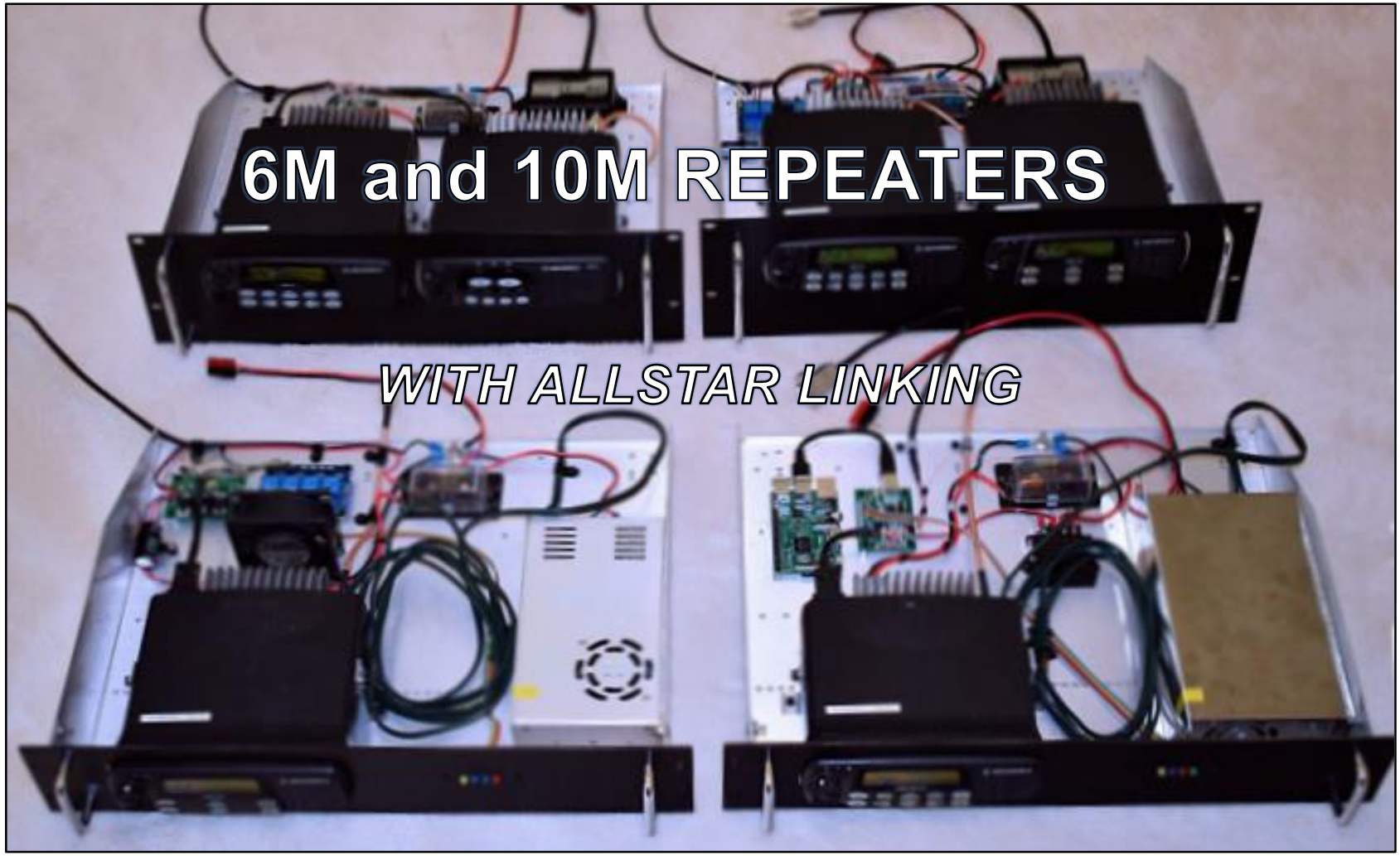
Roadrunners Microwave Group



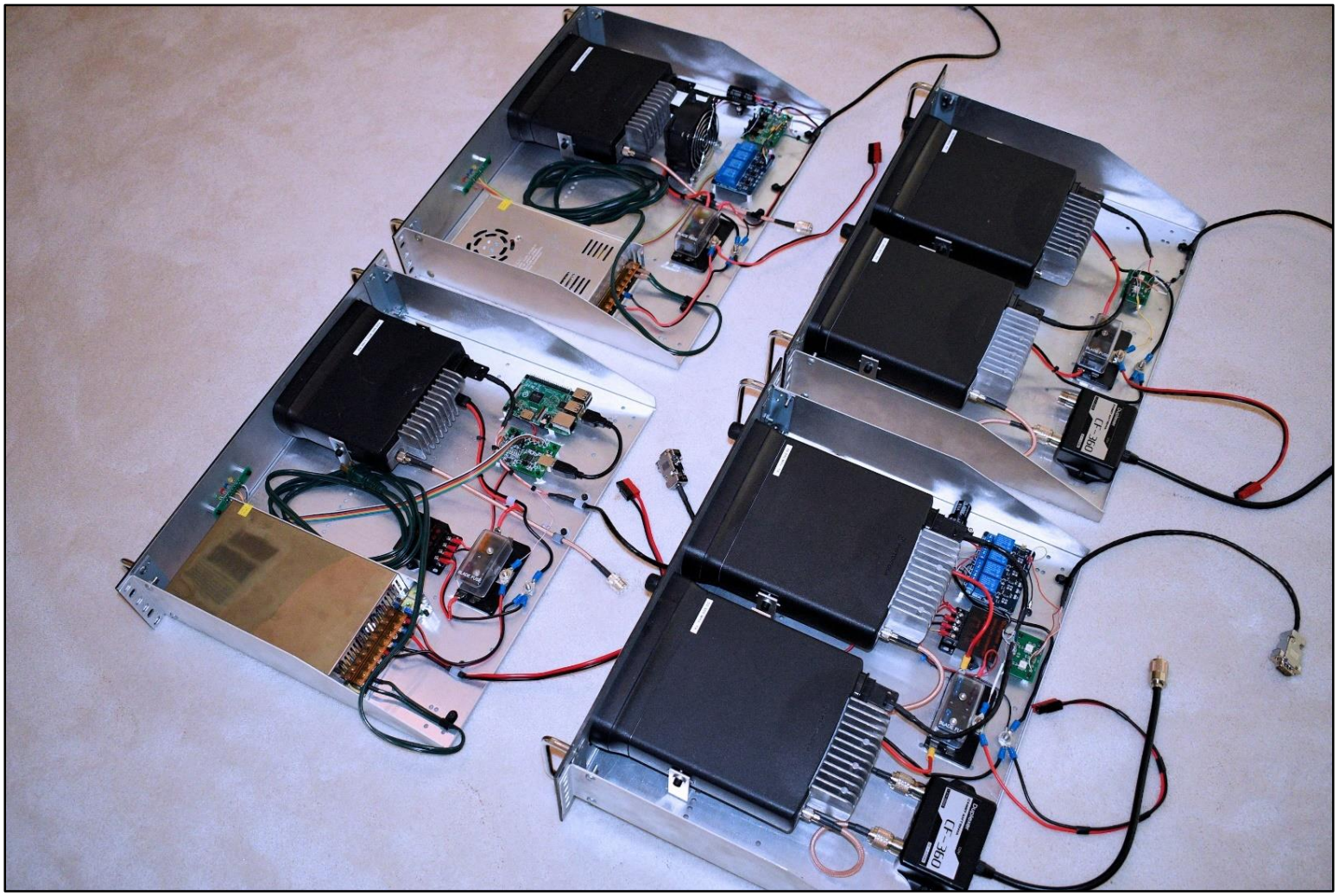
OVERVIEW

- Split site
  - Eliminates need for large duplexers
  - TX and RX sites are separated approximately 3 miles
  - Sites are linked via dedicated (coordinated) UHF channel
- Linking
  - Both bands are permanently linked
  - Talk in on either band to repeated output on both bands
  - Allstar internet linking provided
- Controller is Raspberry Pi-3B and K5TRA USB interface board
- TX and RX proportional audio leveling with pots on dedicated boards
- Transmitter power level is 30W on both bands
- Developed for WD5EMS

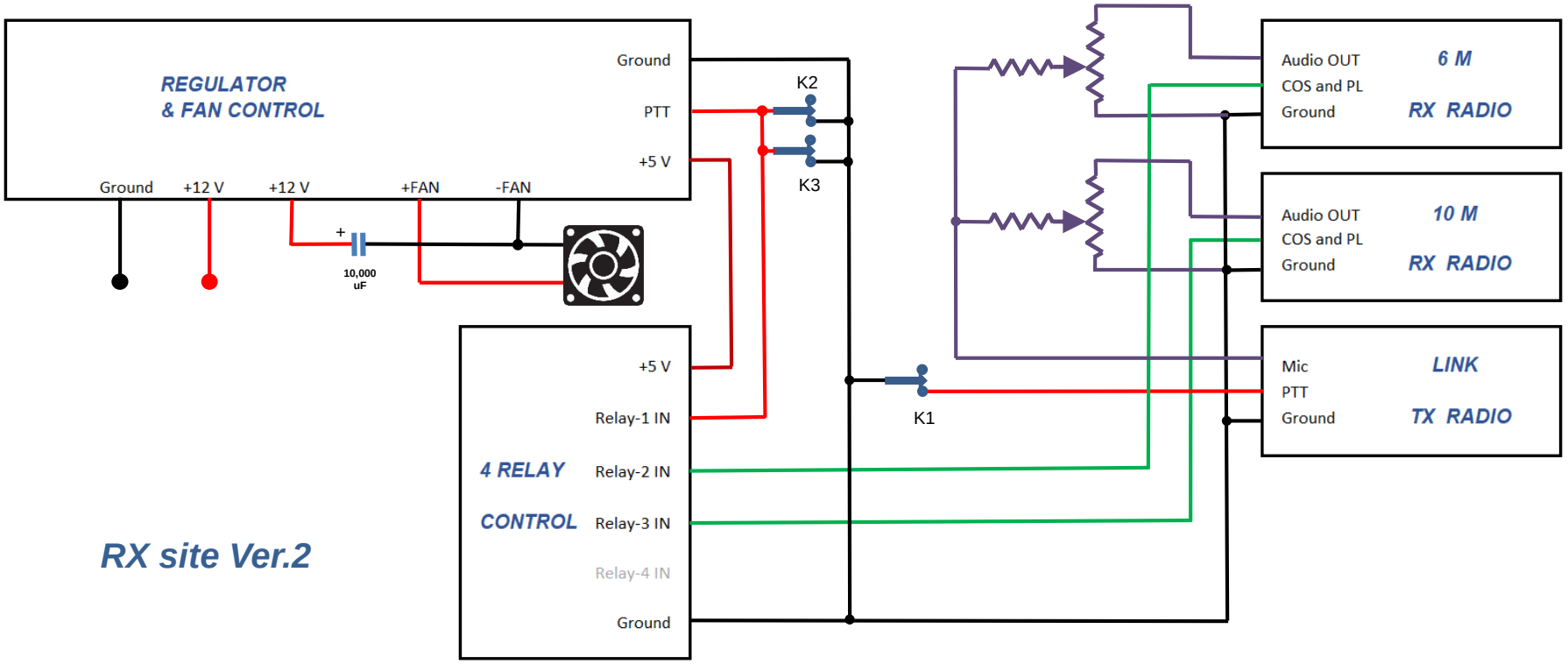
REPEATER DETAILS

- 10 M
  - 29.640 MHz output
  - 29.540 MHz input
  - ~~110.9 Hz PL~~ 141.3 Hz PL
  - 30 W output
- 6 M
  - 52.950 MHz output
  - 51.950 MHz input
  - 100.0 Hz PL
  - 30 W output
- Dual-band antennas at both sites: Diamond CP-610
  - 5.5 dB gain on 6M
  - 3.4 dB gain on 10M
- Allstar node: 48855

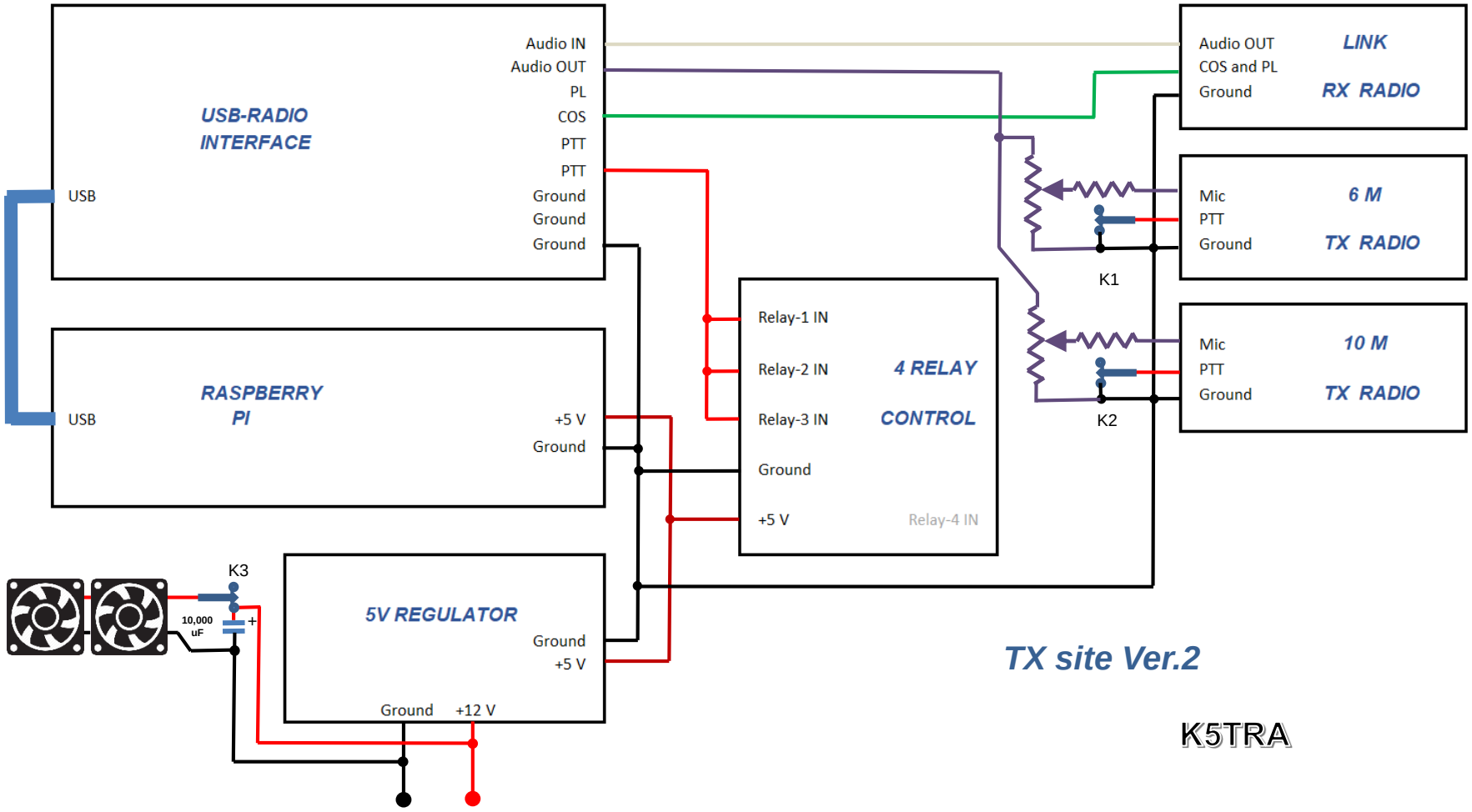
6M and 10M RACK SHELVES



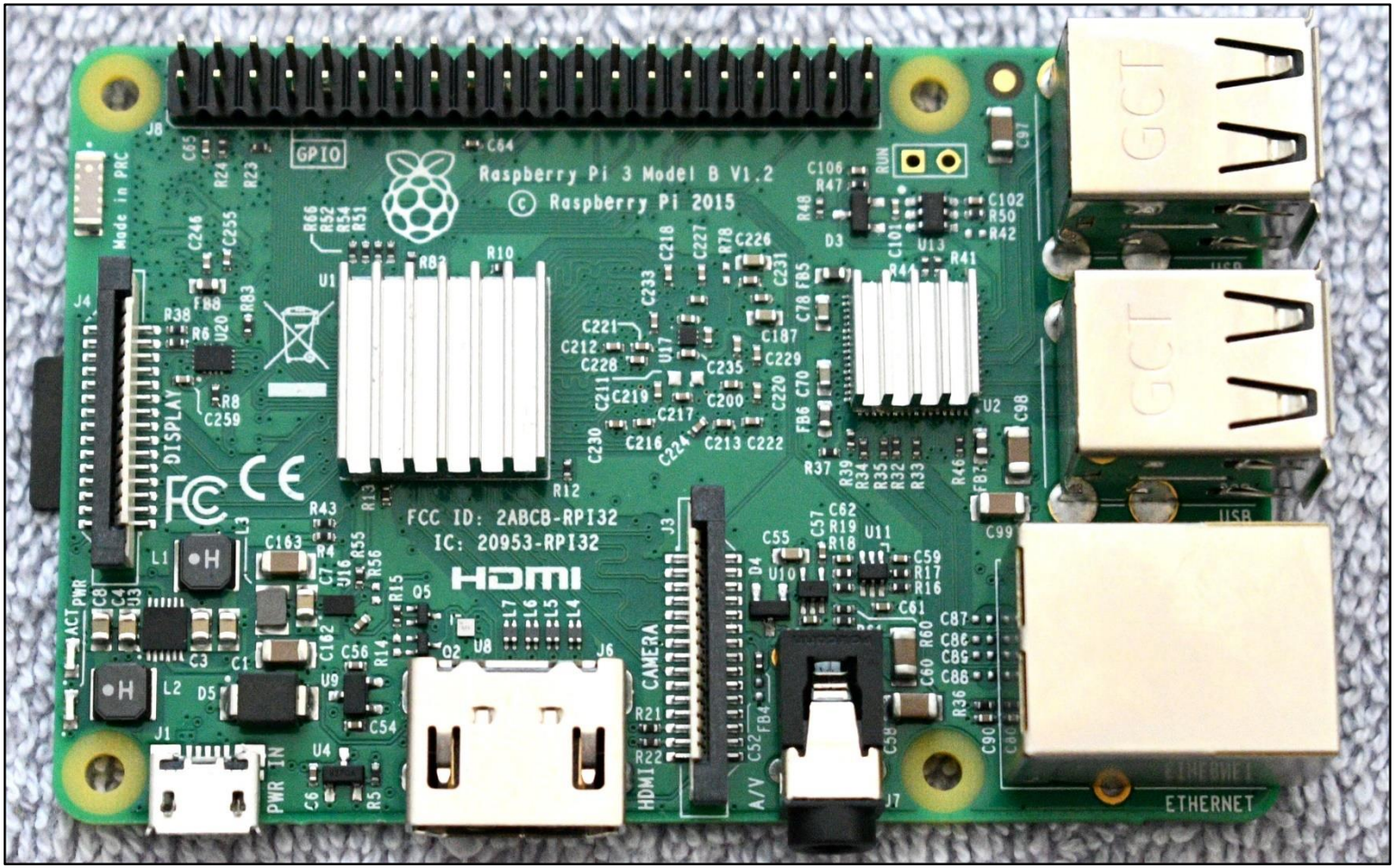
RECEIVE SITE WIRING DIAGRAM



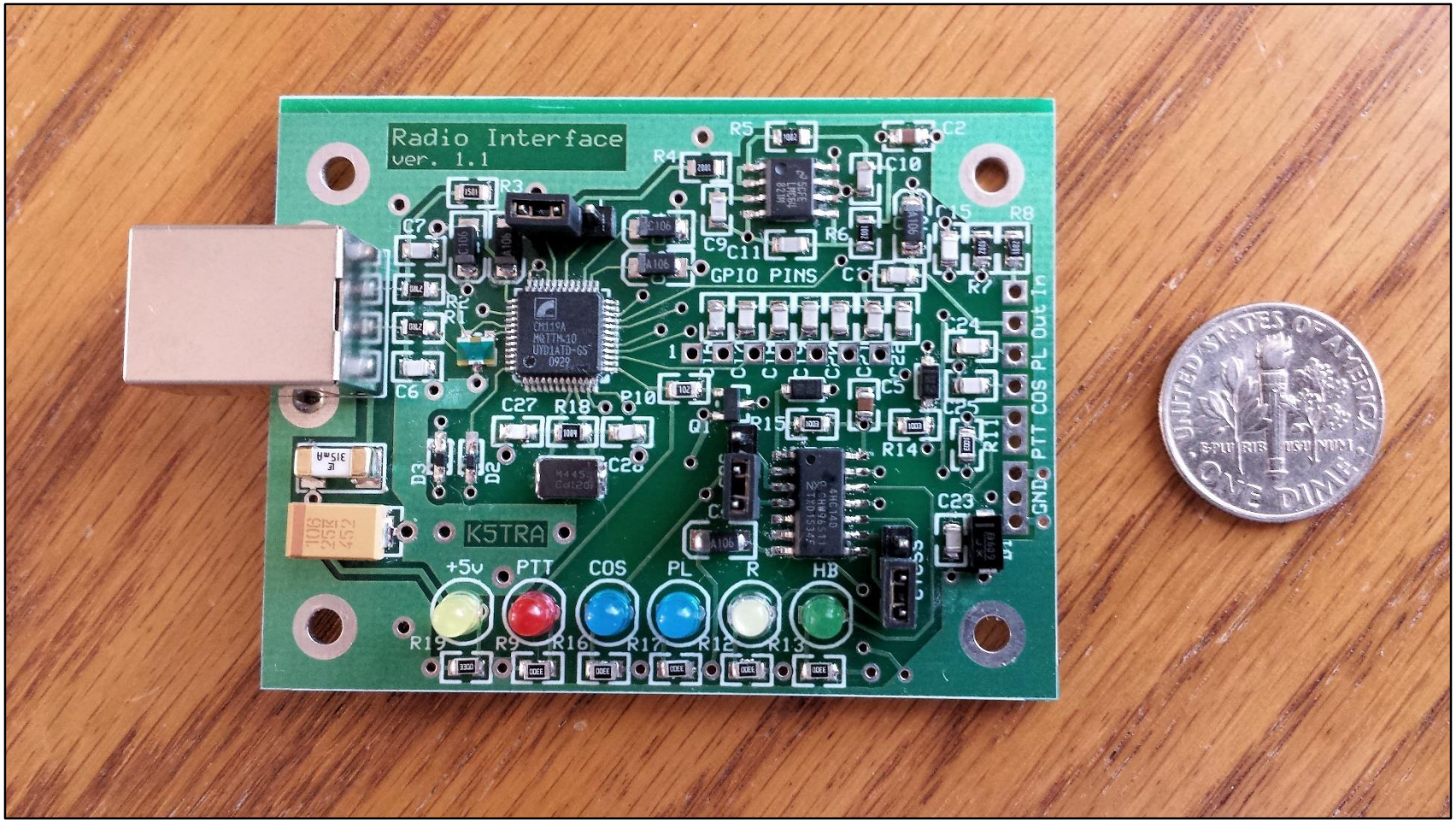
TRANSMIT SITE WIRING DIAGRAM



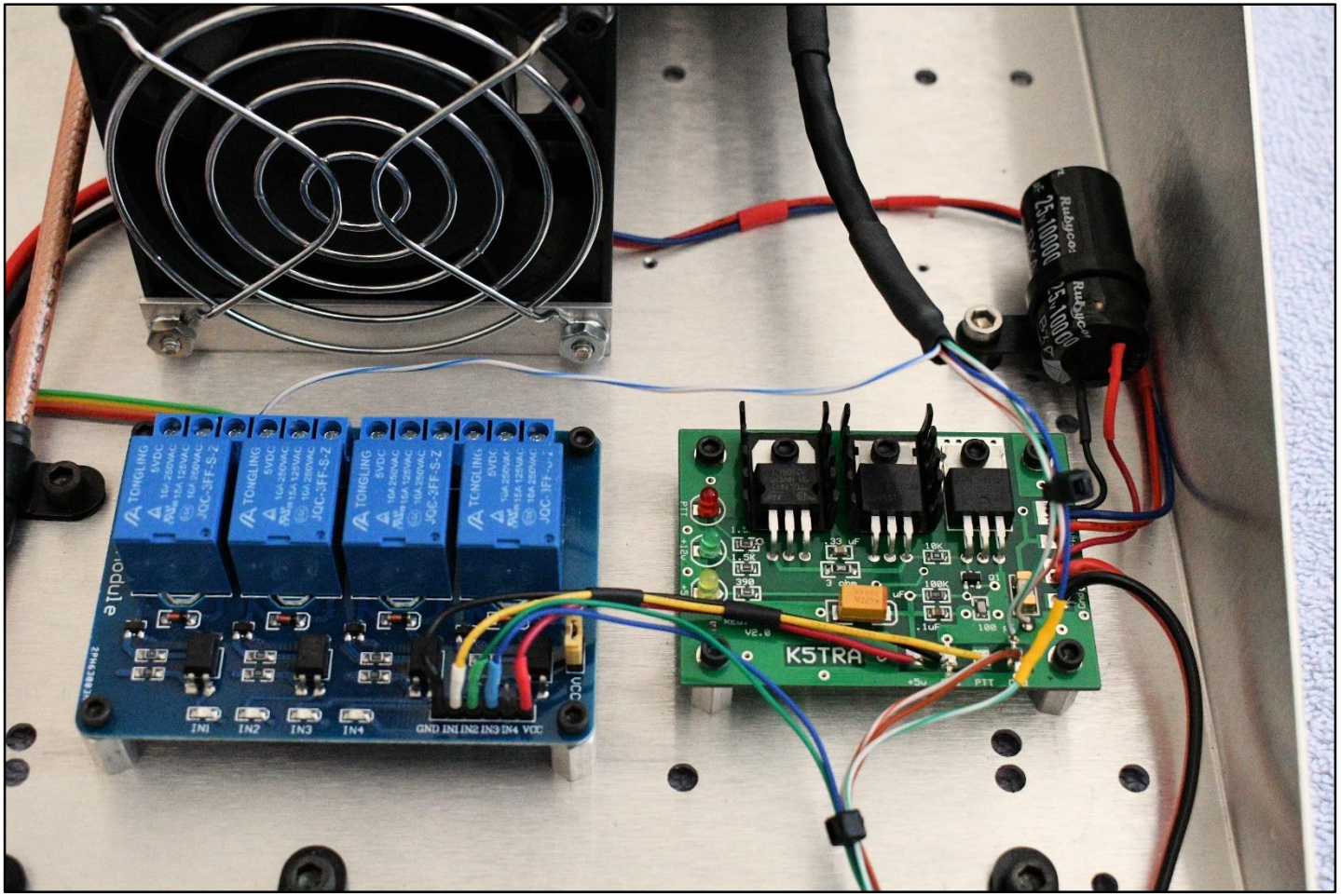
RASPBERRY Pi3B



USB – RADIO INTERFACE BOARD

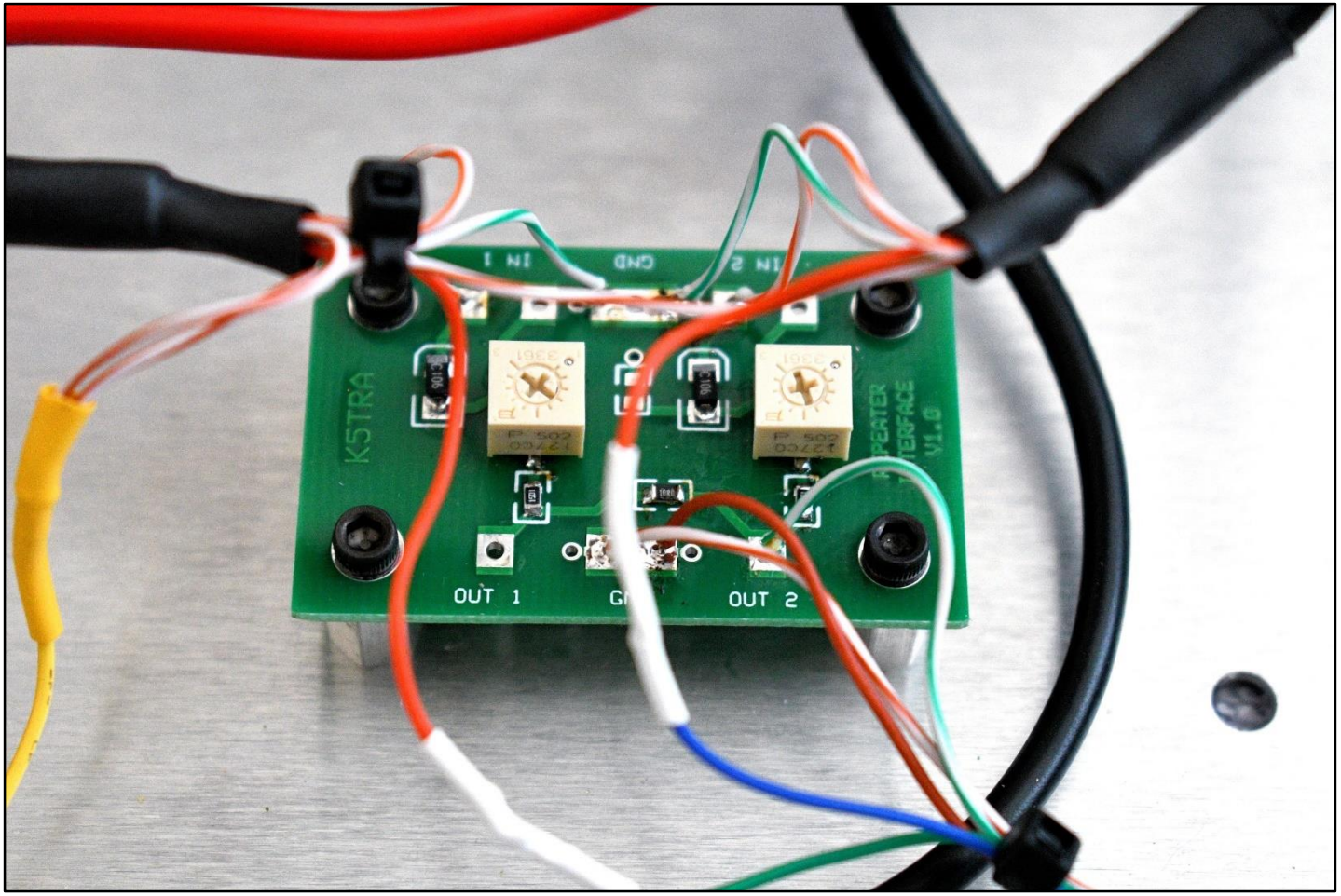


REGULATOR, FAN CONTROL, RELAY BOARDS



DUAL TRANSMITTER TX AUDIO LEVELING

DUAL RECEIVER AUDIO SUMMING



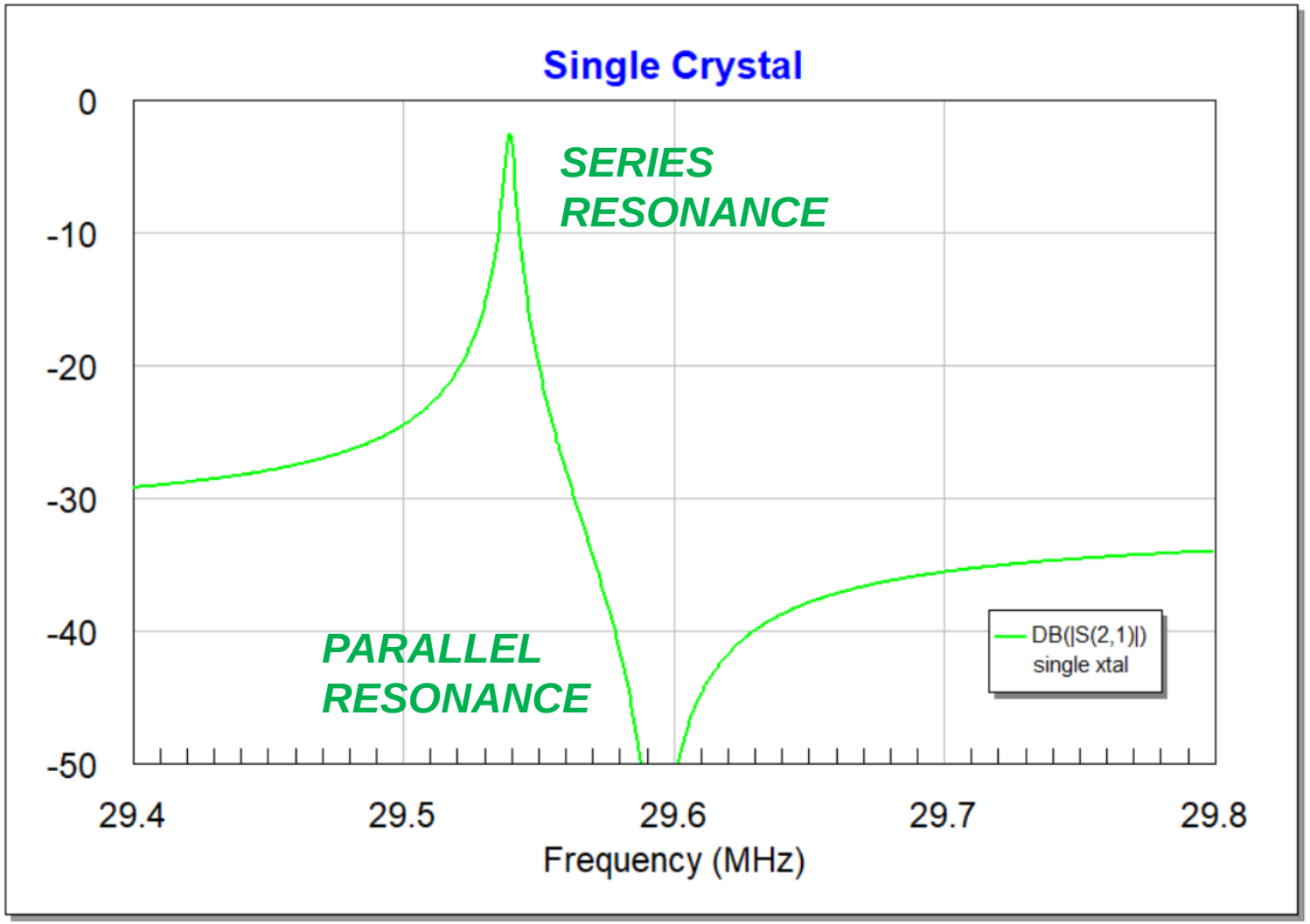
ISOLATION MARGIN

10 M (100 KHz ΔF)		
OK - no desense	-70	dBm
Threshold	-65	dBm
TX PWR	45	dBm
Needed Isolation	110	dB
Path Loss	80	dB
Margin	-30	dB

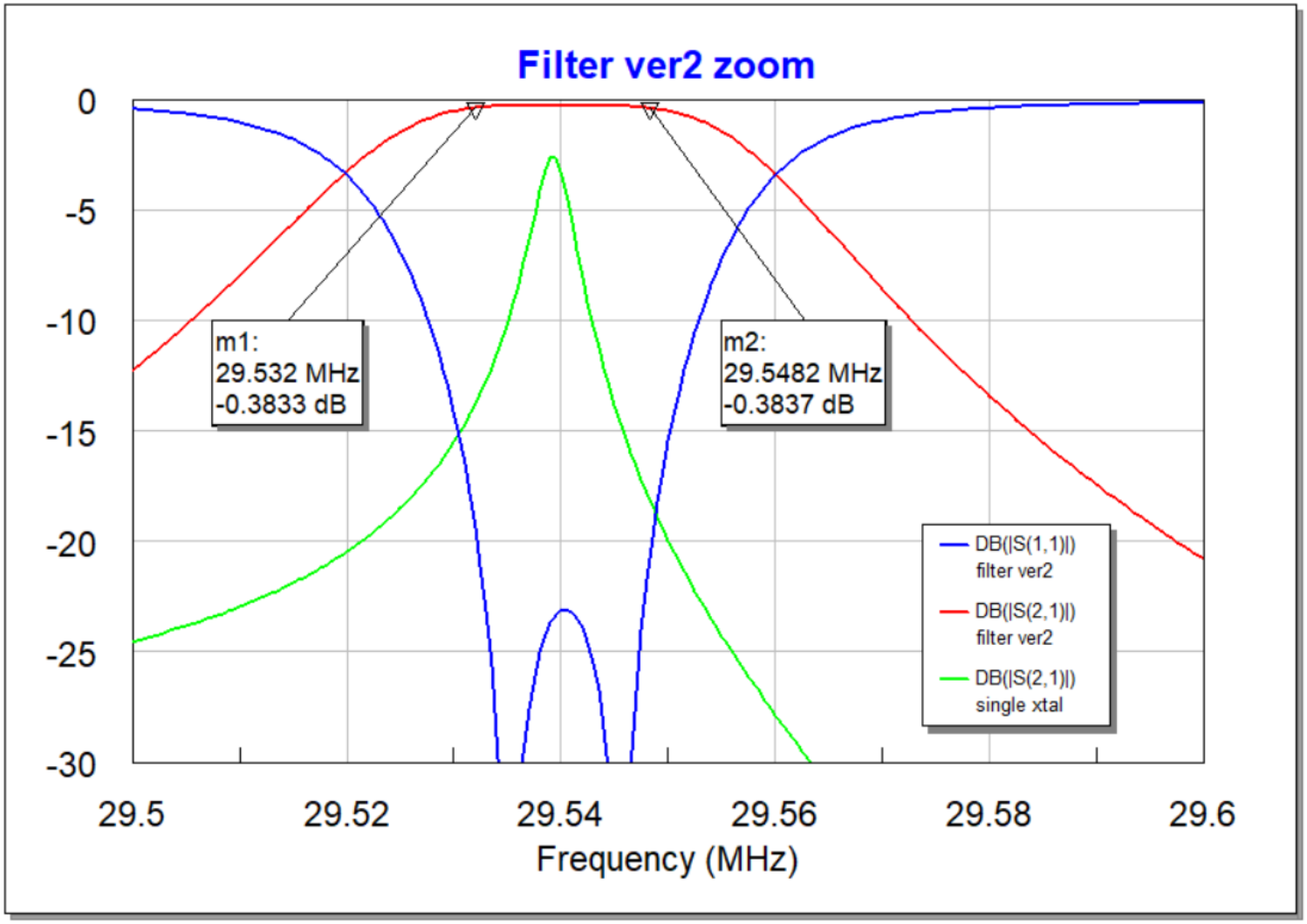
6 M (1 MHz ΔF)		
OK - no desense	-50	dBm
Threshold	-45	dBm
TX PWR	45	dBm
Needed Isolation	90	dB
Path Loss	85	dB
Margin	-5	dB

- Desense measurements on receiver radios
- Path loss for horizontal separation only
- Additional isolation filter needed on 10 M
- Crystal filter is only solution

CRYSTAL |S21| RESPONSE



TWO RESONATOR FILTER RESPONSE



RADIO INTERFACE – *ALL RADIOS*

MOTOROLA CDM 16 PIN INTERFACE

2	4	6	8	10	12	14	16
1	3	5	7	9	11	13	15

2	MIC	Blue
3	PTT	Blue-White
7	GND	Green-White
8	COS	Orange
10	IGN	Brown-White
11	RX AF	Orange-White

RACK SHELF INTERNAL WIRING

REPEATER TX SHELF INTERNAL WIRING		
6M audio in (mic)	<----->	TX audio leveling
10M audio in (mic	<----->	TX audio leveling
Relay 1 input	<----->	Interface PTT out
Relay 2 input	<----->	Interface PTT out
Relay 3 input	<----->	Interface PTT out
K1	<----->	6M TX PTT
K2	<----->	10M TX PTT
K3	<----->	FAN switched +12v

REPEATER RX SHELF INTERNAL WIRING		
6M audio out	<----->	RX audio level & summing
10M audio out	<----->	RX audio level & summing

Link TX SHELF INTERNAL WIRING		
Relay 1 input	<----->	K2, K3 (COS lines)
Relay 2 input	<----->	6M RX COS
Relay 3 input	<----->	10M RX COS
K1	<----->	Link TX PTT
K2	<----->	Link TX PTT control
K3	<----->	Link TX PTT control

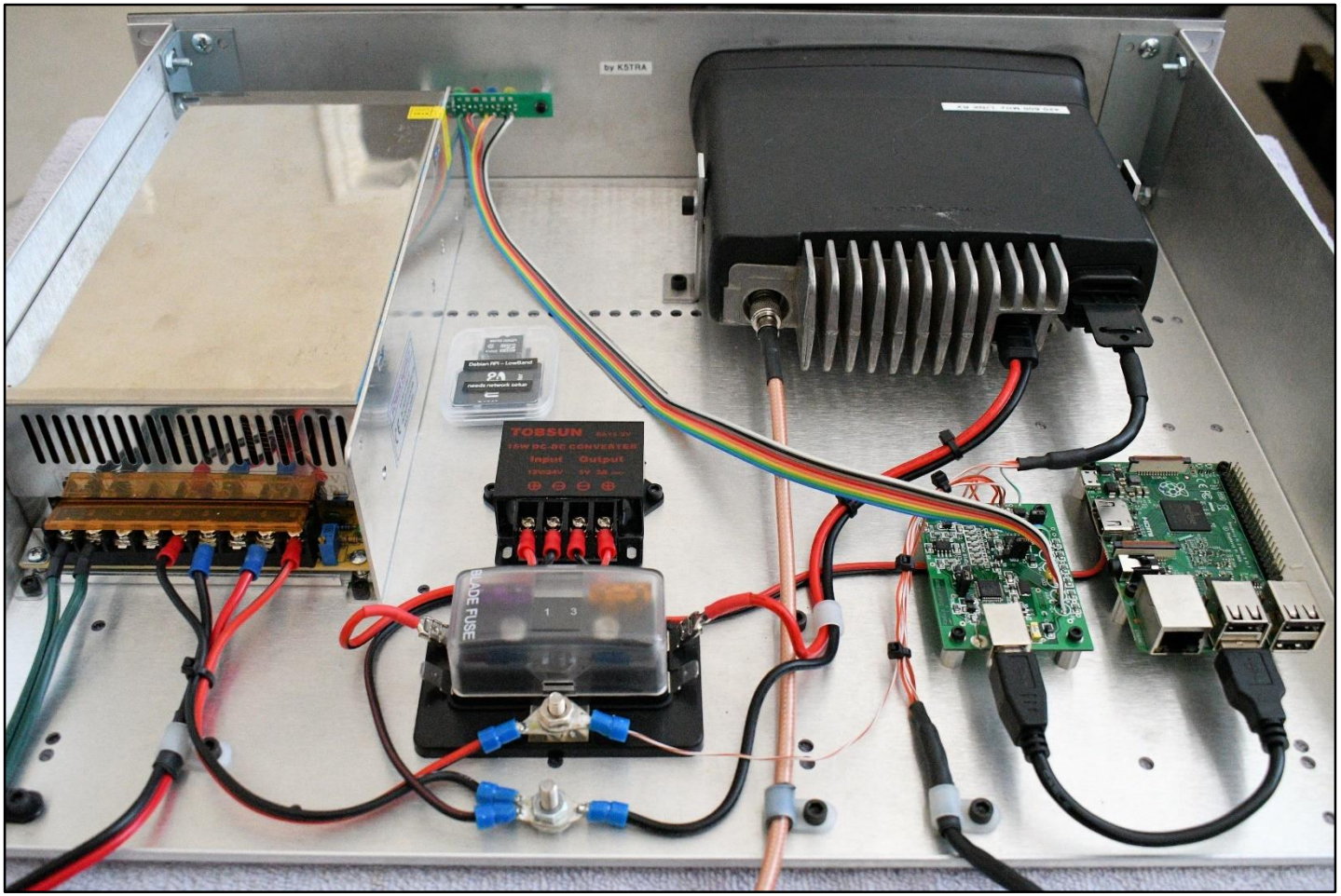
Link RX SHELF INTERNAL WIRING		
Link RX audio out	<----->	Interface audio in
Link COS/PL out	<----->	Interface COS in

INTER-SHELF CABLE DB-9 WIRING

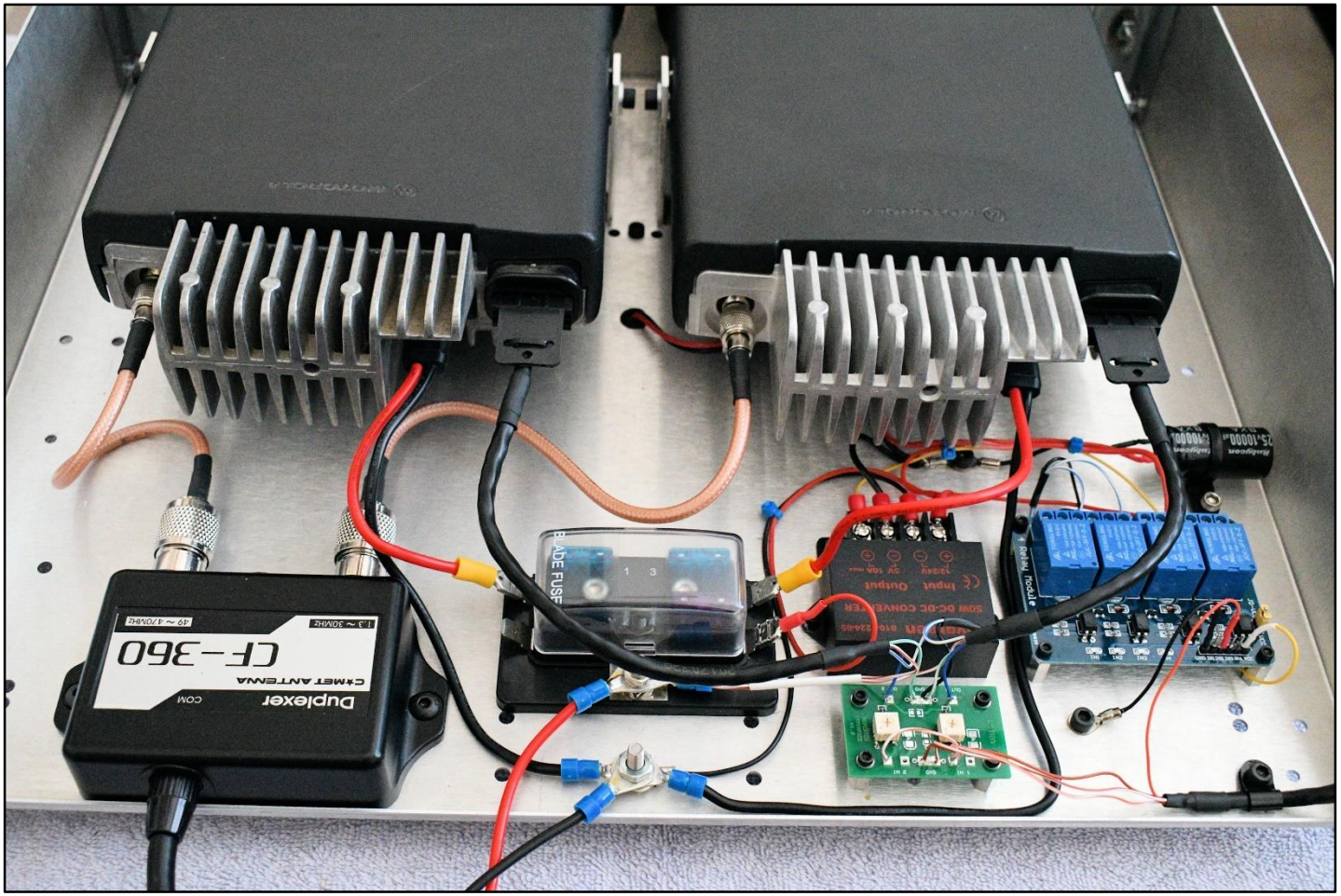
TRANSMIT SITE INTER-SHELF				
PIN	RX Link DB-9		6M & 10M TX DB-9	COLOR
1	Interface audio out	<----->	Repeater TX audio in	orange-white
2				
3	Interface PTT out	<----->	Relay 1,2,3 input	orange
4				
5	ground	<----->	ground	brown
6				
7				
8				
9	ground	<----->	ground	brown-white

RECEIVE SITE INTER-SHELF				
PIN	TX Link DB-9		6M & 10M RX DB-9	COLOR
1				
2	Link TX (mic) audio in	<----->	Repeater TX audio out	green-white
3				
4				
5	ground	<----->	ground	brown
6	Relay 2 input	<----->	6M RX COS/PL out	green
7	Relay 3 input	<----->	10M RX COS/PL out	blue
8				
9	ground	<----->	ground	brown-white

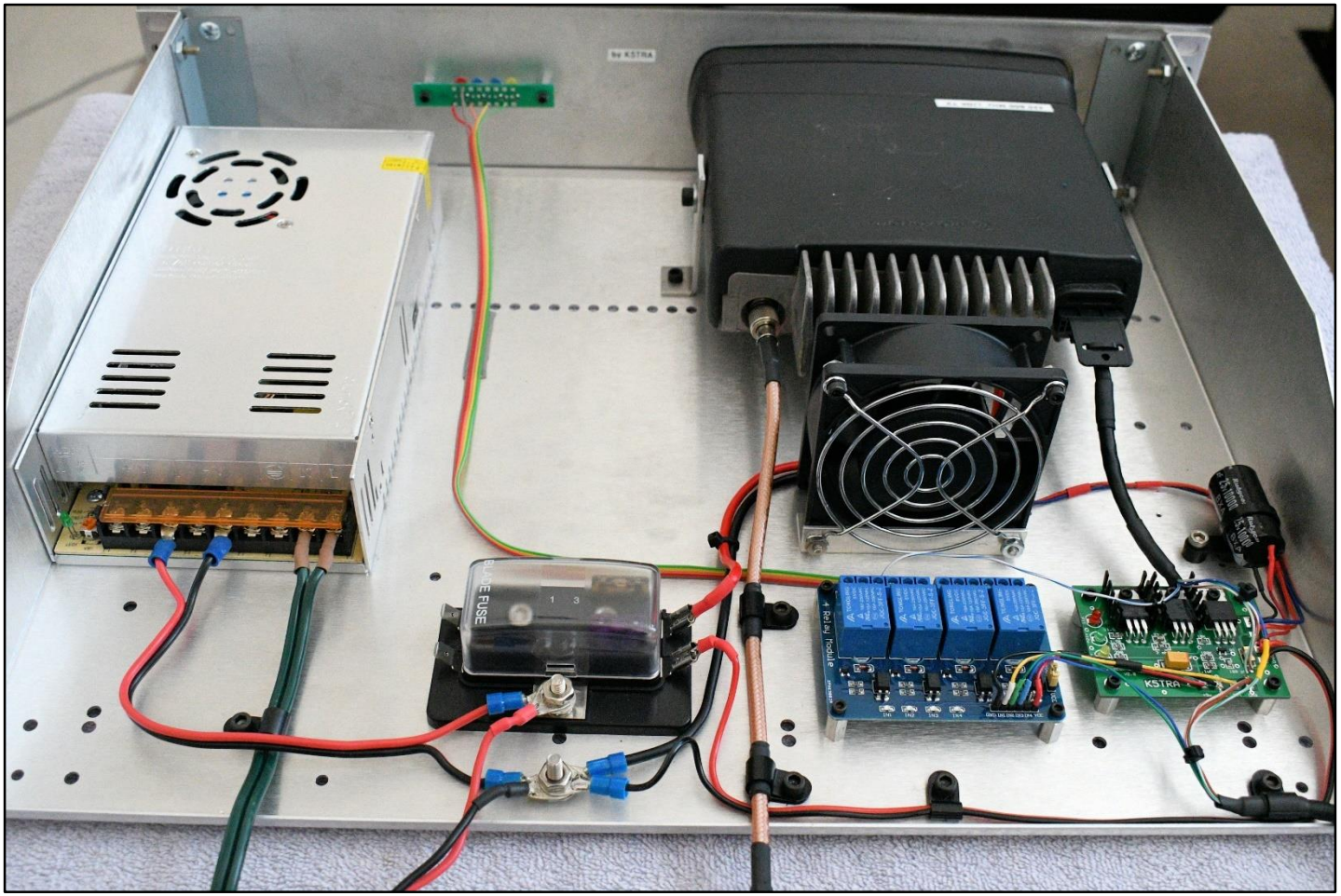
TRANSMIT SITE LINK RX & CONTROLLER



TRANSMIT SITE - TX RADIOS

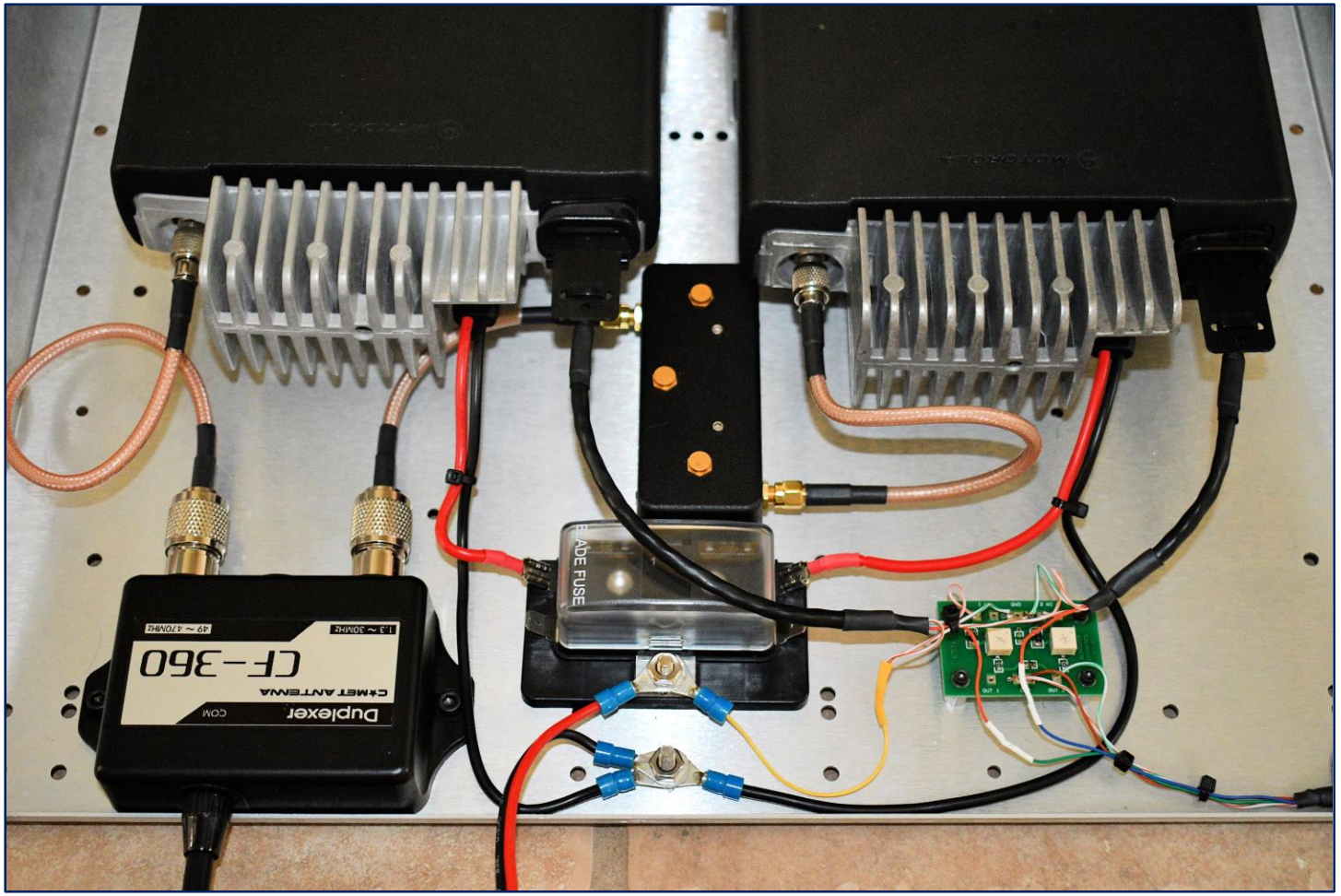


RECEIVE SITE LINK TX & CONTROLLER



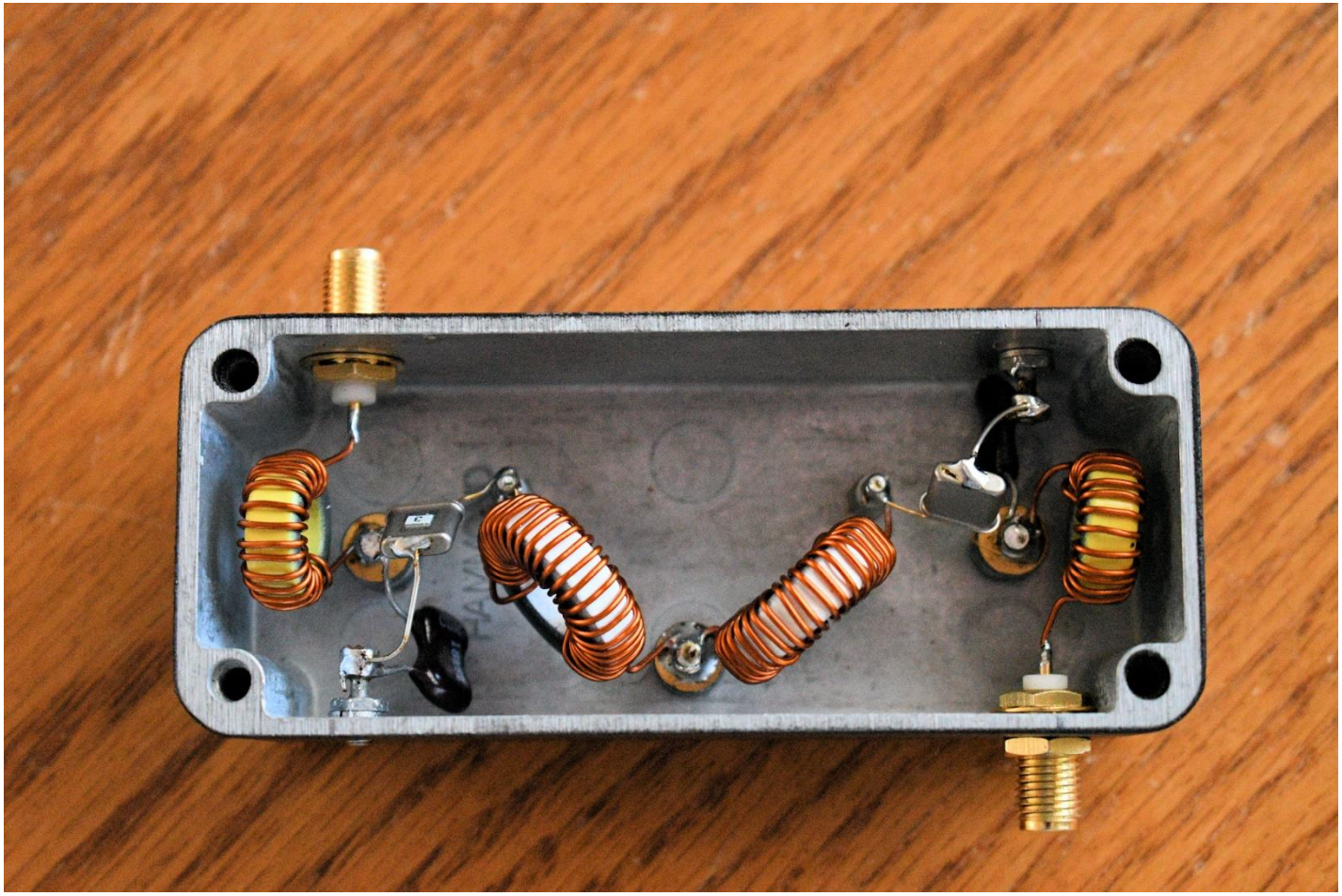
RECIEVE SITE - RX RADIOS

WITH XTAL FILTER

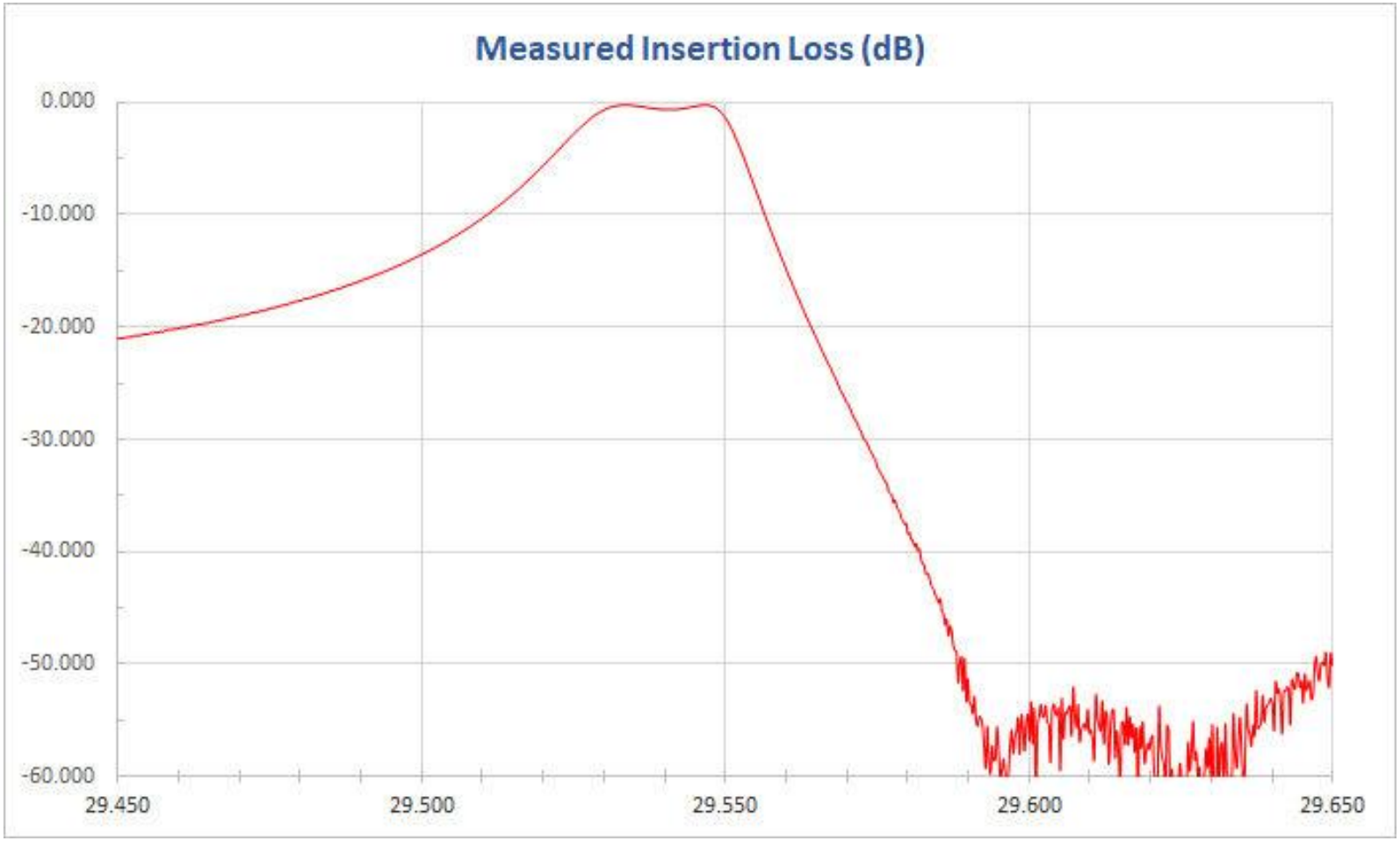


CRYSTAL FILTER - EXTERNAL

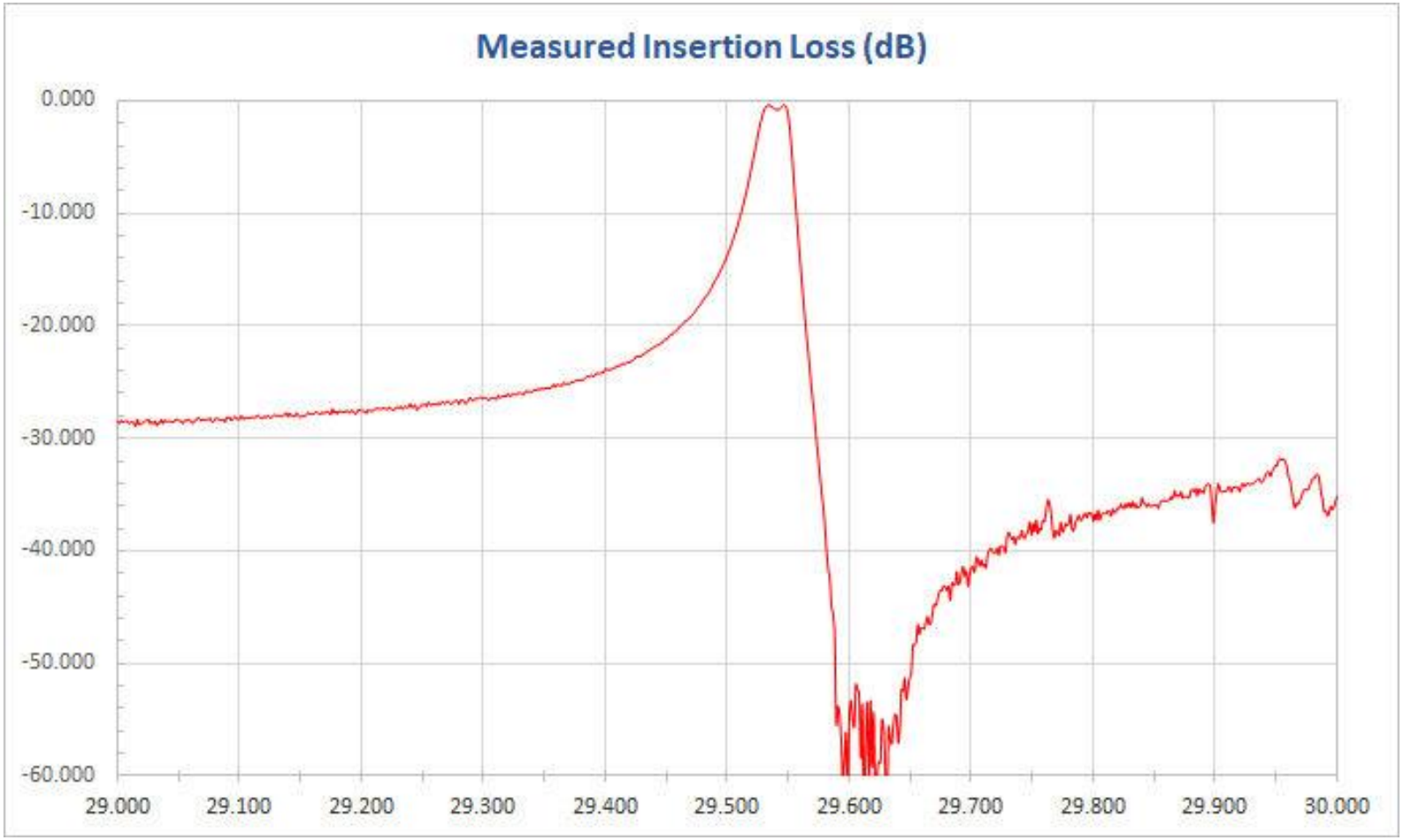
CRYSTAL FILTER - INTERNAL



CRYSTAL FILTER - MEASUREMENTS



CRYSTAL FILTER - MEASUREMENTS



SHOP MESS

MORE SHOP MESS

SUMMARY

- Four rack mount shelves constructed using CDM-1250 series radios
  - RX site:
    - Dual receiver: 3U
    - Link transmitter, controller and power supply: 2U
  - TX site:
    - Dual transmitter: 3U
    - Link receive and power supply: 2U
  - DB-9 and Anderson (DC) cabling between co-located shelves
  - Fuse blocks on each shelf
- Bench testing completed
  - Full functionality tested with all four units operating together
  - Audio leveling and balancing is completed
  - Transmit power output on both bands is 30W
  - Allstar internet linking tested
- Crystal filter for 10M front-end
  - Custom two-pole filter from a pair of 29.54 MHz crystals

6M and 10M RACK SHELVES