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October 6, 2016

Subject: Antenna Kitting

Re: FCC ID: PWO460023

To Whom It May Concern:

The antenna kitting options for model 460023 signal booster were done for 34 Outside Antenna kit options and 17 Inside Antenna kit options. The order of the attached calculations is as follows:

Outside Antenna Kit Options:

1. Kit 314411-40075
2. Kit 314411-5825
3. Kit 314475-0630
4. Kit 301111-0675
5. Kit 301111-5850
6. Kit 311203-40020
7. Kit 311129-400100
8. Kit 311129-5840
9. Kit 311129-0660
10. Kit 311124-0650
11. Kit 311124-400100
12. Kit 314453-5825
13. Kit 311203-5820
14. Kit 311201-0620
15. Kit 301126
16. Kit 301111-11140
17. Kit 311201-1120
18. Kit 311129-11110
19. Kit 314453-40075

20. Kit 314473-0640

21. Kit 311141-0620
22. Kit 311124-1180
23. Kit 311141-1120
24. Kit 314473-1175
25. Kit 314475-1175
26. Kit 301111-400170
27. Kit 311124-5830
28. Kit 304421-1120
29. Kit 304421-17410
30. Kit 304421-0610
31. Kit 304421-5810
32. Kit 304422-40020
33. Kit 304422-5810
34. Kit 304422-1120

Inside Antenna Kit Options:

1. Kit 311135-400150
2. Kit 311135-5840
3. Kit 311155-0670
4. Kit 301121-40050
5. Kit 301151-0630
6. Kit 309900-50N40090
7. Kit 309902-75F0650
8. Kit 309903-75F1180
9. Kit 309904-75F5830
10. Kit 309905-50N17490
11. Kit 311155-11120
12. Kit 301151-1140
13. Kit 304412-400100
14. Kit 304412-5830
15. Kit 304419-1175
16. Kit 304419-17450
17. Kit 304419-0650

All equivalent antennas, cables, and accessories are suitable for use with 460023 signal booster.

Sincerely,

A handwritten signature in black ink, appearing to read 'Patrick L. Cook', written over a light blue horizontal line.

Patrick L. Cook
Chief Technology Officer



Fixed Outside Antenna Kit Options

FCC ID:

PWO460023

Final Output Power Limited to 30 dBm EIRP in all frequency bands

Uplink Frequency (MHz)	698-716	777-787	824-849	1710-1755	1850-1915
Uplink Output Power (dBm)	25.4	25.5	24.8	25.8	25.2

1 Wide Band Directional Antenna With 75' LMR 400 314411-40075

Antenna Gains (dBi)	7.3	7.2	7.8	7.9	9.1
Coax Loss (dB)	2.8	3.0	3.6	4.4	5.4
Final Gain less Loss (dB)	4.5	4.2	4.2	3.5	3.7
Output Power plus Final Gain (dBm EIRP)	29.9	29.7	29	29.3	28.9

2 Wide Band Directional Antenna With 25' RG-58 314411-5825

Antenna Gains (dBi)	7.3	7.2	7.8	7.9	9.1
Coax Loss (dB)	2.9	3.1	3.2	5.1	5.4
Final Gain less Loss (dB)	4.4	4.1	4.6	2.8	3.7
Output Power plus Final Gain (dBm EIRP)	29.8	29.6	29.4	28.6	28.9

3 Wide Band Directional Antenna With 30' RG-6 314475-0630

Antenna Gains (dBi)	7.3	7.2	7.8	7.9	9.1
Coax Loss (dB)	3.0	3.2	3.4	5.1	5.3
Final Gain less Loss (dB)	4.3	4	4.4	2.8	3.8
Output Power plus Final Gain (dBm EIRP)	29.7	29.5	29.2	28.6	29.0

4 Yagi Antenna 301111 With 75' RG-6 301111-0675

Antenna Gains (dBi)	10.0	10.0	10.8	-6.8	-13.8
Coax Loss (dB)	5.7	6.075	6.3	9.525	9.975
Final Gain less Loss (dB)	4.3	3.925	4.5	-16.325	-23.775
Output Power plus Final Gain (dBm EIRP)	29.7	29.4	29.3	9.5	1.4

5 Yagi Antenna 301111 With 50' RG-58 301111-5850

Antenna Gains (dBi)	10.0	10.0	10.8	-6.8	-13.8
Coax Loss (dB)	5.8	6.2	6.5	10.3	10.7
Final Gain less Loss (dB)	4.2	3.8	4.3	-17.1	-24.5
Output Power plus Final Gain (dBm EIRP)	29.6	29.3	29.1	8.7	0.7

6 Omni Directional Antenna (311203) With 20' LMR 400 311203-40020

Antenna Gains (dBi)	-1.5	-0.24	0.57	-2.51	5.09
Coax Loss (dB)	0.7	0.7	0.7	1.1	1.1
Final Gain less Loss (dB)	-2.2	-0.94	-0.13	-3.61	4.0
Output Power plus Final Gain (dBm EIRP)	23.2	24.6	24.7	22.2	29.2



Fixed Outside Antenna Kit Options

FCC ID:

PWO460023

Final Output Power Limited to 30 dBm EIRP in all frequency bands

Uplink Frequency (MHz)	698-716	777-787	824-849	1710-1755	1850-1915
Uplink Output Power (dBm)	25.4	25.5	24.8	25.8	25.2

7 Yagi Antenna 311129 With 100' LMR 400 311129-400100

Antenna Gains (dBi)	1.95	7.18	9.64	-6.67	-11.97
Coax Loss (dB)	3.7	3.9	4.9	5.8	7.1
Final Gain less Loss (dB)	-1.75	3.28	4.74	-12.47	-19.07
Output Power plus Final Gain (dBm EIRP)	23.7	28.8	29.5	13.3	6.1

8 Yagi Antenna 311129 With 40' RG-58 311129-5840

Antenna Gains (dBi)	1.95	7.18	9.64	-6.67	-11.97
Coax Loss (dB)	4.6	5.0	5.2	8.2	8.6
Final Gain less Loss (dB)	-2.7	2.2	4.4	-14.9	-20.6
Output Power plus Final Gain (dBm EIRP)	22.8	27.7	29.2	10.9	4.6

9 Yagi Antenna 311129 With 60' RG-6 311129-0660

Antenna Gains (dBi)	1.95	7.18	9.64	-6.67	-11.97
Coax Loss (dB)	4.56	4.86	5.0	7.6	8.0
Final Gain less Loss (dB)	-2.61	2.32	4.64	-14.29	-19.95
Output Power plus Final Gain (dBm EIRP)	22.8	27.8	29.4	11.5	5.3

10 Yagi Antenna 311124 With 50' RG-6 311124-0650

Antenna Gains (dBi)	-18.7	-18.7	-23.4	9.1	10.9
Coax Loss (dB)	3.8	4.05	4.2	6.4	6.7
Final Gain less Loss (dB)	-22.50	-22.75	-27.60	2.75	4.25
Output Power plus Final Gain (dBm EIRP)	2.9	2.8	-2.8	28.6	29.5

11 Yagi Antenna 311124 With 100' LMR 400 311124-400100

Antenna Gains (dBi)	-18.7	-18.7	-23.4	9.1	10.9
Coax Loss (dB)	3.7	3.9	4.7	5.8	7.1
Final Gain less Loss (dB)	-22.4	-22.6	-28.1	3.3	3.8
Output Power plus Final Gain (dBm EIRP)	3	2.9	-3.3	29.1	29

12 Panel Antenna With 25' RG-58 314453-5825

Antenna Gains (dBi)	3.84	3.63	4.4	8.21	10.04
Coax Loss (dB)	2.9	3.1	3.2	5.1	5.4
Final Gain less Loss (dB)	0.9	0.5	1.2	3.1	4.6
Output Power plus Final Gain (dBm EIRP)	26.3	26.0	26.0	28.9	29.8



Fixed Outside Antenna Kit Options

FCC ID:

PWO460023

Final Output Power Limited to 30 dBm EIRP in all frequency bands

Uplink Frequency (MHz)	698-716	777-787	824-849	1710-1755	1850-1915
Uplink Output Power (dBm)	25.4	25.5	24.8	25.8	25.2

13 Omni Directional Antenna (311203) With 20' RG-58 311203-5820

Antenna Gains (dBi)	-1.5	-0.24	0.57	-2.51	5.09
Coax Loss (dB)	2.3	2.5	2.6	4.1	4.3
Final Gain less Loss (dB)	-3.8	-2.74	-2.03	-6.61	0.79
Output Power plus Final Gain (dBm EIRP)	21.6	22.8	22.8	19.2	26.0

14 Omni Directional Antenna (311201) With 20' RG-6 311201-0620

Antenna Gains (dBi)	-1.5	-0.24	0.57	-2.51	5.09
Coax Loss (dB)	1.5	1.6	1.7	2.5	2.7
Final Gain less Loss (dB)	-3	-1.84	-1.13	-5.01	2.39
Output Power plus Final Gain (dBm EIRP)	22.4	23.7	23.7	20.8	27.6

15 Mini-Mag Antenna With 12.5' RG-174 301126

Antenna Gains (dBi)	-1.42	-1.69	-1.4	-0.59	0.42
Coax Loss (dB)	2.8	3.0	3.7	4.5	4.7
Final Gain less Loss (dB)	-4.22	-4.69	-5.1	-5.09	-4.28
Output Power plus Final Gain (dBm EIRP)	21.2	20.8	19.7	20.7	20.9

16 Yagi 301111 With 140' RG-11 301111-11140

Antenna Gains (dBi)	10	10	10.8	-6.8	-14.9
Coax Loss (dB)	5.76	6.17	6.43	10.36	10.94
Final Gain less Loss (dB)	4.24	3.83	4.37	-17.16	-25.84
Output Power plus Final Gain (dBm EIRP)	29.6	29.3	29.2	8.6	-0.6

17 Omni Directional Antenna 311201 With 20' RG-11 311201-1120

Antenna Gains (dBi)	-1.5	-0.2	0.6	-2.5	5.1
Coax Loss (dB)	0.8	0.9	0.9	1.5	1.6
Final Gain less Loss (dB)	-2.32	-1.12	-0.34	-3.99	3.53
Output Power plus Final Gain (dBm EIRP)	23.1	24.4	24.5	21.8	28.7

18 Yagi 311129 With 110' RG-11 311129-11110

Antenna Gains (dBi)	2	7.2	9.6	-6.7	-12
Coax Loss (dB)	4.6	4.8	5.0	8.1	8.6
Final Gain less Loss (dB)	-2.55	2.36	4.63	-14.81	-20.57
Output Power plus Final Gain (dBm EIRP)	22.9	27.9	29.4	11.0	4.6



Fixed Outside Antenna Kit Options

FCC ID:

PWO460023

Final Output Power Limited to 30 dBm EIRP in all frequency bands

Uplink Frequency (MHz)	698-716	777-787	824-849	1710-1755	1850-1915
Uplink Output Power (dBm)	25.4	25.5	24.8	25.8	25.2

19 Panel Antenna With 75' LMR 400 314453-40075

Antenna Gains (dBi)	3.84	3.63	4.4	8.21	10.04
Coax Loss (dB)	2.8	3.0	3.6	4.4	5.4
Final Gain less Loss (dB)	1.04	0.63	0.8	3.81	4.64
Output Power plus Final Gain (dBm EIRP)	26.4	26.1	25.6	29.6	29.8

20 Panel Antenna With 40' RG-6 314473-0640

Antenna Gains (dBi)	3.84	3.63	4.4	8.21	10.04
Coax Loss (dB)	3.0	3.2	3.4	5.1	5.3
Final Gain less Loss (dB)	0.84	0.43	1.0	3.11	4.74
Output Power plus Final Gain (dBm EIRP)	26.2	25.9	25.8	28.9	29.9

21 Grey Brick w/20' RG-6 311141-0620

Antenna Gains (dBi)	-2.9	-0.6	1.2	-0.4	5.5
Coax Loss (dB)	1.5	1.6	1.7	2.5	2.7
Final Gain less Loss (dB)	-4.4	-2.2	-0.5	-2.9	2.8
Output Power plus Final Gain (dBm EIRP)	21	23.3	24.3	22.9	28.0

22 Yagi 311124 With 80' RG-11 311124-1180

Antenna Gains (dBi)	-18.7	-18.7	-23.4	9.1	10.9
Coax Loss (dB)	3.3	3.5	3.6	5.9	6.3
Final Gain less Loss (dB)	-21.97	-22.20	-27.00	3.18	4.65
Output Power plus Final Gain (dBm EIRP)	3.43	3.3	-2.2	29.0	29.9

23 Grey Panel With 20' RG-11 311141-1120

Antenna Gains (dBi)	-2.9	-0.6	1.2	-0.4	5.5
Coax Loss (dB)	0.9	0.9	1.0	1.5	1.6
Final Gain less Loss (dB)	-3.75	-1.48	0.25	-1.88	3.94
Output Power plus Final Gain (dBm EIRP)	21.7	24.0	25.1	23.9	29.1

24 Panel Antenna With 75' RG-11 314473-1175

Antenna Gains (dBi)	3.8	3.6	4.4	8.2	10
Coax Loss (dB)	3.0	3.3	3.4	5.5	5.8
Final Gain less Loss (dB)	0.77	0.34	0.98	2.66	4.18
Output Power plus Final Gain (dBm EIRP)	26.2	25.8	25.8	28.5	29.4



Fixed Outside Antenna Kit Options

FCC ID:

PWO460023

Final Output Power Limited to 30 dBm EIRP in all frequency bands

Uplink Frequency (MHz)	698-716	777-787	824-849	1710-1755	1850-1915
Uplink Output Power (dBm)	25.4	25.5	24.8	25.8	25.2

25 Wide Band Directional Antenna With 75' RG-11 314475-1175

Antenna Gains (dBi)	7.3	7.2	7.8	7.9	9.1
Coax Loss (dB)	3.07	3.3	3.42	5.55	5.9
Final Gain less Loss (dB)	4.23	3.91	4.38	2.35	3.24
Output Power plus Final Gain (dBm EIRP)	29.6	29.4	29.2	28.2	28.4

26 Yagi Antenna 301111 With 170' LMR 400 301111-400170

Antenna Gains (dBi)	10.0	10.0	10.8	-6.8	-13.8
Coax Loss (dB)	5.8	6.1	6.3	9.4	9.8
Final Gain less Loss (dB)	4.2	3.9	4.5	-16.2	-23.6
Output Power plus Final Gain (dBm EIRP)	29.6	29.4	29.3	9.6	1.6

27 Yagi Antenna 311124 With 30' RG-58 311124-5830

Antenna Gains (dBi)	-18.7	-18.7	-23.4	9.1	10.9
Coax Loss (dB)	3.5	3.7	3.9	6.2	6.4
Final Gain less Loss (dB)	-22.2	-22.4	-27.3	2.9	4.5
Output Power plus Final Gain (dBm EIRP)	3.2	3.1	-2.5	28.7	29.7

28 Omni Consumer 304421 With 20' RG-11 304421-1120

Antenna Gains (dBi)	1.9	0.0	1.16	5.11	3.81
Coax Loss (dB)	0	0	0.0	1.3	0
Final Gain less Loss (dB)	1.9	0.02	1.16	3.81	3.81
Output Power plus Final Gain (dBm EIRP)	27.3	25.5	26.0	29.6	29.0

29 Omni Consumer 304421 With 10' RG-174 304421-17410

Antenna Gains (dBi)	1.9	0.0	1.16	5.11	3.81
Coax Loss (dB)	0	0	0.0	1.3	0
Final Gain less Loss (dB)	1.9	0.02	1.16	3.81	3.81
Output Power plus Final Gain (dBm EIRP)	27.3	25.5	26.0	29.6	29.0

30 Omni Consumer 304421 With 10' RG-6 304421-0610

Antenna Gains (dBi)	1.9	0.0	1.16	5.11	3.81
Coax Loss (dB)	0	0	0.0	1.3	0
Final Gain less Loss (dB)	1.9	0.02	1.16	3.81	3.81
Output Power plus Final Gain (dBm EIRP)	27.3	25.5	26.0	29.6	29.0



Fixed Outside Antenna Kit Options

FCC ID:

PWO460023

Final Output Power Limited to 30 dBm EIRP in all frequency bands

Uplink Frequency (MHz)	698-716	777-787	824-849	1710-1755	1850-1915
Uplink Output Power (dBm)	25.4	25.5	24.8	25.8	25.2

31 Omni Consumer 304421 With 10' RG-58 304421-5810

Antenna Gains (dBi)	1.9	0.0	1.16	5.11	3.81
Coax Loss (dB)	0	0	0.0	1.3	0
Final Gain less Loss (dB)	1.9	0.02	1.16	3.81	3.81
Output Power plus Final Gain (dBm EIRP)	27.3	25.5	26.0	29.6	29.0

32 Omni Enterprise 304422 With 20' LMR 400 304422-40020

Antenna Gains (dBi)	1.33	1.02	1.34	4.76	4.65
Coax Loss (dB)	0.0	0.0	0.0	1.0	0.0
Final Gain less Loss (dB)	1.3	1.0	1.3	3.81	4.7
Output Power plus Final Gain (dBm EIRP)	1.3	1.0	1.3	3.8	4.7

33 Omni Enterprise 304422 With 10' RG-58 304422-5810

Antenna Gains (dBi)	1.33	1.02	1.34	4.76	4.65
Coax Loss (dB)	0.0	0.0	0.0	1.0	0.0
Final Gain less Loss (dB)	1.3	1.0	1.3	3.81	4.7
Output Power plus Final Gain (dBm EIRP)	1.3	1.0	1.3	3.8	4.7

34 Omni Enterprise 304422 With 20' RG-11 304422-1120

Antenna Gains (dBi)	1.33	1.02	1.34	4.76	4.65
Coax Loss (dB)	0.0	0.0	0.0	1.0	0.0
Final Gain less Loss (dB)	1.3	1.0	1.3	3.81	4.7
Output Power plus Final Gain (dBm EIRP)	1.3	1.0	1.3	3.8	4.7



FCC ID: PWO460023

Uplink Frequency Band (MHz)	698-716	777-787	824-849	1710-1755	1850-1910
Measured Uplink Gain (dB)	56.4	54.70	59.50	63.30	64.90
Measured RSSI Shutoff (dBm/MHz)	-45.40	-45.40	-45.10	-51.00	-53.80
MSCL Minimum (dB)	32.00	33.30	33.40	32.30	33.10
6' Separation Distance Path Loss (dB)	34.70	35.57	36.16	42.48	43.21
Polarity Loss	3.0	3.0	3.0	3.0	3.0
Max Antenna Gain Less Cable Loss (dB)	-0.30	-0.73	-0.24	0.30	2.30

1 Inside Antenna Kit 311135-400150: Panel w/150' LMR 400

Antenna Gain Less Cable Loss (dB)	-1.35	-1.85	-2.36	-0.01	-0.14
	okay	okay	okay	okay	okay
Margin (dB)	-1.05	-1.12	-2.12	-0.31	-2.44

2 Inside Antenna Kit 311135-5840: Panel w/40' RG-58

Antenna Gain Less Cable Loss (dB)	-0.80	-1.35	-0.77	-0.02	1.47
	okay	okay	okay	okay	okay
Margin (dB)	-0.50	-0.62	-0.53	-0.32	-0.83

3 Inside Antenna Kit 311155-0670: Panel w/70' RG-6

Antenna Gain Less Cable Loss (dB)	-1.48	-2.04	-1.48	-0.68	0.75
	okay	okay	okay	okay	okay
Margin (dB)	-1.18	-1.31	-1.24	-0.98	-1.55

4 Inside Antenna Kit 301121-40050: Dome Antenna w/50' LMR 400

Antenna Gain Less Cable Loss (dB)	-4.56	-3.39	-1.75	-0.10	-0.33
	okay	okay	okay	okay	okay
Margin (dB)	-4.26	-2.66	-1.51	-0.40	-2.63

5 Inside Antenna Kit 301151-0630: Dome Antenna w/30' RG-6

Antenna Gain Less Cable Loss (dB)	-4.88	-3.76	-1.76	-0.99	-0.64
	okay	okay	okay	okay	okay
Margin (dB)	-4.58	-3.03	-1.52	-1.29	-2.94

6 Inside Antenna Kit 309900-50N: 2 Panel Antennas and a 50 Ohm 3-Way Splitter - 90' LMR400

Antenna Gain Less Cable/Splitter Loss (dB)	-1.17	-1.37	-2.97	-0.11	1.09
	okay	okay	okay	okay	okay
Margin (dB)	-0.87	-0.64	-2.73	-0.41	-1.21

7 Inside Antenna Kit 309902-75F: 2 Panel Antennas and a 75 Ohm 3-Way Splitter - 50' RG-6

Antenna Gain Less Cable/Splitter Loss (dB)	-1.67	-1.97	-2.87	-1.31	0.79
	okay	okay	okay	okay	okay
Margin (dB)	-1.37	-1.24	-2.63	-1.61	-1.51

8 Inside Antenna Kit 309903-75F: 3 Panel Antennas and three 75 Ohm 2-Way Splitter - 80' RG-11

Antenna Gain Less Cable/Splitter Loss (dB)	-1.17	-1.37	-2.27	-0.81	1.19
	okay	okay	okay	okay	okay
Margin (dB)	-0.87	-0.64	-2.03	-1.11	-1.11

9 Inside Antenna Kit 309904-75F: 1 Panel Antenna and a 75 Ohm 2-Way Splitter - 30' RG-58

Antenna Gain Less Cable/Splitter Loss (dB)	-1.37	-1.57	-2.57	-1.11	1.09
	okay	okay	okay	okay	okay
Margin (dB)	-1.07	-0.84	-2.33	-1.41	-1.21

10 Inside Antenna Kit 309905-50N: 3 Panel Antennas and three 50 Ohm 2-Way Splitter - 20' RG-174

Antenna Gain Less Cable/Splitter Loss (dB)	-2.37	-2.67	-4.57	-2.21	-0.11
	okay	okay	okay	okay	okay
Margin (dB)	-2.07	-1.94	-4.33	-2.51	-2.41

11 Inside Antenna Kit 311155-11120: Panel w/120' RG-11

Antenna Gain Less Cable Loss (dB)	-1.07	-1.63	-1.07	-0.67	0.66
	okay	okay	okay	okay	okay
Margin (dB)	-0.77	-0.90	-0.83	-0.97	-1.64

12 Inside Antenna Kit 301151-1140: Dome Antenna w/40' RG-11

Antenna Gain Less Cable Loss (dB)	-4.24	-3.08	-1.06	-0.06	0.22
	okay	okay	okay	okay	okay
Margin (dB)	-3.94	-2.35	-0.82	-0.36	-2.08

13 Inside Antenna Kit 304412-400100: Dome w/100' LMR 400

Antenna Gain Less Cable Loss (dB)	-2.43	-1.69	-3.09	-0.33	-1.29
	okay	okay	okay	okay	okay
Margin (dB)	-2.13	-0.96	-2.85	-0.63	-3.59

14 Inside Antenna Kit 304412-5830: Dome Antenna w/30' RG-58

Antenna Gain Less Cable Loss (dB)	-2.25	-1.57	-2.23	-0.75	-0.62
	okay	okay	okay	okay	okay
Margin (dB)	-1.95	-0.84	-1.99	-1.05	-2.92

15 Inside Antenna Kit 304419-1175: Dome w/75' RG-11

Antenna Gain Less Cable Loss (dB)	-1.84	-1.12	-1.77	-0.13	-0.05
	okay	okay	okay	okay	okay
Margin (dB)	-1.54	-0.39	-1.53	-0.43	-2.35

16 Inside Antenna Kit 304419-17450: Dome Antenna w/50' RG-174

Antenna Gain Less Cable Loss (dB)	-10.12	-9.82	-13.20	-12.73	-13.12
	okay	okay	okay	okay	okay
Margin (dB)	-9.82	-9.09	-12.96	-13.03	-15.42

17 Inside Antenna Kit 304419-0650: Dome Antenna w/50' RG-6

Antenna Gain Less Cable Loss (dB)	-2.57	-1.88	-2.55	-0.93	-0.84
	okay	okay	okay	okay	okay
Margin (dB)	-2.27	-1.15	-2.31	-1.23	-3.14