SAR TEST REPORT

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

Equipment Under Test	Tula Health Genie
Brand Name	Tula Health Genie
Model No.	THG001
Company Name	Tula Health, Inc.
Company Address	686 North Arbinger Way Suite 300, Farmington, Utah, United States
Standards	IEEE/ANSI C95.1-1992, IEEE 1528-2013,
FCC ID	2AXOYTULA
Date of Receipt	May 19, 2020
Date of Test(s)	Jun. 04, 2021 ~ Jun. 10, 2021
Date of Issue	Sep. 24, 2021

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 Ltd. Central RF Lab or testing done by SGS Taiwan Ltd. Central RF Lab in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Ltd. Central RF Lab in writing.

Signed on behalf of SGS

Clerk / Kimmy Chiou	PM / Kiki Lin	Asst. Manager / John Yeh
Kimmy Chiou	Kiki Lin	John Yeh

Date: Sep. 24, 2021

Revision History

Report Number	Revision	Description	Issue Date
ES/2020/50017	Rev.00	Initial creation of document	Sep. 24, 2021

Contents

0. Guidance applied

The SAR testing method and procedure for this device is in accordance with the following standards:
IEEE/ANSI C95.1-1992
IEEE 1528-2013
KDB865664D01v01r04
KDB865664D02v01r02
KDB941225D01v03r01
KDB447498D01v06
KDB648474D04v01r03
KDB941225D05v02r05

1. General Information

1.1 Testing Laboratory

SGS Taiwan Ltd. Central RF Lab	
No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan	
FCC Designation Number	TW0027
Tel	+886-2-2299-3279
Fax	+886-2-2298-0488
Internet	http://www.tw.sgs.com/

1.2 Details of Applicant

Company Name	Tula Health, Inc.
Company Address	686 North Arbinger Way Suite 300, Farmington, Utah, United States

1.3 Description of EUT

Equipment Under Test	Tula Health Genie			
Brand Name	Tula Health Genie			
Model No.	THG001			
FCC ID	2AXOYTULA			
Mode of Operation	☒WCDMA ☒HSDPA ☒HSUPA ☒HSPA+ ☒LTE FDD ☒Bluetooth			
Duty Cycle	WCDMA	1		
	LTE FDD	1		
TX Frequency Range (MHz)	WCDMA Band II	1850	–	1910
	WCDMA Band V	824	–	849
	LTE FDD Band 2	1850	–	1910
	LTE FDD Band 4	1710	–	1755
	LTE FDD Band 13	777	–	787
	LTE FDD Band 17	704	–	716
	Bluetooth	2402	–	2480
Channel Number (ARFCN)	WCDMA Band II	9262	–	9538
	WCDMA Band V	4132	–	4233
	LTE FDD Band 2	18607	–	19193
	LTE FDD Band 4	19957	–	20393
	LTE FDD Band 13	23205	–	23255
	LTE FDD Band 17	23755	–	23825
	Bluetooth	0	–	78

Max. SAR (1-g) (Unit: W/Kg)				
Mode	Band	Measured	Reported	Position / Channel
Head	WCDMA Band II	0.77	0.80	☐Left ☒Right ☒Cheek ☐Tilt 9538 Channel
	WCDMA Band V	1.25	1.44	☒Left ☐Right ☒Cheek ☐Tilt 4132 Channel
	LTE FDD Band 2	1.29	1.31	☐Left ☒Right ☒Cheek ☐Tilt 18900 Channel
	LTE FDD Band 4	0.76	0.76	☐Left ☒Right ☒Cheek ☐Tilt 20300 Channel
	LTE FDD Band 13	0.94	1.08	☒Left ☐Right ☒Cheek ☐Tilt 23230 Channel
	LTE FDD Band 17	0.87	1.08	☒Left ☐Right ☒Cheek ☐Tilt 23800 Channel

Max. SAR (1-g) (Unit: W/Kg)				
Mode	Band	Measured	Reported	Position / Channel
Body-worn	WCDMA Band II	0.62	0.64	☐Back ☐Front ☒Top ☐Bottom ☐Right ☐Left 9538 Channel
	WCDMA Band V	1.03	1.19	☒Back ☐Front ☐Top ☐Bottom ☐Right ☐Left 4132 Channel
	LTE FDD Band 2	1.32	1.34	☐Back ☐Front ☒Top ☐Bottom ☐Right ☐Left 18700 Channel
	LTE FDD Band 4	1.44	1.45	☐Back ☐Front ☒Top ☐Bottom ☐Right ☐Left 20300 Channel
	LTE FDD Band 13	0.84	0.96	☒Back ☐Front ☐Top ☐Bottom ☐Right ☐Left 23230 Channel
	LTE FDD Band 17	0.79	0.99	☒Back ☐Front ☐Top ☐Bottom ☐Right ☐Left 23800 Channel

WCDMA Band II / Band V - HSDPA / HSUPA / HSPA+ Conducted power table (Unit: dBm):

Band		WCDMA II		
TX Channel		9262	9400	9538
Frequency (MHz)		1852.4	1880	1907.6
Max. Rated Avg. Power+Max. Tolerance (dBm)		**21.50**		
3GPP Rel 99	RMC 12.2Kbps	21.11	21.25	21.35
3GPP Rel 5	HSDPA Subtest-1	19.90	20.23	20.33
	HSDPA Subtest-2	19.86	20.20	20.31
	HSDPA Subtest-3	19.39	19.72	19.81
	HSDPA Subtest-4	19.37	19.71	19.83
3GPP Rel 6	HSUPA Subtest-1	19.88	19.71	19.79
	HSUPA Subtest-2	19.87	20.21	20.31
	HSUPA Subtest-3	18.91	19.25	19.31
	HSUPA Subtest-4	19.89	20.19	20.30
	HSUPA Subtest-5	18.88	19.22	19.29
3GPP Rel 7	HSPA+	18.90	19.21	19.31

Band		WCDMA V		
TX Channel		4132	4183	4233
Frequency (MHz)		826.4	836.6	846.6
Max. Rated Avg. Power+Max. Tolerance (dBm)		**25.00**		
3GPP Rel 99	RMC 12.2Kbps	24.39	24.11	24.28
3GPP Rel 5	HSDPA Subtest-1	24.10	24.24	24.16
	HSDPA Subtest-2	24.11	24.07	24.13
	HSDPA Subtest-3	24.16	24.20	24.16
	HSDPA Subtest-4	24.10	24.06	24.17
3GPP Rel 6	HSUPA Subtest-1	24.22	24.25	24.17
	HSUPA Subtest-2	24.15	24.23	24.20
	HSUPA Subtest-3	24.24	24.14	24.20
	HSUPA Subtest-4	24.13	24.10	24.17
	HSUPA Subtest-5	24.22	24.19	24.07
3GPP Rel 7	HSPA+	24.09	24.25	24.11

Subtests for WCDMA Release 5 HSDPA

SUB-TEST	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15	15/15	64	12/15	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Subtests for WCDMA Release 6 HSUPA

SUB-TEST	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	15/15	64	15/15	30/15	24/15	134/15	4	1	1.0	0.0	21	81

LTE FDD Band 2 / Band 4 / Band 13 / Band 17 conducted power table:

LTE Band 2								
BW(Mhz)	Modulation	RB Size	RB Offset	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)				1860	1880	1900		
Channel				18700	18900	19100		
20	QPSK	1	0	22.68	22.89	22.92	23.00	0
		1	50	22.81	22.95	22.93	23.00	0
		1	99	22.73	22.91	22.94	23.00	0
		50	0	21.92	21.85	21.93	22.00	0-1
		50	25	21.94	21.94	21.79	22.00	0-1
		50	50	21.88	21.89	21.88	22.00	0-1
		100	0	21.88	21.90	21.91	22.00	0-1
	16-QAM	1	0	21.75	21.68	21.60	22.00	0-1
		1	50	21.67	21.79	21.76	22.00	0-1
		1	99	21.68	21.78	21.70	22.00	0-1
		50	0	20.78	20.74	20.79	21.00	0-2
		50	25	20.63	20.71	20.69	21.00	0-2
		50	50	20.65	20.75	20.71	21.00	0-2
		100	0	20.64	20.77	20.79	21.00	0-2
	64-QAM	1	0	20.77	20.67	20.76	21.00	0-2
		1	50	20.62	20.65	20.75	21.00	0-2
		1	99	20.69	20.73	20.75	21.00	0-2
		50	0	19.65	19.66	19.60	20.00	0-3
		50	25	19.62	19.71	19.61	20.00	0-3
		50	50	19.79	19.74	19.61	20.00	0-3
		100	0	19.77	19.75	19.61	20.00	0-3
Frequency (MHz)				1857.5	1880	1902.5	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Channel				18675	18900	19125		
15	QPSK	1	0	22.77	22.73	22.73	23.00	0
		1	36	22.77	22.60	22.61	23.00	0
		1	74	22.80	22.63	22.71	23.00	0
		36	0	21.79	21.62	21.72	22.00	0-1
		36	18	21.73	21.73	21.77	22.00	0-1
		36	37	21.69	21.71	21.73	22.00	0-1
		75	0	21.77	21.64	21.75	22.00	0-1
	16-QAM	1	0	21.74	21.64	21.78	22.00	0-1
		1	36	21.71	21.64	21.70	22.00	0-1
		1	74	21.68	21.75	21.73	22.00	0-1
		36	0	20.70	20.61	20.69	21.00	0-2
		36	18	20.73	20.72	20.73	21.00	0-2
		36	37	20.77	20.65	20.71	21.00	0-2
		75	0	20.77	20.72	20.74	21.00	0-2
	64-QAM	1	0	20.66	20.74	20.76	21.00	0-2
		1	36	20.63	20.63	20.73	21.00	0-2
		1	74	20.73	20.68	20.75	21.00	0-2
		36	0	19.66	19.73	19.79	20.00	0-3
		36	18	19.61	19.64	19.74	20.00	0-3
		36	37	19.68	19.76	19.62	20.00	0-3
		75	0	19.68	19.61	19.62	20.00	0-3

LTE Band 2								
BW(Mhz)	Modulation	RB Size	RB Offset	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)				1855	1880	1905		
Channel				18650	18900	19150		
10	QPSK	1	0	22.74	22.76	22.65	23.00	0
		1	25	22.68	22.71	22.66	23.00	0
		1	49	22.62	22.72	22.70	23.00	0
		25	0	21.61	21.72	21.73	22.00	0-1
		25	12	21.64	21.77	21.66	22.00	0-1
		25	25	21.77	21.79	21.75	22.00	0-1
		50	0	21.67	21.71	21.77	22.00	0-1
	16-QAM	1	0	21.74	21.61	21.71	22.00	0-1
		1	25	21.60	21.62	21.69	22.00	0-1
		1	49	21.69	21.66	21.60	22.00	0-1
		25	0	20.64	20.76	20.76	21.00	0-2
		25	12	20.71	20.76	20.67	21.00	0-2
		25	25	20.61	20.77	20.70	21.00	0-2
		50	0	20.77	20.76	20.76	21.00	0-2
	64-QAM	1	0	20.60	20.77	20.76	21.00	0-2
		1	25	20.75	20.75	20.61	21.00	0-2
		1	49	20.76	20.75	20.74	21.00	0-2
		25	0	19.64	19.73	19.63	20.00	0-3
		25	12	19.79	19.64	19.67	20.00	0-3
		25	25	19.65	19.62	19.76	20.00	0-3
		50	0	19.73	19.79	19.75	20.00	0-3
Frequency (MHz)				1852.5	1880	1907.5	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Channel				18625	18900	19175		
5	QPSK	1	0	22.66	22.65	22.72	23.00	0
		1	12	22.61	22.77	22.67	23.00	0
		1	24	22.70	22.62	22.67	23.00	0
		12	0	21.66	21.65	21.71	22.00	0-1
		12	6	21.74	21.78	21.72	22.00	0-1
		12	13	21.64	21.78	21.73	22.00	0-1
		25	0	21.70	21.70	21.61	22.00	0-1
	16-QAM	1	0	21.76	21.73	21.78	22.00	0-1
		1	12	21.71	21.65	21.79	22.00	0-1
		1	24	21.75	21.65	21.71	22.00	0-1
		12	0	20.62	20.66	20.60	21.00	0-2
		12	6	20.66	20.68	20.66	21.00	0-2
		12	13	20.77	20.71	20.70	21.00	0-2
		25	0	20.65	20.79	20.71	21.00	0-2
	64-QAM	1	0	20.73	20.68	20.67	21.00	0-2
		1	12	20.77	20.75	20.73	21.00	0-2
		1	24	20.69	20.61	20.70	21.00	0-2
		12	0	19.66	19.70	19.66	20.00	0-3
		12	6	19.69	19.64	19.80	20.00	0-3
		12	13	19.61	19.76	19.64	20.00	0-3
		25	0	19.61	19.74	19.71	20.00	0-3

LTE Band 2								
BW(Mhz)	Modulation	RB Size	RB Offset	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)				1851.5	1880	1908.5		
Channel				18615	18900	19185		
3	QPSK	1	0	22.52	22.64	22.66	23.00	0
		1	7	22.51	22.71	22.51	23.00	0
		1	14	22.67	22.47	22.59	23.00	0
		8	0	21.55	21.54	21.70	22.00	0-1
		8	4	21.72	21.74	21.59	22.00	0-1
		8	7	21.58	21.65	21.59	22.00	0-1
		15	0	21.61	21.68	21.57	22.00	0-1
	16-QAM	1	0	21.61	21.68	21.74	22.00	0-1
		1	7	21.61	21.65	21.74	22.00	0-1
		1	14	21.72	21.61	21.61	22.00	0-1
		8	0	20.56	20.54	20.60	21.00	0-2
		8	4	20.59	20.50	20.48	21.00	0-2
		8	7	20.60	20.58	20.52	21.00	0-2
		15	0	20.53	20.78	20.65	21.00	0-2
	64-QAM	1	0	20.63	20.52	20.57	21.00	0-2
		1	7	20.70	20.70	20.68	21.00	0-2
		1	14	20.65	20.56	20.54	21.00	0-2
		8	0	19.60	19.51	19.48	20.00	0-3
		8	4	19.57	19.48	19.73	20.00	0-3
		8	7	19.59	19.75	19.59	20.00	0-3
		15	0	19.52	19.57	19.57	20.00	0-3
Frequency (MHz)				1850.7	1880	1909.3	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Channel				18607	18900	19193		
1.4	QPSK	1	0	22.71	22.68	22.72	23.00	0
		1	2	22.72	22.71	22.82	23.00	0
		1	5	22.84	22.66	22.81	23.00	0
		3	0	22.83	22.77	22.83	23.00	0
		3	2	22.68	22.83	22.66	23.00	0
		3	3	22.79	22.67	22.83	23.00	0
		6	0	21.82	21.71	21.78	22.00	0-1
	16-QAM	1	0	21.67	21.85	21.76	22.00	0-1
		1	2	21.70	21.70	21.83	22.00	0-1
		1	5	21.83	21.70	21.68	22.00	0-1
		3	0	21.75	21.72	21.81	22.00	0-1
		3	2	21.83	21.79	21.65	22.00	0-1
		3	3	21.75	21.78	21.74	22.00	0-1
		6	0	20.67	20.71	20.82	21.00	0-2
	64-QAM	1	0	20.77	20.75	20.75	21.00	0-2
		1	2	20.74	20.81	20.66	21.00	0-2
		1	5	20.82	20.68	20.71	21.00	0-2
		3	0	20.82	20.82	20.82	21.00	0-2
		3	2	20.76	20.72	20.69	21.00	0-2
		3	3	20.67	20.71	20.82	21.00	0-2
		6	0	19.81	19.79	19.69	20.00	0-3

LTE Band 4								
BW(Mhz)	Modulation	RB Size	RB Offset	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)				1720	1732.5	1745		
Channel				20050	20175	20300		
20	QPSK	1	0	21.30	21.20	21.28	22.00	0
		1	50	21.43	21.58	21.98	22.00	0
		1	99	20.74	21.27	21.53	22.00	0
		50	0	20.71	20.56	20.51	21.00	0-1
		50	25	20.65	20.61	20.87	21.00	0-1
		50	50	20.47	20.68	20.73	21.00	0-1
		100	0	20.55	20.63	20.56	21.00	0-1
	16-QAM	1	0	20.78	20.65	20.69	21.00	0-1
		1	50	20.58	20.68	20.55	21.00	0-1
		1	99	20.63	20.78	20.66	21.00	0-1
		50	0	19.60	19.75	19.70	20.00	0-2
		50	25	19.56	19.62	19.65	20.00	0-2
		50	50	19.65	19.56	19.78	20.00	0-2
		100	0	19.58	19.69	19.70	20.00	0-2
	64-QAM	1	0	19.79	19.59	19.61	20.00	0-2
		1	50	19.62	19.53	19.51	20.00	0-2
		1	99	19.56	19.57	19.80	20.00	0-2
		50	0	18.59	18.60	18.76	19.00	0-3
		50	25	18.74	18.52	18.58	19.00	0-3
		50	50	18.70	18.67	18.63	19.00	0-3
		100	0	18.70	18.61	18.71	19.00	0-3
Frequency (MHz)				1717.5	1732.5	1747.5	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Channel				20025	20175	20325		
15	QPSK	1	0	20.90	20.83	21.05	22.00	0
		1	36	21.25	21.39	21.59	22.00	0
		1	74	20.45	20.91	21.25	22.00	0
		36	0	20.41	20.44	20.32	21.00	0-1
		36	18	20.45	20.44	20.70	21.00	0-1
		36	37	20.07	20.56	20.47	21.00	0-1
		75	0	20.16	20.30	20.35	21.00	0-1
	16-QAM	1	0	20.65	20.52	20.42	21.00	0-1
		1	36	20.26	20.55	20.19	21.00	0-1
		1	74	20.52	20.57	20.50	21.00	0-1
		36	0	19.43	19.61	19.45	20.00	0-2
		36	18	19.31	19.39	19.33	20.00	0-2
		36	37	19.55	19.44	19.45	20.00	0-2
		75	0	19.25	19.32	19.34	20.00	0-2
	64-QAM	1	0	19.53	19.27	19.43	20.00	0-2
		1	36	19.37	19.28	19.32	20.00	0-2
		1	74	19.16	19.25	19.50	20.00	0-2
		36	0	18.41	18.25	18.46	19.00	0-3
		36	18	18.61	18.21	18.36	19.00	0-3
		36	37	18.40	18.34	18.29	19.00	0-3
		75	0	18.32	18.25	18.32	19.00	0-3

LTE Band 4								
BW(Mhz)	Modulation	RB Size	RB Offset	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)				1715	1732.5	1750		
Channel				20000	20175	20350		
10	QPSK	1	0	21.18	21.09	20.91	22.00	0
		1	25	21.23	21.31	21.71	22.00	0
		1	49	20.35	21.00	21.27	22.00	0
		25	0	20.54	20.37	20.28	21.00	0-1
		25	12	20.47	20.41	20.65	21.00	0-1
		25	25	20.32	20.34	20.41	21.00	0-1
		50	0	20.42	20.26	20.27	21.00	0-1
	16-QAM	1	0	20.40	20.33	20.51	21.00	0-1
		1	25	20.19	20.29	20.22	21.00	0-1
		1	49	20.39	20.47	20.30	21.00	0-1
		25	0	19.40	19.45	19.48	20.00	0-2
		25	12	19.33	19.37	19.46	20.00	0-2
		25	25	19.37	19.35	19.54	20.00	0-2
		50	0	19.42	19.36	19.36	20.00	0-2
	64-QAM	1	0	19.54	19.22	19.34	20.00	0-2
		1	25	19.45	19.19	19.29	20.00	0-2
		1	49	19.17	19.25	19.54	20.00	0-2
		25	0	18.42	18.36	18.52	19.00	0-3
		25	12	18.39	18.32	18.34	19.00	0-3
		25	25	18.59	18.54	18.51	19.00	0-3
		50	0	18.30	18.48	18.47	19.00	0-3
Frequency (MHz)				1712.5	1732.5	1752.5	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Channel				19975	20175	20375		
5	QPSK	1	0	21.08	21.03	21.17	22.00	0
		1	12	21.10	21.39	21.75	22.00	0
		1	24	20.56	21.05	21.17	22.00	0
		12	0	20.32	20.35	20.12	21.00	0-1
		12	6	20.42	20.43	20.47	21.00	0-1
		12	13	20.20	20.53	20.62	21.00	0-1
		25	0	20.44	20.25	20.44	21.00	0-1
	16-QAM	1	0	20.41	20.52	20.56	21.00	0-1
		1	12	20.41	20.28	20.37	21.00	0-1
		1	24	20.34	20.40	20.54	21.00	0-1
		12	0	19.43	19.35	19.47	20.00	0-2
		12	6	19.28	19.31	19.44	20.00	0-2
		12	13	19.27	19.29	19.47	20.00	0-2
		25	0	19.27	19.47	19.53	20.00	0-2
	64-QAM	1	0	19.62	19.42	19.43	20.00	0-2
		1	12	19.40	19.41	19.13	20.00	0-2
		1	24	19.44	19.26	19.55	20.00	0-2
		12	0	18.21	18.41	18.38	19.00	0-3
		12	6	18.48	18.14	18.43	19.00	0-3
		12	13	18.31	18.39	18.42	19.00	0-3
		25	0	18.31	18.29	18.59	19.00	0-3

LTE Band 4								
BW(Mhz)	Modulation	RB Size	RB Offset	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
Channel				19965	20175	20385		
3	QPSK	1	0	21.14	21.10	21.06	22.00	0
		1	7	21.22	21.30	21.87	22.00	0
		1	14	20.39	20.90	21.43	22.00	0
		8	0	20.49	20.34	20.31	21.00	0-1
		8	4	20.44	20.49	20.53	21.00	0-1
		8	7	20.14	20.48	20.43	21.00	0-1
		15	0	20.16	20.49	20.34	21.00	0-1
	16-QAM	1	0	20.39	20.52	20.37	21.00	0-1
		1	7	20.32	20.43	20.38	21.00	0-1
		1	14	20.44	20.64	20.44	21.00	0-1
		8	0	19.29	19.44	19.59	20.00	0-2
		8	4	19.41	19.51	19.48	20.00	0-2
		8	7	19.40	19.40	19.51	20.00	0-2
		15	0	19.26	19.51	19.47	20.00	0-2
	64-QAM	1	0	19.56	19.28	19.34	20.00	0-2
		1	7	19.26	19.25	19.30	20.00	0-2
		1	14	19.36	19.39	19.65	20.00	0-2
		8	0	18.22	18.36	18.65	19.00	0-3
		8	4	18.64	18.35	18.47	19.00	0-3
		8	7	18.47	18.40	18.50	19.00	0-3
		15	0	18.57	18.44	18.45	19.00	0-3
Frequency (MHz)				1710.7	1732.5	1754.3	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Channel				19957	20175	20393		
1.4	QPSK	1	0	21.51	21.64	21.55	22.00	0
		1	2	21.77	21.73	21.84	22.00	0
		1	5	21.55	21.58	21.75	22.00	0
		3	0	21.56	21.80	21.69	22.00	0
		3	2	21.74	21.74	21.72	22.00	0
		3	3	21.62	21.58	21.58	22.00	0
		6	0	20.51	20.79	20.70	21.00	0-1
	16-QAM	1	0	20.65	20.65	20.66	21.00	0-1
		1	2	20.71	20.54	20.58	21.00	0-1
		1	5	20.63	20.56	20.55	21.00	0-1
		3	0	20.75	20.60	20.54	21.00	0-1
		3	2	20.60	20.56	20.54	21.00	0-1
		3	3	20.54	20.52	20.74	21.00	0-1
		6	0	19.79	19.52	19.69	20.00	0-2
	64-QAM	1	0	19.66	19.57	19.68	20.00	0-2
		1	2	19.62	19.56	19.58	20.00	0-2
		1	5	19.72	19.60	19.67	20.00	0-2
		3	0	19.59	19.66	19.53	20.00	0-2
		3	2	19.64	19.65	19.62	20.00	0-2
		3	3	19.68	19.53	19.57	20.00	0-2
		6	0	18.63	18.75	18.74	19.00	0-3

LTE Band 13								
BW(Mhz)	Modulation	RB Size	RB Offset	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)				782				
Channel				23230				
10	QPSK	1	0	24.09			25.00	0
		1	25	24.38			25.00	0
		1	49	24.02			25.00	0
		25	0	23.05			24.00	0-1
		25	12	22.95			24.00	0-1
		25	25	23.02			24.00	0-1
		50	0	23.02			24.00	0-1
	16-QAM	1	0	22.98			24.00	0-1
		1	25	22.92			24.00	0-1
		1	49	22.88			24.00	0-1
		25	0	21.95			23.00	0-2
		25	12	21.91			23.00	0-2
		25	25	22.01			23.00	0-2
		50	0	21.93			23.00	0-2
	64-QAM	1	0	21.87			23.00	0-2
		1	25	21.82			23.00	0-2
		1	49	21.85			23.00	0-2
		25	0	20.98			22.00	0-3
		25	12	20.92			22.00	0-3
		25	25	20.88			22.00	0-3
		50	0	20.96			22.00	0-3
Frequency (MHz)				779.5	782	784.5	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Channel				23205	23230	23255		
5	QPSK	1	0	24.04	23.93	24.06	25.00	0
		1	12	24.07	23.95	23.89	25.00	0
		1	24	24.07	24.01	24.01	25.00	0
		12	0	23.07	23.04	23.02	24.00	0-1
		12	6	22.90	23.05	22.93	24.00	0-1
		12	13	23.05	22.99	23.02	24.00	0-1
		25	0	22.98	22.91	22.99	24.00	0-1
	16-QAM	1	0	22.96	23.05	23.00	24.00	0-1
		1	12	22.96	22.95	22.90	24.00	0-1
		1	24	22.91	22.95	23.02	24.00	0-1
		12	0	21.89	21.96	22.00	23.00	0-2
		12	6	21.88	22.01	22.04	23.00	0-2
		12	13	21.98	21.97	21.90	23.00	0-2
		25	0	22.04	21.88	22.02	23.00	0-2
	64-QAM	1	0	21.99	22.00	21.98	23.00	0-2
		1	12	21.93	21.87	21.98	23.00	0-2
		1	24	21.96	21.93	21.87	23.00	0-2
		12	0	20.86	20.85	20.90	22.00	0-3
		12	6	20.86	20.96	20.90	22.00	0-3
		12	13	20.94	20.95	20.86	22.00	0-3
		25	0	20.95	20.95	20.93	22.00	0-3

LTE Band 17								
BW(Mhz)	Modulation	RB Size	RB Offset	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)				709	710	711		
Channel				23780	23790	23800		
10	QPSK	1	0	23.98	23.93	24.03	25.00	0
		1	25	23.93	23.30	23.05	25.00	0
		1	49	23.01	23.37	24.01	25.00	0
		25	0	22.95	22.94	22.96	24.00	0-1
		25	12	22.92	22.95	22.93	24.00	0-1
		25	25	22.80	22.89	22.94	24.00	0-1
		50	0	22.88	22.86	22.93	24.00	0-1
	16-QAM	1	0	22.82	22.80	22.89	24.00	0-1
		1	25	22.96	22.83	22.86	24.00	0-1
		1	49	22.86	22.80	22.77	24.00	0-1
		25	0	21.81	21.83	21.80	23.00	0-2
		25	12	21.87	21.89	21.77	23.00	0-2
		25	25	21.95	21.86	21.84	23.00	0-2
		50	0	21.93	21.77	21.81	23.00	0-2
	64-QAM	1	0	21.77	21.78	21.71	23.00	0-2
		1	25	21.74	21.67	21.69	23.00	0-2
		1	49	21.71	21.71	21.61	23.00	0-2
		25	0	20.64	20.68	20.71	22.00	0-3
		25	12	20.66	20.76	20.74	22.00	0-3
		25	25	20.75	20.79	20.77	22.00	0-3
		50	0	20.61	20.74	20.79	22.00	0-3
Frequency (MHz)				706.5	710	713.5	Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Channel				23755	23790	23825		
5	QPSK	1	0	23.90	23.81	23.79	25.00	0
		1	12	23.91	23.78	23.81	25.00	0
		1	24	23.82	23.83	23.90	25.00	0
		12	0	22.80	22.93	22.96	24.00	0-1
		12	6	22.95	22.90	22.85	24.00	0-1
		12	13	22.93	22.90	22.82	24.00	0-1
		25	0	22.95	22.83	22.82	24.00	0-1
	16-QAM	1	0	22.85	22.84	22.81	24.00	0-1
		1	12	22.87	22.81	22.94	24.00	0-1
		1	24	22.95	22.77	22.82	24.00	0-1
		12	0	21.80	21.89	21.88	23.00	0-2
		12	6	21.79	21.86	21.80	23.00	0-2
		12	13	21.80	21.82	21.82	23.00	0-2
		25	0	21.86	21.88	21.84	23.00	0-2
	64-QAM	1	0	21.80	21.76	21.64	23.00	0-2
		1	12	21.74	21.75	21.71	23.00	0-2
		1	24	21.72	21.66	21.68	23.00	0-2
		12	0	20.80	20.70	20.79	22.00	0-3
		12	6	20.80	20.79	20.79	22.00	0-3
		12	13	20.70	20.71	20.62	22.00	0-3
		25	0	20.67	20.71	20.78	22.00	0-3

Bluetooth conducted power table:

Mode	Channel	Frequency (MHz)	1Mbps		2Mbps		3Mbps	
			Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
BR/EDR	CH 00	2402	9.50	7.19	8.00	Not required	8.00	Not required
	CH 39	2441		9.35				
	CH 78	2480		9.00				

1.4 Test Environment

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

1.5 Operation Description

1. The EUT is controlled by using a Radio Communication Tester, and the communication between the EUT and the tester is established by air link.

2. Measurements are performed respectively on the lowest, middle and highest channels of the operating band(s). The EUT is set to maximum power level during all tests, and at the beginning of each test the battery is fully charged.

3. During the SAR testing, the DASY 5 system checks power drift by comparing the e-field strength of one specific location measured at the beginning with that measured at the end of the SAR testing.

4. The 3G SAR test reduction procedure is applied to HSDPA with 12.2 kbps RMC as the primary mode. Since the maximum output power in a secondary mode (HSDPA) is ≤ ¼ dB higher than the primary mode (WCDMA), SAR measurement is not required for the secondary mode (HSDPA).

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (1)(2)	CM (3) (dB)	MPR (3) (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (4)	15/15 (4)	64	12/15 (4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{HS} = 30/15 * β_c.
Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{HS} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{HS} = 24/15 * β_c.
Note 3: CM = 1 for β_c/β_d = 12/15, β_{HS}/β_c = 24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.
Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

5. The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) with 12.2 kbps RMC as the primary mode. Since the maximum output power in a secondary mode (HSPA) is ≤ ¼ dB higher than the primary mode (WCDMA), SAR measurement is not required for the secondary mode (HSPA).

Sub-test	β_c	β_d	β_d (SF)	β_c / β_d	β_{HS} (1)	β_{ec}	β_{ed} (4)(5)	β_{ed} (SF)	β_{ed} (Codes)	CM (2) (dB)	MPR (2)(6) (dB)	AG (5) Index	E-TFCI
1	11/15 (3)	15/15 (3)	64	11/15 (3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{HS} = 30/15 * β_c. For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with β_{HS} = 5/15 * β_c.
Note 2: CM = 1 for β_c/β_d = 12/15, β_{HS}/β_c = 24/15. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

6. LTE modes test according to **KDB 941225D05v02r05.**

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.

7. According to KDB447498D01v06, 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 ≤ 100MHz.

8. According to **KDB865664D01v01r04**, SAR measurement variability must be assessed for each frequency band. When the original highest measured SAR is ≥ 0.8 W/kg, repeated that measurement once. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit)

9. WWAN and BT cannot be transmitted at the same time.

10. The device doesn't support hotspot mode.

11. BT SAR is excluded from testing based on the following table.

Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Back side				
			Test separation distance (mm)	Calculation value	Exclusion thresholds	Require SAR testing?	Estimated SAR (W/kg)
Bluetooth	9.5	8.913	5	2.807	3.000	NO	0.374

Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Top side				
			Test separation distance (mm)	Calculation value	Exclusion thresholds	Require SAR testing?	Estimated SAR (W/kg)
Bluetooth	9.5	8.913	5	2.807	3.000	NO	0.374

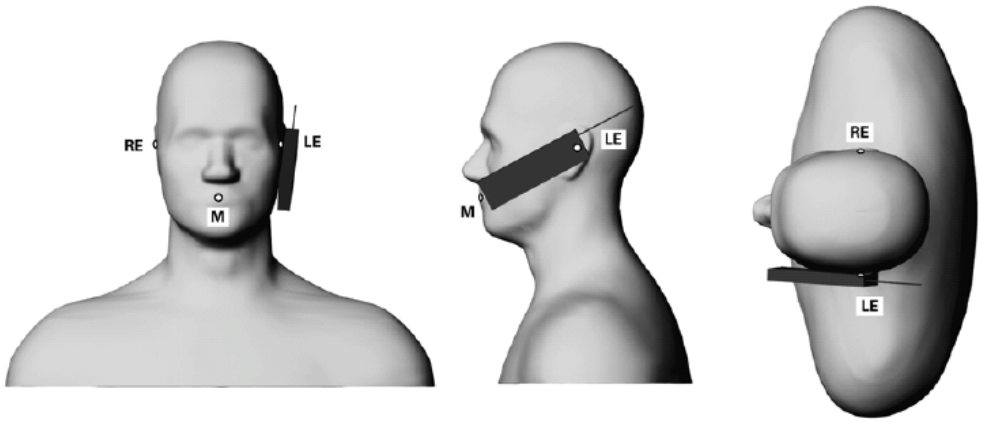
Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Bottom side				
			Test separation distance (mm)	Calculation value	Exclusion thresholds	Require SAR testing?	Estimated SAR (W/kg)
Bluetooth	9.5	8.913	5	2.807	3.000	NO	0.374

Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Right side				
			Test separation distance (mm)	Calculation value	Exclusion thresholds	Require SAR testing?	Estimated SAR (W/kg)
Bluetooth	9.5	8.913	5	2.807	3.000	NO	0.374

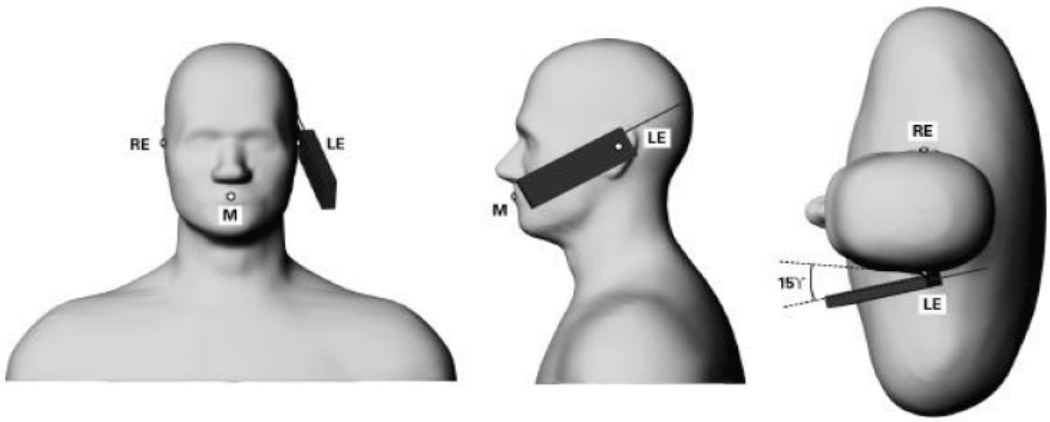
Mode	Max. tune-up power(dBm)	Max. tune-up power(mW)	Left side				
			Test separation distance (mm)	Calculation value	Exclusion thresholds	Require SAR testing?	Estimated SAR (W/kg)
Bluetooth	9.5	8.913	5	2.807	3.000	NO	0.374

1.6 Positioning Procedure

Head SAR measurement statement



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



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

Cheek/Touch Position:
The handset was brought toward the mouth of the head phantom by pivoting against the ear reference point until any point of the mouthpiece or keypad touched the phantom.
Ear/Tilt Position:
With the phone aligned in the Cheek/Touch position, the handset was tilted away from the mouth with respect to the test device reference point by 15 degrees.

Body SAR measurement statement

Body-worn exposure: 5mm
Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. When the same wireless transmission configuration is used for testing body-worn accessory and hotspot mode SAR, respectively, in voice and data mode, SAR results for the most conservative test separation distance configuration may be used to support both SAR conditions. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for the body-worn accessory with a headset attached to the handset.

1.7 Evaluation Procedures

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

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

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

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

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

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

1.8 Probe Calibration Procedures

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

1.8.1 Transfer Calibration with Temperature Probes

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

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

Whereby 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:

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

small.

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

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

1.8.2 Calibration with Analytical Fields

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

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

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

References

(1) N. Kuster, Q. Balzano, and J.C. Lin, Eds., *Mobile Communications Safety*, Chapman & Hall, London, 1997.

(2) K. Meier, M. Burkhardt, T. Schmid, and N. Kuster, \Broadband calibration of E-field probes in lossy media", *IEEE Transactions on Microwave Theory and Techniques*, vol. 44, no. 10, pp. 1954{1962, Oct. 1996.

(3) K. Jokela, P. Hyysalo, and L. Puranen, \Calibration of specific absorption rate (SAR) probes in waveguide at 900 MHz", *IEEE Transactions on Instrumentation and Measurements*, vol. 47, no. 2, pp. 432{438, Apr. 1998.

1.9 The SAR Measurement System

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

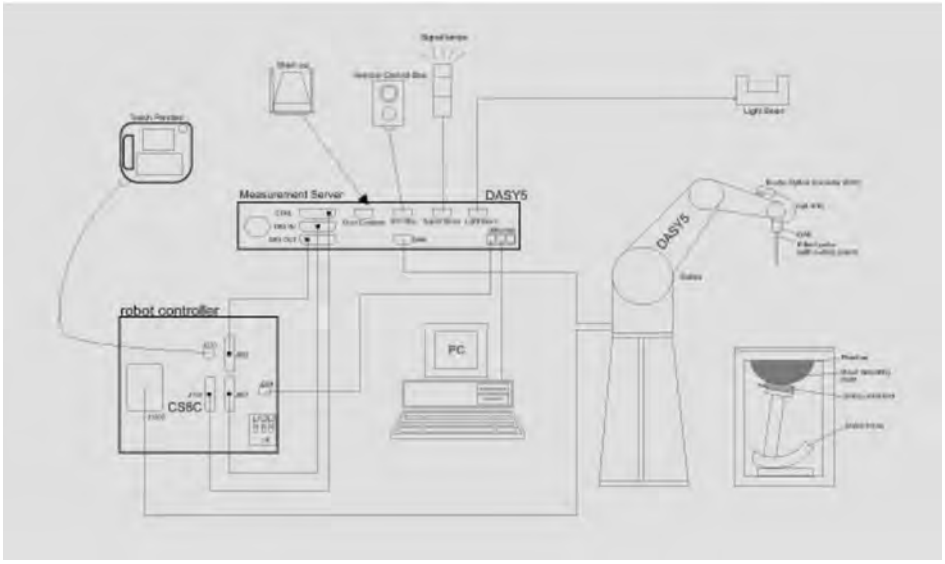


Fig. a A block diagram of the SAR measurement system

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

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

1.10 System Components

EX3DV4 E-Field Probe

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Calibration	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 750/835/1750/1900 MHz Additional CF for other liquids and frequencies upon request	
Frequency	10 MHz to > 6 GHz, Linearity: ± 0.6 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic 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%.	

Phantom

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

DEVICE HOLDER

Construction	In combination with the Twin SAM Phantom V4.0/V4.0C or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Device Holder

1.11 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig. b. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% (according to KDB865664D01) from the target SAR values. These tests were done at 750/835/1750/1900 MHz. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1. During the tests, the liquid depth above the ear reference points was above 15 cm (≤3G) or 10 cm (>3G) in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

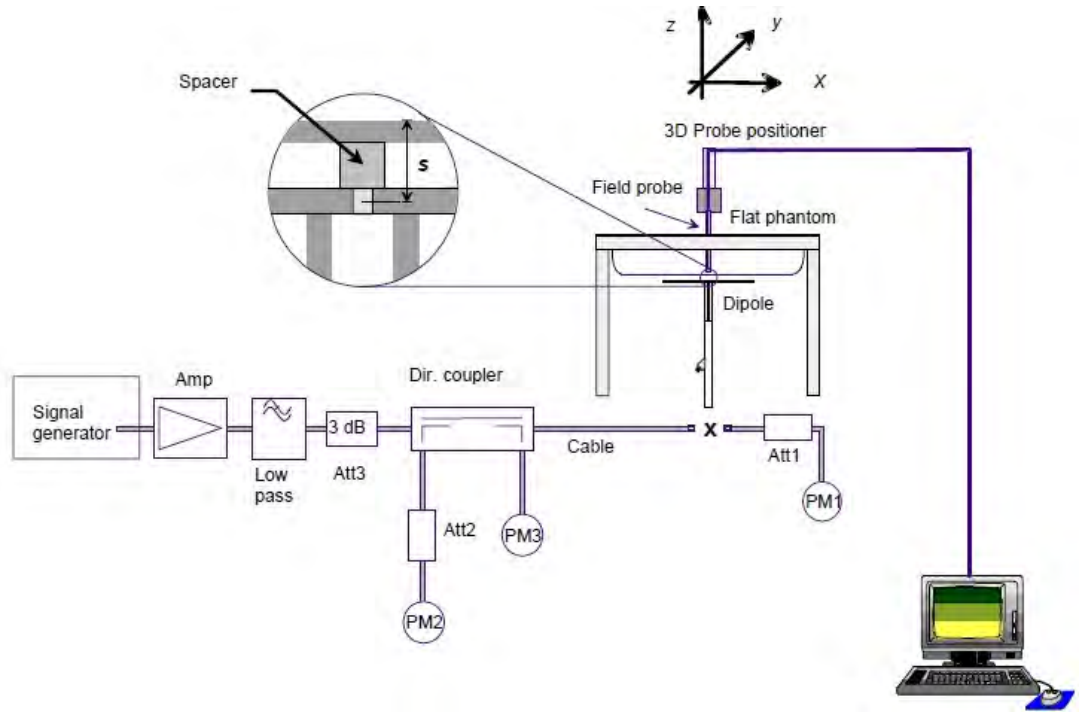


Fig. b The block diagram of system verification

Validation Kit	S/N	Frequency (MHz)		1W Target SAR-1g (mW/g)	pin=250mW Measured SAR-1g (mW/g)	Measured SAR-1g normalized to 1W (mW/g)	Deviation (%)	Measured Date
D750V3	1015	750	Head	8.48	2.14	8.56	0.94%	Jun. 04, 2021
D835V2	4d063	835	Head	9.52	2.39	9.56	0.42%	Jun. 04, 2021
D1750V2	1008	1750	Head	36.00	8.93	35.72	-0.78%	Jun. 10, 2021
D1900V2	5d173	1900	Head	39.40	9.81	39.24	-0.41%	Jun. 07, 2021

Table 1. Results of system validation

1.12 Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this Head-simulant fluid were measured by using the SPEAG Dielectric Assessment Kit (DAKS-3.5)
All dielectric parameters of tissue simulates were measured within 24 hours of SAR measurements. The depth of the tissue simulant in the flat section of the phantom was at least 15 cm (≤3G) or 10 cm (>3G) during all tests. (Appendix Fig. 2)

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
Head	Jun. 04, 2021	709	42.155	0.890	42.523	0.898	0.87%	0.88%
		710	42.149	0.890	42.520	0.899	0.88%	0.98%
		711	42.144	0.890	42.515	0.900	0.88%	1.09%
		750	41.942	0.893	42.311	0.904	0.88%	1.19%
		782	41.775	0.896	42.164	0.906	0.93%	1.13%
		826.4	41.545	0.899	41.935	0.909	0.94%	1.08%
		835	41.500	0.900	41.874	0.910	0.90%	1.11%
		836.6	41.500	0.902	41.853	0.911	0.85%	1.03%
		846.6	41.500	0.912	41.849	0.923	0.84%	1.15%
	Jun. 10, 2021	1720	40.126	1.354	40.584	1.372	1.14%	1.35%
		1732.5	40.107	1.361	40.560	1.380	1.13%	1.40%
		1745	40.087	1.368	40.520	1.387	1.08%	1.38%
		1750	40.079	1.371	40.504	1.391	1.06%	1.45%
	Jun. 07, 2021	1852.4	40.000	1.400	40.442	1.419	1.11%	1.36%
		1860	40.000	1.400	40.440	1.420	1.10%	1.43%
		1880	40.000	1.400	40.436	1.421	1.09%	1.50%
		1900	40.000	1.400	40.433	1.422	1.08%	1.57%
		1907.6	40.000	1.400	40.426	1.424	1.07%	1.71%

Table 2. Dielectric Parameters of Tissue Simulant Fluid

The composition of the tissue simulating liquid:

Frequency (MHz)	Mode	Ingredient						Total amount
		DGMBE	Water	Salt	Preventol D-7	Cellulose	Sugar	
750	Head	—	532.98 g	18.3 g	2.4 g	3.2 g	766 g	1.3L(Kg)
850	Head	—	532.98 g	18.3 g	2.4 g	3.2 g	766 g	1.3L(Kg)
1750	Head	444.52 g	552.42 g	3.06 g	—	—	—	1.0L(Kg)
1900	Head	444.52 g	552.42 g	3.06 g	—	—	—	1.0L(Kg)

Table 3. Recipes for tissue simulating liquid

1.13 Test Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (‘‘SAR’’) in Section 4.2 of ‘‘IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,’’ ANSI/IEEE C95.1, By the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in ‘‘Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields,’’ NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100 kHz to 6 GHz. Portable devices that transmit at frequencies above 6 GHz are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter.
Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 GHz should be made at a minimum distance of 5 cm from the radiating source.

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

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

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

Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube).
General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure.
Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section.(Table .6)

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

Table 4. RF exposure limits

Notes:
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

2.1 Decision rules

Reported measurement data comply with IEEE 1528-2013:
Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.2 Summary of Results

WCDMA Band II

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	
R99 (Head)	RE Cheek	-	9262	1852.4	21.50	21.11	109.40%	0.712	0.779	-
	RE Cheek	-	9400	1880	21.50	21.25	105.93%	0.737	0.781	-
	RE Cheek	-	9538	1907.6	21.50	21.35	103.51%	0.774	0.801	45
	RE Cheek*	-	9538	1907.6	21.50	21.35	103.51%	0.771	0.798	-
	RE Tilt	-	9538	1907.6	21.50	21.35	103.51%	0.522	0.540	-
	LE Cheek	-	9538	1907.6	21.50	21.35	103.51%	0.766	0.793	-
	LE Tilt	-	9538	1907.6	21.50	21.35	103.51%	0.415	0.430	-
Body-Worn	Back side	5	9538	1907.6	21.50	21.35	103.51%	0.516	0.534	-
	Front side	5	9538	1907.6	21.50	21.35	103.51%	0.530	0.549	-
	Top side	5	9262	1852.4	21.50	21.11	109.40%	0.495	0.542	-
	Top side	5	9400	1880	21.50	21.25	105.93%	0.533	0.565	-
	Top side	5	9538	1907.6	21.50	21.35	103.51%	0.622	0.644	46
	Bottom side	5	9538	1907.6	21.50	21.35	103.51%	0.043	0.045	-
	Right side	5	9538	1907.6	21.50	21.35	103.51%	0.198	0.205	-
	Left side	5	9538	1907.6	21.50	21.35	103.51%	0.149	0.154	-

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

WCDMA Band V

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	
R99 (Head)	RE Cheek	-	4132	826.4	25.00	24.39	115.08%	1.060	1.220	-
	RE Cheek*	-	4132	826.4	25.00	24.39	115.08%	1.040	1.197	-
	RE Cheek	-	4183	836.6	25.00	24.11	122.74%	0.858	1.053	-
	RE Cheek	-	4233	846.6	25.00	24.28	118.03%	0.731	0.863	-
	RE Tilt	-	4132	826.4	25.00	24.39	115.08%	0.793	0.913	-
	RE Tilt*	-	4132	826.4	25.00	24.39	115.08%	0.790	0.909	-
	RE Tilt	-	4183	836.6	25.00	24.11	122.74%	0.672	0.825	-
	RE Tilt	-	4233	846.6	25.00	24.28	118.03%	0.638	0.753	-
	LE Cheek	-	4132	826.4	25.00	24.39	115.08%	1.250	1.439	47
	LE Cheek*	-	4132	826.4	25.00	24.39	115.08%	1.230	1.415	-
	LE Cheek	-	4183	836.6	25.00	24.11	122.74%	0.983	1.207	-
	LE Cheek	-	4233	846.6	25.00	24.28	118.03%	0.976	1.152	-
	LE Tilt	-	4132	826.4	25.00	24.39	115.08%	0.830	0.955	-
	LE Tilt*	-	4132	826.4	25.00	24.39	115.08%	0.823	0.947	-
	LE Tilt	-	4183	836.6	25.00	24.11	122.74%	0.731	0.897	-
	LE Tilt	-	4233	846.6	25.00	24.28	118.03%	0.682	0.805	-
Body-Worn	Back side	5	4132	826.4	25.00	24.39	115.08%	1.030	1.185	48
	Back side*	5	4132	826.4	25.00	24.39	115.08%	0.991	1.140	-
	Back side	5	4183	836.6	25.00	24.11	122.74%	0.886	1.088	-
	Back side	5	4233	846.6	25.00	24.28	118.03%	0.759	0.896	-
	Front side	5	4132	826.4	25.00	24.39	115.08%	0.877	1.009	-
	Front side*	5	4132	826.4	25.00	24.39	115.08%	0.868	0.999	-
	Front side	5	4183	836.6	25.00	24.11	122.74%	0.618	0.759	-
	Front side	5	4233	846.6	25.00	24.28	118.03%	0.546	0.644	-
	Top side	5	4132	826.4	25.00	24.39	115.08%	0.247	0.284	-
	Bottom side	5	4132	826.4	25.00	24.39	115.08%	0.041	0.047	-
	Right side	5	4132	826.4	25.00	24.39	115.08%	0.780	0.898	-
	Right side*	5	4132	826.4	25.00	24.39	115.08%	0.774	0.891	-
	Right side	5	4183	836.6	25.00	24.11	122.74%	0.585	0.718	-
	Right side	5	4233	846.6	25.00	24.28	118.03%	0.571	0.674	-
	Left side	5	4132	826.4	25.00	24.39	115.08%	0.530	0.610	-

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

LTE FDD Band 2

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	
Head	20MHz	QPSK	1 RB	50	RE Cheek	-	18700	1860	23.00	22.81	104.47%	1.220	1.275	-
					RE Cheek	-	18900	1880	23.00	22.95	101.16%	1.290	1.305	49
					RE Cheek*	-	18900	1880	23.00	22.95	101.16%	1.280	1.295	-
					RE Tilt	-	18700	1860	23.00	22.81	104.47%	0.994	1.038	-
					RE Tilt	-	18900	1880	23.00	22.95	101.16%	1.100	1.113	-
					RE Tilt*	-	18900	1880	23.00	22.95	101.16%	1.080	1.093	-
					LE Cheek	-	18700	1860	23.00	22.81	104.47%	1.180	1.233	-
					LE Cheek	-	18900	1880	23.00	22.95	101.16%	1.270	1.285	-
					LE Cheek*	-	18900	1880	23.00	22.95	101.16%	1.250	1.264	-
					LE Tilt	-	18900	1880	23.00	22.95	101.16%	0.740	0.749	-
				99	RE Cheek	-	19100	1900	23.00	22.94	101.39%	1.120	1.136	-
					RE Tilt	-	19100	1900	23.00	22.94	101.39%	1.040	1.054	-
					LE Cheek	-	19100	1900	23.00	22.94	101.39%	1.150	1.166	-
			50 RB	0	RE Cheek	-	19100	1900	22.00	21.93	101.62%	0.923	0.938	-
					RE Tilt	-	19100	1900	22.00	21.93	101.62%	0.831	0.845	-
					LE Cheek	-	19100	1900	22.00	21.93	101.62%	0.898	0.913	-
				25	RE Cheek	-	18700	1860	22.00	21.94	101.39%	1.000	1.014	-
					RE Cheek	-	18900	1880	22.00	21.94	101.39%	0.915	0.928	-
					RE Tilt	-	18700	1860	22.00	21.94	101.39%	0.889	0.901	-
					RE Tilt	-	18900	1880	22.00	21.94	101.39%	0.842	0.854	-
					LE Cheek	-	18700	1860	22.00	21.94	101.39%	0.943	0.956	-
					LE Cheek	-	18900	1880	22.00	21.94	101.39%	0.866	0.878	-
					LE Tilt	-	18700	1860	22.00	21.94	101.39%	0.704	0.714	-
					LE Tilt	-	18900	1880	22.00	21.94	101.39%	0.689	0.699	-
			100 RB		RE Cheek	-	18700	1860	22.00	21.88	102.80%	0.834	0.857	-
					RE Cheek	-	18900	1880	22.00	21.90	102.33%	0.828	0.847	-
					RE Cheek	-	19100	1900	22.00	21.91	102.09%	0.886	0.905	-
					RE Tilt	-	19100	1900	22.00	21.91	102.09%	0.738	0.753	-
					LE Cheek	-	19100	1900	22.00	21.91	102.09%	0.776	0.792	-
					LE Tilt	-	19100	1900	22.00	21.91	102.09%	0.540	0.551	-
Body-worn	20MHz	QPSK	1 RB	50	Back side	5	18700	1860	23.00	22.81	104.47%	0.921	0.962	-
					Back side	5	18900	1880	23.00	22.95	101.16%	0.953	0.964	-
					Front side	5	18900	1880	23.00	22.95	101.16%	0.747	0.756	-
					Top side	5	18700	1860	23.00	22.81	104.47%	1.090	1.139	-
					Top side	5	18900	1880	23.00	22.95	101.16%	1.210	1.224	-
					Bottom side	5	18900	1880	23.00	22.95	101.16%	0.054	0.055	-
					Right side	5	18900	1880	23.00	22.95	101.16%	0.437	0.442	-
					Left side	5	18900	1880	23.00	22.95	101.16%	0.209	0.211	-
				99	Back side	5	19100	1900	23.00	22.94	101.39%	0.940	0.953	-
					Top side	5	19100	1900	23.00	22.94	101.39%	1.130	1.146	-
			50 RB	0	Back side	5	19100	1900	22.00	21.93	101.62%	0.944	0.959	-
					Top side	5	19100	1900	22.00	21.93	101.62%	1.110	1.128	-
				25	Back side	5	18700	1860	22.00	21.94	101.39%	0.971	0.985	-
					Back side*	5	18700	1860	22.00	21.94	101.39%	0.963	0.976	-
					Back side	5	18900	1880	22.00	21.94	101.39%	0.942	0.955	-
					Front side	5	18700	1860	22.00	21.94	101.39%	0.749	0.759	-
					Front side	5	18900	1880	22.00	21.94	101.39%	0.717	0.727	-
					Top side	5	18700	1860	22.00	21.94	101.39%	1.320	1.338	50
					Top side*	5	18700	1860	22.00	21.94	101.39%	1.290	1.308	-
					Top side	5	18900	1880	22.00	21.94	101.39%	1.040	1.054	-
					Bottom side	5	18700	1860	22.00	21.94	101.39%	0.057	0.058	-
					Bottom side	5	18900	1880	22.00	21.94	101.39%	0.052	0.053	-
					Right side	5	18700	1860	22.00	21.94	101.39%	0.441	0.447	-
					Right side	5	18900	1880	22.00	21.94	101.39%	0.394	0.399	-
					Left side	5	18700	1860	22.00	21.94	101.39%	0.221	0.224	-
					Left side	5	18900	1880	22.00	21.94	101.39%	0.210	0.213	-
			100 RB		Back side	5	19100	1900	22.00	21.91	102.09%	0.577	0.589	-
					Front side	5	19100	1900	22.00	21.91	102.09%	0.408	0.417	-
					Top side	5	19100	1900	22.00	21.91	102.09%	0.729	0.744	-
					Bottom side	5	19100	1900	22.00	21.91	102.09%	0.033	0.034	-
					Right side	5	19100	1900	22.00	21.91	102.09%	0.214	0.218	-
					Left side	5	19100	1900	22.00	21.91	102.09%	0.139	0.142	-

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

LTE FDD Band 4

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	
Head	20MHz	QPSK	1 RB	50	RE Cheek	-	20050	1720	22.00	21.43	114.02%	0.662	0.755	-
					RE Cheek	-	20175	1732.5	22.00	21.58	110.15%	0.674	0.742	-
					RE Cheek	-	20300	1745	22.00	21.98	100.46%	0.760	0.764	51
					RE Tilt	-	20300	1745	22.00	21.98	100.46%	0.737	0.740	-
					LE Cheek	-	20300	1745	22.00	21.98	100.46%	0.638	0.641	-
					LE Tilt	-	20300	1745	22.00	21.98	100.46%	0.598	0.601	-
			50RB	25	RE Cheek	-	20300	1745	21.00	20.87	103.04%	0.528	0.544	-
					RE Tilt	-	20300	1745	21.00	20.87	103.04%	0.497	0.512	-
					LE Cheek	-	20300	1745	21.00	20.87	103.04%	0.473	0.487	-
					LE Tilt	-	20300	1745	21.00	20.87	103.04%	0.431	0.444	-
			100 RB		RE Cheek	-	20175	1732.5	21.00	20.63	108.89%	0.471	0.513	-
					RE Tilt	-	20175	1732.5	21.00	20.63	108.89%	0.428	0.466	-
					LE Cheek	-	20175	1732.5	21.00	20.63	108.89%	0.405	0.441	-
					LE Tilt	-	20175	1732.5	21.00	20.63	108.89%	0.391	0.426	-
Body-worn	20MHz	QPSK	1 RB	50	Back side	5	20050	1720	22.00	21.43	114.02%	0.799	0.911	-
					Back side	5	20175	1732.5	22.00	21.58	110.15%	0.885	0.975	-
					Back side	5	20300	1745	22.00	21.98	100.46%	0.991	0.996	-
					Back side*	5	20300	1745	22.00	21.98	100.46%	0.983	0.988	-
					Front side	5	20300	1745	22.00	21.98	100.46%	0.566	0.569	-
					Top side	5	20050	1720	22.00	21.43	114.02%	1.120	1.277	-
					Top side	5	20175	1732.5	22.00	21.58	110.15%	1.210	1.333	-
					Top side	5	20300	1745	22.00	21.98	100.46%	1.440	1.447	52
					Top side*	5	20300	1745	22.00	21.98	100.46%	1.410	1.417	-
					Bottom side	5	20300	1745	22.00	21.98	100.46%	0.020	0.020	-
					Right side	5	20300	1745	22.00	21.98	100.46%	0.235	0.236	-
					Left side	5	20300	1745	22.00	21.98	100.46%	0.074	0.074	-
			50 RB	0	Top side	5	20050	1720	21.00	20.71	106.91%	1.040	1.112	-
				25	Back side	5	20300	1745	21.00	20.87	103.04%	0.757	0.780	-
					Front side	5	20300	1745	21.00	20.87	103.04%	0.426	0.439	-
					Top side	5	20300	1745	21.00	20.87	103.04%	1.080	1.113	-
					Bottom side	5	20300	1745	21.00	20.87	103.04%	0.015	0.015	-
					Right side	5	20300	1745	21.00	20.87	103.04%	0.214	0.221	-
					Left side	5	20300	1745	21.00	20.87	103.04%	0.070	0.072	-
				50	Top side	5	20175	1732.5	21.00	20.68	107.65%	0.993	1.069	-
			100 RB		Back side	5	20175	1732.5	21.00	20.63	108.89%	0.699	0.761	-
					Front side	5	20175	1732.5	21.00	20.63	108.89%	0.403	0.439	-
					Top side	5	20050	1720	21.00	20.55	110.92%	0.926	1.027	-
					Top side	5	20175	1732.5	21.00	20.63	108.89%	0.934	1.017	-
					Top side	5	20300	1745	21.00	20.56	110.66%	0.911	1.008	-
					Bottom side	5	20175	1732.5	21.00	20.63	108.89%	0.014	0.015	-
					Right side	5	20175	1732.5	21.00	20.63	108.89%	0.185	0.201	-
					Left side	5	20175	1732.5	21.00	20.63	108.89%	0.053	0.058	-

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

LTE FDD Band 13

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	
Head	10MHz	QPSK	1 RB	0	LE Cheek	-	23230	782	25.00	24.09	123.31%	0.655	0.808	-
				25	RE Cheek	-	23230	782	25.00	24.38	115.35%	0.484	0.558	-
					RE Tilt	-	23230	782	25.00	24.38	115.35%	0.352	0.406	-
					LE Cheek	-	23230	782	25.00	24.38	115.35%	0.939	1.083	53
					LE Cheek*	-	23230	782	25.00	24.38	115.35%	0.933	1.076	-
					LE Tilt	-	23230	782	25.00	24.38	115.35%	0.439	0.506	-
				49	LE Cheek	-	23230	782	25.00	24.02	125.31%	0.631	0.791	-
			25 RB	0	RE Cheek	-	23230	782	24.00	23.05	124.45%	0.393	0.489	-
					RE Tilt	-	23230	782	24.00	23.05	124.45%	0.280	0.348	-
					LE Cheek	-	23230	782	24.00	23.05	124.45%	0.551	0.686	-
					LE Tilt	-	23230	782	24.00	23.05	124.45%	0.350	0.436	-
			50 RB		RE Cheek	-	23230	782	24.00	23.02	125.31%	0.414	0.519	-
					RE Tilt	-	23230	782	24.00	23.02	125.31%	0.289	0.362	-
					LE Cheek	-	23230	782	24.00	23.02	125.31%	0.536	0.672	-
					LE Tilt	-	23230	782	24.00	23.02	125.31%	0.357	0.447	-
Body-worn	10MHz	QPSK	1 RB	0	Back side	5	23230	782	25.00	24.09	123.31%	0.772	0.952	-
				25	Back side	5	23230	782	25.00	24.38	115.35%	0.835	0.963	54
					Back side*	5	23230	782	25.00	24.38	115.35%	0.830	0.957	-
					Front side	5	23230	782	25.00	24.38	115.35%	0.570	0.657	-
					Top side	5	23230	782	25.00	24.38	115.35%	0.162	0.187	-
					Bottom side	5	23230	782	25.00	24.38	115.35%	0.042	0.048	-
					Right side	5	23230	782	25.00	24.38	115.35%	0.374	0.431	-
					Left side	5	23230	782	25.00	24.38	115.35%	0.246	0.284	-
				49	Back side	5	23230	782	25.00	24.02	125.31%	0.751	0.941	-
			25 RB	0	Back side	5	23230	782	24.00	23.05	124.45%	0.518	0.645	-
					Front side	5	23230	782	24.00	23.05	124.45%	0.510	0.635	-
					Top side	5	23230	782	24.00	23.05	124.45%	0.135	0.168	-
					Bottom side	5	23230	782	24.00	23.05	124.45%	0.037	0.046	-
					Right side	5	23230	782	24.00	23.05	124.45%	0.332	0.413	-
					Left side	5	23230	782	24.00	23.05	124.45%	0.218	0.271	-
			50 RB		Back side	5	23230	782	24.00	23.02	125.31%	0.506	0.634	-
					Front side	5	23230	782	24.00	23.02	125.31%	0.504	0.632	-
					Top side	5	23230	782	24.00	23.02	125.31%	0.117	0.147	-
					Bottom side	5	23230	782	24.00	23.02	125.31%	0.035	0.044	-
					Right side	5	23230	782	24.00	23.02	125.31%	0.336	0.421	-
					Left side	5	23230	782	24.00	23.02	125.31%	0.204	0.256	-

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

LTE FDD Band 17

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	
Head	10MHz	QPSK	1 RB	0	LE Cheek	-	23780	709	25.00	23.98	126.47%	0.812	1.027	-
				25	LE Cheek	-	23790	710	25.00	23.93	127.94%	0.798	1.021	-
				49	RE Cheek	-	23800	711	25.00	24.03	125.03%	0.470	0.588	-
					RE Tilt	-	23800	711	25.00	24.03	125.03%	0.339	0.424	-
					LE Cheek	-	23800	711	25.00	24.03	125.03%	0.865	1.081	55
					LE Cheek*	-	23800	711	25.00	24.03	125.03%	0.859	1.074	-
					LE Tilt	-	23800	711	25.00	24.03	125.03%	0.422	0.528	-
			25 RB	0	RE Cheek	-	23800	711	24.00	22.96	127.06%	0.349	0.443	-
					RE Tilt	-	23800	711	24.00	22.96	127.06%	0.264	0.335	-
					LE Cheek	-	23800	711	24.00	22.96	127.06%	0.463	0.588	-
					LE Tilt	-	23800	711	24.00	22.96	127.06%	0.325	0.413	-
			50 RB		RE Cheek	-	23800	711	24.00	22.93	127.94%	0.356	0.455	-
					RE Tilt	-	23800	711	24.00	22.93	127.94%	0.258	0.330	-
					LE Cheek	-	23800	711	24.00	22.93	127.94%	0.456	0.583	-
					LE Tilt	-	23800	711	24.00	22.93	127.94%	0.312	0.399	-
Body-worn	10MHz	QPSK	1 RB	0	Back side	5	23780	709	25.00	23.98	126.47%	0.698	0.883	-
				25	Back side	5	23790	710	25.00	23.93	127.94%	0.773	0.989	-
				49	Back side	5	23800	711	25.00	24.03	125.03%	0.793	0.991	56
					Back side*	5	23800	711	25.00	24.03	125.03%	0.789	0.986	-
					Front side	5	23800	711	25.00	24.03	125.03%	0.516	0.645	-
					Top side	5	23800	711	25.00	24.03	125.03%	0.186	0.233	-
					Bottom side	5	23800	711	25.00	24.03	125.03%	0.034	0.043	-
					Right side	5	23800	711	25.00	24.03	125.03%	0.300	0.375	-
					Left side	5	23800	711	25.00	24.03	125.03%	0.175	0.219	-
			25 RB	0	Back side	5	23800	711	24.00	22.96	127.06%	0.475	0.604	-
					Front side	5	23800	711	24.00	22.96	127.06%	0.433	0.550	-
					Top side	5	23800	711	24.00	22.96	127.06%	0.154	0.196	-
					Bottom side	5	23800	711	24.00	22.96	127.06%	0.027	0.034	-
					Right side	5	23800	711	24.00	22.96	127.06%	0.273	0.347	-
					Left side	5	23800	711	24.00	22.96	127.06%	0.154	0.196	-
			50 RB		Back side	5	23800	711	24.00	22.93	127.94%	0.458	0.586	-
					Front side	5	23800	711	24.00	22.93	127.94%	0.412	0.527	-
					Top side	5	23800	711	24.00	22.93	127.94%	0.142	0.182	-
					Bottom side	5	23800	711	24.00	22.93	127.94%	0.024	0.031	-
					Right side	5	23800	711	24.00	22.93	127.94%	0.258	0.330	-
					Left side	5	23800	711	24.00	22.93	127.94%	0.136	0.174	-

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

2.3 Reporting statements of conformity

The conformity statement in this report is based solely on the test results, measurement uncertainty is excluded.

3. Instruments List

Manufacturer	Device	Type	Serial number	Date of last calibration	Date of next calibration
SPEAG	Dosimetric E-Field Probe	EX3DV4	7466	Jan.29,2021	Jan.28,2022
SPEAG	System Validation Dipole	D750V3	1015	Aug.13,2020	Aug.12,2021
		D835V2	4d063	Aug.13,2020	Aug.12,2021
		D1750V2	1008	Aug.14,2020	Aug.13,2021
		D1900V2	5d173	Apr.15,2021	Apr.20,2022
SPEAG	Data acquisition Electronics	DAE4	877	Mar.22,2021	Mar.21,2022
SPEAG	Software	DASY 52 V52.10.4	N/A	Calibration not required	Calibration not required
SPEAG	Phantom	SAM	N/A	Calibration not required	Calibration not required
SPEAG	Dielectric Assessment Kit	DAKS-3.5	1053	Feb.17,2021	Feb.16,2022
Agilent	Dual-directional coupler	772D	MY46151242	Aug.17,2020	Aug.16,2021
		778D	MY48220468	Aug.17,2020	Aug.16,2021
Agilent	Signal Generator	N5181A	MY50145142	Dec.27,2020	Dec.26,2021
Agilent	Power Meter	E4417A	MY52200004	Oct.18,2020	Oct.17,2021
Agilent	Power Sensor	E9301H	MY52240003	Oct.18,2020	Oct.17,2021
			MY52200003	Oct.18,2020	Oct.17,2021
TECPEL	Digital thermometer	DTM-303A	TP130075	Sep.30.2020	Sep.29.2021
Anritsu	Radio Communication Test	MT8821C	6262044739	Dec.02.2020	Dec.01.2021

4. Measurements

Date: 2021/6/7

Report No. :ES/2020/50017
WCDMA Band II_Head_Right Cheek_CH 9538

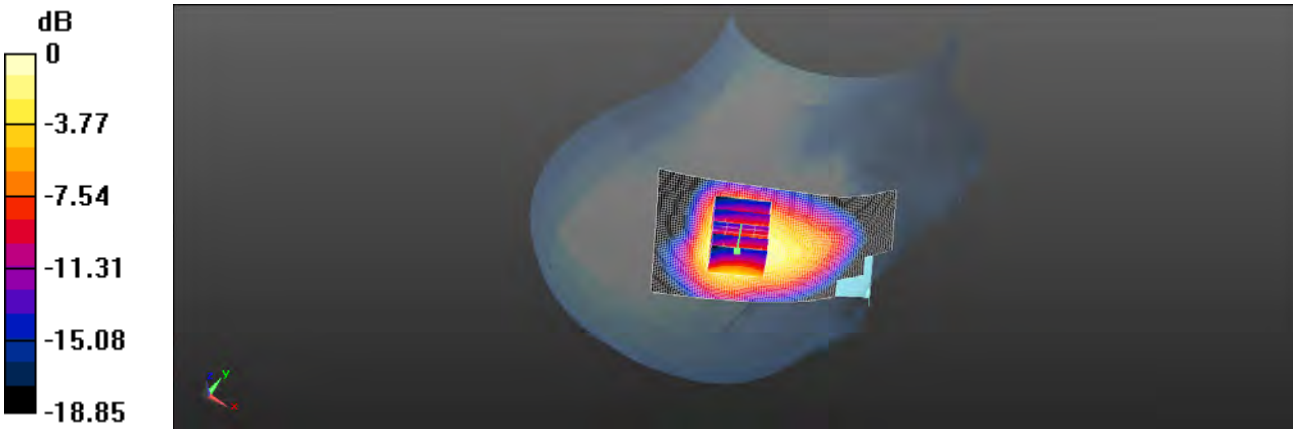
Communication System: WCDMA; Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1908 MHz; σ = 1.424 S/m; ε_r = 40.426; ρ = 1000 kg/m^3
Phantom section: Right Section
Ambient temperature: 22.6°C; Liquid temperature: 22.4°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(8.71, 8.71, 8.71); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.17 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.37 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.32 W/kg
SAR(1 g) = 0.774 W/kg; SAR(10 g) = 0.448 W/kg
Smallest distance from peaks to all points 3 dB below = 12.9 mm
Ratio of SAR at M2 to SAR at M1 = 61.7%
Maximum value of SAR (measured) = 1.01 W/kg



0 dB = 1.01 W/kg = 0.05 dBW/kg

Date: 2021/6/7

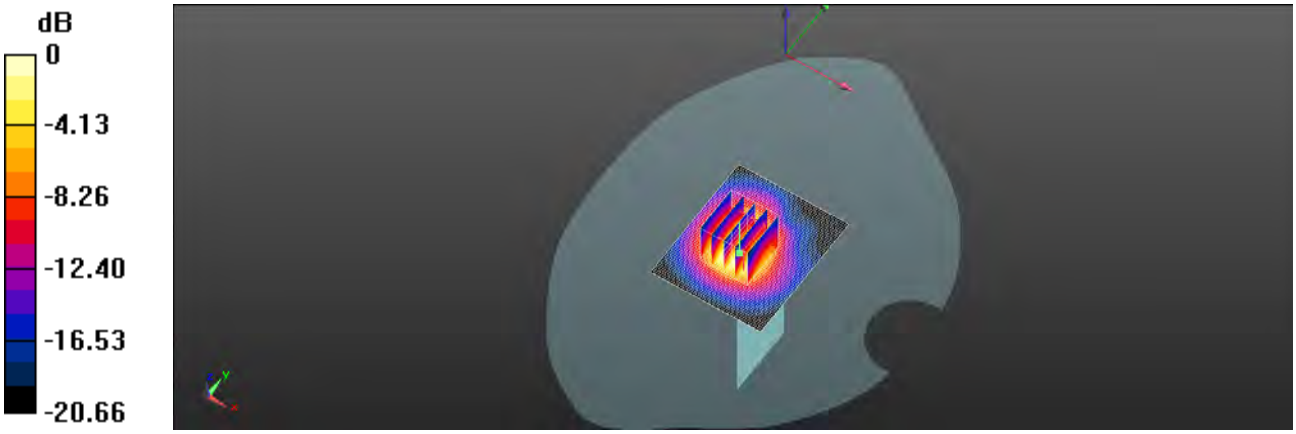
Report No. :ES/2020/50017
WCDMA Band II_Body_Top side_CH 9538_5mm
Communication System: WCDMA; Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1908 MHz; σ = 1.424 S/m; ε_r = 40.426; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.6°C; Liquid temperature: 22.4°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(8.71, 8.71, 8.71); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x61x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.10 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.33 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.28 W/kg
SAR(1 g) = 0.622 W/kg; SAR(10 g) = 0.314 W/kg
Smallest distance from peaks to all points 3 dB below = 11.3 mm
Ratio of SAR at M2 to SAR at M1 = 47.8%
Maximum value of SAR (measured) = 0.908 W/kg



0 dB = 0.908 W/kg = -0.42 dBW/kg

Date: 2021/6/4

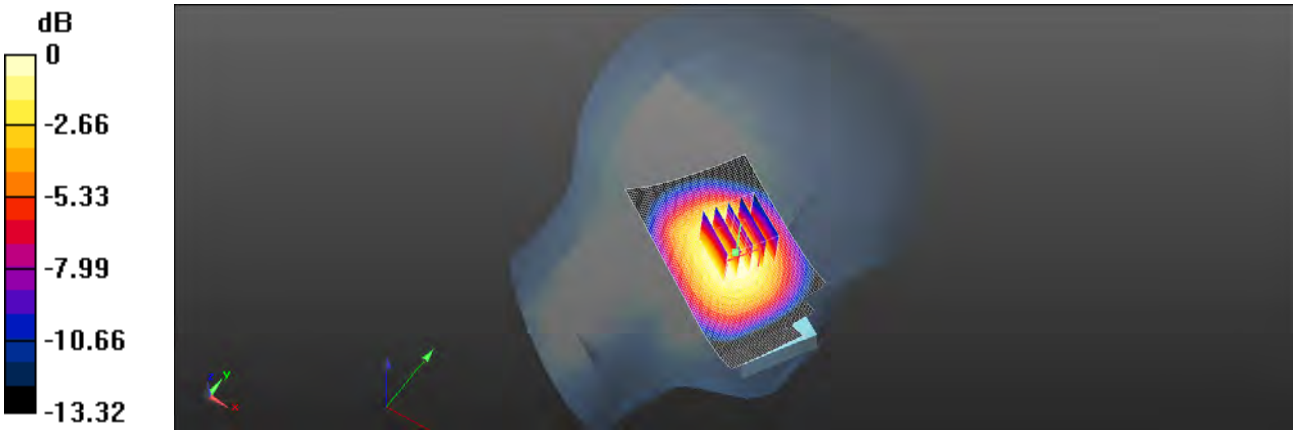
Report No. :ES/2020/50017
WCDMA Band V_Head_Left Cheek_CH 4132
Communication System: WCDMA; Frequency: 826.4 MHz; Duty Cycle: 1:1
Medium parameters used: f = 826.4 MHz; σ = 0.909 S/m; ε_r = 41.935; ρ = 1000 kg/m^3
Phantom section: Left Section
Ambient temperature: 22.3°C; Liquid temperature: 22.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(10.11, 10.11, 10.11); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.65 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.81 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 1.87 W/kg
SAR(1 g) = 1.25 W/kg; SAR(10 g) = 0.851 W/kg
Smallest distance from peaks to all points 3 dB below = 18.3 mm
Ratio of SAR at M2 to SAR at M1 = 69.5%
Maximum value of SAR (measured) = 1.55 W/kg



0 dB = 1.55 W/kg = 1.90 dBW/kg

Date: 2021/6/4

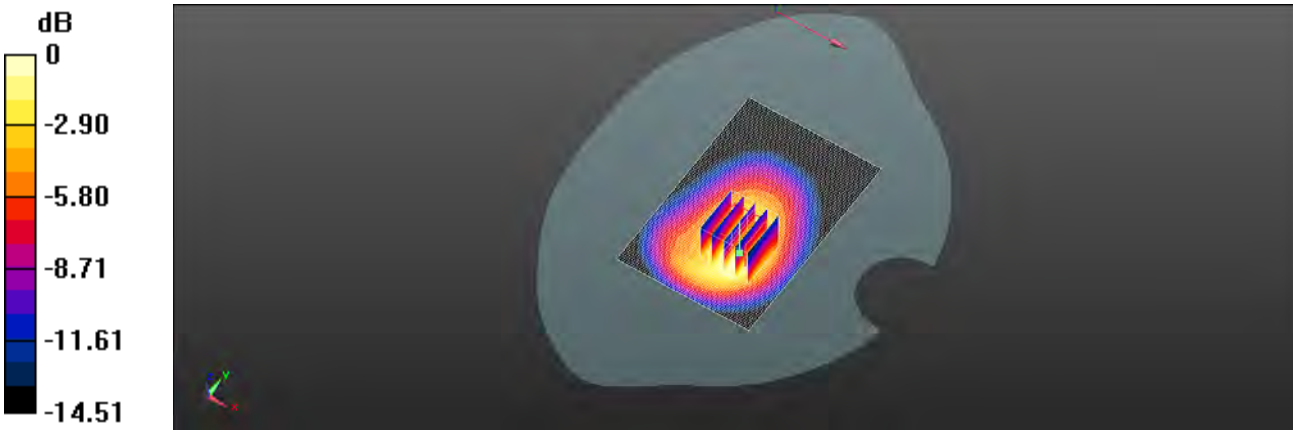
Report No. :ES/2020/50017
WCDMA Band V_Body_Back side_CH 4132_5mm
Communication System: WCDMA; Frequency: 826.4 MHz; Duty Cycle: 1:1
Medium parameters used: f = 826.4 MHz; σ = 0.909 S/m; ε_r = 41.935; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.3°C; Liquid temperature: 22.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(10.11, 10.11, 10.11); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.39 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.71 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.69 W/kg
SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.632 W/kg
Smallest distance from peaks to all points 3 dB below = 14.3 mm
Ratio of SAR at M2 to SAR at M1 = 61%
Maximum value of SAR (measured) = 1.38 W/kg



0 dB = 1.38 W/kg = 1.39 dBW/kg

Date: 2021/6/7

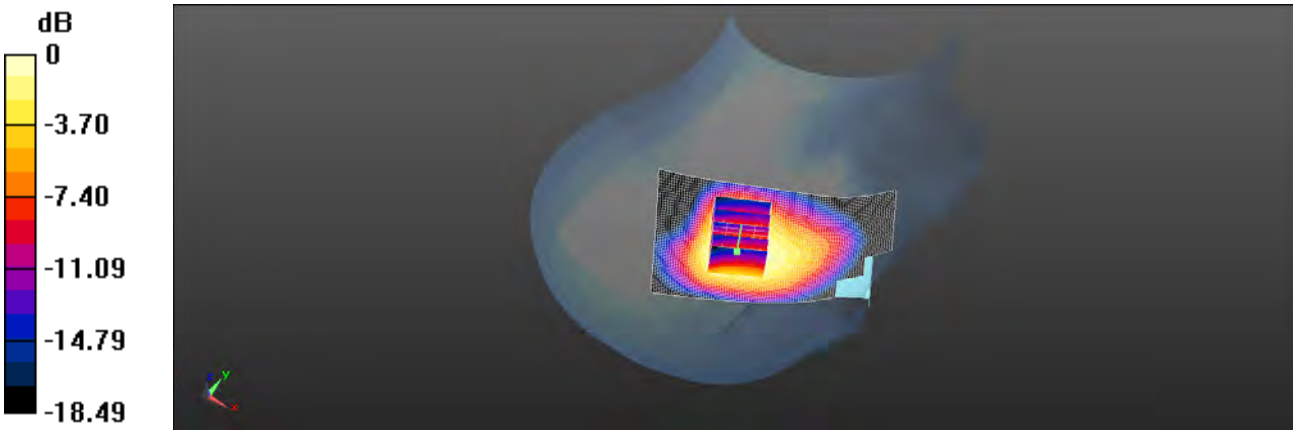
Report No. :ES/2020/50017
LTE Bnad 2 (20MHz)_Head_Right Cheek_CH 18900_QPSK_1-50
Communication System: LTE; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.421 S/m; ε_r = 40.436; ρ = 1000 kg/m^3
Phantom section: Right Section
Ambient temperature: 22.6°C; Liquid temperature: 22.4°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(8.71, 8.71, 8.71); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 2.12 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.53 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.15 W/kg
SAR(1 g) = 1.29 W/kg; SAR(10 g) = 0.751 W/kg
Smallest distance from peaks to all points 3 dB below = 13.7 mm
Ratio of SAR at M2 to SAR at M1 = 61.7%
Maximum value of SAR (measured) = 1.67 W/kg



0 dB = 1.67 W/kg = 2.23 dBW/kg

Date: 2021/6/7

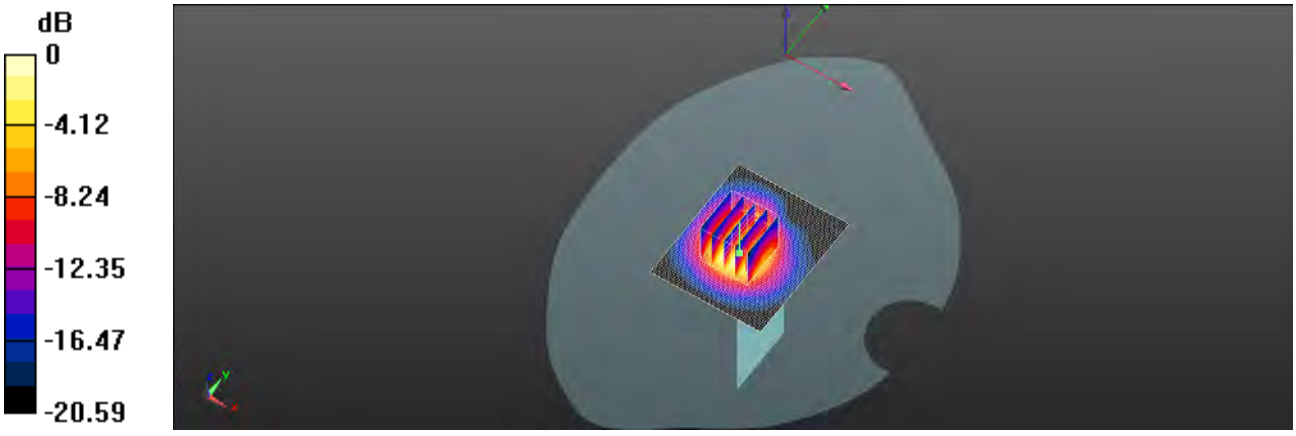
Report No. :ES/2020/50017
LTE Bnad 2 (20MHz)_Body_Top side_CH 18700_QPSK_50-25_5mm
Communication System: LTE; Frequency: 1860 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1860 MHz; σ = 1.42 S/m; ε_r = 40.44; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.6°C; Liquid temperature: 22.4°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(8.71, 8.71, 8.71); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x61x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 2.40 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.34 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 2.71 W/kg
SAR(1 g) = 1.32 W/kg; SAR(10 g) = 0.661 W/kg
Smallest distance from peaks to all points 3 dB below = 11.3 mm
Ratio of SAR at M2 to SAR at M1 = 48.2%
Maximum value of SAR (measured) = 1.95 W/kg



0 dB = 1.95 W/kg = 2.89 dBW/kg

Date: 2021/6/10

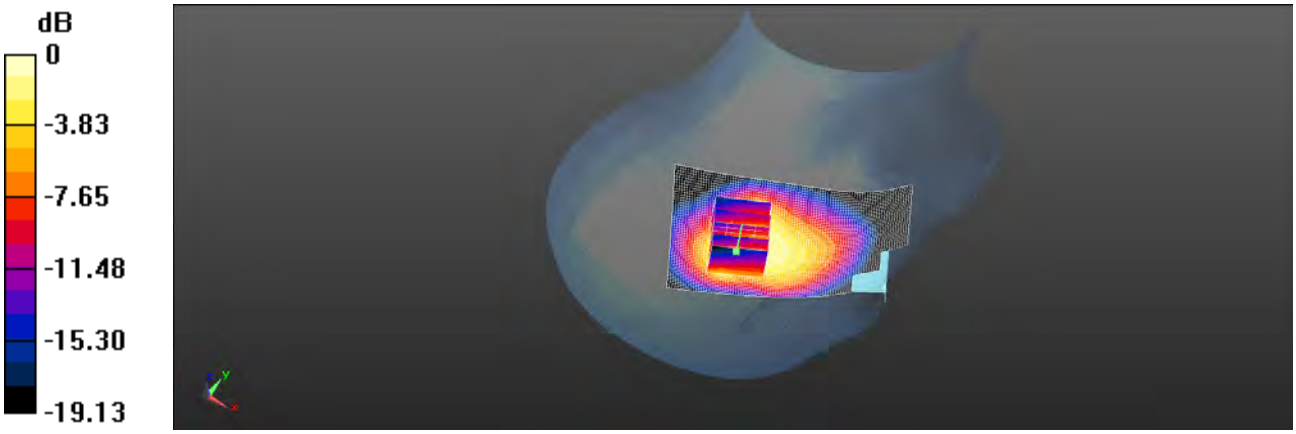
Report No. :ES/2020/50017
LTE Bnad 4 (20MHz)_Head_Right Cheek_CH 20300_QPSK_1-50
Communication System: LTE; Frequency: 1745 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1745 MHz; σ = 1.387 S/m; ε_r = 40.52; ρ = 1000 kg/m^3
Phantom section: Right Section
Ambient temperature: 22.5°C; Liquid temperature: 22.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(9.07, 9.07, 9.07); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.01 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.60 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.23 W/kg
SAR(1 g) = 0.760 W/kg; SAR(10 g) = 0.451 W/kg
Smallest distance from peaks to all points 3 dB below = 12.3 mm
Ratio of SAR at M2 to SAR at M1 = 60.8%
Maximum value of SAR (measured) = 1.02 W/kg



0 dB = 1.02 W/kg = 0.07 dBW/kg

Date: 2021/6/10

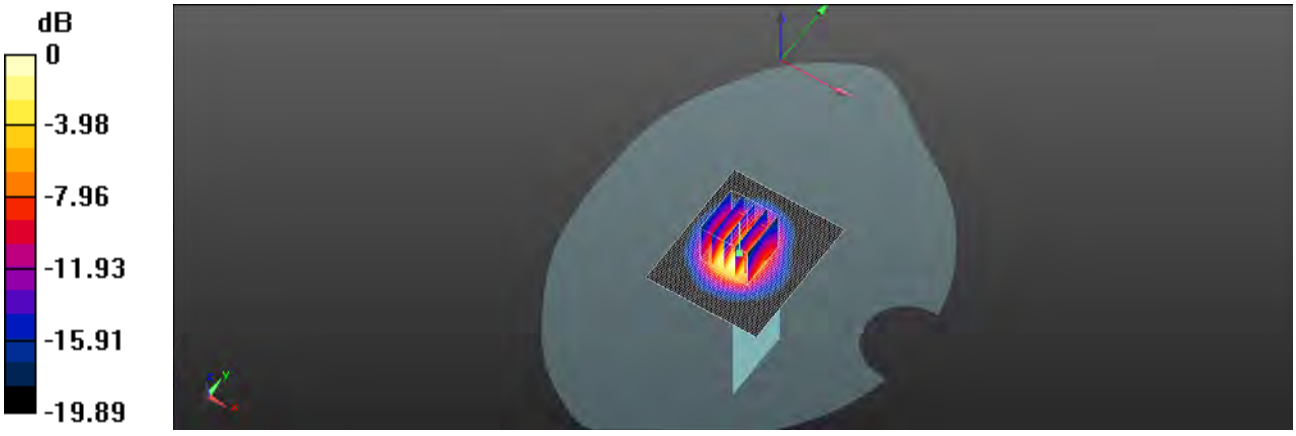
Report No. :ES/2020/50017
LTE Bnad 4 (20MHz)_Body_Top side_CH 20300_QPSK_1-50_5mm
Communication System: LTE; Frequency: 1745 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1745 MHz; σ = 1.387 S/m; ε_r = 40.52; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.5°C; Liquid temperature: 22.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(9.07, 9.07, 9.07); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x61x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 2.37 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.34 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 3.00 W/kg
SAR(1 g) = 1.44 W/kg; SAR(10 g) = 0.707 W/kg
Smallest distance from peaks to all points 3 dB below = 9.6 mm
Ratio of SAR at M2 to SAR at M1 = 49.5%
Maximum value of SAR (measured) = 2.27 W/kg



0 dB = 2.27 W/kg = 3.55 dBW/kg

Date: 2021/6/4

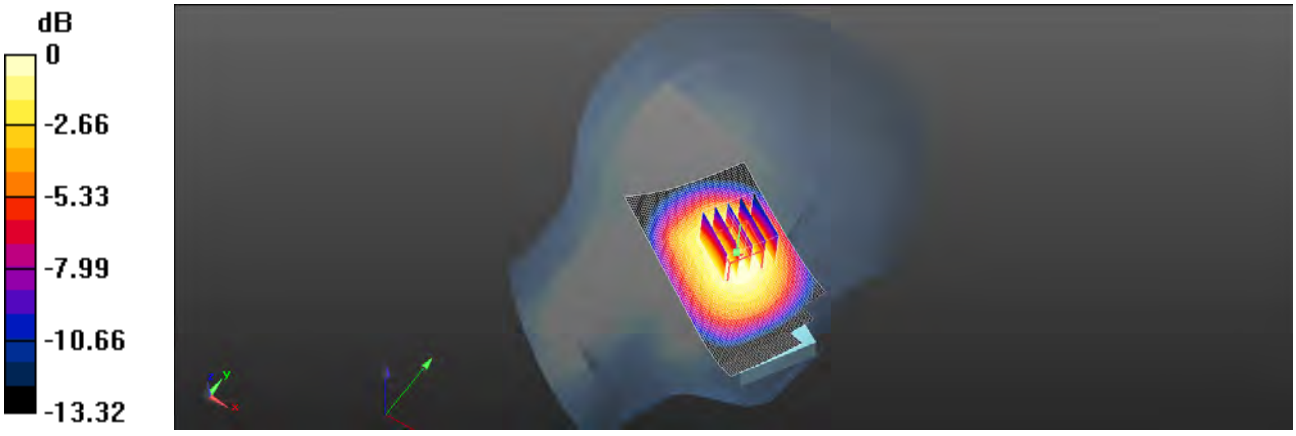
Report No. :ES/2020/50017
LTE Band 13 (10MHz)_Head_Left Cheek_CH 23230_QPSK_1-25
Communication System: LTE; Frequency: 782 MHz; Duty Cycle: 1:1
Medium parameters used: f = 782 MHz; σ = 0.906 S/m; ε_r = 42.164; ρ = 1000 kg/m^3
Phantom section: Left Section
Ambient temperature: 22.4°C; Liquid temperature: 22.7°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(10.27, 10.27, 10.27); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.26 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.28 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 1.37 W/kg
SAR(1 g) = 0.939 W/kg; SAR(10 g) = 0.638 W/kg
Smallest distance from peaks to all points 3 dB below = 20.7 mm
Ratio of SAR at M2 to SAR at M1 = 69.9%
Maximum value of SAR (measured) = 1.16 W/kg



0 dB = 1.16 W/kg = 0.63 dBW/kg

Date: 2021/6/4

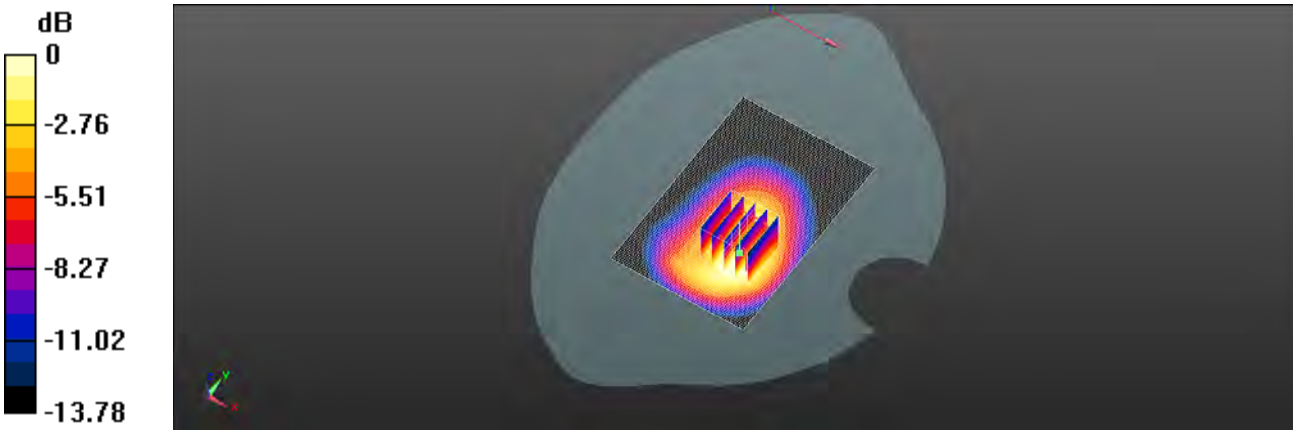
Report No. :ES/2020/50017
LTE Band 13 (10MHz)_Body_Back side_CH 23230_QPSK_1-25_5mm
Communication System: LTE; Frequency: 782 MHz; Duty Cycle: 1:1
Medium parameters used: f = 782 MHz; σ = 0.906 S/m; ε_r = 42.164; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.4°C; Liquid temperature: 22.7°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(10.27, 10.27, 10.27); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.24 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.23 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.32 W/kg
SAR(1 g) = 0.835 W/kg; SAR(10 g) = 0.518 W/kg
Smallest distance from peaks to all points 3 dB below = 15.8 mm
Ratio of SAR at M2 to SAR at M1 = 63.7%
Maximum value of SAR (measured) = 1.09 W/kg



0 dB = 1.09 W/kg = 0.38 dBW/kg

Date: 2021/6/4

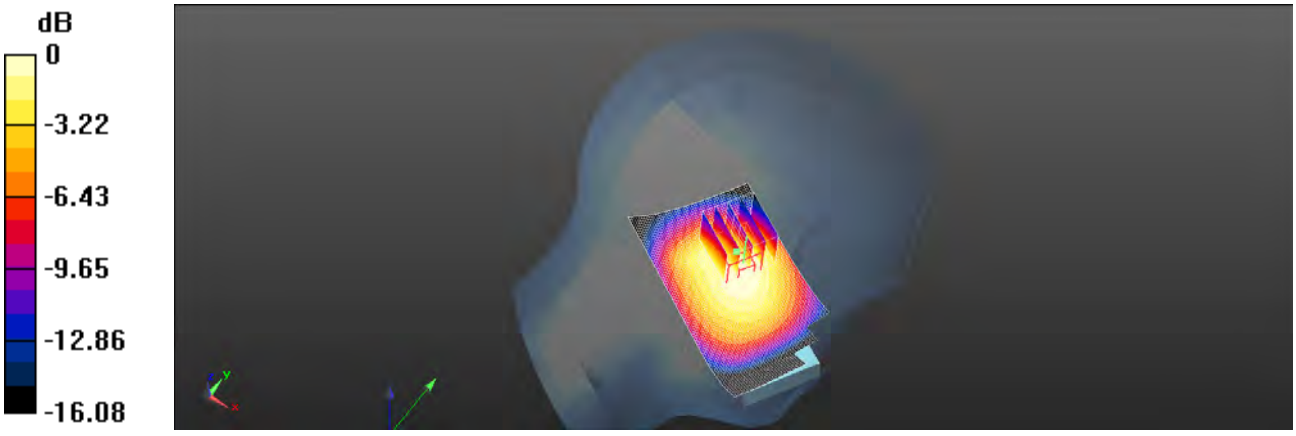
Report No. :ES/2020/50017
LTE Band 17 (10MHz)_Head_Left Cheek_CH 23800_QPSK_1-49
Communication System: LTE; Frequency: 711 MHz; Duty Cycle: 1:1
Medium parameters used: f = 711 MHz; σ = 0.9 S/m; ε_r = 42.515; ρ = 1000 kg/m^3
Phantom section: Left Section
Ambient temperature: 22.4°C; Liquid temperature: 22.7°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(10.27, 10.27, 10.27); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.13 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.36 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 1.33 W/kg
SAR(1 g) = 0.865 W/kg; SAR(10 g) = 0.553 W/kg
Smallest distance from peaks to all points 3 dB below = 17.7 mm
Ratio of SAR at M2 to SAR at M1 = 66.5%
Maximum value of SAR (measured) = 1.09 W/kg



0 dB = 1.09 W/kg = 0.36 dBW/kg

Date: 2021/6/4

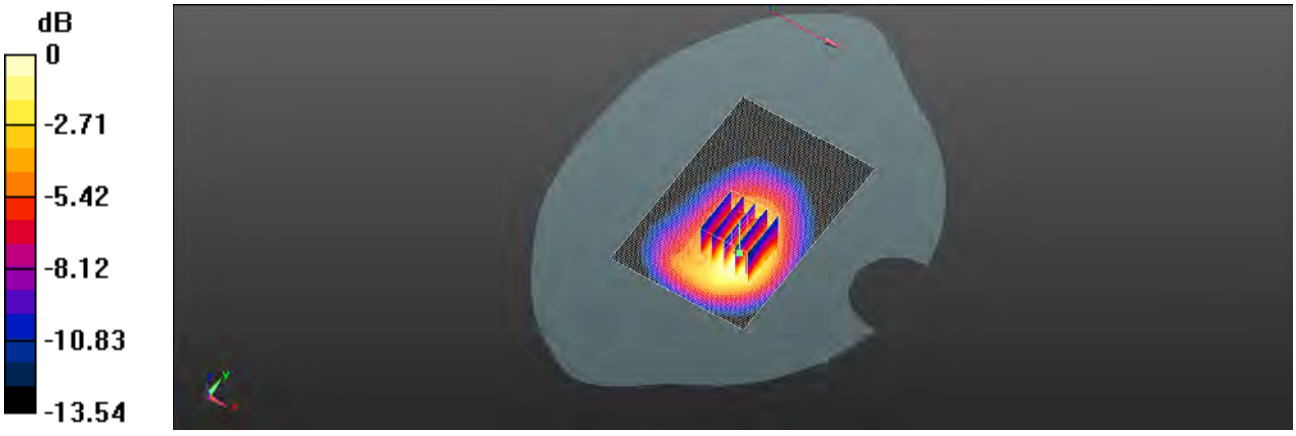
Report No. :ES/2020/50017
LTE Band 17 (10MHz)_Body_Back side_CH 23800_QPSK_1-49_5mm
Communication System: LTE; Frequency: 711 MHz; Duty Cycle: 1:1
Medium parameters used: f = 711 MHz; σ = 0.9 S/m; ε_r = 42.515; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.4°C; Liquid temperature: 22.7°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(10.27, 10.27, 10.27); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 1.04 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.46 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.26 W/kg
SAR(1 g) = 0.793 W/kg; SAR(10 g) = 0.491 W/kg
Smallest distance from peaks to all points 3 dB below = 15.8 mm
Ratio of SAR at M2 to SAR at M1 = 63.7%
Maximum value of SAR (measured) = 1.04 W/kg



0 dB = 1.04 W/kg = 0.15 dBW/kg

5. SAR System Performance Verification

Date: 2021/6/4

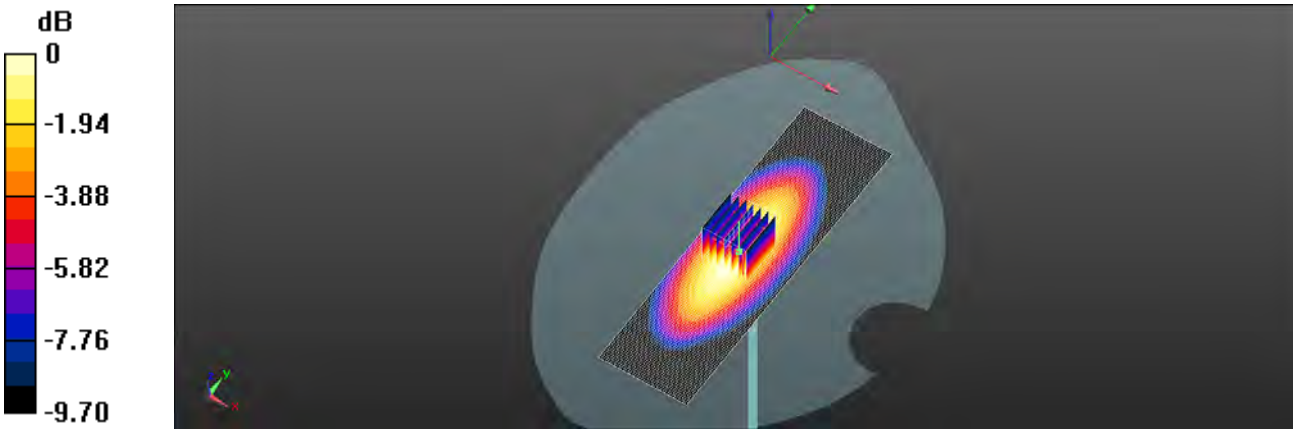
Report No. :ES/2020/50017
Dipole 750 MHz_SN:1015
Communication System: CW; Frequency: 750 MHz; Duty cycle= 1:1
Medium parameters used: f = 750 MHz; σ = 0.904 S/m; ε_r = 42.311; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.4°C; Liquid temperature: 22.7°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(10.27, 10.27, 10.27); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (41x141x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 2.66 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.77 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.15 W/kg
SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.39 W/kg
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 68.4%
Maximum value of SAR (measured) = 2.70 W/kg



0 dB = 2.70 W/kg = 4.31 dBW/kg

Date: 2021/6/4

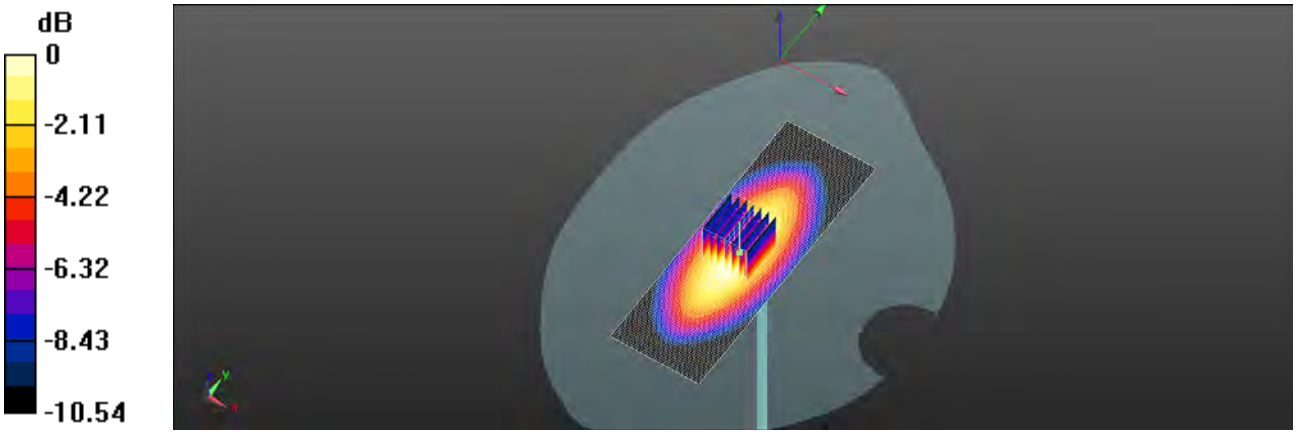
Report No. :ES/2020/50017
Dipole 835 MHz_SN:4d063
Communication System: CW; Frequency: 835 MHz; Duty cycle= 1:1
Medium parameters used: f = 835 MHz; σ = 0.91 S/m; ε_r = 41.874; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.3°C; Liquid temperature: 22.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(10.11, 10.11, 10.11); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (41x121x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 3.27 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.98 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.84 W/kg
SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.56 W/kg
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 66.9%
Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.14 dBW/kg

Date: 2021/6/10

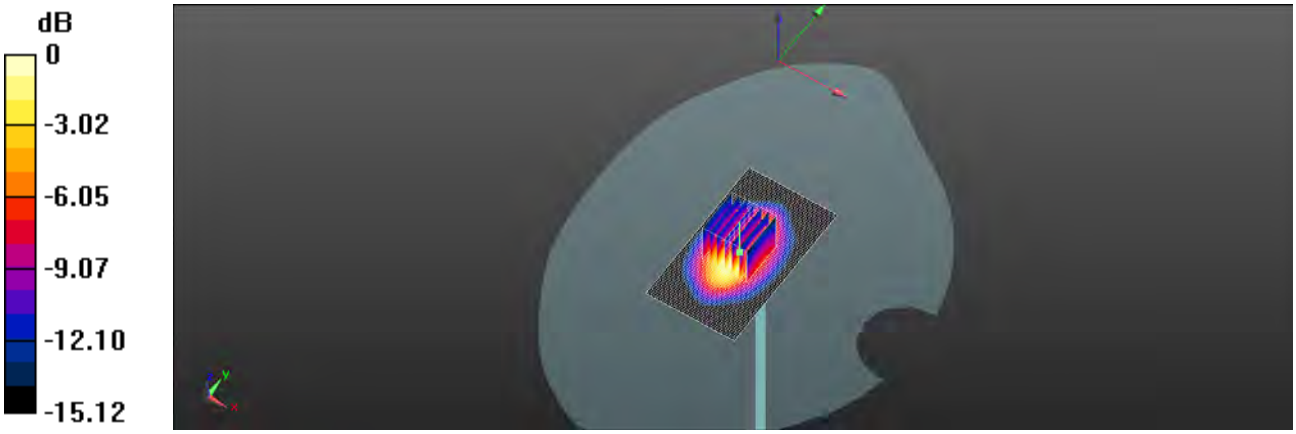
Report No. :ES/2020/50017
Dipole 1750 MHz_SN:1008
Communication System: CW; Frequency: 1750 MHz; Duty cycle= 1:1
Medium parameters used: f = 1750 MHz; σ = 1.391 S/m; ε_r = 40.504; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.5°C; Liquid temperature: 22.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(9.07, 9.07, 9.07); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (41x71x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 12.7 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 82.79 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 15.1 W/kg
SAR(1 g) = 8.93 W/kg; SAR(10 g) = 4.71 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 58.8%
Maximum value of SAR (measured) = 12.2 W/kg



0 dB = 12.2 W/kg = 10.85 dBW/kg

Date: 2021/6/7

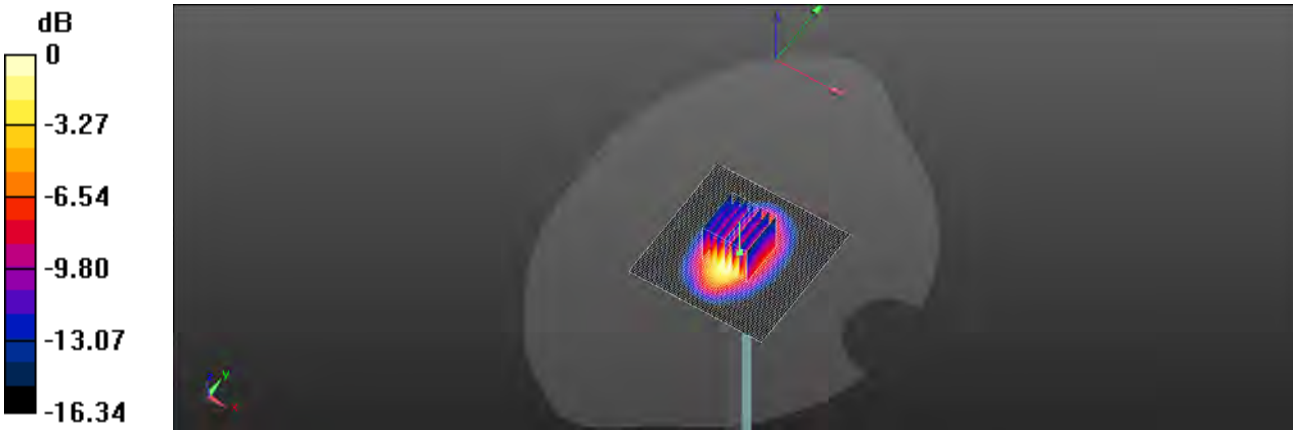
Report No. :ES/2020/50017
Dipole 1900 MHz_SN:5d173
Communication System: CW; Frequency: 1900 MHz; Duty cycle= 1:1
Medium parameters used: f = 1900 MHz; σ = 1.422 S/m; ε_r = 40.433; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.6°C; Liquid temperature: 22.4°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7466; ConvF(8.71, 8.71, 8.71); Calibrated: 2021/01/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn877; Calibrated: 2021/03/22
- Phantom: SAM
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x61x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 14.0 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.93 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 9.81 W/kg; SAR(10 g) = 5.12 W/kg
Smallest distance from peaks to all points 3 dB below = 9.5 mm
Ratio of SAR at M2 to SAR at M1 = 57%
Maximum value of SAR (measured) = 14.0 W/kg



0 dB = 14.0 W/kg = 11.46 dBW/kg

6. Uncertainty Budget

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

A	c	D	e		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probability Distributio	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	6.00%	N	1	1	1	1	6.00%	6.00%	∞
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	∞
Isotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	∞
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	∞
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	∞
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Readout Electronics	0.30%	N	1	1	1	1	0.30%	0.30%	∞
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	∞
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	∞
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	∞
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	∞
Probe Positioning with respect to phantom shell	2.90%	R	√3	1.732	1	1	1.67%	1.67%	∞
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Test Sample related									
Test sample positioning	2.90%	N	1	1	1	1	2.90%	2.90%	M-1
Device Holder Uncertainty	3.60%	N	1	1	1	1	3.60%	3.60%	M-1
Drift of output power	5.00%	R	√3	1.732	1	1	2.89%	2.89%	∞
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	∞
Liquid permittivity (mea.)	1.14%	N	1	1	0.64	0.43	0.73%	0.49%	M
Liquid Conductivity (mea.)	1.71%	N	1	1	0.6	0.49	1.03%	0.84%	M
Combined standard uncertainty		RSS					11.49%	11.45%	
Expant uncertainty (95% confidence interval), K=2							22.97%	22.90%	

Appendixes

Refer to separated files for the following appendixes.

ES202050017 SAR_Appendix A Photographs

ES202050017 SAR_Appendix B DAE & Probe Cal. Certificate

ES202050017 SAR_Appendix C Phantom Description & Dipole Cal. Certificate

- End of report -