W9GF - GAP TITAN DX Antenna Installation
### Change Control

<table>
<thead>
<tr>
<th>Date</th>
<th>Who</th>
<th>What</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-Feb-2012</td>
<td>David Nienhiser/W9GF</td>
<td>Initial Creation</td>
</tr>
<tr>
<td>18-Feb-2012</td>
<td>David Nienhiser/W9GF</td>
<td>Used Lower Resolution Photographs to make the filesize a bit smaller.</td>
</tr>
</tbody>
</table>
Table of Contents

INTRODUCTION ........................................................................................................................................... 5
ORDERING THE GAP TITAN DX .................................................................................................................. 6
GAP TITAN DX ASSEMBLY .......................................................................................................................... 6
GAP QUICK TILT GROUND MOUNT ASSEMBLY ....................................................................................... 6
OTHER ITEMS I PURCHASED TO COMPLETE THE INSTALLATION .......................................................... 7
  SUPPORT MAST ........................................................................................................................................ 7
  SAKRETE ................................................................................................................................................... 8
  GUY ROPE MOUNTING RING .................................................................................................................. 8
  GUY ROPE ............................................................................................................................................... 8
PLANTING THE QUICK TILT GROUND MOUNT ....................................................................................... 9
GAP TITAN DX MEETS THE GAP QUICK TILT MOUNT .......................................................................... 10
CUSTOM COUNTERPOISE .......................................................................................................................... 10
CONNECTING THE COAX ............................................................................................................................ 11
VIEW OF GAP TITAN DX FROM THE STREET ........................................................................................... 11
TUNING THE GAP TITAN DX ...................................................................................................................... 12
  MEASUREMENTS ................................................................................................................................. 12
  SWR MEASUREMENT FORM .................................................................................................................. 12
AIM 4170 OUTPUTS PER BAND ................................................................................................................... 14
  80 METER BASELINE MEASUREMENTS ................................................................................................. 14
  40 METER BASELINE MEASUREMENTS ................................................................................................. 15
  20 METER BASELINE MEASUREMENTS ................................................................................................. 15
  17 METER BASELINE MEASUREMENTS ................................................................................................. 16
  15 METER BASELINE MEASUREMENTS ................................................................................................. 16
  12 METER BASELINE MEASUREMENTS ................................................................................................. 17
  10 METER BASELINE MEASUREMENTS ................................................................................................. 17
  3.5 – 30MHZ BASELINE MEASUREMENTS ............................................................................................ 18
SHORTENING THE COUNTERPOISE ............................................................................................................. 19
  40 FT. COUNTERPOISE .......................................................................................................................... 19
  39 FT. COUNTERPOISE .......................................................................................................................... 20
  38 FT. COUNTERPOISE .......................................................................................................................... 20
  37 FT. COUNTERPOISE .......................................................................................................................... 21
  36 FT. COUNTERPOISE .......................................................................................................................... 21
  35 FT. COUNTERPOISE .......................................................................................................................... 22
34 Ft. COUNTERPOISE .................................................................................................................. 22
33 Ft. COUNTERPOISE .................................................................................................................. 23
32 Ft. COUNTERPOISE (BINGO!) ................................................................................................ 23
32 Ft. COUNTERPOISE – WIDER FREQUENCY SWEEP ............................................................. 24

REFERENCES ................................................................................................................................ 25
Introduction

I live in a location / neighborhood that’s not really friendly to me stringing up wire antenna(s) so I had to find an alternative. I’ve tried various antennas in my attic and they all left a lot to be desired.

I have done a lot of reading, talking and research on my outdoor antenna options and decided that I’d give the GAP TITAN DX antenna a try. I don’t have a lot of good places to put an antenna at my current residence. There is a sort of dog run along the east side of my house. I took a couple of pictures and sent them to the guys at GAP Antenna. They told me how I could use the TITAN DX and instead of using their counterpoise (which was too large for the space I had available) I could instead run a counterpoise wire along my wooden fence.

The rest is History!

I’ve had my GAP TITAN DX in operation now for a couple of days. I have made a couple of very local contacts on 80 meters but haven’t had time to really put it through it’s paces. A couple of mornings as I was walking out to go to work I flipped my FT-2000 on and tuned around on 80, 40 and 20 and heard plenty of traffic but didn’t have time to pick up the microphone and establish a QSO. At some later date I’ll update this document with a “Contacts” section – but for now I’m done typing and ready to start talking!

This document is intended as my personal record-keeping device in case at some point the antenna seems to not be up to par – I can re measure it’s electrical characteristics and compare them with what I’ve recorded here (my baseline). Or you never know I may decide to put up another one someday!

It’s not intended as an installation guide or anything of that sort. It’s just what seemed to work for me. If you can use any of the information provided – knock yourself out but I’m not responsible for any errors, problems or accidents you may encounter trying to implement what worked for me. Your mileage may vary!

Enjoy!

David Nienhiser

W9GF@arrl.net or david@nienhiser.com

Blog: blog.nienhiser.com
Ordering the GAP TITAN DX
The first thing you will have to decide before ordering is your center operating frequency on 75/80 meters. Under advice from the technical folks at GAP Antenna I ended up ordering a TITAN DX with a 75/80-meter center frequency of 3.8 MHz.

I also ordered the GAP Quick Tilt Ground mount.

In about 5 or 6 days I came home from work and was greeted by a couple of long boxes!

The Long box has the GAP TITAN DX Antenna; the shorter box holds the GAP Quick Tilt Ground Mount.

GAP TITAN DX assembly
It took me a little over 3 hours to assemble the GAP TITAN DX antenna. I found the instructions to be adequate. It seems there is always room for improvement in documentation & instructions. I made a couple of stupid mistakes that seemed like should have been covered in the documentation. If the documentation covered everyone’s mistakes they would probably be as thick as the Encyclopedia Britannica! Personally I’d rather have a great antenna with not so great instructions than to have phenomenal assembly instructions but the antenna don’t work!

GAP Quick Tilt Ground Mount assembly
Assembly of the Quick Tilt Ground Mount was about as simple as falling out of a chair! Piece of cake!

One note about the Quick Tilt Ground Mount – I’m 59 years old and not necessarily a specimen of physical fitness and I can very easily raise and lower my TITAN DX without any help from anyone else! Your mileage MAY vary!
Other items I purchased to complete the installation

Support Mast
I needed a pipe (support mast) to connect the TITAN DX to the Quick Tilt Ground Mount. As recommended by the GAP folks I purchased a 48” long x 1” Galvanized pipe (threaded on both ends – although the threads are not used) from my nearby Lowes home improvement store (plumbing department).

Below is a picture of what I ended up with:

![Picture of pipe]

Here is a close-up of the barcode for the pipe.

![Barcode close-up]
Sakrete
I used two (80lb) bags of Sakrete in the hole where the Quick Tilt Mount was installed.

Guy Rope Mounting Ring
I realized that in my haste to get the TITAN DX ordered I forgot to order the GUY KIT from GAP so I decided to ‘home brew’ my own.

I purchased a 1” PVC Coupler (a grey one from the electrical aisle – not the white one from the plumbing aisle) and a couple of stainless steel clamps and a short piece of 3/16” Galvanized chain.

I cut the PVC Coupler in half so it could easily wrap around the TITAN DX immediately above the GAP. This is the recommended location to attach guying.

I cut the links from the short piece of log chain and spaced them evenly around the PVC coupler. They are held in place by the stainless steel clamp. I will attach my guy ropes to these chain links.

Here’s what my ‘home brew’ guy rope mount looks like:

Guy Rope
For Guy Rope I will use Black Dacron Polyester 3/16” rope purchased from Jim Sayne / K4IBW (k4ibw@yahoo.com) who has an ebay store (ebay seller id: k4ibw)

In my installation I can only guy my TITAN DX in 3 locations. The prevailing wind here is from the south and I will be able to guy two points to the south of the antenna and only one on the north side. I’m
hopeful that I can get it let down via the GAP Quick Tilt Ground Mount in advance of any serious approaching storms!

Below is a picture of the spool I’m using for Guy Rope.

![Spool Image]

**Planting the Quick Tilt Ground Mount**

Everything was starting to come together. My initial design was to pound the Quick Tilt Ground Mount into the ground and not bother with digging a hole and filing it with Sakrete. Two problems with the hole and Sakrete are: 1) use of a shovel 2) have to wait for the Sakrete to dry. Neither of which seemed like options I wanted to deal with. I wanted to get this thing up in the air and light a fire under it!

Needless to say my haste sort of backfired. I was encouraging the Quick Tilt into the ground with a large sledgehammer – of course I was hitting a 2x4, which was on top of the Quick Tilt Mount. Texas dirt can be a bit like concrete but I was making good headway because of the recent rains and it’s springtime! I had a couple of inches left when I saw a geyser of water coming up the left leg of the Quick Tilt. OOPS! Fortunately nobody was home to complain about the water being shut off! Off went the water at the meter and out came the dreaded shovel. I just HATE water when it leaks! A couple of hours later and a trip to home depot all was once again well.

The shovel was out and dirty and while I was at Home Depot I picked up a couple of bags of Sakrete so once the plumbing boo-boo was corrected I moved over a few inches and dug a hole almost deep enough to bury the Quick Tilt support legs to a point as described in the documentation. I hit rock or something that I couldn’t penetrate without dynamite so decided to just stop while I was ahead.

I leveled the Quick Tilt in both planes and put 160 lbs. of concrete in the hole. It was almost dark and I was ready to get cleaned up, eat dinner and go to bed!
GAP TITAN DX meets the GAP Quick Tilt Mount

The 48” long pipe (discussed above) fit the plastic pipe in the Quick Tilt perfectly. It took a bit of effort to expand the plastic rings that the U-bolts fasten to the aluminum mount plate but the snug fit worked out well.

I slid the TITAN DX support mast into the Quick Tilt and raised the TITAN DX with one hand and installed the locking bolts in the Quick Tilt. I would have normally used two hands but was too busy patting myself on the back with one hand “Good Job David” while raising the TITAN DX to it’s vertical position.

Below is a picture of the planted Quick Tilt – and the GAP TITAN has been inserted. It’s ready to go vertical (and yes, the large area with no grass between the TITAN and fence is where I struck water!!

Custom Counterpoise

I have about 7 feet between the wood fence and the house. Because of this space limitation I was not able to utilize the square counterpoise supplied with the GAP TITAN DX Antenna. Per discussions with GAP support I instead connected one end of a 40-foot long counterpoise to one of the screws in the mast immediately below where the counterpoise bracket mounts to the antenna. I then added a Power Pole connector so I could easily disconnect the counterpoise when lowering the GAP TITAN DX. The counterpoise was then run toward the stapled to my wooden fence at approximately the same level as the screw I used to connect the counterpoise to the GAP TITAN DX. The 40-foot length was a suggested starting point. After making some measurements and repetitive adjustments the counterpoise wire ended up being about 32 feet long. If you look close on the preceding picture you can see the black counterpoise wire hanging on the wood fence.
For the Counterpoise wire I used FLEXWEAVE 12 AWG with extra tough Black Polyethylene jacket (Part # 547 @ www.thewireman.com)

**Connecting the Coax**

I have about 90 feet of RG8-X Coax between my GAP TITAN DX and my transceiver. The coax runs along the top of the ground next to the foundation of my house inside ¾” Electrical PVC Conduit. In the preceding photograph you can see the RG8x coax coming from the Gray PVC Conduit next to the house.

**View of GAP TITAN DX from the Street**

*Hardly noticeable wouldn’t you agree?*
Tuning the GAP TITAN DX

Measurements
All of the antenna measurements were made with my AIM 4170 Antenna / Lab RF Analyzer. The AIM 4170 is available from Array Solutions.

SWR Measurement Form
I created an Excel spreadsheet containing the data found in the GAP TITAN DX installation and assembly instruction manual PG 13 and it is displayed below. If I didn’t do this I’d be handwriting the information for the GAP engineers. They wouldn’t be able to read it – then they would ask me … and neither would I (be able to read it)!

The data in the first column (12 Feb) probably doesn’t even count. This was before I had connected the counterpoise.

The data in the second column (13 Feb) was collected after the 40 Ft counterpoise was added and the 15 meter element was lengthened one inch per GAP technical support.

The data in the third column (14 Feb) was collected after the optimum length for the counterpoise was determined (32 Ft).
### GAP TITAN DX (3.8 mhz)
Installation & Measurements
David Nienhiser / W9GF
david@nienhiser.com

Measured with: AIM 4170 Analyzer

### Installation & Measurements

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>VSWR</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Feb 2012</td>
<td>Initial Setup, No Counterpoise</td>
<td>1.18:1</td>
<td>3.840</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.015:1</td>
<td>3.820</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.11:1</td>
<td>3.820</td>
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<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>VSWR</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 Feb 2012</td>
<td>Added 40 Ft. Counterpoise* &amp; Lengthened 15 meter element 1 Inch</td>
<td>3.904:1</td>
<td>3.888</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.773:1</td>
<td>3.753</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.758:1</td>
<td>3.758</td>
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<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>VSWR</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 Feb 2012</td>
<td>Shortened Counterpoise to 32 Ft.</td>
<td>1.25:1</td>
<td>10.195</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.27:1</td>
<td>10.271</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.752:1</td>
<td>10.271</td>
</tr>
</tbody>
</table>

#### Record the minimum VSWR on 75/80 meters

- **2.1 VSWR Hi frequency**: 3.904 MHz, 3.888 MHz, 3.758 MHz
- **2.1 VSWR Low frequency**: 3.773 MHz, 3.753 MHz, 3.758 MHz
- Bandwidth (kHz): 131, 135, 136

#### Record the minimum VSWR on 40 meters

- **2.1 VSWR Hi Frequency**: 7.453 MHz
- **2.1 VSWR Low Frequency**: 6.855 MHz
- **Bandwidth (kHz)**: 598

#### 30 Meters VSWR - Minimum VSWR

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>VSWR 1</th>
<th>VSWR 2</th>
<th>VSWR 3</th>
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</thead>
<tbody>
<tr>
<td>10.100 MHz</td>
<td>1.27:1</td>
<td>1.27:1</td>
<td>1.752:1</td>
</tr>
<tr>
<td>10.125 MHz</td>
<td>1.301:1</td>
<td>1.301:1</td>
<td>1.619:1</td>
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<tr>
<td>10.150 MHz</td>
<td>1.370:1</td>
<td>1.368:1</td>
<td>1.486:1</td>
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#### 20 Meters VSWR - Minimum VSWR

<table>
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<tr>
<th>Frequency (MHz)</th>
<th>VSWR 1</th>
<th>VSWR 2</th>
<th>VSWR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.00 MHz</td>
<td>1.34:1</td>
<td>1.56:1</td>
<td>1.259:1</td>
</tr>
<tr>
<td>14.175 MHz</td>
<td>1.37:1</td>
<td>1.48:1</td>
<td>1.115:1</td>
</tr>
<tr>
<td>14.350 MHz</td>
<td>1.38:1</td>
<td>1.39:1</td>
<td>1.139:1</td>
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</table>

#### 17 Meters VSWR - Minimum VSWR

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>VSWR 1</th>
<th>VSWR 2</th>
<th>VSWR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.068 MHz</td>
<td>1.29:1</td>
<td>1.418:1</td>
<td>1.760:1</td>
</tr>
<tr>
<td>18.118 MHz</td>
<td>1.27:1</td>
<td>1.384:1</td>
<td>1.693:1</td>
</tr>
<tr>
<td>18.168 MHz</td>
<td>1.38:1</td>
<td>1.372:1</td>
<td>1.630:1</td>
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#### 15 Meters VSWR - Minimum VSWR

<table>
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<th>Frequency (MHz)</th>
<th>VSWR 1</th>
<th>VSWR 2</th>
<th>VSWR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.00 MHz</td>
<td>2.37:1</td>
<td>2.06:1</td>
<td>1.841:1</td>
</tr>
<tr>
<td>21.225 MHz</td>
<td>1.746:1</td>
<td>1.630:1</td>
<td>1.582:1</td>
</tr>
<tr>
<td>21.450 MHz</td>
<td>1.683:1</td>
<td>1.760:1</td>
<td>1.657:1</td>
</tr>
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#### 12 Meters VSWR - Minimum VSWR

<table>
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<th>Frequency (MHz)</th>
<th>VSWR 1</th>
<th>VSWR 2</th>
<th>VSWR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.890 MHz</td>
<td>1.81:1</td>
<td>1.96:1</td>
<td>2.045:1</td>
</tr>
<tr>
<td>24.990 MHz</td>
<td>1.53:1</td>
<td>1.70:1</td>
<td>1.694:1</td>
</tr>
</tbody>
</table>

#### 10 Meters VSWR - Minimum VSWR

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>VSWR 1</th>
<th>VSWR 2</th>
<th>VSWR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.00 MHz</td>
<td>1.18:1</td>
<td>1.148:1</td>
<td>1.212:1</td>
</tr>
<tr>
<td>28.50 MHz</td>
<td>1.229:1</td>
<td>1.311:1</td>
<td>1.366:1</td>
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<tr>
<td>29.00 MHz</td>
<td>1.316:1</td>
<td>1.473:1</td>
<td>1.535:1</td>
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</tbody>
</table>

Note: Counterpoise was made from: FLEXWEAVE 12 AWG with extra tough Black Polyethylene jacket - Part #547 @ http://www.thewireman.com/antennap.html and stapled to my wooden fence at approximately the same height as where the GAP Counterpoise was installed.
AIM 4170 Outputs Per Band

Follows are screen shots from the AIM 4170 after scanning various bands / frequencies. These measurements were made on 14 Feb after the Counterpoise had been shortened to 32 Ft.

Note that the red line represents SWR.

80 Meter Baseline Measurements
40 Meter Baseline Measurements

20 Meter Baseline Measurements
17 Meter Baseline Measurements

![17 Meter Baseline Measurements Image]

15 Meter Baseline Measurements

![15 Meter Baseline Measurements Image]
12 Meter Baseline Measurements

![Graph showing 12 meter baseline measurements]

10 Meter Baseline Measurements

![Graph showing 10 meter baseline measurements]
3.5 – 30mhz Baseline Measurements
Shortening the Counterpoise

I started with a 40 Ft. Counterpoise, took a measurement then shortened the counterpoise by one foot and measured again. Below are the results from the AIM 4170 for each of those measurements.

40 Ft. Counterpoise
39 Ft. Counterpoise

38 Ft. Counterpoise
37 Ft. Counterpoise

36 Ft. Counterpoise
35 Ft. Counterpoise

![Antenna Analyzer - AAM GUI - prog version 62A](image)

34 Ft. Counterpoise

![Antenna Analyzer - AAM GUI - prog version 62A](image)
33 Ft. Counterpoise

![Graph showing 33 Ft. Counterpoise](image)

32 Ft. Counterpoise (BINGO!)

![Graph showing 32 Ft. Counterpoise](image)
32 Ft. Counterpoise – Wider Frequency Sweep
References
GAP Antenna Web Page (GAP TITAN DX & GAP Quick Tilt Mount): http://www.gapantenna.com
The Wireman Web Page (Counterpoise): http://www.thewireman.com
Array Solutions (AIM 4170): http://www.arraysolutions.com