

FIELD DAY INTERFERENCE BUSTING

CVARC March 17

Topics

Home Versus Field Day Operations

2021 HF Interference Incidents

Likely Causes

-From the Radio to the Antenna

- Within the Receiver

-Defenses Against the Interference Dark Arts Within the Radio

-Anti-Interference Checklist

Home Versus Field Day Operations

Home: Single operator with one transceiver/antenna at a time

- Not concerned with interference
- Maximized transceiver sensitivity/gain/power

Home Versus Field Day Operations

Field Day: Multiple simultaneous operation of the following:

Near-field transceivers and portable antennas;

feed lines;

Filters and Multiplexers

INTERFERENCE BUSTING 101 – RECEIVER SETTINGS

HOME RECEIVER CONTROL SETTINGS

CONTROL	ON or OFF	MAX/MIN
PRE AMP	ON	MAX
ATTENUATOR	OFF	
NOISE BLANKER	ON/OFF*	
RF GAIN	ON	MAX
AGC	ON	OPTIMIZE
BAND PASS TUNING	ON/OFF*	OPTIMIZE
NOISE REDUCTION	ON/OFF*	
NOTCH FILTER	ON/OFF*	

* DEPENDS ON CIRCUMSTANCES

FIELD DAY RECEIVER CONTROL SETTINGS TO MINIMIZE INTERFERENCE

CONTROL	ON or OFF	MAX/MIN
PRE AMP	OFF	MIN
ATTENUATOR	ON	
NOISE BLANKER	OFF	
RF GAIN	ON	MIN*
AGC	ON	OPTIMIZE**
BAND PASS TUNING	ON	OPTIMIZE
NOISE REDUCTION	ON	OPTIMIZE
NOTCH FILTER	ON	OPTIMIZE

** TIME CONSTANT OFF

Towers of Babel

Three fairly tall Towers

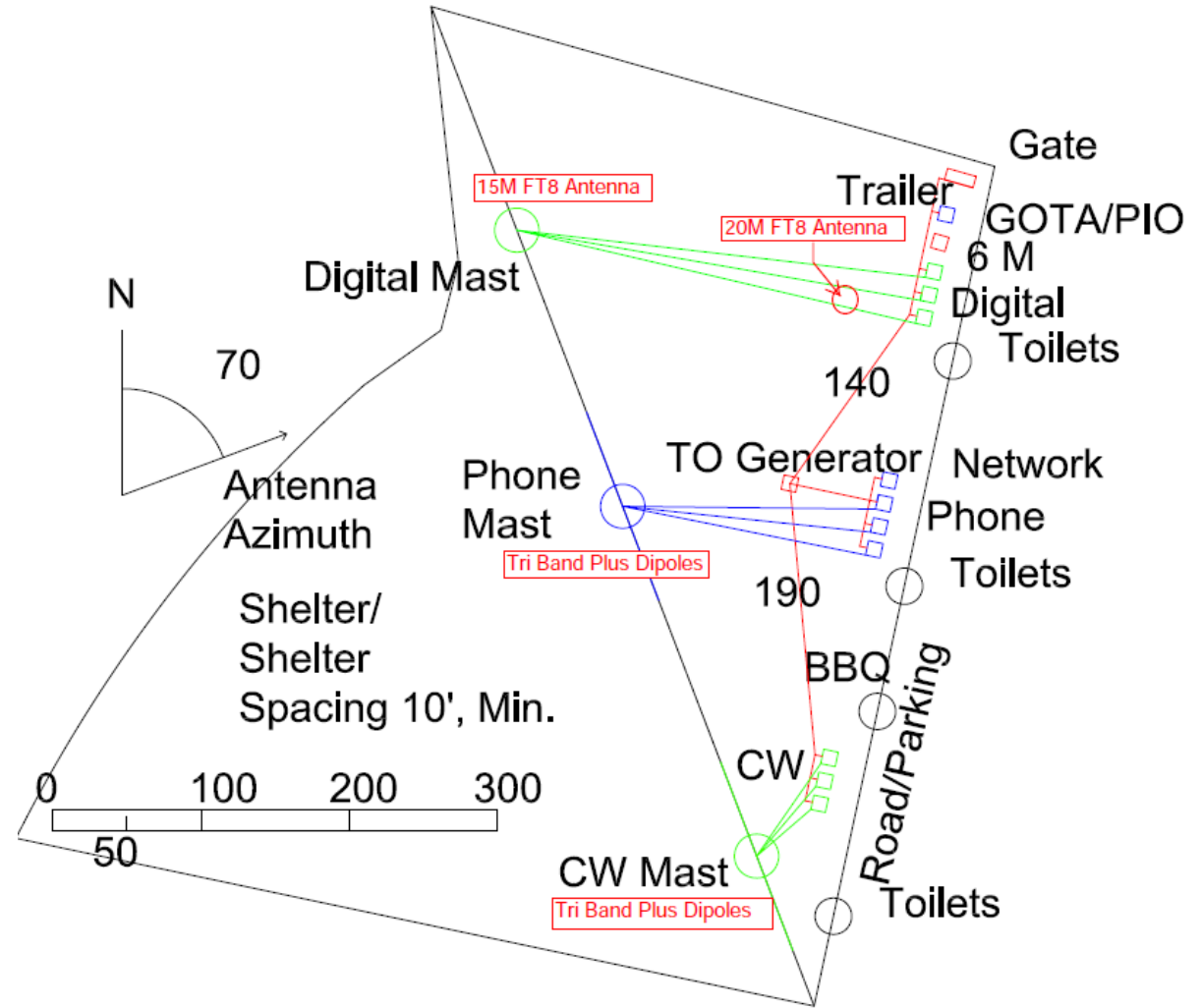
Nicely separated and aligned

Lots of antennas on each tower

- Some multiband, some dipoles

Band pass filters and/or multiplexers for each mode

Note the lone 20M FT8 antenna, not in line with the masts



The Ugly Truth

Results of February 2022 Survey

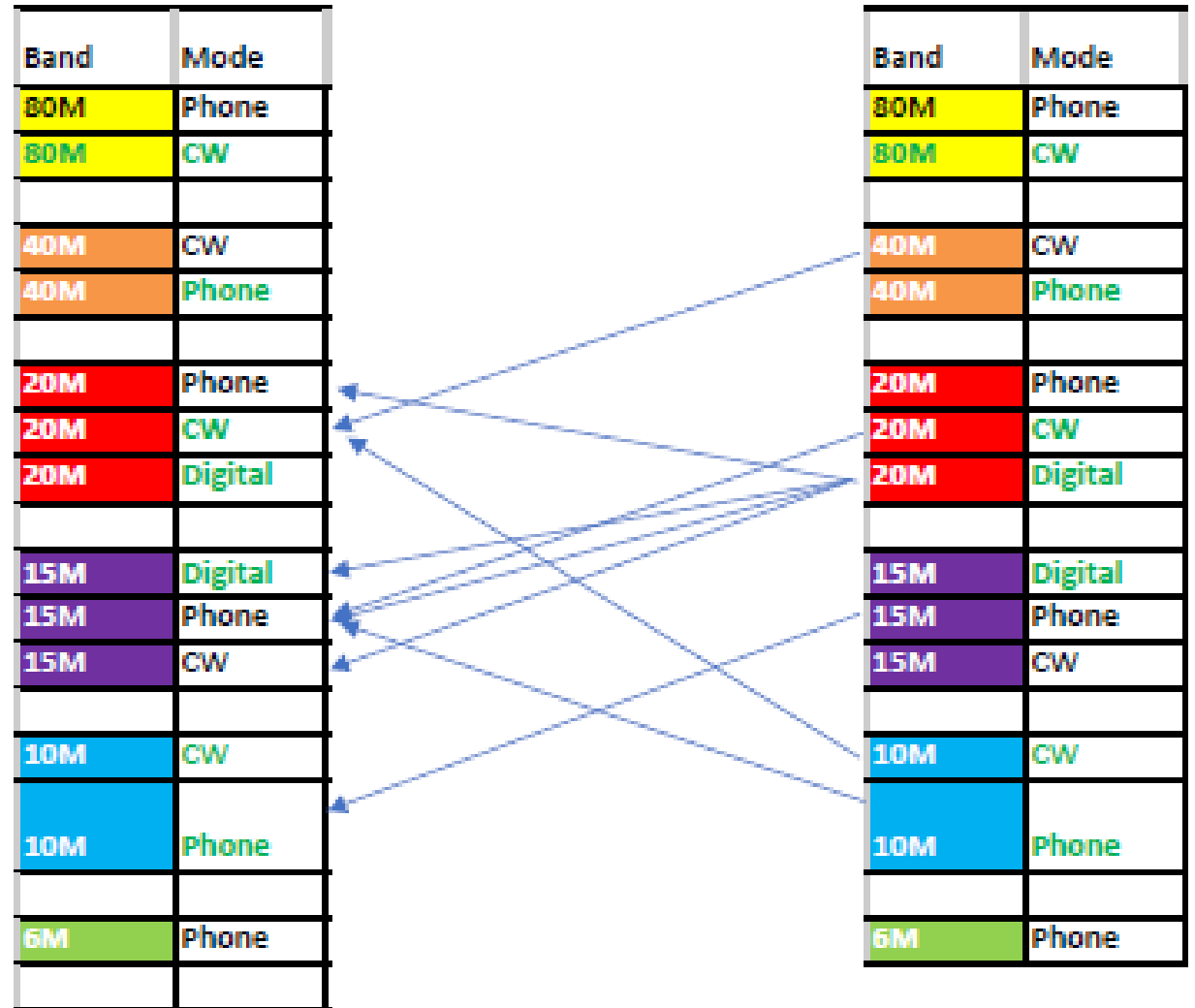
Transmitters on the **Right**,

Receivers on the **Left**

Data is anecdotal, fuzzy and subject to same bias as eyewitness (earwitness?) testimony

No interference noted on the 2M, 6M and 440 MHz bands

2021 CVARC Field Day HF Interference



Interference Involving CW

3 transmission sources with no antenna feed point choke or balun

1 received case with feed through a multiplexer

No known bonding of stations

Likely cause: common mode currents on feed lines

2021 CVARC Field Day Interference Involving CW

Band	Mode
40M	CW
20M	CW
15M	Phone
10M	CW

Band	Mode
40M	CW
20M	CW
15M	Phone
10M	CW

Ant. (1)
Dipole
Mult
Mult
Dipole

Configuration, Notes

Ant. Choke?	Band Pass Filter	Multiplexer
No	Yes	No
No	Yes	Yes
Yes	Yes	Yes
No	Yes	Yes

(1) Dipole - Mono Band Dipole, Multi - Multi Band Yagi or Vertical

Interference Involving Phone

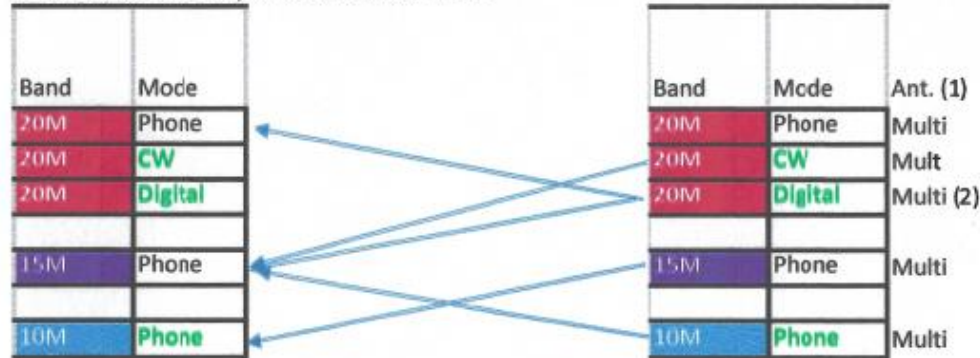
2 instances involving the same antenna, feed line and multiplexer

20M CW to 15M phone no choke/balun plus multiplexer

Only 20M station was bonded

20M digital likely FT8 transmitter power and/or audio drive settings

2021 CVARC Field Day HF Interference Phone



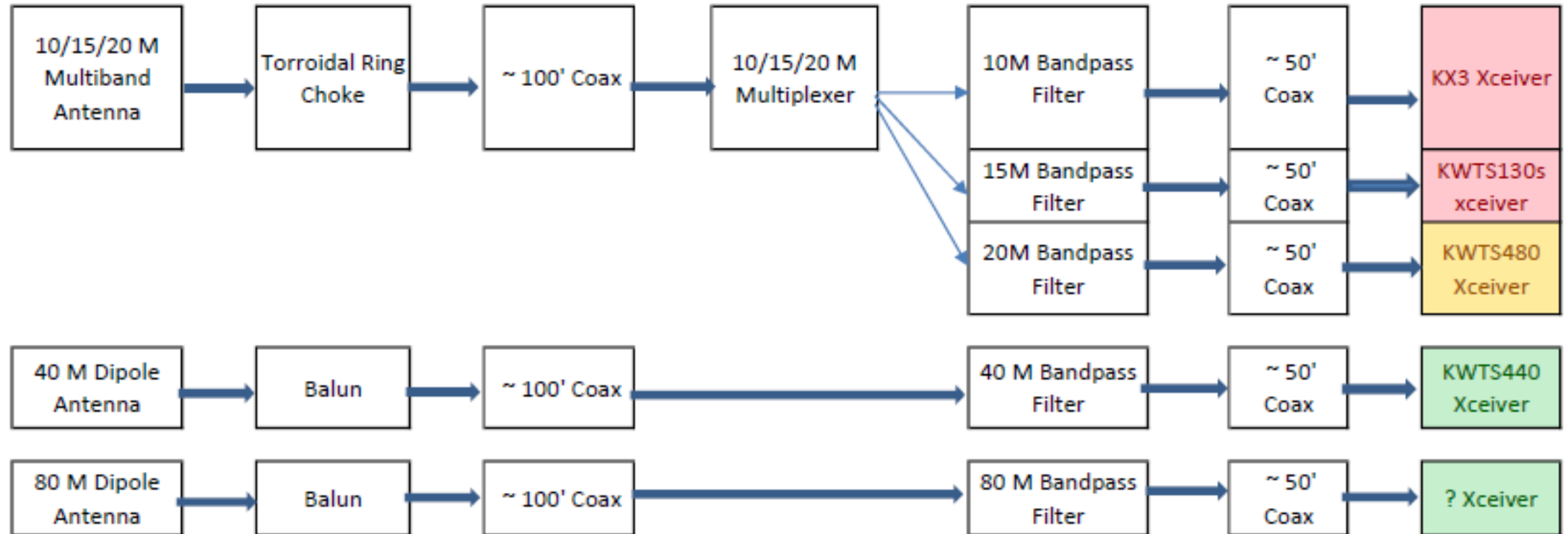
Configuration, Notes

Ant. Choke?	Band Pass Filter	Multiplexer
Yes	Yes	Yes
No	Yes	Yes
Yes	Yes	No
Yes	Yes	Yes
Yes	Yes	Yes

- (1) Dipole - Mono Band Dipole, Multi - Multi Band Yagi or Vertical
- 2 Two Ham Sticks mounted on an octopus with several other bands.

Phone Mode Block Diagram

CVARC 2021 Field Day Phone Band Setup - All On the Same Mast

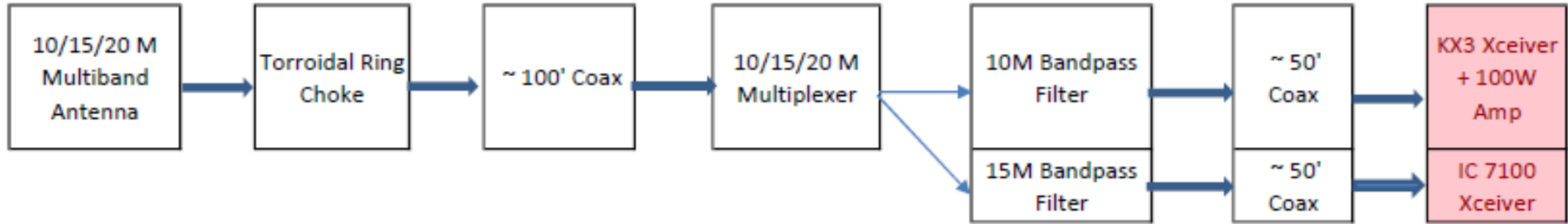


Phone Troubleshooting Experiments

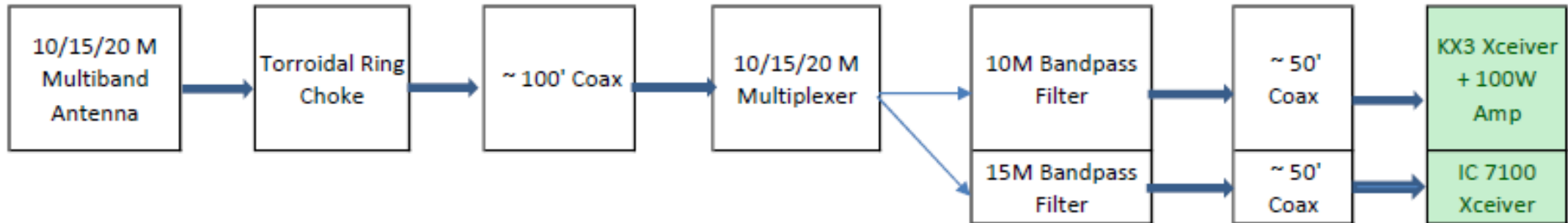
- A series of successive substitutions of components was performed to isolate the source(s) of interference including:
 - The Antenna,
 - The Multiplexer,
 - The Low-pass filters,
 - The Low-pass filter jumpers,
 - Various transceivers

Experiment 1 – Replicate Field Day

Experiment #1 - Replicating Phone Interference - No Attenuator

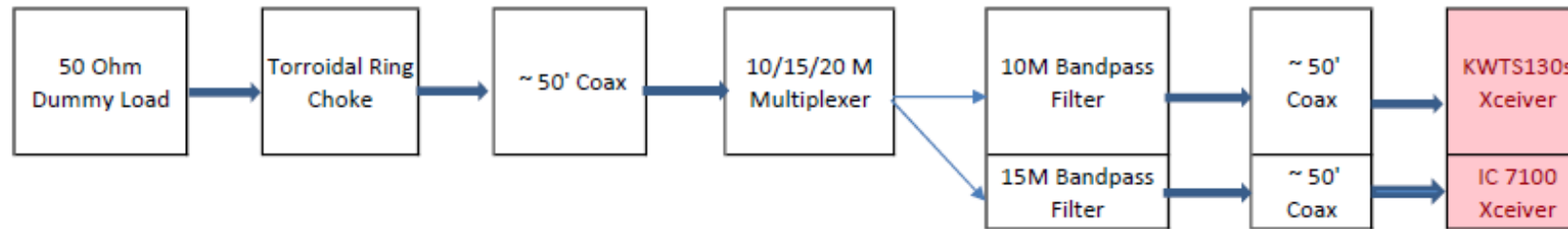


Experiment #1 - Replicating Phone Interference - With Attenuator

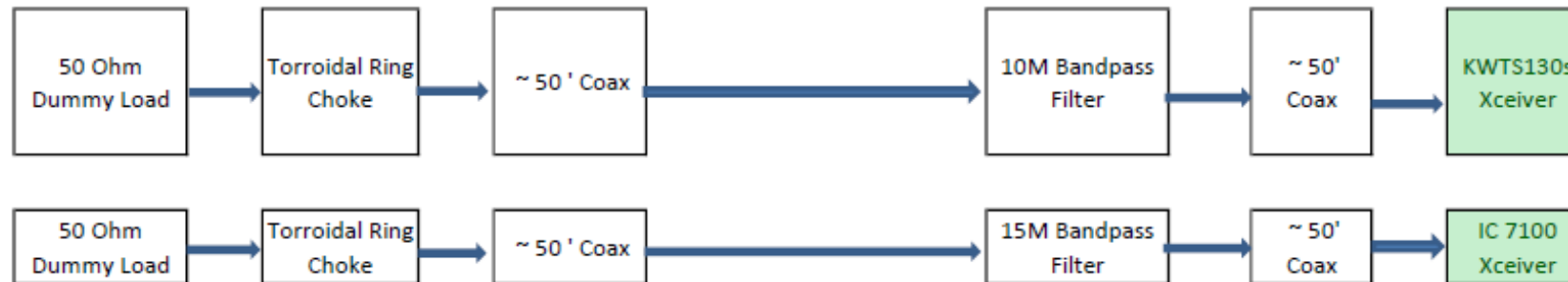


Experiment 2 – Check Antenna and Multiplexer

Experiment #2 - Dummy Load for Antenna

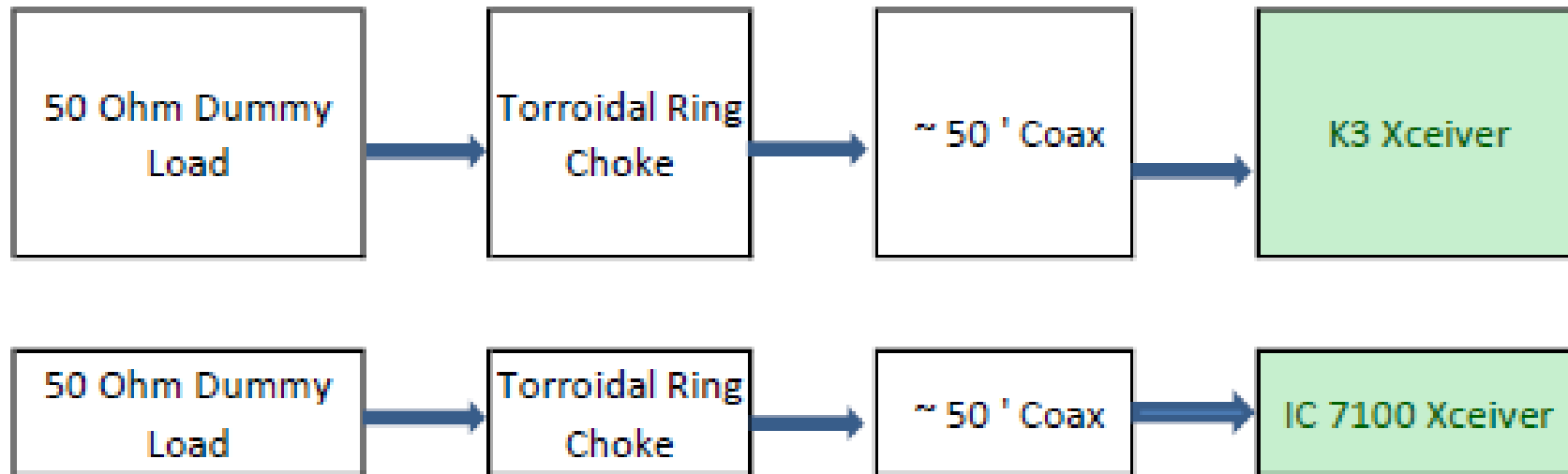


Experiment #2 - Dummy Load for Antenna - No Multiplexer



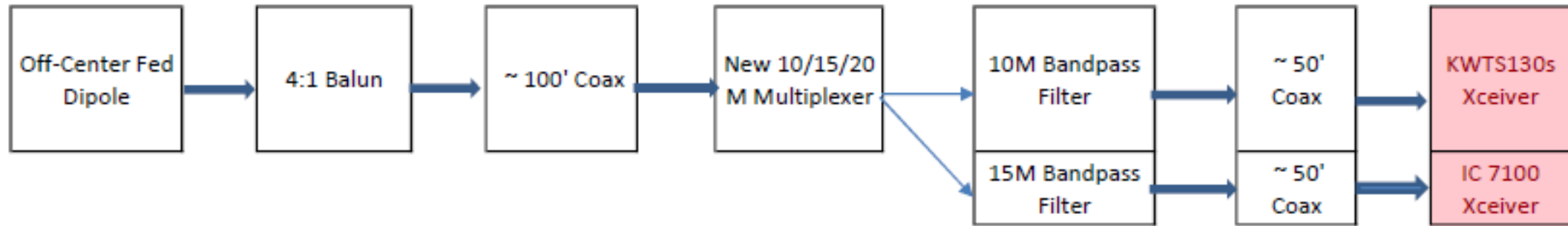
Experiment 3, Dummy Loads, No Multiplexer, No Band pass Filters

Experiment #3 - Dummy Load for Antenna - No Multiplexer or Band Pass Filter



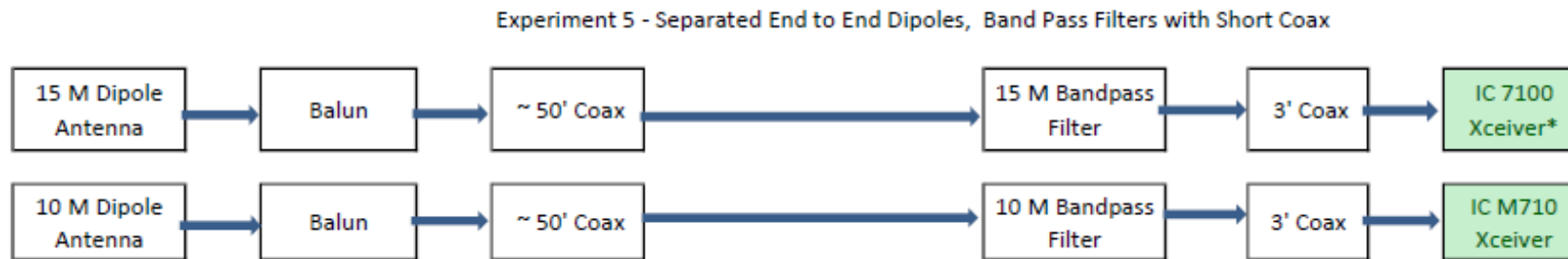
Experiment 4 – Replacement Multiplexer

Experiment #4 - Replacement Multiplexer



Experiment 5, Independent Dipoles, Band Pass Filters, Short Coax with Good Shielding

<http://www.cvarc.org/determined-sleuth-solves-field-day-inter-band-interference/>



* Slight Reduction in Preamp

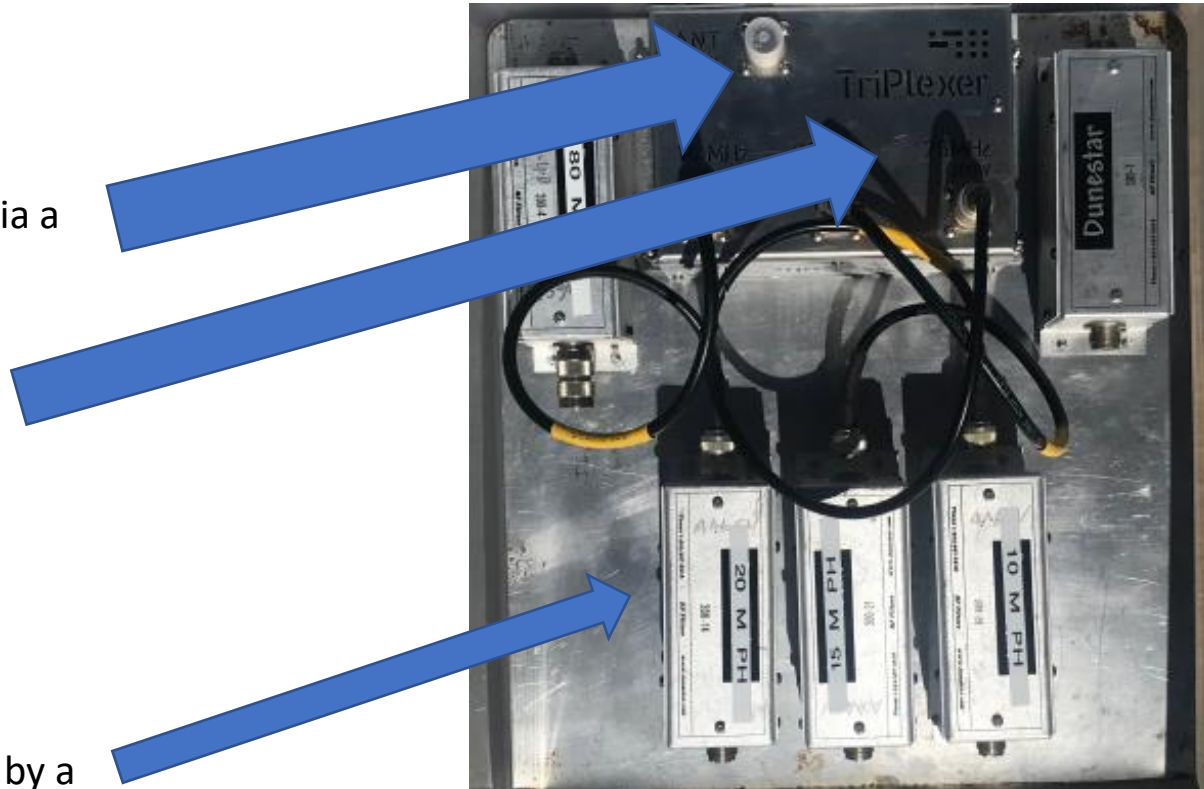
Note: High Quality Shielding on Coax

CVARC Typical Filter Box

Multiplexer feeds a multiband antenna via a single feed line

Band pass filters feed the multiplexer

A selection of band pass filters, each fed by a separate transceiver.



Supplemental Testing of Filter Boxes

- All 3 CVARC filter boxes swept through the HF bands
- Using a mini-NVA, the output isolation from Input was measured
- All 3 boxes were found to be in specification
- Note: Mini-NVA test power was relatively low compared to transceiver power

CVARC 2021 Phone Band Interference Conclusions

- The likely cause of the 10/15 and 20M phone band interference was:
 - The use of a single multi-band antenna and feed line
 - The use of a single 10/15/20 M multiplexer with inadequate isolation at typical transceiver power levels (100W)
 - Interference was essentially eliminated using separated mono-band antennas, with baluns, band pass filters, short, highly-shielded jumpers and judicious management of receiver pre-amplification.
 - It is still not known if multiple mono-band antennas stacked on the same mast will be effective at 10/15 and 20M
- There was no evidence that the type of transceiver was causal

Interference Involving Digital

15 seconds on and 15 seconds off

Most clearly heard on 20M band

Likely FT8 transmitter power and/or audio modulation drive settings

2021 CVARC Field Day Digital Interference

	Mode
20M	Phone
20M	Digital
15M	Digital
15M	Phone
15M	CW

Band	Mode	Ant. (1)
20M	Phone	Multi
20M	Digital	Multi (2)
15M	Digital	Multi
15M	Phone	Multi
15M	CW	Multi

Configuration, Notes

Ant. Choke?	Band Pass Filter	Multi-plexer
Yes	Yes	Yes
Yes	Yes	No
Yes	Yes	Yes
Yes	Yes	Yes
No	Yes	No

- (1) Dipole - Mono Band Dipole, Multi - Multi Band Yagi or Vertical
 -2 Two Ham Sticks mounted on an octopus with several other bands.

Receivers reporting NO interference

Note 80M and 40M phone separate dipoles on same mast, with band pass filters, separate feed lines, but no multiplexers

Dipoles with chokes, separate feed lines, band pass filters seem to predominate

20M digital is unlikely to receive interference due to modulation technique

6M not likely to receive HF interference

2021 CVARC Field Day HF None

Configuration, Notes

Band	Mode	Ant. (1)	Ant. Choke?	Band Pass Filter	Multi-plexer	Configuration, Notes
80M	Phone	Dipole	Yes	Yes	No	On Same mast as 40M, 5' Higher
80M	CW	Dipole	Yes	Yes	No	Away from other masts, night operation
40M	CW	Dipole	No	Yes	No	On Same mast as multiband
40M	Phone	Dipole	Yes	Yes	No	On Same mast as 80M, 5' Lower
20M	Digital	Multi (2)	Yes	Yes	No	
10M	CW	Dipole	No	Yes	No	
6M	Phone	Multi	Yes	No	No	

(1) Dipole - Mono Band Dipole, Multi - Multi Band Yagi or Vertical
 -2 Two Ham Sticks mounted on an octopus with several other bands.

Interference Busting Tips I – Radio to Antenna

- Spread out the antennas **and** the transceivers
- Monoband antennas aligned end to end
 - Vertical antennas broadside to and centered on dipoles
- Feedline Chokes/Baluns at Antenna feeds
- Use good quality coax shielding
- Do not use the multiplexers
- Do use separated band pass filters **with** short jumpers
- Bond and ground station components

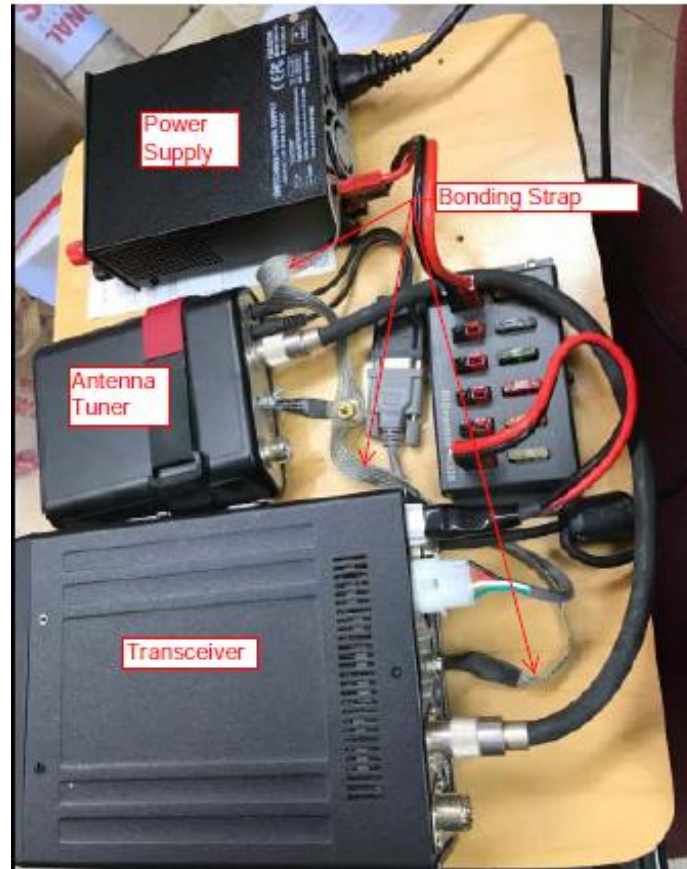
Recommended Transceiver to Antenna Configuration

- Good quality coax shielding
- Band pass filter available from CVARC
- Choke or Balun From CVARC
- Antenna feed
- Short jumper to transceiver From CVARC



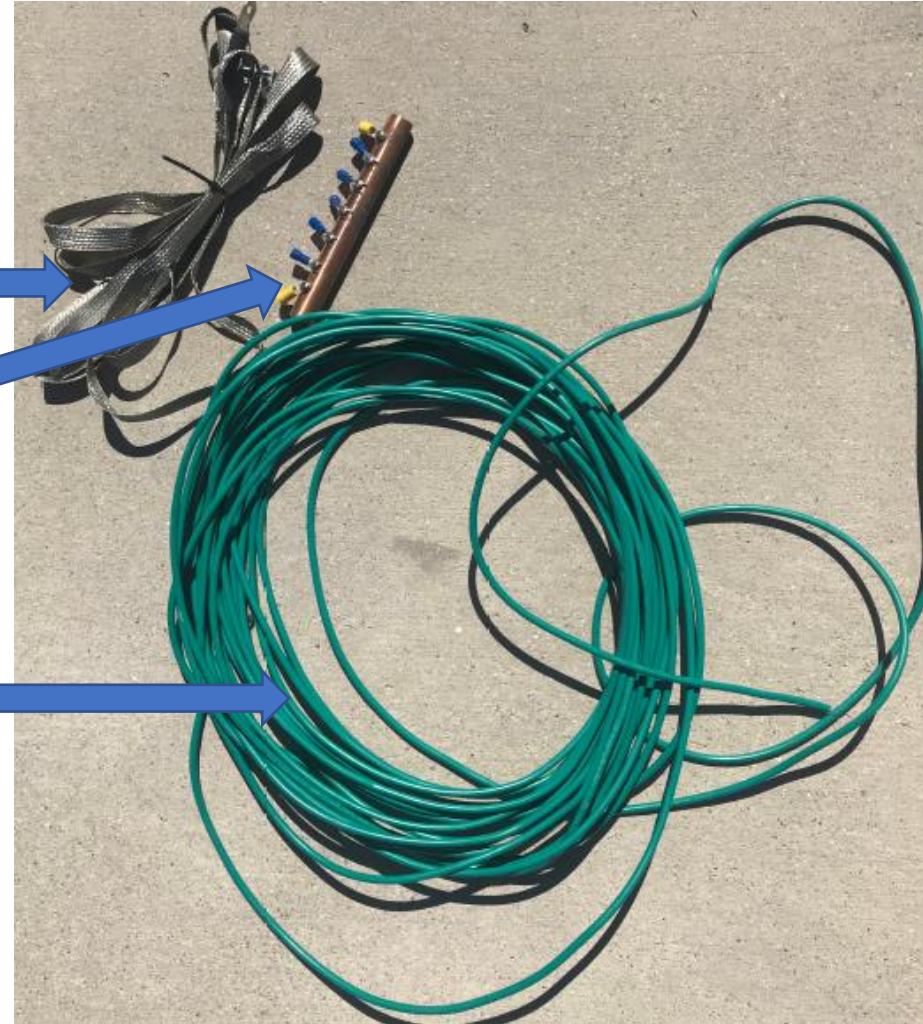
Recommended Station Bonding

<http://www.cvarc.org/rf-bonding-and-ground-planes/>



CVARC Bonding Components Available for Field Day

- Flat strap
- Bus bar with pre-installed connectors
- 10 Ga stranded wire



Interference Busting Tips II – Receiver Tips

FIELD DAY RECEIVER CONTROL SETTINGS TO MINIMIZE INTERFERENCE

CONTROL	ON or OFF	MAX/MIN
PRE AMP	OFF	MIN
ATTENUATOR	ON	
NOISE BLANKER	OFF	
RF GAIN	ON	MIN*
AGC	ON	OPTIMIZE**
BAND PASS TUNING	ON	OPTIMIZE
NOISE REDUCTION	ON	OPTIMIZE
NOTCH FILTER	ON	OPTIMIZE

** TIME CONSTANT OFF

Interference Busting Tips III – When All Else Fails

- Set up a 2M net to help trouble shoot issues
- Diplomatically discuss the issue with the transmitting Station
 - Field Day is a Teaching Opportunity
- Separate the CW and SSB operating frequencies
- Time share transmissions with the interfering station
 - Actually used in 2021 between 10 and 15M Phone
 - Use the down time to socialize (wait, we already do this)
- CVARC Web Page Links/Technical Articles/Anti-Interference Checklist

Final Conclusion

Interference is inevitable...

However...

Final Conclusion

Resistance is **NOT** futile

[Links/Technical Articles/Anti-Interference Checklist](#)