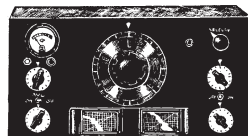


THE COMMUNICATIONS RECEIVER



BY **BARRY WILLIAMS, KD5VC**, 2002 MUSTANG LANE, ROSHARON, TX 77583
E-MAIL: barry.williams@nov.com

The National FBX-A – PSK Combination

I want to start this column with a tribute to Lt. Col. (ret) Phillip Rand. Phil and I met over a year ago when he was looking for parts for an HRO-W. I had most of what he needed and shipped the parts to him. When he asked about payment and I said he had already paid with his service to our country. We exchanged emails almost daily until his death May 19, 2011.

In our discussions I found that Phil had flown fighter aircraft in WWII, Korea, and Vietnam. He flew in an amazing number of aircraft including a ride swap with an Australian pilot. The swap enabled him to fly a Spitfire, famous for the defense of Britain, while the Australian got to fly a P-51 Mustang, usually cited as the best WWII fighter.

Phil knew that he didn't have a lot of time left, and so began selling off his amateur equipment. He had two pieces that he especially wanted to place with to someone who would enjoy them. He asked me if I would take them at no charge. I agreed and, wanting to make the transfer as easy as possible for him, I paid for the packing and shipping.

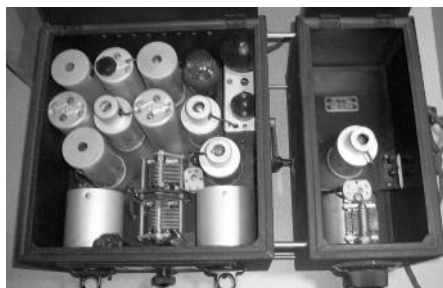
I was very surprised when I got the shipment. It included a National SW-3, 2nd model, a National FB-XA with PSK pre-selector, dozens of coils and two power supplies. Everything was in excellent condition, and Phil put in all the paperwork he had, including a couple of sheets on the PSK which were new to me. All the information I had seen prior to that was a 1933 *QST* article by James Lamb and F. E. Handy, two illustrious names in amateur radio.

Most collectors are familiar with the National FB series receivers. These receivers were also covered in a September, 1985 article in the *Journal* (then *The Old-Timer's Bulletin*) by Bill Fizette. The FB series was introduced in order to provide a low-cost (with

respect to the AGS) receiver with attributes of the 1932 Single Signal Superheterodyne developed by James Lamb and presented in *QST* over the later part of 1932.

The original Single Signal Super had an RF pre-selection stage using three tuned RF circuits. Buying an AGS or building a Single Signal Super as originally presented were two avenues not open to most amateurs. The 1933 introduction of the Hammarlund Comet Pro and National FB-7 presented affordable solutions for many amateurs. In the simplification and reduction of cost, the RF stage was deleted.

Apparently "F.B." were the initials of James Millen's secretary (Frances Bearse, I believe) though, in one of the National one page "Technical Notes" in *QST*, he states that it stood for "Fine Business." The first receivers introduced were the FB-7 and FB-X. Both receivers used 7 tubes as indicated



Top and front view of the FBX-A-PSK combination.



General coverage coils for the system.

by the “-7” on the lower cost version. The “X” was used to indicate that the receiver included the original version of Lamb’s crystal filter.

Within a year, National had upgraded the IF system to use air variable capacitors in place of the compression trimmers; these newer receivers had an “A” appended to the name. Therefore the series includes the earlier FB-7 and FB-X as well as the upgrades to the FB-7A and FB-XA. We should note that all FB series enclosures had cutouts for the crystal filter mounting so that the -7 and -7A could have the crystal filter added later by the owner. This allowed purchase of a lower cost receiver with the possibility of later field upgrade.

The circuit used electron coupled oscillators for the HFO and BFO. The antenna signal was taken directly to the mixer along with the HFO signal. The output of the mixer was sent to the crystal filter (if fitted) at about 500 kHz. There were two IF amplifiers, followed by a triode detector. The BFO can be activated and fed into the detector. There was a pentode final amplifier, which was disabled if you plugged in headphones. The high resistance phones were fed directly from the triode detector.

An article by James Lamb and F.E. Handy titled “Pre-Selection and Image Rejection in Short-Wave Superhets” appeared in the December 1933 *QST*. It dealt with methods of improving the performance of lower-cost receivers, such as the FB-7 series, that lacked an RF stage. As Lamb and Handy said, “Image-frequency interference, caused by the beating of the high frequency oscillator with signals twice intermediate

frequency removed from the desired signal, has become a problem of general concern with the popular adoption by amateurs of the economical type of short-wave superheterodyne receiver in which there is but one tuned circuit between the antenna input and the first detector”.

The article first discusses the simplest system to address the problem, the wave trap. Two types of wave trap are shown; a simple one which uses a parallel capacitor and inductor tuned to the image frequency, and a second type that uses the same principle, but brings a winding from the inductor to the antenna input.

The authors then go on to describe the construction, and installation on a receiver, of a one-stage pre-selector amplifier. The test receiver used is the National FB-XA and the finished product is very similar to the National PSK. The only evident difference is the dial type. The *QST* system appears to use a flat dial with no reduction, whereas the commercial uses a National type “A” dial mechanism.

The chassis and cover of the *QST* version, as well as the method of mounting to the right side of the receiver with standoffs and an extension for the crystal filter switch, were exactly like those used on the National PSK. There are also directions for modifying the receiver to improve operation. These included providing B+ and filament power for the pre-selector, swapping the first detector from a 57 to a 58 and providing gain control for the pre-R.F tube and first detector

Recommended plug-in coil modifications to reduce coupling (thus sharpening selectivity) call for disassembly, cutting the primary winding, drilling a hole and reaching through the hole with a hooked wire to pull the winding ends out. The primary goes to 2 turns for 20 meters, 3 turns for 40 meters and 5 turns for 80 meters. They also suggest using two coupled coils separated by a Faraday screen to couple antenna to input circuit. Finally the receiver needs to be aligned.

After reading the *QST* article, I wasn’t sure that I wanted to add such a pre-selec-



"Doghouse" Power supply for the FBX-A.

tor to the collection here. Then I got the system from Phil along with data sheets on the PSK. The installation and operating instructions, probably authored by James Millen, state that the pre-selector unit is designed for use in conjunction with the FB-7 series receivers. It also states that in addition to thorough laboratory tests the PSK was tested in actual use with a standard receiver and National 5887 power supply.

The PSK was supplied with four wires coming out of the chassis. This included a twisted pair for putting the RF amp heater in parallel with any nearby tube, a black wire to connect to the receiver chassis and a red wire to be connected to the cathode end of the volume control or to the cathode of the first IF amplifier. These four wires come out of the side of the PSK and go through a hole drilled in the FB receiver.

First the 100 uufd capacitor at the antenna input is shorted and this antenna input connected to the B+ line. The B+ connection is made to the low side of the 1,000 ohm first detector plate filter resistor. The antenna connectors of the PSK and receiver are connected together.

The mechanical connections using stand-offs are discussed, but the the reader is referred to the *QST* article mentioned above for details. There is no discussion about modification of coils. A closing statement suggests that it is not advisable to make any changes, such as substitution of tubes or changes in wiring of the first detector cath-

ode circuit, other than those outlined. "Such changes are almost sure to impair performance". James Millen was a mechanical engineer, and I am not sure that he was correct in discarding the Lamb/Handy information in *QST*. The *QST* article also changes the detector to a remote cutoff pentode and adds it to the variable gain circuit controlled by the volume control dial. This was done to reduce overload and intermodulation by strong signals.

A sheet of receiver alignment instructions was also supplied with the PSK. Since the tuning of the PSK is not critical or ganged with the receiver, there is no adjustment on that chassis. The receiver alignment includes increasing the first detector trimmer capacitance by tightening the compression trimmer on the main tuning capacitor to maximize the signal strength. The PSK is then tuned to maximize the signal. The initial alignment is done with the general coverage coils if possible. Then the trimmers on the bandspread coils are adjusted for maximum signal.

There is no reference to special coils for the PSK in the instruction sheet. The unit I received from Phil included FB type coils stamped RF. There are 6 RF coils, AA, A, B, C, D, and E. Apparently the AA coil was home brew for use on 10 meters.

The system included a full set of band spread coils including a set of home brew 15 meter coils. There were also a full set of general coverage coils along with the FB-XA/PSK setup. I have seen another PSK setup that used detector coils in the PSK. I didn't want to disassemble one of the original RF coils to check the differences, but believe that National probably incorporated the reduction in primary turns recommended by Lamb and Handy.

Phil assembled his FB-XA/PSK in the era prior to the internet. This is indicated by the fact that Phil built some of the coils that are not particularly rare. Often when you find a description of the coils for the AGS and FB-7/X-A there is a letter from Jim W8KGI to Phil Rand W7XK concerning Jim Fred being interested in building FB/AGS coils.

(continued on page 34)



Merrill Bancroft won first place in "1920s TRF Receivers" with this QT and RTM receiver pair.



Top honors in World War II (Korea) went to Roy Wildermuth for his PRC6 and PRC10 squad radios of Korea.

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I did an experiment several years ago based on a damaged RHM coil. Looking at the remains of the coil, I realized that the early coils were built up by starting with an SW-3 coil and gluing several adapter pieces to that coil. The damaged coil I took apart still had the feedback coil in place. The leads from this winding were not taken out of the coil form. I had several adapters made to turn an SW-3 coil to an FB/AGS coil.

I was working on a supplier for the finger pulls when I found that Jim Fred had passed on, and there were no SW-3 coil forms available. Since that time I have seen a replacement coil advertised by another supplier. Originally I used Delrin for the parts used in the modification.

One other note on the FB series shows that they were available with tubes using either 6 or 2.5 volts. Thanks again for taking time to read the article. 73, Barry.

REFERENCES:

- "The Remarkable National FB-7," Sept. 1985 *AWA Journal* (Fizette)
- "Pre-Selection and Image Rejection in Short-Wave Superhets," Dec. 1933, *QST* (Lamb and Handy)
- "Installation and Operating Instructions for Pre-Selector Unit," 1933, National Company (Millen?)
- "A New National Superhet," April 1933, *Short Wave Craft* (Millen)
- "The FBX 'Single Signal' SW Receiver Created by National," May 1933 *Short Wave Craft* (unknown)
- "The National Company Type FB-7 Superheterodyne," 1933 *Official Short Wave Radio Manual* (unknown)
- "The National Company FBX Single Signal Variation of FB7 Receiver," 1933 *Official Short Wave Radio Manual* (unknown)