Twin Transmit Configuration, Setup and Patterns

Antenna Setup

- See required item list in Appendix D.
- Configure two transmit antennas separated by 3/8 of the operating frequency wavelength.
    - Antennas should be aligned perpendicular to shore and/or in the direction of desired signal propagation.
- See Appendix A, Figure 1.

Configure Receiver

- Turn on Rx
- Set Attn to 6dB
- Set Tx to Off
- Set Sweep to CW
- Set Bland to Off

Cabling Setup

For the following instructions, refer to Appendix A, Figure 2.

- Connect cable from Tx chassis "Transmit out" port to Splitter "Tx in" port.
- Connect 0° phase cable from Tuner-1 Transmit port to the Splitter.
- Connect 90° phase cable from Tuner-2 Transmit port to the Splitter.
- Connect the Backshore Tx antenna cable to Tuner-1 Antenna port (dashed line in schematic).
- Connect the Seaward Tx antenna cable to Tuner-2 Antenna port (dashed line in schematic).
    - NOTE: Cable lengths from tuners to antennas should be exactly the same length, or within a half a meter at 5MHz; within one quarter meter at 12/13MHz
- Connect two diagnostic probe cables (connected to each tuner) to the oscilloscope. Be sure to connect the cable connected to Tuner-1 to port-1 on the oscilloscope, and Tuner-2 to port-2 on the oscilloscope.
- Switch on CODAR Tx chassis.
- Using tuners, tune to obtain highest forward power while maintaining lowest reflected power.
    - NOTE: Tuning one antenna will often affect the other -- go back and forth between Tuner-1 and Tuner-2 several times to be sure both antennas are optimally tuned.
- Using the oscilloscope, check phase difference.
    - Ideally, you want to tune to see 100°-120° phase difference between the signals.

    - If you do not see 100-120° phase difference with best forward/reflected ration (VSWR), try inserting a “cable add-on” of 10° or 15°. Add to 0° cable between splitter and Tuner-1 to reduce phase difference; add to 90° cable between splitter and Tuner-2 to increase phase difference.
- Check forward and reflected power in SeaSondeConroller and on tuners -- take note of each instrument value displayed.

Conducting a Twin Transmit Pattern

- Plug Tx cable from Splitter into Channel 3 Rx port.

Configure the Receiver:

- Set Blanking to 60μs.
- Set Blank Delay (BDly) to 4.55μs.
- Set Tx to Off.
- Set Sweep to CW.

Configure the Transponder:

- Connect antenna port to transponder’s third channel.
    - Remove top panel of transponder.
    - Remove SMA connector from top board and connect it to the bottom board Channel 3 SMA port. See Appendix B, Figure 1.
- Close transponder.
- Attach 8-foot antenna to top of transponder, and possibly an 8-foot whip to the side of transponder for a ground.

Configure Transponder Settings:

- Connect transponder to computer via transponder USB cable.
- Turn on transponder and select first port (normally reserved for Receiver).
- Select “Receiver”, then “Advanced”
- Set all three transponder channels to same frequency.
    - Hit "Refresh" and, in "Status window," look for hex codes assigned to three channels (Channels 1 & 2 should be the same; Channel 3 will be different). Refer to Appendix B, Figure 2.
    - To set the Channel 3, enter desired frequency in Rx Advanced Controller, then press “freq”
    - Press "Refresh." Confirm all three channels are set for the proper frequency (i.e., all three channels have the same hex code). See Appendix B, Figure 3.
    - If third channel does not set properly, type "FC XXXXXXXX" in the “Send” window, then press "Send". "XXXXXXXX" is the hex code corresponding to desired frequency. For example, type "FC

1CCCCCCD" for 13.5MHz, then press the "Send" button.
    - Store settings in transponder.

Confirm Transponder Signal is Received:

- Select Range Display in SeaSondeAcquisition.
- Select “Enable Diagnostic Processing”
- Zoom out to see several range cells.
- Confirm transponder signal is visible, and walk signal through DC before beginning to log Time Series.

Conduct APM:

- Follow similar protocol for Rx APMs (i.e., sync the GPS to computer clock, log time series, set GPS to log tracks, etc.).
- While recording Time Series and carrying a GPS, walk in a circle around the transmit antennas with radius equal to at least one wavelength from the antennas.
    - When directly in front of and behind Tx antennas, walk toward the Tx antenna and back a few meters (to note front and back of Tx configuration in GPS data).
- Walk in a reverse circle and do same as above.
- If it’s not possible to do a 360° circle around antennas, try to walk 180° in front of antennas and ~20° directly behind antenna.

Process APM:

- Process APM in the same way as you would an Rx APM. What is of use is the power pattern of the transponder signal recorded in Channel 3.

Twin Tx Pattern Results:

When conducting a twin transmit test at 13.5MHz in the field, measured pattern results reveal close-to-calculated theoretical pattern results. See Appendix C, Figures 1, 2, 3 and 4, showing theoretical and measured patterns at 13.5MHz, using 105° phase difference and 130° phase difference.

Appendix A: System Setup and Configuration

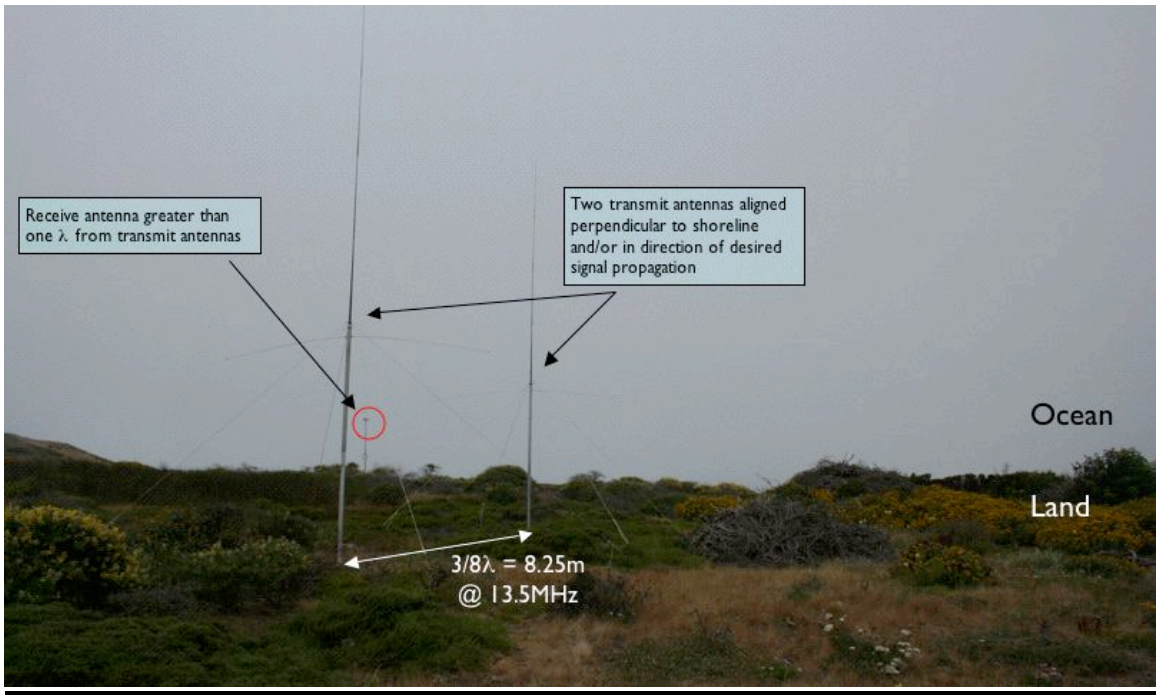

Figure 1. Twin transmit antennas

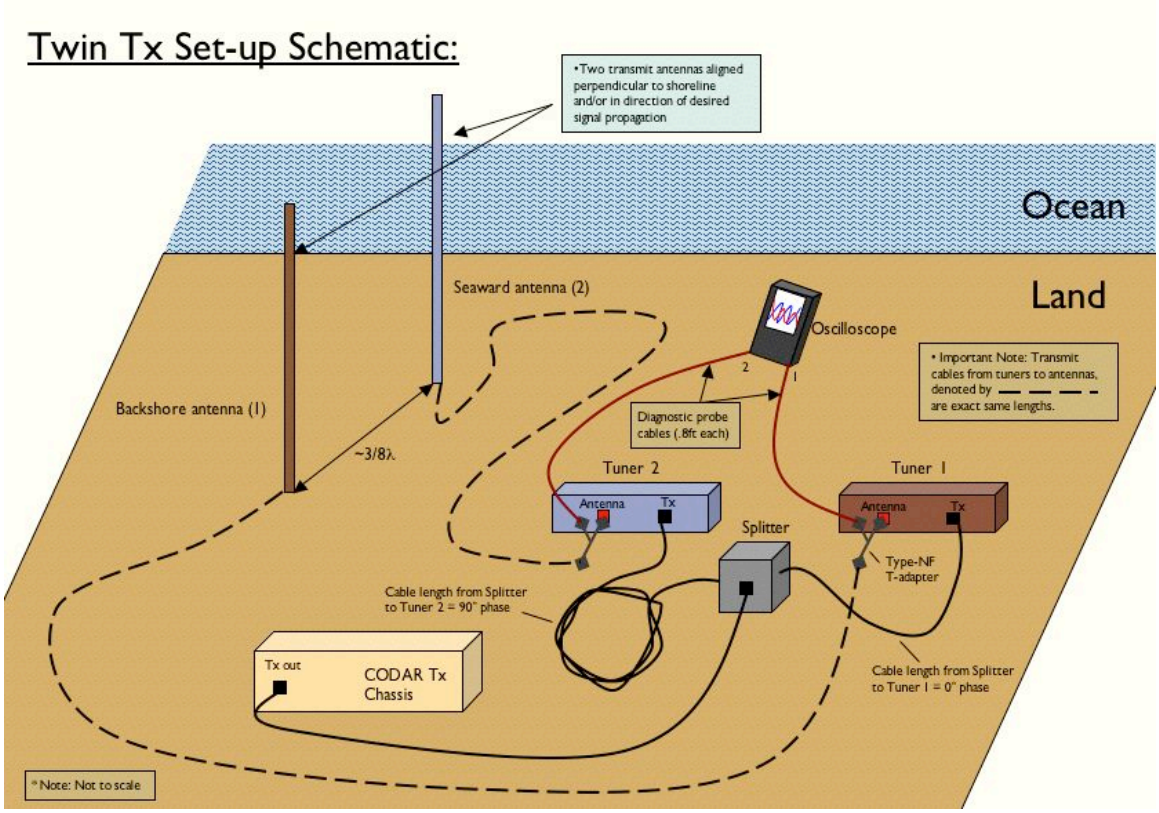

Figure 2. Twin transmit setup schematic

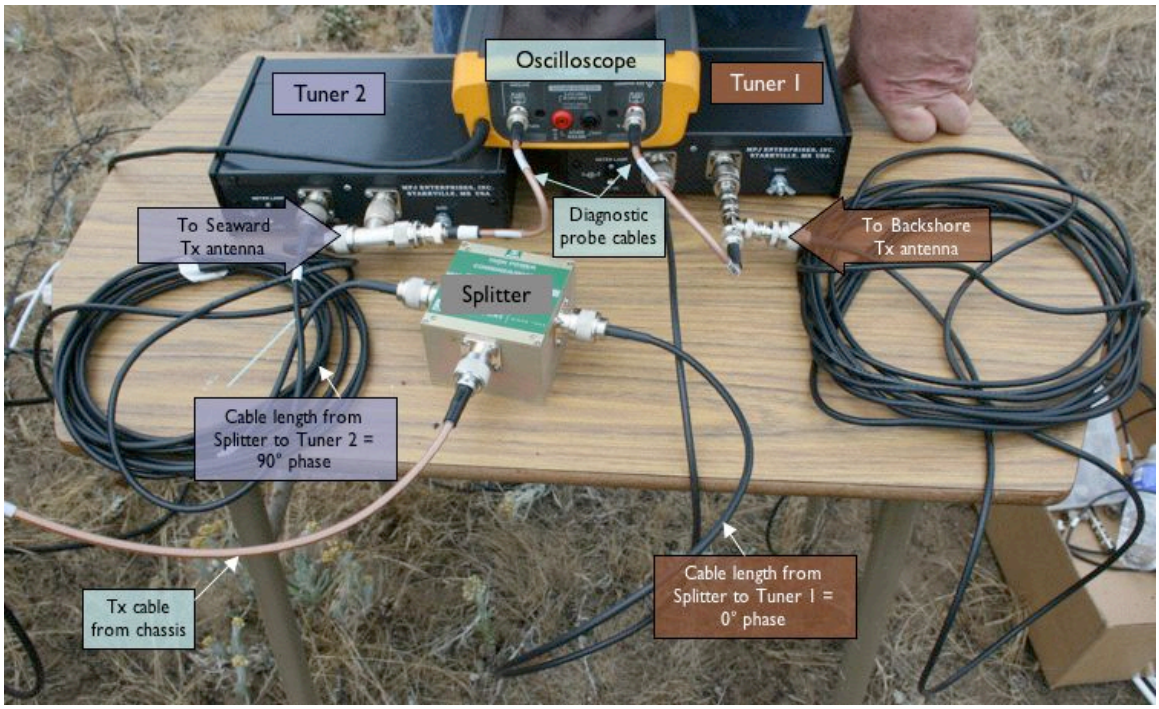

Figure 3. On-site cabling

Appendix B: Twin Transmit Antenna Pattern Configuration and Expected Results

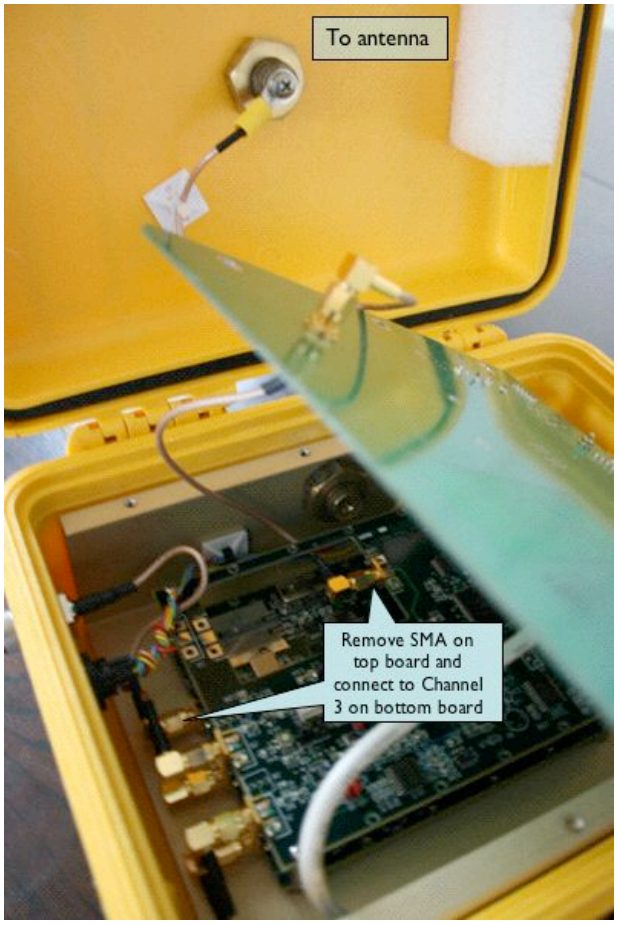

Figure 1. Internal transponder cabling

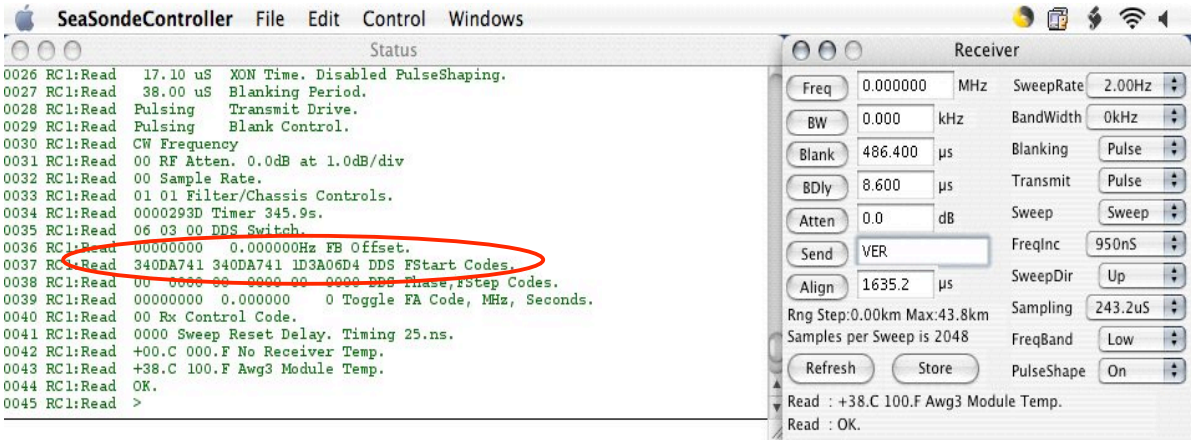

Figure 2. SeaSondeController transponder settings

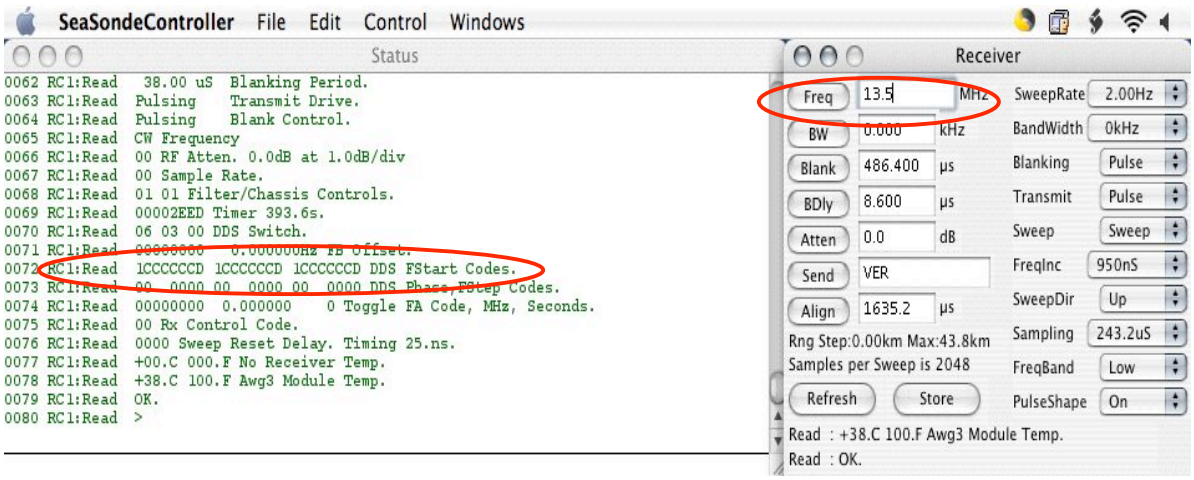

Figure 3. SeaSondeController channel configuration

Appendix C: Theoretical and Measured Twin Transmit Antenna Patterns

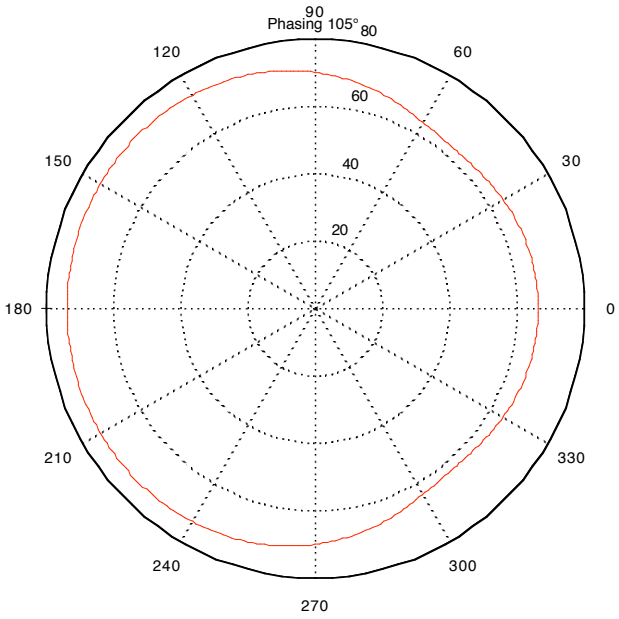

Figure 1. Theoretical calculation of twin transmit pattern with 105° phasing between elements.

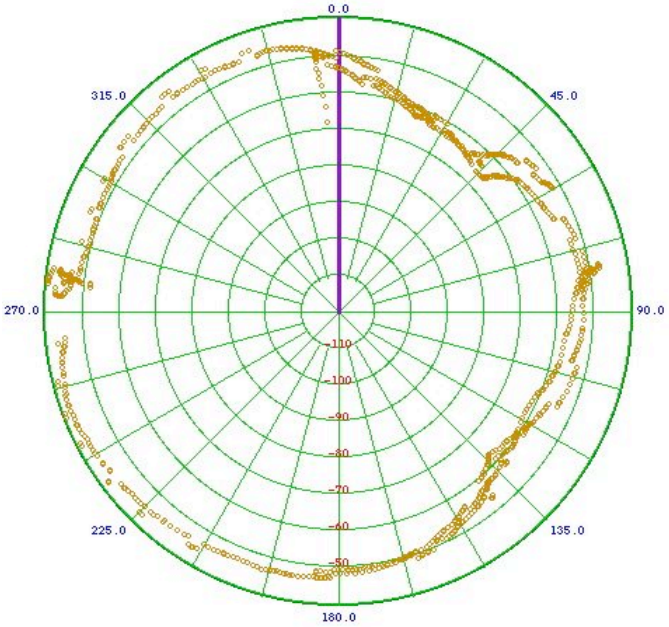

Figure 2. Measured twin transmit pattern with 105° phasing between elements.

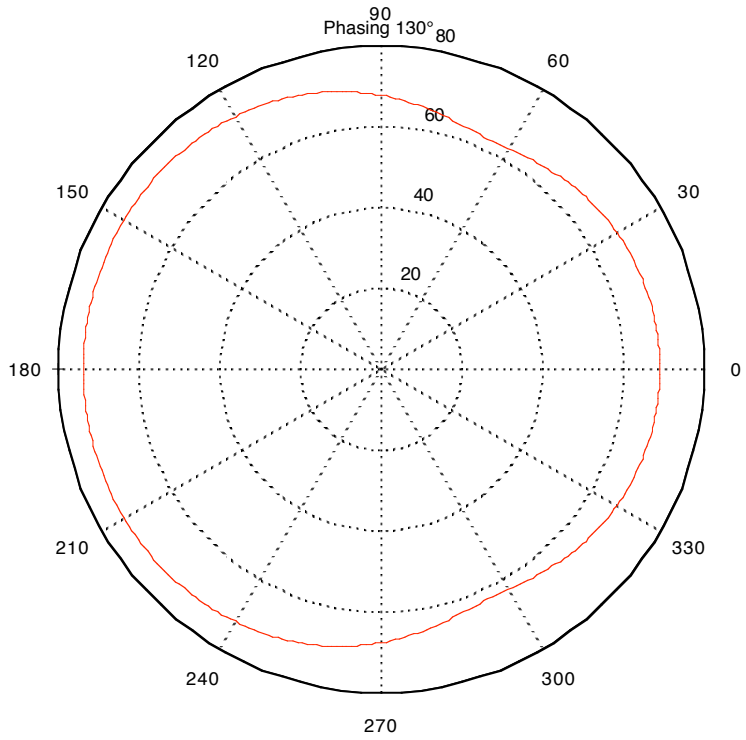

Figure 3. Theoretical calculation of twin transmit pattern with 130° phasing between elements.

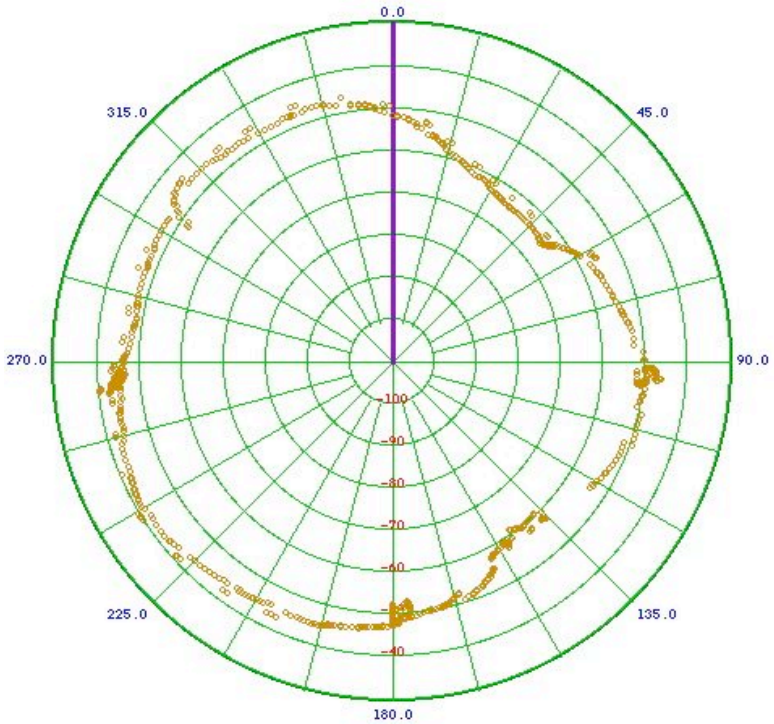

Figure 4. Measured twin transmit pattern with 130° phasing between elements.

Appendix D: Required Items for Twin Transmit Setup

5 MHz Twin Transmit Phasing Kit

Quantity	Description	Connectors	Label
1	43ft RG58 90°	NMNM	4.4-90
2	3ft RG57 0°	NMNM	4.4-0
1	Power Splitter	NFNFNF	D2353
2	10° add-on cable	NMNF	4.4-10
1	15° add-on cable	NMNF	4.4-15
2	Tuner	NMNM	MJF 971
The following items are part of installer's kit:			
2	.8ft RG58 probe cable	NMBNCM	
2	Type-N tee connector	NFNFNM	
1	Portable digital scope		

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