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December 5, 2013

Subject: RF MPE EXPOSURE

Re: FCC ID: PWO460007

To Whom It May Concern:

The MPE calculations for model 460007 signal booster were done for each frequency band: 1700 MHz, 800 MHz, 700 MHz Band 13, 700 MHz Band 12, and 1900 MHz. For each band two calculations were done; these included the different possibilities of antennas that may be connected to this signal booster: fixed and mobile outside antennas. The order of the attached calculations is as follows:

1700 MHz band:

1. Fixed Outside Antenna: 314453-40075
2. Mobile Outside Antenna: 311114

800 MHz band:

3. Fixed Outside Antenna: 311124-400100
4. Mobile Outside Antenna: 311104

700 MHz band 13:

5. Fixed Outside Antenna: 314411-40075
6. Mobile Outside Antenna: 314203

700 MHz band 12:

7. Fixed Outside Antenna: 314411-40075
8. Mobile Outside Antenna: 301126

1900 MHz band:

9. Fixed Outside Antenna: 314473-0640
10. Mobile Outside Antenna: 311101

Radiation Safety

11. Calculated Combined Power Density

A booster's uplink power must not exceed 1 watt equivalent isotropic radiated power (EIRP) for each band of operation. Composite downlink power must not exceed 0.05 watt EIRP for each band of operation (20.21(e)(8)(i)(D)). The following formula was used to calculate the equivalent isotropic radiated power:

$$\text{EIRP} = \text{Power Out (Watts)} * \text{Duty Cycle Percent} * \text{Antenna Gain (non-log)} * \text{Coax loss (non-log)}$$

The power density (mW/cm^2) is calculated using the following formula:

$$\text{Calculated Power Density} = 1000 * \text{EIRP (Watts)} / (4 * \pi * (\text{Distance from Antenna (cm)}^2))$$

Sincerely,

A handwritten signature in black ink, appearing to read 'P. L. Cook', written in a cursive style.

Patrick L. Cook

Senior Research and Development Engineer



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	1710
Pout Watts	0.15849
Duty Cycle Percent	100.0%
Ant. Gain dBi	8.20
Coax Loss dB	4.39
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	3.81
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.3811
FCC Power Density Limit (mw/cm ²)	1.00
Calculated Power Density (mw/cm ²)	0.0735

REFERENCE DATA

Pout dBm	22.00
Antenna Gain (non-log)	6.61
Coax loss (non-log)	0.36
General FCC Limit (mw/cm ²)	1.00

Antenna # 314453-40075



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	1710
Pout Watts	0.15849
Duty Cycle Percent	100.0%
Ant. Gain dBi	2.57
Coax Loss dB	0.00
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	2.57
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.2864
FCC Power Density Limit (mw/cm ²)	1.00
Calculated Power Density (mw/cm ²)	0.0553

REFERENCE DATA

Pout dBm	22.00
Antenna Gain (non-log)	1.81
Coax loss (non-log)	1.00
General FCC Limit (mw/cm ²)	1.00

Antenna # 311114



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	824
Pout Watts	0.30903
Duty Cycle Percent	100.0%
Ant. Gain dBi	9.60
Coax Loss dB	4.70
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	4.90
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.9550
FCC Power Density Limit (mw/cm ²)	0.55
Calculated Power Density (mw/cm ²)	0.1842

REFERENCE DATA

Pout dBm	24.90
Antenna Gain (non-log)	9.12
Coax loss (non-log)	0.34
General FCC Limit (mw/cm ²)	f/1500

Antenna # 311124-400100



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	824
Pout Watts	0.30903
Duty Cycle Percent	100.0%
Ant. Gain dBi	2.48
Coax Loss dB	0.00
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	2.48
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.5470
FCC Power Density Limit (mw/cm ²)	0.55
Calculated Power Density (mw/cm ²)	0.1055

REFERENCE DATA

Pout dBm	24.90
Antenna Gain (non-log)	1.77
Coax loss (non-log)	1.00
General FCC Limit (mw/cm ²)	f/1500

Antenna # 311104



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	776
Pout Watts	0.20370
Duty Cycle Percent	100.0%
Ant. Gain dBi	7.20
Coax Loss dB	3.00
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	4.20
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.5358
FCC Power Density Limit (mw/cm ²)	0.52
Calculated Power Density (mw/cm ²)	0.1034

REFERENCE DATA

Pout dBm	23.09
Antenna Gain (non-log)	5.25
Coax loss (non-log)	0.50
General FCC Limit (mw/cm ²)	f/1500

Antenna # 314411-40075



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	776
Pout Watts	0.20370
Duty Cycle Percent	100.0%
Ant. Gain dBi	0.48
Coax Loss dB	0.00
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	0.48
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.2275
FCC Power Density Limit (mw/cm ²)	0.52
Calculated Power Density (mw/cm ²)	0.0439

REFERENCE DATA

Pout dBm	23.09
Antenna Gain (non-log)	1.12
Coax loss (non-log)	1.00
General FCC Limit (mw/cm ²)	f/1500

Antenna # 314203



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	698
Pout Watts	0.27227
Duty Cycle Percent	100.0%
Ant. Gain dBi	7.30
Coax Loss dB	2.80
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	4.50
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.7674
FCC Power Density Limit (mw/cm ²)	0.47
Calculated Power Density (mw/cm ²)	0.1480

REFERENCE DATA

Pout dBm	24.35
Antenna Gain (non-log)	5.37
Coax loss (non-log)	0.52
General FCC Limit (mw/cm ²)	f/1500

Antenna # 314411-40075



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	698
Pout Watts	0.27227
Duty Cycle Percent	100.0%
Ant. Gain dBi	-0.36
Coax Loss dB	0.00
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	-0.36
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.2506
FCC Power Density Limit (mw/cm ²)	0.47
Calculated Power Density (mw/cm ²)	0.0483

REFERENCE DATA

Pout dBm	24.35
Antenna Gain (non-log)	0.92
Coax loss (non-log)	1.00
General FCC Limit (mw/cm ²)	f/1500

Antenna # 301126



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	1850
Pout Watts	0.18578
Duty Cycle Percent	100.0%
Ant. Gain dBi	10.00
Coax Loss dB	5.26
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	4.74
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.5534
FCC Power Density Limit (mw/cm ²)	1.00
Calculated Power Density (mw/cm ²)	0.1068

REFERENCE DATA

Pout dBm	22.69
Antenna Gain (non-log)	10.00
Coax loss (non-log)	0.30
General FCC Limit (mw/cm ²)	1.00

Antenna # 314473-0640



Minimum Safe Distance From Antennas

Based upon FCC OET Bulletin 65 and other FCC Sources

INPUT DATA

Frequency MHz	1850
Pout Watts	0.18578
Duty Cycle Percent	100.0%
Ant. Gain dBi	6.12
Coax Loss dB	0.00
Distance From Antenna In cm	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	6.12
Distance From Antenna In Inches	8.00
EIRP (Watts)	0.7603
FCC Power Density Limit (mw/cm ²)	1.00
Calculated Power Density (mw/cm ²)	0.1467

REFERENCE DATA

Pout dBm	22.69
Antenna Gain (non-log)	4.09
Coax loss (non-log)	1.00
General FCC Limit (mw/cm ²)	1.00

Antenna # 311101



Radiation Safety - Combined Radiation From Amplifier and Cell Phone

Calculated Power Density and Minimum Safe Distance For Cellular Phones (Uplink)

INPUT DATA

Frequency MHz (Uplink)	698	776	1710	824	1850
Radiated Power (Watts)	1.00000	1.00000	1.00000	1.00000	1.00000
Duty Cycle Percent	100.0%	100.0%	100.0%	100.0%	100.0%
Distance From Antenna In cm	20.3	20.3	20.3	20.3	20.3

RESULTS OF CALCULATIONS

Distance From Antenna In Inches	8.00	8.00	8.00	8.00	8.00
EIRP (Watts)	1.0000	1.0000	1.0000	1.0000	1.0000
FCC Power Density Limit (mw/cm ²)	0.47	0.52	1.00	0.55	1.00
Calculated Power Density (mw/cm ²)	0.19	0.19	0.19	0.19	0.19

Calculated Power Density and Minimum Safe Distance For Amplifier (Downlink)

Frequency MHz	729	746	2110	869	1930
Pout Watts	2.52E-06	1.67E-06	2.19E-06	1.87E-06	2.08E-06
Duty Cycle Percent	100.0%	100.0%	100.0%	100.0%	100.0%
Ant. Gain dBi	-5.00	-5.00	0.70	2.60	1.50
Coax Loss dB	0.00	0.00	0.00	0.00	0.00
Distance From Antenna In cm	20.3	20.3	20.3	20.3	20.3

RESULTS OF CALCULATIONS

Ant. Gain less Coax Loss dBi	-5.00	-5.00	0.70	2.60	1.50
Distance From Antenna In Inches	8.00	8.00	8.00	8.00	8.00
EIRP (Watts)	7.96E-07	5.30E-07	2.57E-06	3.41E-06	2.94E-06
FCC Power Density Limit (mw/cm ²)	0.49	0.50	1.00	0.58	1.00
Calculated Power Density (mw/cm ²)	1.54E-07	1.02E-07	4.96E-07	6.58E-07	5.67E-07

Calculated Combined Power Density and For Amplifier and Phone at 20.31 cm (8.0 in.)

(Determined by Most limiting factors)

FCC Power Density Limit (mw/cm ²)	0.47	0.50	1.00	0.55	1.00
Combined Power Density for Phone and Amp (mw/cm ²)	0.19	0.19	0.19	0.19	0.19