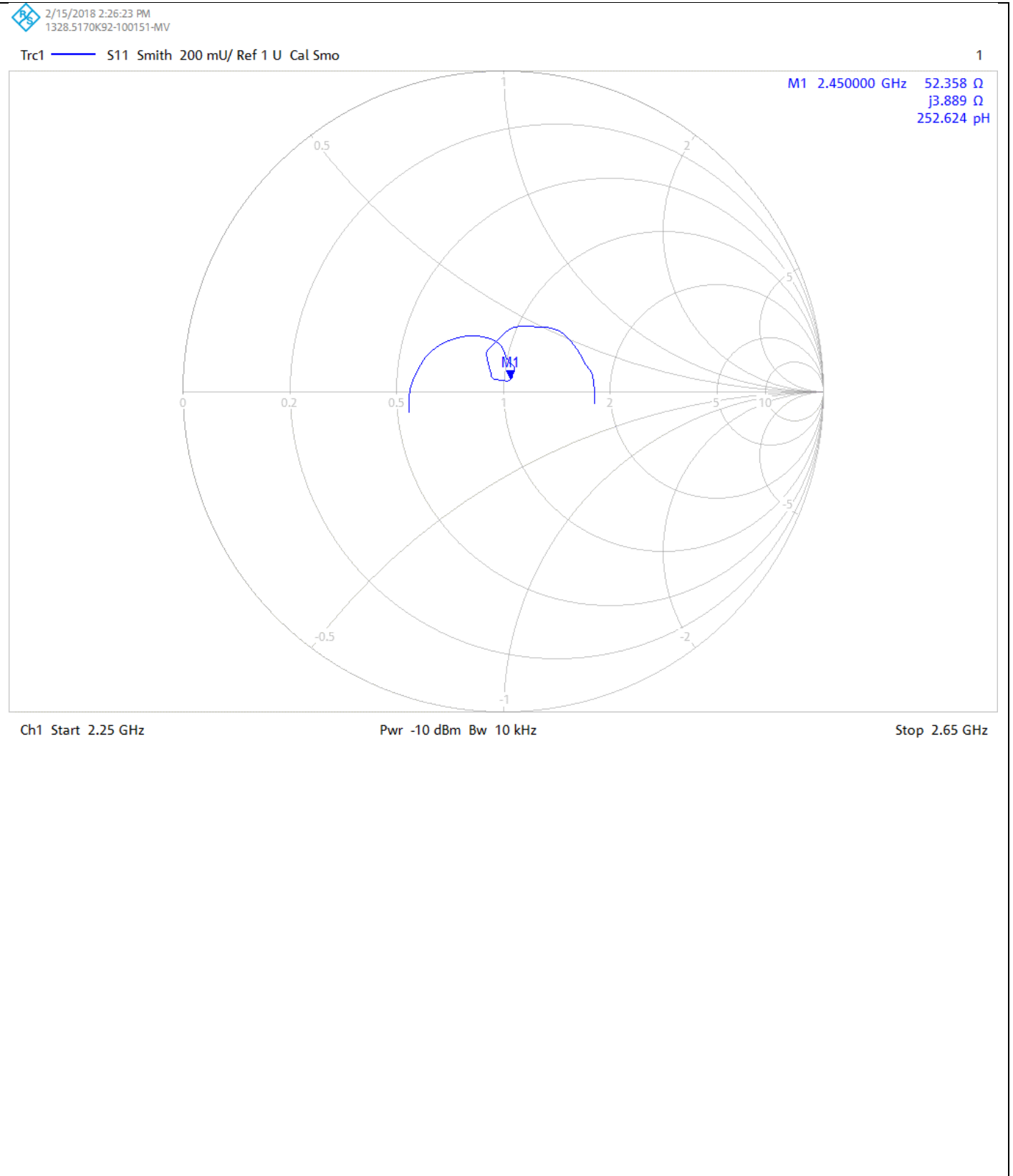
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Impedance Measurement Plot for Head Stimulating Liquid (HSL)



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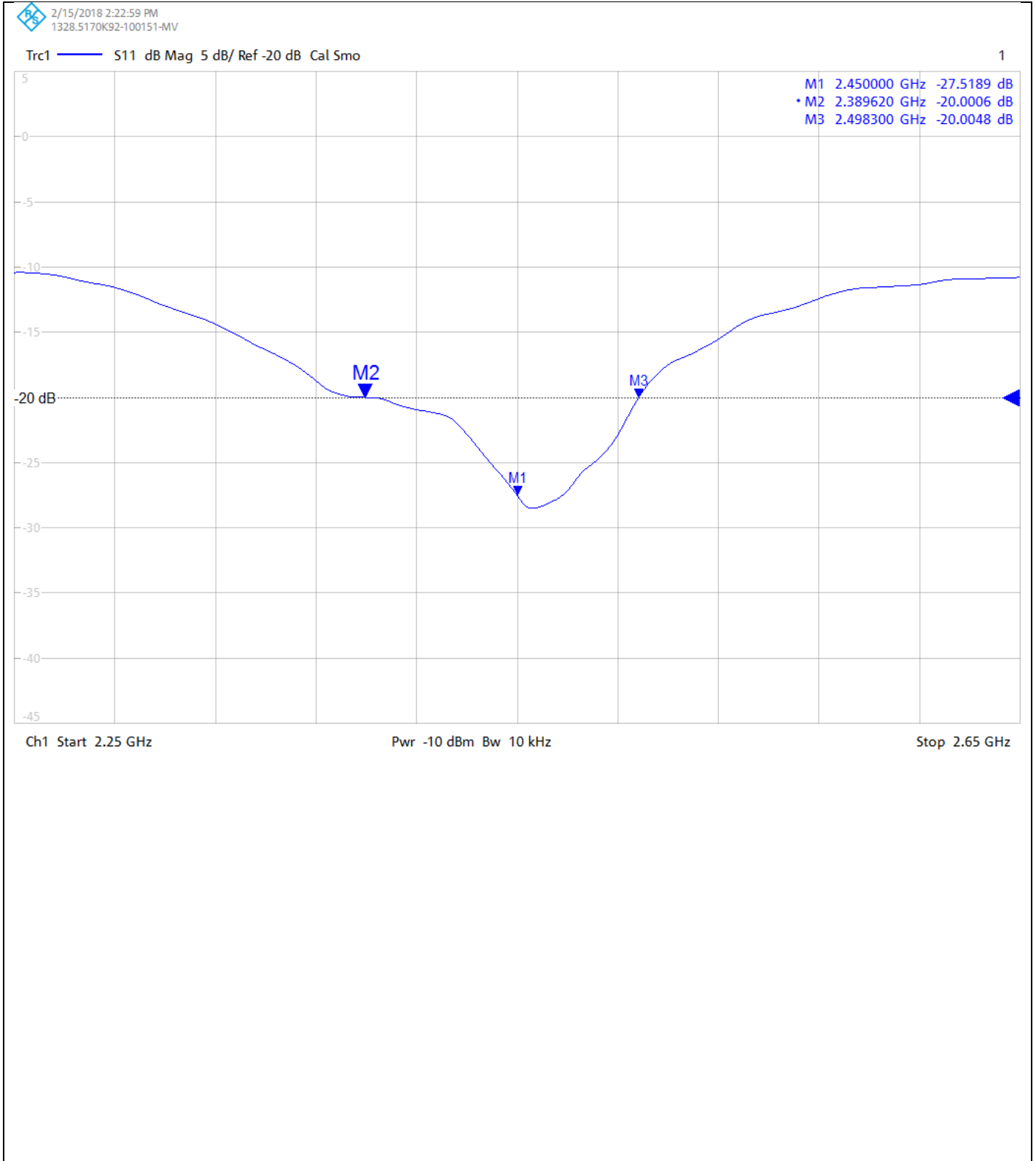
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Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



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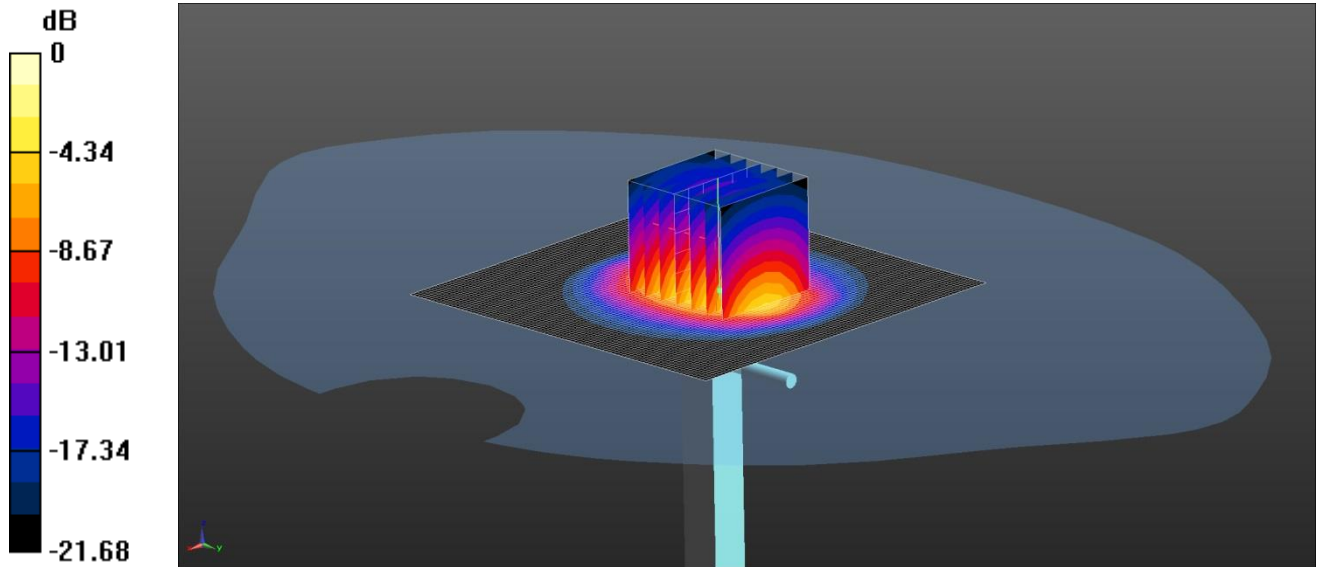
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NUMBER :
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DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: D2450V2 - SN748; Type: D2450V2; Serial: SN748



0 dB = 19.4 W/kg = 12.88 dBW/kg

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 MSL Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ S/m; $\epsilon_r = 50.632$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3814; ConvF(7.2, 7.2, 7.2); Calibrated: 28/09/2017;

- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn431; Calibrated: 08/11/2017

- Phantom: SAM (20deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: TP:1818

- ; SEMCAD X Version 14.6.10 (7372)

Configuration/d=10mm, Pin=250mW /Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 15.4 W/kg

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

Reference Value = 85.33 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 25.8 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.98 W/kg

Maximum value of SAR (measured) = 19.4 W/kg

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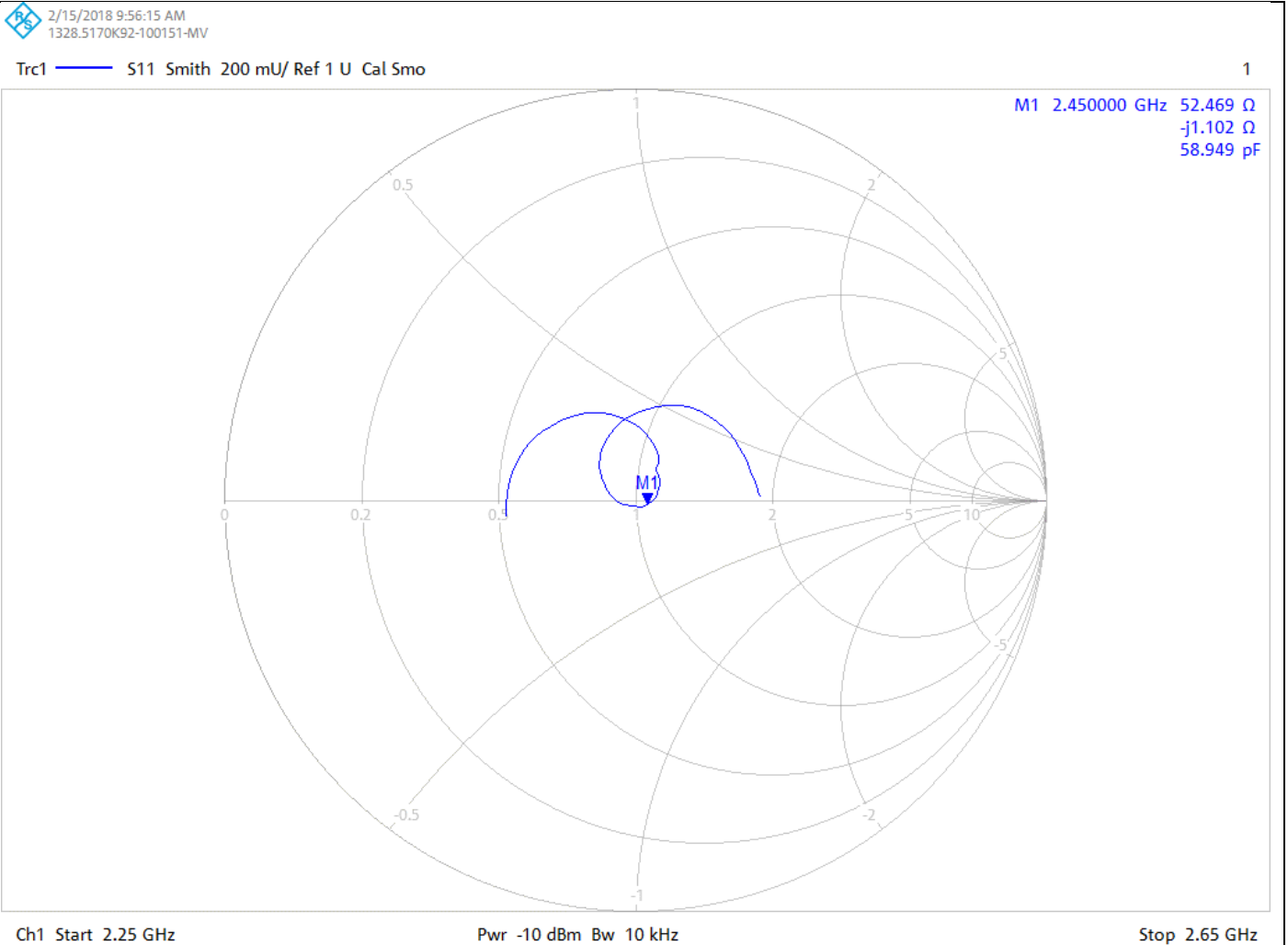
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NUMBER :
12129912JD01A

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Impedance Measurement Plot for Body Stimulating Liquid (MSL)



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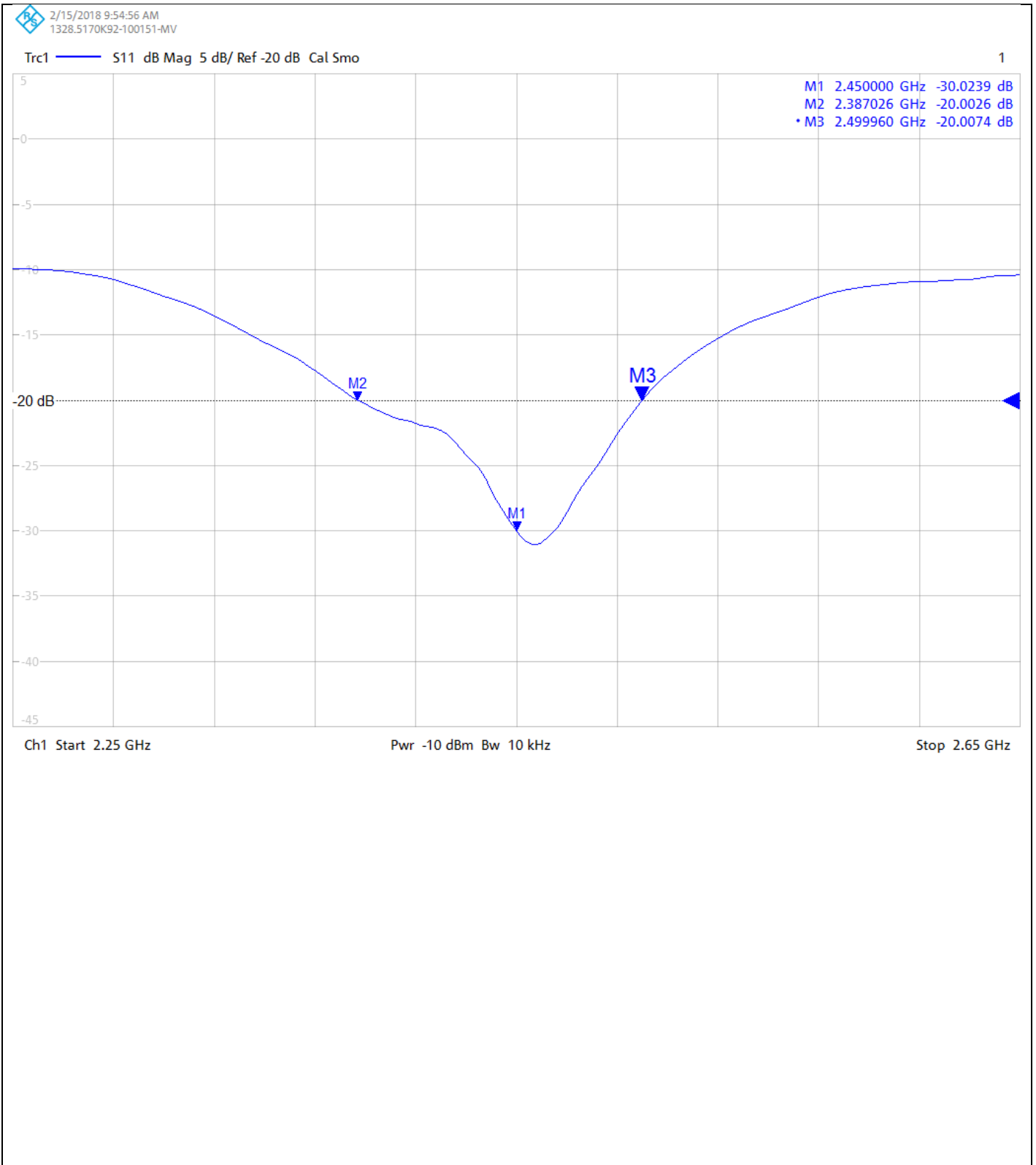
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Return Loss Measurement Plot for Body Stimulating Liquid (MSL)



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|--|--|

| | |
|--|--|
|  <p>UKAS CALIBRATION 5248</p> | <p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12129912JD01A</p> <p>Instrument ID: 748</p> <p>Calibration Date: 14/Feb/2018</p> <p>Calibration Due Date:</p> |
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|--|--|
|  <p>UKAS CALIBRATION 5248</p> | <p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12129912JD01A</p> <p>Instrument ID: 748</p> <p>Calibration Date: 14/Feb/2018</p> <p>Calibration Due Date:</p> |
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DATE OF ISSUE: 28/Mar/2018 CERTIFICATE NUMBER : 12134276JD01D



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BASINGSTOKE, HAMPSHIRE
RG23 8BG, UK
TEL: +44 (0) 1256 312000
FAX: +44 (0) 1256 312001
Email: LST.UK.Calibration@ul.com



Page 1 of 10

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: | 15/Mar/2018 |
| Manufacturer: | Speag | | |
| Type/Model Number: | D2600V2 | | |
| Serial Number: | 1036 | | |
| Calibration Date: | 16/Mar/2018 | | |
| Calibrated By: | Masood Khan Laboratory Engineer | | |

Signature:

A handwritten signature in black ink, appearing to read 'Masood Khan'.

.....

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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CERTIFICATE
NUMBER :
12134276JD01D

Page 2 of 10

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) |
|------------|------------------------------|----------------------|---------------|------------|-----------------------|------------------------|
| A2110 | Data Acquisition Electronics | SPEAG | DAE4 | 431 | 08 Nov 2017 | 12 |
| A2077 | Probe | SPEAG | EX3DV4 | 3814 | 28 Sep 2017 | 12 |
| A2767 | Dipole | SPEAG | D2600V2 | 1109 | 05 Feb 2018 | 12 |
| PRE0151451 | Power Monitoring Kit | Art-Fi | ART 100850-01 | 0001 | Cal as part of System | 12 |
| PRE0151441 | Power Sensor | Rhode & Schwarz | NRP8S | 102481 | 05 Feb 2018 | 12 |
| M1015 | Network Analyser | Agilent Technologies | 8753ES | US39172406 | 10 Oct 2017 | 12 |
| PRE0151154 | Network Analyser | Rhode & Schwarz | ZND8 | 100151 | 14 Dec 2017 | 24 |
| PRE0151877 | Calibration Kit | Rhode & Schwarz | Z135 | 102947 | 09 May 2017 | 12 |
| M1838 | Signal Generator | Rhode & Schwarz | SME06 | 831377/005 | 30 Mar 2017 | 12 |

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UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134276JD01D

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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 | 23.5 °C | 23.5 °C | 22.5°C | 22.5°C | ϵ_r | 39.00 | 39.14 | ± 5% |
| | | | | | | σ | 1.96 | 1.95 | ± 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 | 13.70 W/Kg | 54.54 W/Kg | ± 17.57% |
| | SAR averaged over 10g | 6.17 W/Kg | 24.56 W/Kg | ± 17.32% |

Antenna Parameters – Head Simulating Liquid (HSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|--------------------------------|-----------------------------------|
| Head | Impedance | 52.04 Ω -6.56 $j\Omega$ | ± 0.28 Ω ± 0.044 $j\Omega$ |
| | Return Loss | -23.74 | ± 2.03 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 | 18.1 °C | 18.1 °C | 19.0°C | 19.0°C | ϵ_r | 52.50 | 53.41 | ± 5% |
| | | | | | | σ | 2.16 | 2.24 | ± 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 | 6.29 W/Kg | 25.04 W/Kg | ± 17.44% |

Antenna Parameters – Body Simulating Liquid (MSL)

| Simulant Liquid | Parameter | Measured Level | Uncertainty (%) |
|-----------------|-------------|---------------------------------|------------------------------------|
| Body | Impedance | 48.29 Ω -6.55 j Ω | ± 0.28 Ω ± 0.044 j Ω |
| | Return Loss | -25.48 | ± 2.03 dB |

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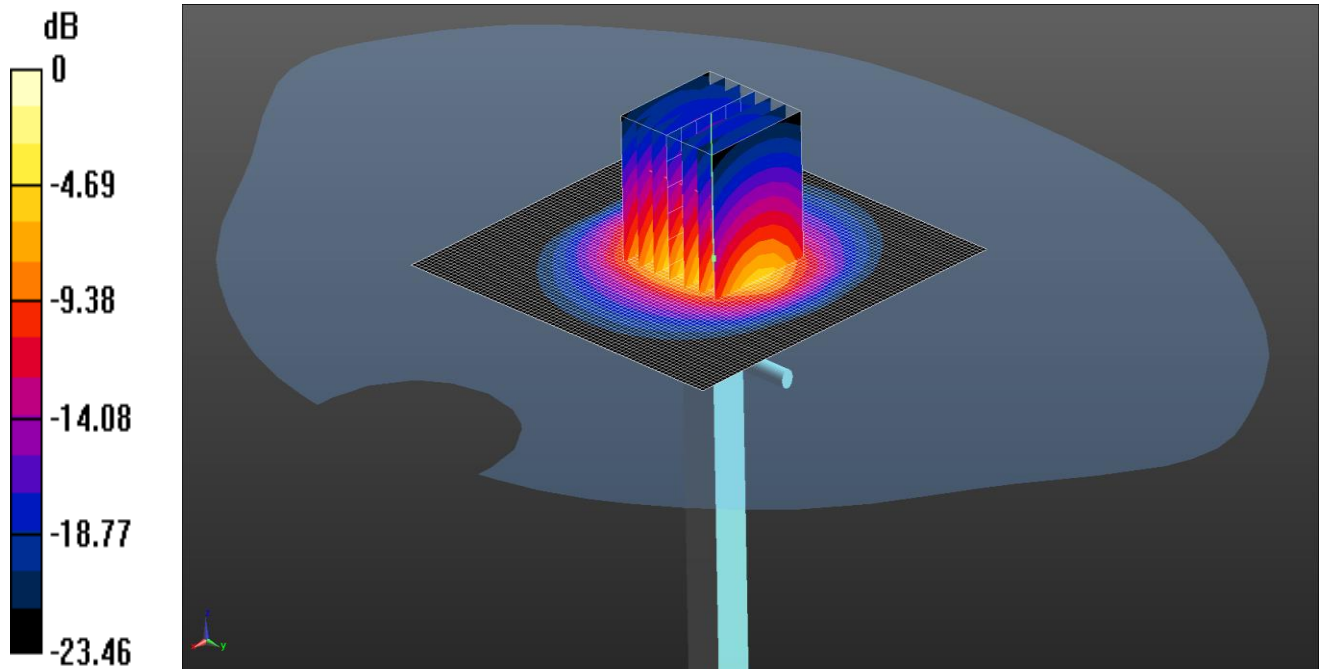
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DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D2600V2 - SN1036; Type: D2600V2; Serial: SN1036



0 dB = 21.3 W/kg = 13.28 dBW/kg

Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: 2300 2450 2600 MHz HSL Medium parameters used: $f = 2600$ MHz; $\sigma = 1.956$ S/m; $\epsilon_r = 39.142$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3814; ConvF(6.91, 6.91, 6.91); Calibrated: 28/09/2017;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn431; Calibrated: 08/11/2017
- Phantom: SAM (20deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: 1817
- ; SEMCAD X Version 14.6.10 (7372)

Configuration/d=10mm, Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 16.1 W/kg

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

Reference Value = 91.37 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 29.3 W/kg

SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.17 W/kg

Maximum value of SAR (measured) = 21.3 W/kg

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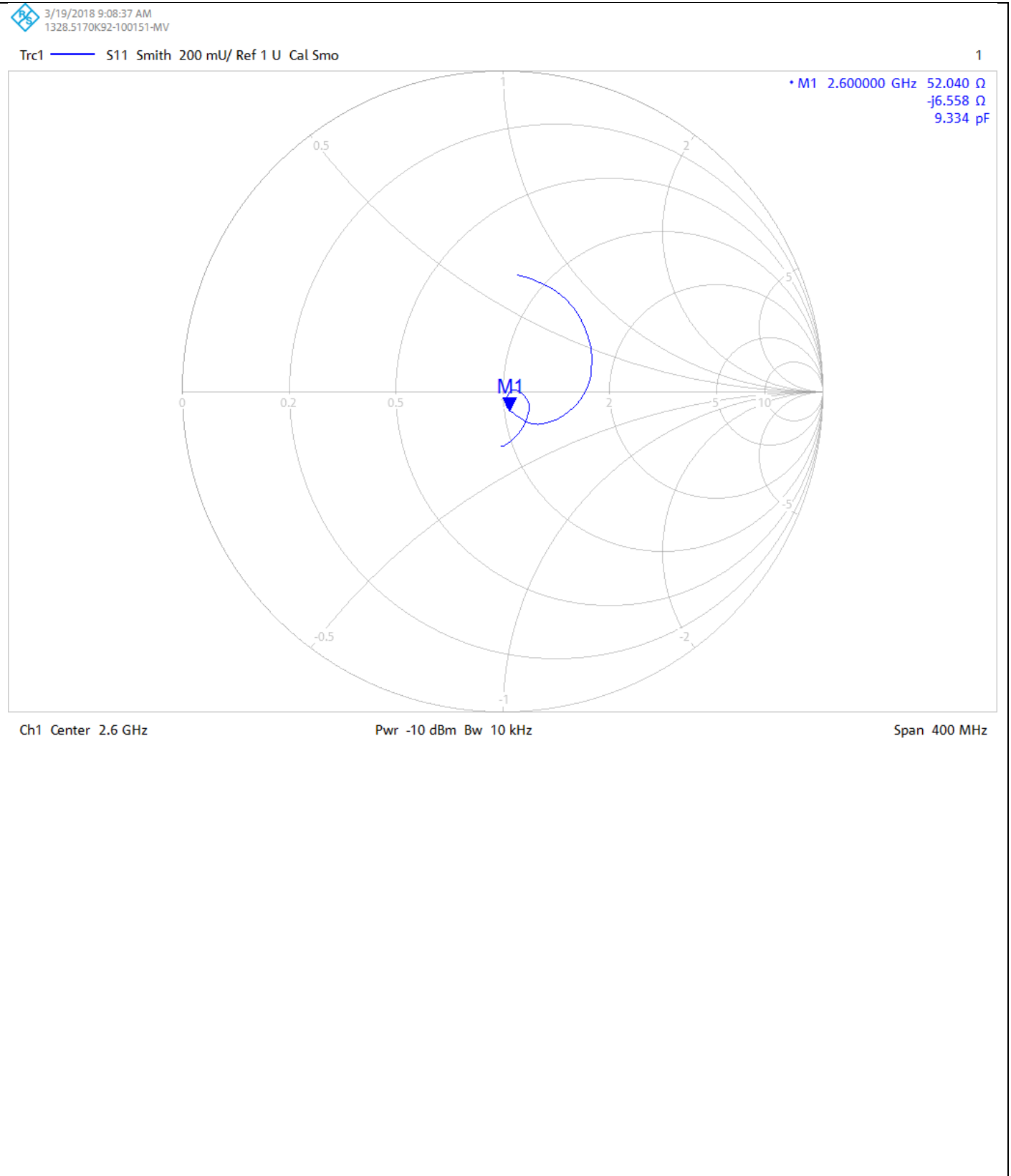
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Impedance Measurement Plot for Head Stimulating Liquid (HSL)



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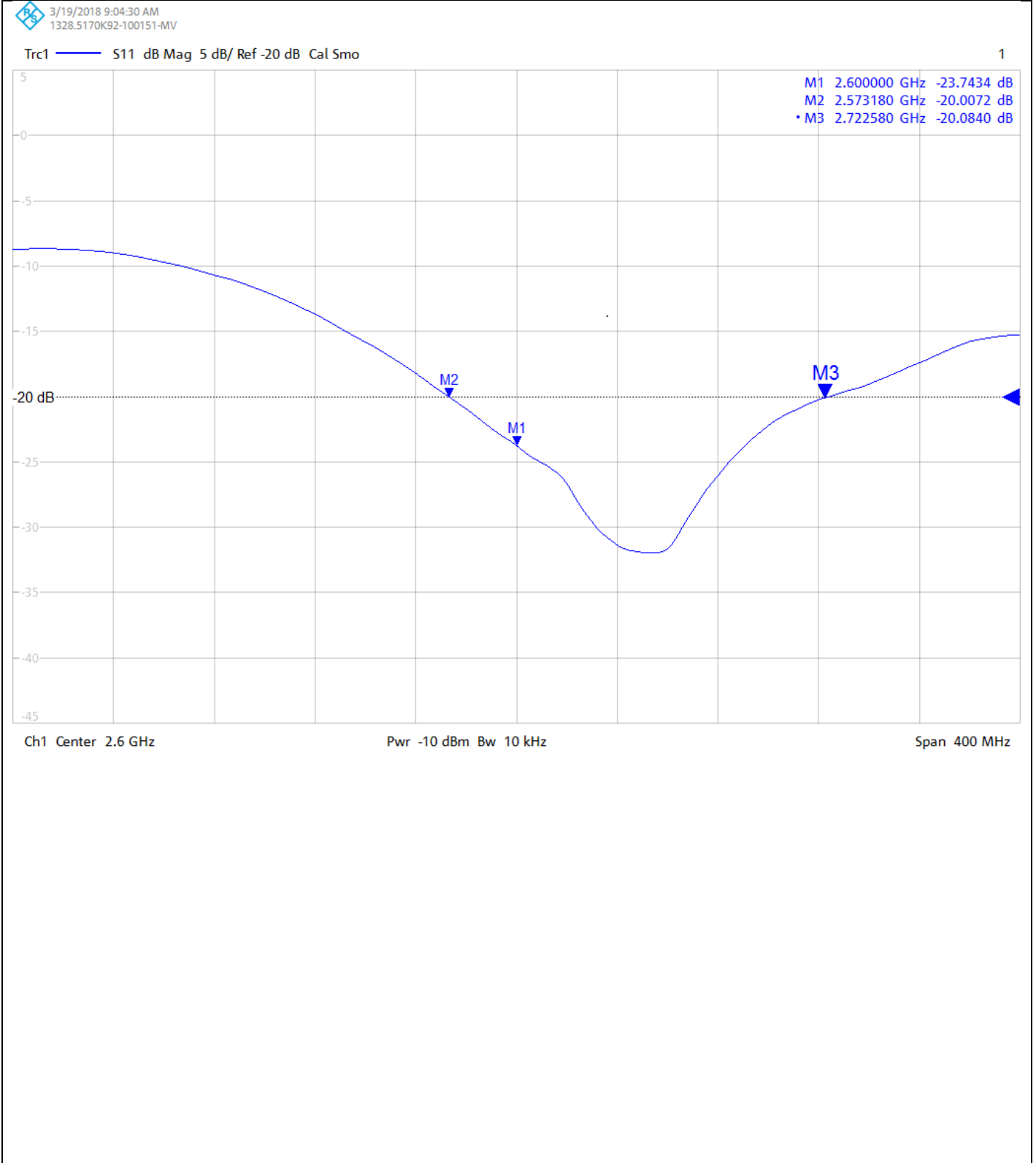
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Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



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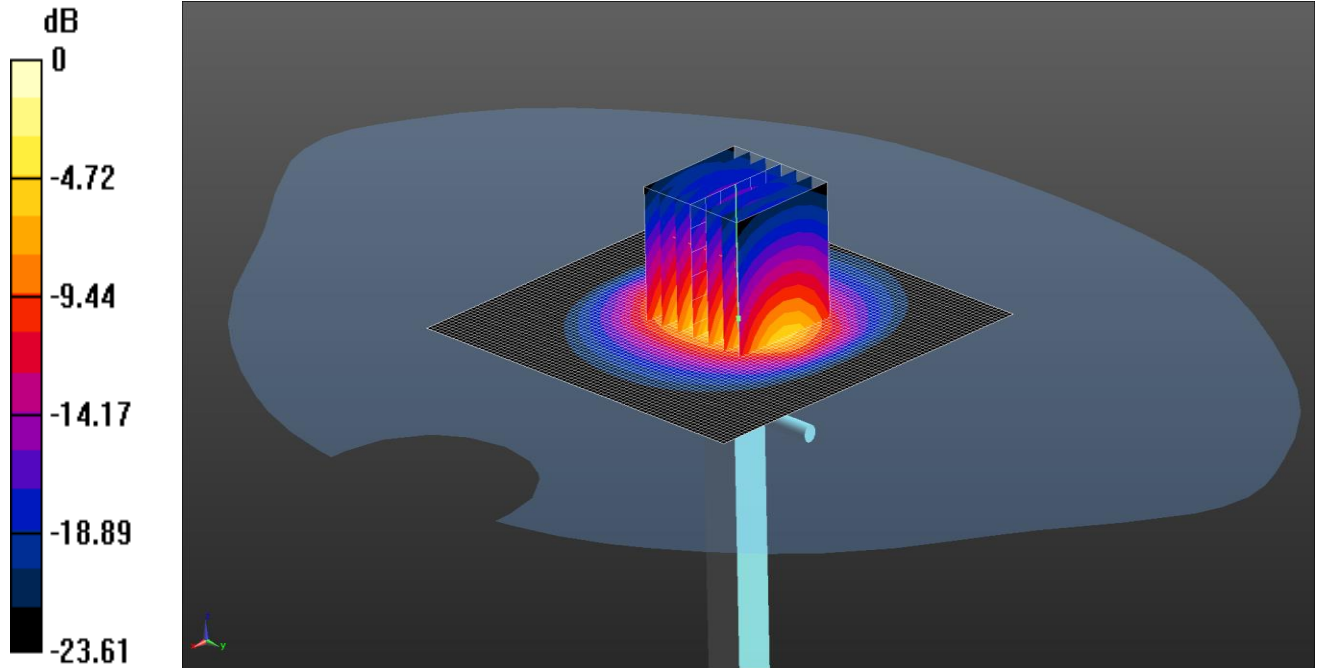
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DASY Validation Scan for Body Stimulating Liquid (MSL)

Date: 20/03/2018

DUT: D2600V2 - SN1036; Type: D2600V2; Serial: SN1036



0 dB = 22.1 W/kg = 13.44 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; $\sigma = 2.243$ S/m; $\epsilon_r = 53.413$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3814; ConvF(7.03, 7.03, 7.03); Calibrated: 28/09/2017;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn431; Calibrated: 08/11/2017
- Phantom: SAM (20deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: 1817
- ; SEMCAD X Version 14.6.10 (7372)

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

Reference Value = 84.64 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.2 W/kg

SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.29 W/kg

Maximum value of SAR (measured) = 22.1 W/kg

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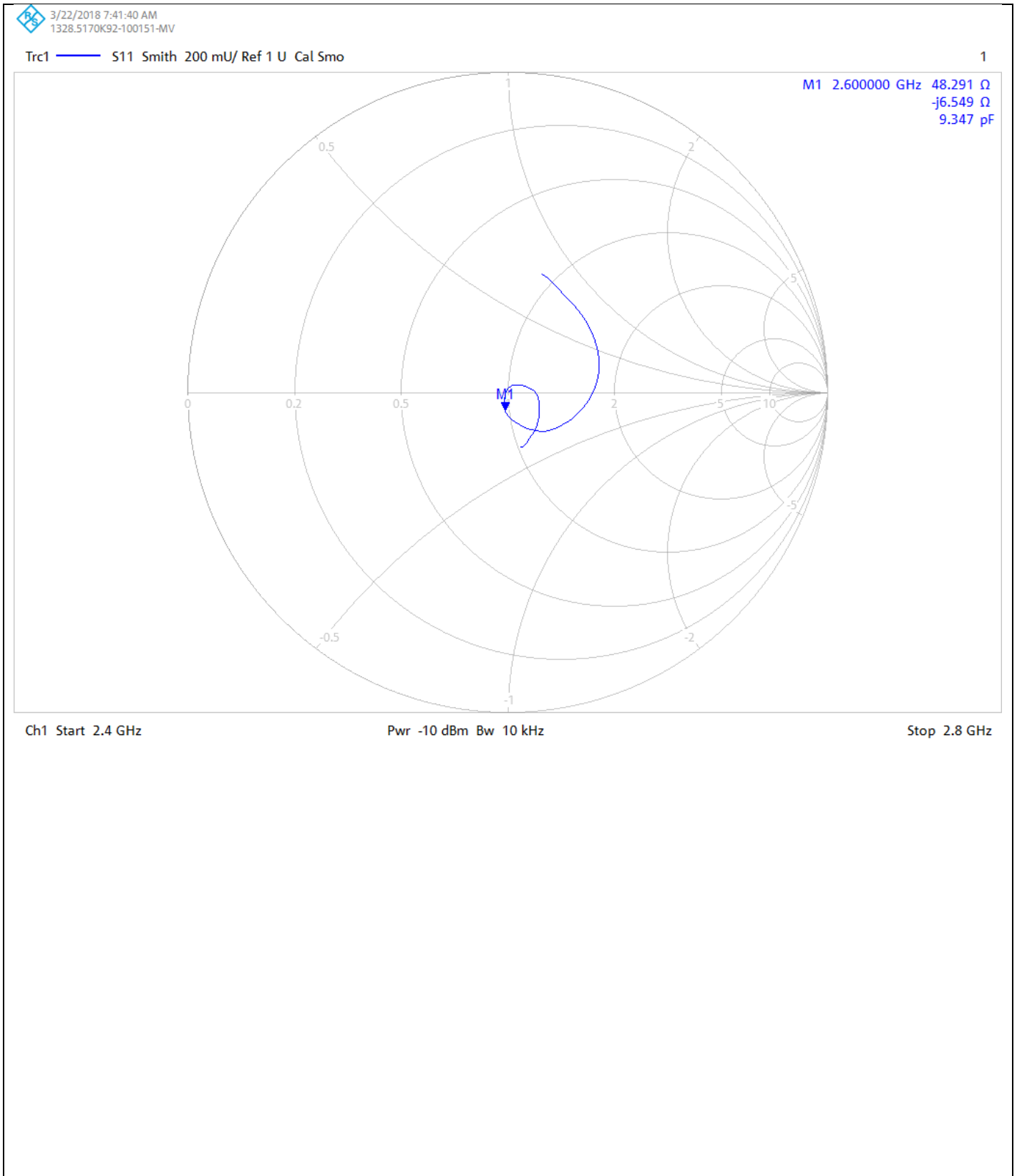
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Impedance Measurement Plot for Body Stimulating Liquid (MSL)



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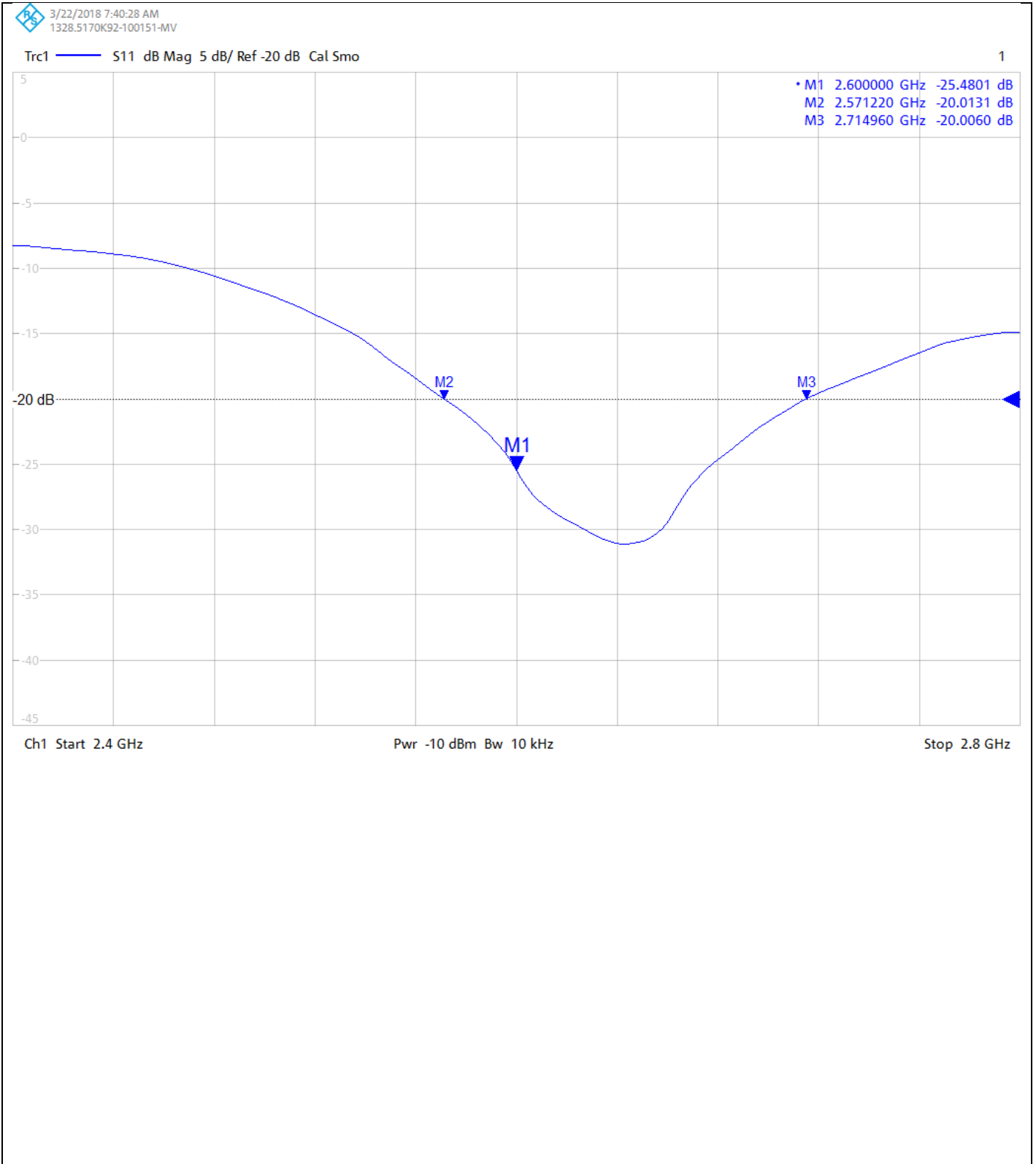
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Return Loss Measurement Plot for Body Stimulating Liquid (MSL)



Calibration Certificate Label:

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