7. Information on the Testing Laboratories

We, EMTEK (SHENZHEN) CO., LTD., were founded in 2000 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

Site Description		
EMC Lab.	:	Accredited by CNAS,2016.10.24 The certificate is valid until 2022.10.28 The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005) The Certificate Registration Number is L2291. Accredited by TUV Rheinland Shenzhen 2016.5.19 The Laboratory has been assessed according to the requirements ISO/IEC 17025. Accredited by FCC, August 06, 2018 Designation Number: CN1204 Test Firm Registration Number: 882943 Accredited by A2LA, August 31, 2020 The Certificate Registration Number is 4321.01. Accredited by Industry Canada, November 09, 2018 The Conformity Assessment Body Identifier is CN0008.
Name of Firm	:	EMTEK(SHENZHEN) CO., LTD.
Site Location	:	Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

If you have any comments, please feel free to contact us at the following:

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TEL: 86-755-26954280
FAX: 86-755-26954282

Email: csg@emtek.com.cn
Web Site: www.emtek.com.cn

The road map of all our labs can be found in our web site also.

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Appendix A. SAR Plots of System Verification

The plots for system verificationwith largest deviation for each SAR system combination are shown as follows.

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2019/4/17

System Check_B2450

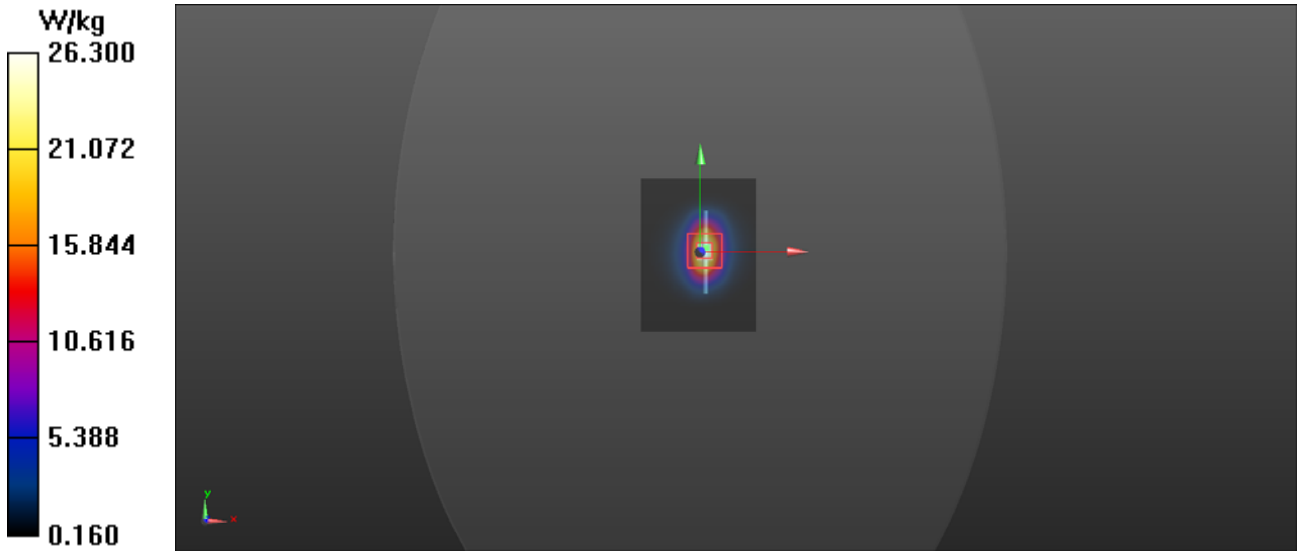
DUT: Dipole 2450 MHz; Type:D2450V2; SN:835

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: B2450 Medium parameters used: f = 2450 MHz; σ = 2.028 S/m; ε_r = 52.823; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.89, 7.89, 7.89); Calibrated: 2018/11/12;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2018/10/29
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 27.2 W/kg

Pin=250mW/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.8 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 32.3 W/kg
SAR(1 g) = 12.95 W/kg; SAR(10 g) = 6.11 W/kg
Maximum value of SAR (measured) = 26.3 W/kg



Appendix B. SAR Plots of SAR Measurement

The SAR plots for highest measured SAR in each exposure configuration, wireless mode and frequency band combination, and measured SAR > 1.5 W/kg are shown as follows.

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2019/4/17

802.11b-ch6-level47-top

DUT: X-431

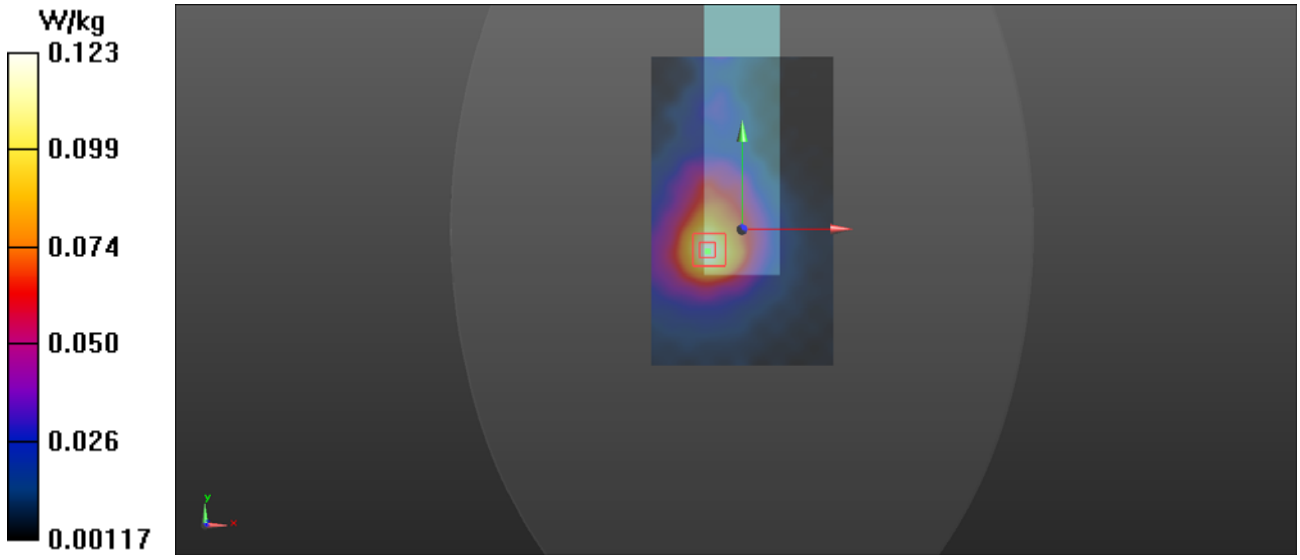
Communication System: 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: B2450 Medium parameters used: f = 2437 MHz; σ = 1.99 S/m; ε_r = 53.024; ρ = 1000 kg/m^3

Ambient Temperature：22.5 ℃; Liquid Temperature：21.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.89, 7.89, 7.89); Calibrated: 2018/11/12;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2018/10/29
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Body Top/Area Scan (101x171x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.126 W/kg

Body Top/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.215 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.151 W/kg
SAR(1 g) = 0.081 W/kg; SAR(10 g) = 0.045 W/kg
Maximum value of SAR (measured) = 0.123 W/kg



Appendix C. Calibration Certificate for Probe and Dipole

The calibration certificates are shown as follows.

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中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client : **Emtek** **Certificate No: Z18-60412**

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1418
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	October 29, 2018

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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	20-Jun-18 (CTTL, No.J18X05034)	June-19

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: October 31, 2018

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Glossary:

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.

- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.

- The report provide only calibration results for DAE, it does not contain other performance test results.

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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV
Low Range: 1LSB = 61nV , full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.115 ± 0.15% (k=2)	404.654 ± 0.15% (k=2)	404.334 ± 0.15% (k=2)
Low Range	3.98905 ± 0.7% (k=2)	4.00041 ± 0.7% (k=2)	3.97608 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	153° ± 1 °

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Client **Emtek** **Certificate No: Z18-60413**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3970
Calibration Procedure(s)	FF-Z11-004-01 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	November 12, 2018

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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	20-Jun-18 (CTTL, No.J18X05032)	Jun-19
Power sensor NRP-Z91	101547	20-Jun-18 (CTTL, No.J18X05032)	Jun-19
Power sensor NRP-Z91	101548	20-Jun-18 (CTTL, No.J18X05032)	Jun-19
Reference10dBAttenuator	18N50W-10dB	09-Feb-18(CTTL, No.J18X01133)	Feb-20
Reference20dBAttenuator	18N50W-20dB	09-Feb-18(CTTL, No.J18X01132)	Feb-20
Reference Probe EX3DV4	SN 3846	25-Jan-18(SPEAG,No.EX3-3846_Jan18)	Jan-19
DAE4	SN 777	15-Dec-17(SPEAG, No.DAE4-777_Dec17)	Dec -18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	21-Jun-18 (CTTL, No.J18X05033)	Jun-19
Network Analyzer E5071C	MY46110673	14-Jan-18 (CTTL, No.J18X00561)	Jan -19

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: November 14, 2018

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i θ=0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) 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

b) 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

c) 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

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below ConvF).
- *NORM(f)x,y,z = NORMx,y,z* frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- *Ax,y,z; Bx,y,z; Cx,y,z; VRx,y,z:* A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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Probe EX3DV4

SN: 3970

Calibrated: November 12, 2018

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3970

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)²)[A]	0.49	0.64	0.26	±10.0%
DCP(mV)[B]	102.4	105.2	96.5	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	165.4	±2.8%
		Y	0.0	0.0	1.0		196.6	
		Z	0.0	0.0	1.0		107.8	

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%.

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 5 and Page 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3970

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	10.62	10.62	10.62	0.40	0.80	±12.1%
835	41.5	0.90	10.33	10.33	10.33	0.17	1.14	±12.1%
900	41.5	0.97	10.19	10.19	10.19	0.22	1.11	±12.1%
1750	40.1	1.37	8.69	8.69	8.69	0.23	1.05	±12.1%
1900	40.0	1.40	8.34	8.34	8.34	0.25	1.02	±12.1%
2300	39.5	1.67	8.15	8.15	8.15	0.58	0.70	±12.1%
2450	39.2	1.80	7.97	7.97	7.97	0.57	0.72	±12.1%
2600	39.0	1.96	7.69	7.69	7.69	0.42	0.90	±12.1%
5250	35.9	4.71	5.82	5.82	5.82	0.40	1.45	±13.3%
5600	35.5	5.07	5.10	5.10	5.10	0.40	1.55	±13.3%
5750	35.4	5.22	5.20	5.20	5.20	0.45	1.55	±13.3%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3970

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	55.5	0.96	10.62	10.62	10.62	0.40	0.80	±12.1%
835	55.2	0.97	10.31	10.31	10.31	0.16	1.43	±12.1%
900	55.0	1.05	10.20	10.20	10.20	0.21	1.23	±12.1%
1750	53.4	1.49	8.42	8.42	8.42	0.25	1.04	±12.1%
1900	53.3	1.52	8.07	8.07	8.07	0.23	1.07	±12.1%
2300	52.9	1.81	8.05	8.05	8.05	0.57	0.80	±12.1%
2450	52.7	1.95	7.89	7.89	7.89	0.60	0.74	±12.1%
2600	52.5	2.16	7.61	7.61	7.61	0.43	0.95	±12.1%
5250	48.9	5.36	5.14	5.14	5.14	0.55	1.45	±13.3%
5600	48.5	5.77	4.40	4.40	4.40	0.55	1.62	±13.3%
5750	48.3	5.94	4.49	4.49	4.49	0.56	1.70	±13.3%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.