

## 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.

### 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 physical test configuration is  $\leq 1.6$  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.

Note: In cases where simultaneous transmission scenarios overlap with the same power level (for example, cellular band + 2.4 GHz WIFI and cellular band + 2.4 GHz WIFI + 802.15.4 ab-NB), the most conservative SAR summation scenario was evaluated.

### 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.

In some cases, SAR evaluations at the maximum output power level were used as the most conservative evaluation for simultaneous transmission analysis.

**Table E-1**  
**Simultaneous Transmission Scenario with 2.4 GHz WIFI and 802.15.4 ab-NB (Head at 1.0 cm)**

| Exposure Condition | Configuration | 2.4 GHz WIFI ER | 802.15.4 ab-NB ER | $\Sigma$ ER |
|--------------------|---------------|-----------------|-------------------|-------------|
|                    |               | 1               | 2                 | 1+2         |
| Head SAR           | Front         | 0.177           | 0.000             | 0.177       |

|                    |                                                                                     |                                                                                                                                                                                                                  |                                   |
|--------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
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**Table E-2**  
**Simultaneous Transmission Scenario with 2.4 GHz Bluetooth and 5 GHz WIFI (Head at 1.0 cm)**

| Exposure Condition | Configuration | 2.4 GHz Bluetooth ER | 5 GHz WIFI ER | $\Sigma$ ER |
|--------------------|---------------|----------------------|---------------|-------------|
|                    |               | 1                    | 2             | 1+2         |
| Head SAR           | Front         | 0.161                | 0.119         | 0.280       |

**Table E-3**  
**Simultaneous Transmission Scenario with 2.4 GHz Bluetooth and 802.15.4 ab-NB (Head at 1.0 cm)**

| Exposure Condition | Configuration | 2.4 GHz Bluetooth ER | 802.15.4 ab-NB ER | $\Sigma$ ER |
|--------------------|---------------|----------------------|-------------------|-------------|
|                    |               | 1                    | 2                 | 1+2         |
| Head SAR           | Front         | 0.161                | 0.000             | 0.161       |

## E.5 Extremity 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.

**Table E-4**  
**Simultaneous Transmission Scenario with 2.4 GHz WIFI, 802.15.4 ab-NB, and NFC (Extremity at 0.0 cm)**

| Exposure Condition | Configuration | 2.4 GHz WIFI ER | 802.15.4 ab-NB ER | NFC ER | $\Sigma$ ER |
|--------------------|---------------|-----------------|-------------------|--------|-------------|
|                    |               | 1               | 2                 | 3      | 1+2+3       |
| Extremity SAR      | Back          | 0.009           | 0.000             | 0.000  | 0.009       |

**Table E-5**  
**Simultaneous Transmission Scenario with 2.4 GHz Bluetooth, 5 GHz WIFI, and NFC (Extremity at 0.0 cm)**

| Exposure Condition | Configuration | 2.4 GHz Bluetooth ER | 5 GHz WIFI ER | NFC ER | $\Sigma$ ER |
|--------------------|---------------|----------------------|---------------|--------|-------------|
|                    |               | 1                    | 2             | 3      | 1+2+3       |
| Extremity SAR      | Back          | 0.010                | 0.003         | 0.000  | 0.013       |

**Table E-6**  
**Simultaneous Transmission Scenario with 2.4 GHz Bluetooth, 802.15.4 ab-NB, and NFC (Extremity at 0.0 cm)**

| Exposure Condition | Configuration | 2.4 GHz Bluetooth ER | 802.15.4 ab-NB ER | NFC ER | $\Sigma$ ER |
|--------------------|---------------|----------------------|-------------------|--------|-------------|
|                    |               | 1                    | 2                 | 3      | 1+2+3       |
| Extremity SAR      | Back          | 0.010                | 0.000             | 0.000  | 0.010       |

|                           |                                                                                     |                                                                                                                                                                                                                  |  |                                          |
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## E.6 Simultaneous Transmission 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 D04v01.

|                           |                                                                                     |                                                                                                                                                                                                                  |                                          |
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