North Texas NTMS Microwave Society

Introduction to Amateur Microwave Radio

October 10, 2023

Greg McIntire, AA5C

Bands and Calling Frequencies for Weak Signal Work

North Texas NTMS Microwave Society

Band	Weak Signal Calling Frequency
902-928 MHz	902.1 MHz
1240-1300 MHz	1296.1 MHz
2300-2310 MHz	2304.1 MHz
2390-2450 MHz	2400.1 MHz (used only for EME)
3300-3450 MHz	3400.1 MHz (lost 3450-3500 MHz to 5G)
5650-5925 MHz	5760.1 MHz
10.0-10.5 GHz	10368.1 MHz (10450.1 MHz also used for EME)
24.0-24.25 GHz	24192.1 MHz (24048.1 MHz used for EME)
47.0-47.2 GHz	47088.1 MHz
76 - 81.0 GHz	78192.1 MHz and 76032.1 MHz
122.25 - 123 GHz	
134 - 141 GHz	
241-250 GHz	
All above 275 GHz	

Amateur Microwaves

North Texas NTMS Microwave Society

- Generally considered to be the allocated frequencies above 902 MHz.
- Available to all amateurs with a technician or higher class license
- Offers new technical and operating challenges

Microwave Operating Modes

North Texas NTMS Microwave Society

- Most work is weak signal
  - CW and SSB when conditions warrant
  - WSJT-X modes are now also being used
    - Q65 for terrestrial work
    - Q65, JT4, and JT9 for EME
- FM Repeaters
  - 902 FM Texas Repeater Network
  - 1285 MHz repeaters
- Amateur Television
  - 23 cm, 13 cm, and 6 cm bands

Microwave Stations

North Texas NTMS Microwave Society

- Fixed Stations
  - Equipment in shack with antennas on a tower or mast
    - Heliax or waveguide needed for low loss
  - Equipment in a weatherproof box on a tower or mast fed by IF signal
  - Generally limited by HOA
- Rovers
  - Portable or mobile operation

Microwave Propagation

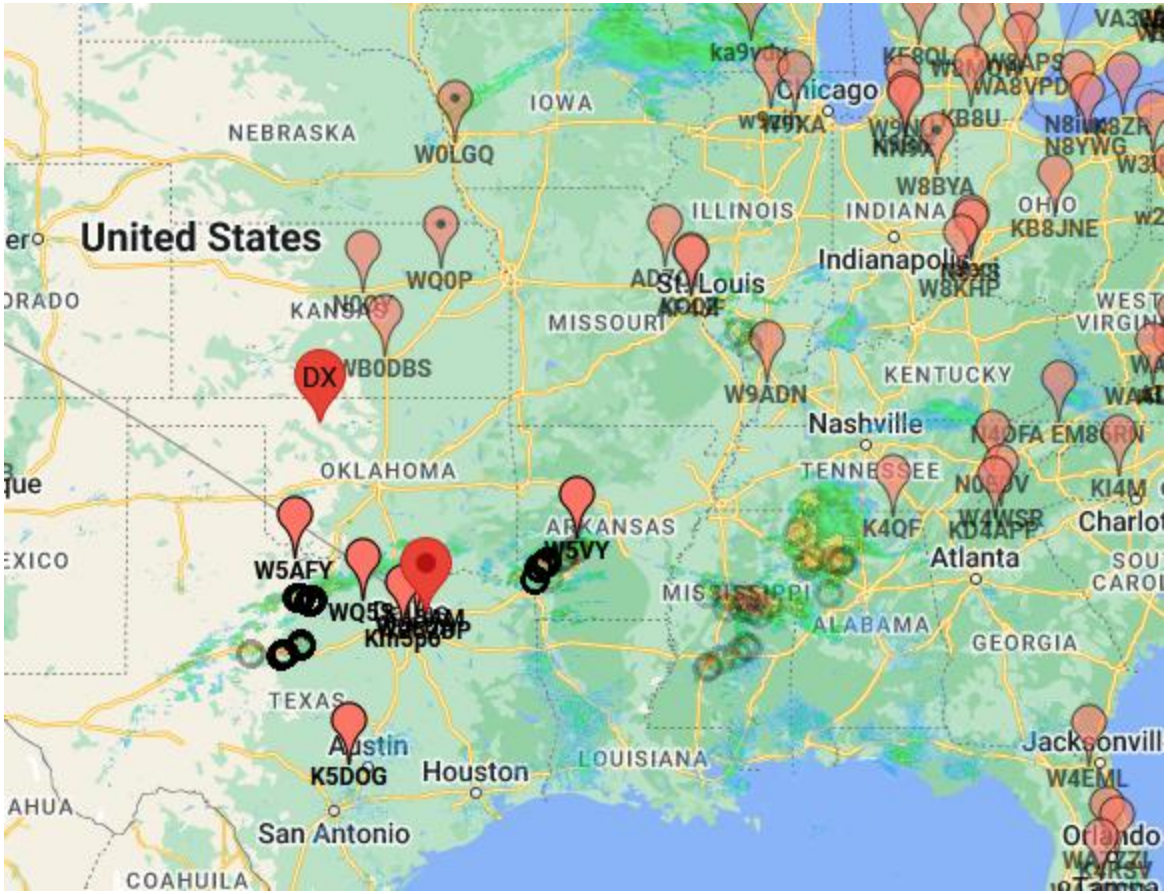
North Texas NTMS Microwave Society

- Microwave contacts are NOT limited to line of site
- Propagation paths can be created by
  - Tropospheric ducting
  - Knife edge refraction
  - Rain scatter
  - Aircraft scatter
  - Earth-Moon-Earth (EME)
  - Reflecting off water towers, building, etc.

North Texas NTMS Microwave Society

Rainscatter.com

- Uses National Weather Service and other data sources to calculate possible paths and beam headings from thunderstorm position and height
- Rain drops are the scattering mechanism
- AA5C 10 GHz RS contact wth WQ0P at 419 miles



The North Texas Microwave Society was formed in 1986

North Texas NTMS Microwave Society

Dedicated to Promoting Activity, the State of the Art in Equipment Design, and the Exchange of Ideas and Technology for the Amateur Bands Above 902 MHz

2023 Officers

President – Jim McMasters KM5PO
Vice President – Scott Armstrong AA5AM
Secretary – Eric Haskell AG5XV
Treasurer - Wes Atchison WA5TKU
Web – Bob Stricklin N5BRG

NTMS web page www.ntms.org

Ntms.org Web Site

North Texas NTMS Microwave Society

Inbox (8,275) - aa5c.mcintir | NTMS

www.ntms.org/

Getting Started | New folder

W5HN

North Texas Microwave Society

Dedicated to Promoting Activity, the State of the Art in Equipment Design, and the Exchange of Ideas and Technology for the Amateur Bands Above 902 MHz

NTMS Net
Sunday 8:00 PM
144.260 MHz

Optimized for 1024x768

- NTMS Home
- Why Microwave?
- Calendar
- Membership
- Microwave Update

Knowledge Base

- Feedpoint Archives
- @ The Meetings
- 802.11/HSMM
- Software
- Tech Library
- W1GHZ Antennas
- Gridsquares

New on the website - Jan 11, 2020 - Cowtown meeting, updated contest dates, club officers, Dec 2019 N5BRG presentations.

Next Meeting: The January 18th 2020 NTMS meeting will be at the Cowtown Hamfest, 6901 Wichita Street Forest Hill, Texas 76140. We have a 10:00 AM time slot.
Greg McIntire, AA5C, will present an NTMS overview and Bob Stricklin, N5BRG will talk about GNU radio. We hope to see you there.

The February 2020 meeting will be February 1 at the St. Barnabas Presbyterian Church in Richardson.

Microwave Update (MUD) 2019 Proceedings
Microwave Update (MUD) 2019 GNU Radio Workshop
Microwave Update (MUD) 2019 Antenna Range Results
Microwave Update (MUD) 2019 Noise Figure Tests
Here is a link to interesting work on a simple dual band (S,X) satellite feed by OM6AA

We are having an NTMS meeting at St. Barnabas Presbyterian Church located at 1220 W. Belt Line Rd, in Richardson. We will start gathering there for general discussions about 12 noon and have a formal meeting starting at 1:00 PM.

Some of the folks attending the meeting get together to eat BBQ at Texas Smokehouse Bar-B-Que, 800 E Arapaho Rd #101, Richardson TX 75081, 972 699 1521. This lunch typically gets started around 11:15 to 11:30 AM Saturday morning

Planning a presentation? Get our template here

Join the email reflector!

For the NTMS email reflector, send an e-mail to NTMS+Subscribe@groups.io

Email the Webmaster

NTMS Activities

- Monthly meetings with informal “bull and swap” session followed by technical presentations
  - In person about four times/year
  - Virtual using Zoom the rest of the year
- Noise figure and network analyzer test sessions at meetings or at members houses
- Antenna range for measuring antenna gain
- Equipment Construction
- Contesting
- Social events
- Sponsor Microwave Update conference

Weekly Lunches

- East Side - Tuesday 11:30AM
  Texas SmokeHouse BBQ
  800 E. Arapaho Rd, Suite #101
  Richardson, TX 75081
- West Side – Wednesday 11:30AM
  Riscky's BBQ
  Ft. Worth

North Texas Beacons

North Texas Microwave Society area Beacon Status updated October 30, 2022

Freq (MHz)	Call	Grid	Power	Antenna	Height above Ground	Status		Frequency Stabilization	Freq Reference	Keying
50.073	W5HN/B	EM13sj	.5 W	Halo	180 ft	OFF THE AIR (1)	HB	Crystal	12.51825 MHz	on/off
144.280.2	W5HN/B	EM13sj	1.5 W	Halo	180 ft	ON THE AIR	HB	Crystal	12.0233 MHz	on/off
222.060	AA5C/B	EM13se	8 W	Folded Dipole	53 ft	ON THE AIR	HB	PLL	10 MHz	on/off
432.370	N5PYK/B	DM93bm	50 W	Yagi towards DFW	70 ft	ON THE AIR		XCVR		on/off
432.380	W5HN/B	EM13kf	.8 W	Halo	280 ft	ON THE AIR	HB	ADF4351	10 MHz OCXO	on/off
903.050	W5HN/B	EM13kf	9 W	Alford Slot	280 ft	ON THE AIR	HB	N5AC PLL	10 MHz OCXO	on/off
1296.375	W5HN/B	EM13kf	3 W	Alford Slot	280 ft	ON THE AIR	HB	N5AC PLL	10 MHz OCXO	on/off
2304.366	W5HN/B	EM13kf	4 W	Alford Slot	280 ft	ON THE AIR	HB	Crystal		FSK
3456.380	W5HN/B	EM13kf	250 mW	Alford Slot	280 ft	OFF THE AIR	DB6NT	Crystal X 27	128.014 MHz	FSK
3400.380	W5HN/B	EM13kf	250 mW	Alford Slot	280 ft	BEING UPGRADED (2)	DB6NT	ADF4351	125.94 MHz	on/off
5760.364	W5HN/B	EM13kf	158 mW	Alford Slot	280 ft	ON THE AIR	DB6NT	Crystal X 48	120.0079 MHz	FSK
10368.368	W5HN/B	EM13kf	2.5 W	Alford Slot	280 ft	ON THE AIR	DB6NT	Crystal X 96	108.00395 MHz	FSK
24192.300	AA5C/B	EM13sf	500 mW	16-slot WR42	75 ft	ON THE AIR	HB	Crystal	112.0015 MHz	on/off
24192.380	W5HN/B	EM13kf		10 slot Alford	280 ft	Under Construction (3)	HB	ZL PLL		on/off
47088.300	W5HN/B	?				Under Construction				

NTMS Sunday Night NET

North Texas NTMS Microwave Society

- Local to DFW gathering on 144.260 MHz USB starting at 8PM
- Generally run by Ross K5ZSJ from the Carrollton area
- Very informal

North Texas NTMS Microwave Society

Meeting and Tune-up Party at N5BRG's QTH

Gathering
Testing - Show and Tell - Build

North Texas NTMS Microwave Society

10 GHz Antenna Range

North Texas NTMS Microwave Society

parking lot antenna range.

Kent, WA5VJB and Jim, WA5JAT

Jim, K0MHC and Jim, WA5JAT

FT8 Activity Nights

North Texas NTMS Microwave Society

- Monday 7:30 PM 144.174
- Tuesday 7:30 PM 222.174
- Wednesday 7:30 PM 432.174
- Equipment and Propagation Checks

Getting on Microwave

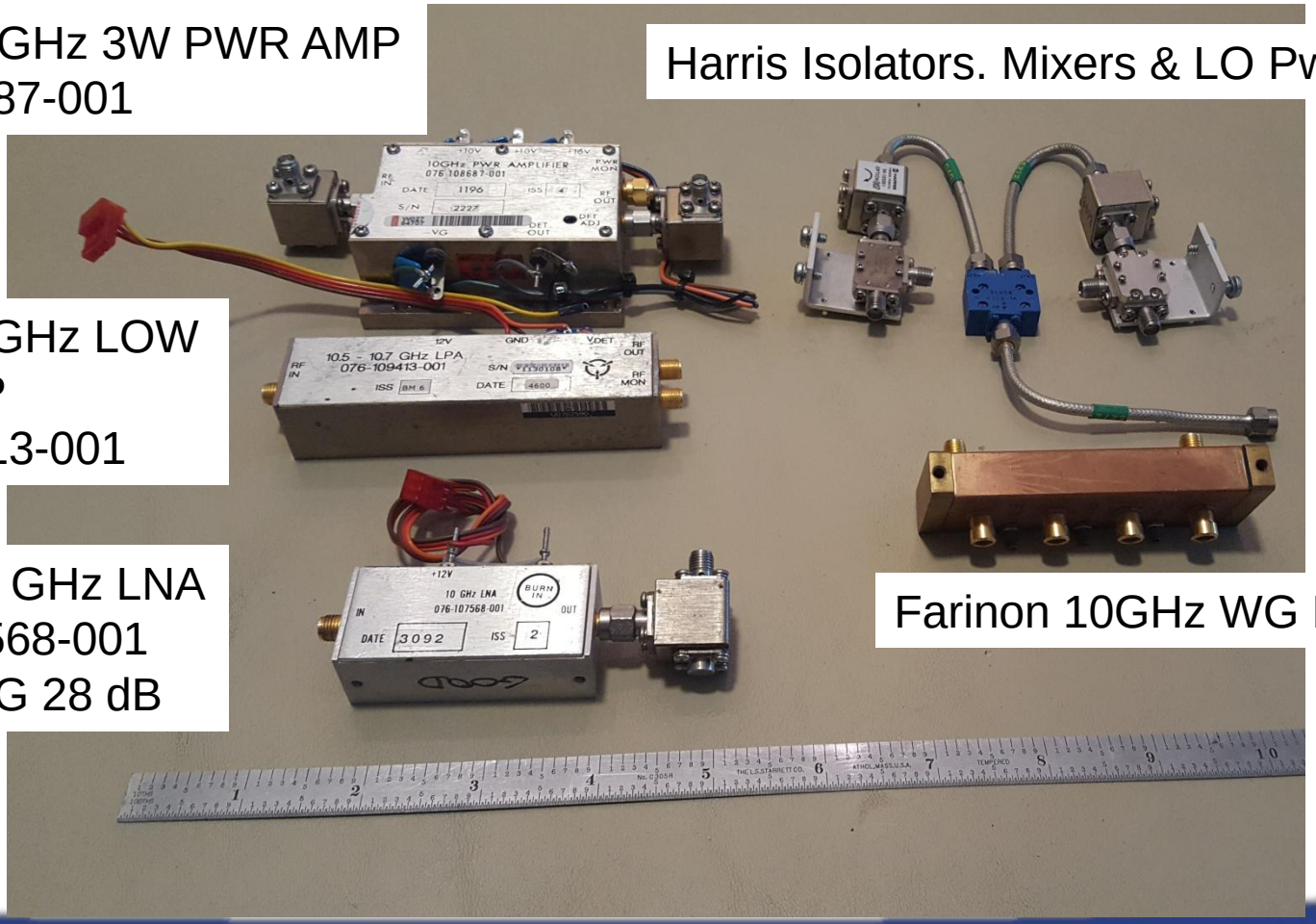
- Conventional method is to use your favorite VHF Multiband SSB-CW Transceiver and connect to a Transverter.
- A transverter uses a local oscillator and mixers to upconvert from an IF like 2m to an RF frequency like 10368 MHz on transmit and the reciprocal on receive.
- As an example an LO of 10224 MHz can be used to mix with 144 MHz to achieve 10368 MHz
- Now to build or buy?

Various 10 GHz surplus items that could be used to build a transverter

North Texas NTMS Microwave Society

Harris 10 GHz 3W PWR AMP
076-108687-001

Harris Isolators. Mixers & LO Pwr Divider



Harris 10 GHz LOW
PWR AMP
076-109413-001

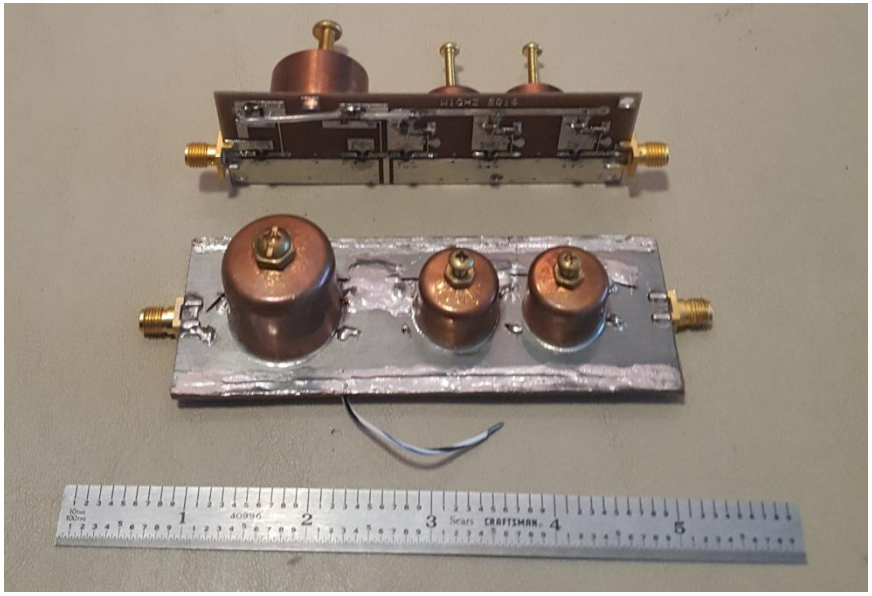
Harris 10 GHz LNA
076-107568-001
NF 2dB, G 28 dB

Farinon 10GHz WG Filter

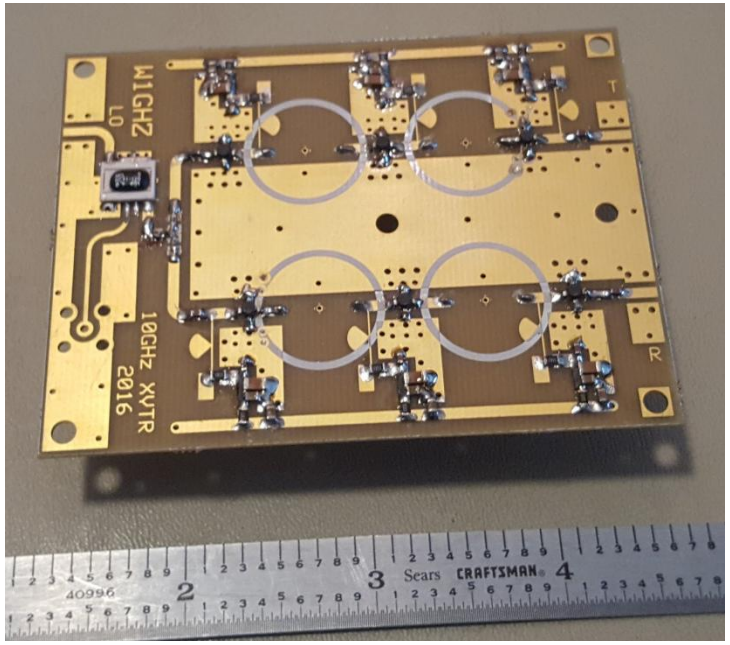
www.w1ghz.org

North Texas NTMS Microwave Society

Paul Wade makes numerous circuit boards for many microwave projects.
Here are 2 PCBs for 10 GHz



X9 Multiplier
Fin=1136 MHz Fout=10224 MHz

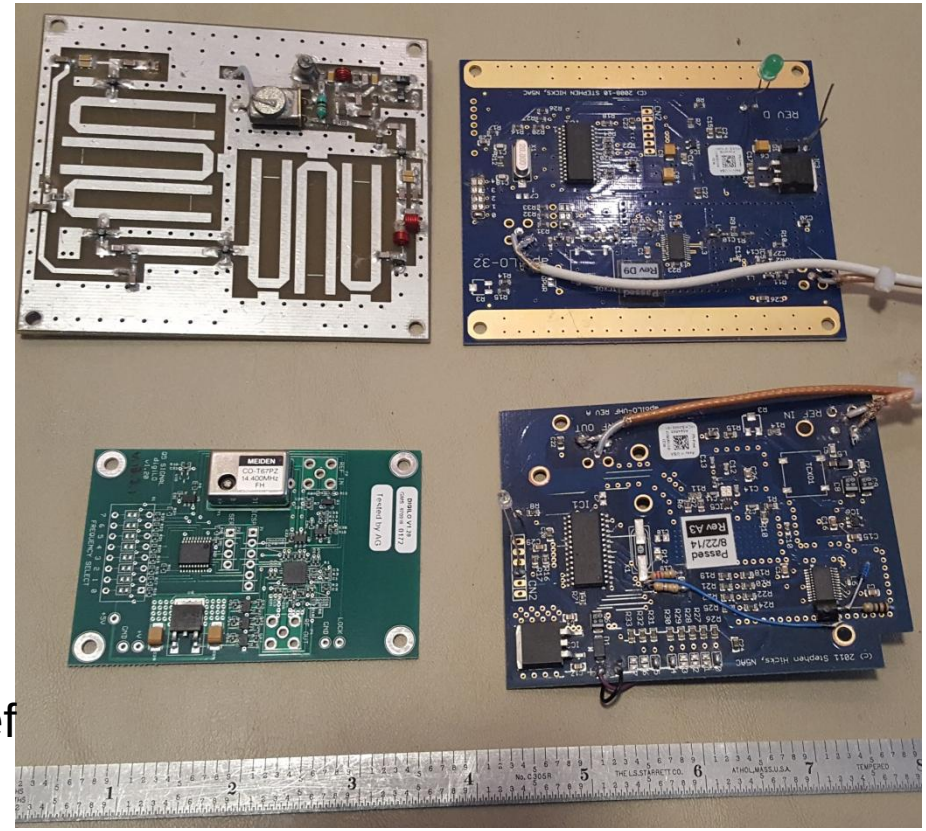


10 GHz Transverter 10368 MHz to 144 MHz
LO in = 10224 MHz

Local Oscillator Boards

North Texas NTMS Microwave Society

DEMI Micro LO
1080-1136 MHz
Crystal Controlled



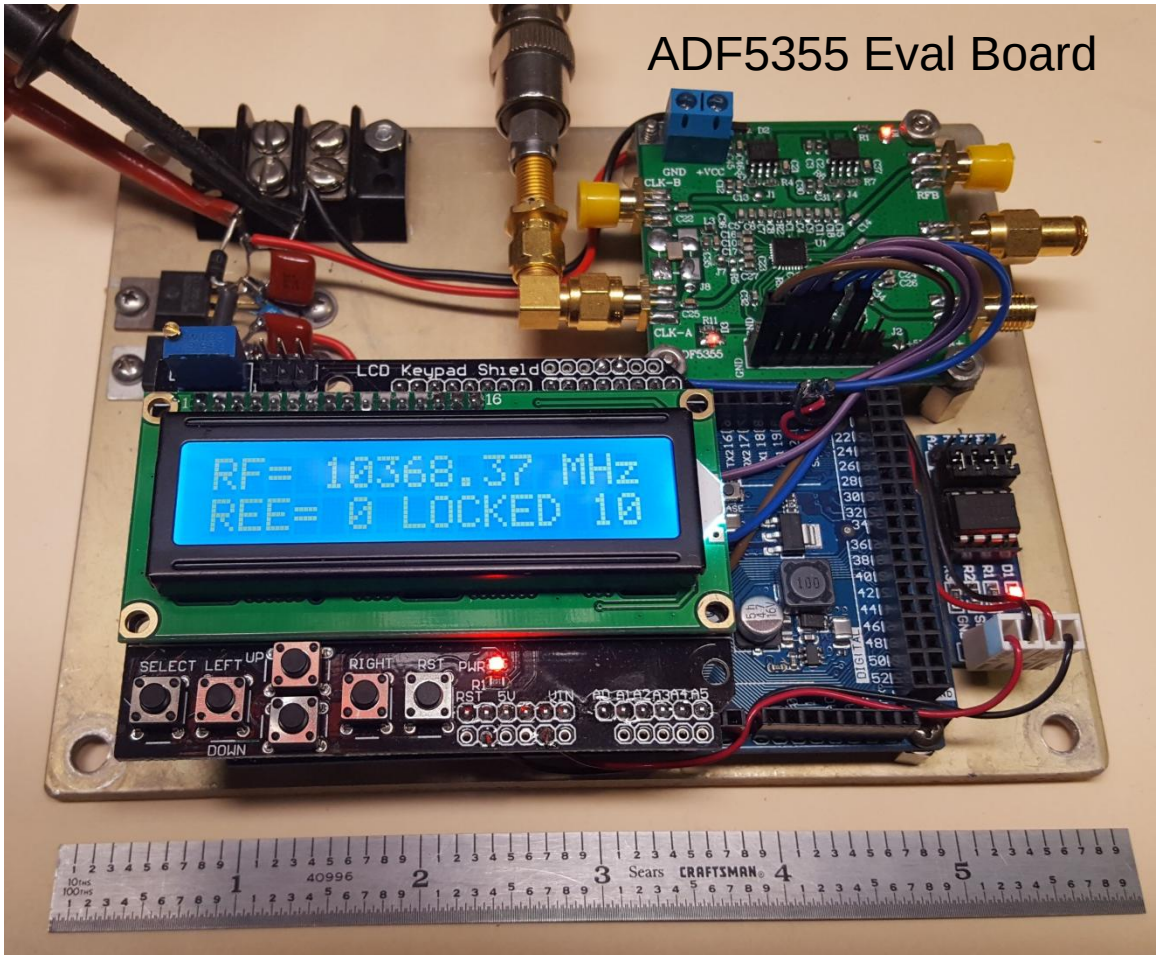
DEMI N5AC ApolLO
900-1300 MHz
PLL 10 MHz Ref

DEMI/Q5Signal
DigiLO PLL
23.5MHz - 6GHz
Internal Ref or
External10 MHz Ref

DEMI N5AC VHF ApolLO
70-410 MHz
PLL 10 MHz Ref

ADF5355 PLL Synthesizer 54 MHz to 13.6 GHz

North Texas NTMS Microwave Society



Presentation on
www.ntms.org
-Knowledge Base
-At the meetings
-September 2017
"ADF4351 and ADF5355 Update by Greg McIntire AA5C

Arduino Due & LCD Shield & EEProm Board

Built by W5LUA

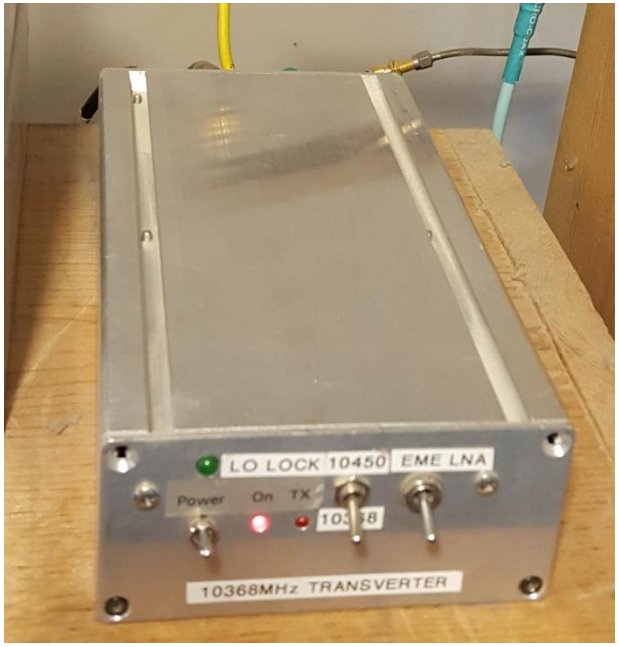
Most Popular Commercial XVTRs

North Texas NTMS Microwave Society

DB6NT

https://shop.kuhne-electronic.com/kuhne/en/shop/

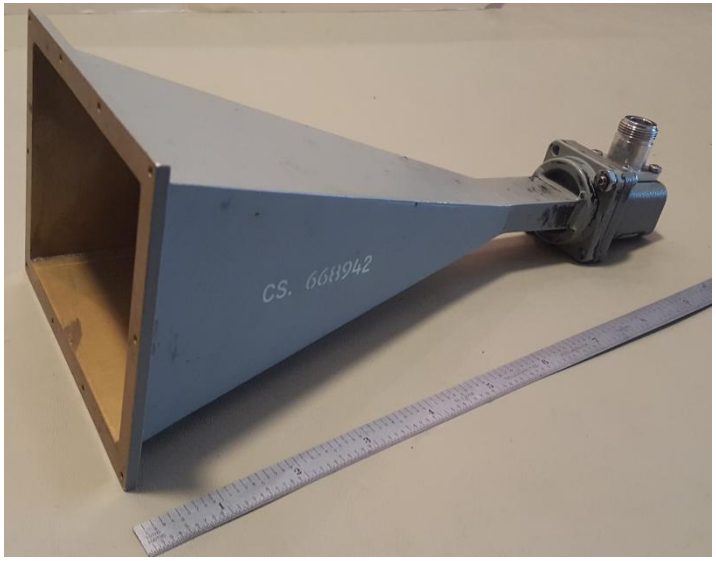
DEMI



https://www.downeastmicrowave.com/

Others as well…

Antenna options for 10 GHz



4.3” X 2.3” Horn
G = 20 dBi
3dB Beamwidth ~ 17 deg

8” Offset Fed Dish
G = 25 dBi
3dB Beamwidth ~ 9 deg

18” Offset Fed Dish
G = 32 dBi
3dB Beamwidth ~ 4.3 deg

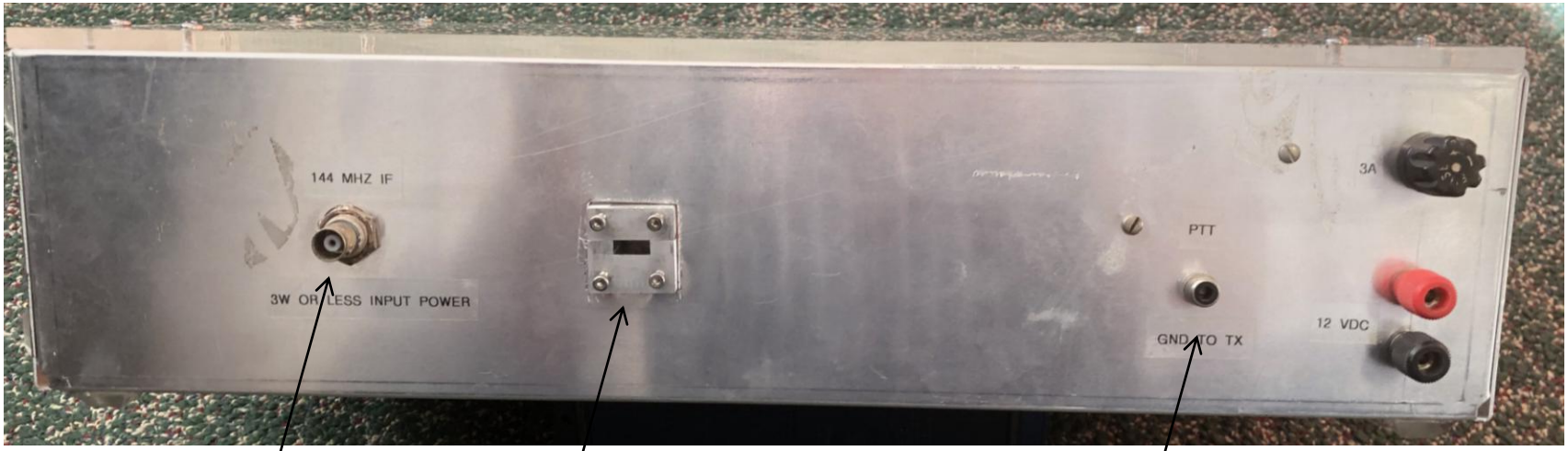
AA5C 24 GHz Transverter

North Texas NTMS Microwave Society

- **Built around Surplus Wavelab Module with PA0MHE designed Plug-on Board**
- **RF Power Out at Waveguide Flange = +28.5 dBm**
- **2 dB Noise Figure**
- **144 MHz IF**

AA5C 24 GHz Transverter

North Texas NTMS Microwave Society



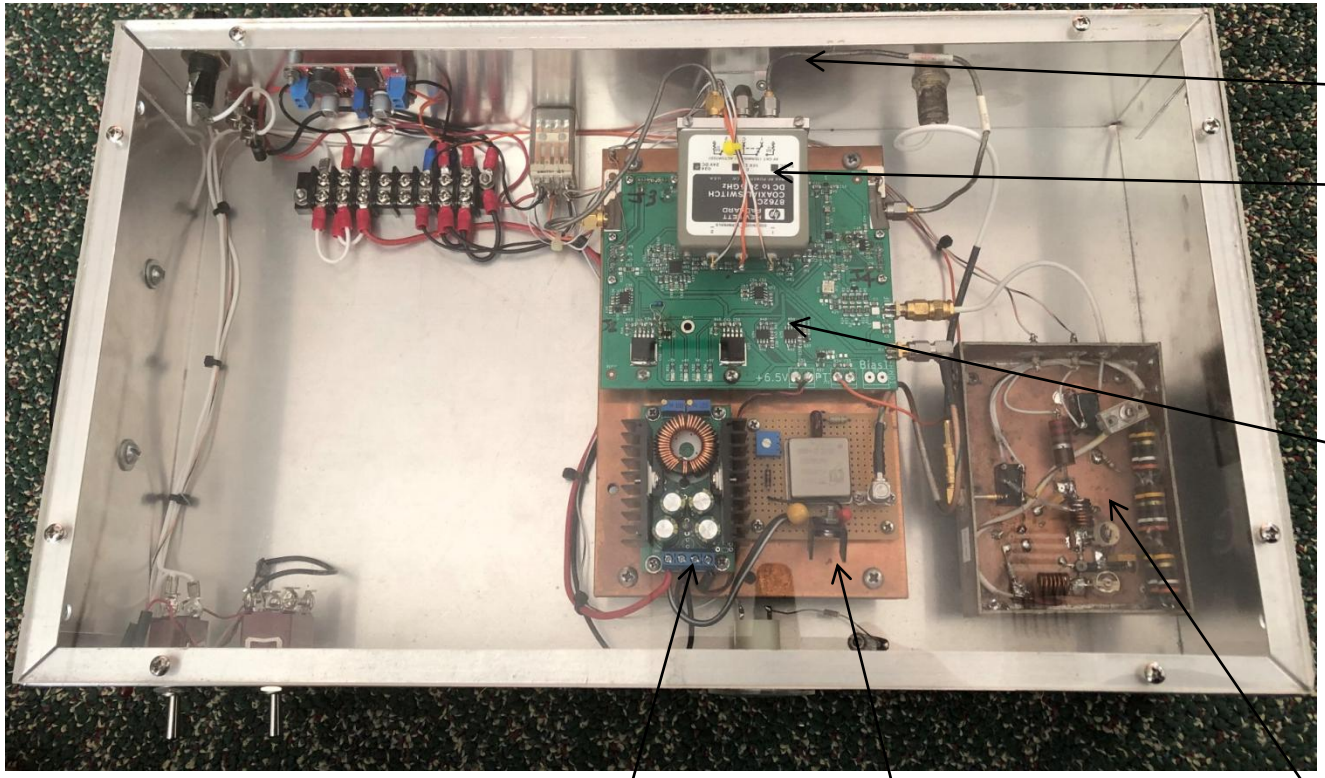
144 MHz IF (3W TX Max)

WR42 Waveguide Flange

PTT Input (GND to TX)

AA5C 24 GHz Transverter

North Texas NTMS Microwave Society



Coax-WG Transition

RF T/R Relay

Wavelab Module w/Plug-on Board
- 2 ADF4351 PLLs
- T/R Switching
- TX amps
- RX amps
- Voltage Regulators

2M IF

12-to-6 V 5A Converter

10 MHz Reference

Roving on 10 GHz & Up

North Texas NTMS Microwave Society

- The major event for the NTMS is to participate in the ARRL 10 GHz and Up Contest in both August and September
- Some stations operate from home and a number of stations are rovers.
- The object of the contest is to work as many stations in as many 6 digit grid squares as possible. Rovers are required to move at least 16km (10 miles) before a station is reworked. Every contact has a distance multiplier in km. The sum of the distance multiplier times the band multipier plus 100 points for each unique call sign provides the total score.
- See ARRL.org

WA5YWC (sk) in 2018 ARRL 10GHz Contest

North Texas NTMS Microwave Society

Operating position in cab of truck

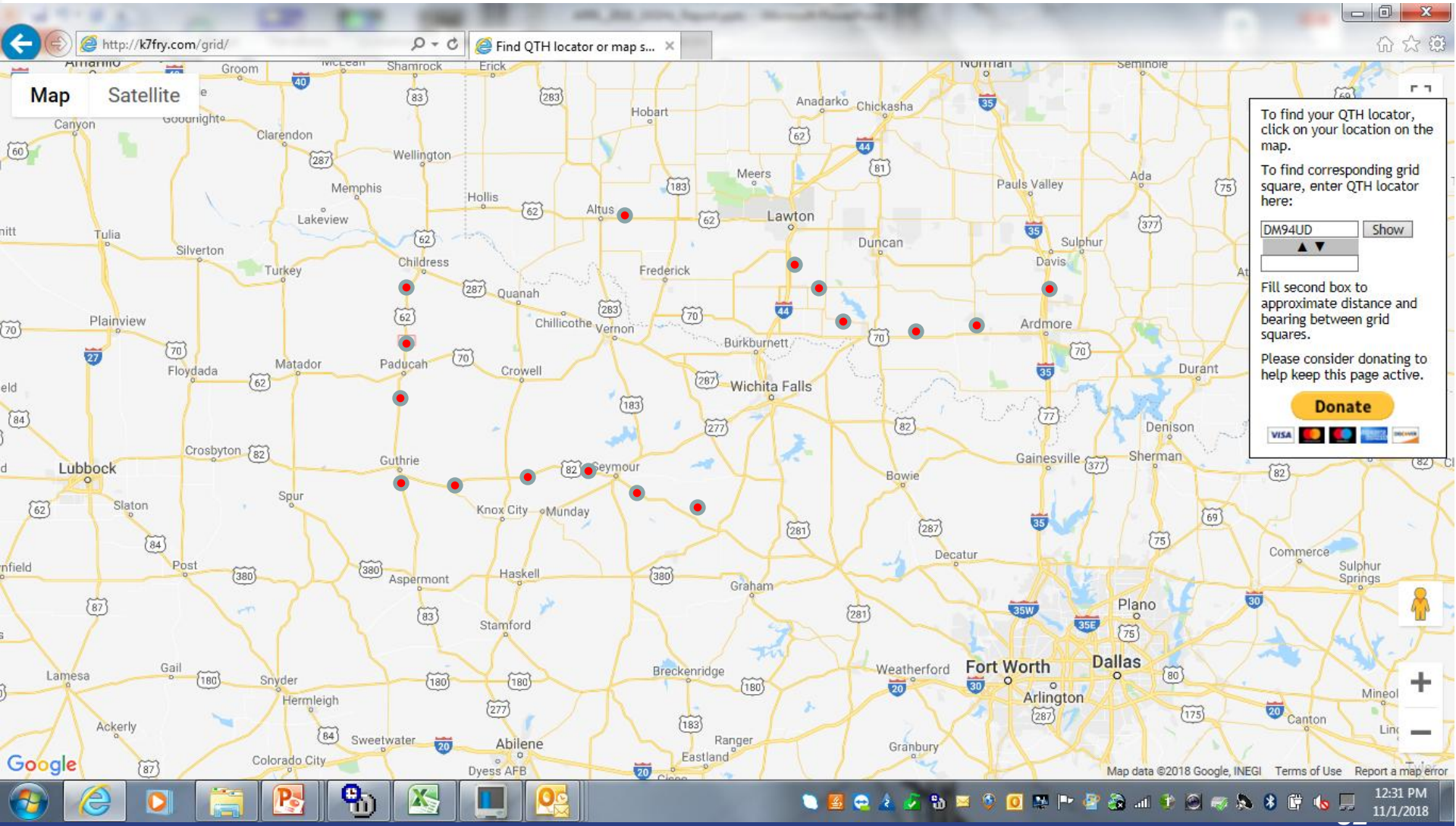
2 ft prime focus dish in bed of truck

November 21, 1944 – October 21, 2018

W5HN

WA5YWC & K8ZR Sept 2019

North Texas NTMS Microwave Society



K8ZR/R 24 GHz EM24tq
Sept 16, 2017

North Texas NTMS Microwave Society

Initial AA5AM 10 GHz Success

North Texas NTMS Microwave Society

Double Balanced Mixer and 8 inch offset fed dish
W5LUA worked at 13 miles
Scott also heard W5RLG at 68 miles
And N5WCO at 56 miles
Scott has since improved his station to a larger dish plus 1watt PA and LNA

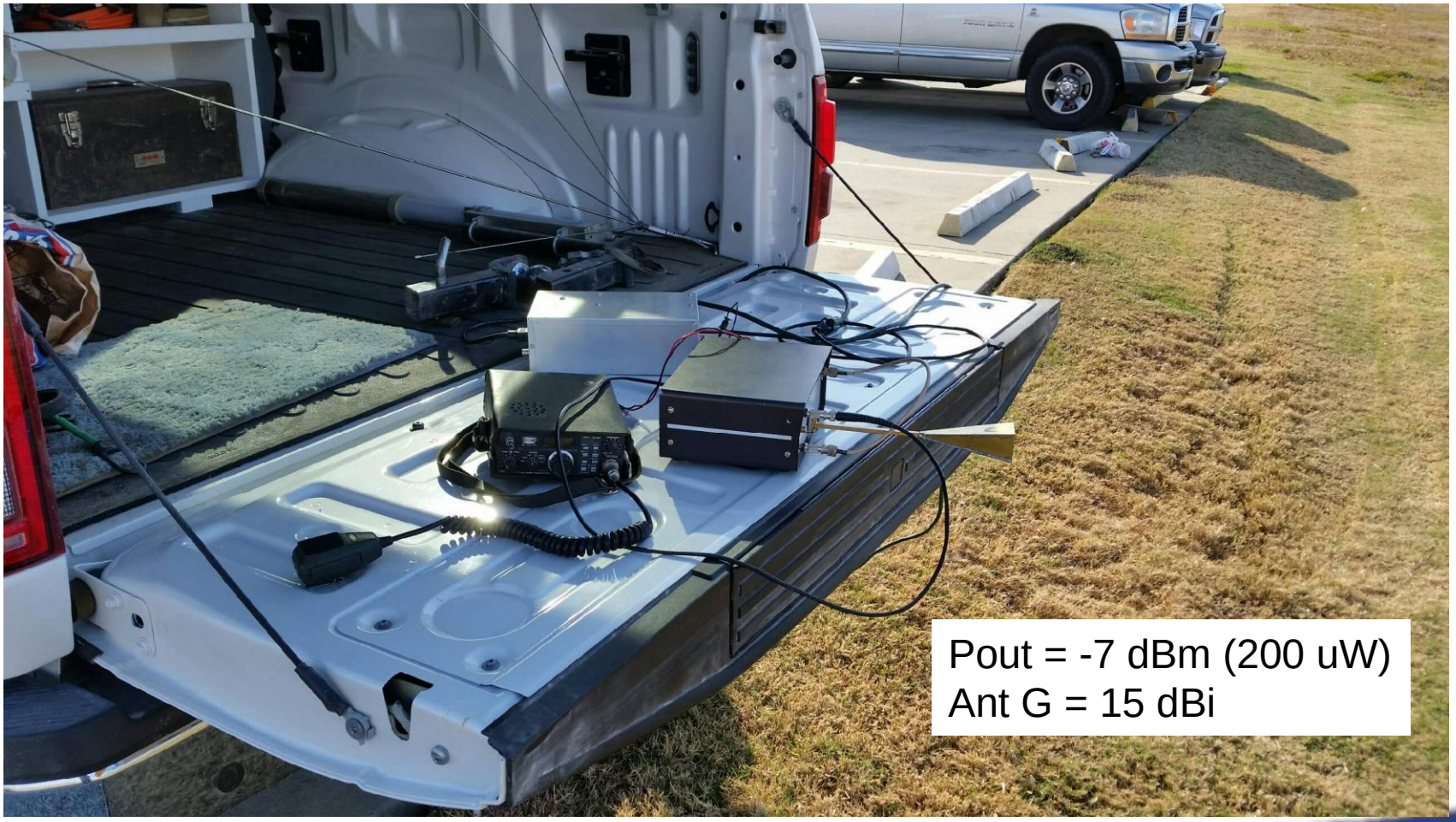
K5TRA's Attic 10 GHz Antenna

North Texas NTMS Microwave Society

W5LUA worked K5TRA on 10 GHz at a distance of over 200 miles

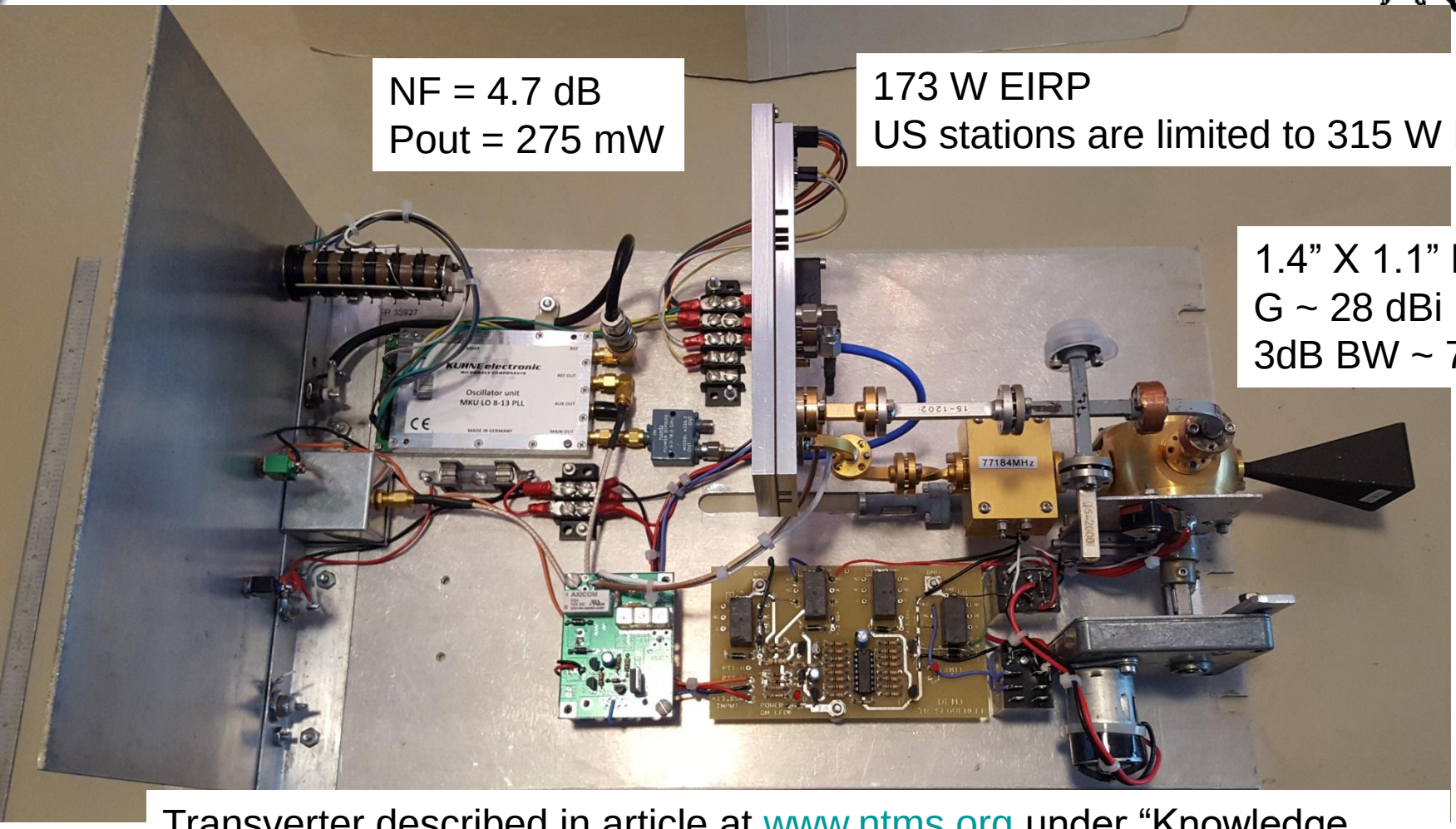
AA5C Tail Gating at EM13td 47088.1 MHz

North Texas NTMS Microwave Society



W5LUA 76 GHz Transverter using DB6NT MKU 76 G2 Transverter & WA1MBA LNA

North Texas NTMS Microwave Society



NF = 4.7 dB
Pout = 275 mW

173 W EIRP
US stations are limited to 315 W EIRP

1.4” X 1.1” Horn
G ~ 28 dBi
3dB BW ~ 7 deg

Transverter described in article at www.ntms.org under “Knowledge Base” then under “Tech Library” and then “Millimeter Wave”

Summary

- Amateur Microwave Bands Offer New Technical and Operating Challenges
- Roving can get you on the bands if you are limited by a HOA
- There are a lot of resources in the North Texas area to help you get active on the microwave bands