

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 3 antennas (E, F, 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 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.

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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, 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).

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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:

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

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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

AGO SAR (W/kg)						
Head SAR	Configuration	A	B	C	D	Max
	Right Cheek	0.354	0.131	0.000	0.000	0.354
	Right Tilt	0.219	0.107	0.000	0.000	0.219
	Left Cheek	0.297	0.411	0.016	0.000	0.411
	Left Tilt	0.212	0.173	0.000	0.000	0.212

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

AG1 SAR (W/kg)					
Head SAR	Configuration	E	F	I	Max
	Right Cheek	0.290	0.709	0.568	0.709
	Right Tilt	0.268	0.946	0.086	0.946
	Left Cheek	0.615	0.522	0.315	0.615
	Left Tilt	0.541	0.625	0.050	0.625

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

Configuration	2.4 GHz WLAN Ant 2 at 11 dBm SAR (W/kg)	2.4 GHz WLAN Ant 2 at 9 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 12 dBm SAR (W/kg)	5 GHz WLAN MIMO at 16 dBm SAR (W/kg)	5 GHz WLAN MIMO at 11 dBm SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 10.5 dBm SAR (W/kg)
	1	2	3	4	5	6	7	8	9
Right Cheek	0.263	0.169	0.319	0.272	0.441	0.182	0.178	0.079	0.041
Right Tilt	0.043	0.019	0.208	0.094	0.293	0.075	0.069	0.027	0.003
Left Cheek	0.522	0.284	0.481	0.343	0.332	0.073	0.033	0.019	0.128
Left Tilt	0.066	0.042	0.070	0.049	0.314	0.048	0.035	0.011	0.007

Configuration	2.4 GHz Bluetooth Ant 1 at 10 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 10.5 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 14 dBm SAR (W/kg)	5 GHz WLAN MIMO at 16 dBm SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 12 dBm + 5 GHz WLAN MIMO at 11 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 12 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10 dBm + 2.4 GHz WLAN MIMO at 11 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10 dBm + 5 GHz WLAN MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 10.5 dBm + 5 GHz WLAN MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 10.5 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10 dBm + 2.4 GHz WLAN Ant 2 at 9 dBm + 5 GHz WLAN MIMO at 11 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10 dBm + 2.4 GHz WLAN Ant 2 at 9 dBm + 6 GHz WLAN MIMO SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	8	9	3	5	7	4+6	4+7	8+1	8+5	9+5	8+7	9+7	8+2+6	8+2+7	
Right Cheek	0.079	0.041	0.319	0.441	0.178	0.454	0.450	0.342	0.520	0.482	0.257	0.219	0.430	0.426	0.520
Right Tilt	0.027	0.003	0.208	0.293	0.069	0.169	0.163	0.070	0.320	0.296	0.096	0.072	0.121	0.115	0.320
Left Cheek	0.019	0.128	0.481	0.332	0.033	0.416	0.376	0.541	0.351	0.460	0.052	0.161	0.376	0.336	0.541
Left Tilt	0.011	0.007	0.070	0.314	0.035	0.097	0.084	0.077	0.325	0.321	0.046	0.042	0.101	0.088	0.325

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

Head SAR	Configuration	AGO SAR (W/kg)	AG1 SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AGO + AG1 + WLAN/BT SAR (W/kg)
	Right Cheek	0.354	0.709	0.520	1.583
	Right Tilt	0.219	0.946	0.320	1.485
	Left Cheek	0.411	0.615	0.541	1.567
	Left Tilt	0.212	0.625	0.325	1.162

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.

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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	0.880	0.498	0.033	0.106

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

AG1 SAR (W/kg)					
Bodyworn SAR	Configuration	E	F	I	Max
		Back	0.031	0.319	0.067

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 MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 15 dBm SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	5 GHz WLAN MIMO at 16 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)							
	1	2	3	4	5	6	7	8							
	Back	0.062	0.229	0.043	0.326	0.127	0.029	0.033	0.009						
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 15 dBm + 5 GHz WLAN MIMO at 16 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 15 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 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 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 6 GHz WLAN MIMO SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)		
	7	8	2	4	6	3+5	3+6	7+1	7+4	8+4	7+6	8+6	7+1+5	7+1+6	
Back	0.033	0.009	0.229	0.326	0.029	0.170	0.072	0.095	0.359	0.335	0.062	0.038	0.222	0.124	0.359

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	0.880	0.319	0.359

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.

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

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

AGO SAR (W/kg)						
Hotspot SAR	Configuration	A	B	C	D	Max
	Back	0.843	0.678	0.082	0.200	0.843
	Front	0.559	0.448	0.054	0.014	0.559
	Top	-	-	-	-	-
	Bottom	1.237	0.762	0.058	0.047	1.237
	Right	0.599	-	-	0.011	0.599
	Left	0.605	0.471	0.090	-	0.605

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

AG1 SAR (W/kg)					
Hotspot SAR	Configuration	E	F	I	Max
	Back	0.086	0.535	0.134	0.535
	Front	0.079	0.418	0.092	0.418
	Top	0.085	0.902	0.005	0.902
	Bottom	-	-	-	-
	Right	0.060	-	-	0.060
	Left	-	0.224	0.034	0.224

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

Configuration	2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 15 dBm SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	5 GHz WLAN MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)
	1	2	3	4	5	6	7
Back	0.130	0.399	0.070	0.497	0.180	0.063	0.025
Front	0.175	0.397	0.063	0.100	0.027	0.092	0.032
Top	0.006	0.147	0.024	0.230	0.067	0.047	0.000
Bottom	-	-	-	-	-	-	-
Right	0.066	0.126	0.016	0.046	0.008	-	0.007
Left	-	0.320	0.077	0.510	0.142	0.131	-

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 15 dBm + 5 GHz WLAN MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 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 Ant 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO at 16 dBm SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	6	7	2	4	3+5	6+1	6+4	7+4	6+1+5	
Back	0.063	0.025	0.399	0.497	0.250	0.193	0.560	0.522	0.373	0.560
Front	0.092	0.032	0.397	0.100	0.090	0.267	0.192	0.132	0.294	0.397
Top	0.047	0.000	0.147	0.230	0.091	0.053	0.277	0.230	0.120	0.277
Bottom	-	-	-	-	-	-	-	-	-	-
Right	-	0.007	0.126	0.046	0.024	0.066	0.046	0.053	0.074	0.126
Left	0.131	-	0.320	0.510	0.219	0.131	0.641	0.510	0.273	0.641

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Table E-12
DSI=3 Hotspot AG Verification

Hotspot SAR	Configuration	AGO SAR (W/kg)	AG1 SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AGO + AG1 + WLAN/BT SAR (W/kg)
		Back	0.843	0.535	0.560
Front	0.559	0.418	0.397	1.374	
Top	-	0.902	0.277	1.179	
Bottom	1.237	-	-	1.237	
Right	0.599	0.060	0.126	0.785	
Left	0.605	0.224	0.641	1.470	

	Bottom Set				Top Set			
	Back Side							
	Ant A	Ant B	Ant C	Ant D	Ant E	Ant F	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
Max SAR (W/kg)	0.843	0.678	0.082	0.200	0.086	0.535	0.134	0.560
Max Y Axis (mm)	-51.600	-40.000	-51.000	-58.500				
Min Y Axis (mm)					63.600	56.500	22.500	35.000
Bottom Set and Top Set Max SAR (W/kg)	0.843				1.095			
Bottom Set Max Y Axis (mm)	-40.000							
Top Set Min Y Axis (mm)					22.500			
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

Phablet SAR	Configuration	AGO SAR (W/kg)				Max
		A	B	C	D	
Back		1.291	2.390	-	-	2.390
Front		1.347	0.584	-	-	1.347
Top		-	-	-	-	-
Bottom		1.418	1.688	-	-	1.688
Right		0.471	-	-	-	0.471
Left		1.074	2.456	-	-	2.456

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

Phablet SAR	Configuration	AG1 SAR (W/kg)			Max
		E	F	I	
Back		-	0.747	-	0.747
Front		-	-	-	-
Top		-	3.130	-	3.130
Bottom		-	-	-	-
Right		-	-	-	-
Left		-	-	-	-

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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)	WLAN/BT Worst-case Combination SAR (W/kg)
	1	2	
Back	0.813	0.224	0.813
Front	1.008	0.088	1.008
Top	0.546	0.044	0.546
Bottom	-	-	-
Right	0.149	0.007	0.149
Left	2.235	0.504	2.235

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

Configuration	NFC SAR (W/kg)
	Limit
Back	0.024
Front	0.000
Top	-
Bottom	-
Right	0.000
Left	0.000

Table E-17
DSI=0 Max Phablet AG Verification

Configuration	AG0 SAR (W/kg)	AG1 SAR (W/kg)	NFC SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + AG1 + NFC + WLAN/BT SAR (W/kg)
	Back	2.390	0.747	0.024	0.813
Front	1.347	-	0.000	1.008	2.355
Top	-	3.130	-	0.546	3.676
Bottom	1.688	-	-	-	1.688
Right	0.471	-	0.000	0.149	0.620
Left	2.456	-	0.000	2.235	See Note 2

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	Bottom Set			Top Set
	Left Edge			
	Ant A	Ant B	Ant NFC	WLAN worst-case combination SAR
Distance (mm)	0 mm	0 mm	0 mm	0 mm
Max SAR (W/kg)	1.074	2.456	0.000	2.235
Max Y Axis (mm)	-58.300	-53.500	-88.000	
Min Y Axis (mm)				60.800
Bottom Set and Top Set Max SAR (W/kg)	2.456			2.235
Bottom Set Max Y Axis (mm)	-53.500			
Top Set Min Y Axis (mm)				60.800
SPLSR	0.09			

Notes:

1. For all combinations where the sum of AG0+AG1+WLAN/BT+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 left edge position, we additionally did a hybrid analysis with NFC summed algebraically with bottom set due to their antenna or hotspot location. The worst case distance including Bottom Set + NFC was used.

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	2.837	2.849	-	-	2.849
	Front	2.610	1.860	-	-	2.610
	Top	-	-	-	-	-
	Bottom	3.100	2.098	-	-	3.100
	Right	0.471	-	-	-	0.471
	Left	1.074	2.456	-	-	2.456

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

AG1 SAR (W/kg)					
Phablet SAR	Configuration	E	F	I	Max
	Back	-	0.747	-	0.747
	Front	-	-	-	-
	Top	-	3.130	-	3.130
	Bottom	-	-	-	-
	Right	-	-	-	-
	Left	-	-	-	-

Table E-20
DSI=1 Reduced Phablet AG Verification

Phablet SAR	Configuration	AG0 SAR (W/kg)	AG1 SAR (W/kg)	NFC SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + AG1 + NFC + WLAN/BT SAR (W/kg)
	Back	2.849	0.747	0.024	0.813	See Note 2
	Front	2.610	-	0.000	1.008	3.618
	Top	-	3.130	-	0.546	3.676
	Bottom	3.100	-	-	-	3.100
	Right	0.471	-	0.000	0.149	0.620
	Left	2.456	-	0.000	2.235	See Note 2

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	Bottom Set			Top Set	
	Back Side				
	Ant A	Ant B	Ant NFC	Ant F	WLAN worst-case combination SAR
Distance (mm)	0 mm	0 mm	0 mm	0 mm	0 mm
Max SAR (W/kg)	2.837	2.849	0.024	0.747	0.813
Max Y Axis (mm)	-63.600	-66.600	-34.000		
Min Y Axis (mm)				56.000	60.100
Bottom Set and Top Set Max SAR (W/kg)	2.873			1.560	
Bottom Set Max Y Axis (mm)	-34.000				
Top Set Min Y Axis (mm)				56.000	
SPLSR	0.10				

	Bottom Set			Top Set	
	Left Edge				
	Ant A	Ant B	Ant NFC	WLAN worst-case combination SAR	
Distance (mm)	0 mm	0 mm	0 mm	0 mm	
Max SAR (W/kg)	1.074	2.456	0.000	2.235	
Max Y Axis (mm)	-58.300	-53.500	-88.000		
Min Y Axis (mm)				60.800	
Bottom Set and Top Set Max SAR (W/kg)	2.456			2.235	
Bottom Set Max Y Axis (mm)	-53.500				
Top Set Min Y Axis (mm)				60.800	
SPLSR	0.09				

Notes:

1. For all combinations where the sum of AG0+AG1+WLAN/BT+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 and left edge positions, we additionally did a hybrid analysis with NFC summed algebraically with bottom set due to their antenna or hotspot location. The worst case distance including Bottom Set + NFC 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				
		AGO					AG1				
		A	B	C	D	E	F	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
GSM 850	SAR	0.843									
GSM 850	Y-Axis	-59.600									
GSM 1900	SAR	0.106									
GSM 1900	Y-Axis	-73.900									
UMTS 850	SAR	0.578									
UMTS 850	Y-Axis	-60.000									
UMTS 1750	SAR	0.472									
UMTS 1750	Y-Axis	-73.500									
UMTS 1900	SAR	0.590									
UMTS 1900	Y-Axis	-74.900									
LTE Band 71	SAR	0.534									
LTE Band 71	Y-Axis	-56.930									
LTE Band 12	SAR	0.571									
LTE Band 12	Y-Axis	-56.950									
LTE Band 13	SAR	0.558									
LTE Band 13	Y-Axis	-59.960									
LTE Band 14	SAR	0.638									
LTE Band 14	Y-Axis	-64.470									
LTE Band 26 (Cell)	SAR	0.645									
LTE Band 26 (Cell)	Y-Axis	-64.000									
LTE Band 5 (Cell)	SAR	0.577									
LTE Band 5 (Cell)	Y-Axis	-59.970									
LTE Band 66 (AWS)	SAR	0.569					0.516				
LTE Band 66 (AWS)	Y-Axis	-73.600					75.900				
LTE Band 25 (PCS)	SAR	0.582					0.477				
LTE Band 25 (PCS)	Y-Axis	-75.000					73.900				
LTE Band 30	SAR	0.508					0.442				
LTE Band 30	Y-Axis	-73.000					76.000				
LTE Band 7	SAR		0.678				0.374				
LTE Band 7	Y-Axis		-50.600				72.000				
LTE Band 41	SAR		0.537				0.368				
LTE Band 41	Y-Axis		-44.000				73.500				
LTE Band 48	SAR						0.513				
LTE Band 48	Y-Axis						56.900				
NR Band n71	SAR	0.713									
NR Band n71	Y-Axis	-52.200									
NR Band n12	SAR	0.656									
NR Band n12	Y-Axis	-51.600									
NR Band n26	SAR	0.610									
NR Band n26	Y-Axis	-61.000									
NR Band n66	SAR	0.551					0.535				
NR Band n66	Y-Axis	-76.900					72.100				
NR Band n25	SAR	0.636					0.149				
NR Band n25	Y-Axis	-71.400					70.800				
NR Band n30	SAR	0.529					0.308				
NR Band n30	Y-Axis	-75.500					70.500				
NR Band n7	SAR		0.660				0.337				
NR Band n7	Y-Axis		-40.000				72.000				
NR Band n41	SAR	0.473			0.169	0.086	0.268				
NR Band n41	Y-Axis		-47.200		-60.000	63.600	64.800				
NR Band n48	SAR			0.082	0.200		0.465	0.134			
NR Band n48	Y-Axis			-54.500	-62.000		56.500	22.500			
NR Band n77 DoD	SAR				0.131		0.222	0.083			
NR Band n77 DoD	Y-Axis				-59.000		60.500	26.000			
NR Band n77	SAR			0.024	0.134		0.509	0.049			
NR Band n77	Y-Axis			-51.000	-58.500		59.000	29.500			
2.4 GHz WLAN Ant 2	SAR									0.130	
2.4 GHz WLAN Ant 2	Y-Axis									36.000	
2.4 GHz WLAN MIMO	SAR										0.399
2.4 GHz WLAN MIMO	Y-Axis										35.000
2.4 GHz WLAN MIMO at 15 dBm	SAR										0.070
2.4 GHz WLAN MIMO at 15 dBm	Y-Axis										43.500
5 GHz WLAN MIMO	SAR										0.497
5 GHz WLAN MIMO	Y-Axis										61.900
5 GHz WLAN MIMO at 16 dBm	SAR										0.180
5 GHz WLAN MIMO at 16 dBm	Y-Axis										60.400
2.4 GHz Bluetooth Ant 1	SAR								0.063		
2.4 GHz Bluetooth Ant 1	Y-Axis								41.500		
2.4 GHz Bluetooth Ant 2	SAR									0.025	
2.4 GHz Bluetooth Ant 2	Y-Axis									36.500	

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Table E-22
DSI=0 Left Edge Max Phablet and DSI=1 Left Edge Reduced Phablet Peak Y Coordinates

Left Edge					
		Bottom Set			Top Set
		AG0			AG1
		A	B	NFC	MIMO
Mode/Band	Distance	0 mm	0 mm	0 mm	0 mm
UMTS 1750	SAR	0.492			
	Y-Axis	-67.900			
UMTS 1900	SAR	0.758			
	Y-Axis	-66.100			
LTE Band 66 (AWS)	SAR	0.993			
	Y-Axis	-67.800			
LTE Band 25 (PCS)	SAR	1.074			
	Y-Axis	-66.300			
LTE Band 30	SAR	0.605			
	Y-Axis	-61.200			
LTE Band 7	SAR		2.161		
	Y-Axis		-57.600		
LTE Band 41	SAR		1.810		
	Y-Axis		-53.500		
NR Band n66	SAR	0.927			
	Y-Axis	-58.300			
NR Band n25	SAR	0.832			
	Y-Axis	-65.400			
NR Band n30	SAR	0.428			
	Y-Axis	-62.100			
NR Band n7	SAR		2.456		
	Y-Axis		-55.200		
5 GHz WLAN MIMO	SAR				2.235
	Y-Axis				60.800
6 GHz WLAN	SAR				0.504
	Y-Axis				62.000
NFC	SAR			0.000	
	Y-Axis			-88.000	

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Table E-23
DSI=1 Back Side Reduced Phablet Peak Y Coordinates

Back Side						
		Bottom Set			Top Set	
		AG0		AG1		
		A	B	NFC	F	MIMO
Mode/Band	Distance	0 mm	0 mm	0 mm	0 mm	0 mm
UMTS 1750	SAR	2.592				
	Y-Axis	-72.700				
UMTS 1900	SAR	2.552				
	Y-Axis	-70.300				
LTE Band 66 (AWS)	SAR	2.837				
	Y-Axis	-73.000				
LTE Band 25 (PCS)	SAR	2.804				
	Y-Axis	-71.700				
LTE Band 30	SAR	2.778				
	Y-Axis	-69.000				
LTE Band 7	SAR		2.685			
	Y-Axis		-69.800			
LTE Band 41	SAR		2.849			
	Y-Axis		-66.600			
NR Band n66	SAR	2.521				
	Y-Axis	-70.800				
NR Band n25	SAR	2.686				
	Y-Axis	-63.600				
NR Band n30	SAR	2.010				
	Y-Axis	-73.800				
NR Band n7	SAR		2.572			
	Y-Axis		-74.400			
NR Band n41	SAR		2.390			
	Y-Axis		-70.000			
NR Band n77 DoD	SAR				0.697	
	Y-Axis				64.500	
NR Band n77	SAR				0.747	
	Y-Axis				56.000	
5 GHz WLAN MIMO	SAR					0.813
	Y-Axis					63.400
6 GHz WLAN	SAR					0.224
	Y-Axis					60.100
NFC	SAR			0.024		
	Y-Axis			-34.000		

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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