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RF MPE EXPOSURE

June 24, 2020
FCC ID: PWO460059

The MPE calculations for **EUT model 460059** 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 (unitless)
Donor	698-716	314475	YX030-15W	7.5	2.6	3.1
Donor	777-787	314475	YX030-15W	7.5	2.6	3.1
Donor	824-849	314475	YX030-15W	7.3	2.8	2.8
Donor	1710-1785	314445	YX030-15W	8.9	4.3	2.9
Donor	1850-1915	314475	YX030-15W	8.8	4.6	2.6
Server	728-746	314440	950630	5.8	2.6	2.1
Server	746-756	314440	950630	5.8	2.6	2.1
Server	869-894	314440	950630	6.0	2.8	2.1
Server	1930-1995	314440	950630	7.3	4.6	2.0
Server	2110-2155	314440	950630	7.6	5	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 460059

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 (mw)	Power density limit (mw/cm^2)	Power density evaluation (mw/cm^2)	Minimum safe distance (cm)
Donor	698-716	24.8 (302.0)	0.47	0.186	20
Donor	777-787	25.0 (316.2)	0.52	0.194	20
Donor	824-849	25.3 (338.8)	0.55	0.190	20
Donor	1710-1785	25.2 (331.1)	1	0.190	20
Donor	1850-1915	25.1 (323.6)	1	0.169	20
Server	728-746	12.7 (18.6)	0.49	0.008	20
Server	746-756	12.3 (17.0)	0.50	0.007	20
Server	869-894	12.8 (19.1)	0.58	0.008	20
Server	1930-1995	12.6 (18.2)	1	0.007	20
Server	2110-2155	12.8 (19.1)	1	0.007	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 302.0 mw and unitless antenna gain less coax loss of 3.1

$$S = \frac{P_t G}{4\pi r^2} = \frac{(302.0)(3.1)}{4\pi 20^2} = 0.186\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is 0.186 (mw/cm^2), which is less than the operational limit of 0.47 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

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Band 13 (777-787 MHz)
Power density is calculated using maximum uplink transmitted power of 316.2 mw and unitless antenna gain less coax loss of 3.1

$$S = \frac{P_t G}{4\pi r^2} = \frac{(316.2)(3.1)}{4\pi 20^2} = 0.194\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.194\ (mw/cm^2)$, 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 338.8 mw and unitless antenna gain less coax loss of 2.8

$$S = \frac{P_t G}{4\pi r^2} = \frac{(338.8)(2.8)}{4\pi 20^2} = 0.190\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.190\ (mw/cm^2)$, 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 331.1 mw and unitless antenna gain less coax loss of 2.9

$$S = \frac{P_t G}{4\pi r^2} = \frac{(331.1)(2.9)}{4\pi 20^2} = 0.190\ (mw/cm^2)$$

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

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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 0.190 (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 323.6 mw and unitless antenna gain less coax loss of 2.6

$$S = \frac{P_t G}{4\pi r^2} = \frac{(323.6)(2.6)}{4\pi 20^2} = 0.169\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is 0.169 (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 uplink transmitted power of 18.6 mw and unitless antenna gain less coax loss of 2.1

$$S = \frac{P_t G}{4\pi r^2} = \frac{(18.6)(2.1)}{4\pi 20^2} = 0.008\ (mw/cm^2)$$

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

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At the minimum safe distance of 20 cm, the power density of the EUT is 0.008 (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 uplink transmitted power of 17.0 mw and unitless antenna gain less coax loss of 2.1

$$S = \frac{P_t G}{4\pi r^2} = \frac{(17.0)(2.1)}{4\pi 20^2} = 0.007\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is 0.007 (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 uplink transmitted power of 19.1 mw and unitless antenna gain less coax loss of 2.1

$$S = \frac{P_t G}{4\pi r^2} = \frac{(19.1)(2.1)}{4\pi 20^2} = 0.008\ (mw/cm^2)$$

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

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

Band 4 (2110-2155 MHz)
Power density is calculated using maximum uplink transmitted power of 19.1 mw and unitless antenna gain less coax loss of 1.7

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$$S = \frac{P_t G}{4\pi r^2} = \frac{(19.1)(1.7)}{4\pi 20^2} = 0.007\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.007\ (mw/cm^2)$, 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 uplink transmitted power of 18.2 mw and unitless antenna gain less coax loss of 2.0

$$S = \frac{P_t G}{4\pi r^2} = \frac{(18.2)(2)}{4\pi 20^2} = 0.007\ (mw/cm^2)$$

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

At the minimum safe distance of 20 cm, the power density of the EUT is $0.007\ (mw/cm^2)$, which is less than the operational limit of 1 (mw/cm^2). Therefore, no minimum safe distance calculation is required.

END OF REPORT