SAR TEST REPORT

FCC 47 CFR Part 2.1093
ISED RSS-102

RF-Exposure evaluation of portable equipment

Report Reference No. .... :		G0M-1903-8127-TFC093SR-V01
Testing Laboratory .... :		Eurofins Product Service GmbH
Address .... :		Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation .... :		DAkkS - Registration number : D-PL-12092-01-03 (ISED) ISED Testing Laboratory site: 3470A-2 DAkkS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant's name .... :		peiker Consumer Electronics Evolution GmbH
Address .... :		Gartenstraße 25 61352 Bad Homburg GERMANY
Test specification:		
Standard.. :		FCC 47 CFR Part 2 §2.1093 447498 D01 General RF Exposure Guidance v06 IEEE Std. 1528 - 2013 ISED RSS-102 Issue 5
Non-standard test method…………..:		None
Test scope………….. .... :		complete Radio compliance test
Equipment under test (EUT):		
Product description		Audio Communication Device
Model No.		C3
Additional Model(s)		None
Brand Name(s)		None
Hardware version		1.00
Firmware / Software version		1.00
FCC-ID:		2ANUYC3
IC:		23265-C3
Test result		**Passed**

eurofins | Product Service

Possible test case verdicts:	
- neither assessed nor tested ....:	N/N
- required by standard but not appl. to test object .....:	N/A
- required by standard but not tested ....:	N/T
- not required by standard for the test object ....:	N/R
- test object does meet the requirement ....:	P (Pass)
- test object does not meet the requirement ....:	F (Fail)

Testing:		
Date of receipt of test item...:	2019-03-14	
Date (s) of performance of tests.................................:	2019-03-14 - 2019-11-09	
Compiled by....................................:	Burkhard Pudell	
Tested by (+ signature) ....: (Responsible for Test)	Matthias Handrik	[signature]
Approved by (+ signature)..............: (Head of Lab)	Christian Weber	C. Weber
Date of issue...................................:	2020-08-20	
Total number of pages ....:	116	

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

Additional comments:

Version History

Version	Issue Date	Remarks	Revised by
01	2020-08-13	Initial Release	

REPORT INDEX

1 Equipment (Test item) Description

Description	Audio Communication Device	
Model	C3	
Additional Model(s)	None	
Brand Name(s)	None	
Serial number	991018	
Hardware version	1.00	
Software / Firmware version	1.00	
PMN	CEEMesh	
HVIN	C3	
FVIN	1.x.x	
HMN	CEEMesh	
FCC-ID	2ANUYC3	
IC	23265-C3	
Equipment type	End product	
Prototype or production unit	Production Unit	
Device category	Generic device	
Environment	General public	
Radio technologies	WLAN 2.4G b,g,n Bluetooth (Classic, LE)	
Tune-up tolerance	(2.4GHz) ±1.5dB	
Operating frequency ranges	WLAN 2.4G: 2412 - 2462 MHz Bluetooth: 2402 - 2480 MHz	
Modulations	WLAN 2.4G: CCK / DSSS / OFDM Bluetooth: GFSK / PI/4-DQPSK / 8-DPSK	
Antenna 1 (Main) Bluetooth, Bluetooth LE, IEEE 802.11b/g/n	Type	integrated PCB antenna
	Model	C3_1
	Manufacturer	peiker CEE
	Gain	max. 2.5 dBi
Antenna 2 (AUX) IEEE 802.11n (HT20/HT40 2SS only)	Type	integrated PCB antenna
	Model	C3_2
	Manufacturer	peiker CEE
	Gain	max. 2.5 dBi
Power supply	V_{NOM}	3.7 VDC
Accessories	Wired Headset, Belt-clip	
Manufacturer	peiker Consumer Electronics Evolution GmbH Gartenstraße 25 61352 Bad Homburg GERMANY	
Note: None.		

1.1 Equipment photos

EUT FRONT


EUT BACK


HEADSET (optional)


BELT-CLIP


BELT-CLIP

BELT-CLIP

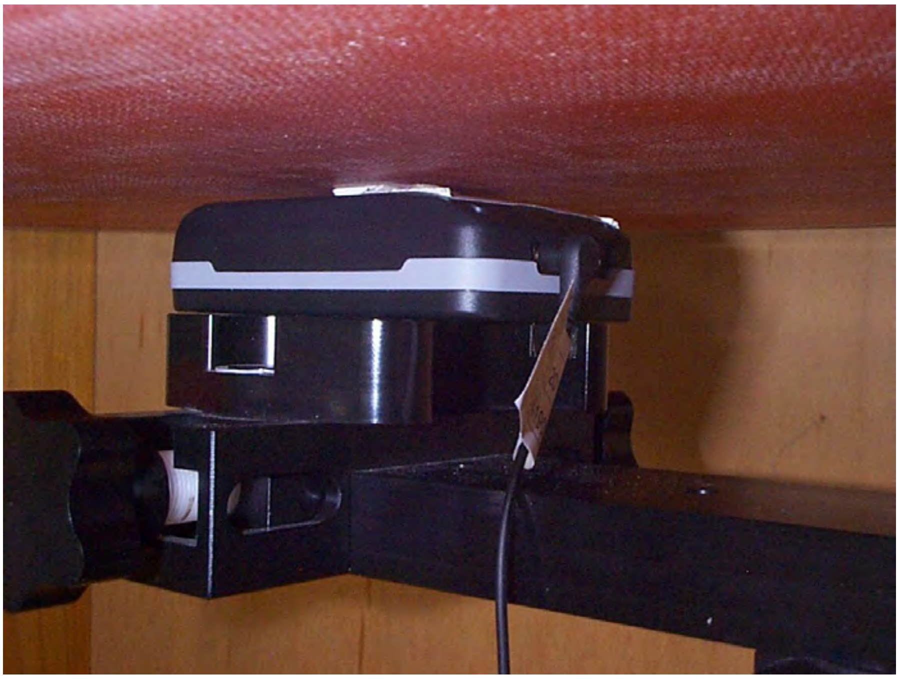
1.2 Equipment setup photos

EUT FRONT1


EUT FRONT2


EUT BACK1

EUT BACK2



EUT LEFT1


EUT LEFT2


EUT RIGHT1

EUT RIGHT2

EUT TOP1


EUT TOP2


EUT BOTTOM1

EUT BOTTOM2

1.3 Reference Documents

KDB Publications		
Name	**Description**	**Date**
447498 D01 v06	Mobile and Portable Devices RF Exposure Procedures And Equipment Authorization Policies	2015-10
865664 D01 v01r04	SAR Measurement Requirements for 100 MHz to 6 GHz	2015-08
865664 D02 v01r02	RF Exposure Compliance Reporting and Documentation Considerations	2015-10
648474 D03 v01r04	Evaluation and Approval Considerations for Handsets with Specific Wireless Charging Battery Covers	2015-12
680106 D01 v03	RF Exposure Considerations for Wireless Charging Applications	2018-04
616217 D04 v01r02	SAR Evaluation Consideration for Laptops and Netbooks and Tablets	2015-10
941225 D05 v02r05	SAR Evaluation Considerations for LTE Devices	2015-12
941225 D05A v01r02	Rel. 10 LTE SAR Test Guidance and KDB Inquiries	2015-10
648474 D04 v01r03	SAR Evaluation Considerations for Wireless Handsets	2015-10
941225 D06 v02r01	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities	2015-10
941225 D07 v01r02	SAR Evaluation Procedures for UMPC Mini-Tablet Devices	2015-10
248227 D01 v02r02	SAR Guidance for 802.11 (Wi-Fi) Transmitters	2015-10
690783 D01 v01r03	SAR Listings on Equipment Authorization Grants	2013-09
941225 D01 v03r01	SAR Measurement Procedures for 3G Devices	2015-10
447498 D02 v02r01	SAR Measurement Procedures for USB Dongle Transmitters	2015-10

TCB Council Presentations		
Name	**Description**	**Date**
RF Exposure Procedures Update	GSM/GPRS SAR	2013-10
RF Exposure Procedures	DUT Holder Perturbations	2016-10
RF Exposure Procedures	HSUPA Configuration Update	2017-05
RF Exposure Procedures	802.11ax SAR Testing	2019-04

1.4 Supporting Equipment Used During Testing

Product Type*	Device	Manufacturer	Model No.	Comments
AE	Laptop	Lenovo	T450	Control unit

***Note:** Use the following abbreviations:

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

1.5 Supported standalone operating modes

Mode	Modulation	Frequency range	Max. Duty cycle
WLAN 2.4G	DBPSK	2412 MHz – 2462 MHz	100%
BT-BR	GFSK	2402 MHz – 2480 MHz	78%
BT-LE	GFSK	2402 MHz – 2480 MHz	66%
Comment: mode with max. output power only			

1.6 Conducted Power Values

IEEE 802.11b – Average Output Power						
Antenna port			ANT 1 (Main)			
Band	Channel	Frequency [MHz]	Source-base time-average power [dBm]			
			Data rate [Mbps]			
			1	2	5.5	11
2.4 GHz	1	2412	14.00	13.68	12.95	12.07
	6	2437	**14.10**	13.78	12.75	12.06
	11	2462	13.96	13.65	12.80	12.03
Date, Operator:			19.08.2019 , B. Pudell			

IEEE 802.11g – Average Output Power										
Antenna port			ANT 1 (Main)							
Band	Channel	Frequency [MHz]	Source-base time-average power [dBm]							
			Data rate [Mbps]							
			6	9	12	18	24	36	48	54
2.4 GHz	1	2412	9.53	8.79	8.13	7.25	6.23	5.24	4.54	3.60
	6	2437	**12.30**	11.61	11.00	10.70	8.25	6.40	4.86	3.68
	11	2462	9.48	8.80	8.23	7.32	6.33	5.24	4.50	3.57
Date, Operator:			19.08.2019 , B. Pudell							

IEEE 802.11n HT20 1SS – Average Output Power											
Antenna port				ANT 1 (Main)							
Band	BW [MHz]	Ch.	Frequency [MHz]	Source-base time-average power [dBm]							
				Data rate [Mbps]							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
2.4 GHz	20	1	2412	11.18	10.72	10.49	10.21	9.61	9.28	8.56	7.26
		6	2437	**12.86**	12.61	12.36	12.11	10.60	9.47	8.53	7.48
		11	2462	11.53	11.28	10.94	10.68	9.98	9.68	8.95	7.69

IEEE 802.11n HT20 2SS – Average Output Power											
Antenna port				ANT 1 (Main)							
Band	BW [MHz]	Ch.	Frequency [MHz]	Source-base time-average power [dBm]							
				Data rate [Mbps]							
				MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
2.4 GHz	20	1	2412	7.27	10.04	9.54	8.99	8.31	7.81	4.03	2.97
		6	2437	7.37	**10.11**	9.82	9.42	8.60	7.89	3.93	2.98
		11	2462	6.73	9.44	8.79	8.52	7.75	7.19	3.35	2.17
Antenna port				ANT 2 (AUX)							
Band	BW [MHz]	Ch.	Frequency [MHz]	Source-base time-average power [dBm]							
				Data rate [Mbps]							
				MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
2.4 GHz	20	1	2412	--	9.13	8.72	8.56	7.71	7.35	5.12	3.97
		6	2437	--	**9.35**	7.75	7.55	6.78	6.35	4.03	3.03
		11	2462	--	8.35	7.69	7.42	6.61	6.08	3.98	2.78
Date, Operator:				20.08.2019 , B. Pudell							

IEEE 802.11n HT40 1SS – Average Output Power											
Antenna port				ANT 1 (Main)							
Band	BW [MHz]	Ch.	Frequency [MHz]	Source-base time-average power [dBm]							
				Data rate [Mbps]							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
2.4 GHz	40	3	2422	7.15	6.51	6.11	5.78	5.13	4.68	4.46	4.24
		6	2437	**11.44**	11.02	10.72	10.34	9.68	7.76	7.54	5.27
		9	2452	11.17	10.91	10.51	10.22	9.58	7.61	7.44	5.14
Date, Operator:				20.08.2019 , B. Pudell							

IEEE 802.11n HT40 2SS – Average Output Power											
Antenna port				ANT 1 (Main)							
Band	BW [MHz]	Ch.	Frequency [MHz]	Source-base time-average power [dBm]							
				Data rate [Mbps]							
				MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
2.4 GHz	40	3	2422	7.15	6.63	6.01	5.87	5.18	4.36	4.36	4.35
		6	2437	7.54	**11.12**	10.67	10.23	9.56	7.44	7.46	5.35
		9	2452	7.17	10.89	10.53	10.12	9.48	7.43	7.40	5.04
Antenna port				ANT 2 (AUX)							
Band	BW [MHz]	Ch.	Frequency [MHz]	Source-base time-average power [dBm]							
				Data rate [Mbps]							
				MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
2.4 GHz	40	3	2422	--	8.87	8.82	8.46	7.63	7.46	5.02	3.98
		6	2437	--	**8.91**	7.77	7.48	6.67	6.44	4.13	3.05
		9	2452	--	8.25	7.26	7.32	6.40	6.00	4.09	3.01
Date, Operator:				20.08.2019 , B. Pudell							

Bluetooth BR+EDR – Average Output Power			
Frequency [MHz]	Source-base time-average power [dBm]		
	BR (GFSK)	EDR (PI/4-DQPSK)	EDR (8-DPSK)
	DH5	2-DH5	3-DH5
2402	**9.99**	5.69	5.69
2441	9.89	5.39	5.39
2480	9.79	5.09	5.09
Date, Operator:	05.11.2019 , B. Pudell		

Bluetooth LE – Average Output Power	
Frequency [MHz]	Source-base time-average power [dBm]
	LE
	GFSK
2402	**5.1**
2440	4.8
2480	4.5
Date, Operator:	05.11.2019 , B. Pudell

1.7 Standalone Operational Mode Test Exclusion for FCC

According to KDB 447498 D01 v05r02 for standalone SAR evaluation the test exclusion power condition is given by

$$\frac{\max Power, mW}{test\ distance, mm} \cdot \sqrt{f_{GHz}} \leq 3.0$$

for test separation distance ≤ 50mm. For test separation distances > 50mm, the SAR test exclusion threshold is:

$$P_{TH}[mW] = Power\ allowed\ at\ numeric\ threshold\ for\ 50mm + (test\ distance, mm - 50mm) \cdot \frac{f[MHz]}{150}\ ,\quad 100\ MHz < f < 1500\ MHz$$

$$P_{TH}[mW] = Power\ allowed\ at\ numeric\ threshold\ for\ 50mm + (test\ distance, mm - 50mm) \cdot 10\ ,\quad 1500\ MHz < f < 6\ GHz$$

SAR Test Exclusion FCC (+ Tuneup= 1.5dB)

Mode	$Pcond_{Max}$ + tune-up [mW]	Antenna	Region	EUT Edge											
				Front		Back		Left		Right		Top		Bottom	
				Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]
BT-BR	14	1	FCC	**8**	**15**	17	32	15	29	15	29	**4**	**8**	85	446
BT-LE	5	1	FCC	8	15	17	32	15	29	15	29	4	8	85	446
WLAN b	36	1	FCC	**8**	**15**	**17**	**32**	**15**	**29**	**15**	**29**	**4**	**8**	85	446
WLAN g	24	1	FCC	**8**	**15**	17	32	15	29	15	29	**4**	**8**	85	446
WLAN n HT20	27	1	FCC	**8**	**15**	17	32	15	29	15	29	**4**	**8**	85	446
WLAN n HT20	12	2	FCC	8	15	17	32	56	156	**4**	**8**	80	396	8	15
WLAN n HT40	20	1	FCC	**8**	**15**	17	32	15	29	15	29	**4**	**8**	85	446
WLAN n HT40	11	2	FCC	8	15	17	32	56	156	**4**	**8**	80	396	8	15
Comments: All bold Threshold values are above the limit and have to be measured															
Date, Operator:				05.11.2019 , B. Pudell											

1.8 Standalone Operational Mode Exemption limits for IC

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW
Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

SAR Test Exclusion ISED(+ Tuneup= 1.5dB) (Gain +2.5 dBi)

Mode	$Pcond_{Max}$ + Gain + tune-up [mW]	Antenna	Region	EUT Edge											
				Front		Back		Left		Right		Top		Bottom	
				Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [3 mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]	Antenna distance to user [mm]	SAR Test Exclusion Threshold [mW]
BT-BR	25	1	ISED	**8**	**5**	**17**	**21**	**15**	**15**	**15**	**15**	**4**	**4**	85	>309
BT-LE	8	1	ISED	**8**	**5**	17	21	15	15	15	15	**4**	**4**	85	>309
WLAN b	65	1	ISED	**8**	**5**	**17**	**21**	**15**	**15**	**15**	**15**	**4**	**4**	85	>309
WLAN g	43	1	ISED	**8**	**5**	**17**	**21**	**15**	**15**	**15**	**15**	**4**	**4**	85	>309
WLAN n HT20	49	1	ISED	**8**	**5**	**17**	**21**	**15**	**15**	**15**	**15**	**4**	**4**	85	>309
WLAN n HT20	22	2	ISED	**8**	**5**	**17**	**21**	56	>309	**5**	**4**	80	>309	**8**	**5**
WLAN n HT40	35	1	ISED	**8**	**5**	**17**	**21**	**15**	**15**	**15**	**15**	**4**	**4**	85	>309
WLAN n HT40	20	2	ISED	**8**	**5**	17	21	56	>309	**5**	**4**	80	>309	**8**	**5**
Comments: All bold Threshold values are above the limit and have to be measured															
Date, Operator:				22.08.2019 , B. Pudell											

1.9 SAR value estimation for multi-transmitter evaluation

According to KDB 447498 D01 v05r02 for standalone SAR evaluation the estimated SAR is given by

$$\frac{\max Power\ (including\ tune\ up\ tolerance), mW}{min.\ test\ separation\ distance, mm} \cdot \sqrt{\frac{f_{GHz}}{x}} \leq 0.4\frac{W}{kg}$$

x=7.5 for 1-g SAR, and x=18.75 for 10-g SAR, for test separation ≤ 50mm.

For test separation distance > 50mm, the estimated SAR value is 0.4 W/kg

1.10 Supported concurrent (multi-transmitter) operating modes

No multi-transmitter evaluation

1.11 Supported use cases

Use case	Distance to human body	corresponding test configuration
EUT placed at human body	0 mm (worst case)	generic device

1.12 Radio Test Modes

Mode	Settings
BT-BR	Mode = TX test mode Modulation = GFSK (DH5) Duty cycle = 78% Output Power max = 10.0 dBm (conducted) Air interface = Antenna 1 (Main)
BT-LE	Mode = TX test mode Modulation = GFSK Duty cycle = 66% Output Power max = 5.1 dBm (conducted) Air interface = Antenna 1 (Main)
WLAN-b	Mode = TX test mode Modulation = DBPSK (1 Mbps) Duty cycle = 82% Output Power max = 14.1 dBm (conducted) Air interface = Antenna 1 (Main)

WLAN-g	Mode = TX test mode Modulation = BPSK (6 Mbps) Duty cycle = 60% Output Power max = 12.3 dBm (conducted) Air interface = Antenna 1 (Main)
WLAN-n HT20-1S	Mode = TX test mode Modulation = BPSK (MCS0) Duty cycle = 92% Output Power max = 12.9 dBm (conducted) Air interface = Antenna 1 (Main)
WLAN-n HT20-2S	Mode = TX test mode Modulation = BPSK (MCS9) Duty cycle = 74% Output Power max = 10.1 dBm (conducted ANT1) Air interface = Antenna 1 (Main) + Antenna 2 (AUX)
WLAN-n HT40-1S	Mode = TX test mode Modulation = BPSK (MCS0) Duty cycle = 87% Output Power max = 11.5 dBm (conducted) Air interface = Antenna 1 (Main)
WLAN-n HT40-2S	Mode = TX test mode Modulation = BPSK (MCS9) Duty cycle = 82% Output Power max = 11.1 dBm (conducted ANT1) Air interface = Antenna 1 (Main) + Antenna 2 (AUX)
Comment: Maximum power (worst case) was searched for all supported configurations. Configuration with maximum output power was selected for compliance testing.	

1.13 Test Positions

Position	Description
Flat Front	EUT front with display against body Distance between EUT and phantom surface 0 mm
Flat Back	EUT back against body Distance between EUT and phantom surface 3 mm (Clipholder)
Flat Left	EUT left against body Distance between EUT and phantom surface 0 mm
Flat Right	EUT right against body Distance between EUT and phantom surface 0 mm
Flat Top	EUT top against body Distance between EUT and phantom surface 0 mm
Flat Bottom	EUT bottom against body Distance between EUT and phantom surface 0 mm
Comment: Belt clip employment optional	

Antenna position inside EUT

ANT 1 & 2 (POSITION orange)

View on keypad

View on PCB
Top Cover removed

Antenna 1 (Main) on upper top side
Antenna 2 (AUX) on lower right corner

Device surface	**Antenna 1 (Main)** Distance (mm)	**Antenna 2 (Aux)** Distance (mm)
Front Side (view keypad)	8	8
Back Side	17	17
Left Side	15	56
Right Side	15	4
Top Side	4	80
Bottom Side	85	8

1.14 Test Equipment Used During Testing

SAR Measurement					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Stäubli Robot	Stäubli	RX90B L	EF00271	functional test	functional test
Stäubli Robot Controller	Stäubli	CS7MB	EF00272	functional test	functional test
DASY 5 Measurement Server	Schmid & Partner	-	EF00273	functional test	functional test
Control Pendant	Stäubli	-	EF00274	functional test	functional test
Dell Computer	Schmid & Partner	Intel	EF00275	functional test	functional test
Data Acquisition Electronics	Schmid & Partner	DAE3V1	EF00276	2018-09	2019-09
Data Acquisition Electronics	Schmid & Partner	DAE3V1	EF00276	2019-09	2020-09
Dosimetric E-Field Probe	Schmid & Partner	EX3DV4	EF00826	2018-09	2019-09
Dosimetric E-Field Probe	Schmid & Partner	EX3DV4	EF00826	2019-09	2020-09
System Validation Kit	Schmid & Partner	D2450V2	EF00284	2018-09	2021-09
Flat phantom	Schmid & Partner	V 4.4	EF00328	no calibration required	no calibration required
Oval flat phantom	Schmid & Partner	ELI 4	EF00289	functional test	functional test
Mounting Device	Schmid & Partner	V 3.1	EF00287	functional test	functional test
Millivoltmeter	Rohde & Schwarz	URV 5	EF00126	2016-08	2019-08
Millivoltmeter	Rohde & Schwarz	URV 5	EF00126	2019-07	2022-07
Power sensor	Rohde & Schwarz	NRV-Z1	EF00127	2018-07	2020-07
Power sensor	Rohde & Schwarz	NRV-Z2	EF00125	2018-07	2020-07
RF signal generator	Rohde & Schwarz	SMP 02	EF00165	2017-07	2019-07
RF signal generator	Rohde & Schwarz	SMP 02	EF00165	2019-07	2021-07
Directional Coupler	HP	HP 87300B	EF00288	functional test	functional test
Network Analyzer 300 kHz to 3 GHz	Agilent	8752C	EF00140	2018-07	2019-07
Network Analyzer 300 kHz to 3 GHz	Agilent	8752C	EF00140	2019-07	2020-07
Dielectric Probe Kit	Agilent	85070C	EF00291	functional test	functional test
Dielectric Probe Kit	SPEAG	DAK-3.5	EF00945	2018-09	2019-09
Dielectric Probe Kit	SPEAG	DAK-3.5	EF00945	2019-09	2020-09
DAK Measurement Software	SPEAG	DAKS	EF00965	-	-
Thermometer	LKM electronic GmbH	DTM3000	EF00967	2019-01	2020-01

2 Result Summary

447498 D01 General RF Exposure Guidance, RSS-102					
Product Specific Standard Section	**Requirement – Test**	**Reference Method**	**Maximum SAR [W/kg]**	**Result**	**Remarks**
447498 D01 General RF Exposure Guidance RSS-102 Section 3	Single-band conformity	KDB Publication 447498 KDB Publication 248227 KDB Publication 865664	**0.459**	PASS	
447498 D01 General RF Exposure Guidance RSS-102 Section 3	Multi-band conformity	KDB Publication 447498 KDB Publication 648474 KDB Publication 865664	N/A	N/R	No concurrent transmission modes
Remarks: The BT/WLAN module has a time-shared antenna, only one technology could transmit at the same time.					

TEST SUMMARY

Frequency Band	Maximum Reported SAR (W/kg)	
	Body-worn (1g)	**Limbs (10g)**
Bluetooth (DSS)	0.093	0.049
WI-FI (2.4GHz) (DTS)	0.459	0.241
SAR Limit (W/kg)	1.6	4.0

3 Definitions

The specific absorption rate (SAR) is defined as the time derivative of the incremental energy (*dW*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element *(dV*) of a given density (ρ_t), expressed in watts per kilogram (W/kg)

$$SAR = d/dt\ (dW/dm) = d/dt\ (dW/\rho_t dV) = \sigma/\rho_t\ |E_t|^2$$

where

$$dW/dt = \int_V E\ J\ dV = \int_V \sigma E^2\ dV$$

3.1 Controlled Exposure

The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category and the general population/uncontrolled exposure limits apply to these devices.

3.2 Uncontrolled Exposure

In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on the risk of potential exposure and instructions on methods to minimize such exposure risks.

3.3 Localized SAR

Compliance with the localized SAR limits is demonstrated using the head and trunk limit because this SAR limit is only half the limbs limit value. The values are obtained by SAR measurements according to EN 62209-2.

4 Localized SAR Measurement Equipment

The measurements were performed with Dasy5 automated near-field scanning system comprised of high precision robot, robot controller, computer, e-field probe, probe alignment unit, phantoms, non-conductive phone positioned and software extension.

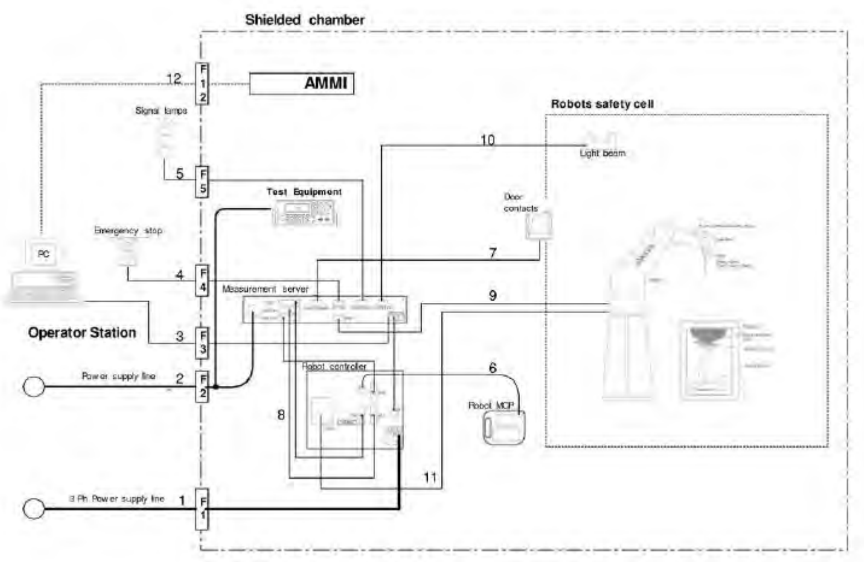
4.1 Complete SAR DASY5 Measurement System

Measurements are performed using the DASY5 automated assessment system made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland.

DASY 5 SAR Measurement Setup

The following Diagram show the elements involved in the measurement setup.

DASY 5 SAR Measurement Diagram



The DASY5 system for performing compliance tests consists of the following items:

DASY5 SAR Measurement System	
Device	Description:
RX90BL	A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software.
Probe Alignment Unit	A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
Teach Pendant	The Manual Control Pendant (MCP), also called the manual teach pendant, is the user interface to the robot. In DASY, it is used for certain installation and teach procedures
Signal Lamps	External warning lamp which indicates when the robot arm is powered-on and if the robot is under software control or in manual mode (controlled with the teach pendant).
DAE	The data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
E-Field Probes	Isotropic E-Field probe optimized and calibrated for E-field measurements in free space.
EOC	The electro-optical converter (EOC) performs the conversion between optical and electrical signals
Measurement Server	The functions of the measurement server is to perform the time critical task such as signal filtering, surveillance of the robot operation, fast movement interrupts.
Control Computer	A computer operating Windows 2000 or Windows NT with DASY 4 Software.
Control Software	DASY4 and SEMCAD post processing Software
SAM Twin Phantom	The SAM twin phantom enabling testing left-hand and right-hand usage.
Flat Phantom	Flat Phantom (only for body-mounted transceivers operating below 800 MHz).
Tissue simulating liquid	Tissue simulating liquid mixed according to the given recipes.
Device Holder	The device holder for handheld mobile phones.
System Validation Dipoles	System validation dipoles allowing to validate the proper functioning of the system.

4.2 Robot Arm

The DASY5 system uses the high precision robots RX90BL type out of the newer series from Stäubli SA (France).

The RX robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

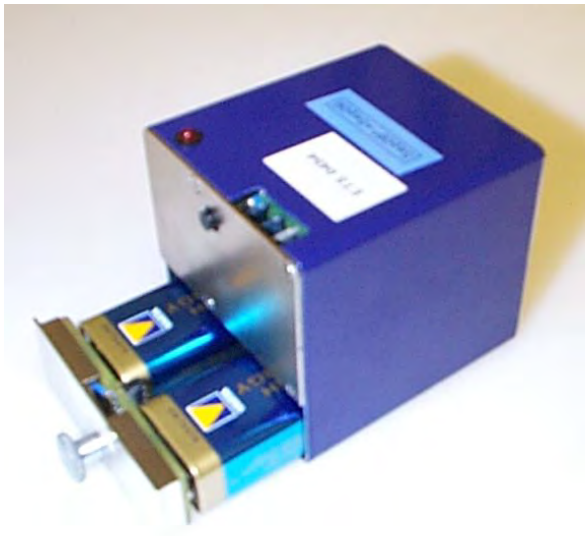
Robot arm

4.3 Data Acquisition Electronics

The data acquisition electronics (DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

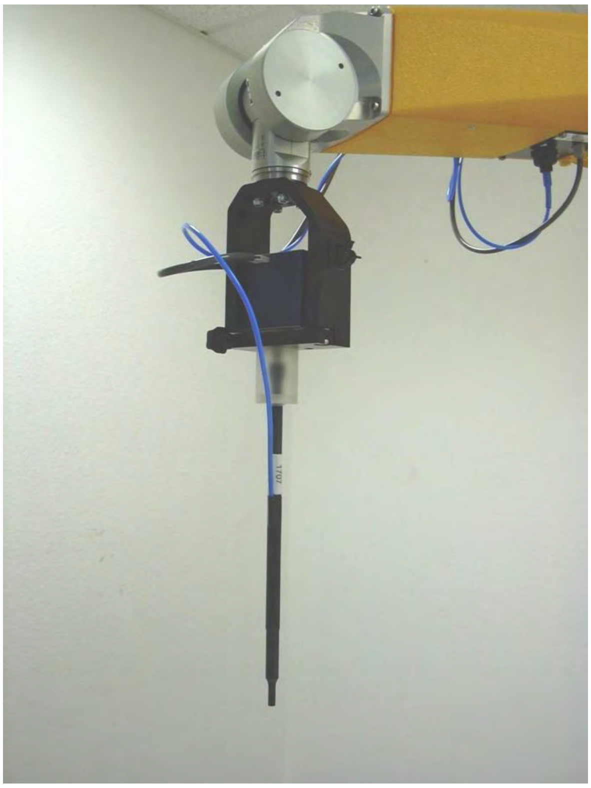
The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

Data Acquisition Electronics



4.4 Isotropic E-Field Probe ≤ 3 GHz

Isotropic E-Field Probe ET3DV6



<u>**Probe Specifications**</u>

Construction:

One dipole parallel, two dipoles normal to probe axis built-in shielding against static charges.

Calibration:

In air from 10 MHz to 2.5 GHz,
In brain and muscle simulating tissue at Frequencies of 835MHz, 900MHz, 1800MHz, 1900 MHz and 2450 MHz

Frequency:

10MHz to > 3GHz,
Linearity ±0.2dB (30MHz to 3GHz)

Directivity:

±0.2dB in HSL (rotation around probe axis)
±0.4dB in HSL (rotation normal to probe axis)

Dynamic Range:

5µW/g to > 100mW/g

Linearity:

±0.2dB

Dimensions:

Overall Length: 330mm (Tip: 16mm),
Tip Diameter: 6.8mm (Body: 12mm),
Distance from probe tip to dipole centers: 2.7mm

Application:

General dosimetry up to 3 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms

4.5 Isotropic E-Field Probe ≤ 6 GHz

Probe Specifications

Construction:

One dipole parallel, two dipoles normal to probe axis built-in shielding against static charges.

Calibration:

In air from 10 MHz to 6 GHz,
In brain and muscle simulating tissue at
Frequencies of 5200, 5500, 5800

Frequency:

10MHz to 6GHz,
Linearity ±0.2dB (30MHz to 6GHz)

Directivity:

±0.3dB in HSL (rotation around probe axis)
±0.5dB in tissue material (rotation normal to probe axis)

Dynamic Range:

10µW/g to > 100mW/g

Linearity:

±0.2dB

Dimensions:

Overall Length: 337mm (Tip: 20mm),
Tip Diameter: 2.5mm (Body: 12mm),
Distance from probe tip to dipole centers: 1mm

Application:

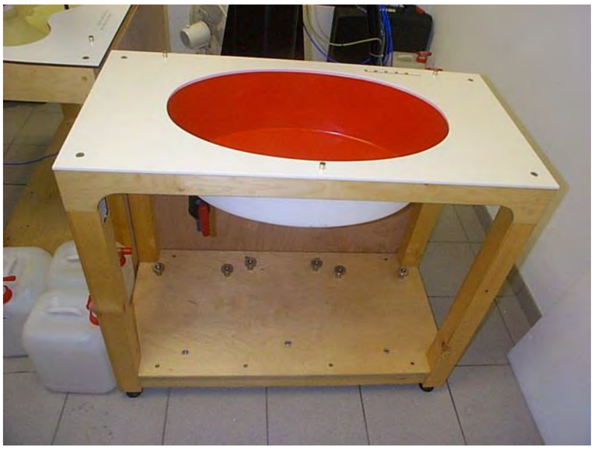
General dosimetry up to 6 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms

Isotropic E-Field Probe EX3DV4

4.6 Test phantom and positioner

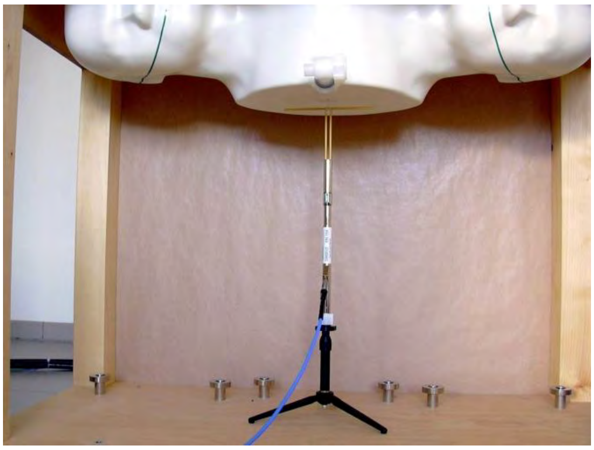
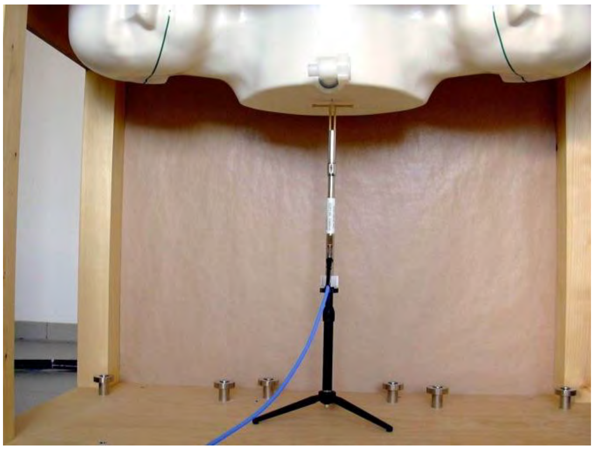
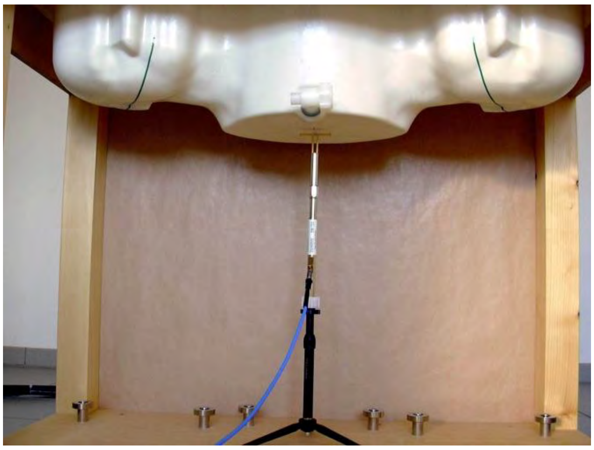
The positioner and test phantoms are manufactured by SPEAG. The test phantoms are used for all tests i.e. for both validation testing and device testing. The positioner and test phantom conforms to the requirements of EN 62209 and IEEE 1528.

The SPEAG device holder was used to position the test device in all tests whilst a tripod was used to position the validation dipoles in the test arch.

Probe Positioner	SAM Twin Phantom
	
ELI4 phantom	**Flat phantom**
	

4.7 System Validation Dipoles

A set of calibration dipoles (D900V2, D1900V2, D2450V2, D5GHzV2) is included as a part of the SAR measurement setup. These are used for the validation of the test setup after its installation and prior to the EUT measurements. The calibration dipole is placed in the position normally occupied by the EUT. All calibration dipoles have the same height which allows an exact fitting below the center point of the test phantom. The dipole center is 10mm below the surface of the test phantom.

900MHz Dipole	1900MHz Dipole
	
2450MHz Dipole	**5000MHz Dipole**
	

5 Single-band SAR Measurement

After successful completion of the tissue and system verification the SAR values of the EUT are measured according to the following description.

5.1 General measurement description

The measurement is performed for each frequency band of the device. If the width of the transmit frequency band exceeds 1% of its center frequency, than the channels at the lowest and highest frequencies should also be tested. Furthermore, if the width of the transmit band exceeds 10% of its center frequency the following formula is used to determine the number of channels:

$$N_C = 2 \cdot \text{roundup}[10 \cdot (f_{high} - f_{low})/f_c] + 1$$

First the device is tested on the center channel of each frequency band used by the device. An operation mode and configuration with maximum transmit power is established. If battery operated equipment is used, the batteries are fully charged.

SAR measurements are performed using the steps outlined in the next section for all relevant operational modes, EUT configurations and measurement positions.

For the condition (position, configuration, operational mode) that provides the highest spatial-average SAR value on the center channel, the other channels are also tested.

Additionally all other conditions where the spatial-average SAR value is within 3dB of the SAR limit are also tested on all determined test frequencies.

5.2 SAR measurement description

First the local SAR value at a test point within 10mm or less in normal direction from the inner surface of the phantom is measured. This SAR value is used to determine the measurement drift during SAR measurement.

Next an area scan is performed over an area larger than the projection of the EUT with antenna on the surface of the phantom with a spatial grid step of 10mm.

From the scanned SAR distribution the position of maximum SAR value is identified as well as any local SAR maxima within 2dB of the maximum value that are not within the zoom scan volume. (The additional peaks are only measured when the primary peak is within 2dB of the SAR limit.)

The zoom-scan volume constructed on the peak SAR position is scanned with a grid step of 5mm. The measured data are extracted and the local SAR value for each measurement point is calculated. The measured values are interpolated over a fine-mesh within the scan volume and the average SAR value over 10g mass is calculated.

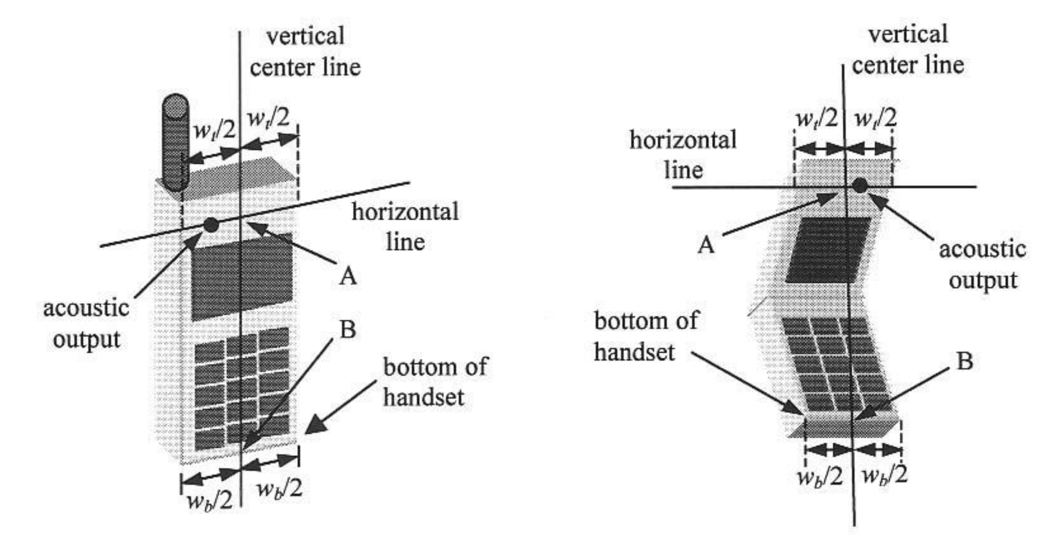
At the end of the measurement the reference point measured at the beginning of the measurement is measured again and from the difference the drift is calculated.

5.3 Reference lines and points for Handsets

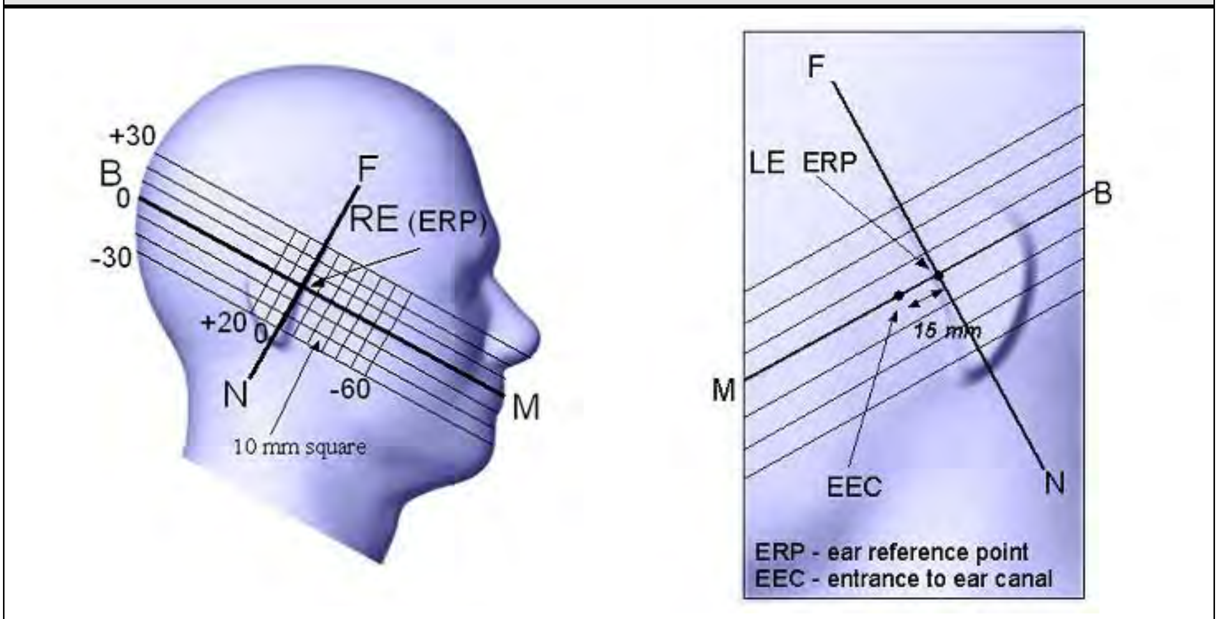
For all measurement positions of the EUT, the EUT has to be place in a specific orientation with respect to the phantom. The orientation of the EUT relative to the phantom is defined by reference lines and points.

According to IEEE 1528, the reference lines and points shall be positioned at the EUT as shown in the following figure.

Reference lines and points on EUT acc. to IEEE 1528



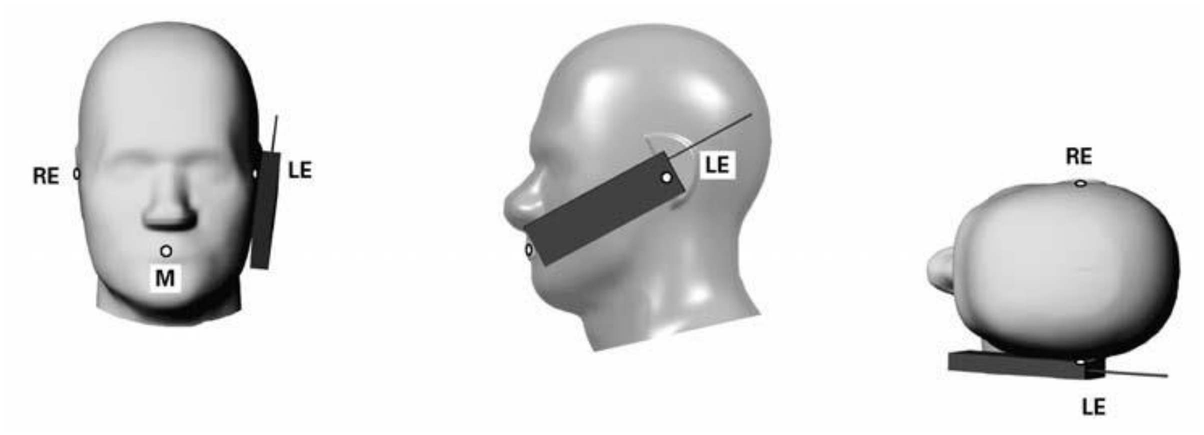
Reference lines and points on human head acc. to IEEE 1528



5.4 Test positions relative to the Head

Cheek position

Cheek positions according to IEEE 1528

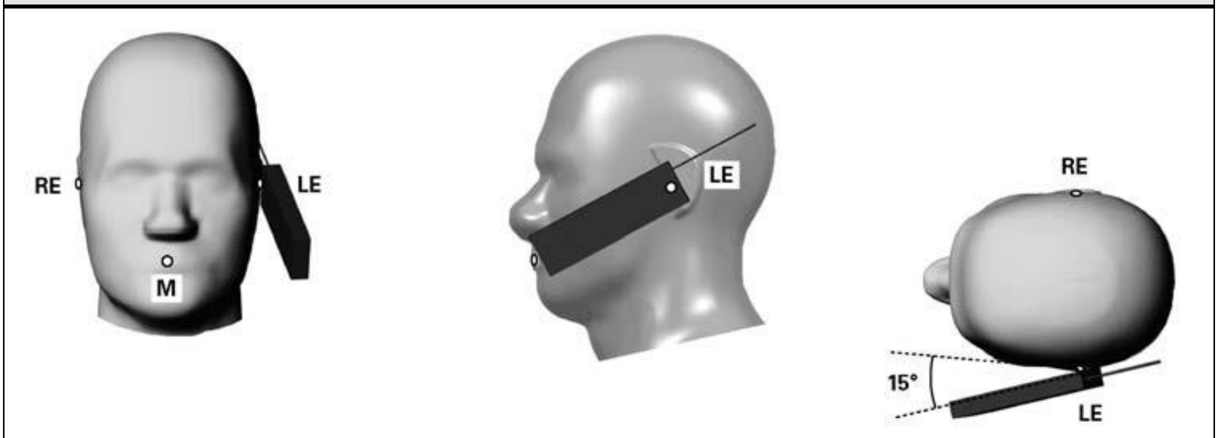


The handset is positioned close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom. Next the handset is translated towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.

While the handset is maintained in this plane, it is rotated around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane. Then it is rotated around the vertical centerline until the handset (horizontal line) is parallel to the N-F line. While the vertical centerline is maintained in the Reference Plane, point A is kept on the line passing through RE and LE, and the handset is maintained in contact with the pinna, the handset is rotated about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek.

Tilt position

Tilt positions according to IEEE 1528

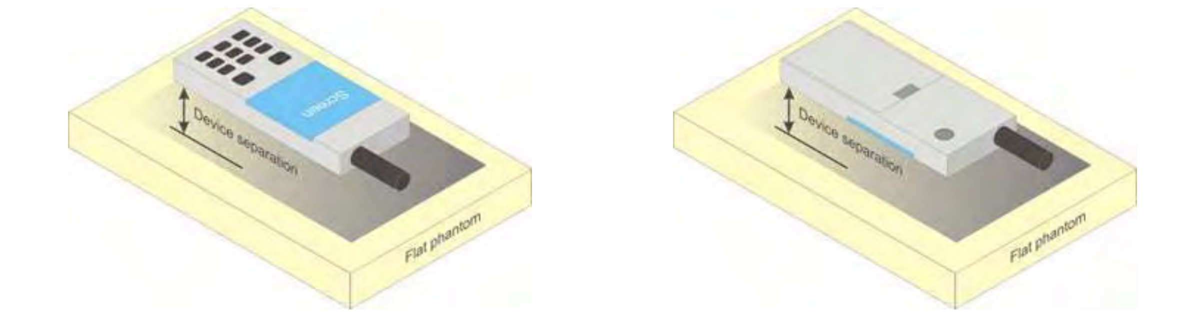


First the EUT is placed in the cheek position. Next the handset is moved away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°. Then the handset is rotated around the horizontal line by 15°.

The handset is moved towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point on the handset is in contact with the phantom, e.g., the antenna with the back of the head

5.5 Test positions relative to the human body

Body positions according to IEEE 1528



In body worn configuration the device is positioned parallel to the phantom surface with either top or bottom side of the EUT facing against the phantom.

The separation distance of the EUT is selected according to the use case of the EUT (e.g. with belt clip or holster).

5.6 Measurement Uncertainty

Error Description	Uncertainty Value	Probability Distribution	Div.	c_i (1g)	c_i (10g)	Std. Unc. 1g	Std. Unc. 10g
Measurement Uncertainty according to IEEE 1528							
Measurement System							
Probe Calibration	±6.55%	N	1	1	1	±6.55%	±6.55%
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%
Modulation Response	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Boundary effects	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
Probe Positioner	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Probe Positioning	±6.7%	R	$\sqrt{3}$	1	1	±3.9%	±3.9%
Post processing	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%
Test Sample Related							
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
Test Sample Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%
Power Scaling	±0%	R	$\sqrt{3}$	1	1	±0%	±0%
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%
Phantom and Setup Related							
Phantom Uncertainty	±7.9%	R	$\sqrt{3}$	1	1	±4.6%	±4.6%
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%
Liquid conductivity (measured)	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
Liquid permittivity (measured)	±2.5%	N	1	0.26	0.26	±0.1%	±0.1%
Temperature uncertainty - Conductivity	±5.2%	R	$\sqrt{3}$	0.78	0.71	±2.3%	±2.1%
Temperature uncertainty - Permittivity	±0.8%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%
Combined Standard Uncertainty						±12.8%	±12.7%
Expanded Standard Uncertainty						**±25.6%**	**±25.4%**
Measurement System							

Measurement Uncertainty according to IEEE 1528							
Error Description	**Uncertainty Value**	**Probability Distribution**	**Div.**	c_i **(1g)**	c_i **(10g)**	**Std. Unc. 1g**	**Std. Unc. 10g**
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%
Boundary effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
Max. SAR Evaluation	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%
Test Sample Related							
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%
Power Scaling	±0%	R	$\sqrt{3}$	1	1	±0.0%	±0.0%
Phantom and Setup Related							
Phantom Uncertainty	±6.1%	R	$\sqrt{3}$	1	1	±3.5%	±3.5%
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%
Liquid conductivity (measured)	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
Liquid permittivity (measured)	±2.5%	N	1	0.26	0.26	±0.6%	±0.7%
Temperature uncertainty - Conductivity	±5.2%	R	$\sqrt{3}$	0.78	0.71	±2.3%	±2.1%
Temperature uncertainty - Permittivity	±0.8%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%
Combined Standard Uncertainty						±11.4%	±11.3%
Expanded Standard Uncertainty						**±22.9%**	**±22.7%**

Measurement Uncertainty according to EN 62209-2							
Error Description	**Uncertainty Value**	**Probability Distribution**	**Div.**	**c_i (1g)**	**c_i (10g)**	**Std. Unc. 1g**	**Std. Unc. 10g**
Measurement System							
Probe Calibration	±6.55%	N	1	1	1	±6.55%	±6.55%
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%
Modulation Response	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Boundary effects	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
Probe Positioner	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Probe Positioning	±6.7%	R	$\sqrt{3}$	1	1	±3.9%	±3.9%
Post processing	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%
Test Sample Related							
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
Test Sample Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%
Power Scaling	±0%	R	$\sqrt{3}$	1	1	±0%	±0%
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%
Phantom and Setup Related							
Phantom Uncertainty	±7.9%	R	$\sqrt{3}$	1	1	±4.6%	±4.6%
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%
Liquid conductivity (measured)	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
Liquid permittivity (measured)	±2.5%	N	1	0.26	0.26	±0.1%	±0.1%
Temperature uncertainty - Conductivity	±5.2%	R	$\sqrt{3}$	0.78	0.71	±2.3%	±2.1%
Temperature uncertainty - Permittivity	±0.8%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%
Combined Standard Uncertainty						±12.8%	±12.7%
Expanded Standard Uncertainty						**±25.6%**	**±25.4%**

6 Test Conditions and Results

6.1 Recipes for Tissue Simulating Liquids

Body Tissue Simulating Liquids					
Ingredient	M 450-B weight (%)	M 900-B weight (%)	M 1800-B weight (%)	M 1950-A weight (%)	M 2450-B weight (%)
Water	46.21	50.75	70.17	69.79	68.64
Sugar	51.17	48.21			
Cellulose	0.18				
Salt	2.34		0.39	0.2	
Preventol	0.08	0.1			
DGBE			29.44	30	31.37
Head Tissue Simulating Liquids					
Ingredient	HSL 450-A weight (%)	HSL 900-B weight (%)	HSL 1800-F weight (%)	HSL 1950-B weight (%)	HSL 2450-B weight (%)
Water	38.91	40.29	55.24	55.41	55
Sugar	56.93	57.9			
Cellulose	0.25	0.24			
Salt	3.79	1.38	0.31	0.08	
Preventol	0.12	0.18			
DGBE			44.45	44.51	45

Water: deionized water, resistivity ≥ 16 MΩ
Sugar: refined white sugar
Salt: pure NaCl
Cellulose: Hydroxyethyl-cellulose
Preservative: Preventol D-7
DGBE: Diethylenglycol-monobuthyl ether

The parameters for the different frequencies are defined in the corresponding compliance standards (e.g., IEEE 1528-2003, IEC 62209-1)

The HBBL3-6GHz and MBBL 3-6 GHz liquids are direct from Speag.

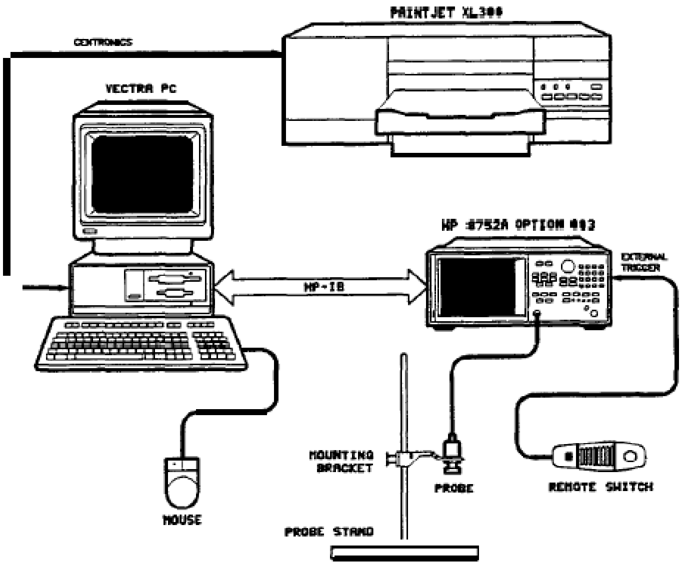
6.2 Test Conditions and Results – Tissue Validation

Tissue Validation acc. to 865664 D01 SAR Measurement 100 MHz to 6 GHz / ISED RSS-102	**Verdict: PASS**
Test according to measurement reference	Reference Method: 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Values

Frequency [MHz]	Head		Body		Permitted tolerance [%]
	Relative dielectric constant ε_r	Conductivity σ [S/m]	Relative dielectric constant ε_r	Conductivity σ [S/m]	
150	52.3	0.76	61.9	0.80	≤ ±5
300	45.3	0.87	58.2	0.92	≤ ±5
450	43.5	0.87	56.7	0.94	≤ ±5
835	41.5	0.90	55.2	0.97	≤ ±5
900	41.5	0.97	55.0	1.05	≤ ±5
915	41.5	0.98	55.0	1.06	≤ ±5
1450	40.5	1.20	54.0	1.30	≤ ±5
1610	40.3	1.29	53.8	1.40	≤ ±5
1800 – 2000	40.0	1.40	53.3	1.52	≤ ±5
2450	39.2	1.80	52.7	1.95	≤ ±5
3000	38.5	2.40	52.0	2.73	≤ ±5
5200	36.0	4.66	49.0	5.30	≤ ±5
5500	35.6	4.96	48.6	5.65	≤ ±5
5800	35.3	5.27	48.2	6.00	≤ ±5

Test setup



Test procedure

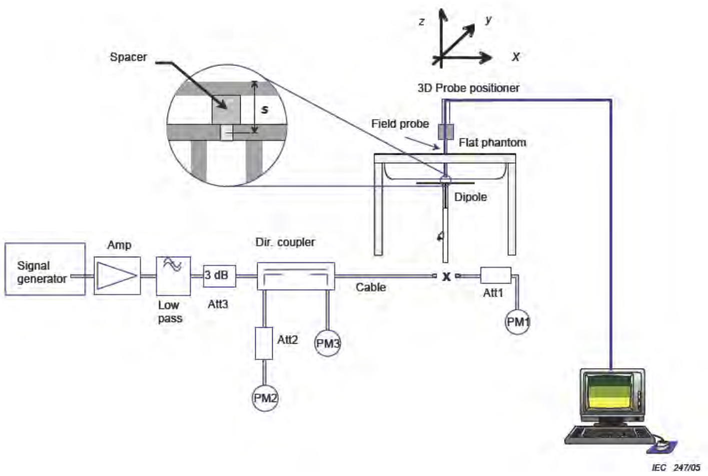
1. The dielectric probe kit is calibrated using the standards air, short circuit and deionized water
2. The tissue simulating liquid is measured using the dielectric probe
3. Target values are compared to the measurement values and deviations are determined

TISSUE VALIDATION									
Room Temperature [°C]					22.5 – 23.5				
Tissue	Freq. [MHz]	Measured ε_r	Target ε_r *	Δ ε_r [%] **	Measured σ [S/m]	Target σ [S/m] *	Δ σ [%] **	Operator	Date
MSL-2450	2450	52.38	52.70	-0.61	1.975	1.95	1.28	B. Pudell	21.08.2019
MSL-2450	2412	52.48	52.75	-0.51	1.923	1.91	0.68	B. Pudell	22.08.2019
MSL-2450	2422	52.48	52.73	-0.47	1.936	1.93	0.31	B. Pudell	22.08.2019
MSL-2450	2437	52.42	52.72	-0.57	1.957	1.93	1.40	B. Pudell	21.08.2019
MSL-2450	2452	52.37	52.70	-0.63	1.978	1.95	1.44	B. Pudell	22.08.2019
MSL-2450	2462	52.34	52.68	-0.65	1.991	1.97	1.07	B. Pudell	22.08.2019
MSL-2450	2450	52.49	52.70	-0.40	2.011	1.95	3.13	B. Pudell	06.11.2019
MSL-2450	2402	52.47	52.76	-0.55	1.921	1.91	0.58	B. Pudell	06.11.2019
MSL-2450	2441	52.53	52.71	-0.34	1.994	1.94	2.78	B. Pudell	06.11.2019
MSL-2450	2480	52.44	52.66	-0.42	2.069	1.99	3.97	B. Pudell	06.11.2019

* The target tissue dielectric properties of the corresponding basic SAR measurement standard apply
** The deviation has to be 5% or lower

6.3 Test Conditions and Results – System Validation

System Validation acc. to 865664 D01 SAR Measurement 100 MHz to 6 GHz / ISED RSS-102		**Verdict: PASS**
Test according to measurement reference	Reference Method	
	865664 D01 SAR Measurement 100 MHz to 6 GHz / IEEE 1528	
Test frequency range	Tested frequencies	
	2450 MHz	
Test mode	unmodulated CW	
Target Values		
Frequency [MHz]	Normalized 1 W Target SAR value [W/kg]	Permitted tolerance [%]
2450	50.9 (1g) / 24.0 (10g)	≤ ±10
The target reference values are taken from the calibration sheets (see annex)		
Test setup		



Test procedure

1. The dipole antenna input power is set to 250mW
2. The reference dipole is positioned under the phantom
3. With the dipole antenna powered the SAR value is measured
4. The measured SAR values are compared to the target SAR values

SYSTEM VALIDATION – 1g										
Room Temperature [°C]					22.5 – 23.5					
TSL	Validation Dipole	Measurement Phantom	Validation Frequency [MHz]	Input Power [mW]	Measured SAR (1g) [W/kg]	Normalized to 1W SAR (1g) [W/kg] *	Target SAR (1g) [W/kg] *	Δ SAR (1g) [%] **	Operator	Date
MSL-2450	D2450V2	ELI 4	2450	250	13.0	52.0	50.9	2.16	B. Pudell	21.08.19
MSL-2450	D2450V2	ELI 4	2450	250	13.0	52.0	50.9	2.16	B. Pudell	22.08.19
MSL-2450	D2450V2	ELI 4	2450	250	12.7	50.8	50.9	-0.20	B. Pudell	06.11.19
* See calibration documents of system validation dipole ** The deviation has to be 10% or lower										

SYSTEM VALIDATION – 10g										
Room Temperature [°C]					22.5 – 23.5					
TSL	Validation Dipole	Measurement Phantom	Validation Frequency [MHz]	Input Power [mW]	Measured SAR (10g) [W/kg]	Normalized to 1W SAR (10g) [W/kg] *	Target SAR (10g) [W/kg] *	Δ SAR (10g) [%] **	Operator	Date
MSL-2450	D2450V2	ELI 4	2450	250	6.04	24.16	24.0	0.7	B. Pudell	21.08.19
MSL-2450	D2450V2	ELI 4	2450	250	5.99	23.96	24.0	-0.2	B. Pudell	22.08.19
MSL-2450	D2450V2	ELI 4	2450	250	5.94	23.76	24.0	-1.0	B. Pudell	06.11.19
* See calibration documents of system validation dipole ** The deviation has to be 10% or lower										

6.4 Test Conditions and Results – Standalone SAR Measurement

Standalone SAR acc. to 865664 D01 SAR Measurement 100 MHz to 6 GHz / ISED RSS-102		**Verdict: PASS**
Test according to measurement reference	Reference Method	
	865664 D01 SAR Measurement 100 MHz to 6 GHz / ISED RSS-102 Issue 5	
Room temperature	22.5 – 23.5 °C	
Liquid depth	16.0 cm	
Environment	general public	
Limits		
Region	Occupational SAR values [W/kg]	General public SAR values [W/kg]
Whole body average SAR	0.4	0.08
Localized SAR (Head and trunk) SAR averaging mass = 1g	8	1.6
Localized SAR (Limbs) SAR averaging mass = 10g	20	4

SINGLE TRANSMITTER SAR EVALUATION – 1g											
Room Temperature [°C]						22.5 – 23.5					
Mode	Position	TSL	Phant.	Ch.	Freq. [MHz]	Power Drift [dB]	Measured SAR (1g) [W/kg]	Power Scaling Factor*	Reported SAR (1g) [W/kg][3]	Operator	Date
WLAN-b	Front	MSL-2450	ELI 4	6	2437	-0.17	0.267	1.72[2]	**0.459**	B. Pudell	21.08.2019
WLAN-n HT20-2S	Front	MSL-2450	ELI 4	6	2437	-0.18	0.108	1.91[2]	0.206	B. Pudell	22.08.2019
WLAN-b	Back	MSL-2450	ELI 4	6	2437	-0.10	0.098	1.72[2]	0.169	B. Pudell	22.08.2019
WLAN-n HT20-2S	Back	MSL-2450	ELI 4	6	2437	-0.09	0.031	1.91[2]	0.059	B. Pudell	22.08.2019
WLAN-b	Left	MSL-2450	ELI 4	6	2437	-0.04	0.140	1.72[2]	0.241	B. Pudell	21.08.2019
WLAN-b	Right	MSL-2450	ELI 4	6	2437	-0.02	0.089	1.72[2]	0.153	B. Pudell	21.08.2019
WLAN-n HT20-2S	Right	MSL-2450	ELI 4	6	2437	-0.17	0.055	1.91[2]	0.105	B. Pudell	22.08.2019
WLAN-b	Top	MSL-2450	ELI 4	6	2437	-0.14	0.061	1.72[2]	0.105	B. Pudell	21.08.2019
WLAN-n HT20-2S	Bottom	MSL-2450	ELI 4	6	2437	-0.11	0.052	1.91[2]	0.099	B. Pudell	22.08.2019
BT-BR	Front	MSL-2450	ELI 4	0	2402	0.14	0.066	1.41[1]	**0.093**	B. Pudell	06.11.2019
BT-BR	Back	MSL-2450	ELI 4	0	2402	-0.11	0.020	1.41[1]	0.028	B. Pudell	06.11.2019
BT-BR	Left	MSL-2450	ELI 4	0	2402	-0.06	0.025	1.41[1]	0.035	B. Pudell	06.11.2019
BT-BR	Right	MSL-2450	ELI 4	0	2402	0.07	0.015	1.41[1]	0.021	B. Pudell	06.11.2019
BT-BR	Top	MSL-2450	ELI 4	0	2402	0.12	0.016	1.41[1]	0.023	B. Pudell	06.11.2019
BT-LE	Front	MSL-2450	ELI 4	0	2402	0.01	0.043	1.41[1]	0.061	B. Pudell	08.11.2019
BT-LE	Top	MSL-2450	ELI 4	0	2402	0.13	0.013	1.41[1]	0.018	B. Pudell	08.11.2019

1 Scaling factor = Max. conducted power (including tune up tolerance) / measured conducted power
2 Scaling factor = Max. conducted power (including tune up tolerance) / measured conducted power [1] * 1/DutyCycle
3 Reported SAR = Measured SAR * Scaling Factor

According to KDB 865664 D02 v01r01 only the SAR plots for the highest SAR results for each EUT configuration and operating condition are given in the “SAR Results” part of the report.

SINGLE TRANSMITTER SAR EVALUATION – 10g											
Room Temperature [°C]						22.5 – 23.5					
Mode	Position	TSL	Phant.	Ch.	Freq. [MHz]	Power Drift [dB]	Measured SAR (10g) [W/kg]	Power Scaling Factor*	Reported SAR (10g) [W/kg][3]	Operator	Date
WLAN-b	Front	MSL-2450	ELI 4	6	2437	-0.17	0.140	1.72[2]	**0.241**	B. Pudell	21.08.2019
WLAN-n HT20-2S	Front	MSL-2450	ELI 4	6	2437	-0.18	0.056	1.91[2]	0.107	B. Pudell	22.08.2019
WLAN-b	Back	MSL-2450	ELI 4	6	2437	-0.10	0.052	1.72[2]	0.089	B. Pudell	22.08.2019
WLAN-n HT20-2S	Back	MSL-2450	ELI 4	6	2437	-0.09	0.016	1.91[2]	0.031	B. Pudell	22.08.2019
WLAN-b	Left	MSL-2450	ELI 4	6	2437	-0.04	0.066	1.72[2]	0.114	B. Pudell	21.08.2019
WLAN-b	Right	MSL-2450	ELI 4	6	2437	-0.02	0.042	1.72[2]	0.072	B. Pudell	21.08.2019
WLAN-n HT20-2S	Right	MSL-2450	ELI 4	6	2437	-0.17	0.023	1.91[2]	0.044	B. Pudell	22.08.2019
WLAN-b	Top	MSL-2450	ELI 4	6	2437	-0.14	0.029	1.72[2]	0.050	B. Pudell	21.08.2019
WLAN-n HT20-2S	Bottom	MSL-2450	ELI 4	6	2437	-0.11	0.020	1.91[2]	0.038	B. Pudell	22.08.2019
BT-BR	Front	MSL-2450	ELI 4	0	2402	0.14	0.035	1.41[1]	**0.049**	B. Pudell	06.11.2019
BT-BR	Back	MSL-2450	ELI 4	0	2402	-0.11	0.0085	1.41[1]	0.012	B. Pudell	06.11.2019
BT-BR	Left	MSL-2450	ELI 4	0	2402	-0.06	0.011	1.41[1]	0.016	B. Pudell	06.11.2019
BT-BR	Right	MSL-2450	ELI 4	0	2402	0.07	0.0062	1.41[1]	0.009	B. Pudell	06.11.2019
BT-BR	Top	MSL-2450	ELI 4	0	2402	0.12	0.0072	1.41[1]	0.010	B. Pudell	06.11.2019
BT-LE	Front	MSL-2450	ELI 4	0	2402	0.01	0.022	1.41[1]	0.031	B. Pudell	08.11.2019
BT-LE	Top	MSL-2450	ELI 4	0	2402	0.13	0.0049	1.41[1]	0.007	B. Pudell	08.11.2019

1 Scaling factor = Max. conducted power (including tune up tolerance) / measured conducted power
2 Scaling factor = Max. conducted power (including tune up tolerance) / measured conducted power [1] * 1/DutyCycle
3 Reported SAR = Measured SAR * Scaling Factor

6.5 Test Conditions and Results – Multi-transmitter SAR Result

None

ANNEX A Calibration Documents

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 0108

Client **Eurofins**

Certificate No: D2450V2-722_Sep18

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:722
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 04, 2018

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 4, 2018

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	1.86 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	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.4 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	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	2.02 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	13.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.0 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5 Ω + 8.9 jΩ
Return Loss	- 20.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.7 Ω + 10.9 jΩ
Return Loss	- 18.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 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	October 16, 2002

DASY5 Validation Report for Head TSL

Date: 04.09.2018

Test Laboratory: SPEAG, Zurich, Switzerland

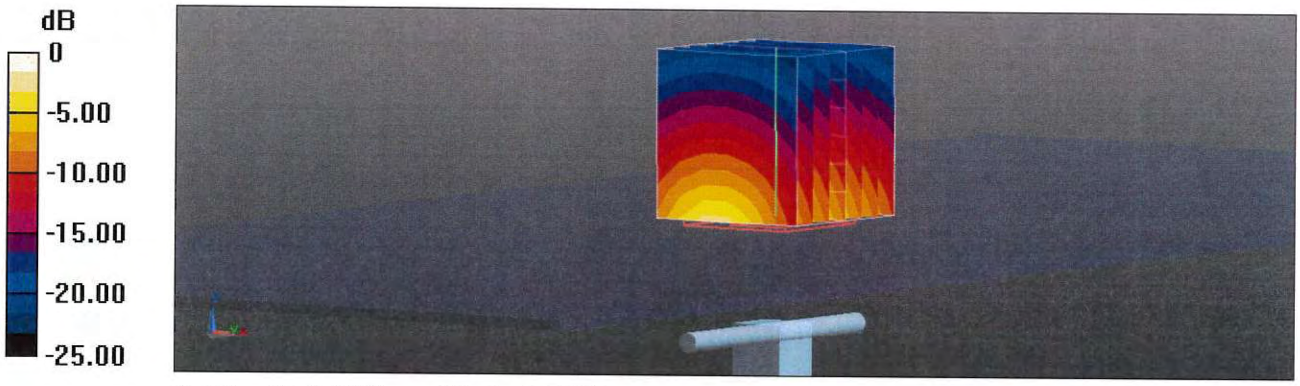
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:722

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 37.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

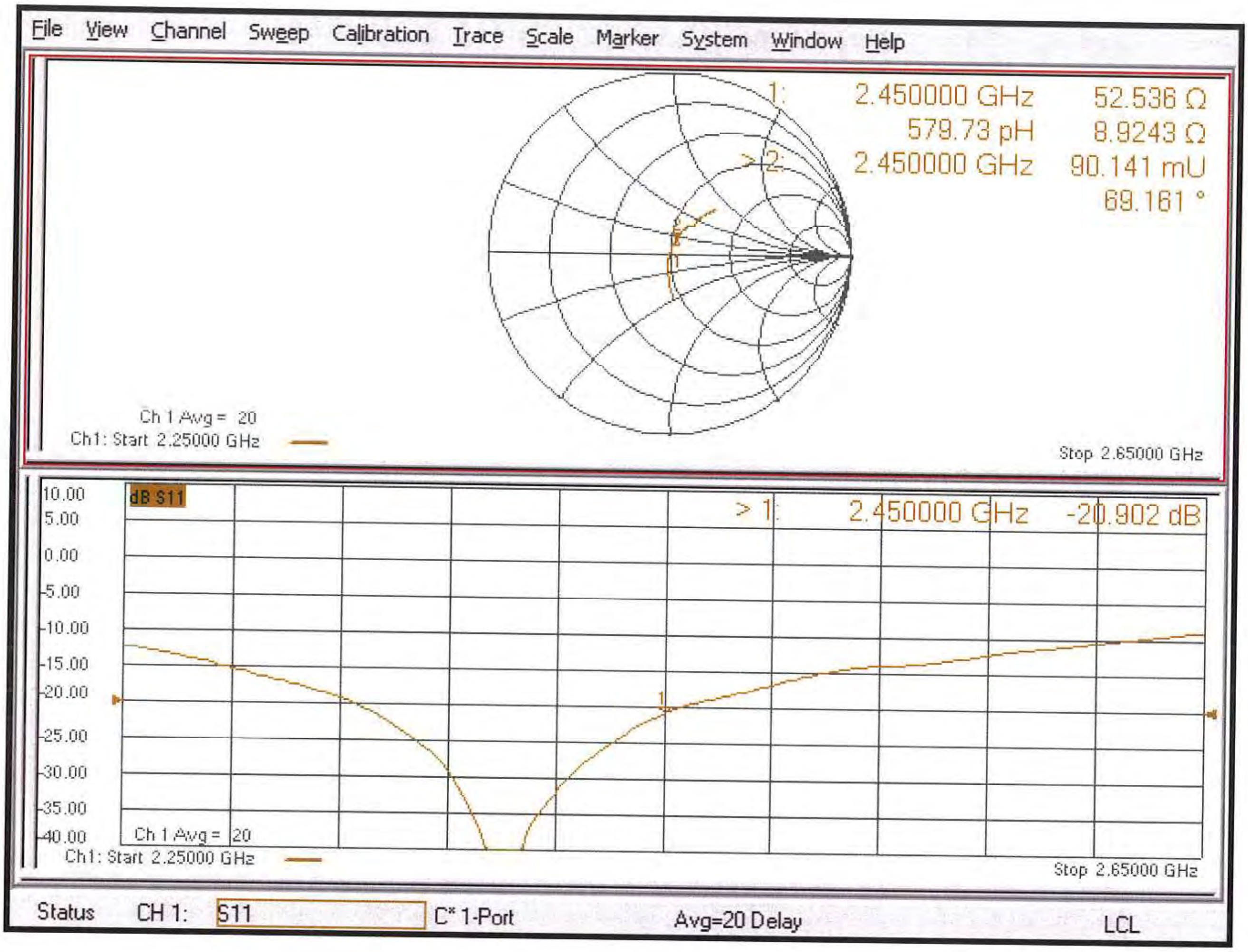
- Probe: EX3DV4 - SN7349; ConvF(7.88, 7.88, 7.88) @ 2450 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 113.8 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 26.8 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.19 W/kg
Maximum value of SAR (measured) = 21.0 W/kg



0 dB = 21.0 W/kg = 13.22 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 04.09.2018

Test Laboratory: SPEAG, Zurich, Switzerland

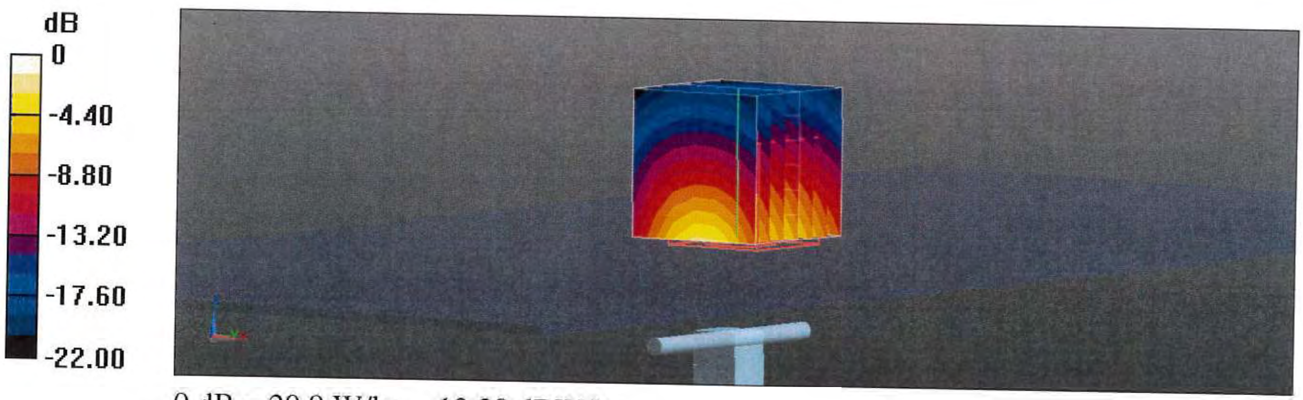
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:722

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

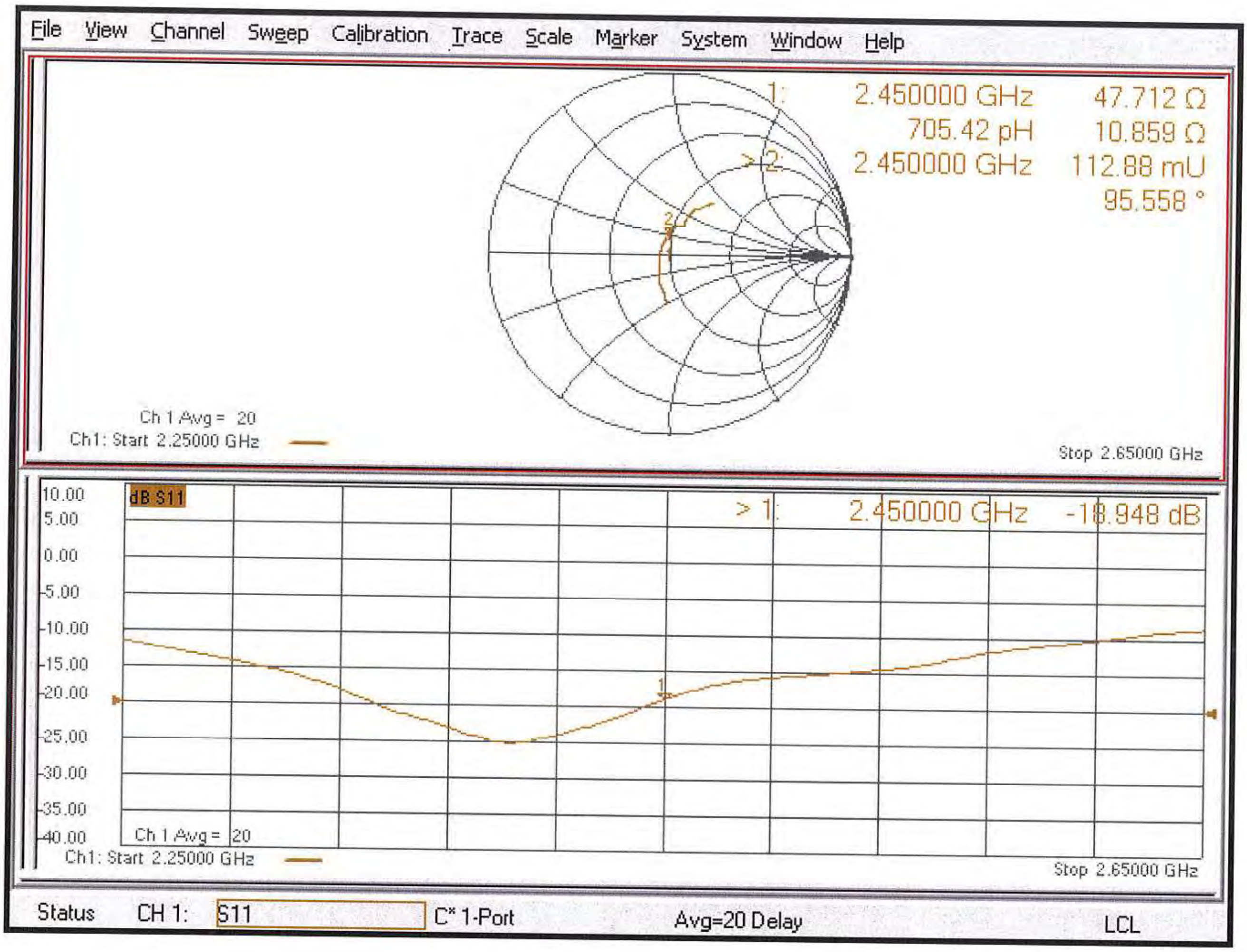
- Probe: EX3DV4 - SN7349; ConvF(8.01, 8.01, 8.01) @ 2450 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 107.4 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 25.8 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.08 W/kg
Maximum value of SAR (measured) = 20.9 W/kg



0 dB = 20.9 W/kg = 13.20 dBW/kg

Impedance Measurement Plot for Body TSL



Validation Report
No. VAL_0284_EF 2019-11

Kind of doc.:
QM Template

EUROFINS PRODUCT SERVICE GmbH
Storkower Str. 38c, 15526 Reichenwalde, Germany

1 Customer

Eurofins Product Service GmbH

2 Object

Equipment Number	EF00284
Equipment Name:	System validation dipole
Equipment Type:	D2450V2
Serial Number:	722
Manufacturer:	Schmid & Partner Engineering AG

3 State of Measurement

Validation: ☒

Performance Control: ☒

Other: ☐

4 Performance of Measurement

4.1 Generals

(e.g. object of validation such as specific setup, non-standard method or SW, specification of the requirements, test set-up configuration, risk analysis etc.)

Dipol verification

4.2 Validation procedure / measurement

(e.g. comparison of results achieved with other methods, interlaboratory comparison, systematic assessment of factors influencing the result, assessment of the uncertainty of the results based on scientific understanding of the theoretical principles of the method and practical experience; criteria/requirements for approval/rejection etc.)

According KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 3.2.2 Dipole calibration

Limits for the verification: return loss <20% to the original measurement or >20 dB minimum return-loss
Impedance <5 Ω to the original measurement.

4.3 Used reference equipment

Equipment name	Equipment type	Manufacturer	Equipment number	Cal. Date	Cal. Due Date
RF Network analyzer	8752 C	Hewlett-Packard Company Santa Clara	EF00140	2019-07-26	2020-07-26

- new acquired (incl. calibration) ☐
- new calibrated ☐
- check reference standard ☒

4.4 Environmental conditions

Temperature:	_23_°C + 2°C
Relative Air Humidity:	_50_ rH + 5%
Air Pressure:	_1020_ hPa + 5%