

RF MPE EXPOSURE

August 17, 2020
 FCC ID: PWO460060

The MPE calculations for **EUT model 460060** signal booster were done for frequency bands:

- 700 MHz (Band 12)
- 700 MHz (Band 13)
- 800 MHz (Band 5)
- 1900 MHz (Band 2)
- 1700/2100 MHz (Band 4)

Antennas recommended for the EUT:

Port	Frequency Range (MHz)	Antenna Product Number	Coax Product Number	Maximum Antenna Gain (dBi)	Minimum Coax Loss (dB)	Gain – Coax Loss (dB)	Gain - Coax Loss (unitless)
Donor	698-716	314475	951175	7.5	3.1	4.4	2.8
Donor	777-787	314475	951175	7.5	3.3	4.2	2.6
Donor	824-849	314475	951175	7.3	3.4	3.9	2.5
Donor	1710-1785	314473	951175	10.1	5.7	4.4	2.8
Donor	1850-1915	314473	951175	10.6	6	4.6	2.9
Server	728-746	314440	951160	5.8	2.5	3.3	2.1
Server	746-756	314440	951160	5.8	2.7	3.1	2.0
Server	869-894	314440	951160	6.0	2.8	3.2	2.1
Server	1930-1995	314440	951160	7.3	4.8	2.5	1.8
Server	2110-2155	314440	951160	7.6	5.2	2.4	1.7

*Maximum antenna gain and minimum cable losses were selected to compute “worst case” limit and are indicated in the antenna kitting specification for model 460060

EUT Operating Limits

Limits for Uncontrolled Exposure 47 CFR 1.1310 Table 1(B)

Frequency Range (MHz)	Limit (mw/cm ²)
0.3-1.234	100
1.24-30	180/f ²
30-300	0.2
300-1500	f/1500
1500-100,000	1

EUT Operating Limits Evaluation

Port	Frequency Range (MHz)	EUT Maximum Output power (dBm)	EUT Maximum Output power (mw)	Power density limit (mw/cm ²)	Power density evaluation (mw/cm ²)	Minimum safe distance (cm)
Donor	698-716	25.6	363.08	0.47	0.19894	20
Donor	777-787	25.2	331.13	0.52	0.17327	20
Donor	824-849	25.8	380.19	0.55	0.18567	20
Donor	1710-1785	25.2	331.13	1	0.18144	20
Donor	1850-1915	25.2	331.13	1	0.18999	20
Server	728-746	13.6	22.91	0.49	0.00963	20
Server	746-756	13.3	21.38	0.50	0.00858	20
Server	869-894	12.7	18.62	0.58	0.00774	20
Server	1930-1995	12.5	17.78	1	0.00629	20
Server	2110-2155	12.9	19.50	1	0.00674	20

*The lowest frequency in each band was used to compute the “worst case” limit.

NOTE: Simultaneous transmission does not apply to consumer boosters as the output power is capped at 30 dBm EIRP regardless of how many signals are present.

EUT Power Density Evaluation

Calculated power density - Uplink:

Band 12 (698-716 MHz)

Power density is calculated using maximum uplink transmitted power of 363.08 mw and unitless antenna gain less coax loss of 2.8

$$S = \frac{P_t G}{4\pi r^2} = \frac{(363.08)(2.8)}{4\pi 20^2} = 0.198 \text{ (mw/cm}^2\text{)}$$

S = Power Density (mw/cm²)

P_t = Transmitter Power (mw)

G = Antenna Gain (nonlog) * Coax Loss (nonlog) * duty cycle (%)

r = Distance to center of radiation of antenna (cm)

At the minimum safe distance of 20 cm, the power density of the EUT is $0.198 \text{ (mw/cm}^2\text{)}$, which is less than the operational limit of $0.47 \text{ (mw/cm}^2\text{)}$. Therefore, no minimum safe distance calculation is required.

Band 13 (777-787 MHz)

Power density is calculated using maximum uplink transmitted power of 331.13 mw and unitless antenna gain less coax loss of 2.6

$$S = \frac{P_t G}{4\pi r^2} = \frac{(331.13)(2.6)}{4\pi 20^2} = 0.173 \text{ (mw/cm}^2\text{)}$$

S = Power Density (mw/cm²)

P_t = Transmitter Power (mw)

G = Antenna Gain (nonlog) * Coax Loss (nonlog) * duty cycle (%)

r = Distance to center of radiation of antenna (cm)

At the minimum safe distance of 20 cm, the power density of the EUT is $0.173 \text{ (mw/cm}^2\text{)}$, which is less than the operational limit of $0.52 \text{ (mw/cm}^2\text{)}$. Therefore, no minimum safe distance calculation is required.

Band 5 (824-849 MHz)

Power density is calculated using maximum uplink transmitted power of 380.19 mw and unitless antenna gain less coax loss of 2.5

$$S = \frac{P_t G}{4\pi r^2} = \frac{(380.19)(2.5)}{4\pi 20^2} = 0.186 \text{ (mw/cm}^2\text{)}$$

S = Power Density (mw/cm²)

P_t = Transmitter Power (mw)

G = Antenna Gain (nonlog) * Coax Loss (nonlog) * duty cycle (%)

r = Distance to center of radiation of antenna (cm)

At the minimum safe distance of 20 cm, the power density of the EUT is $0.186 \text{ (mw/cm}^2\text{)}$, which is less than the operational limit of $0.55 \text{ (mw/cm}^2\text{)}$. Therefore, no minimum safe distance calculation is required.

Band 4 (1710-1785 MHz)

Power density is calculated using maximum uplink transmitted power of 331.13 mw and unitless antenna gain less coax loss of 2.8

$$S = \frac{P_t G}{4\pi r^2} = \frac{(331.13)(2.8)}{4\pi 20^2} = 0.181 \text{ (mw/cm}^2\text{)}$$

S = Power Density (mw/cm²)

P_t = Transmitter Power (mw)

*G = Antenna Gain (nonlog) * Coax Loss (nonlog) * duty cycle (%)*

r = Distance to center of radiation of antenna (cm)

At the minimum safe distance of 20 cm, the power density of the EUT is 0.181(mw/cm²), which is less than the operational limit of 1 (mw/cm²). Therefore, no minimum safe distance calculation is required.

Band 2 (1850-1915 MHz)

Power density is calculated using maximum uplink transmitted power of 331.13 mw and unitless antenna gain less coax loss of 2.6

$$S = \frac{P_t G}{4\pi r^2} = \frac{(331.13)(2.9)}{4\pi 20^2} = 0.190 \text{ (mw/cm}^2\text{)}$$

S = Power Density (mw/cm²)

P_t = Transmitter Power (mw)

*G = Antenna Gain (nonlog) * Coax Loss (nonlog) * duty cycle (%)*

r = Distance to center of radiation of antenna (cm)

At the minimum safe distance of 20 cm, the power density of the EUT is 0.190 (mw/cm²), which is less than the operational limit of 1 (mw/cm²). Therefore, no minimum safe distance calculation is required.

Calculated power density - Downlink:

Band 12 (728-746 MHz)

Power density is calculated using maximum downlink transmitted power of 22.91 mw and unitless antenna gain less coax loss of 2.1

$$S = \frac{P_t G}{4\pi r^2} = \frac{(22.91)(2.1)}{4\pi 20^2} = 0.010 \text{ (mw/cm}^2\text{)}$$

S = Power Density (mw/cm²)

P_t = Transmitter Power (mw)

$$G = \text{Antenna Gain (nonlog)} * \text{Coax Loss (nonlog)} * \text{duty cycle (\%)} \\ r = \text{Distance to center of radiation of antenna (cm)}$$

At the minimum safe distance of 20 cm, the power density of the EUT is $0.010 \text{ (mw/cm}^2\text{)}$, which is less than the operational limit of $0.49 \text{ (mw/cm}^2\text{)}$. Therefore, no minimum safe distance calculation is required.

Band 13 (746-756 MHz)

Power density is calculated using maximum downlink transmitted power of 21.38 mw and unitless antenna gain less coax loss of 2.0

$$S = \frac{P_t G}{4\pi r^2} = \frac{(21.38)(2.0)}{4\pi 20^2} = 0.009 \text{ (mw/cm}^2\text{)}$$

$$S = \text{Power Density (mw/cm}^2\text{)} \\ P_t = \text{Transmitter Power (mw)} \\ G = \text{Antenna Gain (nonlog)} * \text{Coax Loss (nonlog)} * \text{duty cycle (\%)} \\ r = \text{Distance to center of radiation of antenna (cm)}$$

At the minimum safe distance of 20 cm, the power density of the EUT is $0.009 \text{ (mw/cm}^2\text{)}$, which is less than the operational limit of $0.50 \text{ (mw/cm}^2\text{)}$. Therefore, no minimum safe distance calculation is required.

Band 5 (869-894 MHz)

Power density is calculated using maximum downlink transmitted power of 18.62 mw and unitless antenna gain less coax loss of 2.1

$$S = \frac{P_t G}{4\pi r^2} = \frac{(18.62)(2.1)}{4\pi 20^2} = 0.008 \text{ (mw/cm}^2\text{)}$$

$$S = \text{Power Density (mw/cm}^2\text{)} \\ P_t = \text{Transmitter Power (mw)} \\ G = \text{Antenna Gain (nonlog)} * \text{Coax Loss (nonlog)} * \text{duty cycle (\%)} \\ r = \text{Distance to center of radiation of antenna (cm)}$$

At the minimum safe distance of 20 cm, the power density of the EUT is $0.008 \text{ (mw/cm}^2\text{)}$, which is less than the operational limit of $0.58 \text{ (mw/cm}^2\text{)}$. Therefore, no minimum safe distance calculation is required.

Band 4 (2110-2155 MHz)

Power density is calculated using maximum downlink transmitted power of 19.50 mw and unitless antenna gain less coax loss of 1.7

$$S = \frac{P_t G}{4\pi r^2} = \frac{(19.50)(1.7)}{4\pi 20^2} = 0.007 \text{ (mw/cm}^2\text{)}$$

S = Power Density (mw/cm²)

P_t = Transmitter Power (mw)

*G = Antenna Gain (nonlog) * Coax Loss (nonlog) * duty cycle (%)*

r = Distance to center of radiation of antenna (cm)

At the minimum safe distance of 20 cm, the power density of the EUT is 0.007 (mw/cm²), which is less than the operational limit of 1 (mw/cm²). Therefore, no minimum safe distance calculation is required.

Band 2 (1930-1995 MHz)

Power density is calculated using maximum downlink transmitted power of 17.78 mw and unitless antenna gain less coax loss of 1.8

$$S = \frac{P_t G}{4\pi r^2} = \frac{(17.78)(1.8)}{4\pi 20^2} = 0.006 \text{ (mw/cm}^2\text{)}$$

S = Power Density (mw/cm²)

P_t = Transmitter Power (mw)

*G = Antenna Gain (nonlog) * Coax Loss (nonlog) * duty cycle (%)*

r = Distance to center of radiation of antenna (cm)

At the minimum safe distance of 20 cm, the power density of the EUT is 0.006 (mw/cm²), which is less than the operational limit of 1 (mw/cm²). Therefore, no minimum safe distance calculation is required.

END OF REPORT