July 2012, issue 1.2.0

4RF White Paper

Reducing deployment cost and time with Yagi and parabolic grid antennas

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1 Overview

One key advantage of using sub 3 GHz frequency bands for point-to-point microwave linking is that infrastructure requirements can be greatly reduced through the use of Yagi and grid type parabolic antennas, unlike higher frequency bands where solid parabolic antennas are needed.

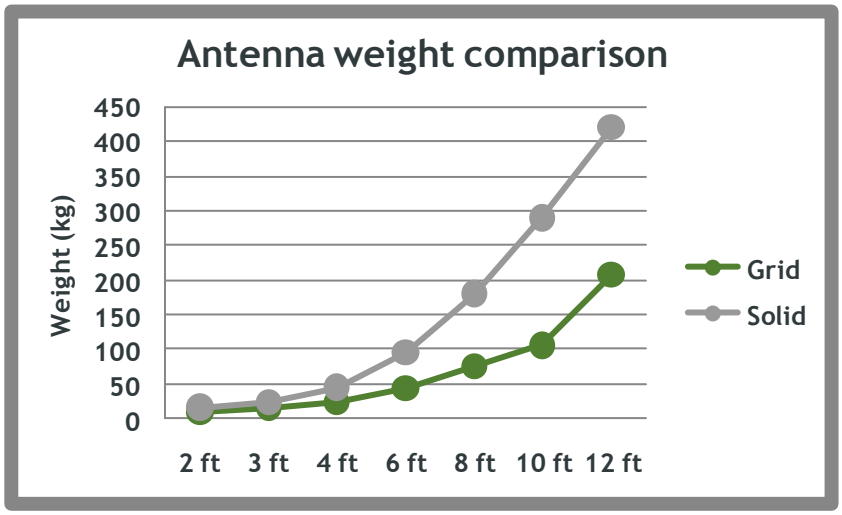
The use of Yagi and parabolic grid antennas reduces tower loading by reducing both weight and wind force. Reduced tower loading means reduced operational costs.

This paper details the advantages of using Yagi and grid type antennas compared to solid antenna systems. It also provides detailed data comparing the weight and loading of different types of antennas, together with examples detailing how operational costs can be reduced.

2 Reduced weight and wind force

2.1 Reduced weight

Parabolic grid antennas weigh on average only half as much as solid parabolic antennas, for an immediate reduction in tower loading.



Antenna size	Weight (kg) Grid	Solid
0.6m (2 ft)	10	16
0.9m (3 ft)	16	24
1.2m (4 ft)	24	45
1.8m (6 ft)	43	95
2.4m (8 ft)	76	180
3.0m (10 ft)	106	290
3.7m (12 ft)	208	420

Comparison of weight for grid vs. Solid parabolic antennas (average figures calculated from multiple manufacturers)

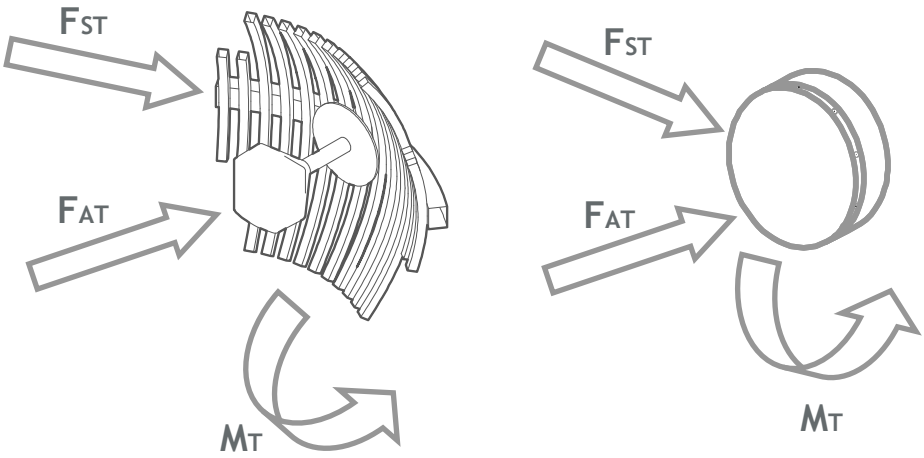
Yagi antennas are extremely lightweight, as can be seen in the table below (with average figures calculated from multiple manufacturers):

Antenna size	Weight (kg)
0.3m (1 ft)	0.2
0.6m (2 ft)	0.5
0.9m (3 ft)	0.7
1.4m (4.6 ft)	0.9
1.6m (5.25 ft)	1.0
2.4m (8 ft)	1.35

Reduced wind force

The design of parabolic grid antennas means that they are subject to substantially less loading and turning force than solid parabolic antennas, significantly reducing the overall tower loading:

- Using grid antennas can reduce the frontal loading by 75% compared to the loading experienced by solid parabolic antennas
- Horizontal loading can be reduced by 60%, with grid antennas experiencing significantly less loading than solid parabolic antennas
- Grid antennas typically experience only 15% of the turning force that is exerted on solid parabolic antennas

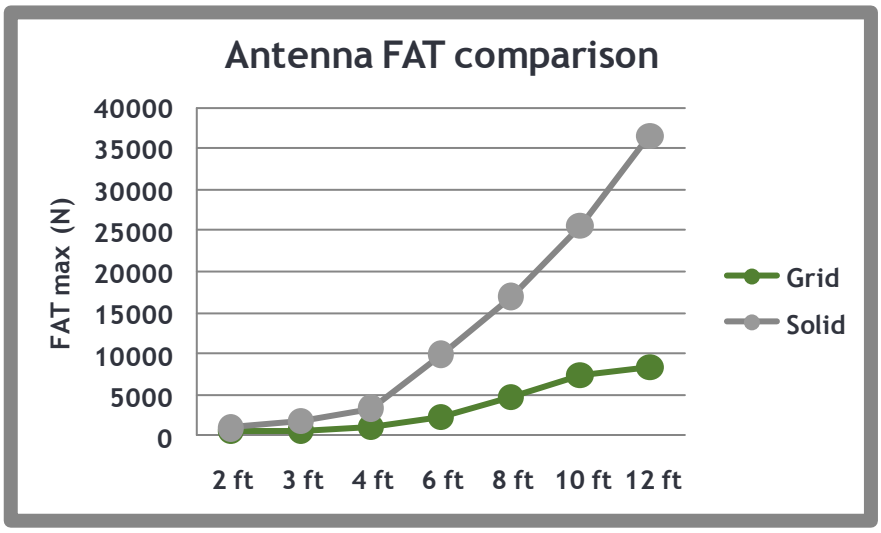


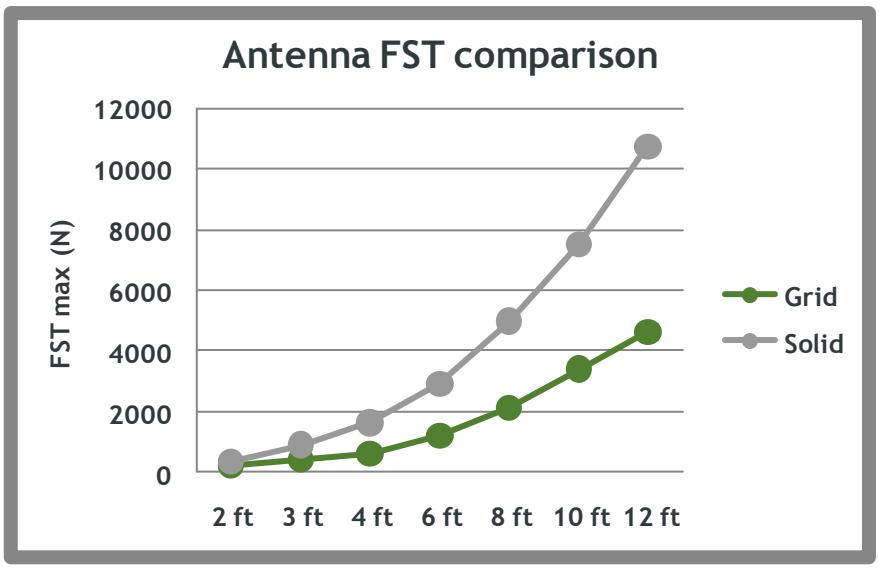
The table and graphs below compare the average frontal loading (FAT: Force Axial on mounting Tube), horizontal loading (FST: Force Sideways on mounting Tube) and turning forces (MT: Moment torque on mounting Tube) for parabolic grid antennas compared with solid parabolic antennas at a wind speed of 200 km per hour:

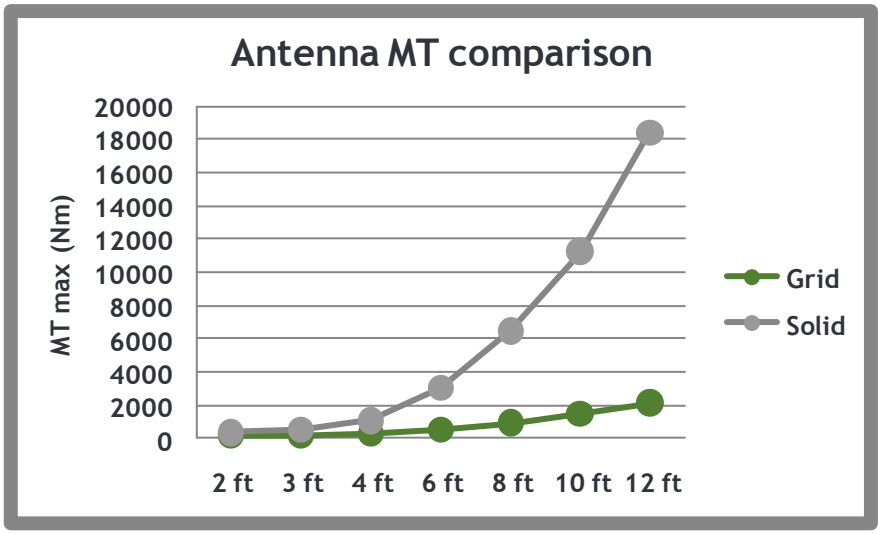
Antenna size	FAT max (N)*		FST max (N)*		MT max (Nm)*	
	Grid	Solid	Grid	Solid	Grid	Solid
0.6m (2 ft)	600	905	200	330	160	340
0.9m (3 ft)	641	1800	391	890	168	530
1.2m (4 ft)	1094	3290	625	1630	269	1055
1.8m (6 ft)	2189	9900	1203	2910	517	3055
2.4m (8 ft)	4688	16940	2109	4980	907	6470
3.0m (10 ft)	7344	25570	3394	7520	1459	11260
3.7m (12 ft)	8300	36530	4600	10740	2116	18450

* average figures calculated from multiple manufacturers

Tower infrastructure required for solid parabolic antennas

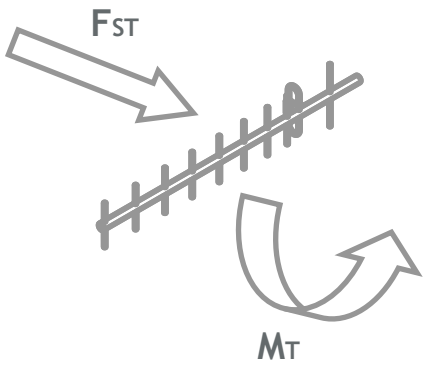






Typical lightweight grid style parabolic antenna

Similarly, Yagi antennas are subjected to significantly less horizontal loading and turning force than solid parabolic antennas:



The table below shows the average loading exerted on Yagi antennas of various sizes, with a wind speed of 160 km per hour:

Antenna size	FST max (N)*	MT max (Nm)*
0.3m (1 ft)	11	1
0.6m (2 ft)	27	5
0.9m (3 ft)	43	15
1.4m (4.6 ft)	70	40
1.6m (5.25 ft)	75	53
2.4m (8 ft)	108	116

* average figures calculated from multiple manufacturers

Typical lightweight Yagi antenna

3 Reduced operational cost

Reduced tower loading and simplified support structures for lightweight parabolic grid and Yagi antennas can significantly reduce the operational cost for deploying microwave links below 3 GHz.

Inexpensive pole mounts or guyed masts can be used to support multiple grid or Yagi antennas, whereas solid parabolic antennas often require expensive self-supporting structures. Solid parabolic antennas are not suitable for use with guyed mast or pole support structures due to excessive tower loading or flex.

With lightweight antennas, busy or crowded support structures can continue to be used, due to reduced tower loading and aperture, which reduces the need for investment in additional sites.

Additionally, site acquisition can be greatly simplified and expedited, often resulting in reduced costs, with the use of small, inexpensive support structures

A final aesthetic benefit of using small antennas is that the visual impact for tourist or suburban deployment is greatly reduced.

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