13 Annex A - Gemini OS 58XXC

13.1 Scope

This Annex details the changes and additional features relevant to the connectorised variant of the Gemini Product, OS 58XXC.

13.2 Product Description

13.2.1 Hardware

The OS58XXC is a variant designed to provide the system integrator and installer with the ability to provide extra capability to cope with very difficult radio links compared to the basic Gemini product. The variant allows the use of a variety of externally mounted antennas, either Flat Plate or Dish, which have higher gains than provided by the integrated antenna that is normally used.
The OS 58XXC is shown as Fig 38.

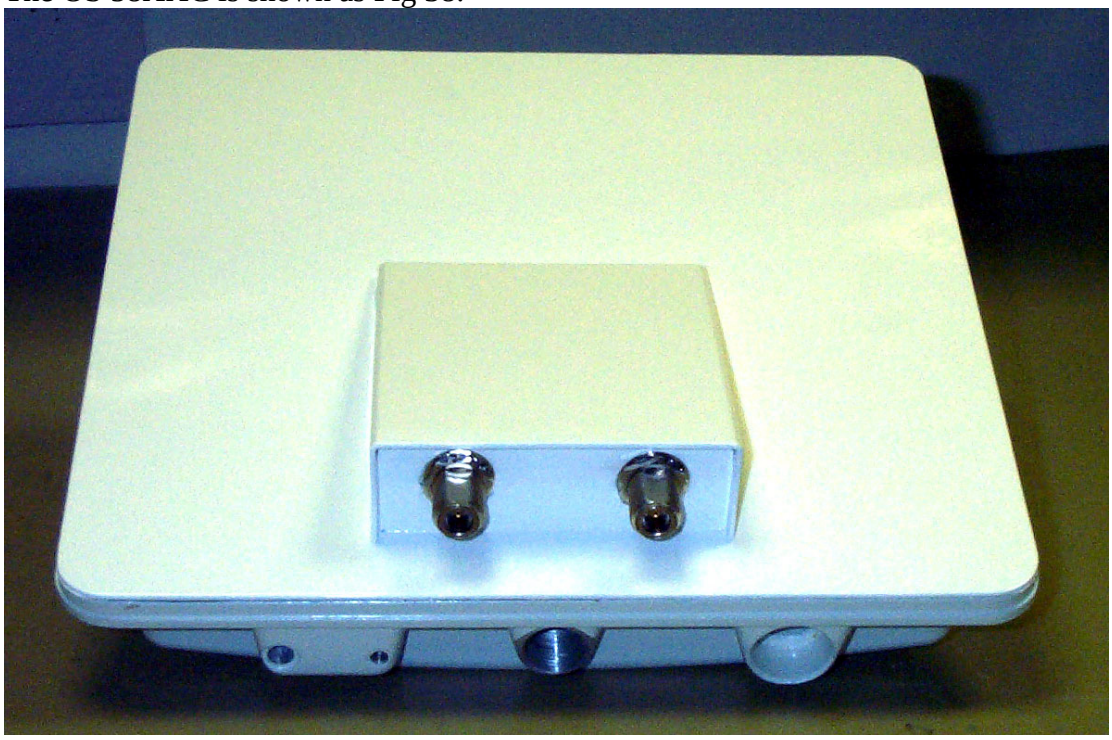

Figure 1 : 58XXC Outdoor Unit

13.2.2 Antenna Choices

The integrated antenna has a gain of 23dBi. External antennas from the list in Table 10 can be used with the OS58XXC. These are approved by the FCC for use with the product and are basically constrained by the following limits:

- Single Polarisation Flat Plate Antennas – up to 28dBi per antenna
- Single/Dual Polarisation Parabolic Dish Antennas – up to 37.7dBi per polarisation or antenna

All external antennas – cable loss between OS 58XXC and the antenna ports must not be less than 1.2dB

13.3 Software/Features

The variant operates in the same way as the basic Gemini product and is released initially with the feature set of the OS 5815 product. The areas where the functionality is modified are

13.3.1 Status Page

The link loss calculation presented on the Status Page on the management interface has to be modified to allow for the increased antenna gains at each end of the link. The manufacturing process of the OS5815C configures the standard hardware of the unit for use with external antennas. The installer is prompted, as part of the installation process, to enter the gain of the external antenna(s) and cable losses at each end of the link. Peer-Peer messaging is used to pass the effective antenna gain to each end of the link so that the link loss calculations can be correctly computed.

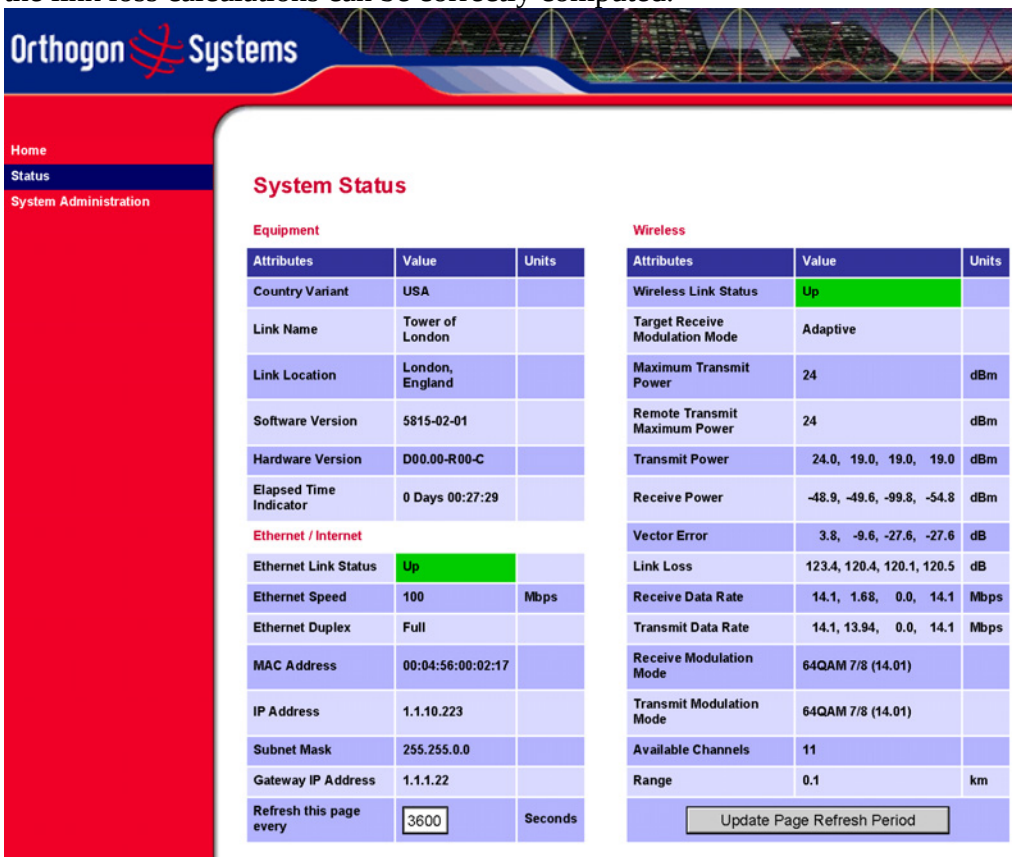

Figure 2 : Example Status Page (showing new hardware Version data for Connector Version)

13.3.2 Installation Pages

The installer is prompted to enter the Antenna Gain and Cable Loss (OS 5815C to antenna) at each end of the link. The Installation Page(s) is shown as Fig 40/41

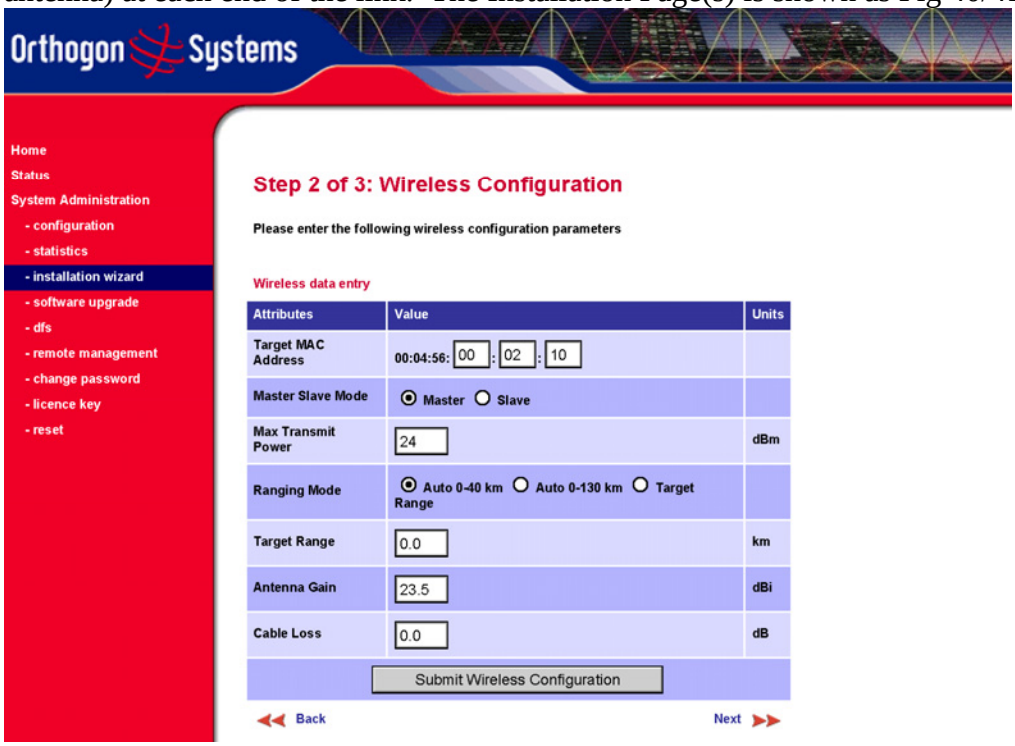

Figure 3 : Amended Installation Wizard Page

Note: In the event that there is a significant difference in length of the antenna cables for the two antenna ports, then the average value should be entered.

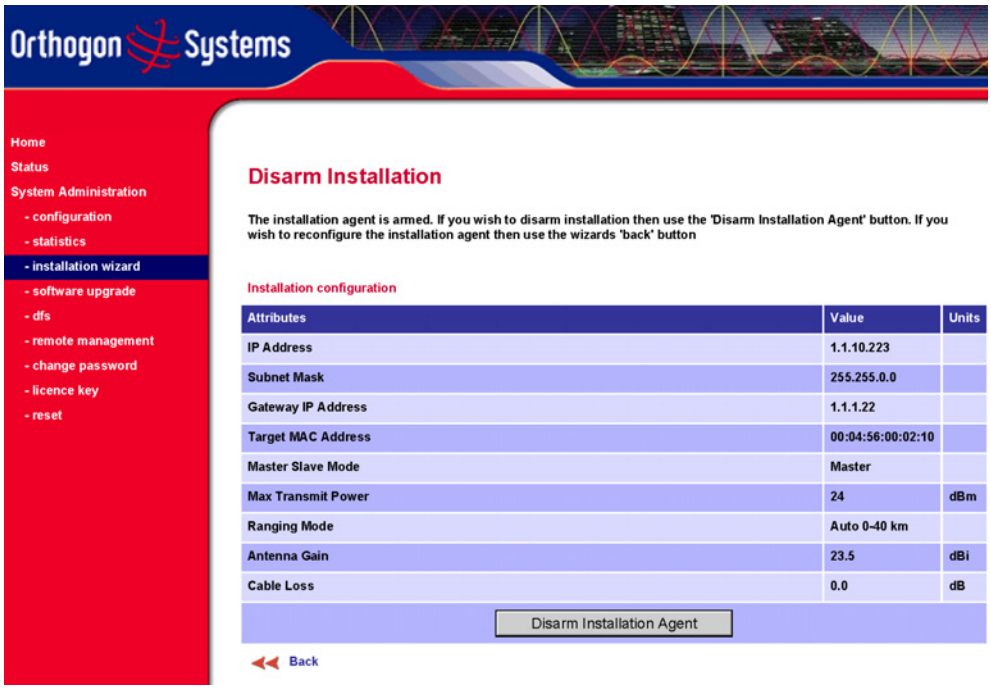

Figure 4 : Amended ‘Disarm Installation’ Page

13.3.3 Configuration Pages

The amended Configuration Web page is shown below as Figure 42.

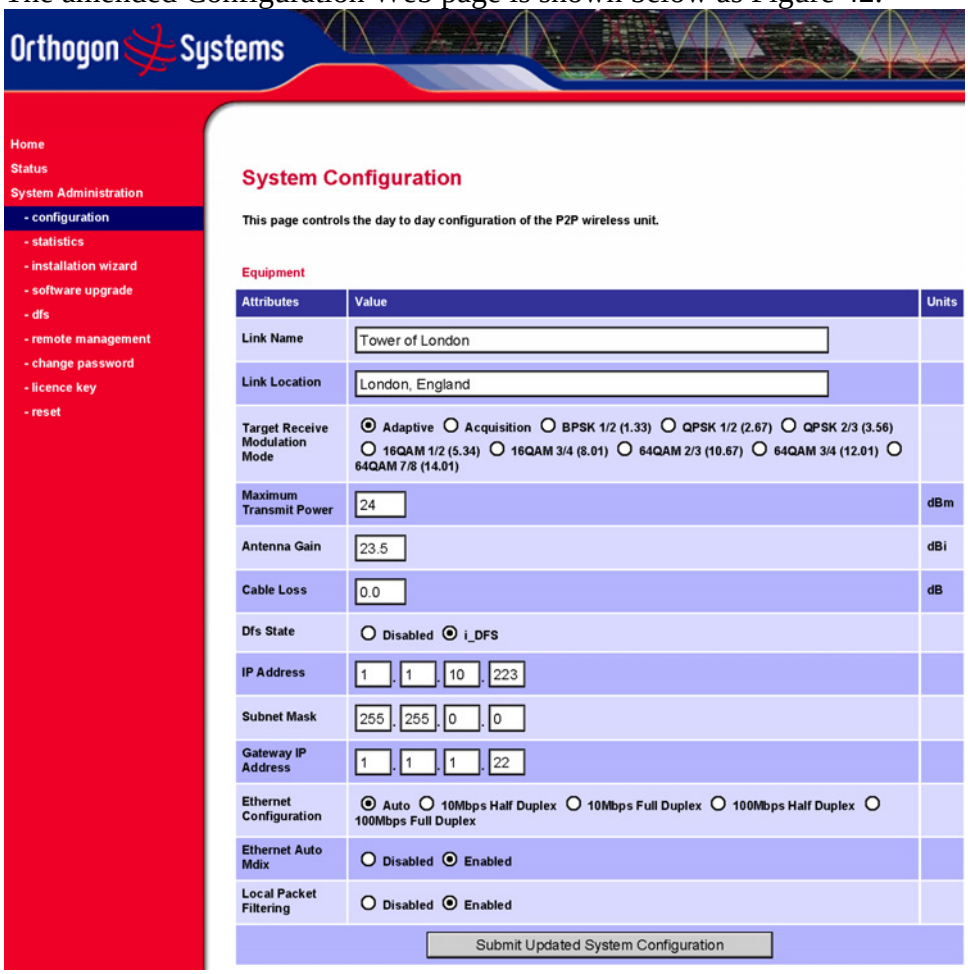

Figure 5 : Amended System Configuration Page

13.4 Gemini Path Calculator

The Gemini Path Calculator described in Para 4.3 of the main user handbook is provided with additional functionality to allow for the higher gains of the external antennas permissible with OS 5815C. When the 'Standard Antenna' check box in the spreadsheet is de-selected, the user is offered a pull-down menu of allowed antenna options. When the required antenna is selected, the appropriate gain is entered in the spreadsheet. Alternatively, the user can select the 'Other' antenna option and enter a gain value to determine how much antenna gain would be required for a specific link.

13.5 Deployment Considerations

The majority of radio links can be successfully deployed with the OS5815 product. It should only be necessary to use external antennas where the Link Budget Calculator indicates marginal performance for a specific link. Examples of this would be where the link is heavily obscured by dense woodland on an NLOS link or extremely long LOS links (>80km) over water.

The external antennas can be either dual-polarisation (as the integrated antenna) or two single polarised antennas can be used in a spatially diverse configuration. It is expected that the dual-polarisation antennas would normally be used to simplify the installation process; spatially diverse antennas may provide additional fade margin on very long LOS links where there is evidence of correlation of the fading characteristics on Vertical and Horizontal polarisations.
Dual polarisation antennas (with a gain greater than the integrated antenna) are currently only available in parabolic dish form.

13.6 Regulatory Issues 1

This section applies to products deployed in the USA or where FCC Part 15 regulations are used for unlicensed radio equipments

13.6.1 Antenna Choice

The antennas allowed to be deployed (in the USA) with the Gemini 5815C are shown in Table 10

13.6.2 Cable Losses

The FCC approval for the product is based on tests with a cable loss between the unit and the antenna of 1.2dB at 5.8GHz. The use of lower cable losses with the highest gain antennas of either type would result in the installation being outside the FCC rules.

As an indication, 1.2dB of cable loss corresponds to the following cable lengths excluding connector losses (source: Times Microwave).

Cable	Length for 1.2dB Cable Loss at 5.8GHz (ft/m)
LMR100	1.9/0.6
LMR200	4.6/1.4
LMR300	7.25/2.2
LMR400	11.1/3.4

Table 1 : Cable Losses per Length

13.7 Regulatory Issues 2

In countries where FCC regulations are not relevant, installations should conform to any applicable local regulations for the Equivalent Isotropic Radiated Power (EIRP).

13.8 Link Budget

This is increased by the additional gain of the external antenna(s) less the cable losses. The improvement in link budget is indicated in Table 9 for representative antennas when operating in the various modes.

Operating Mode	Static Link Budget (dB)				
	14 inch, Dual Polar, 23.5dBi Integrated Antenna	2ft Single Pol Flat Plat or Parabolic Dish, ~28dBi	3ft Single/Dual Pol Parabolic Dish, ~31.5dBi	4ft Single/Dual Pol Parabolic Dish, ~34.5dBi	6ft Single/Dual Pol Parabolic Dish, ~37.7dBi
BPSK 1/2	167	173.6	180.6	186.6	193
QPSK 1/2	163	169.6	176.6	182.6	189
QPSK 2/3	161.1	167.7	174.7	180.7	187.1
16QAM 1/2	156.6	163.2	170.2	176.2	182.6
16QAM 3/4	152.2	158.8	165.8	171.8	178.2
64QAM 2/3	146.7	153.3	160.3	166.3	172.7
64QAM 3/4	144.7	151.3	158.3	164.3	170.7
64QAM 7/8	140.5	147.1	154.1	160.1	166.5

Table 2 : Static Link Budget for Various Antenna Options

Notes:

Cable Loss is 1.2dB for the External Antennas
Gains shown for external antennas are typical values; specific antennas may have different gains
Maximum allowed gain is 37.7dBi for a parabolic dish, and 28dBi for flat plate antenna.

Manufacturer	Antenna Type	Gain (dBi)	Flat Plate	Parabolic Dish
Andrew	Andrew 1-foot Flat Panel, FPA5250D12-N (23.6dBi)	23.6	Y	
Andrew	Andrew 2-foot Flat Panel, FPA5250D24-N (28dBi)	28	Y	
Gabriel	Gabriel 1-foot Flat Panel, DFPD1-52 (23.5dBi)	23.5	Y	
Gabriel	Gabriel 2-foot Flat Panel, DFPD2-52 (28dBi)	28	Y	
MTI	MTI 17 inch Diamond Flat Panel, MT-485009 (23dBi)	23	Y	
MTI	MTI 15 inch Dual-Pol Flat Panel, MT-485025/NVH (23dBi)	23	Y	
MTI	MTI 2 ft Directional Flat Panel, MT-20004 (28dBi)	28	Y	
MTI	MTI 2 ft Flat Panel, MT-486001 (28dBi)	28	Y	
RFS	RFS 1-foot Flat Panel, MA0528-23AN (23dBi)	23	Y	
RFS	RFS 2-foot Flat Panel, MA0528-28AN (28dBi)	28	Y	
Telectronics	Teletronics 2-foot Flat Plate Antenna, ANT-P5828 (28dBi)	28	Y	
Andrew	Andrew 2-foot Parabolic, P2F-52 (29.4dBi)	29.4		Y
Andrew	Andrew 2-foot Dual-Pol Parabolic, PX2F-52 (29.4dBi)	29.4		Y
Andrew	Andrew 3-foot Parabolic, P3F-52 (33.4dBi)	33.4		Y
Andrew	Andrew 3-foot Dual-Pol Parabolic, PX3F-52 (33.4dBi)	33.4		Y
Andrew	Andrew 4-foot Parabolic, P4F-52 (34.9dBi)	34.9		Y
Andrew	Andrew 4-foot Dual-Pol Parabolic, PX4F-52 (34.9dBi)	34.9		Y
Andrew	Andrew 6-foot Parabolic, P6F-52 (37.6dBi)	37.6		Y
Andrew	Andrew 6-foot Dual-Pol Parabolic, PX6F-52 (37.6dBi)	37.6		Y
Gabriel	Gabriel 2-foot High Performance QuickFire Parabolic, HQF2-52-N	28.2		Y
Gabriel	Gabriel 4-foot High Performance QuickFire Parabolic, HQF4-52-N	34.4		Y
Gabriel	Gabriel 6-foot High Performance QuickFire Parabolic, HQF6-52-N	37.4		Y
Gabriel	Gabriel 2-foot High Performance Dual QuickFire Parabolic, HQFD2-52-N	28.1		Y
Gabriel	Gabriel 4-foot High Performance Dual QuickFire Parabolic, HQFD4-52-N	34.3		Y
Gabriel	Gabriel 6-foot High Performance Dual QuickFire Parabolic, HQFD6-52-N	37.3		Y
Gabriel	Gabriel 2-foot Standard QuickFire Parabolic, QF2-52-N	28.5		Y
Gabriel	Gabriel 2-foot Standard QuickFire Parabolic, QF2-52-N-RK	28.5		Y
Gabriel	Gabriel 2.5-foot Standard QuickFire Parabolic, QF2.5-52-N	31.2		Y
Gabriel	Gabriel 4-foot Standard QuickFire Parabolic, QF4-52-N	34.8		Y
Gabriel	Gabriel 4-foot Standard QuickFire Parabolic, QF4-52-N-RK	34.8		Y
Gabriel	Gabriel 6-foot Standard QuickFire Parabolic, QF6-52-N	37.7		Y
Gabriel	Gabriel 2-foot Standard Dual QuickFire Parabolic, QFD2-52-N	28.4		Y
Gabriel	Gabriel 2.5-foot Standard Dual QuickFire Parabolic, QFD2.5-52-N	31.1		Y
Gabriel	Gabriel 2-foot Standard Dual QuickFire Parabolic, QFD2-52-N-RK	28.4		Y
Gabriel	Gabriel 4-foot Standard Dual QuickFire Parabolic, QFD4-52-N	34.7		Y
Gabriel	Gabriel 4-foot Standard Dual QuickFire Parabolic, QFD4-52-N-RK	34.7		Y
Gabriel	Gabriel 6-foot Standard Dual QuickFire Parabolic, QFD6-52-N	37.7		Y
RadioWaves	Radio Waves 2-foot Dual-Pol Parabolic, SPD2-5.2 (28.1dBi)	28.1		Y
RadioWaves	Radio Waves 2-foot Parabolic, SP2-5.2 (29.0dBi)	29		Y
RadioWaves	Radio Waves 3-foot Dual-Pol Parabolic, SPD3-5.2 (31.1dBi)	31.1		Y
RadioWaves	Radio Waves 3-foot Parabolic, SP3-5.2 (31.4dBi)	31.4		Y
RadioWaves	Radio Waves 4-foot Dual-Pol Parabolic, SPD4-5.2 (34.4dBi)	34.4		Y
RadioWaves	Radio Waves 4-foot Parabolic, SP4-5.2 (34.8dBi)	34.8		Y
RadioWaves	Radio Waves 6-foot Dual-Pol Parabolic, SPD6-5.2 (37.5dBi)	37.5		Y
RadioWaves	Radio Waves 6-foot Parabolic, SP6-5.2 (37.7dBi)	37.7		Y
RadioWaves	Radio Waves 2-foot Parabolic, SP2-2/5 (28.3dBi)	28.3		Y
RadioWaves	Radio Waves 3-foot Parabolic, SP3-2/5 (31.4dBi)	31.4		Y
RadioWaves	Radio Waves 4-foot Parabolic, SP4-2/5 (34.6dBi)	34.6		Y
RadioWaves	Radio Waves 6-foot Parabolic, SP6-2/5 (37.7dBi)	37.7		Y
RFS	RFS 2-foot Parabolic, SPF2-52AN or SPFX2-52AN (27.9dBi)	27.9		Y
RFS	RFS 3-foot Parabolic, SPF3-52AN or SPFX3-52AN(31.4dBi)	31.4		Y
RFS	RFS 4-foot Parabolic, SPF4-52AN or SPFX4-52AN(33.9dBi)	33.9		Y
RFS	RFS 6-foot Parabolic, SPF6-52AN or SPFX6-52AN (37.4dBi)	37.4		Y
RFS	RFS 2-foot HP Parabolic, SDF2-52AN or SDFX2-52AN (31.4dBi)	31.4		Y
RFS	RFS 4-foot HP Parabolic, SDF4-52AN or SDFX4-52AN (33.9dBi)	33.9		Y
RFS	RFS 6-foot HP Parabolic, SDF6-52AN or SDFX6-52AN (37.4dBi)	37.4		Y
StellaDoradus	StellaDoradus 45 inch Parabolic Antenna, 58PSD113	33.8		Y

Table 3 : Allowed Antennas for Deployment in USA/Canada