APPENDIX D: ANTENNA GROUPING ANALYSIS & JUSTIFICATION

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 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 ("-").

(*) 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.

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. Appendix D contains analysis to demonstrate the AG0 and AG1 are operate mutually exclusive. Additional analysis is provided below to show compliance between AG0 and BT/WLAN/NFC/UWB and AG1 BT/WLAN/NFC/UWB.

D.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 D01) 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 2 antennas (A, B) and AG1 having 1 antennas (F), and two WIFI/BT antennas outside of Smart Transmit. The conditions are verified through the following criterias:

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.

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: { [max.SAR.AG0 + max.SAR.AG1] + WIFI/BT Ant 1 + WIFI/BT Ant 2} ≤ 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) in AG0; antenna (F) 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: {max.SAR.AG0 + WIFI/BT Ant 1 + WIFI/BT Ant 2} ≤ 1.6 and {max.SAR.AG1 + WIFI/BT Ant 1 + WIFI/BT Ant 2} ≤ 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 Section D.7 below for each DSI configuration.

For bottom AG0, Y_max coordinate represents the worst case hotspot location that is closest to the top AG1. Similarly, for top AG1, Y_min coordinate represents the worst case hotspot location that is closest to the bottom AG0.

The following formula is used to calculate the SPLSR between AG0 and AG1 for each exposure configuration:

$$SPLSR = \frac{(Max\ SAR\ AG0 + Max\ SAR\ AG1)^{1.5}}{|Y_{max} - Y_{min}|}$$

D.4 Head (DSI = 4) SAR Antenna Group Analysis

Table D-1
DSI=4 Held-to-ear AG0 Highest Reported SAR

AG0 SAR (W/kg)					
	Configuration	A	A+B	B	Max
Head SAR	Right Cheek	0.118	0.154	0.104	0.154
	Right Tilt	0.064	0.076	0.058	0.076
	Left Cheek	0.092	0.097	0.095	0.097
	Left Tilt	0.047	0.051	0.053	0.053

Table D-2
DSI=4 Held-to-ear AG1 Highest Reported SAR

AG1 SAR (W/kg)			
	Configuration	F	Max
Head SAR	Right Cheek	0.236	0.236
	Right Tilt	0.266	0.266
	Left Cheek	0.236	0.236
	Left Tilt	0.330	0.330

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

Configuration	2.4 GHz WLAN Ant 2 at 12 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 15 dBm SAR (W/kg)	5 GHz WLAN MIMO at 14 dBm SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10.5 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 8.5 dBm SAR (W/kg)
	1	2	3	4	5	6
Right Cheek	0.017	0.343	0.466	0.344	0.339	0.000
Right Tilt	0.000	0.503	0.602	0.379	0.288	0.000
Left Cheek	0.000	0.503*	0.288	0.138	0.185	0.004
Left Tilt	0.000	0.503*	0.320	0.145	0.225	0.000

Configuration	2.4 GHz WLAN Ant 2 at 12 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 15 dBm SAR (W/kg)	5 GHz WLAN MIMO at 14 dBm SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10.5 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 8.5 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10.5 dBm + 2.4 GHz WLAN Ant 2 at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 8.5 dBm + 5 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 8.5 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10.5 dBm + 5 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10.5 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 15 dBm + 5 GHz WLAN MIMO at 14 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 at 10.5 dBm + 2.4 GHz WLAN Ant 2 at 12 dBm + 5 GHz WLAN MIMO at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 10.5 dBm + 2.4 GHz WLAN Ant 2 at 12 dBm + 6 GHz WLAN MIMO SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	1	2	3	4	5	6	5+1	6+3	6+4	5+3	5+4	2+3	2+4	5+1+3	5+1+4	
Right Cheek	0.017	0.343	0.466	0.344	0.339	0.000	0.356	0.466	0.344	0.805	0.683	0.809	0.687	0.822	0.700	0.822
Right Tilt	0.000	0.503	0.602	0.379	0.288	0.000	0.288	0.602	0.379	0.890	0.667	1.105	0.882	0.890	0.667	1.105
Left Cheek	0.000	0.503	0.288	0.138	0.185	0.004	0.185	0.292	0.142	0.473	0.323	0.791	0.641	0.473	0.323	0.791
Left Tilt	0.000	0.503	0.320	0.145	0.225	0.000	0.225	0.320	0.145	0.545	0.370	0.823	0.648	0.545	0.370	0.823

Table D-4
DSI=4 Held-to-ear AG Verification

	Configuration	AG0 SAR (W/kg)	AG1 SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + AG1 + WLAN/BT SAR (W/kg)
Head SAR	Right Cheek	0.154	0.236	0.822	1.212
	Right Tilt	0.076	0.266	1.105	**1.447**
	Left Cheek	0.097	0.236	0.791	1.124
	Left Tilt	0.053	0.330	0.823	1.206

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.

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

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

AG0 SAR (W/kg)					
Bodyworn SAR	Configuration	A	A+B	B	Max
	Back	0.147	0.161	0.575	0.575

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

AG1 SAR (W/kg)			
Bodyworn SAR	Configuration	F	Max
	Back	0.059	0.059

Table D-7
Simultaneous Transmission Scenarios of WLAN/BT (Held to Ear)

Configuration	2.4 GHz WLAN 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 Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)
	1	2	3	4	5	6
Back	0.004	0.038	0.033	0.002	0.029	0.003

Configuration	2.4 GHz WLAN 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 Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 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 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 WLAN MIMO + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO 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)
	1	2	3	4	5	6	5+1	6+3	6+4	5+3	5+4	2+3	2+4	5+1+3	5+1+4	
Back	0.004	0.038	0.033	0.002	0.029	0.003	0.033	0.036	0.005	0.062	0.031	0.071	0.040	0.066	0.035	0.071

Table D-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	0.575	0.059	0.071	0.705

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.

D.6 Hotspot (DSI = 6) SAR Antenna Group Analysis

Table D-9
DSI=6 Hotspot AG0 Highest Reported SAR

AG0 SAR (W/kg)					
	Configuration	A	A+B	B	Max
Hotspot SAR	Back	0.304	0.277	0.529	0.529
	Front	0.111	0.176	0.149	0.176
	Top	0.000	-	0.000	-
	Bottom	0.117	0.102	0.593	0.593
	Right	0.266	0.321	0.094	0.321
	Left	0.000	0.185	0.075	0.185

Table D-10
DSI=6 Hotspot AG1 Highest Reported SAR

AG1 SAR (W/kg)			
	Configuration	F	Max
Hotspot SAR	Back	0.111	0.111
	Front	0.043	0.043
	Top	0.235	0.235
	Bottom	0.000	-
	Right	0.000	-
	Left	0.066	0.066

Table D-11
Simultaneous Transmission Scenarios of WLAN/BT (Held to Ear)

Configuration	2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	5 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
Back	0.005	0.075	0.039	0.057	0.005
Front	0.034	0.536	0.219	0.301	0.029
Top	-	0.393	0.267	0.373	-
Bottom	0.040	0.035	0.194	-	0.030
Right	-	-	-	-	-
Left	0.160	0.050	0.071	0.089	0.008

Configuration	2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	5 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 Ant 1 + 2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	1	2	3	4	5	4+1	5+3	4+3	2+3	4+1+3	
Back	0.005	0.075	0.039	0.057	0.005	0.062	0.044	0.096	0.114	0.101	0.114
Front	0.034	0.536	0.219	0.301	0.029	0.335	0.248	0.520	0.755	0.554	0.755
Top	-	0.393	0.267	0.373	-	0.373	0.267	0.640	0.660	0.640	0.660
Bottom	0.040	0.035	0.194	-	0.030	0.040	0.224	0.194	0.229	0.234	0.234
Right	-	-	-	-	-	-	-	-	-	-	-
Left	0.160	0.050	0.071	0.089	0.008	0.249	0.079	0.160	0.121	0.320	0.320

Table D-12
DSI=6 Hotspot AG Verification

	Configuration	AG0 SAR (W/kg)	AG1 SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + AG1 + WLAN/BT SAR (W/kg)
Hotspot SAR	Back	0.529	0.111	0.114	0.754
	Front	0.176	0.043	0.755	0.974
	Top	-	0.235	0.660	0.895
	Bottom	0.593	-	0.234	0.827
	Right	0.321	-	-	0.321
	Left	0.185	0.066	0.320	0.571

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.

D.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 D-13
DSI=0 Max Phablet AG0 Highest Reported SAR

AG0 SAR (W/kg)			
Phablet SAR	Configuration	B	Max
	Back	0.526	0.526
	Front	0.999	0.999
	Top	-	-
	Bottom	0.464	0.464
	Right	0.747	0.747
	Left	0.207	0.207

Table D-14
Simultaneous Transmission Scenarios of WLAN/BT (Held to Ear)

Configuration	5 GHz WLAN MIMO SAR (W/kg)	6 GHz WLAN MIMO SAR (W/kg)
	1	2
Back	0.076	0.003
Front	1.385	0.316
Top	1.839	0.336
Bottom	1.301	0.167
Right	-	-
Left	0.139	0.014

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	0.076	0.003	0.076
Front	1.385	0.316	1.385
Top	1.839	0.336	1.839
Bottom	1.301	0.167	1.301
Right	-	-	-
Left	0.139	0.014	0.139

Table D-15
Simultaneous Transmission Scenarios of NFC/UWB (Phablet)

	Configuration	NFC SAR (W/kg)	UWB Ant 0 SAR (W/kg)	UWB Ant 1 SAR (W/kg)	NFC + UWB Ant 0 SAR (W/kg)	NFC + UWB Ant 1 SAR (W/kg)	NFC/UWB Worst-case Combination SAR (W/kg)
Phablet SAR	Back	0.009	0.000	0.000	0.009	0.009	0.009
	Front	0.000	0.000	0.000	0.000	0.000	0.000
	Top	-	0.001	0.000	0.001	0.000	0.001
	Bottom	-	-	-	-	-	-
	Right	0.000	0.000	-	0.000	0.000	0.000
	Left	0.000	0.002	0.002	0.002	0.002	0.002

Table D-16
DSI=0 Max Phablet AG Verification

	Configuration	AG0 SAR (W/kg)	NFC/UWB Worst-case Combination SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + NFC/UWB Worst-case Combination + WLAN/BT SAR (W/kg)
Phablet SAR	Back	0.526	0.009	0.076	0.611
	Front	0.999	0.000	1.385	2.384
	Top	-	0.001	1.839	1.840
	Bottom	0.464	-	1.301	1.765
	Right	0.747	0.000	-	0.747
	Left	0.207	0.002	0.139	0.348

Notes:

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

D.8 Reduced Phablet (DSI = 2) SAR Antenna Group Analysis

For SAR summation, the highest reported SAR across all test distances was used as the most conservative evaluation for simultaneous transmission analysis for each device edge.

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-17
DSI=2 Reduced Phablet AG0 Highest Reported SAR

AG0 SAR (W/kg)			
	Configuration	B	Max
Phablet SAR	Back	1.887	1.887
	Front	0.999	0.999
	Top	-	-
	Bottom	1.981	1.981
	Right	0.747	0.747
	Left	0.207	0.207

Table D-18
DSI=2 Reduced Phablet AG Verification

	Configuration	AG0 SAR (W/kg)	NFC/UWB Worst-case Combination SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + NFC/UWB Worst-case Combination + WLAN/BT SAR (W/kg)
Phablet SAR	Back	1.887	0.009	0.076	1.972
	Front	0.999	0.000	1.385	2.384
	Top	-	0.001	1.839	1.840
	Bottom	1.981	-	1.301	3.282
	Right	0.747	0.000	-	0.747
	Left	0.207	0.002	0.139	0.348

Notes:

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

D.9 Max UMPC Body (DSI = 0) SAR Antenna Group Analysis

Table D-19
DSI=0 Max UMPC Body AG0 Highest Reported SAR

AG0 SAR (W/kg)				
	Configuration	A+B	B	Max
UMPC Body SAR	Back	0.340	0.391	0.391
	Front	0.344	0.411	0.411
	Top	-	-	-
	Bottom	0.274	0.481	0.481
	Right	0.227	0.327	0.327
	Left	-	-	-

Table D-20
Simultaneous Transmission Scenarios of WLAN/BT (Held to Ear)

Configuration	2.4 GHz WLAN 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 Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm SAR (W/kg)
	1	2	3	4	5	6	7	8
Back	0.117	0.415	0.234	0.031	0.370	0.199	0.060	0.050
Front	0.103	0.334	0.255	0.028	0.291	0.138	0.052	0.035
Top	-	0.442	0.343	0.057	0.446	0.264	-	-
Bottom	0.205	0.295	0.191	0.015	-	-	0.124	0.081
Right	-	-	-	-	-	-	-	-
Left	-	-	-	-	-	-	-	-

Configuration	2.4 GHz WLAN 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 Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 14 dBm + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 14 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 14 dBm + 2.4 GHz WLAN Ant 2 + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 14 dBm + 2.4 GHz WLAN Ant 2 + 6 GHz WLAN MIMO SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	1	2	3	4	5	7	5+1	8+3	8+4	6+3	6+4	2+3	2+4	6+1+3	6+1+4	
Back	0.117	0.415	0.234	0.031	0.370	0.060	0.487	0.284	0.081	0.433	0.230	0.649	0.446	0.550	0.347	0.649
Front	0.103	0.334	0.255	0.028	0.291	0.052	0.394	0.290	0.063	0.393	0.166	0.589	0.362	0.496	0.269	0.589
Top	-	0.442	0.343	0.057	0.446	-	0.446	0.343	0.057	0.607	0.321	0.785	0.499	0.607	0.321	0.785
Bottom	0.205	0.295	0.191	0.015	-	0.124	0.205	0.272	0.096	0.191	0.015	0.486	0.310	0.396	0.220	0.486
Right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Left	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-21
DSI=0 Max UMPC Body AG Verification

	Configuration	AG0 SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + WLAN/BT SAR (W/kg)
UMPC Body SAR	Back	0.391	0.649	1.040
	Front	0.411	0.589	1.000
	Top	-	0.785	0.785
	Bottom	0.481	0.486	0.967
	Right	0.327	-	0.327
	Left	-	-	0.000

D.10 Reduced UMPC Body (DSI = 0) SAR Antenna Group Analysis

Table D-22
DSI=2 Reduced UMPC Body AG0 Highest Reported SAR

AG0 SAR (W/kg)				
	Configuration	A+B	B	Max
UMPC Body SAR	Back	0.340	0.250	0.340
	Front	0.344	0.253	0.344
	Top	-	-	-
	Bottom	0.274	0.549	0.549
	Right	0.227	0.327	0.327
	Left	-	-	-

Table D-23
DSI=2 Reduced UMPC Body AG Verification

UMPC Body SAR	Configuration	AG0 SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + WLAN/BT SAR (W/kg)
	Back	0.340	0.649	0.989
	Front	0.344	0.589	0.933
	Top	-	0.785	0.785
	Bottom	0.549	0.486	1.035
	Right	0.327	-	0.327
	Left	-	-	0.000

D.11 Max UMPC Extremity (DSI = 0) SAR Antenna Group Analysis

Table D-24
DSI=0 Max UMPC Extremity AG0 Highest Reported SAR

AG0 SAR (W/kg)				
	Configuration	A+B	B	Max
UMPC Extremity SAR	Back	1.989	0.210	1.989
	Front	1.410	0.227	1.410
	Top	-	-	-
	Bottom	1.399	0.250	1.399
	Right	1.324	1.015	1.324
	Left	-	-	-

Table D-25
Simultaneous Transmission Scenarios of WLAN/BT (UMPC Extremity)

Configuration	2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz WLAN Ant 2 at 14 dBm SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 17 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 1 at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 2 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm SAR (W/kg)
	1	2	3	4	5	6	7	8	9	10	11
Back	0.632	0.256	0.817	0.308	1.153	0.586	0.149	0.760	0.481	0.293	0.183
Front	0.557	0.215	0.904	0.384	1.241	0.473	0.214	0.954	0.556	0.155	0.093
Top	-	-	1.317	0.574	1.958	0.870	0.357	1.261	0.887	-	-
Bottom	0.541	0.236	0.435	0.190	1.349	0.525	0.150	-	-	0.251	0.174
Right	-	-	-	-	-	-	-	-	-	-	-
Left	-	-	-	-	-	-	-	-	-	-	-

Configuration	2.4 GHz WLAN 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 Bluetooth Ant 2 SAR (W/kg)	2.4 GHz Bluetooth Ant 1 SAR (W/kg)	2.4 GHz Bluetooth Ant 1 + 2.4 GHz WLAN Ant 2 SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 2 at 12 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 14 dBm + 5 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 14 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz WLAN MIMO at 17 dBm + 5 GHz WLAN MIMO at 17 dBm SAR (W/kg)	2.4 GHz WLAN MIMO at 17 dBm + 6 GHz WLAN MIMO SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 14 dBm + 2.4 GHz WLAN Ant 2 at 14 dBm + 5 GHz WLAN MIMO at 17 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 14 dBm + 2.4 GHz WLAN Ant 2 at 14 dBm + 6 GHz WLAN MIMO SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	1	3	5	7	10	8	8+1	11+5	11+7	9+5	9+7	4+6	4+7	9+2+6	9+2+7	
Back	0.632	0.817	1.153	0.149	0.293	0.760	1.392	1.336	0.332	1.634	0.630	0.894	0.457	1.323	0.886	1.634
Front	0.557	0.904	1.241	0.214	0.155	0.954	1.511	1.334	0.307	1.797	0.770	0.857	0.598	1.244	0.985	1.797
Top	-	1.317	1.958	0.357	-	1.261	1.261	1.958	0.357	2.845	1.244	1.444	0.931	1.757	1.244	2.845
Bottom	0.541	0.435	1.349	0.150	0.251	-	0.541	1.523	0.324	1.349	0.150	0.715	0.340	0.761	0.386	1.523
Right	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Left	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-26
Simultaneous Transmission Scenarios of NFC/UWB (Phablet)

	Configuration	NFC SAR (W/kg)	UWB Ant 0 SAR (W/kg)	UWB Ant 1 SAR (W/kg)	NFC + UWB Ant 0 SAR (W/kg)	NFC + UWB Ant 1 SAR (W/kg)	NFC/UWB Worst-case Combination SAR (W/kg)
UMPC Extremity	Limit	1.6	0	-	1.6	1	0
	Back	0.009	0.000	0.000	0.009	0.009	0.009
	Front	0.000	0.001	0.000	0.001	0.000	0.001
	Top	-	0.000	0.000	0.000	0.000	0.000
	Bottom	-	-	-	-	-	-
	Right	0.000	0.000	-	0.000	0.000	0.000
	Left	-	-	-	-	-	-

Table D-27
DSI=0 Max UMPC Extremity AG Verification

UMPC Extremity SAR	Configuration	AG0 SAR (W/kg)	NFC/UWB Worst-case Combination SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
	Back	1.989	0.009	1.634
	Front	1.410	0.001	1.797
	Top	-	0.000	2.845
	Bottom	1.399	-	1.523
	Right	1.324	0.000	-
	Left	-	-	-

D.12 Reduced UMPC Extremity (DSI = 1) SAR Antenna Group Analysis

Table D-28
DSI=1 Reduced UMPC Extremity AG0 Highest Reported SAR

AG0 SAR (W/kg)				
	Configuration	A+B	B	Max
UMPC Extremity SAR	Back	1.989	0.974	1.989
	Front	1.410	1.220	1.410
	Top	-	-	-
	Bottom	1.399	2.396	2.396
	Right	1.324	1.015	1.324
	Left	-	-	-

Table D-29
DSI=1 Reduced Extremity Body AG Verification

UMPC Extremity SAR	Configuration	AG0 SAR (W/kg)	NFC/UWB Worst-case Combination SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)	AG0 + NFC/UWB Worst-case Combination + WLAN/BT SAR (W/kg)
	Back	1.989	0.009	1.634	3.632
	Front	1.410	0.001	1.797	3.208
	Top	-	0.000	2.845	2.845
	Bottom	2.396	-	1.523	**3.919**
	Right	1.324	0.000	-	1.324
	Left	-	-	-	-

D.13 Conclusion

The above numerical summed SAR results for all of 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 D01v06 and IEEE 1528- 2013 Section 6.3.4.1.