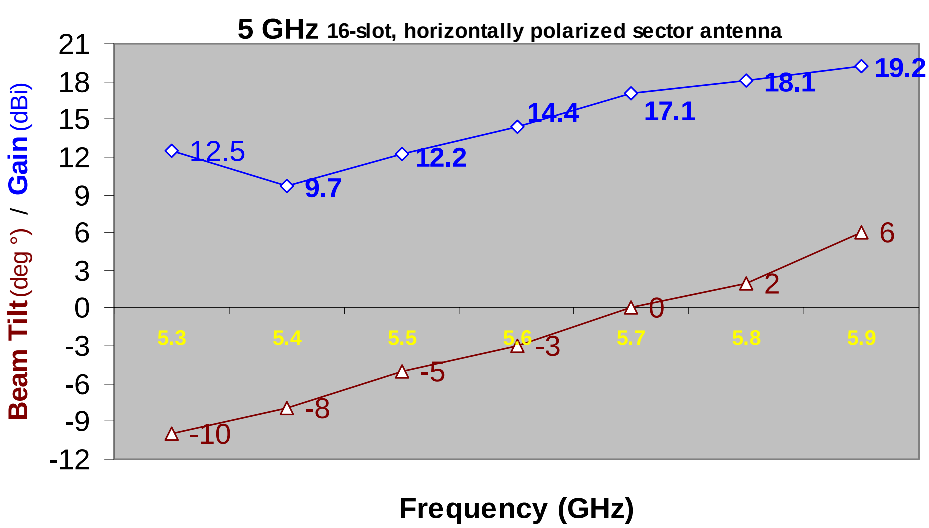
Introduction:

360°RF has been retained to measure RF Gain and SWR/Return Loss of two 16-slot horizontally polarized sector design antennas (2.4 & 5 GHz models). What follows are the **findings** from our independent testing and analysis of the supplied antennas:

Model 5 GHz Antenna *horizontally polarized sector design*

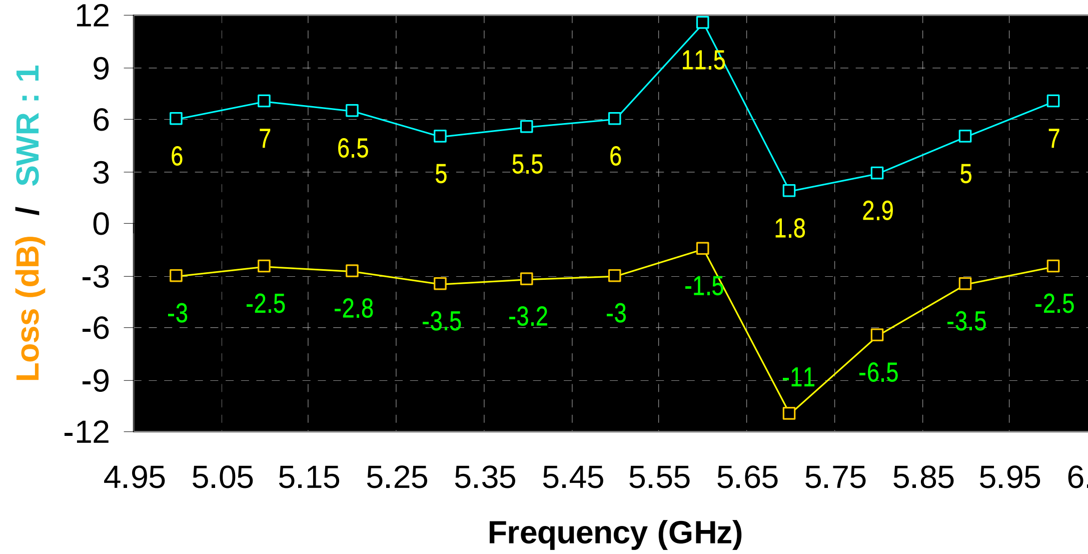
"I calculate the gain as 12.9dB with a beamwidth of 5.2 degrees."



Frequency (GHz)	Gain (dBi)	Beam Tilt (deg °) [1]
5.3	12.5	-10
5.4	9.7	-8
5.5	12.2	-5
5.6	14.4	-3
5.7	17.1	0
5.8	18.1	2
5.9	19.2	6
6	19.2	10

[1] - Degrees Below the Horizon / + Degrees Above the Horizon

5 - 6 GHz Sweep



Frequency (GHz)	Return Loss (dB)	SWR : 1
5	-3	6
5.1	-2.5	7
5.2	-2.8	6.5
5.3	-3.5	5
5.4	-3.2	5.5
5.5	-3	6
5.6	-1.5	11.5
5.7	-11	1.8
5.8	-6.5	2.9
5.9	-3.5	5
6	-2.5	7

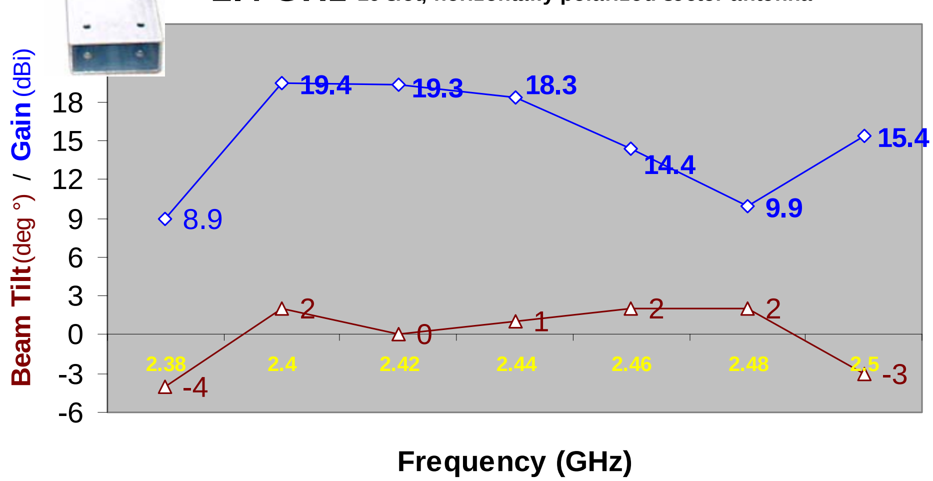
Testing Notes:

See end of document for notations.

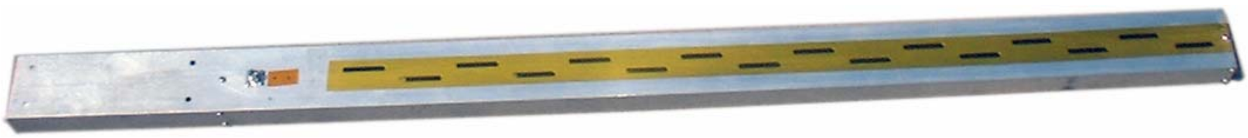
Model 2.4 GHz Antenna *horizontally polarized sector design*

"The 2.4 GHz antenna is a 16 slot, horizontally polarized sector design. I calculate the gain as 13.2dB with a beamwidth of 5 degrees."

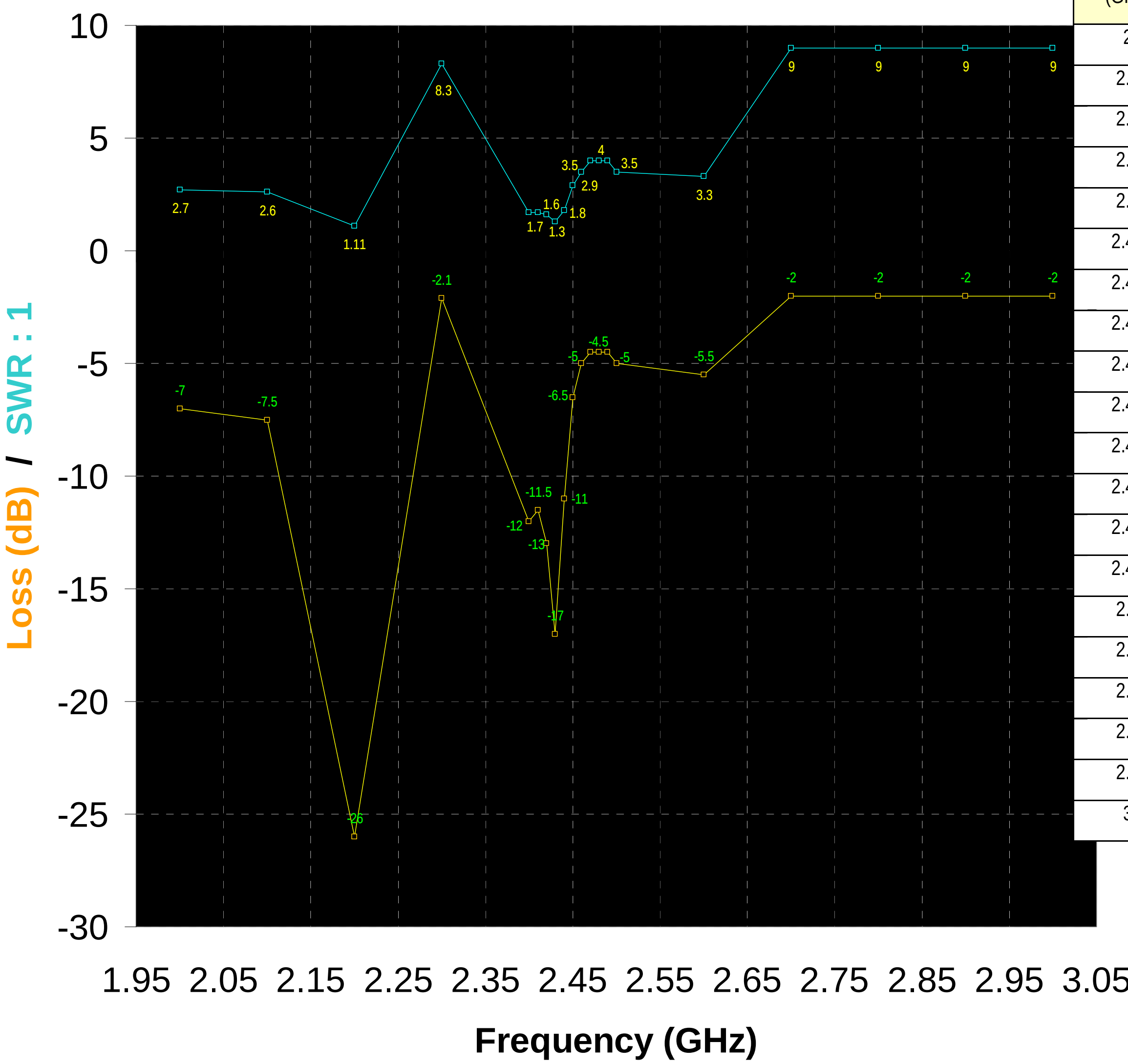
2.4 GHz **16-slot, horizontally polarized sector antenna**



Frequency (GHz)	Gain (dBi)	Beam Tilt (deg °)
2.38	8.9	-4
2.4	19.4	2
2.42	19.3	0
2.44	18.3	1
2.46	14.4	2
2.48	9.9	2
2.5	15.4	-3



2 - 3 GHz Sweep



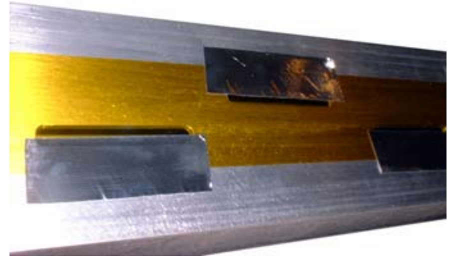
Frequency (GHz)	Return Loss (dB)	SWR : 1
2	-7	2.7
2.1	-7.5	2.6
2.2	-26	1.11
2.3	-2.1	8.3
2.4	-12	1.7
2.41	-11.5	1.7
2.42	-13	1.6
2.43	-17	1.3
2.44	-11	1.8
2.45	-6.5	2.9
2.46	-5	3.5
2.47	-4.5	4
2.48	-4.5	4
2.49	-4.5	4
2.5	-5	3.5
2.6	-5.5	3.3
2.7	-2	9
2.8	-2	9
2.9	-2	9
3	-2	9

Testing Notes:

Both antennas have considerable internal reflections.

Ideally, the horizontal beam pattern makes a smooth sweep from below to above the horizon as you sweep from below to above the design frequency.   The 5 GHz slot array showed this behavior, the 2.4 GHz slot array did not. A properly matched Slot antenna will show > -20 dB Return Loss over its entire operating band.

Covering the 2.4 GHz slots with RADAR absorber only slightly improved Return Loss. This implied that the slots were too low in impedance. Using Aluminum Tape the slots were narrowed. This improved Return loss only a few dB. Taking advantage of 2-tapped holes near the coax connector, tuning screws were added. Adding a screw nearest the coax connector only made Return Loss worse. The second hole could be used to improve return loss to better than -20 dB, but only over a 20 MHz or so part of the band.



Design Notes:

End feed collinear arrays suffer from problems with power dividing. Let's say the 1st slot radiates 10% of the power, then the 2nd slot radiates 10% of the remaining 90%. The 3rd slot radiates 10% of the remaining 81%, etc. So going from an 8-slot design to a 16-slot design does not improve gain 3 dB. The last slots are not sharing power.

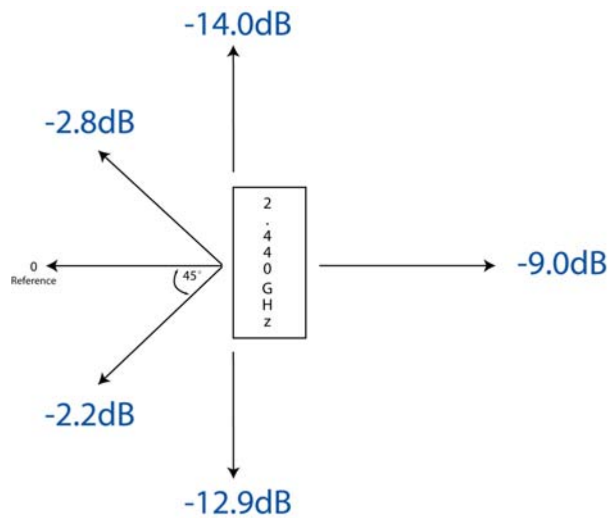
A slot exactly on the centerline of the waveguide does not radiate. As the slot is moved away from the centerline more and more power couples into the slot. Most long slot arrays are designed with the slots closest to the input also closest to the centerline and taper away as you go along the length of the antenna. This improves power dividing, pattern, and gain.

Possible Solutions:

Since changing the loading on the slots did little, we suspect the Return Loss/SWR problem is in the coax to waveguide transition. The end stops were not easily removable and we did not want to risk damaging the antennas. Thus, their design is unknown.

Changing the End stops from a reflector to an absorber, then re-measuring Return Loss could tell if the mismatch is in the end reflector or the coax to waveguide transition.

Because of surface currents on the outside of the waveguide, there are lobes off the back of the antenna. If greater Front/Back ratio is desired, adding wings, as shown X-Band Slot array will improve that slightly—the larger the better.



Reception Patterns