Low-cost Panadapter for the FT-817
and other rigs

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A panadapter is a great help for microwave operation. Once you've used one, it becomes essential – both for finding stations not quite on frequency, and for finding signals sometimes too weak to hear. Once a signal is found, peaking the antennas can often find enough dB to make a contact.

The Yaesu FT-817 is a good IF rig for portable operation. Since Mike, N1JEZ, described[1] how he and Don, W1FKF, connected a Funcube Dongle to act as a panadapter, many microwave operators have added a panadapter tap to their rig. I worked with Mike to develop a small PC board[2] to provide this tap.

The panadapter tap simply brings out the 68 MHz first IF signal from the receiver before any sharp filtering, so that a wider bandwidth may be displayed. The problem is to filter out several other strong signals, between 212 and 850 MHz, inside the FT-817 which will overload the Funcube Dongle or cause birdies in the display.

Mike used a Minicircuits 70 MHz filter in the original, and we then used a printed-circuit version of the filter from Minicircuits (minicircuits.com). However, the price of these filters has been increasing, and they are hard to obtain in other countries.

Other hams have adapted these boards to other rigs[3,4], using different Minicircuits filters. Other versions of the panadapter tap have been published[5,6], but PC boards were not generally available except for a version sold by G4HUP before he passed away.

Low-Cost Panadapter Board

Recently, I was playing with some simple filters using SMT (surface-mount) inductors and capacitors for another project, and it occurred to me that one might be adequate for the panadapter tap – a sharp filter is not required, since the undesired frequencies are much higher than the 68 MHz IF frequency. I put together a quick breadboard to test the filter, and found that it had about 20 MHz bandwidth and almost 10 dB loss. The bandwidth is similar to the Minicircuits filter, wide enough so that no tuning is needed, and the PC board already has a MMIC amplifier to overcome filter loss. The amplifier also isolates the IF circuit from the filter.

I modified the PC board layout to use the SMT filter and found enough free space on another PCB order to add the modified board so I could build a prototype, shown in Figure 1. The new schematic is shown in Figure 2. The layout allows sufficient space around the SMT components

to permit easy assembly. At initial assembly, the attenuator is bypassed with a zero-ohm resistor until I could determine how much attenuation is needed in the FT-817.

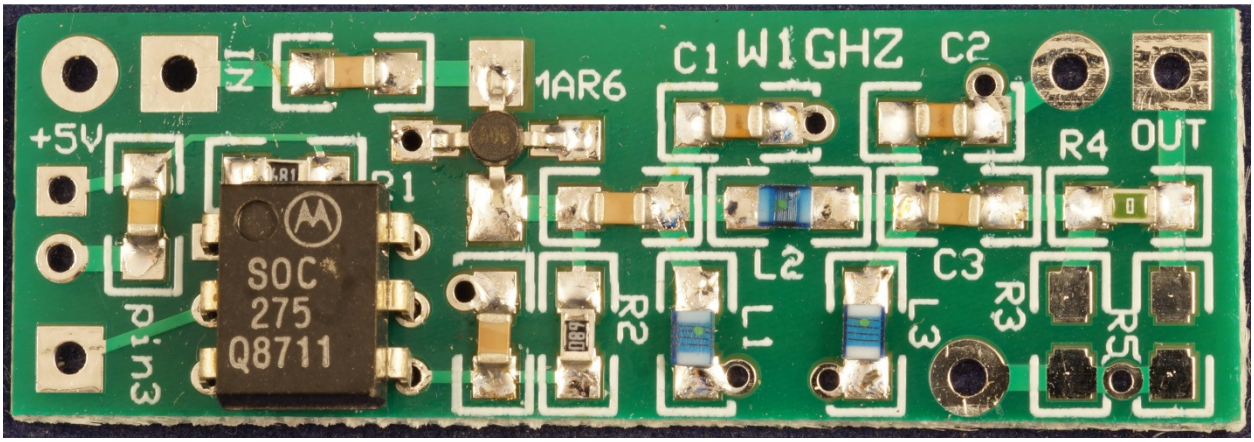

Figure 1 – Low-cost Panadapter Tap Prototype for FT-817 with SMT filter

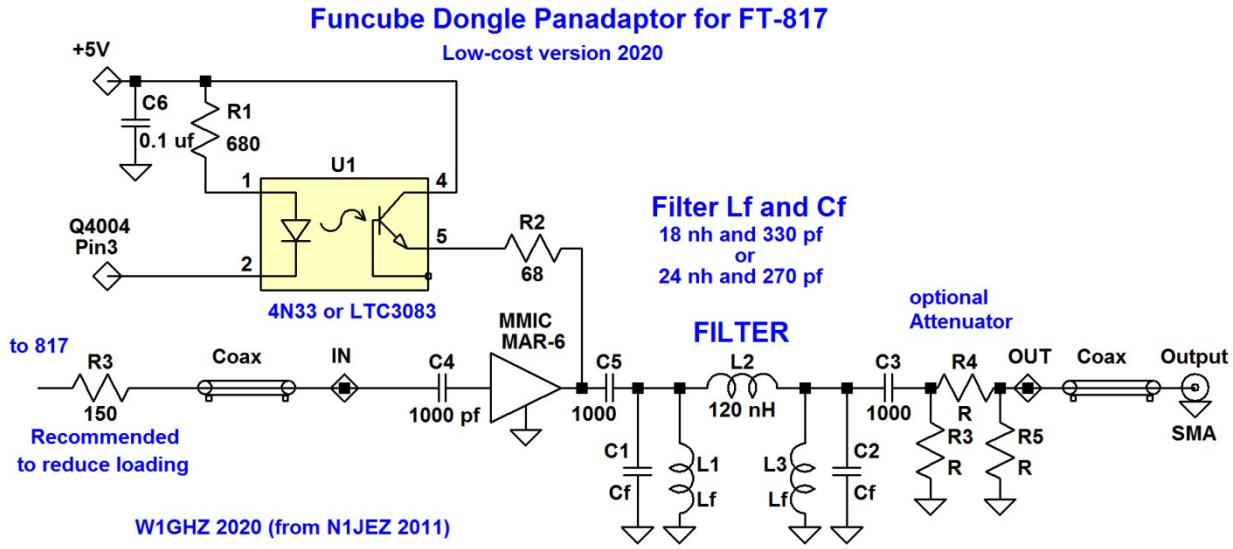

Figure 2 – Panadapter Tap prototype schematic for FT-817 with SMT fillter

Installation

Mike's instructions for installing the original PCB in the FT-817 required disassembly of the front panel to access a control signal from Q4004, which drove an opto-isolator to power the amplifier on receive only. I also reviewed installation instructions from Dave Powis, G4HUP, (SK), who had been offering a Panadapter Tap kit. Dave found a point on top of the FT-817 main PC board near the IF filter (XF1001) to access +RxB, the 5 volts available only on receive. Using the voltage makes the opto-isolator unnecessary, with +RxB connected directly to R2 (there is a bypass capacitor there on the PC board which was left out of the schematic). A thin

wire, like #30 wire-wrap wire, will fit into the +RxB hole – just carefully scrape off the green soldermask on top of the pad so solder will stick.

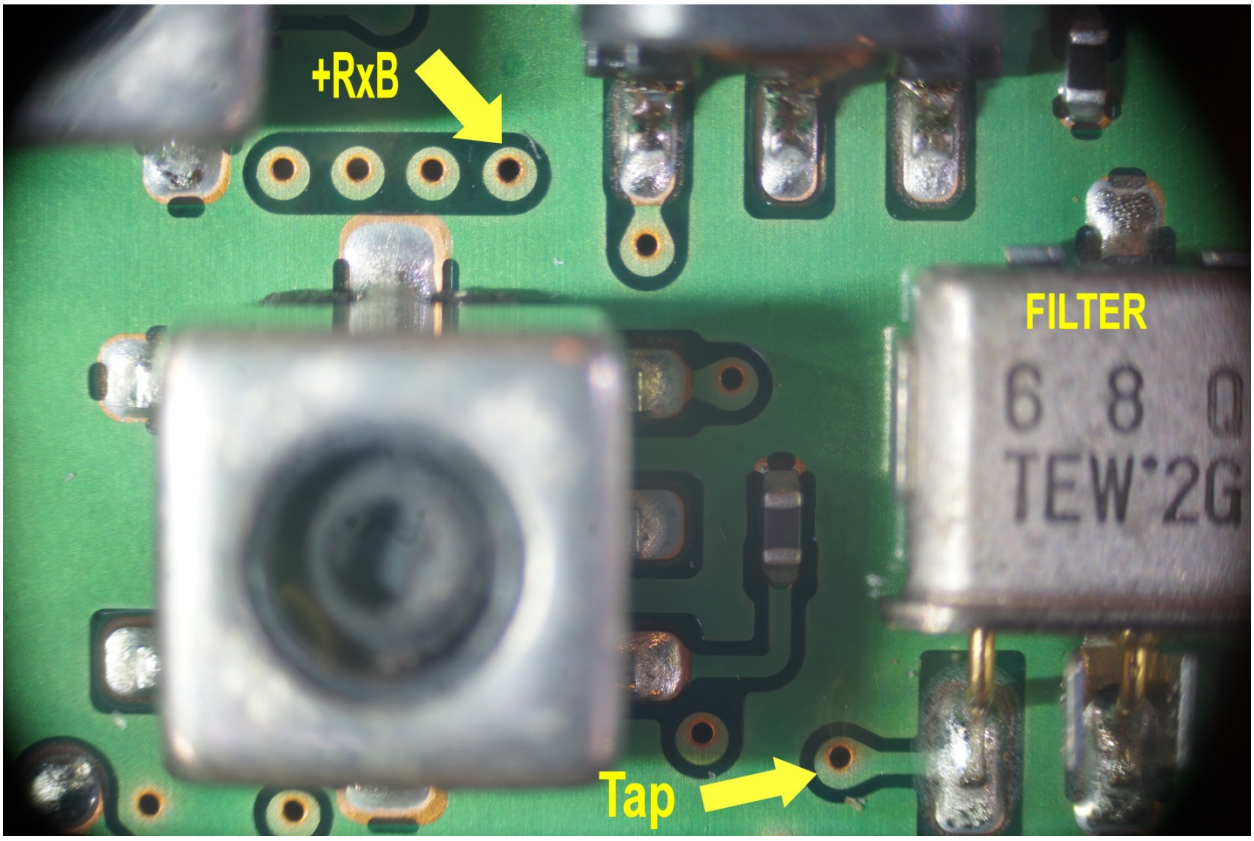

Figure 3 – Connection point locations in FT-817 for Panadapter Tap

The SMT board does not have the tall Minicircuits filter, so it can be placed close to the Tap point and not require coax at the input. I added thin wires to the +RxB and Tap points, then placed the new PC board nearby on three layer of double-sided tap, and attached the wires to it. Wire-wrap wire, #30 silver with Teflon insulation, fits perfectly into the small holes in the board.

The output coax was already attached to the board – I used an SMA cable from ebay with an SMA bulkhead connector on one end and the other end cut off.

Figure 4 shows the prototype Panadapter tap board in place over the IF filter and some of the tunable cans on the PC board, and grounded to the large shield can. If you are foolish enough to play with the internal tuning, the tap board can be folded back on the Ground wires. The SMA bulkhead connector passes through a hole drilled in the back panel of the FT-817. Don't forget to protect the insides with blue painters tape before drilling.

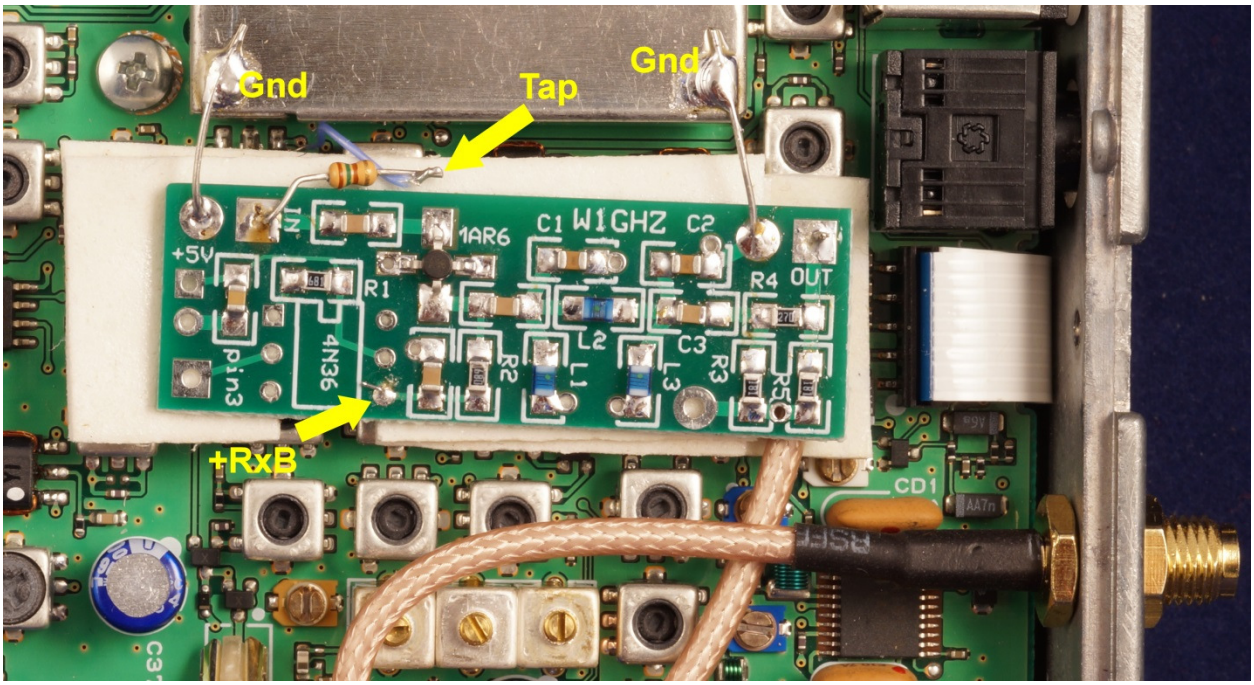

Figure 4 – Low-cost Panadapter prototype PC board installed in FT-817

Operation

The prototype Panadapter Tap board works identically to the original, in a side-by-side comparison with another FT-817 (the new one is actually an FT-817ND). I added external attenuators to adjust the noise floor levels to match, and found that 5 dB seems about right. Resistors for 5 dB attenuation were added to the board, as shown in Figure 4: 27 ohms for R4, and 180 ohms for both R3 and R5. The 150-ohm resistor at the input to reduce loading on the FT-817 IF was recommended by I6IBE[6] and does not seem to hurt performance.

Surface-mount Low-Cost Panadapter Board

Since the opto-isolator is no longer needed, I removed it from the PCB layout to make the board smaller with a low profile, so it can fit in a small space. The new board, with all SMT components, is shown in Figure 5, and the final schematic in Figure 6. The 150-ohm resistor at the input is included on this board.

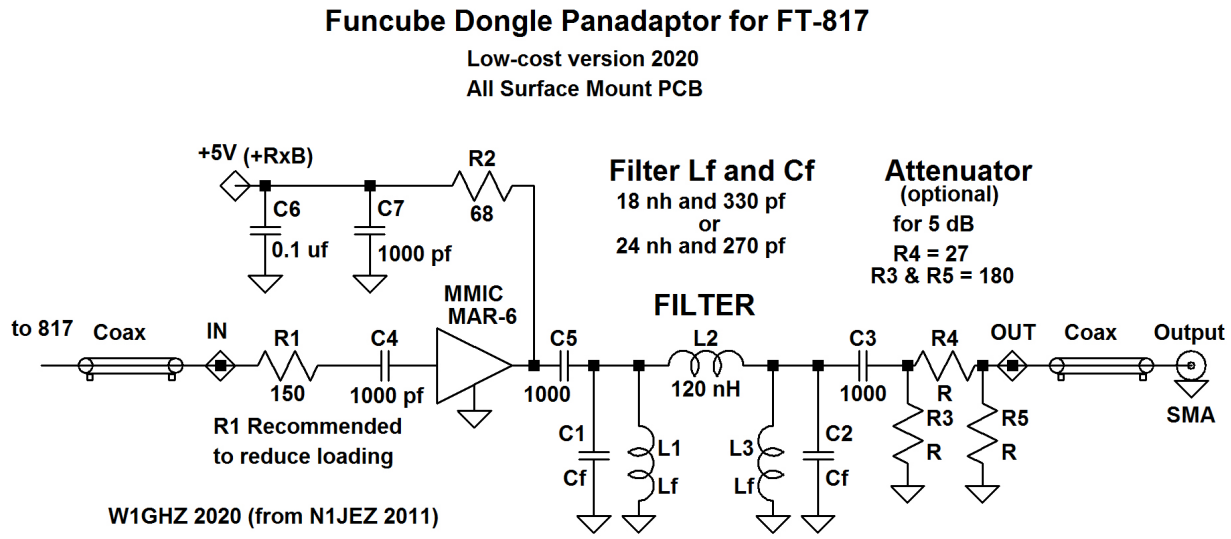

Figure 5 – Schematic of surface-mount version Panadapter board

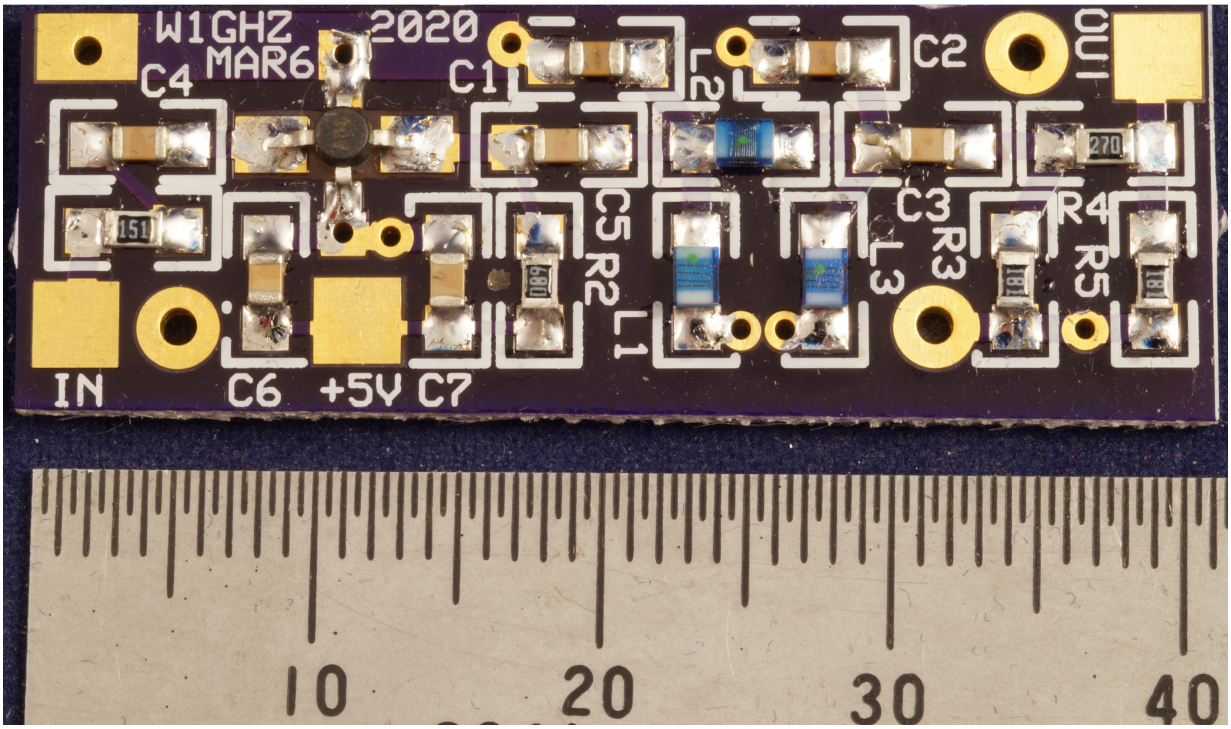

Figure 6 – All surface-mount version of Panadapter board

To make sure that the low-cost filter is doing an adequate job, I measured the finished board standalone, with the passband shown in Figure 7. There is adequate bandwidth at 68 MHz so that no tuning is required, and the stopband is at least 40 dB down at the higher frequencies where attenuation is needed.

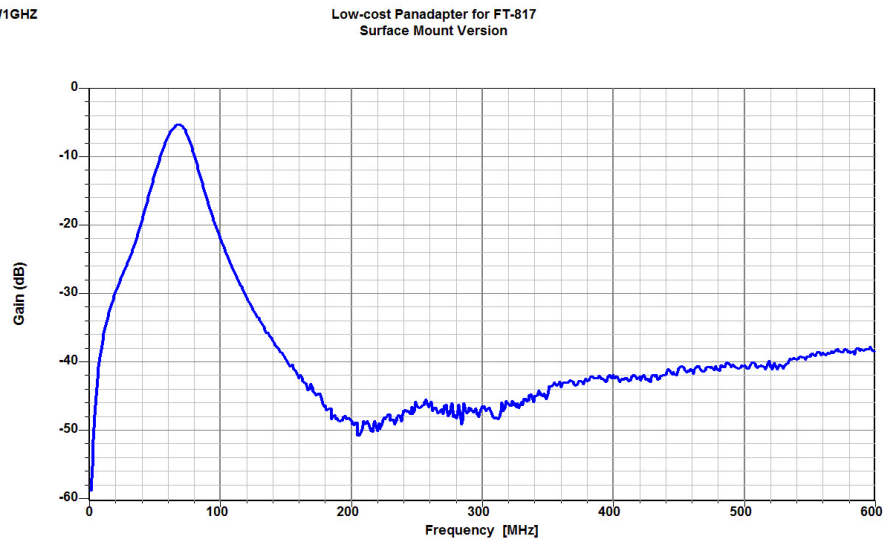

Figure 7 – Frequency response of surface-mount version Panadapter board

The filter components I used: C1 & C2 = 330 pf, L1 & L3 (18nh) = Coilcraft 0805CS-180XJE, and L2 (120nh) = Coilcraft 0805CS-121XJE.

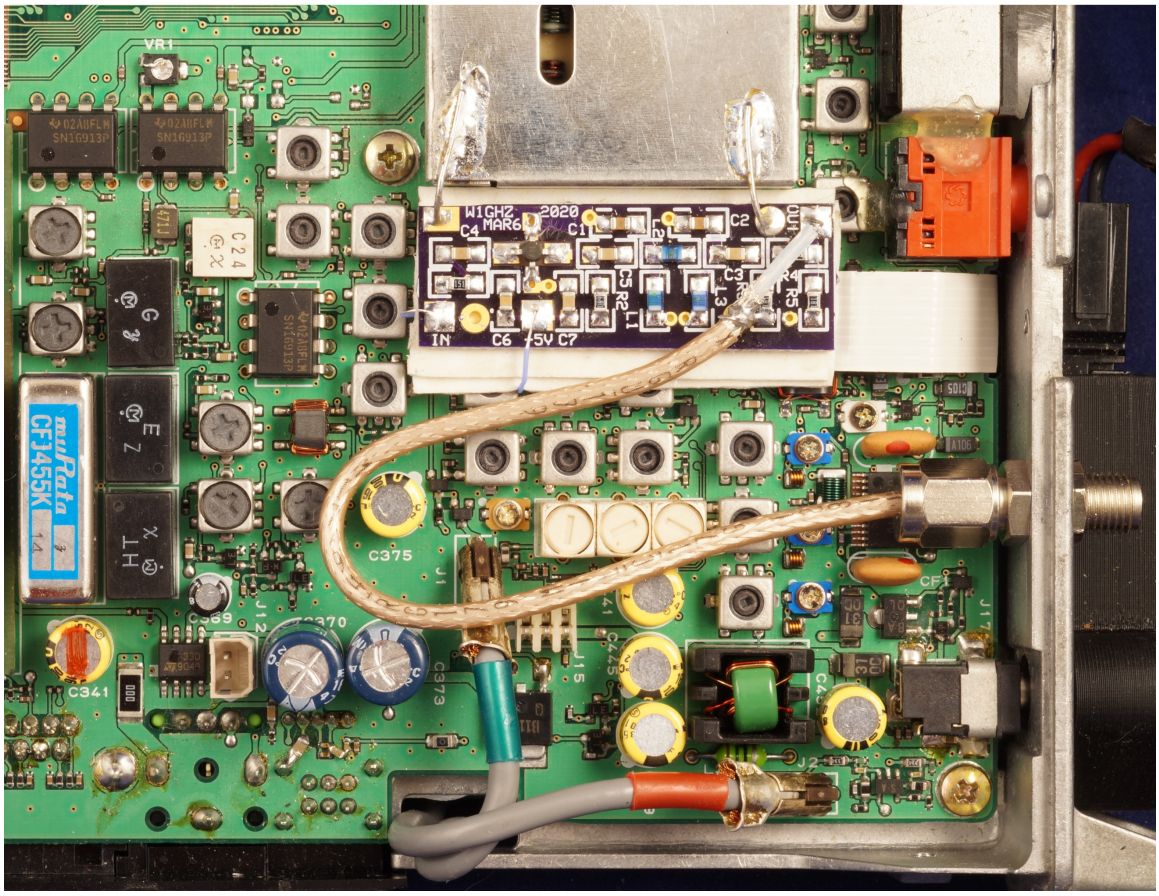

Figure 8 – Low-cost surface-mount version Panadapter board installed in FT-817

The final test is in the rig. My neighbor, W1AIM, has been talking about adding a panadapter to his FT-817 for a while, so I offered to install it in his rig. The installation, shown in Figure 8, is cleaner than the prototype. Side-by-side tests of this rig, one with the prototype, and one with the original board show identical performance.

Options

The filter on this board is just inductors and capacitors, so it is easily changed for other IF frequencies. Then it is a matter of finding the right tap point in other rigs. K9EK[7] has looked at a number of them and made suggestions. Some of the newer rigs now include a panadapter display, but it is usually on the small front panel. It might be useful to supplement it with a larger display with more flexibility.

To reduce the cost even further, an inexpensive DVB-T dongle can be used instead of the Funcube Dongle. I6IBE[6] has looked at some of these.

Summary

A panadapter has proved invaluable for microwave operation and handy for VHF and UHF. This new version of the panadapter board makes it easier and less expensive to add one to your rig. PC boards are available, and I will include some wire-wrap wire on request. If your rig needs the opto-isolator, a few of the prototype boards are available.

Notes

1. Mike Seguin, N1JEZ, "A Panadapter for the FT-817," *Proceedings of Microwave Update 2011*, ARRL, 2011. www.w1ghz.org/small_proj/FT-817_Panadapter-N1JEZ.zip
2. Paul Wade, W1GHZ, "Printed-Circuit Board for the FT-817 Panadapter," www.w1ghz.org/small_proj/FT-817_Panadapter_board.zip
3. Bob Bownes, KI2L, "Installing the W1GHZ / N1JEZ Panadapter Adapter in theYaesu FT-2000", *Proceedings of 40th Eastern VHF-UHF Conference,* 2014
4. Dave Hallidy, K2DH, "Another Adaptation of 'A Panadapter for the FT-817'", *Proceedings of the 2016 VHF Super Conference*, ARRL, 2016
5. Wayne Getchell, VE3CZO, Low-Cost Panadapter Interface,*Proceedings of 41st Eastern VHF-UHF Conference*, 2015.
6. Ivo Brugnera, I6IBE, "Panadapter Yaesu FT-817, 897, 857 RTL2832u out IF MF 68,33 Mhz,", *Proceedings of 40th Eastern VHF-UHF Conference*, 2014
7. Ed Krome, K9EK, "SDR Panadaptors – A Practical Guide," *Proceedings of the 2016 VHF Super Conference*, ARRL, 2016