



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. In the report only additional evaluated supplemental antenna tuner tests results for NR n12 and n26, other supplemental antenna tuner results include in reference model of FCC ID: A4RG8HHN, part1 SAR report appendix G.
6. 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 tuning states
Ant0	LTE B12/B17	60
	LTE B13	20
	LTE B14	25
	LTE B26/B5	59
	LTE B71	60
	NR n5	57
	NR n12	60
	NR n26	59
	NR n71	60



<Supplemental Head SAR results>

Head (Ant0)	RF exposure position									Average Value of Time Sweep Single Point SAR (W/kg)									
	Band	Mode	Channel	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)										
										1	2	3	4	5	6	7	8	9	10
FR1 n12	15M_BPSK_36_22	Middle	141500	Left Cheek	0.258	0.362	3	0.283	3	0.257	0.180	0.283	0.281	0.170	0.269	0.110	0.162	0.247	0.104
										11	12	13	14	15	16	17	18	19	20
										0.182	0.275	0.092	0.112	0.104	0.267	0.031	0.103	0.038	0.050
										21	22	23	24	25	26	27	28	29	30
										0.076	0.167	0.248	0.179	0.251	0.104	0.266	0.147	0.103	0.191
										31	32	33	34	35	36	37	38	39	40
										0.169	0.104	0.107	0.072	0.062	0.086	0.077	0.044	0.174	0.276
										41	42	43	44	45	46	47	48	49	50
										0.244	0.159	0.138	0.080	0.186	0.101	0.262	0.074	0.084	0.042
										51	52	53	54	55	56	57	58	59	60
										0.101	0.165	0.264	0.088	0.067	0.070	0.071	0.040	0.163	0.180
										1	2	3	4	5	6	7	8	9	10
										0.400	0.423	0.383	0.362	0.407	0.335	0.348	0.187	0.167	0.338
										11	12	13	14	15	16	17	18	19	20
										0.337	0.414	0.169	0.299	0.179	0.421	0.223	0.052	0.107	0.177
FR1 n26	20M_BPSK_50_28	Middle	166300	Left Cheek	0.361	0.502	2	0.423	2	21	22	23	24	25	26	27	28	29	30
										0.311	0.391	0.296	0.292	0.304	0.275	0.189	0.406	0.404	0.374
										31	32	33	34	35	36	37	38	39	40
										0.351	0.191	0.116	0.108	0.305	0.276	0.263	0.284	0.337	0.227
										41	42	43	44	45	46	47	48	49	50
										0.374	0.352	0.308	0.362	0.354	0.422	0.180	0.115	0.232	0.380
										51	52	53	54	55	56	57	58	59	
										0.182	0.087	0.101	0.086	0.148	0.118	0.165	0.082	0.064	



<Supplemental Body SAR results>

Body (Ant0)	RF exposure position									Average Value of Time Sweep Single Point SAR (W/kg)									
	Band	Mode	Channel		Test Position	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Auto-Tuner (State)	Auto-Tuner Single Point SAR (W/kg)										
	FR1 n12	15M_BPSK_1_1	Middle	141500	Left Side	0.367	0.512	3	0.439	3	1	2	3	4	5	6	7	8	9
0.381											0.266	0.439	0.374	0.248	0.390	0.183	0.267	0.372	0.160
11											12	13	14	15	16	17	18	19	20
0.264											0.398	0.157	0.171	0.161	0.395	0.055	0.170	0.062	0.078
21											22	23	24	25	26	27	28	29	30
0.114											0.246	0.366	0.268	0.372	0.161	0.389	0.246	0.167	0.286
31											32	33	34	35	36	37	38	39	40
0.249											0.160	0.156	0.119	0.103	0.144	0.127	0.068	0.286	0.436
41											42	43	44	45	46	47	48	49	50
0.404											0.300	0.267	0.152	0.306	0.171	0.423	0.136	0.154	0.073
51											52	53	54	55	56	57	58	59	60
0.169	0.263	0.423	0.170	0.127	0.130	0.129	0.070	0.263	0.266										
FR1 n26	20M_BPSK_50_28	Middle	166300	Left Side	0.507	0.635	2	0.635	2	1	2	3	4	5	6	7	8	9	10
										0.616	0.635	0.629	0.598	0.614	0.569	0.580	0.282	0.270	0.474
										11	12	13	14	15	16	17	18	19	20
										0.473	0.621	0.290	0.477	0.287	0.613	0.380	0.096	0.181	0.241
										21	22	23	24	25	26	27	28	29	30
										0.509	0.603	0.490	0.480	0.501	0.457	0.280	0.567	0.573	0.573
										31	32	33	34	35	36	37	38	39	40
										0.549	0.318	0.193	0.181	0.475	0.353	0.331	0.383	0.526	0.347
										41	42	43	44	45	46	47	48	49	50
										0.577	0.553	0.483	0.560	0.485	0.632	0.269	0.197	0.352	0.585
										51	52	53	54	55	56	57	58	59	
0.318	0.153	0.174	0.135	0.230	0.225	0.291	0.148	0.103											



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)	Ant.	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 2	GPRS (4 Tx slots)	Front	25mm	-	Index 1	661	1880	27.01	28.00	1.256	-	1.000	-0.09	0.149	0.187
WCDMA II_Ant 2	RMC 12.2Kbps	Front	25mm	-	Index 1	9538	1907.6	25.13	25.70	1.140	-	1.000	0.01	0.224	0.255
LTE Band 48_Ant 6	20M_QPSK_1_0	Left Side	25mm	-	Index 1	56640	3690	24.01	25.20	1.315	62.9	1.006	-0.12	0.291	0.385
FR1 n77_Ant 6	100M_BPSK_1_1	Left Side	25mm	-	Index 1	656000	3840	24.38	25.20	1.208	-	1.000	-0.06	0.467	0.564
WLAN2.4GHz	802.11g 6Mbps	Top Side	25mm	Ant 4+3(4)	Index 0	6	2437.000	20.70	21.00	1.072	93.46	1.070	-0.19	0.132	0.151
WLAN2.4GHz	802.11g 6Mbps	Top Side	25mm	Ant 4+3(3)	Index 0	6	2437.000	19.95	21.00	1.274	93.46	1.070	-0.19	0.001	0.001
WLAN5GHz	802.11a 6Mbps	Front	25mm	Ant 4+3(4)	Index 0	169	5845	19.90	20.00	1.023	93.42	1.070	0.14	0.131	0.143
WLAN5GHz	802.11a 6Mbps	Front	25mm	Ant 4+3(3)	Index 0	169	5845	19.50	20.00	1.122	93.42	1.070	0.14	0.057	0.068
Bluetooth	1Mbps	Top Side	25mm	-	Index 0	78	2480.000	20.24	21.00	1.192	77.07	1.081	-0.06	0.125	0.161