

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 other transmitters.

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 ≤ 1.6 W/kg. Alternatively, simultaneous transmission SAR test exclusion may be evaluated using Total Exposure Ratio (TER). The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the TER.

E.3 Exposure Ratios

The exposure ratio (ER), for different transmitters is calculated as following:

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

Where:

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

Compliance with the SAR based RF exposure limits is achieved if $TER_{SAR} \leq 1$. When $TER_{SAR} > 1$, SPLSR is additionally evaluated per below equation:

$$SPLSR = \frac{(ER_j + ER_k)^{1.5}}{R}$$

Where:

- ER_j and ER_k are exposure ratio of transmitter j and k
- R is the distance between transmitter j and k

When SPLSR is ≤ 0.02 for 1g exposure conditions simultaneous SAR evaluation is not required.

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E.4 Body Analysis

Table E-1
Simultaneous Transmission Scenarios of NFC

Body	Configuration	NFC Reader Ratio to Limit	Wireless Charging NFC Ratio to Limit	NFC Reader + Wireless Charging NFC Ratio to Limit
	Back	0.000	0.000	0.000
	Top	0.000	0.000	0.000
	Bottom	0.000	0.000	0.000
	Right	0.000	-	0.000
	Left	0.000	0.000	0.000

Right edge for Wireless Charging NFC antenna was excluded from testing due to equipment limitations

Notes:

1. For all combinations where the sum of NFC Reader + Wireless Charging NFC is less than 1, there's no further analysis required for compliance demonstration.

E.5 Conclusion

The above analysis for all the worst-case simultaneous transmission conditions were below the SAR limit and that simultaneous transmission cases will not exceed the limit and therefore no measured volumetric simultaneous summation is required per FCC KDB Publication 447498 D04v01 and IEEE 1528- 2013 Section 6.3.4.1.

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