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 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.

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E.3 NP960XMA Body SAR Simultaneous Transmission Analysis

Table E-1
WLAN/BT Highest Reported SAR

Configuration	2.4 GHz WIFI Ant 1 at 14 dBm SAR (W/kg)	2.4 GHz WIFI Ant MIMO at 17 dBm SAR (W/kg)	5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 16 dBm SAR (W/kg)
	1a	1b	1c	1d	2a	2b
Bottom	0.447	0.382	0.673	0.545	0.397	0.430

Table E-2
Simultaneous Transmission Scenarios for WLAN/BT

Configuration	2.4 GHz Bluetooth Ant 0 at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz Bluetooth Ant 1 at 16 dBm SAR (W/kg)	2.4 GHz WIFI Ant 1 at 14 dBm SAR (W/kg)	2.4 GHz WIFI Ant MIMO at 17 dBm SAR (W/kg)	5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz WIFI Ant 1 at 14 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz WIFI Ant 1 at 14 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz WIFI Ant MIMO at 17 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz WIFI Ant MIMO at 17 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz WIFI Ant 1 at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 16 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 16 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz Bluetooth Ant 1 at 16 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz Bluetooth Ant 1 at 16 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz WIFI Ant 1 at 14 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz WIFI Ant 1 at 14 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
Bottom	0.397	0.430	0.827	0.447	0.382	0.673	0.545	1.120	0.992	1.055	0.927	0.844	1.070	0.942	1.103	0.975	1.500	1.372	1.517	1.389	1.517

Notes:

1. 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.4 NP960XMB Body SAR Simultaneous Transmission Analysis

Table E-3
WLAN/BT Highest Reported SAR

Configuration	2.4 GHz WIFI Ant 1 at 14 dBm SAR (W/kg)	2.4 GHz WIFI Ant MIMO at 17 dBm SAR (W/kg)	5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 16 dBm SAR (W/kg)
	1a	1a	1b	1c	1d	2a
Bottom	0.467	0.628	0.663	0.636	0.455	0.404

Table E-4
Simultaneous Transmission Scenarios for WLAN/BT

Configuration	2.4 GHz Bluetooth Ant 0 at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz Bluetooth Ant 1 at 16 dBm SAR (W/kg)	2.4 GHz WIFI Ant 1 at 14 dBm SAR (W/kg)	2.4 GHz WIFI Ant MIMO at 17 dBm SAR (W/kg)	5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz WIFI Ant 1 at 14 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz WIFI Ant 1 at 14 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz WIFI Ant MIMO at 17 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz WIFI Ant MIMO at 17 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz WIFI Ant 1 at 14 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 16 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 1 at 16 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz Bluetooth Ant 1 at 16 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz Bluetooth Ant 1 at 16 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz WIFI Ant 1 at 14 dBm + 5 GHz WIFI Ant MIMO at 16 dBm SAR (W/kg)	2.4 GHz Bluetooth Ant 0 at 16 dBm + 2.4 GHz WIFI Ant 1 at 14 dBm + 6 GHz WIFI Ant MIMO at 12 dBm SAR (W/kg)	WLAN/BT Worst-case Combination SAR (W/kg)
Bottom	0.455	0.404	0.859	0.467	0.628	0.663	0.636	1.130	1.103	1.291	1.264	0.922	1.118	1.091	1.067	1.040	1.522	1.495	1.585	1.558	1.585

Notes:

1. 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 summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is 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 6.3.4.1.2.