

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 a 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 (“-“).

This device is enabled with Qualcomm® Smart Transmit Gen2 with pre-defined sub6 antenna groups (AG0 and AG1). Simultaneous transmission analysis is performed per antenna groups. Below analysis demonstrates the mutually exclusive operation of AG0 and AG1 and the compliance between AG0 and BT/WLAN/NFC/UWB, and between AG1 and BT/WLAN/NFC/UWB.

When operating in the same antenna group, Qualcomm Smart Transmit algorithm in WWAN directly adds the time-averaged RF exposure from 4G and time-averaged RF exposure from 5G NR. Smart Transmit algorithm controls the total RF exposure from both 4G and 5G NR to not exceed FCC limit. Therefore, simultaneous transmission compliance between 4G+5G operations within an antenna group is demonstrated in the Part 2 Report during algorithm validation.

E.3 Sub6 Antenna Groups

The 2nd generation of Smart Transmit (GEN2) operates based on pre-defined sub6 antenna groups (AG) and mmW module groups (MG). Sub6 Tx antennas in the device are grouped based on spatial variation of RF exposure distributions, where the RF exposure of one AG is mutually exclusive from other AG. This is accomplished by demonstrating either of below conditions for all exposure scenarios:

- a) Sum of SAR of one antenna from each of the sub6 AGs and the RF exposure from radios outside Smart Transmit is less than regulatory limits. This condition must be demonstrated for all antenna combinations of sub6 AGs.

(or)

- b) Every antenna from each sub6 AG meets SPLSR criteria (Section 4.3.2(c) in FCC KDB 447498 D04) with every antenna from another sub6 AG. This criteria must be demonstrated for all antenna combinations for each pair of AGs.

This device supports two sub6 AG: AG0 and AG1, with AG0 having 4 antennas (A, B, C, D) and AG1 having 4 antennas (E, F, G, I), and two WIFI/BT antennas outside of Smart Transmit. The conditions are verified through the following criteria:

- i) (SAR1 + SAR2 criteria): If SPLSR criteria is not used, then the highest reported SAR at P_{limit} (or P_{max} when $P_{limit} > P_{max}$) for each antenna should be obtained out of all supported technologies and frequency bands for each DSI. Demonstrate that the sum of reported SAR of one antenna from

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each of the sub6 AGs and the sum of RF exposure from all supported radios outside of Smart Transmit should be less than the regulatory limit as given below for each DSI.

1. Obtain the worst-case reported SAR for each antenna group (i.e., maximum reported SAR at P_{limit} (or P_{max} when $P_{limit} > P_{max}$) out of all supported technologies, frequency bands and antennas in AG0 and AG1), denoted as max.SAR.AG0 and max.SAR.AG1, and obtain the worst-case RF exposure for each external radio, and demonstrate that the sum of these RF exposures meets: $\{ [\text{max.SAR.AG0} + \text{max.SAR.AG1}] + \text{WIFI/BT Ant 1} + \text{WIFI/BT Ant 2} \} \leq 1.6$ (for 1g, or 4.0 for 10g).

ii) (SPLSR criteria): For each antenna, obtain the highest reported SAR value at P_{limit} out of all supported technologies for each frequency band. Using these values, demonstrate for a given DSI that every antenna from one sub6 AG meets SPLSR criteria with every antenna in another sub6 AG for all frequency bands. This criteria must be demonstrated for all antenna pair combinations irrespective of supported simultaneous transmission scenarios as given below for each DSI:

- SPLSR criteria should be met for all antenna pair combinations of AG0 and AG1: {antenna (A, B, C, D) in AG0; antenna (E, F, G, I) in AG1. As it can be seen, these include all combinations of antenna groups, antennas, and frequency bands.

iii) (combination of SPLSR & SAR1+SAR2 criteria): If SPLSR criteria for all the combinations of sub6 antenna groups in (i) is demonstrated to show that each AG is mutually exclusive from other AGs, and if the WIFI/BT antennas supported outside of Smart Transmit do not meet SPLSR criteria, then the condition in (ii) reduces to: $\{ \text{max.SAR.AG0} + \text{WIFI/BT Ant 1} + \text{WIFI/BT Ant 2} \} \leq 1.6$ and $\{ \text{max.SAR.AG1} + \text{WIFI/BT Ant 1} + \text{WIFI/BT Ant 2} \} \leq 1.6$ for compliance demonstration (for 1g, or 4.0 for 10g).

If SPLSR criteria evaluation and analysis is needed to determine compliance for a certain DSI configuration, SPLSR is performed by taking the highest reported SAR for each of the supported technologies and bands per antenna, along with the peak SAR locations. Per Qualcomm guidance, only Y-axis coordinates are recorded in the analysis for calculation simplicity (assumes all 0mm of separation on the x-axis). Peak locations are documented in the Highest Report SAR and Hotspot Location Section below for each DSI configuration.

For this device, AG0 is located at the bottom of the device and is identified in this report as the “bottom set”. Per April 2022 TCB Workshop Notes, AG1 and the BT/WIFI antennas are located at the top of the device and were summed together as the “top set” for hybrid SPLSR calculation. The minimum distance when considering all transmissions between the top set and bottom set groups was considered when calculating the SPLSR. The SAR of the transmissions within each set is less than 1.6 W/kg (for 1g, and 4.0W/kg for 10g). (for ex: SAR for AG0 < 1.6W/kg (for 1g, 4.0 W/kg for 10g) for bottom set, and SAR for AG1+BT/WIFI < 1.6 W/kg (for 1g, 4.0 W/kg for 10g) for top set).

For bottom set (AG0), Y_max coordinate represents the worst case hotspot location that is closest to the top set (AG1 + BT/WIFI Antennas). Similarly, for top set (AG1 + BT/WIFI Antennas), Y_min coordinate represents the worst case hotspot location that is closest to the bottom set (AG0).

The following formula is used to calculate the SPLSR between Top Set and Bottom Set for each exposure configuration:

$$SPLSR = \frac{(\text{Max SAR Top Set} + \text{Max SAR Bottom Set})^{1.5}}{|Y_{max} - Y_{min}|}$$

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E.4 Head (DSI = 2) SAR Antenna Group Analysis

Table E-1
DSI=2 Held-to-ear AG0 Highest Reported SAR

AG0 SAR (W/kg)						
Head SAR	Configuration	A	B	C	D	Max
	Right Cheek	0.238	0.037	0.009	0.000	0.238
	Right Tilt	0.177	0.033	0.004	0.000	0.177
	Left Cheek	0.289	0.054	0.002	0.000	0.289
	Left Tilt	0.154	0.030	0.027	0.000	0.154

Table E-2
DSI=2 Held-to-ear AG1 Highest Reported SAR

AG1 SAR (W/kg)						
Head SAR	Configuration	E	F	G	I	Max
	Right Cheek	0.331	0.808	0.808	0.261	0.808
	Right Tilt	0.243	1.124	0.777	0.037	1.124
	Left Cheek	0.469	0.556	0.251	0.521	0.556
	Left Tilt	0.361	0.724	0.280	0.058	0.724

Table E-3
Simultaneous Transmission Scenarios of WLAN/BT (Held to Ear)

Configuration	2.4 GHz WLAN Ant 2 at 15 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 18 dBm SAR (W/kg)	5 GHz WLAN MIMO at 15 dBm SAR (W/kg)	6 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth MIMO at 15 dBm SAR (W/kg)
	1	2	3	4	5	6	7
Right Cheek	0.216	0.200	0.153	0.080	0.148	0.165	0.116
Right Tilt	0.026	0.096	0.131	0.067	0.084	0.020	0.043
Left Cheek	0.368	0.288	0.243	0.165	0.061	0.190	0.191
Left Tilt	0.040	0.036	0.189	0.096	0.030	0.024	0.028

Configuration	2.4 GHz Bluetooth Ant 1 at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 18 dBm SAR (W/kg)	5 GHz WLAN MIMO at 15 dBm SAR (W/kg)	6 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 18 dBm + 5 GHz WLAN MIMO at 15 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 18 dBm + 6 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 12 dBm + 2.4 GHz WLAN Ant 2 at 15 dBm SAR (W/kg)	2.4 GHz Bluetooth MIMO at 15 dBm SAR (W/kg)
	5	6	2	3	4	2+3	2+4	5+1	7
Right Cheek	0.148	0.165	0.200	0.153	0.080	0.353	0.280	0.364	0.116
Right Tilt	0.084	0.020	0.096	0.131	0.067	0.227	0.163	0.110	0.043
Left Cheek	0.061	0.190	0.288	0.243	0.165	0.531	0.453	0.429	0.191
Left Tilt	0.030	0.024	0.036	0.189	0.096	0.225	0.132	0.070	0.028

Configuration	2.4 GHz Bluetooth Ant 1 at 12 dBm + 5 GHz WLAN MIMO at 15 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 12 dBm + 6 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm + 5 GHz WLAN MIMO at 15 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm + 6 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth MIMO at 15 dBm + 5 GHz WLAN MIMO at 15 dBm SAR (W/kg)	2.4 GHz Bluetooth MIMO at 15 dBm + 6 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 12 dBm + 2.4 GHz WLAN Ant 2 at 15 dBm + 5 GHz WLAN MIMO at 15 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 12 dBm + 2.4 GHz WLAN Ant 2 at 15 dBm + 6 GHz WLAN MIMO at 14 dBm SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	5+3	5+4	6+3	6+4	7+3	7+4	5+1+3	5+1+4	
Right Cheek	0.301	0.228	0.318	0.245	0.269	0.196	0.517	0.444	0.517
Right Tilt	0.215	0.151	0.151	0.087	0.174	0.110	0.241	0.177	0.241
Left Cheek	0.304	0.226	0.433	0.355	0.434	0.356	0.672	0.594	0.672
Left Tilt	0.219	0.126	0.213	0.120	0.217	0.124	0.259	0.166	0.259

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Table E-4
DSI=2 Held-to-ear AG Verification

Head SAR	Configuration	AG0 SAR (W/kg)	AG1 SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + AG1 + WLAN/BT SAR (W/kg)
	Right Cheek	0.238	0.808	0.517	1.563
	Right Tilt	0.177	1.124	0.241	1.542
	Left Cheek	0.289	0.556	0.672	1.517
	Left Tilt	0.154	0.724	0.259	1.137

Notes:

- For all combinations where the sum of AG0+AG1+WLAN/BT is less than 1.6 W/kg, there's no further analysis required for compliance demonstration.

E.5 Body-worn (DSI = 0) SAR Antenna Group Analysis

Table E-5
DSI=0 Body-worn AG0 Highest Reported SAR

AG0 SAR (W/kg)						
Bodyworn SAR	Configuration	A	B	C	D	Max
		Back	0.920	0.556	0.048	0.087

Table E-6
DSI=0 Body-worn AG1 Highest Reported SAR

AG1 SAR (W/kg)						
Bodyworn SAR	Configuration	E	F	G	I	Max
		Back	0.037	0.194	0.140	0.141

Table E-7
Simultaneous Transmission Scenarios of WLAN/BT (Body-worn)

Configuration	2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz WLAN Ant 2 at 16 dBm SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 19 dBm SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	5 GHz WLAN MIMO at 17 dBm SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)	2.4 GHz Bluetooth MIMO SAR (W/kg)
	1	2	3	4	5	6	7	8	9	10
Back	0.071	0.037	0.110	0.071	0.132	0.092	0.038	0.039	0.020	0.020
Configuration	2.4 GHz Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 19 dBm + 5 GHz WLAN MIMO at 17 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 19 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz Bluetooth MIMO SAR (W/kg)	
Back	8	9	3	5	7	4+6	4+7	8+1	10	
	0.039	0.020	0.110	0.132	0.038	0.163	0.109	0.110	0.020	
Configuration	2.4 GHz Bluetooth Ant 1 + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 2 + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 2 + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth MIMO + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth MIMO + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 at 16 dBm + 5 GHz WLAN MIMO at 17 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 at 16 dBm + 6 GHz WLAN MIMO SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	
Back	8+5	8+7	9+5	9+7	10+5	10+7	8+2+6	8+2+7	0.171	
	0.171	0.077	0.152	0.058	0.152	0.058	0.168	0.114		

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**Table E-8
DSI=0 Body-worn AG Verification**

Bodyworn SAR	Configuration	AG0 SAR (W/kg)	AG1 SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + AG1 + WLAN/BT SAR (W/kg)
	Back	0.920	0.194	0.171	1.285

Notes:

1. For all combinations where the sum of AG0+AG1+WLAN/BT is less than 1.6 W/kg, there's no further analysis required for compliance demonstration.

E.6 Hotspot (DSI = 3) SAR Antenna Group Analysis

**Table E-9
DSI=3 Hotspot AG0 Highest Reported SAR**

AG0 SAR (W/kg)						
Hotspot SAR	Configuration	A	B	C	D	Max
	Back	1.111	0.564	0.096	0.213	1.111
	Front	0.568	0.440	0.039	0.023	0.568
	Top	-	-	-	-	-
	Bottom	1.157	0.998	0.019	0.045	1.157
	Right	0.269	0.270	0.179	-	0.270
	Left	0.369	-	-	0.016	0.369

**Table E-10
DSI=3 Hotspot AG1 Highest Reported SAR**

AG1 SAR (W/kg)						
Hotspot SAR	Configuration	E	F	G	I	Max
	Back	0.071	0.404	0.379	0.266	0.404
	Front	0.104	0.273	0.167	0.076	0.273
	Top	0.084	0.792	0.357	-	0.792
	Bottom	-	-	-	-	-
	Right	0.058	-	-	-	0.058
	Left	-	0.106	0.294	0.091	0.294

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Table E-11
Simultaneous Transmission Scenarios of WLAN/BT (Hotspot)

Configuration	2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz WLAN Ant 2 at 16 dBm SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 19 dBm SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	5 GHz WLAN MIMO at 17 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)	2.4 GHz Bluetooth MIMO SAR (W/kg)
	1	2	3	4	5	6	7	8	9
Back	0.144	0.091	0.202	0.121	0.191	0.138	0.067	0.050	0.041
Front	0.140	0.065	0.139	0.084	0.102	0.078	0.084	0.048	0.037
Top	0.004	0.004	0.134	0.049	0.165	0.111	0.047	0.000	0.000
Bottom	-	-	-	-	-	-	-	-	-
Right	0.077	0.040	0.108	0.051	0.117	0.076	-	0.025	0.026
Left	-	-	0.408	0.234	0.144	0.156	0.216	-	0.002

Configuration	2.4 GHz Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 19 dBm + 5 GHz WLAN MIMO at 17 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz Bluetooth MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 2 + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth MIMO + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 at 16 dBm + 5 GHz WLAN MIMO at 17 dBm SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	7	8	3	5	4+6	7+1	9	7+5	8+5	9+5	7+2+6	
Back	0.067	0.050	0.202	0.191	0.259	0.211	0.041	0.258	0.241	0.232	0.296	0.296
Front	0.084	0.048	0.139	0.102	0.162	0.224	0.037	0.186	0.150	0.139	0.227	0.227
Top	0.047	0.000	0.134	0.165	0.160	0.051	0.000	0.212	0.165	0.165	0.162	0.212
Bottom	-	-	-	-	-	-	-	-	-	-	-	-
Right	-	0.025	0.108	0.117	0.127	0.077	0.026	0.117	0.142	0.143	0.116	0.143
Left	0.216	-	0.408	0.144	0.390	0.216	0.002	0.360	0.144	0.146	0.372	0.408

Table E-12
DSI=3 Hotspot AG Verification

Hotspot SAR	Configuration	AG0 SAR (W/kg)	AG1 SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + AG1 + WLAN/BT SAR (W/kg)
	Back		1.111	0.404	0.296
Front		0.568	0.273	0.227	1.068
Top		-	0.792	0.212	1.004
Bottom		1.157	-	-	1.157
Right		0.270	0.058	0.143	0.471
Left		0.369	0.294	0.408	1.071

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	Bottom Set				Top Set				
	Back Side								
	Ant A	Ant B	Ant C	Ant D	Ant E	Ant F	Ant G	Ant I	WLAN/BT Worst-case Combination SAR (W/kg)
Distance (mm)	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm
Max SAR (W/kg)	1.111	0.564	0.096	0.213	0.071	0.404	0.379	0.266	0.296
Max Y Axis (mm)	-66.600	-72.000	-55.000	-69.600					
Min Y Axis (mm)					64.800	63.000	77.500	9.500	35.500
Bottom Set and Top Set Max SAR (W/kg)	1.111				0.700				
Bottom Set Max Y Axis (mm)	-55.000								
Top Set Min Y Axis (mm)					9.500				
SPLSR	0.04								

Notes:

1. For all combinations where the sum of AG0+AG1+WLAN/BT is less than 1.6, there's no further analysis required for compliance demonstration.
2. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.04 per FCC KDB 447498 D04v01. Please see the Highest Report SAR and Hotspot Location Section for Y-axis peak locations.

E.7 Max Phablet (DSI = 0) SAR Antenna Group 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 E-13
DSI=0 Max Phablet AG0 Highest Reported SAR

AG0 SAR (W/kg)						
Phablet SAR	Configuration	A	B	C	D	Max
	Back	1.308	1.775	-	-	1.775
	Front	1.390	1.378	-	-	1.390
	Top	-	-	-	-	-
	Bottom	1.564	2.020	-	-	2.020
	Right	0.865	2.541	-	-	2.541
	Left	0.457	-	-	-	0.457

Table E-14
DSI=0 Max Phablet AG1 Highest Reported SAR

AG1 SAR (W/kg)						
Phablet SAR	Configuration	E	F	G	I	Max
	Back	-	-	0.842	-	0.842
	Front	-	-	-	-	-
	Top	-	3.121	0.499	-	3.121
	Bottom	-	-	-	-	-
	Right	-	-	-	-	-
	Left	-	-	2.012	-	2.012

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Table E-15
Simultaneous Transmission Scenarios of WLAN/BT (Phablet)

Configuration	5 GHz WLAN MIMO SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)
	1	2
Back	0.514	0.094
Front	0.608	0.116
Top	0.308	0.078
Bottom	-	-
Right	0.429	0.083
Left	1.353	0.171

Configuration	5 GHz WLAN MIMO SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	1	2	
Back	0.514	0.094	0.514
Front	0.608	0.116	0.608
Top	0.308	0.078	0.308
Bottom	-	-	-
Right	0.429	0.083	0.429
Left	1.353	0.171	1.353

Table E-16
Simultaneous Transmission Scenarios of NFC/UWB (Phablet)

Configuration	NFC SAR (W/kg)	UWB (1) SAR (W/kg)	UWB (2) SAR (W/kg)	NFC + UWB Worst -case SAR (W/kg)
	Back	0.030	0.002	0.001
Front	0.000	0.002	0.000	0.002
Top	-	-	0.002	0.002
Bottom	-	-	-	-
Right	0.000	-	-	0.000
Left	0.000	0.000	0.000	0.000

Table E-17
DSI=0 Max Phablet AG Verification

Phablet SAR	Configuration	AG0 SAR (W/kg)	AG1 SAR (W/kg)	NFC + UWB Worst -case SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + AG1 + NFC + UWB Worst -case + WLAN/BT SAR (W/kg)
		Back	1.775	0.842	0.032	0.514
Front	1.390	-	0.002	0.608	2.000	
Top	-	3.121	0.002	0.308	3.431	
Bottom	2.020	-	-	-	2.020	
Right	2.541	-	0.000	0.429	2.970	
Left	0.457	2.012	0.000	1.353	3.822	

Notes:

1. For all combinations where the sum of AG0+AG1+WLAN/BT+UWB+NFC is less than 4W/kg, there's no further analysis required for compliance demonstration.

E.8 Reduced Phablet (DSI = 1) SAR Antenna Group 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 E-18
DSI=1 Reduced Phablet AG0 Highest Reported SAR

AG0 SAR (W/kg)						
Phablet SAR	Configuration	A	B	C	D	Max
	Back	2.283	2.851	-	-	2.851
	Front	1.934	1.638	-	-	1.934
	Top	-	-	-	-	-
	Bottom	3.129	2.273	-	-	3.129
	Right	0.865	2.541	-	-	2.541
	Left	0.457	-	-	-	0.457

Table E-19
DSI=1 Reduced Phablet AG1 Highest Reported SAR

AG1 SAR (W/kg)						
Phablet SAR	Configuration	E	F	G	I	Max
	Back	-	-	0.842	-	0.842
	Front	-	-	-	-	-
	Top	-	3.121	0.499	-	3.121
	Bottom	-	-	-	-	-
	Right	-	-	-	-	-
	Left	-	-	2.012	-	2.012

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**Table E-20
DSI=1 Reduced Phablet AG Verification**

Phablet SAR	Configuration	AG0 SAR (W/kg)	AG1 SAR (W/kg)	NFC + UWB Worst -case SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + AG1 + NFC + UWB Worst -case + WLAN/BT SAR (W/kg)
	Back	2.851	0.842	0.032	0.514	See Note 2
	Front	1.934	-	0.002	0.608	2.544
	Top	-	3.121	0.002	0.308	3.431
	Bottom	3.129	-	-	-	3.129
	Right	2.541	-	0.000	0.429	2.970
	Left	0.457	2.012	0.000	1.353	3.822

	Bottom Set			Top Set		
	Back Side					
	Ant A	Ant B	NFC SAR (W/kg)	Ant G	UWB Worst-case SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
Distance (mm)	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Max Ratio to Limit	2.283	2.851	0.030	0.842	0.002	0.514
Max Y Axis (mm)	-78.400	-72.600	-36.400			
Min Y Axis (mm)				78.200	49.000	74.200
Bottom Set and Top Set Max Ratio to Limit	2.881			1.358		
Bottom Set Max Y Axis (mm)	-36.400					
Top Set Min Y Axis (mm)				49.000		
SPLSR	0.10					

Notes:

1. For all combinations where the sum of AG0+AG1+WLAN/BT+UWB+NFC is less than 4W/kg, there's no further analysis required for compliance demonstration.
2. No evaluation was performed to determine the aggregate 10g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.10 per FCC KDB 447498 D04v01. Please see the Highest Report SAR and Hotspot Location Section for Y-axis peak locations.
3. For back side position, we additionally did a hybrid analysis with NFC summed algebraically with bottom set and UWB summed algebraically with top set due to their antenna or hotspot location. The worst case distance including Bottom Set + NFC and Top Set + UWB was used.

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E.9 Highest Report SAR and SAR Hotspot Locations

As a conservative assessment, the distances between Bottom Set and Top Set were determined using the y-axis coordinates of the peak locations only (assumes 0 mm separation on x/z axis)

Table E-21
DSI=3 Back Side Peak Y Coordinates

		Back Side										
		Bottom Set					Top Set					
		AG0					AG1					
		A	B	C	D	E	F	G	I	1	2	MIMO
Mode/Band	Distance	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm
GSM 850	SAR	1.111										
GSM 850	Y-Axis	-70.100										
GSM 1900	SAR	0.383										
GSM 1900	Y-Axis	-81.400										
UMTS 850	SAR	0.765										
UMTS 850	Y-Axis	-70.460										
UMTS 1750	SAR	0.554										
UMTS 1750	Y-Axis	-80.700										
UMTS 1900	SAR	0.431										
UMTS 1900	Y-Axis	-86.900										
LTE Band 71	SAR	0.311										
LTE Band 71	Y-Axis	-68.600										
LTE Band 12	SAR	0.344										
LTE Band 12	Y-Axis	-71.100										
LTE Band 13	SAR	0.565										
LTE Band 13	Y-Axis	-72.800										
LTE Band 14	SAR	0.522										
LTE Band 14	Y-Axis	-70.300										
LTE Band 26 (Cell)	SAR	0.735										
LTE Band 26 (Cell)	Y-Axis	-67.450										
LTE Band 5 (Cell)	SAR	0.778										
LTE Band 5 (Cell)	Y-Axis	-68.980										
LTE Band 66 (AWS)	SAR	0.529					0.347					
LTE Band 66 (AWS)	Y-Axis	-80.400					83.800					
LTE Band 25 (PCS)	SAR	0.356					0.163					
LTE Band 25 (PCS)	Y-Axis	-80.300					81.700					
LTE Band 30	SAR	0.401					0.197					
LTE Band 30	Y-Axis	-79.300					83.000					
LTE Band 7	SAR		0.298				0.363					
LTE Band 7	Y-Axis		-76.000				76.500					
LTE Band 41	SAR		0.376				0.291					
LTE Band 41	Y-Axis		-73.000				79.500					
NR Band n71	SAR	0.306										
NR Band n71	Y-Axis	-66.600										
NR Band n12	SAR	0.354										
NR Band n12	Y-Axis	-68.100										
NR Band n26	SAR	0.924										
NR Band n26	Y-Axis	-76.600										
NR Band n66	SAR	0.545					0.250					
NR Band n66	Y-Axis	-82.700					82.700					
NR Band n25	SAR	0.453					0.235					
NR Band n25	Y-Axis	-83.400					81.700					
NR Band n30	SAR	0.389					0.196					
NR Band n30	Y-Axis	-82.000					63.000					
NR Band n7	SAR		0.564				0.404					
NR Band n7	Y-Axis		-72.000				75.500					
NR Band n41	SAR		0.282		0.213	0.071	0.235					
NR Band n41	Y-Axis		-81.600		-69.600	64.800	76.800					
NR Band n48	SAR			0.096	0.172			0.379	0.244			
NR Band n48	Y-Axis			-55.500	-74.500			78.000	12.000			
NR Band n77	SAR			0.039	0.127			0.266	0.266			
NR Band n77	Y-Axis			-55.000	-72.000			77.500	9.500			
2.4 GHz WLAN	SAR										0.144	0.202
2.4 GHz WLAN	Y-Axis										37.500	81.500
2.4 GHz WLAN at 16 dBm	SAR										0.091	
2.4 GHz WLAN at 16 dBm	Y-Axis										35.500	
2.4 GHz WLAN at 19 dBm	SAR											0.121
2.4 GHz WLAN at 19 dBm	Y-Axis											47.500
5 GHz WLAN	SAR											0.191
5 GHz WLAN	Y-Axis											72.500
5 GHz WLAN at 17 dBm	SAR											0.138
5 GHz WLAN at 17 dBm	Y-Axis											66.200
2.4 GHz Bluetooth	SAR									0.067	0.050	0.041
2.4 GHz Bluetooth	Y-Axis									46.000	42.500	40.000

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Table E-22
DSI=1 Back Side Reduced Phablet Peak Y Coordinates

Back Side								
Mode/Band	Distance	Bottom Set			Top Set			
		AG0			AG1			
		A	B	NFC	G	MIMO	UWB (1)	UWB (2)
		0 mm	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
GSM 1900	SAR	0.954						
	Y-Axis	-83.000						
UMTS 1750	SAR	1.592						
	Y-Axis	-80.300						
UMTS 1900	SAR	1.751						
	Y-Axis	-83.300						
LTE Band 66 (AWS)	SAR	1.705						
	Y-Axis	-80.800						
LTE Band 25 (PCS)	SAR	1.650						
	Y-Axis	-83.100						
LTE Band 30	SAR	1.623						
	Y-Axis	-88.500						
LTE Band 7	SAR		2.561					
	Y-Axis		-83.900					
LTE Band 41	SAR		2.331					
	Y-Axis		-72.600					
NR Band n66	SAR	1.692						
	Y-Axis	-83.900						
NR Band n25	SAR	2.283						
	Y-Axis	-81.200						
NR Band n30	SAR	2.130						
	Y-Axis	-78.400						
NR Band n7	SAR		2.851					
	Y-Axis		-78.200					
NR Band n41	SAR		1.775					
	Y-Axis		-81.600					
NR Band n77	SAR				0.842			
	Y-Axis				78.200			
5 GHz WLAN	SAR					0.514		
	Y-Axis					75.700		
6 GHz WLAN	SAR					0.094		
	Y-Axis					74.200		
NFC	SAR			0.030				
	Y-Axis			-36.400				
UWB	SAR						0.002	0.001
	Y-Axis						49.000	77.200

E.10 Conclusion

The above numerical summed SAR results and SPLSR for all the combinations of sub6 antenna groups are sufficient to show that AG0 is mutually exclusive from AG1 and 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 D04v01 and IEEE 1528- 2013 Section 6.3.4.1.

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