

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. Dynamic antenna tuning mechanism is available at Ant.0 for its < 3GHz LTE and NR band. The number of supported tune codes is different for each frequency band as shown in the following table. And it's verified that tune state results in the highest SAR configuration
3. The antenna tuner state shall be controlled remotely such that the DUT position is not moved during the series of single-point SAR measurements.
4. For each air interface, exposure condition, and antenna that supports dynamic antenna tuning (DAT), the following procedure shall be followed:
 - a. An area scan is performed with the DUT positioned for the exposure condition with auto-tuner enabled to determine the peak SAR location
 - b. A single-point SAR measurement (i.e., time sweep) is performed at the peak SAR location of step a (that is, with auto-tuner enabled). The auto-tuner state shall be recorded, after verifying that it is stable. If fluctuations occur, the scan procedure can be restarted, or the state with the highest SAR needs to be recorded
 - c. Without moving the probe, or introducing any other perturbation, the auto-tuner shall be disabled, and two other adjacent tune states shall be chosen by increasing and decreasing the state identification number by 1
 - d. A single point SAR measurement is then performed on both chosen adjacent states and compared with the value of step b. The measured SAR for auto-tuner disabled is expected to be less than or equal to the recorded SAR of step b. If the measured SAR is higher beyond documented tolerance, then the auto-tuning feature is not working as intended and is not suitable for compliance. DAT functionality shall be removed or adjusted by the manufacturer. If the measured SAR is higher than the value of step b but within tolerance, the next adjacent state(s) shall be chosen and the measure repeated until a lower SAR value can be shown; otherwise, the DAT is considered inoperative and shall be removed or adjusted by the manufacturer.
 - e. Repeat step b with auto-tuning enabled as a test for variability within tolerance: the previous measured value in step 2.2 shall be recovered. If the measured SAR is outside the expected tolerance, then the auto-tuning feature is considered not working as intended and not suitable for compliance. DAT functionality shall be removed or adjusted by the manufacturer
 - f. If any single-point SAR measurement result is >1.4 W/kg, then all tune states for that particular combination of air interface, exposure condition, and antenna selection shall be evaluated with single-point SAR measurements.

Antenna	Band	Number of tune states
ANT 0	LTE Band 12/17/ FR1 n12	421
	LTE Band 13 / FR1 n13	421
	LTE Band 14 / FR1 n14	421
	LTE Band 26/5 / FR1 n26/5	421
	LTE Band 71 / FR1 n71	421

<Antenna tuner Verification result>

Ant.	RF exposure position														
	Band	Mode	Channel	Power State	Test Position	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Auto-tuner enable_Initial		Auto-tuner disabled Verify adjacent tuner				Repeat Auto-tuner enable	
								State	Single Point SAR (W/kg)	State	Single Point SAR (W/kg)	State	Single Point SAR (W/kg)	State	Single Point SAR (W/kg)
Ant 0	LTE Band 12	10M_QPSK_1_0	23095	ECI2	Left Cheek	0.285	0.305	416	0.333	415	0.221	417	0.230	416	0.310
Ant 0	LTE Band 12	10M_QPSK_25_0	23095	ECI6	Back	0.623	0.633	416	0.811	415	0.700	417	0.520	416	0.803
Ant 0	LTE Band 13	10M_QPSK_1_0	23230	ECI2	Left Cheek	0.359	0.393	415	0.403	414	0.333	416	0.310	415	0.395
Ant 0	LTE Band 13	10M_QPSK_25_12	23230	ECI6	Back	0.566	0.692	415	0.833	414	0.755	416	0.456	415	0.812
Ant 0	LTE Band 14	10M_QPSK_1_0	23330	ECI2	Left Cheek	0.353	0.387	415	0.396	414	0.255	416	0.310	415	0.390
Ant 0	LTE Band 14	10M_QPSK_25_0	23330	ECI6	Back	0.780	0.785	415	0.922	414	0.811	416	0.860	415	0.902
Ant 0	LTE Band 26	15M_QPSK_1_0	26865	ECI2	Left Cheek	0.371	0.424	416	0.466	415	0.410	417	0.388	416	0.458
Ant 0	LTE Band 26	15M_QPSK_36_0	26865	ECI6	Back	0.740	0.784	416	0.866	415	0.641	417	0.711	416	0.852
Ant 0	LTE Band 71	20M_QPSK_1_0	133297	ECI2	Left Cheek	0.263	0.292	418	0.355	417	0.255	419	0.310	418	0.347
Ant 0	LTE Band 71	20M_QPSK_50_0	133297	ECI6	Left Edge	0.563	0.630	418	0.766	417	0.599	419	0.495	418	0.752
Ant 0	FR1 n12	15M_BPSK_1_77	141500	ECI2	Left Cheek	0.331	0.349	416	0.388	415	0.300	417	0.255	416	0.377
Ant 0	FR1 n12	15M_BPSK_1_77	141500	ECI6	Back	0.566	0.628	416	0.730	415	0.544	417	0.633	416	0.712
Ant 0	FR1 n13	10M_BPSK_25_14	141500	ECI2	Left Cheek	0.376	0.400	415	0.433	414	0.410	416	0.422	415	0.430
Ant 0	FR1 n13	10M_BPSK_25_14	141500	ECI6	Back	0.765	0.777	415	0.861	414	0.644	416	0.721	415	0.843
Ant 0	FR1 n14	10M_BPSK_25_14	158600	ECI2	Left Cheek	0.348	0.383	415	0.439	414	0.255	416	0.269	415	0.422
Ant 0	FR1 n14	10M_BPSK_25_0	158600	ECI6	Back	0.733	0.752	415	0.913	414	0.722	416	0.813	415	0.899
Ant 0	FR1 n26	20M_QPSK_50_28	166300	ECI2	Left Cheek	0.371	0.418	416	0.477	415	0.400	417	0.355	416	0.466
Ant 0	FR1 n26	20M_QPSK_1_1	166300	ECI6	Back	0.771	0.783	416	0.897	415	0.711	417	0.655	416	0.873
Ant 0	FR1 n71	35M_BPSK_90_45	136100	ECI2	Left Cheek	0.257	0.277	418	0.344	417	0.255	419	0.320	418	0.341
Ant 0	FR1 n71	35M_BPSK_90_45	136100	ECI6	Back	0.768	0.790	418	0.864	417	0.556	419	0.489	418	0.844