APPENDIX E: MULTI-TX AND ANTENNA SAR CONSIDERATIONS

E.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D04v01 3.1.8 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 3.1.8 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. Alternatively, simultaneous transmission SAR test exclusion may be evaluated using Total Exposure Ratio (TER).

E.3 Exposure Ratios

Exposure ratio (ER) for different transmitters is calculated as following:

$$ER_{SAR,n} = \frac{SAR_n}{SAR_{limit,n}}$$

Where:

- SAR_n is the SAR value for the *n*-th transmitter/test frequency
- $SAR_{limit,n}$ is the basic restriction limit that is applicable to the *n*-th transmitter/test frequency

E.4 Head SAR Simultaneous Transmission Analysis

For SAR summation, the highest reported SAR across all housing and wristband types was used as a conservative evaluation for simultaneous transmission analysis.

Note: NFC was evaluated for extremity only based on expected usage conditions.

Table E-1
Simultaneous Transmission Scenario with 2.4 GHz WIFI (Head at 1.0 cm)

Exposure Condition	Configuration	Cellular Band ER	2.4 GHz WIFI ER	∑ ER
		1	2	1+2
Head SAR	Front	0.725	0.153	0.878

Table E-2
Simultaneous Transmission Scenario with 2.4 GHz Bluetooth (Head at 1.0 cm)

Exposure Condition	Configuration	Cellular Band ER	2.4 GHz Bluetooth ER	∑ ER
		1	2	1+2
Head SAR	Front	0.725	0.159	0.884

E.5 Extremity SAR Simultaneous Transmission Analysis

Note: NFC was evaluated for extremity only based on expected usage conditions.

Table E-3
Simultaneous Transmission Scenario with 2.4 GHz WIFI and NFC (Extremity at 0.0 cm)

Exposure Condition	Configuration	Cellular Band ER	2.4 GHz WIFI ER	NFC ER	∑ ER
		1	2	3	1+2+3
Extremity SAR	Back	0.148	0.008	0.000	0.156

Table E-4
Simultaneous Transmission Scenario with 2.4 GHz Bluetooth and NFC (Extremity at 0.0 cm)

Exposure Condition	Configuration	Cellular Band ER	2.4 GHz Bluetooth ER	NFC ER	∑ ER
		1	2	3	1+2+3
Extremity SAR	Back	0.148	0.008	0.000	0.156

E.6 Simultaneous Transmission Conclusion

The above numerical summed TER results for all the worst-case simultaneous transmission conditions were below the TER 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 D04v01.