

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 26	60
	FR1 n5	50
	FR1 n12	59
	FR1 n26	60



<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	0.689	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 26	15M_QPSK_1_0	Head	26865	230	Left Cheek	0.316	0.401	24	24	24	0.325	0.320	0.233	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	
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	0.458	0.409	0.173	0.343	0.250	0.064	0.374	0.615		
												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	0.283	0.277	0.096	0.308	
FR1 n26	20M_BPSK_50_28	Head	166300	230	Left Cheek	0.355	0.414	24	20	20	0.425	0.1	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.9	5.1	5.3	5.5	5.7	5.9	
	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	

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	26.53	28.00	1.403	-	-0.02	0.122	0.171
WCDMA II_Ant 2	RMC 12.2Kbps	Right Side	25mm	-	9262	1852	24.17	25.00	1.211	-	-0.07	0.213	0.258
LTE Band 7_Ant 2	20M_QPSK_1_0	Right Side	25mm	-	21350	2560	23.93	25.70	1.503	-	-0.18	0.339	0.510
FR1 n77_Ant 2	100M_BPSK_1_1	Right Side	25mm	-	656000	3840	23.76	25.20	1.393	-	-0.12	0.401	0.559
WLAN2.4GHz	802.11b 1Mbps	Left Side	25mm	Ant 3	6	2437	22.06	22.50	1.107	99.08	-0.01	0.237	0.265
WLAN5GHz	802.11a 6Mbps	Top Side	25mm	Ant 4+3 (4)	157	5785	19.91	20.00	1.021	93.46	-0.11	0.220	0.240
WLAN5GHz	802.11a 6Mbps	Top Side	25mm	Ant 4+3 (3)	157	5785	18.77	20.00	1.327	93.46	-0.11	0.001	0.001
Bluetooth	1Mbps	Left Side	25mm	Ant 3	78	2480	19.71	20.00	1.069	77.13	-0.13	0.126	0.145