Maximum Permissible Exposure to RF (MPE), CFR 1.1310 (e) And Total Sum of MPE Calculation

The maximum exposure level to the public from the RF power of the EUT shall not exceed a power density, **S** as per the respective limits in Table 1 below, at a distance, d, of 20 cm (Mobile condition) from the EUT.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	$*180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

Therefore, for:

MPE for 2404 MHz – 2480 MHz for BLE:

Limit: 1.0 mW/cm^2

Peak Power (dBm) = 7.5 dBm
Gain of Transmit Antenna = +2.64 dB_i

d = Distance = 20 cm = 0.2 m

$$\mathbf{S = (PG/ 4\pi d^2)} =$$
$$= 0.002\ mW/cm^2$$

which is << less than S = 1.0 mW/cm^2

See attached RF Exposure Report # SZ23050028S01 for details.

MPE for 2412 MHz – 2462 MHz for WiFi:

Limit: 1.0 mW/cm^2

Peak Power (dBm) = 16.5 dBm
Gain of Transmit Antenna = +2.64 dB_i

d = Distance = 20 cm = 0.2 m

$S = (PG/ 4\pi d^2)$ =
= 0.016 mW/cm^2

which is << less than S = 1.0 mW/cm^2

See attached RF Exposure Report # SZ23050028S01 for details.

MPE for 2400 MHz – 2500 MHz for Microwave Oven:

Limit: 1.0 mW/cm^2

Signal Strength (V/m) = 3.8 V/m

Power Flux Density (PFD) = $V/m^2/377 = W/m^2$
= $8.14^2/377 = 0.0271$ W/m^2
= (0.0271 W/m^2) (1m^2/W) (0.1 mW/cm^2)
= 0.00271 mW/cm^2

which is << less than S = 1.0 mW/cm^2

See attached US Tech report # 23-0051 for details.

Simultaneous Transmission Collocation considerations:

Please either confirm that the transmitters operate standalone per KDB 447498 D01 v06 section 7.1 or, if the transmitters can transmit simultaneously, include the necessary calculations for simultaneous transmission per KDB 447498 D01 v06 section 7.2.

The Transmitters **do** simultaneously broadcast at the same frequency band, 2400-2483.5 MHz. The device has three radios on board, however two of the radios are Wi-Fi or BLE combo radio and not both can transmit at the same time. The radios that operate at the same time is either one Wi-Fi/BLE radio and Microwave Oven or the other Wi-Fi/BLE and Microwave Oven.

The Wi-Fi and BLE radio share a common antenna. The microwave oven has it's own transmit antenna.

Calculations for simultaneous transmission per KDB 447498 D01 v06 section 7.2 is provided here to show that Simultaneous transmission MPE test exclusion applies since the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0.

Total Sum of MPE:

Sum of the total MPE for Wi-Fi + BLE + Microwave Oven =
0.016 mW/cm^2 + 0.002 mW/cm^2 + 0.00271 mW/cm^2 = **0.0207** which is << less than 1.0

The EUT was tested with all radios ON and active. The emissions generated with a single radio ON and active versus all radios ON and active did not produce additional unwanted spurious emissions or intermodulation that would require additional testing. The radios can be collocated as designed.