902 MHz Presentations

North Texas NTMS Microwave Society

- *Getting Started on 902 MHz at W5LUA*
- *Paralleling high power 900 MHz amplifiers by W5LUA*
- *Review of the W1GHz 902 MHz transverter by N5AC*
- *902 MHz Transverter at KA5BOU*
- *902 MHz Transverter at NM5M*
- *902 MHz Transverter at WB5ZDP*
- *902 MHz W0PW Dual Dipole Feed by WW2R*
- *902 MHz EME at WA8RJF EN91*
- *DEMI 902 MHz Transverter demo by W5SXD*

The 33 cm Band

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- 902 to 928 MHz
- Weak signal work at 902.0 to 902.5 MHz and at 903 to 903.5 MHz east of the Mississippi River
- Weak signal calling frequency for us is 902.1 MHz
- Shared with Part 15 and ISM on a non-interfering basis - Bull
- No commercial store bought radios available for SSB and CW
- Build or buy a transverter to go with your multimode 2M radio or HF transceiver
- Antennas – both loop yagis and standard yagi design available including some pretty simple antennas by Kent WA5VJB

WB5LUA 902 MHz Transverter

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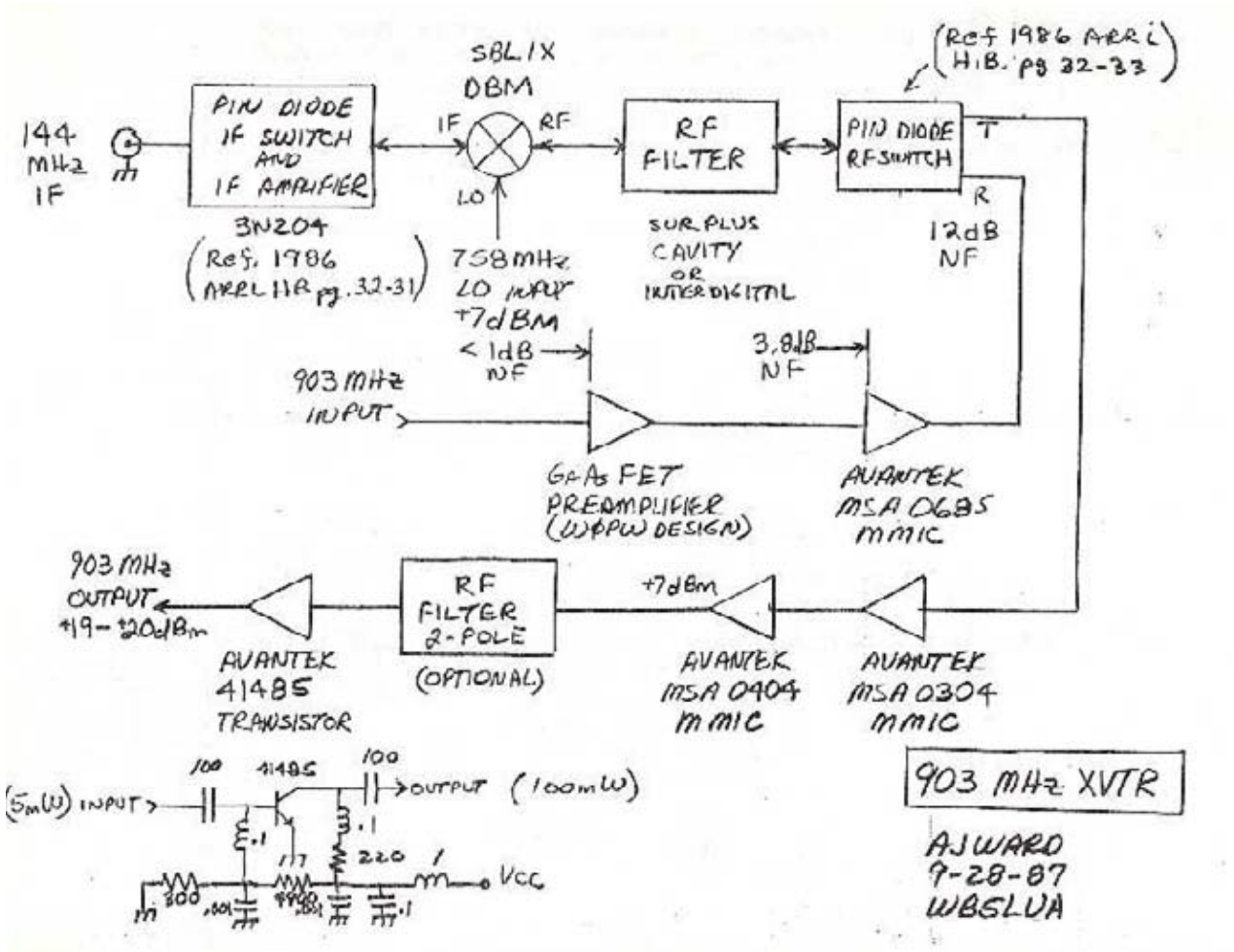

758 MHz LO

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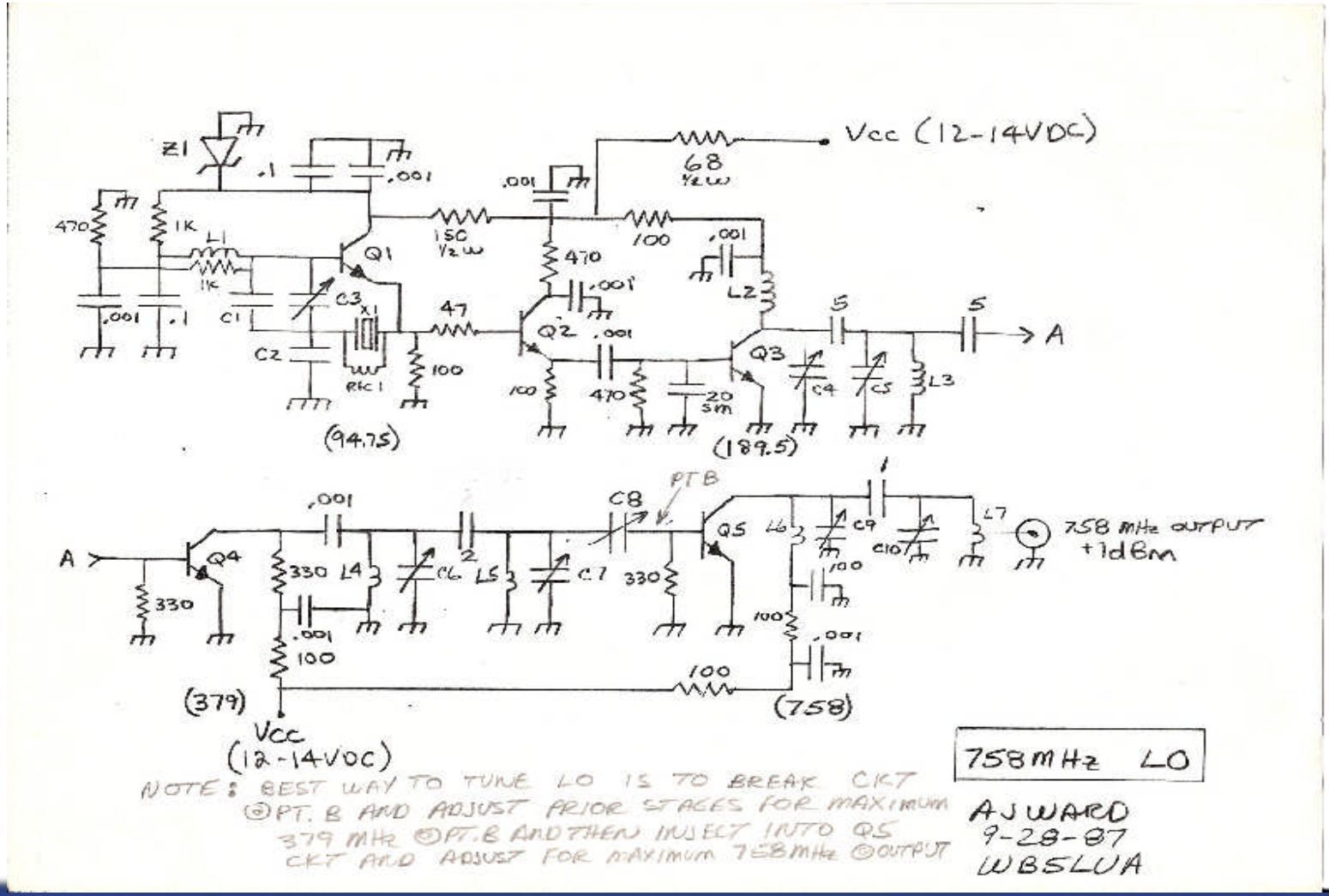

758 MHz LO Parts List

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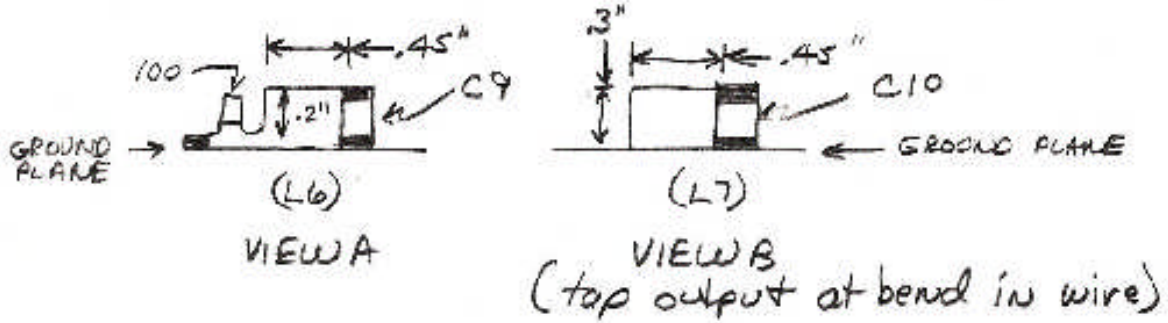
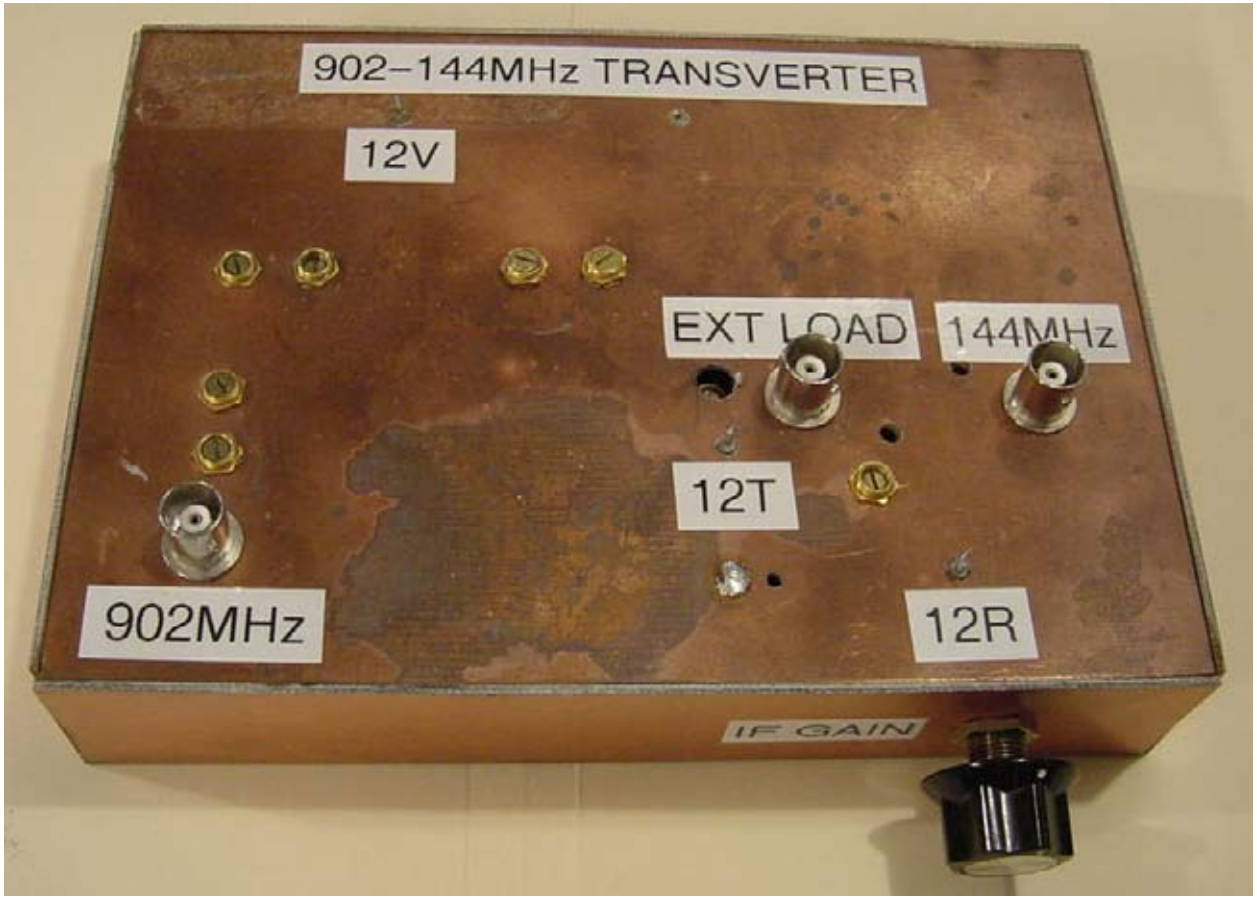
Z1	IN751 5 VOLT ZENER DIODE
Q1-Q3	MRF904
Q4-Q5	MRF901
X1	94.75 MHz CRYSTAL (HA-5)
RFC1	.38 uH RF CHOKE
L1	7 TURNS #24, .25" I.D., CLOSE SPACED, WOUND ON
L2, L3	3 TURNS #14, .5" LONG
L4, L5	1 TURN #14, .25" I.D.
L6	WIRE #24 Guage AS SHOWN IN VIEW A
L7	WIRE #24 Guage AS shown IN VIEW B
C1	10pF N750 CAP
C2	33pF N750 CAP
C3	3-18pF CERAMIC VARIABLE
C4-C10	.8-10pf PISTON VARIABLE



WB5LUA 902 MHz Transverter

North Texas NTMS Microwave Society



Built 1987

WB5LUA 902 MHz Transverter

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Band Pass Filters for 902 MHz

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Components for 902 MHz

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N5QGH 902 MHz Transverter using old KK7B no tune transverter Approach

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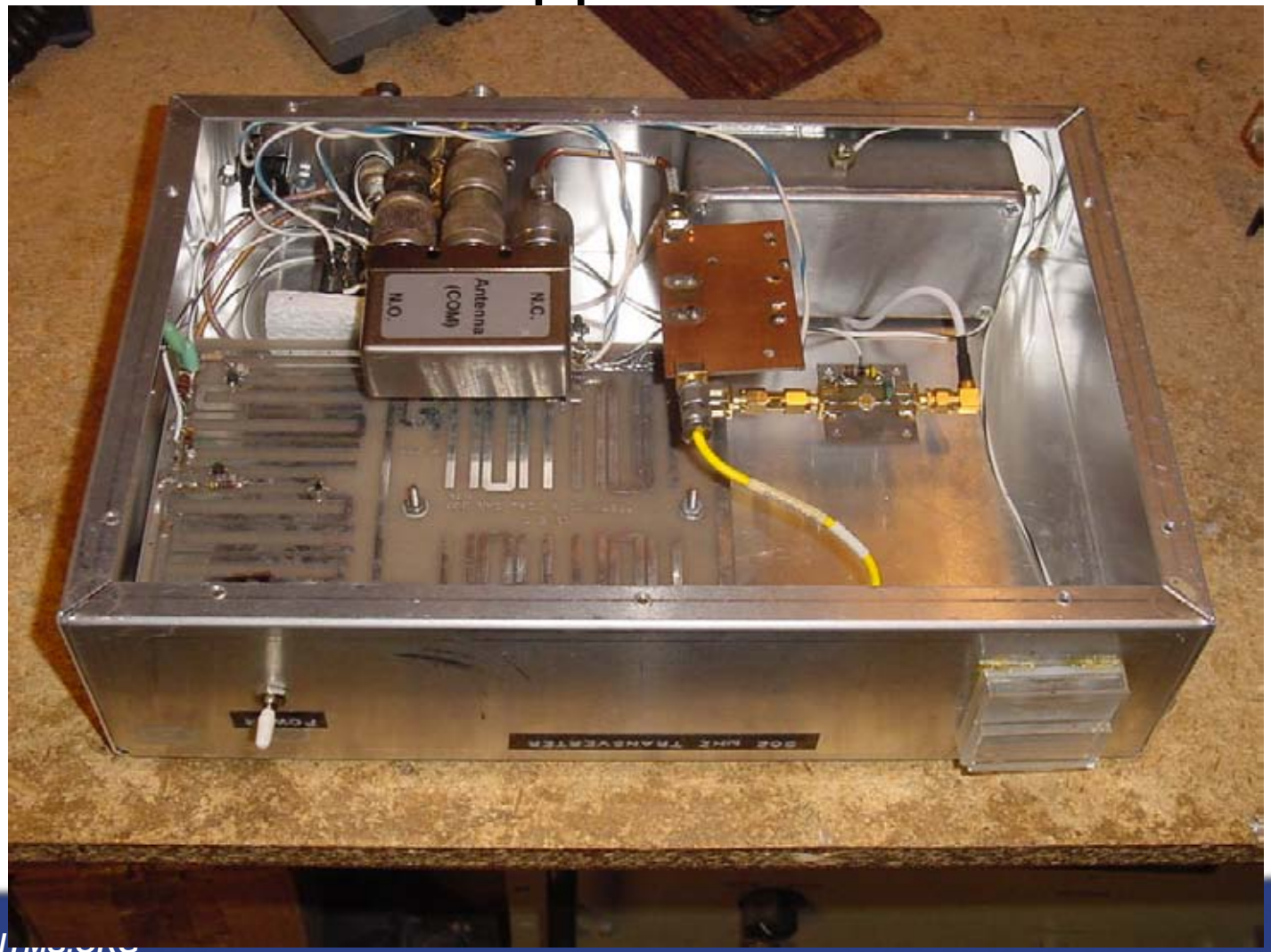

W5LUA 902 MHz ATF-36077 LNA

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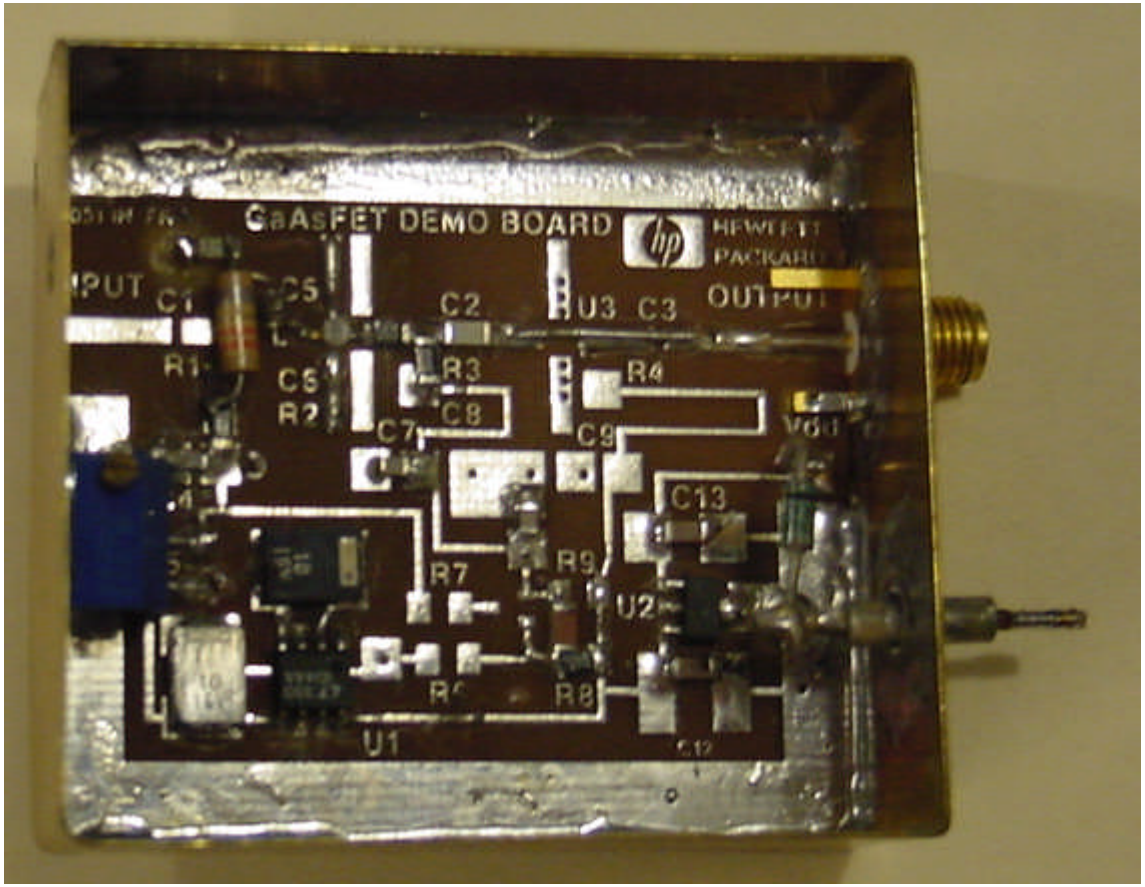

Reference Avago
Ap Note 1128

WW2R 902 MHz Transverter

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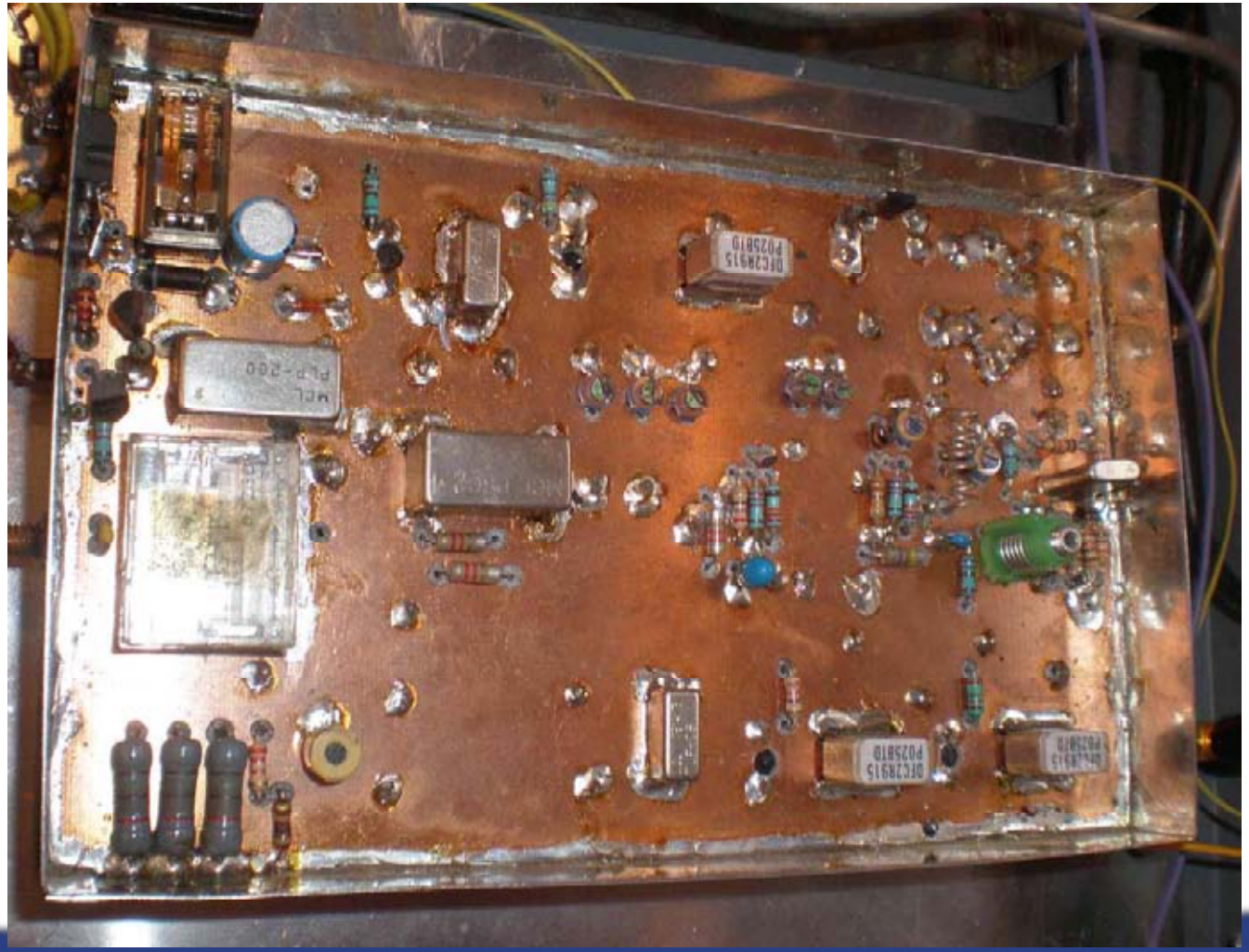
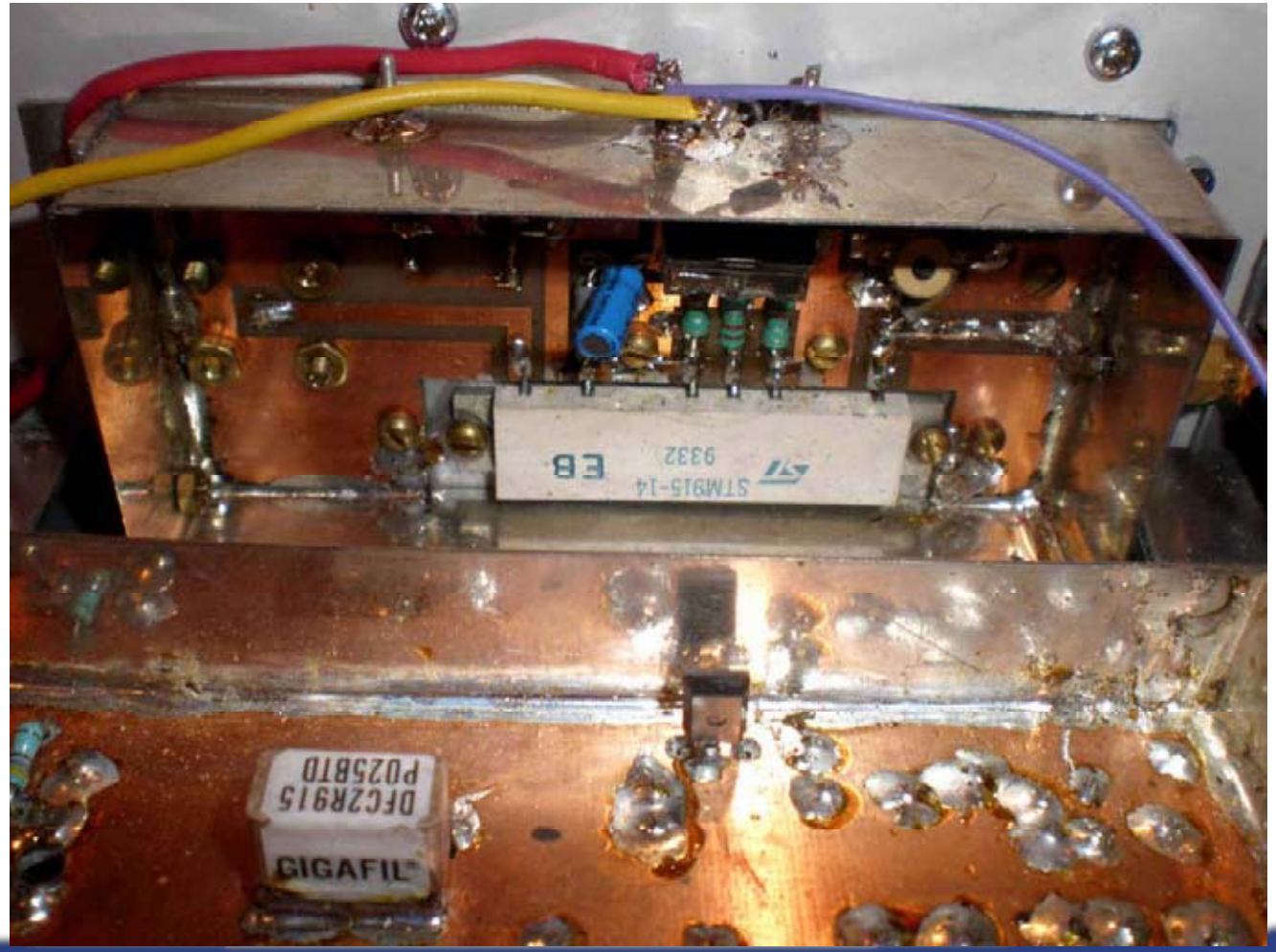


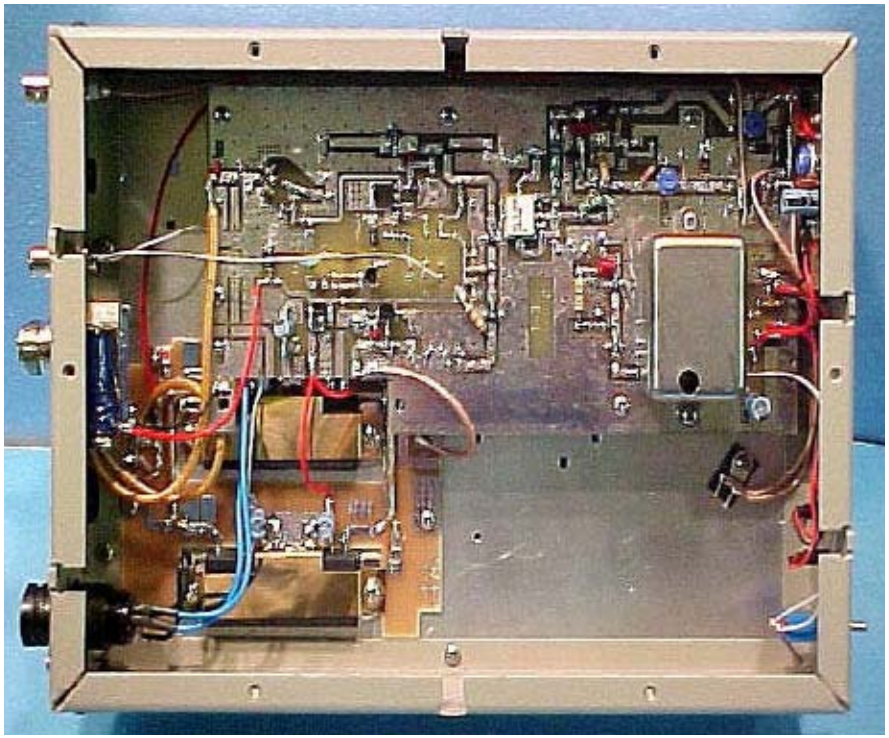
902 MHz PA Module

North Texas NTMS Microwave Society



DEMI 902 MHz Transverter

North Texas NTMS Microwave Society



DEMI Demo by W5SXD

NM5M's 902 MHz XVTR

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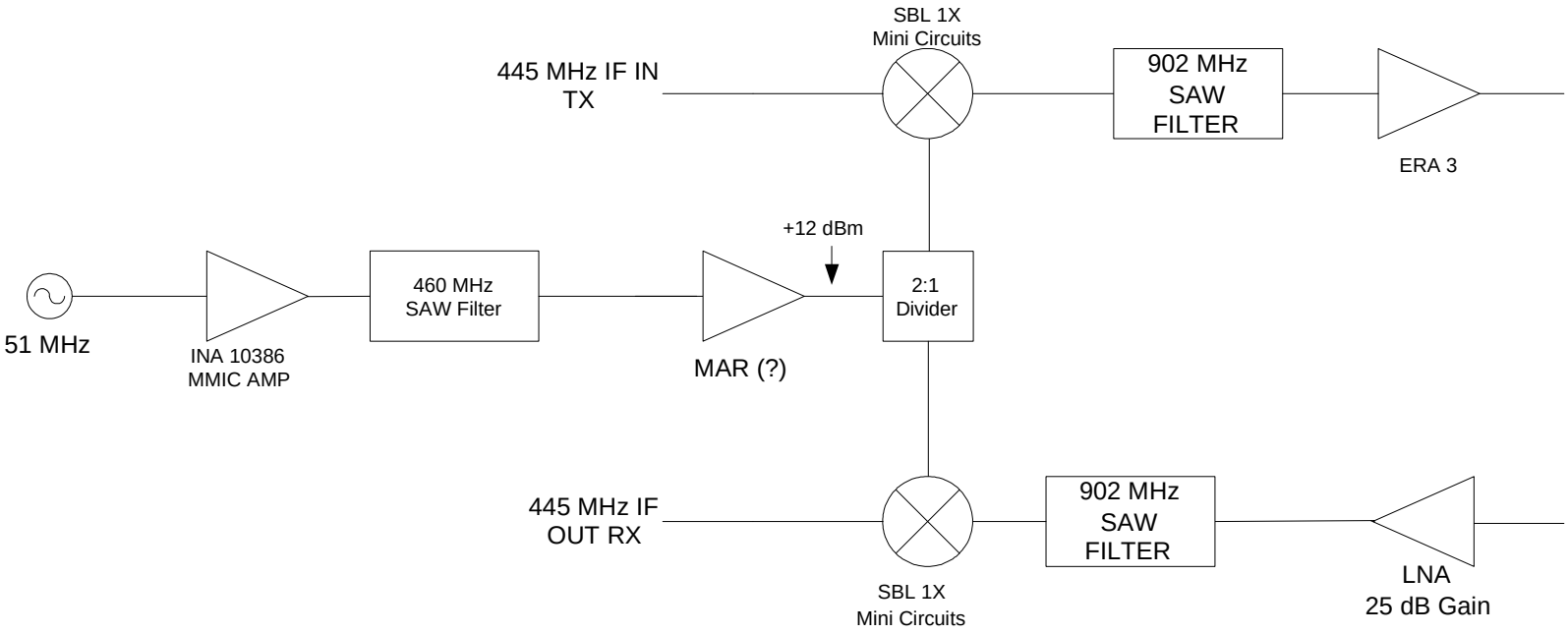
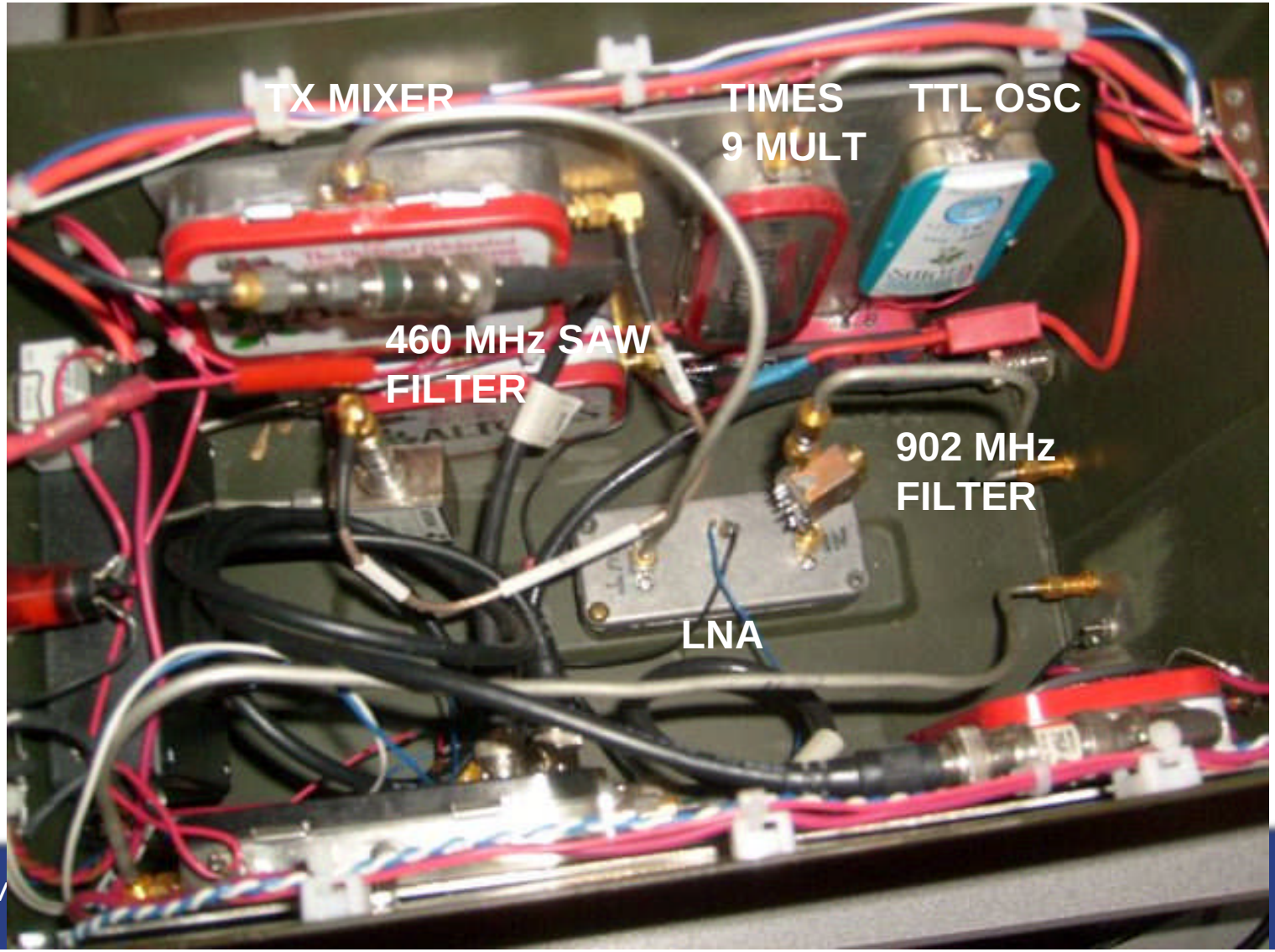
902 AMMO CAN TRANSVERTER



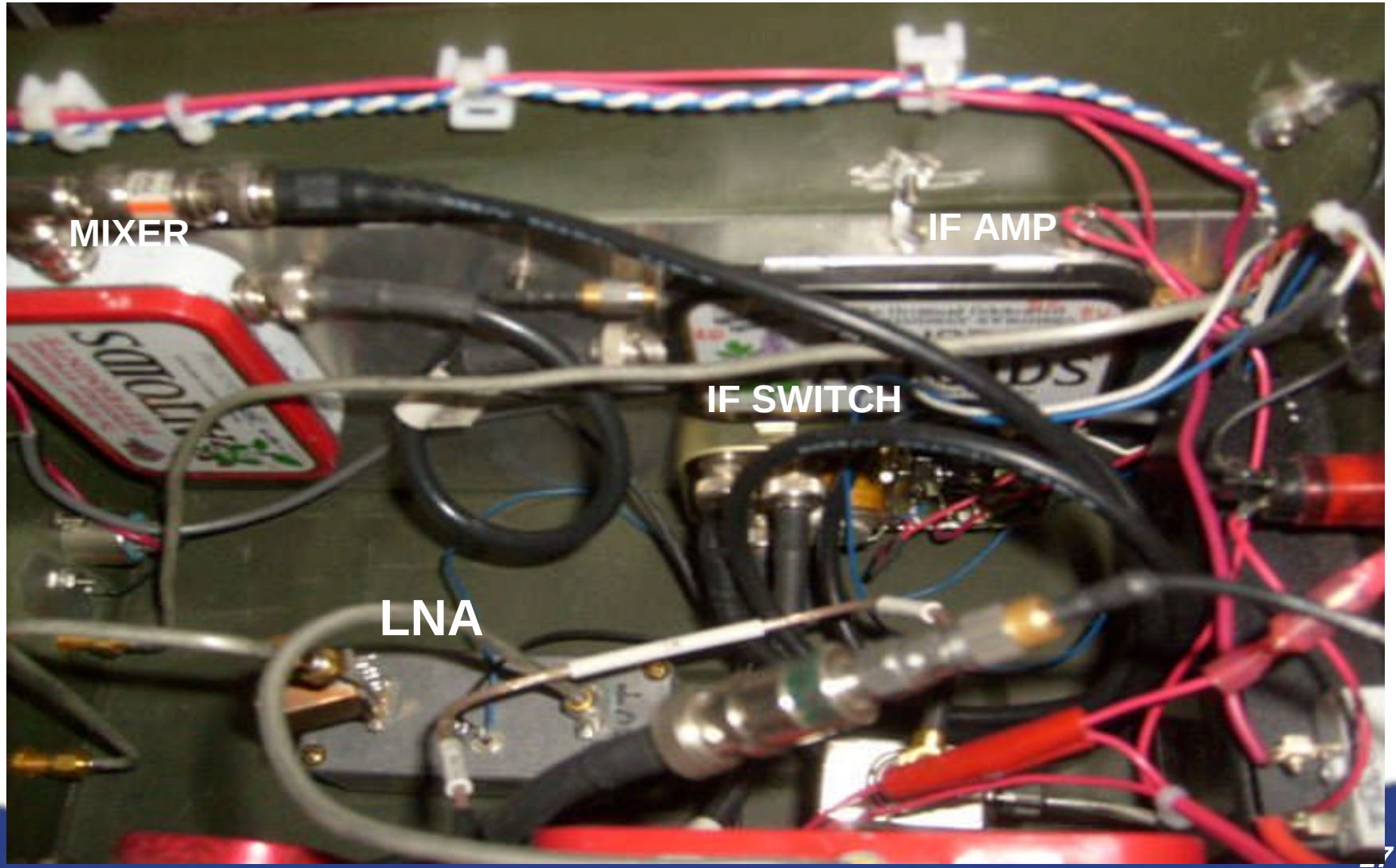
NM5M's 902 MHz XVTR

North Texas NTMS Microwave Society



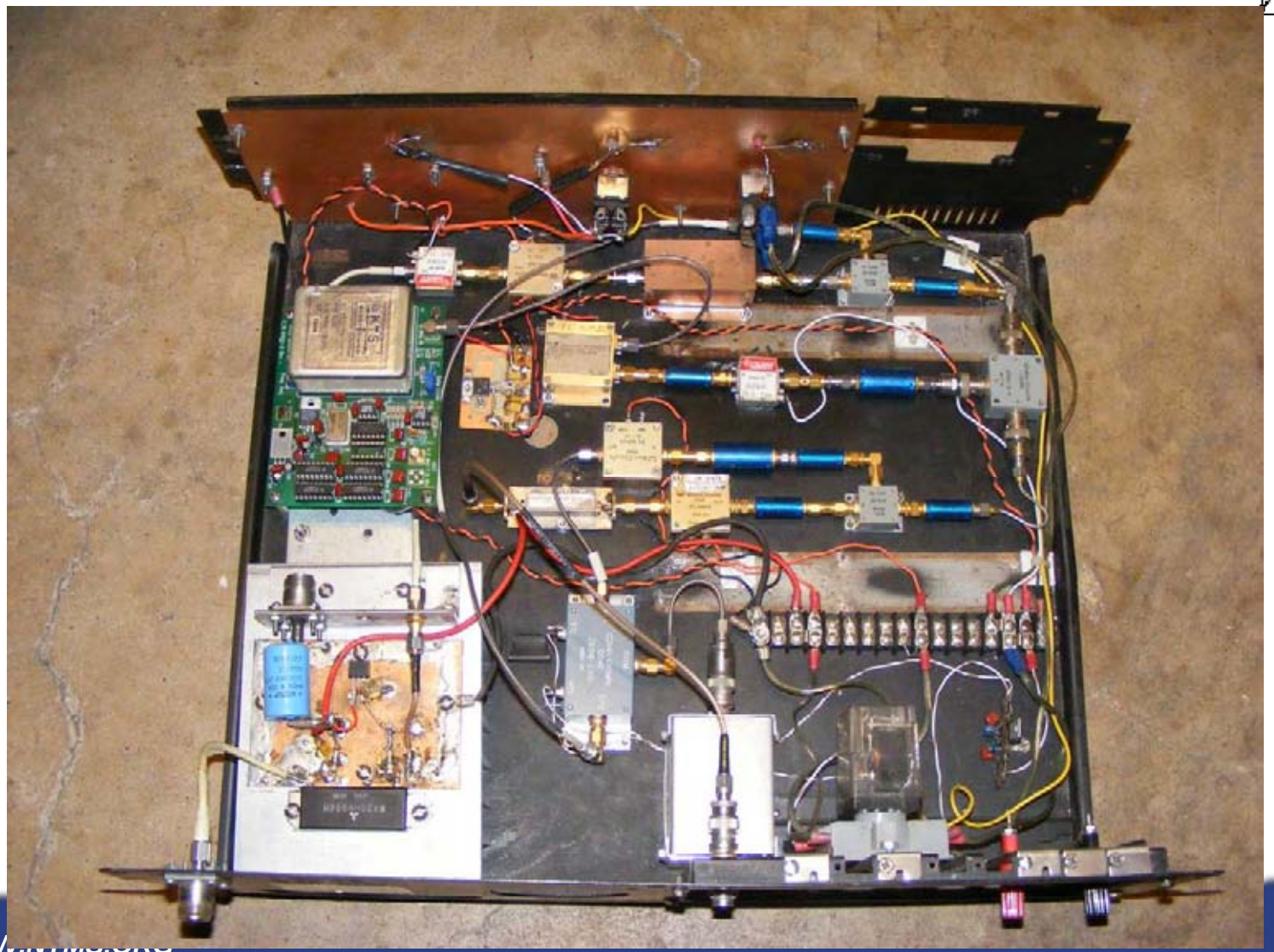
NM5M's 902 MHz XVTR

North Texas NTMS Microwave Society



WB5ZDP 902 MHz Transverter

North Texas NTMS Microwave Society



W1GHZ 902 MHz Transverter

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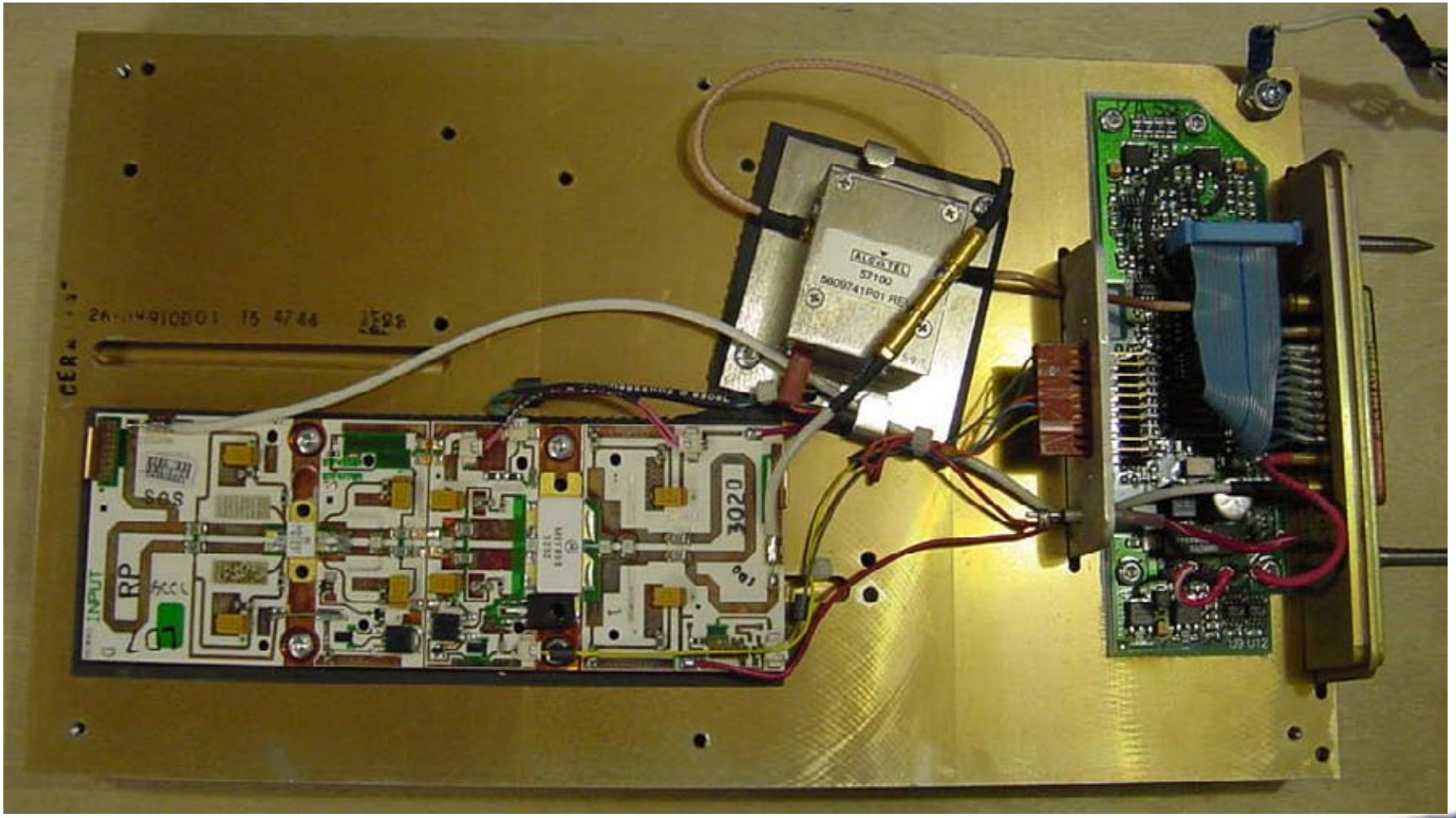
- Inexpensive 2 board approach providing low power and moderate NF
- http://www.w1ghz.org/MBT/902_MHz_Transverter_for_the_Multiband_Rover.pdf
- Group Buy?

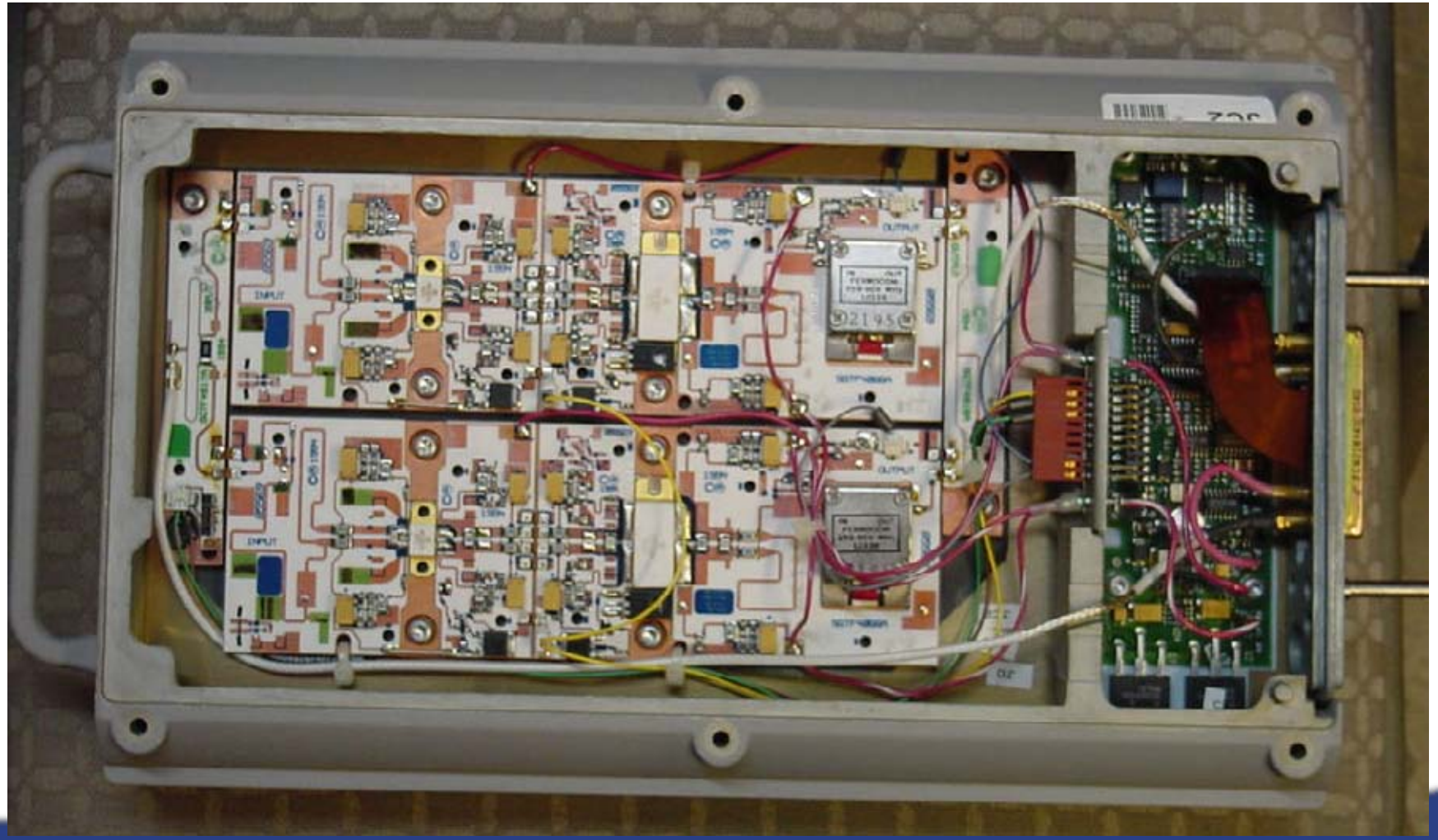
150 Watt Motorola SSPA
Model STF2520A

North Texas NTMS Microwave Society



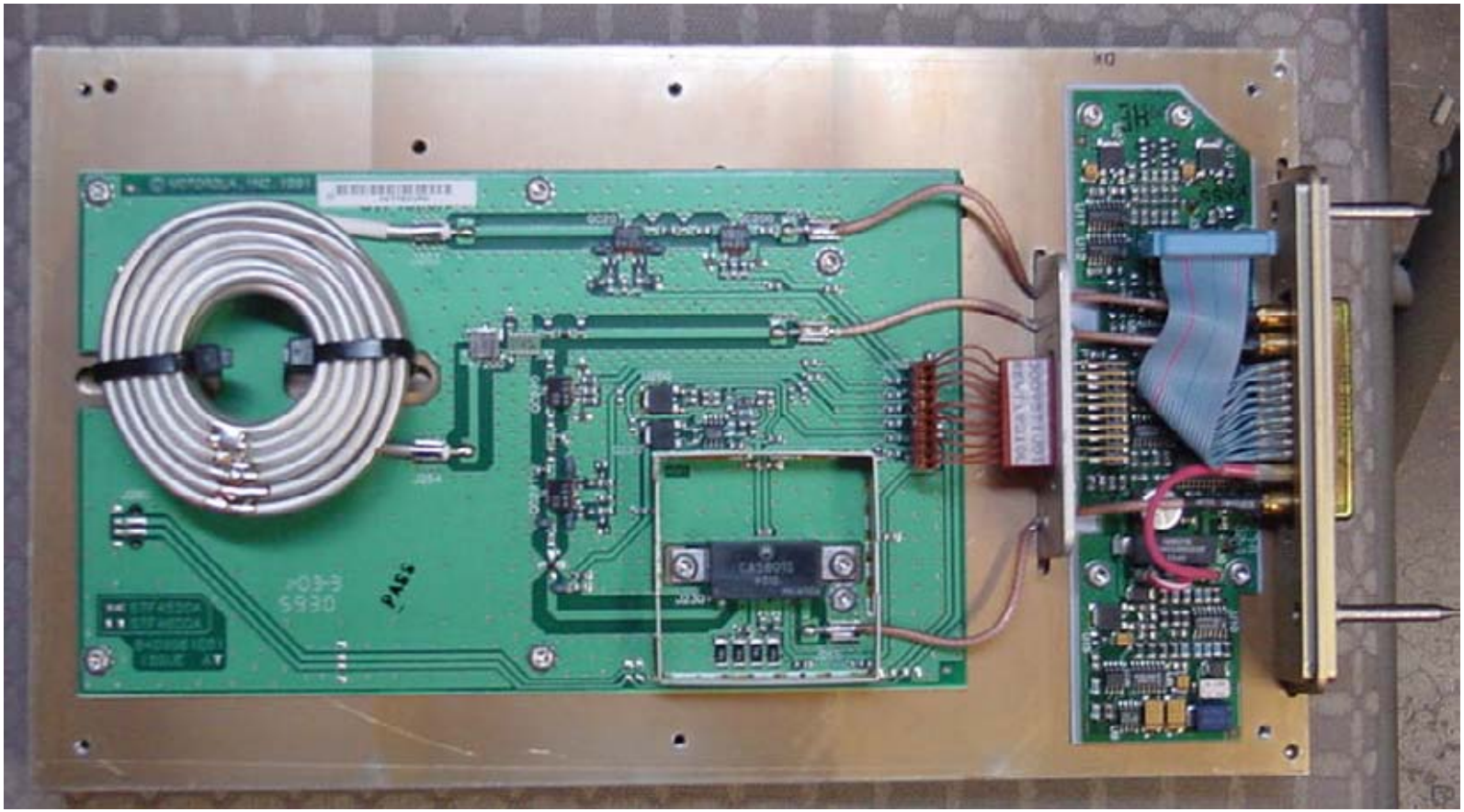
300 Watt Motorola SSPA
Model SGTF 1038A

North Texas NTMS Microwave Society



1 Watt Low Level Leveling Amplifier Model STF 2540A

North Texas NTMS Microwave Society



This unit is the same form factor as the 150 watt and 300 watts SSPAs – Buyer be aware!

Motorola 150 W and 300 W SSPAs

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- www.vhfsouth.com modifications per KD5FZX on both 150W and 300W SSPAs
- Article by N5AC

W5LUA Pair 300W SSPA

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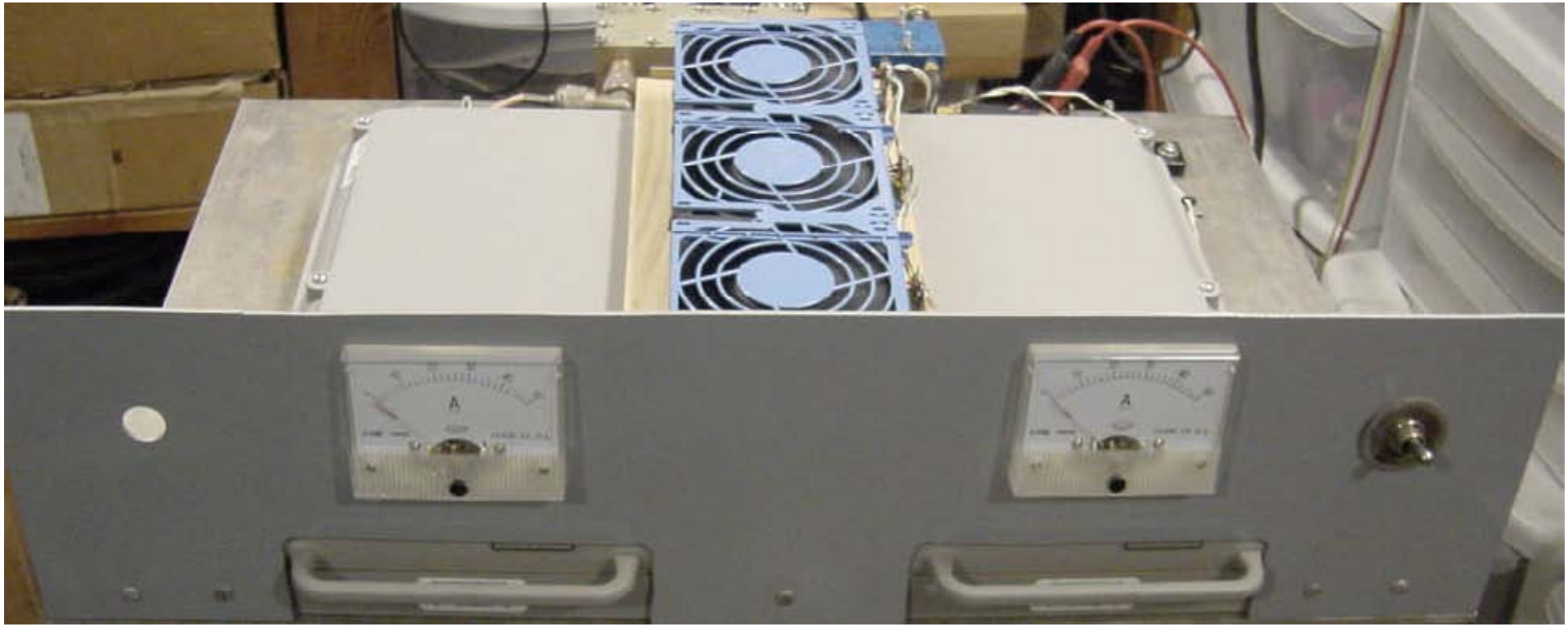
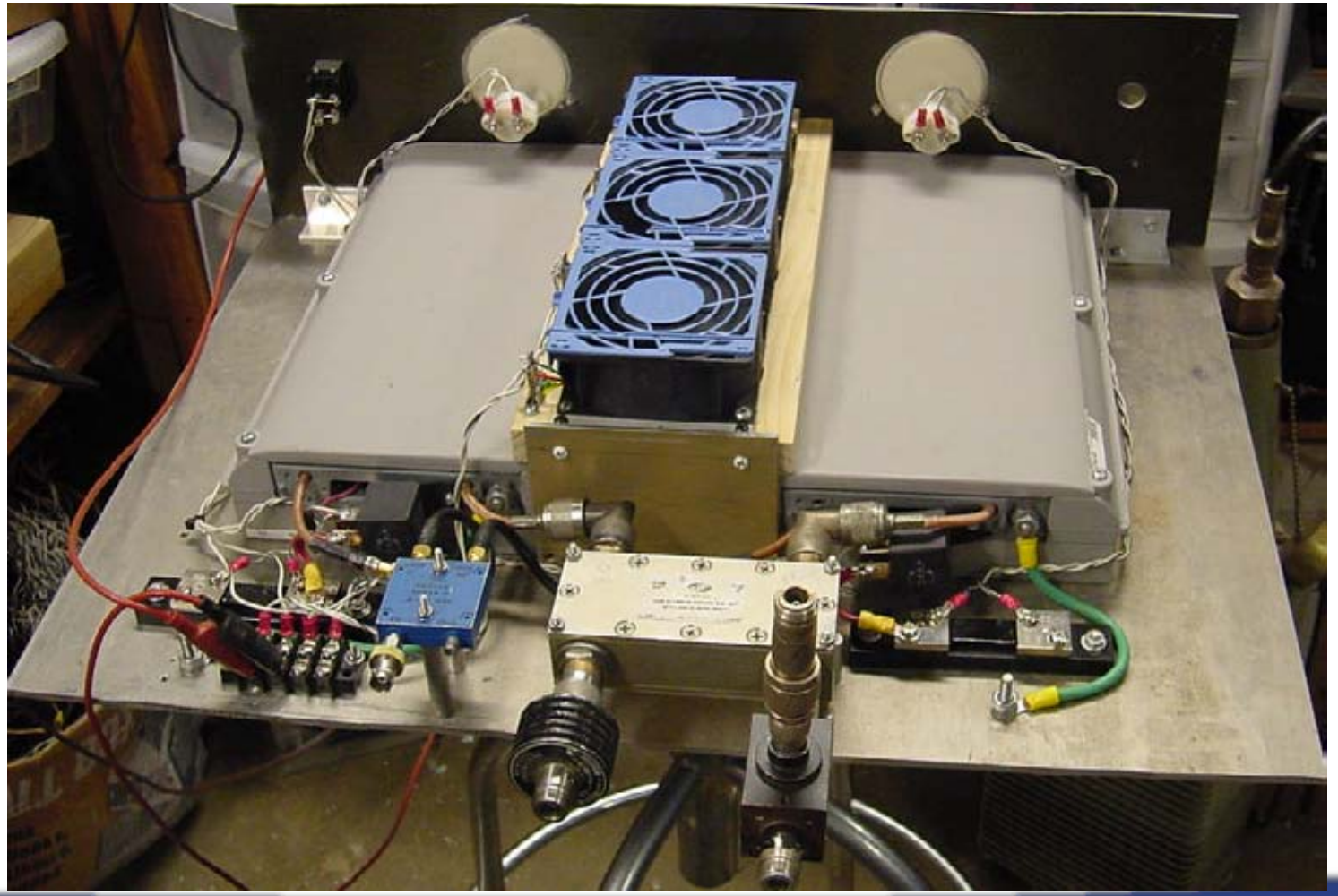


50 Amp meters and shunts available from www.allelectronics.com
$12 / meter and $12 / shunt

Back View SSPA

North Texas NTMS Microwave Society



Close-Up Power Dividers

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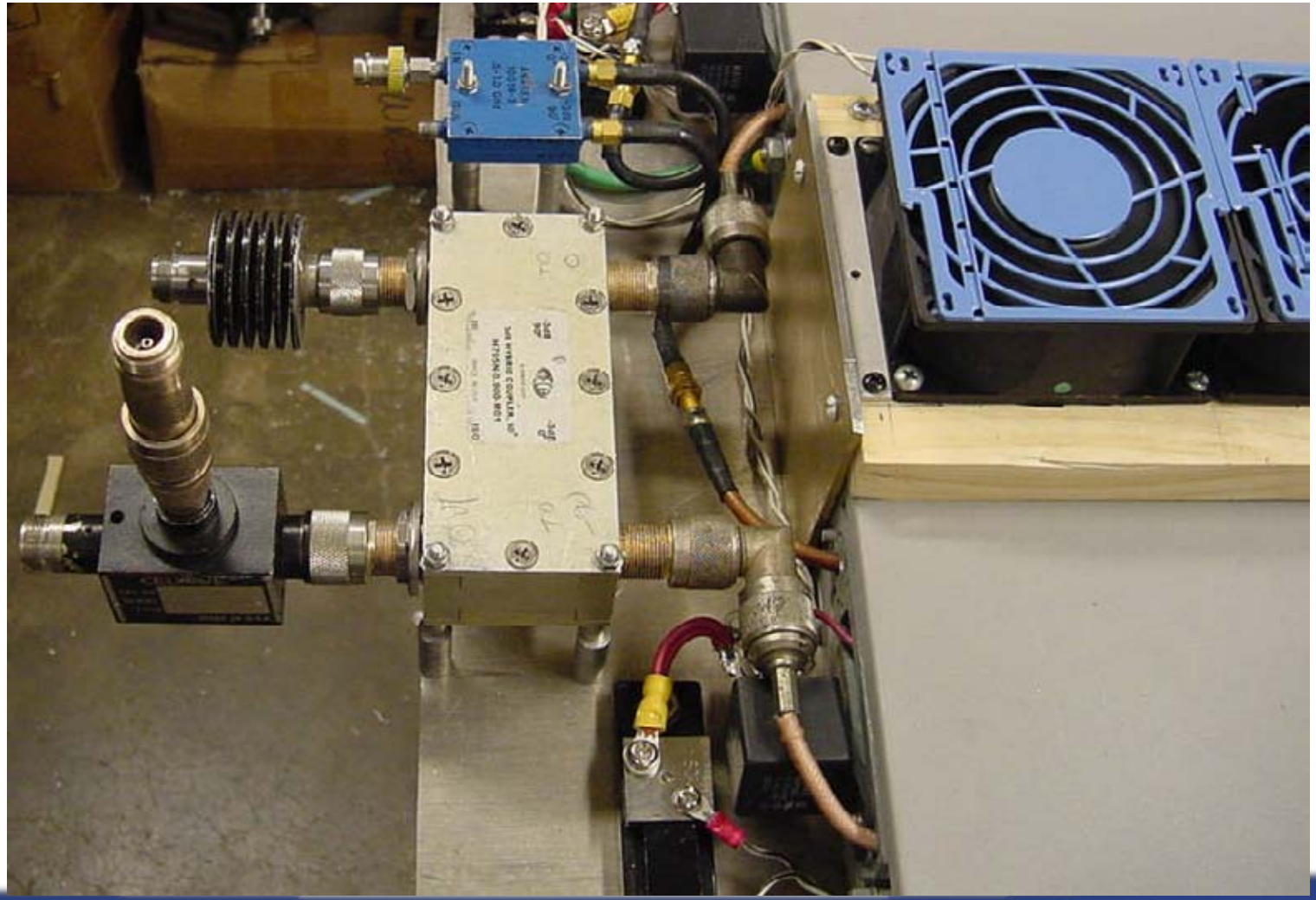

Paralleling two 300 Watt SSPAs at WA8RJF using 90 Degree Hybrid Couplers

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Showing Method of Attachment of 24V and PTT at WA8RJF

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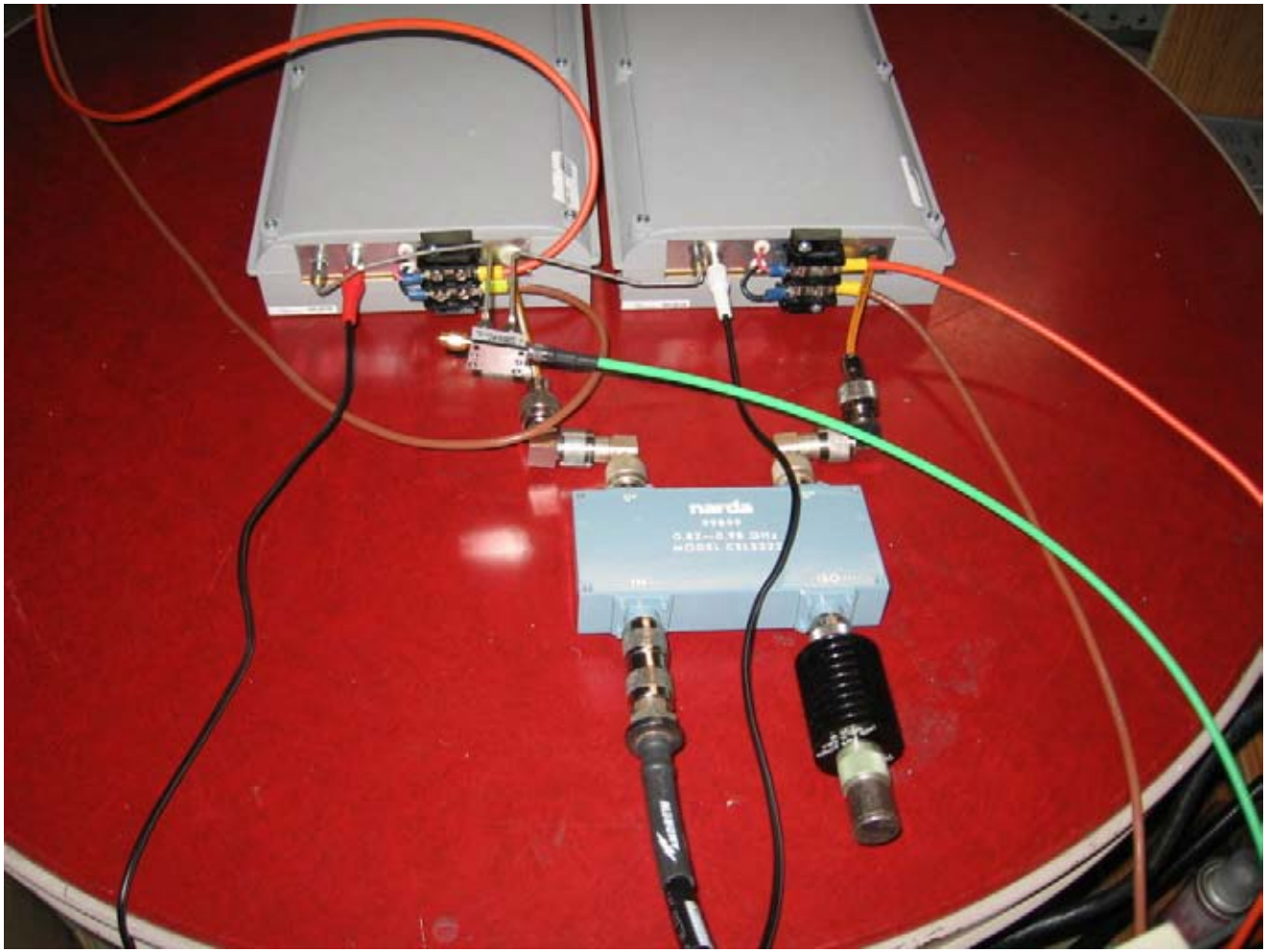

SMA 90 Degree Hybrid Couplers

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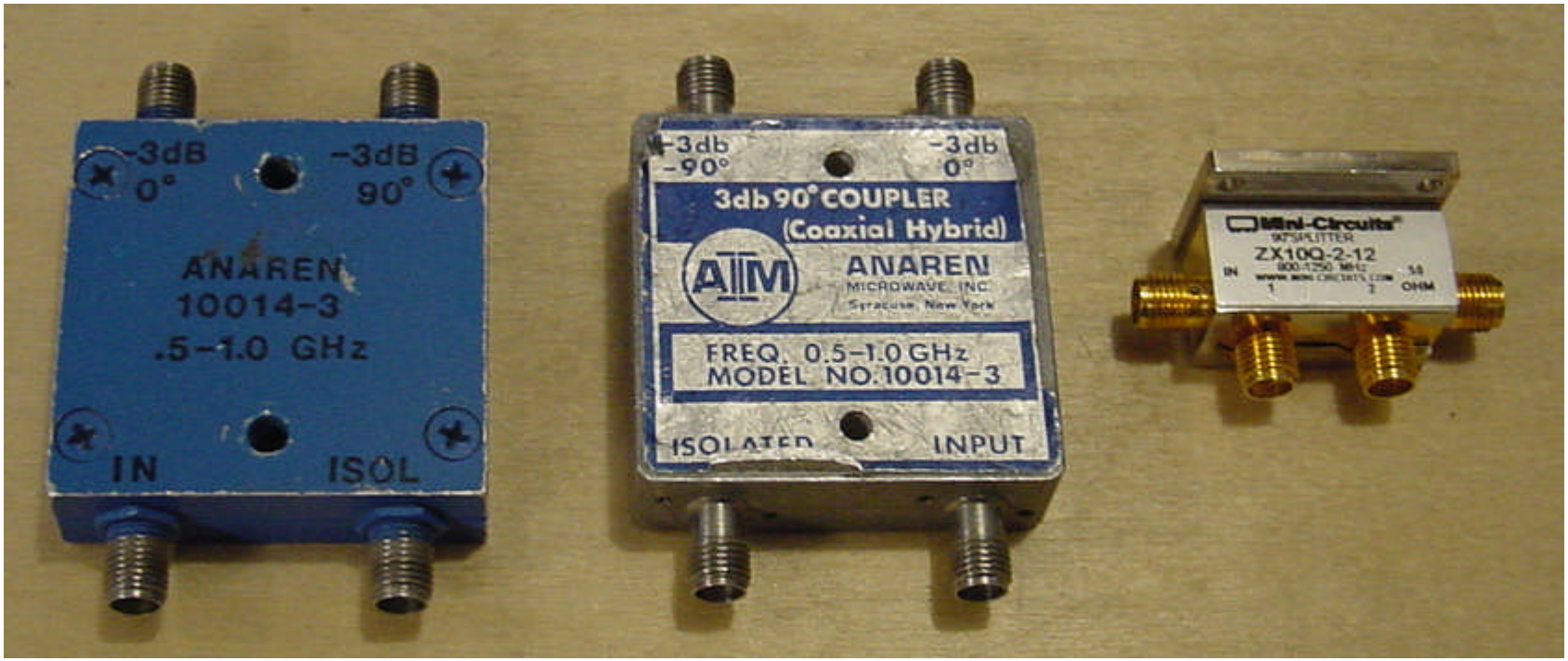

Anaren 10014-3 .5 to 1 GHz 3dB 90º Hybrid

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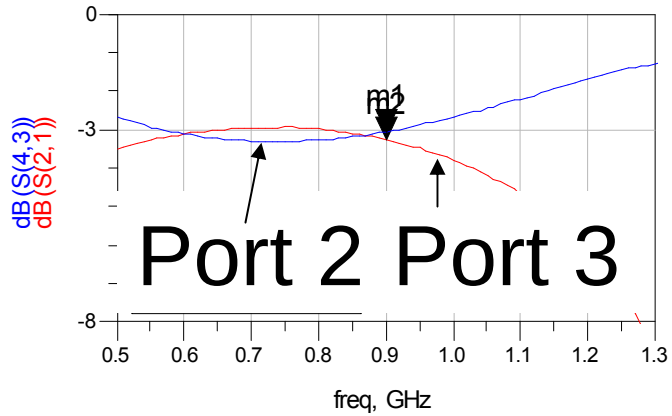

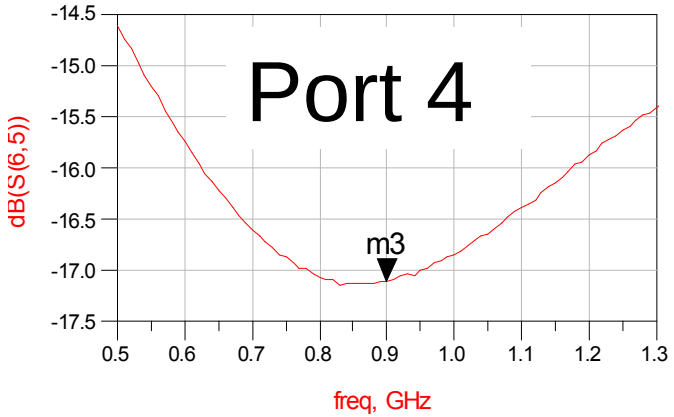

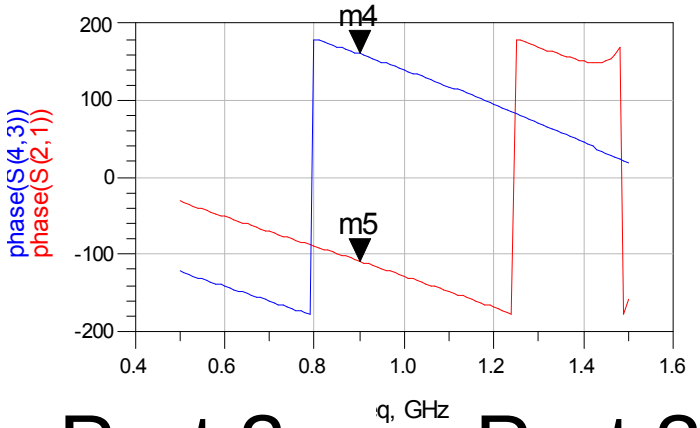

Port 2 -109º

Port 3 160.1º

Difference = 160.1--109=269.1 – 360 =-90.9

MECA 900 MHz 3dB 90º Hybrid

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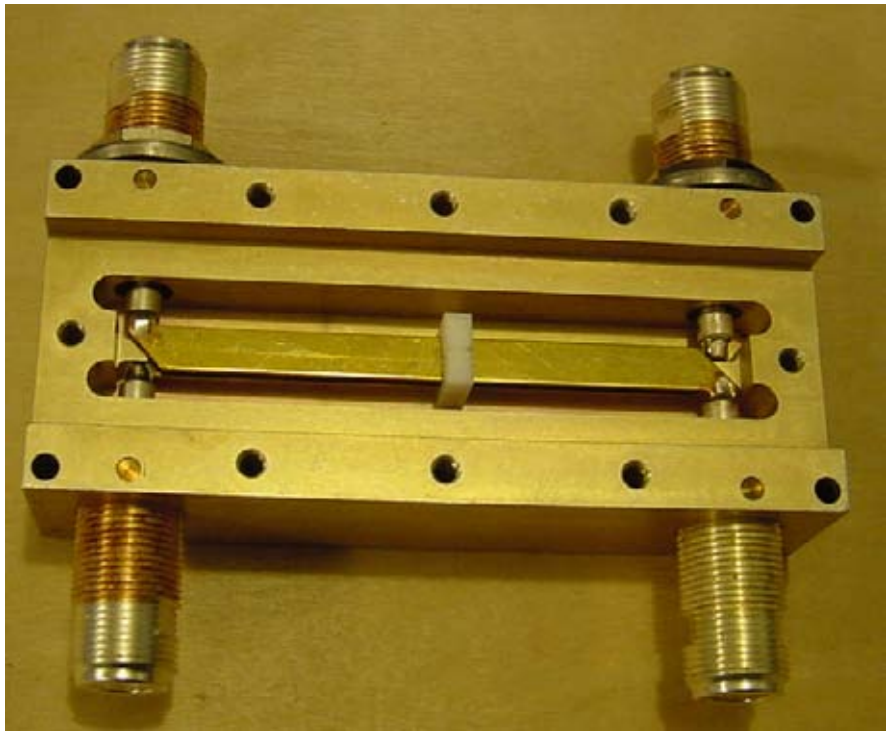
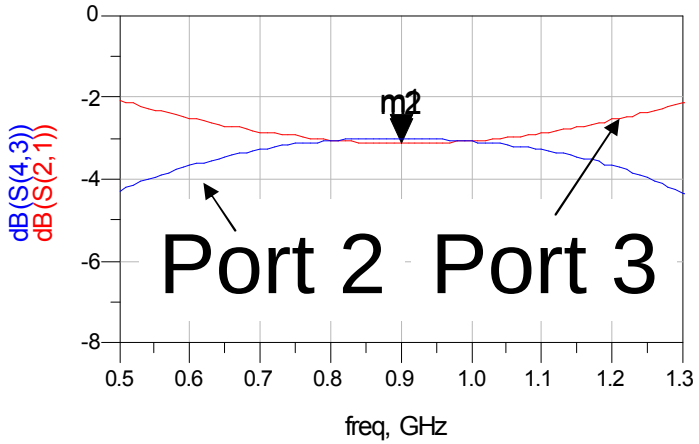
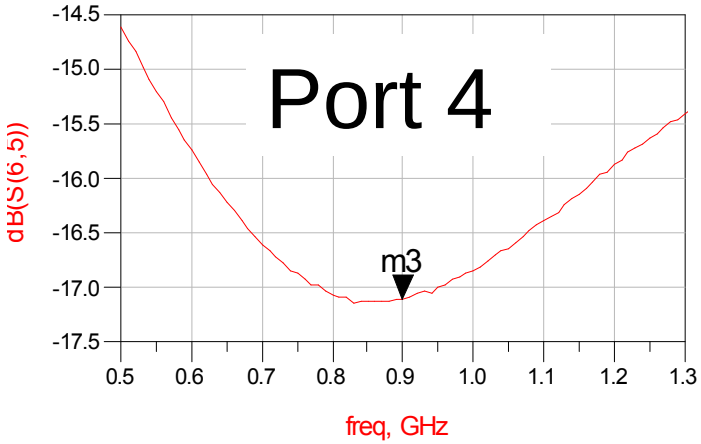
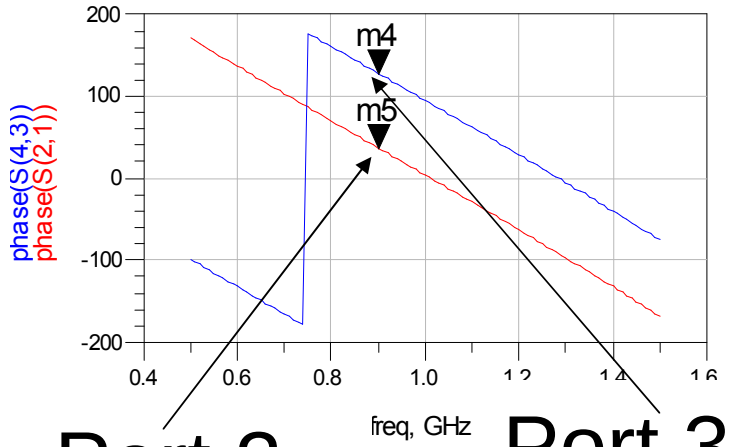


MECA 900 MHz 3dB 90º Hybrid

North Texas NTMS Microwave Society

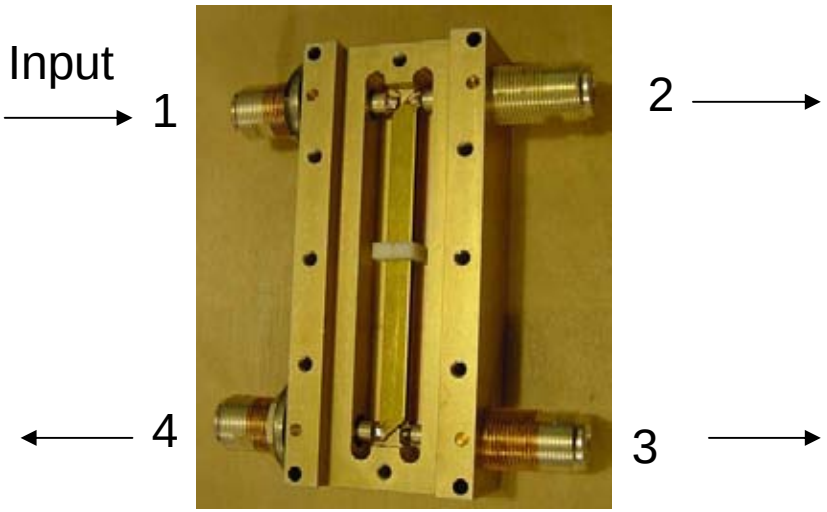






Port 2
36.7º

Port 3
127.7º



Difference = 127.7-36.7=91º

ADS Coupler Simulation

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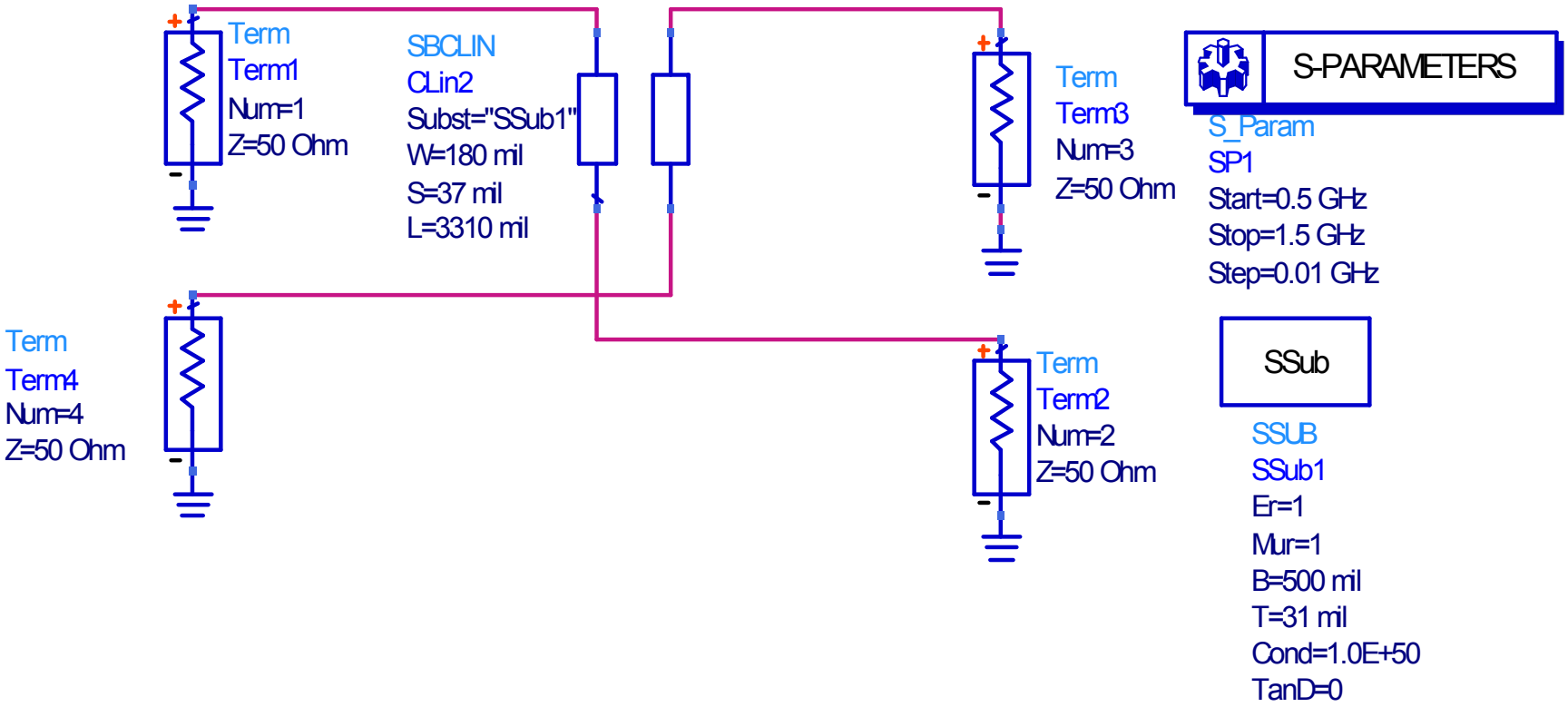

MECA 900 MHz 3dB 90º Hybrid ADS Simulation

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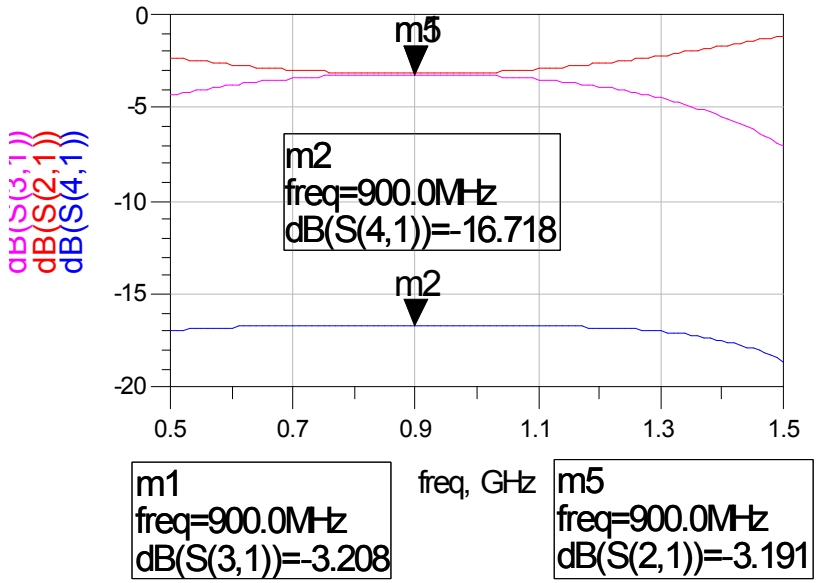

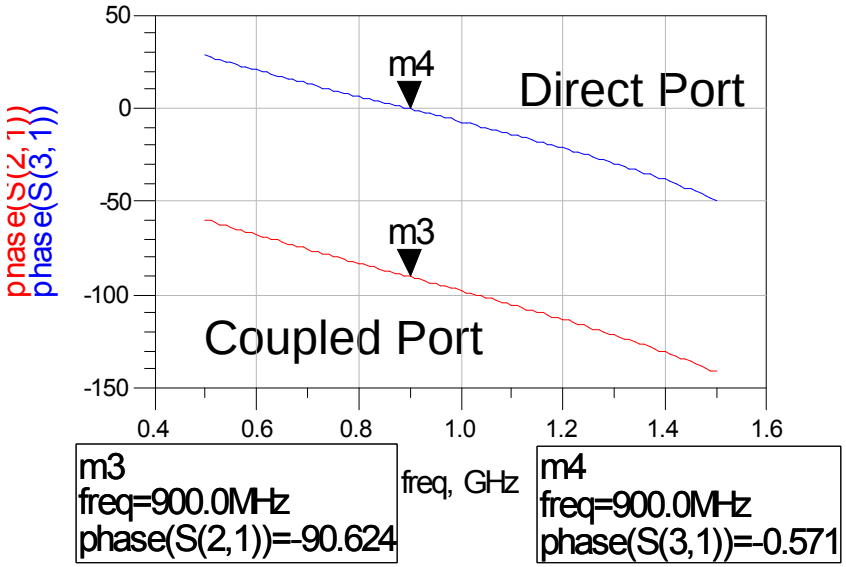

Directivity = Isolation – Coupling = 16.7dB – 3.2dB = 13.5dB not too spectacular but may not be too important since we are not trying to accurately measure return loss but rather just combine amplifiers

Coupled port leads by 90 degrees
Or direct port lags by 90 degrees

Broad band Response of the Ideal 90 Degree Hybrid

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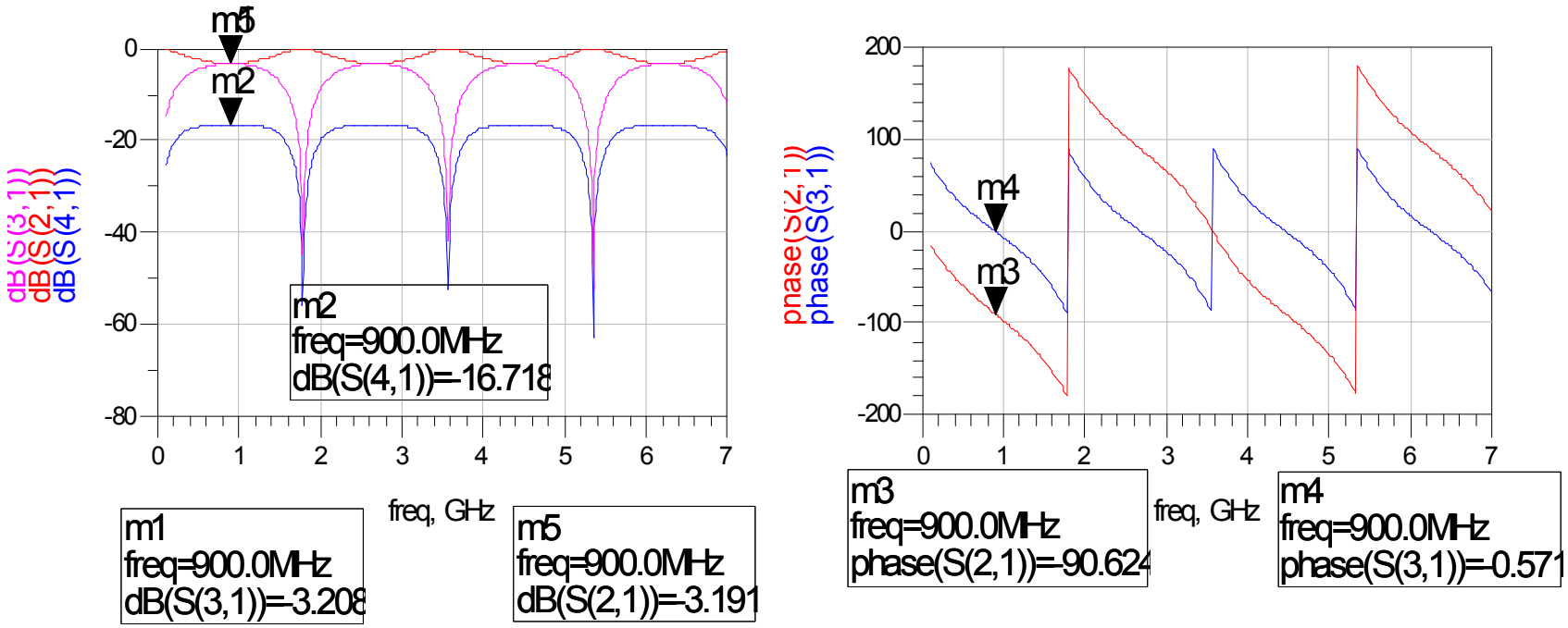
Also known as a “Backward Wave” Coupler

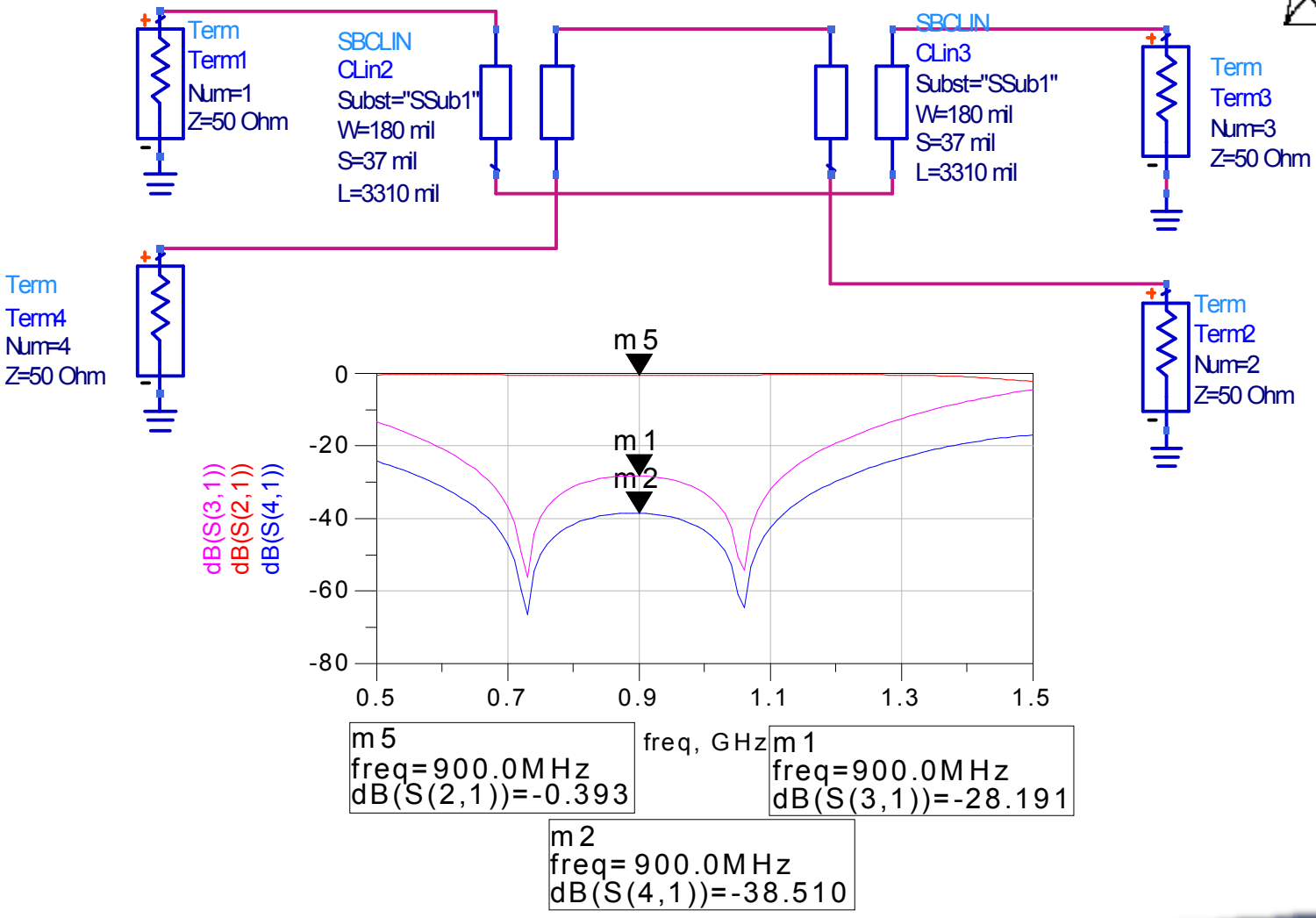


Amplitude response repeats at 3fo, 5fo, 7fo, etc.

Phase difference remains constant at 90 degrees regardless of frequency!

In reality discontinuities and parasitics can create imbalances

Cascade of 2 couplers



Cascade of 2 couplers with Open Circuit on one Port1

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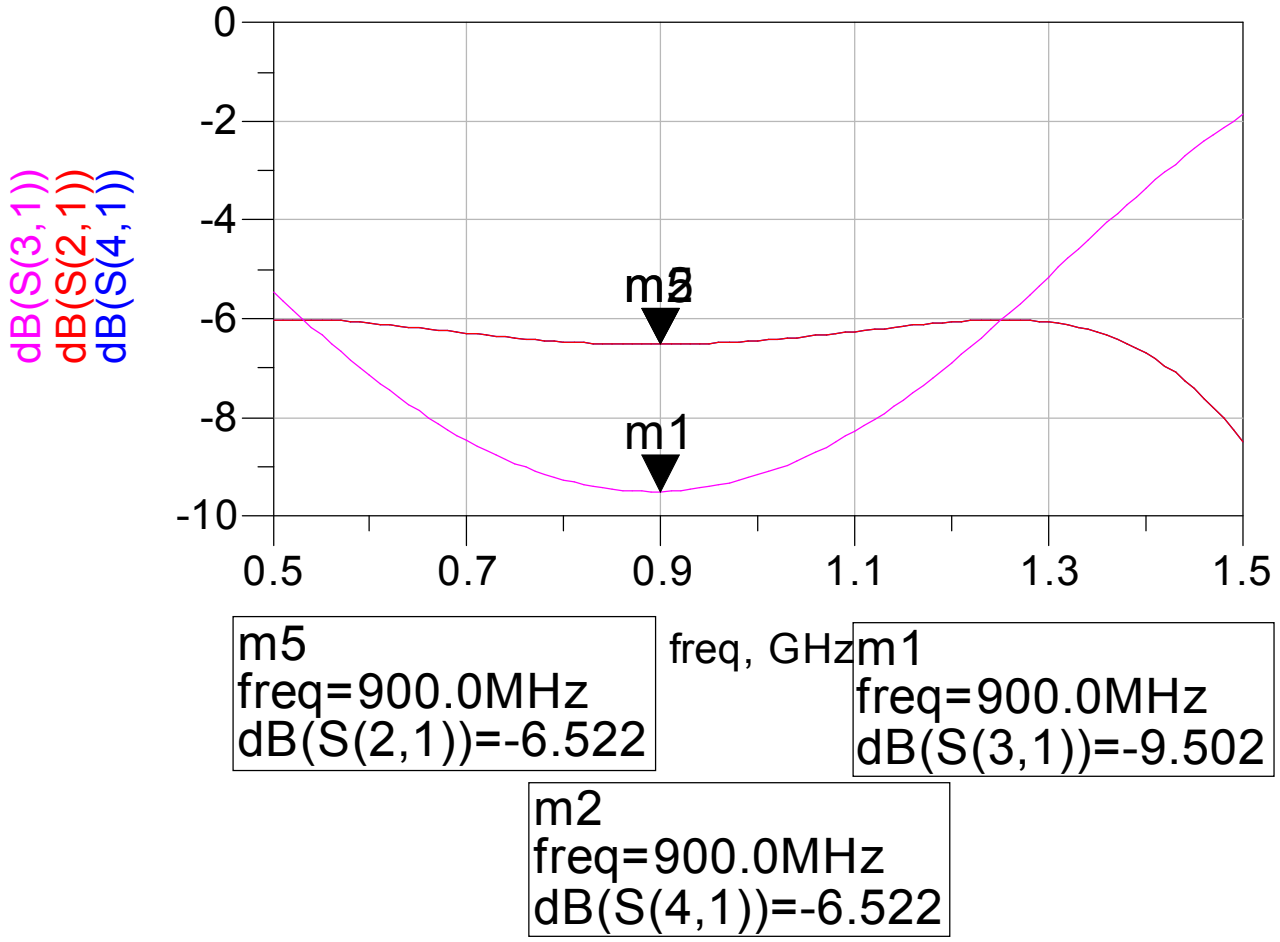

Through Loss = 6.5 dB
Power at isolated port down only 6.5 dB, need 50 ohm load that can handle this at least temporarilly. In addition some power is also available at the “other” output port of the coupler – none of this is very good!

Cascade of 2 couplers with 1 and 3 dB attenuators in one path

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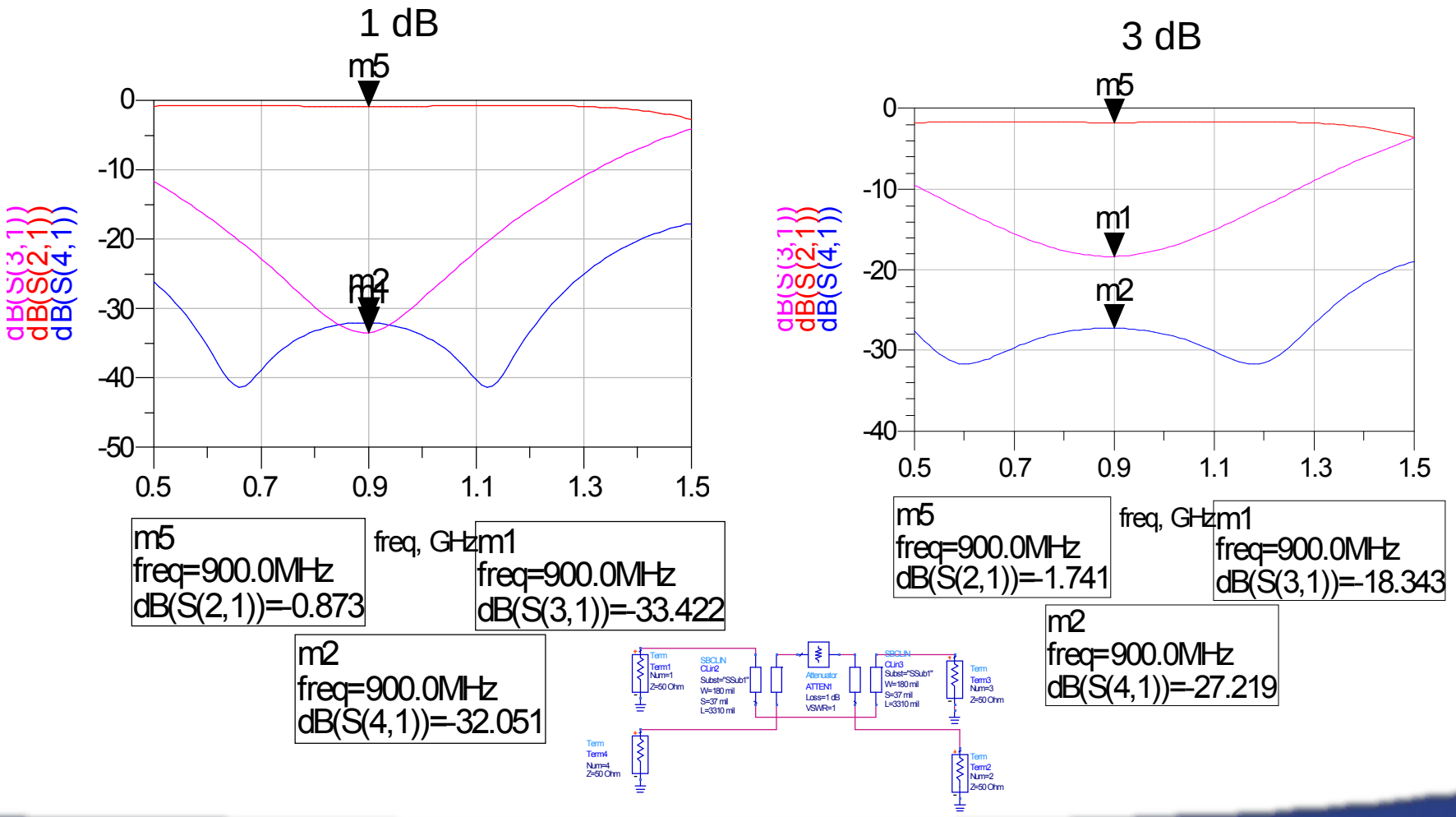

Cascade of 2 couplers with 10 and 45 degree offset in one path

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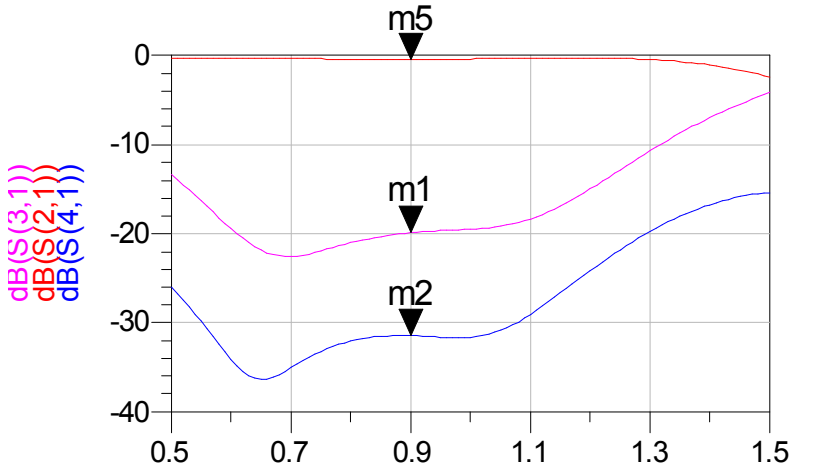
10 degree offset

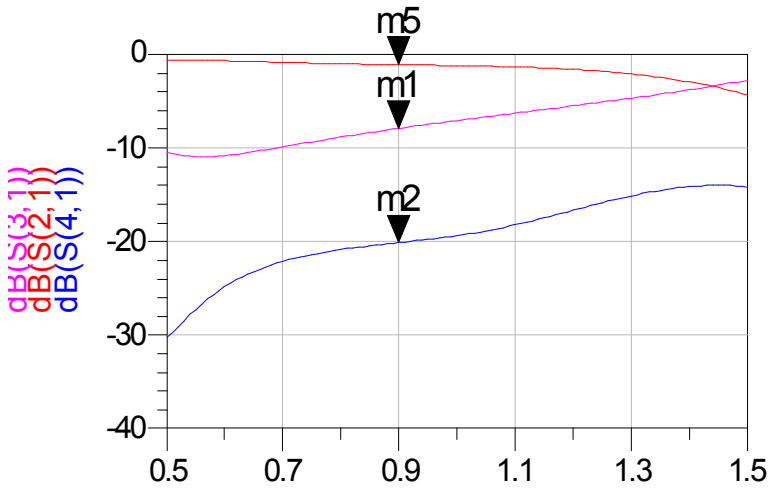


m5
freq=900.0MHz
dB(S(2,1))=-0.429

m1
freq=900.0MHz
dB(S(3,1))=-19.919

m2
freq=900.0MHz
dB(S(4,1))=-31.472

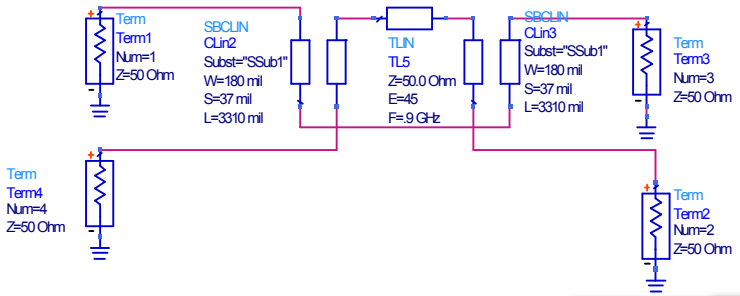
45 degree offset



m5
freq=900.0MHz
dB(S(2,1))=-1.137

m1
freq=900.0MHz
dB(S(3,1))=-7.941

m2
freq=900.0MHz
dB(S(4,1))=-20.145



Single coupler with both outputs open circuited

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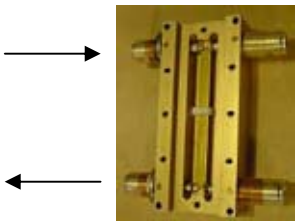
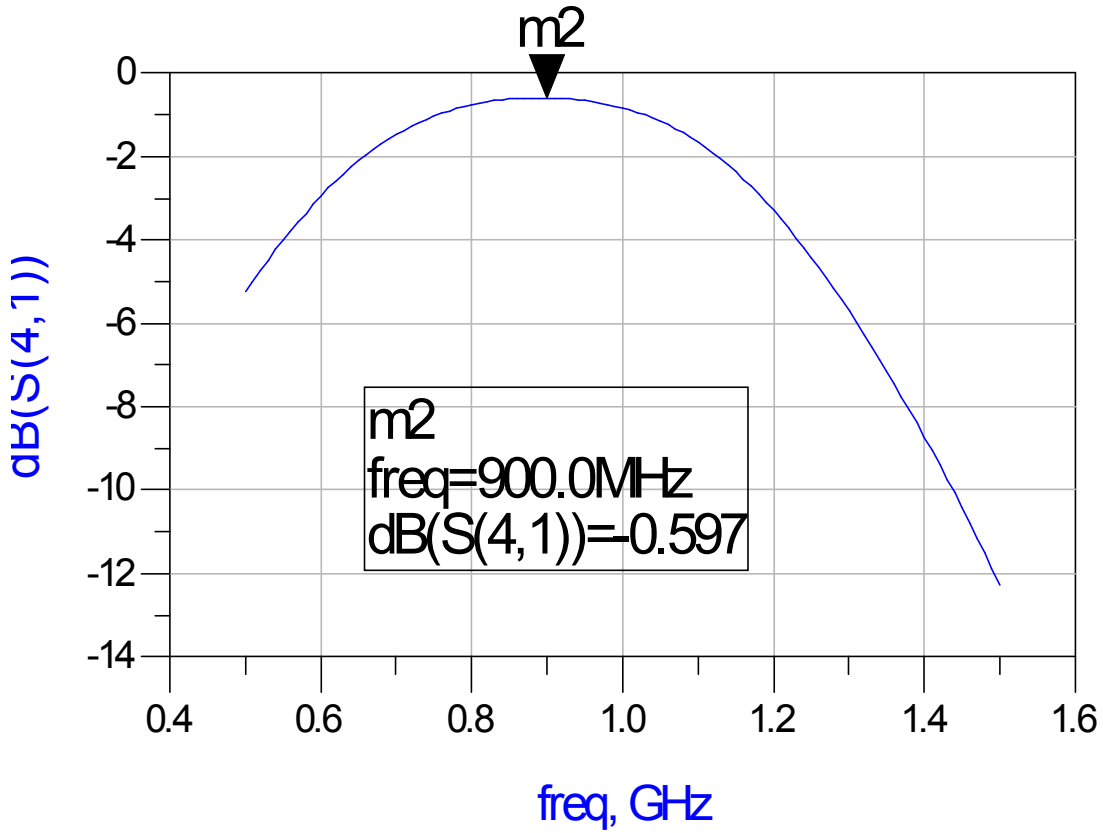
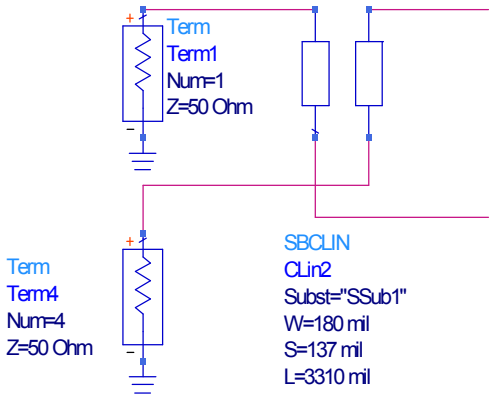
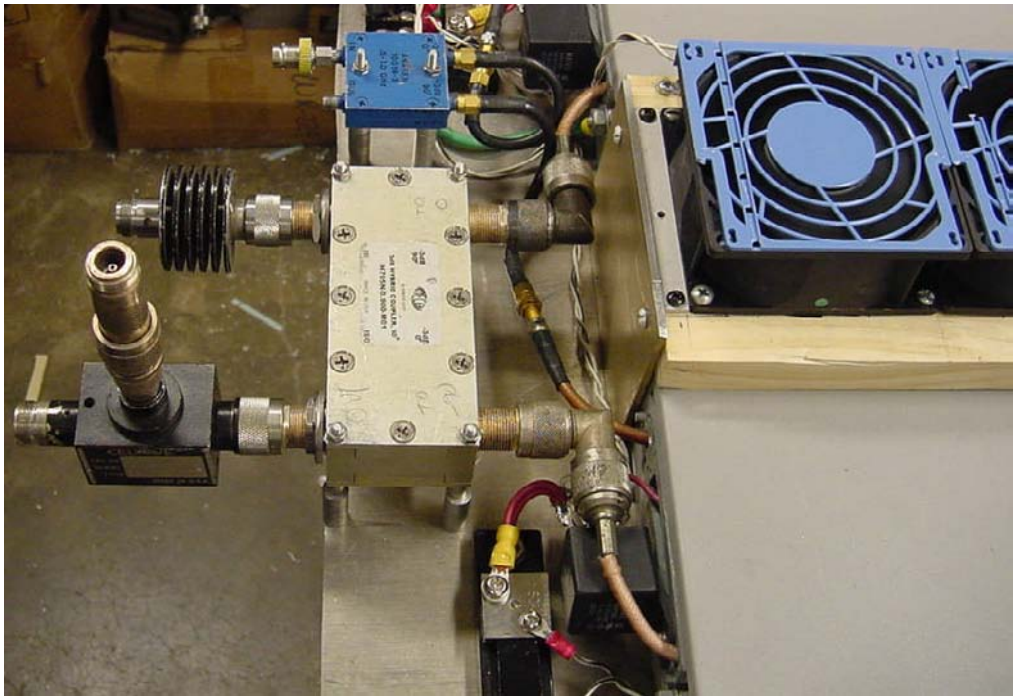






All power is reflected back to port 4. Termination on port 4 must be capable of handing the entire available driver power.

Optimizing Power Output



Best solution is to adjust amplitude and phase to keep current drawn by each amp as equal as possible when amps are driven to full power

Try flipping hybrids

Add some line length

Adjust load on output coupler isolated port

Each amp has some form of adjustable attenuator on its input

W0PW EIA Dual Dipole Feed

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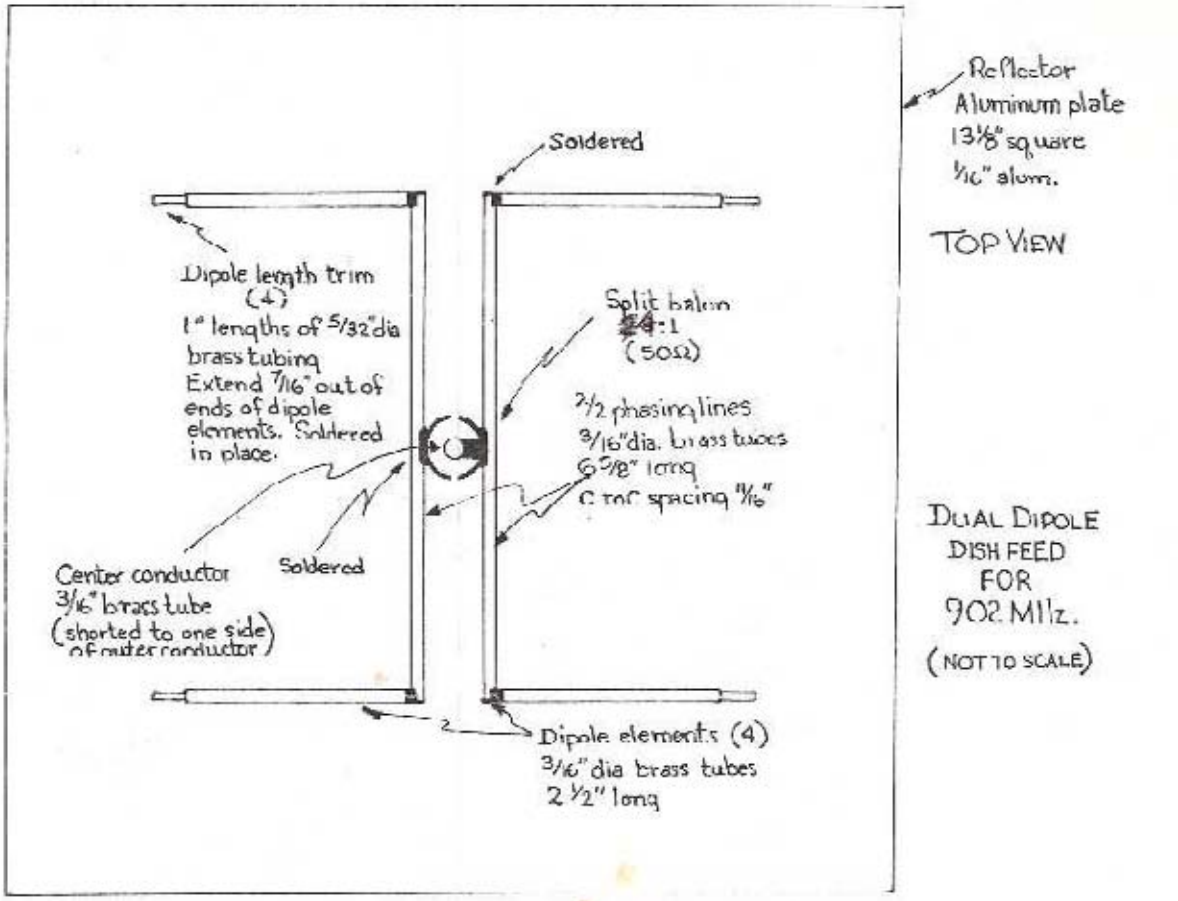
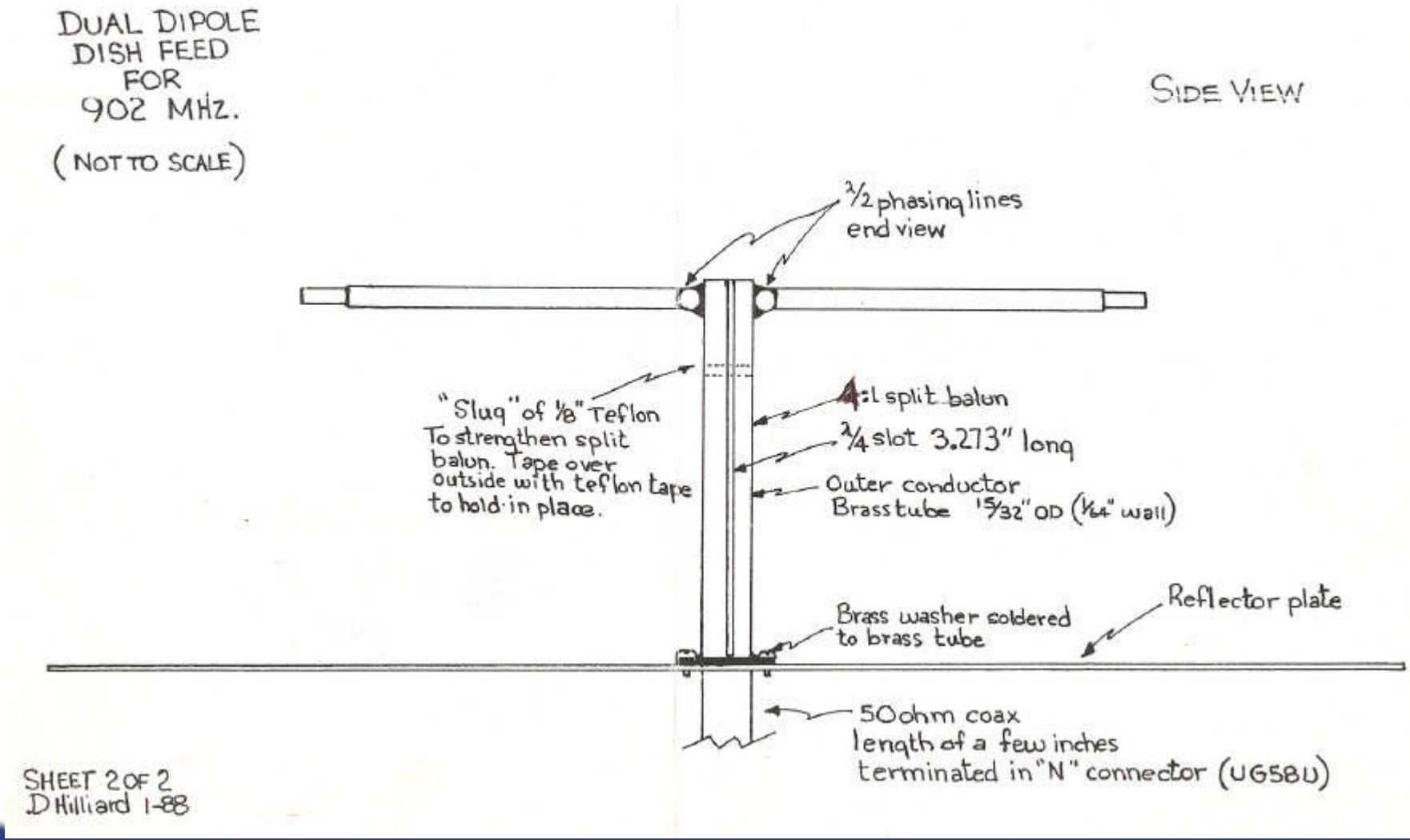


W0PW EIA Dual Dipole Feed

North Texas NTMS Microwave Society



902 MHz W0PW EIA Dual Dipole Feed @ W5LUA

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WA8RJF 3M Dish on 902 MHz

North Texas NTMS Microwave Society

Dual Dipole Feed for 902 MHz Built by WW2R

North Texas NTMS Microwave Society

Side View of Dual Dipole Feed

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Return Loss of 902 MHz Dual Dipole Feed

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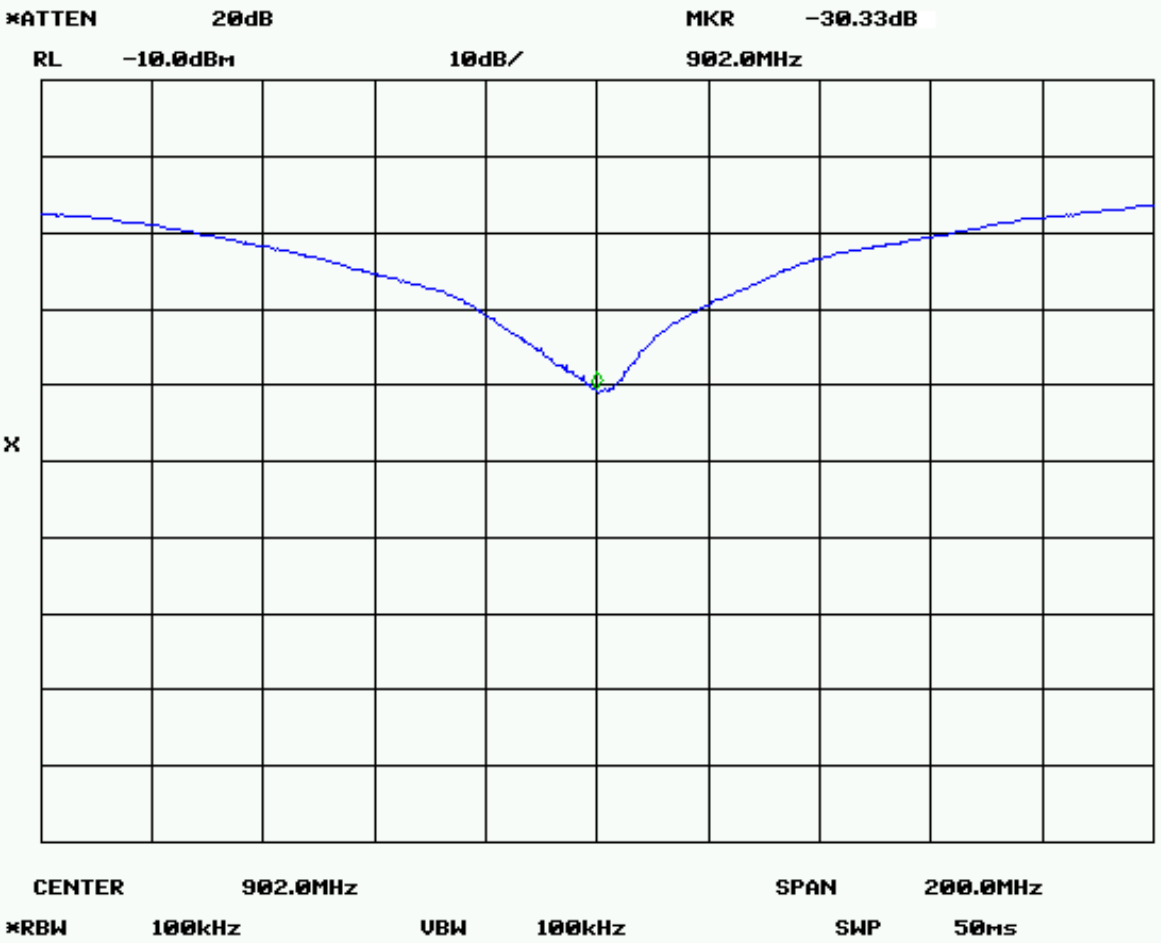

WW2R 3M Dish on 902 MHz

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902 MHz Feed at WW2R

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Waterproofing Feed at WW2R

North Texas NTMS Microwave Society

Summary

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- Questions?
- Group buys?