

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 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).
6. The auto-tune state determined by the device during normal SAR measurement has been verified immediately before and after each SAR measurement by reading the auto-tune state and confirm that they are the same and also listed alongside the reported SAR results in following table to facilitate comparing these with the single point SAR to be measured for the other tuner states.

Antenna	Band	Number of tune states
Ant 0 (LB)	LTE Band 5	50
	LTE Band 12/17	59
	LTE Band 13	41
	LTE Band 14	54
	LTE Band 26	60
	LTE Band 71	61
	FR1 n5	50
	FR1 n12	59
	FR1 n14	54
	FR1 n26	60
	FR1 n71	61



FCC SAR TEST REPORT

Report No. :FA451606B

<Verification SAR result for Ant 0>

RF exposure position												Average Value of Time Sweep Single Point SAR (W/kg)																																			
Band	Mode	Exposure Condition	Channel	Setting NV	Test Position	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Default-Tuner (State)	Before Auto-Tuner (State)	After Auto-Tuner (State)	Auto-Tuner Single-Point SAR (W/kg)	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	59						
LTE Band 12	10M_QPSK_1_0	Head	23095	230	Left Cheek	0.190	0.241	19	19	19	0.271	0.193	0.236	0.201	0.230	0.102	0.179	0.080	0.194	0.080	0.270	0.195	0.194	0.195	0.248	0.195	0.080	0.177	0.079	0.205	0.148	0.195	0.265	0.195	0.238	0.205	0.210	0.114	0.159	0.200	0.206						
	10M_QPSK_1_0	Body	23095	230	Left Side	0.359	0.456	19	24	24	0.701	0.695	0.545	0.631	0.619	0.584	0.526	0.375	0.101	0.359	0.608	0.618	0.700	0.635	0.645	0.399	0.329	0.474	0.374	0.101	0.595	0.546	0.643	0.570	0.622	0.300	0.503	0.053	0.368	0.608							
LTE Band 13	10M_QPSK_1_0	Head	23230	230	Left Cheek	0.269	0.338	41	41	41	0.281	0.253	0.267	0.247	0.175	0.158	0.256	0.158	0.240	0.142	0.200	0.248	0.254	0.198	0.158	0.202	0.247	0.036	0.249	0.188	0.181	0.277															
	10M_QPSK_1_0	Body	23230	230	Left Side	0.586	0.656	41	30	30	0.924	0.846	0.903	0.579	0.570	0.805	0.638	0.169	0.847	0.557	0.867	0.872	0.842	0.505	0.645	0.922	0.441	0.677	0.396	0.805	0.923																
LTE Band 14	10M_QPSK_1_0	Head	23330	230	Left Cheek	0.290	0.363	18	21	21	0.345	0.276	0.300	0.164	0.256	0.334	0.149	0.300	0.275	0.338	0.267	0.340	0.240	0.266	0.160	0.210	0.044	0.166	0.275	0.339	0.287	0.286	0.290	0.289	0.160	0.231	0.083	0.250									
	10M_QPSK_1_0	Body	23330	230	Left Side	0.604	0.658	18	24	24	0.987	0.898	0.971	0.799	0.713	0.400	0.141	0.259	0.818	0.880	0.752	0.905	0.987	0.381	0.295	0.714	0.195	0.833	0.930	0.768	0.934	0.649	0.762	0.378	0.594	0.135	0.452	0.986									
LTE Band 26	15M_QPSK_1_0	Head	26865	230	Left Cheek	0.316	0.401	24	24	24	0.325	0.320	0.239	0.258	0.123	0.318	0.107	0.200	0.029	0.035	0.260	0.312	0.168	0.323	0.257	0.122	0.186	0.229	0.074	0.036	0.260	0.302	0.226	0.186	0.205	0.223	0.126	0.234	0.227	0.076	0.270						
	15M_QPSK_1_0	Body	26865	230	Left Side	0.536	0.649	24	27	27	0.803	0.760	0.663	0.398	0.720	0.297	0.303	0.636	0.368	0.781	0.750	0.613	0.787	0.713	0.614	0.405	0.682	0.623	0.571	0.602	0.593	0.731	0.743	0.767	0.487	0.459	0.515	0.556	0.186	0.429	0.799						
LTE Band 71	20M_QPSK_1_0	Head	133297	230	Left Cheek	0.180	0.223	22	22	22	0.275	0.269	0.263	0.220	0.145	0.271	0.140	0.175	0.070	0.068	0.149	0.033	0.238	0.178	0.140	0.176	0.134	0.265	0.268	0.049	0.266	0.267	0.265	0.257	0.186	0.249	0.127	0.138	0.266	0.028	0.095	0.267					
	20M_QPSK_1_0	Body	133297	230	Left Side	0.397	0.492	22	22	22	0.652	0.510	0.609	0.287	0.395	0.644	0.263	0.637	0.035	0.262	0.580	0.645	0.515	0.291	0.503	0.217	0.250	0.601	0.604	0.190	0.303	0.469	0.597	0.210	0.472	0.328	0.211	0.248	0.594	0.196	0.507						
FR1 n12	15M_BPSK_36_22	Head	141500	230	Left Cheek	0.238	0.293	19	19	19	0.301	0.172	0.197	0.182	0.188	0.216	0.109	0.060	0.066	0.194	0.301	0.181	0.196	0.195	0.140	0.163	0.116	0.099	0.180	0.237	0.180	0.171	0.195	0.182	0.180	0.148	0.154	0.180	0.193	0.214	0.218						
	15M_BPSK_1_1	Body	141500	230	Left Side	0.385	0.473	19	19	19	0.618	0.525	0.476	0.469	0.136	0.338	0.414	0.271	0.411	0.407	0.479	0.415	0.445	0.225	0.310	0.378	0.134	0.166	0.425	0.484	0.514	0.449	0.456	0.409	0.173	0.343	0.250	0.064	0.374	0.615							
FR1 n14	10M_BPSK_1_1	Head	158600	230	Left Cheek	0.300	0.361	18	21	21	0.388	0.280	0.293	0.155	0.250	0.315	0.143	0.309	0.271	0.338	0.272	0.342	0.249	0.276	0.153	0.201	0.044	0.158	0.281	0.341	0.278	0.280	0.294	0.151	0.119	0.220	0.078	0.246									
	10M_BPSK_1_1	Body	158600	230	Left Side	0.564	0.621	18	22	22	0.875	0.806	0.855	0.681	0.645	0.336	0.132	0.211	0.737	0.771	0.638	0.798	0.874	0.314	0.243	0.605	0.155	0.742	0.814	0.681	0.817	0.580	0.676	0.311	0.498	0.121	0.379	0.870									
FR1 n26	20M_BPSK_50_28	Head	166300	230	Left Cheek	0.355	0.414	24	20	20	0.425	0.335	0.231	0.262	0.122	0.337	0.107	0.206	0.027	0.033	0.312	0.348	0.188	0.346	0.313	0.139	0.186	0.256	0.085	0.034	0.312	0.347	0.277	0.218	0.331	0.276	0.150	0.263	0.277	0.096	0.308						
	20M_BPSK_50_28	Body	166300	230	Left Side	0.554	0.646	24	25	25	0.830	0.751	0.640	0.363	0.760	0.275	0.288	0.672	0.332	0.805	0.770	0.641	0.804	0.714	0.654	0.393	0.657	0.653	0.580	0.590	0.622	0.747	0.760	0.743	0.515	0.499	0.487	0.587	0.211	0.439	0.802						
FR1 n71	20M_BPSK_1_1	Head	136100	230	Left Cheek	0.193	0.239	22	22	22	0.225	0.220	0.217	0.186	0.120	0.222	0.112	0.143	0.219	0.058	0.124	0.028	0.198	0.151	0.117	0.149	0.113	0.218	0.220	0.042	0.220	0.219	0.219	0.213	0.154	0.204	0.110	0.114	0.219	0.024	0.081	0.218					
	20M_BPSK_1_1	Body	136100	230	Left Side	0.386	0.477	22	22	22	0.638	0.503	0.602	0.287	0.528	0.635	0.268	0.633	0.037	0.262	0.573	0.636	0.502	0.286	0.494	0.214	0.252	0.596	0.596	0.190	0.310	0.460	0.579	0.207	0.468	0.316	0.209	0.249	0.580	0.195	0.500						

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	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
GSM1900_Ant 2	GPRS (4 Tx slots)	Back	25mm	-	661	1880	26.75	28.00	1.334	-	0.01	0.142	0.189
WCDMA II_Ant 2	RMC 12.2Kbps	Right Side	25mm	-	9400	1880	24.55	25.70	1.303	-	-0.01	0.233	0.304
LTE Band 7_Ant 2	20M_QPSK_1_0	Right Side	25mm	-	21350	2560	24.35	25.70	1.365	-	-0.02	0.377	0.514
FR1 n77_Ant 2	100M_BPSK_1_1	Right Side	25mm	-	656000	3840	23.50	25.20	1.479	-	-0.03	0.363	0.537
WLAN2.4GHz	802.11b 1Mbps	Left Side	25mm	Ant 3	6	2437	22.02	22.50	1.117	99.08	-0.06	0.279	0.314
WLAN5GHz	802.11a 6Mbps	Top Side	25mm	Ant 4+3 (4)	157	5785	19.90	20.00	1.023	93.46	0.18	0.297	0.325
WLAN5GHz	802.11a 6Mbps	Top Side	25mm	Ant 4+3 (3)	157	5785	18.63	20.00	1.371	93.46	0.18	0.001	0.001
Bluetooth	1Mbps	Left Side	25mm	Ant 3	78	2480	19.79	20.00	1.050	77.13	0.02	0.123	0.139