

Appendix G. Supplemental Antenna Tuner Tests Results

General Note:

1. This device implements antenna tuning techniques in the several frequency band and list as below. SAR test proposal was measured according to the normally required SAR configurations with the tuner active and worst tune state (auto tune) was used for SAR testing and this design will provide the highest power at different user scenarios and would not influence to the antenna characteristics other than impedance matching.
2. The following test procedure was followed to demonstrate that the SAR results in this report represent the appropriate SAR test conditions. For bands with dynamic tuning implemented, SAR will be measured according to the required FCC SAR test procedures with the dynamic tuner active to allow the device to automatically tune to the antenna state for the respective RF exposure test configurations. Additional single point SAR time-sweep measurements will be evaluated for other tuner states to determine that the other tuner configurations would result in equivalent or lower SAR values.
3. The number of supported tune codes is different for each frequency band as shown in the following table.
4. Dynamic antenna tuning mechanism is available at Ant.0/1/2 for its < 3GHz LTE and NR band, details are illustrated in the operational description, all supported tuning states for each band are tested and it's verified that auto-tune state results in the highest SAR configuration.
5. The tuner state was established remotely through Wi-Fi so that the device is not moved for the entire series of single point SAR for the tuner states in each combination (band, mode, exposure conditions).

Antenna	Band	Number of tune states
Ant 0 (LB)	LTE B5	53
	LTE B12	41
	LTE B13	25
	LTE B14	27
	LTE B17	41
	LTE B26	53
	LTE B71	57
	NR n5	53
	NR n12	41
	NR n14	25
	NR n26	53
	NR n71	57
Ant 1 (LB)	LTE B5	50
	LTE B12	49
	LTE B13	24
	LTE B14	16
	LTE B17	49
	LTE B26	50
	LTE B71	44
	NR n5	50
	NR n12	49
	NR n14	16
	NR n26	50
	NR n71	44
Ant 2 (M/HB)	LTE B2	57
	LTE B4	62
	LTE B7	39
	LTE B25	57
	LTE B30	29
	LTE B66	62
	NR n2	52
	NR n7	39
	NR n25	57
	NR n30	29
	NR n66	62



<Supplemental SAR result for Ant 0>

RF exposure position						Average Value of Time Sweep Single Point SAR (W/kg)																																					
Band	Test Position	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Auto-Tuner (State)	Auto-Tuner Single Point SAR (W/kg)	Default-Tuner (State)																																					
LTE Band 12	Left Cheek	0.264	0.334	8	0.299	7	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41																
							0.200	0.293	0.120	0.294	0.279	0.120	0.084	0.291	0.205	0.062	0.180	0.190	0.134	0.080	0.056	0.200	0.126	0.182	0.284	0.098	0.173																
	Left Side	0.422	0.534	7	0.606		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40																	
LTE Band 13	Left Cheek	0.277	0.357	3	0.326	3	0.377	0.518	0.344	0.605	0.508	0.271	0.198	0.548	0.181	0.307	0.542	0.365	0.241	0.176	0.400	0.290	0.549	0.276	0.517	0.212																	
							1	3	5	7	9	11	13	15	17	19	21	23	25																								
	Left Side	0.555	0.715	3	0.648		0.248	0.326	0.233	0.175	0.179	0.264	0.106	0.121	0.259	0.318	0.147	0.112	0.091																								
LTE Band 14	Left Cheek	0.293	0.377	4	0.332	4	2	4	6	8	10	12	14	16	18	20	22	24																									
							0.575	0.625	0.653	0.268	0.644	0.569	0.171	0.215	0.508	0.330	0.305	0.246																									
	Back	0.482	0.620	4	0.610		1	3	5	7	9	11	13	15	17	19	21	23	25	27																							
LTE Band 26	Left Cheek	0.299	0.353	35	0.390	34	0.323	0.251	0.236	0.143	0.235	0.068	0.324	0.172	0.102	0.087	0.250	0.202	0.114	0.075																							
							2	4	6	8	10	12	14	16	18	20	22	24	26																								
	Back	0.665	0.750	34	0.867		0.414	0.610	0.312	0.373	0.245	0.575	0.602	0.169	0.048	0.551	0.469	0.330	0.100																								
LTE Band 71	Left Cheek	0.299	0.353	35	0.390	34	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53										
							0.330	0.200	0.345	0.125	0.298	0.366	0.098	0.073	0.242	0.203	0.066	0.030	0.088	0.192	0.309	0.036	0.355	0.390	0.300	0.058	0.058	0.253	0.288	0.218	0.278	0.254	0.213										
	Back	0.665	0.750	34	0.867		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52											
FR1 n12	Left Cheek	0.264	0.332	30	0.276	30	0.419	0.668	0.299	0.322	0.776	0.624	0.110	0.376	0.456	0.214	0.260	0.211	0.231	0.521	0.589	0.865	0.867	0.506	0.564	0.057	0.176	0.848	0.853	0.775	0.557	0.628											
							1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57								
	Left Side	0.383	0.482	30	0.491		0.101	0.137	0.136	0.028	0.011	0.261	0.029	0.013	0.049	0.250	0.011	0.127	0.098	0.020	0.269	0.058	0.018	0.007	0.015	0.003	0.001	0.035	0.127	0.100	0.096	0.064	0.005	0.188	0.024								
FR1 n14	Left Cheek	0.264	0.332	30	0.276	30	0.235	0.208	0.235	0.027	0.175	0.487	0.042	0.099	0.287	0.149	0.067	0.224	0.083	0.066	0.491	0.019	0.018	0.055	0.057	0.033	0.015	0.282	0.287	0.087	0.482	0.041	0.071	0.083									
							2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56									
	Left Side	0.383	0.482	30	0.491		0.190	0.290	0.060	0.291	0.259	0.110	0.064	0.201	0.105	0.060	0.120	0.160	0.104	0.075	0.056	0.130	0.096	0.112	0.264	0.008	0.153																
FR1 n26	Left Cheek	0.250	0.290	8	0.295	7	0.419	0.668	0.299	0.322	0.776	0.624	0.110	0.376	0.456	0.214	0.260	0.211	0.231	0.521	0.589	0.865	0.867	0.506	0.564	0.057	0.176	0.848	0.853	0.775	0.557	0.628											
							1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57								
	Left Side	0.481	0.559	7	0.550		0.190	0.290	0.060	0.291	0.259	0.110	0.064	0.201	0.105	0.060	0.120	0.160	0.104	0.075	0.056	0.130	0.096	0.112	0.264	0.008	0.153																
FR1 n71	Left Cheek	0.292	0.345	4	0.330	4	0.357	0.458	0.254	0.545	0.418	0.211	0.128	0.518	0.161	0.227	0.452	0.285	0.161	0.136	0.340	0.250	0.489	0.236	0.517	0.162																	
							1	3	5	7	9	11	13	15	17	19	21	23	25	27																							
	Back	0.475	0.561	4	0.560		0.323	0.201	0.176	0.063	0.195	0.068	0.324	0.102	0.072	0.007	0.210	0.122	0.104	0.071																							
FR1 n12	Left Cheek	0.292	0.345	4	0.330	4	0.414	0.560	0.302	0.293	0.155	0.535	0.532	0.109	0.045	0.491	0.389	0.300	0.060																								
							1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53										
	Back	0.475	0.561	4	0.560		0.300	0.150	0.295	0.095	0.228	0.316	0.098	0.069	0.192	0.173	0.066	0.000	0.038	0.092	0.219	0.036	0.305	0.305	0.210	0.060	0.058	0.153	0.208	0.158	0.258	0.224	0.123										
FR1 n26	Left Cheek	0.325	0.384	35	0.371	34	0.399	0.568	0.259	0.312	0.726	0.594	0.060	0.276	0.426	0.214	0.180	0.111	0.211	0.421	0.529	0.835	0.837	0.466	0.494	0.055	0.106	0.828	0.753	0.745	0.457	0.618											
							2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52											
	Back	0.620	0.732	34	0.837		0.399	0.568	0.259	0.312	0.726	0.594	0.060	0.276	0.426	0.214	0.180	0.111	0.211	0.421	0.529	0.835	0.837	0.466	0.494	0.055	0.106	0.828	0.753	0.745	0.457	0.618											
FR1 n71	Left Cheek	0.241	0.273	30	0.265	30	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57								
							0.091	0.067	0.116	0.025	0.010	0.261	0.009	0.012	0.039	0.240	0.008	0.117	0.078	0.016	0.265	0.049	0.016	0.009	0.018	0.005	0.001	0.005	0.097	0.080	0.066	0.024	0.008	0.188	0.019								
	Left Side	0.424	0.480	30	0.519		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56									
FR1 n71	Left Cheek	0.241	0.273	30	0.265	30	0.225	0.108	0.205	0.017	0.095	0.427	0.002	0.049	0.197	0.129	0.027	0.194	0.053	0.065	0.519	0.015	0.020	0.005	0.052	0.030	0.018	0.252	0.277	0.027	0.462	0.036	0.041	0.043									
							0.225	0.108	0.205	0.017	0.095	0.427	0.002	0.049	0.197	0.129	0.027	0.194	0.053	0.065	0.519	0.015	0.020	0.005	0.052	0.030	0.018	0.252	0.277	0.027	0.462	0.036	0.041	0.043									
	Left Side	0.424	0.480	30	0.519		0.225	0.108	0.205	0.017	0.095	0.427	0.002	0.049	0.197	0.129	0.027	0.194	0.053	0.065	0.519	0.015	0.020	0.005	0.052	0.030	0.018	0.252	0.277	0.027	0.462	0.036	0.041	0.043									



<Supplemental SAR result for Ant 1>

RF exposure position							Average Value of Time Sweep Single Point SAR (W/kg)																													
Band	Test Position	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Auto-Tuner (State)	Auto-Tuner Single Point SAR (W/kg)	Default-Tuner (State)																														
LTE Band 12	Right Cheek	0.665	0.910	2	1.040	2	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49					
							1.030	0.899	0.802	0.728	0.462	0.402	0.842	0.725	0.710	0.404	1.020	0.715	0.511	0.732	0.867	0.714	0.681	0.525	0.695	1.020	0.670	0.488	0.587	0.293	0.474					
	Left Side	0.267	0.350	21	0.357		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48						
LTE Band 13	Right Cheek	0.676	0.883	8	0.772	2	1	3	5	7	9	11	13	15	17	19	21	23																		
							0.771	0.629	0.744	0.517	0.644	0.552	0.601	0.693	0.721	0.328	0.413	0.514																		
	Back	0.307	0.389	2	0.400		2	4	6	8	10	12	14	16	18	20	22	24																		
LTE Band 14	Right Cheek	0.673	0.904	5	0.977	2	1	3	5	7	9	11	13	15																						
							0.970	0.767	0.977	0.772	0.951	0.769	0.195	0.759																						
	Back	0.310	0.407	2	0.448		2	4	6	8	10	12	14	16																						
LTE Band 26	Right Cheek	0.718	0.906	24	1.180	5	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49					
							1.170	1.040	1.130	0.941	0.405	0.712	1.060	0.618	1.010	0.719	0.312	1.090	0.691	1.120	1.140	0.872	0.926	0.862	0.868	1.160	1.060	1.150	1.010	0.803	1.000					
	Back	0.393	0.478	2	0.528		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50					
LTE Band 71	Right Cheek	0.703	0.918	26	0.849	26	0.528	0.392	0.502	0.326	0.407	0.184	0.452	0.353	0.186	0.070	0.469	0.423	0.398	0.443	0.246	0.420	0.033	0.248	0.355	0.416	0.480	0.410	0.489	0.422	0.315					
							1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43								
	Back	0.268	0.304	26	0.320		0.449	0.321	0.655	0.799	0.415	0.067	0.811	0.527	0.096	0.401	0.748	0.844	0.489	0.558	0.185	0.023	0.625	0.462	0.822	0.825	0.505	0.226								
FR1 n12	Right Cheek	0.699	0.917	2	1.030	2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48						
							0.194	0.069	0.076	0.177	0.038	0.024	0.311	0.152	0.092	0.114	0.099	0.045	0.320	0.127	0.058	0.043	0.180	0.261	0.057	0.315	0.057	0.175								
	Left Side	0.260	0.315	21	0.316		1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49					
FR1 n14	Right Cheek	0.618	0.873	5	0.947	2	1.020	0.899	0.702	0.638	0.412	0.372	0.802	0.665	0.640	0.364	0.930	0.625	0.451	0.672	0.867	0.644	0.681	0.435	0.685	0.980	0.620	0.408	0.527	0.213	0.414					
							2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48						
	Back	0.306	0.380	2	0.418		0.234	0.173	0.088	0.255	0.144	0.079	0.175	0.002	0.132	0.097	0.280	0.179	0.216	0.141	0.130	0.018	0.000	0.301	0.198	0.196	0.283	0.166	0.211	0.007						
FR1 n26	Right Cheek	0.665	0.920	24	1.150	5	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49					
							1.140	1.010	1.040	0.871	0.345	0.662	1.020	0.548	0.960	0.669	0.312	1.000	0.691	1.100	1.060	0.862	0.866	0.852	0.868	1.110	1.030	1.080	0.940	0.773	0.990					
	Back	0.354	0.435	2	0.495		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50					
FR1 n71	Right Cheek	0.785	0.922	26	0.861	26	0.495	0.372	0.482	0.296	0.337	0.124	0.402	0.273	0.116	0.070	0.459	0.373	0.318	0.383	0.176	0.380	0.013	0.198	0.315	0.326	0.440	0.390	0.419	0.362	0.275					
							1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43								
	Back	0.301	0.350	26	0.315		0.439	0.231	0.645	0.729	0.335	0.058	0.781	0.427	0.016	0.371	0.708	0.844	0.449	0.538	0.095	0.019	0.605	0.422	0.772	0.725	0.415	0.136								
							2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44								
							0.194	0.049	0.046	0.157	0.032	0.021	0.311	0.132	0.092	0.074	0.089	0.048	0.315	0.067	0.061	0.045	0.180	0.231	0.051	0.275	0.055	0.125								



TEL : 886-3-327-3456
FAX : 886-3-328-4978

Appendix G. Supplemental SAR Tests Results

SAR test result

1. The test data is selected according to the worst case SAR configuration per cellular technology.
2. The test data is to demonstrate the device is in compliance with FCC requirements at 25mm when all power reduction mechanisms are OFF. The worst case body SAR at 10mm was used for simultaneous transmission SAR analysis since they are more conservative than the 25mm SAR.

Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
GSM1900_Ant 0	GPRS (4 Tx slots)	Bottom Side	25mm	-	Index 0	661	1880	27.43	27.50	1.016	-	1.000	-0.01	0.110	0.112
WCDMA II_Ant 0	RMC 12.2Kbps	Bottom Side	25mm	-	Index 0	9400	1880	24.69	25.00	1.074	-	1.000	-0.02	0.486	0.522
LTE Band 7_Ant 0	20M_QPSK_1_0	Bottom Side	25mm	-	Index 0	21100	2535	23.75	25.00	1.334	-	1.000	-0.04	0.369	0.492
FR1 n7_Ant 0	50M_BPSK_1_1	Bottom Side	25mm	-	Index 0	507000	2535	23.39	25.00	1.449	-	1.000	-0.02	0.402	0.582
WLAN2.4GHz	802.11b 1Mbps	Left Side	25mm	-	Index 0	1	2412	22.45	22.50	1.012	100	1.000	0.04	0.105	0.106
WLAN5GHz	802.11a 6Mbps	Left Side	25mm	Ant 3+4(3)	Index 0	165	5825	20.55	21.00	1.109	100	1.000	-0.09	0.355	0.394
WLAN5GHz	802.11a 6Mbps	Left Side	25mm	Ant 3+4(4)	Index 0	165	5825	20.98	21.00	1.005	100	1.000	-0.09	0.001	0.001
Bluetooth	1Mbps	Left Side	25mm	Ant 3+4(3)	Index 0	0	2402	19.09	20.00	1.232	77.13	1.080	0.09	0.002	0.003
Bluetooth	1Mbps	Left Side	25mm	Ant 3+4(4)	Index 0	0	2402	19.79	20.00	1.049	77.13	1.080	0.09	0.001	0.001