

# SAR TEST REPORT



The following samples were submitted and identified on behalf of the client as:

Equipment Under Test	Smart phone
Company Name	Sharp Corporation, Mobile Communication B.U.
Company Address	2-13-1, Hachihonmatsu-Iida, Higashi-hiroshima-shi,Hiroshima 739-0192, Japan
Standards	IEEE/ANSI C95.1-1992, IEEE 1528-2013,
	KDB248227D01v02r02,KDB865664D01v01r04,
	KDB865664D02v01r02,KDB941225D01v03r01,
	KDB941225D06v02r01,KDB447498D01v06,
	KDB648474D04v01r03, KDB941225D05v02r05
FCC ID	APYHRO00267
Date of Receipt	Sep. 27, 2018
Date of Test(s)	Oct. 05, 2018 ~ Oct. 09, 2018
<b>e</b>	Nov. 01, 2018 JT complied with the standards specified above.
Remarks:	

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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#### Signed on behalf of SGS

Clerk / Ruby Ou	Engineer / Bond Tsai	Asst. Manager / John Yeh		
Kuby Ou	Bonditrai	John Teh		
		Date: Nov. 01, 2018		

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	Highest SAR Summary				
Equipment class	Frequency Band	Head (Separation 0mm)	Body-worn (Separation 10mm)	Hotspot (Separation 10mm)	Highest Simultaneous Transmission 1g SAR(W/Kg)
			1g S/	AR(W/Kg)	
Licensed	UMTS Band II	0.19	-	-	
Licensed	UMTS Band IV	-	0.45	0.96	
Licensed	UMTS Band 4	0.19	-	-	1.55
DTS	2.4GHz WLAN	0.60	0.09	0.23	1.55
NII	5GHz WLAN	1.14	0.09	-	
DSS	Bluetooth	0.32	0.05	-	
Date	of Testing	2018/10/05~2018/10/09			

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## **Revision History**

Report Number	Revision	Description	Issue Date
E5/2018/90016	Rev.00	Initial creation of document	Oct. 16, 2018
E5/2018/90016	Rev.01	Initial creation of document	Nov. 01, 2018

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### **1. General Information**

### 1.1 Testing Laboratory

SGS Taiwan Ltd. Electronics & Communication Laboratory			
No. 2, Keji 1 <sup>st</sup> Rd., Guishan Township, Taoyuan County, 33383, Taiwan			
Tel	+886-2-2299-3279		
Fax +886-2-2298-0488			
Internet	nternet http://www.tw.sgs.com/		

#### **1.2 Details of Applicant**

Company Name Sharp Corporation, Mobile Communication B.U.	
Compony Addrood	2-13-1, Hachihonmatsu-Iida, Higashi-hiroshima-shi,Hiroshima 739-0192, Japan

#### 1.2.1 Details of Manufacturer

Company Name	Sharp Corporation
Company Address	1 Takumi-cho, Sakai-ku, Sakai City,Osaka 590-8522,Japan

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#### **1.3 Description of EUT**

EUT Name	Smart phone				
FCC ID	APYHRO00267				
Mode of Operation	GSM GPRS WCDMA HSDPA HSUPA HSPA+ UTE FDD WLAN802.11 a/b/g/n/ac(20M/40M/80M) Bluetooth				
	GSM (DTM multi class B) GPRS	1/8.3 1/2 (1Dn4UP) 1/2.76 (1Dn3UP)			
	(support multi class 12 max)	1/4.1	(1Dn2 (1Dn1	2UP)	
Duty Cycle	LTE FDD		1		
	WCDMA		1		
	WLAN802.11		1		
	a/b/g/n/ac(20M/40M/80M)		4		
	Bluetooth GSM1900	1850	1	1010	
	WCDMA Band II	1850		1910 1910	
	WCDMA Band IV	1710		1755	
	LTE FDD Band 2	1850		1910	
TX Frequency Range (MHz)	LTE FDD Band 4	1710	_	1755	
(	WiFi 2.4GHz	2400		2462	
	WiFi 5GHz	5150	_	5725	
	Bluetooth	2402	_	2480	
	GSM1900	512	_	810	
	WCDMA Band II	9262	_	9538	
Channel Number	WCDMA Band IV	1312		1513	
(ARFCN)	LTE FDD Band 2	18607	_	19193	
	LTE FDD Band 4	19957	_	20393	
	WiFi 2.4GHz	1	_	11	

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Channel Number	WiFi 5GHz	36	_	144
(ARFCN)	Bluetooth	0	_	78

Max. SAR (1-g) (Unit: W/Kg)					
Mode	Band	Measured	Reported	Position / Channel	
	GSM 1900	0.08	0.11	☐Left ☐Right ☐Cheek ☐Tilt <u>661</u> Channel	
	WCDMA Band II	0.15	0.19	Left Right Cheek Tilt <u>9262</u> Channel	
Head	WCDMA Band IV	0.13	0.16	Left Right Cheek Tilt <u>1513</u> Channel	
	LTE FDD Band 2 LTE FDD Band 4	0.13	0.15	□Left □Right □Cheek □Tilt 18900 Channel	
		0.16	0.19	☐Left ☐Right ☐Cheek ☐Tilt 20300 Channel	

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	Max. SAR (1-g) (Unit: W/Kg)					
Mode	Band	Measured	Reported	Position / Channel		
	WLAN802.11 b	0.59	0.60	□Left ⊠Right ⊠Cheek □Tilt <u>1</u> Channel		
	WLAN802.11n(40M)5.2G	0.96	1.03	□Left ⊠Right ⊠Cheek □Tilt <u>38</u> Channel		
	WLAN802.11ac(80M)5.2G	1.02	1.14	□Left ⊠Right ⊠Cheek □Tilt <u>42</u> Channel		
Head	WLAN802.11n(40M)5.3G	0.97	1.05	□Left ⊠Right ⊠Cheek □Tilt <u>54</u> Channel		
	WLAN802.11ac(80M)5.3G	1.05	1.10	□Left ⊠Right ⊠Cheek □Tilt <u>58</u> Channel		
	WLAN802.11ac(80M)5.6G	1.06	1.12	□Left ⊠Right ⊠Cheek □Tilt <u>138</u> Channel		
	Bluetooth	0.19	0.32	□Left ⊠Right ⊠Cheek □Tilt <u>0</u> Channel		

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	Max. SAR (1-	g) (Unit: W	//Kg)	
Mode	Band	Measured	Reported	Position / Channel
	GSM 1900	0.02	0.03	☐Front ⊠Back <u>661</u> Channel
	WCDMA Band II	0.26	0.33	⊠Front ⊡Back <u>9262</u> Channel
	WCDMA Band IV	0.37	0.45	⊠Front □Back <u>1513</u> Channel
	LTE FDD Band 2	0.24	0.29	⊠Front
Deducuere	LTE FDD Band 4	0.36	0.42	⊠Front □Back 20300 Channel
Body-worn	WLAN802.11 b	0.09	0.09	□Front ⊠Back <u>1</u> Channel
	WLAN802.11ac(80M)5.2G	0.07	0.08	⊠Front □Back <u>42</u> Channel
	WLAN802.11ac(80M)5.3G	0.08	0.08	⊠Front ⊡Back <u>58</u> Channel
	WLAN802.11ac(80M)5.6G	0.09	0.09	⊠Front
	Bluetooth	0.03	0.05	☐Front ⊠Back 0_Channel

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	Max. SAR	(1-g) (Unit:	W/Kg)	
Mode	Band	Measured	Reported	Position / Channel
Hotspot	GPRS 1900 (1Dn4UP)	0.17	0.26	☐Front ☐Back ⊠Bottom ☐Right ☐Left <u>512</u> Channel
	WCDMA Band II	0.57	0.71	☐Front ☐Back ⊠Bottom ☐Right ☐Left <u>9262</u> Channel
	WCDMA Band IV	0.78	0.96	Front Back Bottom Right Left 1513 Channel
mode	LTE FDD Band 2	0.49	0.57	Front Back Bottom Right Left <u>18900</u> Channel
	LTE FDD Band 4	0.72	0.84	☐Front ☐Back ⊠Bottom ☐Right ☐Left <u>20300</u> Channel
	WLAN802.11 b	0.22	0.23	☐Front ☐Back ☐Top ☐Right ☐Left ☐Bottom <u>1 </u> Channel

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#### GSM 1900 - conducted power table:

EUT mode	Frequency (MHz)	СН	Max. Rated Avg. Power + Max.Tolerance (dBm)	Burst average power Avg. (dBm)	Source-based time average power Avg. (dBm)		
0014000	1850.2	512	30.7	29.10	20.07		
GSM1900 (GMSK)	1800	661	30.7	29.14	20.11		
	1909.8	810	30.7	29.08	20.05		
	The divis	sion factor o	compared to the n	umber of TX time	slot		
	Divit	sion factor		1 TX time slot			
	DIVI			-9.03			

#### GPRS 1900 - conducted power table:

			Burst avera	age power		
	ted Avg. Powe olerance (dBr		30.7	28.3	26.5	25.7
			1Dn1UP	1Dn2UP	1Dn3UP	1Dn4UP
EUT mode	(MHz)		Avg. (dBm)	A∨g. (dBm)	Avg. (dBm)	Avg. (dBm)
GPRS	1850.2	512	29.10	26.77	24.97	23.90
1900	1880 66		29.14	26.82	24.96	23.86
1900	1909.8	810	29.08	26.83	24.93	23.85
		So	ource-based tim	e average powe	er	
GPRS	1850.2	512	20.07	20.75	20.71	20.89
1900	1880	661	20.11	20.80	20.70	20.85
1900	1909.8	810	20.05	20.81	20.67	20.84
	The div	ision fa	ctor compared			
Div	vision factor		1 TX time slot -9.03	2 TX time slot -6.02	3 TX time slot -4.26	4 TX time slot -3.01

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	Band	WCDMA II				
	TX Channel	9262	9400	9538		
	Frequency (MHz)	1850.2	1880	1907.6		
Max. Rated Ave	g. Power+Max. Tolerance (dBm)		23.30			
3GPP Rel 99	RMC 12.2Kbps	22.32	22.12	21.96		
	HSDPA Subtest-1	21.29	21.33	21.34		
3GPP Rel 5	HSDPA Subtest-2	20.87	20.92	20.84		
JOFF INCI J	HSDPA Subtest-3	20.88	20.92	20.83		
	HSDPA Subtest-4	20.87	20.91	20.83		
	HSUPA Subtest-1	21.34	21.41	21.29		
	HSUPA Subtest-2	19.36	19.43	19.39		
3GPP Rel 6	HSUPA Subtest-3	20.33	20.47	20.41		
	HSUPA Subtest-4	19.46	19.52	19.45		
	HSUPA Subtest-5	21.41	21.43	21.32		
3GPP Rel 7	HSPA+ Subtest-1	21.28	21.36	21.23		

#### WCDMA Band II / Band IV - HSDPA / HSUPA Conducted power table (Unit: dBm):

	Band		WCDMA I\	/
	TX Channel	1312	1412	1513
	Frequency (MHz)	1712.4	1732.4	1752.6
Max. Rated Ave	g. Power+Max. Tolerance (dBm)		23.30	
3GPP Rel 99	RMC 12.2Kbps	22.20	22.32	22.42
	HSDPA Subtest-1	21.49	21.51	21.63
3GPP Rel 5	HSDPA Subtest-2	20.94	21.03	21.15
JOFF Keij	HSDPA Subtest-3	20.99	21.03	21.15
	HSDPA Subtest-4	21.01	21.02	21.14
	HSUPA Subtest-1	21.44	21.50	21.61
	HSUPA Subtest-2	19.44	19.47	19.53
3GPP Rel 6	HSUPA Subtest-3	20.46	20.48	20.52
	HSUPA Subtest-4	19.42	19.54	19.62
	HSUPA Subtest-5	21.41	21.45	21.51
3GPP Rel 7	HSPA+ Subtest-1	21.37	21.41	21.48

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#### Subtests for WCDMA Release 5 HSDPA

SUB-TEST	βc	$\beta_d$	β <sub>d</sub> (SF)	β <sub>c</sub> /β <sub>d</sub>	β <sub>HS</sub> (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15	15/15	64	12/15	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

#### Subtests for WCDMA Release 6 HSUPA

SUB-TEST	βc	βd	β₀ (SF)	β₀/βd	<sub>βнs</sub> (Note1)	β <sub>ec</sub>	β <sub>ed</sub> (Note 5) (Note 6)	β <sub>ed</sub> (SF)	β <sub>ed</sub> (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β <sub>ed</sub> 1: 47/15 β <sub>ed</sub> 2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	15/15	64	15/15	30/15	24/15	134/15	4	1	1.0	0.0	21	81

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				FDD Band 2				
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
				1860	18700	22.23	23.3	0
			0	1880	18900	22.09	23.3	0
				1900	19100	22.14	23.3	0
				1860	18700	22.61	23.3	0
		1 RB	50	1880	18900	22.66	23.3	0
				1900	19100	22.02	23.3	0
				1860	18700	22.01	23.3	0
			99	1880	18900	22.47	23.3	0
				1900	19100	22.01	23.3	0
				1860	18700	21.39	22.3	0-1
	QPSK		0	1880	18900	21.45	22.3	0-1
				1900	19100	21.32	22.3	0-1
				1860	18700	21.30	22.3	0-1
	50 RB	25	1880	18900	21.36	22.3	0-1	
			1900	19100	21.33	22.3	0-1	
			50	1860	18700	21.25	22.3	0-1
				1880	18900	21.30	22.3	0-1
				1900	19100	21.22	22.3	0-1
				1860	18700	21.30	22.3	0-1
		100	)RB	1880	18900	21.42	22.3	0-1
20			-	1900	19100	21.38	22.3	0-1
20			0	1860	18700	21.35	22.3	0-1
				1880	18900	21.50	22.3	0-1
				1900	19100	21.38	22.3	0-1
				1860	18700	20.92	22.3	0-1
		1 RB	50	1880	18900	21.58	22.3	0-1
				1900	19100	20.98	22.3	0-1
				1860	18700	20.95	22.3	0-1
			99	1880	18900	20.97	22.3	0-1
				1900	19100	20.93	22.3	0-1
				1860	18700	20.55	21.3	0-2
	16-QAM		0	1880	18900	20.42	21.3	0-2
				1900	19100	20.22	21.3	0-2
				1860	18700	20.47	21.3	0-2
	50 RB	25	1880	18900	20.45	21.3	0-2	
				1900	19100	20.19	21.3	0-2
				1860	18700	20.27	21.3	0-2
			50	1880	18900	20.44	21.3	0-2
				1900	19100	20.19	21.3	0-2
				1860	18700	20.33	21.3	0-2
		100	)RB	1880	18900	20.51	21.3	0-2
				1900	19100	20.17	21.3	0-2

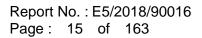
#### LTE FDD Band 2 / Band 4 - conducted power table:

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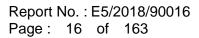




				FDD Band 2				
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
				1857.5	18675	22.28	23.3	0
			0	1880	18900	22.20	23.3	0
				1902.5	19125	22.09	23.3	0
				1857.5	18675	22.27	23.3	0
	QPSK	1 RB	36	1880	18900	22.42	23.3	0
				1902.5	19125	22.27	23.3	0
				1857.5	18675	22.29	23.3	0
			74	1880	18900	22.36	23.3	0
				1902.5	19125	22.26	23.3	0
				1857.5	18675	21.28	22.3	0-1
			0	1880	18900	21.33	22.3	0-1
				1902.5	19125	21.34	22.3	0-1
				1857.5	18675	21.22	22.3	0-1
		36 RB	18	1880	18900	21.36	22.3	0-1
				1902.5	19125	21.40	22.3	0-1
			37	1857.5	18675	21.31	22.3	0-1
				1880	18900	21.32	22.3	0-1
				1902.5	19125	21.28	22.3	0-1
				1857.5	18675	21.29	22.3	0-1
		/5	RB	1880	18900	21.32	22.3	0-1
15				1902.5	19125	21.31	22.3	0-1
			0	1857.5	18675	21.44	22.3	0-1
				1880	18900	21.22	22.3	0-1
				1902.5	19125	21.05	22.3	0-1
				1857.5	18675	21.29	22.3	0-1
		1 RB	36	1880	18900	21.26	22.3	0-1
				1902.5	19125	21.26	22.3	0-1
			74	1857.5	18675	21.31	22.3	0-1
			74	1880	18900	21.19	22.3	0-1
				1902.5 1857.5	19125 18675	21.34 20.33	22.3 21.3	0-1 0-2
	16-QAM		0		18900		21.3	
			0	1880 1902.5	19125	20.39 20.33	21.3	0-2 0-2
				1902.5	18675	20.33	21.3	0-2
		36 RB	18	1880	18900	20.39	21.3	0-2
		00 NB		1902.5	19125	20.43	21.3	0-2
				1857.5	18675	20.41	21.3	0-2
			37	1880	18900	20.33	21.3	0-2
				1902.5	19125	20.33	21.3	0-2
				1857.5	18675	20.10	21.3	0-2
		75	RB	1880	18900	20.32	21.3	0-2
		/3		1902.5	19125	20.47	21.3	0-2

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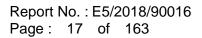


				FDD Band 2				
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
				1855	18650	22.36	23.3	0
			0	1880	18900	22.21	23.3	0
				1905	19150	22.14	23.3	0
				1855	18650	22.32	23.3	0
		1 RB	25	1880	18900	22.41	23.3	0
				1905	19150	22.44	23.3	0
	QPSK			1855	18650	22.46	23.3	0
			49	1880	18900	22.13	23.3	0
				1905	19150	22.38	23.3	0
				1855	18650	21.29	22.3	0-1
			0	1880	18900	21.40	22.3	0-1
				1905	19150	21.33	22.3	0-1
				1855	18650	21.27	22.3	0-1
		25 RB	12	1880	18900	21.35	22.3	0-1
				1905	19150	21.32	22.3	0-1
				1855	18650	21.30	22.3	0-1
			25	1880	18900	21.25	22.3	0-1
				1905	19150	21.35	22.3	0-1
				1855	18650	21.24	22.3	0-1
		50	RB	1880	18900	21.42	22.3	0-1
10				1905	19150	21.32	22.3	0-1
			0	1855	18650	21.31	22.3	0-1
				1880	18900	20.98	22.3	0-1
				1905	19150	21.10	22.3	0-1
				1855	18650	21.11	22.3	0-1
		1 RB	25	1880	18900	21.20	22.3	0-1
				1905	19150	20.98	22.3	0-1
				1855	18650	20.88	22.3	0-1
			49	1880	18900	21.12	22.3	0-1
				1905	19150	21.40	22.3	0-1
				1855	18650	20.29	21.3	0-2
	16-QAM		0	1880	18900	20.34	21.3	0-2
				1905	19150	20.59	21.3	0-2
			40	1855	18650	20.45	21.3	0-2
		25 RB	12	1880	18900	20.31	21.3	0-2
				1905	19150	20.37	21.3	0-2
			05	1855	18650	20.25	21.3	0-2
			25	1880	18900	20.27	21.3	0-2
				1905	19150	20.51	21.3	0-2
		F 00	חחו	1855	18650	20.41	21.3	0-2
		500	)RB	1880	18900	20.49	21.3	0-2
				1905	19150	20.29	21.3	0-2

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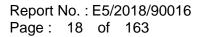




				FDD Band 2				
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
				1852.5	18625	22.16	23.3	0
			0	1880	18900	22.19	23.3	0
				1907.5	19175	22.09	23.3	0
				1852.5	18625	22.44	23.3	0
		1 RB	12	1880	18900	22.46	23.3	0
				1907.5	19175	22.36	23.3	0
				1852.5	18625	22.33	23.3	0
			24	1880	18900	22.04	23.3	0
				1907.5	19175	22.08	23.3	0
				1852.5	18625	21.32	22.3	0-1
	QPSK		0	1880	18900	21.39	22.3	0-1
				1907.5	19175	21.34	22.3	0-1
				1852.5	18625	21.32	22.3	0-1
		12 RB	6	1880	18900	21.35	22.3	0-1
				1907.5	19175	21.38	22.3	0-1
			13	1852.5	18625	21.22	22.3	0-1
				1880	18900	21.33	22.3	0-1
				1907.5	19175	21.40	22.3	0-1
				1852.5	18625	21.24	22.3	0-1
		25	RB	1880	18900	21.34	22.3	0-1
5				1907.5	19175	21.29	22.3	0-1
			0	1852.5	18625	21.23	22.3	0-1
				1880	18900	21.03	22.3	0-1
				1907.5	19175	21.05	22.3	0-1
		1 RB	12	1852.5	18625	21.26	22.3	0-1
		IKD		1880 1907.5	18900 19175	21.31 21.33	22.3 22.3	0-1 0-1
				1852.5	18625	21.33	22.3	0-1
			24	1880	18900	20.75	22.3	0-1
			24	1907.5	19175	20.74	22.3	0-1
				1852.5	18625	20.30	22.3	0-1
	16-QAM		0	1880	18900	20.28	21.3	0-2
			Ŭ	1907.5	19175	20.20	21.3	0-2
				1852.5	18625	20.07	21.3	0-2
		12 RB	6	1880	18900	20.41	21.3	0-2
			Ŭ	1907.5	19175	20.43	21.3	0-2
				1852.5	18625	20.24	21.3	0-2
			13	1880	18900	20.16	21.3	0-2
			-	1907.5	19175	20.34	21.3	0-2
			1	1852.5	18625	20.21	21.3	0-2
		25	RB	1880	18900	20.30	21.3	0-2
				1907.5	19175	20.28	21.3	0-2

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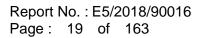




				FDD Band 2							
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)			
				1851.5	18615	22.31	23.3	0			
			0	1880	18900	22.17	23.3	0			
				1908.5	19185	22.06	23.3	0			
				1851.5	18615	22.37	23.3	0			
		1 RB	7	1880	18900	18900 22.62 23.3	23.3	0			
				1908.5	19185 22.30 23.3	0					
0.000				1851.5		22.15	23.3	0			
			14	1880 18900	22.25	23.3	0				
				1908.5			23.3	0			
				1851.5				0-1			
	QPSK		0	1880	18900	21.35	22.3	0-1			
				1908.5	19185		22.3	0-1 0-1			
				1851.5	18615	35       22.15       23.3         15       21.38       22.3         00       21.35       22.3         35       21.43       22.3         15       21.28       22.3         15       21.38       22.3         15       21.38       22.3         00       21.38       22.3         35       21.38       22.3         15       21.22       22.3         00       21.37       22.3         35       21.44       22.3         15       21.19       22.3         00       21.38       22.3					
		8 RB	4	1880	18900			0-1			
				1908.5	19185			0-1			
			_	1851.5	18615	•		0-1			
			7	1880	18900			0-1			
				1908.5	19185		0-1				
				1851.5	18615			0-1			
		15	RB	1880	18900			0-1			
3			1	1908.5	19185	21.28	22.3	0-1			
			0	1851.5	18615	21.29	22.3	0-1			
			0	1880	18900	21.18	22.3	0-1			
				1908.5	19185	21.08	22.3	0-1			
		1 RB	7	1851.5	18615	21.06	22.3	0-1			
		TKD	7					0-1 0-1			
								0-1			
			14			•		0-1			
			17				0-1				
								0-2			
	16-QAM		0	18801890021.1022.31908.51918521.3622.31851.51861520.7122.318801890021.0222.31908.51918521.2422.31851.51861520.3321.3			21.3	0-2			
				1908.5	19185	20.26	21.3	0-2			
				1851.5	18615	20.34	21.3	0-2			
		8 RB	4	1880	18900	20.40	21.3	0-2			
				1908.5	19185	0-2					
				1851.5	18615	20.53 20.33	21.3 21.3	0-2			
			7	1880	18900	20.50	21.3	0-2			
				1908.5	19185	20.58	21.3	0-2			
				1851.5	18615	20.35	21.3	0-2			
		15	RB	1880	18900	20.32	21.3	0-2			
				1908.5	19185	20.34	21.3	0-2			

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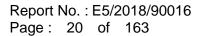


				FDD Band 2				
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
				1850.7	18607	22.19	23.3	0
			0	1880	18900	22.32	23.3	0
				1909.3	19193	22.22	23.3	0
		1 RB		1850.7	18607	22.27	23.3	0
			2	1880	18900	22.43	23.3	0
				1909.3	19193	22.29	23.3	0
				1850.7	18607	22.17	23.3	0
			5	1880	18900	22.34	23.3	0
				1909.3		22.25	23.3	0
			0	1850.7	18607	22.29	23.3	0
Q	QPSK			1880	18900	22.37	23.3	0
				1909.3	19193	22.28	23.3	0
				1850.7	18607	22.51	23.3	0
		3 RB	2	1880	18900	22.56	23.3	0
				1909.3	19193	22.30	23.3	0
				1850.7	18607	22.44	23.3	Import         Import           Tolerance (dBm)         Allowed per 3GPP(dB)           23.3         0
			3	1880	18900	22.59	23.3	0
				1909.3	19193	22.38		
		CDD		1850.7	18607	21.20	22.3	0-1
		66	RB	1880	18900	21.33	22.3	0-1
1.4			•	1909.3	19193	21.28	22.3	
			0	1850.7	18607	21.28		
				1880	18900	20.92		
				1909.3	19193	21.38		-
				1850.7	18607	20.96		
		1 RB	2	1880	18900	21.03		
				1909.3	19193	21.03		
			_	1850.7	18607	20.92		
			5	1880	18900	21.09		
				1909.3	19193	21.42		
	16-QAM		0	1850.7	18607	21.18		
	Ιο-QΑΙΝΙ		0	1880	18900	21.42		
				1909.3	19193	21.29	1	
		3 RB	2	1850.7	18607	21.17		
		JKD	<u> </u>	1880 1909.3	18900 19193	21.46		
				1909.3	18607	21.41 21.02		
			3	1880	18900	21.02		
			5	1909.3	18900	21.46		
				1850.7	18607	20.19		
		61	RB	1880	18900	20.19		
		0		1909.3	19193	20.27		
				1909.3	19192	20.20	21.3	0-2

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				FDD Band 4							
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)			
				1720	20050	22.12	23.3	0			
			0	1732.5	20175	22.08	23.3	0			
				1745	20300	22.15	23.3	0			
				1720	20050	22.49	23.3	0			
		1 RB	50	1732.5	20175	22.39	23.3	0			
				1745	20300	22.65	23.3	0			
				1720	20050	22.23	23.3	0			
			99	1732.5	20175	22.31	23.3	0			
				1745	20300	22.30	23.3	0			
			0	1720	20050	21.30	22.3	0-1			
	QPSK			1732.5	20175	21.27	22.3	0-1			
				1745	20300	21.41	22.3	0-1			
				1720	20050	21.27	22.3	0-1			
		50 RB	25	1732.5	20175	21.23	22.3	0-1			
				1745	20300	21.39	Power + Max. Tolerance (dBm)         Mirr R Allowed p 3GPP(dE)           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1           22.3         0.1				
				1720	20050	21.28	Power + Max. Tolerance (dBm)         Minrk Allowed per 3GPP(dB)           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           23.3         0           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1           22.3         0-1				
			50	1732.5	20175         21.18         22.3           20300         21.37         22.3	0-1					
				1745							
		10000		1720	20050	21.31					
		100	)RB	1732.5	20175	21.18					
20				1745	20300	21.38					
-			0	1720	20050	21.19					
				1732.5	20175	21.09					
				1745	20300	21.08					
				1720	20050						
		1 RB	50	1732.5	20175						
				1745	20300						
			00	1720	20050						
			99	1732.5	20175						
				1745	20300						
	16 0 4 14		0	1720	20050						
	16-QAM		0	1732.5	20175						
				1745	20300	1	1				
		50 RB	25	1720	20050						
		JUKD	20	1732.5 1745	20175 20300		22.15       23.3       0         22.49       23.3       0         22.39       23.3       0         22.65       23.3       0         22.31       23.3       0         22.30       23.3       0         22.31       23.3       0         22.30       23.3       0         22.31       23.3       0         22.30       23.3       0         21.30       22.3       0         21.27       22.3       0         21.27       22.3       0         21.27       22.3       0         21.27       22.3       0         21.27       22.3       0         21.27       22.3       0         21.28       22.3       0         21.39       22.3       0         21.31       22.3       0         21.38       22.3       0         21.31       22.3       0         21.38       22.3       0         21.38       22.3       0         21.48       22.3       0         21.51       22.3       0         21.48				
				1745	20300						
			50	1720	20050						
				1732.5	20175						
				1745	20300						
		100	RB	1732.5	20050						
		100		1732.5	20175		1	0-2			
				1740	20300	20.21	21.3	0-2			

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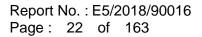
				FDD Band 4					
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)	
				1717.5	20025	22.38	23.3	0	
			0	1732.5	20175	22.26	23.3	0	
				1747.5	20325	22.27	23.3	0	
		1 RB		1717.5	20025	22.38	23.3	0	
			36	1732.5	20175	22.31	23.3	0	
QPSK				1747.5	1717.520025221732.520175211747.520325221717.520025211732.52017521	22.36	23.3	0	
			1717.5	20025	22.34	23.3	0		
			74	1732.5	20175	21.94	23.3	0	
				1747.5	20325	22.25	23.3	0	
				1717.5	20025	21.37	22.3	0-1	
	QPSK		0	1732.5	20175	21.25	22.3	0-1	
				1747.5	20325	21.38	22.3	0-1	
				1717.5	20025	21.25	22.3	0-1	
		36 RB	18	1732.5	20175	21.22	22.3	0-1	
				1747.5	20325	21.38	Implex er (dBm)Power + Max. Tolerance (dBm)Implex Allowed p 3GPP(dl $22.38$ $23.3$ 0 $22.26$ $23.3$ 0 $22.27$ $23.3$ 0 $22.38$ $23.3$ 0 $22.34$ $23.3$ 0 $22.34$ $23.3$ 0 $22.34$ $23.3$ 0 $22.34$ $23.3$ 0 $22.34$ $23.3$ 0 $22.34$ $23.3$ 0 $22.34$ $23.3$ 0 $22.34$ $23.3$ 0 $22.35$ $22.3$ 0-1 $21.25$ $22.3$ 0-1 $21.25$ $22.3$ 0-1 $21.25$ $22.3$ 0-1 $21.25$ $22.3$ 0-1 $21.25$ $22.3$ 0-1 $21.25$ $22.3$ 0-1 $21.25$ $22.3$ 0-1 $21.25$ $22.3$ 0-1 $21.22$ $22.3$ 0-1 $21.34$ $22.3$ 0-1 $21.35$ $22.3$ 0-1 $21.37$ $22.3$ 0-1 $21.37$ $22.3$ 0-1 $21.37$ $22.3$ 0-1 $21.42$ $22.3$ 0-1 $21.42$ $22.3$ 0-1 $21.42$ $22.3$ 0-1 $21.42$ $22.3$ 0-1 $22.32$ $21.3$ 0-2 $22.33$ 0-1 $21.42$ $22.3$ 0-1 $22.32$ $21.3$ 0-2 $22.33$ 0-1 $22.42$ $22.3$ 0-1 $22.52$ $22.3$ 0-1 </td		
				1717.5         20025         21.22           1732.5         20175         21.31	21.22	22.3	0-1		
			37	1732.5	20175	21.38         22.3         0-1           21.22         22.3         0-1           21.31         22.3         0-1           21.34         22.3         0-1           21.25         22.3         0-1			
				1747.5	20325	21.34	22.3	0-1	
				1717.5	20025	21.25	22.3	0-1	
		75	75RB		20175	21.10	22.3	0-1	
15				1747.5	20325	21.37	22.3	0-1	
10			0	1717.5	20025	21.19	22.3	0-1	
				1732.5	20175	21.23	22.3	0-1	
				1747.5	20325	21.50	22.3	0-1	
				1717.5	20025	21.02	22.3	0-1	
		1 RB	36	1732.5	20175	21.11	22.3	0-1	
				1747.5	20325	21.04	22.3	0-1	
				1717.5	20025	20.92	22.3	0-1	
			74	1732.5	20175	21.02	22.3	0-1	
				1747.5	20325	21.42			
				1717.5	20025	20.32	21.3	0-2	
	16-QAM		0	1732.5	20175	20.17		0-2	
				1747.5	20325	20.37	21.3	0-2	
				1717.5	20025	20.33			
		36 RB	18	1732.5	20175	20.10			
				1747.5	20325	20.32			
				1717.5	20025	20.20			
			37	1732.5	20175	20.11			
				1747.5	20325	20.26	21.3	0-2	
1				1717.5	20025	20.32	21.3	0-2	
		75	RB	1732.5	20175	20.12	21.3	0-2	
				1747.5	20325	20.36	21.3	0-2	

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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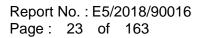




				FDD Band 4				
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
				1715	20000	22.12	23.3	0
			0	1732.5	20175	22.15	23.3	0
				1750	20350	22.26	23.3	0
				1715	20000	22.15	23.3	0
		1 RB	25	1732.5	20175	22.13	23.3	0
				1750	20350	22.43	23.3	0
				1715	20000	22.03	23.3	0
			49	1732.5	20175	22.08	23.3	0
				1750	20350	22.11	23.3	0
			0	1715	20000	21.08	22.3	0-1
QPSK	QPSK			1732.5	20175	20.99	22.3	0-1
				1750	20350	21.19	22.3	0-1
				1715	20000	21.15	22.3	0-1
		25 RB	12	1732.5	20175	21.01	22.3	0-1
				1750	20350	21.24 21.05	22.3 22.3	0-1
				1715	20000	0-1		
			25	1732.5	2017520.9922.32035021.2222.3	0-1		
				1750				0-1
		5000		1715	20000	21.19	22.3	0-1
		50	RB	1732.5	20175	21.01	22.3	0-1
10				1750	20350	21.21	22.3	0-1
-			0	1715	20000	20.81	22.3	0-1
				1732.5	20175	20.88	22.3	0-1
				1750	20350	21.34	22.3	0-1
				1715	20000	21.29	22.3	0-1
		1 RB	25	1732.5	20175	21.22	22.3	0-1
				1750	20350	21.41	22.3	0-1
			10	1715	20000	20.71	22.3	0-1
			49	1732.5	20175	20.99	22.3	0-1
				1750	20350	20.97	22.3	0-1
	16 0 4 14		0	1715	20000	20.07	21.3	0-2
	16-QAM		0	1732.5	20175	20.15	21.3	0-2
				1750	20350	20.23	21.3	0-2
		25 RB	12	1715	20000	20.11	21.3	0-2
		20 KD	12	1732.5 1750	20175 20350	20.09 20.39	21.3 21.3	0-2 0-2
				1750	20350	20.39	21.3	0-2
			25	1715	20000	20.07	21.3	0-2
			25	1732.5	20175	20.10	21.3	0-2
				1750	20350	20.11	21.3	0-2
		500	RB	1732.5	20000	20.10	21.3	0-2
		500		1750	20175	20.17	21.3	0-2
	1			1750	20000	20.23	21.0	0-2

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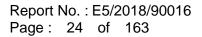




				FDD Band 4				
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
				1712.5	19975	21.88	23.3	0
			0	1732.5	20175	21.98	23.3	0
				1752.5	20375	22.13	23.3	0
				1712.5	19975	22.39	23.3	0
		1 RB	12	1732.5	20175	22.03	23.3	0
				1752.5	20375	22.18	23.3	0
				1712.5	1712.51997521.89231732.52017521.81231752.52037521.98231712.51997521.00221732.52017521.0522	23.3	0	
			24	1732.5		23.3	0	
				1752.5	20375	21.98	23.3	0
				1712.5	19975	21.00	22.3	0-1
	QPSK		0				22.3	0-1
				1752.5	20375	21.25	22.3	0-1
				1712.5	19975	21.08	22.3	0-1
		12 RB	6	1732.5	20175	21.05	22.3	0-1
				1752.5	20375	21.34	22.3	0-1
				1712.5	19975	21.07	22.3	0-1
			13	1732.5		22.3	0-1	
				1752.5	20375	21.20	22.3	0-1
				1712.5	19975	21.07	22.3	0-1
		25	RB	1732.5	20175	20.97	22.3	0-1
5				1752.5	20375	21.17	22.3	0-1
-			0	1712.5	19975	20.71	22.3	0-1
			0	1732.5	20175	20.79	22.3	0-1
				1752.5	20375	21.02	22.3	0-1
				1712.5	19975	20.88	22.3	0-1
		1 RB	12	1732.5	20175	20.99	22.3	0-1
				1752.5	20375	21.01	22.3	0-1
				1712.5	19975	20.97	22.3	0-1
			24	1732.5	20175	20.86	22.3	0-1
				1752.5	20375	21.25	22.3	0-1
	40.0414			1712.5	19975	20.14	21.3	0-2
	16-QAM		0	1732.5	20175	20.09	21.3	0-2
				1752.5	20375	20.36	21.3	0-2
		10 00	e	1712.5	19975	20.16	21.3	0-2
		12 RB	6	1732.5	20175	20.14	21.3	0-2
				1752.5	20375	20.19	21.3	0-2
			13	1712.5	19975	20.02	21.3	0-2
			13	1732.5 1752.5	20175 20375	20.00 20.07	21.3 21.3	0-2
					19975		21.3	0-2
		<b>2</b> 5	RB	1712.5		20.05		0-2
		25		1732.5 1752.5	20175	20.00 20.06	21.3	0-2 0-2
				1752.5	20375	20.00	21.3	0-2

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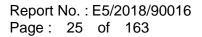




				FDD Band 4								
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)				
				1711.5	19965	21.94	23.3	0				
			0	1732.5	20175	21.91	23.3	0				
				1753.5	20385	22.21	23.3	0				
				1711.5	19965	22.31	23.3	0				
		1 RB	7	1732.5	20175	22.15	Power + Max. Tolerance (dBm)         Alloy 3GI           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           23.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3         -           22.3	0				
				1753.5	20385	22.45	23.3	0				
				1711.5	19965	21.92	23.3	0				
			14	1732.5	2.5         20175         21.96           3.5         20385         22.22           1.5         19965         21.16	23.3	0					
				1753.5		22.22		0				
				1711.5			22.3	0-1				
	QPSK		0	1732.5	20175	21.09	22.3	0-1				
				1753.5	20385	21.12	22.3	0-1				
				1711.5	19965	21.09	22.3	0-1				
		8 RB	4	1732.5	20175	21.12	22.3	0-1				
				1753.5	20385	21.13		0-1				
				1711.5	19965	21.15		0-1				
			7	1732.5	20175	21.10		0-1				
				1753.5	20385	21.16		0-1				
				1711.5	19965	21.07						
		15	RB	1732.5	20175	21.04						
3				1753.5	20385	21.14						
				1711.5	19965	20.73						
			0	1732.5	20175	20.80						
				1753.5	20385	20.73		-				
		4.00	-	1711.5	19965	20.77						
		1 RB	7	1732.5	20175							
				1753.5	20385							
			4.4	1711.5	19965		21.12         22.3           20.87         22.3					
			14	1732.5	20175	20.89	1.12         22.3         0-1           1.09         22.3         0-1           1.12         22.3         0-1           1.13         22.3         0-1           1.13         22.3         0-1           1.15         22.3         0-1           1.15         22.3         0-1           1.15         22.3         0-1           1.16         22.3         0-1           1.07         22.3         0-1           1.07         22.3         0-1           1.04         22.3         0-1           1.07         22.3         0-1           0.73         22.3         0-1           0.73         22.3         0-1           0.77         22.3         0-1           0.73         22.3         0-1           0.73         22.3         0-1           0.77         22.3         0-1           0.80         22.3         0-1           0.87         22.3         0-1           0.80         22.3         0-1           0.80         22.3         0-1           0.80         22.3         0-1           0.80					
				1753.5	20385							
	16-QAM		0	1711.5	19965							
			0	1732.5	20175 20385							
				1753.5								
		8 RB	4	1711.5	19965							
		010	-	1732.5 1753.5	20175 20385							
				1755.5	19965							
			7	1711.5	20175	19.97						
			'	1753.5	20175	20.14						
				1733.5	19965	20.14	21.3	0-2				
		15	RB	1711.5	20175	19.90	21.3	0-2				
		15		1753.5	20175	20.21	21.3	0-2				
	I			1755.5	20303	20.21	21.3	0-2				

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				FDD Band 4				
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
				1710.7	19957	21.99	23.3	0
			0	1732.5	20175	22.10	23.3	0
				1754.3	20393	22.22	23.3	0
		1 RB		1710.7	19957	22.05	23.3	0
			2	1732.5	20175	22.12	23.3	0
				1754.3	20393	22.15	23.3	0
				1710.7	19957	22.08	23.3	0
			5	1732.5	20175	22.03	23.3	0
				1754.3	4.3 20393 22.12	22.12	23.3	0
			0	1710.7	19957	22.22	23.3	0
QPS	QPSK			1732.5	20175	22.18	23.3	0
				1754.3	20393	22.24	23.3	0
				1710.7	19957	22.18	23.3	0
		3 RB	2	1732.5	20175	22.11	23.3	0
				1754.3	20393	22.43	23.3	0
				1710.7	19957	22.30	Power + Max. Tolerance (dBm)         Allowed per 3GPP(dB)           23.3         0           22.3         0-1           22.3         0-1           22.3         0-1	
			3	1732.5				
				1754.3	20393	22.39	23.3	0
				1710.7	19957	21.08	22.3	0-1
		61	RB	1732.5	20175	20.99	22.3	0-1
1.4				1754.3	20393	21.15	22.3	0-1
			0	1710.7	19957	21.32		
				1732.5	20175	20.77		
				1754.3	20393	21.26		
				1710.7	19957	21.16		
		1 RB	2	1732.5	20175	21.06		
				1754.3	20393	20.77		
			_	1710.7	19957	21.48		
			5	1732.5	20175	21.07		
				1754.3	20393	21.22		
	40.0414		0	1710.7	19957	21.09		
	16-QAM		0	1732.5	20175	21.10		
				1754.3	20393	21.12	1	
		2 00	_	1710.7	19957	21.13		
		3 RB	2	1732.5	20175	21.03		
				1754.3	20393	21.31		
			3	1710.7	19957	21.10		
			3	1732.5	20175	21.11		
				1754.3	20393	21.39	22.3	
		~	סכ	1710.7	19957	19.87	21.3	0-2
		61	RB	1732.5	20175	19.97	21.3	0-2
				1754.3	20393	20.04	21.3	0-2

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	Main Antenna									
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)				
		1	2412		13.00	12.92				
	802.11b	6	2437	1Mbps	13.00	12.90				
		11	2462		13.00	12.85				
		1	2412		13.00	12.92				
2450 MHz	802.11g	6	2437	6Mbps	13.00	12.72				
		11	2462		13.00	12.75				
		1	2412		13.00	12.85				
	802.11n-HT20	6	2437	MCS0	13.00	12.72				
		11	2462		13.00	12.70				

#### WLAN802.11 a/b/g/n/ac (20/40/80M) conducted power table:

Main Antenna								
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)		
		36	5180		13.00	12.89		
	802.11a	40	5200	6Mbps	13.00	12.72		
	002.114	44	5220	01010003	13.00	12.72		
		48	5240		13.00	12.51		
		36	5180		13.00	12.90		
	802.11n-HT20	40	5200	MCS0	13.00	12.73		
	002.11111120	44	5220		13.00	12.65		
		48	5240		13.00	12.56		
5.15-5.25 GHz		36	5180		13.00	12.89		
	802.11ac20-VHT0	40	5200	MCS0	13.00	12.68		
	002.118020-01110	44	5220	WICCO	13.00	12.58		
		48	5240		13.00	12.59		
	802.11n-HT40	38	5190	MCS0	13.00	12.70		
	002.1111-11140	46	5230	10000	13.00	12.66		
	802.11ac40-VHT0	38	5190	MCS0	13.00	12.66		
	002.11a040-VH10	46	5230	NIC30	13.00	12.66		
	802.11ac80-VHT0	42	5210	MCS0	13.00	12.52		

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Main Antenna								
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)		
		52	5260		13.00	12.56		
	802.11a	56	5280	6Mbps	13.00	12.55		
	002.118	60	5300	0101043	13.00	12.70		
		64	5320		13.00	12.89		
		52	5260		13.00	12.67		
	802.11n-HT20	56	5280	MCS0	13.00	12.71		
	002.1111-11120	60	5300		13.00	12.63		
		64	5320		13.00	12.83		
5.25-5.35 GHz		52	5260		13.00	12.60		
	802.11ac20-VHT0	56	5280	MCS0	13.00	12.72		
	002.118020-01110	60	5300	NIC30	13.00	12.61		
		64	5320		13.00	12.81		
	802.11n-HT40	54	5270	MCS0	13.00	12.68		
-	002.111-11140	62	5310	10000	13.00	12.49		
	802.11ac40-VHT0	54	5270	MCS0	13.00	12.67		
	002.11a040-VIII0	62	5310	10000	13.00	12.52		
	802.11ac80-VHT0	58	5290	MCS0	13.00	12.80		

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		Main	Antenna			
Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
		100	5500		13.00	12.92
		116	5580		13.00	12.53
	802.11a	120	5600	6Mbps	13.00	12.72
	002.11a	124	5620	olviops	13.00	12.66
		128	5640		13.00	12.56
		140	5700		13.00	12.63
		100	5500		13.00	12.58
		116	5580		13.00	12.69
	802.11n-HT20	120	5600	MCS0	13.00	12.54
	002.111-0120	124	5620	NIC30	13.00	12.63
		128	5640		13.00	12.71
		140	5700		13.00	12.63
	802.1ac20-VHT0	100	5500		13.00	12.54
		116	5580	MCS0	13.00	12.61
		120	5600		13.00	12.48
		124	5620		13.00	12.54
5600 MHz		128	5640		13.00	12.48
		140	5700		13.00	12.59
		144	5720		13.00	12.55
		102	5510		13.00	12.65
		110	5550		13.00	12.51
	802.11n-HT40	118	5590	MCS0	13.00	12.74
		126	5630		13.00	12.68
		134	5670		13.00	12.93
		102	5510		13.00	12.76
		110	5550		13.00	12.57
		118	5590	N000	13.00	12.77
	802.11ac40-VHT0	126	5630	MCS0	13.00	12.72
		134	5670		13.00	12.92
		142	5710		13.00	12.83
		106	5530		13.00	12.85
	802.11ac80-VHT0		5610	MCS0	13.00	12.80
		138	5690		13.00	12.77

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#### Bluetooth maximum power table:

Mode	Channel	Frequency (MHz)	Average	Max. Rated Avg. Power + Max.			
			1Mbps	2Mbps	3Mbps	Tolerance (dBm)	
	CH 00	2402	10.19	8.13	8.12		
BR/EDR	CH 39	2441	10.17	8.09	8.06	12.5	
	CH 78	2480	10.01	8.02	7.91		

Mode	Channel	Frequency	Average Output Power (dBm)	Max. Rated Avg. Power + Max.		
	Channel	(MHz)	GFSK	Tolerance (dBm)		
	CH 00	2402	6.60			
LE	CH 19	2440	6.52	12.5		
	CH 39	2480	6.48			

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#### **1.4 Test Environment**

Ambient Temperature: 22±2° C Tissue Simulating Liquid: 22±2° C

#### **1.5 Operation Description**

- The EUT is controlled by using a Radio Communication Tester (MT8820C), and 1. the communication between the EUT and the tester is established by air link.
- 2. Measurements are performed respectively on the lowest, middle and highest channels of the operating band(s). The EUT is set to maximum power level during all tests, and at the beginning of each test the battery is fully charged.
- During the SAR testing, the DASY 5 system checks power drift by comparing the 3. e-field strength of one specific location measured at the beginning with that measured at the end of the SAR testing.
- SAR test reduction for GPRS mode is determined by the source-based 4. time-averaged output power. The data mode with highest specified time-averaged output power should be tested for SAR compliance.
- 5. The 3G SAR test reduction procedure is applied to HSDPA with 12.2 kbps RMC as the primary mode. Since the maximum output power in a secondary mode (HSDPA) is  $\leq \frac{1}{4}$  dB higher than the primary mode (WCDMA), SAR measurement is not required for the secondary mode (HSDPA). The following 4 sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS 34.121. A summary of these setting are illustrated below:

Sub-test	βc	βa	βd (SF)	βc/βa	β <sub>HS</sub> <sup>(1)(2)</sup>	CM <sup>(3)</sup> (dB)	MPR <sup>(3)</sup> (dB)			
1	2/15	15/15	64	2/15	4/15	0.0	0.0			
2	12/15 <sup>(4)</sup> 15/15 <sup>(4)</sup> 64 12/15 <sup>(4)</sup> 24/15 1.0									
3	15/15	8/15	64	15/8	30/15	1.5	0.5			
4	15/15	5/15 4/15 64		15/4 30/15		1.5	0.5			
Note 1: Δ <sub>ACK</sub> , Δ <sub>NACK</sub> and Δ <sub>COI</sub> = 30/15 with β <sub>HS</sub> = 30/15 * β <sub>c</sub> . Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ <sub>ACK</sub> and Δ <sub>NACK</sub> = 30/15 with β <sub>HS</sub> = 30/15 * β <sub>c</sub> , and Δ <sub>COI</sub> = 24/15 with β <sub>HS</sub> = 24/15 * β <sub>c</sub> .										
Note 3: CM = 1 for β <sub>0</sub> /β <sub>d</sub> = 12/15, β <sub>H0</sub> /β <sub>c</sub> = 24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.										
Note 4: For subtest 2 the $\beta_d/\beta_d$ ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$ .										

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with 6. RMC) with 12.2 kbps RMC as the primary mode. Since the maximum output power

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in a secondary mode (HSPA) is  $\leq \frac{1}{4}$  dB higher than the primary mode (WCDMA), SAR measurement is not required for the secondary mode (HSPA). The following 5 sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS 34.121. A summary of these setting are illustrated below:

Sub-test	βε	βd	β₄ (SF)	βc / βd	β <sub>HS</sub> (1)	βes	$\beta_{ed}$ <sup>(4)(5)</sup>	β <sub>ed</sub> (SF)	β <sub>ed</sub> (Codes)	CM (2) (dB)	MPR (2)(6) (dB)	AG (5) Index	E-TFCI
1	11/15 (३)	15/15 (3)	64	11/15 (3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	βed1:47/15 βed2:47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67
Note 1: For sub-test 1 to 4, Δ <sub>ACK</sub> , Δ <sub>MACK</sub> and Δ <sub>CQI</sub> = 30/15 with β <sub>HS</sub> = 30/15 * β <sub>c</sub> . For sub-test 5, Δ <sub>ACK</sub> , Δ <sub>MACK</sub> and Δ <sub>CQI</sub> = 5/15 with β <sub>HS</sub> = 5/15 * β <sub>c</sub> . Note 2: CM = 1 for β <sub>J</sub> β <sub>d</sub> = 12/15, β <sub>HS</sub> β <sub>c</sub> = 24/15. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference. Note 3: For subtest 1 the β <sub>J</sub> β <sub>d</sub> ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC													
Note 4: In ca Note 5: βed 0	(TF1, TF1) to β <sub>5</sub> = 10/15 and β <sub>4</sub> = 15/15. Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g. Note 5: β <sub>45</sub> can not be set directly; it is set by Absolute Grant Value. Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.												

#### LTE modes test according to KDB 941225D05v02r05. 7.

a. Per Section 5.2.1, the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation.

Using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.

When the reported SAR is  $\leq 0.8$  W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel.

When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel. b. Per Section 5.2.2, the largest channel bandwidth and measure SAR for QPSK with 50% RB allocation

The procedures required for 1 RB allocation in 5.2.1 are applied to measure the SAR for QPSK with 50% RB allocation.

c. Per Section 5.2.3, the largest channel bandwidth and measure SAR for QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 5.2.1 and 5.2.2 are  $\leq$  0.8 W/kg.

Otherwise, SAR is measured for the highest output power channel and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

d. Per Section 5.2.4, Higher order modulations

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For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in sections 5.2.1, 5.2.2 and 5.2.3 to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > 1/2 dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

e. Per Section 5.3, other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section 5.2 to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is >  $\frac{1}{2}$  dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg. The equivalent channel configuration for the RB allocation, RB offset and modulation etc. is determined for the smaller channel bandwidth according to the same number of RB allocated in the largest channel bandwidth.

#### **WLAN**

802.11b DSSS SAR Test Requirements:

- SAR is measured for 2.4 GHz 802.11b DSSS mode using the highest measured 8. maximum output power channel, when the reported SAR of the highest measured maximum output power channel for the exposure configuration is  $\leq 0.8$  W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 9. When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

802.11g/n OFDM SAR Test Exclusion Requirements:

- 10. SAR is not required for 802.11q/n since the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg.
- 11. BT and WLAN use the same antenna path and Bluetooth can't transmit with WLAN simultaneously.

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- 12. According to KDB447498D01v06, testing of other required channels is not required when the reported 1-g SAR for the highest output channel is  $\leq$  0.8 W/kg, when the transmission band is  $\leq$  100MHz.
- 13. According to KDB865664D01v01r04, SAR measurement variability must be assessed for each frequency band. When the original highest measured SAR is ≥ 0.8 W/kg, repeated that measurement once. 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  $\geq$  1.45 W/kg (~ 10% from the 1-g SAR limit)

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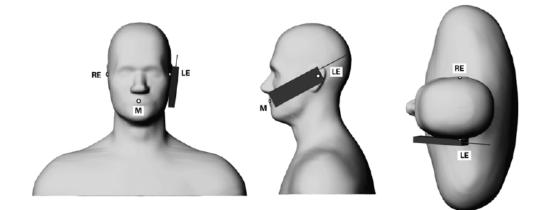
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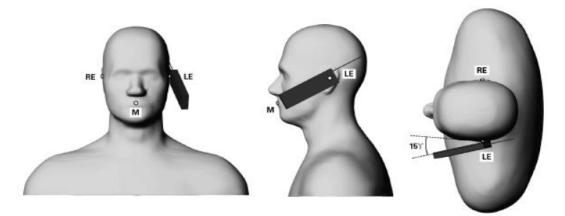
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#### **1.6 Positioning Procedure**

#### Head SAR measurement statement



Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning.



Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning.

#### Cheek/Touch Position:

The handset was brought toward the mouth of the head phantom by pivoting against the ear reference point until any point of the mouthpiece or keypad touched the phantom.

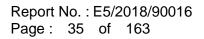
Ear/Tilt Position:

With the phone aligned in the Cheek/Touch position, the handset was tilted away from the mouth with respect to the test device reference point by 15 degrees.

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#### Body SAR measurement statement

1. Body-worn exposure: 10mm

Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. When the same wireless transmission configuration is used for testing body-worn accessory and hotspot mode SAR, respectively, in voice and data mode, SAR results for the most conservative test separation distance configuration may be used to support both SAR conditions. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for the body-worn accessory with a headset attached to the handset.

2. Hotspot exposure: 10mm

A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge when the form factor of a handset is larger than  $9 \text{ cm} \times 5 \text{ cm}$ ,

Test configurations of WWAN:

- (1) Front side
- (2) Back side
- (3) Bottom side
- (4) Right side
- (5) Left side

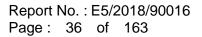
Test configurations of WLAN:

- (1) Front side
- (2) Back side
- (3) Top side
- (4) Left side
- 3. Phablet SAR test consideration

Since the device is not a phablet (overall diagonal dimension < 16.0 cm), the phablet SAR procedure is not required.

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4. Based on KDB941225D06v02r01, the hotspot mode and body-worn accessory SAR test configurations may overlap for handsets. When the same wireless mode transmission configurations for voice and data are required for SAR measurements, the more conservative configuration with a smaller separation distance should be tested for the overlapping SAR configurations. For WCDMA /LTE/WLAN, since the maximum power is the same between body-worn and hotspot mode, and the test distance of hotspot mode is the same with that of body-worn mode, hotspot mode SAR is used to support body-worn SAR. For GSM1900, since the wireless mode transmission configurations is different between body-worn and hotspot mode, body-worn SAR is performed.

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# **1.7 Evaluation Procedures**

The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- 1. The extraction of the measured data (grid and values) from the Zoom Scan.
- 2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters).
- 3. The generation of a high-resolution mesh within the measured volume.
- 4. The interpolation of all measured values from the measurement grid to the high-resolution grid.
- 5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface.
- 6. The calculation of the averaged SAR within masses of 1g and 10g.

The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated. The angle between the probe axis and the surface normal line is less than 30 degree.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extreme of the SAR distribution. The uncertainty on the locations of the extreme is less than 1/20 of the grid size. Only local maximum within -2 dB of the global maximum are searched and passed for the Cube Scan measurement. In the Cube Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5mm.

The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 7x7x7 scans.

The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 30x30x30mm contains about 30g of tissue. The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D

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interpolation to get all points within the measured volume. In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found.

If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

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# **1.8 Probe Calibration Procedures**

For the calibration of E-field probes in lossy liquids, an electric field with an accurately known field strength must be produced within the measured liquid. For standardization purposes it would be desirable if all measurements which are necessary to assess the correct field strength would be traceable to standardized measurement procedures. In the following two different calibration techniques are summarized:

# **1.8.1 Transfer Calibration with Temperature Probes**

In lossy liquids the specific absorption rate (SAR) is related both to the electric field (*E*) and the temperature gradient ( $\delta T / \delta t$ ) in the liquid.

$$SAR = C \frac{\delta T}{\delta t}$$

Whereby  $\sigma$  is the conductivity,  $\rho$  the density and c the heat capacity of the liquid.

Hence, the electric field in lossy liquid can be measured indirectly by measuring the temperature gradient in the liquid. Non-disturbing temperature probes (optical probes or thermistor probes with resistive lines) with high spatial resolution (<1-2 mm) and fast reaction time (<1 s) are available and can be easily calibrated with high precision [1]. The setup and the exciting source have no influence on the calibration; only the relative positioning uncertainties of the standard temperature probe and the E-field probe to be calibrated must be considered. However, several problems limit the available accuracy of probe calibrations with temperature probes:

1. The temperature gradient is not directly measurable but must be evaluated from temperature measurements at different time steps. Special precaution is necessary to avoid measurement errors caused by temperature gradients due to energy equalizing effects or convection currents in the liquid. Such effects cannot be completely avoided, as the measured field itself destroys the

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thermal equilibrium in the liquid. With a careful setup these errors can be kept small.

- 2. The measured volume around the temperature probe is not well defined. It is difficult to calculate the energy transfer from a surrounding gradient temperature field into the probe. These effects must be considered, since temperature probes are calibrated in liquid with homogeneous temperatures. There is no traceable standard for temperature rise measurements.
- 3. The calibration depends on the assessment of the specific density, the heat capacity and the conductivity of the medium. While the specific density and heat capacity can be measured accurately with standardized procedures (~ 2% for c; much better for  $\rho$ ), there is no standard for the measurement of the conductivity. Depending on the method and liquid, the error can well exceed ±5%.
- 4. Temperature rise measurements are not very sensitive and therefore are often performed at a higher power level than the E-field measurements. The nonlinearities in the system (e.g., power measurements, different components, etc.) must be considered.

Considering these problems, the possible accuracy of the calibration of E-field probes with temperature gradient measurements in a carefully designed setup is about ±10% (RSS) [2]. Recently, a setup which is a combination of the waveguide techniques and the thermal measurements was presented in [3]. The estimated uncertainty of the setup is ±5% (RSS) when the same liquid is used for the calibration and for actual measurements and ±7-9% (RSS) when not, which is in good agreement with the estimates given in [2].

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# **1.8.2 Calibration with Analytical Fields**

In this method a technical setup is used in which the field can be calculated analytically from measurements of other physical magnitudes (e.g., input power). This corresponds to the standard field method for probe calibration in air; however, there is no standard defined for fields in lossy liquids.

When using calculated fields in lossy liquids for probe calibration, several points must be considered in the assessment of the uncertainty:

- 1. The setup must enable accurate determination of the incident power.
- 2. The accuracy of the calculated field strength will depend on the assessment of the dielectric parameters of the liquid.
- 3. Due to the small wavelength in liquids with high permittivity, even small setups might be above the resonant cutoff frequencies. The field distribution in the setup must be carefully checked for conformity with the theoretical field distribution.

# References

- (1) N. Kuster, Q. Balzano, and J.C. Lin, Eds., Mobile Communications Safety, Chapman & Hall, London, 1997.
- (2) K. Meier, M. Burkhardt, T. Schmid, and N. Kuster, \Broadband calibration of E-field probes in lossy media", IEEE Transactions on Microwave Theory and Techniques, vol. 44, no. 10, pp. 1954{1962, Oct. 1996.
- (3) K. Jokela, P. Hyysalo, and L. Puranen, \Calibration of specific absorption rate (SAR) probes in waveguide at 900 MHz", IEEE Transactions on Instrumentation and Measurements, vol. 47, no. 2, pp. 432{438, Apr. 1998.

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# 1.9 The SAR Measurement System

A block diagram of the SAR measurement system is given in Fig. a. This SAR measurement system uses a Computer-controlled 3-D stepper motor system (SPEAG DASY 5 professional system). Model EX3DV4 field probes are used to determine the internal electric fields. The SAR can be obtained from the equation SAR=  $\sigma$  (|Ei|2)/ $\rho$ where  $\sigma$  and  $\rho$  are the conductivity and mass density of the tissue-simulant.

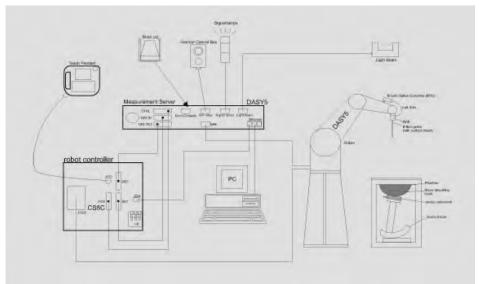


Fig. a A block diagram of the SAR measurement system

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The DASY 5 system for performing compliance tests consists of the following items:

- 1. A standard high precision 6-axis robot (Staubli RX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
- 2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- 3. 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.
- 4. The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- 5. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- 6. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- 7. A computer operating Windows7
- 8. DASY 5 software.
- 9. Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- 10. The SAM twin phantom enabling testing left-hand and right-hand usage.
- 11. The device holder for handheld mobile phones.
- 12. Tissue simulating liquid mixed according to the given recipes.
- 13. Validation dipole kits allowing to validate the proper functioning of the system.

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# **1.10 System Components**

# **EX3DV4 E-Field Probe**

Construction	Symmetrical design with triangular core
	Built-in shielding against static charges
	PEEK enclosure material (resistant to
	organic solvents, e.g., DGBE)
Calibration	Basic Broad Band Calibration in air
	Conversion Factors (CF) for
	HSL1750/1900/2450/5200/5300/5600 MHz
	Additional CF for other liquids and
	frequencies upon request
Frequency	10 MHz to > 6 GHz, Linearity: ± 0.6 dB
Directivity	± 0.3 dB in HSL (rotation around probe axis)
	± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic	10 μW/g to > 100 mW/g
Range	Linearity: $\pm$ 0.2 dB (noise: typically < 1 $\mu$ W/g)
Dimensions	Tip diameter: 2.5 mm
Application	High precision dosimetric measurements in any exposure scenario
	(e.g., very strong gradient fields). Only probe which enables
	compliance testing for frequencies up to 6 GHz with precision of
	better 30%.

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Phantom	
Model	Twin SAM
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Height: 850 mm; Length: 1000 mm; Width: 500 mm

# **DEVICE HOLDER**

Construction	In combination with the Twin SAM Phantom	1
	V4.0/V4.0C or Twin SAM, the Mounting	ALC: NO.
	Device (made from POM) enables the	THE C
	rotation of the mounted transmitter in	
	spherical coordinates, whereby the rotation	
	point is the ear opening. The devices can	and the second se
	be easily and accurately positioned	1 North Contraction
	according to IEC, IEEE, CENELEC, FCC or	
	other specifications. The device holder can	
	be locked at different phantom locations	Device Holder
	(left head, right head, flat phantom).	

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# 1.11 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig. b. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% (according to KDB865664D01) from the target SAR values.

These tests were done at 1750/1900/2450/5200/5300/5600 MHz. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1. During the tests, the liquid depth above the ear reference points was above 15 cm (≤3G) or 10 cm (>3G) in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

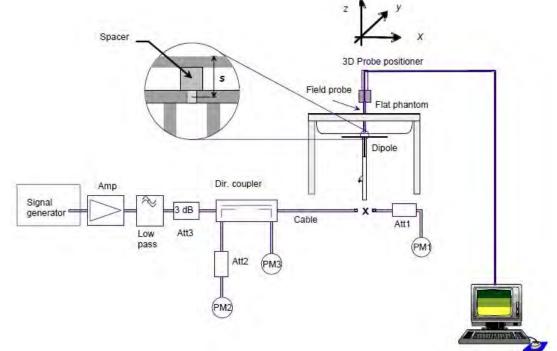


Fig. b The block diagram of system verification

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Validation Kit	S/N	Frequency (MHz)		1W Target SAR-1g (mW/g)	Measured SAR-1g (mW/g)	Measured SAR-1g normalized to 1W (mW/g)	Deviation (%)	Measured Date
D1750V2	1008	1750	Head	36.5	9.09	36.36	-0.38%	Oct. 08, 2018
D1750V2	1008	1750	Body	37.0	9.16	36.64	-0.97%	Oct. 08, 2018
D1900V2	5d173	1900	Head	40.7	9.92	39.68	-2.51%	Oct. 09, 2018
D1900v2	50175	1900	Body	40.9	9.91	39.64	-3.08%	Oct. 09, 2018
D2450V2	707	727 2450	Head	52.1	13.10	52.40	0.58%	Oct. 05, 2018
D2450V2	121		Body	50.8	12.80	51.20	0.79%	Oct. 05, 2018
		5200	Head	77.3	7.76	77.60	0.39%	Oct. 06, 2018
			5200	Body	70.9	7.15	71.50	0.85%
D5GHzV2	1023	5300	Head	80.9	8.04	80.40	-0.62%	Oct. 06, 2018
	1023	5500	Body	72.9	7.37	73.70	1.10%	Oct. 07, 2018
		5600	Head	81.9	8.24	82.40	0.61%	Oct. 06, 2018
		5000	Body	77.6	7.84	78.40	1.03%	Oct. 07, 2018

Table 1. Results of system validation

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# 1.12 Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this Head-simulant fluid were measured by using the Agilent Model 85070E Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with Network Analyzer.

All dielectric parameters of tissue simulates were measured within 24 hours of SAR measurements. The depth of the tissue simulant in the flat section of the phantom was at least 15 cm (≤3G) or 10 cm (>3G) during all tests. (Appendix Fig. 2)

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Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	% dev ɛr	% dev σ
		1712.4	40.138	1.349	40.740	1.363	-1.50%	-1.02%
		1720	40.126	1.354	40.724	1.367	-1.49%	-0.95%
		1732.4	40.107	1.361	40.700	1.374	-1.48%	-0.96%
	Oct, 08. 2018	1732.5	40.107	1.361	40.700	1.375	-1.48%	-1.02%
		1745	40.087	1.368	40.692	1.382	-1.51%	-1.03%
		1750	40.079	1.371	40.672	1.384	-1.48%	-0.96%
		1752.6	40.075	1.373	40.664	1.386	-1.47%	-0.95%
		1850.2	40.000	1.400	40.364	1.403	-0.91%	-0.21%
		1852.4	40.000	1.400	40.361	1.405	-0.90%	-0.36%
		1860	40.000	1.400	40.360	1.407	-0.90%	-0.48%
	Oct, 09. 2018	1880	40.000	1.400	40.356	1.408	-0.89%	-0.55%
		1900	40.000	1.400	40.353	1.409	-0.88%	-0.64%
		1907.6	40.000	1.400	40.350	1.411	-0.88%	-0.79%
		1909.8	40.000	1.400	40.348	1.411	-0.87%	-0.79%
		2402	39.285	1.757	38.877	1.739	1.04%	1.05%
Head		2412	39.268	1.766	38.855	1.748	1.05%	1.03%
пеац		2437	39.223	1.788	38.835	1.770	0.99%	1.01%
	Oct, 05. 2018	2441	39.216	1.792	38.836	1.775	0.97%	0.96%
		2450	39.200	1.800	38.800	1.783	1.02%	0.95%
		2462	39.185	1.813	38.795	1.794	0.99%	1.03%
		2480	39.162	1.827	38.786	1.808	0.96%	1.01%
		5190	35.997	4.645	35.500	4.694	1.38%	-1.05%
		5200	35.986	4.655	35.493	4.702	1.37%	-1.01%
		5210	35.974	4.665	35.481	4.711	1.37%	-0.97%
		5230	35.951	4.686	35.441	4.733	1.42%	-1.01%
		5270	35.906	4.727	35.349	4.789	1.55%	-1.32%
	Oct, 06. 2018	5290	35.883	4.747	35.324	4.808	1.56%	-1.27%
		5300	35.871	4.758	35.315	4.822	1.55%	-1.35%
		5310	35.860	4.768	35.286	4.831	1.60%	-1.32%
		5530	35.609	4.993	34.843	4.913	2.15%	1.60%
		5600	35.529	5.065	34.782	4.985	2.10%	1.58%
		5690	35.426	5.157	34.696	5.075	2.06%	1.60%

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Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	% dev ɛr	% dev σ
		1712.4	53.531	1.465	52.911	1.444	1.16%	1.39%
		1720	53.511	1.469	52.895	1.450	1.15%	1.35%
		1732.4	53.478	1.477	52.847	1.456	1.18%	1.45%
	Oct, 08. 2018	1732.5	53.478	1.477	52.841	1.457	1.19%	1.37%
		1745	53.445	1.485	52.830	1.465	1.15%	1.38%
		1750	53.432	1.488	52.796	1.467	1.19%	1.44%
		1752.6	53.425	1.490	52.784	1.468	1.20%	1.45%
		1850.2	53.300	1.520	54.061	1.527	-1.43%	-0.46%
		1852.4	53.300	1.520	54.060	1.528	-1.43%	-0.53%
		1860	53.300	1.520	54.057	1.530	-1.42%	-0.66%
	Oct, 09. 2018	1880	53.300	1.520	54.030	1.532	-1.37%	-0.79%
		1900	53.300	1.520	54.025	1.535	-1.36%	-0.99%
		1907.6	53.300	1.520	54.023	1.536	-1.36%	-1.05%
		1909.8	53.300	1.520	54.020	1.538	-1.35%	-1.18%
		2402	52.764	1.904	51.714	1.877	1.99%	1.42%
Body		2412	52.751	1.914	51.669	1.887	2.05%	1.42%
воау		2437	52.717	1.938	51.663	1.909	2.00%	1.45%
	Oct, 05. 2018	2441	52.712	1.941	51.652	1.914	2.01%	1.40%
		2450	52.700	1.950	51.635	1.922	2.02%	1.44%
		2462	52.685	1.967	51.610	1.940	2.04%	1.37%
		2480	52.662	1.993	51.582	1.964	2.05%	1.42%
		5190	49.028	5.288	49.778	5.234	-1.53%	1.01%
		5200	49.014	5.299	49.764	5.244	-1.53%	1.04%
		5210	49.001	5.311	49.716	5.256	-1.46%	1.04%
		5230	48.974	5.334	49.713	5.283	-1.51%	0.96%
		5270	48.919	5.381	49.673	5.328	-1.54%	0.98%
	Oct, 07. 2018	5290	48.892	5.404	49.616	5.351	-1.48%	0.98%
		5300	48.879	5.416	49.602	5.365	-1.48%	0.95%
		5310	48.865	5.428	49.608	5.372	-1.52%	1.02%
		5530	48.566	5.685	49.523	5.740	-1.97%	-0.98%
		5600	48.471	5.766	49.436	5.827	-1.99%	-1.05%
		5690	48.349	5.872	49.292	5.930	-1.95%	-1.00%

Table 2. Dielectric Parameters of Tissue Simulant Fluid

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The composition of the tissue simulating liqu	id:
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Frequency (MHz)			Ingredient							
	Mode	DGMBE	Water	Salt	Preventol D-7	Cellulose	Sugar	Total amount		
4750	Head	444.52 g	552.42 g	3.06 g	_		_	1.0L(Kg)		
1750	Body	300.67 g	716.56 g	4.0 g	_		_	1.0L(Kg)		
4000	Head	444.52 g	552.42 g	3.06 g	_		-	1.0L(Kg)		
1900	Body	300.67 g	716.56 g	4.0 g	_	-	-	1.0L(Kg)		
0.450	Head	550 g	450 g		_	_	_	1.0L(Kg)		
2450	Body	301.7 g	698.3 g	_	_	_	_	1.0L(Kg)		

### Simulating Liquids for 5 GHz, Manufactured by SPEAG:

Ingredients	Water	Esters, Emulsifiers, Inhibitors	Sodium and Salt
(% by weight)	60-80	20-40	0-1.5

Table 3. Recipes for tissue simulating liquid

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# 1.13 Test Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ("SAR") in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1, By the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100 kHz to 6 GHz. Portable devices that transmit at frequencies above 6 GHz are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter.

Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 GHz should be made at a minimum distance of 5 cm from the radiating source.

1. Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over a 10 grams of tissue (defined as a tissue volume in the shape of a cube).

Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.

2. Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube).

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Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube).

General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure.

Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section. (Table .6)

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR (Brain)	1.60 W/kg	8.00 W/kg
Spatial Average SAR (Whole Body)	0.08 W/kg	0.40 W/kg
Spatial Peak SAR (Hands/Feet/Ankle/Wrist)	4.00 W/kg	20.00 W/kg

Table 4. RF exposure limits

Notes:

- Uncontrolled environments are defined as locations where there is potential exposure of 1. individuals who have no knowledge or control of their potential exposure.
- 2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

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# 2. Summary of Results

# **GSM 1900**

Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	1 (W/	SAR over g (kg)	Plot page
				1000				Measured		
	Re Cheek	-	661	1880	30.70	29.14	43.22%	0.05	0.07	-
	Re Tilt	-	661	1880	30.70	29.14	43.22%	0.04	0.06	-
Head	Le Cheek	-	512	1850.2	30.70	29.10	44.54%	0.07	0.10	-
(GSM)	Le Cheek	-	661	1880	30.70	29.14	43.22%	0.08	0.11	71
	Le Cheek	-	810	1909.8	30.70	29.08	45.21%	0.07	0.10	-
	Le Tilt	-	661	1880	30.70	29.14	43.22%	0.03	0.04	-
	Front side	10	661	1880	30.70	29.14	43.22%	0.01	0.01	-
Body-worn	Back side	10	512	1850.2	30.70	29.10	44.54%	0.01	0.01	-
(GSM)	Back side	10	661	1880	30.70	29.14	43.22%	0.02	0.03	72
	Back side	10	810	1909.8	30.70	29.08	45.21%	0.01	0.01	-
	Front side	10	512	1850.2	25.70	23.90	51.36%	0.06	0.09	-
	Back side	10	512	1850.2	25.70	23.90	51.36%	0.06	0.09	-
Hotspot	Bottom side	10	512	1850.2	25.70	23.90	51.36%	0.17	0.26	73
(GPRS)	Bottom side	10	661	1880	25.70	23.86	52.76%	0.15	0.23	-
<1Dn4Up>	Bottom side	10	810	1909.8	25.70	23.85	53.11%	0.16	0.24	-
	Right side	10	512	1850.2	25.70	23.90	51.36%	0.01	0.02	-
	Left side	10	512	1850.2	25.70	23.90	51.36%	0.04	0.06	-

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#### WCDMA Band II

Mode	Position	Distance (mm)	СН	Freq. (MHz) Power + Max. Ave	Measured Avg. Power (dBm)	Scaling	Averaged 1 (W/	Plot page		
						. ,		Measured	Reported	
	RE Cheek	-	9262	1850.2	23.3	22.32	25.31%	0.07	0.09	-
	RE Tilt	-	9262	1850.2	23.3	22.32	25.31%	0.06	0.08	-
R99	LE Cheek	-	9262	1850.2	23.3	22.32	25.31%	0.15	0.19	74
(Head)	LE Cheek	-	9400	1880	23.3	22.12	31.22%	0.13	0.17	-
	LE Cheek	-	9538	1907.6	23.3	21.96	36.14%	0.13	0.18	-
	LE Tilt	-	9262	1850.2	23.3	22.32	25.31%	0.05	0.06	-
Rody worn	Front side	10	9262	1850.2	23.3	22.32	25.31%	0.26	0.33	-
Body-worn	Back side	10	9262	1850.2	23.3	22.32	25.31%	0.22	0.28	-
	Front side	10	9262	1850.2	23.3	22.32	25.31%	0.26	0.33	-
	Back side	10	9262	1850.2	23.3	22.32	25.31%	0.22	0.28	-
	Bottom side	10	9262	1850.2	23.3	22.32	25.31%	0.57	0.71	75
Hotspot	Bottom side	10	9400	1880	23.3	22.12	31.22%	0.53	0.70	-
	Bottom side	10	9538	1907.6	23.3	21.96	36.14%	0.51	0.69	-
	Right side	10	9262	1850.2	23.3	22.32	25.31%	0.07	0.09	-
	Left side	10	9262	1850.2	23.3	22.32	25.31%	0.21	0.26	-

#### WCDMA Band IV

Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	<u> </u>	SAR over g ⁄kg)	Plot page
					. ,	· · /		Measured	Reported	
	RE Cheek	-	1513	1752.6	23.3	22.42	22.46%	0.05	0.06	-
	RE Tilt	-	1513	1752.6	23.3	22.42	22.46%	0.06	0.07	-
R99	LE Cheek	-	1312	1712.4	23.3	22.20	28.82%	0.11	0.14	-
(Head)	LE Cheek	-	1412	1732.4	23.3	22.32	25.31%	0.12	0.15	-
	LE Cheek	-	1513	1752.6	23.3	22.42	22.46%	0.13	0.16	76
	LE Tilt	-	1513	1752.6	23.3	22.42	22.46%	0.04	0.05	-
Podu worp	Front side	10	1513	1752.6	23.3	22.42	22.46%	0.37	0.45	-
Body-worn	Back side	10	1513	1752.6	23.3	22.42	22.46%	0.31	0.38	-
	Front side	10	1513	1752.6	23.3	22.42	22.46%	0.37	0.45	-
	Back side	10	1513	1752.6	23.3	22.42	22.46%	0.31	0.38	-
	Bottom side	10	1312	1712.4	23.3	22.20	28.82%	0.74	0.95	-
Hotspot	Bottom side	10	1412	1732.4	23.3	22.32	25.31%	0.72	0.90	-
	Bottom side	10	1513	1752.6	23.3	22.42	22.46%	0.78	0.96	77
	Right side	10	1513	1752.6	23.3	22.42	22.46%	0.12	0.15	-
	Left side	10	1513	1752.6	23.3	22.42	22.46%	0.30	0.37	-

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#### LTE FDD Band 2

Mode	Bandwidth	Modulatior	RB Size	RB start	Position	Distance	СН	Freq.	Max. Rated Avg. Power +	Measured Avg.	Scaling		SAR over V/kg)	Plot				
Wode	(MHz)	vioudiation	ND 0120	ND Start	1 USILION	(mm)	Ö	(MHz)	Max. Tolerance (dBm)	Power (dBm)	ocaning	Measured	Reported	page				
				0	LE Cheek	-	19100	1900	23.3	22.14	30.62%	0.11	0.14	-				
					RE Cheek	-	18900	1880	23.3	22.66	15.88%	0.02	0.02	-				
			1 RB		RE Tilt	-	18900	1880	23.3	22.66	15.88%	0.02	0.02	-				
			TRD	50	LE Cheek	-	18700	1860	23.3	22.61	17.22%	0.11	0.13	-				
					LE Cheek	-	18900	1880	23.3	22.66	15.88%	0.13	0.15	78				
		OPSK			LE Tilt	-	18900	1880	23.3	22.66	15.88%	0.05	0.06	-				
Head	20MHz	QPSK 50 PB		RE Cheek	-	18900	1880	22.3	21.45	21.62%	0.02	0.02	-					
ricau	2011112	50 RB	0	RE Tilt	-	18900	1880	22.3	21.45	21.62%	0.01	0.01	-					
		50 K	30 110	U	LE Cheek	-	18900	1880	22.3	21.45	21.62%	0.11	0.13	-				
					LE Tilt	-	18900	1880	22.3	21.45	21.62%	0.04	0.05	-				
					RE Cheek	-	18900	1880	22.3	21.42	22.46%	0.02	0.02	-				
		100	RB	RE Tilt	-	18900	1880	22.3	21.42	22.46%	0.01	0.01	-					
			100	КВ	LE Cheek	-	18900	1880	22.3	21.42	22.46%	0.11	0.13	-				
					LE Tilt	-	18900	1880	22.3	21.42	22.46%	0.04	0.05	-				
Body-worn	20MHz	QPSK	50RB	0	Front side	10	18900	1880	22.3	21.45	21.62%	0.24	0.29	-				
Dody Wolli	2011112	di on	1 RB	50	Back side	10	18900	1880	23.3	22.66	15.88%	0.22	0.25	-				
								0	Bottom side	10	19100	1900	23.3	22.14	30.62%	0.42	0.55	-
					Front side	10	18900	1880	23.3	22.66	15.88%	0.22	0.25	-				
					Back side	10	18900	1880	23.3	22.66	15.88%	0.22	0.25	-				
			1 RB	50	Bottom side	10	18700	1860	23.3	22.61	17.22%	0.41	0.48	-				
				50	Bottom side	10	18900	1880	23.3	22.66	15.88%	0.49	0.57	79				
					Right side	10	18900	1880	23.3	22.66	15.88%	0.05	0.06	-				
					Left side	10	18900	1880	23.3	22.66	15.88%	0.18	0.21	-				
					Front side	10	18900	1880	22.3	21.45	21.62%	0.24	0.29	-				
Hotspot	20MHz	QPSK			Back side	10	18900	1880	22.3	21.45	21.62%	0.18	0.22	-				
			50 RB	0	Bottom side	10	18900	1880	22.3	21.45	21.62%	0.43	0.52	-				
				Right side	10	18900	1880	22.3	21.45	21.62%	0.05	0.06	-					
					Left side	10	18900	1880	22.3	21.45	21.62%	0.16	0.19	-				
					Front side	10	18900	1880	22.3	21.42	22.46%	0.21	0.26	-				
					Back side	10	18900	1880	22.3	21.42	22.46%	0.19	0.23	-				
			100	RB	Bottom side	10	18900	1880	22.3	21.42	22.46%	0.46	0.56	-				
					Right side	10	18900	1880	22.3	21.42	22.46%	0.05	0.06	-				
					Left side	10	18900	1880	22.3	21.42	22.46%	0.16	0.20	-				

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#### LTE FDD Band 4

Mode	Bandwidth	Modulatior	RB Size	RB start	Position	Distance	СН	Freq.	Max. Rated Avg. Power +	Measured Avg. Power	Scaling		SAR over N/kg)	Plot
	(MHz)					(mm)		(MHz)	Max. Tolerance (dBm)	(dBm)		Measured	Reported	page
					RE Cheek	-	20300	1745	23.3	22.65	16.14%	0.05	0.06	-
					RE Tilt	-	20300	1745	23.3	22.65	16.14%	0.04	0.05	-
			1 RB	50	LE Cheek	-	20050	1720	23.3	22.49	20.50%	0.15	0.18	-
			IND	50	LE Cheek	-	20175	1732.5	23.3	22.39	23.31%	0.15	0.18	-
					LE Cheek	-	20300	1745	23.3	22.65	16.14%	0.16	0.19	80
					LE Tilt	-	20300	1745	23.3	22.65	16.14%	0.04	0.05	-
Head	20MHz	QPSK			RE Cheek	-	20300	1745	22.3	21.41	22.74%	0.05	0.06	-
пеац		QPSK	50 RB	0	RE Tilt	-	20300	1745	22.3	21.41	22.74%	0.03	0.04	-
			50 KD	0	LE Cheek	-	20300	1745	22.3	21.41	22.74%	0.11	0.14	-
					LE Tilt	-	20300	1745	22.3	21.41	22.74%	0.03	0.04	-
					RE Cheek	-	20300	1745	22.3	21.38	23.59%	0.04	0.05	-
		1	100	100 RB	RE Tilt	-	20300	1745	22.3	21.38	23.59%	0.04	0.05	-
			100	КD	LE Cheek	-	20300	1745	22.3	21.38	23.59%	0.12	0.15	-
					LE Tilt	-	20300	1745	22.3	21.38	23.59%	0.04	0.05	-
Body-worn	20MHz	QPSK	1RB	50	Front side	10	20300	1745	23.3	22.65	16.14%	0.36	0.42	-
Body-worn		QPSK	IKD	50	Back side	10	20300	1745	23.3	22.65	16.14%	0.28	0.33	-
					Front side	10	20300	1745	23.3	22.65	16.14%	0.36	0.42	-
					Back side	10	20300	1745	23.3	22.65	16.14%	0.28	0.33	-
					Bottom side	10	20050	1720	23.3	22.49	20.50%	0.65	0.78	-
			1 RB	50	Bottom side	10	20175	1732.5	23.3	22.39	23.31%	0.67	0.83	-
					Bottom side	10	20300	1745	23.3	22.65	16.14%	0.72	0.84	81
					Right side	10	20300	1745	23.3	22.65	16.14%	0.09	0.10	-
					Left side	10	20300	1745	23.3	22.65	16.14%	0.26	0.30	-
					Front side	10	20300	1745	22.3	21.41	22.74%	0.33	0.41	-
Hotspot	20MHz	QPSK			Back side	10	20300	1745	22.3	21.41	22.74%	0.25	0.31	-
			50 RB	0	Bottom side	10	20300	1745	22.3	21.41	22.74%	0.64	0.79	-
				Right side	10	20300	1745	22.3	21.41	22.74%	0.07	0.09	-	
					Left side	10	20300	1745	22.3	21.41	22.74%	0.24	0.29	-
					Front side	10	20300	1745	22.3	21.38	23.59%	0.32	0.40	-
					Back side	10	20300	1745	22.3	21.38	23.59%	0.26	0.32	-
			100	RB	Bottom side	10	20300	1745	22.3	21.38	23.59%	0.67	0.83	-
					Right side	10	20300	1745	22.3	21.38	23.59%	0.08	0.10	-
					Left side	10	20300	1745	22.3	21.38	23.59%	0.23	0.28	-

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#### WLAN 802.11b

Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged S (W/	-	Plot page
						(ubiii)		Measured	Reported	
	RE Cheek	-	1	2412	13	12.90	2.33%	0.59	0.60	82
	RE Cheek	-	6	2437	13	12.88	2.80%	0.55	0.57	-
Head	RE Cheek	-	11	2462	13	12.83	3.99%	0.56	0.58	-
Tieau	RE Tilt	-	1	2412	13	12.90	2.33%	0.54	0.55	-
	LE Cheek	-	1	2412	13	12.90	2.33%	0.22	0.23	-
	LE Tilt	-	1	2412	13	12.90	2.33%	0.23	0.24	-
Body-	Front side	10	1	2412	13	12.90	2.33%	0.07	0.07	-
worn	Back side	10	1	2412	13	12.90	2.33%	0.09	0.09	-
	Front side	10	1	2412	13	12.90	2.33%	0.07	0.07	-
	Back side	10	1	2412	13	12.90	2.33%	0.09	0.09	-
Hotspot	Top side	10	1	2412	13	12.90	2.33%	0.22	0.23	83
потерот	Top side	10	6	2437	13	12.88	2.80%	0.17	0.17	-
	Top side	10	11	2462	13	12.83	3.99%	0.21	0.22	-
	Left side	10	1	2412	13	12.90	2.33%	0.05	0.05	-

#### **Bluetooth**

Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power	Scaling	Averaged S (W/		Plot page
				· · ·	Tolerance (dBill)	(dBm)		Measured	Reported	
	RE Cheek	-	0	2402	12.5	10.19	70.22%	0.19	0.32	84
	RE Cheek	-	39	2441	12.5	10.17	71.00%	0.13	0.22	-
Head	RE Cheek	-	78	2480	12.5	10.01	77.42%	0.13	0.23	-
Tieau	RE Tilt	-	0	2402	12.5	10.19	70.22%	0.16	0.27	-
	LE Cheek	-	0	2402	12.5	10.19	70.22%	0.08	0.14	-
	LE Tilt	-	0	2402	12.5	10.19	70.22%	0.07	0.12	-
	Front side	10	0	2402	12.5	10.19	70.22%	0.03	0.05	-
Body-	Back side	10	0	2402	12.5	10.19	70.22%	0.03	0.05	85
worn	Back side	10	39	2441	12.5	10.17	71.00%	0.02	0.03	-
	Back side	10	78	2480	12.5	10.01	77.42%	0.01	0.02	-

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# WLAN 802.11n(40M) 5.2G

Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power		Averaged S (W/	-	Plot page
				· · ·	Tolerance (dbm)	(dBm)		Measured	Reported	
	RE Cheek	-	38	5190	13	12.70	7.24%	0.96	1.03	86
Head	RE Tilt	-	38	5190	13	12.70	7.24%	0.54	0.58	-
Tieau	LE Cheek	-	38	5190	13	12.70	7.24%	0.30	0.32	-
	LE Tilt	-	38	5190	13	12.70	7.24%	0.22	0.24	-

# WLAN 802.11ac(80M) 5.2G

Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max.	Measured Avg. Power	Scaling	Averaged S (W/	•	Plot page
				. ,	Tolerance (dBm)	(dBm)		Measured	Reported	
	RE Cheek	-	42	5210	13	12.52	11.76%	1.02	1.14	87
	RE Cheek*	-	42	5210	13	12.52	11.76%	0.99	1.11	-
Head	RE Tilt	-	42	5210	13	12.52	11.76%	0.61	0.68	-
	LE Cheek	-	42	5210	13	12.52	11.76%	0.33	0.37	-
	LE Tilt	-	42	5210	13	12.52	11.76%	0.21	0.23	-
Body-	Front side	10	42	5210	13	12.52	11.76%	0.07	0.08	88
worn	Back side	10	42	5210	13	12.52	11.76%	0.07	0.08	-

\* - repeated at the highest SAR measurement according to the KDB 865664 D01

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# WLAN 802.11n(40M) 5.3G

Mode	Position	Distance (mm)	СН	Freq. (MHz)		Measured Avg. Power		Averaged S (W/	-	Plot page
				· · /	Tolerance (dBm)	(dBm)		Measured	Reported	
	RE Cheek	-	54	5270	13	12.68	7.73%	0.97	1.05	89
Head	RE Tilt	-	54	5270	13	12.68	7.73%	0.58	0.62	-
neau	LE Cheek	-	54	5270	13	12.68	7.73%	0.33	0.36	-
	LE Tilt	-	54	5270	13	12.68	7.73%	0.19	0.20	-

# WLAN 802.11ac(80M) 5.3G

Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged S (W/	-	Plot page
				, ,		(UDIII)		Measured	Reported	
	RE Cheek	-	58	5290	13	12.80	4.78%	1.05	1.10	90
	RE Cheek*	-	58	5290	13	12.80	4.78%	1.01	1.06	-
Head	RE Tilt	-	58	5290	13	12.80	4.78%	0.63	0.66	-
	LE Cheek	-	58	5290	13	12.80	4.78%	0.38	0.40	-
	LE Tilt	-	58	5290	13	12.80	4.78%	0.23	0.24	-
Body-	Front side	-	58	5290	13	12.80	4.78%	0.08	0.08	91
worn	Back side	-	58	5290	13	12.80	4.78%	0.07	0.07	-

\* - repeated at the highest SAR measurement according to the KDB 865664 D01

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#### WLAN 802.11ac(80M) 5.6G

Mode	Position	Distance (mm)	СН	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power	Scaling	Averaged S (W/		Plot page
				· · ·	Tolerance (dbill)	(dBm)		Measured	Reported	
	RE Cheek	-	106	5530	13	12.85	3.58%	1.02	1.06	-
	RE Cheek	-	122	5610	13	12.80	4.78%	1.00	1.05	-
	RE Cheek	-	138	5690	13	12.77	5.44%	1.06	1.12	92
Head	RE Cheek*	-	138	5690	13	12.77	5.44%	1.00	1.05	-
	RE Tilt	-	106	5530	13	12.85	3.58%	0.59	0.61	-
	LE Cheek	-	106	5530	13	12.85	3.58%	0.41	0.42	-
	LE Tilt	-	106	5530	13	12.85	3.58%	0.22	0.23	-
	Front side	10	106	5530	13	12.85	3.58%	0.09	0.09	93
Body-	Front side	10	122	5610	13	12.80	4.78%	0.08	0.08	-
worn	Front side	10	138	5690	13	12.77	5.44%	0.08	0.08	-
	Back side	10	106	5530	13	12.85	3.58%	0.08	0.08	-

\* - repeated at the highest SAR measurement according to the KDB 865664 D01

Note:

Scaling =  $\frac{\text{reported SAR}}{\text{measured SAR}} = \frac{P2(mW)}{P1(mW)} = 10^{\left(\frac{P_2-P_1}{10}\right)(dBm)}$ 

Reported SAR = measured SAR \* (scaling) Where P2 is maximum specified power, P1 is measured conducted power

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# 3. Simultaneous Transmission Analysis Simultaneous Transmission Scenarios:

Simultaneous Transmit Configurations	Head	Body-Worn	Hotspot
GSM + 2.4GHz Wi-Fi	Yes	Yes	No
GPRS + 2.4GHz Wi-Fi	No	No	Yes
WCDMA + 2.4GHz Wi-Fi	Yes	Yes	Yes
LTE + 2.4GHz Wi-Fi	Yes	Yes	Yes
GSM + 5GHz Wi-Fi	Yes	Yes	No
GPRS + 5GHz Wi-Fi	No	Yes	No
WCDMA + 5GHz Wi-Fi	Yes	Yes	No
LTE + 5GHz Wi-Fi	Yes	Yes	No
GSM + BT	Yes	Yes	No
GPRS + BT	No	Yes	No
WCDMA + BT	Yes	Yes	No
LTE + BT	Yes	Yes	No
GSM + BT + 5GHz WiFi	Yes	Yes	No
GPRS + BT + 5GHz WiFi	No	Yes	No
WCDMA + BT + 5GHz Wi-Fi	Yes	Yes	No
LTE + BT + 5GHz Wi-Fi	Yes	Yes	No

Note:

1. The device does not support DTM function. Body-worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.

2. Based on KDB447498D01 note 36, when SAR test exclusion is allowed by other published RF exposure KDB procedures, such as the 2.5 cm hotspot mode SAR test exclusion for an edge or surface, then estimated SAR is not required to determine simultaneous SAR test exclusion.

3: Based on KDB 648474 D04v01r03 note 6, simultaneous transmission SAR for 10-g extremity SAR requires consideration only when standalone 10-g SAR is required.

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# 3.1 Estimated SAR calculation

According to KDB447498 D01v06 – When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

Estimated SAR = 
$$\frac{\text{Max.tune up power (mW)}}{\text{Min.test separation distance(mm)}} \times \frac{\sqrt{f(GHz)}}{7.5}$$

If the minimum test separation distance is < 5mm, a distance of 5mm is used for estimated SAR calculation. When the test separation distance is >50mm, the 0.4W/kg is used for SAR-1g.

# 3.2 SPLSR evaluation and analysis

Per KDB447498D01, when the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR sum to peak location separation ratio(SPLSR).

The simultaneous transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion.

The ratio is determined by (SAR1 + SAR2)^1.5/Ri, rounded to two decimal digits, and must be  $\leq$  0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

SAR1 and SAR2 are the highest reported or estimated SAR for each antenna in the pair, and Ri is the separation distance between the peak SAR locations for the antenna pair in mm.

When standalone test exclusion applies, SAR is estimated; the peak location is assumed to be at the feed-point or geometric center of the antenna.

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#### **Simultaneous Transmission Combination**

		WAN and WI		, ΣSAR evalu	ation
Frequency	D.		reported	SAR / W/kg	ΣSAR
band	P	osition	WWAN	WLAN	<1.6W/kg
		Right cheek	0.07	0.60	0.67
GSM 1900	Head	Right tilt	0.06	0.55	0.61
G2INI 1900	пеац	Left cheek	0.11	0.23	0.34
		Left tilt	0.04	0.24	0.28
		Front side	0.09	0.07	0.16
		Back side	0.09	0.09	0.18
GPRS 1900	Hotopot	Top side	-	0.23	-
(1Dn4UP)	Hotspot	Bottom side	0.26	-	-
		Right side	0.02	-	-
		Left side	0.06	0.05	0.11
		Right cheek	0.09	0.60	0.69
	Llood	Right tilt	0.08	0.55	0.63
	Head	Left cheek	0.19	0.23	0.42
		Left tilt	0.06	0.24	0.30
WCDMA		Front side	0.33	0.07	0.40
Band II			Back side	0.28	0.09
	Listenat	Top side	-	0.23	-
	Hotspot	Bottom side	0.71	-	-
		Right side	0.09	-	-
		Left side	0.26	0.05	0.31
		Right cheek	0.06	0.60	0.66
	Head	Right tilt	0.07	0.55	0.62
	пеац	Left cheek	0.16	0.23	0.39
		Left tilt	0.05	0.24	0.29
WCDMA		Front side	0.45	0.07	0.52
Band IV		Back side	0.38	0.09	0.47
	Hotopot	Top side	-	0.23	-
	Hotspot	Bottom side	0.96	-	-
		Right side	0.15	-	-
		Left side	0.37	0.05	0.42

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reported SAR WWAN and WLAN 2.4GHz, ΣSAR evaluation							
Frequency		aaitian	reported	ΣSAR			
band	Position		WWAN	WLAN	<1.6W/kg		
	Head	Right cheek	0.02	0.60	0.62		
		Right tilt	0.02	0.55	0.57		
	Tieau	Left cheek	0.15	0.23	0.38		
		Left tilt	0.06	0.24	0.30		
LTE		Front side	0.29	0.07	0.36		
Band 2	Hotspot	Back side	0.25	0.09	0.34		
		Top side	-	0.23	-		
		Bottom side	0.57	-	-		
		Right side	0.06	-	-		
		Left side	0.21	0.05	0.26		
	Head	Right cheek	0.06	0.60	0.66		
		Right tilt	0.05	0.55	0.60		
	Tieau	Left cheek	0.19	0.23	0.42		
LTE Band 4		Left tilt	0.05	0.24	0.29		
		Front side	0.42	0.07	0.49		
		Back side	0.33	0.09	0.42		
	Hotspot	Top side	-	0.23	-		
	Ποιοροι	Bottom side	0.84	-	-		
		Right side	0.10	-	-		
		Left side	0.30	0.05	0.35		

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reported SAR WWAN and WLAN 5GHz, ΣSAR evaluation							
Frequency	Position		reported SAR / W/kg		ΣSAR		
band			WWAN	WLAN	<1.6W/kg		
GSM 1900	body-	Front side	0.01	0.09	0.10		
	worn	Back side	0.03	0.08	0.11		
WCDMA Band II	body- worn	Front side	0.33	0.09	0.42		
		Back side	0.28	0.08	0.36		
WCDMA Band IV	body- worn	Front side	0.45	0.09	0.54		
		Back side	0.38	0.08	0.46		
LTE Band 2	body- worn	Front side	0.29	0.09	0.38		
		Back side	0.25	0.08	0.33		
LTE Band 4	body-	Front side	0.42	0.09	0.51		
	worn	Back side	0.33	0.08	0.41		

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reported SAR WWAN and WLAN 5GHz, ΣSAR evaluation							
Frequency			reported S	ΣSAR			
band	P	osition	WWAN	WLAN	<1.6W/kg		
		Right cheek	0.07	1.14	1.21		
	Head	Right tilt	0.06	0.68	0.74		
GSM 1900	neau	Left cheek	0.11	0.42	0.53		
GOW 1900		Left tilt	0.04	0.24	0.28		
	body-	Front side	0.01	0.09	0.10		
	worn	Back side	0.03	0.08	0.11		
		Right cheek	0.09	1.14	1.23		
	Head	Right tilt	0.08	0.68	0.76		
WCDMA Band II		Left cheek	0.19	0.42	0.61		
		Left tilt	0.06	0.24	0.30		
	body- worn	Front side	0.33	0.09	0.42		
		Back side	0.28	0.08	0.36		
	Head	Right cheek	0.06	1.14	1.20		
		Right tilt	0.07	0.68	0.75		
WCDMA Band IV		Left cheek	0.16	0.42	0.58		
		Left tilt	0.05	0.24	0.29		
	body- worn	Front side	0.45	0.09	0.54		
		Back side	0.38	0.08	0.46		
	Head	Right cheek	0.02	1.14	1.16		
		Right tilt	0.02	0.68	0.70		
LTE Band 2		Left cheek	0.15	0.42	0.57		
		Left tilt	0.06	0.24	0.30		
	body- worn	Front side	0.29	0.09	0.38		
		Back side	0.25	0.08	0.33		
		Right cheek	0.06	1.14	1.20		
	Head	Right tilt	0.05	0.68	0.73		
LTE Band 4	rieau	Left cheek	0.19	0.42	0.61		
		Left tilt	0.05	0.24	0.29		
	body-	Front side	0.42	0.09	0.51		
	worn	Back side	0.33	0.08	0.41		

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reported SAR WWAN and Bluetooth, ΣSAR evaluation							
Frequency	Position		reported S	ΣSAR			
band			WWAN	BT	<1.6W/kg		
		Right cheek	0.07	0.32	0.39		
	Head	Right tilt	0.06	0.27	0.33		
GSM 1900	neau	Left cheek	0.11	0.14	0.25		
G3W 1900		Left tilt	0.04	0.12	0.16		
	body-	Front side	0.01	0.05	0.06		
	worn	Back side	0.03	0.05	0.08		
		Right cheek	0.09	0.32	0.41		
	Head	Right tilt	0.08	0.27	0.35		
WCDMA Band II	neau	Left cheek	0.19	0.14	0.33		
		Left tilt	0.06	0.12	0.18		
	body-	Front side	0.33	0.05	0.38		
	worn	Back side	0.28	0.05	0.33		
	Head	Right cheek	0.06	0.32	0.38		
		Right tilt	0.07	0.27	0.34		
WCDMA Band IV		Left cheek	0.16	0.14	0.30		
		Left tilt	0.05	0.12	0.17		
	body-	Front side	0.45	0.05	0.50		
	worn	Back side	0.38	0.05	0.43		
		Right cheek	0.02	0.32	0.34		
	Head	Right tilt	0.02	0.27	0.29		
LTE Band 2	Head	Left cheek	0.15	0.14	0.29		
LIE Danu Z		Left tilt	0.06	0.12	0.18		
	body-	Front side	0.29	0.05	0.34		
	worn	Back side	0.25	0.05	0.30		
		Right cheek	0.06	0.32	0.38		
	Head	Right tilt	0.05	0.27	0.32		
LTE Band 4	neau	Left cheek	0.19	0.14	0.33		
LIE Dallu 4		Left tilt	0.05	0.12	0.17		
	body-	Front side	0.42	0.05	0.47		
	worn	Back side	0.33	0.05	0.38		

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reported SAR WWAN and WLAN 5GHz and Bluetooth, $\Sigma$ SAR evaluation							
Frequency	Position		repo	reported SAR / W/kg			
band			WWAN	WLAN	BT	ΣSAR	
		Right cheek	0.07	1.14	0.32	1.53	
	Head	Right tilt	0.06	0.68	0.27	1.01	
GSM 1900		Left cheek	0.11	0.42	0.14	0.67	
G2W 1900		Left tilt	0.04	0.24	0.12	0.40	
	body-	Front side	0.01	0.09	0.05	0.15	
	worn	Back side	0.03	0.08	0.05	0.16	
		Right cheek	0.09	1.14	0.32	1.55	
		Right tilt	0.08	0.68	0.27	1.03	
WCDMA Band II	Head	Left cheek	0.19	0.42	0.14	0.75	
		Left tilt	0.06	0.24	0.12	0.42	
	body-	Front side	0.33	0.09	0.05	0.47	
	worn	Back side	0.28	0.08	0.05	0.41	
	Head	Right cheek	0.06	1.14	0.32	1.52	
		Right tilt	0.07	0.68	0.27	1.02	
WCDMA Band IV		Left cheek	0.16	0.42	0.14	0.72	
		Left tilt	0.05	0.24	0.12	0.41	
	body- worn	Front side	0.45	0.09	0.05	0.59	
		Back side	0.38	0.08	0.05	0.51	
	Head	Right cheek	0.02	1.14	0.32	1.48	
		Right tilt	0.02	0.68	0.27	0.97	
LTE EDD Band 2		Left cheek	0.15	0.42	0.14	0.71	
LTE FDD Band 2		Left tilt	0.06	0.24	0.12	0.42	
	body- worn	Front side	0.29	0.09	0.05	0.43	
		Back side	0.25	0.08	0.05	0.38	
		Right cheek	0.06	1.14	0.32	1.52	
	Head	Right tilt	0.05	0.68	0.27	1.00	
LTE FDD Band 4	Head	Left cheek	0.19	0.42	0.14	0.75	
LIE FUU Band 4		Left tilt	0.05	0.24	0.12	0.41	
	body-	Front side	0.42	0.09	0.05	0.56	
	worn	Back side	0.33	0.08	0.05	0.46	

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# 4. Instruments List

Manufacturer	Device	Туре	Serial number	Date of last calibration	Date of next calibration
SPEAG	Dosimetric E-Field Probe	EX3DV4	7351	Dec.21,2017	Dec.20,2018
		D1750V2	1008	Aug.30,2018	Aug.29,2019
SPEAG	System Validation	D1900V2	5d173	Apr.25,2018	Apr.25,2019
SPEAG	Dipole	D2450V2	727	Apr.24,2018	Apr.23,2019
		D5GHzV2	1023	Jan.25,2018	Jan.24,2019
SPEAG	Data acquisition Electronics	DAE4	1336	Mar.21,2018	Mar.20,2019
SPEAG	Software	DASY 52 V52.8.8	N/A	Calibration not required	Calibration not required
SPEAG	Phantom	SAM	N/A	Calibration not required	Calibration not required
Network Analyzer	Agilent	E5071C	MY46107530	Feb.26,2018	Feb.25,2019
Agilent	Dielectric Probe Kit	85070E	MY44300677	Calibration not required	Calibration not required
Agilent	Dual-directional	772D	MY52180142	Jul.04,2018	Jul.03,2019
Aglient	coupler	778D	MY52180302	Jul.05,2018	Jul.04,2019
Agilent	RF Signal Generator	N5181A	MY50144143	Mar.14,2018	Mar.13,2019
Agilent	Power Meter	E4417A	MY52240003	Dec.21,2017	Dec.20,2018
Agilent	Power Sensor	E9301H	MY52200003	Dec.21,2017	Dec.20,2018
	Fower Sensor		MY52200004	Dec.21,2017	Dec.20,2018
TECPEL	Digital thermometer	DTM-303A	TP130077	Mar.09,2018	Mar.08,2019
Anritsu	Radio Communication Test	MT8820C	6201061049	Apr.08,2018	Apr.07,2019

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# 5. Measurements

Date: 2018/10/9

# GSM1900 Head Le Cheek CH 661

Communication System: GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.30042 Medium parameters used: f = 1880 MHz;  $\sigma$  = 1.408 S/m;  $\epsilon_r$  = 40.356;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Left Section Ambient temperature: 22.2°C; Liquid temperature: 21.8°C

DASY5 Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.5, 8.5, 8.5); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Area Scan (81x121x1): Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.106 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 2.430 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 0.131 W/kg SAR(1 g) = 0.080 W/kg; SAR(10 g) = 0.047 W/kgMaximum value of SAR (measured) = 0.107 W/kg



0 dB = 0.107 W/kg = -9.72 dBW/kg

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# GSM 1900 Body-worn Back side CH 661 10mm

Communication System: GSM; Frequency: 1880 MHz; Duty Cycle: 1:8.30042 Medium parameters used: f = 1880 MHz;  $\sigma$  = 1.532 S/m;  $\epsilon_r$  = 54.03;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.3°C; Liquid temperature: 21.8°C

DASY5 Configuration:

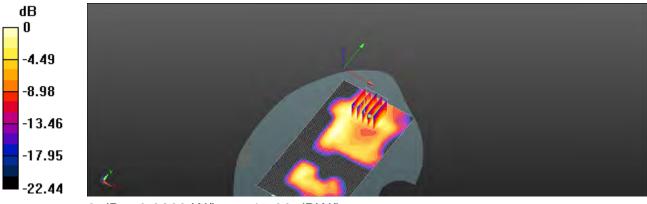
- Probe: EX3DV4 SN7351; ConvF(8.22, 8.22, 8.22); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Area Scan (71x131x1): Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.0262 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 0.6770 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 0.0340 W/kg SAR(1 g) = 0.019 W/kg; SAR(10 g) = 0.011 W/kg

Maximum value of SAR (measured) = 0.0263 W/kg



0 dB = 0.0263 W/kg = -15.80 dBW/kg

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### GPRS 1900 Hotspot Bottom side CH 512 10mm

Communication System: GPRS (1Dn4Up); Frequency: 1850.2 MHz; Duty Cycle: 1:1.99986 Medium parameters used: f = 1850.2 MHz;  $\sigma$  = 1.527 S/m;  $\epsilon_r$  = 54.061;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.3°C; Liquid temperature: 21.8°C

DASY5 Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.22, 8.22, 8.22); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Area Scan (51x61x1): Interpolated grid: dx=15 mm, dy=15 mm

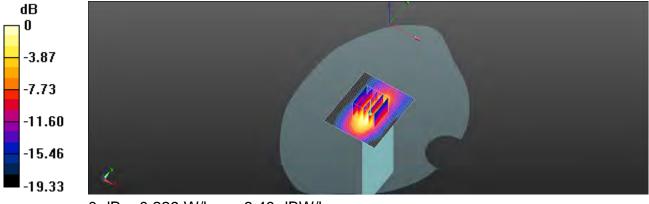
Maximum value of SAR (interpolated) = 0.239 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 9.830 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.284 W/kg

SAR(1 g) = 0.165 W/kg; SAR(10 g) = 0.088 W/kg

Maximum value of SAR (measured) = 0.229 W/kg



0 dB = 0.229 W/kg = -6.40 dBW/kg

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### WCDMA Band II Head Le Cheek CH 9262

Communication System: WCDMA; Frequency: 1850.2 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1850.2 MHz;  $\sigma$  = 1.403 S/m;  $\epsilon_r$  = 40.364;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Left Section Ambient temperature: 22.2°C; Liquid temperature: 21.8°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.5, 8.5, 8.5); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

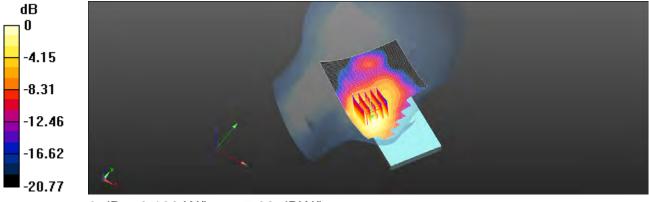
Area Scan (71x121x1): Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.193 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 3.638 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 0.243 W/kg

SAR(1 g) = 0.151 W/kg; SAR(10 g) = 0.092 W/kg

Maximum value of SAR (measured) = 0.199 W/kg



0 dB = 0.199 W/kg = -7.02 dBW/kg

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#### WCDMA Band II Hotspot Bottom side CH 9262 10mm

Communication System: WCDMA; Frequency: 1850.2 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1850.2 MHz;  $\sigma$  = 1.527 S/m;  $\epsilon_r$  = 54.061;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.3°C; Liquid temperature: 21.8°C

**DASY5** Configuration:

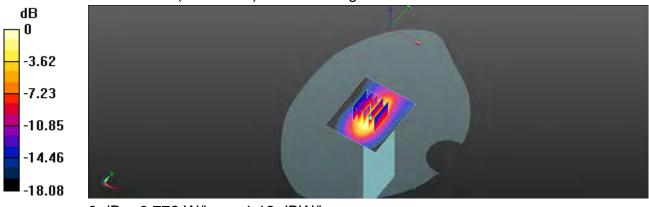
- Probe: EX3DV4 SN7351; ConvF(8.22, 8.22, 8.22); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Area Scan (51x61x1): Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.846 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 17.99 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 0.984 W/kg

SAR(1 g) = 0.572 W/kg; SAR(10 g) = 0.305 W/kg Maximum value of SAR (measured) = 0.772 W/kg



0 dB = 0.772 W/kg = -1.12 dBW/kg

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### WCDMA Band IV Head Le Cheek CH 1513

Communication System: WCDMA; Frequency: 1752.6 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1753 MHz;  $\sigma$  = 1.386 S/m;  $\epsilon_r$  = 40.664;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Left Section Ambient temperature: 22.3°C; Liquid temperature: 21.8°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.78, 8.78, 8.78); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

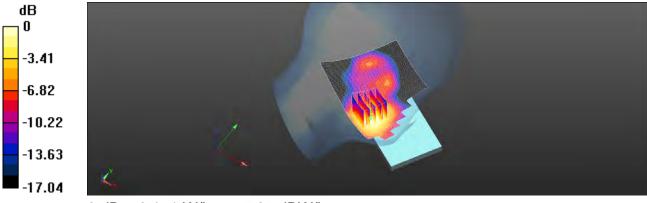
Area Scan (71x121x1): Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.163 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 4.318 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 0.204 W/kg

SAR(1 g) = 0.131 W/kg; SAR(10 g) = 0.083 W/kg

Maximum value of SAR (measured) = 0.171 W/kg



0 dB = 0.171 W/kg = -7.67 dBW/kg

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### WCDMA Band IV Hotspot Bottom side CH 1513 10mm

Communication System: WCDMA; Frequency: 1752.6 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1753 MHz;  $\sigma$  = 1.468 S/m;  $\epsilon_r$  = 52.784;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.1°C; Liquid temperature: 21.6°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.58, 8.58, 8.58); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Area Scan (51x61x1): Interpolated grid: dx=15 mm, dy=15 mm

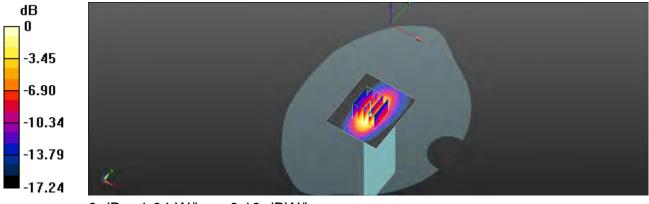
Maximum value of SAR (interpolated) = 1.22 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 20.88 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.29 W/kg

SAR(1 g) = 0.783 W/kg; SAR(10 g) = 0.425 W/kg

Maximum value of SAR (measured) = 1.04 W/kg



0 dB = 1.04 W/kg = 0.19 dBW/kg

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### LTE Band 2 (20MHz) Head Le Cheek CH 18900 QPSK 1-50

Communication System: LTE; Frequency: 1880 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1880 MHz;  $\sigma$  = 1.408 S/m;  $\epsilon_r$  = 40.356;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Left Section Ambient temperature: 22.2°C; Liquid temperature: 21.8°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.5, 8.5, 8.5); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

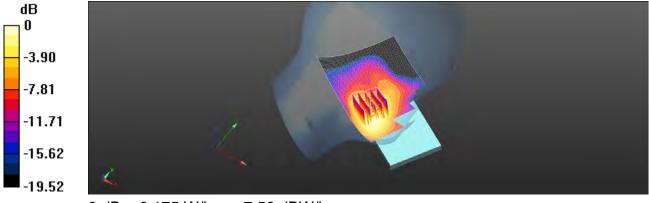
Area Scan (71x121x1): Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.160 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 3.407 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 0.213 W/kg

SAR(1 g) = 0.133 W/kg; SAR(10 g) = 0.082 W/kg

Maximum value of SAR (measured) = 0.175 W/kg



0 dB = 0.175 W/kg = -7.56 dBW/kg

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#### LTE Band 2 (20MHz) Hotspot Bottom side CH 18900 QPSK 1-50 10mm

Communication System: LTE; Frequency: 1880 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1880 MHz;  $\sigma$  = 1.532 S/m;  $\epsilon_r$  = 54.03;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.3°C; Liquid temperature: 21.8°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.22, 8.22, 8.22); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

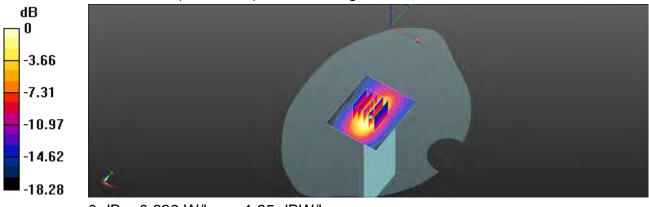
Area Scan (51x61x1): Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.821 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 16.18 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 0.839 W/kg

SAR(1 g) = 0.492 W/kg; SAR(10 g) = 0.265 W/kg

Maximum value of SAR (measured) = 0.639 W/kg



0 dB = 0.639 W/kg = -1.95 dBW/kg

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### LTE Band 4 (20MHz) Head Le Cheek CH 20300 QPSK 1-50

Communication System: LTE; Frequency: 1745 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1745 MHz;  $\sigma$  = 1.382 S/m;  $\epsilon_r$  = 40.692;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Left Section Ambient temperature: 22.3°C; Liquid temperature: 21.8°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.78, 8.78, 8.78); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

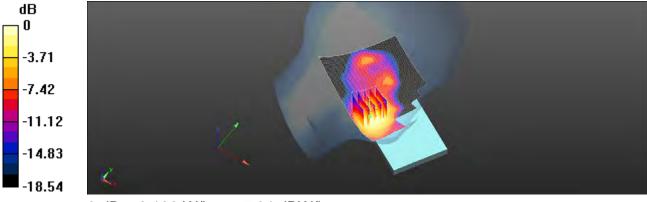
Area Scan (71x121x1): Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.202 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 4.312 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 0.234 W/kg

SAR(1 g) = 0.156 W/kg; SAR(10 g) = 0.099 W/kg

Maximum value of SAR (measured) = 0.198 W/kg



0 dB = 0.198 W/kg = -7.04 dBW/kg

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#### LTE Band 4 (20MHz) Hotspot Bottom side CH 20300 QPSK 1-50 10mm

Communication System: LTE; Frequency: 1745 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1745 MHz;  $\sigma$  = 1.465 S/m;  $\epsilon_r$  = 52.83;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.1°C; Liquid temperature: 21.6°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.58, 8.58, 8.58); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

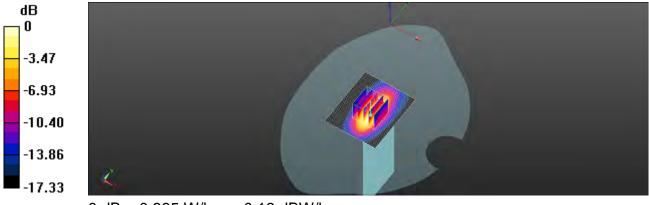
Area Scan (51x61x1): Interpolated grid: dx=15 mm, dy=15 mm

Maximum value of SAR (interpolated) = 0.06 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm Reference Value = 21.07 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 1.18 W/kg

SAR(1 g) = 0.717 W/kg; SAR(10 g) = 0.390 W/kg

Maximum value of SAR (measured) = 0.965 W/kg



0 dB = 0.965 W/kg = -0.16 dBW/kg

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### WLAN 802.11b Head Re Cheek CH 1

Communication System: WLAN 2.45G; Frequency: 2412 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2412 MHz;  $\sigma$  = 1.748 S/m;  $\epsilon_r$  = 38.855;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Right Section Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

DASY5 Configuration:

- Probe: EX3DV4 SN7351; ConvF(7.74, 7.74, 7.74); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

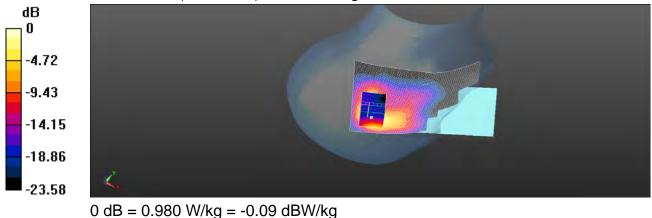
Area Scan (81x151x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.933 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 11.44 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 1.41 W/kg

SAR(1 g) = 0.592 W/kg; SAR(10 g) = 0.241 W/kg

Maximum value of SAR (measured) = 0.980 W/kg



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### WLAN 802.11b\_Hotspot\_Top side\_CH 1\_10mm

Communication System: WLAN 2.45G; Frequency: 2412 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2412 MHz;  $\sigma$  = 1.887 S/m;  $\epsilon_r$  = 51.669;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.0°C; Liquid temperature: 21.0°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(7.82, 7.82, 7.82); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

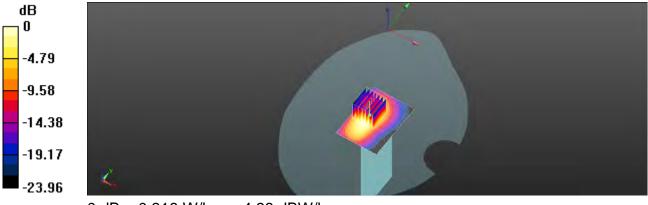
Area Scan (51x71x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.323 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 8.101 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 0.419 W/kg

SAR(1 g) = 0.218 W/kg; SAR(10 g) = 0.108 W/kg

Maximum value of SAR (measured) = 0.318 W/kg



0 dB = 0.318 W/kg = -4.98 dBW/kg

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## Bluetooth(GFSK) Head Re Cheek CH 0

Communication System: Bluetooth; Frequency: 2402 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2402 MHz;  $\sigma$  = 1.739 S/m;  $\epsilon_r$  = 38.877;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Right Section Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

DASY5 Configuration:

- Probe: EX3DV4 SN7351; ConvF(7.74, 7.74, 7.74); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

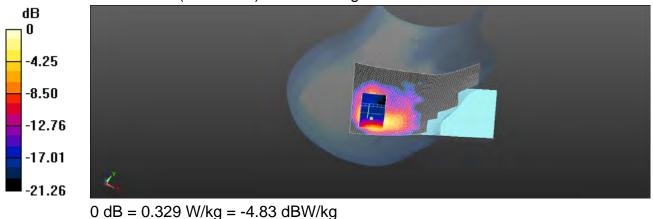
Area Scan (81x151x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.306 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 6.793 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 0.485 W/kg

SAR(1 g) = 0.193 W/kg; SAR(10 g) = 0.078 W/kg

Maximum value of SAR (measured) = 0.329 W/kg



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#### Bluetooth(GFSK)\_Body-worn\_Back side\_CH 0\_10mm

Communication System: Bluetooth; Frequency: 2402 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2402 MHz;  $\sigma$  = 1.877 S/m;  $\epsilon_r$  = 51.714;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.0°C; Liquid temperature: 21.0°C

**DASY5** Configuration:

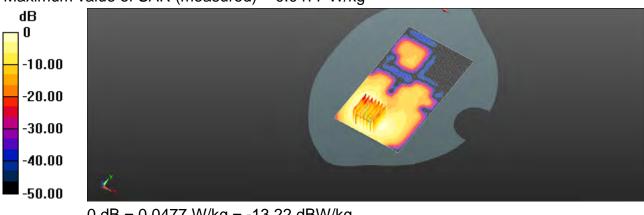
- Probe: EX3DV4 SN7351; ConvF(7.82, 7.82, 7.82); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Area Scan (81x141x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.0399 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 1.007 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 0.0640 W/kg

SAR(1 g) = 0.031 W/kg; SAR(10 g) = 0.015 W/kg Maximum value of SAR (measured) = 0.0477 W/kg



0 dB = 0.0477 W/kg = -13.22 dBW/kg

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#### WLAN 802.11n(40M) 5.2G Head Re Cheek CH 38

Communication System: WLAN 5G; Frequency: 5190 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5190 MHz;  $\sigma$  = 4.694 S/m;  $\epsilon_r$  = 35.5;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Right Section Ambient temperature: 22.2°C; Liquid temperature: 21.7°C

DASY5 Configuration:

- Probe: EX3DV4 SN7351; ConvF(5.49, 5.49, 5.49); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Area Scan (91x181x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.25 W/kg

Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 4.277 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 4.73 W/kg

SAR(1 g) = 0.961 W/kg; SAR(10 g) = 0.290 W/kg

Maximum value of SAR (measured) = 1.94 W/kg



0 dB = 1.94 W/kg = 2.87 dBW/kg

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#### WLAN 802.11ac(80M) 5.2G\_Head\_Re Cheek\_CH 42

Communication System: WLAN 5G; Frequency: 5210 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5210 MHz;  $\sigma$  = 4.711 S/m;  $\epsilon_r$  = 35.481;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Right Section Ambient temperature: 22.2°C; Liquid temperature: 21.7°C

DASY5 Configuration:

- Probe: EX3DV4 SN7351; ConvF(5.49, 5.49, 5.49); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

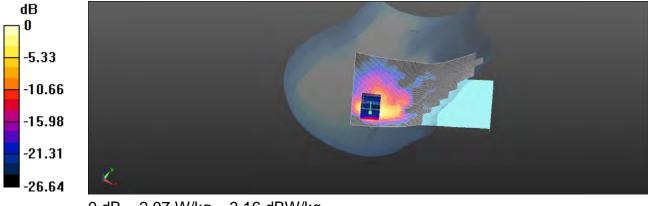
Area Scan (101x181x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.74 W/kg

Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 4.264 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 4.68 W/kg

SAR(1 g) = 1.02 W/kg; SAR(10 g) = 0.307 W/kg

Maximum value of SAR (measured) = 2.07 W/kg



0 dB = 2.07 W/kg = 3.16 dBW/kg

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#### WLAN 802.11ac(80M) 5.2G\_Body-worn\_Front side\_CH 42\_10mm

Communication System: WLAN 5G; Frequency: 5210 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5210 MHz;  $\sigma$  = 5.256 S/m;  $\epsilon_r$  = 49.716;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.4°C; Liquid temperature: 21.8°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(4.6, 4.6, 4.6); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

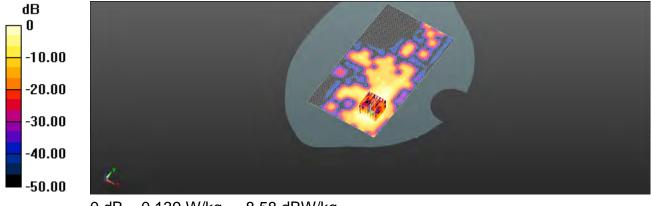
Area Scan (101x181x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.132 W/kg

Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 1.172 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 0.251 W/kg

SAR(1 g) = 0.068 W/kg; SAR(10 g) = 0.024 W/kg

Maximum value of SAR (measured) = 0.139 W/kg



0 dB = 0.139 W/kg = -8.58 dBW/kg

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#### WLAN 802.11n(40M) 5.3G Head Re Cheek CH 54

Communication System: WLAN 5G; Frequency: 5270 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5270 MHz;  $\sigma$  = 4.789 S/m;  $\epsilon_r$  = 35.349;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Right Section Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

DASY5 Configuration:

- Probe: EX3DV4 SN7351; ConvF(5.15, 5.15, 5.15); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

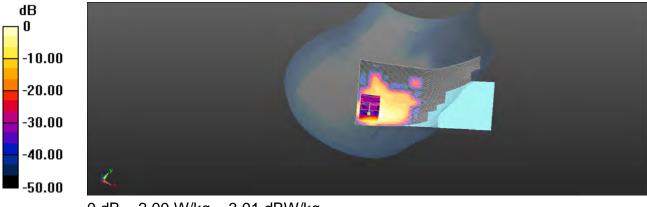
Area Scan (91x171x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.00 W/kg

Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 3.706 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 4.72 W/kg

SAR(1 g) = 0.966 W/kg; SAR(10 g) = 0.281 W/kg

Maximum value of SAR (measured) = 2.00 W/kg



0 dB = 2.00 W/kg = 3.01 dBW/kg

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Date: 2018/10/6

### WLAN 802.11ac(80M) 5.3G\_Head\_Re Cheek\_CH 58

Communication System: WLAN 5G; Frequency: 5290 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5290 MHz;  $\sigma$  = 4.808 S/m;  $\epsilon_r$  = 35.324;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Right Section Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

DASY5 Configuration:

- Probe: EX3DV4 SN7351; ConvF(5.15, 5.15, 5.15); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

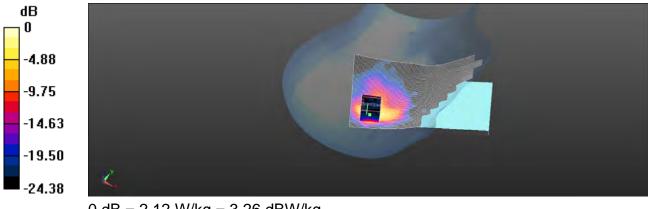
Area Scan (101x181x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.38 W/kg

Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 3.985 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 5.05 W/kg

SAR(1 g) = 1.05 W/kg; SAR(10 g) = 0.327 W/kg

Maximum value of SAR (measured) = 2.12 W/kg



0 dB = 2.12 W/kg = 3.26 dBW/kg

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Report No. : E5/2018/90016 Page: 91 of 163

Date: 2018/10/7

#### WLAN 802.11ac(80M) 5.3G\_Body-worn\_Front side\_CH 58\_10mm

Communication System: WLAN 5G; Frequency: 5290 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5290 MHz;  $\sigma$  = 5.351 S/m;  $\epsilon_r$  = 49.616;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.1°C; Liquid temperature: 21.5°C

**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(4.56, 4.56, 4.56); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

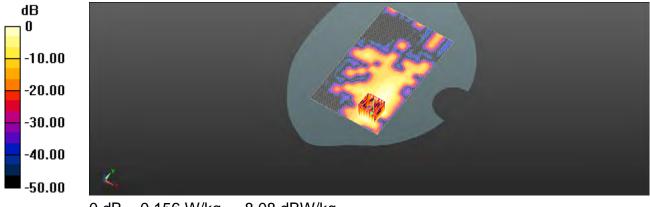
Area Scan (101x171x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.196 W/kg

Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 1.204 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 0.374 W/kg

SAR(1 g) = 0.080 W/kg; SAR(10 g) = 0.026 W/kg

Maximum value of SAR (measured) = 0.156 W/kg



0 dB = 0.156 W/kg = -8.08 dBW/kg

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Date: 2018/10/6

#### WLAN 802.11ac(80M) 5.6G\_Head\_Re Cheek\_CH 138

Communication System: WLAN 5G; Frequency: 5690 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5690 MHz;  $\sigma$  = 5.075 S/m;  $\epsilon_r$  = 34.696;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Right Section Ambient temperature: 22.0°C; Liquid temperature: 21.8°C

DASY5 Configuration:

- Probe: EX3DV4 SN7351; ConvF(4.81, 4.81, 4.81); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

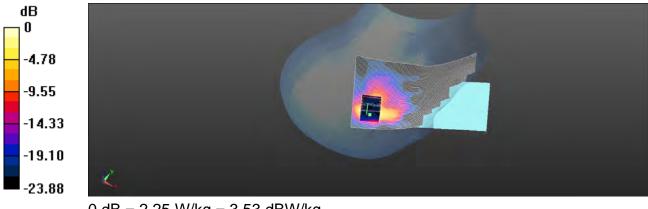
Area Scan (101x171x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 2.20 W/kg

Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 4.714 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 5.72 W/kg

SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.309 W/kg

Maximum value of SAR (measured) = 2.25 W/kg



0 dB = 2.25 W/kg = 3.53 dBW/kg

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Date: 2018/10/7

#### WLAN 802.11ac(80M) 5.6G\_Body-worn\_Front side\_CH 106\_10mm

Communication System: WLAN 5G; Frequency: 5530 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5530 MHz;  $\sigma$  = 5.74 S/m;  $\epsilon_r$  = 49.523;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

**DASY5** Configuration:

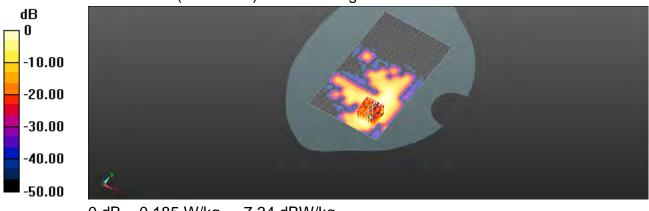
- Probe: EX3DV4 SN7351; ConvF(3.98, 3.98, 3.98); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Area Scan (101x171x1): Interpolated grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 0.236 W/kg

Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm Reference Value = 0.8340 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 0.416 W/kg

SAR(1 g) = 0.092 W/kg; SAR(10 g) = 0.029 W/kg Maximum value of SAR (measured) = 0.185 W/kg



0 dB = 0.185 W/kg = -7.34 dBW/kg

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# 6. SAR System Performance Verification

Date: 2018/10/8

## Dipole 1750 MHz SN:1008 Head

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz;  $\sigma$  = 1.384 S/m;  $\epsilon_r$  = 40.672;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.3°C; Liquid temperature: 21.8°C

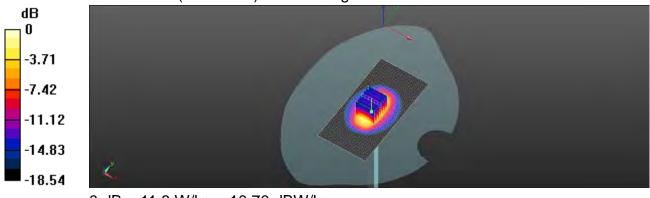
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.78, 8.78, 8.78); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=250mW/Area Scan (51x101x1): Interpolated grid: dx=15 mm, dy=15 mm Maximum value of SAR (interpolated) = 11.9 W/kg

#### Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.58 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 15.4 W/kg SAR(1 g) = 9.09 W/kg; SAR(10 g) = 4.84 W/kgMaximum value of SAR (measured) = 11.8 W/kg



0 dB = 11.8 W/kg = 10.70 dBW/kg

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### Dipole 1750 MHz SN:1008

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz;  $\sigma$  = 1.467 S/m;  $\epsilon_r$  = 52.796;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.1°C; Liquid temperature: 21.6°C

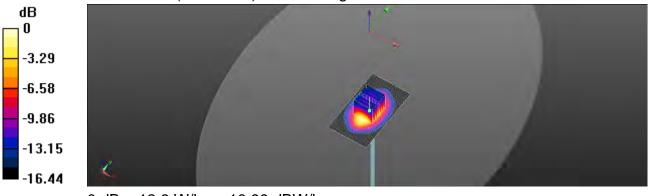
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.58, 8.58, 8.58); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=250mW/Area Scan (41x71x1): Interpolated grid: dx=15 mm, dy=15 mm Maximum value of SAR (interpolated) = 13.2 W/kg

#### Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.40 V/m: Power Drift = -0.02 dB Peak SAR (extrapolated) = 15.8 W/kg SAR(1 g) = 9.16 W/kg; SAR(10 g) = 4.91 W/kgMaximum value of SAR (measured) = 12.6 W/kg



0 dB = 12.6 W/kg = 10.99 dBW/kg

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Date: 2018/10/9

### Dipole 1900 MHz SN:5d173 Head

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.409 S/m;  $\epsilon_r$  = 40.353;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.2°C; Liquid temperature: 21.8°C

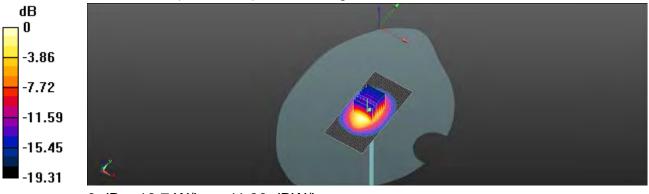
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.5, 8.5, 8.5); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=250mW/Area Scan (41x81x1): Interpolated grid: dx=15 mm, dy=15 mm Maximum value of SAR (interpolated) = 13.9 W/kg

#### Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.3 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 18.0 W/kg SAR(1 g) = 9.92 W/kg; SAR(10 g) = 5.19 W/kgMaximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.7 W/kg = 11.38 dBW/kg

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#### Dipole 1900 MHz SN:5d173

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.535 S/m;  $\epsilon_r$  = 54.025;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.3°C; Liquid temperature: 21.8°C

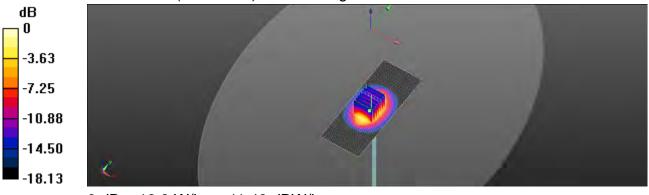
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(8.22, 8.22, 8.22); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=250mW/Area Scan (41x101x1): Interpolated grid: dx=15 mm, dy=15 mm Maximum value of SAR (interpolated) = 14.0 W/kg

#### Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.69 V/m: Power Drift = 0.03 dB Peak SAR (extrapolated) = 17.8 W/kg SAR(1 g) = 9.91 W/kg; SAR(10 g) = 5.29 W/kg Maximum value of SAR (measured) = 13.9 W/kg



0 dB = 13.9 W/kg = 11.43 dBW/kg

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### Dipole 2450 MHz SN:727 Head

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz;  $\sigma$  = 1.783 S/m;  $\epsilon$ r = 38.8;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

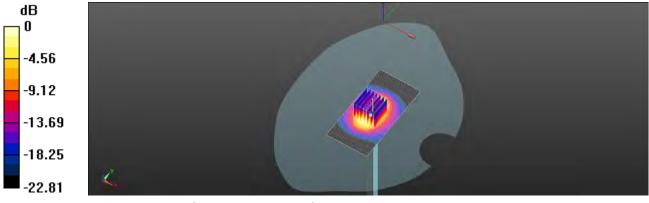
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(7.74, 7.74, 7.74); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=250mW/Area Scan (51x101x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 20.1 W/kg

#### Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 105.3 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 26.4 W/kg SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.08 W/kgMaximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

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### Dipole 2450 MHz SN:727

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz;  $\sigma$  = 1.922 S/m;  $\epsilon_r$  = 51.635;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.0°C; Liquid temperature: 21.0°C

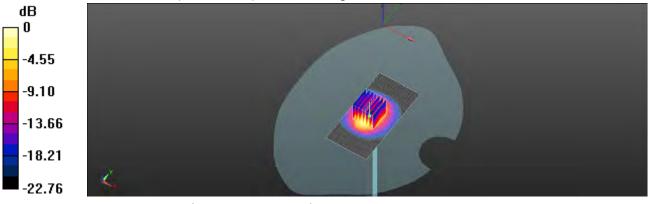
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(7.82, 7.82, 7.82); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=250mW/Area Scan (51x101x1): Interpolated grid: dx=12 mm, dy=12 mm Maximum value of SAR (interpolated) = 20.7 W/kg

#### Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.5 V/m: Power Drift = 0.01 dB Peak SAR (extrapolated) = 27.9 W/kg SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.96 W/kgMaximum value of SAR (measured) = 20.5 W/kg



0 dB = 20.5 W/kg = 13.11 dBW/kg

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### Dipole 5200 MHz SN:1023 Head

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5200 MHz;  $\sigma$  = 4.702 S/m;  $\epsilon$ r = 35.493;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.2°C; Liquid temperature: 21.7°C

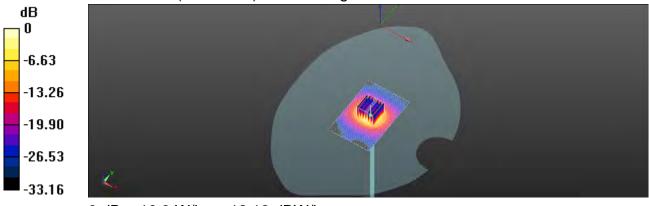
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(5.49, 5.49, 5.49); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 16.4 W/kg

#### Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 60.47 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 31.9 W/kg SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.24 W/kgMaximum value of SAR (measured) = 16.3 W/kg



0 dB = 16.3 W/kg = 12.12 dBW/kg

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### Dipole 5200 MHz SN:1023

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5200 MHz;  $\sigma$  = 5.244 S/m;  $\epsilon_r$  = 49.764;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.4°C; Liquid temperature: 21.8°C

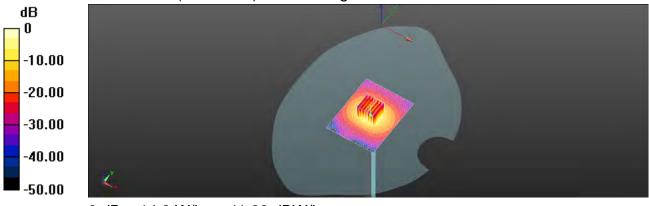
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(4.6, 4.6, 4.6); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=100mW/Area Scan (71x91x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 14.9 W/kg

#### Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 56.51 V/m: Power Drift = -0.03 dB Peak SAR (extrapolated) = 25.6 W/kg SAR(1 g) = 7.15 W/kg; SAR(10 g) = 2.01 W/kgMaximum value of SAR (measured) = 14.8 W/kg



0 dB = 14.8 W/kg = 11.69 dBW/kg

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### Dipole 5300 MHz SN:1023 Head

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5300 MHz;  $\sigma$  = 4.822 S/m;  $\epsilon_r$  = 35.315;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

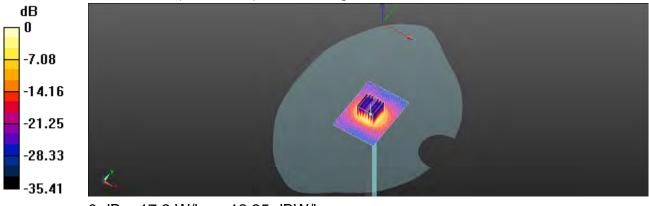
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(5.15, 5.15, 5.15); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 16.9 W/kg

#### Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 62.43 V/m: Power Drift = 0.01 dB Peak SAR (extrapolated) = 35.8 W/kg SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.28 W/kgMaximum value of SAR (measured) = 17.2 W/kg



0 dB = 17.2 W/kg = 12.35 dBW/kg

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### Dipole 5300 MHz SN:1023

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5300 MHz;  $\sigma$  = 5.365 S/m;  $\epsilon_r$  = 49.602;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.1°C; Liquid temperature: 21.5°C

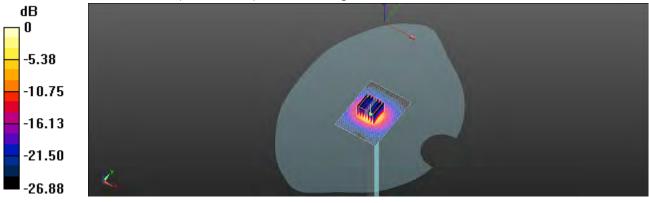
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(4.56, 4.56, 4.56); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 14.8 W/kg

#### Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 52.53 V/m: Power Drift = -0.02 dB Peak SAR (extrapolated) = 27.7 W/kg SAR(1 g) = 7.37 W/kg; SAR(10 g) = 2.07 W/kg Maximum value of SAR (measured) = 14.8 W/kg



0 dB = 14.8 W/kg = 11.71 dBW/kg

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### Dipole 5600 MHz SN:1023 Head

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5600 MHz;  $\sigma$  = 4.985 S/m;  $\epsilon$ r = 34.782;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.0°C; Liquid temperature: 21.8°C

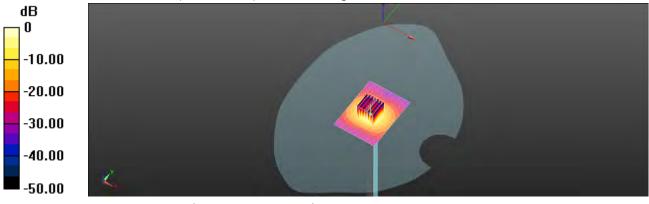
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(4.81, 4.81, 4.81); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 28.5 W/kg

#### Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 77.74 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 58.6 W/kg SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.36 W/kgMaximum value of SAR (measured) = 28.2 W/kg



0 dB = 28.2 W/kg = 14.51 dBW/kg

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### Dipole 5600 MHz SN:1023

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1 Medium parameters used: f = 5350 MHz;  $\sigma$  = 5.827 S/m;  $\epsilon_r$  = 49.436;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Ambient temperature: 22.1°C; Liquid temperature: 21.8°C

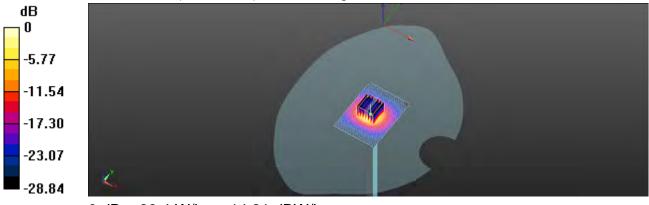
**DASY5** Configuration:

- Probe: EX3DV4 SN7351; ConvF(3.98, 3.98, 3.98); Calibrated: 2017/12/21;
- Sensor-Surface: 2mm (Mechanical Surface Detection) •
- Electronics: DAE4 Sn1336; Calibrated: 2018/3/21
- Phantom: SAM
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=10 mm, dy=10 mm Maximum value of SAR (interpolated) = 25.5 W/kg

#### Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 73.03 V/m: Power Drift = 0.01 dB Peak SAR (extrapolated) = 47.0 W/kg SAR(1 g) = 7.84 W/kg; SAR(10 g) = 2.21 W/kgMaximum value of SAR (measured) = 26.4 W/kg



0 dB = 26.4 W/kg = 14.21 dBW/kg

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# 7. DAE & Probe Calibration Certificate

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*G and humidity < 70%. Scheduled Calibration Aug-18
Scheduled Calibration
Scheduled Calibration Aug-18
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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S

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (BAS) The Swiss Accreditation Service is one of the signaturies to the EA. Multilateral Agreement for the recognition of calibration certificate

#### Glossary

DAE Connector angle

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

#### Methods Applied and Interpretation of Parameters

- DC Voltage Measurement: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- Connector angle: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - ÷. DC Voltage Measurement Linearity: Verification of the Linearity at +10% and +10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement
  - Common mode sensitivity: Influence of a positive or negative common mode voltage on the differential measurement.
  - Channel separation: Influence of a voltage on the neighbor channels not subject to an input voltage.
  - AD Converter Values with inputs shorted: Values on the internal AD converter corresponding to zero input voltage
  - Input Offset Measurement: Output voltage and statistical results over a large number of zero voltage measurements.
  - Input Offset Current: Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - Input resistance: Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - Low Battery Alarm Voltage: Typical value for information. Below this voltage, a battery alarm signal is generated.
  - Power consumption: Typical value for information. Supply currents in various operating modes.

Certificate No: DAE4-1338 Marte

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#### DC Voltage Measurement

High Range:	ILSB =	6.1µV	full range =	-100	+300 mV
Low Range:	1LSB =	BinV.	full range =	-1	+SmV

<b>Calibration Factors</b>	×	Y	Z
High Range	403.362 ± 0.02% (k=2)	403.664 ± 0.02% (k=2)	403.144 ± 0.02% (k=2)
Low Range		3.98716 ± 1.50% (k=2)	the second se

#### **Connector Angle**

Connector Angle to be used in DASY system	122.0 " + 1 "

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# Appendix (Additional assessments outside the scope of SCS0108)

# t. DC Voltage Linearity

High Range	Randing (µV)	Difference (uV)	Error (%)
Channel X + Input	200032.51	0,12	0.00
Channel X. + Input	20006.40	1.23	0.01
Channel X - Input	-20003.02	1.97	0.01
Channel Y + Input	200031.85	-0.59	-0.00
Citennel Y + Input	20004.04	-0.97	-0.00
Channel Y - Input	-20005.95	-0.92	0.00
Channel Z + Input	200033.31	0.61	0.00
Channel Z + Input	20003.33	-1.51	-0,01
Channel Z - Input	-20007.20	2.06	0.01

	Difference (µV)	Error (%)
2001.00	-0.33	-0.02
201.62	0.25	0.12
-198.41	0.24	-0.12
2001.15	-0.05	-0.00
200.95	-0.35	-0.17
-199.53	-0.77	0.39
2001.57	0.47	0.02
199.98	-1.22	-0.61
-200.14	-1.28	0,65
	201,62 -198,41 2001,15 200,95 -199,53 2001,57 199,38	201.62         0.25           -198.41         0.24           2001.15         -0.05           200.95         -0.35           -199.53         -0.77           2001.57         0.47           199.98         -1.22

#### 2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	6.48	4.38
	- 200	+3.75	-4.83
Channel Y	200	-4.18	-3.84
	- 200	1.89	2.38
Channel Z	200	20.84	21.26
	-200	-23.99	24,35

#### 3. Channel separation

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

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200		5.48	-1.63
Channel Y	200	8.85	1	6.35
Channel Z	200	8.27	6.90	

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# 4. AD-Converter Values with inputs shorled

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

	High Range (LSB)	Low Range (LSB)
Channel X	15667	16592
Channel Y	15909	15806
Channel Z	15857	15707

# 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec (nout 10MO)

	Average (µV)	min. Offset (µV)	max. Offset (µV)	Std. Deviation (µV)
Channel X	0.56	-0,27	1.89	0.40
Channel Y	-0,08	+0.95	0.75	0.38
Channel Z	-1,39	-2.93	-0.50	0.41

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25tA

## 7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

#### B. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Lavel (VDC)
Supply (+ Vcc)	17.9
Supply (- Vcc)	-7,6

#### 9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)	
Supply (+ Vcc)	+0.01	+8	+14	
Supply (- Voc)	-0.01	-8	-9	

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ient Auden		Cartificate No:	EX3-7351_Dec17
CALIBRATION	CERTIFICATE	-	
0.960	EX3DV4 - SN:735	1	
Calibration procedure(5)		A CAL-14 v4, QA CAL-23.v5, QA ure for dosimetric E-field probes	CAL-25.v6
Calibration date	December 21, 201	7	
All calenations have been cond	ucted in The closed lationatory	facility environment temperature (22 ± 3)°C a	and burnicity < 70%
		facility ensurgament temperature (22 $\pm$ 3)*C $_{\rm c}$	and humicity < 70%
Calibration Equipment used (M		facility enstrumment temperature (22 ± 3)°C a	and trumically < 70%
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Carlbration Equipment used (M Primary Standards Power moder NRP Power sensor NRP-291	8TE erman for cationation) ID SN: 104778 SN: 103244	Cal Date (Centicate No.)	Scheduled Calibration
Caribration Equipment used (M Primary Standards Power minder NRP Power sensor NRP-291 Power sensor NRP-281	8TE cmsai for catérolion) ID SN: 104778 SN: 103244 SN: 103245	Cal Date (Centicitie No.) D4-Apr-17 (No. 217-02521/02522) D4-Apr-17 (No. 217-02521) D4-Apr-17 (No. 217-02523)	Scheduled Calibration Apr-18 Apr-18 Apr-18
Carlbration Equipment used (M Primary Slandards Power sensor NRP- Power sensor NRP-291 Power sensor NRP-291 Reference 20 dR Attenuator	8TE emisai for cationation) SN: 104778 SN: 103244 SN: 103245 SN: 55277 (20x)	Cai Date (Centicate No.) D4-Apr-17 (No. 217-02524/02522) D4-Apr-17 (No. 217-02521) D4-Apr-17 (No. 217-0252) D7-Apr-17 (No. 217-02528)	Scheduled Calibration Apr-18 Apr-18 Apr-18 Apr-18 Apr-18
Caribration Equipment used (M Primary Standards Power render NRP Power sensor NRP-291 Power sensor NRP-291 Relevance 20 dB Atternator Relevance Probe ES3DV2	8TE etmain for catibration) SN: 104776 SN: 103244 SN: 103245 SN: 103245 SN: 55277 (20k) SN: 3013	Ear Date (Centificate No.) D4-Apr-17 (No. 217-0252)/02522) D4-Apr-17 (No. 217-02521) D4-Apr-17 (No. 217-02525) D7-Apr-17 (No. 217-02525) 31-Oec-16 (No. ES3-3013, Dec16)	Scheduled Calibration Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Dac-17
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Carlbration Equipment used (M Primary Standards Power senser NRP- Power sensor NRP-291 Power sensor NRP-291 Relevance 20 dB Atemator Reference Probe ES3DV2 DAE4 Sectordary Standards Power sensor E44156 Power sensor E4412A Power sensor E4412A	BTE tringen for cellstotion) SN: 104778 SN: 103244 SN: 103245 SN: 05245 SN: 55277 (20k) SN: 3553 SN: 554 SN: CB41283574 SN: CB41283574 SN: MY41488057	Car Date (Centificate No.) 04-Apr-17 (No. 217-02524/02522) 04-Apr-17 (No. 217-02524) 04-Apr-17 (No. 217-02525) 07-Apr-17 (No. 217-02526) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. DAE4-034, Jul 24-Jul-17 (No. DAE4-034, Jul 05-Apr-16 (In house) 05-Apr-16 (In house check Jun-16) 06-Apr-16 (In house check Jun-16)	Scheduled Calibration Apr-18 Apr-18 Apr-18 Apr-18 Dec-17 Juli -18 Scheduled Check In house sheet, Jun-18 In house check; Jun-18
Calibration Equipment used (M Primary Standards Power sensor NRP-291 Power sensor NRP-291 Power sensor NRP-291 Relevance 20 dit Atternator Reference Probe ES3DV2 DAE4 Secondary Standards Power mater E44198 Power sensor E4412A RF generator HP 5046C	BTE criseal for celebration) SN: 104778 SN: 103244 SN: 103245 SN: 35277 (20x) SN: 3013 SN: 654 SN: 654 SN: 6641220874 SN: 600110210	Cal Date (Centicipte No.) D4-Apr-17 (No. 217-02521/02522) D4-Apr-17 (No. 217-02521/02522) D4-Apr-17 (No. 217-02523) D7-Apr-17 (No. 217-02523) 31-Orec-16 (No. ES3-3013, Dec16) 24-Jul-17 (No. DAE4-034, Jul/17) Check Date (in house) D5-Apr-16 (in house) check Jun-16) D5-Apr-16 (in house check Jun-16) D5-Apr-16 (in house check Jun-16)	Scheduled Calibration Apr-18 Apr-18 Apr-18 Dec-17 Juli-18 Scheduled Check In house check: Jun-18 In house check: Jun-18 In house check: Jun-18
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Accreditation No.: SCS 0105

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Glossary:

Giosany	
TSL	tissue simulating figure.
NORMX/V.2	sensitivity in free space
ConvF	sensitivity in TSL / NORMX.y.z
DCP	Globe compression point
CF	crest factor (1/duty, cycle) of the RF stand
A, B, C, D	modulation dependent imparization parameters
Polarization m	2 fotalion around probe axis
Polarization #	W rotation around an axis that is in the plane normal to proce axis (at measurement center), i.e., A = 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:

- 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 IEC 62209-1, ""Measurement procedure for the assessment of Specific Absorption Rate (SAR) from handb)
- held and body-mounted devices used text to the ser (frequency range of 300 MHz to 6 GHz)", July 2016 IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wretexs communication devices. **c**)
- used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)". March 2010 d) KDB 865654. "SAR Measurement Requirements for 100 MHz to 6 GHz!"

#### Methods Applied and Interpretation of Parameters:

- NORMs y.z. Assessed for E-field polarization 8 = 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-field uncertainty inside TSL (see below ConvF).
- NORM(f),x/y z = NORM(y,y z \* (requency, requency, 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, v.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 for media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal **Derecteristics**
- Ax, V, Z, Bx, V, Z, Cx, V, Z, Dx, V, Z, W, Y, Z, A, B, C, D are numerical inestization parameters assessed based on the state of power sweep for specific modulation signal. The parameters do not depend on frequency nor metha. VR is the maximum calibration range expressed in RMS voltage across the diode. ConvF and Boundary Effect Parameters: Assessed in Rat bitamorn using E-Weld (or Temperature Transfer .
- ConvP and Boundary Effect Parameters: Assessed in real phanom using ensert (or remperature that are Standard for f s B00 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 comparisation (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 and the boundary comparisation (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 the boundary of the boundary. The sensitivity in TSL corresponds and the boundary of the boundary. The sensitivity in TSL corresponds and the boundary of the boundary of the boundary. The sensitivity in TSL corresponds and the boundary of the boundary of the boundary. to ADRAy y.z. "ConvE whereby the uncertainty corresponds to that given for ConvE. A frequency dependent ConvE 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 affset corresponds to the offset of virtual measurement center from the probe lin (on probe axis). No tolerance required
- . Connector Angle: The angle is assessed using the information gained by determining the NORMs (no uncertainty required).

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EX3DV4 - SN:7351

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December 21, 2017

# Probe EX3DV4

# SN:7351

Manufactured: Calibrated:

October 13, 2014 December 21, 2017

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

Certificate No: EX3-7351\_Dec17

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EX3DV4- SN:7351

December 21, 2017

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7351

#### **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m) <sup>2</sup> ) <sup>4</sup> DCP (mV) <sup>8</sup>	0.47	0.44	0.45	± 10.1 %
DCP (mV) <sup>8</sup>	97.9	104.3	97.1	

#### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dBõV	с	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	136.5	±3.8 %
		Y	0.0	0.0	1.0		136.4	
		Z	0.0	0.0	1.0		147.3	

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%.

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>3</sup>-field uncertainty inside TSL (see Pages 5 and 6). <sup>9</sup> Numerical linearization parameter: uncertainty not required. <sup>6</sup> Uncertainty is determined using the max-deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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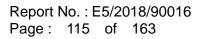
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EX3DV4-SN:7351

December 21, 2017

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7351

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)
750	41.9	0.89	10.92	10.92	10.92	0.55	0.80	± 12.0 %
835	41.5	0.90	10.60	10.60	10.60	0.55	0.80	± 12.0 %
900	41.5	0.97	10.31	10.31	10.31	0.40	0.95	± 12.0 %
1750	40.1	1.37	8.78	8.78	8.78	0.28	0.80	± 12.0 %
1900	40.0	1.40	8.50	8.50	8.50	0.29	0.80	± 12.0 %
2000	40.0	1.40	8.41	8.41	8.41	0.30	0.80	± 12.0 %
2300	39.5	1.67	8.03	8.03	8.03	0.31	0.84	± 12.0 %
2450	39.2	1.80	7.74	7.74	7.74	0.34	0.85	± 12.0 %
2600	39.0	1.96	7.51	7.51	7.51	0.36	0.81	± 12.0 %
5200	36.0	4.66	5.49	5.49	5.49	0.35	1.80	± 13.1 %
5300	35.9	4.76	5.15	5.15	5.15	0.40	1.80	± 13.1 %
5500	35.6	4.96	5.04	5.04	5.04	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.81	4.81	4.81	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.90	4.90	4.90	0.40	1.80	± 13.1 %

Calibration Parameter Determined in Head Tissue Simulating Media

<sup>6</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), also it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity and be extended to ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity and be extended to ± 105 if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (is and ii) 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 (is and ii) is restricted to ± 5%. The uncertainty for indicated target issue parameters.
<sup>6</sup> At the uncertainty for indicated target issue parameters.
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<sup>6</sup> At a set 3 (5 for frequencies below 3 GHz a

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EX3DV4- SN:7351

December 21, 2017

f(MHz) <sup>c</sup>	Relative Permittivity"	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)
750	55.5	0.96	10.81	10.81	10.81	0.40	0.91	± 12.0 %
835	55.2	0.97	10.39	10.39	10.39	0.47	0.87	± 12.0 9
900	55.0	1.05	10.18	10.18	10.18	0.4B	0.85	± 12.0 9
1750	53.4	1.49	8.58	8.58	8.58	0.37	0.85	± 12.0 %
1900	53.3	1.52	8.22	8.22	8.22	0.43	0.80	± 12.0 9
2000	53.3	1.52	8.40	8.40	8.40	0.31	0.99	± 12.0 9
2300	52.9	1.81	7.98	7.98	7.98	0.40	0.87	± 12.0 %
2450	52.7	1.95	7.82	7.82	7.82	0.37	0.88	± 12.0 %
2600	52.5	2.16	7.56	7.56	7.56	0.32	0.93	± 12.0 %
5200	49.0	5.30	4.60	4.60	4.60	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.56	4.56	4.56	0.40	1.90	± 13.1 %
5500	48.6	5.65	4.09	4.09	4.09	0.45	1.90	± 13.1 9
5600	48.5	5.77	3.98	3.98	3.98	0.45	1.90	± 13.1 %
5800	48.2	6.00	4.21	4.21	4.21	0.45	1.90	± 13.1 %

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7351

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

measured SAR values. Af the quencies above 3 GHz, the validity of tissue parameters (i, and or) senses (i, and or) is restricted to ± 0%. The uncertainty is the RSS of the Con-F uncertainty for indicated target tissue parameters. • AlphalOpeth are determined during california. SPEAR 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 distance larger than the boundary tip distance larger than the boundary tip distance larger than the boundary tip distance larger than the tip distance larger than the boundary tip distance larger than the boundary tip distance larger than the tip distance larger the tip distance larger th

diameter from the boundary

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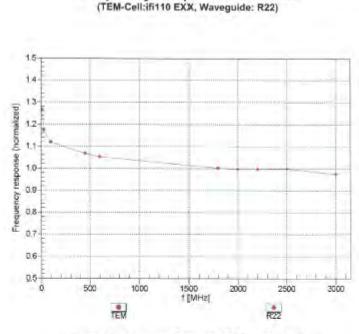
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EX30V4- SN/7351

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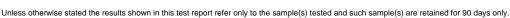
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Frequency Response of E-Field

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

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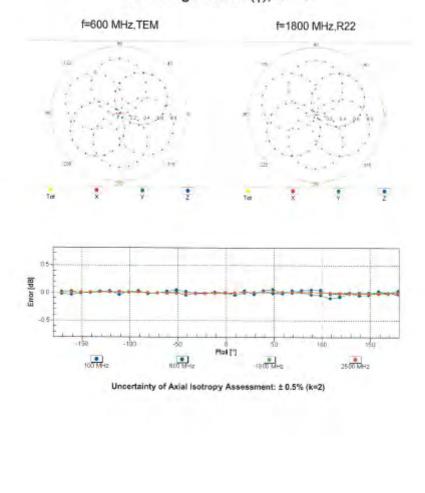
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Receiving Pattern (\$), 9 = 0°

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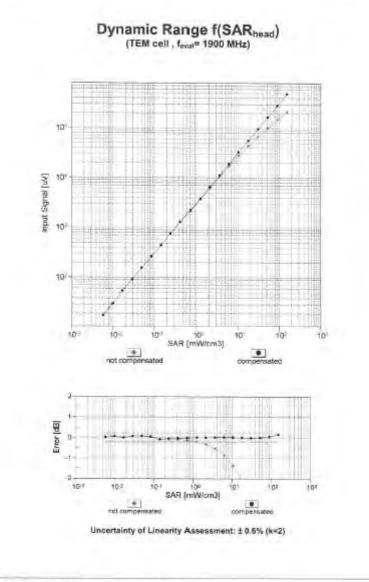
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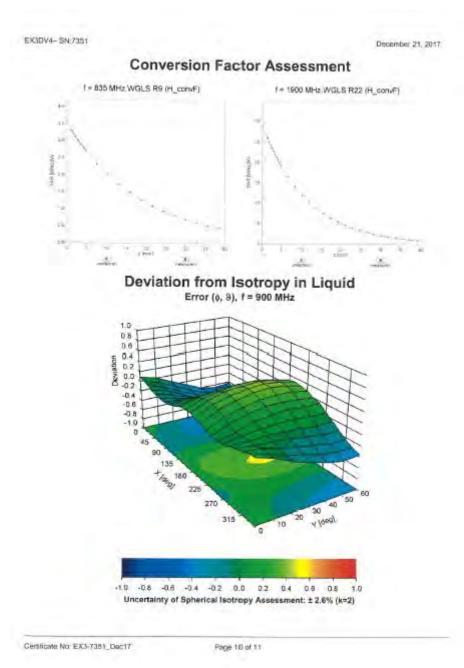
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EX3DV4- SN:7351

December 21, 2017

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:7351

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (*)	68.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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# 8. Uncertainty Budget

A	с	D	е		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probabilit y	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	6.00%	N	1	1	1	1	6.00%	6.00%	~
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	$\infty$
lsotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	8
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	~
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	$\infty$
Readout Electronics	0.30%	N	1	1	1	1	0.30%	0.30%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	8
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	8
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	8
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	8
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	$\infty$
Probe Positioning with respect to phantom	2.90%	R	√3	1.732	1	1	1.67%	1.67%	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	8
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	~
Test Sample related									
Test sample positioning	2.90%	N	1	1	1	1	2.90%	2.90%	M-1
Device Holder Uncertainty	3.60%	N	1	1	1	1	3.60%	3.60%	M-1
Drift of output power	5.00%	R	√3	1.732	1	1	2.89%	2.89%	8
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	~
Liquid permittivity (mea.)	2.05%	N	1	1	0.64	0.43	1.31%	0.88%	М
Liquid Conductivity (mea.)	1.45%	N	1	1	0.6	0.49	0.87%	0.71%	М
Combined standard uncertainty		RSS					11.53%	11.46%	
Expant uncertainty (95% confidence							23.05%	22.93%	

Measurement Uncertainty evaluation template for DUT SAR test (0.3-3G)

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f (886-2) 2298-0488



А	с	D	е		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probabilit v	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	6.55%	N	1	1	1	1	6.55%	6.55%	8
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	00
lsotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	80
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	8
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	00
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	80
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	00
Readout Electronics	0.30%	N	1	1	1	1	0.30%	0.30%	8
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	00
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	80
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	00
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	00
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	00
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	00
Probe Positioning with respect to phantom	2.90%	R	√3	1.732	1	1	1.67%	1.67%	80
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	00
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	00
Test Sample related									
Test sample positioning	2.90%	N	1	1	1	1	2.90%	2.90%	M-1
Device Holder Uncertainty	3.60%	N	1	1	1	1	3.60%	3.60%	M-1
Drift of output power	5.00%	R	√3	1.732	1	1	2.89%	2.89%	80
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	œ
Liquid permittivity (mea.)	2.15%	N	1	1	0.64	0.43	1.38%	0.92%	М
Liquid Conductivity (mea.)	1.60%	N	1	1	0.6	0.49	0.96%	0.78%	М
Combined standard uncertainty		RSS					11.84%	11.77%	
Expant uncertainty (95% confidence							23.67%	23.54%	

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# 9. Phantom Description

Schmus & Panner Engineering AG

e s а D

Zoughausstnaser 43, 8004 Zurich, Switzerlan Phone +41 1 245 9700, Fax +41 1 245 9779 Info@spasg.com, http://www.spasg.com

Certificate of Conformity / First Article Inspection

tem	SAM Twin Phentom V4.0
Type No .	QD 000 P40 C
Series No	TP-1150 and higher
Manufacturer	SPEAG Zeughausstrasse 43 CH-8004 Zürich Switzerland

#### Tests

Tests The series production process used allows the imitation to test of first articles. Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series items (called samples) or are tested at each item.

Test	Requirement	Details	Units tested
Dimensions	Compliant with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness of shell	Compliant with the requirements according to the standards	2mm +/- 0.2mm in flat and specific areas of head section	First article, Samples, TP-1314 ff,
Material thickness at ERP	Compliant with the requirements according to the standarda	6mm +/- 0.2mm at ERP	First article, All items
Material parameters	laterial Dielectric partimeters for required		Material samples
Material resistivity The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe technical Note for material compatibility.		DEGMBE based simulating liquids	Pre-series, First article, Material samples
Sagging	Compliant with the requirements according to the standards. Sagging of the flat section when filled with tissue simulating liquid	< 1% typical < 0.8% if filed with 155mm of HSL900 and without OUT below	Prototypes, Sample testing

- 5tandarda [1] CENELEC EN 50361 [2] IEEE Std 1528-2003 [3] IEC 62209 Part I 1234

- The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

Conformity Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standards [1] to [4]

Date	07.07.2005	3 D 8 8 9
Signature / Stamp	and a second	Seignty & Pagnin Englineering AG ជាចិត្តវាលេខាច្រើននេះ 43, 8004 20165 ភ្លែងទំនាំ Phone អ្នក្សី ស្ថិតទំនាំ១១០/ខណ្ឌន៍ទំនាំ។ 245.07 នៃ២០ មិនមានចុះcom, http://www.spiedg.com

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# **10. System Validation from Original Equipment Supplier**

Engineering AG sughausstrasse 43, 8004 Zurich,	, Switzerland		Schweizerischer Kalibrierdienst Service suisse d'étaionnage Servizie svizzere di taratura Swiss Calibration Service
ecredited by the Swiss Accreditate the Swise Accreditation Service in Autoistoral Agreement for the rec	is one of the signatorie	to the EA.	Accession No.: SCS 0108
Signt SGS-TW (Auden	1)	Certilicate N	to: D1750V2-1008_Aug18
CALIBRATION C	ERTIFICATE	E	
Object	D1750V2 - SN:1	8008	
Calibration procedure(s)	QA CAL-05.v10		
	Calibration proce	dure for dipole validation kits at	oove 700 MHz
Calibration date:	Augus: 30, 2018		
		ry facility: environment temperature (22 $\pm$ 3)	"C and humidity $<70\%$
Calibration Equipment used (M&TE			°C and humidity < 70%
Celibration Equipment used (M&TE Primary Standards	E critical for celibration)	ry facility: environment temperature (22 ± 3) Car Date (Certificate No.) 04-Apr-16 (No.) 217-02672/02673)	
Celibration Equipment used (M&TE Primary Standards Rower mater NRP Power senso: NRIP-291	E citilical for citilibration) ID k SN: 104778 SN: 103244	Car Date (Certificate No.) 04-0pr-16 (No. 217-02672/02673) 04-0pr-18 (No. 217-02672)	Scheduled Calibration
Celibration Equipment used (M&TE Primary Standards Prower meter NRP Power sensor NRP-291 Power sensor NRP-291	E critical for cellbration) 10 k SN: 104778 SN: 103244 SN: 103245	Car Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02672)	Scheduled Calibration Apr-19 Apr-19 Apr-19
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator	E onlice) for cellbration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k)	Car Date (Certificate No.) 04-Apr-16 (No.) 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr 18 (No. 217-02673)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19
Calibration Equipment used (M&TE Permany Standards Power mater NRP-201 Power sensor NRP-201 Power sensor NRP-201 Reference 20 dB Attenuator Fyge-N mismatch combination	E critical for ostbration) 10 # SN: 104778 SN: 103244 SN: 103245 SN: 5032 (20k) SN: 5047.2706327	Car Date (Certificate No.) 04-0pr-16 (No. 217-02672)/02673) 04-0pr-18 (No. 217-02672) 04-0pr-18 (No. 217-02672) 04-0pr-18 (No. 217-02682) 04-0pr-18 (No. 217-02683)	Schecklad Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19
Calibration Equipment used (M&TE Primary Standards Rower mater NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	E onlice) for cellbration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k)	Car Date (Certificate No.) 04-Apr-16 (No.) 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr 18 (No. 217-02673)	Scheduled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19
Calibration Equipment used (M&TE Primary Standards Dewer meter NRP Power sensor NRP-291 Power sensor NRP-291 Retenence 20 dB Attenuator Type-N inisimatch combination Retenence Probe EX3DV4 DAE4	E ortilicai for cellibration) 10 # 5N: 104778 SN: 103244 SN: 103245 SN: 5058 (29k) SN: 5058 (29k) SN: 5058 (29k)	Cal Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02682) 04-Apr-18 (No. 217-02683) 30-Dec-17 (No. EX3-7348_Dec17)	Scheck/od Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-10
Calibration Equipment used (M&TE Primary Standards Power mater NRP Power sensor NRP-291 Power sensor NRP-291 Reterence 20 dB Attenuator Type=N neimratch combination Reterence Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A	E ortilicai for ontibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 103245 SN: 5058 (20k) BN: 5047.27 06327 SN: 5058 SN: 5051 ID # SN: 6(3337480704	Car Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 30-Det-17 (No. EX3-7349_Det-17) 26-Oct-17 (No. DAE4-601_Oct17) 26-Oct-17 (No. DAE4-601_Oct17) Chack Date (in house) 07-Oct-16 (in house check Oct-16)	Scheduled Calibration Apr-19 Apr-19 Apr-18 Apr-19 Apr-19 Dec-18 Oct-18 Scheduled Check In house check: Oct-18
Calibration Equipment used (M&TE Primary Standards Rower mater NRP Power sensor NRP-291 Power sensor NRP-291 Retenence 20 dB Attenuator Pype-N mismatch combination Retenence Probe EX30V4 DAE4 Secondary Standards Power meter EPM-442A Power meter EPM-442A Power sensor HP 8481A	E onlikal for onfibration) 10 # SN: 104778 SN: 103244 SN: 103245 SN: 5047.27 (2014) SN: 5047.27 (2014) SN: 5047.27 (2014) SN: 501 10 # SN: 601 10 # SN: 6037490704 SN: 4037292783	Car Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-18 (in house check Oct-16) 07-Oct-16 (in house check Oct-16) 07-Oct-16 (in house check Oct-16)	Schookilod Calibration Apr-19 Apr-19 Apr-18 Apr-18 Apr-19 Dec-18 Dec-18 Dec-18 Schedwied Check Is house check: Oct-18 In house check: Oct-18
Calibration Equipment used (M&TE Power mater NRP Power sensor: NRP-291 Power sensor: NRP-291 Retenence 20 dB Attenuator Type-N mismatch combination Retenence Probe EX3DV4 DAE4 Stecondary Standards Power meter EPM-442A Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	E onlikal for onfibration) ID # SNL 104778 SNL 103244 SNL 103245 SNL 5058 (20k) SNL 5047.27 06327 SNL 7348 SNL 701 ID # SNL 6037490704 SNL 603728078 SNL 603728 SNL 60378 SNL 603	Car Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02682) 04-Apr-18 (No. 217-02683) 30-Dec-17 (No. 252-7398_Dec17) 26-Orc-17 (No. DAL4-601_Dct17) 26-Orc-17 (No. DAL4-601_Dct17) Check Date (in house check Dct-16) 07-Oct-15 (in house check Dct-16) 07-Oct-15 (in house check Dct-16)	Schoolulud Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dec-18 Schoolulud Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Calibration Equipment used (M&TE Primary Standards Power sensor NEP-291 Power sensor NEP-291 Power sensor NEP-291 Reterence 20 dB Attenuator Type-N nisimatch combination Reterence Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power meter EPM-442A Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	E onlikal for onfibration) 10 # SN: 104778 SN: 103244 SN: 103245 SN: 5047.27 (204) SN: 5047.27 (204) SN: 5047.27 (204) SN: 5047 SN: 5047	Car Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-17 (No. 273-02683) 04-Apr-18 (in house check Oct-16) 07-Oct-16 (in house check Oct-16) 07-Oct-16 (in house check Oct-16)	Schooking Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dec-18 Dec-18 Schedwied Check In house check: Oct-18 In house check: Oct-18
Calibration Equipment used (M&TE Permany Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Retensore 20 dB Attenuator Type-N mismatch combination Relevance Probe EX3004 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Rower sensor HP 8481A RF generator R&S SMT-00 Natwork Analyzer Agiloni E8368A	E onlikal for onfibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 5047.27 (0087) SN: 7346 SN: 601 ID # SN: 63737490704 SN: 63837490704 SN: 0587296783 SN: WK41082317 SN: 100972 SN: 0541060477 Name	Car Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 04-Apr-17 (No. 273-7248_Dec17) 26-Oct-17 (No. 273-7248_Dec17) 26-Oct-17 (No. 273-7248_Dec17) 26-Oct-17 (No. 273-7248_Dec17) 26-Oct-17 (No. 273-7248_Dec17) 26-Oct-16 (in nouse check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jan-15 (in house check Oct-16) 15-Jan-14 (in house check Oct-17) Function	Schecklod Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Oct-18 Schecklad Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Calibration Equipment used (M&TE Primary Standards Power mater NRP Power sensor NRP-291 Power sensor NRP-291 Retendoe 20 dB Attenuator Type-N mismatch combination Retendoe Probe EX3074 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-00 Network Analyzer Aglioni E8358A	E ortilicai for onfibration) 10 4 SN: 104778 SN: 103244 SN: 103244 SN: 5058 (284) SN: 5058 (284) SN: 5058 (284) SN: 5058 (284) SN: 601 10 8 SN: 6037480704 SN: 0537282783 SN: 00341080477	Car Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02682) 04-Apr-18 (No. 217-02683) 30-Dec-17 (No. 217-02683) 07-Oct-15 (In house check Oct-16) 07-Oct-15 (In house check Oct-16) 07-Oct-15 (In house check Oct-16) 15-Jun-15 (In house check Oct-17)	Scheckled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-10 Decc-10 Decc-10
All calibrations have been conclude Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reterence 20 dB Attenuator Type-Ninismatch combination Neterence Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A Rower sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilioni E8368A Calibrated by:	E onlikal for onfibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 5047.27 (0087) SN: 7346 SN: 601 ID # SN: 63737490704 SN: 63837490704 SN: 0587296783 SN: WK41082317 SN: 100972 SN: 0541060477 Name	Car Date (Certificate No.) 04-Apr-16 (No. 217-02672/02673) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02673) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 04-Apr-18 (No. 217-02683) 04-Apr-17 (No. 273-7248_Dec17) 26-Oct-17 (No. 273-7248_Dec17) 26-Oct-17 (No. 273-7248_Dec17) 26-Oct-17 (No. 273-7248_Dec17) 26-Oct-17 (No. 273-7248_Dec17) 26-Oct-16 (in nouse check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jan-15 (in house check Oct-16) 15-Jan-14 (in house check Oct-17) Function	Scheckled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-10 Decc-10 Decc-10
Calibration Equipment used (M&TE Pamary Standards Power sensor NRP-291 Power sensor NRP-291 Power sensor NRP-291 Retenence 20 dB Attenuator Type-M nismatch combination Retexence Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A RF generator R83 SAT-06 Network Analyzer Agilent E8358A Calibrated by:	E orilical for onfbrakton) ID # SN: 104778 SN: 103244 SN: 103245 SN: 5058 (204) SN: 5058	Car Date (Certificate No.) 04-Apr-16 (No. 217-02672/02672) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02672) 04-Apr-18 (No. 217-02682) 04-Apr-18 (No. 217-02682) 04-Apr-18 (No. 217-02682) 04-Apr-18 (No. 217-02682) 04-Apr-17 (No. 2X3-7348_Dec17) 26-Oct-17 (No. DAE4-601_Oct17) 26-Oct-17 (No. DAE4-601_Oct17) 26-Oct-16 (In house check Oct-16) 07-Oct-15 (In house check Oct-16) 07-Oct-15 (In house check Oct-16) 15-Jun-15 (In house check Oct-16) 15-Jun-15 (In house check Oct-17) Function Libbryating Technician	Scheckled Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Oec-18 Oct-18 Scheckled Check In house check: Oct-18 In house check: Oct-18 Signature

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



Schweizerischer Kalibrierdien 5 Service suissa d'étalonneg Ċ Servizin svizsero di taratura 5 Swiss Calibration Service

Accessitation No.: SCS 0108

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

Glossary: TSL

tissue simulating liquid sensitivity in TSL / NORM x,y,z ConvF 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) 1EC 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.
- Anlenna 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 leed 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%.

Certificate No: D1750V2-1008, Aug18

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#### Measurement Conditions

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

DASY Version	DASY5	V52,10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Fiat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacor
Zoom Scan Resolution	dx, dy, dz; = 5 mm	
Frequency	1750 MHz ± 1 MHz	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mbolm
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.34 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>1</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.07 W/kg
SAR for opminal Head TSL parameters	normalized to 1W	35.5 W/kg = 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL. SAR measured	condition 250 mW input power	4.B1 W/kg

## Body TSL parameters

The following parameters and calculations were applied.

	Temperatura	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mino/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± <del>0</del> %	1.47 mho/m = 6 %
Body TSL temperature change during test	< 0.5 °C		-

#### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.0 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR everaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 250 mW input power	4.93 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.0 Ω + 1.6 jΩ	
Ratum Loss	+ 32.2 dB	

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	=i6.3 Ω + 0.6 jΩ
Ristum Loss	- 34.7 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1:207 ns	
----------------------------------	----------	--

After long terra use with 100W radiated power, only a slight warming of the dipole near the leadpoint 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 aim 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 aims 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	February 11, 2009

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#### DASY5 Validation Report for Head TSL

Date: 30.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1008

Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz;  $\sigma = 1.34 \text{ S/m}$ ;  $e_r = 38.9$ ;  $p = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

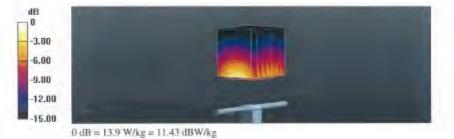
**DASY52** Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 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 = 107.6 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 16.3 W/kg SAR(1 g) = 9.07 W/kg; SAR(10 g) = 4.81 W/kg

Maximum value of SAR (measured) = 13.9 W/kg



Certificate No: D1750V2-1008\_Aug18

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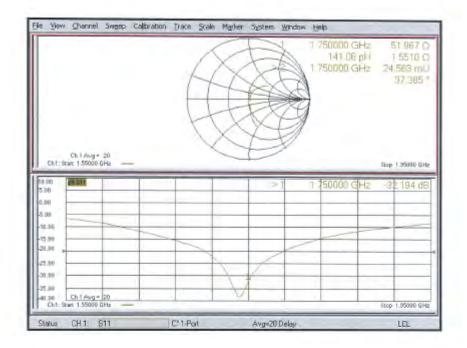
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Impedance Measurement Plot for Head TSL



Certificate No: D1750V2-1008 Aug18

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### **DASY5 Validation Report for Body TSL**

Date: 30.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

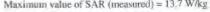
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1008

Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz;  $\sigma = 1.47 \text{ S/m}$ ;  $\epsilon_c = 53.4$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.35, 8.35, 8.35) @ 1750 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) ٠

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 = 101.7 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 15.9 W/kg SAR(1 g) = 9.16 W/kg; SAR(10 g) = 4.93 W/kg Maximum value of SAR (measured) = 13.7 W/kg





Certificate No: D1750V2-1008\_Aug18

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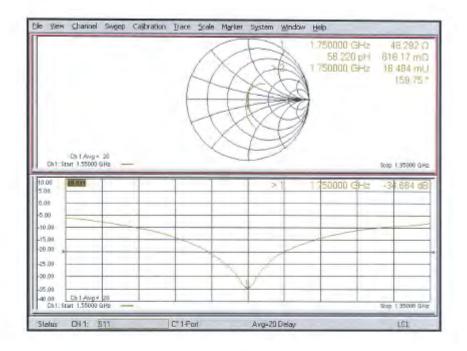
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Impedance Measurement Plot for Body TSL



Certificate No: D1750V2-1008\_Aug18

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# Report No. : E5/2018/90016 Page: 133 of 163

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CALIBRATION O	CERTIFICATI	B	
Object	D1900V2 - SN:5	d173	
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Colibration date:	April 25, 2018		
		ry facility: environment temperature (22 ± 3)*	and the second se
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Primery Standards Power meter NRP Power sensor NRP-201	ID # SN: 104776	Cel Dale (Certificate No.) D4-Apr-15 (No. 217-08579/02673)	Schedulei) Calibration Apr-19
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Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismistich combinistion Reference Probe EX3DV4	ID # -SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5058 (20k) SN: 5068 (20k) SN: 7349	Cal Date (Certificate No.) D4-Apr-18 (No. 217-C6572/02673) D4-Apr-18 (No. 217-C6572) D4-Apr-18 (No. 217-C6573) D4-Apr-18 (No. 217-C6583) D4-Apr-18 (No. 217-C6583) 30-Dia:-17 (No. EX5-7349 [Dec17)	Scheduleit Calibration Apr-19 Apr-19 Apr-19 Apr-18 Apr-18 Dec-18
Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N meenstatch combinistion Reference Probe EX3DV4	ID # SN: 104778 SN: 103244 SN: 103245 SN: 5068 (20k) SN: 5067.2 / 06327	Cal Date (Certificate No.) D4-Apr-18 (No. 217-02572)/02473) D4-Apr-16 (No. 217-02572) D4-Apr-16 (No. 217-02573) D4-Apr-18 (No. 217-02582) D4-Apr-18 (No. 217-02583)	Schedule/I Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19
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Primary Standards Power sensor NRP-201 Power sensor NRP-201 Perver sensor NRP-201 Perver sensor NRP-201 Perver sensor NRP-201 Perver sensor NRP-201 Power mater EPM-442A	ID 8 SN: 104775 SN: 103245 SN: 5068 (20k) SN: 5068 (20k) SN: 5047.2 / 06327 SN: 7349 SN: 601 ID # SN: GB37460704	Cal Date (Certificate No.) D4-Apr-18 (No. 217-C6972/02673) D4-Apr-18 (No. 217-C6972)/02673) D4-Apr-18 (No. 217-C6973) D4-Apr-18 (No. 217-C6982) D4-Apr-18 (No. 217-C6983) 30-Dac-17 (No. 272-C6983) 30-Dac-17 (No. 5X5-7349, Dec17) 28-Oci-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oci-15 (in house check Oci-16)	Schaduseil Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dec-18 Dec-18
Primary Standards Power sensor NRP-201 Power sensor NRP-201 Reference 20 dB Attenuator Type-N mensistic combination Reletence Probe EX3DV4 DAE4 Secondary Standards Power motor EPM-442A Power sensor HP 8481A	ID # SN: 104775 SN: 103244 SN: 103245 SN: 50372 / D6327 SN: 7344 SN: 601 ID # SN: G857460704 SN: U557252763	Cal Date (Certificate No.)           D4-Apr-18 (No. 217-06572/02673)           D4-Apr-18 (No. 217-02672)           D4-Apr-18 (No. 217-02682)           D4-Apr-18 (No. 217-02682)           D4-Apr-18 (No. 217-02683)           30-Dacr-17 (No. 217-02683)           30-Dacr-17 (No. DAC-1601_Oct17)           26-Oct-17 (No. DAC-4601_Oct17)           Check Date (in house)           07-Oct-15 (in house check Oct-16)           07-Oct-15 (in house check Oct-16)	Schedulei) Calibration Apr-19 Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dec-18 Dci-18 Scheduled Check In house check: Oci-18 In house check: Oci-18
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Primary Standards Power sensor NRP-201 Power sensor NRP-201 Pelerance 20 dB Attenuator Type-N meetatch combination Telerance Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 6481A Power sensor HP 6481A PF generator R&S SMT-00	ID 8 SN: 104776 SN: 103245 SN: 5068 (20k) SN: 5067 (2 / 06327 SN: 7349 SN: 601 ID 9 SN: GB57460704 SN: US375292785 SN: W141092317 SN: 100972	Cal Date (Certificate No.) D4-Apr-18 (No. 217-02572)/02673) D4-Apr-16 (No. 217-02572) D4-Apr-16 (No. 217-02573) D4-Apr-18 (No. 217-02582) D4-Apr-18 (No. 217-02582) D4-Apr-18 (No. 217-02583) 30-Dac+77 (No. DAE4-601_0-017) 26-Dat-17 (No. DAE4-601_0-017) Check Date (In house check Dat-16) 07-0at-15 (In house check Dat-16) 07-0at-15 (In house check Dat-16) 15-Jun-15 (In house check Dat-16)	Schedule/I Calibration Apr-19 Apr-19 Apr-19 Apr-19 Dec-18 Dec-18 Dec-18 Dec-18 Dec-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
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Certificate No: D1900V2-50173\_Apr16

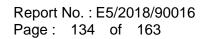
Page 1 of 8

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Calibration Laboratory of Schmid & Partner

Engineering AG Zeugheusstrasez 43, 8604 Zurich, Switzerland



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Glossary: TSL

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "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 885664, "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 cartificate. 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%.

Camilcate No: D1900V2-5d173 April

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#### Measurement Conditions

DASY system configuration, as far as not given on page

DASY5	V52:10.0
Advanced Extrapolation	
Modular Fist Phantom	
10 mm	with Spacer
ctx, dy', dz = 5 mm	
1900 MHz ± T MHz	
	Advanced Extraporation Modular Flat Phantom 10 mm dx, dy, dz = 5 mm

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	411±8%	1.35 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C.		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.7 W/kg = 17.0 % (k=2)
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL	opertition	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL SAR measured	condition 250 mW input powar	5.21 W/kg

#### Body TSL parameters

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.3 ± 6 %	1.47 mho/m±6 %
Body TSL temperature change during test	£0.5 °C	-	

#### SAR result with Body TSL

SAR averaged over 1 cm <sup>2</sup> (1 g) of Body TSL	Contition	
SAR measured	250 mW input power	9.93 W/kg
SAR for nominal Body TSL parameters	W1 of besilemon	40.9 W/kg ± 17.0 % (k=2)
	The second se	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Body TSL SAR measured	condition 250 mW input power	5.30 W/kg

Certificate No: D1900V2-5d173\_April8

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## Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.4 Q + 5 1 JQ
Return Loss	- 25.8 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed pully	47.341 + 7.2 10
Return Loss	- 22 1 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1,195 ns	
and the second second second second	1.104 110-	

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The clipple is made of standard semirigid conxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipola. The antenna is therefore short-circuited for DC-signals, Or nome 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	June 08, 2012

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#### **DASY5 Validation Report for Head TSL**

Date: 25.04.2018

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d173

Communication System: UID 0 - CW: Frequency: 1900 MHz Medium parameters used: f = 1900 MHz;  $\sigma = 1.35$  S/m;  $v_c = 41.1$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.18, 8.18, 8.18); 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 52.10.0(1446); SEMCAD X 14.6.10(7417) .

# 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 = 110.9 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 18.3 W/kg SAR(1 g) = 9.89 W/kg; SAR(10 g) = 5.21 W/kg

Maximum value of SAR (measured) = 15.2 W/kg



0 dB = 15.2 W/kg = 11.82 dBW/kg

Certificate No: D1900V2-5d173\_Apr18

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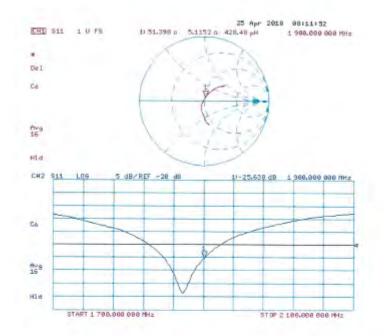
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#### Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d173\_Apr18.

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#### **DASY5 Validation Report for Body TSL**

Date: 25.04.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d173

Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz;  $\sigma = 1.47$  S/m;  $\epsilon_f = 55.3$ ; p = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.15, 8.15, 8.15); 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 52.10.0(1446); SEMCAD X 14.6.10(7417)

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 = 104.6 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 17.7 W/kg SAR(1 g) = 9.93 W/kg; SAR(10 g) = 5.3 W/kg Maximum value of SAR (measured) = 14.7 W/kg



0 dB = 14.7 W/kg = 11.67 dBW/kg

Certificate No: D1900V2-5d173\_Apr18

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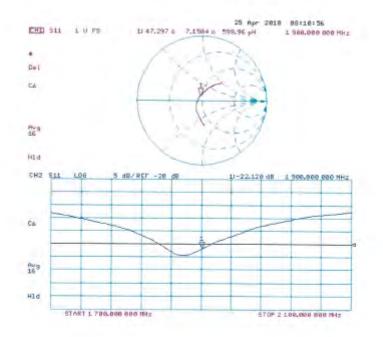
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## Impedance Measurement Plot for Body TSL



Certificate No: D1900V2-5d173\_Apr18

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# Report No. : E5/2018/90016 Page: 141 of 163

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Calibration procedure(s)	QA CAL-05.v10 Calibration proce	dure for dipole validation kits ab	ove 700 MHz
Calibration date:	April 24, 2018		
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Certificate No: D2450V2-727\_Apr18

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# Report No. : E5/2018/90016 Page: 142 of 163

Calibration Laboratory of Schmid & Partner Engineering AG astrases 43, 8904 Zurich, Switzerland



Sanweizerischer Kallbrierdi S Service suisse d'étalormage C Servizio svizzero di taratura s Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swites Accreditation Service is one of the signatories to the EA

Multilateral Agreement for the recognition of calibration conflicates Glossary:

TSL

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

### 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
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate b) (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 SAB 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%.

Certificate No: 02450V2-727\_April

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#### Measurement Conditions

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

DASY Version	DASYS	V52.10.0
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	38.3 ± 8 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	Wt of bezilamon	52.1 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 250 mW input power	6.16 W/kg
		5.16 W/kg 24.3 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	52.5 ± 6 %	2.01 mhc/m = 6 %.
Body TSL temperature change during test	< 0,5 °C	_	

#### SAR result with Body TSL

SAR sveraged over 1 cm <sup>1</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.8 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	conclition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 250 mW input power	6.00 W/kg

Certificale No: D2450V2-727\_Apr18

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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.2 Ω + 2.7 JΩ
Return Loss	= 25.1 dB

#### Antenna Parameters with Body TSL

Impledance, transformed to lead point	51.2 (Q + 5.6 (Q
Return Loss	- 25.0 dB

#### General Antenna Parameters and Design

Electrical Delay (one and alon)	Electrical Delay (one direction)	1.149 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard seminoid 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 capsare added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurment 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 emits, because they might bond or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG	
Manufactured on	January 09, 2003	

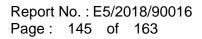
Certificate No: D2450V2+727\_Apr18

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Date: 24.04.2018

# SG

## **DASY5 Validation Report for Head TSL**

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:727

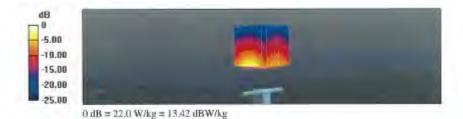
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz;  $\sigma = 1.86 \text{ S/m}$ ;  $\epsilon_t = 38.3$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.88, 7.88, 7.88); 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 52.10.0(1446); SEMCAD X 14.6.10(7417)

## 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 = 116.0 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 26.7 W/kg SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.16 W/kg Maximum value of SAR (measured) = 22.0 W/kg



Certificate No: D2450V2-727\_Apr18

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

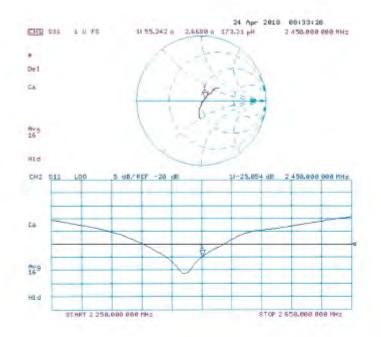
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## Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-727\_Apr18

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## **DASY5 Validation Report for Body TSL**

Date: 24.04.2018

Test Laboratory: SPEAG, Zurich, Switzerland

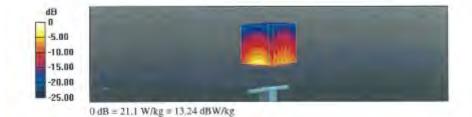
## DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:727

Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz;  $\sigma = 2.01$  S/m;  $v_r = 52.5$ ;  $\rho = 1000$  kg/m<sup>3</sup> 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); 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 52.10.0(1446); SEMCAD X 14.6.10(7417)

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 = 108.4 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 25.5 W/kg SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6 W/kg Maximum value of SAR (measured) = 21.1 W/kg



Certificate No: D2450V2-727 April8

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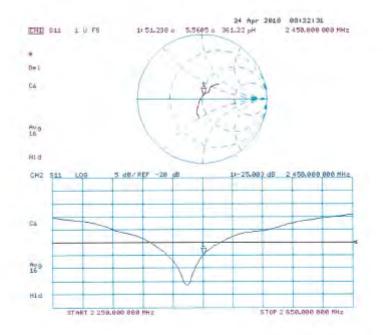
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## Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-727\_Apr18

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# Report No. : E5/2018/90016 Page: 149 of 163

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bjed	D5GHzV2 - SN:1	023	
Celibration procedure(s)	QA CAL-22.v2 Calibration proce	dure for dipole validation kits bat	veen 3-6 GHz
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Calibration date:	January 25, 2018		
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Primery Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Primery Standards Primer meter NRP	1D #	04-Apr-17 (No. 217-02521/02522)	Apr-18
Primery Standards Power meter NRP Priwer sensor NRP-201	ID # IBN: 104778 ISN: 103244	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521)	Apr-18 Apr-18
Primery Standards Power meder NRP Power sensor NRP-291 Power sensor NRP-291	ID # EN: 104778 SN: 105244 SN: 103245	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522)	Apr-1E Apr-1E Apr-18
Primery Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator	ID # EN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k)	04-Apr-17 (No. 217-02521)02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528)	Арг-18 Арг-18 Арг-18 Арг-18
Primery Standards Priver meter NPP Priver sensor NPP-291 Priver sensor NPP-291 Referance 20 dB Attenustor Type-N mismatch combination	ID # EN: 104778 SN: 105244 SN: 105246 SN: 5058 (20k) SN: 5047.2 / 06327	04-Apr-17 (No. 217-02521)02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528) 07-Apr-17 (No. 217-02529)	Арг-18 Арг-18 Арг-18 Арг-16 Арг-16
Primery Standards Power meter NRP Power sensor NRP-2291 Power sensor NRP-2291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	ID # EN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k)	04-Apr-17 (No. 217-02521)02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02528)	Арг-18 Арг-18 Арг-18 Арг-18
Primery Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	ID # EN: 104778 SN: 105644 SN: 103645 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3047.2 / 06327 SN: 3045	84-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 213-02529)	Apr-18 Apr-18 Apr-18 Apr-18 Apr-18 Dec-18 Dec-18
Primery Standards Power meter NRP Power sensor NRP-201 Power sensor NRP-201 Recence 20 dB Attenuator Type-N mismatich combination Reference Probe EX3DV4 DAE4 Secondary Standards	ID A EN: 104778 SN: 103244 SN: 103246 SN: 5058 (20k) SN: 5057 2 / 06327 SN: 5047 2 / 06327 SN: 5055 SN: 601	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apt-17 (No. 217-02521) 07-Apt-17 (No. 217-02522) 07-Apt-17 (No. 217-02529) 07-Apt-17 (No. 217-02529) 30-Dec-17 (No. EX3-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17)	Apr-18 Apr-18 Apr-18 Apr-16 Apr-16 Dec-18 Oct-18
Primary Standards Priver meter NPP Priver sensor NRP-201 Priver sensor NRP-201 Retraintice 20 dB Attenuistor Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Prover meter EPM-442A	ID # EN: 104778 EN: 105644 SN: 105645 SN: 5058 (20k) SN: 5058 (20k) SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 501 ID #	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02522) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. EX3-3503_Dec17) 26-Oct-17 (No. DAE4-601_Oct17) Check Date (in house)	Apr-18 Apr-18 Apr-18 Apr-18 Dec-18 Dec-18 Oct-18 Scheduled Offeck In house check: Oct-18 In house check: Oct-18
Primary Standards Primer meter NRP Primer sensor NRP-291 Power sensor NRP-291 Relatantics 20 dB Attenustor Type-N mismatich combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-448A Power sensor HP 8481A.	ID # EN: 104778 SN: 105644 SN: 103645 SN: 5056 (20k) SN: 5047 2 / 06327 SN: 5047 2 / 0747	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 07-Apr-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	Apr-18 Apr-18 Apr-18 Apr-16 Dec-18 Oct-18 Oct-18 Scheduled Oneck In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Primary Standards. Power meter NRP Power sensor NRP-201 Power sensor NRP-201 Power sensor NRP-201 Reterence 20 dB Atternator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-448A Power sensor HP 0461A APF generator R&S SMT-06	ID # EN: 104778 EN: 105244 SN: 105246 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 601 ID # SN: 6B37460704 SN: 6B37460704 SN: 0537292783 SN: MY41092317 SN: 106972	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apt-17 (No. 217-02521) 07-Apt-17 (No. 217-02529) 07-Apt-17 (No. 217-02529) 07-Apt-17 (No. 217-02529) 07-Opt-17 (No. 217-02529) 26-Opt-17 (No. 225303_Dec17) 26-Opt-17 (No. DAE4-601_Opt17) Check Date (in house) 07-Opt-15 (in house check Opt-16) 07-Opt-15 (in house check Opt-16) 15-Jun-15 (in house check Opt-16)	Apr-18 Apr-18 Apr-18 Apr-16 Apr-16 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Primary Standards Primer meter NPP Power sensor NPP-291 Pewer sensor NPP-291 Reteamce 20 dB Atternator Type-N mismatich combination Reteinence Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power meter EPM-442A Power sensor HP 0461A AF generator R&S 3MT-06	ID # EN: 104778 SN: 105644 SN: 103645 SN: 5056 (20k) SN: 5047 2 / 06327 SN: 5047 2 / 0747	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 30-Dec-17 (No. 217-02529) 07-Apr-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	Apr-18 Apr-18 Apr-18 Apr-16 Dec-18 Oct-18 Oct-18 Scheduled Oneck In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Primary Standards Priver meter NPP Priver sensor NPP-201 Priver sensor NPP-201 Retraintice 20 dB Attenustor Type-N mismatich combination Retreince Probe EX3DV4 DAE4 Secondary Standards Priver meter EPM-442A Priver meter EPM-442A Priver meter EPM-442A Priver sensor HP 8481A Priver sensor HP 8481A	ID # EN: 104778 SN: 105344 SN: 105346 SN: 5058 (20k) SN: 5047 2 / 06327 SN: 5047 2 / 06327 SN: 601 ID # SN: 6B37460704 SN: 0537289783 SN: MY41092317 SN: 106672 SN: 106672 SN: US37360685 Name	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No.	Apr-18 Apr-18 Apr-18 Apr-16 Apr-16 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Primary Standards Primer meter NPP Power sensor NPP-291 Pewer sensor NPP-291 Reteamce 20 dB Atternator Type-N mismatich combination Reteinence Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power meter EPM-442A Power sensor HP 0461A AF generator R&S 3MT-06	ID 4 EN: 104778 EN: 105844 SN: 105846 SN: 5058 (20k) SN: 5058 (20k) SN: 5047 2 / 06327 SN: 601 ID # SN: 6637460704 SN: 0537460704 SN: 0537460704 SN: 0537282783 BN: MY41092317 SN: 106972 SN: 0537360585	B4-Apr-1/f (No. 217-02521/02522)           B4-Apr-17 (No. 217-02521)           D4-Apr-17 (No. 217-02522)           D7-Apr-17 (No. 217-02528)           D7-Apr-17 (No. 217-02529)           D9-Dec-17 (No. DAE4-601_Dec17)           Check Date (in house check Cd-16)           D7-Oct-15 (in house check Cd-16)           D7-Oct-15 (in house check Cd-16)           D9-Oct-10 (in house check Cd-17)	Apr-18 Apr-18 Apr-18 Apr-18 Dec-18 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Primery Standards Prover meter NIPP Prover sensor NIPP-201 Prover sensor NIPP-201 Restancios 20 dB Attenustor Type-N mismatich combination Reference Probe EX3DV4 DAE4 Secondary Standards Prover meter EPM-442A Prover sensor HP 8481A Prover sensor HP 8481A Prover sensor HP 8481A RF generator R&S SMT-66 Network Analyzer HP-8753E	ID # EN: 104778 SN: 105344 SN: 105346 SN: 5058 (20k) SN: 5047 2 / 06327 SN: 5047 2 / 06327 SN: 601 ID # SN: 6B37460704 SN: 0537289783 SN: MY41092317 SN: 106672 SN: 106672 SN: US37360685 Name	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 30-Dec-17 (No.	Apr-18 Apr-18 Apr-18 Apr-18 Dec-18 Dec-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Primary Standards Power mater NRP: 201 Power censor NRP: 201 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sansor HP 8481A Power sansor	ID # EN: 104778 EN: 105244 SN: 105245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 6047.2 / 06327 SN: 601 ID # SN: 6037460704 SN: 0537292783 EN: WS37292783 EN: WS37290685 Name Jorion Kastinal	04-Apr-17 (No. 217-02521/02522) 04-Apr-17 (No. 217-02521) 04-Apr-17 (No. 217-02521) 07-Apr-17 (No. 217-02529) 07-Apr-17 (No. 217-02529) 07-Dec-17 (No. 217-02529) 07-Oct-17 (No. 237-02529) 07-Oct-17 (No. DAE4-601_Oct17) Check Date (in house) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 16-Oct-01 (in house check Oct-17) Function Laboratory Technicase	Apr-18 Apr-18 Apr-18 Apr-18 Dec-18 Dec-18 Oct-18 Oct-18 Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18

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# Report No. : E5/2018/90016 Page: 150 of 163

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Schweizerischer Kalibrierdianst Service subse d'ataionnage Servizio evizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

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## Glossarvt

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
- EC 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%.

Certificate No: D5GHzV2-1023 Jan18

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#### Measurement Conditions

DASY system	configuration	, as far	as not	given	on page 1
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DASY Version	DASY5	V52,10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	T0 mm	with Spacer
Zoom Scan Resolution	dx. dy = 4.0 mm, dz = 1,4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

## Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 °C	38.0	4.66 mino/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	4.50 mha/m ± 8 %
Head TSL temperature change during lest	<0.5 ℃	-	-

## SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7:72 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	77.3 W/kg = 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR everaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.22 W/kg

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#### Head TSL parameters at 5300 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mbo/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	4.60 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	-

### SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.9 W / kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.32 W/Ag

## Head TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	4.90 mhaim ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	+

## SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm <sup>2</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.9 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.34 W/kg

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## Head TSL parameters at 5800 MHz

The following	parameters	and	calculations	were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5±6%	5.11 mho/m ±⊚%
Head TSL temperature change during test	< 0.5 °C	(and	-

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm <sup>2</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW Input power	7.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.0 W/kg ± 19.9 % (k=2)
10 1 10 1 10 1 10 1	and the second	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2,25 W/kg

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## Body TSL parameters at 5200 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3±6%	5.41 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		-

## SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm <sup>2</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	70.5 W/kg ± 19.9 % (k+2)
SAR averaged over 10 cm <sup>2</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.00 W/kg

## Body TSL parameters at 5300 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47 1 ± 6 %	5.54 mho/m = 6 %
Body TSL temperature change during test	< 0.5 °C	-	0-0-0

## SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW Input power	7.34 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.4 W/kg ± 19.5 % (k=2)

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## Body TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.6 ± 6 %	5.94 mha/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	- special	

## SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.81 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	77.6 W/kg ± 19.9 % (k=2)
the second se		
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.19 W/kg

# Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mhoim
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.2 ± 6 %	6.22 mhaim ± 6 %
Body TSL temperature change during test	< 0.5 °C	-	-

#### SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm <sup>2</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.1 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>2</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Body TSL SAR measured	condition 100 mW input power	2.07 W/kg

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# Appendix (Additional assessments outside the scope of SCS 0108)

# Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.1 Ω - 8.1 jΩ
Return Loss	- 21.9 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	50.5 Ω - 2.3 jΩ
Return Loss	- 32.7 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.9 Ω - 0.7 μΩ
Return Loss	- 28.4 dB

## Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.3 Ω + 2.6 jΩ	
Return Loss	- 25.1 dB	

# Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.8 Ω - 6.9 jΩ.	
Return Loss	- 23.2 dB	

# Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to leed point	50.9 Ω - 0.9 jΩ	
Return Loss	- 37.9 dB	

# Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	56.0 Ω + 0.5 JΩ	
Return Loss	- 24,9 dB	

# Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to leed point	56.6 Ω + 2.3 μΩ
Return Loss	- 23.7 dB

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### General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 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	February 05, 2004

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## **DASY5 Validation Report for Head TSL**

Date: 25.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1023

Communication System: UID 0 = CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz Medium parameters used: f = 5200 MHz; σ = 4.5 S/m; ε = 36.3; p = 1000 kg/m<sup>3</sup>, Medium purameters used: f = 5300 MHz; a = 4.6 S/m; a = 36.2; p = 1000 kg/m Medium parameters used: i = 5600 MHz; v = 4.9 S/m; t, = 35.8; p = 1000 kg/m<sup>3</sup> Medium parameters used: f = 5800 MHz;  $\sigma = 5.11$  S/m;  $e_r = 35.5$ ;  $\rho = 1000$  kg/m<sup>2</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.75, 5.75, 5.75); Calibrated: 30.12.2017. . ConvF(5.5, 5.5, 5.5); Calibrated: 30.12.2017, ConvF(5.05, 5.05, 5.05); Calibrated: 30.12.2017. ConvF(4.96, 4,96, 4,96); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electromics: DAE4 Sn601; Calibrated: 26.10.2017.
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52,10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 70.47 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 27.5 W/kg SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.22 W/kg Maximum value of SAR (measured) = 17.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm\_dz=1.4mm Reference Value = 74.63 V/m; Power Drift = 40.06 dB Peak SAR (extrapolated) = 29.6 W/kg SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.32 W/kg Maximum value of SAR (measured) = 18.6 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid; dx=4mm, dy=4mm, dz=1.4mm Reference Value = 70.79 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 8.19 W/kg; SAR(10 g) = 2.34 W/kg Maximum value of SAR (measured) = 19.6 W/kg

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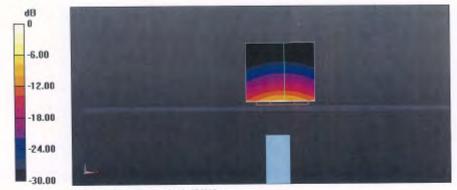
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Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.22 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 31.2 W/kg SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.25 W/kg Maximum value of SAR (measured) = 19.0 W/kg



0 dB = 17.7 W/kg = 12.48 dBW/kg



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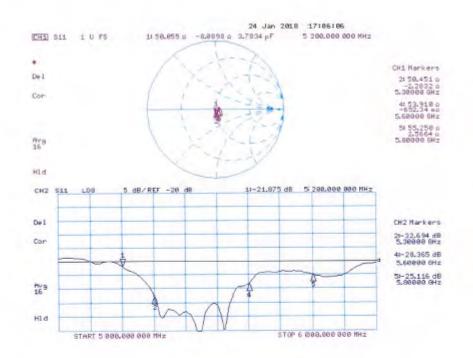
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#### Impedance Measurement Plot for Head TSL



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## **DASY5 Validation Report for Body TSL**

Date: 23.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1023

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz Medium parameters used: f = 5200 MHz;  $\sigma = 5.41 \text{ S/m}$ ;  $\epsilon_i = 47.3$ ;  $\rho = 1000 \text{ kg/m}^3$ , Medium parameters used: f = \$300 MHz; o = 5.54 S/m; e<sub>t</sub> = 47.1; p = 1000 kg/m<sup>3</sup> Medium parameters used: f = 5600 MHz;  $\sigma = 5.94 \text{ S/m}$ ;  $\varepsilon_r = 46.6$ ;  $p = 1000 \text{ kg/m}^3$ . Medium parameters used: f = 5800 MHz;  $\sigma = 6.22$  S/m;  $\epsilon_r = 46.2$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.35, 5.35, 5.35); Calibrated: 30.12.2017. ConvF(5.15, 5.15, 5.15); Calibrased: 30.12.2017, ConvF(4.65, 4.65); Calibrated: 30.12.2017, ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Plantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Senal: 1002
- DASY52 52,10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 66.00 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 26.4 W/kg SAR(1 g) = 7.14 W/kg; SAR(10 g) = 2 W/kg Maximum value of SAR (measured) = 16.8 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1,4mm Reference Value = 65.19 V/m: Power Drift = -0.06 dB Peak SAR (extrapolated) = 28.4 W/kg SAR(1 g) - 7.34 W/kg; SAR(10 g) = 2.06 W/kg Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 66.21 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 32.8 W/kg SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.19 W/kg Maximum value of SAR (measured) = 19.1 W/kg

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Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 64.05 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 32.3 W/kg SAR(1 g) = 7.46 W/kg; SAR(10 g) = 2.07 W/kg Maximum value of SAR (measured) = 18.8 W/kg



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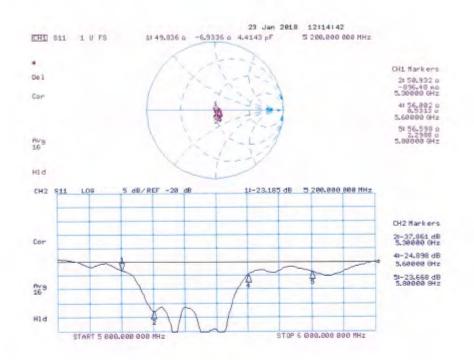
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## Impedance Measurement Plot for Body TSL



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