

# Building a 10 GHz Rig From Surplus Parts

HAMCOM 2012

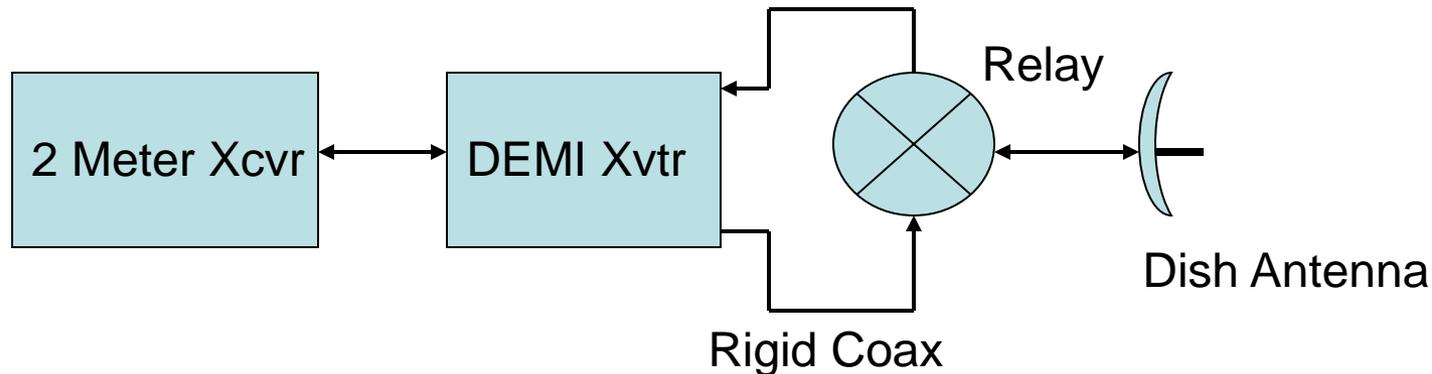
Plano, TX

Bob Gormley WA5YWC

&

Al Ward W5LUA

# Basic Components



- **Down East Microwave 10 GHz Transverter Kit**
- **2 meter I/F transceiver**
- **Relay and rigid coax**
- **Dish or Horn antenna**

## 2 Meter Multimode I/F Radio



- FT-817
- FT-857
- IC-202
- FT-290
- IC-251
- TS-700A

- My choice is the ICOM IC-706. Affordable and readily available
- 10 Watts out on 2 meters, adjustable to 0.5 watts out
- Built-in keyer, Accessory jack for transceiver interface

# DEMI Transverter Kit

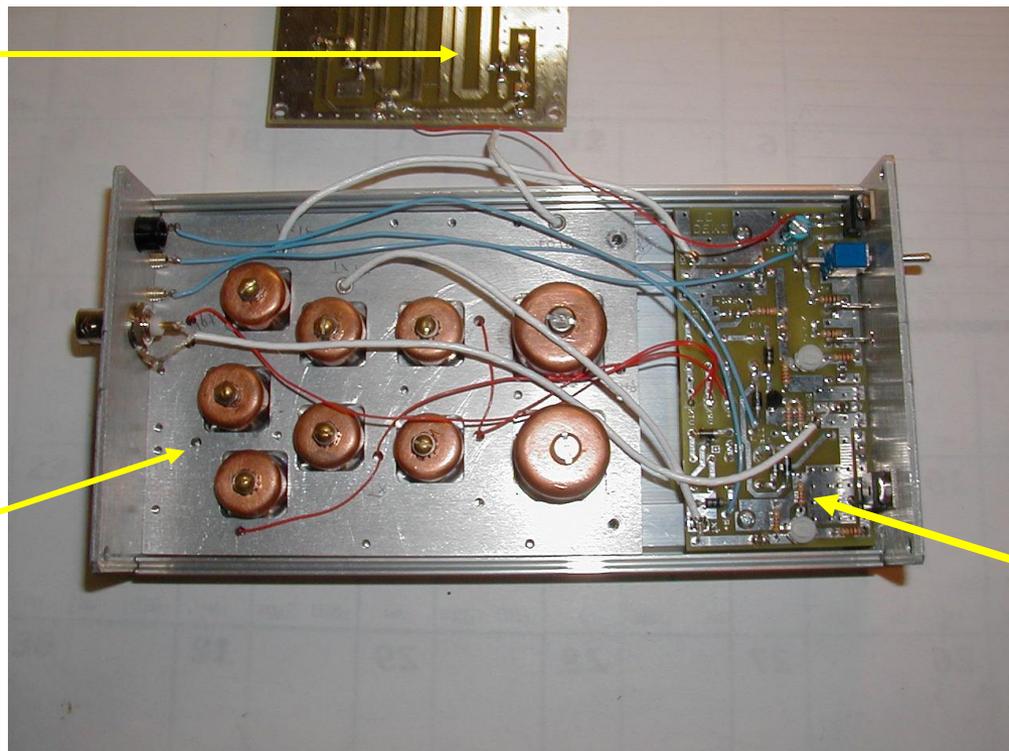
Osc/multiplier



Pipe Cap Filters

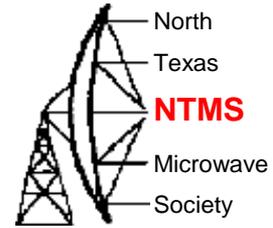


DC Control Board



Top View

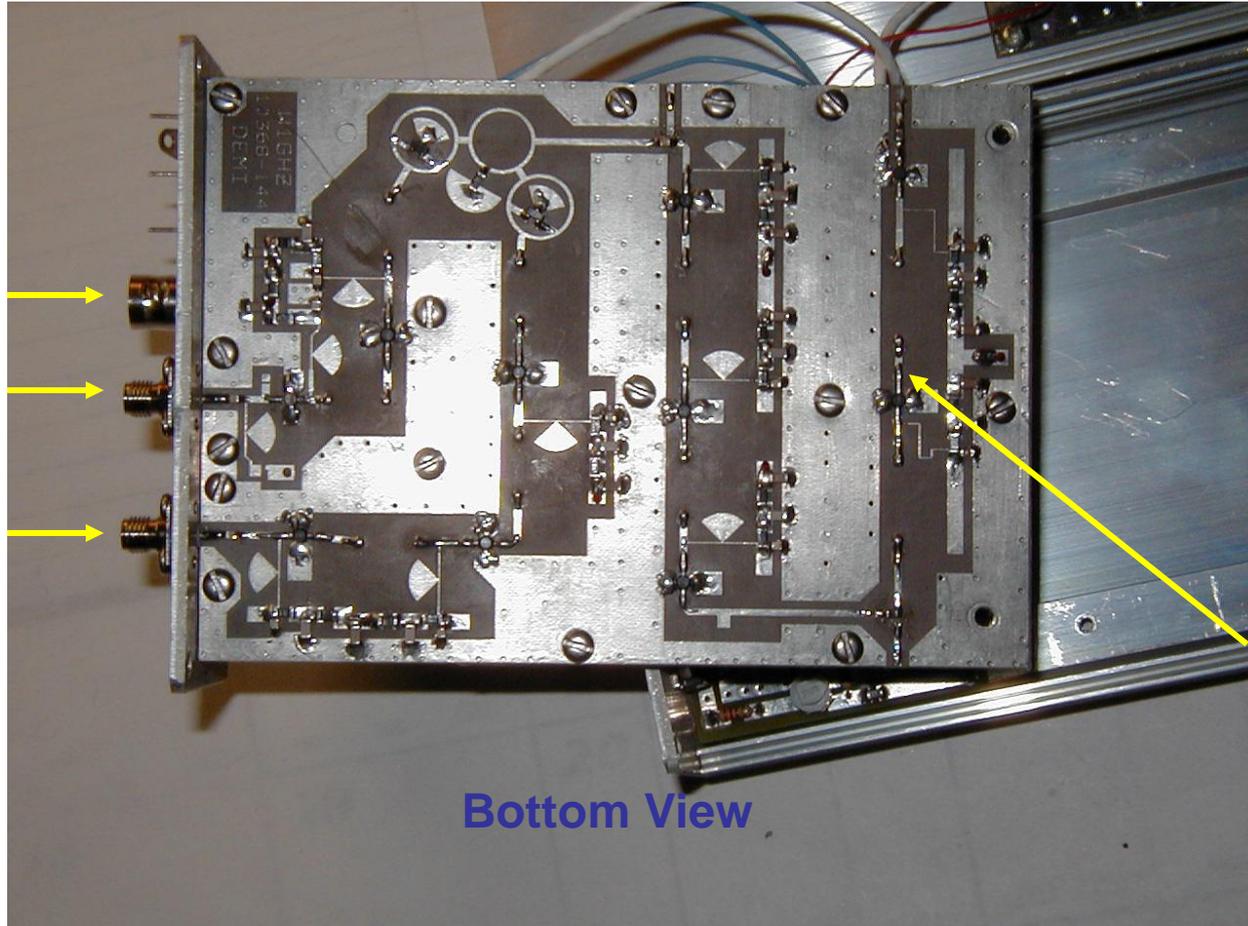
# DEMI Transverter Kit



144 MHz in/out

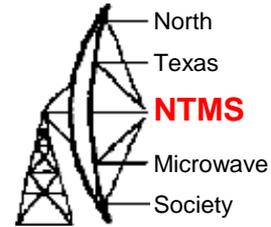
10 GHz in

10 GHz out  
(10 mW)



Surface mount  
construction

Bottom View

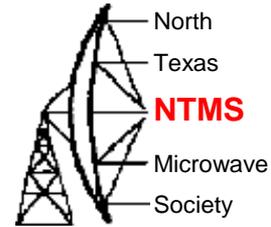


## A Different Construction Approach

There are a few kits available for the skilled builder. These include Down East Microwave and DB6NT. The kits are not builder friendly such as a Heathkit with thru-hole components and point to point wiring. These kits require precision assembly using surface mount construction.

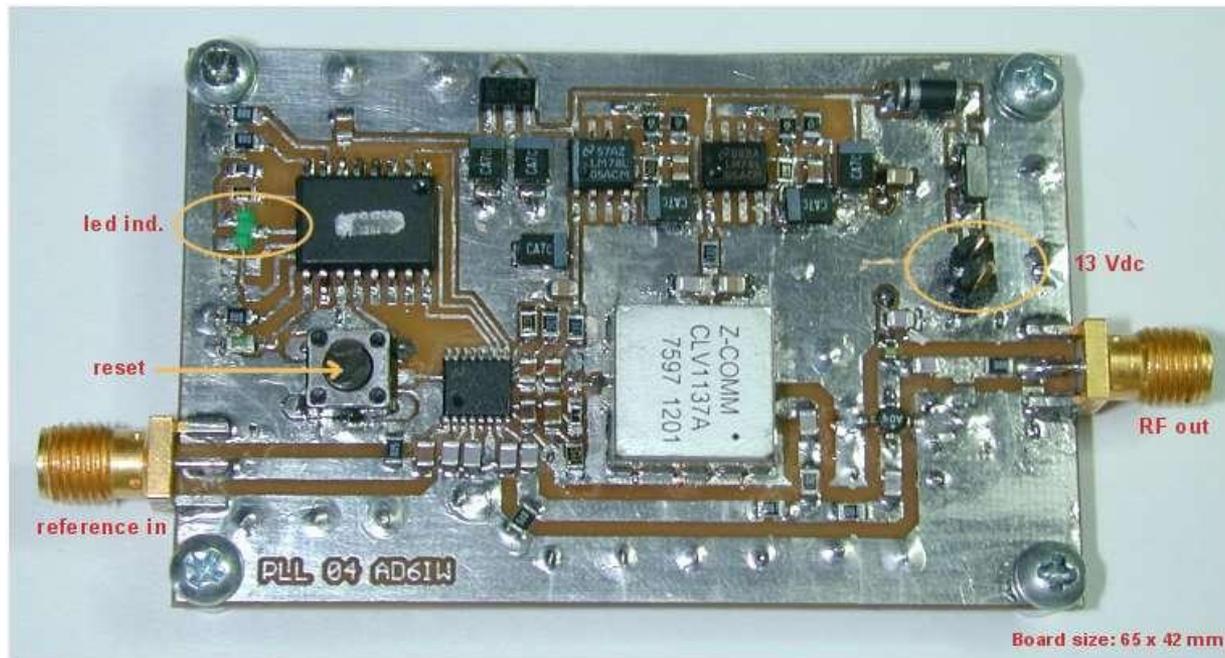
The following approach uses modular assembly techniques with minimal surface mount assembly.

# Basic Building Blocks for a 10GHz Transverter



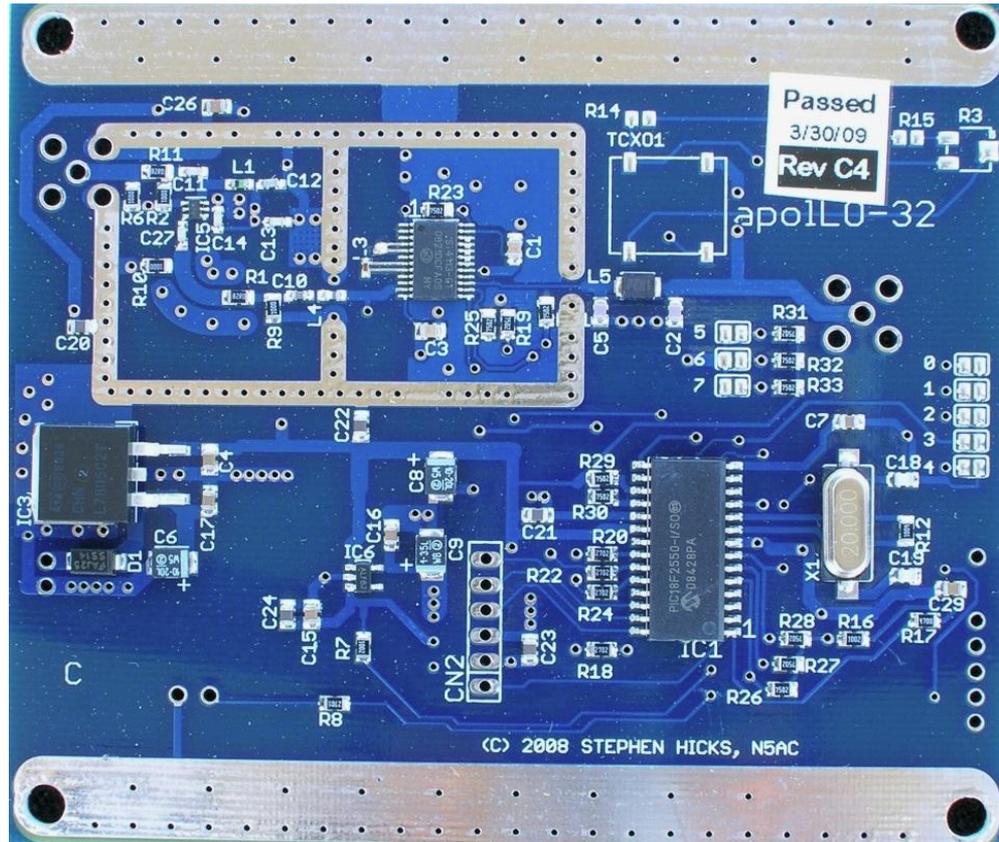
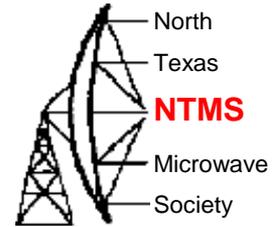
- Local Oscillator
- Frequency multiplier
- Power Divider
- Mixer
- Isolators
- Filter
- Low Noise Amplifier for Receive
- Power Amplifier for Transmit
- Transmit/Receive Relay
- Hardline Coax with connectors

# AD6IW $\mu$ Wave PLL LO



Available from Goran Popovic, AD6IW  
[ad6iw@ad6iw.com](mailto:ad6iw@ad6iw.com)

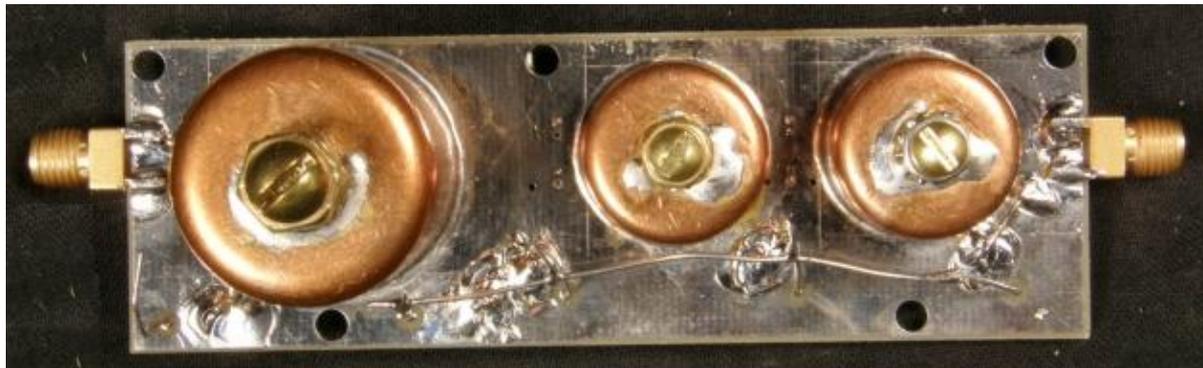
# ApoLO A32 Frequency Synthesizer By Steve Hicks, N5AC



Available from Down East Microwave.

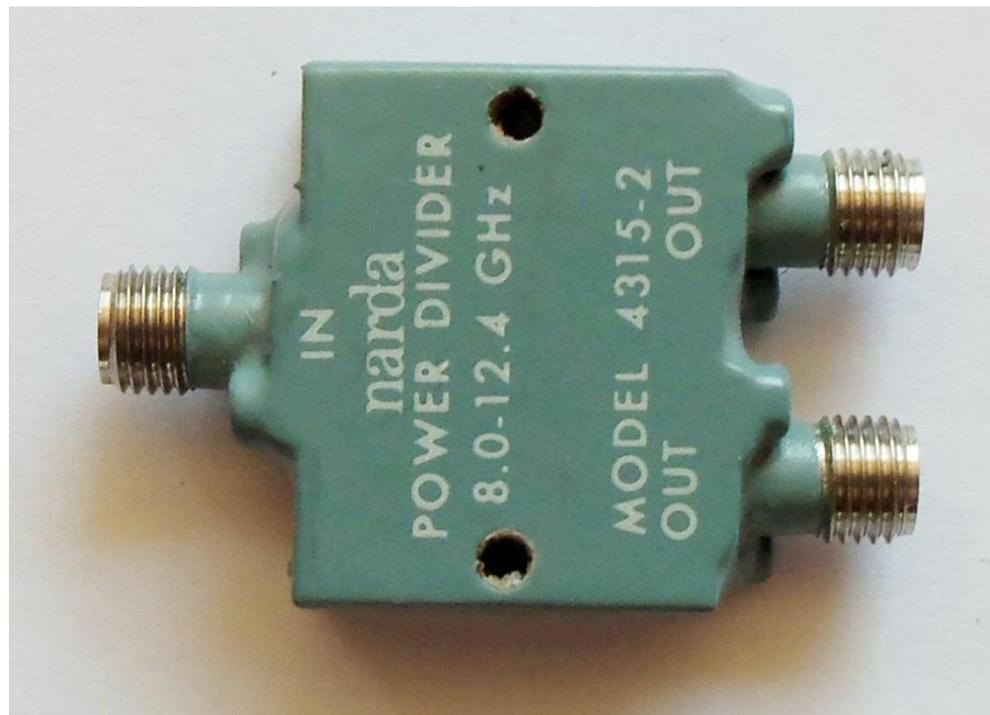
# Frequency Multiplier

By  
**W1GHZ**

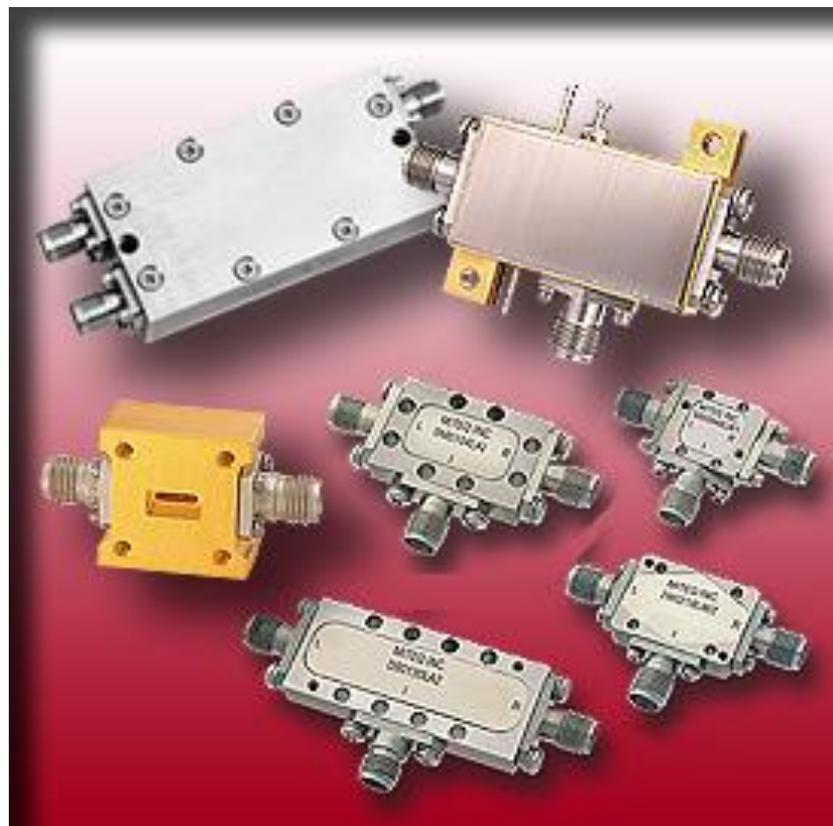


Personal Beacon for 10GHz by Paul Wade, W1GHZ  
Contact Paul at [w1ghz@arrl.net](mailto:w1ghz@arrl.net)  
[www.w1ghz.org](http://www.w1ghz.org)

# Power Splitter



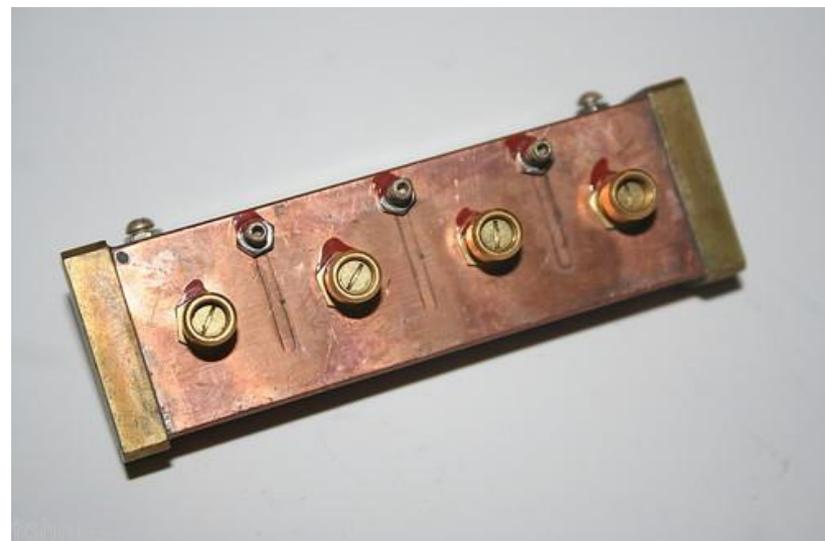
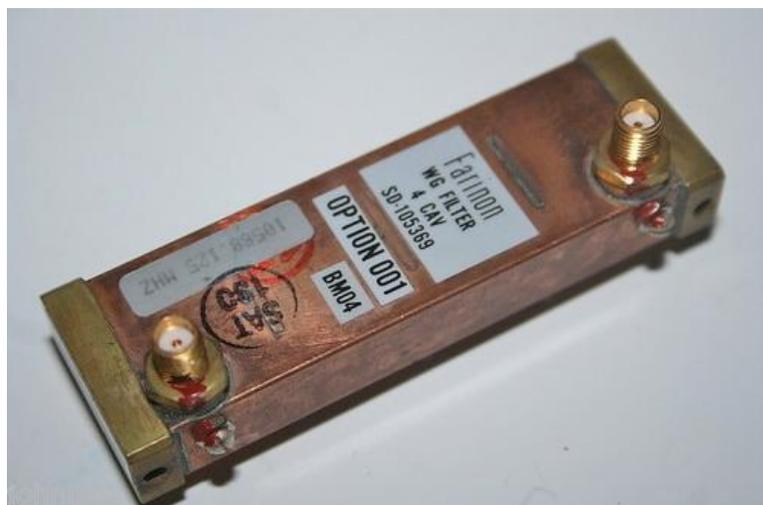
# Microwave Mixers



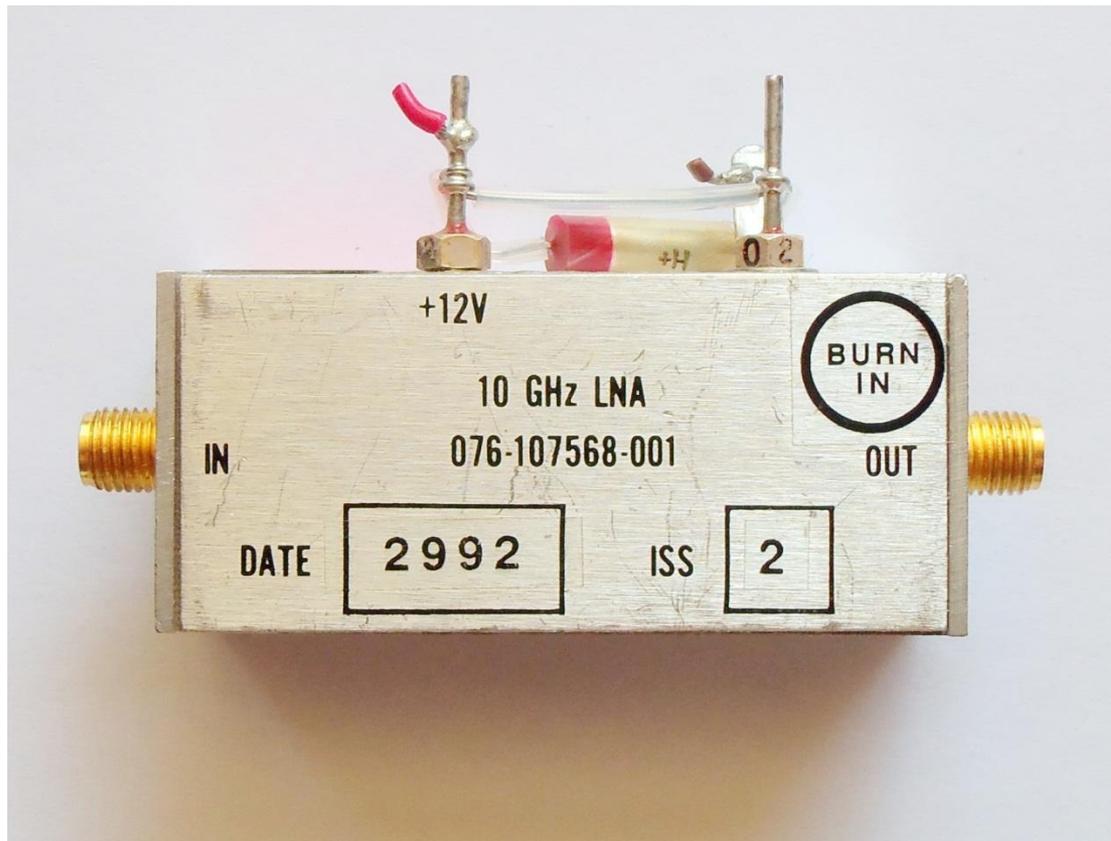
# Microwave Isolator



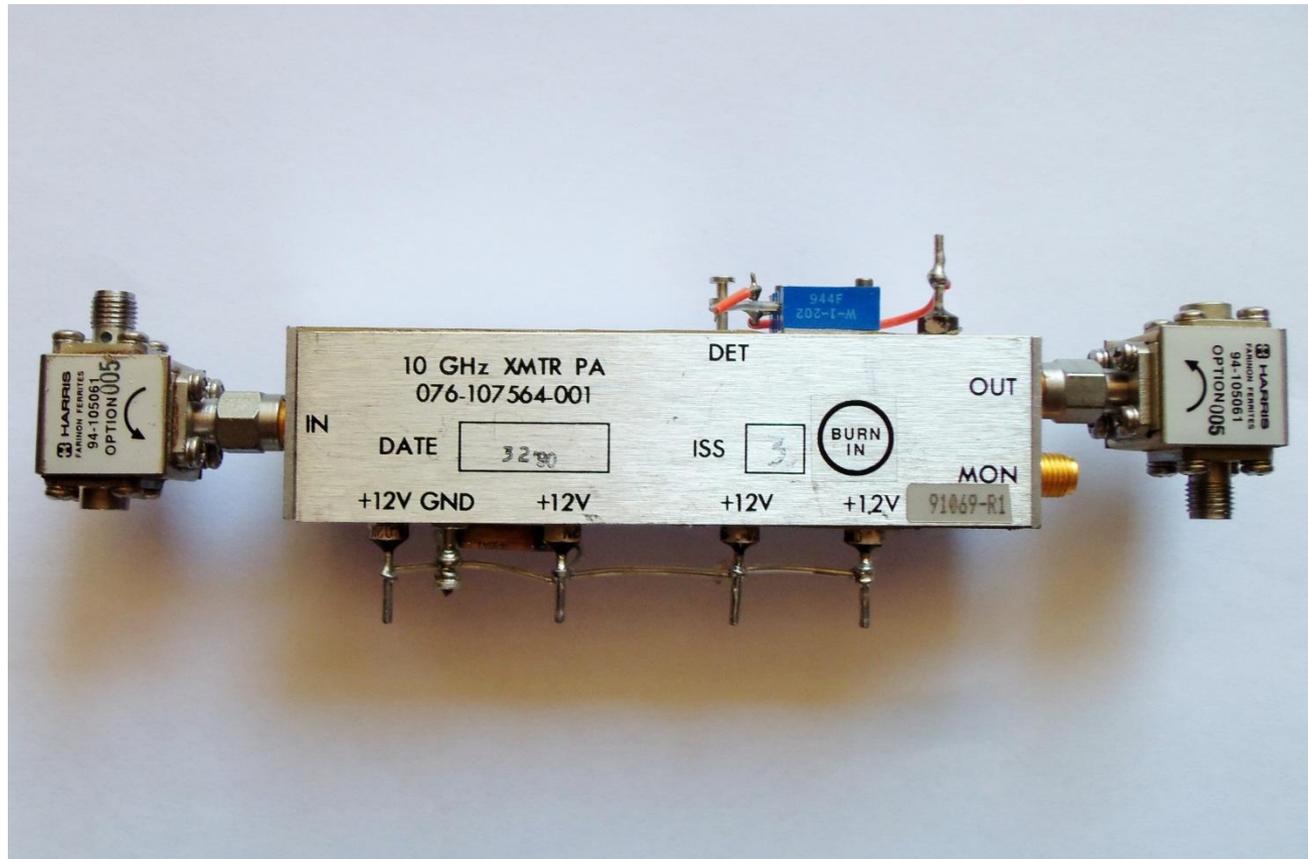
# Waveguide Filter



# Low Noise Amplifier for RX



# Power Amplifier for TX



# Relays



SPDT 28 VDC  
0-18 GHz - SMA

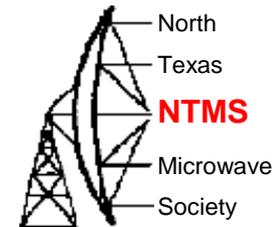


Transfer Relay  
0-18 GHz - SMA

# Hardline Coax



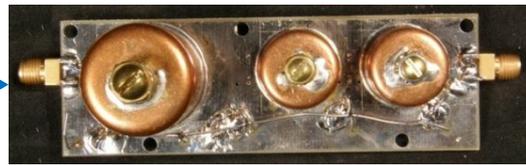
# 10 GHz Transverter With Connectorize Parts



1136 MHz LO

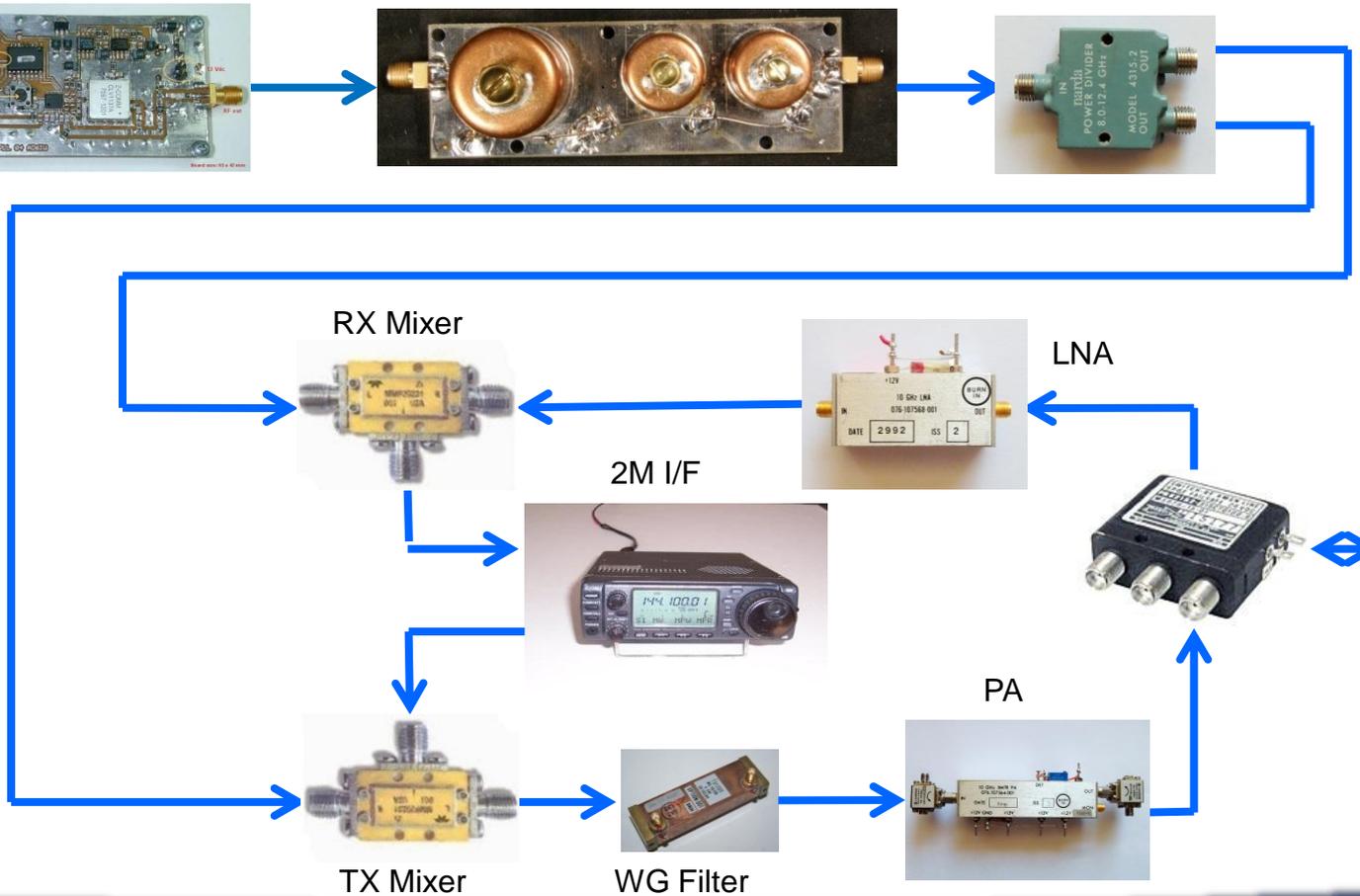


X9 Multiplier



10224 MHz

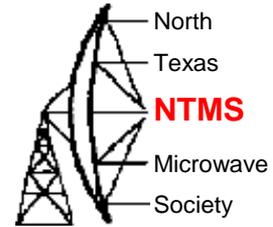
Pwr Splitter



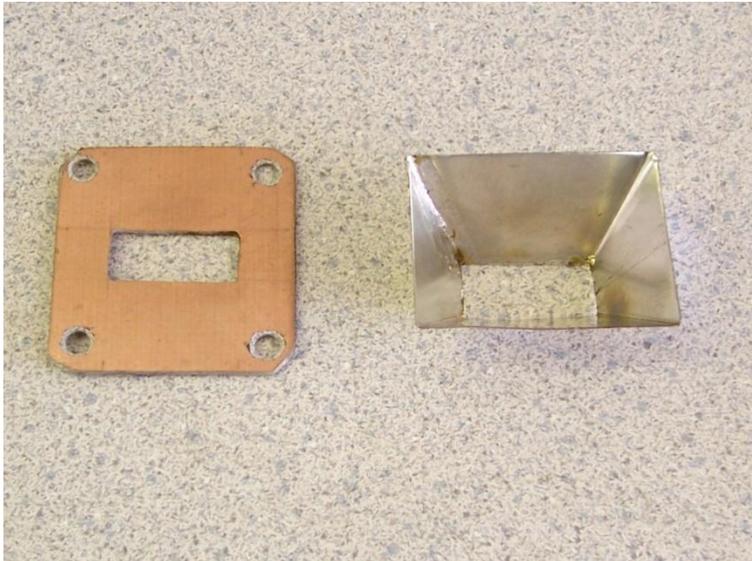
Dish Ant



# WR-90 uWave Horn Antenna



## Solder it all together



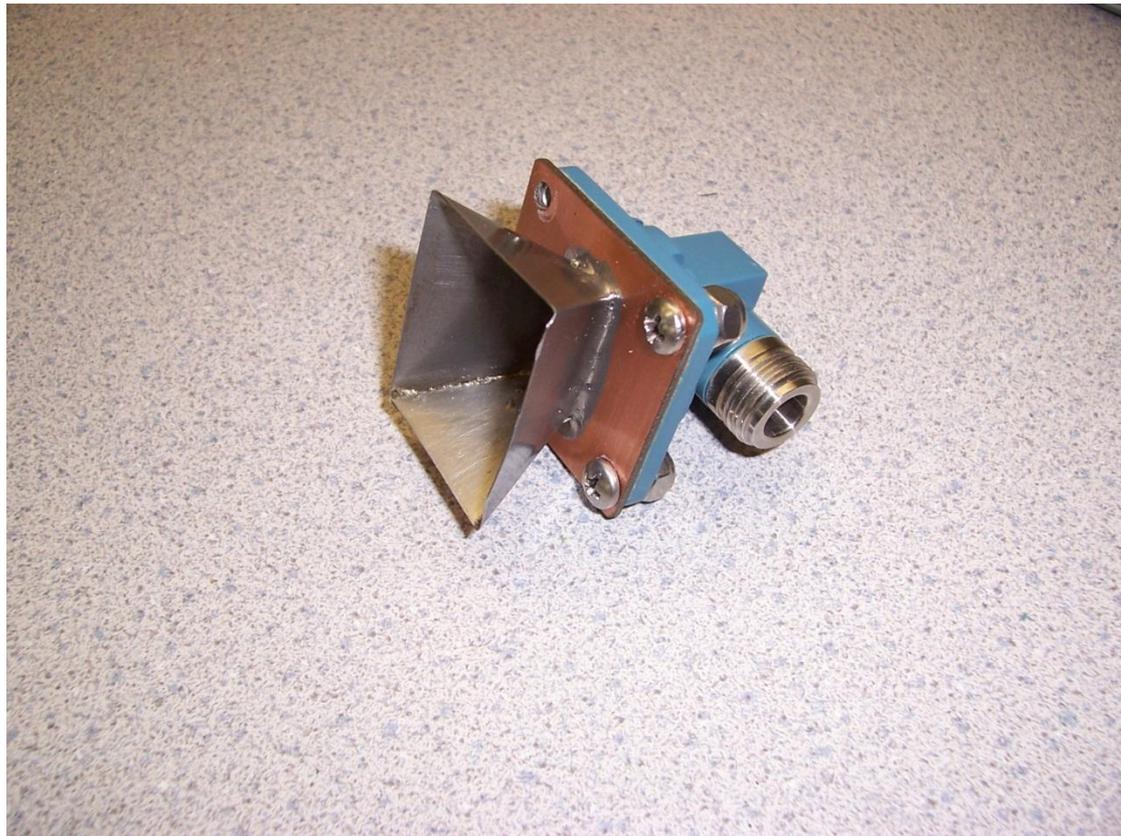
Double side circuit board and tin



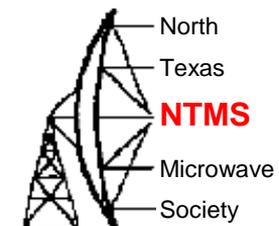
# WR90 Waveguide to Coax Transition



# New Horn and Waveguide Transition



# Surplus Dish Antenna



- 18 inch offset dish
- Readily available
- High gain typically 30+ dB
- Remove commercial feed and install new horn and transition

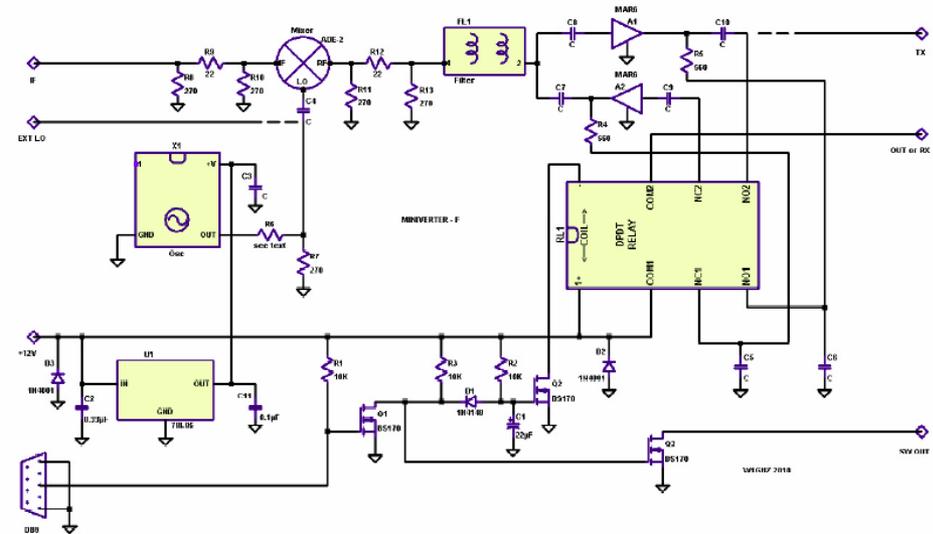
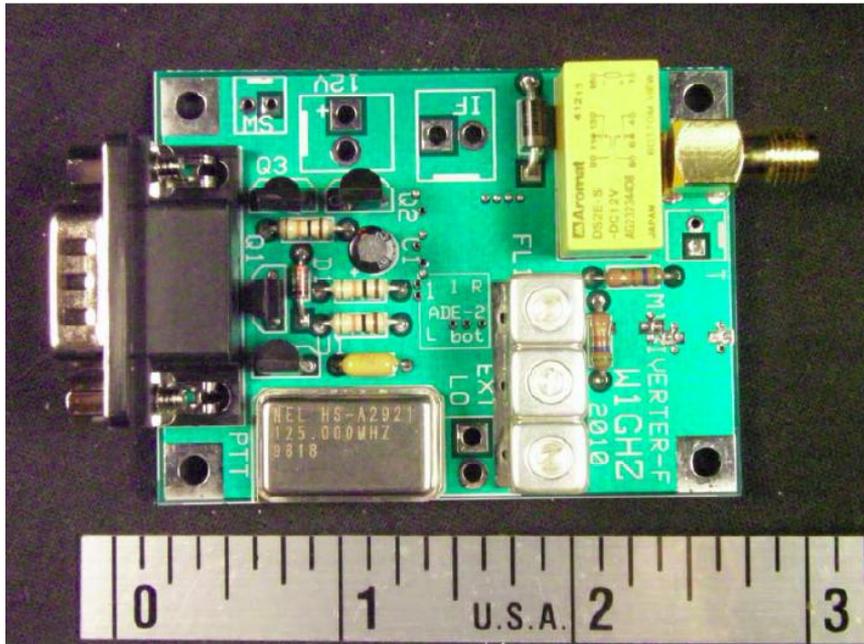
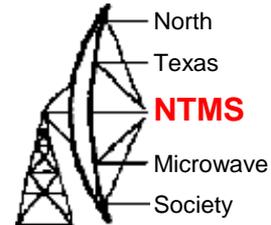
W1GHZ 2M to 10M Mini-Verter integrated  
with the N5AC VHF LO Board

5 & 10 GHz DX Record Broken

ARRL 10 GHz & Up Contest

Al Ward  
June 8th, 2012  
HamCom  
Plano, Texas

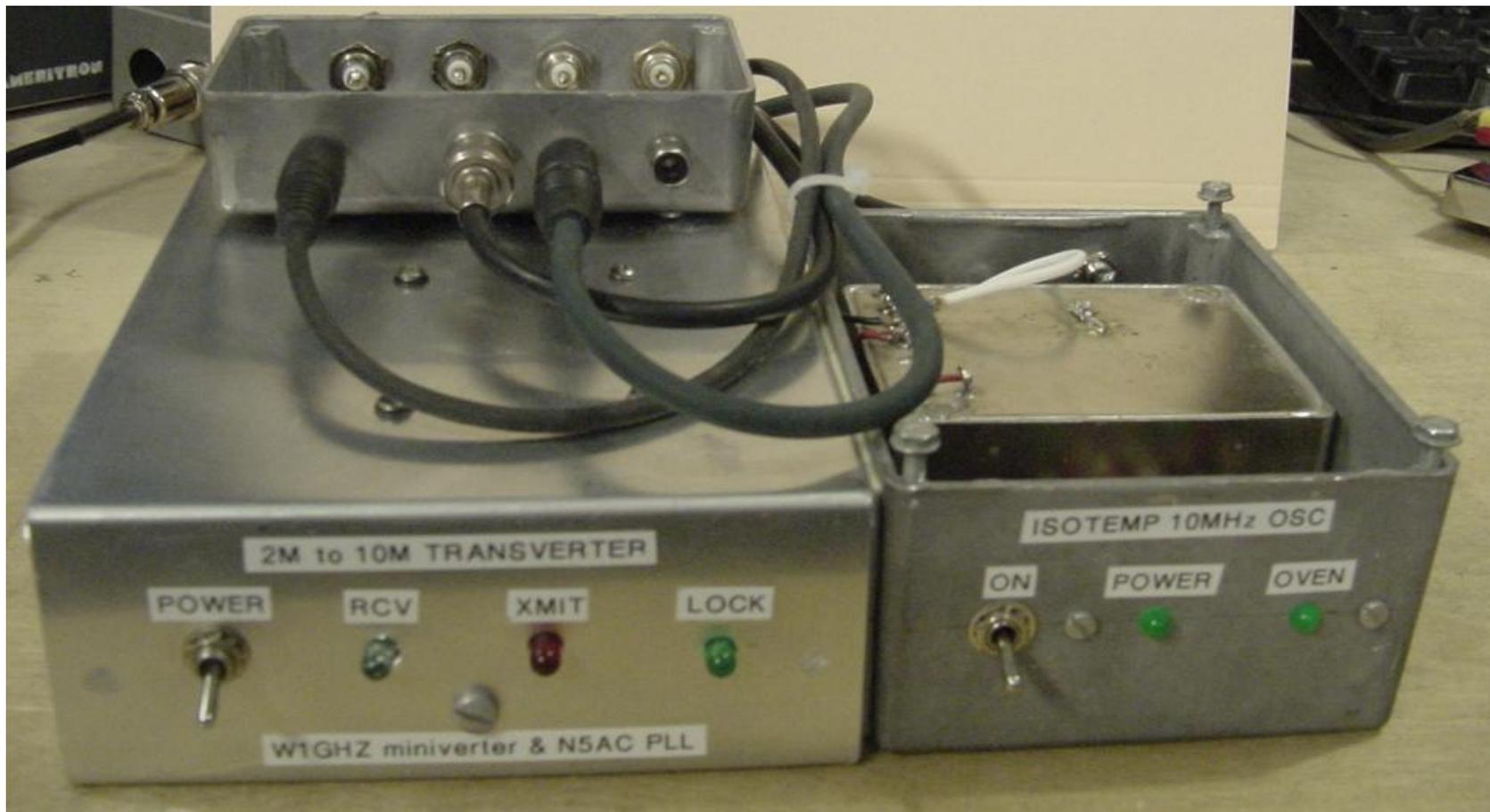
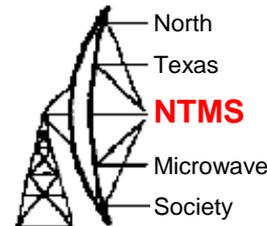
# W1GHZ Miniverter



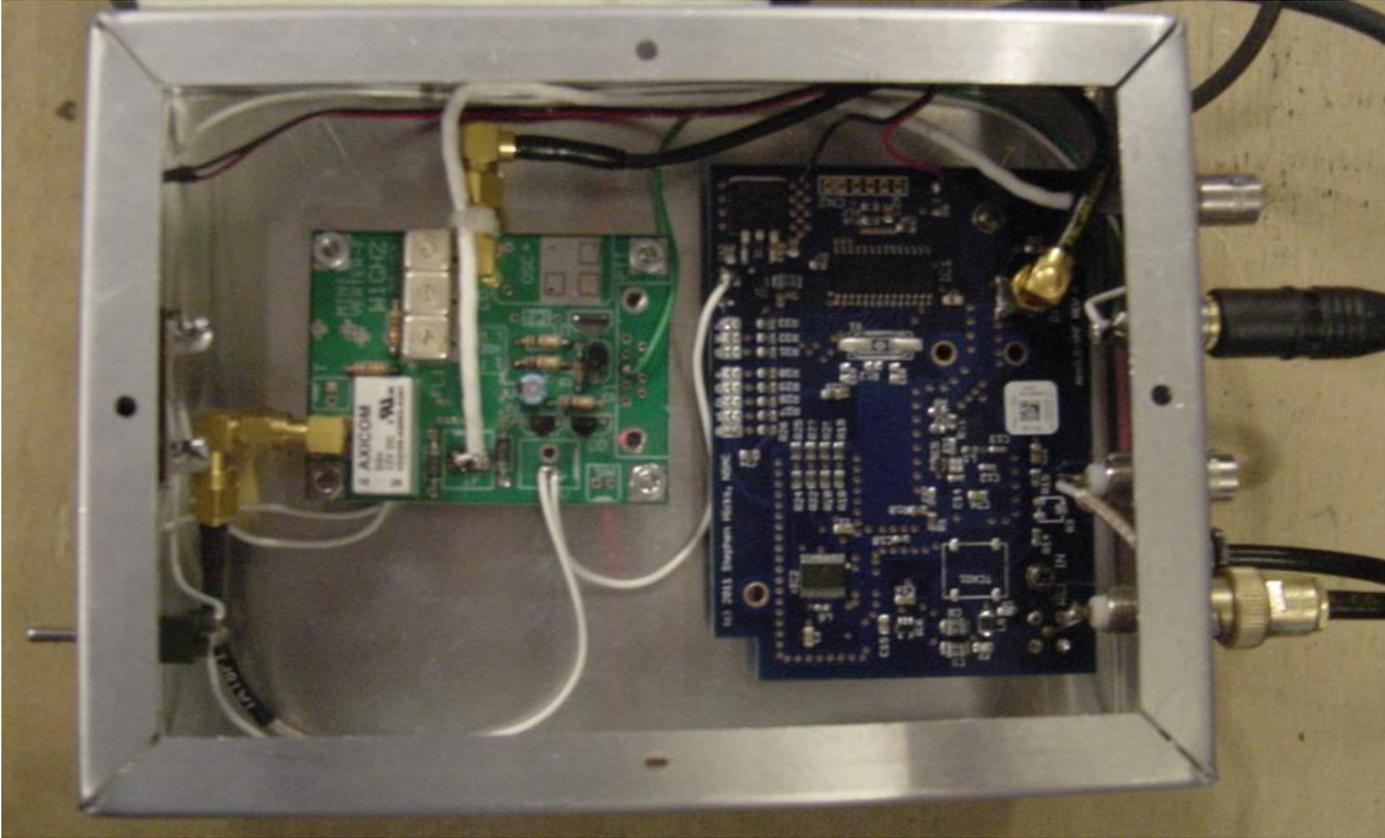
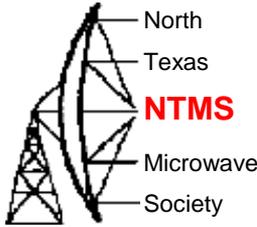
- GHZMIN-144: 144 MHz. RF frequency less oscillator. \$49**
- GHZMIN-222: 222 MHz. RF frequency less oscillator. \$49**
- GHZMIN-432: 432 MHz. RF frequency less oscillator. \$49**
- GHZMIN-PCB: W1GHZ Miniverter PCB only. \$6**
- CLK-110: 110 MHz oscillator for Miniverter (limited stock) \$3**

My unit has 2dB conversion gain and 3.5 dB NF

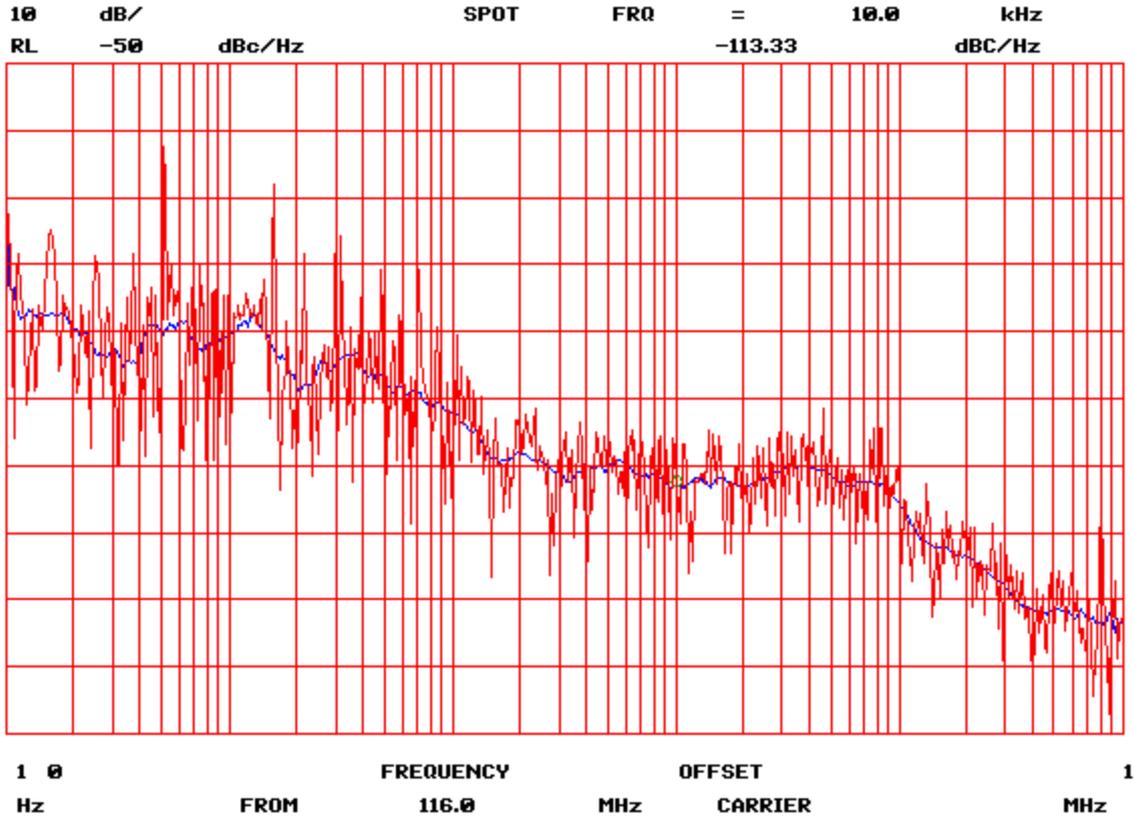
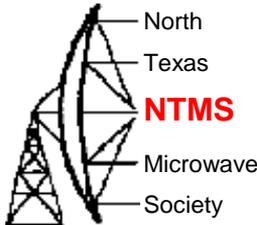
# W1GHZ Mini-Verter with N5AC VHF LO Board & Isotemp 10 MHz Oscillator



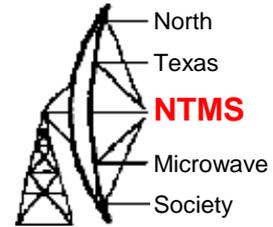
# Bottom View of 2M to 10 M XVTR



# 116 MHz PLL Driven From Isotemp 10 MHz Reference @ +3 dBm



# Flex-1500 at W5LUA/Rover, receiving AA5C 24 GHz beacon



FlexRadio Systems™ PowerSDR™ v2.3.5 FLEX-1500: 2210-0031

Setup Memory Wave Equalizer XVRTs CWX Mixer Antenna FlexControl ESC Get Help Heros About

VFO A: 24192.323 800  
24GHz General TX

VFO Sync Tune Step: - 50Hz +  
VFO Lock 7.000000 Save Restore

VFO B: 24192.382 651  
TX 24GHz General

RX1 Meter TX Meter  
Signal Fwd Pwr  
-93.0 dBm

MON TUN  
MOX  
MUT  
REC PLAY

AF: 59  
AGC-T: 106  
Drive: 50  
AGC Preamp  
Fast +30  
SQL: -90

24192.300 24192.305 24192.310 24192.315 24192.320 24192.325 24192.330 24192.335 24192.340

-70 -80 -90 -100 -110 -120 -130 -140

FlexRadio Systems  
Software Defined Radio

24192.300 24192.305 24192.310 24192.315 24192.320 24192.325 24192.330 24192.335 24192.340

-5982.0Hz 0.0sec 24192.317 818 MHz 787.3Hz -93.7dBm 24192.324 587 MHz

Pan: Center Zoom: 0.5x 1x 2x 4x

RX: X/TX/COM TX: X/TX/COM

SPLT A > B NR ANF Panafall  
u Beat A < B NB NB2 AVG Peak  
IF->V A < B SR BIN TNF +TNF

XIT 0 RIT 0  
0 0  
VACT VACZ MultiRX Swap

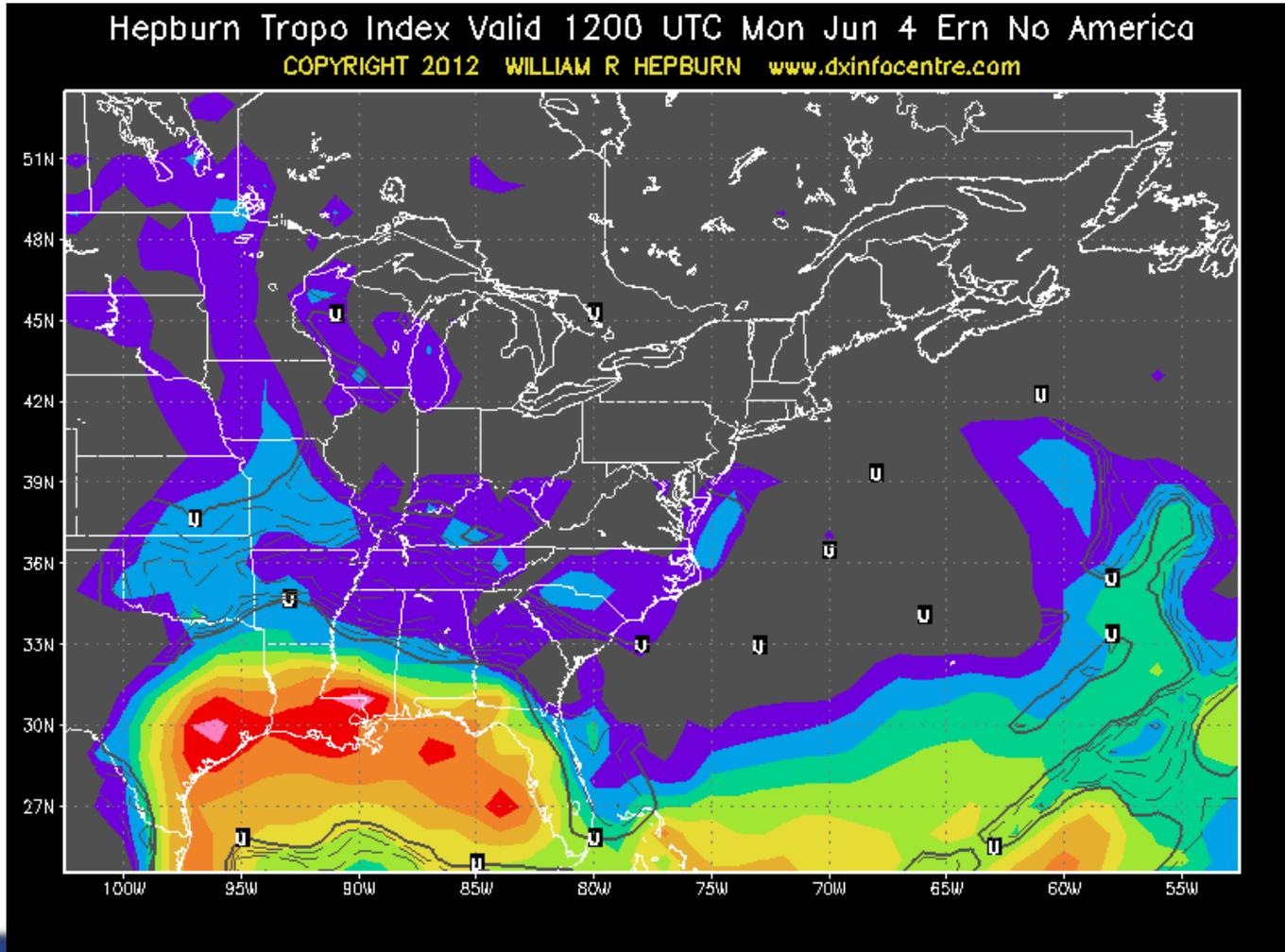
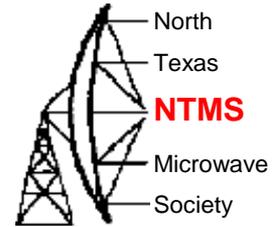
Mic 14 Transmit Profile Default  
DX 10 Show TX Filter on Display  
CPDR 1 RX EQ TX EQ  
DEXP -40

5.0k 4.4k 3.8k  
3.3k 2.9k 2.7k  
2.4k 2.1k 1.8k  
1.0k Var 1 Var 2  
Low 150 High 1950  
Width: Shift: Reset

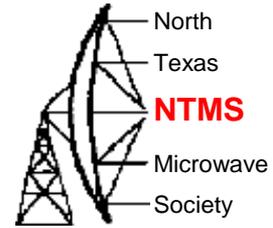
6/5/2012  
LOC 19:55:50  
CPU %: 19.1

# William Hepburn's Tropospheric Ducting Forecast

<http://www.dxinfocentre.com/tropo.html>



# W5LUA to K0VXM



Google

Get directions My places Save to My Places

Explore making custom maps in an [interactive tutorial](#).

**W5LUA-K0VXM-10GHz**  
 Central Texas (Dallas Area) to East Coast of Florida (Space Coast Area) on the morning of June 5, 2012.  
 Unlisted · 16 views  
 Created on Jun 6 · By John · Updated 2 hours ago  
[Rate this map](#) · [Write a comment](#) · [KML](#)

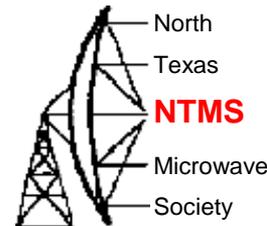
W5LUA-K0VXM 10GHz

Report a problem

Satellite Traffic

Map data ©2012 Google Report a problem

# K0VXM EL98pj @ 1000 miles



Setup Memory Wave Equalizer XVTRs CWX Mixer Antenna FlexControl ESC Get Help Heros About

**STOP**

MON TUN  
MOX  
MUT  
REC PLAY

AF: 36  
AGC-T: 106  
Drive: 65  
AGC Preamp  
Fast On

SQL: -80

RX1: ANT1  
TX: ANT1  
RX2: RX2 IN

6/4/2012  
LOC 11:50:53  
CPU %: 30.5

VFO A: **10368.100** 320  
10GHz General TX

VFO Sync VFO Lock 7.000000  
Tune Step: - 10Hz +  
Save Restore

VFO B: **24048.120** 000  
TX Out of Band

FlexRadio Systems®  
software defined radio

10368.060 10368.070 10368.080 10368.090 10368.100 10368.110 10368.120 10368.130

-15780.3Hz 2.9sec 10368.083 680 MHz; 505.6Hz -120.5dBm 10368.100 276 MHz;

Pan: Center Zoom: 0.5x 1x 2x 4x

SPLT A > B NR ANF Panafall  
u Beat A < B NB NB2 AVG Peak  
IF->V A <> B SR BIN TNF +TNF  
XIT 0 RIT 0  
0 10  
VAC1 VAC2 MultiRX Swap

Speed: 25 WPM Pitch Freq (Hz): 550  
Break In: Enabled Delay (ms): 300  
 Iambic  
 Sidetone  
 Show TX CW Frequency

RX1 Meter TX Meter  
Signal Fwd Pwr  
**-107.1 dBm**

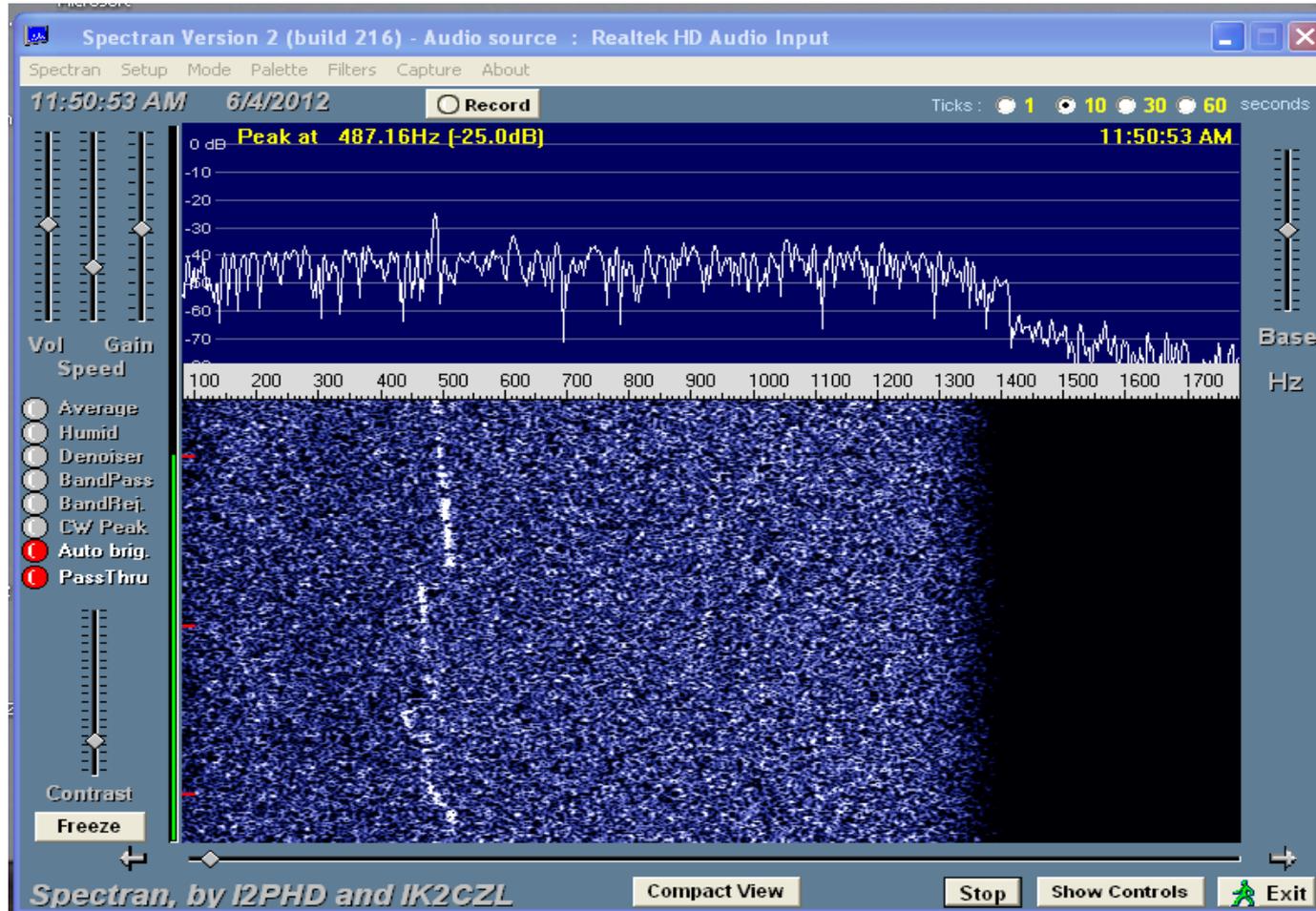
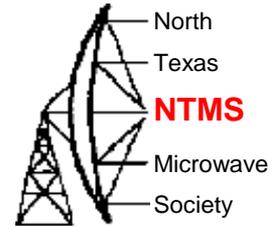
Zm	70cm	902
1296	2304	3400
3456	5760	10368
24048	24192	47088
HF	78192	Z-Z

LSB	USB	DSB
CwL	CwU	FM
AM	SAM	SPEC
DIGL	DIGU	DRM

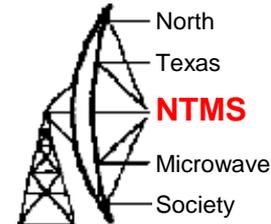
1.0k	800	750
600	500	400
250	100	50
25	Var 1	Var 2

Low: -251 High: 1351  
Width: Shift: Reset

# Using Spectran for better resolution of K0VXM's 10 GHz signal



# VE7CC & DX Sherlock Loggers



CC Cluster User W5LUA @ VE7CC-1

Configuration Set Reflector Help

Update Program **\*\*\*Connected to: VE7CC-1** Disconnect 04 Jun 13:31:01

```

CC11^50110.00^CU1CB^04-Jun-2012^1329^first time hrd this
season^K8LEE^0^14^VE7CC-1^36^14^8^4^IN^CU^K^HM76^EM79^^^98.226.85.231^
CC11^50125.0^K1GUP^04-Jun-2012^1329^EL98<>FN54 Tnx for MA^KD2JA^43^3^AB5K^8^5^8^5^ME^FL^K^FN54^EL98^^^
<- dx 10368100 k0vxn 1002 miles EL98 to EM13
W5LUA de VE7CC-1 04-Jun-2012 1329Z CCC >
CC11^10368100.00^K0VXM^04-Jun-2012^1329^1002 miles EL98 to
EM13^W5LUA^3^2^VE7CC-1^8^5^7^4^FL^TX^K^K^EL98^EM13^^^70.240.121.49^
CC11^50110.0^UP2EKG^04-Jun-2012^1329^^NW0W^0^20^ED7ZAB-5^11^8^7^4^^MO^UP2E^K^FK88^EM47^^^188.165.198.144^
    
```

Spotter	Freq	DX	St	deg	nile	Time	Date	Comments
VE9AA	50068.1	N4LR/B	GA	85	671	13222	4	UNITED STATES: 519
N4UHZ	50125.0	K1GUP	ME	54	1671	13222	4	UNITED STATES: FN54<>EM86
W4AS	50008.1	H1W/B		116	1878	13252	4	DOMINICAN REPUBLIC: 59+
W3UR	50110.0	CU1CB		65	3974	13262	4	AZORES:
K4NNX	50095.0	UP2EKG		108	2308	13282	4	ANGUILLA: Fk88>EL94
K5SW	50110.0	CU1CB		65	3974	13292	4	AZORES: HM76 4x2 static bad
W5LUA	5760100.0	K0VXM	FL	105	979	13292	4	UNITED STATES: 1002 miles EL98 to EM1
K8CXM	50078.0	N2GHR/B	NY	62	1397	13292	4	UNITED STATES: FN30>EM79 in and out
K2HUB	50079.8	TI2NA/B		149	1848	13292	4	COSTA RICA: loud
K8LEE	50110.0	CU1CB		65	3974	13292	4	AZORES: first time hrd this season
KD2JA	50125.0	K1GUP	ME	54	1671	13292	4	UNITED STATES: EL98<>FN54 Tnx for MA
W5LUA	10368100.0	K0VXM	FL	105	979	13292	4	UNITED STATES: 1002 miles EL98 to EM1
NW0W	50110.0	UP2EKG		108	2308	13292	4	ANGUILLA:

Settings Country State Bands Users DX WWV = 41 Login Msg Ann = 125 Wx Plus Mail

ALL 2871  
160 2 2  
6 5 2720  
2 123 124  
1  
70 22 22  
MW 1 3  
4  
Alarm

Minor Radio Blackouts  
SA: Eruptive  
GMF: Active  
SFI=129 A=14 K=5

0 **Conn** Configure Fix Spots Set Alarm Clear ALL Clear Sound Ann Spot Get Spots ALL

QSO/SWL real time maps - NA - SHF - Windows Internet Explorer

http://www.v... Bing

File Edit View Favorites Tools Help

QSO/SWL real time maps - NA - ...

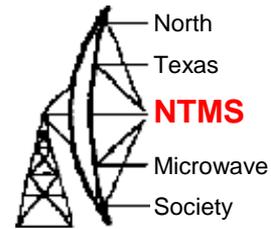
10 MHz 70 MHz 144 MHz 432 MHz >450 All Sat. FM DX Ticker

WWW.DXSHERLOCK.INFO  
QSO above 450 MHz  
from 12:29z to 13:29z

HWV info 2012-06-04 12:00  
SFI=129 A=19 K=4 (Minor)

http://www.vhfdx.info/spots/h Internet 100%

# Antennas at K0VXM & W5LUA



## K0VXM



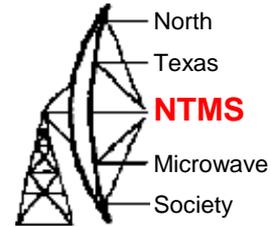
5760 MHz 7W to DSS dish @ 28ft  
10368 MHz 7W to 3ft dish @ 30 ft  
All equipment is antenna mounted

## W5LUA



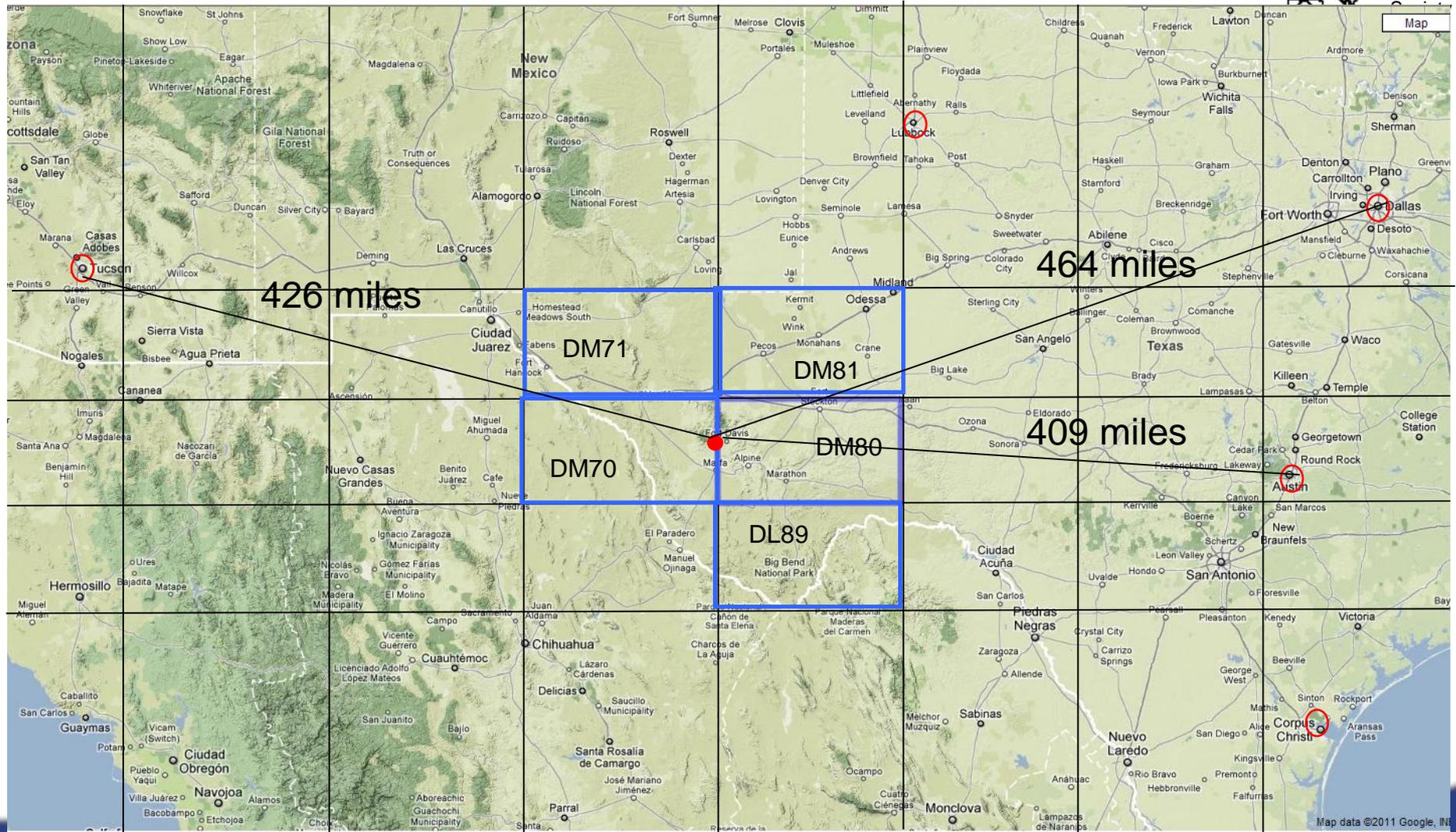
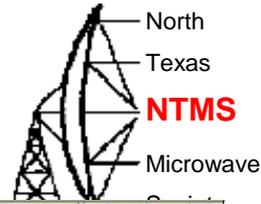
5760MHz 150W in shack to 5 ft mesh  
dish @ 70ft  
10368 MHz 100W in shack to 2 ft dish  
@ 75ft

# 2012 ARRL 10 GHz Contest Weekends

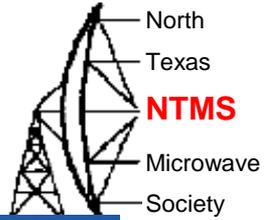


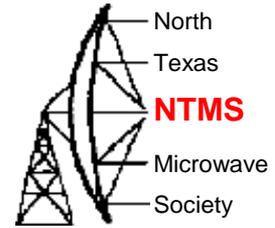
- August 18 & 19
- September 15 & 16
- West Texas trip planned for the second weekend

# Working 5 grids for VUCC on 5.7 GHz and Higher



# Views from the Ft. Davis Area





[www.ntms.org](http://www.ntms.org)