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RF MPE EXPOSURE

September 3, 2020
FCC ID: PWO460061

The MPE calculations for **EUT model 460061** 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	314405	904423	3.2	2	1.2	1.32
Donor	777-787	314405	904423	3.2	2	1.2	1.32
Donor	824-849	311215	N/A	1.1	0	1.1	1.29
Donor	1710-1785	311215	N/A	0.8	0	0.8	1.20
Donor	1850-1915	311215	N/A	0.4	0	0.4	1.10
Server	728-746	314401	N/A	2.1	0	2.1	1.62
Server	746-756	311160	N/A	2.6	0	2.6	1.82
Server	869-894	311160	N/A	3.0	0	3.0	2.00
Server	1930-1995	314401	N/A	2.7	0	2.7	1.86
Server	2110-2155	314401	N/A	2.1	0	2.1	1.62

*Maximum antenna gain and minimum cable losses were selected to compute “worst case” limit and are indicated in the antenna kitting specification for model 460061

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

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EUT Operating Limits Evaluation

Port	Frequency Range (MHz)	EUT Maximum Output power (dBm)	EUT Maximum Output power (mw)	Gain - Coax Loss (unitless)	Power density limit (mw/cm^2)	Power density evaluation (mw/cm^2)	Minimum safe distance (cm)
Donor	698-716	25.4	346.74	1.32	0.47	0.091	20
Donor	777-787	25.6	363.08	1.32	0.52	0.095	20
Donor	824-849	25.6	363.08	1.29	0.55	0.093	20
Donor	1710-1785	26.7	467.74	1.20	1	0.112	20
Donor	1850-1915	26.9	489.78	1.10	1	0.107	20
Server	728-746	4.8	3.02	1.62	0.49	0.001	20
Server	746-756	4.8	3.02	1.82	0.50	0.001	20
Server	869-894	4.8	3.02	2.00	0.58	0.001	20
Server	1930-1995	4.5	2.82	1.86	1	0.001	20
Server	2110-2155	4.6	2.88	1.62	1	0.001	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 346.74 mw and unitless antenna gain less coax loss of 1.32

$$S = \frac{P_t G}{4\pi r^2} = \frac{(346.74)(1.32)}{4\pi 20^2} = 0.091\ (mw/cm^2)$$

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

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At the minimum safe distance of 20 cm, the power density of the EUT is 0.091 (mw/cm^2), which is less than the operational limit of 0.47 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

Band 13 (777-787 MHz)
Power density is calculated using maximum uplink transmitted power of 363.08 mw and unitless antenna gain less coax loss of 1.32

$$S = \frac{P_t G}{4\pi r^2} = \frac{(363.08)(1.32)}{4\pi 20^2} = 0.095\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is 0.095 (mw/cm^2), which is less than the operational limit of 0.52 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

Band 5 (824-849 MHz)
Power density is calculated using maximum uplink transmitted power of 363.08 mw and unitless antenna gain less coax loss of 1.29

$$S = \frac{P_t G}{4\pi r^2} = \frac{(363.08)(1.29)}{4\pi 20^2} = 0.093(mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is 0.093 (mw/cm^2), which is less than the operational limit of 0.55 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

Band 4 (1710-1785 MHz)
Power density is calculated using maximum uplink transmitted power of 467.74 mw and unitless antenna gain less coax loss of 1.20

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$$S = \frac{P_t G}{4\pi r^2} = \frac{(467.74)(1.20)}{4\pi 20^2} = 0.112\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.112(mw/cm^2)$, which is less than the operational limit of 1 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

Band 2 (1850-1915 MHz)
Power density is calculated using maximum uplink transmitted power of 489.78 mw and unitless antenna gain less coax loss of 1.10

$$S = \frac{P_t G}{4\pi r^2} = \frac{(489.78)(1.10)}{4\pi 20^2} = 0.107\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.107\ (mw/cm^2)$, which is less than the operational limit of 1 (mw/cm^2). 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 3.02 mw and unitless antenna gain less coax loss of 1.62

$$S = \frac{P_t G}{4\pi r^2} = \frac{(3.02)(1.62)}{4\pi 20^2} = 0.001\ (mw/cm^2)$$

$S = Power\ Density\ (mw/cm^2)$

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$P_t = Transmitter\ Power\ (mw)$
$G = Antenna\ Gain\ (nonlog) * Coax\ Loss\ (nonlog) * duty\ cycle\ (\%)$
$r = Distance\ to\ center\ of\ radiation\ of\ antenna\ (cm)$

At the minimum safe distance of 20 cm, the power density of the EUT is $0.001\ (mw/cm^2)$, which is less than the operational limit of 0.49 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

Band 13 (746-756 MHz)
Power density is calculated using maximum downlink transmitted power of 3.02 mw and unitless antenna gain less coax loss of 1.82

$$S = \frac{P_t G}{4\pi r^2} = \frac{(3.02)(1.82)}{4\pi 20^2} = 0.001\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.001\ (mw/cm^2)$, which is less than the operational limit of 0.50 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

Band 5 (869-894 MHz)
Power density is calculated using maximum downlink transmitted power of 3.02 mw and unitless antenna gain less coax loss of 2.0

$$S = \frac{P_t G}{4\pi r^2} = \frac{(3.02)(2.0)}{4\pi 20^2} = 0.001\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.001\ (mw/cm^2)$, which is less than the operational limit of 0.58 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

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Band 4 (2110-2155 MHz)
Power density is calculated using maximum downlink transmitted power of 2.88 mw and unitless antenna gain less coax loss of 1.62

$$S = \frac{P_t G}{4\pi r^2} = \frac{(2.88)(1.62)}{4\pi 20^2} = 0.001\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.001\ (mw/cm^2)$, which is less than the operational limit of 1 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

Band 2 (1930-1995 MHz)
Power density is calculated using maximum downlink transmitted power of 2.82 mw and unitless antenna gain less coax loss of 1.86

$$S = \frac{P_t G}{4\pi r^2} = \frac{(2.82)(1.86)}{4\pi 20^2} = 0.001\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.001\ (mw/cm^2)$, which is less than the operational limit of 1 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

END OF REPORT