Instructions

Model BUT-TBR-160X

160 Meter add-on for the HF2V, HF6V and HF9V

The TBR-160X is a parallel tuned circuit that attaches to the base of BUTTERNUT® vertical antenna models HF2V, HF6V and HF9V permitting operation on 160 meters. This new design incorporates four larger capacitors mounted between two aluminum plates that act as a heat sink to help avoid frequency drift when the components heat up under power and environmental conditions.

IMPORTANT NOTES

- **Your Butternut Vertical antenna must be properly tuned on all bands PRIOR to adding this 160 meter kit.** This will help after the 160 kit is installed and you are ready to perform tuning again.
- **The band width on 160 meters is *very narrow*.** When tuning, choose the frequency you desire. Using a tuner is not recommended since this is a resonant antenna system.
- **Power levels are recommended to be: 1,000 watts SSB, 500 watts CW, 150 watts Digital (RTTY, FT4, FT8, etc).** Prolonged tune-up at these power levels must be avoided. Exceeding these levels may cause damage to the antenna and/or your transceiver.

THEORY OF OPERATION

The TBR-160X functions as an inductive reactance in series with the antenna feedpoint, loading the antenna structure to resonance on the 160 meter band. On the higher bands the TBR-160X produces decreasing values of capacitive reactance, slightly raising the resonant frequency (by 300-400 kHz) on 80 & 40 meters. Above 7 MHz this detuning is negligible, and the antenna may be adjusted to compensate. In general, the only compromise that one must accept for the sake of 160 meter operation is reduced SWR bandwidth on 80 meters and to a lesser extent, on 40 meters with the HF2V/6V/9V. The TBR-160X bandwidth for SWR of 2:1 or less on 160 meters will depend to a large extent on the efficiency of the ground system used with the antenna; 10 kHz is a typical figure with a fair-to-good ground system and a relatively short antenna such as the HF6V/9V. With the longer HF2V, especially if top loading "umbrella" wires are used, SWR bandwidths of 15 to 35 kHz between 2:1 points are possible. Greater bandwidths are likely with poorer (higher loss) ground systems, but the best possible ground systems should always be used with electrically short loaded antennas.

Since this is a short antenna for 160 meters, optimum performance cannot be expected. Also note that a good radial system (32 or more radials of 50-65 feet each) is a requirement. Even at best, the bandwidth will be **very narrow** so when tuning for 160 meters, you will have to determine which slice of the band you will be working in.

PARTS LIST

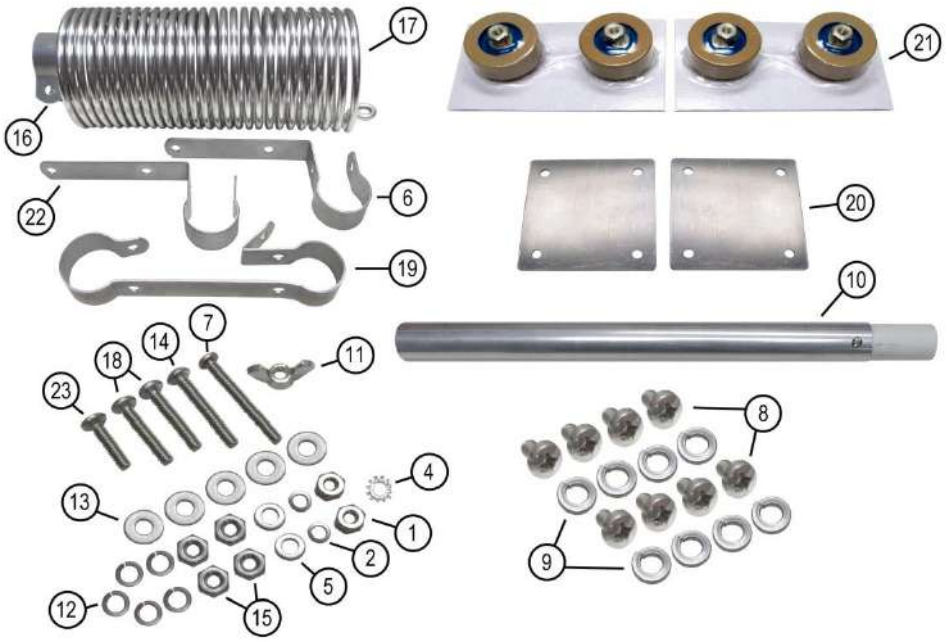
Drawing Ref #	Description	Qty	Notes
1	#8-32 Hex Nut, Stainless Steel	2	
2	#8 Lock Washer, Stainless Steel	2	
3	Ring Terminal, Tin Plated Copper	2	(1)
4	#8 Star Washer, Stainless Steel	1	
5	#8 Flat Washer, Stainless Steel	2	
6	Butternut 160M Cap Clamp	1	
7	#8 x 1-1/2" Screw, Stainless Steel	1	
8	M6 x 10 mm Screw, Stainless Steel	8	
9	1/4" Lock Washer, Stainless Steel	8	
10	Coil Support Tube Assembly	1	
11	#10 Wing Nut, Stainless Steel	1	
12	#10 Lock Washer, Stainless Steel	6	(2)
13	#10 Flat Washer, Stainless Steel	6	(3)
14	#10 x 1-1/4" Screw, Stainless Steel	1	
15*	#10 Hex Nut, Stainless Steel	5	(4)
16	Coil Clamp 'A' HF6V	1	(5)
17	Coil M10072	1	
18	#10 x 1" Screw, Stainless Steel	2	
19	Butternut 10M Coil Clamp	1	
20	Capacitor Plate	2	
21	Capacitor, High Voltage	4	
22	Butternut 160M Cap Clamp	1	
23	#10 x 3/4" Screw, Stainless Steel	1	

- - There may be spare parts included - -

- - Notes for Parts List - -

(1) - Ring Terminals are on existing Feedpoint Connection and Q-Coil

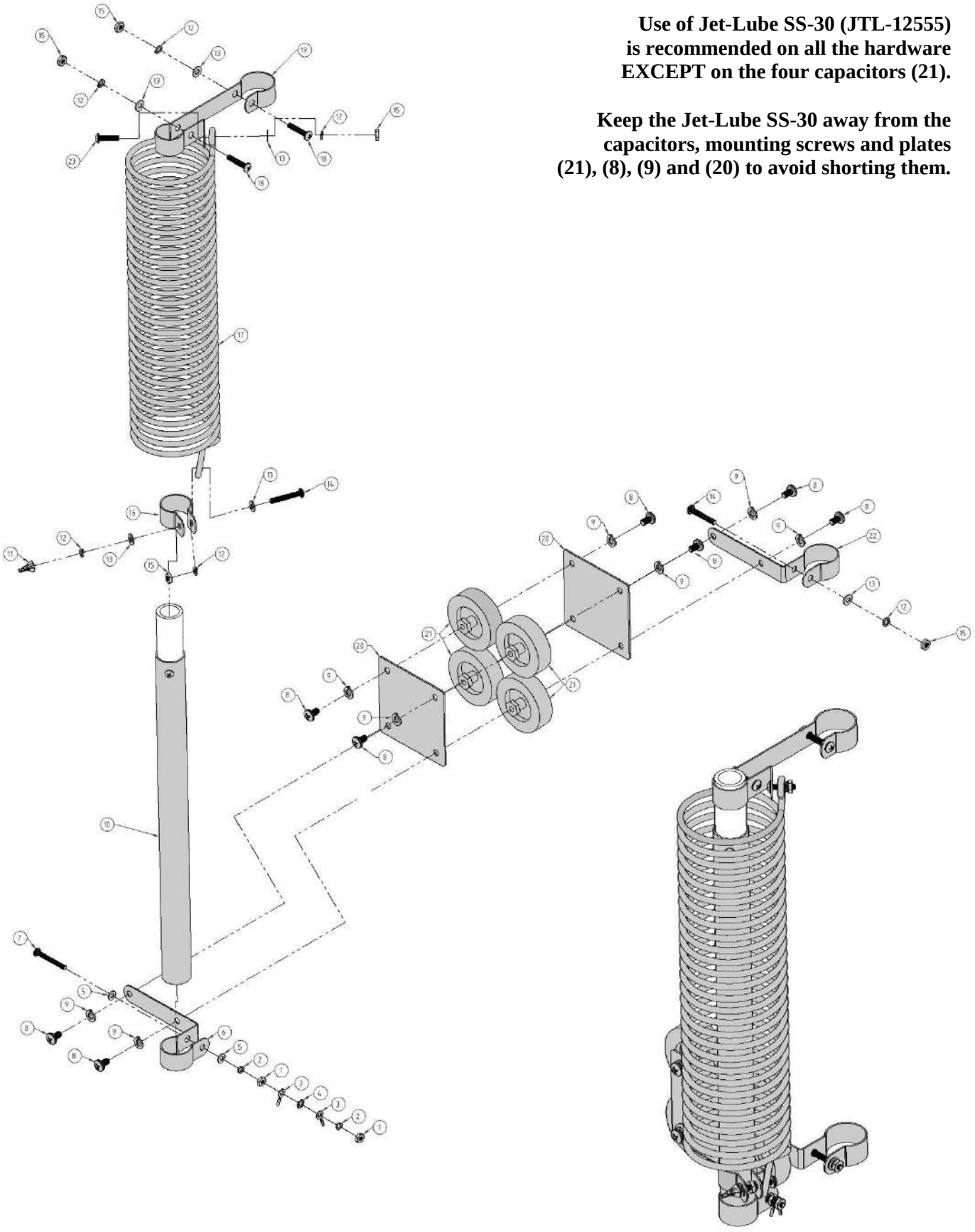
(2) - **(3)** - **(4)** - **(5)** - Some parts are pre-mounted on coil (17)



REFERENCE DRAWING

Use of Jet-Lube SS-30 (JTL-12555) is recommended on all the hardware EXCEPT on the four capacitors (21).

Keep the Jet-Lube SS-30 away from the capacitors, mounting screws and plates (21), (8), (9) and (20) to avoid shorting them.

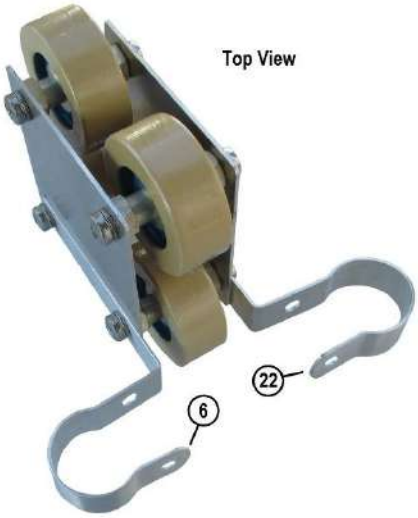


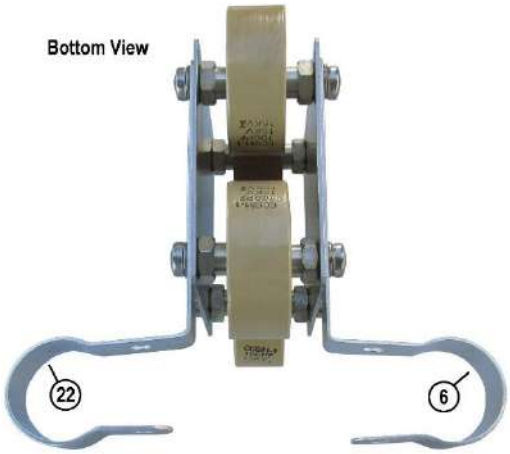
ASSEMBLY

Refer to the drawing and make sure that all parts are present before proceeding.

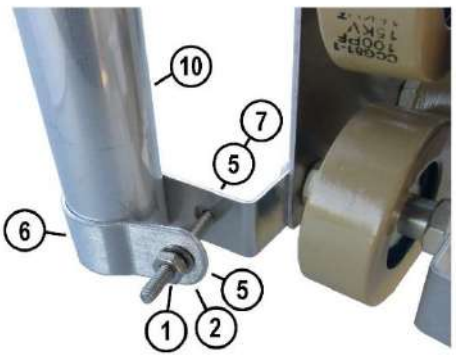
1. Install the upper two Capacitors (21) to the two Plates (20) using the short metric Phillips head screws (8) and split lock washers (9) as shown. **NOTE: When installing the Capacitors, use an open end wrench to hold the Hex Nuts that are attached to the Capacitors in place while you tighten the Phillips Head Screws to avoid putting strain on the Capacitors.**

2. Install the bottom two Capacitors (21) with the Brackets (6) and (22) as shown.

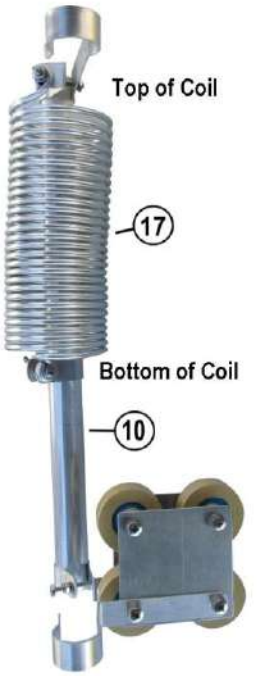




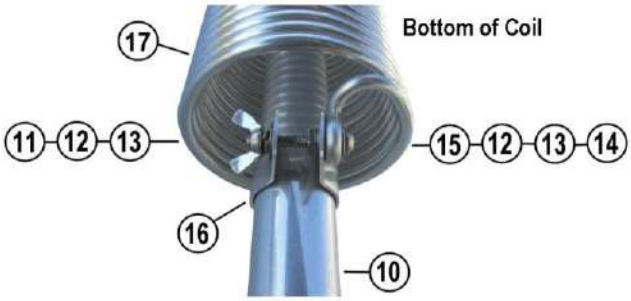
3. Install the Coil Mounting Tube (10) to the Capacitor Assembly in Bracket (6) using the Phillips Head Screw (7), two Flat Washers (5), Split Washer (2) and Hex Nut (1) as shown.



4. Install the 160 meter Coil (17) to the coil Mounting Tube (10) with the parts shown below. You can slightly adjust the coil (17) to be centered around the coil support tube (10) if needed. The coil is soft aluminum and can be bent to center it in the coil. Take care not to misshape the coil when adjusting.



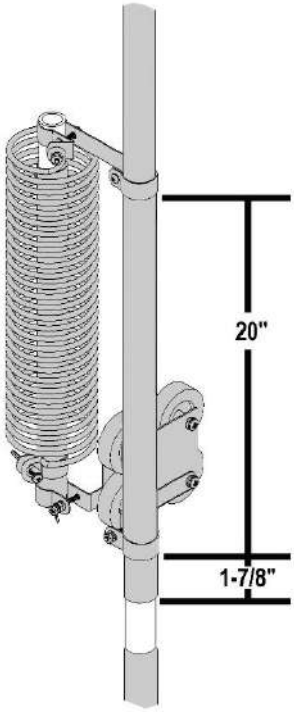
Bottom adjustment shown.
Top can be adjusted as well



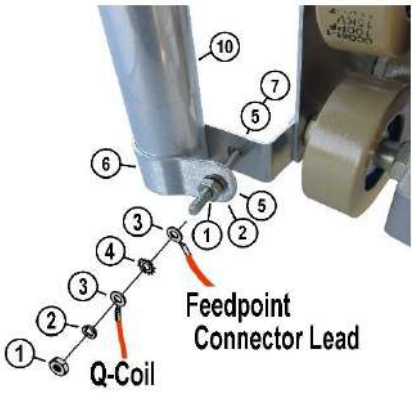
5. Install the TBR-160X assembly on the antenna, simply slide the free ends of clamps around the lower antenna element tube. At top of Coil snug the clamp in place - This will be adjusted during tuning.

   Use the Phillips Head Screw (18) Flat Washer 13, Split washer 12 and Hex Nut 15 at the top as shown in the reference drawing.

   On the bottom position the bottom clamp around the lower antenna element approximately 1-7/8" above the white insulator as shown use the Phillips Head Screw (7), two Flat Washers (5), and Hex Nut (2) to hold the assembly securely in place at the bottom as shown.



6. Connect the Q-Coil and the red lead of Feedpoint Connector to the bottom bracket for the 160 meter coil using the hardware as shown. The Star Washer (4) goes in between the ring terminals for the red Feed Point Connector lead and the Q-Coil lead.



Tuning

As stated earlier in this manual, you must tune your antenna prior to installing the BUT-TBR-160X kit to ensure proper operation and ease of tuning when this 160 meter kit is installed and tuned.

Some users have reported that a new "Q" coil made with 12 gauge wire, 15 turns and a 2.25" to 2.5" diameter will help not only with 160 meters, but will also allow the other bands on your antenna to be tuned properly.

You will most likely have to examine and re-tune all of the bands after adding the 160 meter kit. All the bands will probably shift up in frequency. The 80M coil has to be compressed about 3" and the 40M coil an inch. The overall length will most likely need to be increased by 6" for 10 meters. The 15M wire has to be lengthened by 3". Once 30M is adjusted, it may also bring 20M back in, so you can avoid adjusting the 20M tap. 17M and 12M coils may need to be compressed fractions of an inch for tuning. The 17M adjustment may be better than it was without the 160M coil. The only elements that may not require adjusting after adding the 160M kit are the 20M tap and the 6M wire.

Loosen the wing nut on the lower coil clamp and stretch the coil by sliding the clamp down tube C until the lower edge of the clamp is approximately 4-3/4" (12 cm.) from the lower edge of clamp D. This setting should produce lowest SWR between 1800 and 1900 kHz. Tuning is very sharp so SWR checks at intervals of 5 kHz may be necessary to determine the resonant frequency with the initial setting. If no frequency can be found where the SWR drops to a minimum value, simply stretch the coil out an inch or less, and begin another series of SWR checks. Once the low SWR point has been found, it is a simple matter to make adjustments for any frequency between 1800 and 2000 kHz. To raise the frequency of lowest SWR, stretch the coil a slight amount. To lower the frequency, compress the coil. Final adjustments should be made with changes of 1/2" or less. For operation above 1900 kHz it may be necessary to short out or remove several turns of the coil if it cannot be stretched sufficiently.

After the TBR-160X has been adjusted for 160 meter operation it will be necessary to readjust the 80 and 40 meter resonator circuits for greater inductance. Do this by compressing the coils for those bands. The 80M coil has to be compressed about 3" and the 40M coil an inch.

Refer to the manual for your specific antenna – HF2V, HF6V or HF-9V as needed.

*Photo from a **BUT-TBR-160X** installation*

Matching Considerations

It is totally unrealistic to expect a perfect match to 50 ohm cable over the 1.8 to 28 MHz range with a single antenna, because earth losses, antenna radiation resistance and conductor losses, all of which determine the feedpoint impedance of the antenna, can vary greatly over the HF spectrum.

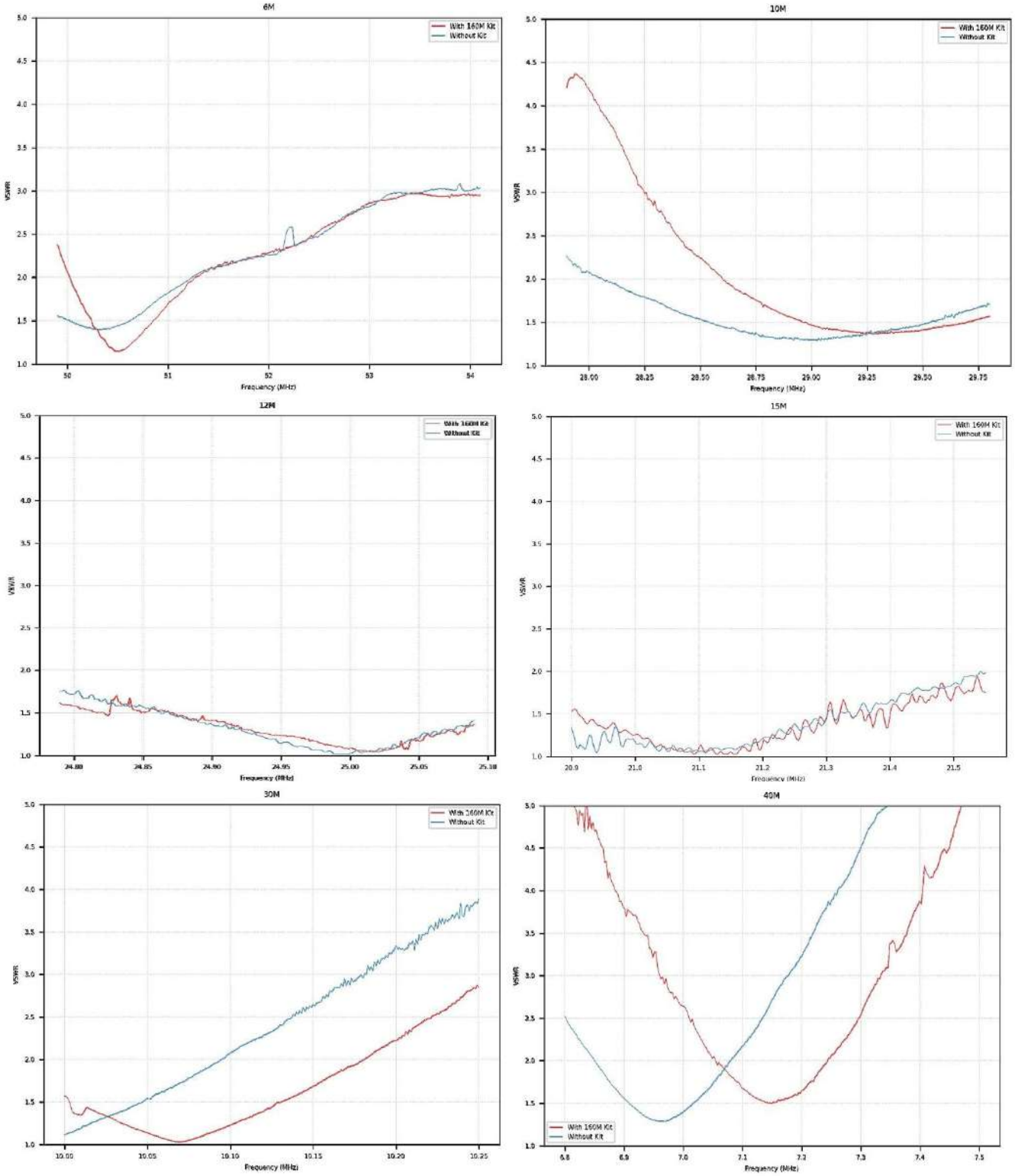
With poor-to-fair ground systems SWR resonance on 160 meters should be less than 2:1 (narrow bandwidth as described earlier) when properly tuned.

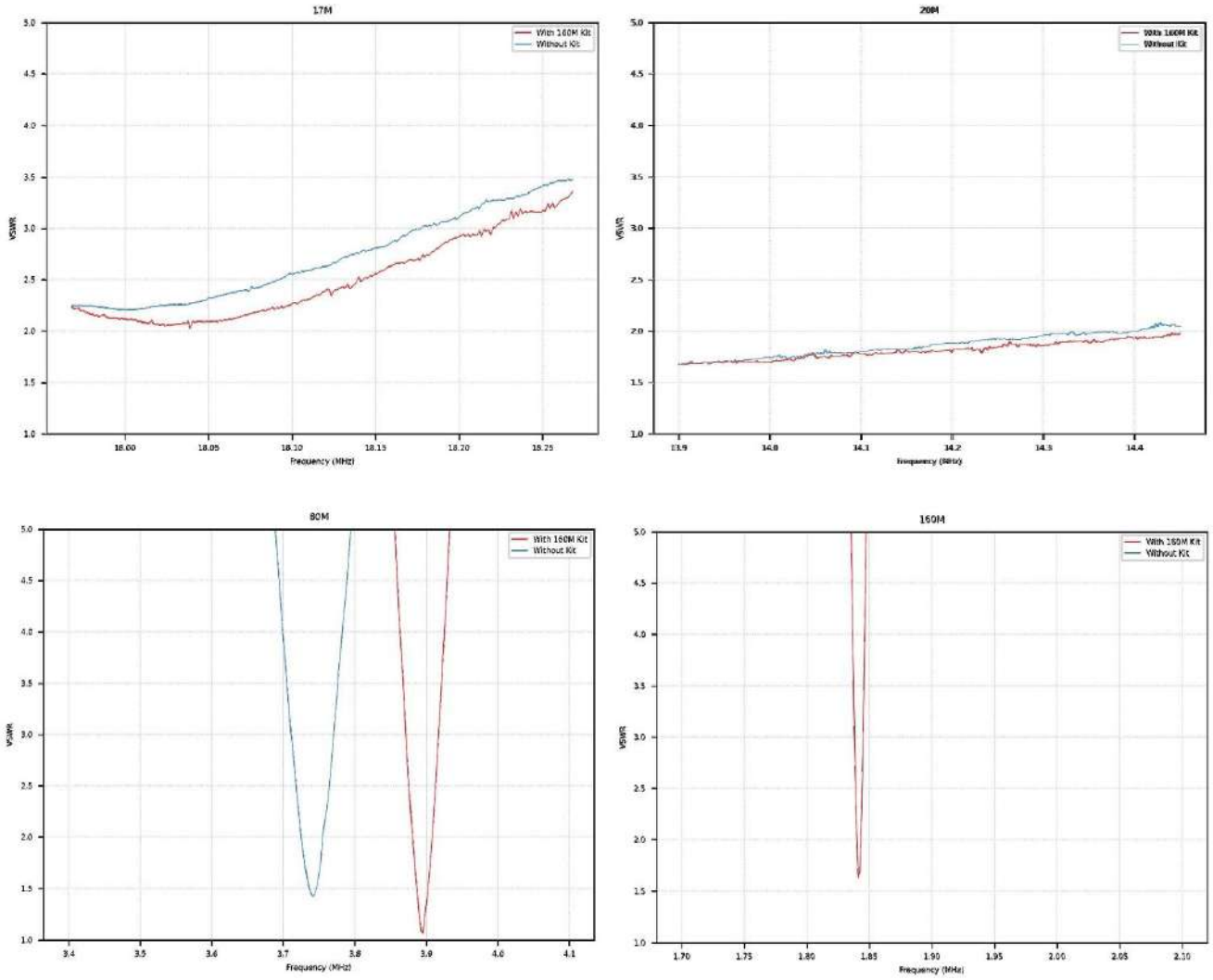
With better ground radial systems, SWR may exceed 2:1, although the antenna will perform more efficiently.

Important Operating Considerations

Use a good antenna analyzer to check the SWR on 160 meters prior to transmitting in case something has changed due to weather, animals or mowing may have disturbed your coil settings.

Typical SWR Graphs - Before BUT-TBR-160X installed (antenna tuned) and after BUT-TBR-160X installed & tuned





Manual Updates and Information

Every effort is made to offer the latest manual revision with each product. Occasionally a manual will be updated between the time your DX Engineering/Butternut kit is shipped and when you receive it. Please check the DX Engineering web site (www.dxengineering.com) for the latest revision manual.

Technical Support

If you have questions about this product, or if you experience difficulties during the installation, contact DX Engineering at (330) 572-3200. You can also e-mail us at: DXEngineering@DXEngineering.com For best service, please take a few minutes to review this manual before you call.

Warranty

All products manufactured by DX Engineering are warranted to be free from defects in material and workmanship for a period of one (1) year from date of shipment. DX Engineering's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by DX Engineering. If DX Engineering's products are claimed to be defective in material or workmanship, DX Engineering shall, upon prompt notice thereof, issue shipping instructions for return to DX Engineering (transportation-charges prepaid by Buyer). Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing. The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation, damaged from severe weather including floods, or abnormal environmental conditions such as prolonged exposure to corrosives or power surges, or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's specifications. In addition, DX Engineering's warranties do not extend to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to DX Engineering. The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR DX ENGINEERING ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.
Specifications subject to change without notice.

BUT-TBR-160X-INS