

APPENDIX E: MULTI-TX AND ANTENNA SAR CONSIDERATIONS

E.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D04v01 are applicable to devices with built-in unlicensed transmitters such as 802.11 and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

E.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore, simultaneous transmission analysis is required. Per FCC KDB Publication 447498 D04v01 and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1g SAR for all the simultaneous transmitting antennas in a specific physical test configuration is ≤ 1.6 W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1g SAR.

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E.3 Tablet SAR Analysis

Table E-1
Simultaneous Transmission Scenarios for WLAN/BT

Configuration	2.4 GHz WLAN Ant WiFi 0 SAR (W/kg)	2.4 GHz WLAN Ant WiFi 0 at 13 dBm SAR (W/kg)	2.4 GHz WLAN Ant WiFi 1 SAR (W/kg)	2.4 GHz WLAN Ant WiFi 1 at 13 dBm SAR (W/kg)	2.4 GHz WLAN Ant WiFi 1 at 11.5 dBm SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 13 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm SAR (W/kg)	5 GHz WLAN Ant WiFi 0 SAR (W/kg)	5 GHz WLAN Ant WiFi 0 at 8.5 dBm SAR (W/kg)	5 GHz WLAN Ant WiFi 1 SAR (W/kg)	5 GHz WLAN Ant WiFi 1 at 8.5 dBm SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	5 GHz WLAN MIMO at 8.5 dBm SAR (W/kg)	5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	6 GHz WLAN Ant WiFi 0 SAR (W/kg)	6 GHz WLAN Ant WiFi 0 at 7 dBm SAR (W/kg)	6 GHz WLAN Ant WiFi 1 SAR (W/kg)	6 GHz WLAN Ant WiFi 1 at 7 dBm SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)	6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 0 SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 0 at 10 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 1 SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 1 at 10 dBm SAR (W/kg)
Back	0.065	1.065	0.111	0.387	0.378	0.125	0.774	0.490	0.295	0.746	0.136	0.405	0.387	0.430	0.226	0.017	0.642	0.009	0.081	0.032	0.647	0.004	0.523	0.036	0.395
Top	0.018	0.347	0.020	0.329	0.324*	0.054	0.697	0.697*	0.133	0.728	0.086	0.234	0.120	0.316	0.104*	0.009	0.112	0.006	0.066	0.013	0.112	0.003	0.209	0.005	0.353
Bottom	0.035	0.035*	0.040	0.040*	0.040*	0.039	0.039*	0.039*	0.059	0.059*	0.072	0.072*	0.066	0.066*	0.066*	0.003	0.003*	0.003	0.003*	0.003	0.003*	0.003	0.003*	0.022	0.022*
Right	0.011	0.011*	0.221	1.004	0.650	0.362	0.982	0.595	0.040	0.040*	0.727	1.139	0.765	0.872	0.707	0.000	0.000*	0.045	0.046	0.046	0.341	0.000	0.000*	0.240	0.714
Left	0.093	0.534	0.000	0.000*	0.000*	0.094	0.686	0.378	0.735	1.062	0.072	0.072*	0.798	0.745	0.849	0.080	0.621	0.000	0.000*	0.106	0.461	0.118	0.491	0.000	0.000*
Configuration	2.4 GHz Bluetooth Ant WiFi 1 at 10 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 1 at 10 dBm + 5 GHz WLAN MIMO at 8.5 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 0 at 10 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 0 at 10 dBm + 5 GHz WLAN MIMO at 8.5 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 5 GHz WLAN MIMO at 7 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 11.5 dBm + 6 GHz WLAN MIMO at 7 dBm SAR (W/kg)
Back	1.042	0.825	0.825	1.170	0.953	1.137	0.716	1.127	1.548	1.110	1.548	1.110	1.548	1.110	1.548	1.110	1.548	1.110	1.548	1.110	1.548	1.110	1.548	1.110	1.548
Top	0.485	0.669	0.391	0.575	0.829	1.013	0.904	0.720	0.588	1.013	0.904	0.720	0.588	1.013	0.904	0.720	0.588	1.013	0.904	0.720	0.588	1.013	0.904	0.720	0.588
Bottom	0.025	0.088	0.006	0.069	0.042	0.105	0.046	0.109	0.043	0.109	0.043	0.109	0.043	0.109	0.043	0.109	0.043	0.109	0.043	0.109	0.043	0.109	0.043	0.109	0.043
Right	1.057	1.586	0.343	0.872	0.938	1.302	1.357	0.993	1.004	1.586	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340
Left	0.461	0.745	0.952	1.236	0.839	1.227	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340	0.952	1.340

Notes:

- For all combinations where the sum of WLAN + BT is less than 1.6 W/kg, there's no further analysis required for compliance demonstration.
- Values with * were tested at a higher, more conservative power level.

E.4 Laptop SAR Analysis

Table E-2
Simultaneous Transmission Scenarios for WLAN/BT

Configuration	2.4 GHz WLAN Ant WiFi 0 SAR (W/kg)	2.4 GHz WLAN Ant WiFi 1 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	5 GHz WLAN Ant WiFi 0 SAR (W/kg)	5 GHz WLAN Ant WiFi 1 SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	6 GHz WLAN Ant WiFi 0 SAR (W/kg)	6 GHz WLAN Ant WiFi 1 SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 0 SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 1 SAR (W/kg)
Bottom	0.137	0.000	0.143	0.308	0.028	0.378	0.150	0.000	0.164	0.156	0.000
Configuration	2.4 GHz Bluetooth Ant WiFi 1 + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 1 + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 0 + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant WiFi 0 + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN Ant WiFi 1 + 5 GHz WLAN MIMO + 2.4 GHz Bluetooth Ant WiFi 0 SAR (W/kg)	2.4 GHz WLAN Ant WiFi 1 + 6 GHz WLAN MIMO + 2.4 GHz Bluetooth Ant WiFi 0 SAR (W/kg)	2.4 GHz WLAN Ant WiFi 1 + 5 GHz WLAN MIMO + 2.4 GHz Bluetooth Ant WiFi 0 SAR (W/kg)	2.4 GHz WLAN Ant WiFi 1 + 6 GHz WLAN MIMO + 2.4 GHz Bluetooth Ant WiFi 0 SAR (W/kg)	2.4 GHz WLAN Ant WiFi 1 + 5 GHz WLAN MIMO + 2.4 GHz Bluetooth Ant WiFi 0 SAR (W/kg)
Bottom	0.164	0.378	0.320	0.534	0.307	0.521	0.534	0.320	0.156	0.534	0.534

Notes:

- For all combinations where the sum of WLAN + BT is less than 1.6 W/kg, there's no further analysis required for compliance demonstration.

E.5 Conclusion

The above numerical SAR summation results for all valid simultaneous transmission combinations demonstrate that the total 1-g SAR remains below 1.6 W/kg. Therefore, measured volumetric simultaneous SAR summation is not required. This evaluation complies with FCC KDB Publication 447498 D04v01 and IEEE 1528-2013 Section 6.3.4.1, which permit SAR test exclusion when the sum of 1-g SAR values from individually tested transmitters operating simultaneously is ≤ 1.6 W/kg.

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