Antenna to adjacent sides>50mm Sensor off

Bnad	Exposure Condition	f (GHz)	Pmax (dBm)	Pmax (mw)	separation distance(mm)					Calculated Value					SAR Test (Yes or No)				
					Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side
WIFI 2.4G Ant1	Body 0mm	2.462	20.00	100.00	5	148.9	5	5	241	<50mm	1084.83	<50mm	<50mm	2005.83	<50mm	No	<50mm	<50mm	No
WIFI 2.4G Ant2	Body 0mm	2.462	20.00	100.00	5	5	123.3	5	241	<50mm	<50mm	828.83	<50mm	2005.83	<50mm	<50mm	No	<50mm	No
WIFI 2.4G MIMO	Body 0mm	2.462	23.00	199.53	5	5	5	5	241	<50mm	<50mm	<50mm	<50mm	2005.83	<50mm	<50mm	<50mm	<50mm	No
WIFI 5G Ant1	Body 0mm	5.850	18.00	63.10	5	148.9	5	5	241	<50mm	1051.29	<50mm	<50mm	1972.29	<50mm	No	<50mm	<50mm	No
WIFI 5G Ant2	Body 0mm	5.850	18.00	63.10	5	5	123.3	5	241	<50mm	<50mm	795.29	<50mm	1972.29	<50mm	<50mm	No	<50mm	No
WIFI 5G MIMO	Body 0mm	5.850	21.00	125.89	5	5	5	5	241	<50mm	<50mm	<50mm	<50mm	1972.29	<50mm	<50mm	<50mm	<50mm	No
BT Ant1	Body 0mm	2.480	16.50	44.67	5	148.9	5	5	241	<50mm	1084.83	<50mm	<50mm	2005.83	<50mm	No	<50mm	<50mm	No
BT Ant2	Body 0mm	2.480	16.50	44.67	5	5	123.3	5	241	<50mm	<50mm	828.83	<50mm	2005.83	<50mm	<50mm	No	<50mm	No

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

1) (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]· [√f(GHz)/x] W/kg for test separation distances ≤ 50 mm,where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is > 50 mm.

Senor on

Mode	Position	Pmax (dBm)	Pmax (mw)	test separation distance(mm)					f(GHz)	X	Estimated SAR(W/Kg)				
				Back side	Left side	Right side	Top side	Bottom side			Back side	Left side	Right side	Top side	Bottom side
WIFI 2.4G Ant1	Body 0mm	11.00	12.59	5	148.9	5	5	241	2.462	7.5	measure	0.400	measure	measure	0.400
WIFI 2.4G Ant2	Body 0mm	11.00	12.59	5	5	123.3	5	241	2.462	7.5	measure	measure	0.400	measure	0.400
WIFI 2.4G MIMO	Body 0mm	14.00	25.12	5	5	5	5	241	2.462	7.5	measure	measure	measure	measure	0.400
WIFI 5G Ant1	Body 0mm	9.00	7.94	5	148.9	5	5	241	5.850	7.5	measure	0.400	measure	measure	0.400
WIFI 5G Ant2	Body 0mm	9.00	7.94	5	5	123.3	5	241	5.850	7.5	measure	measure	0.400	measure	0.400
WIFI 5G MIMO	Body 0mm	12.00	15.85	5	5	5	5	241	5.850	7.5	measure	measure	measure	measure	0.400
BT Ant1	Body 0mm	8.50	7.08	5	148.9	5	5	241	2.480	7.5	0.297	0.400	0.297	0.297	0.400
BT Ant2	Body 0mm	8.50	7.08	5	5	123.3	5	241	2.480	7.5	0.297	0.297	0.400	0.297	0.400

Senor off

Mode	Position	Pmax (dBm)	Pmax (mw)	test separation distance(mm)					f(GHz)	X	Estimated SAR(W/Kg)				
				Back side	Left side	Right side	Top side	Bottom side			Back side	Left side	Right side	Top side	Bottom side
WIFI 2.4G Ant1	Body 0mm	20.00	100.00	5	148.9	5	5	241	2.462	7.5	measure	0.400	measure	measure	0.400
WIFI 2.4G Ant2	Body 0mm	20.00	100.00	5	5	123.3	5	241	2.462	7.5	measure	measure	0.400	measure	0.400
WIFI 2.4G MIMO	Body 0mm	23.00	199.53	5	5	5	5	241	2.462	7.5	measure	measure	measure	measure	0.400
WIFI 5G Ant1	Body 0mm	18.00	63.10	5	148.9	5	5	241	5.850	7.5	measure	0.400	measure	measure	0.400
WIFI 5G Ant2	Body 0mm	18.00	63.10	5	5	123.3	5	241	5.850	7.5	measure	measure	0.400	measure	0.400
WIFI 5G MIMO	Body 0mm	21.00	125.89	5	5	5	5	241	5.850	7.5	measure	measure	measure	measure	0.400
BT Ant1	Body 0mm	16.50	44.67	5	148.9	5	5	241	2.480	7.5	measure	0.400	measure	measure	0.400
BT Ant2	Body 0mm	16.50	44.67	5	5	123.3	5	241	2.480	7.5	measure	measure	0.400	measure	0.400

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

Mode	Position	Pmax (dBm)	Pmax (mW)	Distance(mm)	f(GHz)	X	Estimated SAR(W/kg)
BT	Body 0mm	8.5	7.08	5	2.48	7.5	0.297

Table 5： Estimated SAR calculation for BT
Note:
1) * - maximum possible output power declared by manufacturer

SAR test plan:
Because the max power level of the RSDB mode are less than the non-RSDB mode, the non-RSDB mode SAR can cover the RSDB mode, SAR of the RSDB mode are not measured in this report.

8.3 Measurement of SAR Data

8.3.1 SAR Result of Wi-Fi 2.4GHz

Ant1 Test Record												
Test position	**Test mode**	**Test Ch./ Freq.**	**Duty Cycle**	**Duty Cycle Scaled factor**	**SAR (W/kg) 1-g**	**Power drift (dB)**	**Conducted power (dBm)**	**Tune up Limit (dBm)**	**Scaled factor**	**Scaled SAR (W/kg)**	**Liquid Temp.**	**Plot**
Body Test data (Separate 0mm sensor on)												
Back side	802.11b	11/2462	98.33%	1.017	0.232	-0.19	10.07	11.00	1.239	0.292	22	/
Right side	802.11b	11/2462	98.33%	1.017	0.221	0.19	10.07	11.00	1.239	0.278	22	/
Top side	802.11b	11/2462	98.33%	1.017	0.113	0.02	10.07	11.00	1.239	0.142	22	/
Right Comer	802.11b	11/2462	98.33%	1.017	0.106	0.11	10.07	11.00	1.239	0.134	22	/
Body Test data (sensor off)												
Back side-10mm	802.11b	1/2412	98.33%	1.017	0.178	-0.02	19.50	20.00	1.122	0.203	22	/
Right side-8mm	802.11b	1/2412	98.33%	1.017	0.324	0.02	19.50	20.00	1.122	**0.370**	22	Plot 1#
Top side-15mm	802.11b	1/2412	98.33%	1.017	0.045	-0.09	19.50	20.00	1.122	0.051	22	/
Right Comer-12mm	802.11b	1/2412	98.33%	1.017	0.096	0.00	19.50	20.00	1.122	0.110	22	/
Body Test Data with Keyboard cover												
Keyboard Face 0mm	802.11b	1/2412	98.33%	1.017	0.104	-0.12	19.50	20.00	1.122	0.119	22	/
Ant2 Test Record												
Test position	**Test mode**	**Test Ch./ Freq.**	**Duty Cycle**	**Duty Cycle Scaled factor**	**SAR (W/kg)1-g**	**Power drift (dB)**	**Conducted power (dBm)**	**Tune up Limit (dBm)**	**Scaled factor**	**Scaled SAR (W/kg)**	**Liquid Temp.**	**Plot**
Body Test data (Separate 0mm sensor on)												
Back side	802.11b	11/2462	98.33%	1.017	0.252	-0.07	10.21	11.00	1.199	**0.307**	22	Plot 2#
Left side	802.11b	11/2462	98.33%	1.017	0.040	0.02	10.21	11.00	1.199	0.049	22	/
Left Comer	802.11b	11/2462	98.33%	1.017	0.070	0.01	10.21	11.00	1.199	0.085	22	/
Top side	802.11b	11/2462	98.33%	1.017	0.022	-0.02	10.21	11.00	1.199	0.027	22	/
Body Test data (sensor off)												
Back side-11mm	802.11b	11/2462	98.33%	1.017	0.195	0.18	19.45	20.00	1.135	0.225	22	/
Left side-7mm	802.11b	11/2462	98.33%	1.017	0.189	-0.09	19.45	20.00	1.135	0.218	22	/
Top side-14mm	802.11b	11/2462	98.33%	1.017	0.049	0.18	19.45	20.00	1.135	0.114	22	/
Left Corner-10mm	802.11b	11/2462	98.33%	1.017	0.099	-0.02	19.45	20.00	1.135	0.057	22	/
Body Test Data with Keyboard cover												
Keyboard Face 0mm	802.11b	11/2462	98.33%	1.017	0.172	-0.09	19.45	20.00	1.135	0.199	22	/

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

Ant1+2 Test Record MIMO													
Test position	Test mode	Test Ch./Freq.	Duty Cycle	Duty Cycle Scaled factor	SAR (W/kg) 1-g	Power drift (dB)	Conducted power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg)	Liquid Temp.	Antenna Location	Plot
Body Test data (Separate 0mm sensor on)													
Back side	802.11b	6/2437	97.68%	1.024	0.182	0.14	10.08	11.00	1.236	0.230	22	Ant1	/
Left side	802.11b	6/2437	97.68%	1.024	0.086	-0.12	10.08	11.00	1.236	0.109	22	Ant2	/
Right side	802.11b	6/2437	97.68%	1.024	0.226	-0.13	10.08	11.00	1.236	0.286	22	Ant2	/
Top side	802.11b	6/2437	97.68%	1.024	0.074	0.16	10.08	11.00	1.236	0.094	22	Ant1	/
Left Comer	802.11b	6/2437	97.68%	1.024	0.077	-0.01	10.08	11.00	1.236	0.097	22	Ant1	/
Right Comer	802.11b	6/2437	97.68%	1.024	0.065	-0.11	10.08	11.00	1.236	0.082	22	Ant1	/
Body Test data (sensor off)													
Back side-10mm	802.11b	6/2437	97.68%	1.024	0.298	0.06	19.10	20.00	1.230	0.375	22	Ant1	/
Left side-7mm	802.11b	6/2437	97.68%	1.024	0.216	-0.04	19.10	20.00	1.230	0.272	22	Ant2	/
Right side-8mm	802.11b	6/2437	97.68%	1.024	0.330	0.12	19.10	20.00	1.230	**0.416**	22	Ant1	Plot 3#
Top side-14mm	802.11b	6/2437	97.68%	1.024	0.107	-0.11	19.10	20.00	1.230	0.135	22	Ant1	/
Left Comer-10mm	802.11b	6/2437	97.68%	1.024	0.097	0.11	19.10	20.00	1.230	0.122	22	Ant2	/
Right Comer-12mm	802.11b	6/2437	97.68%	1.024	0.082	0.17	19.10	20.00	1.230	0.103	22	Ant1	/
Body Test Data with Keyboard cover-sensor off													
Keyboard Face 0mm	802.11b	6/2437	97.68%	1.024	0.184	0.09	19.10	20.00	1.230	0.232	22	Ant1	/

Table 6： SAR of Wi-Fi 2.4G for Body

Note:

1) For MIMO SAR testing:

a. Back side: The trigger distance for ANT 1 sensor is 11mm and for ANT 2 sensor it is 12mm. Tests at full power were performed at 10(11-1) mm (11 < 12) for both antennas to allow for simultaneous SAR to be more easily evaluated at 10mm at full power.

b. Top side: The trigger distance for ANT 1 sensor is 16mm and for ANT 2 sensor it is 15mm. Tests at full power were performed at14 (15-1) mm (15 < 16) for both antennas to allow for simultaneous SAR to be more easily evaluated at 14mm at full power.

2) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B

3) If the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

4) Each channel was tested at the lowest data rate.

5) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, 802.11g/n OFDM SAR Test is not required.

Mode	Tune up (dBm)	Tune up (mW)	Max reported SAR(W/kg)	Adjusted SAR(W/kg)	SAR Test (Yes/No)
802.11b	20	100	0.370	/	Yes
802.11g	19	79.43	/	0.294	No
802.11n-HT20	18	63.09	/	0.233	No

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

8.3.1 SAR Result of Wi-Fi 5GHz

Ant1 Test Record												
Test position	Test mode	Test Ch. /Freq.	Duty Cycle	Duty Cycle Scaled factor	SAR (W/kg) 1-g	Power drift (dB)	Conducted power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg)	Liquid Temp.	Plot
Test data of U-NII-2A(Separate 0mm)-sensor on												
Back side	802.11ac VHT80	58/5290	94.06%	1.063	0.419	-0.02	8.01	9.00	1.256	0.559	22.2	/
Right side	802.11ac VHT80	58/5290	94.06%	1.063	0.826	-0.04	8.01	9.00	1.256	**1.103**	22.2	Plot 4#
Right Comer	802.11ac VHT80	58/5290	94.06%	1.063	0.168	0.02	8.01	9.00	1.256	0.224	22.2	/
Top side	802.11ac VHT80	58/5290	94.06%	1.063	0.149	-0.04	8.01	9.00	1.256	0.199	22.2	/
Right side-repeat	802.11ac VHT80	58/5290	94.06%	1.063	0.815	0.05	8.01	9.00	1.256	1.088	22.2	/
Test data of U-NII-2A-sensor off												
Back side-10mm	802.11a	60/5300	98.11%	1.019	0.325	-0.07	17.45	18.00	1.135	0.376	22.2	/
Right side-8mm	802.11a	60/5300	98.11%	1.019	0.610	-0.19	17.45	18.00	1.135	0.706	22.2	/
Right Comer-12mm	802.11a	60/5300	98.11%	1.019	0.195	0.09	17.45	18.00	1.135	0.226	22.2	/
Top side-15mm	802.11a	60/5300	98.11%	1.019	0.140	-0.04	17.45	18.00	1.135	0.162	22.2	/
Body Test Data with Keyboard cover												
Keyboard Face 0mm	802.11a	60/5300	98.11%	1.019	0.193	-0.15	17.45	18.00	1.135	0.223	22.2	/
Test data of U-NII-2C(Separate 0mm)-sensor on												
Back side	802.11ac VHT80	106/5530	94.06%	1.063	0.234	-0.02	8.05	9.00	1.245	0.310	22.2	/
Right side	802.11ac VHT80	106/5530	94.06%	1.063	0.428	-0.05	8.05	9.00	1.245	0.566	22.2	/
Right Comer	802.11ac VHT80	106/5530	94.06%	1.063	0.179	-0.03	8.05	9.00	1.245	0.237	22.2	/
Top side	802.11ac VHT80	106/5530	94.06%	1.063	0.144	-0.09	8.05	9.00	1.245	0.191	22.2	/
Test data of U-NII-2C-sensor off												
Back side-10mm	802.11a	136/5680	98.11%	1.019	0.276	-0.08	17.11	18.00	1.227	0.345	22.2	/
Right side-8mm	802.11a	136/5680	98.11%	1.019	0.359	0.00	17.11	18.00	1.227	0.449	22.2	/
Right Comer-12mm	802.11a	136/5680	98.11%	1.019	0.198	0.12	17.11	18.00	1.227	0.248	22.2	/
Top side-15mm	802.11a	136/5680	98.11%	1.019	0.156	-0.05	17.11	18.00	1.227	0.195	22.2	/
Body Test Data with Keyboard cover												
Keyboard Face 0mm	802.11a	136/5680	98.11%	1.019	0.184	0.04	17.11	18.00	1.227	0.230	22.2	/
Test data of U-NII-3 (Separate 0mm)-sensor on												
Back side	802.11ac VHT80	155/5775	94.06%	1.063	0.225	-0.03	8.22	9.00	1.197	0.286	22.2	/
Right side	802.11ac VHT80	155/5775	94.06%	1.063	0.473	-0.09	8.22	9.00	1.197	0.602	22.2	/
Right Come	802.11ac VHT80	155/5775	94.06%	1.063	0.190	0.00	8.22	9.00	1.197	0.242	22.2	/
Top side	802.11ac VHT80	155/5775	94.06%	1.063	0.150	-0.07	8.22	9.00	1.197	0.191	22.2	/
Test data of U-NII-3-sensor off												/

Back side-10mm	802.11a	165/5825	98.11%	1.019	0.288	-0.05	17.10	18.00	1.230	0.361	22.2	/
Right side-8mm	802.11a	165/5825	98.11%	1.019	0.386	0.08	17.10	18.00	1.230	0.484	22.2	/
Right Comer-12mm	802.11a	165/5825	98.11%	1.019	0.216	-0.18	17.10	18.00	1.230	0.271	22.2	/
Top side-15mm	802.11a	165/5825	98.11%	1.019	0.159	-0.08	17.10	18.00	1.230	0.199	22.2	/
Body Test Data with Keyboard cover												
Keyboard Face 0mm	802.11a	165/5825	98.11%	1.019	0.186	0.19	17.10	18.00	1.230	0.233	22.2	/
Ant2 Test Record												
Test position	**Test mode**	**Test Ch. /Freq.**	**Duty Cycle**	**Duty Cycle Scaled factor**	**SAR (W/kg) 1-g**	**Power drift (dB)**	**Conducted power (dBm)**	**Tune up Limit (dBm)**	**Scaled factor**	**Scaled SAR (W/kg)**	**Liquid Temp.**	**Plot**
Test data of U-NII-2A(Separate 0mm)-sensor on												
Back side	802.11ac VHT80	58/5290	94.59%	1.057	0.594	-0.04	8.12	9.00	1.225	0.769	22.2	/
Left side	802.11ac VHT80	58/5290	94.59%	1.057	0.289	0.01	8.12	9.00	1.225	0.374	22.2	/
Left Comer	802.11ac VHT80	58/5290	94.59%	1.057	0.169	0.80	8.12	9.00	1.225	0.219	22.2	/
Top side	802.11ac VHT80	58/5290	94.59%	1.057	0.150	0.06	8.12	9.00	1.225	0.194	22.2	/
Test data of U-NII-2A-sensor off												
Back side-11mm	802.11a	60/5300	98.28%	1.017	0.233	-0.09	17.23	18.00	1.194	0.283	22.2	/
Left side-7mm	802.11a	60/5300	98.28%	1.017	0.318	-0.02	17.23	18.00	1.194	0.386	22.2	/
LeftComer-10mm	802.11a	60/5300	98.28%	1.018	0.188	-0.02	17.23	18.00	1.194	0.228	22.2	/
Top side-14mm	802.11a	60/5300	98.28%	1.017	0.132	-0.08	17.23	18.00	1.194	0.160	22.2	/
Body Test Data with Keyboard cover												
Keyboard Face 0mm	802.11a	60/5300	98.28%	1.017	0.304	-0.09	17.23	18.00	1.194	0.369	22.2	/
Test data of U-NII-2C(Separate 0mm)-sensor on												
Back side	802.11ac VHT80	138/5690	94.59%	1.057	0.713	-0.03	7.96	9.00	1.271	**0.958**	22.2	Plot 5#
Back side	802.11ac VHT80	106/5530	94.59%	1.057	0.644	-0.11	7.81	9.00	1.315	0.895	22.2	/
Back side	802.11ac VHT80	122/5610	94.59%	1.057	0.680	0.01	7.94	9.00	1.276	0.918	22.2	/
Left side	802.11ac VHT80	138/5690	94.59%	1.057	0.323	0.08	7.96	9.00	1.271	0.434	22.2	/
Top side	802.11ac VHT80	138/5690	94.59%	1.057	0.170	0.11	7.96	9.00	1.271	0.228	22.2	/
Left Comer	802.11ac VHT80	138/5690	94.59%	1.057	0.249	-0.04	7.96	9.00	1.271	0.334	22.2	/
Test data of U-NII-2C-sensor off												
Back side-11mm	802.11a	108/5540	98.28%	1.017	0.207	-0.06	17.36	18.00	1.159	0.244	22.2	/
Left side-7mm	802.11a	108/5540	98.28%	1.017	0.327	-0.06	17.36	18.00	1.159	0.386	22.2	/
Left Comer-10mm	802.11a	108/5540	98.28%	1.018	0.212	-0.08	17.36	18.00	1.159	0.250	22.2	/
Top side-14mm	802.11a	108/5540	98.28%	1.017	0.158	-0.03	17.36	18.00	1.159	0.186	22.2	/
Body Test Data with Keyboard cover												
Keyboard Face 0mm	802.11a	108/5540	98.28%	1.017	0.284	-0.02	17.36	18.00	1.159	0.335	22.2	/

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

Test data of U-NII-3 (Separate 0mm)-sensor on												
Back side	802.11ac VHT80	155/5775	94.59%	1.057	0.327	0.11	8.22	9.00	1.197	0.414	22.2	/
Left side	802.11ac VHT80	155/5775	94.59%	1.057	0.242	0.07	8.22	9.00	1.197	0.306	22.2	/
Left Comer	802.11ac VHT80	155/5775	94.59%	1.057	0.207	0.01	8.22	9.00	1.197	0.262	22.2	/
Top side	802.11ac VHT80	155/5775	94.59%	1.057	0.167	0.01	8.22	9.00	1.197	0.211	22.2	/
Test data of U-NII-3-sensor off												
Back side-11mm	802.11a	157/5785	98.28%	1.017	0.200	-0.05	17.15	18.00	1.216	0.247	22.2	/
Left side-7mm	802.11a	157/5785	98.28%	1.017	0.282	-0.02	17.15	18.00	1.216	0.349	22.2	/
Left Comer-10mm	802.11a	157/5785	98.28%	1.018	0.219	0.07	17.15	18.00	1.216	0.271	22.2	/
Top side-14mm	802.11a	157/5785	98.28%	1.017	0.361	-0.03	17.15	18.00	1.216	0.447	22.2	/
Body Test Data with Keyboard cover												
Keyboard Face 0mm	802.11a	157/5785	98.28%	1.017	0.221	-0.08	17.15	18.00	1.216	0.273	22.2	/

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

Ant1+2 Test Record MIMO													
Test position	**Test mode**	**Test Ch./Freq.**	**Duty Cycle**	**Duty Cycle Scaled factor**	**SAR (W/kg)1-g**	**Power drift(dB)**	**Conducted power(dBm)**	**Tune up Limit(dBm)**	**Scaled factor**	**Scaled SAR(W/kg)**	**Liquid Temp.**	**Antenna Location**	**Plot**
Test data of U-NII-2A(Separate 0mm)-sensor on													
Back side	802.11ac VHT80	58/5290	91.43%	1.094	0.559	-0.02	7.19	9.00	1.517	0.928	22.2	Ant2	/
Left side	802.11ac VHT80	58/5290	91.43%	1.094	0.493	-0.17	7.19	9.00	1.517	0.818	22.2	Ant2	/
Right side	802.11ac VHT80	58/5290	91.43%	1.094	0.621	-0.04	7.19	9.00	1.517	**1.030**	22.2	Ant1	Plot 6#
Top side	802.11ac VHT80	58/5290	91.43%	1.094	0.146	-0.07	7.19	9.00	1.517	0.242	22.2	Ant2	/
Left Comer	802.11ac VHT80	58/5290	91.43%	1.094	0.190	0.05	7.19	9.00	1.517	0.315	22.2	Ant2	/
Right Comer	802.11ac VHT80	58/5290	91.43%	1.094	0.165	0.06	7.19	9.00	1.517	0.274	22.2	Ant1	/
Test data of U-NII-2A-sensor off													
Back side-10mm	802.11a	60/5300	98.12%	1.019	0.141	-0.04	16.92	18.00	1.282	0.184	22.2	Ant2	/
Left side-7mm	802.11a	60/5300	98.12%	1.019	0.145	-0.06	16.92	18.00	1.282	0.189	22.2	Ant2	/
Right side-8mm	802.11a	60/5300	98.12%	1.019	0.174	-0.08	16.92	18.00	1.282	0.227	22.2	Ant1	/
Top side-14mm	802.11a	60/5300	98.12%	1.019	0.115	-0.09	16.92	18.00	1.282	0.150	22.2	Ant2	/
Left Corner-10mm	802.11a	60/5300	98.12%	1.019	0.188	0.02	16.92	18.00	1.282	0.246	22.2	Ant2	/
Right Comer-12mm	802.11a	60/5300	98.12%	1.019	0.198	0.08	16.92	18.00	1.282	0.259	22.2	Ant1	/
Body Test Data with Keyboard cover-sensor off													
Keyboard Face 0mm	802.11a	60/5300	98.12%	1.019	0.202	-0.09	16.92	18.00	1.282	0.264	22.2	Ant2	/
Test data of U-NII-2C(Separate 0mm)-sensor on													
Back side	802.11ac VHT80	106/5530	91.43%	1.094	0.472	-0.07	7.61	9.00	1.377	0.711	22.2	Ant2	/
Left side	802.11ac VHT80	106/5530	91.43%	1.094	0.522	0.08	7.61	9.00	1.377	0.786	22.2	Ant2	/
Right side	802.11ac VHT80	106/5530	91.43%	1.094	0.298	-0.03	7.61	9.00	1.377	0.449	22.2	Ant1	/
Top side	802.11ac VHT80	106/5530	91.43%	1.094	0.177	-0.06	7.61	9.00	1.377	0.267	22.2	Ant2	/
Left Comer	802.11ac VHT80	106/5530	91.43%	1.094	0.244	0.10	7.61	9.00	1.377	0.368	22.2	Ant2	/
Right Comer	802.11ac VHT80	106/5530	91.43%	1.094	0.177	0.13	7.61	9.00	1.377	0.267	22.2	Ant1	/
Test data of U-NII-2C-sensor off													
Back side-10mm	802.11a	108/5540	98.12%	1.019	0.173	-0.03	16.82	18.00	1.312	0.231	22.2	Ant2	/
Left side-7mm	802.11a	108/5540	98.12%	1.019	0.182	-0.04	16.82	18.00	1.312	0.243	22.2	Ant2	/
Right side-8mm	802.11a	108/5540	98.12%	1.019	0.160	-0.03	16.82	18.00	1.312	0.214	22.2	Ant1	/
Top side-14mm	802.11a	108/5540	98.12%	1.019	0.129	-0.09	16.82	18.00	1.312	0.173	22.2	Ant2	/
Left Corner-10mm	802.11a	108/5540	98.12%	1.019	0.241	0.10	16.82	18.00	1.312	0.322	22.2	Ant2	/
Right Comer-12mm	802.11a	108/5540	98.12%	1.019	0.197	0.03	16.82	18.00	1.312	0.263	22.2	Ant1	/
Body Test Data with Keyboard cover-sensor off													
Keyboard Face 0mm	802.11a	108/5540	98.12%	1.019	0.264	-0.03	16.82	18.00	1.312	0.353	22.2	Ant2	/
Test data of U-NII-3 (Separate 0mm)-sensor on													
Back side	802.11ac VHT80	155/5775	91.43%	1.094	0.398	0.04	7.48	9.00	1.419	0.618	22.2	Ant2	/
Left side	802.11ac VHT80	155/5775	91.43%	1.094	0.299	-0.13	7.48	9.00	1.419	0.464	22.2	Ant2	/
Right side	802.11ac VHT80	155/5775	91.43%	1.094	0.323	-0.01	7.48	9.00	1.419	0.501	22.2	Ant1	/
Top side	802.11ac VHT80	155/5775	91.43%	1.094	0.164	-0.08	7.48	9.00	1.419	0.255	22.2	Ant2	/

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

Left Comer	802.11ac VHT80	155/5775	91.43%	1.094	0.221	0.00	7.48	9.00	1.419	0.343	22.2	Ant2	/
Right Comer	802.11ac VHT80	155/5775	91.43%	1.094	0.192	-0.15	7.48	9.00	1.419	0.298	22.2	Ant1	/
Test data of U-NII-3-sensor off													
Back side-10mm	802.11a	165/5825	98.12%	1.019	0.172	-0.05	16.95	18.00	1.274	0.223	22.2	Ant2	/
Left side-7mm	802.11a	165/5825	98.12%	1.019	0.161	-0.04	16.95	18.00	1.274	0.209	22.2	Ant2	/
Right side-8mm	802.11a	165/5825	98.12%	1.019	0.291	-0.07	16.95	18.00	1.274	0.378	22.2	Ant1	/
Top side-14mm	802.11a	165/5825	98.12%	1.019	0.149	-0.05	16.95	18.00	1.274	0.193	22.2	Ant2	/
Left Corner-10mm	802.11a	165/5825	98.12%	1.019	0.112	-0.07	16.95	18.00	1.274	0.145	22.2	Ant2	/
Right Comer-12mm	802.11a	165/5825	98.12%	1.019	0.093	0.13	16.95	18.00	1.274	0.121	22.2	Ant1	/
Body Test Data with Keyboard cover-sensor off													
Keyboard Face 0mm	802.11a	165/5825	98.12%	1.019	0.199	-0.04	16.95	18.00	1.274	0.258	22.2	Ant2	/

Table 7： SAR of Wi-Fi 5G for Body

Note:

1) For MIMO SAR testing:

a. Back side: The trigger distance for ANT 1 sensor is 11mm and for ANT 2 sensor it is 12mm. Tests at full power were performed at 10(11-1) mm (11 < 12) for both antennas to allow for simultaneous SAR to be more easily evaluated at 10mm at full power.

b. Top side: The trigger distance for ANT 1 sensor is 16mm and for ANT 2 sensor it is 15mm. Tests at full power were performed at14 (15-1) mm (15 < 16) for both antennas to allow for simultaneous SAR to be more easily evaluated at 14mm at full power.

2) The maximum Scaled SAR value is marked in bold. Graph Results refer to Appendix B

3) If the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

4) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. As the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration;

Mode	Tune up (dBm)	Tune up (mW)	Max reported SAR(W/kg)	Adjusted SAR(W/kg)	SAR Test (Yes/No)
802.11a 20M (U-NII-2A)	9.00	7.94	1.103	/	Yes
802.11a 20M (U-NII-1)	9.00	7.94	/	1.103	No

5) Per KDB248227D01, as the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes are not required.

Mode	Tune up (dBm)	Tune up (mW)	Max reported SAR(W/kg)	Adjusted SAR(W/kg)	SAR Test (Yes/No)
5.3G U-NII-2A Band					
802.11ac 80M	9.00	7.94	1.103	/	Yes
802.11a	9.00	7.94	/	1.103	No
802.11n-HT20	9.00	7.94	/	1.103	No
802.11n-HT40	9.00	7.94	/	1.103	No
802.11ac 20M	9.00	7.94	/	1.103	No

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

802.11ac 40M	9.00	7.94	/	1.103	No
5.5G U-NII-2C Band					
802.11ac 80M	9.00	7.94	0.566	/	Yes
802.11a	9.00	7.94	/	0.566	No
802.11n-HT20	9.00	7.94	/	0.566	No
802.11n-HT40	9.00	7.94	/	0.566	No
802.11ac 20M	9.00	7.94	/	0.566	No
802.11ac 40M	9.00	7.94	/	0.566	No
5.8G U-NII-3 Band					
802.11ac 80M	9.00	7.94	0.602	/	Yes
802.11a	9.00	7.94	/	0.602	No
802.11n-HT20	9.00	7.94	/	0.602	No
802.11n-HT40	9.00	7.94	/	0.602	No
802.11ac 20M	9.00	7.94	/	0.602	No
802.11ac 40M	9.00	7.94	/	0.602	No

Test Position	Channel/ Frequency (MHz)	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	3rd Repeated SAR (1g)
Right side 0mm	58/5290	0.826	0.815	1.01	N/A	N/A

Note: 1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.

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

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

4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

8.3.2 SAR Result of Bluetooth

Ant1 Test Record												
Test position	**Test mode**	**Test Ch. /Freq.**	**Duty Cycle**	**Duty Cycle Scaled factor**	**SAR (W/kg) 1-g**	**Power drift (dB)**	**Conducted power (dBm)**	**Tune up Limit (dBm)**	**Scaled factor**	**Scaled SAR (W/kg)**	**Liquid Temp.**	**Plot**
Body Test data (sensor off)												
Back side-10mm	DH5	78/2480	76.82%	1.302	0.104	-0.09	15.08	16.50	1.387	0.188	22	/
Right side-8mm	DH5	78/2480	76.82%	1.302	0.111	0.05	15.08	16.50	1.387	**0.200**	22	Plot 7#
Top side-15mm	DH5	78/2480	76.82%	1.302	0.056	-0.06	15.08	16.50	1.387	0.101	22	/
Right Comer-12mm	DH5	78/2480	76.82%	1.302	0.022	0.01	15.08	16.50	1.387	0.040	22	/
Body Test Data with Keyboard cover (sensor off)												
Keyboard Face 0mm	DH5	78/2480	76.82%	1.302	0.098	0.15	15.08	16.50	1.387	0.177	22	/
Ant2 Test Record												
Test position	**Test mode**	**Test Ch. /Freq.**	**Duty Cycle**	**Duty Cycle Scaled factor**	**SAR (W/kg) 1-g**	**Power drift (dB)**	**Conducted power (dBm)**	**Tune up Limit (dBm)**	**Scaled factor**	**Scaled SAR (W/kg)**	**Liquid Temp.**	**Plot**
Body Test data (sensor off)												
Back side-11mm	DH5	78/2480	76.84%	1.301	0.052	-0.06	14.95	16.50	1.429	0.096	22	/
Left side-7mm	DH5	78/2480	76.84%	1.301	0.050	0.09	14.95	16.50	1.429	0.093	22	/
Top side-14mm	DH5	78/2480	76.84%	1.301	0.074	-0.07	14.95	16.50	1.429	**0.137**	22	Plot 8#
Left Comer-10mm	DH5	78/2480	76.84%	1.301	0.011	0.01	14.95	16.50	1.429	0.020	22	/
Body Test Data with Keyboard cover (sensor off)												
Keyboard Face 0mm	DH5	78/2480	76.85%	1.301	0.062	-0.13	14.95	16.50	1.429	0.115	22	/

Note:

1) The maximum Scaled SAR value is marked in bold. Graph Results refer to Appendix B

2) The other frequencies were measured at the worst position.

3) If the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

8.4 Multiple Transmitter Evaluation

8.4.1Simultaneous SAR test evaluation

1) Simultaneous Transmission

NO.	Simultaneous Transmission Configuration	Body
1	BT Antenna 1+WiFi 5GHz MIMO	Yes
2	BT Antenna 1+WiFi 2.4GHz Antenna2+WiFi 5GHz MIMO	Yes
3	BT Antenna 2+ WiFi 5GHz MIMO	Yes
4	WiFi 2.4GHz MIMO(RSDB)+WiFi 5GHz MIMO(RSDB)	Yes

8.4.2Simultaneous Transmission SAR Summation Scenario

Test position		Antenna SARmax (W/kg)								Summed SAR (3+6)	Summed SAR (2+6+7)	Summed SAR (6+7)	Summed SAR (6+8)
		1	2	3	4	5	6	7	8				
		WiFi 2.4G Ant1	WiFi 2.4G Ant2	WiFi 2.4G MIMO	WiFi 5G Ant1	WiFi 5G Ant2	WiFi 5G MIMO	Bluetooth Ant1	Bluetooth Ant2				
Sensor on	Back side	0.292	0.307	0.230	0.559	0.958	0.928	0.297	0.297	1.158	1.532	1.225	1.225
	Left side	0.400	0.049	0.109	0.400	0.434	0.818	0.400	0.297	0.927	1.267	1.218	1.115
	Right side	0.278	0.400	0.286	1.103	0.400	1.030	**0.164**	0.400	1.316	**1.594**	1.194	1.430
	Top side	0.142	0.027	0.094	0.199	0.228	0.267	0.297	0.297	0.361	0.591	0.564	0.564
	Bottom side	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.800	1.200	0.800	0.800
Sensor off	Back side	0.203	0.225	0.375	0.376	0.283	0.231	0.188	0.096	0.606	0.644	0.419	0.327
	Left side	0.400	0.218	0.272	0.400	0.386	0.243	0.400	0.093	0.515	0.861	0.643	0.336
	Right side	0.370	0.400	0.416	0.706	0.400	0.378	0.200	0.400	0.794	0.978	0.578	0.778
	Top side	0.051	0.114	0.135	0.199	0.447	0.193	0.101	0.137	0.328	0.408	0.294	0.330
	Bottom side	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.800	1.200	0.800	0.800

Note：For Simultaneous Transmission SAR, additional test Bluetooth antenna 1 sensor on in Right side

Ant1 Test Record											
Test position	**Test mode**	**Test Ch./Freq.**	**Duty Cycle**	**Duty Cycle Scaled factor**	**SAR (W/kg) 1-g**	**Power drift (dB)**	**Conducted power (dBm)**	**Tune up Limit (dBm)**	**Scaled factor**	**Scaled SAR (W/kg)**	**Liquid Temp.**
Body Test data (Separate 0mm sensor on)											
Right side	DH5	78/2480	76.82%	1.302	0.090	-0.03	7.04	8.50	1.400	**0.164**	22

9 Equipment list

Test Platform		SPEAG DASY5 Professional				
Location		SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch				
Description		SAR Test System (Frequency range 300MHz-6GHz)				
Software Reference		DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)				
Hardware Reference						
Equipment		Manufacturer	Model	Serial Number	Calibration Date	Due date of calibration
☒	Twin Phantom	SPEAG	SAM 1	1640	NCR	NCR
☒	DAE	SPEAG	DAE4	896	2019-09-18	2020-09-17
☒	E-Field Probe	SPEAG	EX3DV4	3923	2019-10-22	2020-10-21
☒	Validation Kits	SPEAG	D2450V2	733	2019-12-17	2022-12-16
☒	Validation Kits	SPEAG	D5GHzV2	1165	2019-12-20	2022-12-19
☒	Agilent Network Analyzer	Agilent	E5071C	MY46523591	2020-04-16	2021-04-15
☒	Dielectric Probe Kit	Agilent	85070E	US01440210	NCR	NCR
☒	RF Bi-Directional Coupler	Agilent	86205-60001	MY31400031	NCR	NCR
☒	Signal Generator	Agilent	N5171B	MY53050736	2020-04-15	2021-04-14
☒	Preamplifier	Mini-Circuits	ZHL-42W	15542	NCR	NCR
☒	Preamplifier	Compliance Directions Systems Inc.	AMP28-3W	073501433	NCR	NCR
☒	Power Meter	Agilent	E4416A	GB41292095	2020-04-15	2021-04-14
☒	Power Sensor	Agilent	8481H	MY41091234	2020-04-15	2021-04-14
☒	Power Sensor	R&S	NRP-Z92	100025	2020-04-16	2021-04-15
☒	Attenuator	SHX	TS2-3dB	30704	NCR	NCR
☒	Coaxial low pass filter	Mini-Circuits	VLF-2500(+)	NA	NCR	NCR
☒	Coaxial low pass filter	Microlab Fxr	LA-F13	NA	NCR	NCR
☒	50 Ω coaxial load	Mini-Circuits	KARN-50+	00850	NCR	NCR
☒	DC POWER SUPPLY	SAKO	SK1730SL5A	NA	NCR	NCR
☒	Speed reading thermometer	MingGao	T809	NA	2020-04-21	2021-04-20
☒	Humidity and Temperature Indicator	KIMTOKA	KIMTOKA	NA	2020-04-21	2021-04-20

Note: All the equipments are within the valid period when the tests are performed.

10 Calibration certificate

Please see the Appendix C

11 Photographs

Please see the Appendix D

Appendix A: Detailed System Check Results

Appendix B: Detailed Test Results

Appendix C: Calibration certificate

Appendix D: Photographs

---END---

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

Appendix A

Detailed System Check Results

1. System Performance Check
System Performance Check 2450 MHz Head
System Performance Check 5250 MHz Head
System Performance Check 5600 MHz Head
System Performance Check 5750 MHz Head

Date: 2020-07-14

Test Laboratory: SGS-SAR Lab

System Performance Check 2450MHz Head

DUT: D2450V2; Type: D2450V2; Serial: 733

Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1

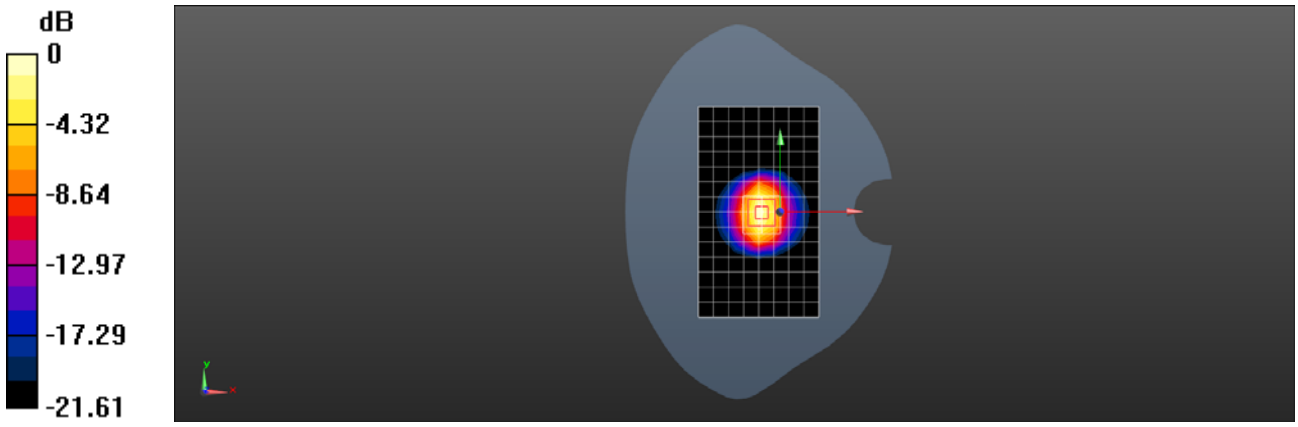
Medium: HSL2450;Medium parameters used: f = 2450 MHz; σ = 1.852 S/m; ε_r = 38.025; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(7.87, 7.87, 7.87); Calibrated: 2019-10-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250mW/Area Scan (9x15x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 21.3 W/kg

Body/d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.41 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 26.8 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.29 W/kg
Maximum value of SAR (measured) = 21.9 W/kg



0 dB = 21.9 W/kg = 13.40 dBW/kg

Date: 2020-07-10

Test Laboratory: SGS-SAR Lab

System Performance Check 5.25GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1

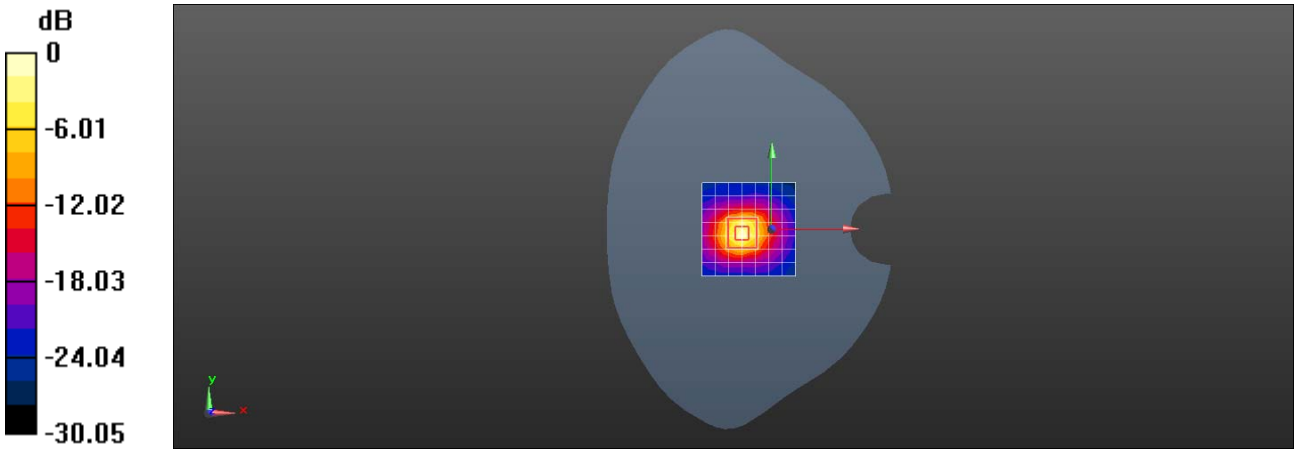
Medium: HSL5G;Medium parameters used: f = 5250 MHz; σ = 4.872 S/m; ε_r = 36.861; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(5.34, 5.34, 5.34); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5250 MHz/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 19.9 W/kg

Body/d=10mm, Pin=100mW, f=5250 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.28 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.33 W/kg
Maximum value of SAR (measured) = 21.0 W/kg



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

Date: 2020-07-11

Test Laboratory: SGS-SAR Lab

System Performance Check 5.25GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1

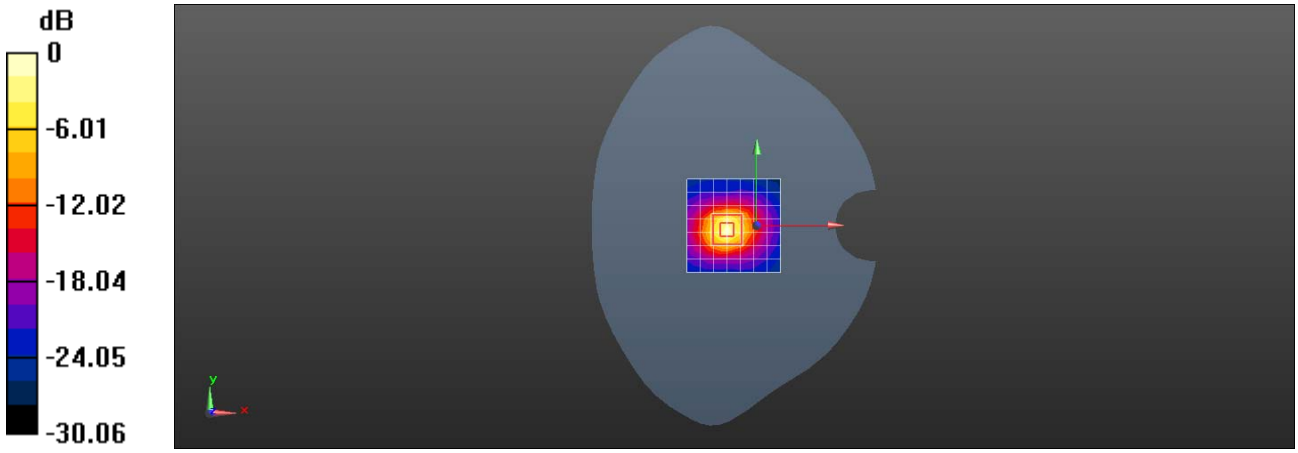
Medium: HSL5G;Medium parameters used: f = 5250 MHz; σ = 4.842 S/m; ε_r = 36.638; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(5.34, 5.34, 5.34); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5250 MHz/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 19.8 W/kg

Body/d=10mm, Pin=100mW, f=5250 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.28 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.35 W/kg
Maximum value of SAR (measured) = 20.9 W/kg



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

Date: 2020-07-12

Test Laboratory: SGS-SAR Lab

System Performance Check 5.25GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1

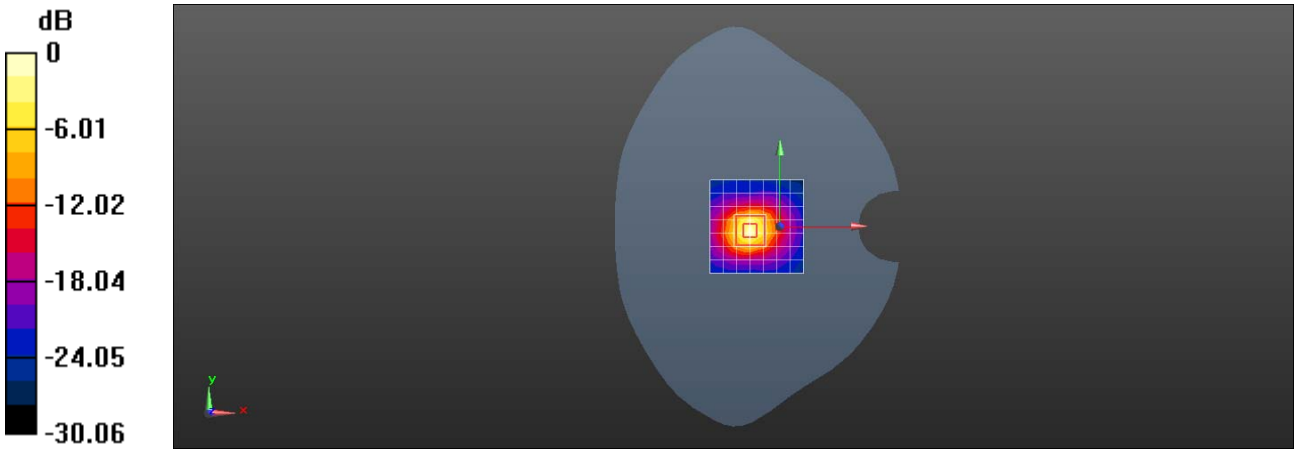
Medium: HSL5G;Medium parameters used: f = 5250 MHz; σ = 4.675 S/m; ε_r = 36.73; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(5.34, 5.34, 5.34); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5250 MHz/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 19.1 W/kg

Body/d=10mm, Pin=100mW, f=5250 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.28 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 7.89 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 20.2 W/kg



0 dB = 20.2 W/kg = 13.05 dBW/kg

Date: 2020-07-10

Test Laboratory: SGS-SAR Lab

System Performance Check 5.6GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5600 MHz;Duty Cycle: 1:1

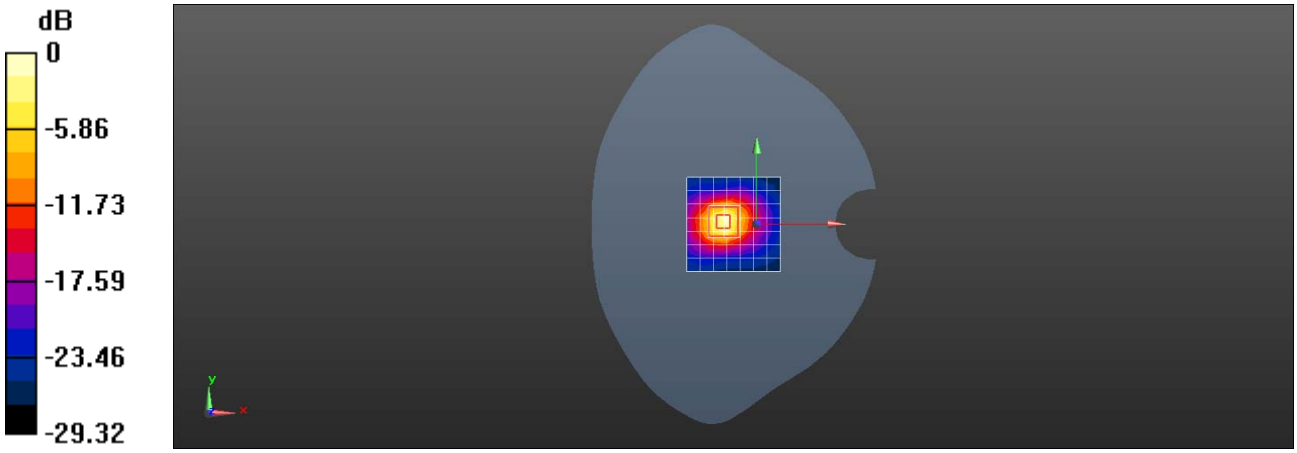
Medium: HSL5G;Medium parameters used: f = 5600 MHz; σ = 5.265 S/m; ε_r = 35.993; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(4.9, 4.9, 4.9); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 18.7 W/kg

Body/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 49.86 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 37.9 W/kg
SAR(1 g) = 8.74 W/kg; SAR(10 g) = 2.49 W/kg
Maximum value of SAR (measured) = 22.7 W/kg



0 dB = 22.7 W/kg = 13.56 dBW/kg

Date: 2020-07-11

Test Laboratory: SGS-SAR Lab

System Performance Check 5.6GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5600 MHz;Duty Cycle: 1:1

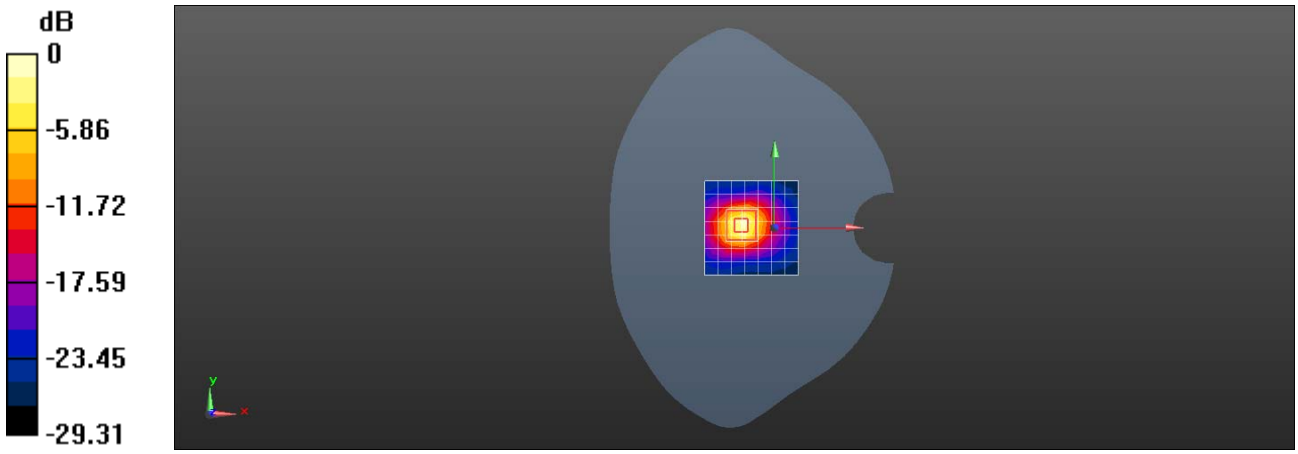
Medium: HSL5G;Medium parameters used: f = 5600 MHz; σ = 5.233 S/m; ε_r = 35.77; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(4.9, 4.9, 4.9); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 18.6 W/kg

Body/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 49.86 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 37.6 W/kg
SAR(1 g) = 8.69 W/kg; SAR(10 g) = 2.48 W/kg
Maximum value of SAR (measured) = 22.5 W/kg



0 dB = 22.5 W/kg = 13.52 dBW/kg

Date: 2020-07-12

Test Laboratory: SGS-SAR Lab

System Performance Check 5.6GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5600 MHz;Duty Cycle: 1:1

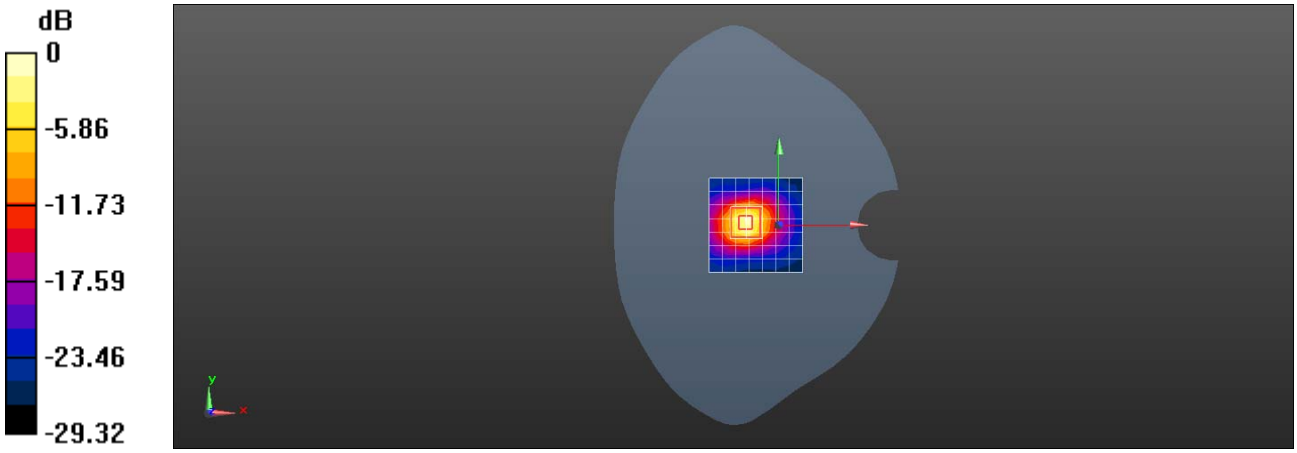
Medium: HSL5G;Medium parameters used: f = 5600 MHz; σ = 5.059 S/m; ε_r = 35.778; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(4.9, 4.9, 4.9); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 18.0 W/kg

Body/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 49.86 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 36.4 W/kg
SAR(1 g) = 8.4 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 21.8 W/kg



0 dB = 21.8 W/kg = 13.38 dBW/kg

Date: 2020-07-10

Test Laboratory: SGS-SAR Lab

System Performance Check 5.75GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1

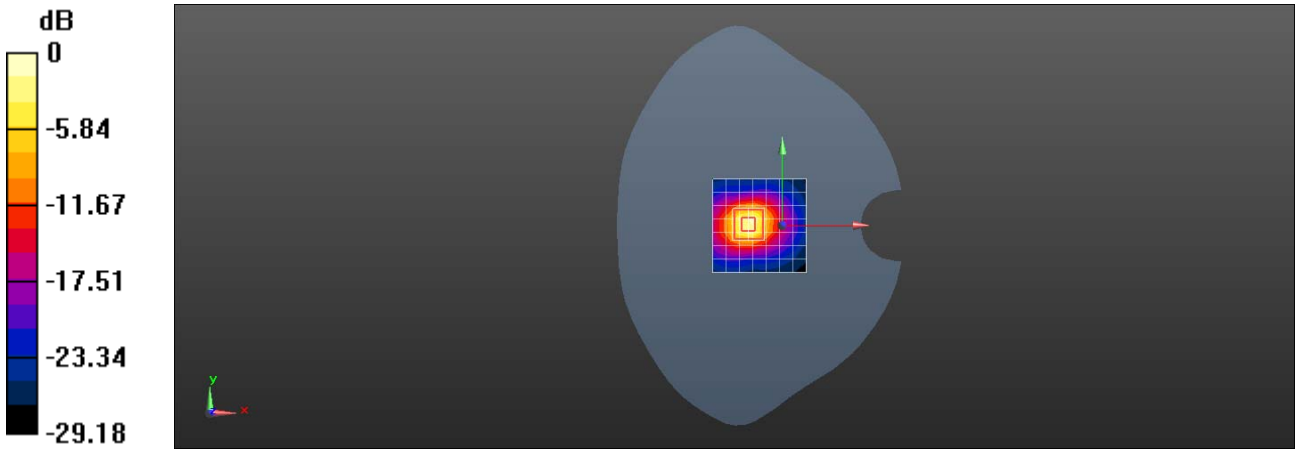
Medium: HSL5G;Medium parameters used: f = 5750 MHz; σ = 5.463 S/m; ε_r = 35.812; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(4.83, 4.83, 4.83); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5750 MHz/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.9 W/kg

Body/d=10mm, Pin=100mW, f=5750 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 45.88 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 36.0 W/kg
SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 21.5 W/kg



0 dB = 21.5 W/kg = 13.32 dBW/kg

Date: 2020-07-11

Test Laboratory: SGS-SAR Lab

System Performance Check 5.75GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1

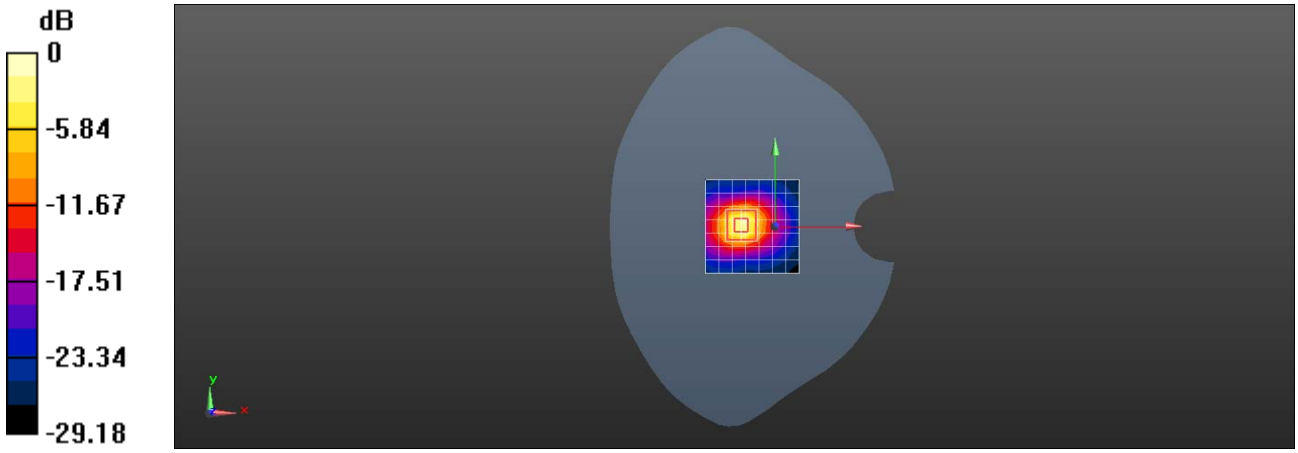
Medium: HSL5G;Medium parameters used: f = 5750 MHz; σ = 5.43 S/m; ε_r = 35.589; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(4.83, 4.83, 4.83); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5750 MHz/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.8 W/kg

Body/d=10mm, Pin=100mW, f=5750 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 45.88 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 35.8 W/kg
SAR(1 g) = 8.06 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

Date: 2020-07-12

Test Laboratory: SGS-SAR Lab

System Performance Check 5.75GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1

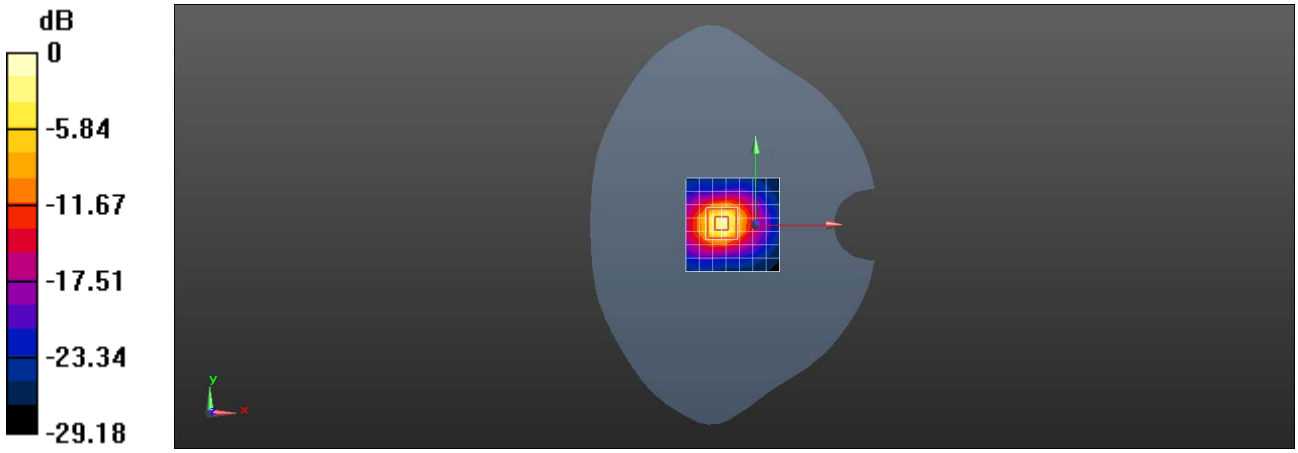
Medium: HSL5G;Medium parameters used: f = 5750 MHz; σ = 5.229 S/m; ε_r = 35.414; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(4.83, 4.83, 4.83); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5750 MHz/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.2 W/kg

Body/d=10mm, Pin=100mW, f=5750 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 45.88 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 34.5 W/kg
SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 20.6 W/kg



0 dB = 20.6 W/kg = 13.14 dBW/kg

Appendix B

Detailed Test Results

1. WiFi
WiFi 2.4G for Body
WiFi 5G for Body
2.Bluetooth
Bluetooth for Body

Date: 2020-07-14

Test Laboratory: SGS-SAR Lab

Plot1#:SM-T870 WIFI 2.4G 802.11b 1CH Right side 8mm Ant1

DUT: SM-T870; Type: Tablet; Serial: R32N600131L

Communication System: UID 0, WI-FI(2.4GHz) (0); Frequency: 2412 MHz;Duty Cycle: 1:1.017

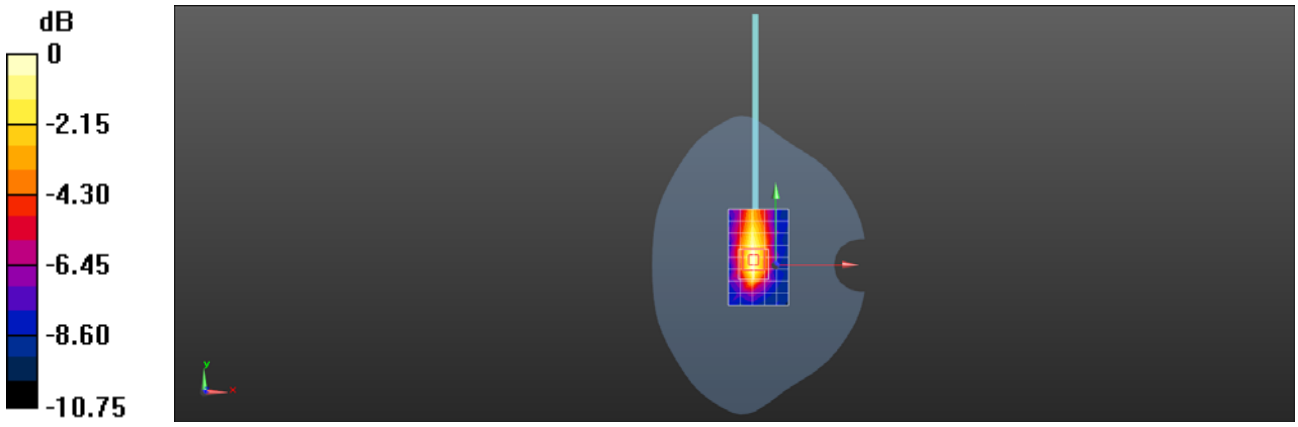
Medium: HSL2450;Medium parameters used: f = 2412 MHz; σ = 1.814 S/m; ε_r = 38.171; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(7.87, 7.87, 7.87); Calibrated: 2019-10-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (6x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.465 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.00 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.581 W/kg
SAR(1 g) = 0.324 W/kg; SAR(10 g) = 0.176 W/kg
Maximum value of SAR (measured) = 0.457 W/kg



0 dB = 0.457 W/kg = -3.40 dBW/kg

Date: 2020-07-14

Test Laboratory: SGS-SAR Lab

Plot2#:SM-T870 WIFI 2.4G 802.11b 11CH Back side 0mm Ant2

DUT: SM-T870; Type: Tablet; Serial: R32N600131L

Communication System: UID 0, WI-FI(2.4GHz) (0); Frequency: 2462 MHz;Duty Cycle: 1:1.017

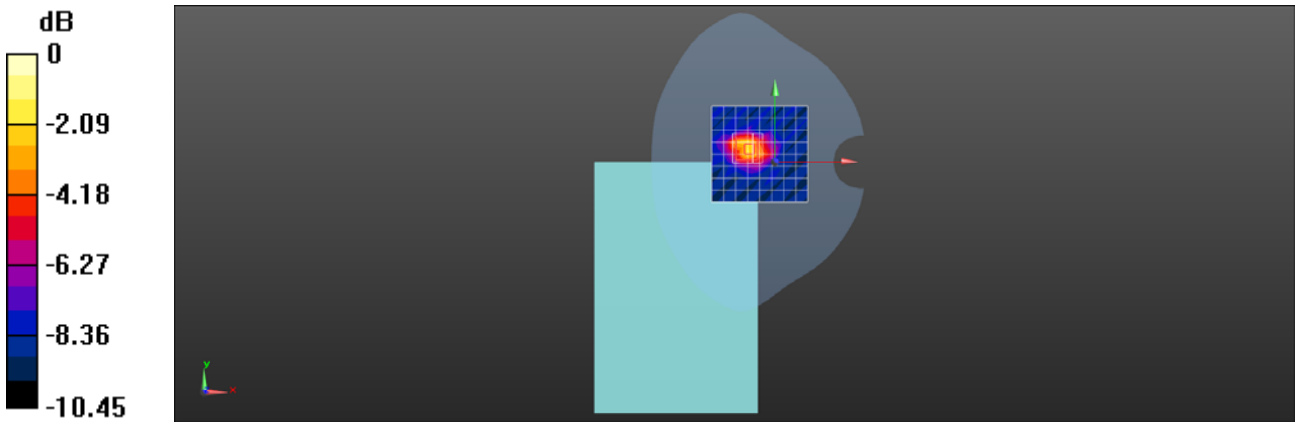
Medium: HSL2450;Medium parameters used: f = 2462 MHz; σ = 1.871 S/m; ε_r = 37.967; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(7.87, 7.87, 7.87); Calibrated: 2019-10-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (9x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.288 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.730 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.925 W/kg
SAR(1 g) = 0.252 W/kg; SAR(10 g) = 0.124 W/kg
Maximum value of SAR (measured) = 0.438 W/kg



0 dB = 0.438 W/kg = -3.59 dBW/kg

Date: 2020-07-14

Test Laboratory: SGS-SAR Lab

Plot3#:SM-T870 WIFI 2.4G 802.11b 6CH Right side 8mm MIMO

DUT: SM-T870; Type: Tablet; Serial: R32N600131L

Communication System: UID 0, WI-FI(2.4GHz) (0); Frequency: 2437 MHz;Duty Cycle: 1:1.024

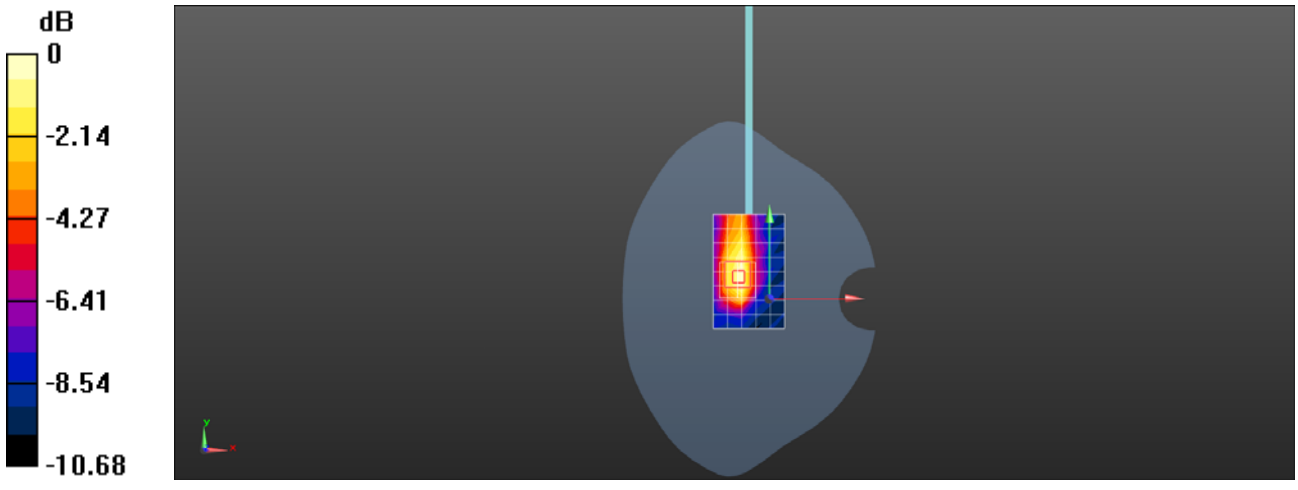
Medium: HSL2450;Medium parameters used: f = 2437 MHz; σ = 1.838 S/m; ε_r = 38.074; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(7.87, 7.87, 7.87); Calibrated: 2019-10-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (6x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.456 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.565 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.588 W/kg
SAR(1 g) = 0.330 W/kg; SAR(10 g) = 0.180 W/kg
Maximum value of SAR (measured) = 0.464 W/kg



0 dB = 0.464 W/kg = -3.33 dBW/kg

Date: 2020-07-10

Test Laboratory: SGS-SAR Lab

Plot4#:SM-T870 WIFI 5G 802.11ac VHT80 58CH Right side 0mm Ant1

DUT: SM-T870; Type: Tablet; Serial: R32N600131L

Communication System: UID 0, WI-FI(5GHz) (0); Frequency: 5290 MHz;Duty Cycle: 1:1.063

Medium: HSL5G;Medium parameters used: f = 5290 MHz; σ = 4.671 S/m; ε_r = 35.5; ρ = 1000 kg/m^3

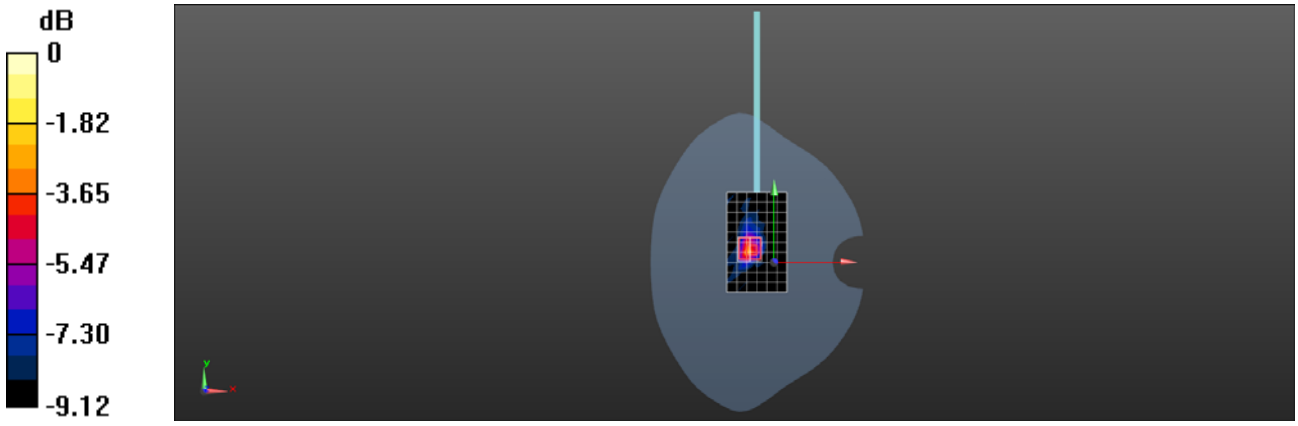
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(5.34, 5.34, 5.34); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.970 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 7.956 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 6.13 W/kg
SAR(1 g) = 0.826 W/kg; SAR(10 g) = 0.342 W/kg
Maximum value of SAR (measured) = 1.66 W/kg



0 dB = 1.66 W/kg = 2.20 dBW/kg

Date: 2020-07-11

Test Laboratory: SGS-SAR Lab

Plot5#:SM-T870 WIFI 5G 802.11ac VHT80 138CH Back side 0mm

Ant2 DUT: SM-T870; Type: Tablet; Serial: R32N600131L

Communication System: UID 0, WI-FI(5GHz) (0); Frequency: 5690 MHz;Duty Cycle: 1:1.057

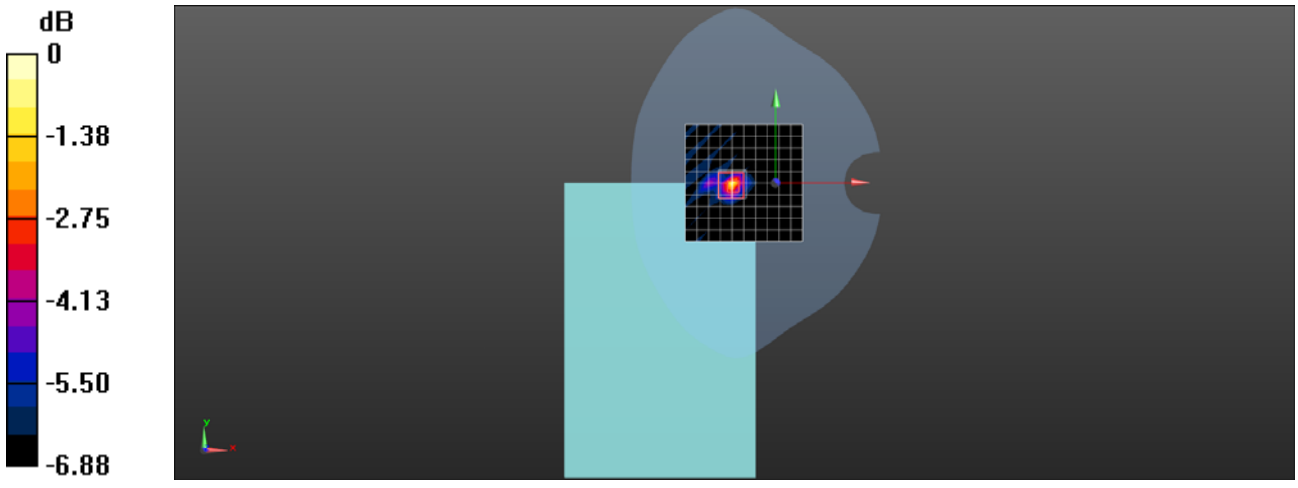
Medium: HSL5G;Medium parameters used: f = 5690 MHz; σ = 5.217 S/m; ε_r = 34.748; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(4.9, 4.9, 4.9); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.17 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 6.630 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 5.41 W/kg
SAR(1 g) = 0.713 W/kg; SAR(10 g) = 0.381 W/kg
Maximum value of SAR (measured) = 1.33 W/kg



0 dB = 1.33 W/kg = 1.24 dBW/kg

Date: 2020-07-12

Test Laboratory: SGS-SAR Lab

Plot6#:SM-T870 WIFI 5G 802.11ac VHT80 58CH Right side 0mm MIMO

DUT: SM-T870; Type: Tablet; Serial: R32N600131L

Communication System: UID 0, WI-FI(5GHz) (0); Frequency: 5290 MHz;Duty Cycle: 1:1.094

Medium: HSL5G;Medium parameters used: f = 5290 MHz; σ = 4.671 S/m; ε_r = 35.5; ρ = 1000 kg/m^3

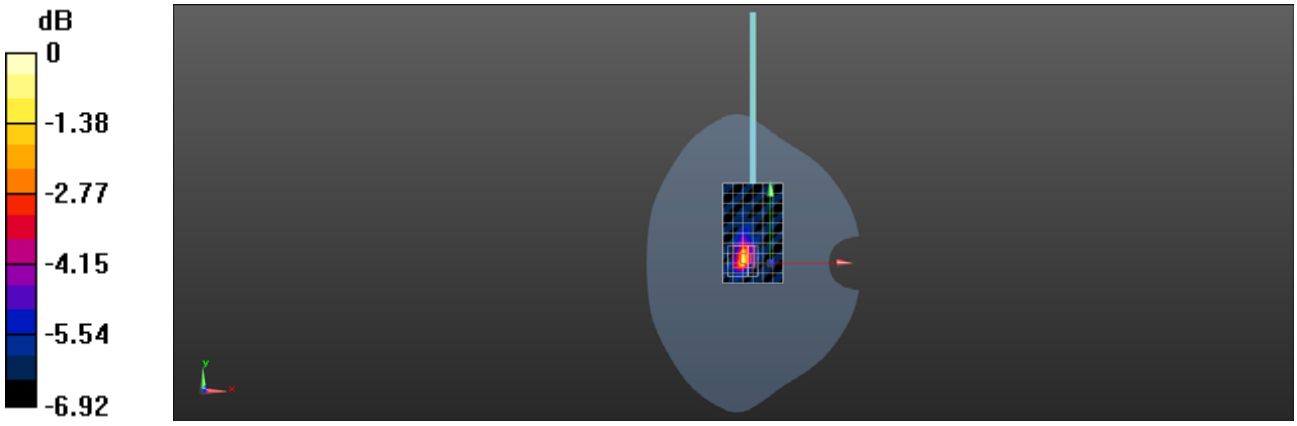
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(5.34, 5.34, 5.34); Calibrated: 2019-10-22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.00 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 7.538 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.85 W/kg
SAR(1 g) = 0.621 W/kg; SAR(10 g) = 0.318 W/kg
Maximum value of SAR (measured) = 1.10 W/kg



0 dB = 1.10 W/kg = 0.41 dBW/kg

Date: 2020-07-14

Test Laboratory: SGS-SAR Lab

Plot7#:SM-T870 Bluetooth DH5 78CH Right side 8mm Ant1

DUT: SM-T870; Type: Tablet; Serial: R32N600131L

Communication System: UID 0, Bluetooth (0); Frequency: 2480 MHz;Duty Cycle: 1:1.302

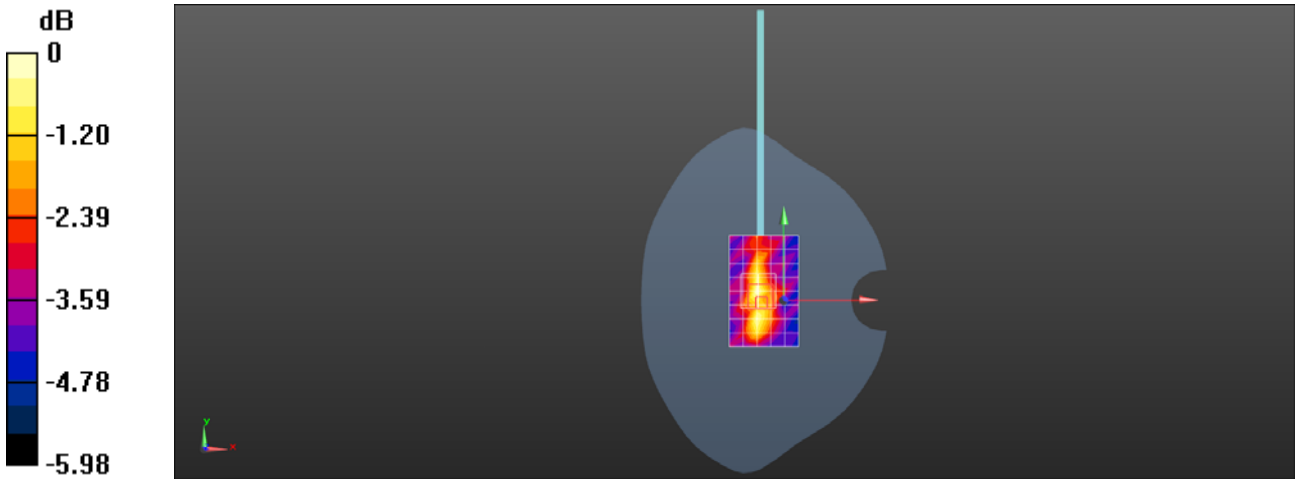
Medium: HSL2450;Medium parameters used: f = 2480 MHz; σ = 1.626 S/m; ε_r = 37.89; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(7.87, 7.87, 7.87); Calibrated: 2019-10-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (6x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.155 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.224 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.287 W/kg
SAR(1 g) = 0.111 W/kg; SAR(10 g) = 0.071 W/kg
Maximum value of SAR (measured) = 0.156 W/kg



0 dB = 0.156 W/kg = -8.07 dBW/kg

Date: 2020-07-14

Test Laboratory: SGS-SAR Lab

Plot8#:SM-T870 Bluetooth DH5 78CH Top side 14mm Ant2

DUT: SM-T870; Type: Tablet; Serial: R32N600131L

Communication System: UID 0, Bluetooth (0); Frequency: 2480 MHz;Duty Cycle: 1:1.301

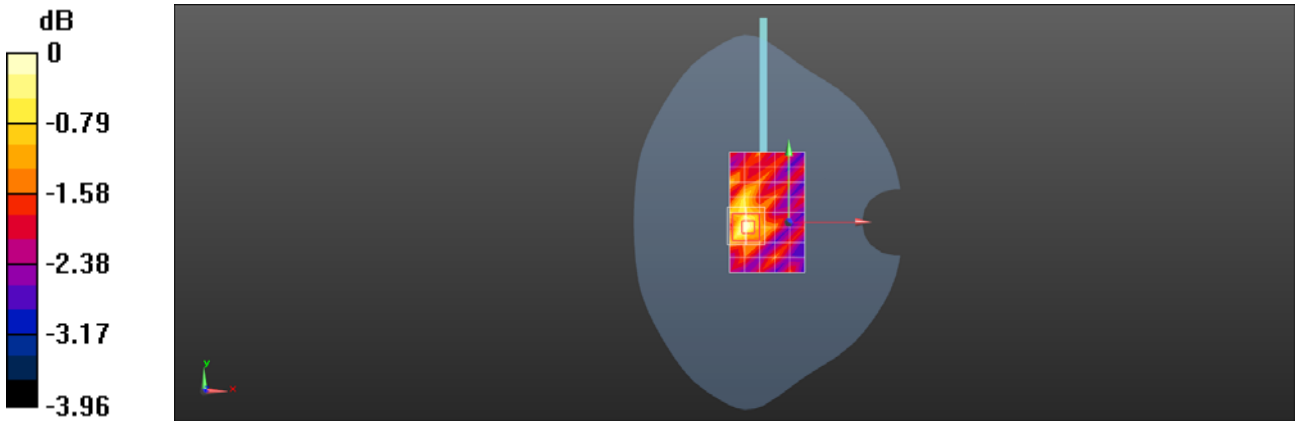
Medium: HSL2450;Medium parameters used: f = 2480 MHz; σ = 1.886 S/m; ε_r = 37.89; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3923; ConvF(7.87, 7.87, 7.87); Calibrated: 2019-10-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn896; Calibrated: 2019-09-18
- Phantom: SAM 1; Type: SAM; Serial: 1640
- DASY52 52.10.3(1513); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (6x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.100 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.427 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.210 W/kg
SAR(1 g) = 0.074 W/kg; SAR(10 g) = 0.054 W/kg
Maximum value of SAR (measured) = 0.0960 W/kg



0 dB = 0.0960 W/kg = -10.18 dBW/kg

Appendix C

Calibration certificate

1. Dipole
D2450V2-SN 733(2019-12-17)
D5GHzV2-SN 1165(2019-12-20)
2. DAE
DAE4-SN 896(2019-09-18)
3. Probe
EX3DV4-SN 3923(2019-10-22)

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client **SGS** **Certificate No: Z19-60474**

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 733

Calibration Procedure(s) FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: December 17, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Power sensor NRP6A	101369	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: December 23, 2019

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Glossary:

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

Calibration is Performed According to the Following Standards:

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

b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Measurement Conditions

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

DASY Version	DASY52	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.77 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.9 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.9 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.92 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 18.7 % (k=2)**

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.2Ω+ 3.88 jΩ
Return Loss	- 27.2dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.018 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

DASY5 Validation Report for Head TSL Date: 12.17.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 733

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.772 S/m; ε_r = 39.01; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.62, 7.62, 7.62) @ 2450 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.5 V/m; Power Drift = -0.07 dB

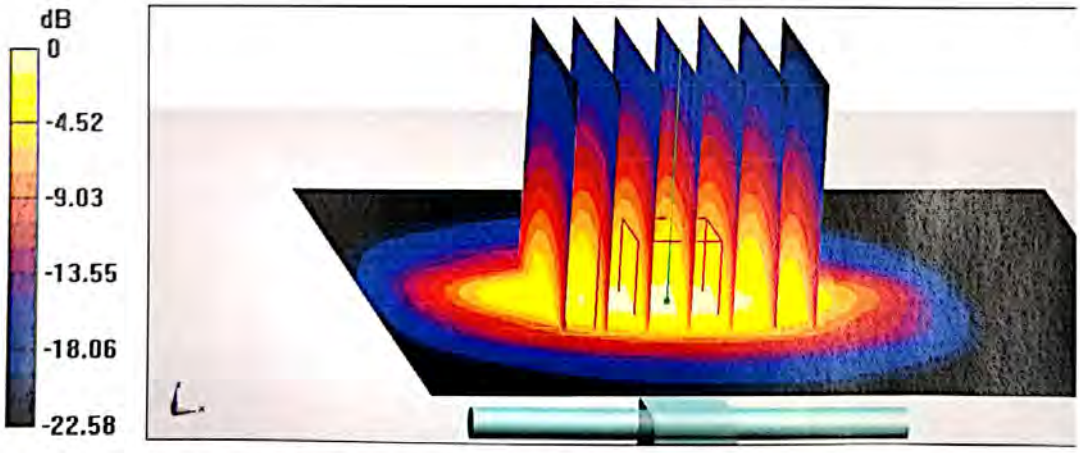
Peak SAR (extrapolated) = 27.3 W/kg

SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.92 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 47.5%

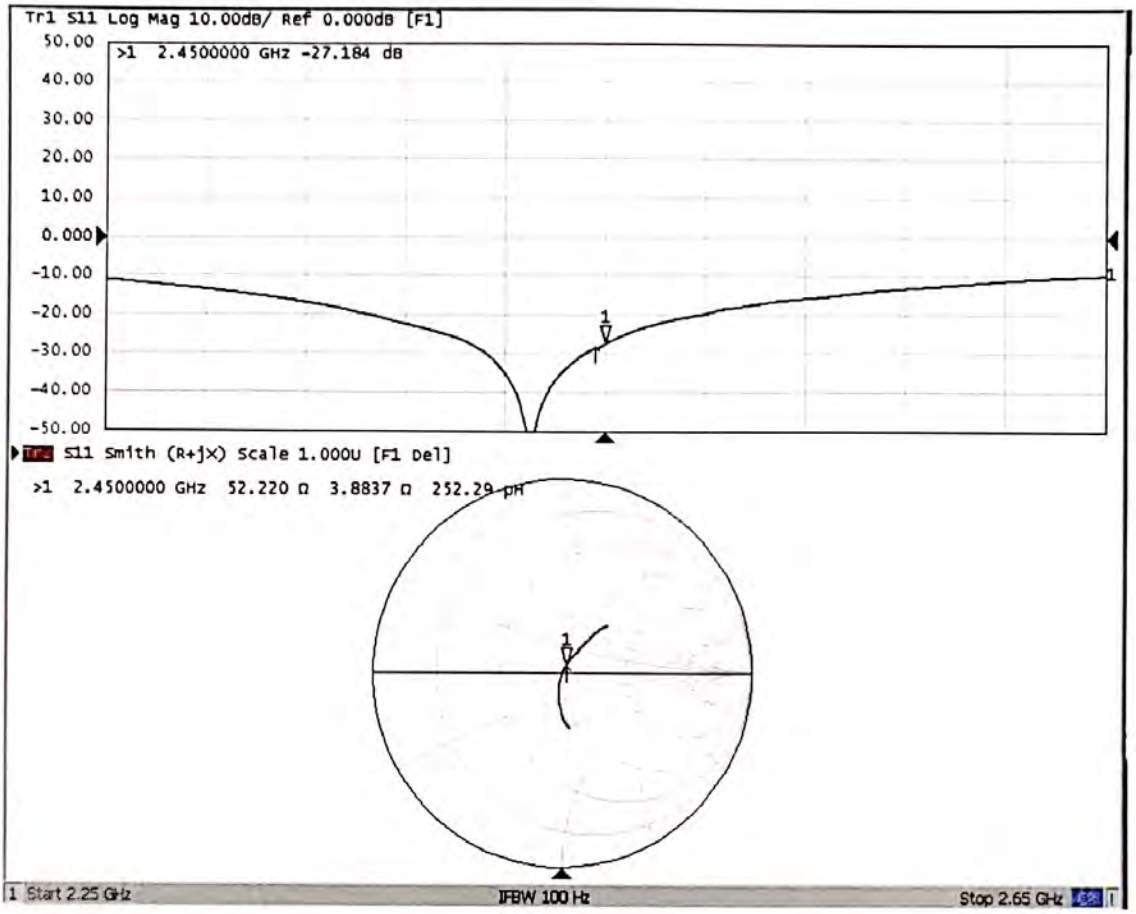
Maximum value of SAR (measured) = 21.8 W/kg



0 dB = 21.8 W/kg = 13.38 dBW/kg

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Impedance Measurement Plot for Head TSL



In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client **SGS** **Certificate No: Z19-60476**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1165
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	December 20, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Power sensor NRP6A	101369	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
ReferenceProbe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzerE5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: December 24, 2019

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Glossary:

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

Calibration is Performed According to the Following Standards:

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

b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Measurement Conditions

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

DASY Version	DASY52	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	4.69 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**75.2 W/kg ± 24.4 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.5 W/kg ± 24.2 % (k=2)**

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.7 ± 6 %	5.07 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.0 W/kg ± 24.4 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.7 W/kg ± 24.2 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	5.23 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.87 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.7 W/kg ± 24.4 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 W/kg ± 24.2 % (k=2)**

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	45.2Ω - 1.52jΩ
Return Loss	- 25.5dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	52.0Ω - 4.20jΩ
Return Loss	- 26.8dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	50.0Ω - 4.23jΩ
Return Loss	- 27.5dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.077 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

DASY5 Validation Report for Head TSL Date: 12.20.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1165

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz,

Medium parameters used: f = 5250 MHz; σ = 4.688 S/m; ε_r = 36.3; ρ = 1000 kg/m3, Medium parameters used: f = 5600 MHz; σ = 5.066 S/m; ε_r = 35.69; ρ = 1000 kg/m3, Medium parameters used: f = 5750 MHz; σ = 5.23 S/m; ε_r = 35.47; ρ = 1000 kg/m3,

Phantom section: Center Section

DASY5 Configuration:

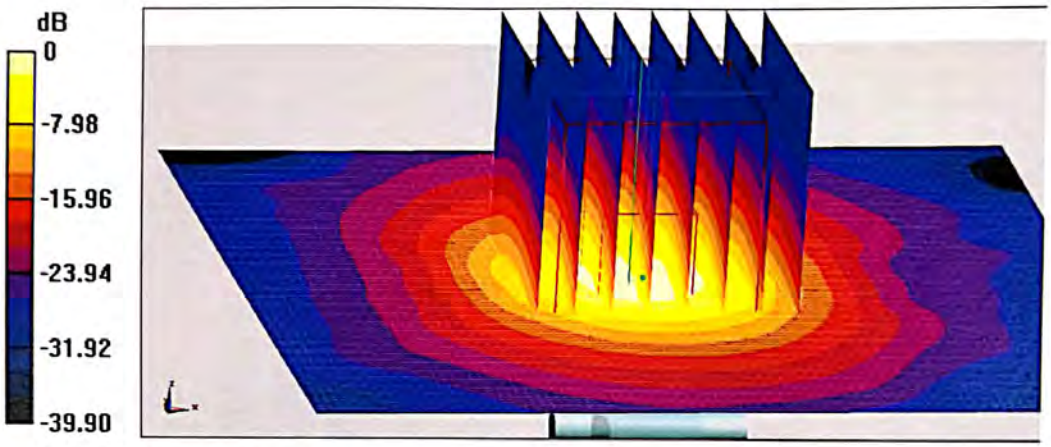
- Probe: EX3DV4 - SN3617; ConvF(5.39, 5.39, 5.39) @ 5250 MHz; ConvF(5.06, 5.06, 5.06) @ 5600 MHz; ConvF(5.07, 5.07, 5.07) @ 5750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.00 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 31.8 W/kg
SAR(1 g) = 7.5 W/kg; SAR(10 g) = 2.14 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 62.5%
Maximum value of SAR (measured) = 18.2 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.55 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 35.6 W/kg
SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.27 W/kg
Smallest distance from peaks to all points 3 dB below = 7.5 mm
Ratio of SAR at M2 to SAR at M1 = 62.8%
Maximum value of SAR (measured) = 19.4 W/kg

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

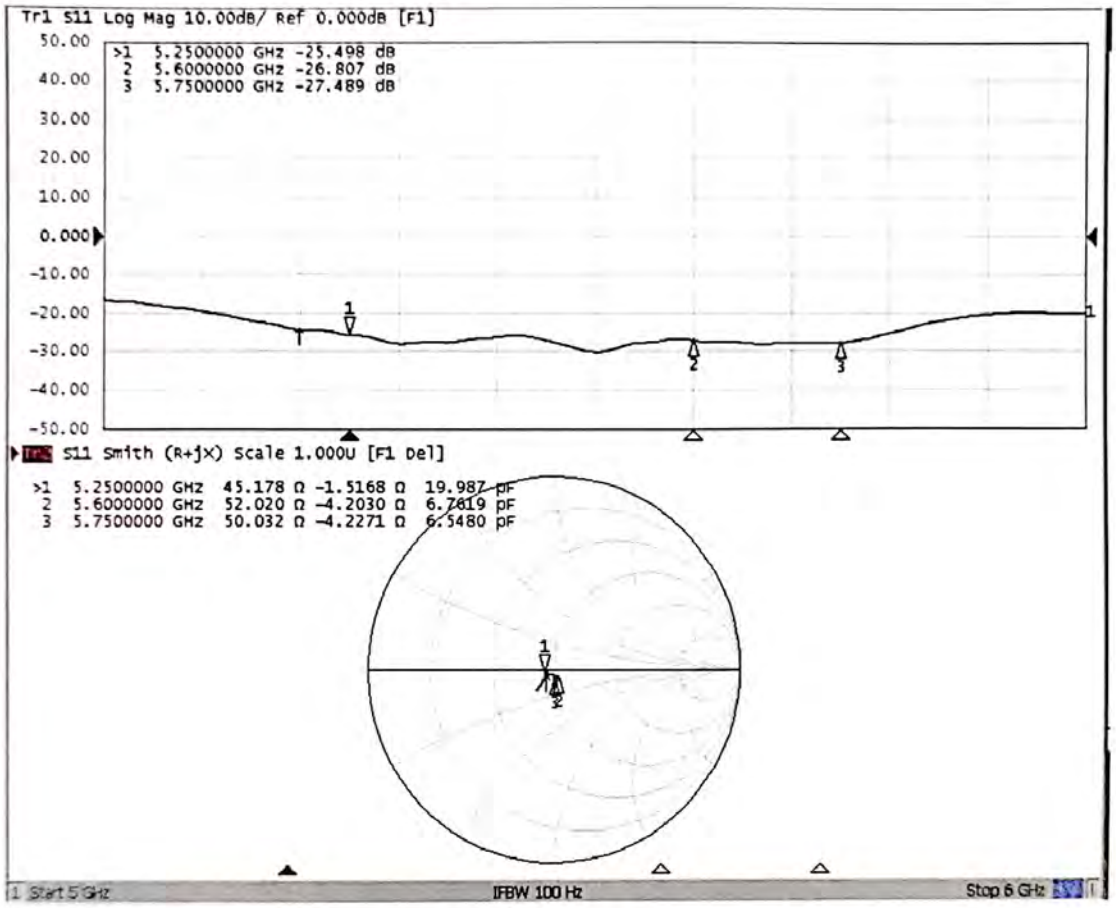
Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.75 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 37.3 W/kg
SAR(1 g) = 7.87 W/kg; SAR(10 g) = 2.23 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 60.9%
Maximum value of SAR (measured) = 20.1 W/kg



0 dB = 20.1 W/kg = 13.03 dBW/kg

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Impedance Measurement Plot for Head TSL



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

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

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

Accreditation No.: SCS 0108

Client SGS - CN (Auden)

Certificate No: DAE4-896_Sep19

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BJ - SN: 896
Calibration procedure(s)	QA CAL-06.v29 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	September 18, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Sep-19 (No:25949)	Sep-20
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-19 (in house check)	In house check: Jan-20
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-19 (in house check)	In house check: Jan-20

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: September 18, 2019

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1μV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.....+3mV

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

Calibration Factors	X	Y	Z
High Range	404.022 ± 0.02% (k=2)	404.257 ± 0.02% (k=2)	404.191 ± 0.02% (k=2)
Low Range	3.98013 ± 1.50% (k=2)	3.99657 ± 1.50% (k=2)	3.97235 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	37.5 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200040.89	5.76	0.00
Channel X	+ Input	20006.10	0.48	0.00
Channel X	- Input	-20002.92	2.55	-0.01
Channel Y	+ Input	200032.08	-3.21	-0.00
Channel Y	+ Input	20004.20	-1.29	-0.01
Channel Y	- Input	-20004.09	1.52	-0.01
Channel Z	+ Input	200033.60	-1.56	-0.00
Channel Z	+ Input	20003.49	-2.00	-0.01
Channel Z	- Input	-20004.81	0.85	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.63	-0.76	-0.04
Channel X	+ Input	201.08	-0.29	-0.15
Channel X	- Input	-199.07	-0.39	0.20
Channel Y	+ Input	2001.55	0.25	0.01
Channel Y	+ Input	199.66	-1.59	-0.79
Channel Y	- Input	-199.65	-0.88	0.45
Channel Z	+ Input	2001.32	0.14	0.01
Channel Z	+ Input	200.72	-0.51	-0.25
Channel Z	- Input	-200.26	-1.43	0.72

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	11.76	10.55
	- 200	-10.27	-11.69
Channel Y	200	15.87	16.13
	- 200	-17.91	-18.33
Channel Z	200	5.47	5.16
	- 200	-7.23	-6.76

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-0.54	-4.17
Channel Y	200	7.56	-	0.46
Channel Z	200	9.61	5.52	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15562	17474
Channel Y	15992	17482
Channel Z	15642	14726

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.71	-0.23	2.09	0.45
Channel Y	-0.40	-1.78	0.63	0.55
Channel Z	-0.76	-1.83	0.29	0.47

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
www.speag.swiss, info@speag.swiss

IMPORTANT NOTICE

USAGE OF THE DAE4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client SGS Certificate No: Z19-60327

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3923

Calibration Procedure(s) FF-Z11-004-01
Calibration Procedures for Dosimetric E-field Probes

Calibration date: October 22, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	18-Jun-19 (CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101547	18-Jun-19 (CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101548	18-Jun-19 (CTTL, No.J19X05125)	Jun-20
Reference10dBAttenuator	18N50W-10dB	09-Feb-18(CTTL, No.J18X01133)	Feb-20
Reference20dBAttenuator	18N50W-20dB	09-Feb-18(CTTL, No.J18X01132)	Feb-20
Reference Probe EX3DV4	SN 7307	24-May-19(SPEAG,No.EX3-7307_May19/2)	May-20
DAE4	SN 1525	26-Aug-19(SPEAG, No.DAE4-1525_Aug19)	Aug -20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	18-Jun-19 (CTTL, No.J19X05127)	Jun-20
Network Analyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan -20

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: October 24, 2019

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Glossary:

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

Calibration is Performed According to the Following Standards:

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

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Probe EX3DV4

SN: 3923

Calibrated: October 22, 2019

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)^A	0.57	0.46	0.48	±10.0%
DCP(mV)^B	101.6	103.7	103.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	181.3	±2.6%
		Y	0.0	0.0	1.0		164.5	
		Z	0.0	0.0	1.0		166.3	

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

^{A} The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 5).
^{B} Numerical linearization parameter: uncertainty not required.
^{E} Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

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

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	10.62	10.62	10.62	0.40	0.80	±12.1%
835	41.5	0.90	10.34	10.34	10.34	0.13	1.48	±12.1%
1450	40.5	1.20	9.20	9.20	9.20	0.10	1.46	±12.1%
1640	40.3	1.29	9.06	9.06	9.06	0.24	0.97	±12.1%
1750	40.1	1.37	8.90	8.90	8.90	0.20	1.14	±12.1%
1900	40.0	1.40	8.64	8.64	8.64	0.26	0.96	±12.1%
2000	40.0	1.40	8.63	8.63	8.63	0.19	1.11	±12.1%
2450	39.2	1.80	7.87	7.87	7.87	0.53	0.74	±12.1%
2600	39.0	1.96	7.74	7.74	7.74	0.47	0.82	±12.1%
5250	35.9	4.71	5.34	5.34	5.34	0.40	1.70	±13.3%
5600	35.5	5.07	4.90	4.90	4.90	0.50	1.20	±13.3%
5750	35.4	5.22	4.83	4.83	4.83	0.45	1.70	±13.3%

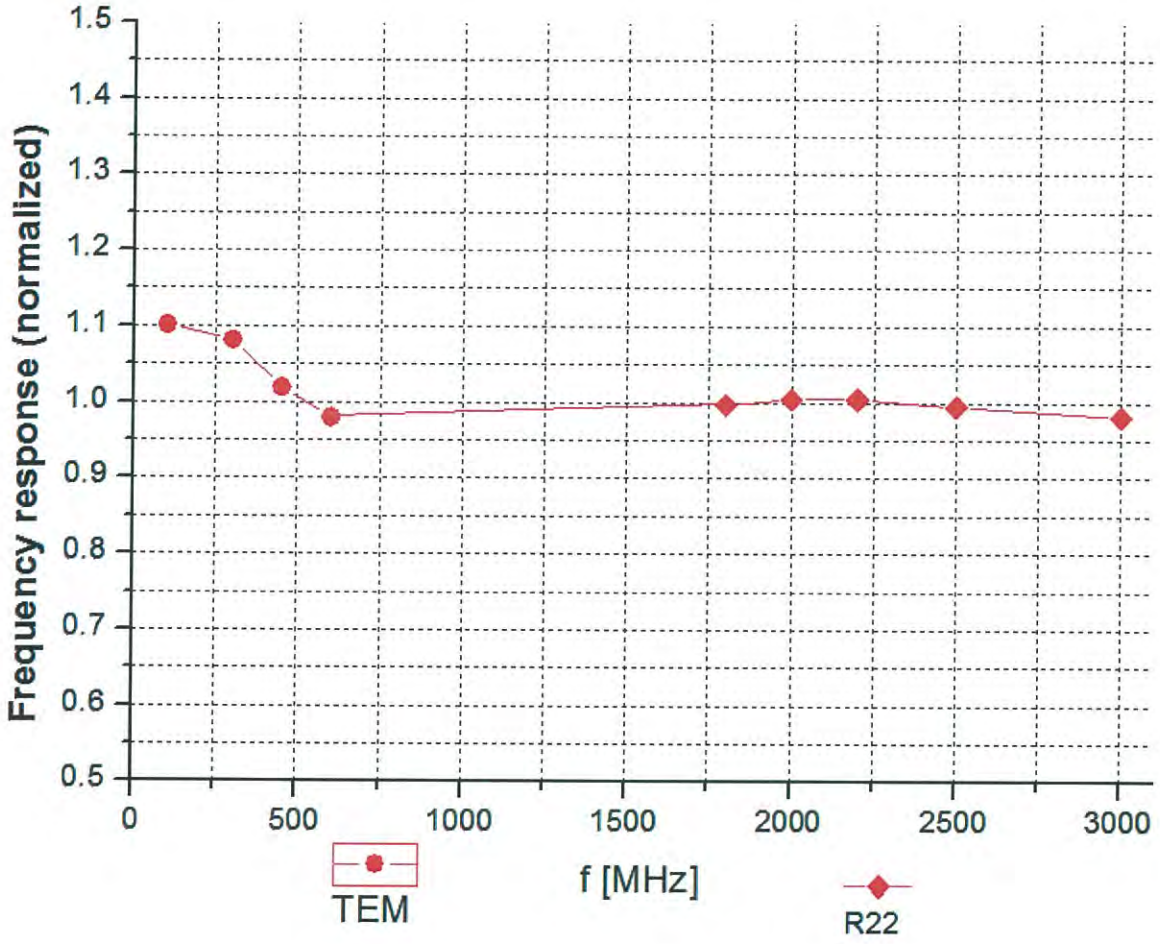
[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25,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

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

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

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

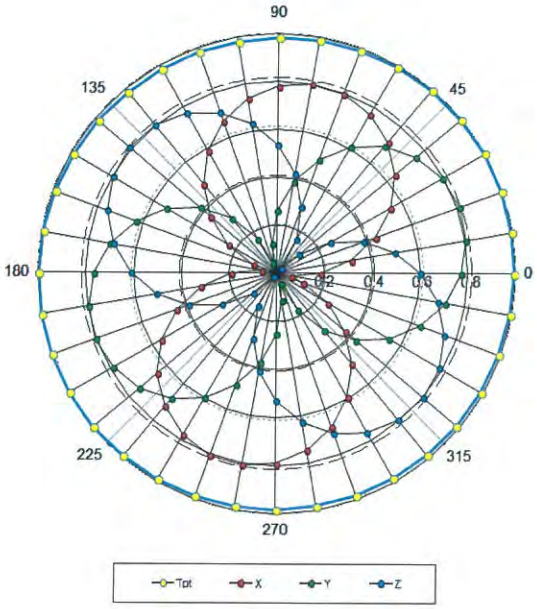


Uncertainty of Frequency Response of E-field: ±7.4% (k=2)

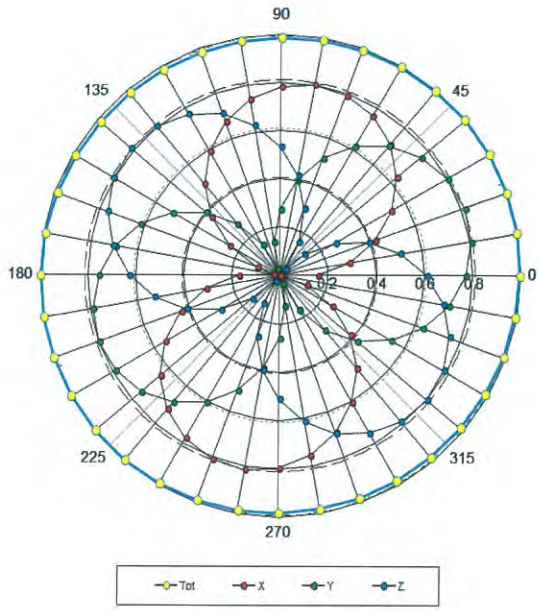
In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

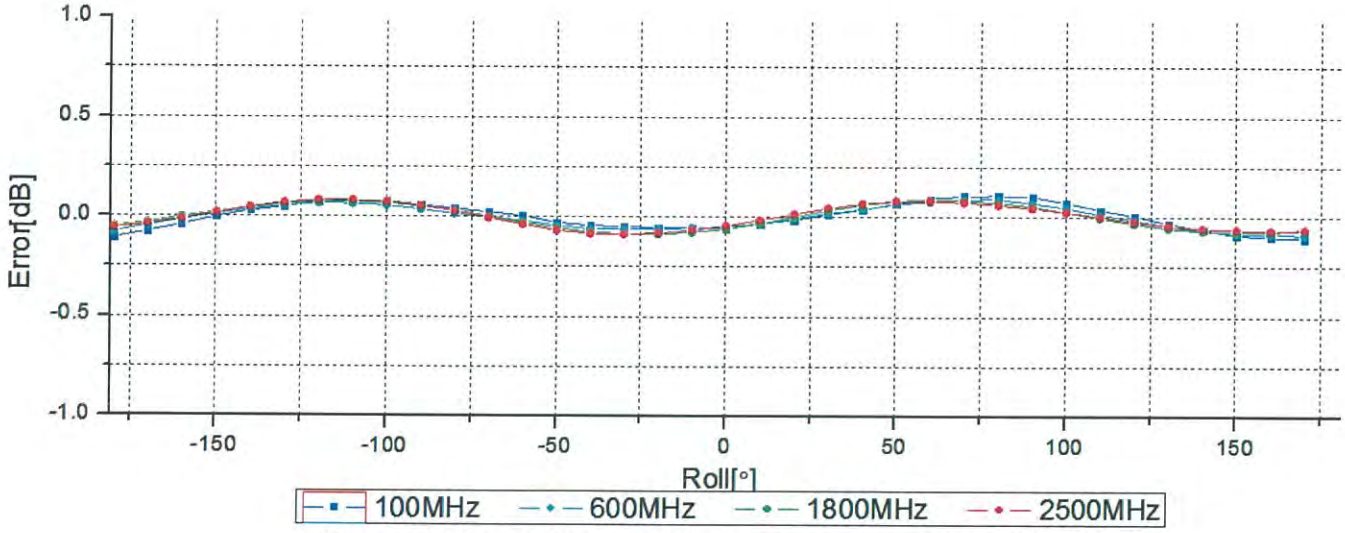
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22

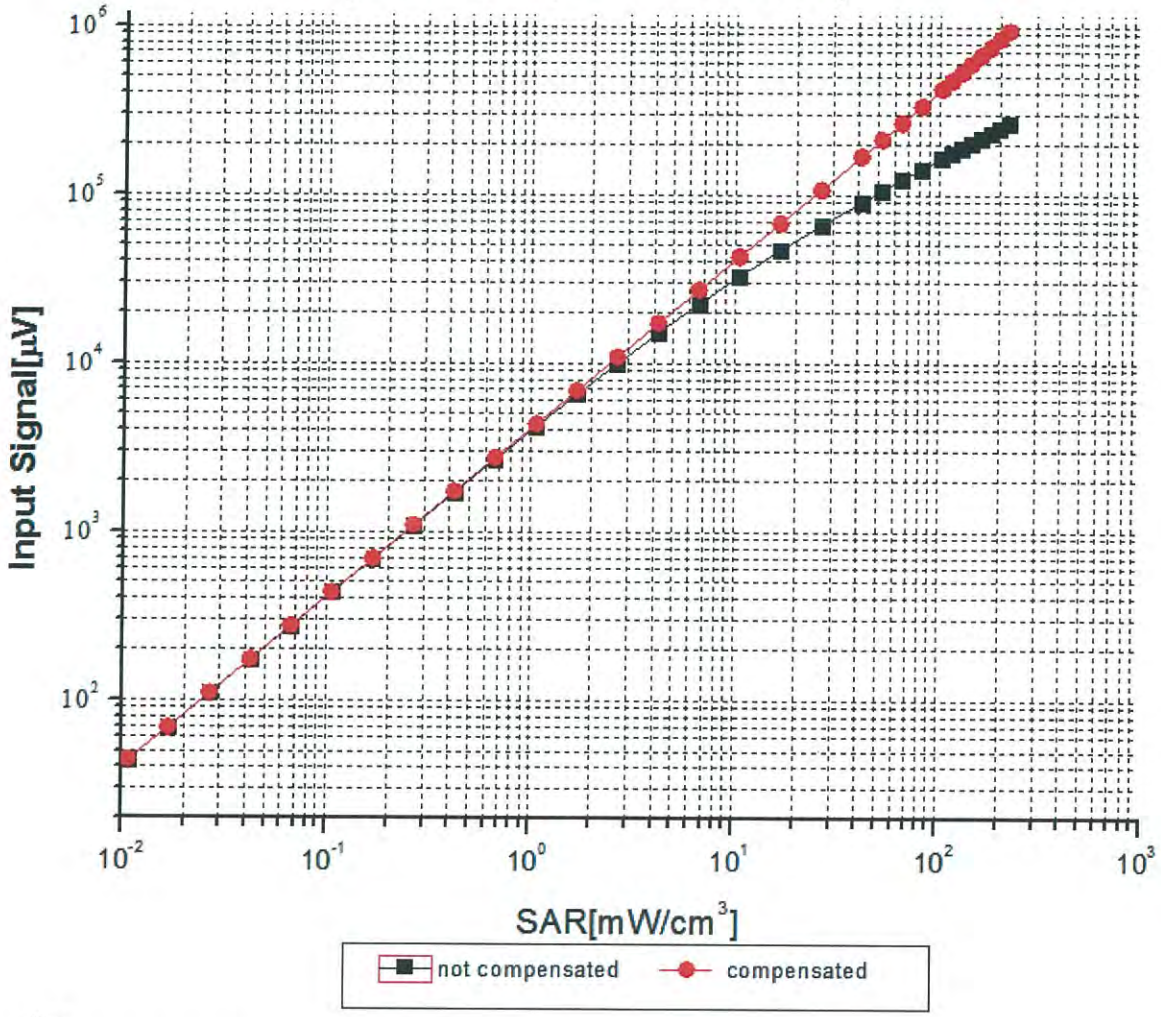


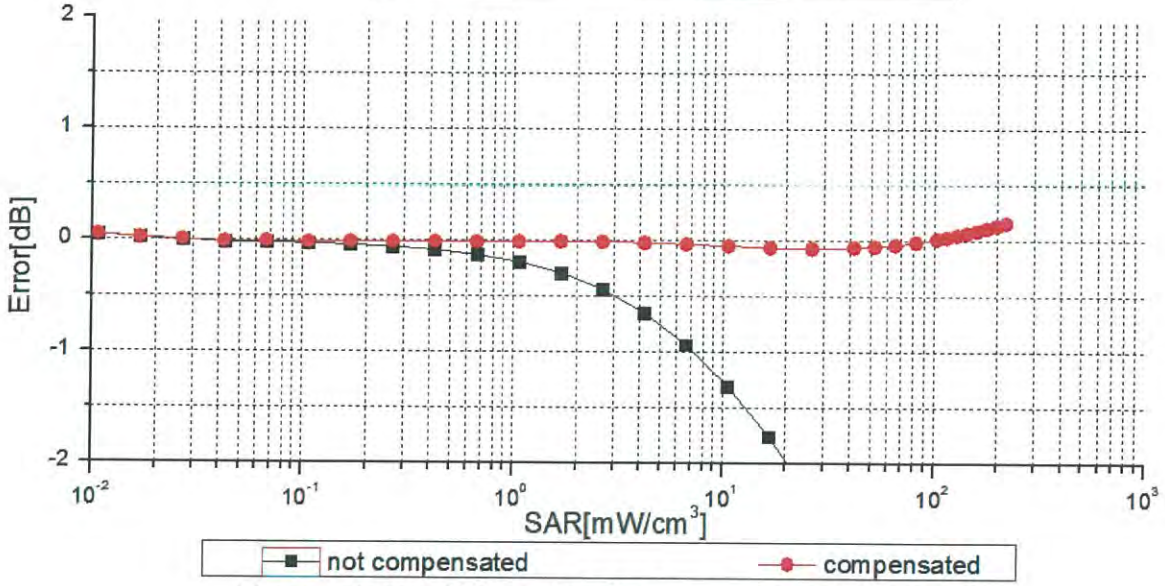


Uncertainty of Axial Isotropy Assessment: ±1.2% (k=2)

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)



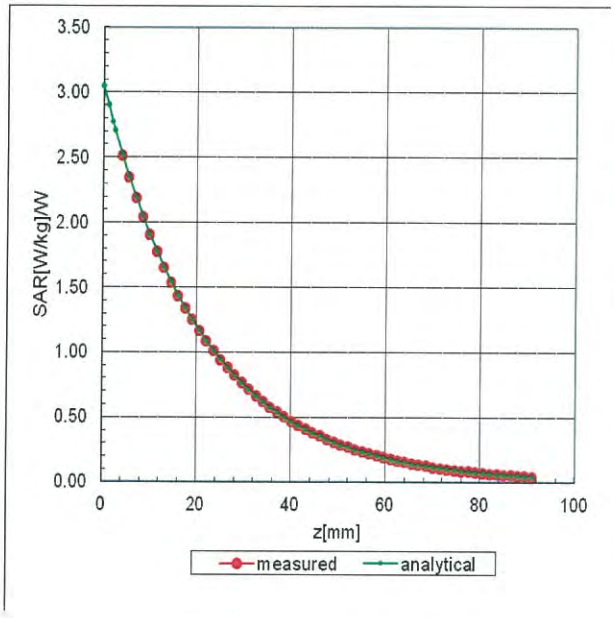


Uncertainty of Linearity Assessment: ±0.9% (k=2)

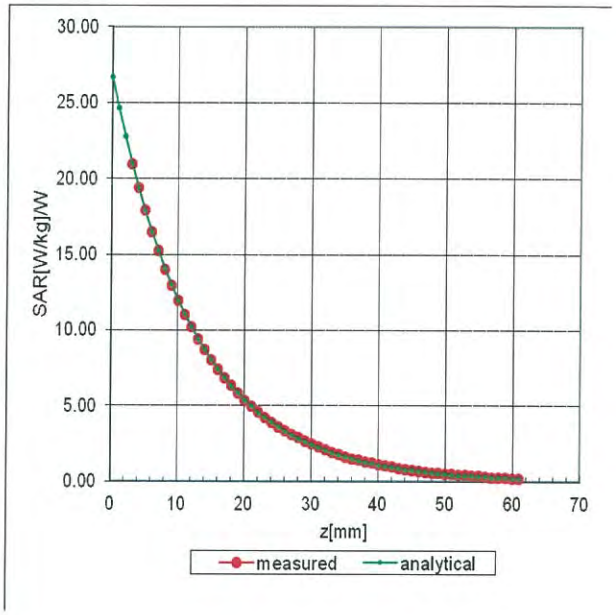
In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Conversion Factor Assessment

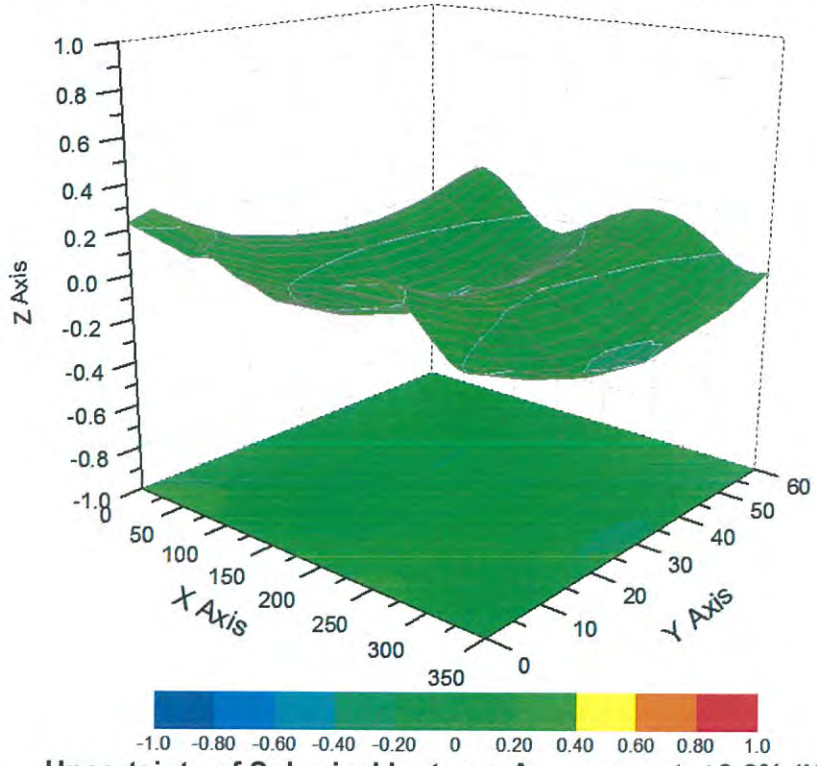
f=750 MHz, WGLS R9(H_convF)



f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (K=2)

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	26.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm