

CERTIFICATE OF CALIBRATION

ISSUED BY **UL VS LTD**

DATE OF ISSUE: 28/Nov/2018 CERTIFICATE NUMBER : 12134289JD01A



5248

UL VS LTD
UNIT 1 HORIZON
KINGSLAND PARK, WADE ROAD
BASINGSTOKE, HAMPSHIRE
RG24 8AH, 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:	20/Nov/2017
Manufacturer:	Speag		
Type/Model Number:	D750V3		
Serial Number:	1071		
Calibration Date:	28/Nov/2018		
Calibrated By:	Chanthu Thevarajah Senior Engineer		
Signature:	A handwritten signature in black ink, appearing to be a stylized 'C'.		

.....

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.

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01A

Page 2 of 10

The calibration methods and procedures used were as detailed in:

1. **IEC 62209-1:2016:** 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)
PRE0178318	Data Acquisition Electronics	SPEAG	DAE4	1543	08 Mar 2018	12
PRE0178315	Probe	SPEAG	ES3DV3	3360	17 Aug 2018	12
A1985	Dipole	SPEAG	D750V3	1011	07 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
PRE0151154	Network Analyser	Rhode & Schwarz	ZND8	100151	14 Dec 2017	12
PRE0151877	Calibration Kit	Rhode & Schwarz	ZV-Z135	102947-Bt	27 Apr 2018	12
PRE0178154	Signal Generator	Rhode & Schwarz	SMB 100A	175325	09 Apr 2018	12

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01A

Page 3 of 10

SAR System Specification

Robot System Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Robot Serial Number:	F17/5ENYG1/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	20.0 °C	20.5 °C	20.5°C	20.5°C	ϵ_r	41.96	41.83	± 5%
						σ	0.89	0.90	± 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	2.09 W/Kg	8.32 W/Kg	± 17.57%
	SAR averaged over 10g	1.37 W/Kg	5.45 W/Kg	± 17.32%

Antenna Parameters – Head Simulating Liquid (HSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Head	Impedance	47.158 Ω 3.05 j Ω	± 0.28 Ω ± 0.044 j Ω
	Return Loss	-26.81	± 2.03 dB

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01A

Page 4 of 10

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	20.0 °C	20.0 °C	19.3°C	20.0°C	ϵ_r	55.55	54.19	± 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	2.17 W/Kg	8.63 W/Kg	± 18.06%
	SAR averaged over 10g	1.42 W/Kg	5.65 W/Kg	± 17.44%

Antenna Parameters – Body Simulating Liquid (MSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Body	Impedance	52.66 Ω 4.35 j Ω	± 0.28 Ω ± 0.044 j Ω
	Return Loss	-26.59	± 2.03 dB

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

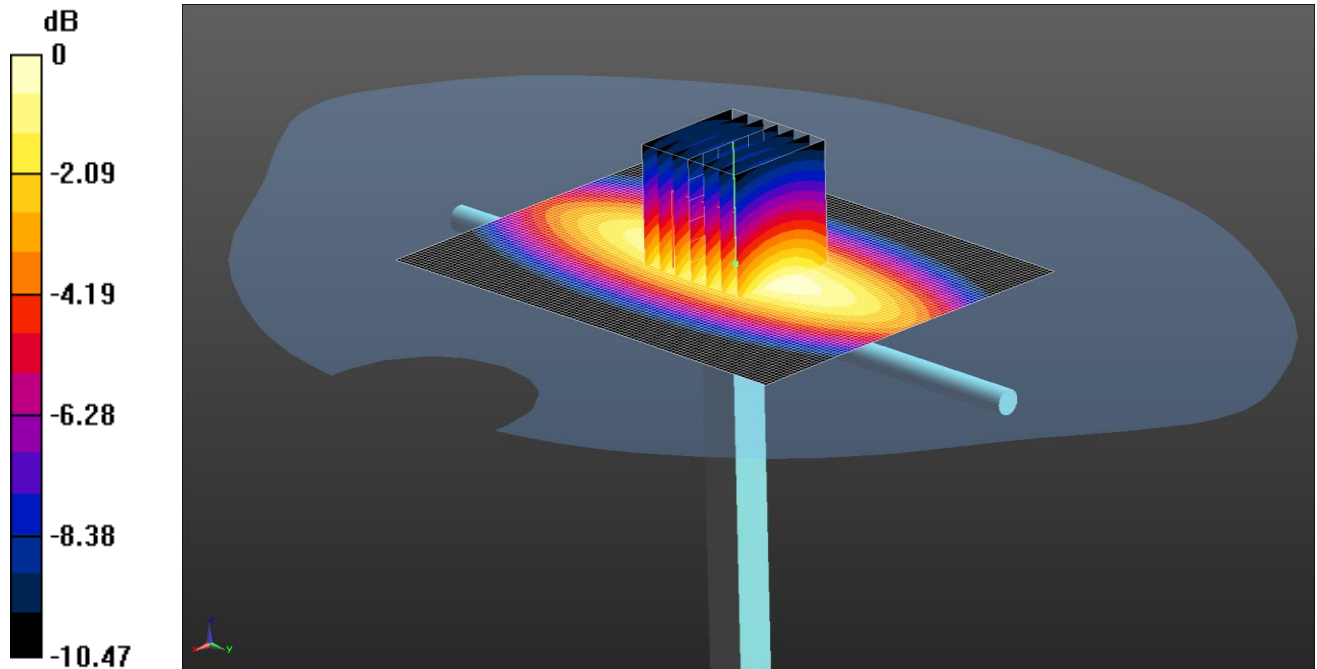
UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01A

Page 5 of 10

DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D750V3 - SN1071; Type: D750V3; Serial: SN1071



0 dB = 2.45 W/kg = 3.89 dBW/kg

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

Medium: 750 835 900 1800 1900 MHz HSL Medium parameters used: $f = 750$ MHz; $\sigma = 0.899$ S/m; $\epsilon_r = 41.829$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3360; ConvF(6.48, 6.48, 6.48); Calibrated: 17/08/2018;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1543; Calibrated: 08/03/2018
- Phantom: Twin SAM A (Site 65); Type: SAM 8.0; Serial: TP:1945
- ; SEMCAD X Version 14.6.10 (7417)

Configuration/d=10mm, Pin=250mW 2/Area Scan (81x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 2.45 W/kg

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

Reference Value = 53.77 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.13 W/kg

SAR(1 g) = 2.09 W/kg; SAR(10 g) = 1.37 W/kg

Maximum value of SAR (measured) = 2.45 W/kg

CERTIFICATE OF CALIBRATION

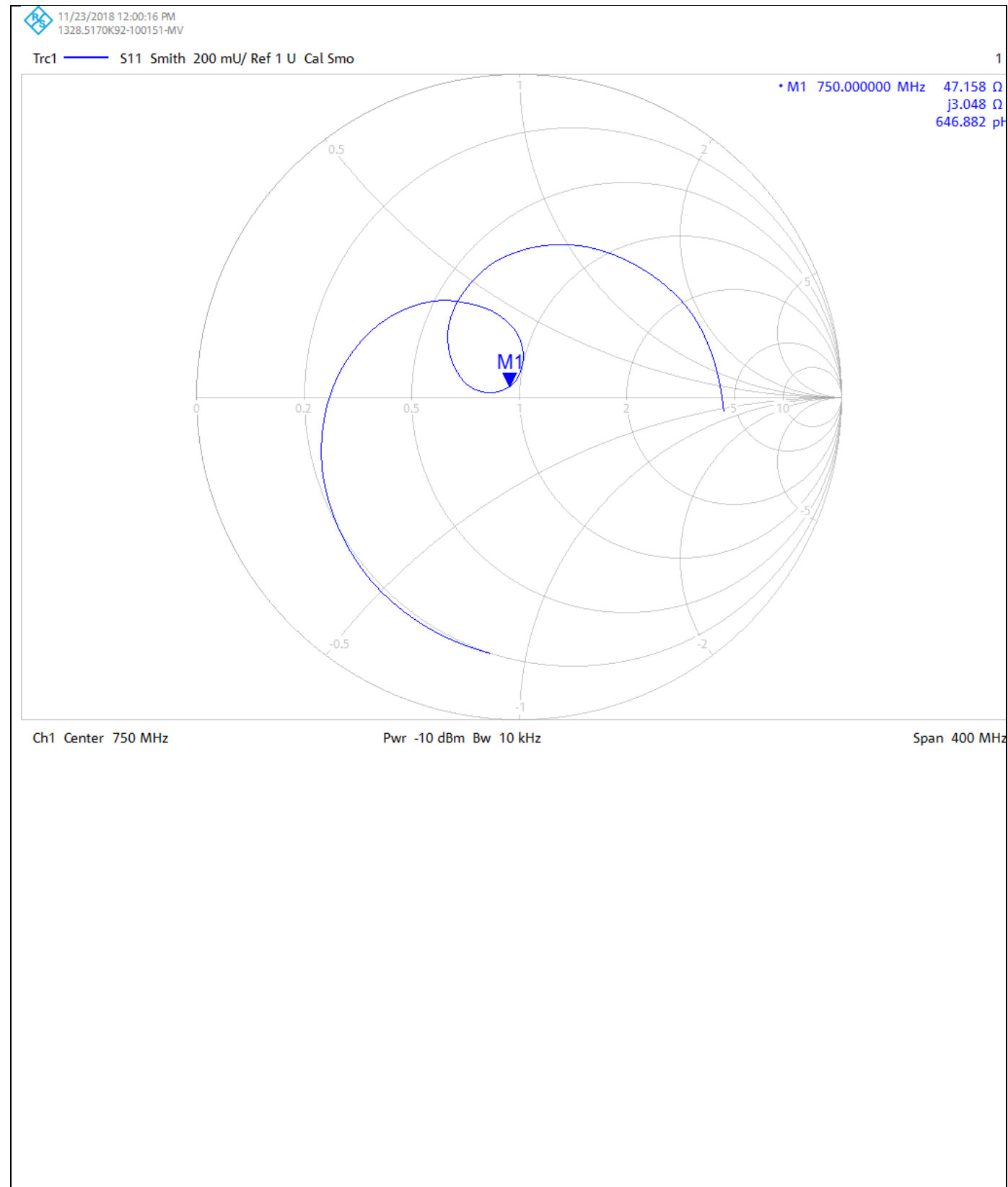
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01A

Page 6 of 10

Impedance Measurement Plot for Head Stimulating Liquid (HSL)



CERTIFICATE OF CALIBRATION

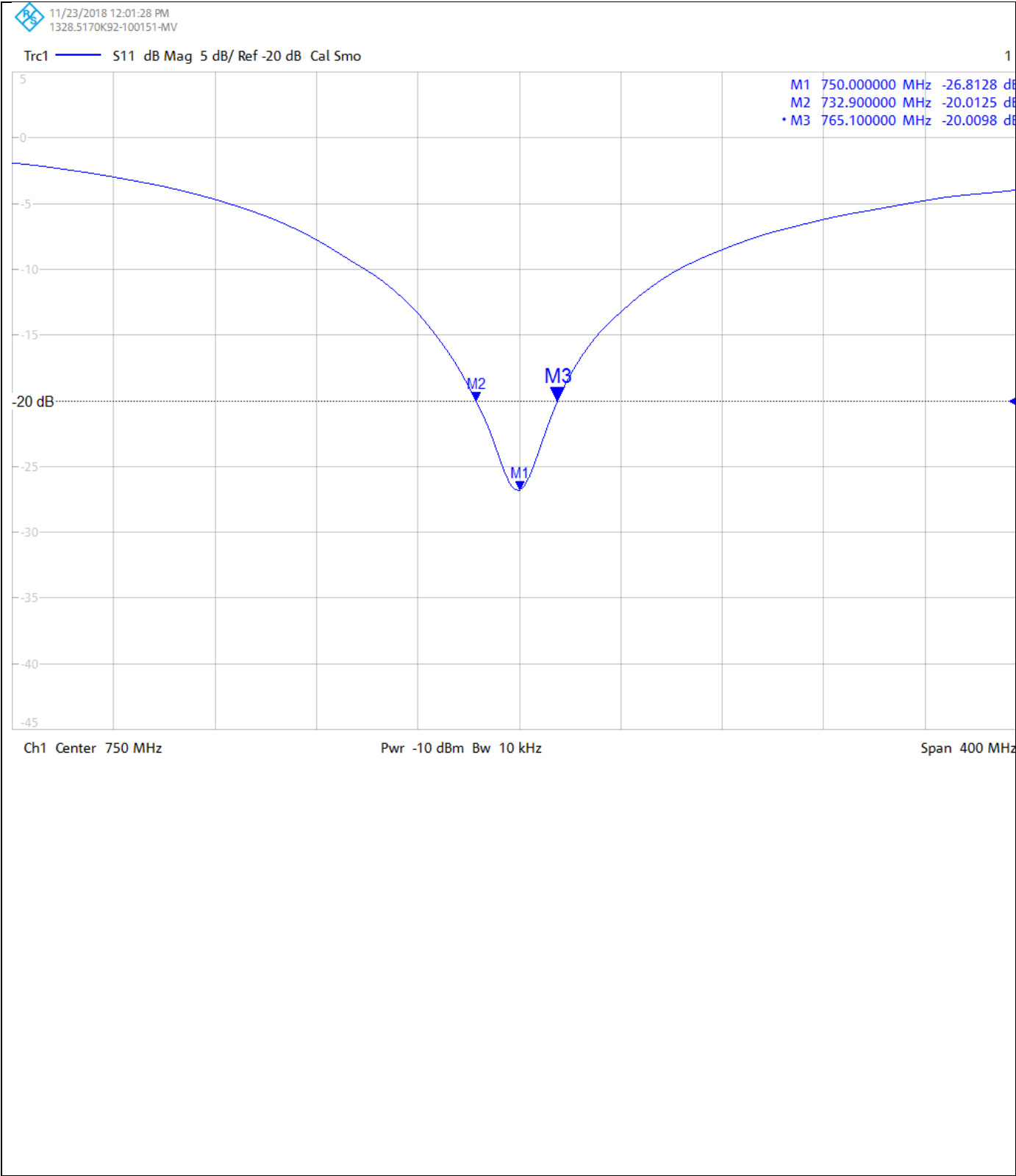
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01A

Page 7 of 10

Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

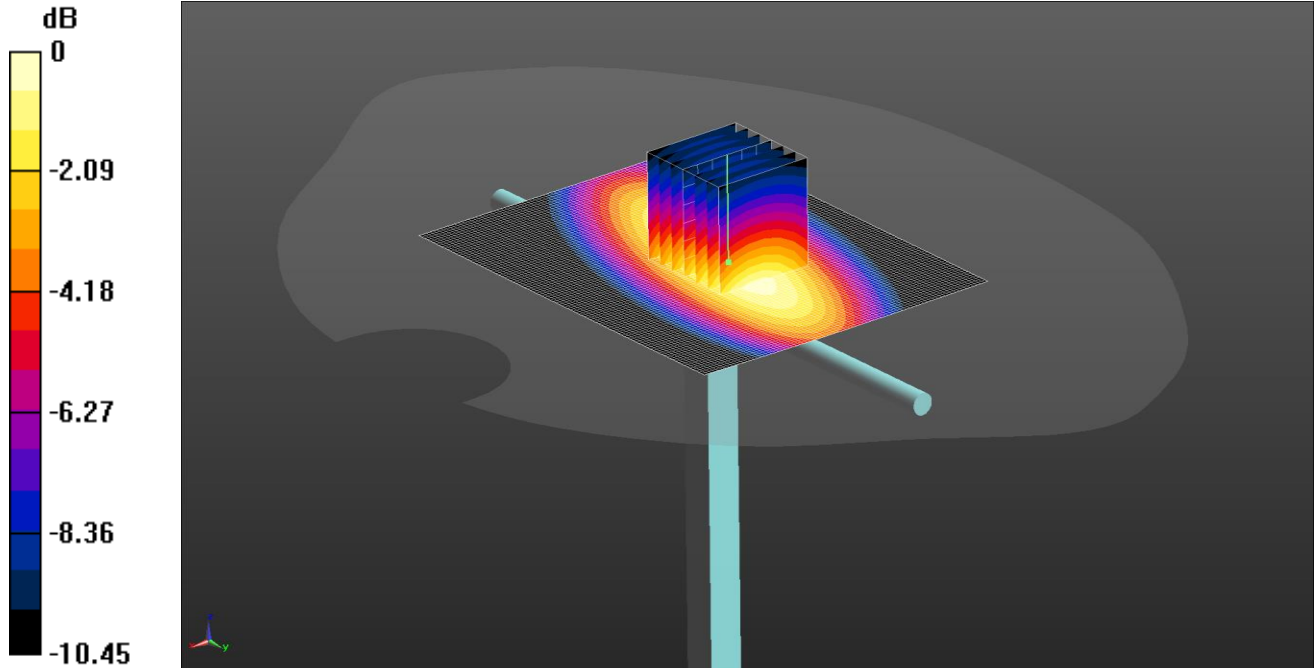
UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01A

Page 8 of 10

DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: D750V3 - SN1071; Type: D750V3; Serial: SN1071



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

Medium: 750 835 900 1800 MHz MSL Medium parameters used: $f = 750$ MHz; $\sigma = 0.959$ S/m; $\epsilon_r = 54.189$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3360; ConvF(6.55, 6.55, 6.55); Calibrated: 17/08/2018;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1543; Calibrated: 08/03/2018
- Phantom: Twin SAM B (Site 65); Type: SAM 5.0; Serial: TP:1836
- ; SEMCAD X Version 14.6.10 (7417)

Configuration/d=10mm, Pin=250mW 2/Area Scan (81x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 2.53 W/kg

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

Reference Value = 51.97 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.28 W/kg

SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.42 W/kg

Maximum value of SAR (measured) = 2.54 W/kg

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01A

Page 9 of 10

Impedance Measurement Plot for Body Stimulating Liquid (MSL)



CERTIFICATE OF CALIBRATION

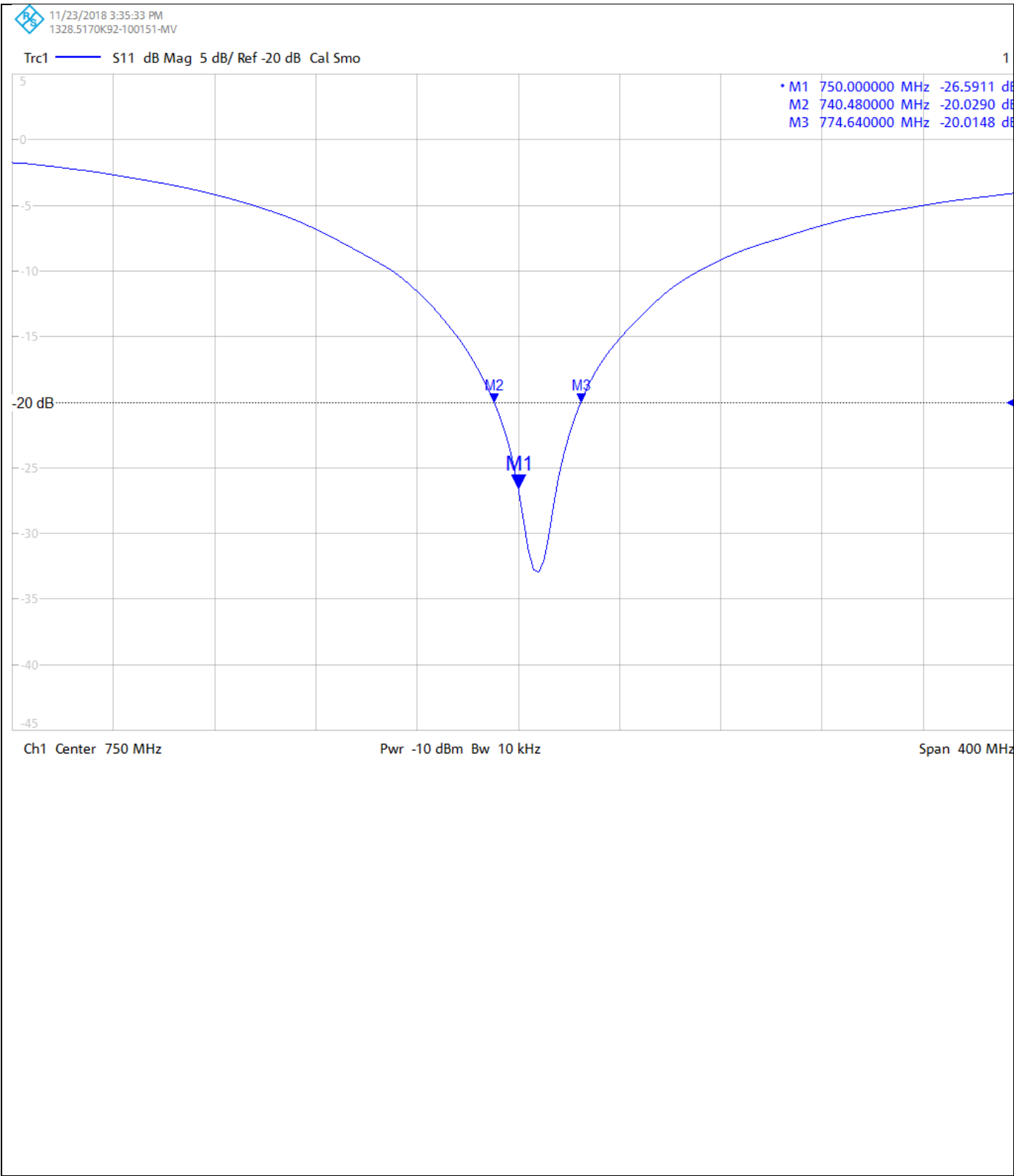
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248


CERTIFICATE
NUMBER :
12134289JD01A


Page 10 of 10


Return Loss Measurement Plot for Body Stimulating Liquid (MSL)



Calibration Certificate Label:

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12134289JD01A</p> <p>Instrument ID: 1071</p> <p>Calibration Date: 28/Nov/2018</p> <p>Calibration Due Date:</p>
---	---

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12134289JD01A</p> <p>Instrument ID: 1071</p> <p>Calibration Date: 28/Nov/2018</p> <p>Calibration Due Date:</p>
---	---

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12134289JD01A</p> <p>Instrument ID: 1071</p> <p>Calibration Date: 28/Nov/2018</p> <p>Calibration Due Date:</p>
---	---

CERTIFICATE OF CALIBRATION

ISSUED BY **UL VS LTD**

DATE OF ISSUE: 28/Nov/2018 CERTIFICATE NUMBER : 12134289JD01B



5248

UL VS LTD
UNIT 1 HORIZON
KINGSLAND PARK, WADE ROAD
BASINGSTOKE, HAMPSHIRE
RG24 8AH, 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:	20/Nov/2017
Manufacturer:	Speag		
Type/Model Number:	D835V2		
Serial Number:	4d002		
Calibration Date:	28/Nov/2018		
Calibrated By:	Chanthu Thevarajah Senior Engineer		

Signature:

A handwritten signature in black ink, appearing to be a stylized "CT".

.....

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 recognized at the National Physical Laboratory or other recognized 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.

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01B

Page 2 of 10

The calibration methods and procedures used were as detailed in:

1. **IEC 62209-1:2016:** 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)
PRE0178318	Data Acquisition Electronics	SPEAG	DAE4	1543	08 Mar 2018	12
PRE0178315	Probe	SPEAG	ES3DV3	3360	17 Aug 2018	12
A2588	Dipole	SPEAG	D900V2	1d168	18 Sep 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
PRE0151154	Network Analyser	Rhode & Schwarz	ZND8	100151	14 Dec 2017	12
PRE0151877	Calibration Kit	Rhode & Schwarz	ZV-Z135	102947-Bt	27 Apr 2018	12
PRE0178154	Signal Generator	Rhode & Schwarz	SMB 100A	175325	09 Apr 2018	12

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01B

Page 3 of 10

SAR System Specification

Robot System Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Robot Serial Number:	F17/5ENYG1/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:	835 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	835	20.0 °C	20.0 °C	20.5°C	20.0°C	ϵ_r	41.50	41.57	± 5%
						σ	0.90	0.93	± 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	2.48 W/Kg	9.87 W/Kg	± 17.57%
	SAR averaged over 10g	1.60 W/Kg	6.36 W/Kg	± 17.32%

Antenna Parameters – Head Simulating Liquid (HSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Head	Impedance	47.85 Ω 0.47 j Ω	± 0.28 Ω ± 0.044 j Ω
	Return Loss	-31.95	± 2.03 dB

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01B

Page 4 of 10

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	835	20.0 °C	20.0 °C	19.3°C	20.0°C	ϵ_r	55.20	54.10	± 5%
						σ	0.97	0.99	± 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	2.53 W/Kg	10.07 W/Kg	± 18.06%
	SAR averaged over 10g	1.65 W/Kg	6.56 W/Kg	± 17.44%

Antenna Parameters – Body Simulating Liquid (MSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Body	Impedance	46.49 Ω 5.59 j Ω	± 0.28 Ω ± 0.044 j Ω
	Return Loss	-23.73	± 2.03 dB

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

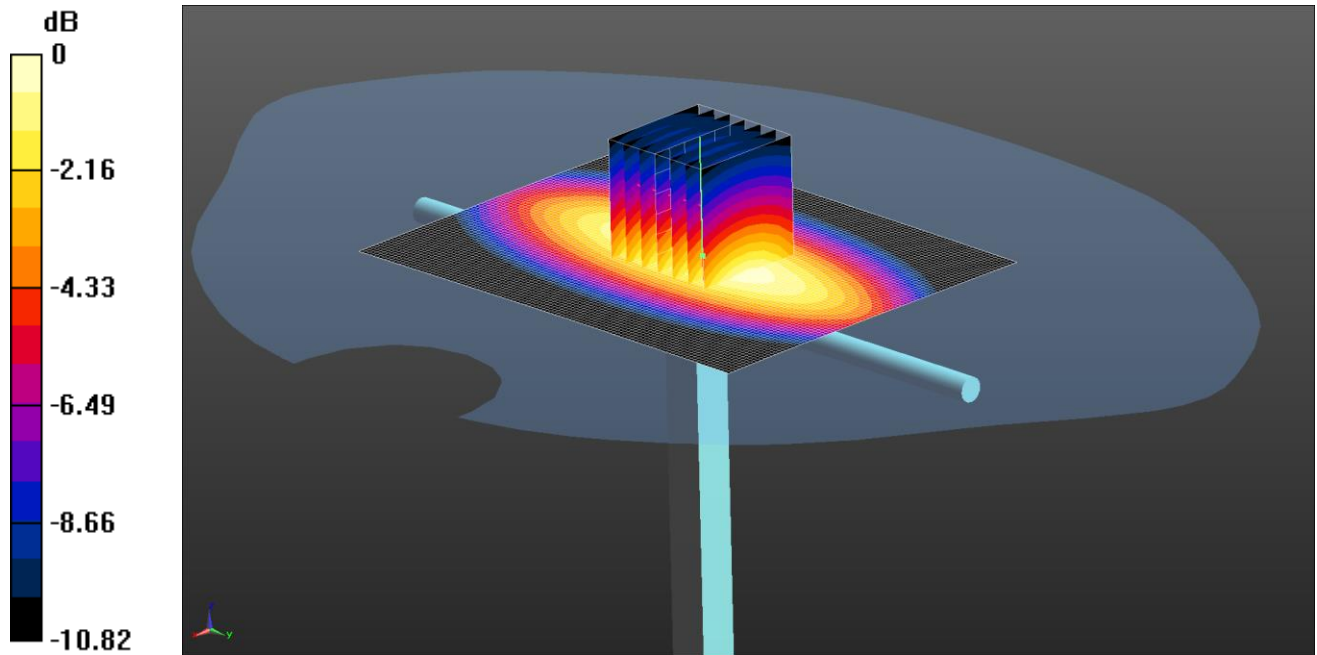
UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01B

Page 5 of 10

DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D835V2 - SN4d002; Type: D835V2; Serial: SN4d002



0 dB = 2.91 W/kg = 4.64 dBW/kg

Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 750 835 900 1800 1900 MHz HSL Medium parameters used (interpolated): $f = 835$ MHz; $\sigma = 0.931$ S/m; $\epsilon_r = 41.573$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3360; ConvF(6.23, 6.23, 6.23); Calibrated: 17/08/2018;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1543; Calibrated: 08/03/2018
- Phantom: Twin SAM A (Site 65); Type: SAM 8.0; Serial: TP:1945
- ; SEMCAD X Version 14.6.10 (7417)

Configuration/d=10mm, Pin=250mW 2/Area Scan (81x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 2.90 W/kg

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

Reference Value = 57.40 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.75 W/kg

SAR(1 g) = 2.48 W/kg; SAR(10 g) = 1.6 W/kg

Maximum value of SAR (measured) = 2.91 W/kg

CERTIFICATE OF CALIBRATION

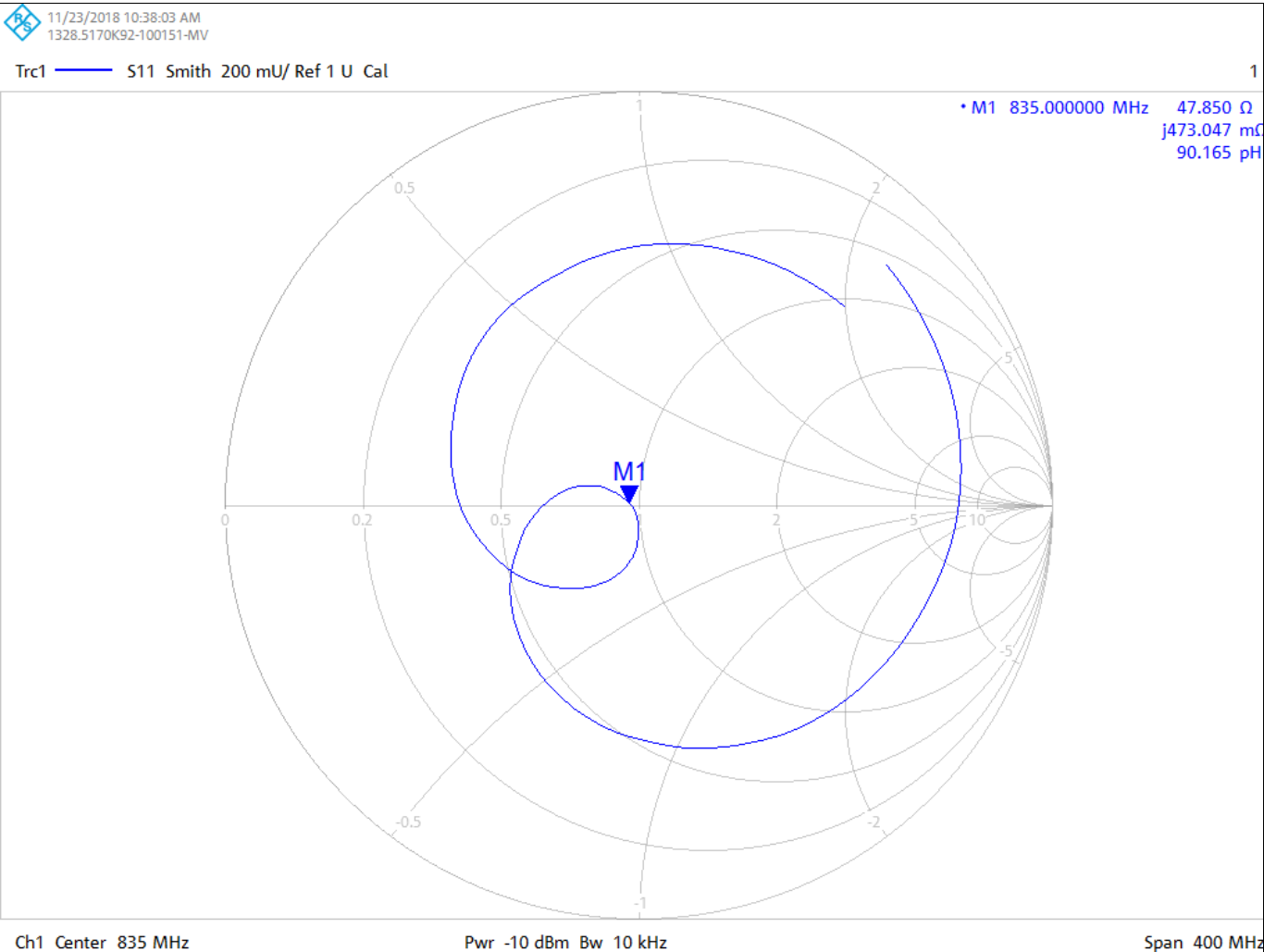
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01B

Page 6 of 10

Impedance Measurement Plot for Head Stimulating Liquid (HSL)



CERTIFICATE OF CALIBRATION

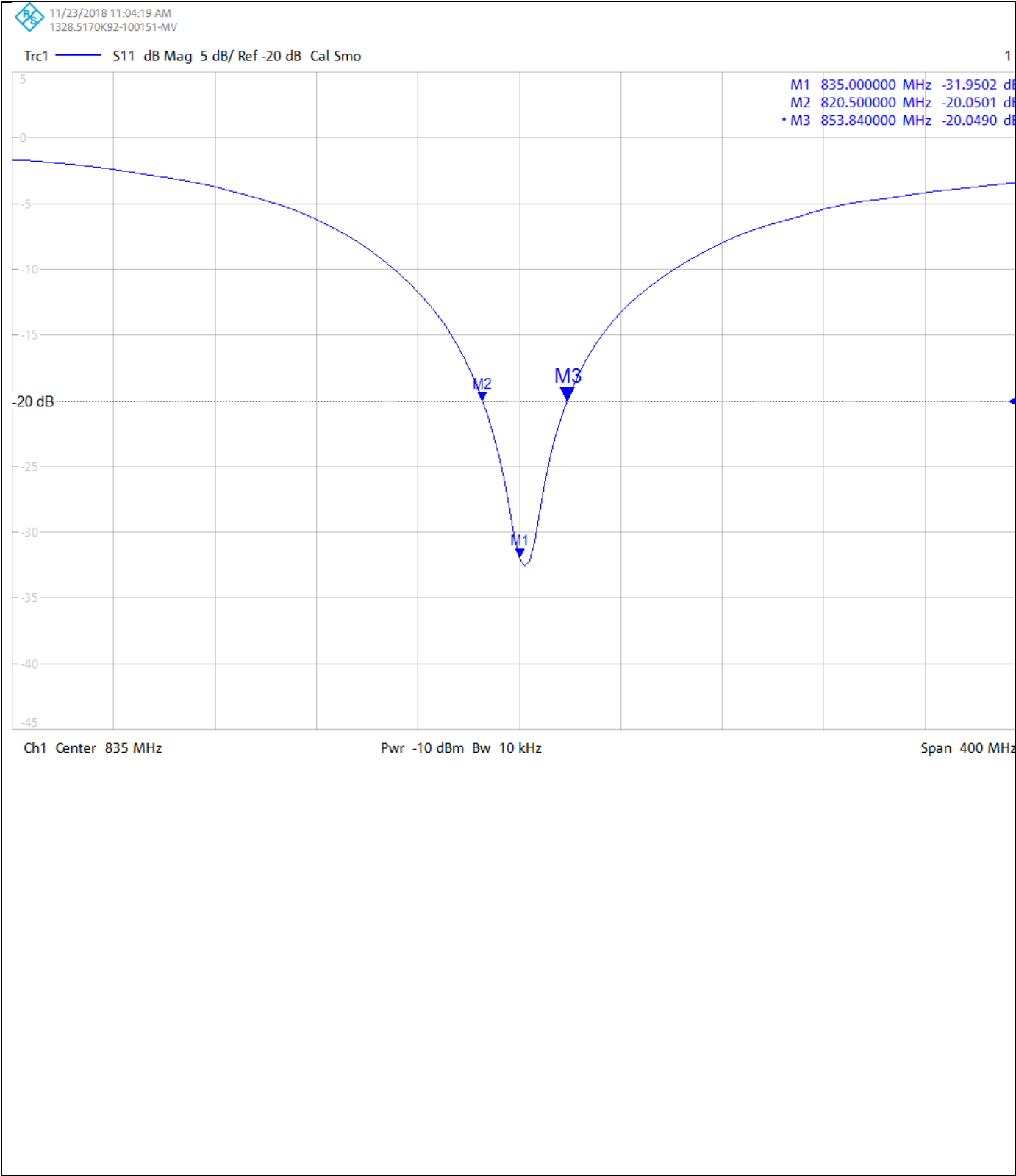
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01B

Page 7 of 10

Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

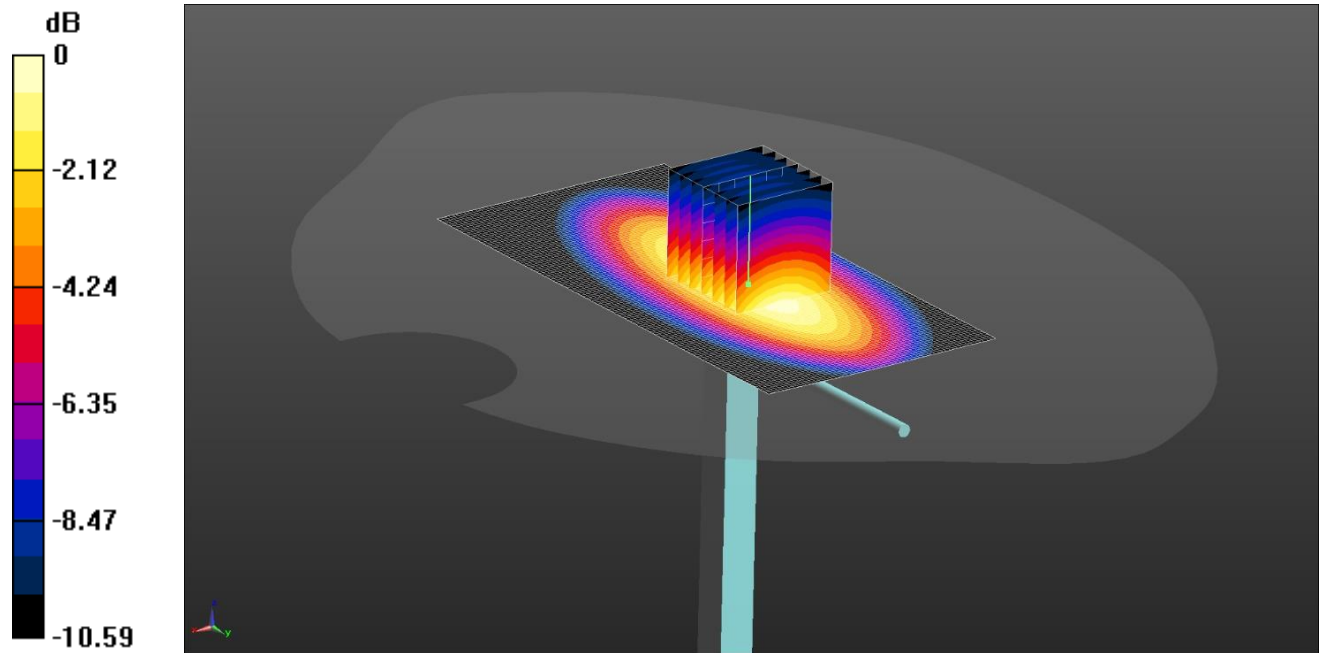
UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01B

Page 8 of 10

DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: D835V2 - SN4d002; Type: D900V2; Serial: SN4d002



0 dB = 2.97 W/kg = 4.73 dBW/kg

Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 750,835,900,1800 5%MHz MSL Medium parameters used (interpolated): $f = 835$ MHz; $\sigma = 0.992$ S/m; $\epsilon_r = 54.099$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3360; ConvF(6.31, 6.31, 6.31); Calibrated: 17/08/2018;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1543; Calibrated: 08/03/2018
- Phantom: Twin SAM B (Site 65); Type: SAM 5.0; Serial: TP:1836
- ; SEMCAD X Version 14.6.10 (7417)

SAR/d=10mm, Pin=50 mW/Area Scan (61x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 2.96 W/kg

SAR/d=10mm, Pin=50 mW/Zoom Scan 2 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.17 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.82 W/kg

SAR(1 g) = 2.53 W/kg; SAR(10 g) = 1.65 W/kg

Maximum value of SAR (measured) = 2.97 W/kg

CERTIFICATE OF CALIBRATION

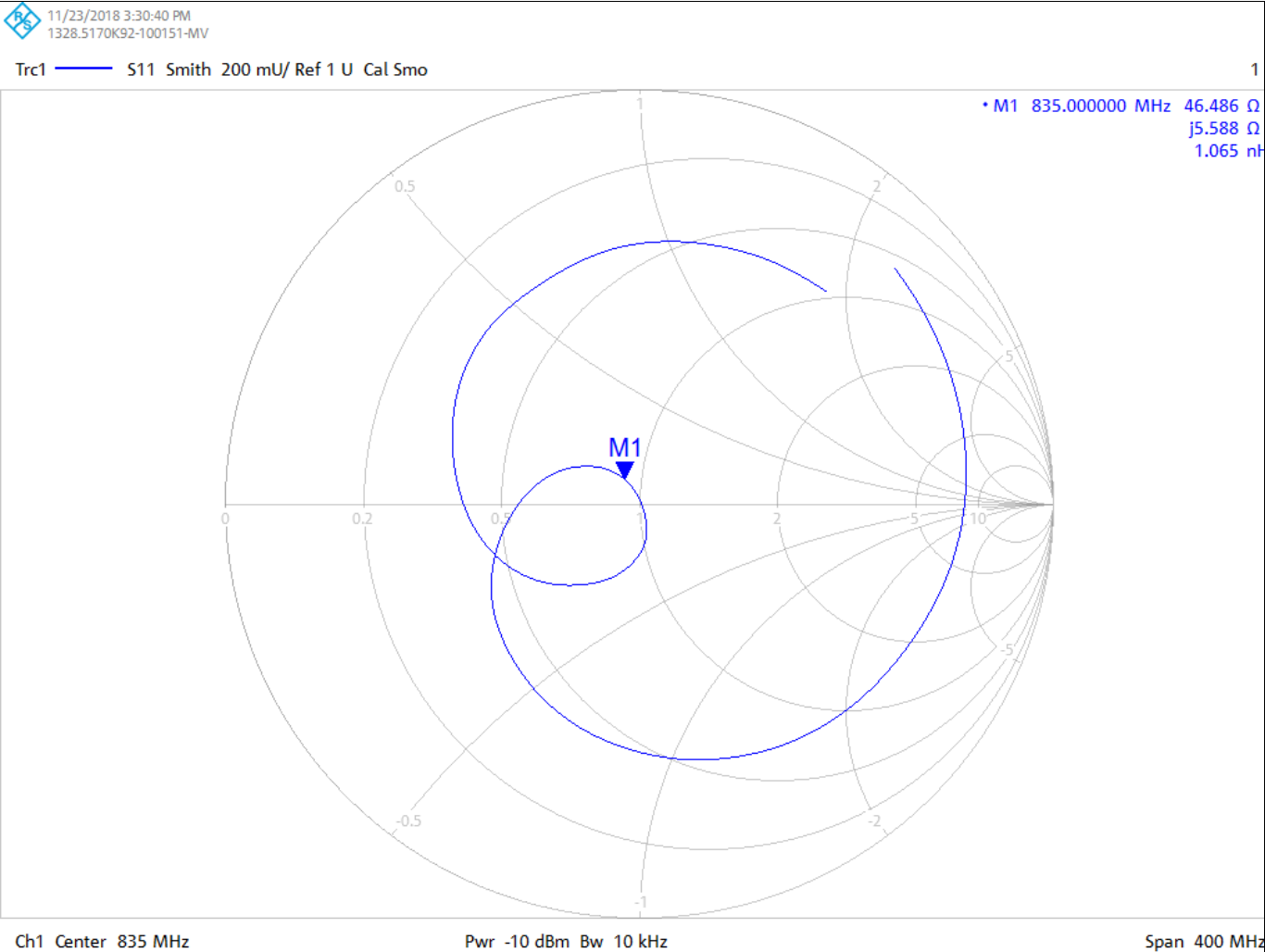
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134289JD01B

Page 9 of 10

Impedance Measurement Plot for Body Stimulating Liquid (MSL)



CERTIFICATE OF CALIBRATION

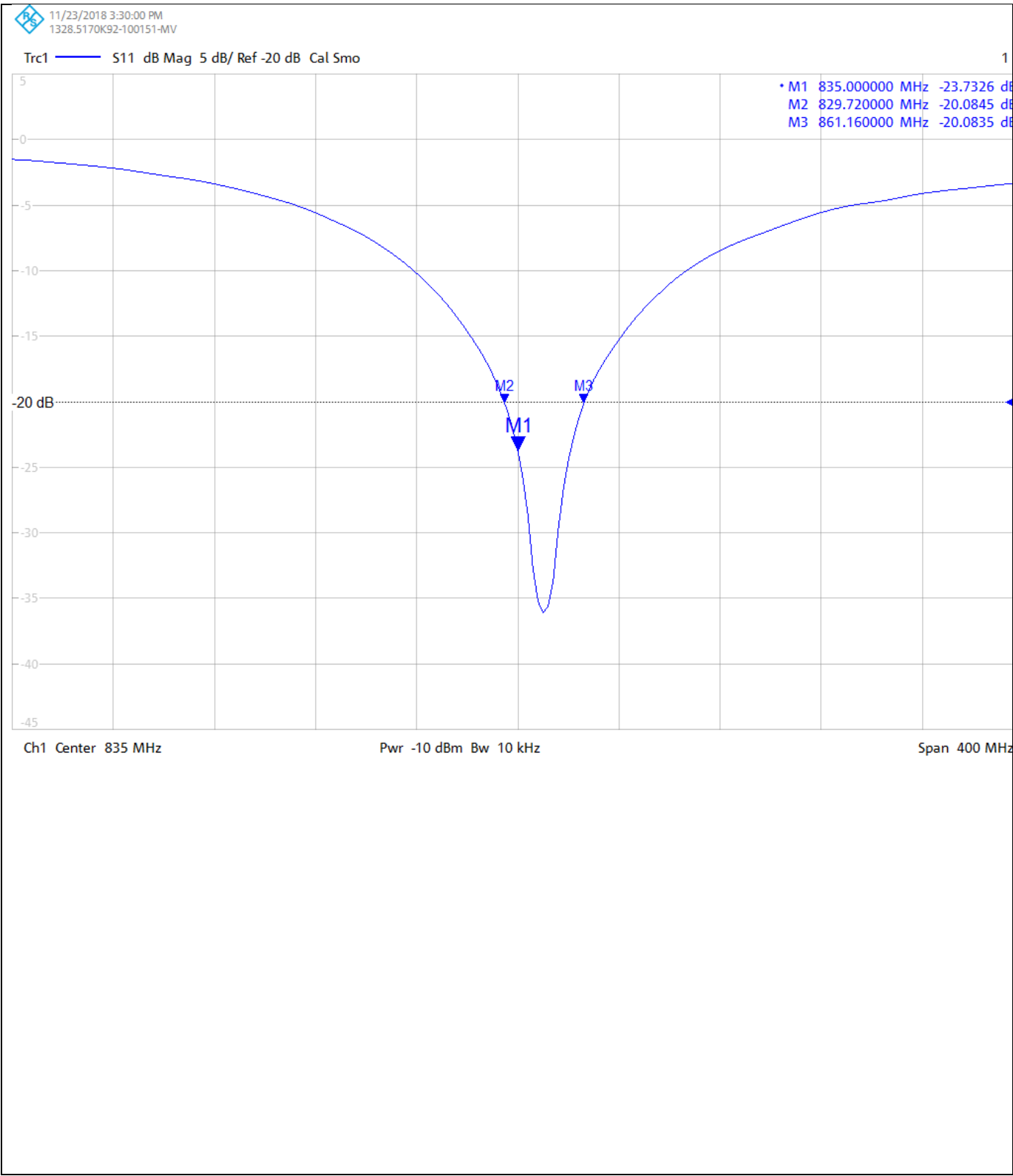
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248


CERTIFICATE
NUMBER :
12134289JD01B


Page 10 of 10


Return Loss Measurement Plot for Body Stimulating Liquid (MSL)



Calibration Certificate Label:

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12134289JD01B</p> <p>Instrument ID: 4d002</p> <p>Calibration Date: 28/Nov/2018</p> <p>Calibration Due Date:</p>
---	--

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12134289JD01B</p> <p>Instrument ID: 4d002</p> <p>Calibration Date: 28/Nov/2018</p> <p>Calibration Due Date:</p>
---	--

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12134289JD01B</p> <p>Instrument ID: 4d002</p> <p>Calibration Date: 28/Nov/2018</p> <p>Calibration Due Date:</p>
---	--

CERTIFICATE OF CALIBRATION

ISSUED BY **UL VS LTD**

DATE OF ISSUE: 03/Oct/2018

CERTIFICATE NUMBER : 11903949JD01B



5248

UL VS LTD
UNIT 1 HORIZON
KINGSLAND PARK, WADE ROAD
BASINGSTOKE, HAMPSHIRE
RG24 8AH, 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:	07/Sep/2018
Manufacturer:	Speag		
Type/Model Number:	D1750V2		
Serial Number:	1053		
Calibration Date:	02/Oct/2018		
Calibrated By:	Chanthu Thevarajah Senior Engineer		
Signature:	A handwritten signature in black ink, appearing to read 'Chanthu'.		

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.

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903949JD01B

Page 2 of 10

The calibration methods and procedures used were as detailed in:

1. **IEC 62209-1:2016**: 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)
PRE0178318	Data Acquisition Electronics	SPEAG	DAE4	1543	08 Mar 2018	12
PRE0178315	Probe	SPEAG	ES3DV3	3360	17 Aug 2018	12
A1236	Dipole	SPEAG	D1800V2	2d009	06 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	103246	05 Feb 2018	12
PRE0151154	Network Analyser	Rhode & Schwarz	ZND8	100151	14 Dec 2017	24
PRE0151877	Calibration Kit	Rhode & Schwarz	Z135	102947	27 Apr 2018	12
PRE0178154	Signal Generator	Rhode & Schwarz	SMB 100A	175325	09 Apr 2018	12

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903949JD01B

Page 3 of 10

SAR System Specification

Robot System Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Robot Serial Number:	F17/5ENYG1/C/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	22.2 °C	22.2 °C	22.4°C	22.4°C	ϵ_r	40.10	38.34	± 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	9.91 W/Kg	39.45 W/Kg	± 17.57%
	SAR averaged over 10g	5.23 W/Kg	20.82 W/Kg	± 17.32%

Antenna Parameters – Head Simulating Liquid (HSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Head	Impedance	49.35 Ω - 0.47 j Ω	± 0.28 Ω ± 0.044 j Ω
	Return Loss	41.61	± 2.03 dB

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903949JD01B

Page 4 of 10

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	22.2 °C	22.2 °C	21.0°C	21.0°C	ϵ_r	53.40	52.06	± 5%
						σ	1.49	1.48	± 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	10.10 W/Kg	40.20 W/Kg	± 18.06%
	SAR averaged over 10g	5.41 W/Kg	21.53 W/Kg	± 17.44%

Antenna Parameters – Body Simulating Liquid (MSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Body	Impedance	49.38 Ω + 4.41 j Ω	± 0.28 Ω ± 0.044 j Ω
	Return Loss	26.86	± 2.03 dB

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

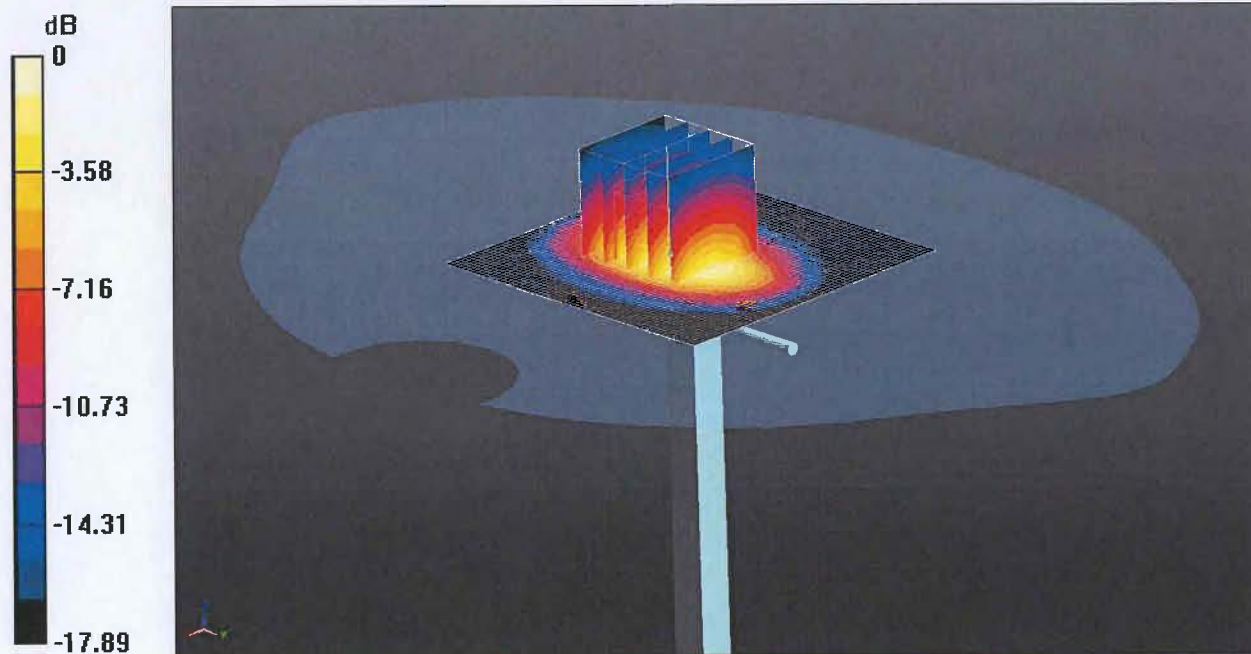
UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903949JD01B

Page 5 of 10

DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D1750V2 - SN1053; Type: D1750V2; Serial: SN1053



0 dB = 12.5 W/kg = 10.97 dBW/kg

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

Medium: 1450, 1750, 2300 5% MHz HSL Medium parameters used: $f = 1750$ MHz; $\sigma = 1.394$ S/m; $\epsilon_r = 38.335$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3360; ConvF(5.27, 5.27, 5.27); Calibrated: 17/08/2018;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1543; Calibrated: 08/03/2018
- Phantom: Twin SAM A (Site 65); Type: SAM 4.0; Serial: 1031
- ; SEMCAD X Version 14.6.10 (7417)

Configuration/d=10mm, Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 12.9 W/kg

Configuration/d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 97.38 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 17.8 W/kg

SAR(1 g) = 9.91 W/kg; SAR(10 g) = 5.23 W/kg

Maximum value of SAR (measured) = 12.5 W/kg

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903949JD01B

Page 6 of 10

Impedance Measurement Plot for Head Stimulating Liquid (HSL)

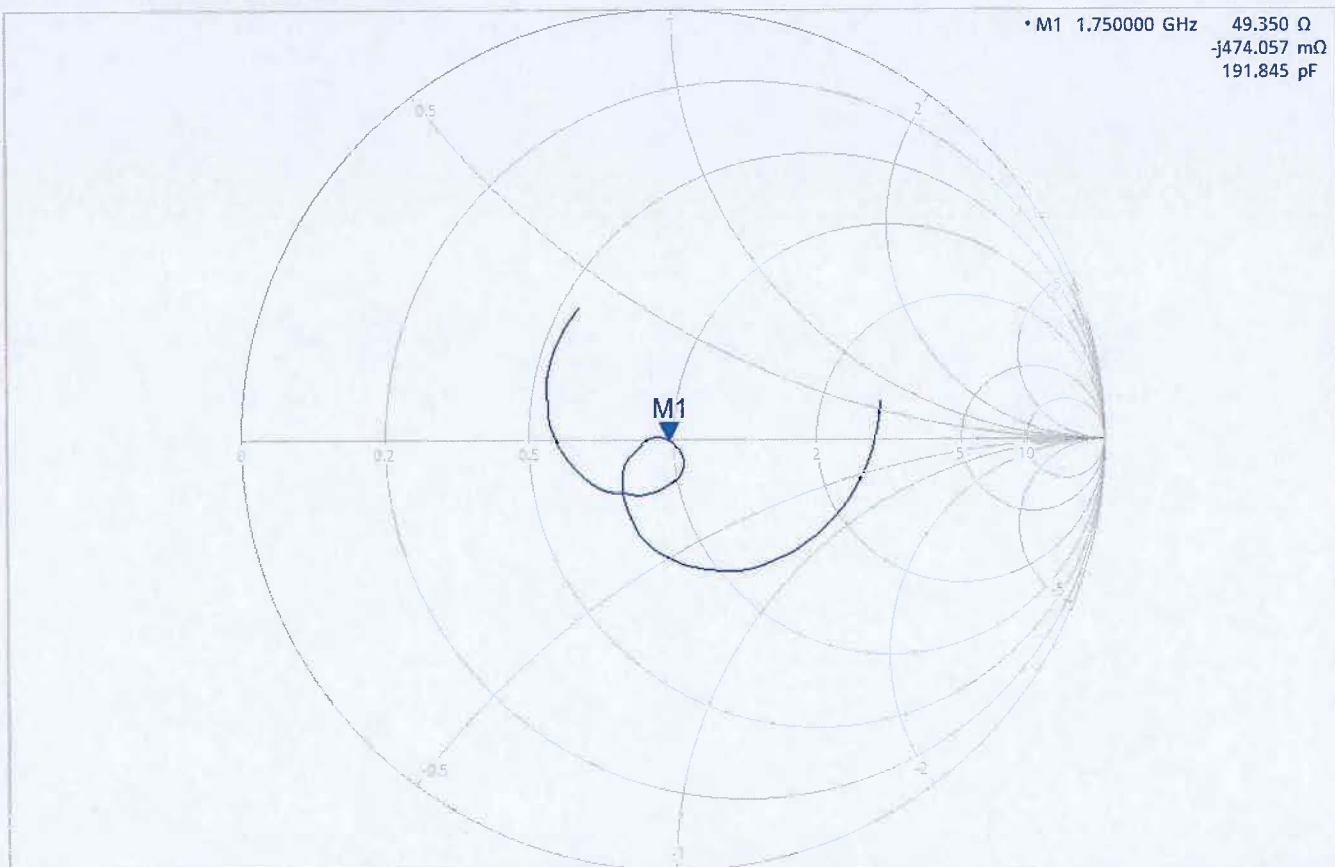


10/2/2018 3:23:43 PM
1328.5170K92-100151-MV

Trc1 — S11 Smith 200 mU/ Ref 1 U Cal

1

• M1 1.750000 GHz 49.350 Ω
-j474.057 m Ω
191.845 pF



Ch1 Center 1.75 GHz

Pwr -10 dBm Bw 10 kHz

Span 400 MHz

CERTIFICATE OF CALIBRATION

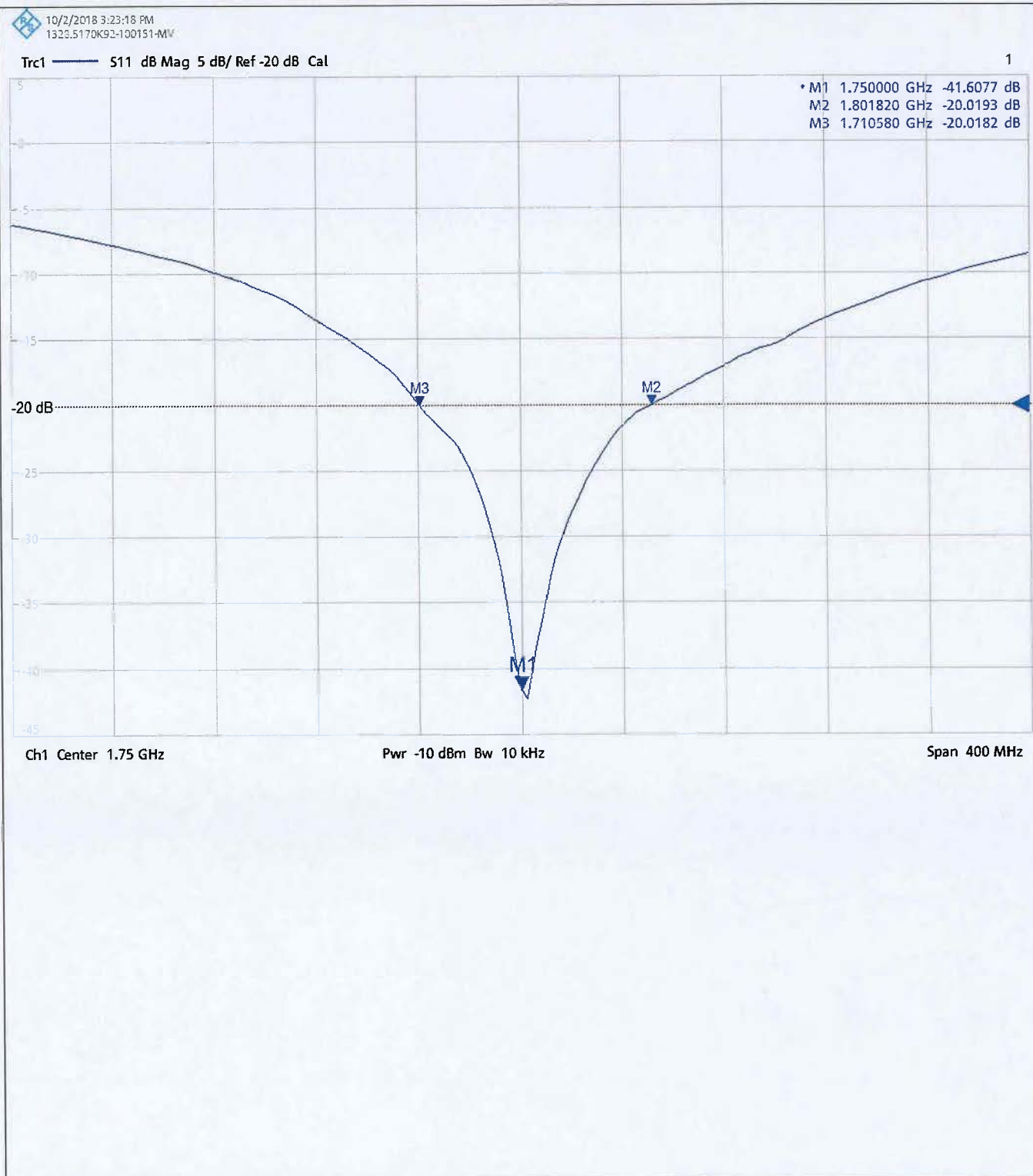
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903949JD01B

Page 7 of 10

Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

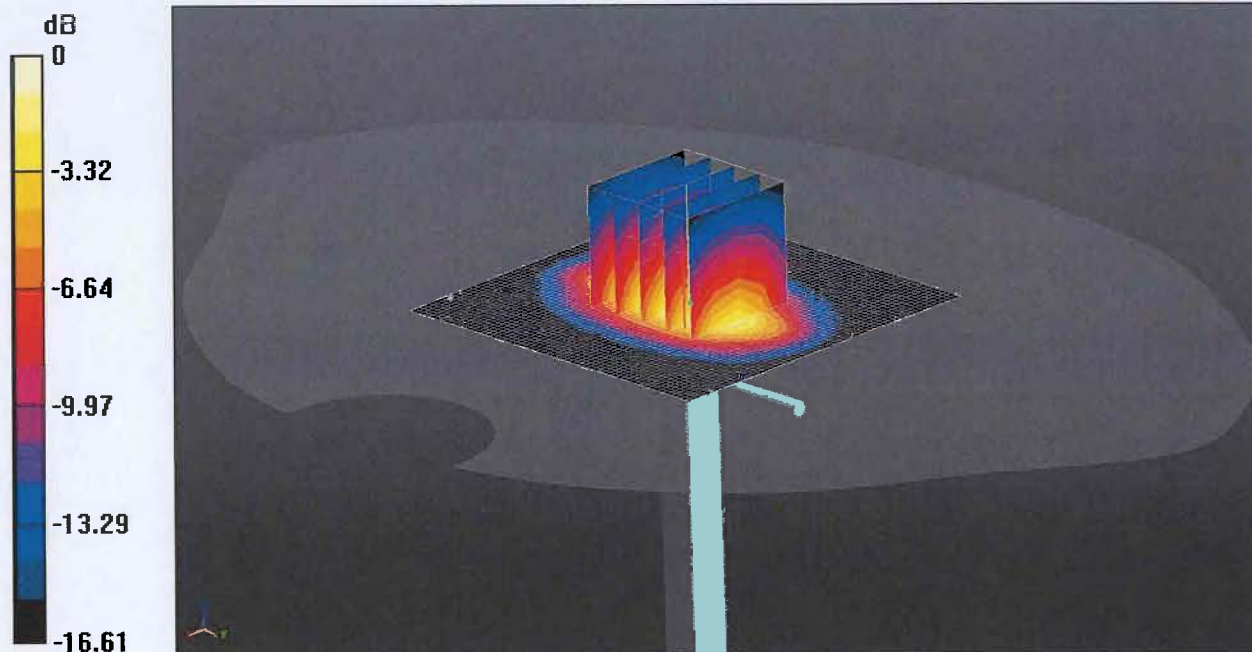
UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903949JD01B

Page 8 of 10

DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: D1750V2 - SN1053; Type: D1750V2; Serial: SN1053



0 dB = 12.8 W/kg \approx 11.07 dBW/kg

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

Medium: 1450, 1750, 2300 5% MHz MSL Medium parameters used: $f = 1750$ MHz; $\sigma = 1.478$ S/m; $\epsilon_r = 52.059$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3360; ConvF(4.92, 4.92, 4.92); Calibrated: 17/08/2018;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1543; Calibrated: 08/03/2018
- Phantom: Twin SAM B (Site 65); Type: SAM 8.0; Serial: 1945
- ; SEMCAD X Version 14.6.10 (7417)

Configuration/d=10mm, Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 12.8 W/kg

Configuration/d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 96.33 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 17.9 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.41 W/kg

Maximum value of SAR (measured) = 12.8 W/kg

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903949JD01B

Page 9 of 10

Impedance Measurement Plot for Body Stimulating Liquid (MSL)

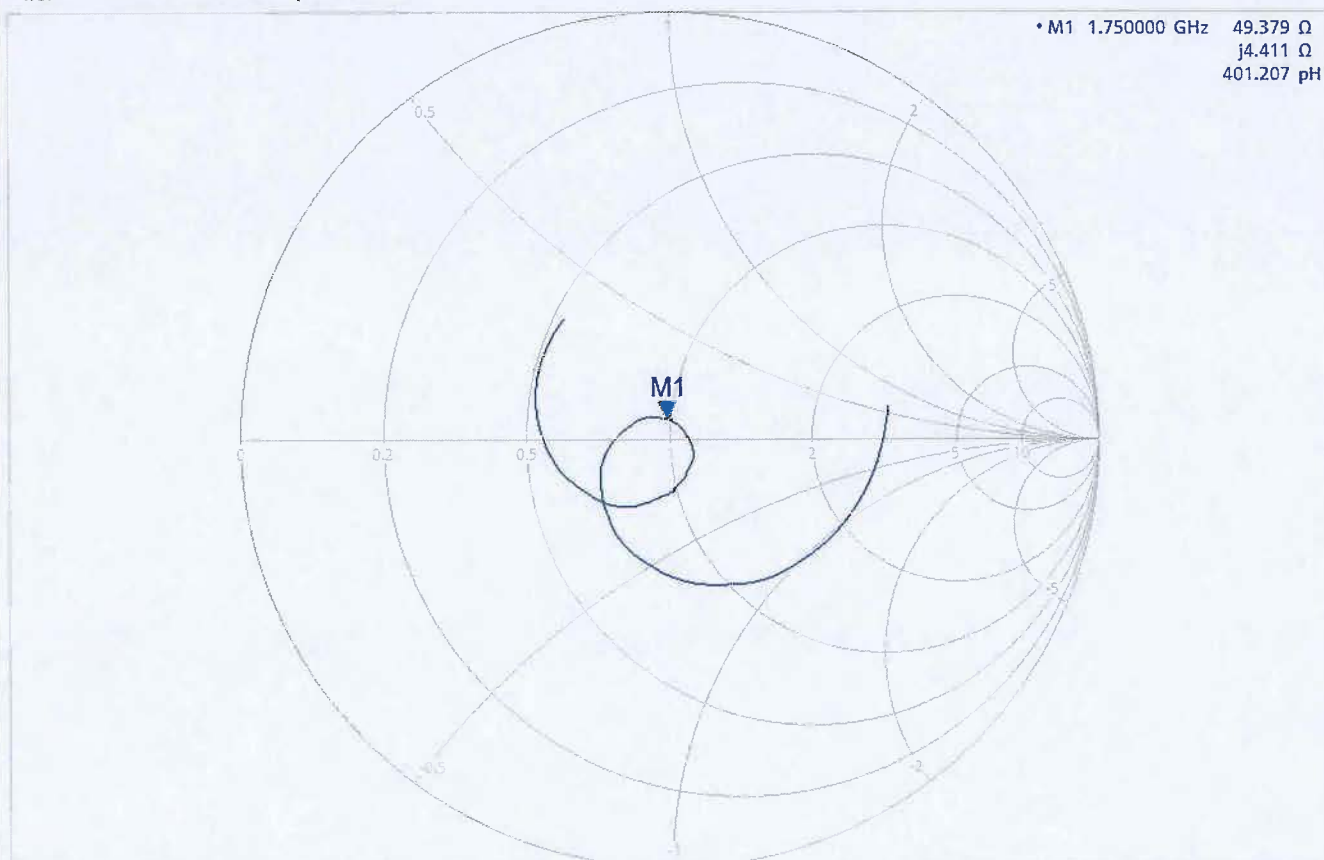


10/2/2018 3:13:34 PM
1328.5170K92-100151-MV

Trc1 — S11 Smith 200 mU/ Ref 1 U Cal

1

• M1 1.750000 GHz 49.379 Ω
j4.411 Ω
401.207 pH



Ch1 Center 1.75 GHz

Pwr -10 dBm Bw 10 kHz

Span 400 MHz

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
11903949JD01B

Page 10 of 10

Return Loss Measurement Plot for Body Stimulating Liquid (MSL)

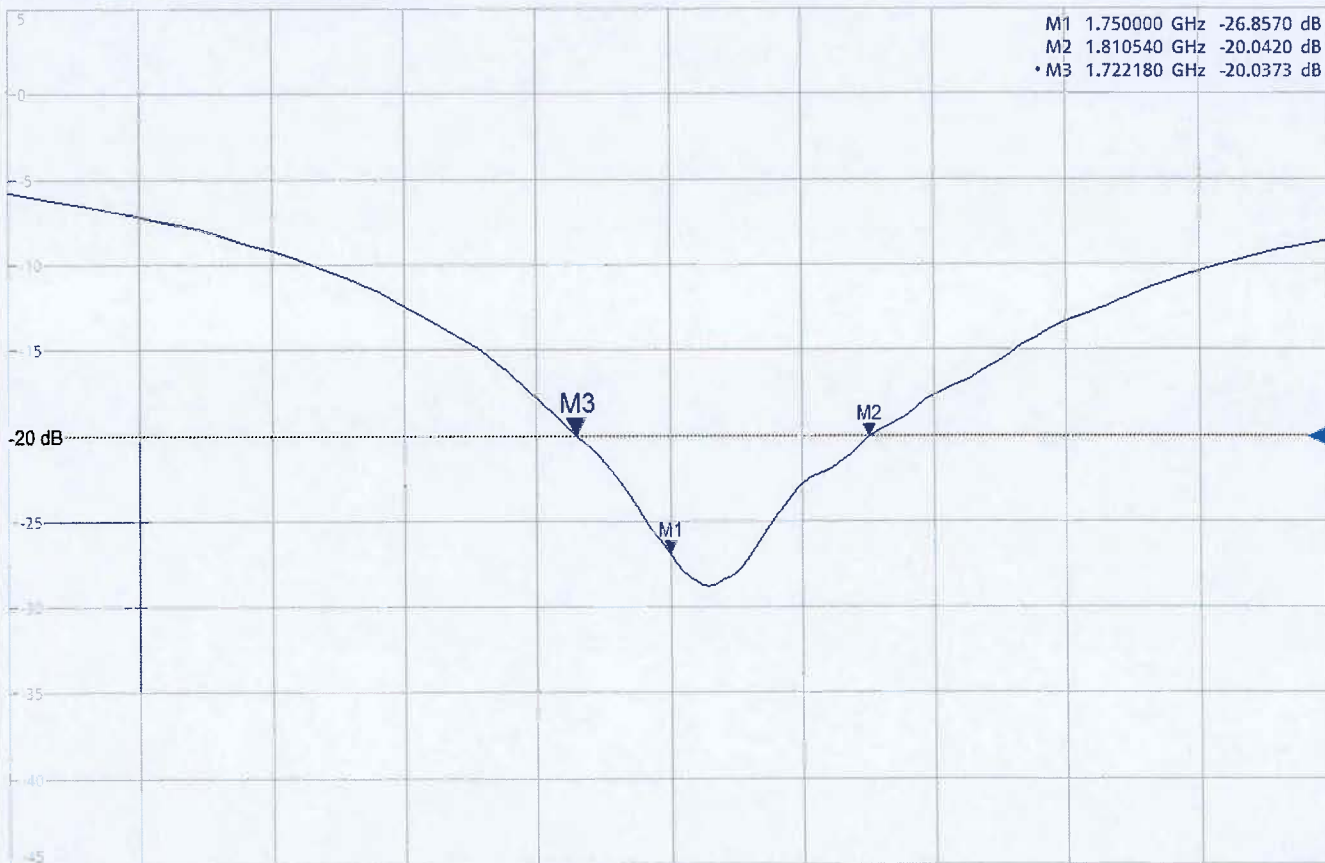


10/2/2018 3:15:00 PM
1326.5170K92-100151-MV

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

1

M1 1.750000 GHz -26.8570 dB
M2 1.810540 GHz -20.0420 dB
• M3 1.722180 GHz -20.0373 dB





Ch1 Center 1.75 GHz


Pwr -10 dBm Bw 10 kHz

Span 400 MHz

Calibration Certificate Label:

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 11903949JD01B</p> <p>Instrument ID: 1053</p> <p>Calibration Date: 02/Oct/2018</p> <p>Calibration Due Date:</p>
---	---

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 11903949JD01B</p> <p>Instrument ID: 1053</p> <p>Calibration Date: 02/Oct/2018</p> <p>Calibration Due Date:</p>
---	---

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 11903949JD01B</p> <p>Instrument ID: 1053</p> <p>Calibration Date: 02/Oct/2018</p> <p>Calibration Due Date:</p>
--	---

CERTIFICATE OF CALIBRATION

ISSUED BY **UL VS LTD**

DATE OF ISSUE: 16/Oct/2018

CERTIFICATE NUMBER : 12134285JD01D



5248

UL VS LTD
UNIT 1 HORIZON
KINGSLAND PARK, WADE ROAD
BASINGSTOKE, HAMPSHIRE
RG24 8AH, 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:	08/Oct/2018
Manufacturer:	SPEAG		
Type/Model Number:	D1900V2		
Serial Number:	5d163		
Calibration Date:	16/Oct/2018		
Calibrated By:	Chanthu Thevarajah Senior Engineer		
Signature:	A handwritten signature in black ink, appearing to be '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.

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

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134285JD01D

Page 2 of 10

The calibration methods and procedures used were as detailed in:

1. **IEC 62209-1:2016**: 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)
PRE0178318	Data Acquisition Electronics	SPEAG	DAE4	1543	08 Mar 2018	12
PRE0178315	Probe	SPEAG	ES3DV3	3360	17 Aug 2018	12
PRE0178326	Dipole	SPEAG	D1900V2	5d227	07 Mar 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
PRE0151154	Network Analyser	Rhode & Schwarz	ZND8	100151	14 Dec 2017	12
PRE0151877	Calibration Kit	Rhode & Schwarz	ZV-Z135	102947-Bt	27 Apr 2018	12
PRE0178154	Signal Generator	Rhode & Schwarz	SMB 100A	175325	09 Apr 2018	12

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134285JD01D

Page 3 of 10

SAR System Specification

Robot System Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Robot Serial Number:	F17/5ENYG1/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	22.0 °C	22.0 °C	21.1°C	21.5°C	ϵ_r	40.00	39.71	± 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	10.60 W/Kg	42.19 W/Kg	± 17.57%
	SAR averaged over 10g	5.46 W/Kg	21.73 W/Kg	± 17.32%

Antenna Parameters – Head Simulating Liquid (HSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Head	Impedance	47.246 Ω -3.29 j Ω	± 0.28 Ω ± 0.044 j Ω
	Return Loss	27.20	± 2.03 dB

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134285JD01D

Page 4 of 10

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	20.0 °C	21.0 °C	19.9°C	20.5°C	ϵ_r	53.30	53.10	± 5%
						σ	1.52	1.58	± 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	10.70 W/Kg	42.59 W/Kg	± 18.06%
	SAR averaged over 10g	5.57 W/Kg	22.17 W/Kg	± 17.44%

Antenna Parameters – Body Simulating Liquid (MSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Body	Impedance	52.08 Ω -5.44 j Ω	± 0.28 Ω ± 0.044 j Ω
	Return Loss	25.11	± 2.03 dB

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

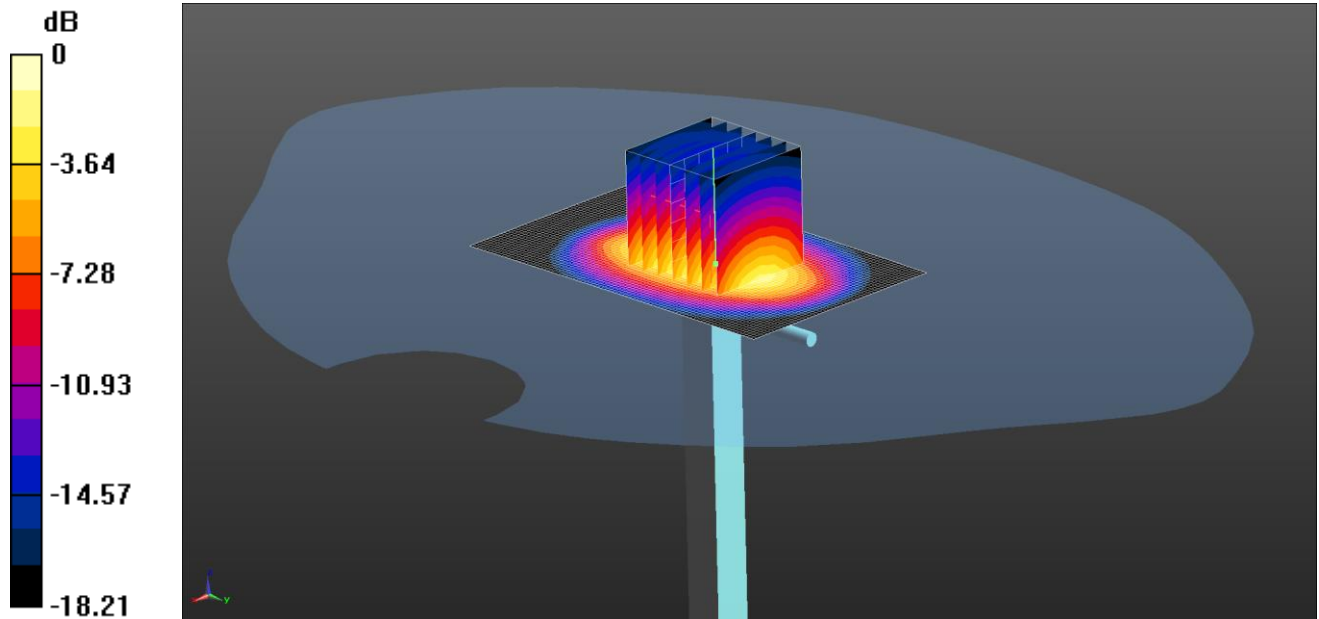
UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134285JD01D

Page 5 of 10

DASY Validation Scan for Head Stimulating Liquid (HSL)

DUT: D1900V2 - SN5d163; Type: D1900V2; Serial: SN5d163



0 dB = 13.5 W/kg = 11.30 dBW/kg

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

Medium: 1900 5% MHz HSL Medium parameters used: $f = 1900$ MHz; $\sigma = 1.444$ S/m; $\epsilon_r = 39.709$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3360; ConvF(5.11, 5.11, 5.11); Calibrated: 17/08/2018;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1543; Calibrated: 08/03/2018
- Phantom: Twin SAM A (Site 65); Type: SAM 8.0; Serial: TP:1945
- ; SEMCAD X Version 14.6.10 (7417)

SAR/d=10mm, Pin=250mW/Area Scan (51x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 13.8 W/kg

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

Reference Value = 100.1 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 19.9 W/kg

SAR(1 g) = 10.6 W/kg; SAR(10 g) = 5.46 W/kg

Maximum value of SAR (measured) = 13.5 W/kg

CERTIFICATE OF CALIBRATION

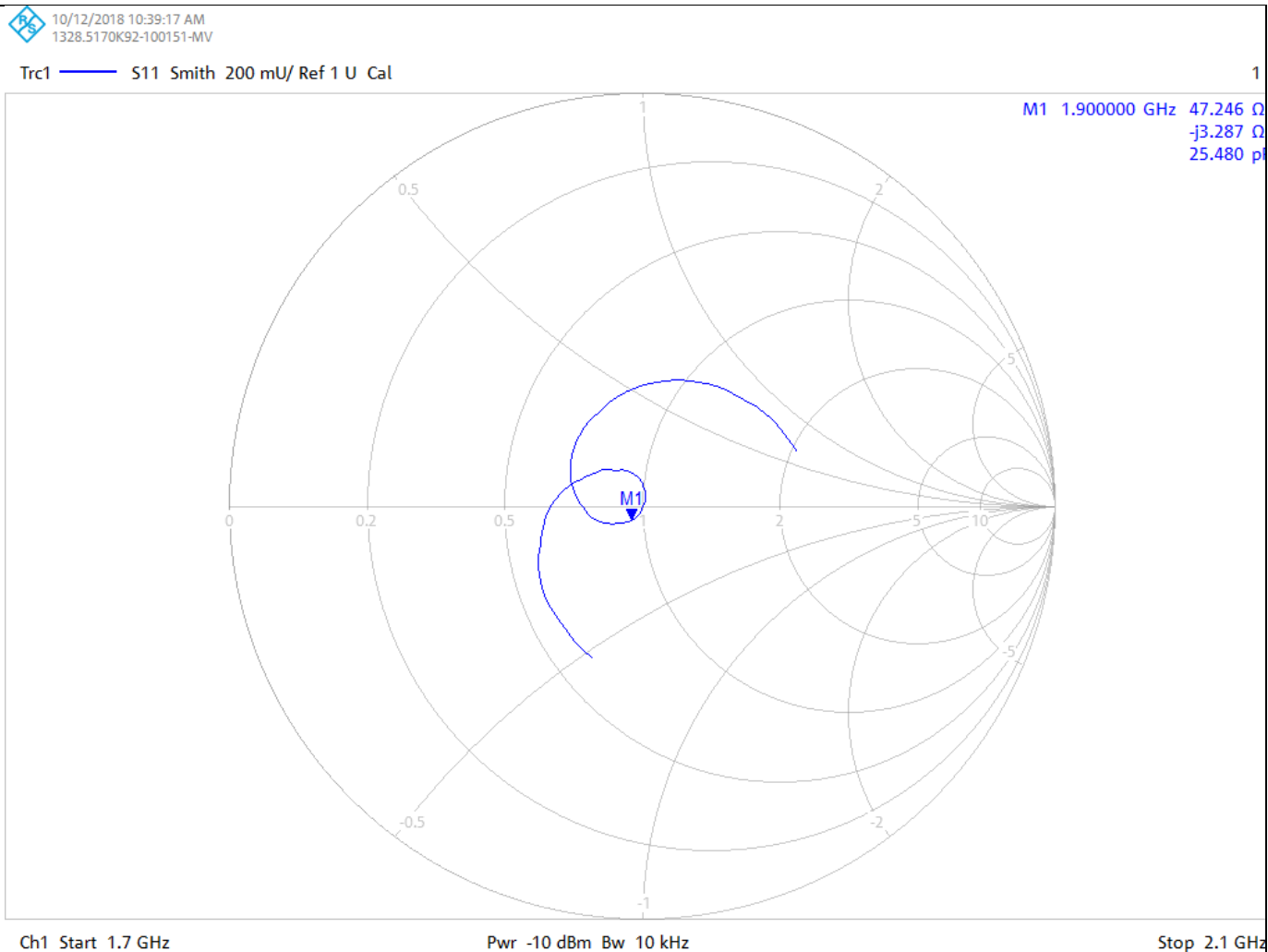
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134285JD01D

Page 6 of 10

Impedance Measurement Plot for Head Stimulating Liquid (HSL)



CERTIFICATE OF CALIBRATION

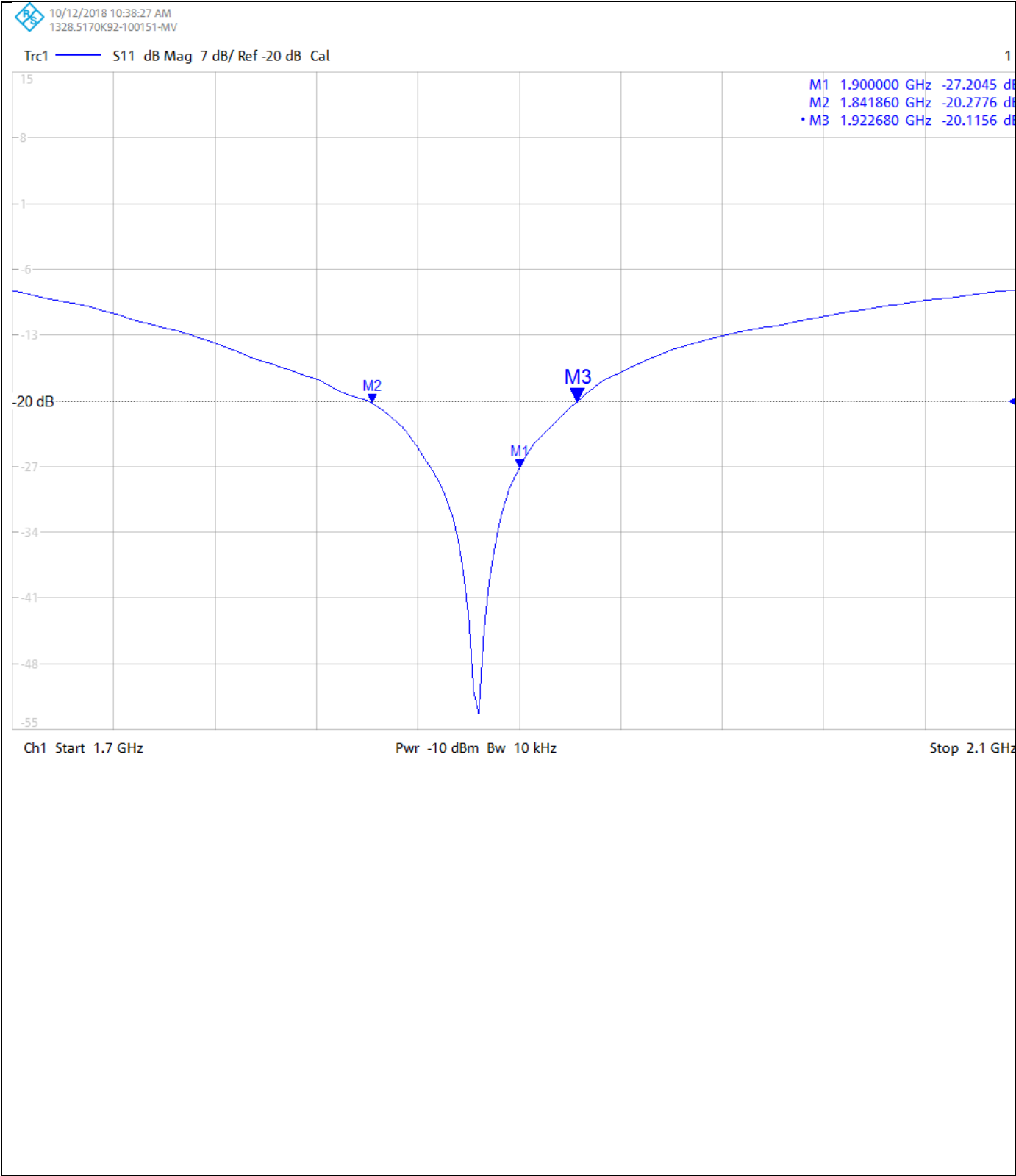
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134285JD01D

Page 7 of 10

Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

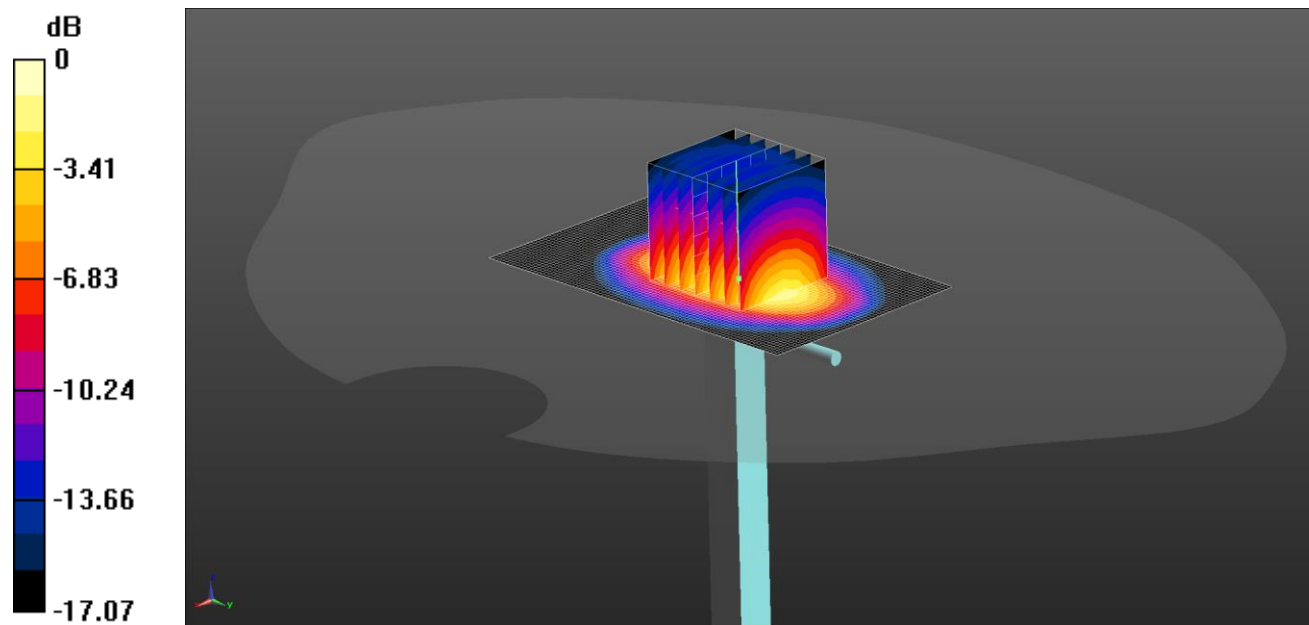
UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134285JD01D

Page 8 of 10

DASY Validation Scan for Body Stimulating Liquid (MSL)

DUT: D1900V2 - SN5d163; Type: D1900V2; Serial: SN5d163



0 dB = 13.7 W/kg = 11.37 dBW/kg

Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 900, 1750, 1800, 1900 5% MHz MSL Medium parameters used: $f = 1900$ MHz; $\sigma = 1.583$ S/m; $\epsilon_r = 53.097$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV3 - SN3360; ConvF(4.77, 4.77, 4.77); Calibrated: 17/08/2018;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1543; Calibrated: 08/03/2018
- Phantom: Twin SAM A (Site 65); Type: SAM 5.0; Serial: TP:1836
- ; SEMCAD X Version 14.6.10 (7417)

SAR/d=10mm, Pin=250mW/Area Scan (51x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 14.3 W/kg

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

Reference Value = 3.856 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 19.2 W/kg

SAR(1 g) = 10.7 W/kg; SAR(10 g) = 5.57 W/kg

Maximum value of SAR (measured) = 13.7 W/kg

CERTIFICATE OF CALIBRATION

ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248

CERTIFICATE
NUMBER :
12134285JD01D

Page 9 of 10

Impedance Measurement Plot for Body Stimulating Liquid (MSL)

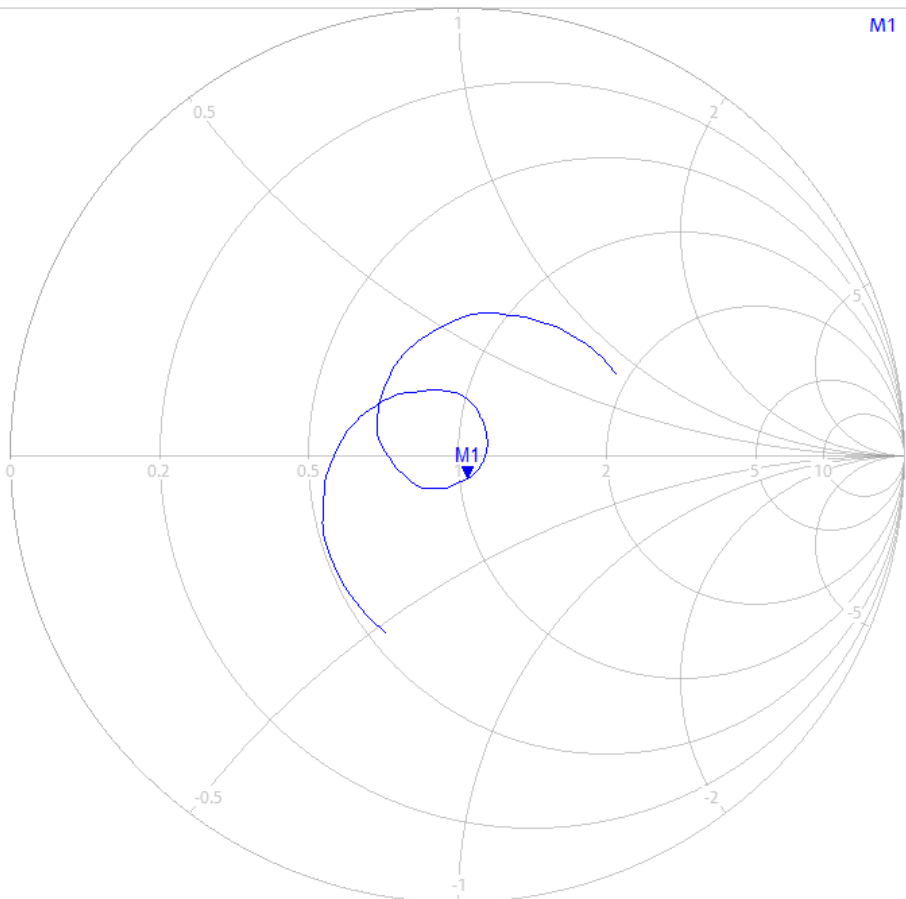


10/15/2018 2:06:28 PM
1328.5170K92-100151-MV

Trc1 — S11 Smith 200 mU/ Ref 1 U Cal

1

M1 1.900000 GHz 52.082 Ω
-j5.437 Ω
15.408 pF



Ch1 Center 1.9 GHz

Pwr -10 dBm Bw 10 kHz

Span 400 MHz

CERTIFICATE OF CALIBRATION

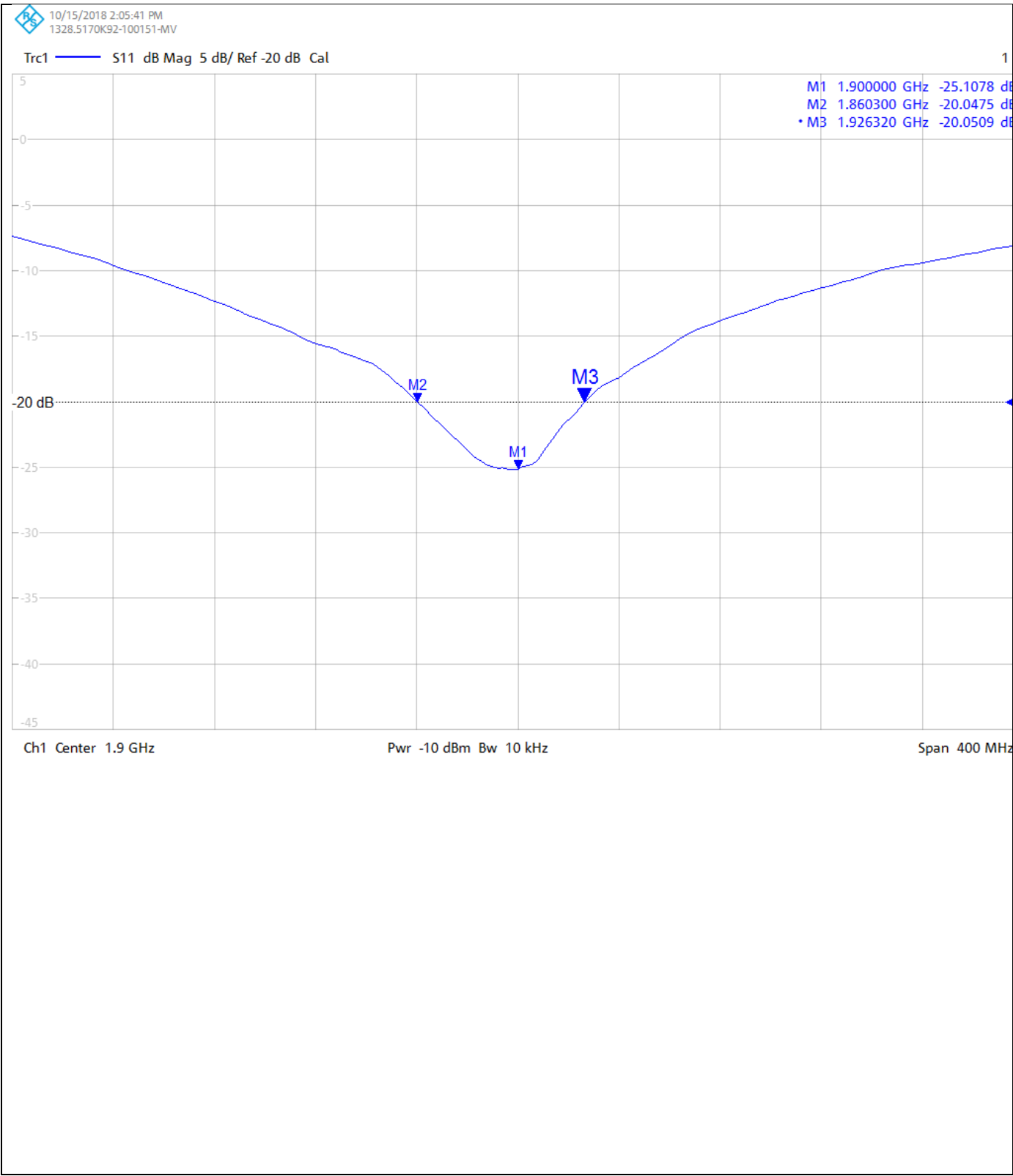
ISSUED BY UL VS LTD

UKAS Accredited Calibration Laboratory No. 5248


CERTIFICATE
NUMBER :
12134285JD01D


Page 10 of 10


Return Loss Measurement Plot for Body Stimulating Liquid (MSL)



Calibration Certificate Label:

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12134285JD01D</p> <p>Instrument ID: 5d163</p> <p>Calibration Date: 16/Oct/2018</p> <p>Calibration Due Date:</p>
---	--

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12134285JD01D</p> <p>Instrument ID: 5d163</p> <p>Calibration Date: 16/Oct/2018</p> <p>Calibration Due Date:</p>
---	--

	<p>UL VS LTD - Tel: +44 (0) 1256312000</p> <p>Certificate Number: 12134285JD01D</p> <p>Instrument ID: 5d163</p> <p>Calibration Date: 16/Oct/2018</p> <p>Calibration Due Date:</p>
---	--