

APPENDIX D: SIMULTANEOUS NUMERICAL CALCULATIONS

D.1 Introduction




The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to devices with built-in unlicensed transmitters such as 802.11 and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

D.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore, simultaneous transmission analysis is required. Per FCC KDB Publication 447498 D01v06 4.3.2 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 or 10g SAR.

Per FCC KDB Publication 941225 D06v02r01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR (“-”).

(*) For test positions that were not required to be evaluated for WLAN SAR per FCC KDB publication 248227, the worst case WLAN SAR result for the applicable exposure conditions was used for simultaneous transmission analysis.

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D.3 Head Simultaneous Transmission Analysis

Table D-1
Simultaneous Transmission Scenarios of WLAN/BT (Held to Ear)

Configuration	2.4 GHz WLAN Ant 2	2.4 GHz WLAN MIMO	2.4 GHz Bluetooth	5 GHz WLAN Ant 1	5 GHz WLAN MIMO
Right Cheek	0.049	0.303	0.347	0.323	0.324
Right Tilt	0.032	0.303*	0.073	0.323*	0.324*
Left Cheek	0.017	0.265	0.385	0.323*	0.324*
Left Tilt	0.014	0.303*	0.046	0.323*	0.324*

2.4 GHz WLAN MIMO	5 GHz WLAN Ant 1	5 GHz WLAN MIMO	2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO	2.4 GHz Bluetooth	2.4 GHz Bluetooth + 2.4 GHz WLAN Ant 2	2.4 GHz Bluetooth + 5 GHz WLAN Ant 1	2.4 GHz Bluetooth + 5 GHz WLAN MIMO	2.4 GHz Bluetooth + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN Ant 1	2.4 GHz Bluetooth + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO	WLAN/BT Worst-case Combination
0.303	0.323	0.324	0.627	0.347	0.396	0.670	0.671	0.719	0.720	0.720
0.303	0.323	0.324	0.627	0.073	0.105	0.396	0.397	0.428	0.429	0.627
0.265	0.323	0.324	0.589	0.385	0.402	0.708	0.709	0.725	0.726	0.726
0.303	0.323	0.324	0.627	0.046	0.060	0.369	0.370	0.383	0.384	0.627

Table D-2
Simultaneous Transmission Scenario with WLAN/BT (Held to Ear)

	Configuration	Licensed	WLAN/BT Worst-case Combination	Licensed + WLAN/BT
Head SAR	Right Cheek	0.366	0.720	1.086
	Right Tilt	0.190	0.627	0.817
	Left Cheek	0.281	0.726	1.007
	Left Tilt	0.192	0.627	0.819

D.4 Body-worn Simultaneous Transmission Analysis



Table D-3
Simultaneous Transmission Scenarios of WLAN/BT (Body-worn at 1.5 cm)

Configuration	2.4 GHz WLAN Ant 2	2.4 GHz WLAN MIMO	2.4 GHz Bluetooth	5 GHz WLAN Ant 1	5 GHz WLAN MIMO
Back	0.087	0.229	0.053	0.083	0.169

2.4 GHz WLAN MIMO	5 GHz WLAN Ant 1	5 GHz WLAN MIMO	2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO	2.4 GHz Bluetooth	2.4 GHz Bluetooth + 2.4 GHz WLAN Ant 2	2.4 GHz Bluetooth + 5 GHz WLAN Ant 1	2.4 GHz Bluetooth + 5 GHz WLAN MIMO	2.4 GHz Bluetooth + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN Ant 1	2.4 GHz Bluetooth + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO	WLAN/BT Worst-case Combination
0.229	0.083	0.169	0.398	0.053	0.140	0.136	0.222	0.223	0.309	0.398

Table D-4
Simultaneous Transmission Scenario with WLAN/BT (Body-worn at 1.5 cm)

	Configuration	Licensed	WLAN/BT Worst-case Combination	Licensed + WLAN/BT
Bodyworn SAR	Back	0.981	0.398	1.379

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D.5 Hotspot Simultaneous Transmission Analysis



Table D-5
Simultaneous Transmission Scenarios of WLAN/BT (Hotspot at 1.0 cm)

Configuration	2.4 GHz WLAN Ant 2	2.4 GHz WLAN MIMO	2.4 GHz Bluetooth	5 GHz WLAN Ant 1	5 GHz WLAN MIMO
Back	0.217	0.475	0.107	0.063	0.173
Front	0.014	0.188	0.098	0.057	0.173*
Top	0.030	0.065	0.014	-	0.173*
Bottom	-	-	-	-	-
Right	-	-	-	-	-
Left	0.006	0.305	0.154	0.088	0.064

2.4 GHz WLAN MIMO	5 GHz WLAN Ant 1	5 GHz WLAN MIMO	2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO	2.4 GHz Bluetooth	2.4 GHz Bluetooth + 2.4 GHz WLAN Ant 2	2.4 GHz Bluetooth + 5 GHz WLAN Ant 1	2.4 GHz Bluetooth + 5 GHz WLAN MIMO	2.4 GHz Bluetooth + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN Ant 1	2.4 GHz Bluetooth + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO	WLAN/BT Worst-case Combination
0.475	0.063	0.173	0.648	0.107	0.324	0.170	0.280	0.387	0.497	0.648
0.188	0.057	0.173	0.361	0.098	0.112	0.155	0.271	0.169	0.285	0.361
0.065	0.000	0.173	0.238	0.014	0.044	0.014	0.187	0.044	0.217	0.238
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-
0.305	0.088	0.064	0.369	0.154	0.160	0.242	0.218	0.248	0.224	0.369

Table D-6
Simultaneous Transmission Scenarios with WLAN/BT (Hotspot at 1.0 cm)

	Configuration	Licensed	WLAN/BT Worst-case Combination	Licensed + WLAN/BT
Hotspot SAR	Back	0.737	0.648	1.385
	Front	0.600	0.361	0.961
	Top	0.000	0.238	0.238
	Bottom	0.953	-	0.953
	Right	0.637	-	0.637
	Left	0.422	0.369	0.791

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D.6 Phablet Simultaneous Transmission Analysis

Per FCC KDB Publication 648474 D04 Handset SAR, Phablet SAR tests were not required if wireless router 1g SAR (scaled to the maximum output power, including tolerance) < 1.2 W/kg. Therefore, no further analysis beyond the tables included in this section was required to determine that possible simultaneous transmission scenarios would not exceed the SAR limit.

Table D-7
Simultaneous Transmission Scenarios of WLAN/BT

Configuration	5 GHz WLAN Ant 1	5 GHz WLAN MIMO
Back	0.607	0.648
Front	0.999*	0.818
Top	-	0.161
Bottom	-	-
Right	-	-
Left	0.999	0.908

5 GHz WLAN Ant 1	5 GHz WLAN MIMO	WLAN/BT Worst-case Combination
0.607	0.648	0.648
0.999	0.818	0.999
0.000	0.161	0.161
0.000	0.000	-
0.000	0.000	-
0.999	0.908	0.999

Table D-8
Simultaneous Transmission Scenarios with WLAN/BT (Phablet Max DSI= 0)




	Configuration	Licensed	WLAN/BT Worst-case Combination	Licensed + WLAN/BT
Phablet SAR	Back	1.333	0.648	1.981
	Front	1.526	0.999	2.525
	Top	0.000	0.161	0.161
	Bottom	1.470	-	1.470
	Right	0.493	-	0.493
	Left	2.235	0.999	3.234

Table D-9
Simultaneous Transmission Scenarios with WLAN/BT (Phablet Reduced DSI= 1)

	Configuration	Licensed	WLAN/BT Worst-case Combination	Licensed + WLAN/BT
Phablet SAR	Back	1.860	0.648	2.508
	Front	1.730	0.999	2.729
	Top	0.000	0.161	0.161
	Bottom	1.846	-	1.846
	Right	0.493	-	0.493
	Left	2.235	0.999	3.234

D.7 Simultaneous Transmission Conclusion

The above numerical summed SAR results are sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06 and IEEE 1528- 2013 Section 6.3.4.1.

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