TEST REPORT

Test of: General Dynamics Broadband, LTE USB Stick: APJ

To: KDB 865664 D01 SAR Measurement 100MHz to 6GHz

FCC ID: PKTUSBSTKAPJ

Test Report Serial No:
UL-SAR-RP10258871JD04A V3.0

Version 3.0 superseded all previous report versions

This Test Report Is Issued Under The Authority Of Richelieu Quoi, SAR Technology Consultant:	**PP** (APPROVED SIGNATORY)
Checked By: Sandhya Menon	(APPROVED SIGNATORY)
Issue Date:	**08 July 2014**
Test Dates:	**03 April 2014 to 07 April 2014**

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1. Customer Information

Company Name:	General Dynamics Broadband
Address:	Unit 7 Greenways Business Park Bellinger Close Chippenham Wilts SN15 1BN United Kingdom

2. Summary of Test Results

Test Name	Specification Reference	Result
Specific Absorption Rate – LTE Band 14	KDB 865664 D01 SAR Measurement 100MHz to 6GHz	
Key to Results	= Complied = Did not comply	

2.1. Highest Standalone Reported SAR

Individual Transmitter Evaluation per Band: USB Dongle					
Exposure Configuration	**Technology Band**	**Mode**	**Highest Reported 1g -SAR (W/kg)**	**Equipment Class**	**Max Rated Source base Avg Power + Max Tolerance [dBm]**
Body (Separation Distance 5mm)	LTE Band 14	Data	1.146	TNB	24.0
Individual Transmitter Evaluation per Band: Transmitter Antenna					
Exposure Configuration	**Technology Band**	**Mode**	**Highest Reported 1g -SAR (W/kg)**	**Equipment Class**	**Max Rated Source base Avg Power + Max Tolerance [dBm]**
Body (Separation Distance 10mm)	LTE Band 14	Data	0.998	TNB	24.0

Note:

1. The Simultaneous transmission was not evaluated as the EUT did not support this feature.
2. For All SAR measurement in this report, the SAR limit tested to is **1.6 W/Kg** average over 1g-SAR.

2.2. SAR measurement variability and measurement uncertainty analysis:

Exposure Configuration	Technology Band	Measured 1g -SAR (W/Kg)	Equipment Class	Max Meas. Source base Avg Power [dBm]	Ratio of Largest to Smallest SAR Measured
Body (Separation Distance 5mm)	LTE Band 14	0.869	TNB	22.8	1.03
		0.840			

Note(s):

1. The following step below were followed as per KDB publication 865664 D01:

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

*2) When the original **highest measured** SAR is ≥ 0.80 W/kg, repeat that measurement once.*

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

2.3.Nominal and Maximum Output power:

Bands	Max Rated with Upper Tolerance (dBm)		
	1 RB	50% RB	100% RB
LTE Band 14	24.0	24.0	24.0

Note:

1. As per KDB865664 D02 SAR Reporting v02, the nominal and maximum average source based rated power, declared by manufacturer are shown in the above tables.
2. These are specified maximum allowed average power for all the wireless mode and frequency band supported as indicated by manufacturer.

2.4. Location of Tests

All the measurements described in this report were performed at the premises of
UL, Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG United Kingdom

3. Test Specification, Methods and Procedures

3.1. Test Specification

Reference:	KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
Title:	SAR Measurement Requirements for 100 MHz to 6 GHz
Purpose of Test:	Field probes, tissue dielectric properties, SAR scans, measurement accuracy and variability of the measured results are discussed. The field probe and SAR scan requirements are derived from criteria considered in draft standard IEEE P1528-2011. The similar requirements in Supplement C 01-01 are generally superseded by the procedures in this document, and which are required to be used to qualify for TCB equipment approval.
The Equipment Under Test complied with the Specific Absorption Rate for general population/uncontrolled exposure limit of 1.6 W/kg as specified in FCC 47 CFR part 2 (2.1093) and ANSI C95.1-1992 and has been tested in accordance with the reference documents in section 3.2 of this report.	

3.2. Methods and Procedures Reference Documentation

The methods and procedures used were as detailed in:

Federal Communications Commission, “Evaluating compliance with FCC Guidelines for human exposure to radio frequency electromagnetic fields”, OET Bulletin 65 Supplement C, FCC, Washington, D.C, 20554, 2001.

Thomas Schmid, Oliver Egger and Neils Kuster, “Automated E-field scanning system for dosimetric assessments”, IEEE Transaction on microwave theory and techniques,
Vol. 44, pp. 105-113, January 1996.

Neils Kuster, Ralph Kastle and Thomas Schmid, “Dosimetric evaluation of mobile communications equipment with know precision”, IEICE Transactions of communications, Vol. E80-B, No.5, pp. 645-652, May 1997.

447498 D01 General RF Exposure Guidance v05r02

447498 D02 SAR Procedures for Dongle Xmtr v02

941225 D05 SAR for LTE Devices v02r03

865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03

865664 D02 RF Exposure Reporting v01r01

3.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Appendix 1 contains a list of the test equipment used.

4. Equipment Under Test (EUT)

4.1. Identification of Equipment Under Test (EUT)

Description:	LTE USB Stick
Brand Name:	General Dynamics Broadband
Model Name or Number:	APJ
Serial Number:	APJHD06005222
IMEI Number:	Not Applicable
Hardware Version Number:	Pass 1
Software Version Number:	Release 4
Hardware Revision of GSM Module:	Not Applicable
Software Revision of GSM Module:	Not Applicable
FCC ID Number:	PKTUSBSTKAPJ
Country of Origin:	United Kingdom
Date of Receipt:	01 April 2014

4.2. Identification of Equipment Under Test (EUT)

Description:	Remote antenna Accessory
Brand Name:	General Dynamics Broadband.
Model Name or Number:	LTE-ODUP001-IPW
Serial Number:	GT1229LT006170
IMEI Number:	Not Applicable
Cable Length and Type:	~3.2 m Dual RF Cable
Hardware Version Number:	None Stated
Country of Manufacture:	China
Date of Receipt:	01 April 2014

4.3. Description of EUT

The Equipment Under Test is a 'LTE USB Dongle Stick Modem' and an 'attachable antenna' with Mono band capability supporting LTE Band 14, 10 MHz Bandwidth channel. The EUT is a power class 3 device.

4.4. Accessories

The following accessories were supplied with the EUT during testing:

Description:	USB Cable
Brand Name:	None Stated
Model Name or Number:	None Stated
Serial Number:	Not Applicable
Cable Length and Type:	~132.5mm USB Cable
Country of Manufacture:	None Sated
Connected to Port	Standard USB Port

4.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	Latitude D620
Serial Number:	None Stated
Cable Length and Type:	Not Applicable
Connected to Port:	Not Applicable

Description:	Radio Communication Analyzer
Brand Name:	Anritsu
Model Name or Number:	MT8820C
Serial Number:	6200938937
Cable Length and Type:	~4.0m Utiflex Cable
Connected to Port:	RF (Input / Output) Air Link

4.6. Additional Information Related to Testing

Equipment Category	4G LTE Band	FDD 14		Data
Type of Unit	Portable Transceiver			
Intended Operating Environment:	Within LTE Coverage for General Population / Uncontrolled Exposure category.			
Transmitter Maximum Output Power Characteristics:	LTE Band 14	Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D05.		
Transmitter Frequency Range:	LTE Band 14	788 to 798 MHz		
Transmitter Frequency Allocation of EUT When Under Test:	**Bands**	**Channel Number**	**Channel Description**	**Frequency (MHz)**
	LTE Band 14	23330	Middle	793.0
Modulation(s):	FDD(QPSK / 16QAM): 0 Hz			0 Hz
Modulation Scheme (Crest Factor for technologies SAR tested):	FDD (QPSK / 16QAM): 1			1
Antenna Type:	USB Dongle: Internal Integral Unknown Type Attachable Antenna: Unknown Type			
Antenna Length:	USB Dongle: Unknown Attachable Antenna: 172mm			
Antenna Dimensions:	Attachable Antenna: (172 x 28 x 15) mm			
Number of Antenna Positions:	1 Fixed			
Power Supply Requirement:	5v (USB Port Supply)			
Battery Type(s):	Not Applicable			

5. Deviations from the Test Specification

Test was performed as per KDB publication and standards listed in section 3.2

Prior to the SAR testing, the test procedure was agreed and accepted by FCC for testing as per the KDB 447498 D02.

6. Operation and Configuration of the EUT during Testing

6.1. Operating Modes

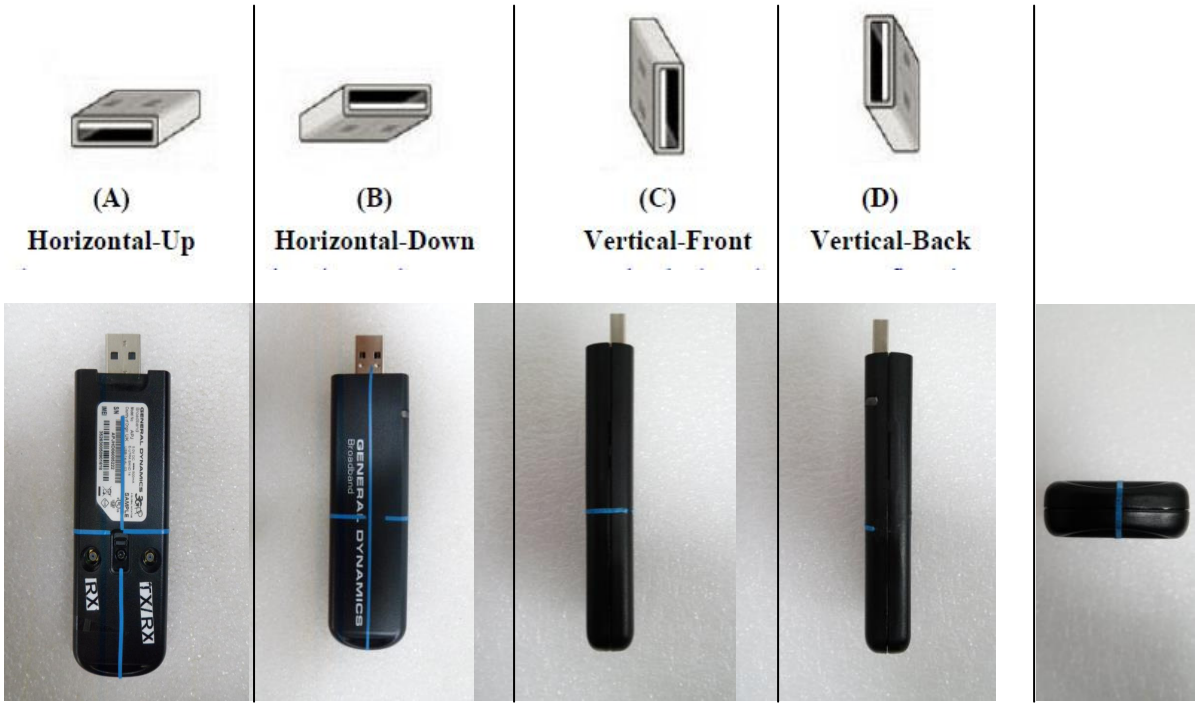
The EUT was tested in the following operating mode(s) unless otherwise stated:

- LTE Band 14 data allocated mode at QPSK & 16 QAM on the 10 MHz channel only, using an Anritsu MT8820C Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D05.

6.2. Configuration and Peripherals

The EUT was tested in the following configuration(s) unless otherwise stated:

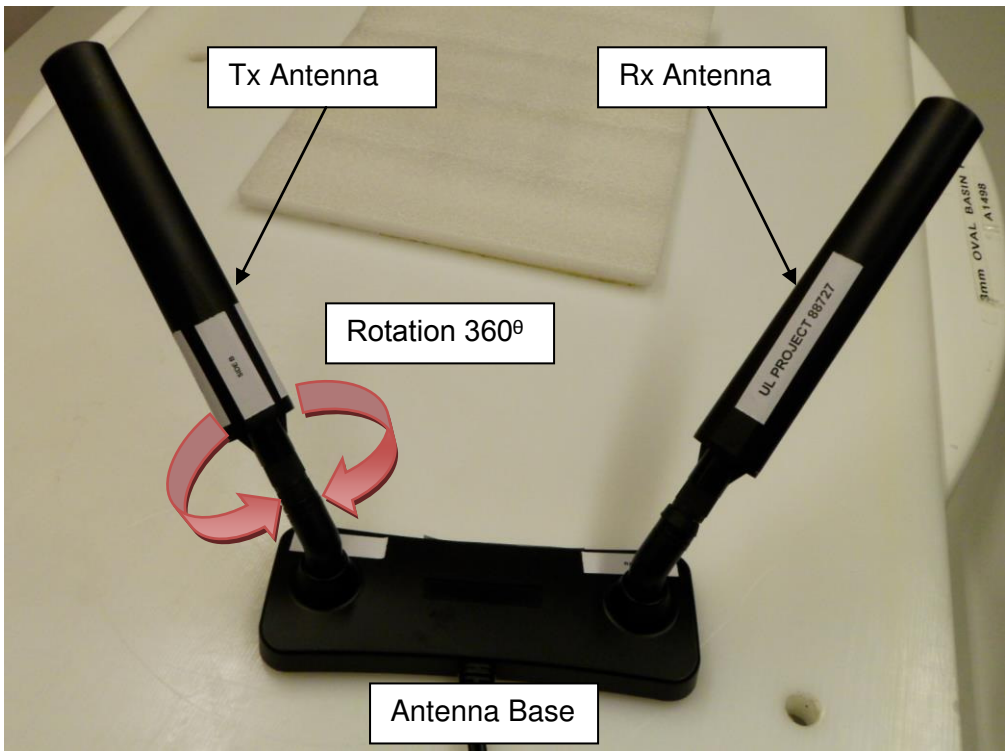
- Powered via a USB port.
- SAR measurements were performed using a duty cycle of 100% and maximum average power of 23 dBm (+/-1dBm tolerance). All modulation types (QPSK and 16QAM) were evaluated.
- EUT was tested in the body-worn position with all 5 edges (Horizontal-Down, Horizontal-Up, Vertical-Front, Vertical-Back and Top or Tip) facing the SAR phantom at a separation distance of 5mm for the USB dongle and at 10mm for the antenna. The following configurations highlighted below were used.
- The below are the configuration covered is as per KDB 447498 D02 SAR Procedures for Dongle Xmtr v02. Appendix 4 shows the EUT setup in these configurations.
- SAR Test Configuration for USB Dongle was performed on CH 23330 (793.0 MHz).
- USB configuration with respect to connector orientation implemented on laptop computer:



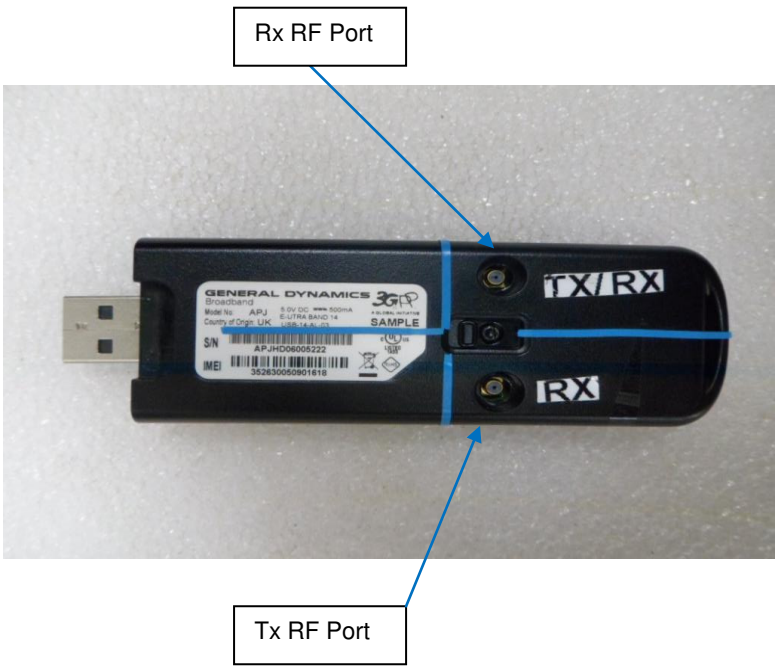
Tip Configuration

EUT Position For USB dongle
Side (A): Horizontal-Up
Side (B): Horizontal-Down
Side (C): Vertical-Front
Side (D): Vertical-Back
Tip

- SAR Test Configuration for USB Dongle + Antenna Operating was performed on CH 23330 (793.0 MHz).
- Antenna configuration: The neck of the antenna rotates in a 360 degrees angle of rotation. To ensure all surfaces of the antenna is evaluated the neck is rotated while the base holder is kept fixed as the shape of the antenna does not allow the entire unit (antenna + base) to be rotated.



- The antenna when mounted to the base has 2 elements, one for Tx and one for Rx. SAR test will be performed on the Tx element indicated below. Prior to selecting the Tx antenna, the output of the RF port on the base unit was checked to ensure power was transmitting from the correct RF port to the antenna.



Side (A): Horizontal-Up

Side (B): Horizontal-Down

Side (C): Vertical-Front

Side (D): Vertical-Back

Tip

EUT Position For USB dongle
Side (A): Horizontal-Up
Side (B): Horizontal-Down
Side (C): Vertical-Front
Side (D): Vertical-Back
Tip

Body Configuration

a) The EUT was placed in a normal operating position where the centre of EUT was aligned with the centre reference point on the flat section of the 'Eli phantom.

b) With the EUT touching the phantom at an imaginary centre line. The EUT was aligned with a marked plane (X and Y axis) consisting of two lines.

c) For the touch-safe position the EUT was gradually moved towards the flat section of the 'SAM' phantom until any point of the EUT touched the phantom.

d) For position(s) greater then 0mm separation the EUT was positioned as per the touch-safe position, and then the vertical height was decreased/adjusted as required.

e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.

f) The device was keyed to operate continuously in the transmit mode for the duration of the test.

g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the EUT and its antenna.

h) The EUT was transmitting at full power throughout the duration of the test powered by a USB Interface.

7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to section 8 for details of measurement uncertainties.

7.2. RF Output Average Power Measurement: LTE

7.2.1. LTE Band 14 (700 MHz)

Ch. BW	Modulations	RB Config	Start RB Offset		Rated power(dBm)	Max Rated Power with Tolerance (dBm)	Measured Avg Power (dBm).		
							Frequency **788.0 MHz** (Low)	Frequency **793.0 MHz** (Middle)	Frequency **798.0 MHz** (High)
10 MHz	QPSK	1	Low	0	23.0	24.0	Not Supported	22.4	Not Supported
		1	Mid	24	23.0	24.0		22.8	
		1	High	49	23.0	24.0		22.4	
		25	Low	0	23.0	24.0		22.5	
		25	Mid	12	23.0	24.0		23.0	
		25	High	25	23.0	24.0		22.8	
		50	-	0	23.0	24.0		22.7	
	16QAM	1	Low	0	23.0	24.0		22.4	
		1	mid	24	23.0	24.0		22.5	
		1	High	49	23.0	24.0		22.4	
		25	Low	0	23.0	24.0		22.5	
		25	Mid	12	23.0	24.0		22.8	
		25	High	25	23.0	24.0		22.8	
		50	-	0	23.0	24.0		22.7	

7.3. Test Results

For All SAR measurement in this report the SAR limit tested to is 1.6 W/kg

7.3.1.Specific Absorption Rate - LTE Band 14 - 10MHz Channel BW – USB Dongle Body Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.869
Maximum Reported Level (W/kg):	1.146

Results:

Scan No.	EUT Position	Channel Number	Separation Distance (mm)	Meas. Avg Power (dBm)	Max Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note (s)	Mod.
1	Side (A): Horizontal-Up	23330	5.0	22.8	24.0	0.869	1.146	1, 4	QPSK
2	Side (A): Horizontal-Up	23330	5.0	23.0	24.0	0.836	1.052	2	QPSK
3	Side (A): Horizontal-Up	23330	5.0	22.7	24.0	0.777	1.048	3	QPSK
4	Side (B): Horizontal-Down	23330	5.0	22.8	24.0	0.575	0.758	1	QPSK
5	Side (B): Horizontal-Down	23330	5.0	23.0	24.0	0.618	0.778	2	QPSK
6	Side (C): Vertical-Front	23330	5.0	22.8	24.0	0.343	0.452	1	QPSK
7	Side (C): Vertical-Front	23330	5.0	23.0	24.0	0.341	0.429	2	QPSK
8	Side (D): Vertical-Back	23330	5.0	22.8	24.0	0.221	0.291	1	QPSK
9	Side (D): Vertical-Back	23330	5.0	23.0	24.0	0.227	0.286	2	QPSK
10	Tip	23330	5.0	22.8	24.0	0.056	0.074	1	QPSK
11	Tip	23330	5.0	23.0	24.0	0.059	0.074	2	QPSK

Note(s):

1. 1 RB Allocation - Middle of the Channel Bandwidth.
2. 50% RB Allocation - Middle of the Channel Bandwidth.
3. 100% RB Allocation – of the channel Bandwidth.
4. As per 865664 D01, the highest SAR measured > 0.8 W/kg has been re-measured and included in the report in section 2.3 under ***SAR Measurement Variability and Measurement Uncertainty Analysis Results*** Table.

7.3.2.Specific Absorption Rate - LTE Band 14 - 10MHz Channel BW – Transmitter Antenna
Body Configuration 1g
Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.740
Maximum Reported Level (W/kg):	0.998

Results:

Scan No.	EUT Position	Channel Number	Separation Distance (mm)	Meas. Avg Power (dBm)	Max Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
12	Side (A): Horizontal-Up	23330	10.0	22.8	24.0	0.455	0.600	1	QPSK
13	Side (A): Horizontal-Up	23330	10.0	23.0	24.0	0.482	0.607	2	QPSK
14	Side (B): Horizontal-Down	23330	10.0	22.8	24.0	0.620	0.817	1	QPSK
15	Side (B): Horizontal-Down	23330	10.0	23.0	24.0	0.660	0.831	2	QPSK
16	Side (B): Horizontal-Down	23330	10.0	22.7	24.0	0.740	0.998	3	QPSK
17	Side (C): Vertical-Front	23330	10.0	22.8	24.0	0.240	0.316	1	QPSK
18	Side (C): Vertical-Front	23330	10.0	23.0	24.0	0.257	0.324	2	QPSK
19	Side (D): Vertical-Back	23330	10.0	22.8	24.0	0.646	0.852	1	QPSK
20	Side (D): Vertical-Back	23330	10.0	23.0	24.0	0.677	0.852	2	QPSK
21	Side (D): Vertical-Back	23330	10.0	22.7	24.0	0.684	0.923	3	QPSK
22	Tip	23330	10.0	22.8	24.0	0.014	0.018	1	QPSK
23	Tip	23330	10.0	23.0	24.0	0.014	0.017	2	QPSK

Note(s):

1. 1 RB Allocation - Middle of the Channel Bandwidth.
2. 50% RB Allocation - Middle of the Channel Bandwidth.
3. 100% RB Allocation – of the channel Bandwidth.

*As per KDB 941225 D05 SAR for LTE Devices v02r03, the following steps were followed to perform SAR evaluation:

Largest Channel BW

1. QPSK 1RB Allocation

Start with 1RB offset Config with the highest maximum output power on required test channel (1RB low, 1RB high or 1RB mid). If value in (1) is ≤ 0.8W/kg, testing of remaining RB offset configurations and test channels not required for 1RB

2. QPSK 50% RB Allocation

Apply steps followed in (1) for measuring 50% RB

3. QPSK 100% RB Allocation

SAR not required if highest output power from (1) and (2) is higher than 100% RB output power and if SAR Values in step (1) and (2) ≤0.8W/kg

4. 16 QAM

Apply steps (1), (2) and (3) for testing 16-QAM/64-QAM, for each configuration SAR required only when highest maximum output power for the highest order modulation (ex. 16-QAM) > QPSK by 0.5dB or when reported SAR for QPSK > 1.45W/kg

8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Test Name	Confidence Level	Calculated Uncertainty
Specific Absorption Rate- LTE Band 14 Body Configurations 1g	95%	±18.36%

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

Note:

1. See Appendix 2 section A.2.3 for table calculations and parameters

Appendix 1. Test Equipment Used

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A034	Narda 20W Termination	Narda	374BNM	8706	Calibrated as part of system	-
A1097	SMA Directional Coupler	MiDISCO	MDC6223-30	None	Calibrated as part of system	-
A1234	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	450	31 Oct 2013	12
A2436	Probe	Schmid & Partner Engineering AG	ES3DV3	3335	08 Jan 2014	12
A1985	750 MHz Dipole Kit	Schmid & Partner Engineering AG	D750V3	1011	13 Feb 2013	24
A1938	Amplifier	Mini-Circuits	zhl-42	QA0826002	Calibrated as part of system	-
A2437	Eli Phantom	Schmid & Partner Engineering AG	Eli5 (Site 56)	1235	Calibrated before use	-
A215	20 dB Attenuator	Narda	766-20	9402	Calibrated as part of system	-
A1137	3dB Attenuator	Narda	779	04690	Calibrated as part of system	-
A2263	Digital Camera	Samsung	PL211	9453C90B 607487L	-	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	04 October 2013	12
C1146	Cable	Rosenberger MICRO-COAX	FA147A F030003030	41752-1	Calibrated as part of system	-
M1047	Robot Power Supply	Schmid & Partner Engineering AG	DASY4	F00/SD89A1/A/01	Calibrated before use	-
G087	PSU	Thurlby Thandar	CPX200	100701	Calibrated before use	-
M1047	Robot Arm	Staubli	RX908 L	F00/SD89A1/A/01	Calibrated before use	-
M1839	Signal Generator	R&S	SME06	837633/001	Calibrated as part of system	-
M509	Digital Thermometer	RS	N/A	N/A	01 May 2014	12
M1023	Dual Channel Power Meter	R&S	NRVD	863715/030	06 June 2013	12
A119	SAR Lab	UL	Site 57	N/A	Calibrated before use	-

A.1.1. Calibration Certificates

This section contains the calibration certificates and data for the Probe(s) and Dipole(s) used, which are not included in the total number of pages for this report.

Checked M. Nasen 24/01/2014

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
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

Client UL RFI UK A2436

Certificate No: ES3-3335_Jan14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3335

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

Calibration date: January 8, 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	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
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: January 8, 2014

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

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:3335

Manufactured: January 24, 2012
Calibrated: January 8, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3335

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.87	0.90	1.20	± 10.1 %
DCP (mV)[B]	105.3	103.5	101.9	

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	171.8	±2.7 %
		Y	0.0	0.0	1.0		177.1	
		Z	0.0	0.0	1.0		151.9	

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 5 and 6).
[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:3335

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	6.33	6.33	6.33	0.75	1.19	± 12.0 %
835	41.5	0.90	6.13	6.13	6.13	0.80	1.15	± 12.0 %
900	41.5	0.97	6.00	6.00	6.00	0.47	1.51	± 12.0 %
1750	40.1	1.37	5.41	5.41	5.41	0.67	1.32	± 12.0 %
1900	40.0	1.40	5.23	5.23	5.23	0.54	1.50	± 12.0 %
2100	39.8	1.49	5.25	5.25	5.25	0.48	1.64	± 12.0 %
2450	39.2	1.80	4.55	4.55	4.55	0.80	1.30	± 12.0 %
2600	39.0	1.96	4.36	4.36	4.36	0.77	1.37	± 12.0 %

[C] Frequency validity 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.
[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.

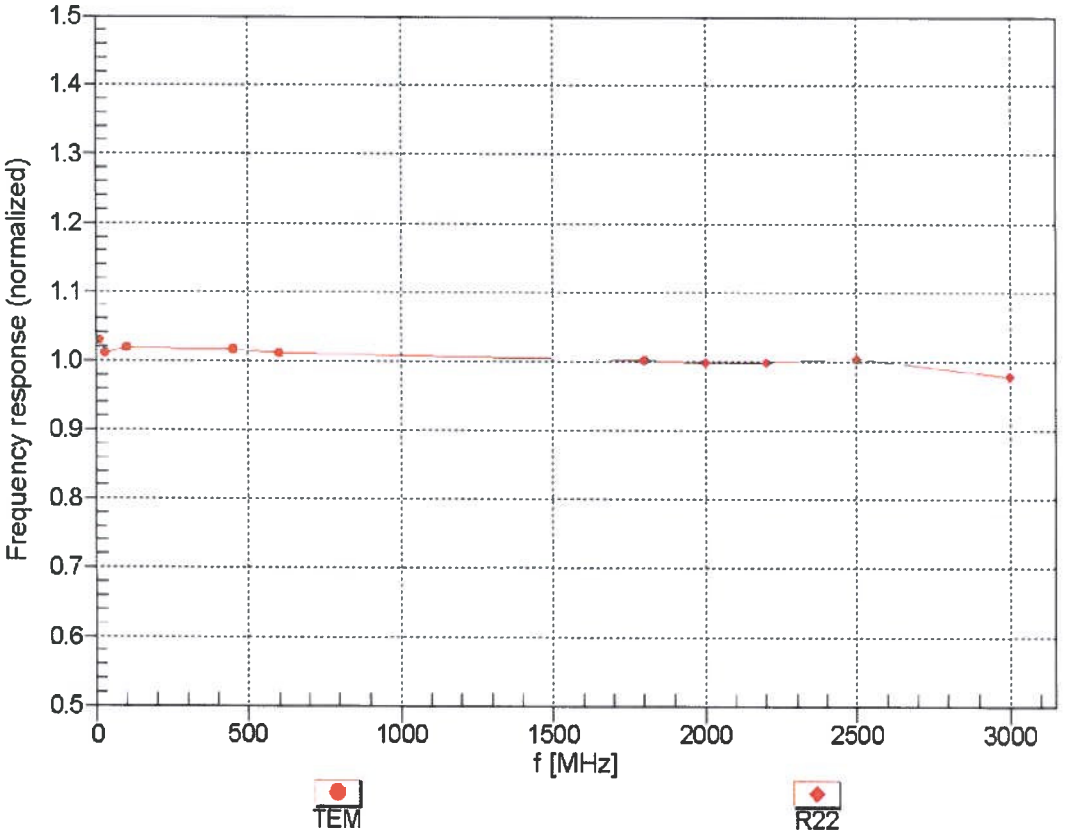
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3335

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	6.20	6.20	6.20	0.30	1.98	± 12.0 %
835	55.2	0.97	6.15	6.15	6.15	0.37	1.74	± 12.0 %
900	55.0	1.05	6.04	6.04	6.04	0.80	1.18	± 12.0 %
1750	53.4	1.49	5.21	5.21	5.21	0.80	1.33	± 12.0 %
1900	53.3	1.52	4.95	4.95	4.95	0.61	1.56	± 12.0 %
2100	53.2	1.62	4.99	4.99	4.99	0.61	1.57	± 12.0 %
2450	52.7	1.95	4.42	4.42	4.42	0.71	1.19	± 12.0 %
2600	52.5	2.16	4.14	4.14	4.14	0.80	1.03	± 12.0 %

[C] Frequency validity 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.
[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.

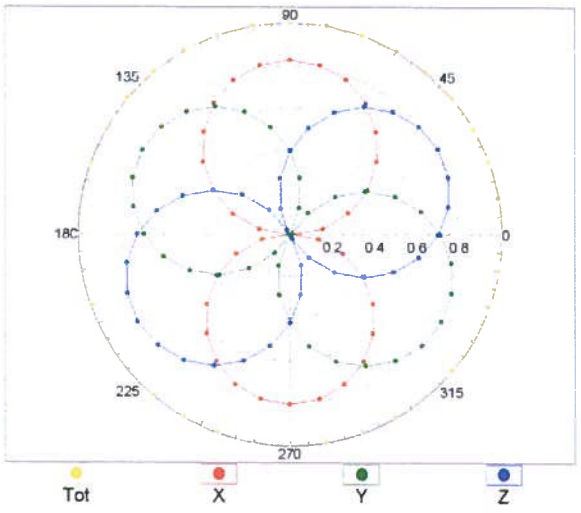
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



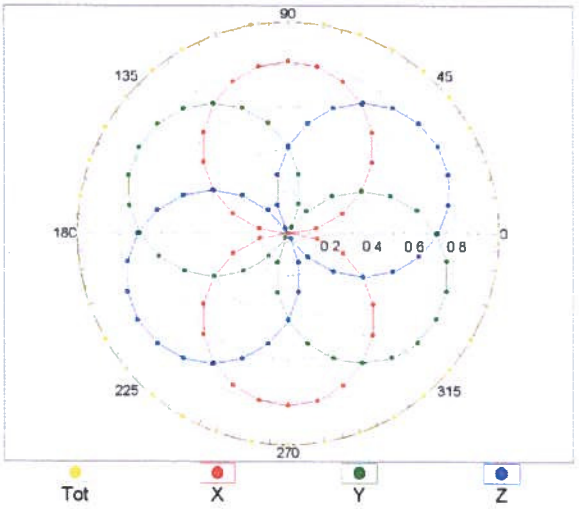
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

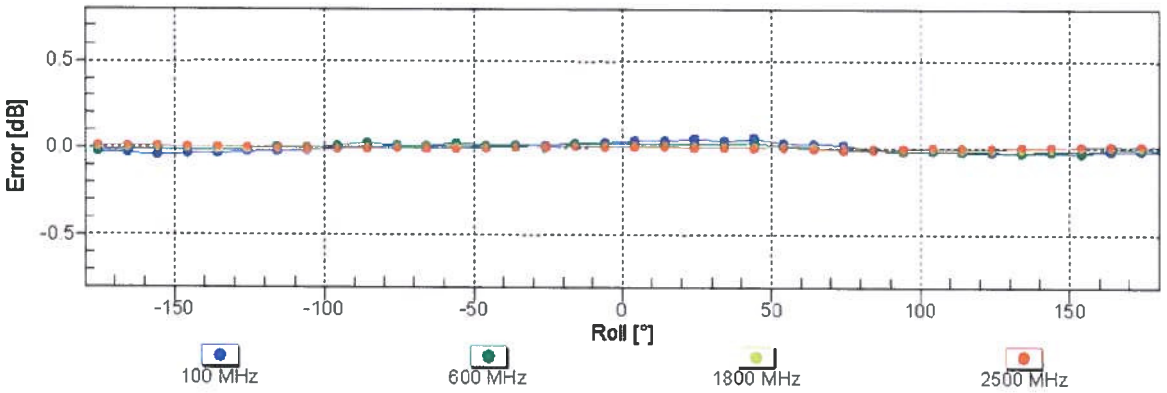
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



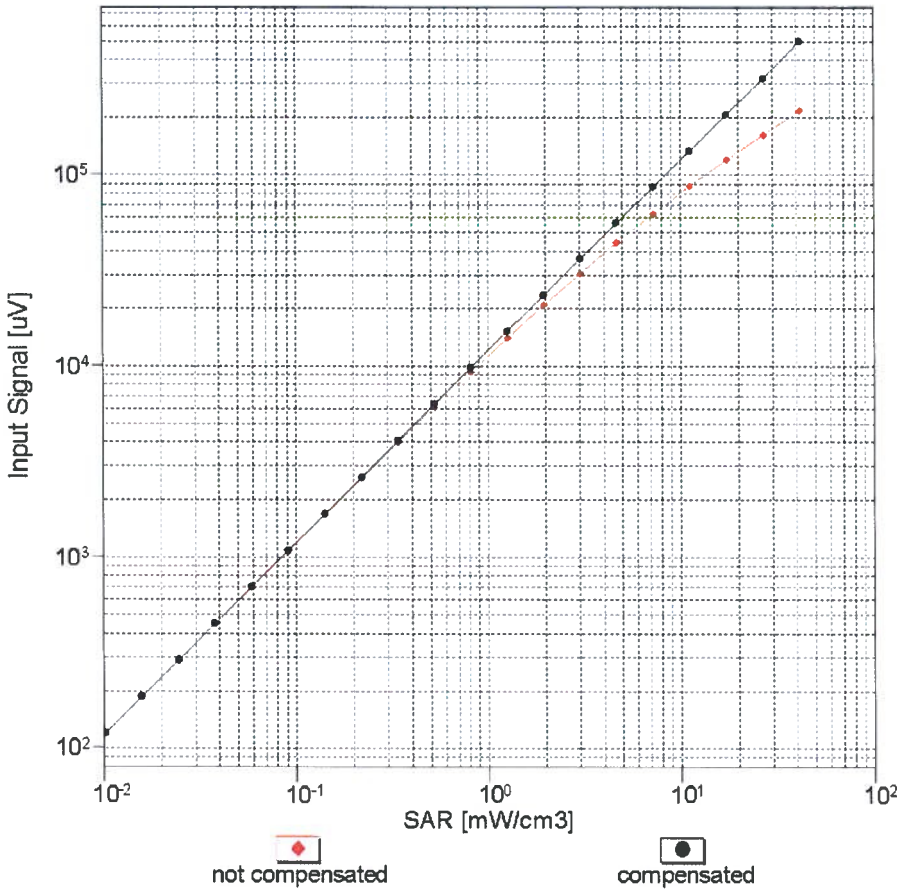
f=1800 MHz,R22

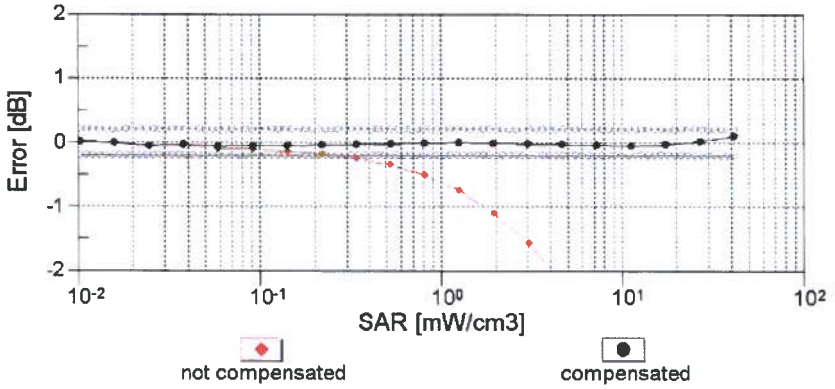




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)
(TEM cell , f = 900 MHz)

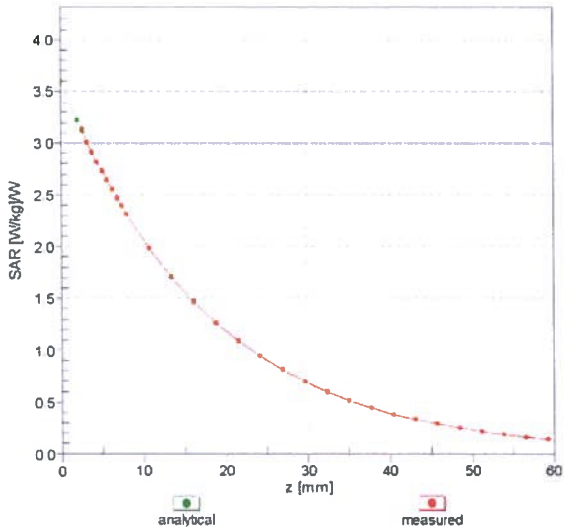




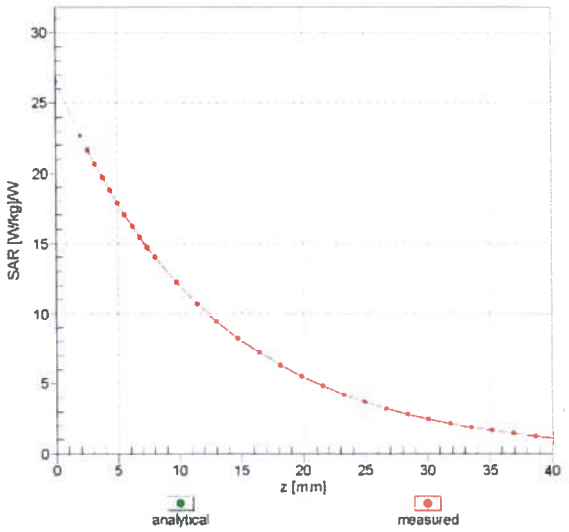
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

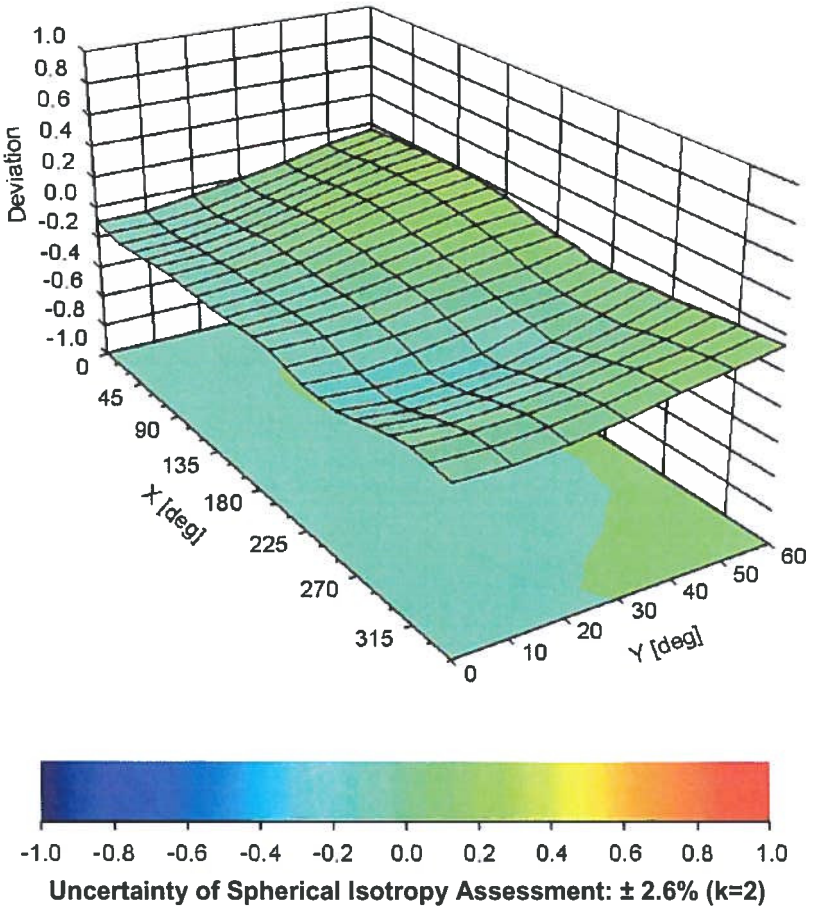


f = 1750 MHz,WGLS R22 (H_convF)



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:3335

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-75.8
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

checked by AH
DATE: 26-JAN-2013

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
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

Client RFI A1985

Certificate No: D750V3-1011_Feb13

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1011
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 18, 2013

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 18, 2013

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.2 ± 6 %	0.91 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	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.50 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.55 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	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.8 ± 6 %	0.99 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	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.77 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.84 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.5 Ω + 0.0 jΩ
Return Loss	- 29.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7 Ω - 1.4 jΩ
Return Loss	- 38.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.040 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 29, 2009

DASY5 Validation Report for Head TSL

Date: 15.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1011

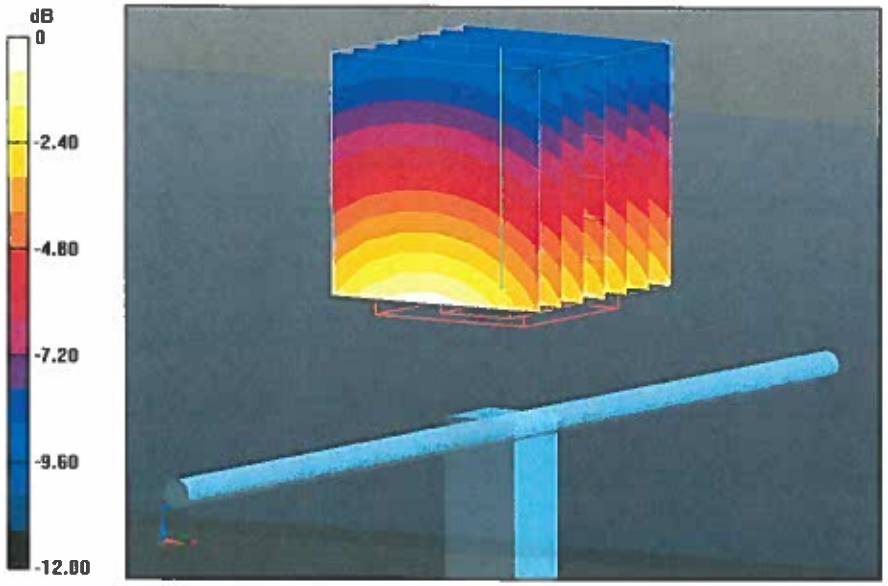
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.91 S/m; ε_r = 41.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.28, 6.28, 6.28); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

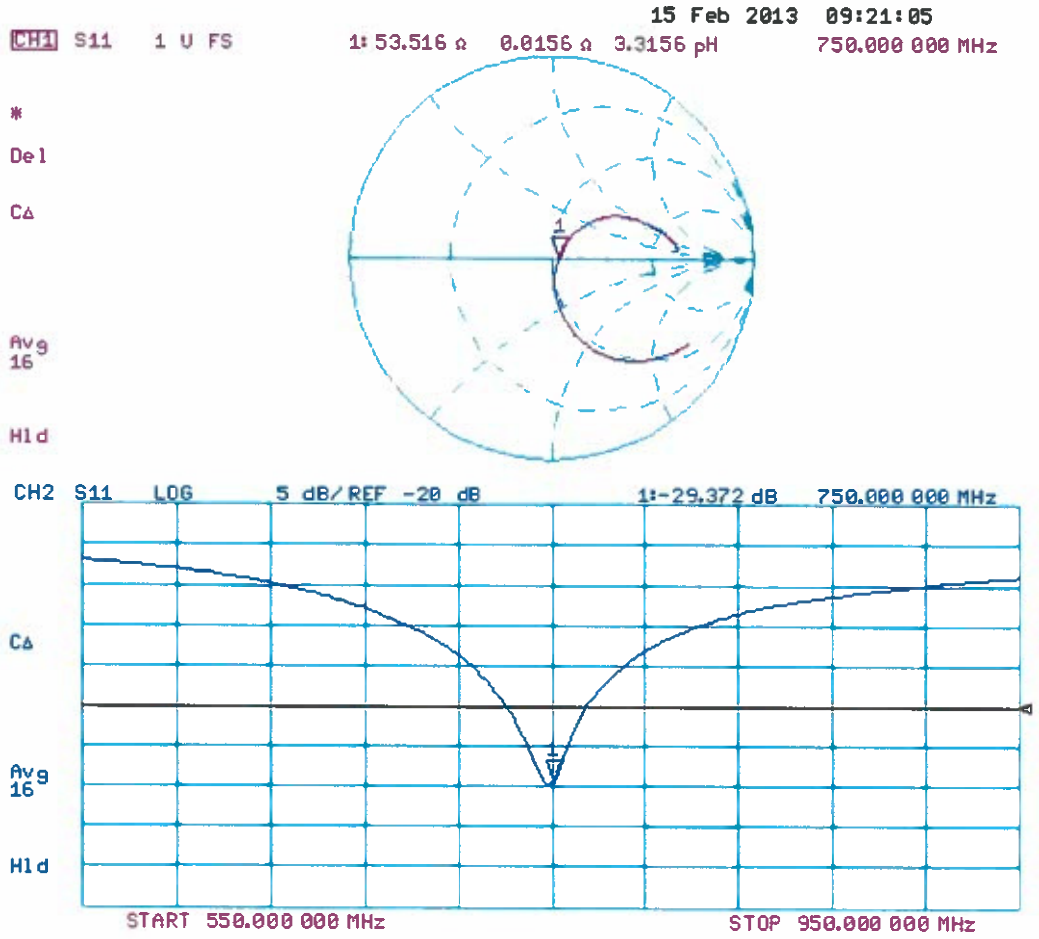
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.195 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.30 W/kg
SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.41 W/kg
Maximum value of SAR (measured) = 2.54 W/kg



0 dB = 2.54 W/kg = 4.05 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1011

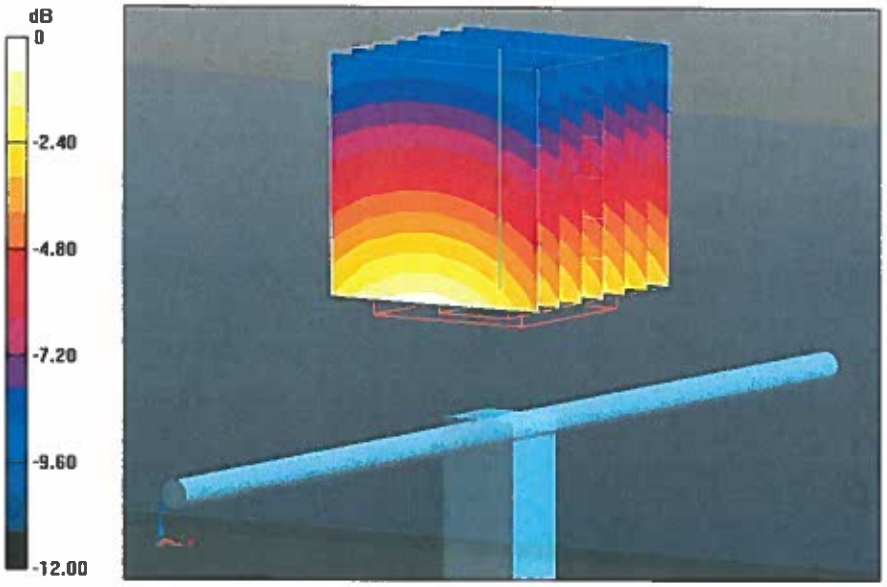
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.99 S/m; ε_r = 54.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.11, 6.11, 6.11); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

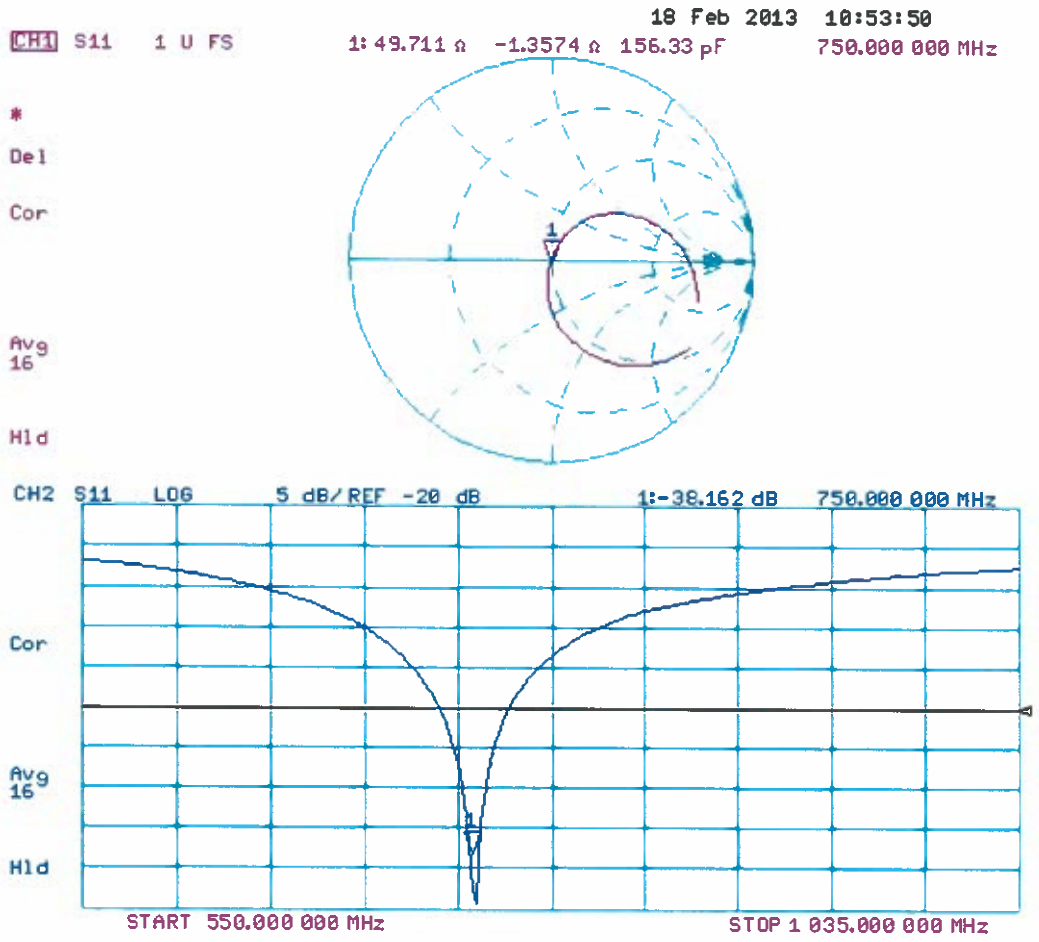
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.190 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.30 W/kg
SAR(1 g) = 2.25 W/kg; SAR(10 g) = 1.49 W/kg
Maximum value of SAR (measured) = 2.61 W/kg



0 dB = 2.61 W/kg = 4.17 dBW/kg

Impedance Measurement Plot for Body TSL



Appendix 2. Measurement Methods

A.2.1. Evaluation Procedure

The Specific Absorption Rate (SAR) evaluation was performed in the following manner:

a) (i) The evaluation was performed in an applicable area of the phantom depending on the type of device being tested. For devices worn about the ear during normal operation, both the left and right ear positions were evaluated at the centre frequency of the band at maximum power. The side, which produced the greatest SAR, determined which side of the phantom would be used for the entire evaluation. The positioning of the head worn device relative to the phantom was dictated by the test specification identified in section 3.1 of this report.

(ii) For body worn devices or devices which can be operated within 20 cm of the body, the flat section of the SAM phantom was used were the size of the device(s) is normal. for bigger devices and base station the 2mm Oval phantom is used for evaluation. The type of device being evaluated dictated the distance of the EUT to the outer surface of the phantom flat section.

b) The SAR was determined by a pre-defined procedure within the DASY4 software. The exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm or appropriate resolution.

c) A 5x5x7 matrix for measurement < 2.0 GHz, 7x7x7 matrix for measurement 2.0 GHz to 3.0 GHz, and 7x7x12 for > 5.0 GHz was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.

d) If the EUT had any appreciable drift over the course of the evaluation, then the EUT was re-evaluated. Any unusual anomalies over the course of the test also warranted a re-evaluation.

A.2.2. Specific Absorption Rate (SAR) Measurements to 865664 D01 SAR Measurement 100 MHz to 6MHz

Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields

SAR measurements were performed in accordance with IEEE 1528 and FCC KDB procedures, against appropriate limits for each measurement position in accordance with the standard. In some cases the FCC was contacted using a PBA or KDB process to ensure test is performed correctly.

The test was performed in a shielded enclosure with the temperature controlled to remain between +18.0ºC and +25.0ºC. The tissue equivalent material fluid temperature was controlled to give a maximum variation of ± 2.0ºC

Prior to any SAR measurements on the EUT, system Check and material dielectric property measurements were conducted. In the absence of a detailed procedure within the specification, system Check and material dielectric property measurements were performed in accordance with FCC KDB publication 865664 D01.

Following the successful system Check and material dielectric property measurements, a SAR versus time sweep shall be performed within 10 mm of the phantom inner surface. If the EUT power output is stable after three minutes then the measurement probe will perform a coarse surface level scan at each test position in order to ascertain the location of the maximum local SAR level. Once this area had been established, a 5x5x7 cube of 175 points for frequency below 2.0 GHz, above 2.0GHz up to 3.0 GHz 7x7x7 cube of 343 points and a 7x7x12 cube of 588 points for frequency 5.0 GHz and above will be centred at the area of concern. Extrapolation and interpolation will then be carried out on the 27g of tissue and the highest averaged SAR over a 1g cube determined.

Once the maximum interpolated SAR measurement is complete; the coarse scan is visually assessed to check for secondary peaks within 50% of the maximum SAR level. If there are any further SAR measurements required, extra 5x5x7 or 7x7x7 or 7x7x12 cubes shall be centred on each of these extra local SAR maxima.

At the end of each position test case a second time sweep shall be performed to check whether the EUT has remained stable throughout the test.

A.2.3. Measurement Uncertainty Tables

A.2.3.1 Specific Absorption Rate-LTE Band 14 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration /Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.510	2.510	normal (k=1)	1.0000	1.0000	2.510	2.510	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.000	2.000	normal (k=1)	1.0000	0.6400	1.280	1.280	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	1.560	1.560	normal (k=1)	1.0000	0.6000	0.936	0.936	5
	Combined standard uncertainty			t-distribution			9.37	9.37	>250
	Expanded uncertainty			k = 1.96			18.36	18.36	>250