SAR TEST REPORT

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

Equipment Under Test	Mobile Tablet
Brand Name	DT Research Inc.
Model No.	DT395BV / Atlas 91i
Model difference	The only difference is the color, and there is no metal content in the color.
Company Name	DT Research Inc.
Company Address	6F, NO.1, Ning-Po E. Street, Taipei 100, Taiwan
Standards	IEEE /ANSI C95.1 , C95.3, IEEE 1528 2003, KDB248227D01v02r01, KDB616217D04v01r01, KDB865664D01v01r03, KDB865664D02v01r01, KDB941225D01v03,KDB941225D05v02r03, KDB447498D01v05r02
FCC ID	YE3800E
Date of Receipt	Jun. 23, 2015
Date of Test(s)	Jul. 07, 2015 ~ Jul. 17, 2015
Date of Issue	Jul. 29, 2015

In the configuration tested, the EUT 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.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS Taiwan Electronic & Communication Laboratory or testing done by SGS Taiwan Electronic & Communication Laboratory in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Electronic & Communication Laboratory in writing.

Signed on behalf of SGS

Sr. Engineer	**Sr. Engineer**
Kevin Li	John Yeh
Kevin Li	**John Yeh**
Date: Jul. 29, 2015	**Date: Jul. 29, 2015**

Version

Report Number	Revision	Date	Memo
E5/2015/60010	00	2015/7/22	Initial creation of test report.
E5/2015/60010	01	2015/7/29	1st modification

This test report contains a reference to the previous version test report that it replaces.

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Contents

1. General Information

1.1 Testing Laboratory

SGS Taiwan Ltd. Electronics & Communication Laboratory	
No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan	
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1.2 Details of Applicant

Company Name	DT Research Inc.
Company Address	6F, NO.1, Ning-Po E. Street, Taipei 100, Taiwan

1.3 Description of EUT

Equipment Under Test	Mobile Tablet	
Brand Name	DT Research Inc.	
Model No.	DT395BV / Atlas 91i	
Model difference	The only difference is the color, and there is no metal content in the color. DT395BV: Black Atlas 91i: Black + red	
FCC ID	YE3800E	
Mode of Operation	☒LTE ☒CDMA 1xRTT ☒CDMA 1x EVDO Rev.0/ Rev.A ☒WLAN802.11a/b/g/n(20M/40M)/ac(20M/40M/80M) ☒Bluetooth	
Duty Cycle	LTE	1
	CDMA 1xRTT/ EVDO Rev.0/ Rev. A	1
	WLAN802.11 a/b/g/n(20M/40M)/ ac(20M/40M/80M)	1
	Bluetooth	1

TX Frequency Range (MHz)	LTE FDD Band IV	1710	–	1755
	LTE FDD Band XIII	777	–	787
	CDMA (BC0)	824.7	–	848.31
	CDMA (BC1)	1851.25	–	1908.75
	WLAN802.11 b/g/n(20M)	2412	–	2462
	WLAN802.11 n(40M)	2422	–	2452
	WLAN802.11 a/n(20M)/ac(20M) 5.2G	5180	–	5240
	WLAN802.11 n(40M)/ac(40M) 5.2G	5190	–	5230
	WLAN802.11 ac(80M) 5.2G	5210		
	WLAN802.11 a/n(20M)/ac(20M) 5.3G	5260	–	5320
	WLAN802.11 n(40M)/ac(40M) 5.3G	5270	–	5310
	WLAN802.11 ac(80M) 5.3G	5290		
	WLAN802.11 a/n(20M) 5.6G	5500	–	5700
	WLAN802.11 ac(20M) 5.6G	5500	–	5720
	WLAN802.11 n(40M) 5.6G	5510	–	5670
	WLAN802.11 ac(40M) 5.6G	5510	–	5710
	WLAN802.11 ac(80M) 5.6G	5530	–	5690
	WLAN802.11 a/n(20M)/ac(20M) 5.8G	5745	–	5825
	WLAN802.11 n(40M)/ac(40M) 5.8G	5710	–	5795
	WLAN802.11 ac(80M) 5.8G	5775		
	Bluetooth	2402	–	2480

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Channel Number (ARFCN)	LTE FDD Band IV	19957	–	20393
	LTE FDD Band XIII	23205	–	23255
	CDMA (BC0)	1013	–	777
	CDMA (BC1)	25	–	1175
	WLAN802.11 b/g/n(20M)	1	–	11
	WLAN802.11 n(40M)	3	–	9
	WLAN802.11 a/n(20M)/ac(20M) 5.2G	36	–	48
	WLAN802.11 n(40M)/ac(40M) 5.2G	38	–	46
	WLAN802.11 ac(80M) 5.2G	42		
	WLAN802.11 a/n(20M)/ac(20M) 5.3G	52	–	64
	WLAN802.11 n(40M)/ac(40M) 5.3G	54	–	62
	WLAN802.11 ac(80M) 5.3G	58		
	WLAN802.11 a/n(20M) 5.6G	100	–	140
	WLAN802.11 ac(20M) 5.6G	100	–	144
	WLAN802.11 n(40M) 5.6G	102	–	134
	WLAN802.11 ac(40M) 5.6G	102	–	142
	WLAN802.11 ac(80M) 5.6G	106	–	138
	WLAN802.11 a/n(20M)/ac(20M) 5.8G	149	–	165
	WLAN802.11 n(40M)/ac(40M) 5.8G	142	–	159
	WLAN802.11 ac(80M) 5.8G	155		
	Bluetooth	0	–	78

Max. SAR (1 g) (Unit: W/Kg)				
Band	Measured	Reported	Channel	Position
LTE FDD Band IV	0.618	0.618	20050	Lap-held
LTE FDD Band XIII	0.353	0.432	23230	Top side
CDMA (BC0)	0.785	0.968	777	Top side
CDMA (BC1)	0.441	0.443	25	Lap-held

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Max. SAR (1 g) (Unit: W/Kg)					
Antenna	Band	Measured	Reported	Channel	Position
Main	WLAN802.11 b	0.054	0.055	1	Top side
	WLAN802.11 n(40M)	0.126	0.127	6	Top side
	WLAN802.11 a 5.2G	0.141	0.141	48	Lap-held
	WLAN802.11 n(40M) 5.2G	0.112	0.113	46	Top side
	WLAN802.11 a 5.3G	0.122	0.122	56	Top side
	WLAN802.11 n(40M) 5.3G	0.063	0.063	54	Top side
	WLAN802.11 a 5.6G	0.085	0.085	104	Lap-held
	WLAN802.11 n(40M) 5.6G	0.048	0.049	118	Top side
	WLAN802.11 ac(80M) 5.8G	0.093	0.094	155	Top side
Aux	WLAN802.11 b	0.409	0.423	1	Right side
	WLAN802.11 n(40M)	0.376	0.400	6	Right side
	WLAN802.11 a 5.2G	0.080	0.082	44	Lap-held
	WLAN802.11 n(40M) 5.2G	0.095	0.098	46	Right side
	WLAN802.11 a 5.3G	0.138	0.141	52	Right side
	WLAN802.11 n(40M) 5.3G	0.099	0.099	54	Right side
	WLAN802.11 a 5.6G	0.087	0.091	104	Right side
	WLAN802.11 n(40M) 5.6G	0.044	0.047	118	Right side
	WLAN802.11 ac(80M) 5.8G	0.098	0.103	155	Lap-held

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LTE FDD Band IV / Band XIII power table:

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)
20	QPSK	1 RB	0	1720	20050	23.61	24	0
				1732.5	20175	23.57	24	0
				1745	20300	23.72	24	0
			50	1720	20050	23.22	24	0
				1732.5	20175	23.64	24	0
				1745	20300	23.42	24	0
			99	1720	20050	24.00	24	0
				1732.5	20175	23.75	24	0
				1745	20300	23.58	24	0
		50 RB	0	1720	20050	22.06	23	0-1
				1732.5	20175	22.47	23	0-1
				1745	20300	22.50	23	0-1
			25	1720	20050	22.02	23	0-1
				1732.5	20175	22.50	23	0-1
				1745	20300	22.47	23	0-1
			50	1720	20050	22.23	23	0-1
				1732.5	20175	22.47	23	0-1
				1745	20300	22.35	23	0-1
		100RB		1720	20050	22.18	23	0-1
				1732.5	20175	22.58	23	0-1
				1745	20300	22.43	23	0-1
	16-QAM	1 RB	0	1720	20050	22.88	23	0-1
				1732.5	20175	22.78	23	0-1
				1745	20300	22.82	23	0-1
			50	1720	20050	22.21	23	0-1
				1732.5	20175	22.74	23	0-1
				1745	20300	22.82	23	0-1
			99	1720	20050	23.00	23	0-1
				1732.5	20175	22.88	23	0-1
				1745	20300	22.58	23	0-1
		50 RB	0	1720	20050	20.95	22	0-2
				1732.5	20175	21.37	22	0-2
				1745	20300	21.38	22	0-2
			25	1720	20050	20.99	22	0-2
				1732.5	20175	21.48	22	0-2
				1745	20300	21.38	22	0-2
			50	1720	20050	21.26	22	0-2
				1732.5	20175	21.36	22	0-2
				1745	20300	21.36	22	0-2
		100RB		1720	20050	20.99	22	0-2
				1732.5	20175	21.50	22	0-2
				1745	20300	21.32	22	0-2

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)
15	QPSK	1 RB	0	1717.5	20025	22.97	24	0
				1732.5	20175	23.10	24	0
				1747.5	20325	23.38	24	0
			36	1717.5	20025	22.59	24	0
				1732.5	20175	23.13	24	0
				1747.5	20325	23.19	24	0
			74	1717.5	20025	22.81	24	0
				1732.5	20175	23.42	24	0
				1747.5	20325	22.96	24	0
		36 RB	0	1717.5	20025	21.51	23	0-1
				1732.5	20175	21.92	23	0-1
				1747.5	20325	21.92	23	0-1
			18	1717.5	20025	21.35	23	0-1
				1732.5	20175	21.92	23	0-1
				1747.5	20325	21.95	23	0-1
			37	1717.5	20025	21.31	23	0-1
				1732.5	20175	21.79	23	0-1
				1747.5	20325	21.84	23	0-1
		75RB		1717.5	20025	21.44	23	0-1
				1732.5	20175	21.92	23	0-1
				1747.5	20325	21.81	23	0-1
	16-QAM	1 RB	0	1717.5	20025	22.25	23	0-1
				1732.5	20175	22.00	23	0-1
				1747.5	20325	22.03	23	0-1
			36	1717.5	20025	22.05	23	0-1
				1732.5	20175	22.10	23	0-1
				1747.5	20325	22.39	23	0-1
			74	1717.5	20025	22.04	23	0-1
				1732.5	20175	21.88	23	0-1
				1747.5	20325	22.24	23	0-1
		36 RB	0	1717.5	20025	20.42	22	0-2
				1732.5	20175	20.84	22	0-2
				1747.5	20325	20.98	22	0-2
			18	1717.5	20025	20.43	22	0-2
				1732.5	20175	20.95	22	0-2
				1747.5	20325	20.93	22	0-2
			37	1717.5	20025	20.37	22	0-2
				1732.5	20175	21.25	22	0-2
				1747.5	20325	20.87	22	0-2
		75RB		1717.5	20025	20.38	22	0-2
				1732.5	20175	20.84	22	0-2
				1747.5	20325	20.77	22	0-2

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)
10	QPSK	1 RB	0	1715	20000	23.58	24	0
				1732.5	20175	23.33	24	0
				1750	20350	23.79	24	0
			25	1715	20000	23.62	24	0
				1732.5	20175	24.00	24	0
				1750	20350	23.80	24	0
			49	1715	20000	23.39	24	0
				1732.5	20175	23.88	24	0
				1750	20350	23.45	24	0
		25 RB	0	1715	20000	22.37	23	0-1
				1732.5	20175	22.75	23	0-1
				1750	20350	22.50	23	0-1
			12	1715	20000	22.30	23	0-1
				1732.5	20175	23.00	23	0-1
				1750	20350	22.53	23	0-1
			25	1715	20000	22.17	23	0-1
				1732.5	20175	22.77	23	0-1
				1750	20350	22.64	23	0-1
		50RB		1715	20000	22.17	23	0-1
				1732.5	20175	22.45	23	0-1
				1750	20350	22.49	23	0-1
	16-QAM	1 RB	0	1715	20000	22.91	23	0-1
				1732.5	20175	22.91	23	0-1
				1750	20350	22.72	23	0-1
			25	1715	20000	22.41	23	0-1
				1732.5	20175	22.69	23	0-1
				1750	20350	22.53	23	0-1
			49	1715	20000	22.22	23	0-1
				1732.5	20175	22.98	23	0-1
				1750	20350	22.17	23	0-1
		25 RB	0	1715	20000	21.35	22	0-2
				1732.5	20175	21.76	22	0-2
				1750	20350	21.46	22	0-2
			12	1715	20000	21.26	22	0-2
				1732.5	20175	22.00	22	0-2
				1750	20350	21.65	22	0-2
			25	1715	20000	21.18	22	0-2
				1732.5	20175	21.74	22	0-2
				1750	20350	21.60	22	0-2
		50RB		1715	20000	21.15	22	0-2
				1732.5	20175	21.55	22	0-2
				1750	20350	21.48	22	0-2

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)
5	QPSK	1 RB	0	1712.5	19975	23.12	24	0
				1732.5	20175	22.86	24	0
				1752.5	20375	23.02	24	0
			12	1712.5	19975	22.85	24	0
				1732.5	20175	22.83	24	0
				1752.5	20375	23.07	24	0
			24	1712.5	19975	22.65	24	0
				1732.5	20175	23.01	24	0
				1752.5	20375	22.84	24	0
		12 RB	0	1712.5	19975	21.84	23	0-1
				1732.5	20175	22.10	23	0-1
				1752.5	20375	22.00	23	0-1
			6	1712.5	19975	21.82	23	0-1
				1732.5	20175	22.17	23	0-1
				1752.5	20375	21.99	23	0-1
			13	1712.5	19975	21.83	23	0-1
				1732.5	20175	22.24	23	0-1
				1752.5	20375	21.94	23	0-1
		25RB		1712.5	19975	21.59	23	0-1
				1732.5	20175	21.95	23	0-1
				1752.5	20375	21.86	23	0-1
	16-QAM	1 RB	0	1712.5	19975	21.98	23	0-1
				1732.5	20175	21.79	23	0-1
				1752.5	20375	22.10	23	0-1
			12	1712.5	19975	22.05	23	0-1
				1732.5	20175	22.34	23	0-1
				1752.5	20375	21.92	23	0-1
			24	1712.5	19975	21.49	23	0-1
				1732.5	20175	22.16	23	0-1
				1752.5	20375	21.77	23	0-1
		12 RB	0	1712.5	19975	20.83	22	0-2
				1732.5	20175	21.06	22	0-2
				1752.5	20375	21.03	22	0-2
			6	1712.5	19975	20.91	22	0-2
				1732.5	20175	21.09	22	0-2
				1752.5	20375	21.08	22	0-2
			13	1712.5	19975	20.84	22	0-2
				1732.5	20175	21.31	22	0-2
				1752.5	20375	20.89	22	0-2
		25RB		1712.5	19975	20.62	22	0-2
				1732.5	20175	21.03	22	0-2
				1752.5	20375	20.91	22	0-2

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)
3	QPSK	1 RB	0	1711.5	19965	23.06	24	0
				1732.5	20175	22.75	24	0
				1753.5	20385	23.11	24	0
			7	1711.5	19965	23.22	24	0
				1732.5	20175	23.26	24	0
				1753.5	20385	23.02	24	0
			14	1711.5	19965	22.82	24	0
				1732.5	20175	23.22	24	0
				1753.5	20385	22.80	24	0
		8 RB	0	1711.5	19965	21.69	23	0-1
				1732.5	20175	22.03	23	0-1
				1753.5	20385	22.00	23	0-1
			4	1711.5	19965	21.95	23	0-1
				1732.5	20175	22.01	23	0-1
				1753.5	20385	22.01	23	0-1
			7	1711.5	19965	21.89	23	0-1
				1732.5	20175	22.28	23	0-1
				1753.5	20385	21.95	23	0-1
		15RB		1711.5	19965	21.82	23	0-1
				1732.5	20175	22.39	23	0-1
				1753.5	20385	21.91	23	0-1
	16-QAM	1 RB	0	1711.5	19965	22.31	23	0-1
				1732.5	20175	21.87	23	0-1
				1753.5	20385	22.28	23	0-1
			7	1711.5	19965	21.67	23	0-1
				1732.5	20175	22.33	23	0-1
				1753.5	20385	21.63	23	0-1
			14	1711.5	19965	21.66	23	0-1
				1732.5	20175	22.21	23	0-1
				1753.5	20385	21.86	23	0-1
		8 RB	0	1711.5	19965	20.93	22	0-2
				1732.5	20175	21.06	22	0-2
				1753.5	20385	20.96	22	0-2
			4	1711.5	19965	20.99	22	0-2
				1732.5	20175	20.98	22	0-2
				1753.5	20385	20.52	22	0-2
			7	1711.5	19965	20.93	22	0-2
				1732.5	20175	21.01	22	0-2
				1753.5	20385	20.98	22	0-2
		15RB		1711.5	19965	20.77	22	0-2
				1732.5	20175	20.93	22	0-2
				1753.5	20385	21.02	22	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)
1.4	QPSK	1 RB	0	1710.7	19957	22.99	24	0
				1732.5	20175	23.18	24	0
				1754.3	20393	22.87	24	0
			2	1710.7	19957	23.05	24	0
				1732.5	20175	23.08	24	0
				1754.3	20393	22.92	24	0
			5	1710.7	19957	22.67	24	0
				1732.5	20175	23.12	24	0
				1754.3	20393	22.88	24	0
		3 RB	0	1710.7	19957	23.00	23	0-1
				1732.5	20175	22.94	23	0-1
				1754.3	20393	22.98	23	0-1
			2	1710.7	19957	22.98	23	0-1
				1732.5	20175	22.84	23	0-1
				1754.3	20393	22.88	23	0-1
			3	1710.7	19957	22.97	23	0-1
				1732.5	20175	22.98	23	0-1
				1754.3	20393	22.87	23	0-1
		6RB		1710.7	19957	22.02	23	0-1
				1732.5	20175	22.25	23	0-1
				1754.3	20393	21.87	23	0-1
	16-QAM	1 RB	0	1710.7	19957	22.00	23	0-1
				1732.5	20175	21.94	23	0-1
				1754.3	20393	21.72	23	0-1
			2	1710.7	19957	22.05	23	0-1
				1732.5	20175	21.97	23	0-1
				1754.3	20393	21.86	23	0-1
			5	1710.7	19957	22.04	23	0-1
				1732.5	20175	22.09	23	0-1
				1754.3	20393	21.78	23	0-1
		3 RB	0	1710.7	19957	21.91	22	0-2
				1732.5	20175	22.00	22	0-2
				1754.3	20393	21.94	22	0-2
			2	1710.7	19957	21.84	22	0-2
				1732.5	20175	21.93	22	0-2
				1754.3	20393	21.95	22	0-2
			3	1710.7	19957	22.00	22	0-2
				1732.5	20175	21.78	22	0-2
				1754.3	20393	21.88	22	0-2
		6RB		1710.7	19957	21.05	22	0-2
				1732.5	20175	20.91	22	0-2
				1754.3	20393	20.91	22	0-2

FDD Band 13								
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
10	QPSK	1 RB	0	782	23230	22.40	24	0
			25	782	23230	23.25	24	0
			49	782	23230	22.82	24	0
		25 RB	0	782	23230	22.03	23	0-1
			12	782	23230	22.12	23	0-1
			25	782	23230	22.05	23	0-1
		50RB		782	23230	22.06	23	0-1
	16-QAM	1 RB	0	782	23230	22.42	23	0-1
			25	782	23230	22.09	23	0-1
			49	782	23230	22.06	23	0-1
		25 RB	0	782	23230	21.94	22	0-2
			12	782	23230	21.13	22	0-2
			25	782	23230	21.11	22	0-2
		50RB		782	23230	21.06	22	0-2

FDD Band 13								
BW(Mhz)	Modulation	RB Size	RB Offset	Frequency (MHz)	Channel	Conducted power (dBm)	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
5	QPSK	1 RB	0	779.5	23205	22.62	24	0
				782	23230	22.29	24	0
				784.5	23255	22.80	24	0
			12	779.5	23205	22.71	24	0
				782	23230	22.88	24	0
				784.5	23255	22.66	24	0
			24	779.5	23205	22.82	24	0
				782	23230	22.65	24	0
				784.5	23255	22.29	24	0
		12 RB	0	779.5	23205	21.50	23	0-1
				782	23230	21.70	23	0-1
				784.5	23255	21.78	23	0-1
			6	779.5	23205	21.67	23	0-1
				782	23230	21.80	23	0-1
				784.5	23255	21.67	23	0-1
			13	779.5	23205	21.71	23	0-1
				782	23230	21.85	23	0-1
				784.5	23255	21.48	23	0-1
		25RB		779.5	23205	21.39	23	0-1
				782	23230	21.62	23	0-1
				784.5	23255	21.58	23	0-1
	16-QAM	1 RB	0	779.5	23205	21.85	23	0-1
				782	23230	21.40	23	0-1
				784.5	23255	22.06	23	0-1
			12	779.5	23205	21.77	23	0-1
				782	23230	21.60	23	0-1
				784.5	23255	21.50	23	0-1
			24	779.5	23205	21.90	23	0-1
				782	23230	21.97	23	0-1
				784.5	23255	21.62	23	0-1
		12 RB	0	779.5	23205	20.46	22	0-2
				782	23230	20.73	22	0-2
				784.5	23255	20.76	22	0-2
			6	779.5	23205	20.77	22	0-2
				782	23230	20.82	22	0-2
				784.5	23255	20.69	22	0-2
			13	779.5	23205	20.74	22	0-2
				782	23230	20.83	22	0-2
				784.5	23255	20.57	22	0-2
		25RB		779.5	23205	20.63	22	0-2
				782	23230	20.57	22	0-2
				784.5	23255	20.55	22	0-2

CDMA conducted power table:

Band	Channel	Frequency (MHz)	Target Power + Max. Tolerance (dBm)	1xRTT				EVDO	
				SO55	SO55	TDSO/SO32	TDSO/SO32	1x EvDO Rev. 0, FTAP/RTAP	1x EvDO Rev. A, FETAP/RETAP
				RC1	RC3	FCH+SCH	FCH	Subtype 0/1	Subtype 2
CDMA (BC0)	1013	824.7	24.50	23.67	23.59	23.71	23.73	23.82	23.79
	384	836.52	24.50	23.82	23.94	24.03	24.09	24.17	24.11
	777	848.31	24.50	23.31	23.42	23.49	23.52	23.59	23.54
CDMA (BC1)	25	1851.25	24.50	24.23	24.36	24.39	24.42	24.48	24.44
	600	1880	24.50	23.59	23.64	23.77	23.83	23.89	23.86
	1175	1908.75	24.50	24.08	24.17	24.27	24.21	24.35	24.31

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

Antenna / Band	SISO		MIMO
	Chain 0	Chain 1	Chain0+1
WLAN802.11b	V	V	—
WLAN802.11g	V	V	—
WLAN802.11n(20M)	V	V	V
WLAN802.11n(40M)	V	V	V
WLAN802.11a	V	V	—
WLAN802.11n(20M) 5G	V	V	V
WLAN802.11n(40M) 5G	V	V	V
WLAN802.11ac(20M) 5G	V	V	V
WLAN802.11ac(40M) 5G	V	V	V
WLAN802.11ac(80M) 5G	V	V	V

Main Antenna (CH0)

802.11 b		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			1
1	2412	14.5	14.41
6	2437	14.5	14.35
11	2462	14.5	14.32

802.11 g		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			6
1	2412	12.5	12.48
2	2417	14	13.95
6	2437	15	14.76
10	2452	14	13.83
11	2462	11	10.83
1	2412	12.5	12.48

Main Antenna (CH0)

802.11 n(20M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			6.5
1	2412	12.5	12.46
2	2417	14	13.94
6	2437	15	14.98
10	2452	14	13.77
11	2462	11	10.96

802.11 n(40M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			13.5
3	2422	12	11.91
4	2427	13	12.85
6	2437	15	14.96
8	2447	14.5	14.34
9	2452	11	10.73

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Main Antenna (CH0)

802.11 a		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
5.2/5.3/5.6/5.8G			Data Rate (Mbps)
CH	Frequency (MHz)		6
36	5180	12.5	12.44
40	5200	13.5	13.39
44	5220	13.5	13.47
48	5240	13.5	13.49
52	5260	14.5	14.48
56	5280	14.5	14.49
60	5300	14.5	14.38
64	5320	12	11.97
100	5500	12	11.87
104	5520	14.5	14.46
120	5600	14.5	14.4
136	5680	14.5	14.47
140	5700	11.5	11.48
149	5745	14.5	14.34
157	5785	14.5	14.49
165	5825	14.5	14.45

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Main Antenna (CH0)

802.11 n(20M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		6.5
36	5180	12.5	12.48
40	5200	13.5	13.46
44	5220	13.5	13.48
48	5240	13.5	13.49
52	5260	14.5	14.49
56	5280	14.5	14.49
60	5300	14.5	14.46
64	5320	12	11.96
100	5500	12	11.98
104	5520	14.5	14.48
120	5600	14.5	14.48
136	5680	14.5	14.48
140	5700	11.5	11.48
149	5745	14.5	14.47
157	5785	14.5	14.47
165	5825	14.5	14.46

Main Antenna (CH0)

802.11 n(40M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
5.2/5.3/5.6/5.8G			Data Rate (Mbps)
CH	Frequency (MHz)		13.5
38	5190	10.5	10.48
46	5230	14.5	14.46
54	5270	14.5	14.47
62	5310	12	11.97
102	5510	12	11.98
110	5550	14.5	14.48
118	5590	14.5	14.41
134	5670	14.5	14.48
151	5755	15	14.97
159	5795	15	14.96

Main Antenna (CH0)

802.11 ac(20M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
CH	Frequency (MHz)		Data Rate (Mbps) 6.5
36	5180	12.5	12.41
40	5200	13.5	13.42
44	5220	13.5	13.41
48	5240	13.5	13.48
52	5260	14.5	14.47
56	5280	14.5	14.47
60	5300	14.5	14.39
64	5320	12	11.81
100	5500	12	11.97
104	5520	14.5	14.43
120	5600	14.5	14.42
132	5660	14.5	14.45
140	5700	11.5	11.43
149	5745	14.5	14.41
157	5785	14.5	14.44
165	5825	14.5	14.42

Main Antenna (CH0)

802.11 ac(40M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		13.5
38	5190	12	11.81
46	5230	14.5	14.41
54	5270	14.5	14.43
62	5310	12	11.94
102	5510	12	11.94
110	5550	14.5	14.39
118	5590	14.5	14.22
134	5670	14.5	14.43
151	5755	15	14.55
159	5795	15	14.8

802.11 ac(80M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		29.3
42	5210	12	11.73
58	5290	12	11.86
106	5530	12	11.81
122	5610	13.5	13.48
155	5775	15	14.97

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Aux Antenna (CH1)

802.11 b		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			1
1	2412	14.5	14.35
6	2437	14.5	14.25
11	2462	14.5	14.24

802.11 g		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			6
1	2412	13	12.30
2	2417	14	13.63
6	2437	15	14.68
10	2452	14	13.73
11	2462	11	10.71

802.11 n(20M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
CH	Frequency (MHz)		Data Rate (Mbps)
			6.5
1	2412	13	12.22
2	2417	14	13.84
6	2437	15	14.91
10	2452	14	13.65
11	2462	11	10.78

802.11 n(40M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		13.5
3	2422	12	11.81
4	2427	13	12.79
6	2437	15	14.73
8	2447	12	11.96
9	2452	10	9.93

Aux Antenna (CH1)

802.11 a		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
5.2/5.3/5.6/5.8G			
			Data Rate (Mbps)
CH	Frequency (MHz)		6
36	5180	12.5	12.37
40	5200	13.5	13.38
44	5220	13.5	13.4
48	5240	13.5	13.31
52	5260	14.5	14.41
56	5280	14.5	14.24
60	5300	14.5	14.2
64	5320	12	11.81
100	5500	12	11.61
104	5520	14.5	14.3
120	5600	14.5	14.23
136	5680	14.5	14.25
140	5700	11.5	11.23
149	5745	14	13.76
157	5785	14	13.73
165	5825	14	13.83

Aux Antenna (CH1)

802.11 n(20M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
5.2/5.3/5.6/5.8G			
CH	Frequency (MHz)		Data Rate (Mbps)
			6.5
36	5180	12.5	12.45
40	5200	13.5	13.38
44	5220	13.5	13.41
48	5240	13.5	13.46
52	5260	14.5	14.25
56	5280	14.5	14.27
60	5300	14.5	14.48
64	5320	12	11.81
100	5500	12	11.84
104	5520	14.5	14.47
120	5600	14.5	14.46
136	5680	14.5	14.43
140	5700	11.5	11.44
149	5745	14	13.96
157	5785	14	13.98
165	5825	14	13.89

Aux Antenna (CH1)

802.11 n(40M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
CH	Frequency (MHz)		Data Rate (Mbps) 13.5
38	5190	12	11.79
46	5230	14.5	14.37
54	5270	14.5	14.49
62	5310	12	11.82
102	5510	12.5	11.98
110	5550	14.5	14.37
118	5590	14.5	14.25
134	5670	14.5	14.48
151	5755	15	14.86
159	5795	15	14.73

Aux Antenna (CH1)

802.11 ac(20M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		6.5
36	5180	12.5	12.32
40	5200	13.5	13.36
44	5220	13.5	13.38
48	5240	13.5	13.46
52	5260	14.5	14.24
56	5280	14.5	14.21
60	5300	14.5	14.35
64	5320	12	11.75
100	5500	12	11.68
104	5520	14.5	14.42
120	5600	14.5	14.37
132	5660	14.5	14.36
140	5700	11.5	11.39
149	5745	14	13.94
157	5785	14	13.95
165	5825	14	13.74

Aux Antenna (CH1)

802.11 ac(40M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		13.5
38	5190	12	11.7
46	5230	14.5	14.34
54	5270	14.5	14.36
62	5310	12	11.73
102	5510	12.5	11.91
110	5550	14.5	14.18
118	5590	14.5	14.09
134	5670	14.5	14.41
151	5755	15	14.48
159	5795	15	14.53

802.11 ac(80M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output(dBm)
			Data Rate (Mbps)
CH	Frequency (MHz)		29.3
42	5210	12	11.64
58	5290	12	11.69
106	5530	12	11.72
122	5610	13.5	13.25
155	5775	15	14.78

MIMO (CH0 + CH1)

802.11 n(20M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)		
			Data Rate (Mbps)		
CH	Frequency (MHz)		CH0	CH1	CH0 + CH1
1	2412	10.5	7.23	7.22	10.24
2	2417	12	8.87	8.77	11.83
6	2437	12	8.90	8.69	11.81
10	2452	12	8.79	8.69	11.75
11	2462	10.5	7.32	7.13	10.24

802.11 n(40M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)		
			Data Rate (Mbps)		
CH	Frequency (MHz)		CH0	CH1	CH0 + CH1
3	2422	8	4.87	4.31	7.61
4	2427	10	6.66	6.89	9.79
6	2437	12	9.05	8.87	11.97
8	2447	10	6.81	6.73	9.78
9	2452	8	4.79	4.35	7.59

MIMO (CH0 + CH1)

802.11 n(20M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)		
			Data Rate (Mbps)		
CH	Frequency (MHz)		CH0	CH1	CH0 + CH1
36	5180	10	6.71	7.21	9.98
40	5200	10	6.83	7.13	9.99
44	5220	10	6.93	6.91	9.93
48	5240	10	7.05	6.82	9.95
52	5260	11.5	8.16	8.69	11.44
56	5280	11.5	8.07	8.79	11.46
60	5300	11.5	8.13	8.71	11.44
64	5320	10	6.86	6.91	9.90
100	5500	9	5.86	6.07	8.98
104	5520	12	9.02	8.87	11.96
120	5600	12	8.93	8.91	11.93
136	5680	12	8.98	8.81	11.91
140	5700	9.5	6.04	6.69	9.39
149	5745	12	8.93	8.89	11.92
157	5785	12	8.89	8.88	11.90
165	5825	12	9.02	8.94	11.99

MIMO (CH0 + CH1)

802.11 n(40M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm) Data Rate (Mbps)		
CH	Frequency (MHz)		CH0	CH1	CH0 + CH1
38	5190	8.5	5.27	5.54	8.42
46	5230	11.5	8.17	8.35	11.27
54	5270	11.5	8.21	8.41	11.32
62	5310	10	6.62	6.77	9.71
102	5510	10	6.82	6.81	9.83
110	5550	12	8.79	9.12	11.97
118	5590	12	8.61	9.09	11.87
134	5670	12	8.71	9.15	11.95
151	5755	12.5	9.06	9.87	12.49
159	5795	12.5	9.04	9.86	12.48

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MIMO (CH0 + CH1)

802.11 ac(20M)		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm)		
5.2/5.3/5.6/5.8G					
CH	Frequency (MHz)		Data Rate (Mbps)		
			CH0	CH1	CH0 + CH1
36	5180	10	6.63	7.27	9.97
40	5200	10	6.73	7.15	9.96
44	5220	10	6.67	7.14	9.92
48	5240	10	6.65	7.19	9.94
52	5260	11.5	8.26	8.56	11.42
56	5280	11.5	8.31	8.49	11.41
60	5300	11.5	8.29	8.55	11.43
64	5320	10	6.85	6.88	9.88
100	5500	9	5.61	5.84	8.74
104	5520	12	8.75	8.94	11.86
120	5600	12	8.89	8.95	11.93
132	5660	12	8.81	8.91	11.87
140	5700	9.5	6.02	6.21	9.13
149	5745	12	8.75	9.03	11.90
157	5785	12	8.81	8.81	11.82
165	5825	12	8.71	9.11	11.92

MIMO (CH0 + CH1)

802.11 ac(40M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm) Data Rate (Mbps)		
CH	Frequency (MHz)		CH0	CH1	CH0 + CH1
38	5190	8.5	5.12	5.61	8.38
46	5230	11.5	8.10	8.33	11.23
54	5270	11.5	8.17	8.41	11.30
62	5310	10	6.53	6.72	9.64
102	5510	10	6.61	6.81	9.72
110	5550	12	8.76	8.74	11.76
118	5590	12	8.71	8.66	11.70
134	5670	12	8.86	8.71	11.80
151	5755	12.5	9.25	9.64	12.46
159	5795	12.5	9.14	9.65	12.41

802.11 ac(80M) 5.2/5.3/5.6/5.8G		Max. Rated Avg. Power + Max. Tolerance (dBm)	Average Power Output (dBm) Data Rate (Mbps)		
CH	Frequency (MHz)		CH0	CH1	CH0 + CH1
42	5210	10	6.29	7.04	9.69
58	5290	10	7.03	6.91	9.98
106	5530	10	6.41	6.18	9.31
122	5610	12	8.47	8.15	11.32
155	5775	12.5	8.77	9.35	12.08

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#. Bluetooth maximum power table:

Mode	Maximum tune-up power (dBm)
all	6

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1.4 Test Environment

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

1.5 Operation Description

1. WWAN (CDMA 1xRTT / CDMA EVDO rev.0 & rev.A / LTE):

The EUT is controlled by using Radio Communication Tester(R&S CMU200 and Anritsu MT8820C), and the communication between the EUT and the tester is established by air link. **The EUT was tested in the following configurations confirmed via KDB inquiry. (tracking number: 603091)**

Configurations: Back/top/left side_0mm.

2. WLAN (802.11 a/b/g/n/ac):

Use chipset specific software to control the EUT, and makes it transmit in maximum power. **The EUT was tested in the following configurations confirmed via KDB inquiry. (tracking number: 603091)**

Configurations: Back/top/right side_0mm.

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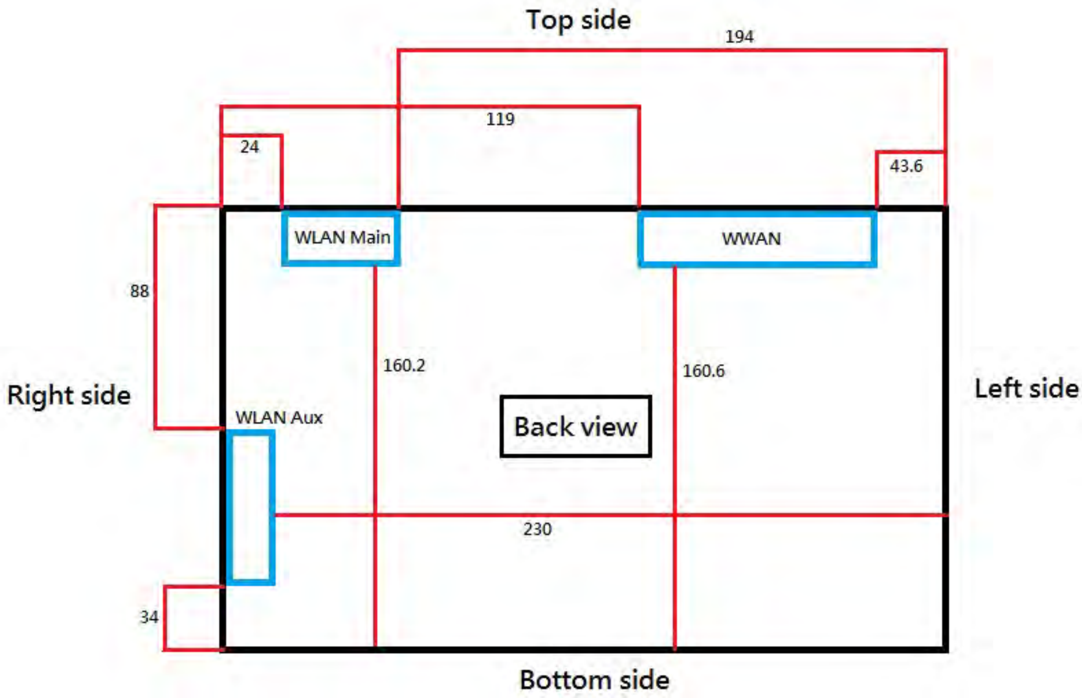

Antenna position plot (Back view)

Note:

1. The protrusion was removed and the battery cover was unloaded to do SAR measurement. The largest separation distance between WLAN Main/WWAN antenna and phantom will be 4.2mm < 5mm, so the test configuration for backside is applicable when the reported SAR is lower than 1.2 W/Kg.(**KDB inquiry 603091**) Ps. When the battery cover is removed, WLAN Aux antenna is touching the phantom for backside testing.

2. Body SAR was measured using Subtype 0/1 Physical Layer configurations for Rev. 0. The 3G SAR test reduction procedure is applied to Rev. A, Subtype 2 Physical layer configuration, with Rev. 0 as the primary mode.

3. For this Ev-Do data device that also support 1x RTT data operations, the 3G SAR test reduction procedure is applied to 1x RTT RC3 and RC1 with Ev-Do Rev. 0, Rev. A as the respective primary modes.(Since SAR is not required for Ev-Do Rev. A, only Rev. 0 need consideration as the primary mode.)

4. LTE modes test according to **FCC KDB 941225 D05v02r03.**
   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 ≤ 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 ≤ 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

- 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 > ½ 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 > ½ 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.

802.11b DSSS SAR Test Requirements:

5. SAR is measured for 2.4 GHz 802.11b DSSS mode using the highest measured maximum output power channel, when the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

6. 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:

7. SAR is not required for 802.11g/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 ≤ 1.2 W/kg.(But we still tested the maximum channel bandwidth n(40) to be more conservative.)

Initial Test Configuration:

8. An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band.
9. SAR is measured using the highest measured maximum output power channel. When the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
10. For WLAN Main & Aux antennas, 5.2G a/n(40), 5.3G a/n(40), 5.6G a/n(40), 5.8G ac(80) are chosen to be the initial test configurations.
11. For WLAN Main & Aux antennas, since the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is < 1.2 W/kg, SAR is not required for that subsequent test configuration.
12. BT and WLAN Aux use the same antenna path and Bluetooth can’t transmit simultaneously with WLAN Aux.
13. Based on KDB447498D01,

(1) SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances≤ 50 mm are determined by:

$$\frac{\text{Max. tune up power(mW)}}{\text{Min. test separation distance(mm)}} \times \sqrt{f(\text{GHz})} \leq 3$$

When the minimum test separation distance is < 5mm, 5mm is applied to determine SAR test exclusion.

(2) For test separation distances > 50 mm, and the frequency at 100 MHz to 1500MHz, the SAR test exclusion threshold is determined according to the following, and as

illustrated in Appendix B of KDB447498 D01.
[(Threshold at 50mm in step1) + (test separation distance-50mm)x($\frac{f(MHz)}{150}$)](mW),

(3) For test separation distances > 50 mm, and the frequency at >1500MHz to 6GHz, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B of KDB447498 D01.

Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Top side			Right side		
			Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?
Cellular BC0 1xEVDO	24.5	281.838	less than 5	51.917	YES	119	395.414	NO
PCS BC1 1xEVDO	24.5	281.838	less than 5	77.876	YES	119	697.788	NO
LTE Band 4	24	251.189	less than 5	66.553	YES	119	696.655	NO
LTE Band 13	24	251.189	less than 5	44.567	YES	119	366.477	NO
WLAN Main 2.45GHz	15	31.623	less than 5	9.924	YES	24	2.067	NO
WLAN Main 5GHz	15	31.623	less than 5	15.264	YES	24	3.180	YES
WLAN Aux 2.45GHz	15	31.623	88	380.992	NO	less than 5	9.924	YES
WLAN Aux 5GHz	15	31.623	88	381.526	NO	less than 5	15.264	YES

Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Left side			Bottom side			Back side		
			Ant. to surface (mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface(mm)	Exclusion threshold (mW)	Require SAR testing?	Ant. to surface(mm)	Exclusion threshold (mW)	Require SAR testing?
Cellular BC0 1xEVDO	24.5	281.838	43.6	5.306	YES	160.6	630.679	NO	less than 5	51.917	YES
PCS BC1 1xEVDO	24.5	281.838	43.6	7.960	YES	160.6	1113.788	NO	less than 5	77.876	YES
LTE Band 4	24	251.189	43.6	8.564	YES	160.6	1112.655	NO	less than 5	66.553	YES
LTE Band 13	24	251.189	43.6	5.735	YES	160.6	584.738	NO	less than 5	44.567	YES
WLAN Main 2.45GHz	15	31.623	194	1440.992	NO	160.2	1102.992	NO	less than 5	9.924	YES
WLAN Main 5GHz	15	31.623	194	1441.526	NO	160.2	1103.526	NO	less than 5	15.264	YES
WLAN Aux 2.45GHz	15	31.623	230	over than 200 mm	NO	34	1.459	NO	less than 5	9.924	YES
WLAN Aux 5GHz	15	31.623	230	over than 200 mm	NO	34	2.245	NO	less than 5	15.264	YES

14. For 2.4/5.2/5.3/5.6/5.8GHz WLAN Main and Aux antennas, the maximum output power of each antenna during simultaneous transmission (for 802.11n/ac) is much less than that used in standalone transmission (802.11a/b/g/n/ac), so it is more conservative to use the sum of 1-g SAR provision to exclude the SAR measurement for 802.11n/ac MIMO.

15. According to KDB447498 D01, testing of other required channels is not required when the reported 1-g SAR for the highest output channel is ≤ 0.8 W/kg, when the transmission band is ≤ 100 MHz.

16. According to KDB865664 D01, 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 ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

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1.6 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). The model EX3DV4 field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= $\sigma (|Ei|^2)/ \rho$ where σ and ρ are the conductivity and mass density of the tissue-simulant.

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

- 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).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage intissue simulating liquid. The probe is equipped with an optical surface detector system.
- A 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.

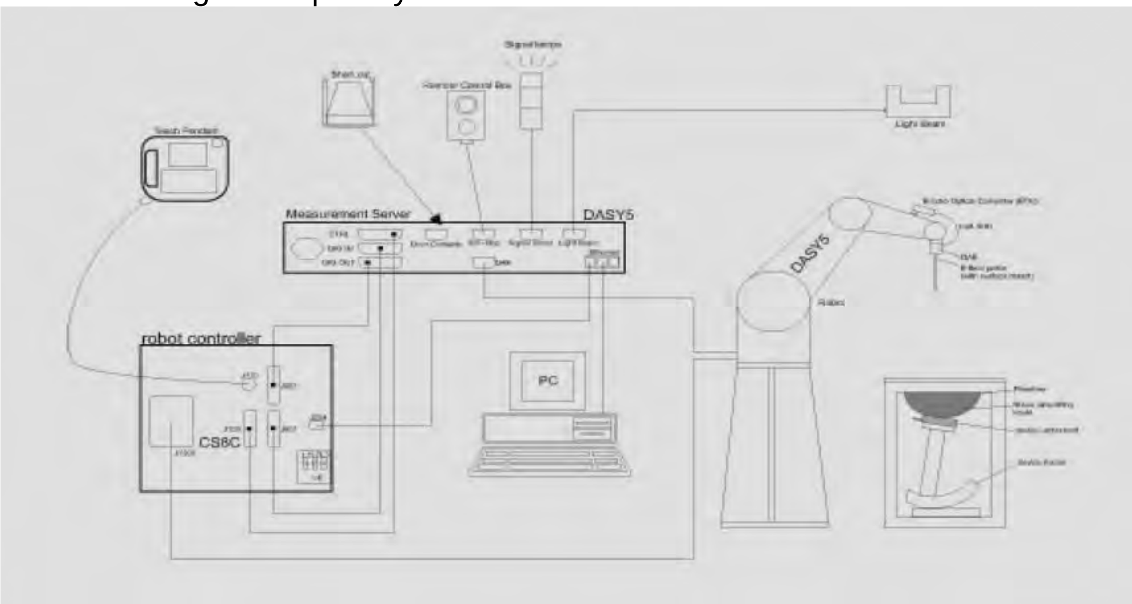

Fig. a The block diagram of SAR system

- 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.
- 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY 5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
  Validation dipole kits allowing to validate the proper functioning of the system.

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1.7 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 HSL 750/835/ 1750/1900/2450/5200/5300/5600/5800 MHz Additional CF for other liquids and frequencies upon request	
Frequency	10 MHz to > 6 GHz	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/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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SAM PHANTOM V4.0C

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	The device holder (Supporter) for Notebook is made by POM (polyoxymethylene resin) , which is non-metal and non-conductive. The height can be adjusted to fit varies kind of notebooks.	 Device Holder

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1.8 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% from the target SAR values. These tests were done at 750/835/1750/1900/2450/5200/5300/5600/ 5800MHz. 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 (SAR values are normalized to 1W forward power delivered to the dipole). During the tests, the ambient temperature of the laboratory was 21.7°C, the relative humidity was 62% and the liquid depth above the ear reference points was ≥ 15 cm ± 5 mm (frequency ≤ 3 GHz) or ≥ 10 cm ± 5 mm (frequency > 3 G Hz) 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.

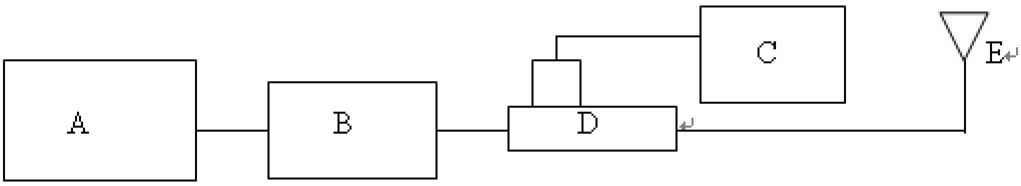
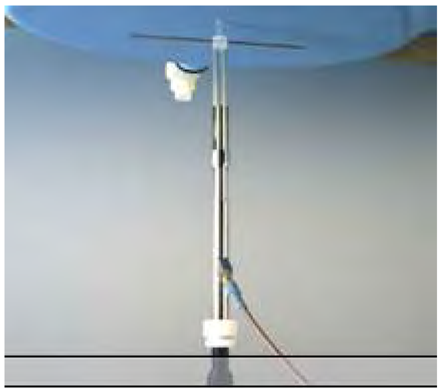


Fig. b The block diagram of system verification

A. Signal generator
B. Amplifier
C. Power meter
D. Dual directional coupling
E. Reference dipole antenna



Photograph of the dipole Antenna

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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
D750V2	1015	750	Body	8.75	2.32	9.28	6.06%	Jul. 07, 2015
D835V2	4d063	835	Body	9.35	2.35	9.4	0.53%	Jul. 08, 2015
D1750V2	1008	1750	Body	37.5	9.73	38.92	3.79%	Jul. 09, 2015
D1900V2	5d027	1900	Body	39.3	9.78	39.12	-0.46%	Jul. 10, 2015
D2450V2	727	2450	Body	51	12.7	50.8	-0.39%	Jul. 13, 2015
D5GHzV2	1023	5200	Body	73.5	7.54	75.4	2.59%	Jul. 14, 2015
		5300	Body	74.6	7.31	73.1	-2.01%	Jul. 15, 2015
		5600	Body	77.9	7.63	76.3	-2.05%	Jul. 16, 2015
		5800	Body	75.6	7.45	74.5	-1.46%	Jul. 17, 2015

Table 1. Results of system validation

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1.9 Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this body-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 (30 KHz-6000 MHz).

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 ≥ 15 cm ± 5 mm (Frequency ≤3G) or ≥ 10 cm ± 5 mm (Frequency >3G) during all tests. (Fig. 2)

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 εr	% dev σ
Body	Jul. 7, 2015	750	55.531	0.963	54.674	0.961	1.54%	0.25%
		782	55.406	0.966	54.559	0.993	1.53%	-2.81%
	Jul. 8, 2015	824.7	55.240	0.969	54.32	0.952	1.67%	1.77%
		835	55.200	0.970	54.285	0.954	1.66%	1.65%
		836.52	55.195	0.972	54.283	0.955	1.65%	1.74%
		848.31	55.159	0.986	54.251	0.971	1.65%	1.56%
	Jul. 9, 2015	1720	53.511	1.469	51.611	1.462	3.55%	0.51%
		1732.5	53.478	1.477	51.582	1.47	3.54%	0.47%
		1745	53.445	1.485	51.549	1.477	3.55%	0.56%
		1750	53.432	1.488	51.538	1.481	3.54%	0.47%
	Jul. 10, 2015	1851.25	53.300	1.520	52.448	1.491	1.60%	1.91%
		1900	53.300	1.520	52.125	1.541	2.20%	-1.38%
	Jul. 13, 2015	2412	52.751	1.914	53.169	1.861	-0.79%	2.77%
		2437	52.717	1.938	53.111	1.887	-0.75%	2.61%
		2450	52.700	1.950	53.074	1.901	-0.71%	2.51%
	Jul. 14, 2015	5200	49.014	5.299	48.505	5.252	1.04%	0.89%
		5220	48.987	5.323	48.488	5.272	1.02%	0.96%
		5230	48.974	5.334	48.464	5.283	1.04%	0.96%
		5240	48.960	5.346	48.457	5.293	1.03%	0.99%
	Jul. 15, 2015	5260	48.933	5.369	48.436	5.312	1.02%	1.06%
		5270	48.919	5.381	48.421	5.322	1.02%	1.10%
		5280	48.906	5.393	48.402	5.332	1.03%	1.13%
		5300	48.879	5.416	48.387	5.353	1.01%	1.16%
	Jul. 16, 2015	5520	48.580	5.673	47.649	5.621	1.92%	0.92%
		5590	48.485	5.755	47.564	5.692	1.90%	1.09%
		5600	48.471	5.766	47.549	5.702	1.90%	1.11%
	Jul. 17, 2015	5775	48.234	5.971	47.332	5.925	1.87%	0.77%
		5800	48.200	6.000	47.307	5.950	1.85%	0.83%

Table 2. Dielectric Parameters of Tissue Simulant Fluid

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The composition of the body tissue simulating liquid:

Frequency (MHz)	Mode	Ingredient						Total amount
		DGMBE	Water	Salt	Preventol D-7	Cellulose	Sugar	
750	Body	–	631.68 g	11.72 g	1.2 g	–	600 g	1.0L(Kg)
850	Body	–	631.68 g	11.72 g	1.2 g	–	600 g	1.0L(Kg)
1750	Body	300.67 g	716.56 g	4.0 g	–	–	–	1.0L(Kg)
1900	Body	300.67 g	716.56 g	4.0 g	–	–	–	1.0L(Kg)
2450	Body	301.7ml	698.3ml	–	–	–	–	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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1.10 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

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between the lowest measured plane and the surface. The next step uses 3D 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.

1.11 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:

1.11.1 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.

$$SAR = \frac{\sigma}{\rho}|E|^2 = c\frac{\delta T}{\delta t}$$

whereby σ is the conductivity, ρ 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:

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

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- 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.
- 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 ρ) , there is no standard for the measurement of the conductivity. Depending on the method and liquid, the error can well exceed ±5%.
- 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].

1.11.2 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:

- The setup must enable accurate determination of the incident power.
- The accuracy of the calculated field strength will depend on the assessment of the dielectric parameters of the liquid.
- 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.

1.12 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 an 10 grams of tissue (defined as a tissue volume in the shape of a cube).

(2) 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.

(3) 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). 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 4.)

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

Table 4. RF exposure limits

Notes:
1. Uncontrolled environments are defined as locations where there is potential exposure of 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.

2. Summary of Results

LTE FDD Band IV

Mode	Bandwidth (MHz)	Modulation	RB Size	RB start	Position	Distance (mm)	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged SAR over 1g (W/kg)		Plot page
												Measured	Reported	
LTE Band 4 (Body)	20MHz	QPSK	1 RB	99	Lap-held	0 mm	20050	1720	24	24	0.00%	0.618	0.618	74
					Top side	0 mm	20300	1745	24	24	0.00%	0.534	0.534	-
					Left side	0 mm	20300	1745	24	24	0.00%	0.042	0.042	-
			50 RB	50	Lap-held	0 mm	20175	1732.5	23	22.5	12.20%	0.458	0.514	-
					Top side	0 mm	20175	1732.5	23	22.5	12.20%	0.359	0.403	-
					Left side	0 mm	20175	1732.5	23	22.5	12.20%	0.028	0.031	-
			100 RB		Lap-held	0 mm	20175	1732.5	23	22.58	10.15%	0.531	0.585	-
					Top side	0 mm	20175	1732.5	23	22.58	10.15%	0.353	0.389	-
					Left side	0 mm	20175	1732.5	23	22.58	10.15%	0.028	0.031	-

LTE FDD Band XIII

Mode	Bandwidth (MHz)	Modulation	RB Size	RB start	Position	Distance (mm)	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged SAR over 1g (W/kg)		Plot page
												Measured	Reported	
LTE Band 13 (Body)	10 MHz	QPSK	1 RB	49	Lap-held	0 mm	23230	782	24	22.82	31.22%	0.132	0.173	-
					Top side	0 mm	23230	782	24	22.82	31.22%	0.265	0.348	-
					Left side	0 mm	23230	782	24	22.82	31.22%	0.044	0.058	-
			25 RB	12	Lap-held	0 mm	23230	782	23	22.12	22.46%	0.213	0.261	-
					Top side	0 mm	23230	782	23	22.12	22.46%	0.353	0.432	75
					Left side	0 mm	23230	782	23	22.12	22.46%	0.057	0.070	-
			50 RB		Lap-held	0 mm	23230	782	23	22.06	24.17%	0.176	0.219	-
					Top side	0 mm	23230	782	23	22.06	24.17%	0.344	0.427	-
					Left side	0 mm	23230	782	23	22.06	24.17%	0.055	0.068	-

CDMA / EVDO (BC0)

Mode		Service	Position	Distance (mm)	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged SAR over 1g (W/kg)		Plot page
										Measured	Reported	
CDMA BC 0	EVDO	Rev. 0 Subtype 0/1	Lap-held	0 mm	384	836.52	24.5	24.17	7.89%	0.319	0.344	-
			Top side	0 mm	1013	824.7	24.5	23.82	16.95%	0.714	0.835	-
			Top side	0 mm	384	836.52	24.5	24.17	7.89%	0.782	0.844	-
			Top side	0 mm	777	848.31	24.5	23.59	23.31%	0.785	0.968	76
			Left side	0 mm	384	836.52	24.5	24.17	7.89%	0.083	0.090	-

CDMA / EVDO (BC1)

Mode		Service	Position	Distance (mm)	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged SAR over 1g (W/kg)		Plot page
										Measured	Reported	
CDMA BC 0	EVDO	Rev. 0 Subtype 0/1	Lap-held	0 mm	25	1851.25	24.5	24.48	0.46%	0.441	0.443	77
			Top side	0 mm	25	1851.25	24.5	24.48	0.46%	0.260	0.261	-
			Left side	0 mm	25	1851.25	24.5	24.48	0.46%	0.050	0.050	-

WLAN802.11 Main Antenna

Antenna	Mode	Position	Distance (mm)	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged SAR over 1g (W/kg)		Plot page
									Measured	Reported	
Main	WLAN802.11 b	Lap-held	0	1	2412	14.5	14.41	2.09%	0.037	0.038	-
		Top side	0	1	2412	14.5	14.41	2.09%	0.054	0.055	78
		Right side	0	1	2412	14.5	14.41	2.09%	0.013	0.013	-
	WLAN802.11 n(40M)	Lap-held	0	6	2437	15	14.96	0.93%	0.081	0.082	-
		Top side	0	6	2437	15	14.96	0.93%	0.126	0.127	79
		Right side	0	6	2437	15	14.96	0.93%	0.018	0.018	-
	WLAN802.11 a 5.2G	Lap-held	0	48	5240	13.5	13.49	0.23%	0.141	0.141	80
		Top side	0	48	5240	13.5	13.49	0.23%	0.086	0.086	-
		Right side	0	48	5240	13.5	13.49	0.23%	0.042	0.042	-
	WLAN802.11 n(40M) 5.2G	Lap-held	0	46	5230	14.5	14.46	0.93%	0.078	0.079	-
		Top side	0	46	5230	14.5	14.46	0.93%	0.112	0.113	81
		Right side	0	46	5230	14.5	14.46	0.93%	0.042	0.042	-
	WLAN802.11 a 5.3G	Lap-held	0	56	5280	14.5	14.49	0.23%	0.105	0.105	-
		Top side	0	56	5280	14.5	14.49	0.23%	0.122	0.122	82
		Right side	0	56	5280	14.5	14.49	0.23%	0.049	0.049	-
	WLAN802.11 n(40M) 5.3G	Lap-held	0	54	5270	14.5	14.47	0.69%	0.058	0.058	-
		Top side	0	54	5270	14.5	14.47	0.69%	0.063	0.063	83
		Right side	0	54	5270	14.5	14.47	0.69%	0.044	0.044	-
	WLAN802.11 a 5.6G	Lap-held	0	104	5520	14.5	14.48	0.46%	0.085	0.085	84
		Top side	0	104	5520	14.5	14.48	0.46%	0.062	0.062	-
		Right side	0	104	5520	14.5	14.48	0.46%	0.039	0.039	-
	WLAN802.11 n(40M) 5.6G	Lap-held	0	118	5590	14.5	14.41	2.09%	0.013	0.013	-
		Top side	0	118	5590	14.5	14.41	2.09%	0.048	0.049	85
		Right side	0	118	5590	14.5	14.41	2.09%	0.034	0.035	-
	WLAN802.11 ac(80M) 5.8G	Lap-held	0	155	5775	15	14.97	0.69%	0.090	0.091	-
		Top side	0	155	5775	15	14.97	0.69%	0.093	0.094	86
		Right side	0	155	5775	15	14.97	0.69%	0.066	0.066	-

WLAN802.11 Aux Antenna

Antenna	Mode	Position	Distance (mm)	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged SAR over 1g (W/kg)		Plot page
									Measured	Reported	
Aux	WLAN802.11 b	Lap-held	0	1	2412	14.5	14.35	3.51%	0.029	0.030	-
		Right side	0	1	2412	14.5	14.35	3.51%	0.409	0.423	87
	WLAN802.11 n(40M)	Lap-held	0	6	2437	15	14.73	6.41%	0.031	0.033	-
		Right side	0	6	2437	15	14.73	6.41%	0.376	0.400	88
	WLAN802.11 a 5.2G	Lap-held	0	44	5220	13.5	13.40	2.33%	0.080	0.082	89
		Right side	0	44	5220	13.5	13.40	2.33%	0.065	0.067	-
	WLAN802.11 n(40M) 5.2G	Lap-held	0	46	5230	14.5	14.37	3.04%	0.094	0.097	-
		Right side	0	46	5230	14.5	14.37	3.04%	0.095	0.098	90
	WLAN802.11 a 5.3G	Lap-held	0	52	5260	14.5	14.41	2.09%	0.105	0.107	-
		Right side	0	52	5260	14.5	14.41	2.09%	0.138	0.141	91
	WLAN802.11 n(40M) 5.3G	Lap-held	0	54	5270	14.5	14.49	0.23%	0.094	0.094	-
		Right side	0	54	5270	14.5	14.49	0.23%	0.099	0.099	92
	WLAN802.11 a 5.6G	Lap-held	0	104	5520	14.5	14.30	4.71%	0.087	0.091	93
		Right side	0	104	5520	14.5	14.30	4.71%	0.065	0.068	-
	WLAN802.11 n(40M) 5.6G	Lap-held	0	118	5590	14.5	14.25	5.93%	0.012	0.013	-
		Right side	0	118	5590	14.5	14.25	5.93%	0.044	0.047	94
	WLAN802.11 ac(80M) 5.8G	Lap-held	0	155	5775	15	14.78	5.20%	0.098	0.103	95
		Right side	0	155	5775	15	14.78	5.20%	0.073	0.077	-

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3. Simultaneous Transmission Analysis

Simultaneous Transmission Scenarios:

Simultaneous Transmit Configurations	Body
LTE B4/13 + 2.4/5GHz WLAN Main	Yes
LTE B4/13 + 2.4/5GHz WLAN Aux	Yes
LTE B4/13 + 2.4/5GHz WLAN MIMO	Yes
CDMA BC0/BC1 + 2.4/5GHz WLAN Main	Yes
CDMA BC0/BC1 + 2.4/5GHz WLAN Aux	Yes
CDMA BC0/BC1 + 2.4/5GHz WLAN MIMO	Yes
LTE B4/13 + 2.4/5GHz WLAN Main + BT	Yes
CDMA BC0/BC1 + 2.4/5GHz WLAN Main + BT	Yes

Note:
1. WWAN and WLAN may transmit simultaneously.
2. Bluetooth and WLAN Aux share the same antenna path, and BT can't transmit with WLAN Aux simultaneously.
3. For 2.4/5GHz WLAN Main and Aux antennas, the maximum output power of each antenna during simultaneous transmission (for 802.11n/ac) is much less than that used in standalone transmission (for 802.11a/b/g/n/ac), so it is more conservative to use the sum of 1-g SAR provision in KDB447498D01 to exclude the SAR measurement for 802.11n/ac MIMO.
4. There are so many combination for simultaneous transmission, we choose the worst cases(all transmitters transmit simultaneously at maximum power) to do the simultaneous transmission analysis to capture the worst cases.

3.1 Estimated SAR calculation

According to KDB447498 D01v05 – 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:

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

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.

Mode / Band	frequency (GHz)	Maximum power(dBm)	Test position	test separation distance(mm)	Estimated SAR(W/kg)
BT / 2.4G	2.48	6	top / left	larger than 50mm	0.4
BT / 2.4G	2.48	6	bottom	34	0.025
BT / 2.4G	2.48	6	right / back	less than 5mm	0.167

Antenna	frequency (GHz)	Maximum power(dBm)	Test position	test separation distance(mm)	Estimated SAR(W/kg)
WLAN Aux	2.462	15	top / left	larger than 50mm	0.4
WLAN Aux	2.462	15	bottom	34	0.195
WLAN Aux	5.825	15	top / left	larger than 50mm	0.4
WLAN Aux	5.825	15	bottom	34	0.299

Antenna	frequency (GHz)	Maximum power(dBm)	Test position	test separation distance(mm)	Estimated SAR(W/kg)
WLAN Main	2.462	15	left/bottom	larger than 50mm	0.4
WLAN Main	5.825	15	left/bottom	larger than 50mm	0.4

Antenna	frequency (GHz)	Maximum power(dBm)	Test position	test separation distance(mm)	Estimated SAR(W/kg)
WWAN	1.851	24.5	right / bottom	larger than 50mm	0.4

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 **≤ 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.

LTE FDD Band IV + 2.4 GHz WLAN MIMO

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
1	LTE Band 4	Lap-held	0	0.618	0.038	0.03	0.686	ΣSAR<1.6, Not required
		Top side	0	0.534	0.055	0.4	0.989	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.195	0.995	ΣSAR<1.6, Not required
		Left side	0	0.042	0.4	0.4	0.842	ΣSAR<1.6, Not required
		Right side	0	0.4	0.013	0.423	0.836	ΣSAR<1.6, Not required

LTE FDD Band XIII + 2.4 GHz WLAN MIMO

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
2	LTE Band 13	Lap-held	0	0.261	0.038	0.03	0.329	ΣSAR<1.6, Not required
		Top side	0	0.432	0.055	0.4	0.887	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.195	0.995	ΣSAR<1.6, Not required
		Left side	0	0.070	0.4	0.4	0.87	ΣSAR<1.6, Not required
		Right side	0	0.4	0.013	0.423	0.836	ΣSAR<1.6, Not required

CDMA / EVDO BC0 + 2.4 GHz WLAN MIMO

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
3	EVDO BC0	Lap-held	0	0.344	0.038	0.03	0.412	ΣSAR<1.6, Not required
		Top side	0	0.968	0.055	0.4	1.423	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.195	0.995	ΣSAR<1.6, Not required
		Left side	0	0.090	0.4	0.4	0.89	ΣSAR<1.6, Not required
		Right side	0	0.4	0.013	0.423	0.836	ΣSAR<1.6, Not required

CDMA / EVDO BC1 + 2.4 GHz WLAN MIMO

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
4	EVDO BC1	Lap-held	0	0.443	0.038	0.03	0.511	ΣSAR<1.6, Not required
		Top side	0	0.261	0.055	0.4	0.716	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.195	0.995	ΣSAR<1.6, Not required
		Left side	0	0.050	0.4	0.4	0.85	ΣSAR<1.6, Not required
		Right side	0	0.4	0.013	0.423	0.836	ΣSAR<1.6, Not required

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LTE FDD Band IV + 5 GHz WLAN MIMO

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
1	LTE Band 4	Lap-held	0	0.618	0.141	0.107	0.866	ΣSAR<1.6, Not required
		Top side	0	0.534	0.127	0.4	1.061	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.299	1.099	ΣSAR<1.6, Not required
		Left side	0	0.042	0.4	0.4	0.842	ΣSAR<1.6, Not required
		Right side	0	0.4	0.066	0.4	0.866	ΣSAR<1.6, Not required

LTE FDD Band XIII + 5 GHz WLAN MIMO

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
2	LTE Band 13	Lap-held	0	0.261	0.141	0.107	0.509	ΣSAR<1.6, Not required
		Top side	0	0.432	0.127	0.4	0.959	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.299	1.099	ΣSAR<1.6, Not required
		Left side	0	0.070	0.4	0.4	0.87	ΣSAR<1.6, Not required
		Right side	0	0.4	0.066	0.4	0.866	ΣSAR<1.6, Not required

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CDMA / EVDO BC0 + 5 GHz WLAN MIMO

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
3	EVDO BC0	Lap-held	0	0.344	0.141	0.107	0.592	ΣSAR<1.6, Not required
		Top side	0	0.968	0.127	0.4	1.495	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.299	1.099	ΣSAR<1.6, Not required
		Left side	0	0.090	0.4	0.4	0.89	ΣSAR<1.6, Not required
		Right side	0	0.4	0.066	0.4	0.866	ΣSAR<1.6, Not required

CDMA / EVDO BC1 + 5 GHz WLAN MIMO

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	Max. WLAN Aux	SAR Sum	SPLSR
4	EVDO BC1	Lap-held	0	0.443	0.141	0.107	0.691	ΣSAR<1.6, Not required
		Top side	0	0.261	0.127	0.4	0.788	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.299	1.099	ΣSAR<1.6, Not required
		Left side	0	0.050	0.4	0.4	0.85	ΣSAR<1.6, Not required
		Right side	0	0.4	0.066	0.4	0.866	ΣSAR<1.6, Not required

LTE FDD Band IV + BT + 2.4 GHz WLAN Main

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	BT	SAR Sum	SPLSR
1	LTE Band 4	Lap-held	0	0.618	0.038	0.167	0.823	ΣSAR<1.6, Not required
		Top side	0	0.534	0.055	0.4	0.989	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.025	0.825	ΣSAR<1.6, Not required
		Left side	0	0.042	0.4	0.4	0.842	ΣSAR<1.6, Not required
		Right side	0	0.4	0.013	0.167	0.58	ΣSAR<1.6, Not required

LTE FDD Band XIII + BT + 2.4 GHz WLAN Main

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	BT	SAR Sum	SPLSR
2	LTE Band 13	Lap-held	0	0.261	0.038	0.167	0.466	ΣSAR<1.6, Not required
		Top side	0	0.432	0.055	0.4	0.887	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.025	0.825	ΣSAR<1.6, Not required
		Left side	0	0.070	0.4	0.4	0.87	ΣSAR<1.6, Not required
		Right side	0	0.4	0.013	0.167	0.58	ΣSAR<1.6, Not required

CDMA / EVDO BC0 + BT + 2.4 GHz WLAN Main

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	BT	SAR Sum	SPLSR
3	EVDO BC0	Lap-held	0	0.344	0.038	0.167	0.549	ΣSAR<1.6, Not required
		Top side	0	0.968	0.055	0.4	1.423	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.025	0.825	ΣSAR<1.6, Not required
		Left side	0	0.090	0.4	0.4	0.89	ΣSAR<1.6, Not required
		Right side	0	0.4	0.013	0.167	0.58	ΣSAR<1.6, Not required

CDMA / EVDO BC1 + BT + 2.4 GHz WLAN Main

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	BT	SAR Sum	SPLSR
4	EVDO BC1	Lap-held	0	0.443	0.038	0.167	0.648	ΣSAR<1.6, Not required
		Top side	0	0.261	0.055	0.4	0.716	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.025	0.825	ΣSAR<1.6, Not required
		Left side	0	0.050	0.4	0.4	0.85	ΣSAR<1.6, Not required
		Right side	0	0.4	0.013	0.167	0.58	ΣSAR<1.6, Not required

LTE FDD Band IV + BT + 5 GHz WLAN Main

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	BT	SAR Sum	SPLSR
1	LTE Band 4	Lap-held	0	0.618	0.141	0.167	0.926	ΣSAR<1.6, Not required
		Top side	0	0.534	0.127	0.4	1.061	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.025	0.825	ΣSAR<1.6, Not required
		Left side	0	0.042	0.4	0.4	0.842	ΣSAR<1.6, Not required
		Right side	0	0.4	0.066	0.167	0.633	ΣSAR<1.6, Not required

LTE FDD Band IV + BT + 5 GHz WLAN Main

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	BT	SAR Sum	SPLSR
2	LTE Band 13	Lap-held	0	0.261	0.141	0.167	0.569	ΣSAR<1.6, Not required
		Top side	0	0.432	0.127	0.4	0.959	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.025	0.825	ΣSAR<1.6, Not required
		Left side	0	0.070	0.4	0.4	0.87	ΣSAR<1.6, Not required
		Right side	0	0.4	0.066	0.167	0.633	ΣSAR<1.6, Not required

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LTE FDD Band IV + BT + 5 GHz WLAN Main

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	BT	SAR Sum	SPLSR
3	EVDO BC0	Lap-held	0	0.344	0.141	0.167	0.652	ΣSAR<1.6, Not required
		Top side	0	0.968	0.127	0.4	1.495	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.025	0.825	ΣSAR<1.6, Not required
		Left side	0	0.090	0.4	0.4	0.89	ΣSAR<1.6, Not required
		Right side	0	0.4	0.066	0.167	0.633	ΣSAR<1.6, Not required

LTE FDD Band IV + BT + 5 GHz WLAN Main

No.	Conditions	Position	Distance (mm)	Max. WWAN	Max. WLAN Main	BT	SAR Sum	SPLSR
4	EVDO BC1	Lap-held	0	0.443	0.141	0.167	0.751	ΣSAR<1.6, Not required
		Top side	0	0.261	0.127	0.4	0.788	ΣSAR<1.6, Not required
		Bottom side	0	0.4	0.4	0.025	0.825	ΣSAR<1.6, Not required
		Left side	0	0.050	0.4	0.4	0.85	ΣSAR<1.6, Not required
		Right side	0	0.4	0.066	0.167	0.633	ΣSAR<1.6, Not required

4. Instruments List

Manufacturer	Device	Type	Serial number	Date of last calibration	Date of next calibration
Schmid & Partner Engineering AG	Dosimetric E-Field Probe	EX3DV4	3923	Aug.28,2014	Aug.27,2015
			3831	Jan.29,2015	Jan.28,2016
Schmid & Partner Engineering AG	System Validation Dipole	D750V2	1015	Aug.28,2014	Aug.27,2015
		D835V2	4d063	Aug.28,2014	Aug.27,2015
		D1750V2	1008	Aug.28,2014	Aug.27,2015
		D1900V2	5d027	Apr.29,2015	Apr.28,2016
		D2450V2	727	Apr.22,2015	Apr.21,2016
		D5GHzV2	1023	Jan.29,2015	Jan.28,2016
Schmid & Partner Engineering AG	Data acquisition Electronics	DAE4	1374	May.06,2015	May.05,2016
			1305	Dec.11,2014	Dec.10,2015
Schmid & Partner Engineering AG	Software	DASY 52 V52.8.8	N/A	Calibration not required	Calibration not required
Schmid & Partner Engineering AG	Phantom	SAM	N/A	Calibration not required	Calibration not required
HP	Network Analyzer	8753D	3410A05547	May.21,2015	May.20,2016
Agilent	Dielectric Probe Kit	85070E	MY44300677	Calibration not required	Calibration not required
Agilent	Dual-directional coupler	777D	50114	Aug.07,2014	Aug.06,2015
		778D	50313	Aug.07,2014	Aug.06,2015
Agilent	RF Signal Generator	N5181A	MY50145142	Feb.06.2015	Feb.05.2016
Agilent	Power Meter	E4417A	MY51410006	Oct.25,2013	Oct.24,2015
Agilent	Power Sensor	E9301H	MY51470001	Dec.11,2014	Dec.10,2015

Manufacturer	Device	Type	Serial number	Date of last calibration	Date of next calibration
TECPEL	Digital thermometer	DTM-303A	TP130078	Mar.30,2015	Mar.29,2016
R&S	Radio Communication Test	CMU200	122498	Aug.14,2014	Aug.13,2015
Anritsu	Radio Communication Test	MT8820C	6201061014	Aug.06,2014	Aug.05,2015

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5. Measurements

Date: 2015/7/9

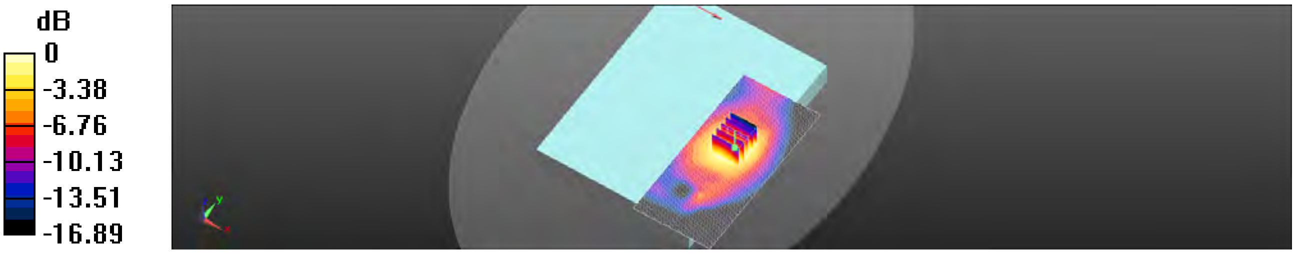
LTE Band 4 (20MHz)_Body-worn_Lap-held_CH 20050_QPSK_1-99_0mm
Communication System: LTE; Frequency: 1720 MHz
Medium parameters used: f = 1720 MHz; σ = 1.462 S/m; ε_r = 51.611; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(8.3, 8.3, 8.3); Calibrated: 2014/8/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/5/6
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (61x131x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 0.803 W/kg

Configuration/BODY/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.493 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.911 W/kg
SAR(1 g) = 0.618 W/kg; SAR(10 g) = 0.383 W/kg
Maximum value of SAR (measured) = 0.780 W/kg



0 dB = 0.780 W/kg = -1.08 dBW/kg

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Date: 2015/7/7

LTE Band 13 (10MHz)_Body-worn_Top side_CH 23230_QPSK_25-12_0mm

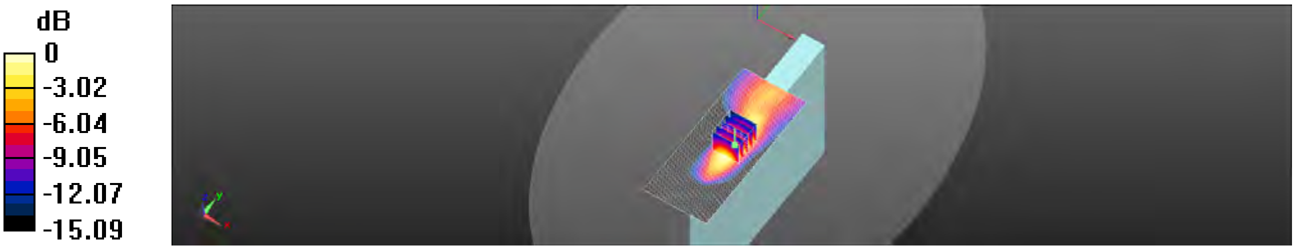
Communication System: LTE; Frequency: 782 MHz
Medium parameters used: f = 782 MHz; σ = 0.993 S/m; ε_r = 54.559; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(10.29, 10.29, 10.29); Calibrated: 2014/8/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/5/6
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (51x121x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 0.523 W/kg

Configuration/BODY/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.43 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.609 W/kg
SAR(1 g) = 0.353 W/kg; SAR(10 g) = 0.197 W/kg
Maximum value of SAR (measured) = 0.490 W/kg



0 dB = 0.490 W/kg = -3.10 dBW/kg

Date: 2015/7/8

Cellular BC0_Body-worn_Top side_CH 777_0mm_1xEVDO Rev. 0

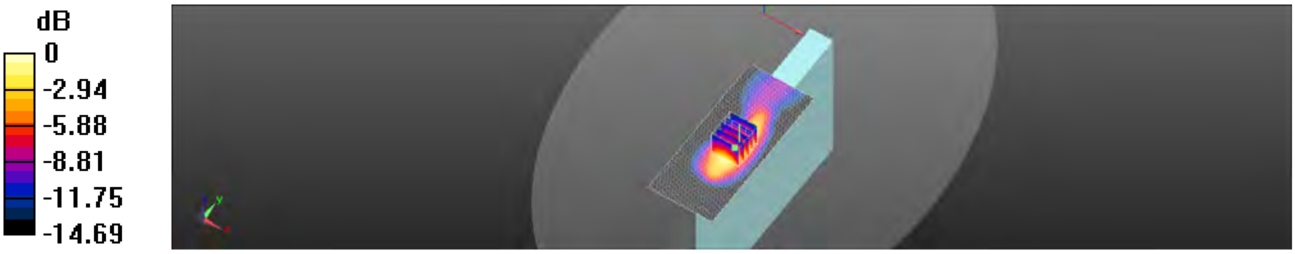
Communication System: 1xEVDO; Frequency: 848.31 MHz
Medium parameters used: f = 848.31 MHz; σ = 0.971 S/m; ε_r = 54.251; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(10.32, 10.32, 10.32); Calibrated: 2014/8/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/5/6
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (51x121x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.11 W/kg

Configuration/BODY/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.09 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.36 W/kg
SAR(1 g) = 0.785 W/kg; SAR(10 g) = 0.447 W/kg
Maximum value of SAR (measured) = 1.08 W/kg



0 dB = 1.08 W/kg = 0.32 dBW/kg

Date: 2015/7/10

PCS BC1_Body-worn_Lap-held_CH 25_0mm_1xEVDO Rev. 0

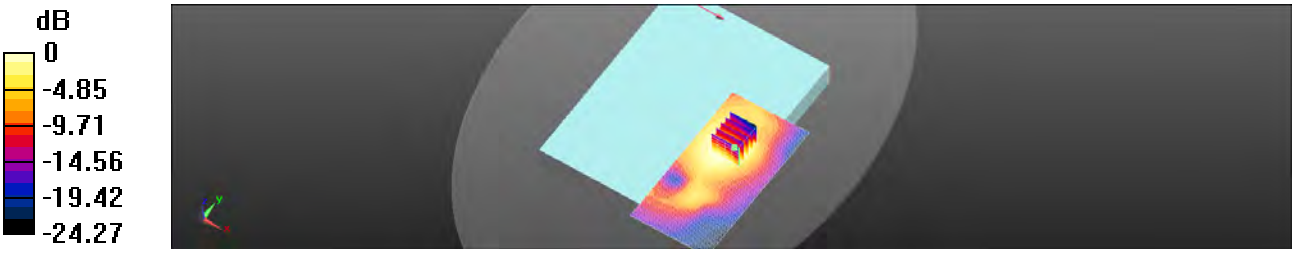
Communication System: 1xEVDO; Frequency: 1851.25 MHz
Medium parameters used: f = 1851.25 MHz; σ = 1.491 S/m; ε_r = 52.448; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(8.03, 8.03, 8.03); Calibrated: 2014/8/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/5/6
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (61x121x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 0.560 W/kg

Configuration/BODY/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.046 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.658 W/kg
SAR(1 g) = 0.441 W/kg; SAR(10 g) = 0.279 W/kg
Maximum value of SAR (measured) = 0.541 W/kg



0 dB = 0.560 W/kg = -2.52 dBW/kg

Date: 2015/7/13

WLAN 802.11b_Body-worn_Top side_CH 1_Main_0mm

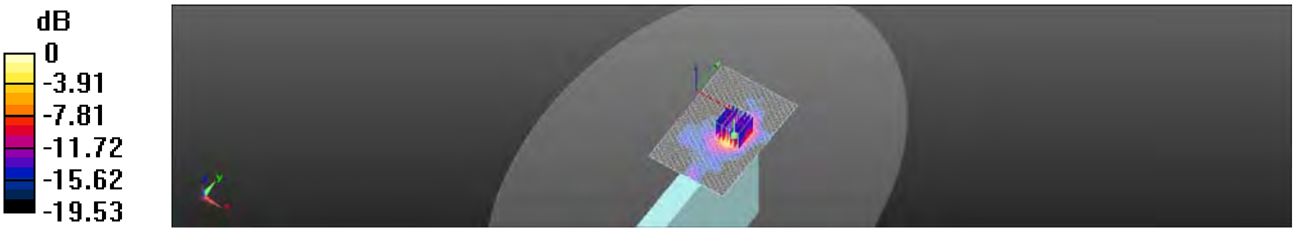
Communication System: WLAN(2.45G); Frequency: 2412 MHz
Medium parameters used: f = 2412 MHz; σ = 1.861 S/m; εr = 53.169; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(6.81, 6.81, 6.81); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (81x121x1): Interpolated grid: dx=12 mm, dy=12 mm
Maximum value of SAR (interpolated) = 0.101 W/kg

Configuration/BODY/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.9810 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.134 W/kg
SAR(1 g) = 0.054 W/kg; SAR(10 g) = 0.023 W/kg
Maximum value of SAR (measured) = 0.0904 W/kg



0 dB = 0.0904 W/kg = -10.44 dBW/kg

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Date: 2015/7/13

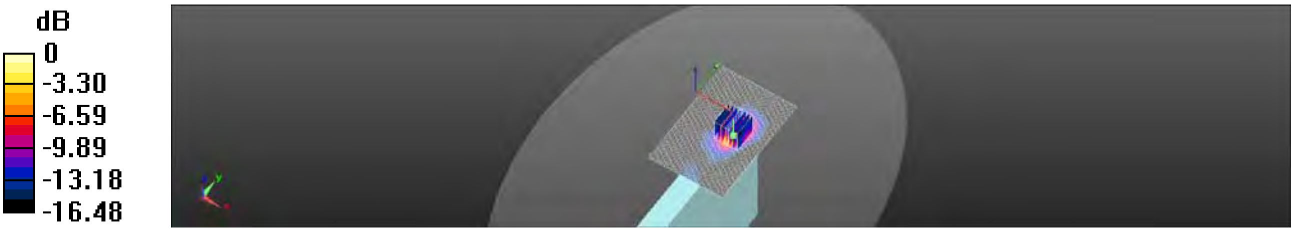
WLAN 802.11n(40M)_Body-worn_Top side_CH 6_Main_0mm
Communication System: WLAN(2.45G); Frequency: 2437 MHz
Medium parameters used: f = 2437 MHz; σ = 1.887 S/m; εr = 53.111; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(6.81, 6.81, 6.81); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (81x121x1): Interpolated grid: dx=12 mm, dy=12 mm
Maximum value of SAR (interpolated) = 0.200 W/kg

Configuration/BODY/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.924 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.301 W/kg
SAR(1 g) = 0.126 W/kg; SAR(10 g) = 0.054 W/kg
Maximum value of SAR (measured) = 0.209 W/kg



0 dB = 0.209 W/kg = -6.81 dBW/kg

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Date: 2015/7/14

WLAN 802.11a 5.2G_Body-worn_Lap-held_CH 48_Main_0mm

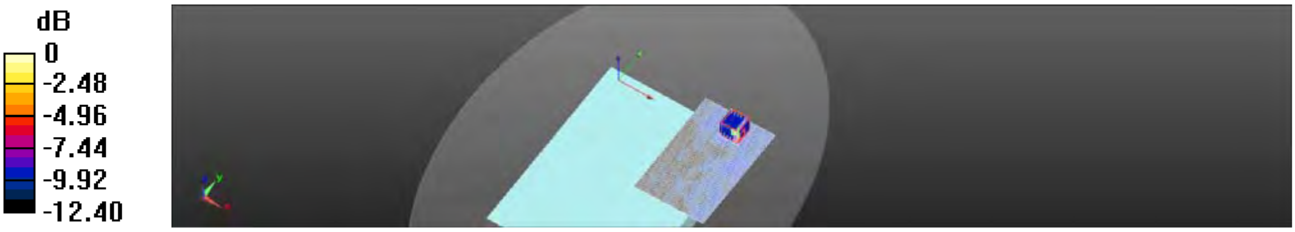
Communication System: WLAN(5G); Frequency: 5240 MHz
Medium parameters used: f = 5240 MHz; σ = 5.293 S/m; εr = 48.457; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.108 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.353 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.777 W/kg
SAR(1 g) = 0.141 W/kg; SAR(10 g) = 0.091 W/kg
Maximum value of SAR (measured) = 0.777 W/kg



0 dB = 0.777 W/kg = -1.10 dBW/kg

Date: 2015/7/14

WLAN 802.11n(40M) 5.2G_Body-worn_Top side_CH 46_Main_0mm

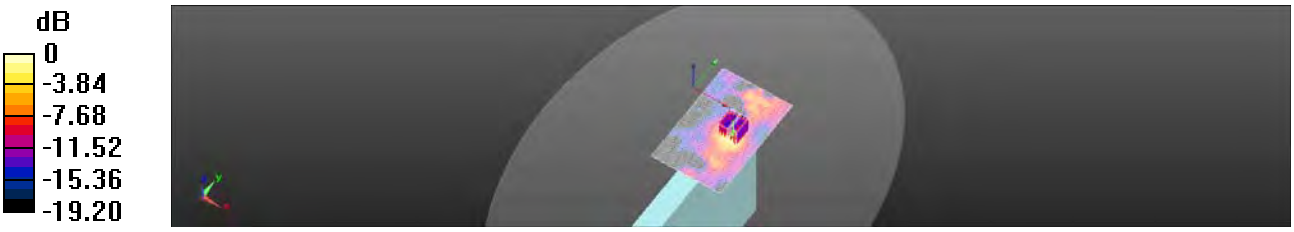
Communication System: WLAN(5G); Frequency: 5230 MHz
Medium parameters used: f = 5230 MHz; σ = 5.283 S/m; εr = 48.464; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.208 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.901 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.374 W/kg
SAR(1 g) = 0.112 W/kg; SAR(10 g) = 0.042 W/kg
Maximum value of SAR (measured) = 0.232 W/kg



0 dB = 0.232 W/kg = -6.34 dBW/kg

Date: 2015/7/15

WLAN 802.11a 5.3G_Body-worn_Top side_CH 56_Main_0mm

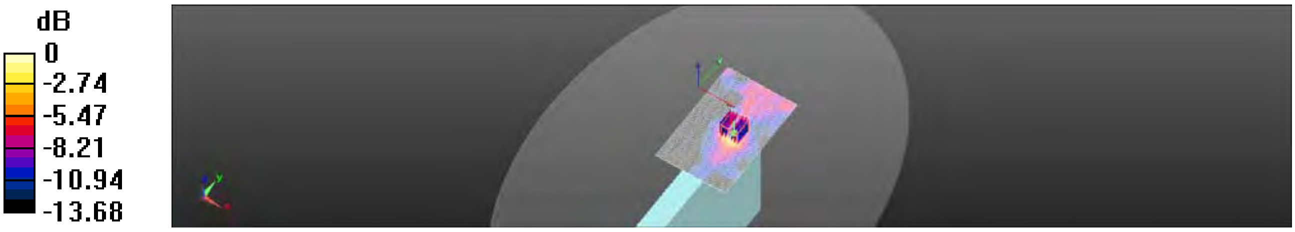
Communication System: WLAN(5G); Frequency: 5280 MHz
Medium parameters used: f = 5280 MHz; σ = 5.332 S/m; εr = 48.402; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.180 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.771 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.825 W/kg
SAR(1 g) = 0.122 W/kg; SAR(10 g) = 0.049 W/kg
Maximum value of SAR (measured) = 0.223 W/kg



0 dB = 0.223 W/kg = -6.51 dBW/kg

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Date: 2015/7/15

WLAN 802.11n(40M) 5.3G_Body-worn_Top side_CH 54_Main_0mm

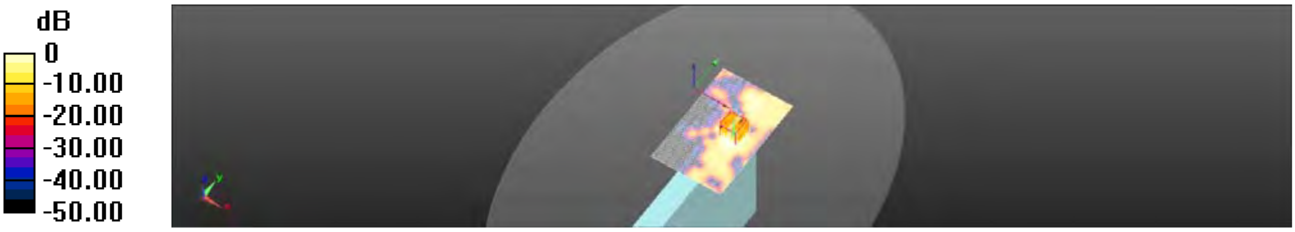
Communication System: WLAN(5G); Frequency: 5270 MHz
Medium parameters used: f = 5270 MHz; σ = 5.322 S/m; εr = 48.421; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.138 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.759 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 0.243 W/kg
SAR(1 g) = 0.063 W/kg; SAR(10 g) = 0.020 W/kg
Maximum value of SAR (measured) = 0.129 W/kg



0 dB = 0.129 W/kg = -8.89 dBW/kg

Date: 2015/7/16

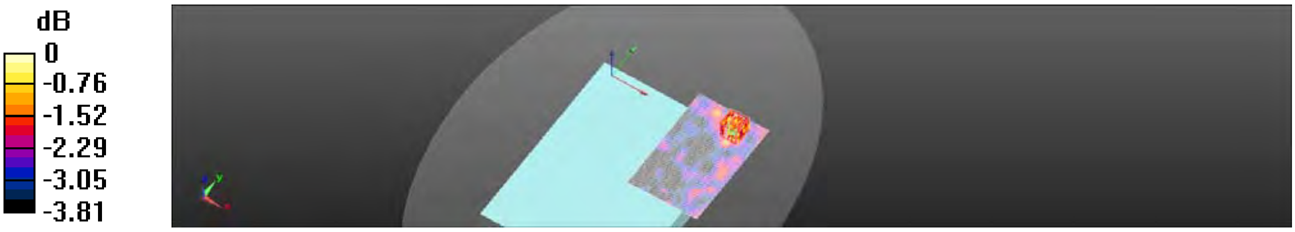
WLAN 802.11a 5.6G_Body-worn_Lap-held_CH 104_Main_0mm
Communication System: WLAN(5G); Frequency: 5520 MHz
Medium parameters used: f = 5520 MHz; σ = 5.621 S/m; εr = 47.649; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.49, 3.49, 3.49); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.0899 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.605 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.188 W/kg
SAR(1 g) = 0.085 W/kg; SAR(10 g) = 0.080 W/kg
Maximum value of SAR (measured) = 0.113 W/kg



0 dB = 0.113 W/kg = -9.48 dBW/kg

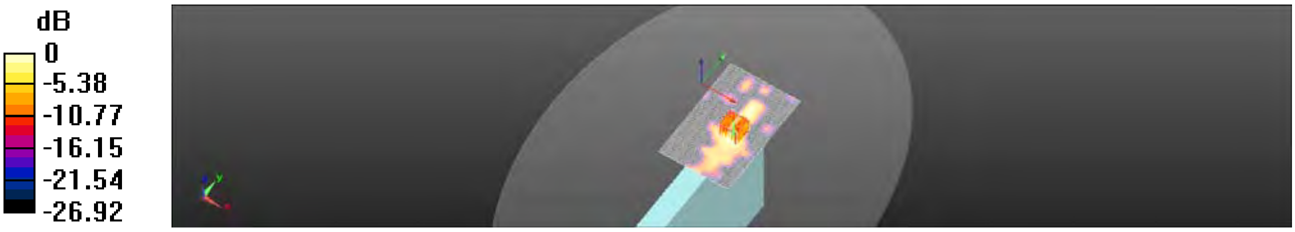
Date: 2015/7/16

WLAN 802.11n(40M) 5.6G_Body-worn_Top side_CH 118_Main_0mm
Communication System: WLAN(5G); Frequency: 5590 MHz
Medium parameters used: f = 5590 MHz; σ = 5.692 S/m; εr = 47.564; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: EX3DV4 - SN3831; ConvF(3.49, 3.49, 3.49); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.0834 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.070 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.250 W/kg
SAR(1 g) = 0.048 W/kg; SAR(10 g) = 0.019 W/kg
Maximum value of SAR (measured) = 0.0858 W/kg



0 dB = 0.0858 W/kg = -10.66 dBW/kg

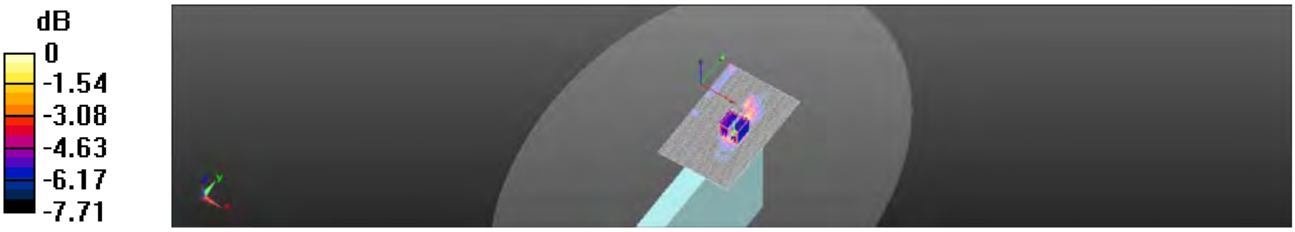
Date: 2015/7/17

WLAN 802.11ac(80M) 5.8G_Body-worn_Top side_CH 155_Main_0mm
Communication System: WLAN(5G); Frequency: 5775 MHz
Medium parameters used: f = 5775 MHz; σ = 5.925 S/m; εr = 47.332; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: EX3DV4 - SN3831; ConvF(3.7, 3.7, 3.7); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.136 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 0.9960 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.351 W/kg
SAR(1 g) = 0.093 W/kg; SAR(10 g) = 0.054 W/kg
Maximum value of SAR (measured) = 0.146 W/kg



0 dB = 0.146 W/kg = -8.34 dBW/kg

Date: 2015/7/13

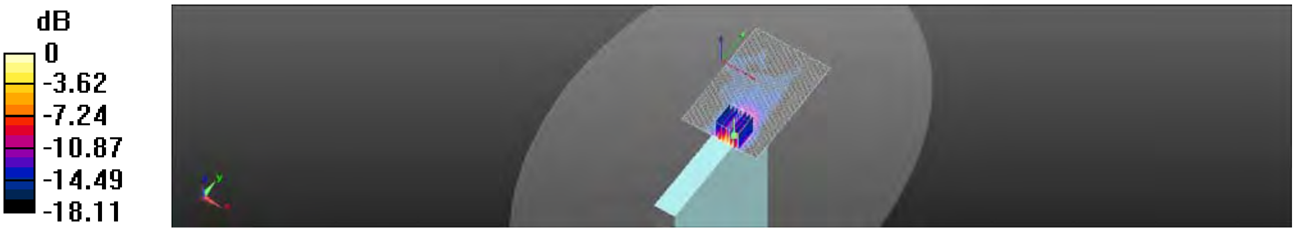
WLAN 802.11b_Body-worn_Right side_CH 1_Aux_0mm
Communication System: WLAN(2.45G); Frequency: 2412 MHz
Medium parameters used: f = 2412 MHz; σ = 1.861 S/m; εr = 53.169; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(6.81, 6.81, 6.81); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (81x121x1): Interpolated grid: dx=12 mm, dy=12 mm
Maximum value of SAR (interpolated) = 0.631 W/kg

Configuration/BODY/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.751 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.883 W/kg
SAR(1 g) = 0.409 W/kg; SAR(10 g) = 0.166 W/kg
Maximum value of SAR (measured) = 0.661 W/kg



0 dB = 0.661 W/kg = -1.80 dBW/kg

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Date: 2015/7/13

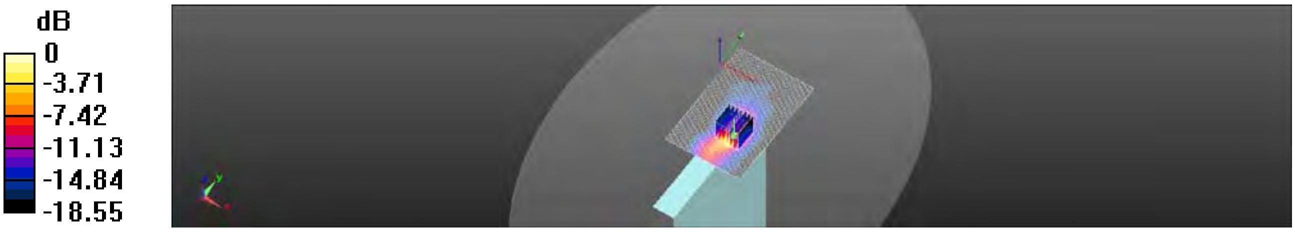
WLAN 802.11n(40M)_Body-worn_Right side_CH 6_Aux_0mm
Communication System: WLAN(2.45G); Frequency: 2437 MHz
Medium parameters used: f = 2437 MHz; σ = 1.887 S/m; εr = 53.111; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(6.81, 6.81, 6.81); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (81x121x1): Interpolated grid: dx=12 mm, dy=12 mm
Maximum value of SAR (interpolated) = 0.594 W/kg

Configuration/BODY/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.870 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.796 W/kg
SAR(1 g) = 0.376 W/kg; SAR(10 g) = 0.155 W/kg
Maximum value of SAR (measured) = 0.600 W/kg



0 dB = 0.600 W/kg = -2.22 dBW/kg

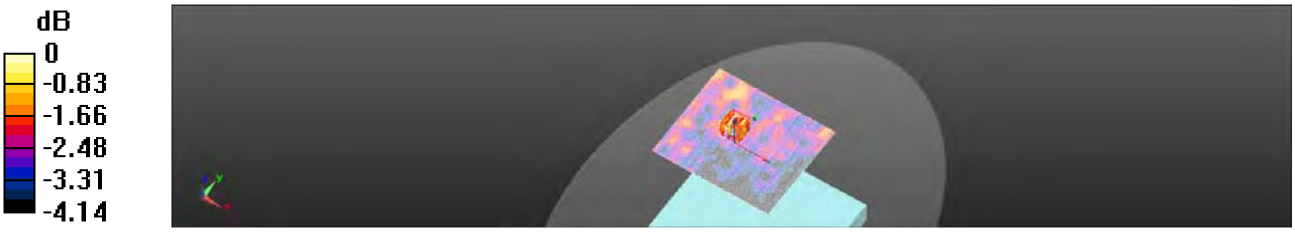
Date: 2015/7/14

WLAN 802.11a 5.2G_Body-worn_Lap-held_CH 44_Aux_0mm
Communication System: WLAN(5G); Frequency: 5220 MHz
Medium parameters used: f = 5220 MHz; σ = 5.272 S/m; εr = 48.488; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (151x131x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.0952 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.118 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.108 W/kg
SAR(1 g) = 0.080 W/kg; SAR(10 g) = 0.075 W/kg
Maximum value of SAR (measured) = 0.108 W/kg



0 dB = 0.108 W/kg = -9.68 dBW/kg

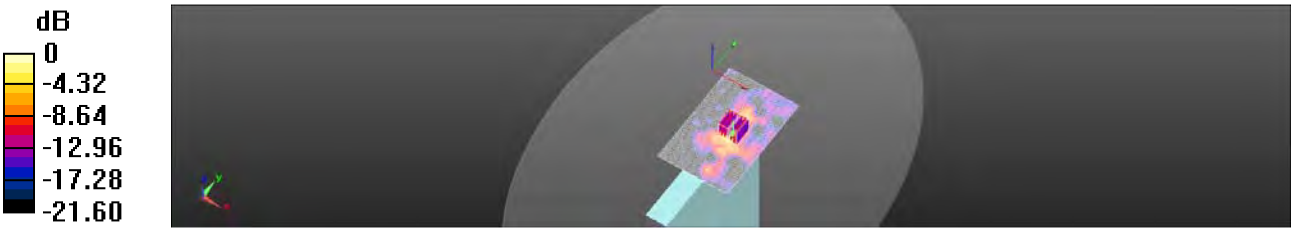
Date: 2015/7/14

WLAN 802.11n(40M) 5.2G_Body-worn_Right side_CH 46_Aux_0mm
Communication System: WLAN(5G); Frequency: 5230 MHz
Medium parameters used: f = 5230 MHz; σ = 5.283 S/m; εr = 48.464; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.193 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.052 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.408 W/kg
SAR(1 g) = 0.095 W/kg; SAR(10 g) = 0.029 W/kg
Maximum value of SAR (measured) = 0.222 W/kg



0 dB = 0.222 W/kg = -6.54 dBW/kg

Date: 2015/7/15

WLAN 802.11a 5.3G_Body-worn_Right side_CH 52_Aux_0mm

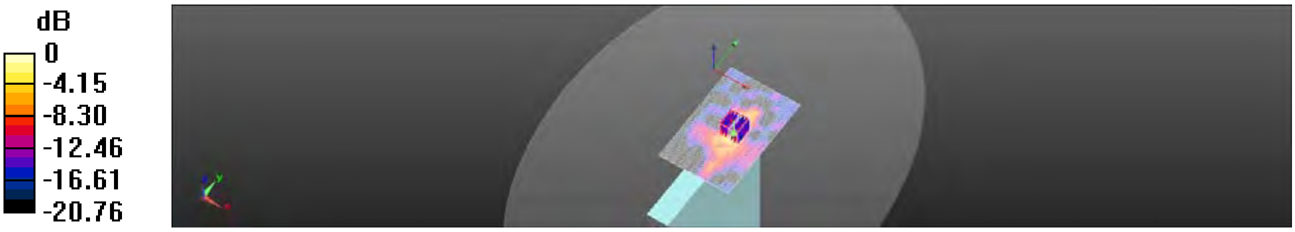
Communication System: WLAN(5G); Frequency: 5260 MHz
Medium parameters used: f = 5260 MHz; σ = 5.312 S/m; εr = 48.436; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.260 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.752 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.700 W/kg
SAR(1 g) = 0.138 W/kg; SAR(10 g) = 0.040 W/kg
Maximum value of SAR (measured) = 0.285 W/kg



0 dB = 0.285 W/kg = -5.46 dBW/kg

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Date: 2015/7/15

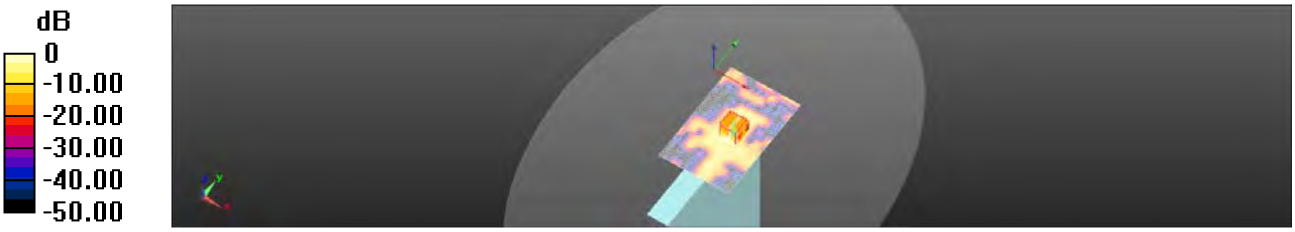
WLAN 802.11n(40M) 5.3G_Body-worn_Right side_CH 54_Aux_0mm
Communication System: WLAN(5G); Frequency: 5270 MHz
Medium parameters used: f = 5270 MHz; σ = 5.322 S/m; εr = 48.421; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.208 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.107 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.393 W/kg
SAR(1 g) = 0.099 W/kg; SAR(10 g) = 0.027 W/kg
Maximum value of SAR (measured) = 0.224 W/kg



0 dB = 0.224 W/kg = -6.49 dBW/kg

Date: 2015/7/16

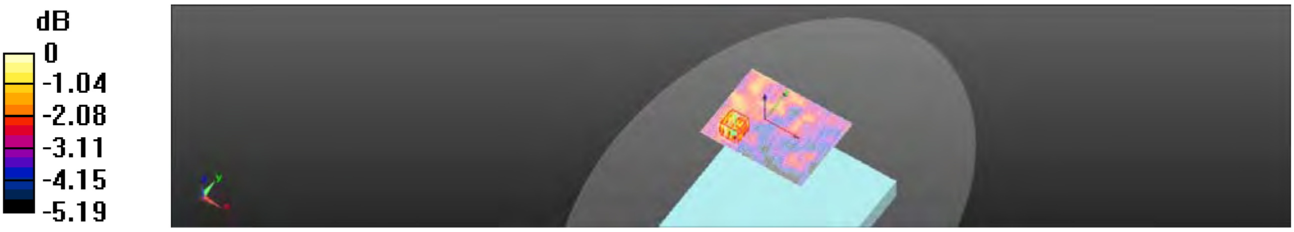
WLAN 802.11a 5.6G_Body-worn_Lap-held_CH 104_Aux_0mm
Communication System: WLAN(5G); Frequency: 5520 MHz
Medium parameters used: f = 5520 MHz; σ = 5.621 S/m; εr = 47.649; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.49, 3.49, 3.49); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (131x101x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.0871 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.626 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.114 W/kg
SAR(1 g) = 0.087 W/kg; SAR(10 g) = 0.080 W/kg
Maximum value of SAR (measured) = 0.114 W/kg



0 dB = 0.114 W/kg = -9.41 dBW/kg

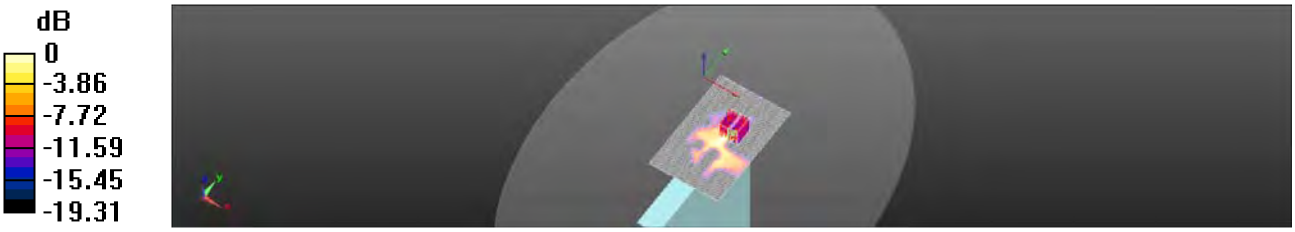
Date: 2015/7/16

WLAN 802.11n(40M) 5.6G_Body-worn_Right side_CH 118_Aux_0mm
Communication System: WLAN(5G); Frequency: 5590 MHz
Medium parameters used: f = 5590 MHz; σ = 5.692 S/m; εr = 47.564; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: EX3DV4 - SN3831; ConvF(3.49, 3.49, 3.49); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (91x141x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.224 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.163 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.781 W/kg
SAR(1 g) = 0.044 W/kg; SAR(10 g) = 0.00733 W/kg
Maximum value of SAR (measured) = 0.110 W/kg



0 dB = 0.110 W/kg = -9.59 dBW/kg

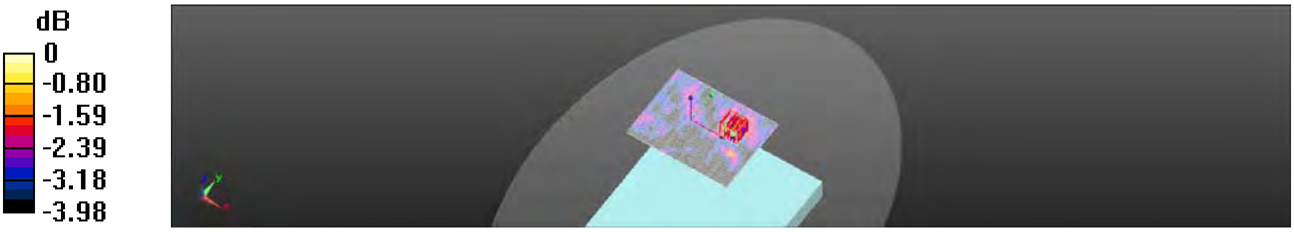
Date: 2015/7/17

WLAN 802.11ac(80M) 5.8G_Body-worn_Lap-held_CH 155_Aux_0mm
Communication System: WLAN(5G); Frequency: 5775 MHz
Medium parameters used: f = 5775 MHz; σ = 5.925 S/m; εr = 47.332; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: EX3DV4 - SN3831; ConvF(3.7, 3.7, 3.7); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/BODY/Area Scan (131x101x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 0.130 W/kg

Configuration/BODY/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.092 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.157 W/kg
SAR(1 g) = 0.098 W/kg; SAR(10 g) = 0.089 W/kg
Maximum value of SAR (measured) = 0.133 W/kg



0 dB = 0.133 W/kg = -8.77 dBW/kg

6. SAR System Performance Verification

Date: 2015/7/7

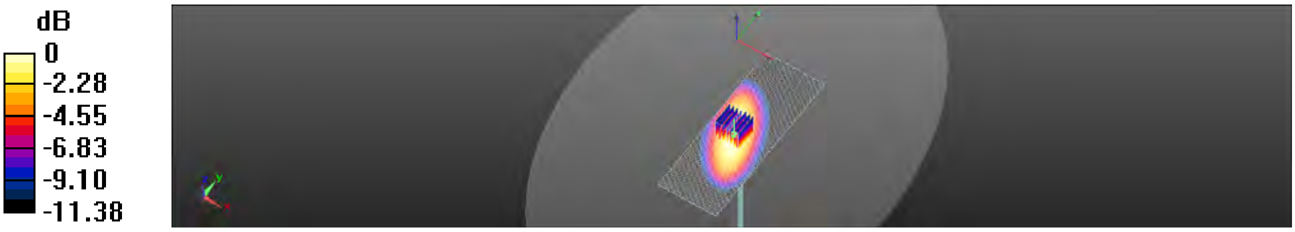
Dipole 750 MHz_SN:1015
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma = 0.961$ S/m; $\varepsilon_r = 54.674$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(10.29, 10.29, 10.29); Calibrated: 2014/8/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/5/6
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=250mW/Area Scan (51x141x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 2.42 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.43 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 2.88 W/kg
SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.42 W/kg
Maximum value of SAR (measured) = 2.42 W/kg



0 dB = 2.42 W/kg = 3.84 dBW/kg

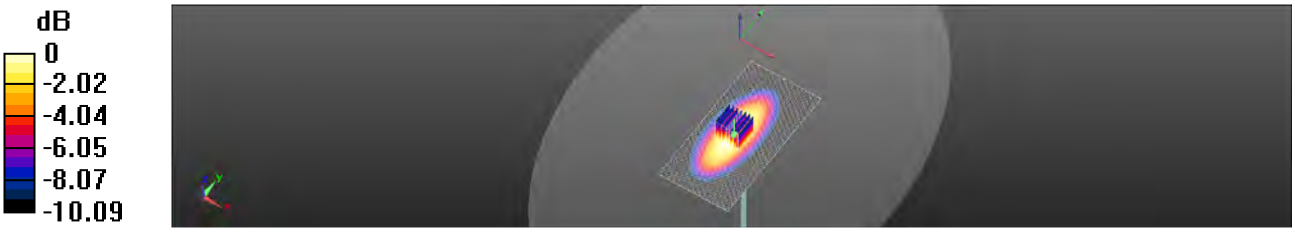
Dipole 835 MHz_SN:4d063
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.954 S/m; ε_r = 54.285; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(10.32, 10.32, 10.32); Calibrated: 2014/8/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/5/6
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=250mW/Area Scan (61x121x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 2.78 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.96 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 3.28 W/kg
SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.52 W/kg
Maximum value of SAR (measured) = 2.82 W/kg



0 dB = 2.82 W/kg = 4.50 dBW/kg

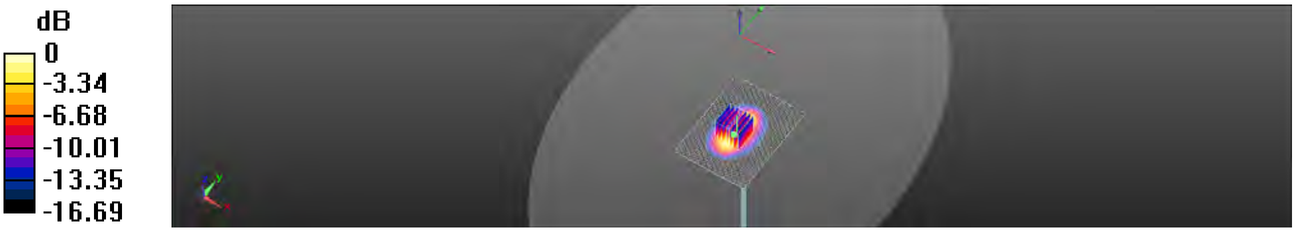
Dipole 1750 MHz_SN:1008
Communication System: CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.481 S/m; ε_r = 51.538; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(8.3, 8.3, 8.3); Calibrated: 2014/8/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/5/6
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 12.7 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.30 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 15.3 W/kg
SAR(1 g) = 9.73 W/kg; SAR(10 g) = 5.14 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



0 dB = 12.4 W/kg = 10.92 dBW/kg

Date: 2015/7/10

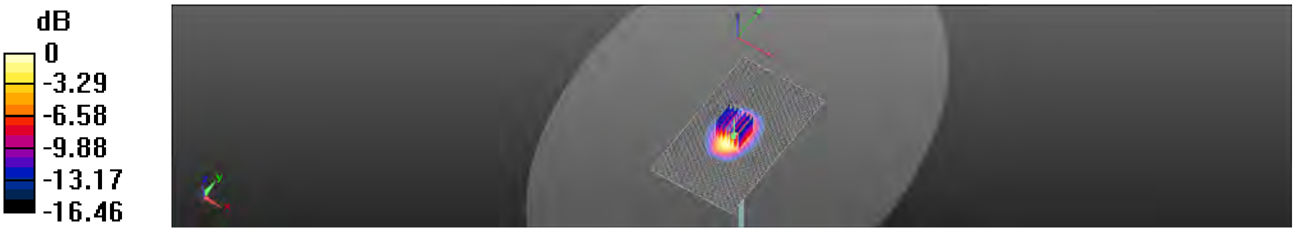
Dipole 1900 MHz_SN:5d027
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.541 S/m; ε_r = 52.125; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(8.03, 8.03, 8.03); Calibrated: 2014/8/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1374; Calibrated: 2015/5/6
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=250mW/Area Scan (71x121x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 13.5 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.09 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.0 W/kg
SAR(1 g) = 9.78 W/kg; SAR(10 g) = 5.21 W/kg
Maximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.7 W/kg = 11.37 dBW/kg

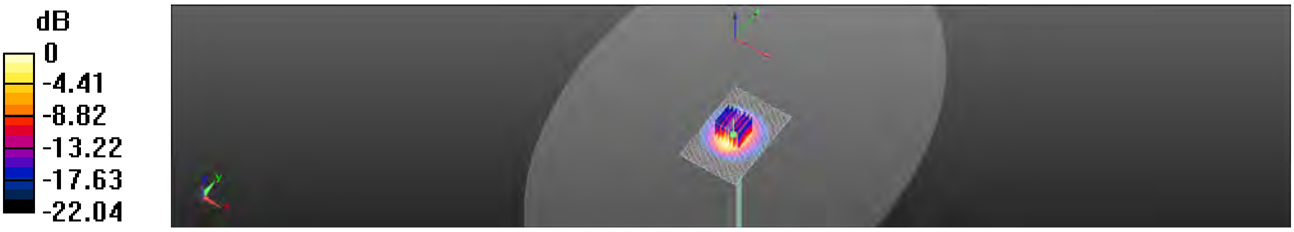
Date: 2015/7/13

Dipole 2450 MHz_SN:727
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.901 S/m; ε_r = 53.074; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: EX3DV4 - SN3831; ConvF(6.81, 6.81, 6.81); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=250mW/Area Scan (61x91x1): Interpolated grid: dx=12 mm, dy=12 mm
Maximum value of SAR (interpolated) = 19.9 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.39 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 25.8 W/kg
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.87 W/kg
Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.85 dBW/kg

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Date: 2015/7/14

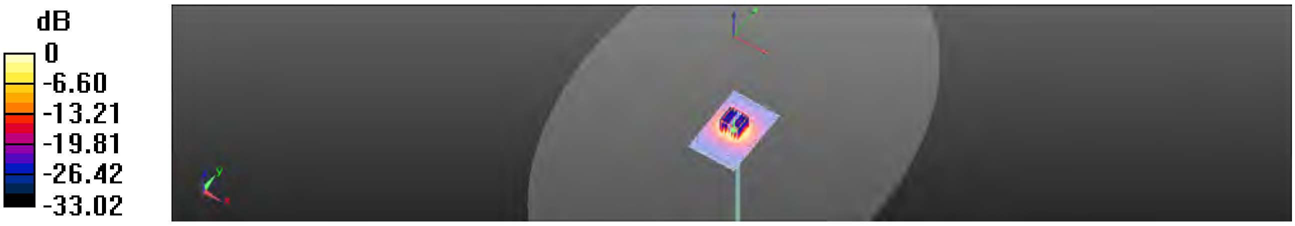
Dipole 5200 MHz_SN:1023
Communication System: CW; Frequency: 5200 MHz
Medium parameters used: f = 5200 MHz; σ = 5.252 S/m; ε_r = 48.505; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 15.9 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 55.86 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 30.6 W/kg
SAR(1 g) = 7.54 W/kg; SAR(10 g) = 2.12 W/kg
Maximum value of SAR (measured) = 15.9 W/kg



0 dB = 15.9 W/kg = 12.01 dBW/kg

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Date: 2015/7/15

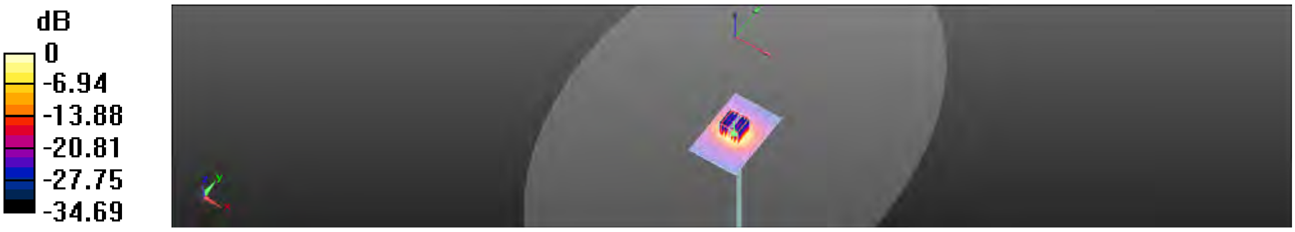
Dipole 5300 MHz_SN:1023
Communication System: CW; Frequency: 5300 MHz
Medium parameters used: f = 5300 MHz; σ = 5.353 S/m; ε_r = 48.387; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.92, 3.92, 3.92); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 16.0 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 55.68 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 29.9 W/kg
SAR(1 g) = 7.31 W/kg; SAR(10 g) = 2.06 W/kg
Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

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Date: 2015/7/16

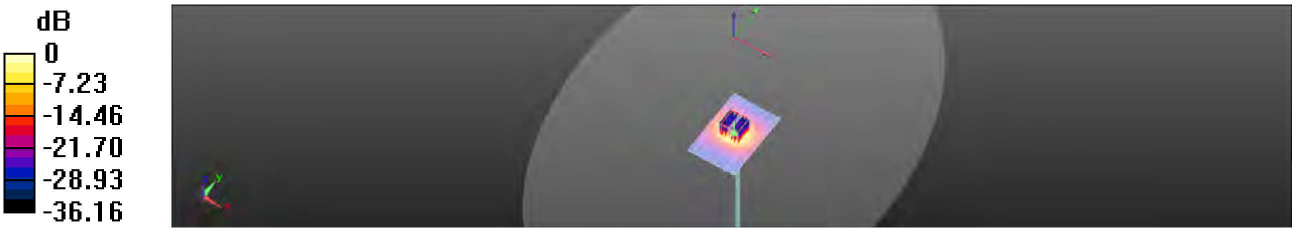
Dipole 5600 MHz_SN:1023
Communication System: CW; Frequency: 5600 MHz
Medium parameters used: f = 5600 MHz; σ = 5.702 S/m; ε_r = 47.549; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.49, 3.49, 3.49); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 16.5 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 55.60 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 7.63 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 16.8 W/kg



0 dB = 16.8 W/kg = 12.24 dBW/kg

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Date: 2015/7/17

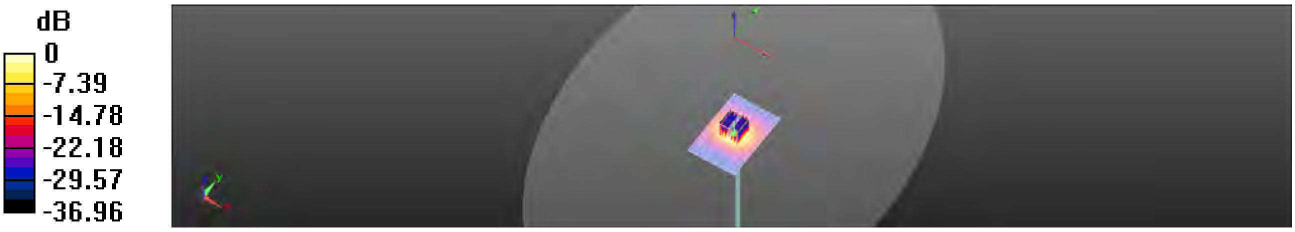
Dipole 5800 MHz_SN:1023
Communication System: CW; Frequency: 5800 MHz
Medium parameters used: f = 5800 MHz; σ = 5.950 S/m; ε_r = 47.307; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3831; ConvF(3.7, 3.7, 3.7); Calibrated: 2015/1/29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 2014/12/11
- Phantom: Body
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Pin=100mW/Area Scan (61x91x1): Interpolated grid: dx=10 mm, dy=10 mm
Maximum value of SAR (interpolated) = 16.0 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 54.00 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 7.45 W/kg; SAR(10 g) = 2.09 W/kg
Maximum value of SAR (measured) = 16.0 W/kg



0 dB = 16.0 W/kg = 12.05 dBW/kg

7. DAE & Probe Calibration Certificate

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

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

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

Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **DAE4-1374_May15**

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BM - SN: 1374

Calibration procedure(s): QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: May 06, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-14 (No:15573)	Oct-15
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	06-Jan-15 (in house check)	In house check: Jan-16
Calibrator Box V2.1	SE UMS 006 AA 1002	06-Jan-15 (in house check)	In house check: Jan-16

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: May 6, 2015

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

Certificate No: DAE4-1374_May15 Page 1 of 5

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
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Accreditation No.: SCS 0108

Glossary

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

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The 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.

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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100…+300 mV

Low Range: 1LSB = 61nV , full range = -1…….+3mV

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

Calibration Factors	X	Y	Z
High Range	405.241 ± 0.02% (k=2)	405.484 ± 0.02% (k=2)	405.011 ± 0.02% (k=2)
Low Range	4.00963 ± 1.50% (k=2)	4.00018 ± 1.50% (k=2)	3.98770 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	245.0 ° ± 1 °

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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200027.58	-3.42	-0.00
Channel X	+ Input	20005.73	2.63	0.01
Channel X	- Input	-20003.18	3.04	-0.02
Channel Y	+ Input	200027.12	-3.98	-0.00
Channel Y	+ Input	20002.62	-0.35	-0.00
Channel Y	- Input	-20006.98	-0.59	0.00
Channel Z	+ Input	200031.31	-0.10	-0.00
Channel Z	+ Input	20000.66	-2.25	-0.01
Channel Z	- Input	-20008.41	-1.94	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	1999.56	-0.09	-0.00
Channel X	+ Input	199.64	0.05	0.02
Channel X	- Input	-201.87	-1.56	0.78
Channel Y	+ Input	1999.63	0.03	0.00
Channel Y	+ Input	198.55	-0.89	-0.45
Channel Y	- Input	-201.10	-0.69	0.35
Channel Z	+ Input	2000.11	0.64	0.03
Channel Z	+ Input	197.27	-2.23	-1.12
Channel Z	- Input	-202.39	-1.99	0.99

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	-6.38	-8.61
	- 200	9.68	7.55
Channel Y	200	3.79	3.72
	- 200	-5.43	-6.05
Channel Z	200	-15.24	-15.61
	- 200	12.53	12.72

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	-	6.28	-2.15
Channel Y	200	9.34	-	7.43
Channel Z	200	9.24	6.77	-

Certificate No: DAE4-1374_May15 Page 4 of 5

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	16120	15044
Channel Y	15972	15769
Channel Z	16364	15426

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.68	-1.85	0.72	0.51
Channel Y	-1.37	-2.25	-0.26	0.36
Channel Z	1.05	-0.13	2.45	0.53

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
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	+6	+14
Supply (- Vcc)	–0.01	-8	-9

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Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **DAE4-1305_Dec14**

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BM - SN: 1305

Calibration procedure(s): QA CAL-06.v28
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: December 11, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-14 (No:15573)	Oct-15
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: December 11, 2014

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Accreditation No.: **SCS 108**

Glossary

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

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The 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.

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DC Voltage Measurement

A/D - Converter Resolution nominal
High Range: 1LSB = 6.1µV , full range = -100…+300 mV
Low Range: 1LSB = 61nV , full range = -1…….+3mV
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.797 ± 0.02% (k=2)	403.960 ± 0.02% (k=2)	404.281 ± 0.02% (k=2)
Low Range	3.98252 ± 1.50% (k=2)	3.99061 ± 1.50% (k=2)	3.99721 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	119.0 ° ± 1 °

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Appendix (Additional assessments outside the scope of SCS108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199995.67	0.47	0.00
Channel X	+ Input	20002.87	1.97	0.01
Channel X	- Input	-19999.51	1.39	-0.01
Channel Y	+ Input	199995.29	0.15	0.00
Channel Y	+ Input	19998.59	-2.14	-0.01
Channel Y	- Input	-20002.00	-1.05	0.01
Channel Z	+ Input	199993.72	-1.31	-0.00
Channel Z	+ Input	20000.15	-0.54	-0.00
Channel Z	- Input	-20002.66	-1.57	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.85	-0.03	-0.00
Channel X	+ Input	201.04	-0.25	-0.12
Channel X	- Input	-198.91	-0.23	0.12
Channel Y	+ Input	2000.72	-0.15	-0.01
Channel Y	+ Input	201.11	-0.09	-0.04
Channel Y	- Input	-199.18	-0.49	0.24
Channel Z	+ Input	2001.00	0.15	0.01
Channel Z	+ Input	199.91	-1.23	-0.61
Channel Z	- Input	-200.09	-1.39	0.70

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	8.59	6.08
	- 200	-5.73	-7.75
Channel Y	200	-22.69	-23.18
	- 200	23.06	22.56
Channel Z	200	-9.55	-9.96
	- 200	7.73	7.68

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	-	1.64	-5.58
Channel Y	200	8.39	-	2.49
Channel Z	200	10.59	6.30	-

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4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15857	13996
Channel Y	16290	15790
Channel Z	15970	15153

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.42	-0.35	1.68	0.40
Channel Y	-0.24	-1.23	0.76	0.37
Channel Z	-0.59	-1.53	1.00	0.45

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
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	+6	+14
Supply (- Vcc)	−0.01	-8	-9

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Accreditation No.: **SCS 108**

Client **SGS-TW (Auden)**

Certificate No: **EX3-3923_Aug14**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3923

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

Calibration date: August 28, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: August 28, 2014

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E²-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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Probe EX3DV4

SN:3923

Manufactured: March 8, 2013
Calibrated: August 28, 2014

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

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3923

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.58	0.48	0.47	± 10.1 %
DCP (mV)[B]	99.2	102.2	102.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	132.9	±3.0 %
		Y	0.0	0.0	1.0		134.8	
		Z	0.0	0.0	1.0		135.0	

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

[A] The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3923

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	10.91	10.91	10.91	0.25	1.16	± 12.0 %
835	41.5	0.90	10.48	10.48	10.48	0.27	1.07	± 12.0 %
900	41.5	0.97	10.26	10.26	10.26	0.17	1.53	± 12.0 %
1750	40.1	1.37	8.72	8.72	8.72	0.75	0.57	± 12.0 %
1900	40.0	1.40	8.42	8.42	8.42	0.45	0.77	± 12.0 %
2000	40.0	1.40	8.46	8.46	8.46	0.67	0.63	± 12.0 %
2300	39.5	1.67	8.02	8.02	8.02	0.35	0.86	± 12.0 %
2450	39.2	1.80	7.66	7.66	7.66	0.33	0.87	± 12.0 %
2600	39.0	1.96	7.41	7.41	7.41	0.35	0.86	± 12.0 %
5200	36.0	4.66	5.17	5.17	5.17	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.99	4.99	4.99	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.71	4.71	4.71	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.67	4.67	4.67	0.40	1.80	± 13.1 %

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

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

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

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3923

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	10.29	10.29	10.29	0.30	1.04	± 12.0 %
835	55.2	0.97	10.32	10.32	10.32	0.55	0.78	± 12.0 %
900	55.0	1.05	10.04	10.04	10.04	0.44	0.88	± 12.0 %
1750	53.4	1.49	8.30	8.30	8.30	0.39	0.85	± 12.0 %
1900	53.3	1.52	8.03	8.03	8.03	0.30	0.95	± 12.0 %
2000	53.3	1.52	8.16	8.16	8.16	0.23	1.16	± 12.0 %
2300	52.9	1.81	7.76	7.76	7.76	0.44	0.77	± 12.0 %
2450	52.7	1.95	7.56	7.56	7.56	0.80	0.50	± 12.0 %
2600	52.5	2.16	7.36	7.36	7.36	0.80	0.60	± 12.0 %
5200	49.0	5.30	4.71	4.71	4.71	0.35	1.90	± 13.1 %
5300	48.9	5.42	4.58	4.58	4.58	0.35	1.90	± 13.1 %
5600	48.5	5.77	4.09	4.09	4.09	0.40	1.90	± 13.1 %
5800	48.2	6.00	4.33	4.33	4.33	0.40	1.90	± 13.1 %

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

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

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

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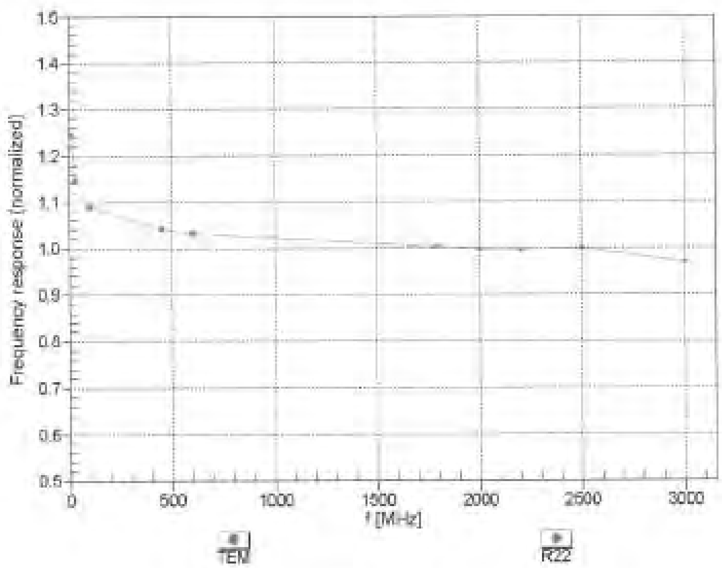
EX3DV4– SN:3923 August 28, 2014

Frequency Response of E-Field

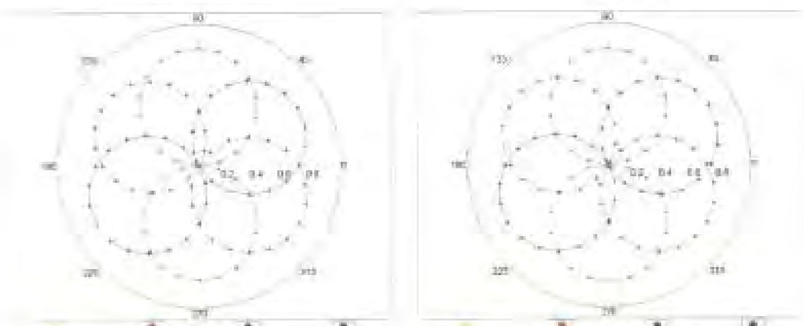
(TEM-Cell:ifi110 EXX, Waveguide: R22)

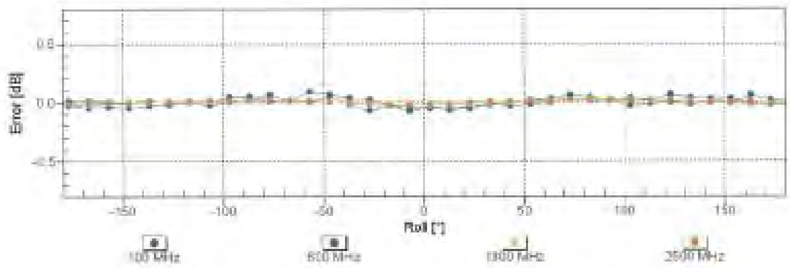


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM f=1800 MHz,R22





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

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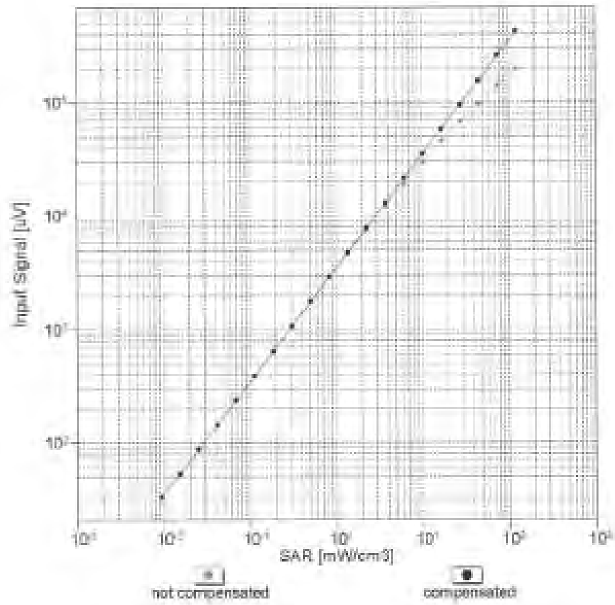
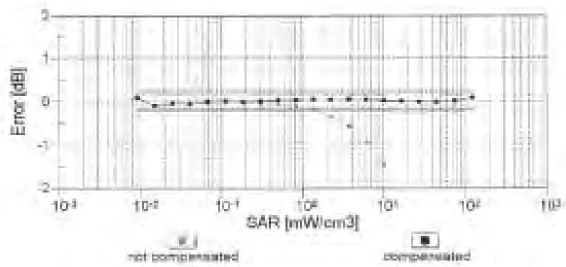
Dynamic Range f(SAR_{head})

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





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

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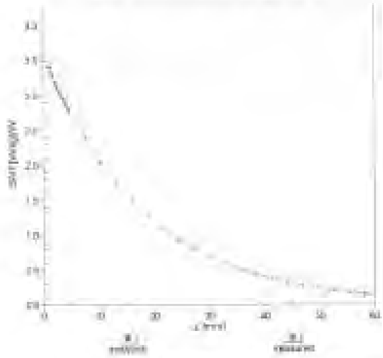
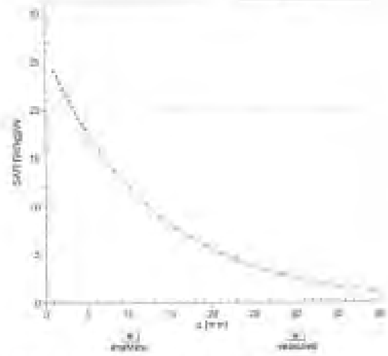
EX3DV4– SN:3923 August 28, 2014

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

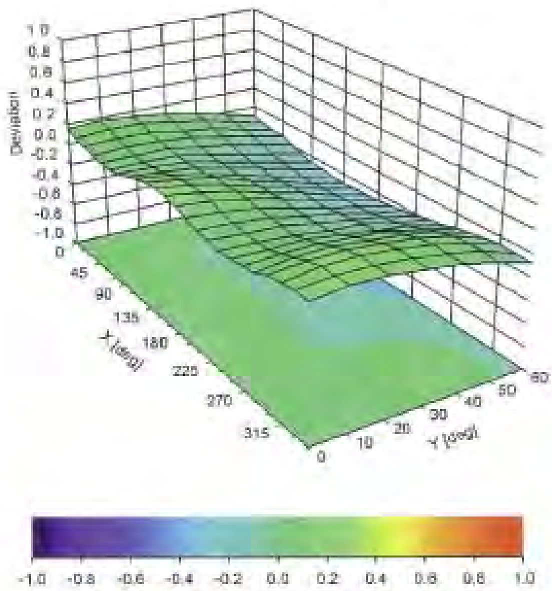


f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



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

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3923

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-57
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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S Schweizerischer Kalibrierdienst
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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **EX3-3831_Jan15**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3831

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

Calibration date: January 29, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: January 29, 2015

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

Certificate No: EX3-3831_Jan15 Page 1 of 11

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Certificate No: EX3-3831_Jan15 Page 2 of 11

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Probe EX3DV4

SN:3831

Manufactured: September 6, 2011
Calibrated: January 29, 2015

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

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EX3DV4– SN:3831 January 29, 2015

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3831

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)^2)[A]	0.45	0.42	0.43	± 10.1 %
DCP (mV)[B]	99.7	101.1	100.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	152.6	±3.5 %
		Y	0.0	0.0	1.0		143.5	
		Z	0.0	0.0	1.0		145.4	

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

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

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3831

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	9.28	9.28	9.28	0.31	0.99	± 12.0 %
835	41.5	0.90	8.95	8.95	8.95	0.28	1.17	± 12.0 %
900	41.5	0.97	8.76	8.76	8.76	0.25	1.23	± 12.0 %
1450	40.5	1.20	7.92	7.92	7.92	0.13	1.92	± 12.0 %
1750	40.1	1.37	7.75	7.75	7.75	0.32	0.89	± 12.0 %
1900	40.0	1.40	7.58	7.58	7.58	0.63	0.65	± 12.0 %
2000	40.0	1.40	7.48	7.48	7.48	0.80	0.57	± 12.0 %
2300	39.5	1.67	7.09	7.09	7.09	0.27	0.99	± 12.0 %
2450	39.2	1.80	6.81	6.81	6.81	0.51	0.68	± 12.0 %
2600	39.0	1.96	6.54	6.54	6.54	0.28	1.01	± 12.0 %
5250	35.9	4.71	4.60	4.60	4.60	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.14	4.14	4.14	0.45	1.80	± 13.1 %
5750	35.4	5.22	4.41	4.41	4.41	0.45	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3831

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	9.07	9.07	9.07	0.20	1.58	± 12.0 %
835	55.2	0.97	9.00	9.00	9.00	0.25	1.30	± 12.0 %
900	55.0	1.05	8.87	8.87	8.87	0.33	1.00	± 12.0 %
1450	54.0	1.30	7.68	7.68	7.68	0.19	1.44	± 12.0 %
1750	53.4	1.49	7.50	7.50	7.50	0.40	0.89	± 12.0 %
1900	53.3	1.52	7.34	7.34	7.34	0.31	1.06	± 12.0 %
2000	53.3	1.52	7.41	7.41	7.41	0.33	0.98	± 12.0 %
2300	52.9	1.81	7.08	7.08	7.08	0.40	0.89	± 12.0 %
2450	52.7	1.95	6.81	6.81	6.81	0.44	0.80	± 12.0 %
2600	52.5	2.16	6.65	6.65	6.65	0.80	0.58	± 12.0 %
5250	48.9	5.36	3.92	3.92	3.92	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.49	3.49	3.49	0.55	1.90	± 13.1 %
5750	48.3	5.94	3.70	3.70	3.70	0.55	1.90	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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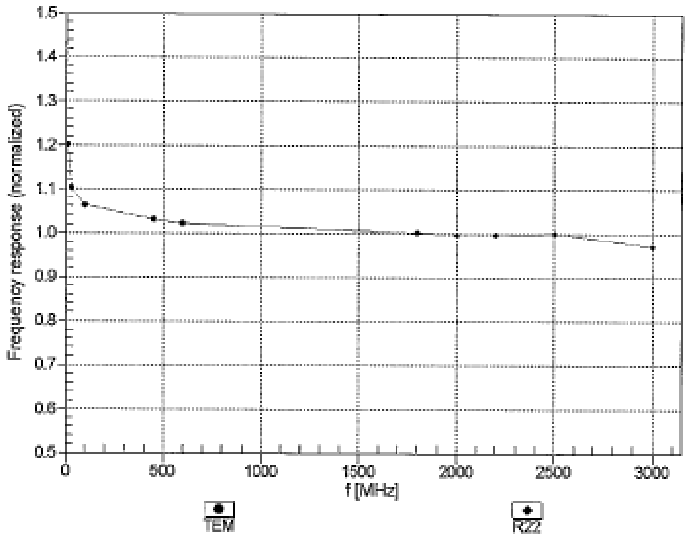
Frequency Response of E-Field

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



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

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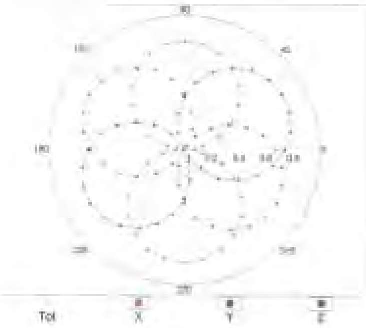
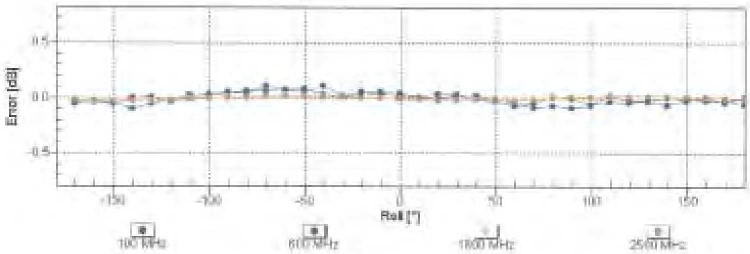
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22



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

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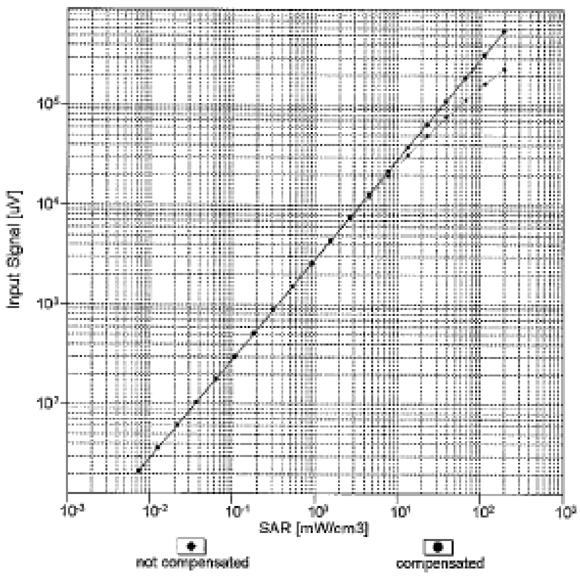
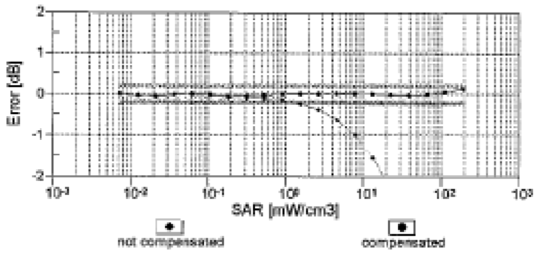
Dynamic Range f(SAR_{head})

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

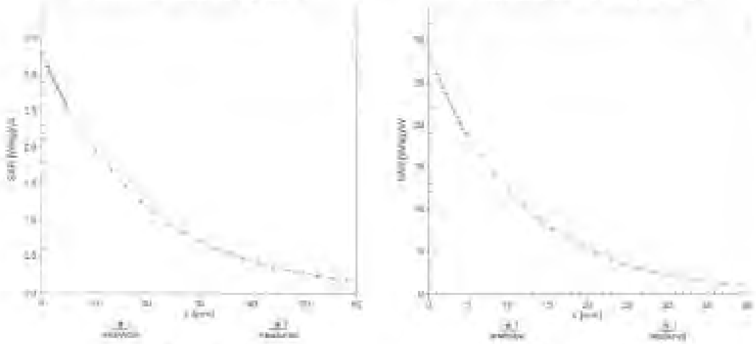




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

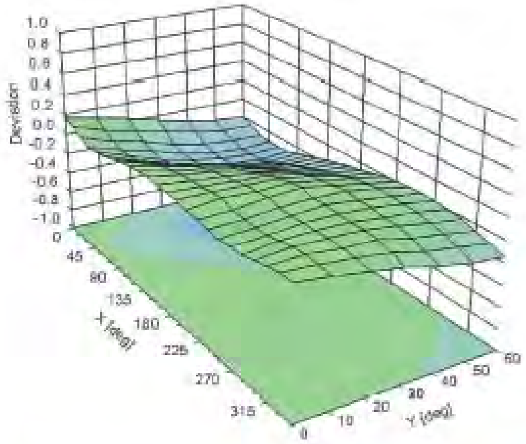
EX3DV4– SN:3831 January 29, 2015

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

Certificate No: EX3-3831_Jan15 Page 10 of 11

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3831

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-20.5
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

Measurement Uncertainty evaluation template for DUT SAR test (3-6G)

A	b	c	D	e	f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Description	Tolerance/ Uncertainty %	Probability Distribution	Div	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	7.2.1	6.55%	N	1	1	1	6.55%	6.55%	∞
Isotropy , Axial	7.2.1.2	3.5%	R	√3	1	1	2.0%	2.0%	∞
Isotropy, Hemispherical	7.2.1.2	9.6%	R	√3	1	1	5.5%	5.5%	∞
Boundary Effect	7.2.1.5	1.0%	R	√3	1	1	0.6%	0.6%	∞
Linearity	7.2.1.3	4.7%	R	√3	1	1	2.7%	2.7%	∞
Detection Limits	7.2.1.4	1.0%	R	√3	1	1	0.6%	0.6%	∞
Readout Electronics	7.2.1.6	0.3%	N	1	1	1	0.3%	0.3%	∞
Response time	7.2.1.7	0.8%	R	√3	1	1	0.5%	0.5%	∞
Integration Time	7.2.1.8	2.6%	R	√3	1	1	1.5%	1.5%	∞
Measurement drift	7.2.1.9	1.8%	R	√3	1	1	1.0%	1.0%	∞
RF ambient condition - noise	7.2.3.4	3.0%	R	√3	1	1	1.7%	1.7%	∞
RF ambient conditions - reflections	7.2.3.4	3.0%	R	√3	1	1	1.7%	1.7%	∞
Probe positioner Mechanical restrictions	7.2.2.1	0.4%	R	√3	1	1	0.2%	0.2%	∞
Probe Positioning with respect to phantom shell	7.2.2.4	2.9%	R	√3	1	1	1.7%	1.7%	∞
Post-processing	7.2.4	1.0%	R	√3	1	1	0.6%	0.6%	∞
Test Sample related									
Test sample positioning	7.2.2.4	2.9%	N	1	1	1	2.9%	2.9%	M-1
Device Holder Uncertainty	7.2.2.4.2	3.6%	N	1	1	1	3.6%	3.6%	M-1
Drift of output power	7.2.1.9	5.0%	R	√3	1	1	2.9%	2.9%	∞
Phantom and Setup									
Phantom	7.2.2.2	4.0%	R	√3	1	1	2.3%	2.3%	∞
Algorithm for correcting SAR for deviations in permitivity and conductivity	7.2.3.3	1.9%	N	1	1	0.84	1.9%	1.6%	∞
Liquid conductivity(meas.)	7.2.3.2	2.5%	N	1	0.64	0.43	1.6%	1.1%	M
Liquid permitivity(meas)	7.2.3.3	2.5%	N	1	0.6	0.49	1.5%	1.2%	M
Combined standard uncertainty	7.3.1		RSS				11.9%	11.8%	
Expant uncertainty (95% confidence interval), K=2	7.3.2						23.8%	23.6%	

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

A	b	c	D	e	f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Description	Tolerance/ Uncertainty %	Probability Distribution	Div	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	7.2.1	6.00%	N	1	1	1	6.00%	6.00%	∞
Isotropy , Axial	7.2.1.2	3.5%	R	√3	1	1	2.0%	2.0%	∞
Isotropy, Hemispherical	7.2.1.2	9.6%	R	√3	1	1	5.5%	5.5%	∞
Boundary Effect	7.2.1.5	1.0%	R	√3	1	1	0.6%	0.6%	∞
Linearity	7.2.1.3	4.7%	R	√3	1	1	2.7%	2.7%	∞
Detection Limits	7.2.1.4	1.0%	R	√3	1	1	0.6%	0.6%	∞
Readout Electronics	7.2.1.6	0.3%	N	1	1	1	0.3%	0.3%	∞
Response time	7.2.1.7	0.8%	R	√3	1	1	0.5%	0.5%	∞
Integration Time	7.2.1.8	2.6%	R	√3	1	1	1.5%	1.5%	∞
Measurement drift	7.2.1.9	1.8%	R	√3	1	1	1.0%	1.0%	∞
RF ambient condition - noise	7.2.3.4	3.0%	R	√3	1	1	1.7%	1.7%	∞
RF ambient conditions - reflections	7.2.3.4	3.0%	R	√3	1	1	1.7%	1.7%	∞
Probe positioner Mechanical restrictions	7.2.2.1	0.4%	R	√3	1	1	0.2%	0.2%	∞
Probe Positioning with respect to phantom shell	7.2.2.4	2.9%	R	√3	1	1	1.7%	1.7%	∞
Post-processing	7.2.4	1.0%	R	√3	1	1	0.6%	0.6%	∞
Test Sample related									
Test sample positioning	7.2.2.4	2.9%	N	1	1	1	2.9%	2.9%	M-1
Device Holder Uncertainty	7.2.2.4.2	3.6%	N	1	1	1	3.6%	3.6%	M-1
Drift of output power	7.2.1.9	5.0%	R	√3	1	1	2.9%	2.9%	∞
Phantom and Setup									
Phantom	7.2.2.2	4.0%	R	√3	1	1	2.3%	2.3%	∞
Algorithm for correcting SAR for deviations in permitivity and conductivity	7.2.3.3	1.9%	N	1	1	0.84	1.9%	1.6%	∞
Liquid conductivity(meas.)	7.2.3.2	2.5%	N	1	0.64	0.43	1.6%	1.1%	M
Liquid permitivity(meas)	7.2.3.3	2.5%	N	1	0.6	0.49	1.5%	1.2%	M
Combined standard uncertainty	7.3.1		RSS				11.6%	11.5%	
Expant uncertainty (95% confidence interval), K=2	7.3.2						23.2%	23.0%	

9. Phantom Description

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Certificate of Conformity / First Article Inspection

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

Tests

The series production process used allows the limitation 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 standards	6mm +/- 0.2mm at ERP	First article, All items
Material parameters	Dielectric parameters for required frequencies	300 MHz – 6 GHz: Relative permittivity < 5, Loss tangent < 0.05	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 filled with 155mm of HSL900 and without DUT below	Prototypes, Sample testing

Standards

[1] CENELEC EN 50361
[2] IEEE Std 1528-2003
[3] IEC 62209 Part I
[4] FCC OET Bulletin 65, Supplement C, Edition 01-01
(*) 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

Signature / Stamp

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Doc No 881 – QD 000 P40 C – F   Page 1 (1)

10. System Validation from Original Equipment Supplier

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

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Swiss Calibration Service

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

Accreditation No.: SCS 108

Client **SGS-TW (Auden)**

Certificate No: **D750V3-1015_Aug14**

CALIBRATION CERTIFICATE

Object: D750V3 - SN: 1015

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: August 28, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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

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

Issued: August 28, 2014

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

Certificate No: D750V3-1015_Aug14 Page 1 of 8

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.2 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.31 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.45 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.4 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.75 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.85 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω - 0.4 jΩ
Return Loss	- 30.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.3 Ω - 2.9 jΩ
Return Loss	- 29.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.037 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	March 22, 2010

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DASY5 Validation Report for Head TSL

Date: 28.08.2014

Test Laboratory: SPEAG, Zurich, Switzerland

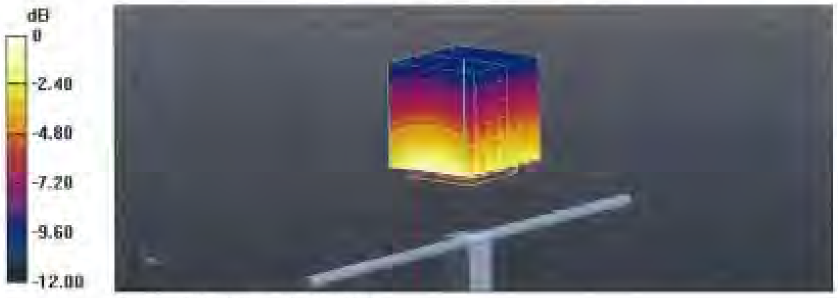
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1015

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.91 S/m; ε_r = 42.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.37, 6.37, 6.37); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.68 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.13 W/kg
SAR(1 g) = 2.11 W/kg; SAR(10 g) = 1.38 W/kg
Maximum value of SAR (measured) = 2.46 W/kg



0 dB = 2.46 W/kg = 3.91 dBW/kg

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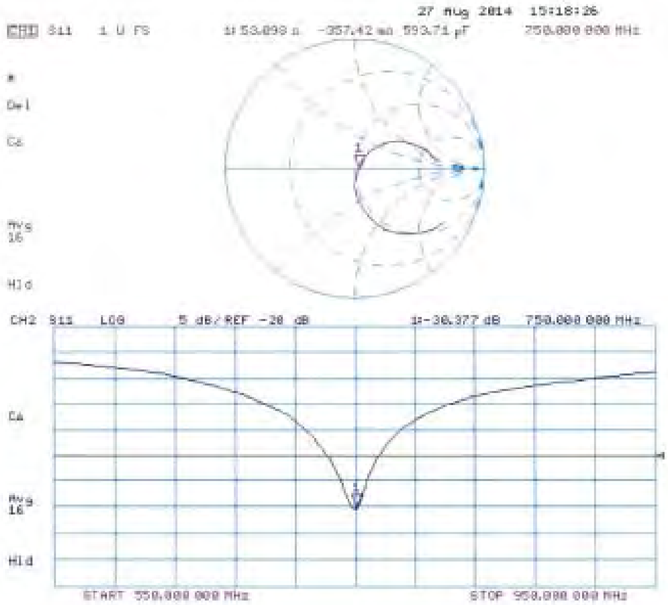
Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1015_Aug14 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 27.08.2014

Test Laboratory: SPEAG, Zurich, Switzerland

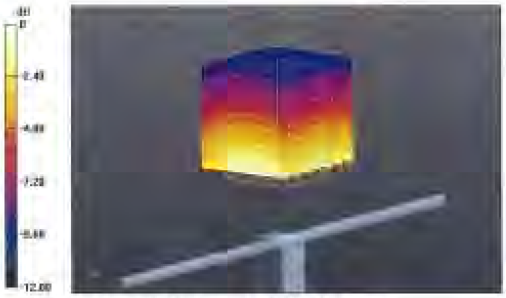
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1015

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.99 S/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.13, 6.13, 6.13); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.06 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.26 W/kg
SAR(1 g) = 2.24 W/kg; SAR(10 g) = 1.49 W/kg
Maximum value of SAR (measured) = 2.60 W/kg



0 dB = 2.60 W/kg = 4.15 dBW/kg

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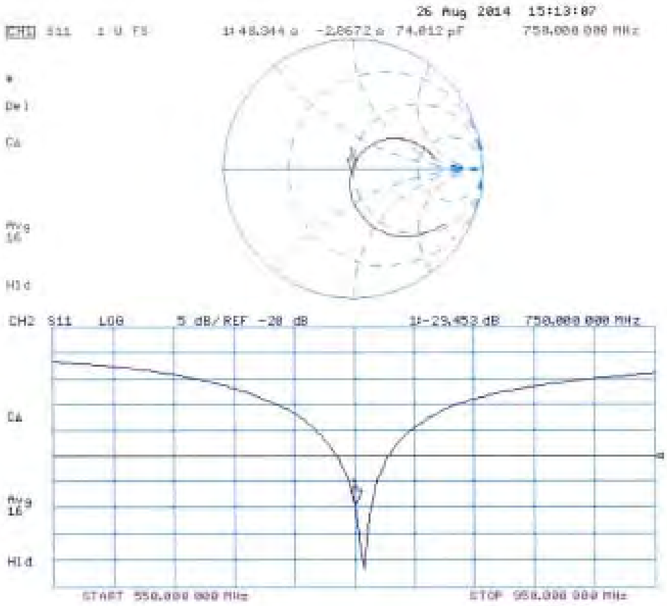
Impedance Measurement Plot for Body TSL



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

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Accreditation No.: SCS 108

Client **SGS-TW (Auden)**

Certificate No: D835V2-4d063_Aug14

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d063
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 28, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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

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

Issued: August 28, 2014

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.0 ± 6 %	0.94 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.24 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.05 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.2 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.35 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.21 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω - 3.6 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω - 5.8 jΩ
Return Loss	- 23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 27, 2006

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DASY5 Validation Report for Head TSL

Date: 28.08.2014

Test Laboratory: SPEAG, Zurich, Switzerland

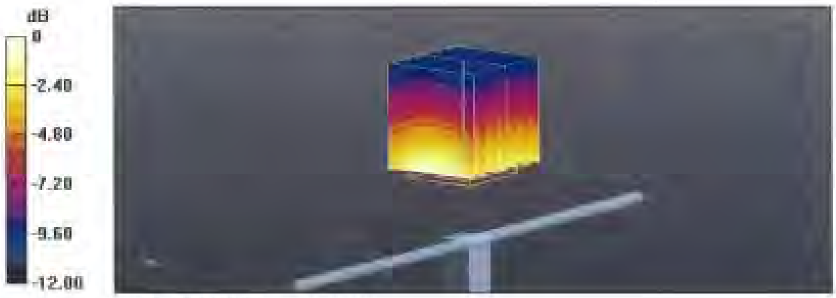
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d063

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 42; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.23 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.53 W/kg
SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (measured) = 2.78 W/kg



0 dB = 2.78 W/kg = 4.44 dBW/kg

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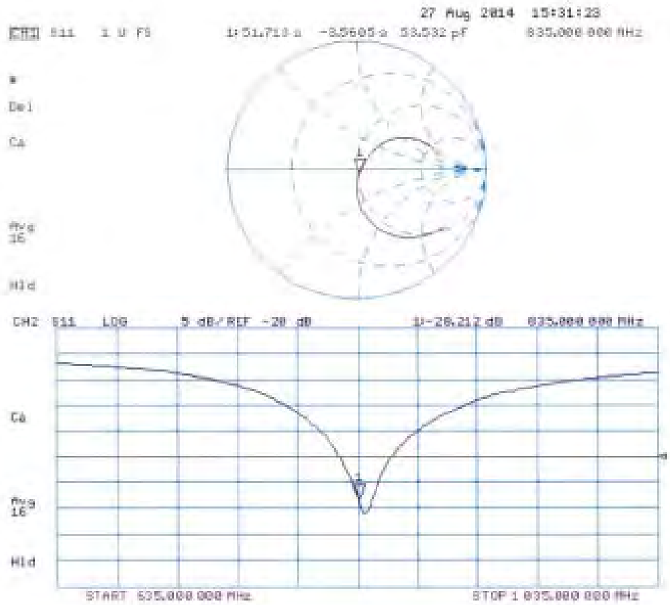
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 27.08.2014

Test Laboratory: SPEAG, Zurich, Switzerland

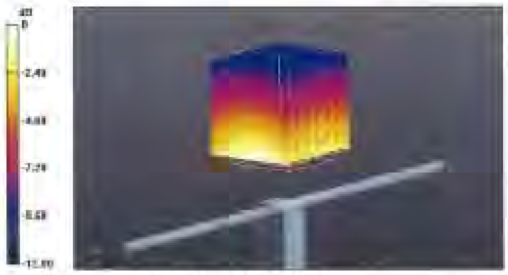
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d063

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 55.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.65 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.53 W/kg
SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 2.80 W/kg



0 dB = 2.80 W/kg = 4.47 dBW/kg

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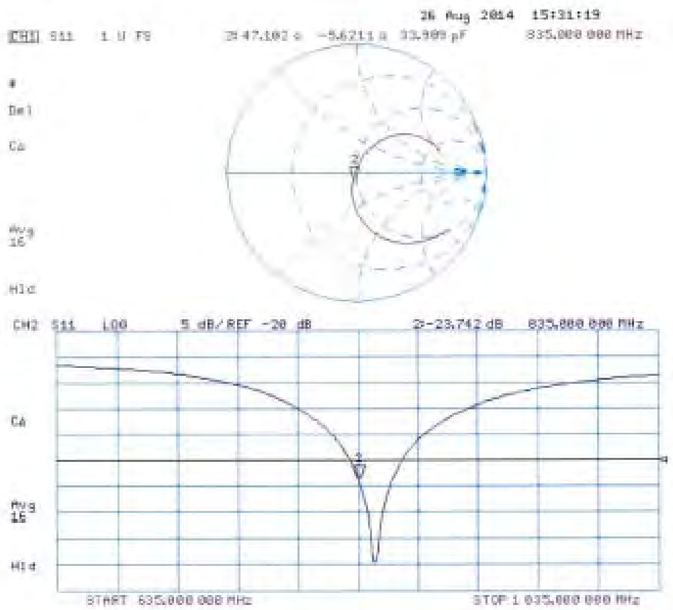
Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 108**

Client **SGS-TW (Auden)**

Certificate No: **D1750V2-1008_Aug14**

CALIBRATION CERTIFICATE

Object: D1750V2 - SN: 1008

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: August 28, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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

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

Issued: August 28, 2014

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Certificate No: D1750V2-1008_Aug14 Page 1 of 8

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
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 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.2 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.91 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.6 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	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.0 ± 6 %	1.49 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.2 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.4 Ω + 0.3 jΩ
Return Loss	- 46.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.4 Ω + 0.3 jΩ
Return Loss	- 28.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.222 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 11, 2009

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DASY5 Validation Report for Head TSL

Date: 28.08.2014

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; σ = 1.37 S/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.23, 5.23, 5.23); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 95.53 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 9.26 W/kg; SAR(10 g) = 4.91 W/kg
Maximum value of SAR (measured) = 11.6 W/kg

0 dB = 11.6 W/kg = 10.64 dBW/kg

Certificate No: D1750V2-1008_Aug14 Page 5 of 8

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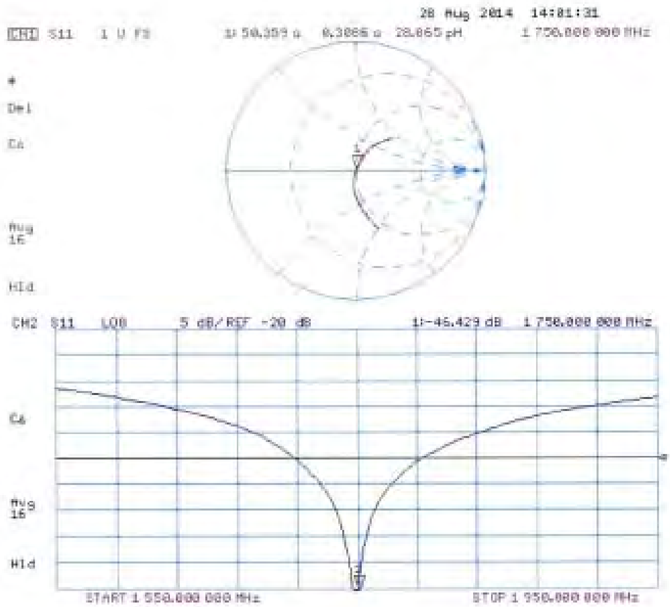
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 28.08.2014

Test Laboratory: SPEAG, Zurich, Switzerland

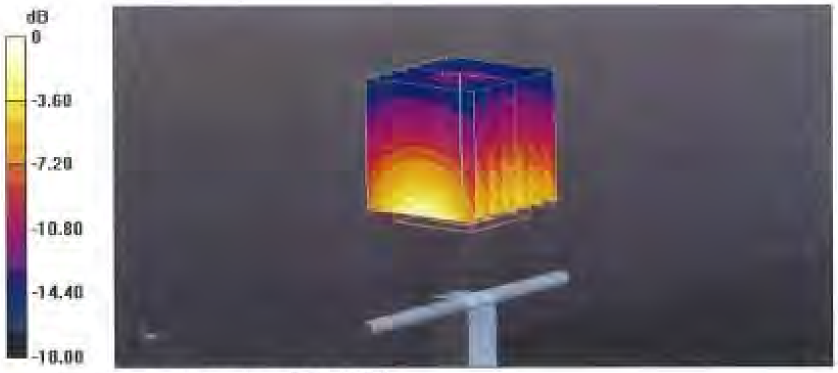
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1008

Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.49 S/m; ε_r = 52; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.89, 4.89, 4.89); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 93.44 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.3 W/kg
SAR(1 g) = 9.44 W/kg; SAR(10 g) = 5.07 W/kg
Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.9 W/kg = 10.76 dBW/kg

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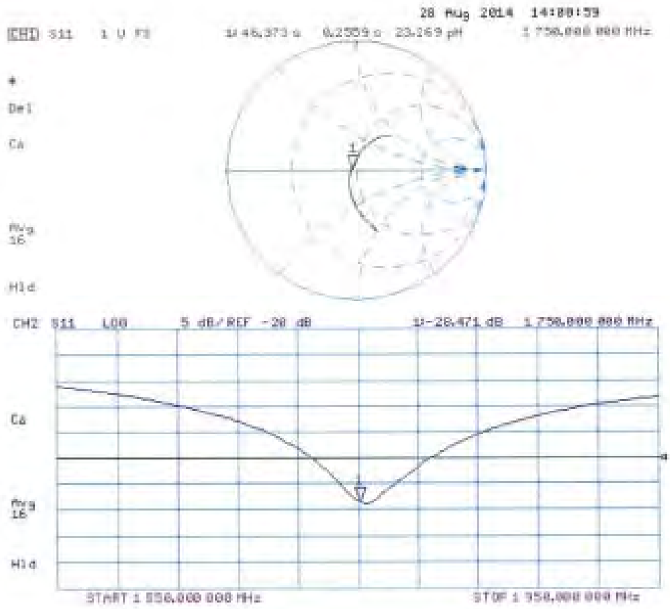
Impedance Measurement Plot for Body TSL



Certificate No: D1750V2-1008_Aug14 Page 8 of 8

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Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **D1900V2-5d027_Apr15**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN:5d027
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	April 29, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: April 29, 2015

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Certificate No: D1900V2-5d027_Apr15 Page 1 of 8

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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

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	38.6 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.3 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.8 ± 6 %	1.50 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.78 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.2 Ω + 2.5 jΩ
Return Loss	- 32.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.5 Ω + 2.5 jΩ
Return Loss	- 27.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 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	December 17, 2002

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DASY5 Validation Report for Head TSL

Date: 29.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

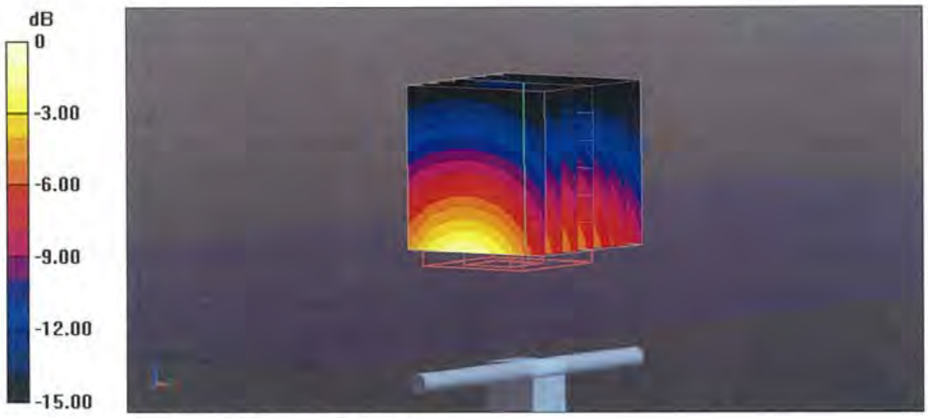
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d027

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.37 S/m; ε_r = 38.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 97.71 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 18.5 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.3 W/kg
Maximum value of SAR (measured) = 12.3 W/kg



0 dB = 12.3 W/kg = 10.90 dBW/kg

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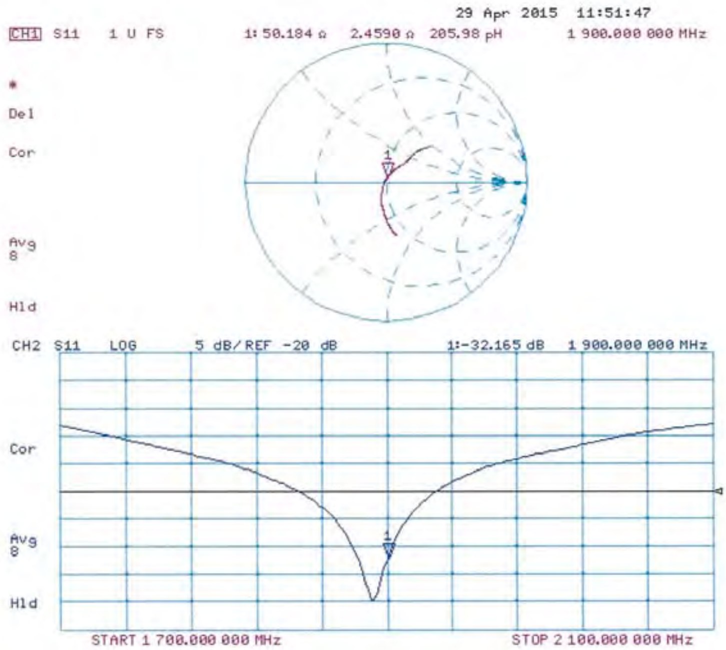
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 29.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

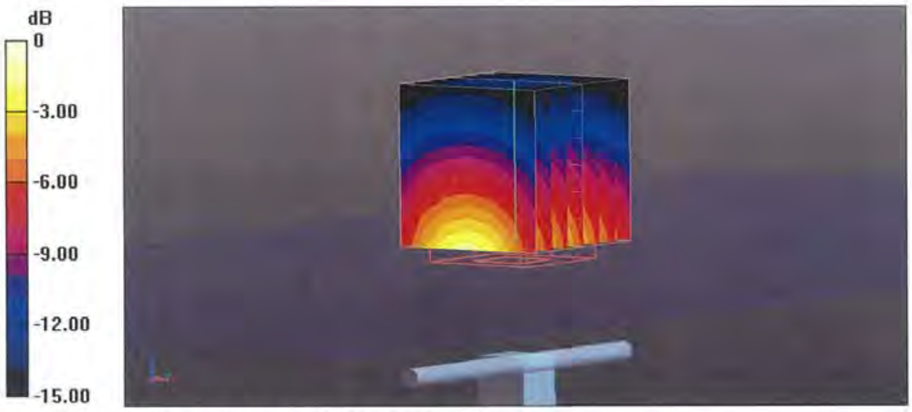
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d027

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.5 S/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

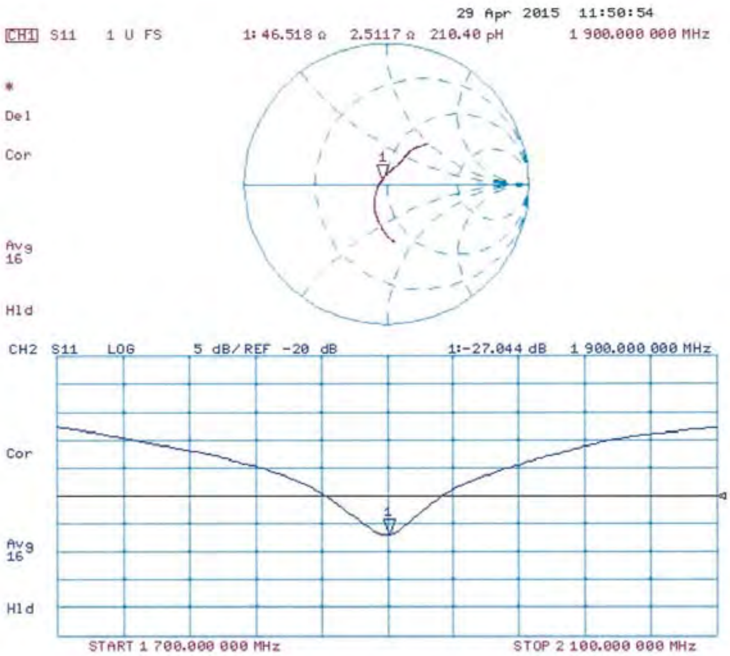
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.63 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 9.78 W/kg; SAR(10 g) = 5.2 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



0 dB = 12.4 W/kg = 10.93 dBW/kg

Certificate No: D1900V2-5d027_Apr15 Page 7 of 8

Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **D2450V2-727_Apr15**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 727

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: April 22, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: April 23, 2015

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.6 ± 6 %	1.82 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 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	50.6 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.0 W/kg ± 16.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.2 Ω + 1.3 jΩ
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.8 Ω + 3.3 jΩ
Return Loss	- 28.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 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	January 09, 2003

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DASY5 Validation Report for Head TSL

Date: 22.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

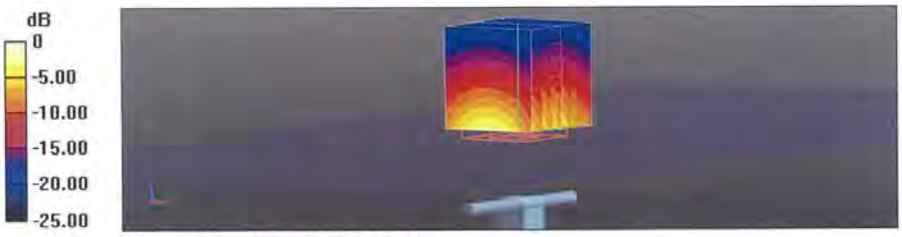
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 727

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.82 S/m; ε_r = 37.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 101.5 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (measured) = 17.5 W/kg



0 dB = 17.5 W/kg = 12.43 dBW/kg

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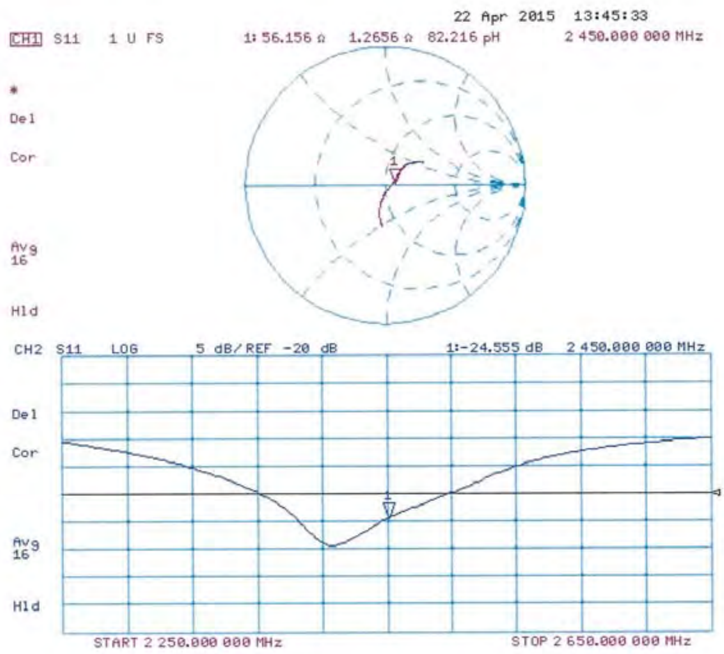
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 22.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

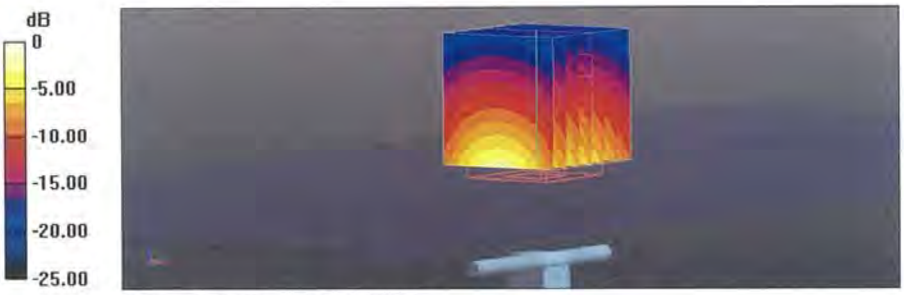
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 727

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 2.02$ S/m; $\varepsilon_r = 50.6$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 95.54 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

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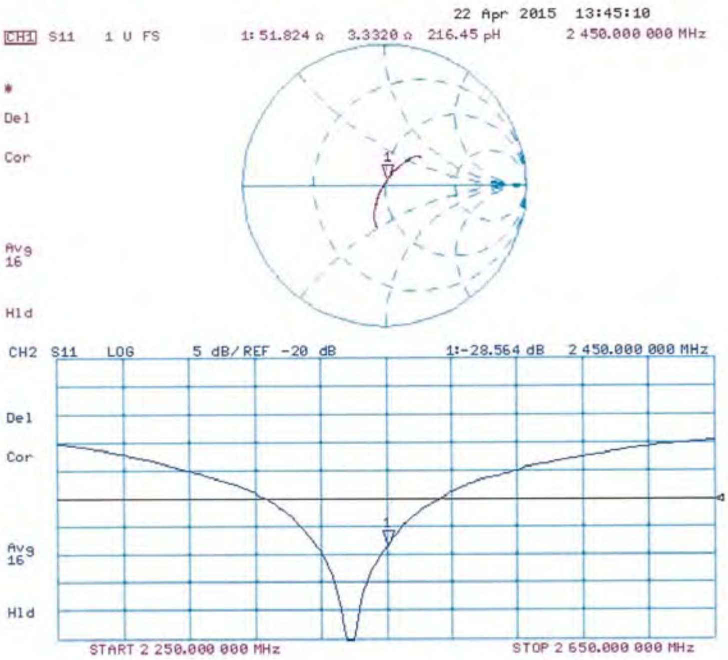
Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 0108**

Client **SGS-TW (Auden)**

Certificate No: **D5GHzV2-1023_Jan15**

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN:1023

Calibration procedure(s): QA CAL-22.v2
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: January 29, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe EX3DV4	SN: 3503	30-Dec-14 (No. EX3-3503_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: January 29, 2015

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

Certificate No: D5GHzV2-1023_Jan15 Page 1 of 15

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Accreditation No.: **SCS 0108**

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) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
c) 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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 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	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	4.56 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.78 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.2 W/kg ± 19.5 % (k=2)**

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Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	4.66 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^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.7 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	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	35.7 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

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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	35.4 ± 6 %	5.16 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 W/kg ± 19.5 % (k=2)**

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Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	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	49.4 ± 6 %	5.42 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^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.33 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**73.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.5 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	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	49.2 ± 6 %	5.55 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	—	—

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.8 W/kg ± 19.5 % (k=2)**

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Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	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	48.7 ± 6 %	5.96 mho/m ± 6 %
Body TSL temperature change during test	≤ 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.77 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 19.5 % (k=2)**

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 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.4 ± 6 %	6.25 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.54 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

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Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	49.2 Ω - 8.5 jΩ
Return Loss	- 21.4 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	51.0 Ω - 3.8 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.4 Ω - 2.7 jΩ
Return Loss	- 27.5 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.5 Ω + 1.0 jΩ
Return Loss	- 25.4 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.0 Ω - 7.1 jΩ
Return Loss	- 22.8 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.5 Ω - 2.2 jΩ
Return Loss	- 31.7 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	54.6 Ω - 1.5 jΩ
Return Loss	- 26.8 dB

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Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.6 Ω + 2.8 jΩ
Return Loss	- 24.5 dB

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: 28.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; 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 = 4.56 S/m; ε_r = 36.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.66 S/m; ε_r = 36.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.97 S/m; ε_r = 35.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.18 S/m; ε_r = 35.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.51, 5.51, 5.51); Calibrated: 30.12.2014, ConvF(5.21, 5.21, 5.21); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 64.14 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.22 W/kg
Maximum value of SAR (measured) = 17.8 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 = 65.47 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.34 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 = 63.68 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 18.9 W/kg

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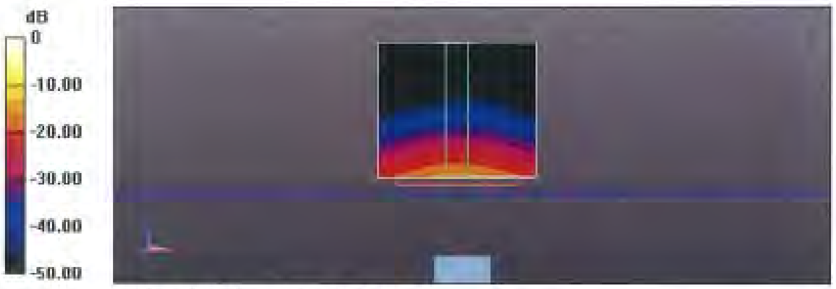
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.76 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 7.82 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 18.4 W/kg



0 dB = 17.8 W/kg = 12.50 dBW/kg

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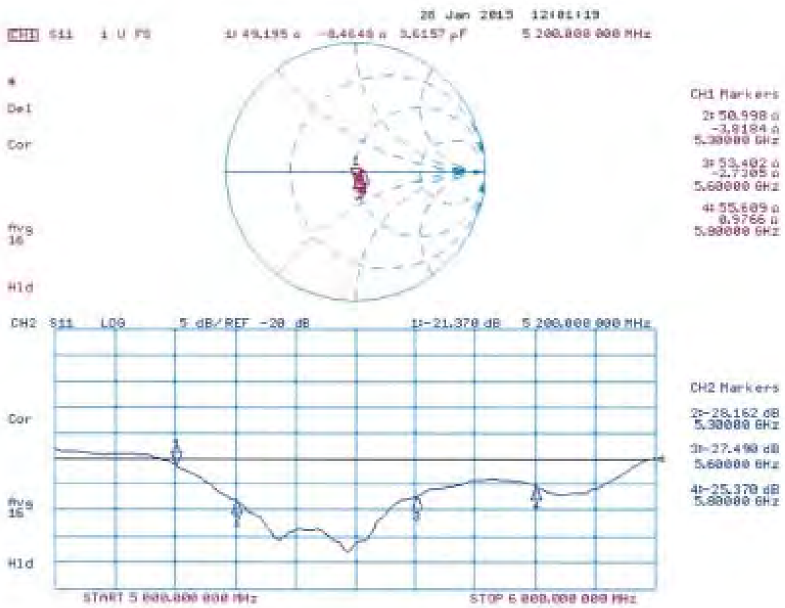
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 29.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; 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 = 5.42 S/m; ε_r = 49.4; ρ = 1000 kg/m^3, Medium parameters used: f = 5300 MHz; σ = 5.55 S/m; ε_r = 49.2; ρ = 1000 kg/m^3, Medium parameters used: f = 5600 MHz; σ = 5.96 S/m; ε_r = 48.7; ρ = 1000 kg/m^3, Medium parameters used: f = 5800 MHz; σ = 6.25 S/m; ε_r = 48.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.95, 4.95, 4.95); Calibrated: 30.12.2014, ConvF(4.78, 4.78, 4.78); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 57.97 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 28.6 W/kg
SAR(1 g) = 7.33 W/kg; SAR(10 g) = 2.04 W/kg
Maximum value of SAR (measured) = 17.3 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 = 57.58 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 30.0 W/kg
SAR(1 g) = 7.45 W/kg; SAR(10 g) = 2.07 W/kg
Maximum value of SAR (measured) = 17.8 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 = 56.88 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 34.4 W/kg
SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.15 W/kg
Maximum value of SAR (measured) = 19.3 W/kg

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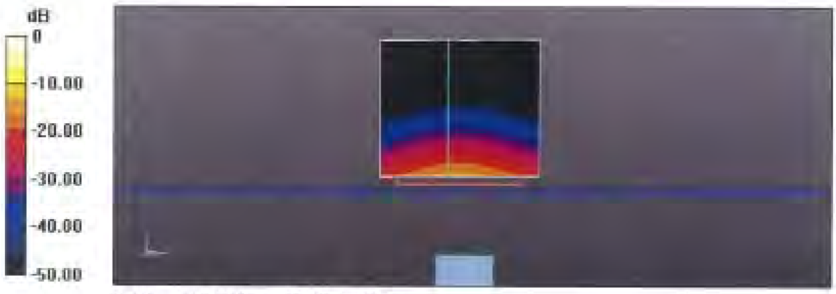
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.10 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 35.2 W/kg
SAR(1 g) = 7.54 W/kg; SAR(10 g) = 2.07 W/kg
Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg

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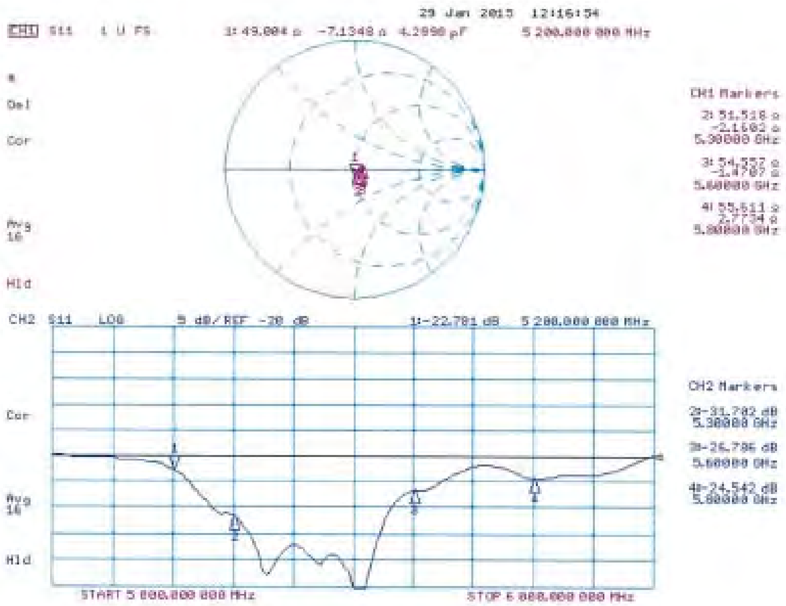
Impedance Measurement Plot for Body TSL



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- End of 1st part of report -

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