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Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D300V3-1014_May13**

CALIBRATION CERTIFICATE

Object **D300V3 - SN: 1014**

Calibration procedure(s) **QA CAL-15.v7
Calibration procedure for dipole validation kits below 700 MHz**

Calibration date: **May 06, 2013**

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 E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ET3DV6	SN: 1507	28-Dec-12 (No. ET3-1507_Dec12)	Dec-13
DAE4	SN: 654	10-Apr-13 (No. DAE4-654_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: **Claudio Leubler** Laboratory Technician

Signature

Approved by: **Katja Pokovic** Technical Manager

Issued: May 6, 2013

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



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Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- d) 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	V52.8.6
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	300 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	45.3	0.87 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	44.6 \pm 6 %	0.87 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	0.725 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	2.89 W/kg \pm 18.1 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	0.478 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	1.91 W/kg \pm 17.6 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	58.2	0.92 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	57.4 \pm 6 %	0.93 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	0.721 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	2.85 W/kg \pm 18.1 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	0.486 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	1.92 W/kg \pm 17.6 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	57.5 Ω - 4.1 j Ω
Return Loss	- 22.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	57.4 Ω - 4.9 j Ω
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.744 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 30, 2010

DASY5 Validation Report for Head TSL

Date: 06.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 300 MHz; Type: D300V3; Serial: D300V3 - SN: 1014

Communication System: UID 0 - CW; Frequency: 300 MHz

Medium parameters used: $f = 300$ MHz; $\sigma = 0.87$ S/m; $\epsilon_r = 44.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(7.32, 7.32, 7.32); Calibrated: 28.12.2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 10.04.2013
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

Dipole Calibration for Head Tissue/ $d=15$ mm, $P_{in}=250$ mW/Zoom Scan (7x7x7)/Cube 0:

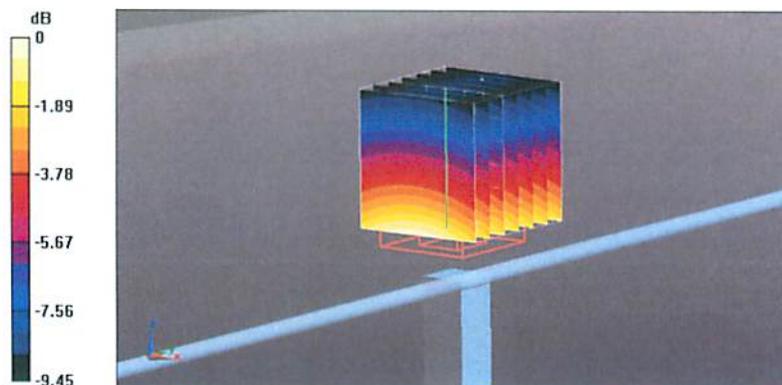
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 30.216 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 1.21 W/kg

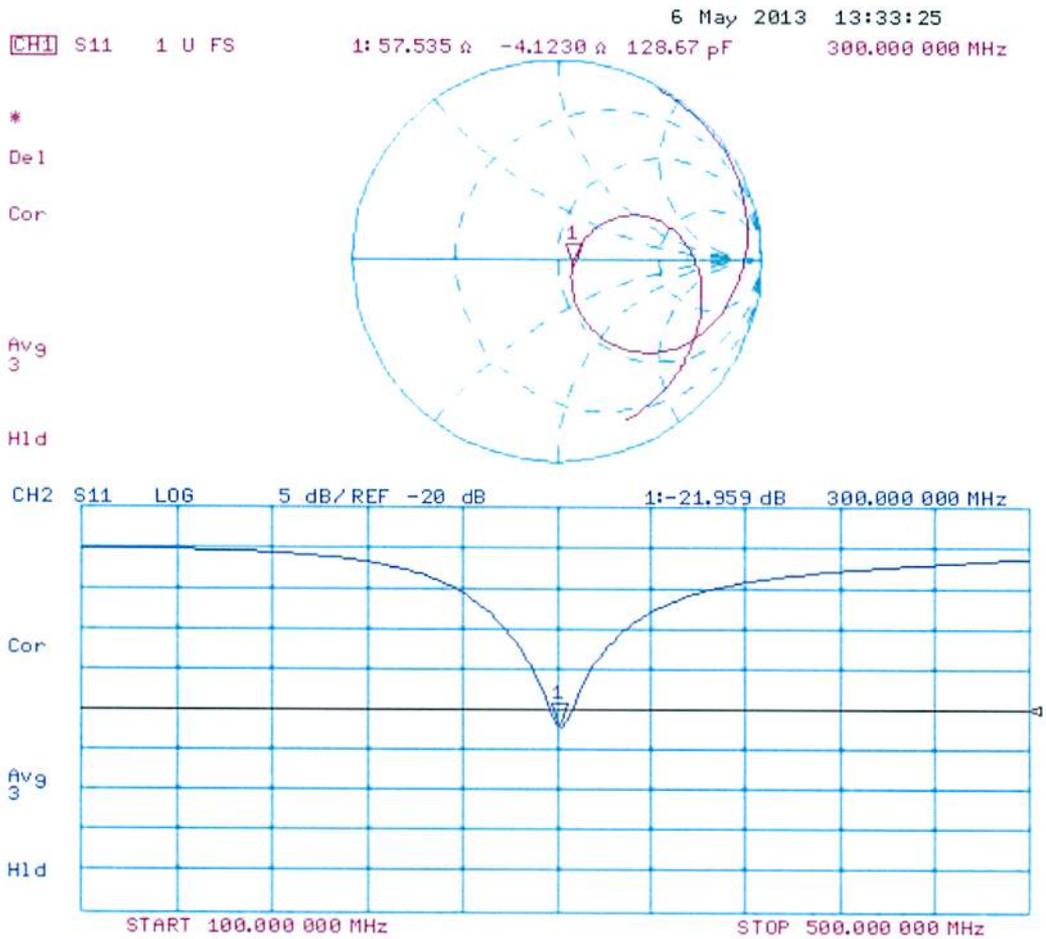
SAR(1 g) = 0.725 W/kg; SAR(10 g) = 0.478 W/kg

Maximum value of SAR (measured) = 0.766 W/kg



0 dB = 0.766 W/kg = -1.16 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 06.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 300 MHz; Type: D300V3; Serial: D300V3 - SN: 1014

Communication System: UID 0 - CW; Frequency: 300 MHz

Medium parameters used: $f = 300$ MHz; $\sigma = 0.93$ S/m; $\epsilon_r = 57.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(7.08, 7.08, 7.08); Calibrated: 28.12.2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 10.04.2013
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

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

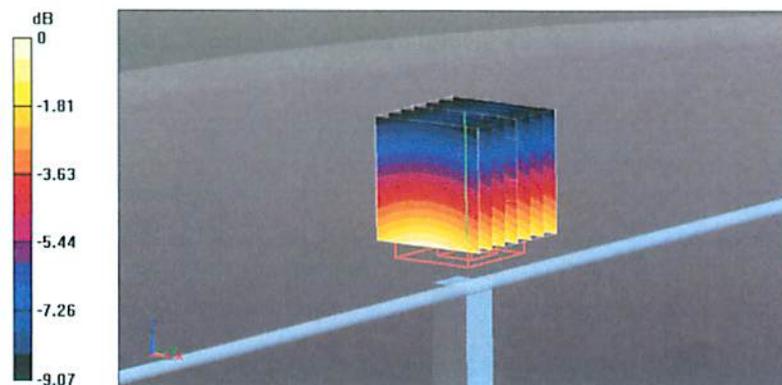
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 30.216 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 1.12 W/kg

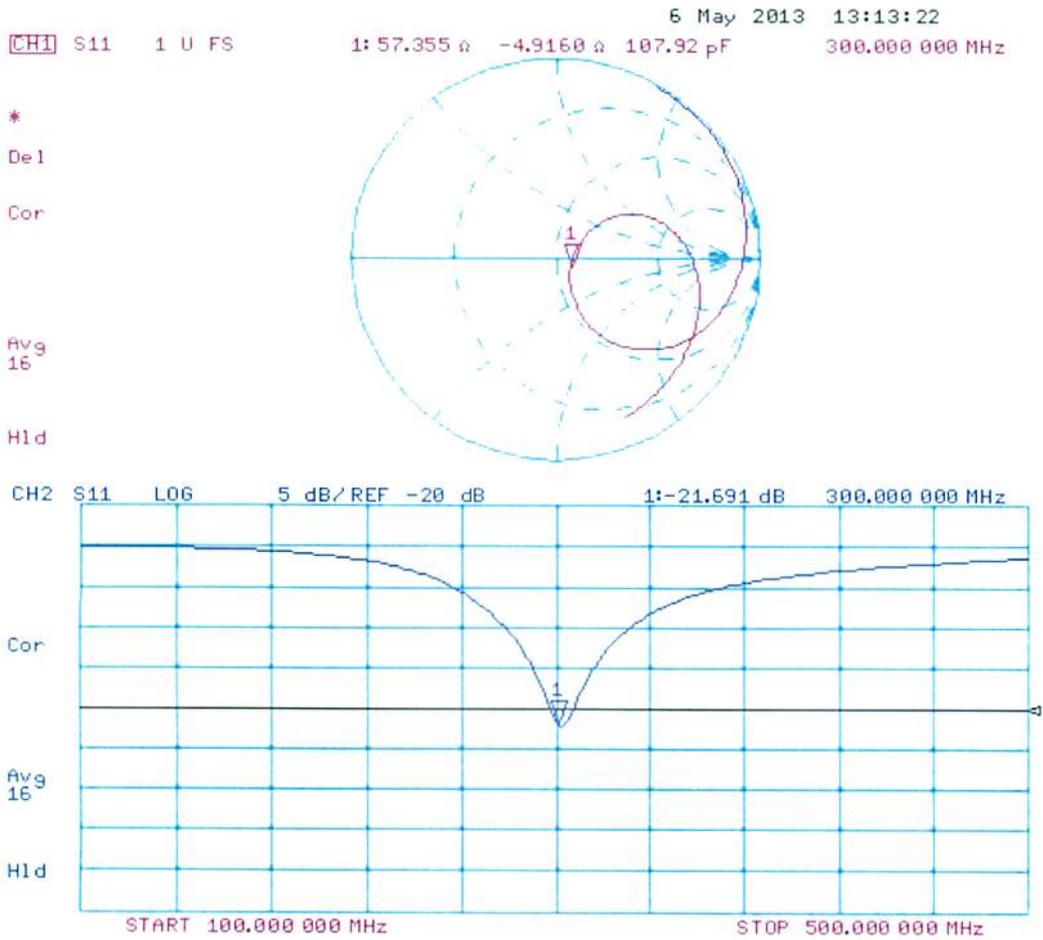
SAR(1 g) = 0.721 W/kg; SAR(10 g) = 0.486 W/kg

Maximum value of SAR (measured) = 0.767 W/kg



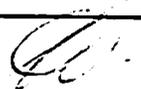
0 dB = 0.767 W/kg = -1.15 dBW/kg

Impedance Measurement Plot for Body TSL



**CUSTOMER
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DIPOLE REPAIR REPORT – SPEAG Production Center

PRODUCT		D300V3 DIPOLE	
SERIAL Nr.:		SN:1014	IN DATE: 29.04.2013
CUSTOMER:		Motorola EME	
DIPOLE REPAIR			
MATERIAL	WORK DESCRIPTION		WORKING TIME (h)
Dipole Arm	fixed <input type="radio"/>	exchanged <input type="radio"/>	re-soldered <input type="radio"/> hours
Dipole Connector	fixed <input type="radio"/>	exchanged <input checked="" type="radio"/>	cleaned <input type="radio"/> 2.50 hours
Gold Plating	fixed <input type="radio"/>	exchanged <input type="radio"/>	new gold plating <input type="radio"/> hours
Housing	fixed <input type="radio"/>	exchanged <input type="radio"/>	new label..... <input type="checkbox"/> hours
Disassemble/clean	fixed <input type="radio"/>	exchanged <input type="radio"/> <input type="checkbox"/> hours
.....	fixed <input type="radio"/>	exchanged <input type="radio"/> <input type="checkbox"/> hours
.....	fixed <input type="radio"/>	exchanged <input type="radio"/> <input type="checkbox"/> hours
Analysis:			hours
Final Assembly:			0.50 hours
Total hours			3.00 hours
COMMENTS:			
Customer informed on the damage of the dipole connector per e-mail (see attached picture). In order to re-establish full functionality, the connector was replaced. The cost for this repair is shown below. The dipole will be newly calibrated after this repair.			
CONDUCTED BY: 		APPROVED BY: 	
DATE: 30.04.2013		DATE: 30.04.2013	
REPAIR COST:			
MATERIAL COST:	150.00	USD <input checked="" type="checkbox"/>	Euro <input type="checkbox"/>
REPAIR:	405.00	USD <input checked="" type="checkbox"/>	Euro <input type="checkbox"/>
TOTAL COST:		QUOTATION #:	
555.00		10397	
APPROVED BY: 			
DATE: 30.04.2013			

