

CERTIFICATE OF CALIBRATION

ISSUED BY UL INTERNATIONAL (UK) LTD

DATE OF ISSUE: 05/Dec/2022 CERTIFICATE NUMBER :
4790351568JD05B



5772

UL INTERNATIONAL (UK) LTD
UNIT 1-3 HORIZON
KINGSLAND PARK, WADE ROAD
BASINGSTOKE, HAMPSHIRE
RG24 8AH, UK
TEL: +44 (0) 1256 312100
FAX: +44 (0) 1256 312001
Email: LST.UK.Calibration@ul.com



Page 1 of 6

APPROVED SIGNATORY

Naseer Mirza

Customer :
UL LLC
12 Laboratory Dr.
RTP, NC 27709 USA

Equipment Details:

Description:	Dipole Validation Kit	Date of Receipt:	24/Nov/2022
Manufacturer:	Speag		
Type/Model Number:	D3700V2		
Serial Number:	1110		
Calibration Date:	30/Nov/2022		
Calibrated By:	Masood Khan Lab Test Engineer		

Signature:

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

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

Use of the UKAS mark demonstrates that compliance with the requirements of BS/EN/ISO/IEC 17025:2017 has been independently assessed.

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%.

CERTIFICATE OF CALIBRATION

ISSUED BY UL INTERNATIONAL (UK) LTD

UKAS Accredited Calibration Laboratory No. 5772

CERTIFICATE
NUMBER :
4790351568JD05B

Page 2 of 6

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. **DASY 6 System Handbook**
6. **Dipole Calibration Procedure V1.3:** Calibration performed as per internal procedure

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)
PRE0178316	Data Acquisition Equipment	SPEAG	DAE4	1541	22 Mar 2022	12
PRE0135113	Probe	SPEAG	EX3DV4	3995	20 Apr 2022	12
PRE0242420	Dipole	SPEAG	D3700V2	SN1121	06 Oct 2022	12
PRE0151451	Power Monitoring Kit	Art-Fi	ART 100850-01	0001	Cal as part of System	-
PRE0151441	Power Sensor	Rhode & Schwarz	NRP8S	102481	31 Mar 2022	12
PRE0151154	Vector Network Analyser	Rohde & Schwarz	ZND	100151	01 Apr 2022	12
212645	Calibration Kit	Rohde & Schwarz	ZN-Z135	101005	Cal as part of System	-
PRE0135028	Signal Generator	Rohde & Schwarz	SME 06	1038.6002.06	30 Mar 2022	12

CERTIFICATE OF CALIBRATION

ISSUED BY UL INTERNATIONAL (UK) LTD

UKAS Accredited Calibration Laboratory No. 5772

CERTIFICATE
NUMBER :
4790351568JD05B

Page 3 of 6

SAR System Specification

Robot System Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Robot Serial Number:	F17/5ENYG1/A/01
DASY Version:	cDASY6.14.0.959
Phantom:	Flat section of SAM Twin Phantom
Distance Dipole Centre:	10 mm (with spacer)
Frequency:	3700 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	3700	20.1	20.2	20.4	20.5	ϵ_r	37.70	38.71	± 5%
						σ	3.12	3.00	± 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	16.10 W/Kg	64.09 W/Kg	+ 20.70 / - 20.50
	SAR averaged over 10g	5.930 W/Kg	23.60 W/Kg	+ 20.45 / - 20.62

Antenna Parameters – Head Simulating Liquid (HSL)

Simulant Liquid	Parameter	Measured Level	Uncertainty (%)
Head	Impedance	56.80 1.675j Ω	± 10.83
	Return Loss	24.00 dB	± 1.37

CERTIFICATE OF CALIBRATION

ISSUED BY UL INTERNATIONAL (UK) LTD

UKAS Accredited Calibration Laboratory No. 5772

CERTIFICATE
NUMBER :
4790351568JD05B

Page 4 of 6

DASY Validation Scan for Head Stimulating Liquid (HSL)

Date: 28 Nov 2022

DUT: D3700V2; Type: Dipole; Serial: SN1110;



Communication System: CW UID: 0; Frequency: 3700.0 MHz; Duty Cycle: 1;
Medium: HSL; Site65_28Nov2022_123958_Head - 3500 3700 6500 5%.prn; Medium
parameters used: $f = 3700.0$ MHz; $\sigma = 3$ S/m; $\epsilon_r = 38.7$; $\rho = 1000$ kg/m³; $\Delta\epsilon_r = 2.67$ %; $\Delta\sigma = -3.85$ %; No correction

Phantom section: Flat;

DASY 6 Configuration:

- Laboratory Name: Site65;
- Probe: EX3DV4 - SN3995; ConvF(7.3, 7.3, 7.3); Calibrated: 20 Apr 2022
- Sensor-Surface: 1.4 mm; VMS + 6p
- Electronics: DAE4 - SN1541; Calibrated: 22 Mar 2022
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 1945
- Measurement SW: cDASY6.14.0.959

Area Scan (40x80): Interpolated grid: dx=10 mm, dy=10 mm

Zoom Scan1(28x28x28): Measurement grid: dx=5 mm, dy=5 mm, dz=1.4 mm; Grading Ratio: 1.5; Reference Value = 22.830 V/m; Power Drift = -0.01 dB

Minimum horizontal 3dB distance: 8.0 mm;

Vertical M2/M1 Ratio: 73.3 %;

SAR(1 g) = 16.100 W/kg; SAR(10 g) = 5.930 W/kg

CERTIFICATE OF CALIBRATION

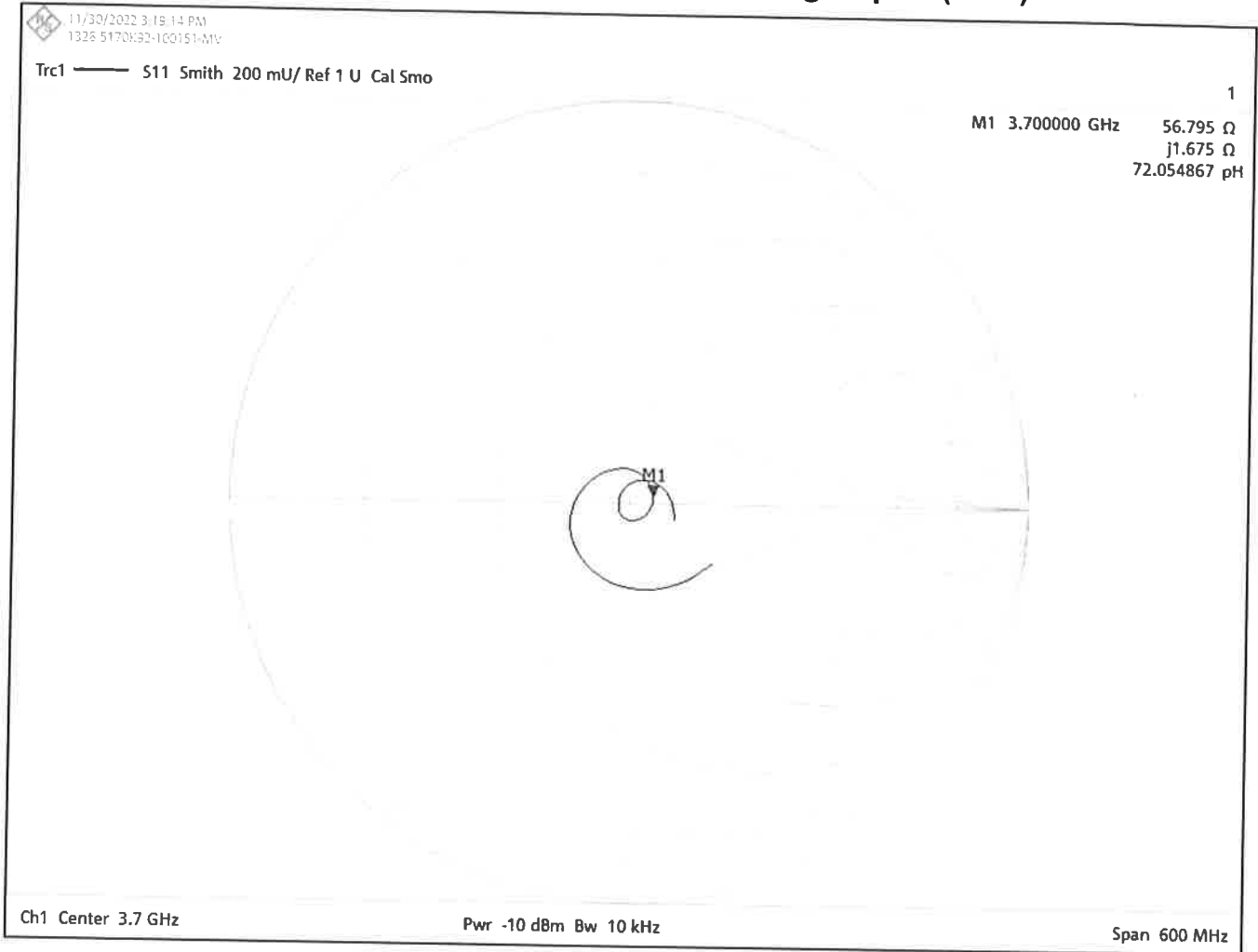
ISSUED BY UL INTERNATIONAL (UK) LTD

UKAS Accredited Calibration Laboratory No. 5772

CERTIFICATE
NUMBER :
4790351568JD05B

Page 5 of 6

Impedance Measurement Plot for Head Stimulating Liquid (HSL)



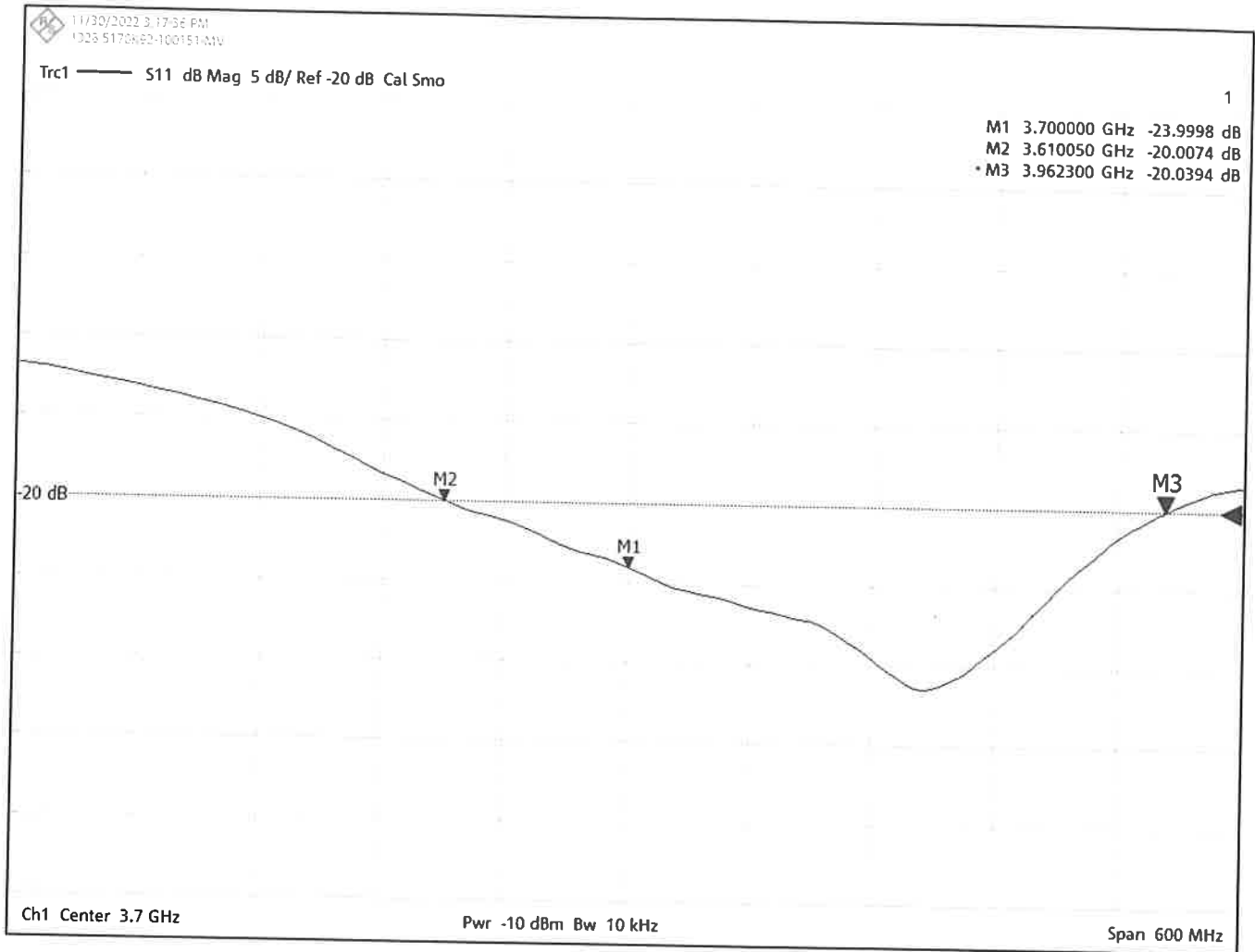
CERTIFICATE OF CALIBRATION ISSUED BY UL INTERNATIONAL (UK) LTD

UKAS Accredited Calibration Laboratory No. 5772


CERTIFICATE
NUMBER :
4790351568JD05B


Page 6 of 6


Return Loss Measurement Plot for Head Stimulating Liquid (HSL)



Calibration Certificate Label:

	<p>UL INTERNATIONAL (UK) LTD Tel: +44 (0) 1256312100</p> <p>Certificate Number: 4790351568JD05B</p> <p>Instrument ID: 1110</p> <p>Calibration Date: 30/Nov/2022</p> <p>Calibration Due Date:</p>
---	--

	<p>UL INTERNATIONAL (UK) LTD Tel: +44 (0) 1256312100</p> <p>Certificate Number: 4790351568JD05B</p> <p>Instrument ID: 1110</p> <p>Calibration Date: 30/Nov/2022</p> <p>Calibration Due Date:</p>
---	--

	<p>UL INTERNATIONAL (UK) LTD Tel: +44 (0) 1256312100</p> <p>Certificate Number: 4790351568JD05B</p> <p>Instrument ID: 1110</p> <p>Calibration Date: 30/Nov/2022</p> <p>Calibration Due Date:</p>
---	--