MOTOROLA SOLUTIONS

ACCREDITED
TESTING CERT # 2518.01

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

Motorola Solutions, Inc.
EME Test Laboratory
8000 West Sunrise Blvd
Fort Lauderdale, FL. 33322

Date of Report: 04/22/2015
Report Revision: E

Responsible Engineer:	Deanna Zakharia (Global EME lab Director)
Report Author(s):	Veeramani Veerapan (Sr.EME Engineer) / William Elliott (Staff EME Engineer)/Jessica Zada (EME Engineer)
Date/s Tested:	02/18/2015 – 02/19/2015, 04/03/2015, 04/08/2015
Manufacturer/Location:	Hi-P Electronics Pte.Ltd, China
Sector/Group/Div.:	Others
Date submitted for test:	02/12/2015
DUT Description:	Handheld Portable , DLR1060 (HKUF4007A), 1watt, 900 MHz, 6CH (BRUS/ BRCAN)
Test TX mode(s):	CW (PTT)
Max. Power output:	1.0 W
Nominal Power:	1.0 W
Tx Frequency Bands:	902-928 MHz
Signaling type:	FSK
Model(s) Tested:	DLR1060 (HKUF4007A)
Model(s) Certified:	DLR1060 (HKUF4007A)
Serial Number(s):	550PRA0335 and 550PRA1033
Classification:	General Population/Uncontrolled
FCC ID:	AZ489FT5870; (902-928 MHz)
IC :	109U-89FT5870

The test results clearly demonstrate compliance with FCC General Population/Uncontrolled RF Exposure limits of 1.6 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d). The 10 grams result is not applicable to FCC filing. The test results clearly demonstrate compliance with ICNIRP (1998) Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz), Health Physics 74, 494-522 RF Exposure limits of 2 W/kg averaged over 10grams of contiguous tissue.

Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 4.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola Solutions Inc EME Laboratory.
I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements. This reporting format is consistent with the suggested guidelines of the TIA TSB-150 December 2004. The results and statements contained in this report pertain only to the device(s) evaluated.

Deanna Zakharia
Digitally signed by Deanna Zakharia
DN: cn=Deanna Zakharia, o=Motorola Solutions, ou=Regulatory Compliance Lab, email=edc015@motorolasolutions.com, c=US
Date: 2015.04.23 15:28:26 -04'00'

Deanna Zakharia
EME Lab Senior Resource Manager,
Laboratory Director
Approval Date: 4/22/2015

Certification Date: 4/14/2015

Certification No. L1150419

Part 1 of 2

APPENDICES

Part 2 of 2

APPENDICES

Report Revision History

Date	Revision	Comments
10/13/2014	O	Initial release (Proto)
02/24/2015	A	Updated report to reflect data taken on Pilot vintage
03/23/2015	B	Update report to reflect DLR1060 (HKUF4007A) model number
03/26/2015	C	Update equipment class to DSS in FCC SAR Summary Table 1
04/14/2015	D	Change all applicable areas to General Population/Uncontrolled
04/22/2015	E	Change KDB 648474 D01 to D04

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurements performed at the Motorola Solutions Inc. EME Test Laboratory for model number DLR1060 (HKUF4007A). This device is classified as General Population/Uncontrolled.

2.0 FCC SAR Summary

Table 1

Equipment Class	Frequency band (MHz)	Max Calc at Body (W/Kg)		Max Calc at Face (W/Kg)		Max Calc at Head (W/Kg)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR	1g-SAR	10g-SAR
DSS	902-928	1.50	1.04	1.24	0.88	NA	NA
*Simultaneous Results		NA	NA	NA	NA	NA	NA

3.0 Abbreviations / Definitions

CNR: Calibration Not Required
EME: Electromagnetic Energy
DUT: Device Under Test
NA: Not Applicable
PTT: Push to Talk
SAR: Specific Absorption Rate
RSM: Remote Speaker Microphone
2FSK: 2 Level, Frequency Shift Keying
4FSK: 4 Level, Frequency Shift Keying
8FSK: 8 Level, Frequency Shift Keying
CW: Continuous wave
ISM: Industrial, Scientific and Medical
TNF: Licensed Non-Broadcast Transmitter Held to Face

Audio accessories: These accessories allow communication while the DUT is worn on the body.
Body worn accessories: These accessories allow the DUT to be worn on the body of the user.
Maximum Power: Defined as the upper limit of the production line final test station.

4.0 Referenced Standards and Guidelines

This product is designed to comply with the following applicable national and international standards and guidelines.

- IEC62209-1*(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)
- Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, FCC, Washington, D.C.:1997.
- IEEE 1528*(2003), Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronics Engineers (IEEE) C95.1-2005
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6 (2009), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
- IEC62209-2 Edition 1.0 2010-03, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 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).

  (*)The IEC62209-1 and IEEE 1528 are applicable for hand-held devices used in close proximity to the ear only.
- FCC KDB - 648474 D04 Handset SAR v01r02
- FCC KDB– 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03 (02/07/2014)

  D02 RF Exposure Reporting v01r01 (05/28/2013)
- FCC KDB – 447498 D01 General RF Exposure Guidance v05r02 (02/07/2014)

5.0 SAR Limits

Table 2

EXPOSURE LIMITS	SAR (W/Kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average - ANSI - (averaged over the whole body)	0.08	0.4
Spatial Peak - ANSI - (averaged over any 1-g of tissue)	1.6	8.0
Spatial Peak – ICNIRP/ANSI - (hands/wrists/feet/ankles averaged over 10-g)	4.0	20.0
Spatial Peak - ICNIRP - (Head and Trunk 10-g)	2.0	10.0

6.0 Description of Device Under Test (DUT)

This portable device operates digital two-way communication architecture. MOTOTALK operates in the 900MHz Industrial, Scientific and Medical (ISM)band. It is a spread spectrum protocol utilizing 2,4, and 8FSK (Frequency Shift Keying). Radio protocall duty cycle is 95%. User transmit duty cucle is 50% (50%Talk and 50% listen).

The model represented under this filing utilizes fixed antenna capable of transmitting in the 902-928 MHz band respectively. The nominal output powers are 1.0 W with maximum output powers of 1.0 W as defined by upper limit of the production line final test station. The intended operating positions are "at the face" with the DUT at least 2.5cm from the mouth, and "at the body" by means of the offered body worn accessories. Body worn audio and PTT operation is accomplished by means of optional remote accessories that are connected to the radio.

7.0 Optional Accessories and Test Criteria

This device is offered with optional accessories. All accessories were individually evaluated during the test plan creation to determine if testing was required per the guidelines outlined in section 4.0 to assess compliance of this device. The following sections identify the test criteria and details for each accessory category.

7.1 Antenna

There is one antenna offered for this product. The table below lists its description.

Table 3

Antenna Model	Description	Selected for test	Tested
Fixed Antenna	Helix antenna, 902-928 MHz, 1/2 wave, 2.5dBi gain	Yes	Yes

7.2 Battery

There is one battery offered for this product. The table below lists its description.

Table 4

Battery Model	Description	Selected for test	Tested	Comments
HKNN4013A	3.7V, Li-Ion capacity, 1800mAh	Yes	Yes	

7.3 Body worn Accessory

There is one body worn offered for this product. The table below lists its description.

Table 5

Body worn Model	Description	Selected for test	Tested	Comments
HKLN4616A (HKLN4615)	DLR Series Belt Clip Holster	Yes	Yes	

7.4 Audio Cable Accessories

All offered audio cable accessories were considered. The table below lists the audio cable accessories and their descriptions. Exhibit 7B illustrates photos of the tested audio accessories.

Table 6

Audio Acc. Models	Description	Selected for test	Tested	Comments
HKLN4604A	Swivel earpiece	Yes	Yes	
HKLN4606A	Remote Speaker Mic	Yes	Yes	
HKLN4599A	Earpiece with in-line PTT Mic	No	No	By similarity to HKLN4604A
HKLN4601A	Dual Pin Surveillance Earpiece with PTT	No	No	

8.0 Description of Test System

8.1 Descriptions of Robotics/Probes/Readout Electronics

Table 7

Dosimetric System type	System version	DAE type	Probe Type
Schmid & Partner Engineering AG SPEAG DASY 5	52.8.7.1137	DAE4	ES3DV3 (E-Field)

The DASY5™ system is operated per the instructions in the DASY5™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess EME SAR compliance was calibrated according to ISO/IEC 17025 A2LA guidelines. Section 9.0 presents additional test equipment information. Appendices B and C present the applicable calibration certificates. The E-field probe first scans a coarse grid over a large area inside the phantom in order to locate the interpolated maximum SAR distribution. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The subsequent scan can directly use this position as reference for the cube evaluations.

8.2 Description of Phantom(s)

Table 8

Phantom Type	Phantom(s) Used	Material Parameters	Phantom Dimensions LxWxD (mm)	Material Thickness (mm)	Support Structure Material	Loss Tangent (wood)
Triple Flat	NA	200MHz -6GHz; Er = 3-5, Loss Tangent = ≤0.05	280x175x175			
SAM	NA	300MHz -6GHz; Er = < 5, Loss Tangent = ≤0.05	Human Model	2mm +/- 0.2mm	Wood	< 0.05
Oval Flat	√	300MHz -6GHz; Er = 4+/- 1, Loss Tangent = ≤0.05	600x400x190			

8.3 Description of Simulated Tissue

The sugar based simulate tissue is produced by placing the correct measured amount of De-ionized water into a large container. Each of the dried ingredients are weighed and added to the water carefully to avoid clumping. If the solution has a high sugar concentration the water is pre-heated to aid in dissolving the ingredients. For Diacetin and similar type simulates, sugar and HEC ingredients are not needed. The solution is mixed thoroughly, covered, and allowed to sit overnight prior to use.

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in Table 9. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at each of the tested frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

Simulated Tissue Composition (by mass)
Table 9

Ingredients	900 MHz	
	Head	Body
Sugar	56.5	44.9
Diacetin	0	0
De ionized – Water	40.95	53.06
Salt	1.45	0.94
HEC	1.0	1.0
Bacteria	0.1	0.1

9.0 Additional Test Equipment

The table below lists additional test equipment used during the SAR assessment.

Table 10

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Speag Probe	ES3SDV3	3301	9/24/2014	9/24/2015
Speag Probe	ES3DV3	3291	7/21/2014	7/21/2015
Speag DAE	DAE3	401	3/11/2014	3/11/2015*
Speag DAE	DAE4	850	7/23/2014	7/23/2015
Speag Dipole	D900V2	085	2/12/2014	2/12/2016
Signal Generator (Keysight)	E4428C	MY47381119	6/7/2013	6/7/2015
Signal Generator (Keysight)	E4438C	MY44270302	8/25/2014	8/25/2015
E-Series Avg. Power Sensor (Keysight)	E9301B	MY41495730	4/10/2014	4/10/2015
E-Series Avg. Power Sensor (Keysight)	E9301B	MY41495733	4/10/2014	4/10/2015
E-Series Avg. Power Sensor	E9301B	MY50290001	9/17//2014	9/17/2015
Power Meter (Keysight)	E4419B	MY45103725	3/3/2014	3/3/2015*
Power Meter (Keysight)	E4419B	MY50000505	9/4/2014	9/4/2015
Bi-Directional Coupler (NARDA)	3020A	40296	1/31/2014	1/31/2016
Bi-Directional Coupler	3020A	40295	9/23/2013	9/23/2015
AMP (Amplifier Research)	10W1000	5924	CNR	CNR
AMP (Amplifier Research)	10WD1000	28782	CNR	CNR
Dickson Temperature Recorder	TM320	12121144	5/16/2014	5/16/2015
Dickson Temperature Recorder	TM320	7081356	9/15/2014	9/16/2015
Omega Digital Thermometer with J Type TC Probe	HH202A	18800	3/3/2014	3/3/2015*
Omega Digital Thermometer with J Type TC Probe	HH200A	20857	10/21/2014	10/21/2015
Keysight PNA-L Network Analyzer	N5230C	MY49002155	8/4/2014	8/4/2015
Dielectric Probe Kit (DAK1)	DAK-12	1013	5/15/2014	5/15/2015

*Out of calibration; replaced with 850, MY50000505 and 20857 for continued testing.

10.0 SAR Measurement System Validation and Verification

DASY output files of the probe/dipole calibration certificates and system performance test results are included in appendices B, C and D respectively.

10.1 System Validation

The SAR measurement system was validated according to the procedures in KDB 865664. The validation status summary table is below.

Table 11

Dates	Probe Calibration Point		Probe SN	Measured Tissue Parameters		Validation for CW		
				σ	ϵ_r	Sensitivity	Linearity	Isotropy
11/13/14	Body	900	3301	1.07	55.0	Pass	Pass	Pass
11/13/14	Head	900	3301	1.00	40.5	Pass	Pass	Pass
09/11/14	Body	900	3291	1.08	55.4	Pass	Pass	Pass

10.2 System Verification

System performance checks were conducted each day during the SAR assessment. The results are normalized to 1W. APPENDIX D includes DASY plots for each day during the SAR assessment. The table below summarizes the daily system check results used for the SAR assessment.

Table 12

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Ref SAR @ 1W (W/kg)	System Check Results Measured (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
3301	FCC Body	SPEAG D900V2/ 085	10.4 +/- 10%	2.77	11.08	2/18/15
				2.76	11.04	2/19/15
	IEEE/IEC Head	SPEAG D900V2/ 085	10.4 +/- 10%	2.49	9.76	2/18/15
3291	FCC Body	SPEAG D900V2/ 085	10.4 +/- 10%	2.66	10.64	4/3/15
				2.74	10.96	4/8/15

10.3 Equivalent Tissue Test Results

Simulated tissue prepared for SAR measurements is measured daily and within 24 hours prior to actual SAR testing to verify that the tissue is within +/- 5% of target parameters at the center of the transmit band. This measurement is done using the applicable equipment indicated in section 9.0. The table below summarizes the measured tissue parameters used for the SAR assessment.

Table 13

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
916	FCC Body	1.06 (1.01-1.11)	55.0 (52.2-57.7)	1.08	53.0	2/18/15
				1.08	52.8	2/19/15
				1.05	53.2	4/03/15
				1.10	53.2	4/08/15
	IEEE/ IEC Head	0.98 (0.93-1.03)	41.5 (39.4-43.6)	1.00	40.4	2/18/15
900	FCC Body	1.05 (1.00-1.10)	55.0 (52.3-57.8)	1.06	53.1	2/18/15
				1.06	53.0	2/19/15
				1.04	53.3	4/03/15
				1.08	53.3	4/08/15
	IEEE/ IEC Head	0.97 (0.92-1.02)	41.5 (39.4-43.6)	0.99	40.5	2/18/15

11.0 Environmental Test Conditions

The EME Laboratory's ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within +/ - 2^{o}C of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was at least 15cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not actively in process in order to minimize evaporation. The lab environment is continuously monitored. The table below presents the range and average environmental conditions during the SAR tests reported herein:

Table 14

	Target	Measured
Ambient Temperature	18 – 25 ˚C	Range: 20.6 – 21.3˚C Avg. 21.8 ˚C
Relative Humidity	30 – 70 %	Range: 30.3 – 59.7 % Avg. 53.8 %
Tissue Temperature	NA	Range: 19.9-20.5˚C Avg. 20.2˚C

Relative humidity target range is a recommended target

The EME Lab RF environment uses a Spectrum Analyzer to monitor for extraneous large signal RF contaminants that could possibly affect the test results. If such unwanted signals are discovered the SAR scans are repeated.

12.0 DUT Test Setup and Methodology

12.1 Measurements

SAR measurements were performed using the DASY system described in section 8.0 using zoom scans. Elliptical flat phantoms filled with applicable simulated tissue were used for body and face testing.

The table below includes the step sizes and resolution of area and zoom scans per KDB 865664 requirements.

Table 15

<table>
<tr><th colspan="2">Description</th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="2">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="2">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="2" rowspan="2">Maximum area scan spatial resolution: ΔxArea, ΔyArea</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="2">Maximum zoom scan spatial resolution: ΔxZoom, ΔyZoom</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td>Maximum zoom scan spatial resolution, normal to phantom surface</td><td>uniform grid: ΔzZoom(n)</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td colspan="4">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

12.2 DUT Configuration(s)

The DUT is a portable device operational at the body and face as described in section 6.0 while using the applicable accessories listed in section 7.0. All accessories listed in section 7.0 of this report were considered.

12.3 DUT Positioning Procedures

The positioning of the device for each body location is described below and illustrated in APPENDIX H.

12.3.1 Body

The DUT was positioned in normal use configuration against the phantom with the offered body worn accessory and the offered audio accessories as applicable.

12.3.2 Head

Not applicable.

12.3.3 Face

The DUT was positioned with its' front side separated 2.5cm from the phantom.

12.4 DUT Test Channels

The number of test channels was determined by using the following IEEE 1528 equation. The use of this equation produces the same or more test channels compared to the FCC KDB 447498 number of test channels formula.

$$N_c = 2 * roundup[10 * (f_{high} - f_{low}) / f_c] + 1$$

Where
N_c = Number of channels
F_{high} = Upper channel
F_{low} = Lower channel
F_c = Center channel

12.5 SAR Result Scaling Methodology

The calculated 1-gram and 10-gram averaged SAR results indicated as "Max Calc. 1g-SAR" and "Max Calc.10g-SAR" in the data tables is determined by scaling the measured SAR to account for power leveling variations and power slump. For this device the "Max Calc. 1g-SAR" and "Max Calc.10g-SAR" are scaled using the following formula:

$$Max\_Calc = SAR\_meas \cdot 10^{\frac{-Drift}{10}} \cdot \frac{P\_max}{P\_int} \cdot DC$$

P_max = Maximum Power (W)
P_int = Initial Power (W)
Drift = DASY drift results (dB)
SAR_meas = Measured 1-g or 10-g Avg. SAR (W/kg)
DC = Transmission mode duty cycle in % where applicable
50% duty cycle is applied for PTT operation

Note: for conservative results, the following are applied:
If P_int > P_max, then P_max/P_int = 1.
Drift = 1 for positive drif

Additional SAR scaling was applied using the methodologies outlined in FCC KDB 865664 using tissue sensitivity values. SAR was scaled for conditions where the tissue permittivity was measured above the nominal target and for tissue conductivity that was measured below the nominal target. Negative or reduced SAR scaling is not permitted.

12.6 DUT Test Plan

The guidelines and requirements outlined from section 4.0 were used to assess compliance of this device. All modes of operation identified in section 6.0 were considered during the development of the test plan. All tests were performed in TDMA mode and then 50% duty cycle was applied respectively to the final results.

13.0 DUT Test Data

13.1 Assessments at the Body

The battery HKNN4013A was used for assessments at the Body because it is the only offered battery (refer to Exhibit 7B for the illustration of the battery). The conducted power measurement for all test channels within the frequency range of 902-928 MHz is listed in Table 16. SAR plots of the highest result per Table (bolded) is presented in Appendix E.

Table 16

Test Freq (MHz)	Power (W)
902.525	0.961
915.525	0.995
927.475	0.962

Assessments at the Body with Body-worn HKLN4616A

Assessment of the offered antennas with the default battery and body worn. Testing of additional channels was not required per KDB 447498. SAR plots of the highest results per Table (bolded) is presented in Appendix E.

Table 17

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
Fixed antenna	HKNN4013A	HKLN4616A	HKLN4604A	902.525							
				915.525	.995	-1.07	2.12	1.47	**1.36**	**0.95**	ErC-Ab-150218-06
				927.475							
Fixed antenna	HKNN4013A	HKLN4616A	HKLN4606A	902.525							
				915.525	0.995	-0.68	2.30	1.58	1.35	0.93	HvH-Ab-150403-10
				927.475							

13.2 Assessments at the Face

The battery HKNN4013A was used for assessments at the Face because it is only one offered battery (refer to Exhibit 7B for the illustration of the battery). The conducted power measurement for all test channels within the frequency range of 902-928 MHz is listed in Table 18. SAR plot of the highest result per Table (bolded) is presented in Appendix E.

Table 18

Test Freq (MHz)	Power (W)
902.525	0.961
915.525	0.995
927.475	0.962

Assessment of the offered antennas with the default battery with front of DUT positioned 2.5cm facing phantom. SAR plot of the highest result per Table (bolded) is presented in Appendix E.

Table 19

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
Fixed antenna	HKNN4013A	NONE	NONE	902.525							
				915.525	0.995	-0.39	2.26	1.60	**1.24**	**0.88**	ErC-Face-150218-04
				927.475							

13.3 Assessments for Industry Canada

Based on the assessment results for body and face, additional tests were not required for the Industry Canada frequency range (902-928 MHz) as the testing performed is in compliance with Industry Canada frequency range.

13.4 Shortened Scan Assessment

A "shortened" scan using the highest SAR configuration overall was performed to validate the SAR drift of the full DASY5™ coarse and zoom scans. Note that the shortened scan represents the zoom scan performance result; this is obtained by first running a coarse scan to find the peak area and then, using a newly charged battery, a zoom scan only was performed. The results of the shortened cube scan presented in APPENDIX E demonstrate that the scaling methodology used to determine the calculated SAR results presented herein are valid. The SAR results from the table below is provided in APPENDIX E.

Table 20

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (mW/g)	Meas. 10g-SAR (mW/g)	Max Calc. 1g-SAR (mW/g)	Max Calc. 10g-SAR (mW/g)	Run#
Shorten scan											
Fixed antenna	HKNN4013A	HKLN4616A	HKLN4604A	915.525	.995	-0.72	2.53	1.76	1.50	1.04	ErC-Ab-150219-03

14.0 Simultaneous Transmission Exclusion

Not applicable.

15.0 Results Summary

Based on the test guidelines, the highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing:

Table 21

Designator	Frequency band (MHz)	Max Calc at Body (W/kg)		Max Calc at Face (W/kg)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR
FCC / Industry Canada	902-928	1.50	1.04	1.24	0.88

All results are scaled to the maximum output power

The test results clearly demonstrate compliance with FCC General Population/Uncontrolled RF Exposure limits of 1.6 W/kg averaged over 1 gram per the requirements of 47 CFR 2.1093(d). The 10 grams result is not applicable to FCC filing.

16.0 Variability Assessment

Per the guidelines in KDB 865664 SAR variability assessment is required because SAR results are above 0.8W/kg (General population).

Table 22

Run#	Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq. (MHz)	Adj Calc. 1g-SAR (W/kg)	Comments
ErC-Ab-150218-06	Fixed antenna	HKNN4013A	HKLN4616A	HKLN4604A	915.525	1.36	
Repeat scan required due to highest Adj. Calc 1g-SAR (W/kg) >= 0.80 W/kg							
ErC-Ab-150219-03	Fixed antenna	HKNN4013A	HKLN4616A	HKLN4604A	915.525	1.49	Within 20% of original scan
Additional repeat scan required due to 1st repeat Adj. Calc 1g-SAR (W/kg) >= 1.45 W/kg							
HvH-Ab-150408-02	Fixed antenna	HKNN4013A	HKLN4616A	HKLN4604A	915.525	1.32	No additional repeat scans required because Adj. Calc 1g-SAR < 1.50 W/kg

17.0 System Uncertainty

Per the guidelines of ISO 17025 a reported system uncertainty is required and therefore measurement uncertainty budget is included in Appendix A.

Appendix A
Measurement Uncertainty Budget

Uncertainty Budget for Device Under Test, for 800 MHz to 3 GHz									
a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h =* *c x f / e*	*i =* *c x g / e*	*k*
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob Dist	Div.	c_i (1 g)	c_i (10 g)	1 g u_i (±%)	10 g u_i (±%)	v_i
Measurement System									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				11	11	419
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				22	22	

Notes for uncertainty budget Table:
a) Column headings *a-k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

Uncertainty Budget for System Verification (dipole & flat phantom) for 900 MHz									
a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	IEEE 1528 section	**Tol. (± %)**	**Prob. Dist.**	**Div.**	c_i (1 g)	c_i (10 g)	1 g u_i (±%)	10 g u_i (±%)	v_i
Measurement System									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				9	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				18	18	

Notes for uncertainty budget Tables:
a) Column headings *a*-*k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

Appendix B
Probe Calibration Certificates

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **ES3-3301_Sep14**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3301

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: September 24, 2014

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	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 24, 2014

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

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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.e., 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, "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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect 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 with CW signal (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; Dx,y,z; VRx,y,z: A, B, C, D* 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 ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values 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 ± 50 MHz to ± 100 MHz.
- *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).

Probe ES3DV3

SN:3301

Manufactured: August 27, 2010
Calibrated: September 24, 2014

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3301

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.48	1.01	1.24	± 10.1 %
DCP (mV)[B]	99.8	104.7	100.6	

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	196.0	±3.3 %
		Y	0.0	0.0	1.0		194.9	
		Z	0.0	0.0	1.0		182.9	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.64	66.0	17.0	1.87	135.0	±0.7 %
		Y	2.82	68.5	18.8		134.3	
		Z	3.36	71.1	20.0		147.5	
10013-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.10	70.3	23.0	9.46	133.1	±3.0 %
		Y	10.53	69.5	22.7		126.7	
		Z	10.96	69.9	22.8		122.1	
10059-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	2.97	67.5	17.7	2.12	133.5	±0.7 %
		Y	3.51	72.2	20.5		133.9	
		Z	3.80	72.5	20.5		147.3	
10060-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	6.67	83.5	23.9	2.83	144.1	±0.7 %
		Y	9.03	93.1	28.5		141.8	
		Z	11.85	95.0	28.5		134.1	
10061-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	7.74	82.2	23.9	3.60	148.4	±0.9 %
		Y	6.90	83.6	25.5		143.8	
		Z	10.31	88.0	26.4		138.3	
10071-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	11.29	70.7	23.5	9.83	129.8	±3.5 %
		Y	10.67	69.7	23.1		124.6	
		Z	11.81	71.9	24.2		146.4	
10072-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	10.90	70.5	23.3	9.62	127.2	±3.3 %
		Y	10.74	71.0	23.8		147.7	
		Z	11.49	72.0	24.2		144.5	
10073-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	10.94	70.7	23.7	9.94	122.7	±4.1 %
		Y	10.70	70.9	24.0		142.0	
		Z	11.64	72.4	24.7		141.5	
10074-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	11.13	71.1	24.2	10.30	120.8	±3.3 %
		Y	10.82	71.3	24.5		138.7	
		Z	11.69	72.4	24.9		139.5	
10075-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	12.35	74.4	26.5	10.77	149.2	±4.4 %
		Y	10.96	71.6	25.1		135.6	
		Z	12.00	73.1	25.7		137.3	
10076-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	12.37	74.5	26.7	10.94	146.4	±3.8 %
		Y	10.95	71.6	25.2		133.8	
		Z	12.11	73.4	25.9		136.7	

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10077-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	12.42	74.7	26.9	11.00	146.0	±4.1 %
		Y	10.95	71.7	25.4		132.9	
		Z	12.13	73.6	26.1		135.9	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.16	66.3	18.9	5.67	126.3	±1.4 %
		Y	6.28	67.2	19.7		126.8	
		Z	6.46	67.5	19.7		140.3	
10101-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	7.31	67.0	19.6	6.42	136.2	±1.7 %
		Y	7.34	67.5	20.1		135.9	
		Z	7.29	66.9	19.7		125.5	
10102-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	7.61	67.3	19.8	6.60	138.6	±1.7 %
		Y	7.60	67.7	20.2		137.8	
		Z	7.56	67.1	19.9		127.8	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.37	67.1	19.5	5.80	148.7	±1.7 %
		Y	6.36	67.6	20.1		148.8	
		Z	6.39	67.2	19.7		138.1	
10109-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	7.06	66.6	19.5	6.43	132.2	±1.7 %
		Y	7.06	67.2	20.0		131.7	
		Z	7.34	67.5	20.1		146.5	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.04	66.6	19.3	5.75	144.8	±1.7 %
		Y	6.02	67.1	19.9		143.8	
		Z	6.05	66.6	19.4		134.0	
10111-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	6.80	66.4	19.4	6.44	128.2	±1.7 %
		Y	6.77	66.9	19.9		126.8	
		Z	7.09	67.3	20.0		142.1	
10112-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	7.35	67.0	19.7	6.59	134.9	±1.9 %
		Y	7.28	67.3	20.2		132.1	
		Z	7.63	67.9	20.4		148.0	
10113-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	7.06	66.6	19.6	6.62	130.4	±1.7 %
		Y	7.00	67.1	20.1		128.1	
		Z	7.36	67.6	20.3		142.4	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.24	68.9	21.3	8.10	138.8	±2.2 %
		Y	10.25	69.3	21.7		136.5	
		Z	10.13	68.6	21.2		126.6	
10115-CAA	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	X	10.79	69.5	21.8	8.46	143.2	±2.5 %
		Y	10.69	69.5	21.9		140.9	
		Z	10.72	69.3	21.7		131.5	
10116-CAA	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	X	10.30	69.0	21.4	8.15	139.8	±2.2 %
		Y	10.23	69.2	21.6		137.9	
		Z	10.12	68.5	21.1		127.7	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.24	68.9	21.3	8.07	139.7	±2.2 %
		Y	10.19	69.1	21.5		138.1	
		Z	10.11	68.5	21.1		128.8	
10118-CAA	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	X	10.96	69.7	22.0	8.59	144.6	±2.5 %
		Y	10.85	69.8	22.1		142.9	
		Z	10.79	69.2	21.7		133.6	

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10119-CAA	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	X	10.30	69.1	21.4	8.13	140.0	±2.2 %
		Y	10.24	69.2	21.6		138.0	
		Z	10.18	68.7	21.3		127.6	
10140-CAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	7.54	67.3	19.8	6.49	138.8	±1.7 %
		Y	7.53	67.7	20.3		137.3	
		Z	7.51	67.2	19.8		128.5	
10141-CAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	7.67	67.3	19.8	6.53	139.5	±1.7 %
		Y	7.67	67.8	20.3		138.8	
		Z	7.64	67.2	19.9		130.2	
10142-CAB	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	5.85	66.3	19.1	5.73	141.0	±1.4 %
		Y	5.82	66.8	19.7		141.6	
		Z	5.90	66.5	19.4		133.1	
10143-CAB	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	6.82	67.2	19.8	6.35	148.8	±1.7 %
		Y	6.75	67.7	20.4		147.1	
		Z	6.87	67.3	20.0		139.7	
10144-CAB	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	6.88	66.5	19.5	6.65	126.1	±1.7 %
		Y	7.08	68.0	20.7		148.4	
		Z	7.18	67.4	20.2		139.9	
10145-CAB	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	5.55	65.8	18.9	5.76	136.3	±1.4 %
		Y	5.55	66.7	19.8		135.4	
		Z	5.63	66.1	19.2		128.4	
10146-CAB	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.50	67.0	19.8	6.41	140.2	±1.4 %
		Y	6.45	67.9	20.5		139.5	
		Z	6.56	67.1	20.0		131.2	
10147-CAB	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	6.78	67.2	20.0	6.72	140.5	±1.7 %
		Y	6.71	68.0	20.8		139.3	
		Z	6.86	67.4	20.3		132.8	
10149-CAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.07	66.7	19.5	6.42	130.9	±1.7 %
		Y	7.09	67.3	20.1		130.4	
		Z	7.37	67.7	20.2		146.5	
10150-CAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	7.32	66.9	19.7	6.60	133.1	±1.9 %
		Y	7.30	67.3	20.2		132.6	
		Z	7.61	67.8	20.3		148.4	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.02	66.5	19.2	5.75	144.2	±1.7 %
		Y	6.03	67.1	19.9		144.2	
		Z	6.06	66.6	19.5		133.8	
10155-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	6.78	66.3	19.3	6.43	128.0	±1.7 %
		Y	6.80	67.0	20.0		126.5	
		Z	7.09	67.3	20.0		141.8	
10156-CAB	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	5.80	66.2	19.1	5.79	140.8	±1.4 %
		Y	5.80	66.9	19.9		138.6	
		Z	5.84	66.3	19.4		130.6	
10157-CAB	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	6.83	67.2	19.9	6.49	147.7	±1.7 %
		Y	6.76	67.8	20.6		143.9	
		Z	6.83	67.1	20.0		135.6	

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10158-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	7.07	66.7	19.6	6.62	129.7	±1.7 %
		Y	7.03	67.2	20.2		126.9	
		Z	7.37	67.6	20.3		143.3	
10159-CAB	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	6.97	67.5	20.1	6.56	148.9	±1.9 %
		Y	6.87	68.0	20.7		144.7	
		Z	6.98	67.4	20.2		136.2	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.21	66.1	18.9	5.82	126.6	±1.4 %
		Y	6.51	67.8	20.2		148.5	
		Z	6.51	67.2	19.7		139.2	
10161-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.16	66.9	19.6	6.43	134.6	±1.7 %
		Y	7.13	67.4	20.2		130.6	
		Z	7.43	67.7	20.2		146.8	
10162-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	7.38	67.1	19.8	6.58	135.8	±1.7 %
		Y	7.31	67.4	20.3		132.2	
		Z	7.67	68.0	20.4		148.4	
10166-CAB	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	4.98	65.6	18.7	5.46	133.0	±1.2 %
		Y	4.98	66.6	19.7		129.0	
		Z	5.21	66.5	19.5		142.4	
10167-CAB	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	5.92	66.8	19.6	6.21	134.2	±1.7 %
		Y	5.80	67.5	20.4		130.1	
		Z	6.23	67.9	20.4		147.0	
10168-CAB	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	6.38	67.0	20.0	6.79	134.8	±1.9 %
		Y	6.25	67.7	20.8		129.5	
		Z	6.70	68.1	20.8		146.8	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.00	66.5	19.4	5.73	147.6	±1.4 %
		Y	4.93	67.4	20.4		142.9	
		Z	5.05	66.7	19.8		134.0	
10170-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	5.79	67.8	20.4	6.52	148.0	±1.7 %
		Y	5.57	68.1	21.1		141.2	
		Z	5.86	68.0	20.7		134.6	
10171-AAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	5.79	67.9	20.4	6.49	148.0	±1.7 %
		Y	5.58	68.3	21.2		141.0	
		Z	5.84	67.9	20.7		135.8	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.99	66.5	19.4	5.72	147.0	±1.4 %
		Y	4.93	67.4	20.4		142.3	
		Z	5.05	66.7	19.8		134.1	
10176-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	5.79	67.8	20.4	6.52	148.0	±1.7 %
		Y	5.58	68.1	21.1		141.1	
		Z	5.84	67.8	20.7		134.3	
10177-CAD	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	4.99	66.5	19.4	5.73	146.6	±1.7 %
		Y	4.93	67.4	20.4		142.6	
		Z	5.06	66.7	19.8		134.1	
10178-CAB	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	5.80	67.8	20.4	6.52	147.7	±1.7 %
		Y	5.59	68.2	21.1		141.1	
		Z	5.84	67.8	20.6		133.7	

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10179-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	5.83	68.0	20.6	6.50	148.0	±1.7 %
		Y	5.58	68.2	21.1		141.3	
		Z	5.85	68.0	20.7		134.7	
10180-CAB	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	5.80	67.9	20.4	6.50	148.0	±1.7 %
		Y	5.60	68.3	21.2		141.4	
		Z	5.85	67.9	20.7		134.4	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.98	66.5	19.4	5.72	147.1	±1.4 %
		Y	4.93	67.4	20.4		142.7	
		Z	5.02	66.6	19.7		133.7	
10182-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	5.81	67.9	20.5	6.52	148.3	±1.7 %
		Y	5.59	68.2	21.1		141.9	
		Z	5.83	67.8	20.6		134.0	
10183-AAA	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	5.79	67.8	20.4	6.50	147.6	±1.7 %
		Y	5.58	68.2	21.1		142.1	
		Z	5.83	67.8	20.6		134.5	
10184-CAB	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	5.00	66.6	19.4	5.73	147.3	±1.4 %
		Y	4.95	67.4	20.4		143.6	
		Z	5.03	66.6	19.7		133.5	
10185-CAB	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	5.79	67.8	20.4	6.51	147.8	±1.7 %
		Y	5.60	68.2	21.2		142.3	
		Z	5.83	67.8	20.6		133.9	
10186-AAB	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	5.81	67.9	20.5	6.50	148.0	±1.7 %
		Y	5.60	68.3	21.1		142.4	
		Z	5.86	68.0	20.7		135.5	
10187-CAB	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	5.00	66.6	19.5	5.73	147.0	±1.4 %
		Y	4.94	67.4	20.4		143.7	
		Z	5.06	66.7	19.8		134.4	
10188-CAB	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	5.80	67.8	20.5	6.52	147.6	±1.9 %
		Y	5.60	68.2	21.1		142.6	
		Z	5.85	67.8	20.7		134.3	
10189-AAB	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	5.81	67.9	20.5	6.50	148.0	±1.9 %
		Y	5.60	68.2	21.1		142.9	
		Z	5.85	67.9	20.7		135.6	
10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.87	68.5	21.1	8.09	133.0	±2.5 %
		Y	9.82	68.9	21.6		129.5	
		Z	10.22	69.3	21.7		146.8	
10194-CAA	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	X	9.96	68.7	21.2	8.12	135.0	±2.5 %
		Y	9.91	69.1	21.7		131.8	
		Z	10.26	69.4	21.8		148.7	
10195-CAA	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	X	10.11	68.9	21.4	8.21	136.5	±2.5 %
		Y	9.92	68.8	21.6		132.7	
		Z	10.41	69.6	21.9		149.8	
10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.91	68.6	21.2	8.10	135.0	±2.5 %
		Y	9.74	68.6	21.4		131.1	
		Z	10.23	69.4	21.7		149.1	

10197-CAA	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	X	9.97	68.7	21.2	8.13	135.5	±2.5 %
		Y	9.86	68.9	21.6		132.8	
		Z	10.30	69.5	21.8		149.9	
10198-CAA	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	X	10.18	69.0	21.5	8.28	136.5	±2.2 %
		Y	10.01	69.0	21.7		133.4	
		Z	9.98	68.3	21.2		123.7	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.79	68.5	21.1	8.03	134.3	±2.7 %
		Y	9.67	68.7	21.4		131.7	
		Z	10.05	69.1	21.5		149.2	
10220-CAA	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	X	9.98	68.7	21.3	8.13	135.9	±2.2 %
		Y	9.85	68.8	21.5		133.1	
		Z	9.92	68.5	21.2		123.4	
10221-CAA	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	X	10.17	68.9	21.4	8.27	136.5	±2.2 %
		Y	10.03	69.0	21.7		134.2	
		Z	10.01	68.4	21.2		124.6	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.24	69.0	21.3	8.06	141.0	±2.2 %
		Y	10.21	69.2	21.6		139.4	
		Z	10.09	68.5	21.1		128.8	
10223-CAA	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	X	10.86	69.7	21.9	8.48	146.1	±2.5 %
		Y	10.79	69.8	22.1		143.7	
		Z	10.67	69.1	21.6		133.7	
10224-CAA	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	X	10.25	69.1	21.3	8.08	140.7	±2.2 %
		Y	10.21	69.2	21.6		139.2	
		Z	10.08	68.5	21.1		128.5	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.10	66.1	19.0	5.81	126.0	±1.4 %
		Y	6.43	67.8	20.3		149.8	
		Z	6.41	67.3	19.8		139.5	
10298-AAA	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	5.66	66.1	19.1	5.72	139.4	±1.4 %
		Y	5.66	66.9	19.9		138.4	
		Z	5.73	66.3	19.3		130.2	
10299-AAA	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.67	67.3	19.9	6.39	145.2	±1.7 %
		Y	6.56	67.8	20.5		142.3	
		Z	6.69	67.3	20.0		134.0	
10300-AAA	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	6.86	67.4	20.1	6.60	144.3	±1.7 %
		Y	6.75	68.0	20.7		142.9	
		Z	6.91	67.5	20.2		134.8	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.65	66.6	19.3	6.06	129.1	±1.7 %
		Y	6.73	67.4	20.1		128.2	
		Z	7.00	67.9	20.2		143.1	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.53	65.9	17.0	1.71	136.4	±0.7 %
		Y	3.41	73.0	21.4		135.7	
		Z	3.03	69.8	19.4		149.3	
10316-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	10.12	68.8	21.5	8.36	134.2	±2.2 %
		Y	10.03	69.2	21.9		130.1	
		Z	10.06	68.6	21.5		122.4	

10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.33	65.2	16.6	1.54	137.1	±0.7 %
		Y	3.11	71.7	20.8		137.0	
		Z	2.76	68.8	19.0		127.4	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.99	68.7	21.3	8.23	133.7	±2.5 %
		Y	9.92	69.0	21.8		130.4	
		Z	10.32	69.5	21.9		149.8	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.87	68.6	21.3	8.14	133.6	±2.5 %
		Y	9.78	68.9	21.7		129.5	
		Z	10.24	69.6	21.9		149.1	
10419-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preambule)	X	9.99	68.8	21.4	8.19	134.9	±2.2 %
		Y	9.81	68.8	21.6		130.3	
		Z	9.81	68.2	21.1		122.9	

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 NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 11 and 12).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3301

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)
150	52.3	0.76	7.37	7.37	7.37	0.06	1.20	± 13.3 %
220	49.0	0.81	7.38	7.38	7.38	0.08	1.20	± 13.3 %
300	45.3	0.87	7.67	7.67	7.67	0.18	1.30	± 13.3 %
450	43.5	0.87	6.74	6.74	6.74	0.19	2.05	± 13.3 %
750	41.9	0.89	6.53	6.53	6.53	0.34	1.79	± 12.0 %
900	41.5	0.97	6.23	6.23	6.23	0.32	1.85	± 12.0 %
1810	40.0	1.40	5.04	5.04	5.04	0.74	1.21	± 12.0 %
1950	40.0	1.40	4.87	4.87	4.87	0.75	1.24	± 12.0 %
2300	39.5	1.67	4.75	4.75	4.75	0.80	1.21	± 12.0 %
2450	39.2	1.80	4.49	4.49	4.49	0.72	1.31	± 12.0 %
2600	39.0	1.96	4.34	4.34	4.34	0.80	1.26	± 12.0 %
3500	37.9	2.91	4.29	4.29	4.29	1.00	1.13	± 13.1 %
3700	37.7	3.12	4.11	4.11	4.11	1.00	1.11	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the 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 frequencies 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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3301

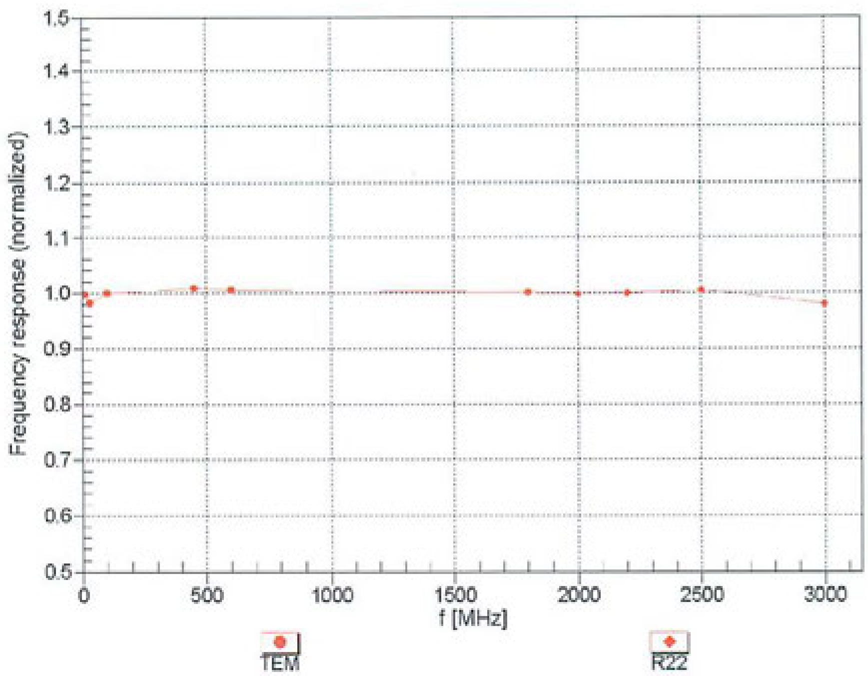
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
150	61.9	0.80	7.03	7.03	7.03	0.08	1.30	± 13.3 %
220	60.2	0.86	7.46	7.46	7.46	0.08	1.20	± 13.3 %
300	58.2	0.92	7.06	7.06	7.06	0.10	1.50	± 13.3 %
450	56.7	0.94	7.10	7.10	7.10	0.11	1.20	± 13.3 %
750	55.5	0.96	6.15	6.15	6.15	0.60	1.36	± 12.0 %
900	55.0	1.05	6.00	6.00	6.00	0.45	1.58	± 12.0 %
1810	53.3	1.52	4.79	4.79	4.79	0.80	1.22	± 12.0 %
1950	53.3	1.52	4.83	4.83	4.83	0.48	1.74	± 12.0 %
2300	52.9	1.81	4.48	4.48	4.48	0.70	1.25	± 12.0 %
2450	52.7	1.95	4.31	4.31	4.31	0.80	1.16	± 12.0 %
2600	52.5	2.16	4.15	4.15	4.15	0.64	0.92	± 12.0 %
3500	51.3	3.31	3.64	3.64	3.64	1.00	1.32	± 13.1 %
3700	51.0	3.55	3.56	3.56	3.56	1.00	1.28	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the 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 frequencies 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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

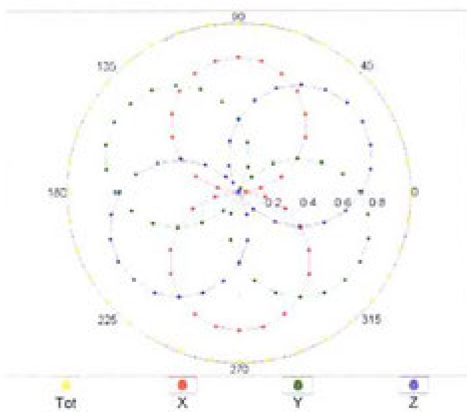
(TEM-Cell:ifi110 EXX, Waveguide: R22)



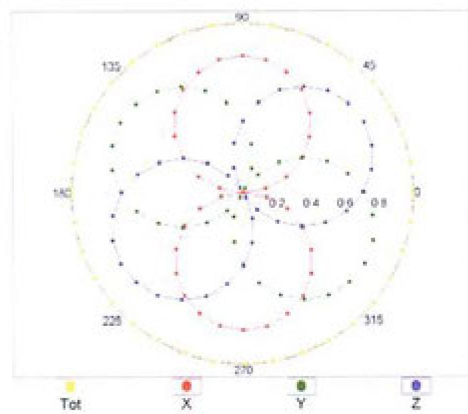
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

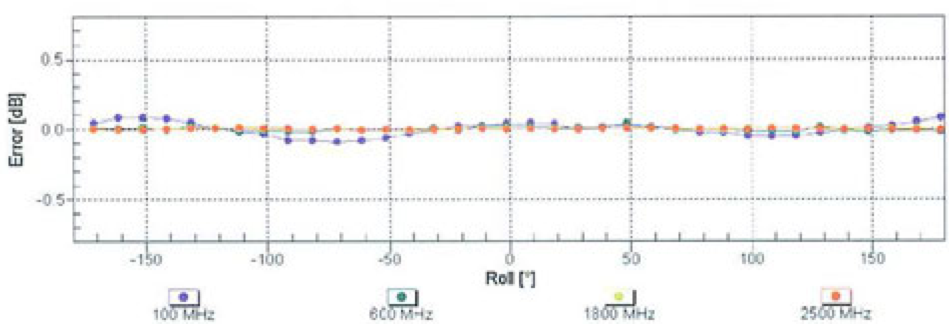
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

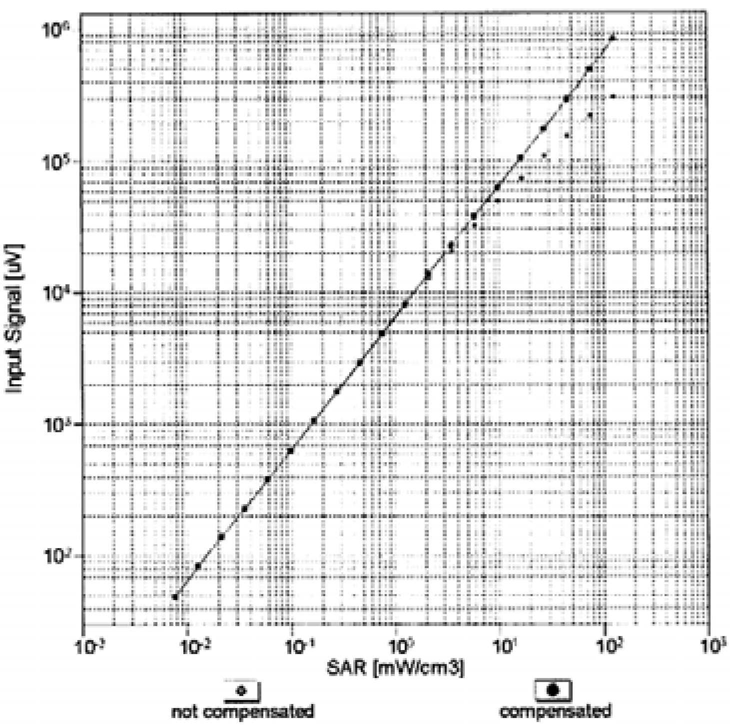


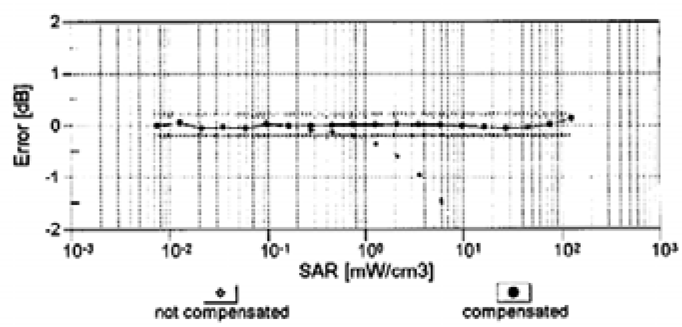


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)

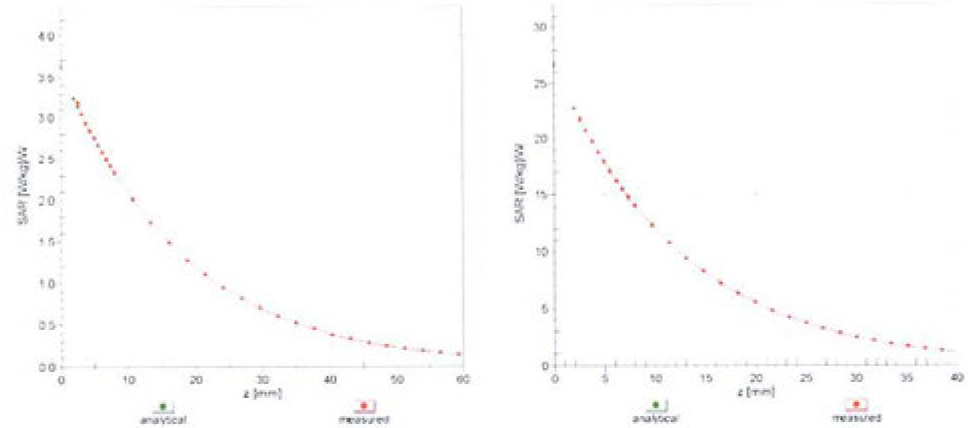




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

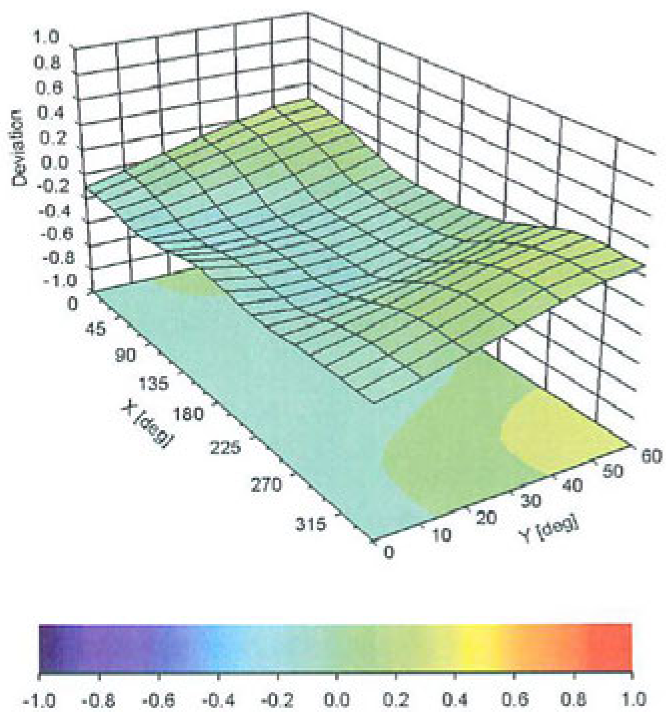
Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF) f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3301

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-71.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	2 mm

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **ES3-3291_Jul14**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3291
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	July 21, 2014

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	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 21, 2014

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

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
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Accreditation No.: **SCS 108**

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.e., 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, "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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect 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 with CW signal (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; Dx,y,z; VRx,y,z*: *A, B, C, D* 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 ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values 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 ± 50 MHz to ± 100 MHz.
- *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).

Probe ES3DV3

SN:3291

Manufactured: July 6, 2010
Calibrated: July 21, 2014

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3291

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.86	1.38	0.82	± 10.1 %
DCP (mV)[B]	105.1	99.8	104.4	

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	173.5	±2.5 %
		Y	0.0	0.0	1.0		168.9	
		Z	0.0	0.0	1.0		167.6	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.24	67.0	19.3	5.67	131.3	±1.4 %
		Y	6.24	66.6	19.2		127.6	
		Z	6.44	67.7	19.7		146.9	
10101-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	7.30	67.3	19.8	6.42	137.0	±1.7 %
		Y	7.39	67.3	19.8		137.3	
		Z	7.25	67.2	19.7		132.6	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.36	67.5	19.7	5.80	149.4	±1.4 %
		Y	6.18	66.4	19.2		126.3	
		Z	6.28	67.3	19.6		144.6	
10109-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	7.02	66.9	19.6	6.43	132.0	±1.4 %
		Y	7.15	66.9	19.7		134.2	
		Z	6.98	66.9	19.7		128.3	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.15	67.5	19.8	5.75	145.5	±1.9 %
		Y	6.08	66.7	19.4		147.1	
		Z	5.94	66.7	19.4		141.7	
10111-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	6.82	67.0	19.7	6.44	131.8	±1.7 %
		Y	6.87	66.6	19.5		130.0	
		Z	6.97	67.6	20.1		147.9	
10112-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	7.36	67.5	20.0	6.59	138.4	±1.9 %
		Y	7.37	67.0	19.8		136.7	
		Z	7.23	67.2	19.9		129.6	
10113-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	7.06	67.2	19.9	6.62	133.6	±1.9 %
		Y	7.14	66.9	19.8		131.7	
		Z	7.22	67.9	20.3		149.7	
10140-CAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	7.58	67.8	20.1	6.49	142.7	±1.7 %
		Y	7.62	67.5	20.0		140.7	
		Z	7.45	67.4	19.9		134.2	
10142-CAB	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	5.88	67.0	19.6	5.73	146.8	±1.4 %
		Y	5.93	66.6	19.4		144.3	
		Z	5.76	66.6	19.4		138.3	
10143-CAB	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	6.56	66.9	19.7	6.35	128.4	±1.4 %
		Y	6.63	66.5	19.5		127.4	
		Z	6.73	67.7	20.1		144.0	

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10145-CAB	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	5.56	66.6	19.4	5.76	141.0	±1.4 %
		Y	5.63	66.2	19.3		139.5	
		Z	5.48	66.5	19.3		132.8	
10146-CAB	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.46	67.7	20.1	6.41	143.9	±1.7 %
		Y	6.57	67.3	20.0		143.2	
		Z	6.34	67.6	20.1		134.8	
10149-CAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.03	67.0	19.7	6.42	131.0	±1.4 %
		Y	7.14	66.9	19.7		133.8	
		Z	6.97	66.8	19.6		128.1	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.01	66.9	19.5	5.75	143.8	±1.4 %
		Y	6.12	66.9	19.6		147.1	
		Z	5.97	66.9	19.5		141.0	
10155-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	6.75	66.7	19.6	6.43	127.1	±1.7 %
		Y	6.87	66.6	19.6		130.2	
		Z	6.98	67.7	20.2		148.1	
10156-CAB	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	5.80	66.8	19.5	5.79	139.6	±1.4 %
		Y	5.87	66.5	19.4		142.9	
		Z	5.72	66.6	19.5		136.2	
10157-CAB	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	6.77	67.7	20.2	6.49	146.2	±1.7 %
		Y	6.90	67.5	20.2		148.7	
		Z	6.68	67.6	20.2		141.4	
10158-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	6.99	67.0	19.8	6.62	129.0	±1.7 %
		Y	7.13	66.9	19.8		131.6	
		Z	7.23	67.9	20.4		149.7	
10159-CAB	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	6.90	67.9	20.3	6.56	146.9	±1.7 %
		Y	7.00	67.5	20.2		149.2	
		Z	6.81	67.8	20.3		142.2	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.21	66.5	19.2	5.82	126.2	±1.4 %
		Y	6.28	66.3	19.2		128.0	
		Z	6.44	67.5	19.8		146.7	
10161-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.07	67.0	19.7	6.43	131.5	±1.7 %
		Y	7.21	67.0	19.8		135.2	
		Z	7.04	67.1	19.8		128.9	
10166-CAB	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	4.91	66.2	19.1	5.46	129.8	±1.2 %
		Y	5.03	65.9	19.0		133.2	
		Z	5.08	67.1	19.7		149.2	
10167-CAB	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	5.76	67.3	19.9	6.21	130.5	±1.2 %
		Y	5.95	67.0	19.8		134.5	
		Z	5.67	67.2	19.9		127.0	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.90	67.3	20.0	5.73	149.0	±1.4 %
		Y	5.01	66.7	19.7		147.7	
		Z	4.83	67.0	19.9		141.6	
10170-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	5.59	68.3	20.9	6.52	147.6	±1.7 %
		Y	5.84	68.2	20.8		148.7	
		Z	5.49	68.0	20.7		140.1	

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10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.88	67.2	19.9	5.72	148.5	±1.4 %
		Y	5.02	66.8	19.7		147.3	
		Z	4.81	66.9	19.8		140.9	
10176-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	5.61	68.4	20.9	6.52	147.6	±1.9 %
		Y	5.83	68.1	20.7		148.5	
		Z	5.48	67.9	20.7		140.4	
10177-CAD	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	4.89	67.2	20.0	5.73	147.9	±1.4 %
		Y	5.02	66.8	19.7		148.0	
		Z	4.84	67.0	19.9		140.5	
10178-CAB	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	5.62	68.5	21.0	6.52	147.7	±1.7 %
		Y	5.84	68.1	20.7		148.2	
		Z	5.47	67.9	20.7		139.8	
10179-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	5.60	68.4	20.9	6.50	148.1	±1.7 %
		Y	5.85	68.3	20.8		148.2	
		Z	5.50	68.1	20.8		139.9	
10180-CAB	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	5.60	68.5	20.9	6.50	147.6	±1.7 %
		Y	5.85	68.2	20.8		148.1	
		Z	5.49	68.0	20.7		139.9	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.92	67.4	20.1	5.72	148.0	±1.4 %
		Y	5.01	66.7	19.7		147.2	
		Z	4.85	67.1	19.9		140.6	
10182-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	5.58	68.3	20.9	6.52	147.0	±1.9 %
		Y	5.83	68.1	20.7		148.5	
		Z	5.50	68.0	20.7		140.0	
10184-CAB	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	4.91	67.3	20.0	5.73	148.2	±1.4 %
		Y	5.03	66.8	19.7		146.9	
		Z	4.84	67.0	19.9		140.7	
10185-CAB	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	5.60	68.4	20.9	6.51	147.0	±1.7 %
		Y	5.83	68.1	20.7		148.2	
		Z	5.50	68.0	20.8		139.1	
10187-CAB	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	4.92	67.4	20.0	5.73	147.7	±1.4 %
		Y	5.03	66.8	19.7		147.6	
		Z	4.83	67.0	19.9		140.9	
10188-CAB	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	5.61	68.4	21.0	6.52	146.5	±1.7 %
		Y	5.85	68.1	20.8		148.0	
		Z	5.49	67.9	20.7		139.9	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.14	66.7	19.4	5.81	126.8	±1.7 %
		Y	6.44	67.4	19.8		149.2	
		Z	6.33	67.4	19.8		143.4	
10298-AAA	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	5.66	66.8	19.5	5.72	141.5	±1.4 %
		Y	5.71	66.3	19.3		140.5	
		Z	5.56	66.6	19.4		133.9	
10299-AAA	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.63	68.0	20.3	6.39	146.3	±1.7 %
		Y	6.69	67.4	20.0		145.5	
		Z	6.48	67.7	20.2		137.5	

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10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.72	67.3	19.7	6.06	132.4	±1.7 %
		Y	6.78	67.2	19.7		130.6	
		Z	6.92	68.0	20.1		149.6	

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 NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages8 and 9).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3291

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)
150	52.3	0.76	7.68	7.68	7.68	0.05	1.50	± 13.3 %
220	49.0	0.81	7.64	7.64	7.64	0.10	1.90	± 13.3 %
300	45.3	0.87	7.56	7.56	7.56	0.20	1.10	± 13.3 %
450	43.5	0.87	7.33	7.33	7.33	0.19	2.00	± 13.3 %
750	41.9	0.89	6.62	6.62	6.62	0.31	1.91	± 12.0 %
900	41.5	0.97	6.26	6.26	6.26	0.52	1.39	± 12.0 %
1810	40.0	1.40	5.19	5.19	5.19	0.42	1.61	± 12.0 %
1950	40.0	1.40	4.98	4.98	4.98	0.80	1.14	± 12.0 %
2300	39.5	1.67	4.76	4.76	4.76	0.75	1.23	± 12.0 %
2450	39.2	1.80	4.50	4.50	4.50	0.74	1.27	± 12.0 %
2600	39.0	1.96	4.39	4.39	4.39	0.80	1.21	± 12.0 %
3500	37.9	2.91	4.37	4.37	4.37	0.80	1.30	± 13.1 %
3700	37.7	3.12	3.99	3.99	3.99	0.80	1.30	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the 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 frequencies 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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3291

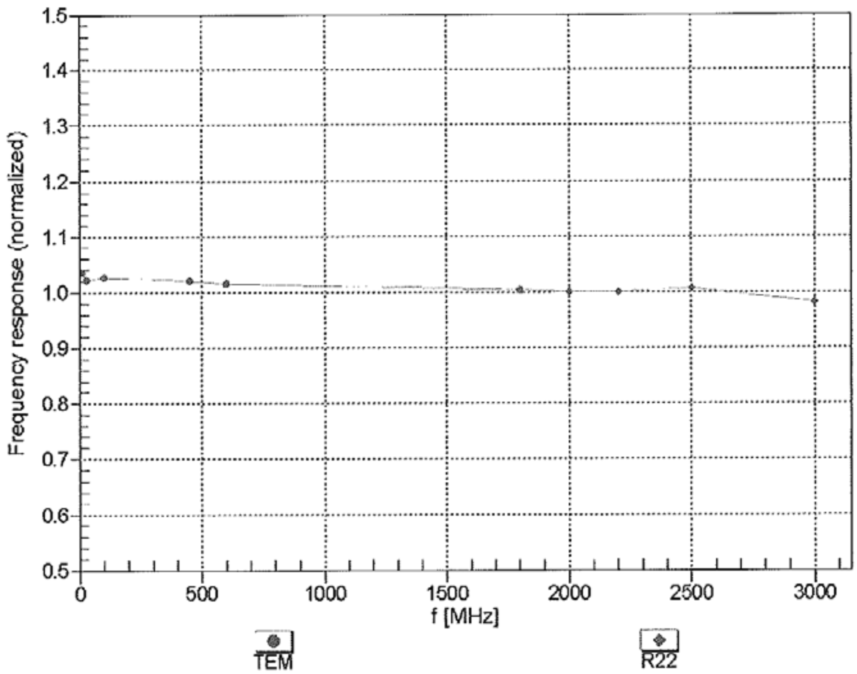
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
150	61.9	0.80	7.28	7.28	7.28	0.05	1.50	± 13.3 %
220	60.2	0.86	7.12	7.12	7.12	0.05	1.60	± 13.3 %
300	58.2	0.92	7.25	7.25	7.25	0.20	1.70	± 13.3 %
450	56.7	0.94	7.41	7.41	7.41	0.11	1.05	± 13.3 %
750	55.5	0.96	6.33	6.33	6.33	0.57	1.34	± 12.0 %
900	55.0	1.05	6.19	6.19	6.19	0.80	1.16	± 12.0 %
1810	53.3	1.52	4.89	4.89	4.89	0.76	1.33	± 12.0 %
1950	53.3	1.52	4.81	4.81	4.81	0.62	1.44	± 12.0 %
2300	52.9	1.81	4.40	4.40	4.40	0.71	1.25	± 12.0 %
2450	52.7	1.95	4.20	4.20	4.20	0.70	1.16	± 12.0 %
2600	52.5	2.16	4.03	4.03	4.03	0.80	1.00	± 12.0 %
3500	51.3	3.31	3.72	3.72	3.72	0.93	1.30	± 13.1 %
3700	51.0	3.55	3.63	3.63	3.63	0.90	1.39	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the 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 frequencies 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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

ES3DV3– SN:3291 July 21, 2014

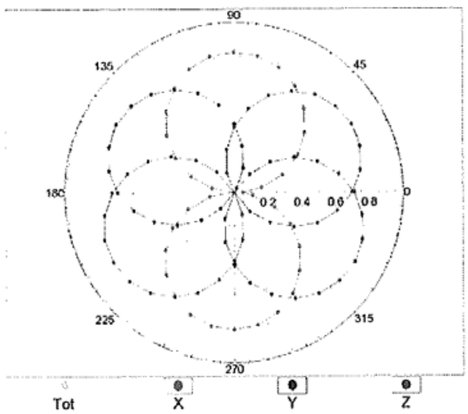
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



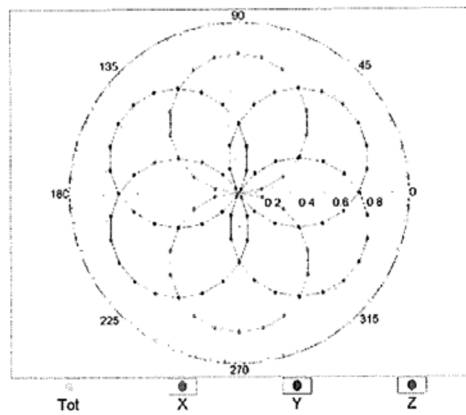
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

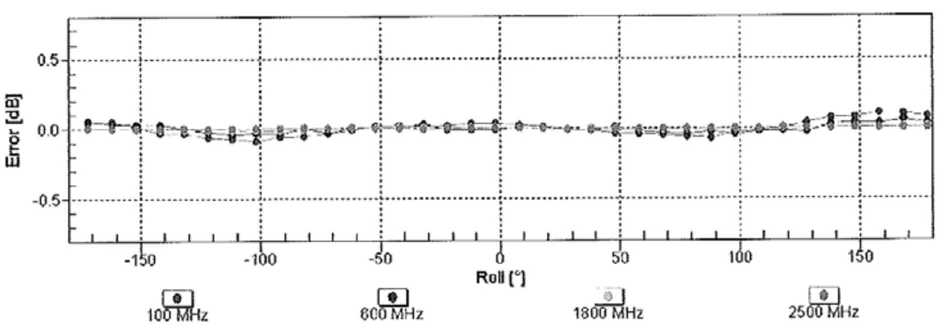
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

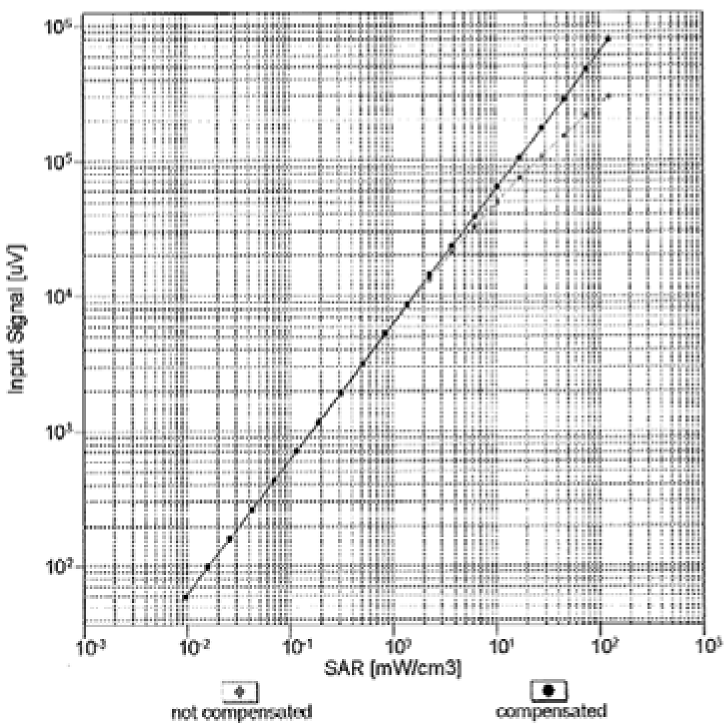


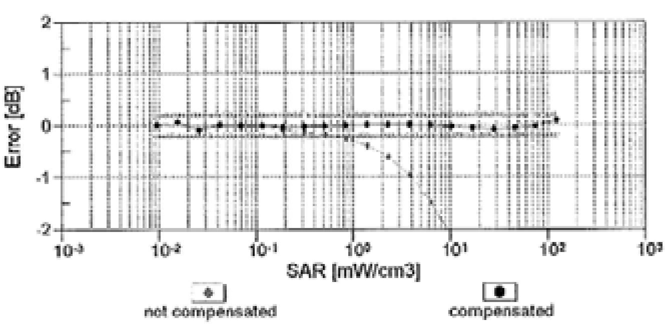


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

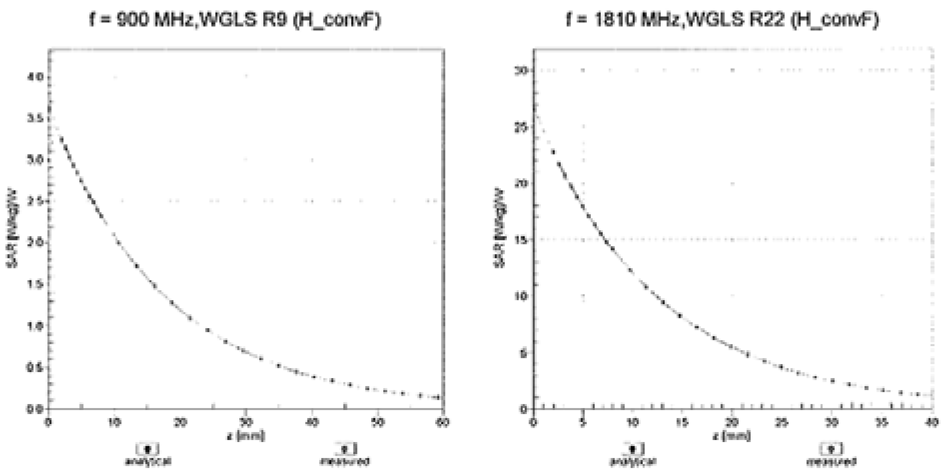
(TEM cell , f_{eval}= 1900 MHz)





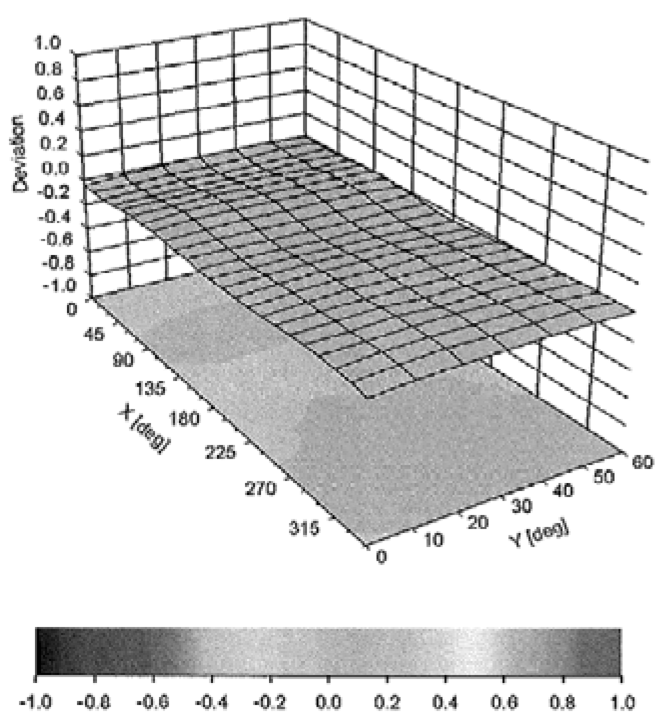
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3291

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-61.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Appendix C
Dipole Calibration Certificates

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola EME**

Certificate No: **D900V2-085_Feb14**

CALIBRATION CERTIFICATE

Object	D900V2 - SN: 085
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 12, 2014

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 EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-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 ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	[signature]
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: February 12, 2014

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

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 1528-2013, "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, "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) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

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	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	0.95 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**10.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.65 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.66 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.0	1.05 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.9 ± 6 %	1.03 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**10.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.66 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.70 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.8 Ω + 0.9 jΩ
Return Loss	- 34.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω - 0.7 jΩ
Return Loss	- 30.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 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	September 20, 2000

DASY5 Validation Report for Head TSL

Date: 11.02.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 085

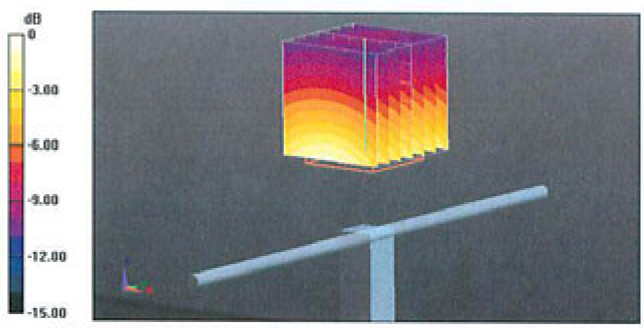
Communication System: UID 0 - CW; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 0.95 S/m; ε_r = 40.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

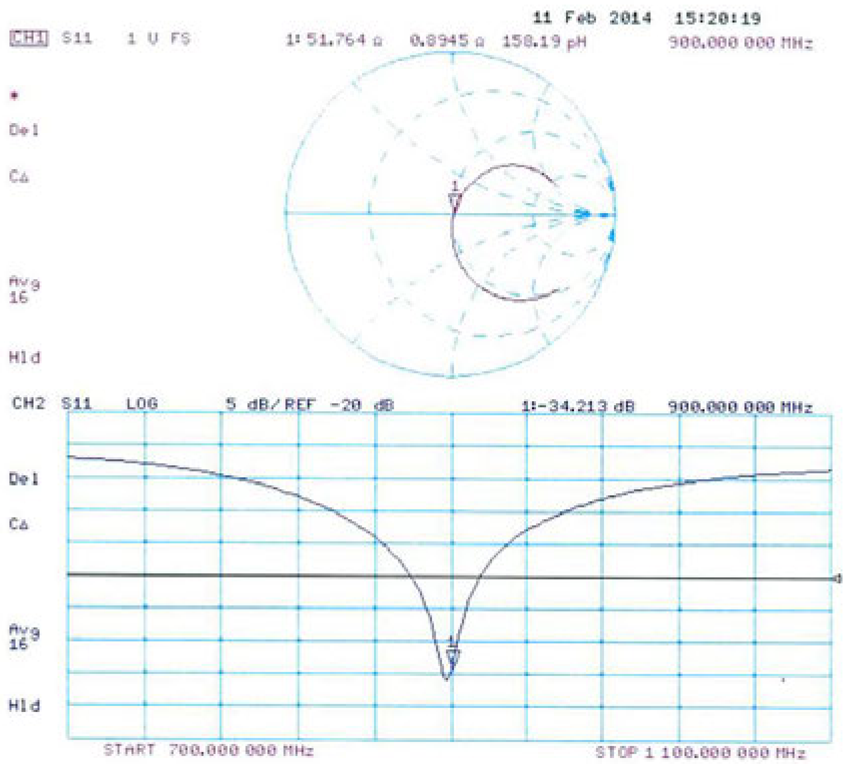
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.223 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.91 W/kg
SAR(1 g) = 2.58 W/kg; SAR(10 g) = 1.65 W/kg
Maximum value of SAR (measured) = 3.01 W/kg



0 dB = 3.01 W/kg = 4.79 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D900V2-085_Feb14 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 12.02.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 085

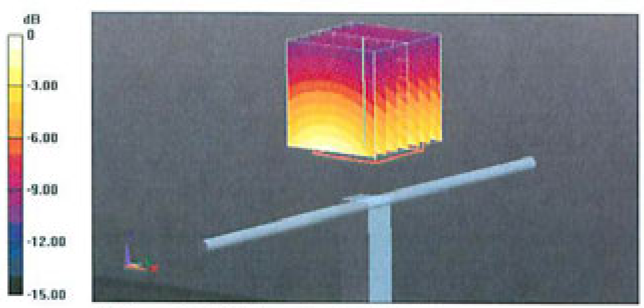
Communication System: UID 0 - CW; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 1.03 S/m; ε_r = 53.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.98, 5.98, 5.98); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:

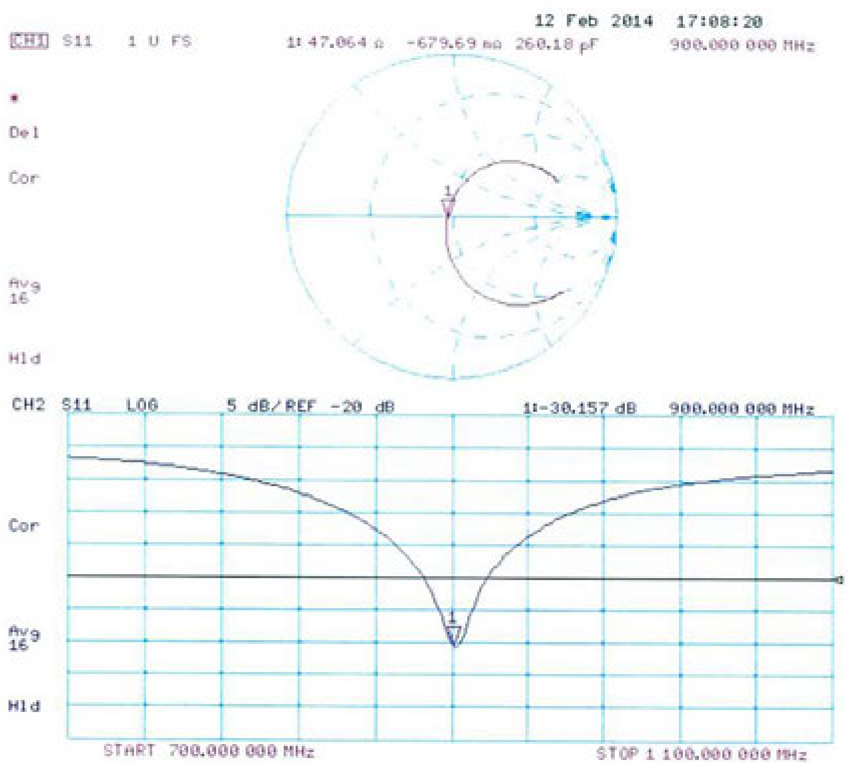
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.048 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.84 W/kg
SAR(1 g) = 2.58 W/kg; SAR(10 g) = 1.66 W/kg
Maximum value of SAR (measured) = 3.01 W/kg



0 dB = 3.01 W/kg = 4.79 dBW/kg

Certificate No: D900V2-085_Feb14 Page 7 of 8

Impedance Measurement Plot for Body TSL



Dipole Data

The table below includes dipole impedance and return loss measurement data measured by Motorola Solutions' EME lab. The results meet the requirements stated in KDB 865664.

900-085	Head			Body		
	Impedance		Return Loss	Impedance		Return Loss
Date Measured	real Ω	imag jΩ	dB	real Ω	imag jΩ	dB
2/12/2014	51.80	0.90	-34.2	47.10	-0.70	-30.2
2/25/2015	52.64	-3.19	-27.79	50.9	3.44	-29.10