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Yaesu FT-891 HF and 6-Meter Transceiver

A compact transceiver especially oriented to mobile and portable operators.

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The FT-891 is a 100 W 160 – 6 meter SSB, CW, AM, FM, and data-mode transceiver that includes a general coverage receiver with response from 100 kHz to 74 MHz. The previous generation Yaesu compact 100 W transceivers included two distinct models with similar architectures but different form factors. The FT-857D (still available at the time of this writing) was designed especially for mobile operation, while the FT-897D, with its provision for an internal battery pack, was more oriented for portable operation. Of course, either radio could be adapted to either role, and both have also served as compact home stations.

The FT-891 has dimensions that are almost identical to those of the FT-857D (just 0.6 inches shorter), so a comparison is perhaps appropriate. The FT-891 adds:

- IF digital signal processing (DSP) with variable width filters for all modes, in place of the two slots for optional crystal filters in the ’857D. The DSP also provides automatic notching, peaking, and noise rejection. A new 3 kHz wide roofing filter in the first IF improves dynamic range on CW, SSB, and data modes.
- A spectrum display (panadapter) that timeshares the receiver with normal audio operation.
- A larger, easier to read, multi-line display.

The FT-891 gives up operation on 144 and 432 MHz in SSB, CW, and FM modes.

It may also be appropriate to consider the FT-891 in comparison to its sibling, the FT-991A.[1] The ’991A is a larger, more expensive (about $700 for the ’891 versus $1,400 for the ’991A), and more capable portable transceiver — perhaps functionally a closer relative to the now-discontinued FT-897D model. If you look at just the ’891’s HF capabilities — without looking at the control panel size and capabilities — the ’891 is similar to its larger brother. However, it gives up VHF and UHF capability, digital voice, the color display, and the additional controls associated with the larger panel. While the dynamic performance isn’t quite up to that of the FT-991 in most respects, it does track fairly closely.

Bottom Line

The Yaesu FT-891 brings improved receiver performance and functionality compared to Yaesu’s previous generation compact transceivers, making it a good candidate for a portable or mobile HF rig.

Controls and Indicators

The compact and easily removable front panel includes a 1⅝-inch diameter main tuning knob on the right that tunes with a smooth, weighted feel. Drag is adjustable, which is a great feature for a mobile rig because hitting a bump with your hand near the dial invariably results in changing the VFO frequency. Alternatively, a quick tap of the POWER button, just above the TUNING knob, locks the frequency until tapped again.

On the left side of the front panel are two smaller knobs. On top is a concentric pair providing AF GAIN and RF GAIN adjustment (becomes a SQUELCH control for FM operation). The lower knob is a single MULTIFUNCTION knob that also has a pushbutton capability. The knob can be used to either move the main (VFO A) frequency in 500 kHz steps to change bands or segments, or with a push of the knob, it

[1] N. Fusaro, W3IZ, “Yaesu FT-991 HF and 6 Meter Transceiver,” Product Review, *QST*, Nov. 2015, pp. 45 – 49.

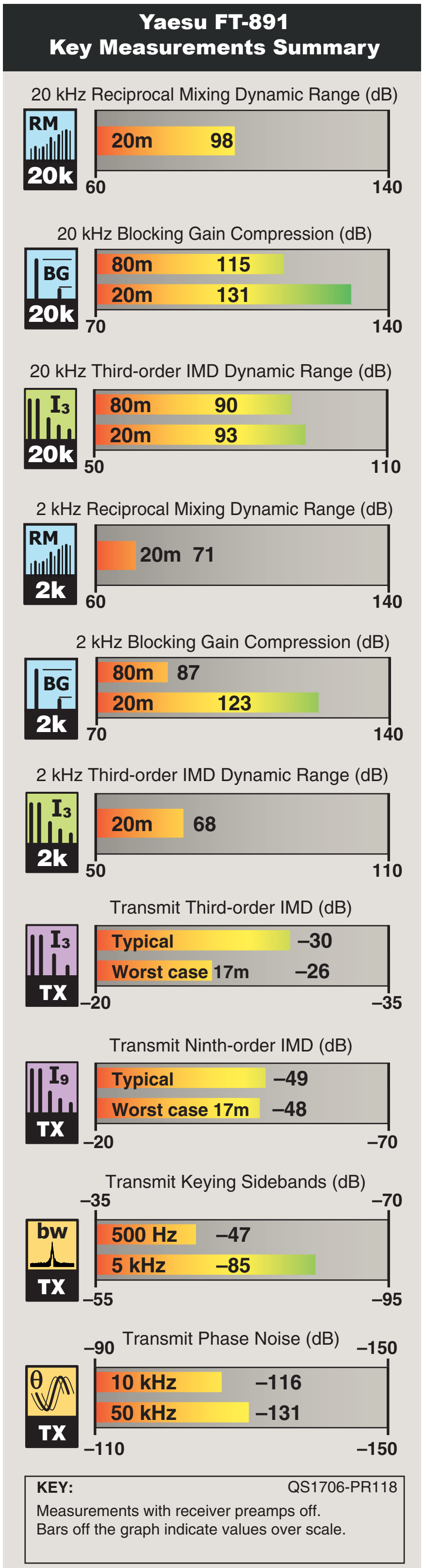

Table 1
Yaesu FT-891, serial number 6K020054 v01.03

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.03 – 54 MHz; transmit, 160 – 6 meter amateur bands.	Receive, 0.100 – 74 MHz; transmit, as specified.
Power requirement: Receive, 2.0 A; transmit, 23 A at 13.8 V dc ±15%.	At 13.8 V dc: Transmit, 18 A (typical), 19 A (maximum). Receive, 1.03 A (max volume, no signal, max backlights); 997 mA (backlights off); 1.01 A (standby, FM only). Power off, 19 mA.
Modes of operation: SSB, CW, AM, FM.	As specified.
Receiver	**Receiver Dynamic Testing**
SSB/CW sensitivity: (S/N 10 dB), 0.16 µV (1.8 – 30 MHz), 0.16 µV (50 – 54 MHz).	Noise floor (MDS), 500 Hz BW: *Preamp off* / *Preamp on* 0.137 MHz –80 dBm / –97 dBm 0.475 MHz –111 dBm / –123 dBm 1.0 MHz –113 dBm / –125 dBm 3.5 MHz –129 dBm / –140 dBm 14 MHz –129 dBm / –140 dBm 50 MHz –129 dBm / –141 dBm
Noise figure: Not specified.	Preamp off/on: 14 MHz, 18/7; 50 MHz, 18/6 dB.
AM sensitivity: (S/N 10 dB), 5 µV (0.5 – 1.8 MHz); 1.6 µV (1.8 – 30 MHz); 0.16 µV (50 – 54 MHz).	10 dB (S+N)/N, 1 kHz, 30% modulation, 6 kHz BW: *Preamp off* / *Preamp on* 1.0 MHz 19.7 µV / 4.62 µV 3.8 MHz 3.75 µV / 0.92 µV 29.0 MHz 3.31 µV / 0.87 µV 50.4 MHz 3.20 µV / 0.79 µV
FM sensitivity: (12 dB SINAD), 0.35 µV (29 MHz and 50 – 54 MHz).	For 12 dB SINAD, 16 kHz BW: *Preamp off* / *Preamp on* 29 MHz 0.72 µV / 0.19 µV 52 MHz 0.82 µV / 0.19 µV
Blocking gain compression dynamic range: Not specified.	Blocking gain compression dynamic range, 500 Hz BW: *20 kHz offset Preamp off/on* / *5/2 kHz offset Preamp off* 3.5 MHz 115/115 dB / 107/87 dB 14 MHz 132/131 dB / 123/123 dB 50 MHz 119/113 dB / 103/90 dB
Reciprocal mixing dynamic range:	14 MHz, 20/5/2 kHz offset: 98/82/71 dB

ARRL Lab Two-Tone IMD Dynamic Range Testing (500 Hz bandwidth)

Band/preamp	*Spacing*	*Measured IMD Level*	*Measured Input Level*	*IMD DR*
3.5 MHz/off	20 kHz	–129 dBm	–39 dBm	90 dB
		–97 dBm	–28 dBm	
14 MHz/off	20 kHz	–129 dBm	–36 dBm	93 dB
		–97 dBm	–28 dBm	
		–28 dBm	0 dBm	
14 MHz/on	20 kHz	–140 dBm	–47 dBm	93 dB
		–97 dBm	–33 dBm	
14 MHz/off	5 kHz	–129 dBm	–38 dBm	91 dB
		–97 dBm	–28 dBm	
		–22 dBm	0 dBm	
14 MHz/off	2 kHz	–129 dBm	–61 dBm	68 dB
		–97 dBm	–50 dBm	
		–10 dBm	0 dBm	
50 MHz/off	20 kHz	–129 dBm	–30 dBm	99 dB
		–97 dBm	–19 dBm	
50 MHz/on	20 kHz	–141 dBm	–47 dBm	94 dB
		–97 dBm	–28 dBm	

Manufacturer's Specifications	Measured in the ARRL Lab
Second-order intercept point: Not specified.	Preamp off/on: 14 MHz, +79/+73 dBm; 21 MHz, +77/+69 dBm; 50 MHz, +91/+73 dBm.
FM adjacent channel rejection: Not specified.	Preamp on, 29 MHz, 66 dB; 52 MHz, 65 dB.
FM intermodulation distortion dynamic range: Not specified.	Preamp on, 20 kHz spacing: 29 MHz, 66 dB*, 52 MHz, 65 dB*. 10 MHz spacing: 29 MHz, 129 dB, 52 MHz, 114 dB.
DSP noise reduction: Not specified.	10 dB, maximum.
Notch filter depth: Not specified.	>60 dB (tunable notch filter).
S-meter sensitivity: Not specified.	S-9 signal, preamp off/on 14 MHz, 138/32.3 µV; 50 MHz, 78.5/66.6 µV.
Receive processing delay time: Not specified.	At speaker, 12 ms.
IF/audio response: Not specified.	Range at –6 dB points (bandwidth):** CW (500 Hz): 345 – 860 Hz (515 Hz); Equivalent Rectangular BW: 509 Hz; USB (2.4 kHz): 272 – 2,680 Hz (2,408 Hz); LSB (2.4 kHz): 281 – 2,680 Hz (2,399 Hz); AM (6 kHz): 225 – 2,725 Hz (5,000 Hz).
IF rejection: Not specified.	14 MHz, 129 dB; 50 MHz, 96 dB.
Image rejection: Not specified.	14 MHz, 123 dB; 50 MHz, 123 dB*.
Transmitter	**Transmitter Dynamic Testing**
Power output: 100 W (40 W AM).	5 – 100 W (CW, SSB, FM); 5 – 40 W (AM). RF power output at minimum specified voltage: 76 W (HF), 73 W (50 MHz).
Spurious-signal and harmonic suppression: >50 dB (HF); >63 dB (50 MHz).	HF, typically ≥66 dB; 61 dB worst case (60 m). 50 MHz, 74 dB. Complies with FCC emission standards.
SSB carrier suppression: Not specified.	>70 dB.
Third-order intermodulation distortion (IMD): Not specified.	3rd/5th/7th/9th order, 100 W PEP: HF, –30/–39/–45/–49 dBc (typical); –26/–40/–45/–48 dBc (worst case, 17 m); 50 MHz, –22/–34/–38/–42 dBc.
Transmit bandwidth: Not specified.	Range at –6 dB points, 200 – 2,800 Hz (default).
CW keyer speed range: Not specified.	4 to 59 WPM, iambic modes A and B.
CW keying characteristics: Not specified.	See Figures 1 and 2.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S-9 signal, AGC fast: SSB, 37 ms; CW, 30 ms.
Receive-transmit turn-around time (tx delay): Not specified.	SSB, 49 ms; FM, 28 ms.
Composite transmitted noise: Not specified.	See Figure 3.

Size (height, width, depth, including protrusions): 2.2 × 6.4 × 10 inches. Weight, 4.7 lb.

Price: FT-891, $699; FH-2 keypad control, $91; FC-40 wire antenna tuner, $275; FC-50 coax antenna tuner, $324; YSK-891 separation kit, $74.

Second-order intercept points were determined using S-5 reference.

*Measurement was noise limited at the value indicated.
**Default values; bandwidth is adjustable via DSP settings.

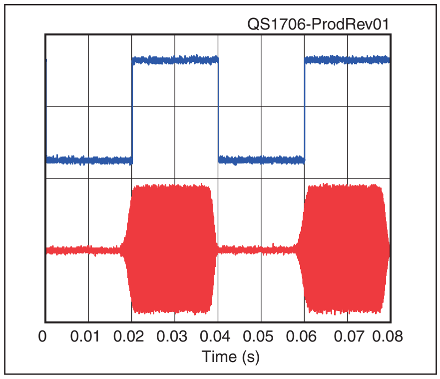

Figure 1 — CW keying waveform for the FT-891 showing the first two dits in full break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on the 14 MHz band.

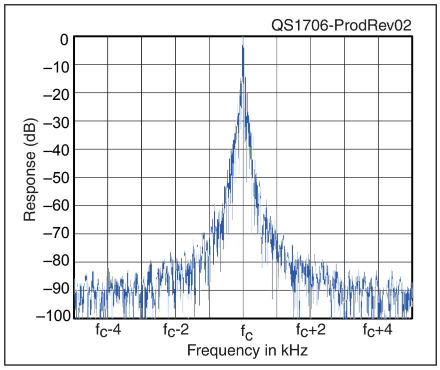

Figure 2 — Spectral display of the FT-891 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 s. The transmitter was being operated at 100 W PEP output on the 14 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

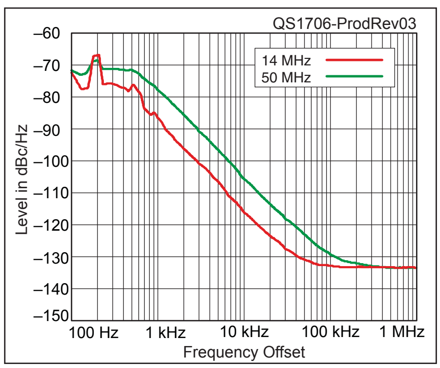

Figure 3 — Spectral display of the FT-891 transmitter output during phase-noise testing. Power output is 100 W on the 14 MHz band (red trace) and 50 MHz band (green trace). The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is –60 dBc/Hz, and the vertical scale is 10 dB per division.

will toggle to adjust the VFO B or secondary frequency at normal rates. This knob and button are also major players in the selection of functions and menu items, to be discussed later.

On the top of the front panel is a row of eight illuminated buttons that provide memory storage and retrieval, VFO A/B selection, BAND selection (a long press provides MODE selection), a FAST key for quicker tuning (but not as quick as the 500 kHz steps of the MULTIFUNCTION knob), and a POWER on/off and LOCK button. The FAST button is very handy for band segment changes. In SSB mode, for example, the very comfortable SSB tuning default rate of 2 kHz per turn (menu settable) jumps to 20 kHz per knob revolution in FAST mode — great for a quick look over the band, or to change segments.

The bottom of the front panel contains five more buttons. The left-hand F button is used to enter the FUNCTION mode. Repeated pressing of the button cycles through four screens with a total of about 28 function choices. One of the four screens is CW specific, while the others are general. In addition, using the menu, special screens for FM (five functions), recording and playback (eight functions), and ATAS antenna control (RAISE and LOWER buttons) can be included in the function selection process.

The FT-891 provides a lot of capability and many configuration and operational choices. A natural consequence is that many adjustments need to be made via menu and function key selection. A long press of the F key moves you into MENU mode, allowing the choice of no less than 184 menu items in 18 groups. Most, but not all, are set-and-forget items. There are so many because of the flexibility offered. Fortunately, they are all in plain English, although some abbreviations will take a look-up the first time.

The bottom right-hand CLAR button serves as receive-incremental tuning (RIT) by default, but it can be changed by a menu item to offset the transmit or transceive frequencies, if desired.

The three middle buttons are labeled A, B, and C. These come configured by default as IF SHIFT (SFT), SPECTRUM DISPLAY INITIATE (SCP), and NOISE BLANKER (NB). By a press of one of the buttons while in FUNCTION mode, the selected function will be set into place with whatever key is pressed. Fortunately, the function labels (as in the default items in parentheses above) appear above the key on the LCD display after assignment. This is a very useful capability. I gave up the SCP function in favor of the NAR function that selects the narrower receive bandwidth for each mode.

Behind the front panel is a SPEAKER/PHONES switch. This sets the level of the combined rear panel SPEAKER/PHONES jack (labeled SPKR) to avoid injury due to high audio levels while plugging in headphones. While we're here, the MIC connector is also behind the front panel on the main unit. The optional YSK-891 separation kit provides the cables and hardware to allow the front panel to be mounted separately from the main equipment chassis. This is particularly handy for mobile installations to allow the front panel to be dash mounted with the main radio body installed under the seat or in the trunk.

There are 99 regular memories, as well as nine pairs of scan range memories, and 10 memories preset for the five US 60-meter channels (five each for CW and SSB). To access the memories, you have to first push the V/M button to enter memory mode. Then you will be able to roll through the memories with the MULTIFUNCTION knob, and be able to transmit on the channels. There are also five one-push "quick memories," accessed by the dedicated QMB button.

Connections and Connectors

The rear panel has all the connectors, except for the eight-pin RJ-45 type MIC connector behind the front panel. The rear panel offers a GROUND terminal, a FIRMWARE UPDATE switch, an eight-pin DIN-type TUN/LIN connector for connecting a Yaesu or compatible antenna tuner, such as the FC-40 or 50, or a VL-1000 amplifier, and a USB jack for interconnection to a PC. The antenna connects to an SO-239 socket.

There are three 3.5-millimeter phone jacks. The first is a REM/ALC stereo jack for either the optional FH-2 keypad or ALC input from a linear amplifier. The next is another stereo jack, this one for CW keying. It can be menu set to use a hand key (or external keyer) or paddles for the internal electronic key. And finally a mono jack for speaker or phones, as set by the switch behind the front panel.

Scope Function

The FT-891 offers a spectrum scope function. The scope time-shares the single receiver, and while on, the soft A, B, and C buttons become scope specific. The display is centered on the receive frequency, and the span can be set to ±17.5, 35, 70, 175, or ±350 kHz using the SPN button.

I found that the scope could be used in a number of ways. In the default mode, it makes a single sweep each time the soft SWEEP (SWP) button is pressed — handy to check nearby signals during a lull in the conversation. A third soft button (LV1-LV3) gives three level options to compensate for different signal or noise levels and set the amplitude range of the display. You can change the transceive frequency while in this mode, and the center cursor will move as you tune. The next time you hit SWP, the display will re-center, so you can easily tune to a displayed signal. The top of the display shows the receive frequency as you tune.

The scope can be set to run continuously, with the receiver muted, by a longer push of the SWP button. This can be handy if you like to monitor a band for openings or pileups while working on something else. The occasional glance at the screen can tell you about the activity across the band, or in your chosen segment. In this mode, the cursor stays centered as you tune, so you quickly move to the center of activity, and a short push of the SWP button returns you to normal operation. While not quite as handy as a full-time independent display, this turned out to be a more useful feature than I expected.

Computer Functionality

The FT-891 supports PC connection options via a USB port. The Yaesu software download website includes a virtual COM port driver needed to use the USB connection. Instructions for installation of the drivers are in a separate manual, also available from the website. The manuals don't provide a lot of information about operating the FT-891 with a computer, except to note that unlike other radios in its family, it doesn't support audio interfacing with an internal sound-card function via the USB connection. A few interface (CAT) menu settings, such as data rate, are provided.

During Lab testing, we were able to successfully download a new firmware version. While an update to the *N1MM+* logging software (version 1.0.6033) that was released during the evaluation listed the FT-891 as a supported radio, it did not communicate at W1ZR for some reason. For those who want to modify or develop their own CAT software, another manual on their website, *FT-891 CAT Operation Reference Book*, provides the details of the command language. A separate DIN RTTY/DATA jack on the rear panel provides connectivity for digital modes.

On the Air at W1ZR

SSB Operation

I used the FT-891 to check into a local radio club net on 75-meter SSB, and then we moved to 40 meters. Reports were better after we moved to 40 meters, which had less noise and better propagation. The supplied microphone has a TONE switch on the rear that can select a FLAT (1) or EMPHASIZED (2) audio response. The consensus was that, for my voice, 1 was a better choice, with 2 sounding too bassy. I found the three-range transmit equalizer more effective in making me sound better on the air. It can be easily adjusted while listening to your audio with the MONITOR on, while using headphones to avoid feedback. The group agreed that using the parametric equalizer made a big difference.

I found that the VOX (voice-operated transmit switching) function worked quite smoothly. This is turned on via a function, with the gain, delay, and anti-vox set from a menu. The transmit gain and compression levels are also set using menu items. The Lab noticed that, as with many radios, if the gain or compression is set to drive the transmitter too hard, the distortion goes up quickly. I received solid reports by keeping the gain and compression levels such that the ALC meter stayed near the middle of the range and the peak power just touched a peak of 100 W on occasions.

Other Voice Modes

The FT-891 supports both AM and FM voice operation in addition to SSB. On AM, the transceiver can put out a carrier level of up to 40 W. AM operation seemed straightforward with good audio on both transmit and receive. FM operation is well supported, including a special function screen that allows setup of repeater offsets, CTCSS tones and DCS (digitally coded squelch) codes. For the first time, I actually was able to make a contact with someone using a 10-meter FM repeater — N2ACF/R located across the Hudson in Rockland County, New York. It seemed to work fine with good reports in both directions — thanks to Ray, K2NET, for being there.

It was easy to set the frequency, offset, and tones into memory. I found that repeaters with different offsets on the same band could not be stored in different memory channels — the last offset entered would apply to all memo-

Lab Notes: Yaesu FT-891 HF/6-Meter Mobile Transceiver

Bob Allison, WB1GCM, ARRL Laboratory Assistant Manager

The Yaesu FT-891 is most suitable for mobile, portable, and home station work, using simple antenna systems with low gain. In other words, it's not a high-performing contest transceiver. Its lowest receive dynamic range at 2 kHz spacing is 68 dB (third-order IMD DR). On the transmit side, the transmit phase is about the highest we've yet seen at the Lab. For this reason alone, I would be wary of pairing this transceiver with an RF amplifier. Users of the FT-891 must watch the ALC level when transmitting voice, because transmit IMD levels tend to get high if the ALC indicator reaches the top end of the scale. Keep it halfway or lower for SSB operation. The indicated ALC level should be minimal when using digital modes, the same as with all other transceivers. The transmitter does have excellent harmonic and spurious suppression, typically at or greater than 66 dB on the HF bands. This is always helpful during Field Day, or appreciated by your neighborhood radio amateur.

One other notable test result: When operating at the minimum specified voltage (11.7 V), the RF power output drops 25%. Though this power reduction will not make a big difference at the receiving end, it is something to keep in mind during battery-powered portable operation. I listened carefully using a test receiver and heard no audio distortion or frequency shifts while operating at the minimum specified voltage.

One operating observation: Filter bandwidth settings are not saved when switching bands. If 500 Hz CW bandwidth is assigned to a band and then the band is changed, then back to the original band, the CW bandwidth reverts to 2,400 Hz.

Overall, this is an easy radio to operate with its flexible menu. The frequency display is larger than most transceivers of its size — a good feature for mobile operation. The FT-891 hears well on 6 meters, too — a band where a low noise floor is helpful.

rized channels on that band. I had to set the offset per band to the standard value (the memory would store a plus or minus offset) and then use the split frequency (SPL) function to set up a repeater with an unusual offset.

CW Operation

The FT-891 was a joy to operate on CW. The built-in electronic keyer worked very well, offering speed selection by function selection from an indicated 4 to 60 words per minute. The key input can be function selected for use with a straight key (or external keyer) or paddles. The paddles can be operated in multiple keyer modes, or be used as a semi-auto (bug) emulation.

I usually operate in full break-in (QSK) mode, to allow hearing interfering signals while I transmit, and the break-in was smooth with just a mildly audible relay sound — well below the monitor level that I used. The relays were not audible to me at all while using headphones. Semi break-in is also provided with a "hang" delay menu adjustable from 30 ms to 3 s. The lower values acted about like full break-in at my keying speeds. The dot/dash weight and waveform rise time are also menu settable between 2 and 4 ms. The spectrum test data was taken with the 4 ms setting, and I would not suggest going for a quicker rise time. A slower rise time would likely improve the bandwidth of the transmitted keying sidebands.

The CW keyer includes five memories, each of up to 50 characters, that can be used in regular or contest mode, with automatically sequenced numbers. The memories can be stored or accessed either through function keys or by using the optional FH-2 keypad. The keypad offers the advantage that the main display, including frequency and functional indicators, can be observed while keying.

I found the rig to be a good performer on CW. My first CW contact happened as I was listening around and heard an old friend, Tony Berg, W1OT, now in Williamsburg, Virginia. I worked with Tony during my first (1969) engineering job in Massachusetts, while Tony managed an HF receiver systems engineering group. He knows his stuff, and he thought my signal sounded as good as with my usual radio.

For my operating preferences on CW, I adjusted the wide bandwidth from its default of 2,400 to 1,200 Hz, set the narrow (NAR) function into button B (instead of the default spectrum display), and set the narrow bandwidth to 250 Hz. These bandwidth settings can be made separately for each mode.

Antenna Tuner Options

The FT-891 does not include a built-in antenna tuner. This won't be a problem for operators who have resonant antennas. In my experience, many antennas (including most HF mobile antennas) have limited bandwidth, and a tuner can be a real plus. The FT-891 does have a jack designed for connection to one of Yaesu's two available auto tuners, either the FC-40 wire antenna tuner, or the FC-50 coax antenna tuner. The jack can also be menu configured to interface with a linear amplifier, or raise and lower their ATAS mobile antenna.

I am sure that the '891 will work seamlessly with one of their auto tuners, or perhaps with a compatible aftermarket unit. Unfortunately, I had a manual-tuned tuner at hand. In order to tune to a new frequency, I had to go to a menu to set the power output to 10 W, then use a function key to change the meter to standing-wave ratio (SWR), change the key to straight key, key the transmitter, and adjust the tuner for minimum SWR. Then remember to go back and reset everything and hope the station I was going to call was still there. I propose that Yaesu consider another option in their TUNER SELECT menu — how about a choice of EXTERNAL? Then, with a single push of the TUN function, all of those actions could occur, with normal operation returning with another push. Fortunately, during the testing, W1ZR added a high-power auto tuner that could tune while 100 W was applied — problem solved — although perhaps not the least expensive solution!

Documentation

Our FT-891 came with a 58-page *Operating Manual* that includes a reference to an *FT-891 Advance Manual*, available for download on their website. You might think that the *Advance Manual* is something to look at only if you are interested in doing some advanced functionality, but it is much more.

While the *Operating Manual* includes a description of every control, along with a short description of the choices, it takes the 113-page *Advance Manual* to find details of what each of the choices means, along with step-by-step instructions for each function, including links to the applicable menu choices.

With a total of 184 menu items in 18 groups, 28 standard functions on three pages, plus extra pages that can be enabled for CW and FM function choices — you really need to look at both volumes to know how to use this radio to its full capability. Once I downloaded the *Advance Manual*, I found the pair of manuals complete, well written, and easy to follow.

Manufacturer: Yaesu USA, 6125 Phyllis Dr., Cypress, CA 90630; Tel. 714-827-7600; **www.yaesu.com**.

Visit https://youtu.be/G_4qi-JeX1Q to see our review of the Yaesu FT-891 HF and 6-meter transceiver on YouTube.

Exciting New Yaesu Field Gear

HF/50 MHz 100 W All Mode Transceiver

FT-891

Actual Size

An Innovative Multi-band, Multi-mode Transceiver within an Ultra Compact Body

- Rugged construction in a Compact Mobile Package (6.1”W x 2.0”H x 8.6”D)
- Stable 100 Watts of RF Power Output with efficient Dual Internal Fans
- Legendary Yaesu Receiver Performance
- Triple conversion receiver with a 1st IF frequency of 69.450 MHz
- 3 kHz Roofing Filter (equipped as standard)
- Detachable Front Panel permits convenient mounting and operation
- Large dot matrix LCD display with Rapid Spectrum Scope
- Enhanced Operating Features:
  - Large diameter Main Tuning Dial (1.6”) with Torque adjustment
  - Pop-up Menus for quick and easy operation
  - Large Transmit/Receive indicator
  - Three Programmable Front Panel Function Keys
- Especially designed FC-50 External Antenna Tuner (option)

YAESU The radio

YAESU USA
6125 Phyllis Drive, Cypress,
CA 90630 (714) 827-7600

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Apache Labs PiHPSDR Controller for ANAN SDRs

Reviewed by Dr. Terry G. Glagowski, W1TR
w1tr@arrl.net

The Apache Labs PiHPSDR Controller is a standalone controller for their ANAN series software-defined (SDR) transceivers.[2] It replaces a traditional desktop or laptop PC running *PowerSDR/OpenHPSDR* software and is connected to the ANAN unit via ethernet. The PiHPSDR controller is in fact a kind of PC, but it uses a Raspberry Pi 3 Model B single-board computer. The operating system is *Raspbian*, a dialect of *Debian* and *Linux*.

The controller is similar in concept to the FlexRadio Systems Maestro Control Console for the FLEX-6000 series transceivers, but simpler and less costly.[3] It was developed by John Melton, G0ORX/N6LYT; Kjell Karlsen, LA2NI, and others. It began with a prototype and hardware kit and has become a product sold by Apache Labs. (It's also available in kit form from Apache Labs.)

Experimenters have made versions of this unit, some with custom hardware and software extensions. The source code is open source and can be downloaded from **github.com/g0orx/pihpsdr** and **github.com/g0orx/wdsp**. Experimenters are welcomed and invited to submit enhancements to the software.

PiHPSDR Controller Overview

The unit tested is serial number PiHPSDR0016. The software delivered with the unit was version 1.0.0, but I upgraded to version 1.0.7, version 1.1.0, and version 1.1.1 after initial testing. I used the controller with an Apache Labs ANAN-100D running firmware version 5.7. Comparisons were made against *PowerSDR/OpenHPSDR* version 3.3.6 running on a *Windows* PC and using a Hercules DJ LE MIDI controller to provide knobs, sliders, and buttons as controls for that application. Both the PiHPSDR controller and the PC were connected to the ANAN-100D via an ethernet switch.

The PiHPSDR unit (see Figures 4 and 5) is approximately 10 inches wide, 6 inches tall, and 2 inches thick, not including the knobs or fold-out stand that allows it to sit at a convenient 30° angle from vertical. Weight is about 4 pounds. Controls include a 1½-inch diameter VFO tuning knob, three ½-inch knobs each with a pushbutton, eight pushbuttons, and a power switch. The display is a 6¼ × 3½ inch color LCD touchscreen, with a resolution of 800 × 480 pixels (the standard Raspberry Pi display that comes with popular kits). Knobs are made from solid aluminum and have a very good feel.

The Raspberry Pi 3B CPU uses a 64-bit quad-core Broadcom processor, 1 GB RAM, and a 16 GB SDHC memory card instead of a traditional hard drive or solid-state drive. Peripherals include an RJ-45 ethernet port, four USB 2.0 ports, and GPIO (general purpose input-output) connections to the knobs (encoders) and pushbuttons. An HDMI port and audio output jack are inaccessible with the case assembled, but they could be used if modifications were made to the case.

The installed software consists of the

Bottom Line

Control your Apache Labs ANAN series SDR transceiver without a desktop or laptop computer.

Figure 4 — Front view of the PiHPSDR Controller. Note that a small dongle for a wireless mouse and keyboard has been inserted in one of the USB ports. A C3-Media USB audio interface was later inserted for testing of USB audio input and output.

Figure 5 — There is a folding stand in the back so that the unit will be self-supporting at about 30 degrees from vertical.

Raspbian operating system, the *PiHPSDR* software, a web browser, *Libre Office*, *Real VNC* remote access, and software development tools that can be used to make modifications to the software. *PiHPSDR* is an adaptation of the *PowerSDR*/*OpenHPSDR* software to the Raspberry Pi hardware and *Raspbian* OS. If you would like to run the program on a *Linux* system, the source, binaries, and documentation are available from **g0orx.blogspot.com**.

Setup

Setup is very easy and can probably be done without reading the documentation and simply following your nose. Documentation is available from **apache-labs.com/instant-downloads.html**. The *User Guide* is particularly relevant.

The shipping container includes only the fully assembled PiHPSDR controller and a coaxial power pigtail, which is about 3 feet long. I attached Anderson Powerpole connectors and made a 6-foot extension, so it would reach my RIGrunner power distribution panel. The unit needs 12 V dc at 2.5 A, so your station power supply should be adequate.

The PiHPSDR controller must also be connected to the Apache Labs ANAN transceiver with a CAT5/CAT6 ethernet cable (not provided) via the RJ-45 connector. Shielded cable is preferable, although I am not using it. When I connected the PiHPSDR controller directly to the ANAN-100D, initially it took quite a number of Discovery screen retries to identify the 100D, but it eventually worked.

Alternatively, you can connect a local gigabit ethernet switch to your ANAN transceiver, the PiHPSDR controller, and your personal computer (running the full *PowerSDR/OpenHPSDR* software and other applications). The uplink from the ethernet switch should be connected to your home router and then to your broadband modem for access to the internet. This will assure maximum network performance between the controller and the ANAN transceiver (see Figure 6).

When both the PiHPSDR Controller and PC are connected to the ANAN 100D through an ethernet switch, it is possible to have the *PowerSDR* application running but with the POWER button in OFF mode while *PiHPSDR* is running without a conflict. This makes it convenient for a quick A/B comparison test.

As noted before, I upgraded the *PiHPSDR* software in several stages to version 1.1.1 beta. Improvements to version 1.0.0 include: improved main menu, independent TX and RX equalizer, transverter features, FM mode, dual receivers and VFOs, direct frequency entry, memory channels, independent TX and RX filter settings, and customizable TX and RX filters with adjustable upper cut and lower cut frequencies. The latest software updates

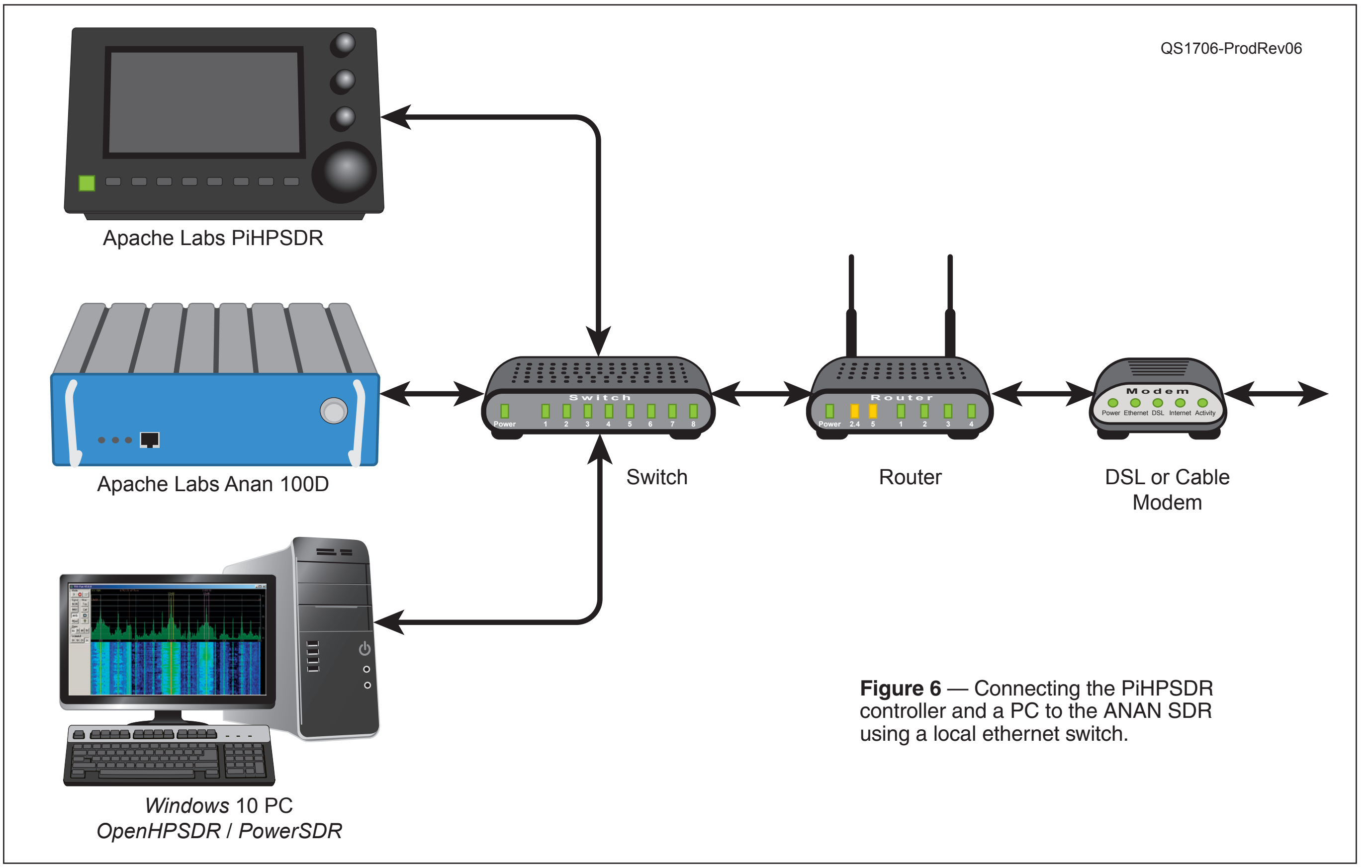


Figure 6 — Connecting the PiHPSDR controller and a PC to the ANAN SDR using a local ethernet switch.

and instructions can be found at **github.com/g0orx/pihpsdr/**.

After initial testing, I added a dongle for a wireless keyboard and mouse, added a USB audio dongle for direct microphone and headphone audio, and enabled *RealVNC* so I could capture screenshots.

Operation

The PiHPSDR controller has just the right features and controls for a small controller to replace an entire PC. *PiHPSDR* version 1.1.1 beta has many of the features of *PowerSDR/OpenHPSDR* on a *Windows* PC. The author is working to close the gap, but the smaller screen of the PiHPSDR controller has a fundamental constraint compared to a large, high-resolution computer monitor. Features not yet implemented include squelch, transmit voice monitor, speech compressor, downward expander, pan and zoom on the panadapter/waterfall display, virtual audio channel, and Pure Signal (a feature that improves transmitter IMD).

To get started, simply perform the following steps:

- With the PiHPSDR controller connected to the ANAN transceiver by ethernet and the power cable connected to a 12 V dc supply, press the power button (ON).
- *Raspbian* will boot up and *PiHPSDR* software will autostart. The Discovery form will appear.
- Select DISCOVER OK for the controller to find the transceiver. It may take more than one retry.
- The *PiHPSDR* GUI (graphical user interface) will appear.

Figures 7 and 8 show the *PiHPSDR* display. Along the top of the screen are VFO frequency, many transceiver settings, meter, and a fixed menu with two buttons — HIDE and MENU. Clicking MENU displays the Main Menu with buttons to enable all other menus. Clicking HIDE minimizes the *PiHPSDR* GUI and shows the *Raspbian* desktop, but *PiHPSDR* will continue to operate.

The display also shows a frequency grid and spectrum panadapter/waterfall (panafall) for each receiver. The slider controls and menu toolbar are below the waterfall display. The toolbar and controls can be customized using the "Display" option in the Main Menu.

Frequency Display and Tuning

The frequency display shows a gridline of frequency (horizontal) and amplitude (vertical). The panadapter shows signals that are within frequency range of the panadapter. The waterfall shows the amplitude versus frequency by color and moves downward in time, making it easy to detect weak signals. The receive filter is a semi-transparent, vertical rectangle showing what will be received. The virtual carrier frequency is a vertical red line indicating the frequency.

Tuning is accomplished by using a finger on the touchscreen, using the mouse, or turning the VFO knob. Select the frequency by sliding your finger horizontally on the panafall display. Holding the left mouse button down is equivalent to pressing your finger on the touchscreen. Fine tuning can be accomplished by rolling a finger on the touchscreen or dragging the panadapter/waterfall slowly with a mouse. Precise tuning can be accomplished by adjusting the VFO knob or using the mouse thumbwheel.

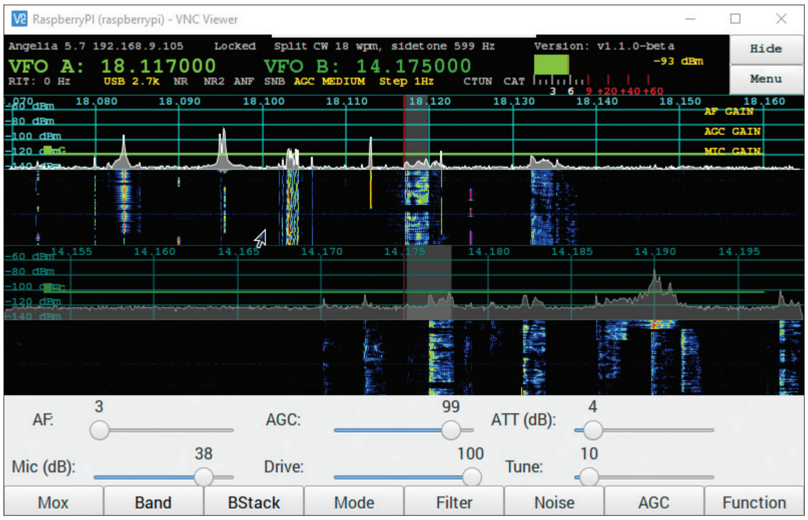


Figure 7 — Starting with *PiHPSDR* version 1.1.0, dual receivers are available if the ANAN radio supports them. The RADIO menu within the Main Menu controls whether one or two receivers are available.

Figure 8 — During transmit, the panadapter shows the spectrum of the transmitted signal.

There are two different tuning modes. With CTUN off, the filter window is fixed — always centered in the display. Tuning is accomplished by sliding the frequency display until the signal is in the filter window. With CTUN on, the frequency display is fixed. Tuning is accomplished by sliding the filter window to enclose the signal. It can also be accomplished by clicking on the virtual carrier frequency, or the signal itself for CW.

Set the virtual carrier (the red line in the display) to the high edge of an LSB signal, low edge of a USB signal, and center of an AM, DSB, or FM signal. Set the filter window center to enclose a CW, PSK, or RTTY signal while the virtual carrier may be somewhere else depending on the sidetone frequency.

Adjustments and Menus

Adjust the AF gain, AGC threshold (similar to RF gain), attenuator (ATT), mode, filter, noise, and AGC parameters using the buttons. This can be done by moving the slider controls using a finger on the touchscreen, using the mouse or the knobs assigned to the appropriate function. Use of the NOISE and FILTER options can improve reception under difficult conditions. Both the noise blanker and the noise reduction worked very well.

Menus are available to configure knob functions, AGC gain and hang delay, antenna switching, band, band stack, mode, transmit and receive filters, equalization, audio input and output device, DSP and noise reduction parameters, CW options, display options, direct frequency entry, memory channels, meter options, open collector outputs for external equipment control per band, power amplifier gain, selection of one or two receivers, SDR sample rate, BPF filter control, tuning step size for VFO and RIT, VOX gain and delay, and transverter control.

Operating Experience

After connecting the PiHPSDR controller, I turned it on and tuned to 20 meters. In my excitement, I didn't bother to read the manual because I was a veteran of using *PowerSDR* on my PC. I found that using the touchscreen was a bit different than the mouse, but I soon learned how to tune the radio using the methods described above. I noticed that the VFO dial worked backward compared to what I was used to, which is clockwise increases the frequency and counterclockwise decreases the frequency. On the Apache Labs blog, I found information that would allow me to change this in the GPIO configuration.

Initially, the tuning steps were set for 100 Hz — too coarse, so I changed that to 1 Hz. Now the VFO took too many revolutions to move the frequency, so I changed the VFO encoder divisor to 1 instead of the default 24. Now tuning with the VFO was similar to other transceivers and the Hercules DJ LE controller that I use with my PC and *PowerSDR*. The finger action on sliding and rolling was also much more smooth and satisfying. For fast frequency excursions, setting the tuning step to 100 Hz or 1 kHz does the job. A means of clicking the screen for 1 kHz or 1 MHz steps would be useful, along the lines of the TS (tuning step) function on other radios.

After listening a while to get acquainted with the interface and touchscreen operation, I made a contact on 20 meters. The party at the other end said that the audio was excellent but a little bassy. I went looking for the equalizer, and found that version 1.0.0 of the software did not have an equalizer. I then switched control over to *PowerSDR* on my PC, where I had the bass cut back a bit and the treble enhanced, and the other party said it sounded better. Later, I found that v1.0.7 of the *PiHPSDR* software added an equalizer function, and I could make my audio sound about the same with either the controller or the PC and *PowerSDR* in an A/B test. With the equalizer properly adjusted, I went on to make a few more SSB contacts on 160, 80, and 40 meters. I was impressed, and so were the parties on the other end of the contact.

After experimenting, I discovered that the receive filter bandwidth also affected the transmit filter bandwidth, which may not be desirable. Hopefully this will be changed in future software releases.

Next, I went to 75-meter AM to see what the PiHPSDR controller sounded like there. I found a roundtable of regulars on 3,885 kHz and broke in. I had the filter set to 5 kHz, so I gave them a full-blown broadcast quality AM signal. They also mentioned the bassiness, which was corrected with the newer software version, but I was complimented on the audio, anyway.

I then went to 160-meter CW on 1,830 kHz and worked a station in New Jersey. There is propagation from northeastern Connecticut to New Jersey at any time of day, but this was about 9 PM local time, and we were both loud and clear to each other. The CW filtering was very smooth, and even at the 25 Hz bandwidth there was no ringing. Using a Bencher iambic paddle, I was able to send without effort and without errors (I am used to a Hamcrafters Winkeyer3 USB).

Finally, I listened in the digital portion of the 20-meter band and was able to decode PSK signals. However, the AF gain control affected the color intensity of the PSK waterfall, which isn't the case with *PowerSDR* and *Fldigi*. I hope that newer versions of the software will change this. It would be really nice to be able to decode RTTY signals as well, and I imagine that some operators would like CW decode, too. It would be nice to use the keyboard to transmit PSK, RTTY, and CW. Once again, those are ideas for future software releases.

I plugged a C-Media USB audio interface into one of the USB jacks. This has stereo headphone output and mono microphone input. I was able to receive audio in a computer boom microphone headset, but not able to get audio from the microphone to the controller, so there must be some configuration setting that I am missing.

Contest Operation

The PiHPSDR controller has many fewer controls than a conventional transceiver or even the Hercules DJ LE MIDI controller used with *PowerSDR*, but it has a sufficient number for contest operation and a good display, so a separate PC is not required. A major drawback is that, currently, there is no provision for computer (CAT) control of the PiHPSDR controller, which is essential to contesters using software such as *N1MM+* logger. I expect this feature to be included in a future release.

The panafall display provides valuable information regarding what is happening on the band, and it is invaluable in locating activity on a band with few signals, such as 10 or 6 meters or VHF/UHF (with a transverter). On microwave frequencies, where the frequency calibration is less accurate, the panadapter can help find a signal that is faint and off frequency. The emission mode can usually be discerned by the shape of the waveform. Open spots for calling CQ can be found by noting the absence or weakness of signals on the panadapter.

An issue with some SDR transceivers is the latency between signal arriving at the antenna and sounding in the speakers or headphones. Likewise, there is a latency between voice into the microphone and out to the antenna. (CW transmit is implemented in the FPGA firmware rather than the *PiHPSDR* or *PowerSDR* software, so there is no latency in that case.) I used my IC-7000 for comparison and noticed some latency on the received signal in the ANAN-100D controlled by either the *PiHPSDR* or *PowerSDR* software, but signal processing time should be adequate for all but the most demanding operators. I read a blog article discussing enhanced software for the 100D that brings the latency down to 15 ms. Advances are being made in SDR hardware technology that will improve this situation as time progresses.

Final Thoughts

The functionality of the *PowerSDR* software on the PC is still much greater than the PiHPSDR controller, but the gap is expected to close. A new software release seems to be available every month or so. Eventually, nearly all the features of *OpenHPSDR* are expected to be available.

Whether the hardware will also advance is an open question. I could visualize a PiHPSDR controller version 2 with two vertical rows of three concentric knob controls, making a total of 12 controls. That should be a sufficient number of knobs, unless you feel the need for one of the high-end contest radios. The developer indicates that there is insufficient GPIO capability at the moment, but an additional chip in the circuit board would alleviate that.

The Apache Labs PiHPSDR Controller frees you from having to use a *Windows* PC with your Apache Labs ANAN transceiver. It gives an operating experience that is closer to a traditional transceiver with knobs, buttons, meters, and displays, which many operators are used to. *PiHPSDR* software and hardware are open source and open hardware design, which allows experimenters to make their own controllers based on the popular Raspberry Pi 3B kits that are commonly available. A longer version of this review may be found on **www.arrl.org/qst-in-depth**.

Manufacturer: Apache Labs Pvt. Ltd., Haryana, India; e-mail **support@apache-labs.com**; **apache-labs.com**. Available from several US dealers. Price: $599.

Notes

[2]M. Ewing, AA6E, "Apache Labs ANAN-100D SDR HF/6 Meter Transceiver," Product Review, *QST*, Oct. 2015, pp. 45 – 52.

[3]M. Ewing, AA6E, "FlexRadio Systems Maestro Control Console," Product Review, *QST*, Nov. 2016, pp. 54 – 58.

Micro-Node International Nano-AE AllStar Nano-Node

Reviewed by Jim MacKenzie, VE5EIS
jim@photojim.ca

Radio amateurs have been linking VHF and UHF systems together for almost as long as they've been using frequencies on these bands. The relative expense of doing this via radio links and the increasing ubiquity of the internet have resulted in the development of computer-based linking of services, beginning with IRLP in the early 1990s and later, EchoLink and AllStar.

Bottom Line

The Micro-Node Nano-AE is a nearly plug-and-play AllStar solution that works equally well at home, in the field, or on the road.

Portable and easy-to-deploy solutions to use these services have given radio hams a fun, flexible way to use their VHF/UHF transceivers to get on the air with distant stations. Micro-Node International has been a leader in developing compact computer-radio combinations, or *nodes*, to get connected to these services. The company

Figure 9 — The Nano-AE AllStar node. The antenna is visible on the left; on the right is a USB flash drive for backups, along with the wired ethernet connection.

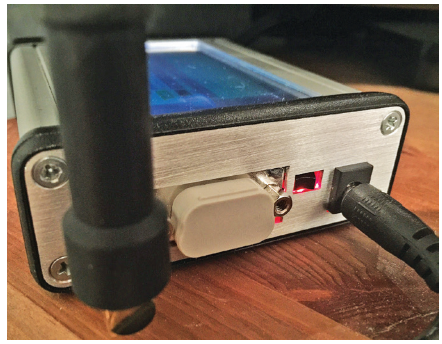


Figure 10 — The antenna connection (left), DE-9 port for an external radio (center), and power connection (right).

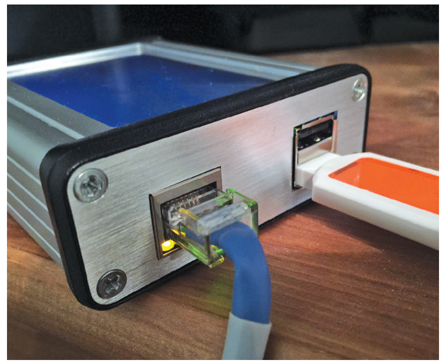


Figure 11 — The wired ethernet networking port (left) and a pair of USB 2.0 ports (right). I have a flash drive inserted into one USB port, where I can store backups.

started with its IRLP solutions, including their IRLP Nano-Node, which I reviewed in the August 2015 issue of *QST*.[4] More recently, Micro-Node added the Nano-AE AllStar node. Let's have a look.

In the Box

The node is a sleek aluminum box, 3.75 × 3.25 × 1.25 inches, with a roughly 4-inch-diagonal touchscreen taking up most of the top of the case (see Figure 9). On one end is a standard SMA female jack (as found on most modern handheld VHF/UHF radios), for the built-in 20 mW transceiver for the 70-centimeter band, as well as a DE-9 port for connection to an external radio (see Figure 10). Micro-Node will supply you one of two cables that fit a number of common radios, or you can fashion your own. On the other end (see Figure 11) are two USB ports (for a keyboard, USB storage, or a Wi-Fi adapter — Wi-Fi is not included but is easily added), and an RJ45 jack for 100BaseTX (100 megabit-per-second) ethernet networking. The included ac power supply feeds the node's lead cable via a standard USB port, so you can power your node from USB if you wish — handy for portable or mobile use. A small, stubby antenna is included, and you can easily build or purchase a higher-gain antenna if you want to extend your range. The node also comes with a small plastic stylus that can make it easier to use the touchscreen interface.

My node came with a multi-page, detailed manual, but you can download the manual from Micro-Node International's website. In fact, I'd recommend that you check the website before proceeding too far — an updated manual was already posted online by the time I started using the node in earnest. The website also details any available software updates, which you should install if needed to keep your node running the most recent release of the software.

Like the IRLP Nano-Node, the Nano-AE AllStar node uses the Raspberry Pi platform for its computing power. These boards are inexpensive but flexible. Having run my IRLP Nano-Node for almost 2 years now, as well as other Raspberry Pi computers for some computer networking projects, I've found the Raspberry Pi to be a reliable base for such projects.

Setup

While the IRLP node must be configured on the touchscreen, this AllStar node can be configured with the touchscreen or a desktop computer, using a VNC (virtual network computing) client, such as *TightVNC*. The Nano-AE uses a true graphical user interface desktop on its small screen, so its windows and menus will feel familiar to users of *Windows*, *Mac OS X*, and *Linux* alike. It is also possible to connect a Bluetooth or wired keyboard if you prefer to avoid the device's built-in virtual keyboard, which makes configuring and deploying the node quite a bit easier than the IRLP version.

One other nice improvement over the

[4]J. MacKenzie, VE5EIS, "Micro-Node International IRLP/EchoLink Nano-Node," Product Review, Aug. 2015, *QST*, pp. 54 – 56.

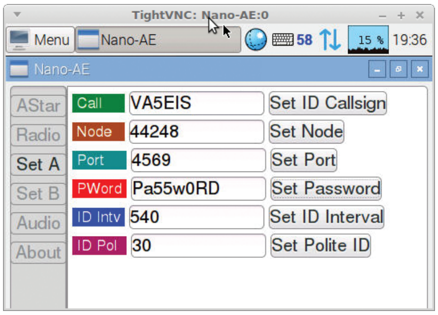


Figure 12 — The AllStar configuration screen. Normally, you will only need to enter your call sign, node number, and password. (I suggest a much more secure password than this one!)

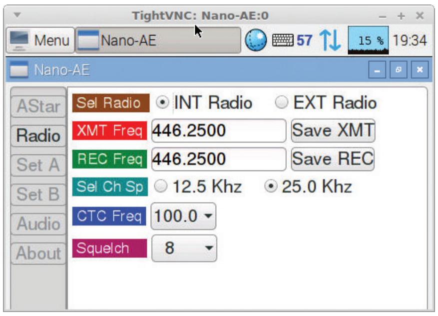


Figure 13 — The radio configuration screen.

AllStar Explained

AllStar is one of several ways to link repeaters, simplex nodes, and networks together using the internet. In this way it is similar to IRLP (the Internet Radio Linking Project) and EchoLink. Additionally, some digital radio systems, such as D-STAR, C4FM (System Fusion), and DMR (digital mobile radio), have similar functionality. Internet linking is really convenient because sites that can't easily be connected via RF links are easily connected using computer networking.

AllStar has some uniqueness that makes it quite distinct from the others. Underneath its lid, AllStar uses *Asterisk*, a *Linux*-based telephony software package that was originally developed for VoIP (voice over internet protocol) telephone calls. To *Asterisk*, nodes (individual repeater or simplex sites that are connected to the AllStar network) are like telephones. When a node calls another, it's very much like making a telephone call using the internet. One of the great consequences of this is that as *Asterisk* is developed, AllStar gains the same extra capabilities and improvements.

Another really interesting consequence of this telephone-network foundation is that you can use actual telephones as part of the service. Using a special code that you receive when you register for AllStar, you can call one of several telephone numbers around the world (for example, 763-230-0000 in the US or Canada) to link to individual AllStar sites, called *nodes*, or sites that facilitate the connection of many nodes together, called *hubs*. While I prefer using these networks with actual radio gear, the ability to literally phone home and talk to someone on your AllStar repeater or node at home is pretty powerful.

Similarly, you can hook up your own hardware that interfaces with *Asterisk* and lets you use a telephone plugged into the hardware to call out to other AllStar sites. I have yet to try this, but I can guarantee you I will — the idea is too fascinating for me to ignore.

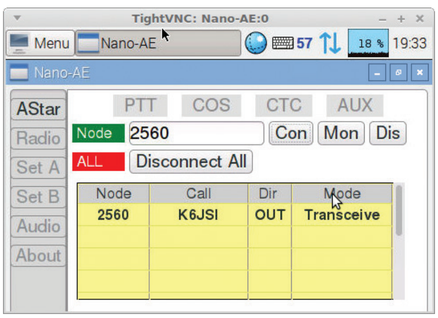


Figure 14 — The main operating screen, showing an active connection to AllStar hub 2560. The node is in "transceive" mode, which means that I will both hear the hub and be able to transmit into it using a radio locally.

IRLP version is the use of DHCP (dynamic host configuration protocol) to set your node's IP (internet protocol) address. This makes using the node on different network connections considerably easier, as reconfiguration isn't required as you move your node from home to car to cottage to hotel to hamfest. Wi-Fi network configuration and passphrases can be entered on the touchscreen, or via the VNC connection on your laptop or desktop.

If you haven't already done so, to configure the Nano-AE, you will need to go to AllStar's website at **www.allstarlink.org** and apply for an account. Once your account is approved, you can go to the REQUEST NODE tab and apply for a node number. You'll need to have chosen the frequency and CTCSS tone for your node when you register it, so decide this in advance. Your node number will be a five-digit number starting with 4. Program this into the configuration screen (see Figure 12), and configure the radio as needed (see Figure 13). Unlike IRLP, AllStar doesn't need to have networking ports forwarded, so at this point, you should be ready to go. (This will make your later portable or mobile operation much simpler, too!)

Using AllStar is similar to using IRLP and EchoLink in most ways, and if you're not familiar with it, see the sidebar, "AllStar Explained." You can enable the "parrot" mode to test your audio, and if all sounds good, go ahead and dial up an AllStar node and make a contact! (I did most of my testing on the Win System, which is a mostly western-US-based system of connected repeaters and nodes. One of its hubs is AllStar node 2560.) Figure 14 shows the main operating screen.

Portable Usage

Like the IRLP node, one of the best aspects of this device is its portability. Its small size makes it easy to take anywhere. (My IRLP version has accompanied me to the UK, France, Minneapolis, Chicago, Toronto, Ottawa, and other cities, as well as the July International Hamfest on the Manitoba-North Dakota border.) Voice-based services, such as AllStar and IRLP, use very little data, so even cellular connections provide plenty of bandwidth for the node. Any cellular connection that's 3G or faster will be enough. Modern LTE connections, while desirable, are not necessary.

As mentioned earlier, the power supplies that Micro-Node now furnishes with these nodes and other similar products are really USB power supplies, so you can detach the lead and plug it directly into a USB port for power in your car or hotel.

Customization and Security

At the heart of it, the Nano-AE AllStar node is a *Raspbian Linux* computer. One of my few criticisms of the IRLP Nano-Node was that it is a closed system — you are not given access to the so-called bare metal to customize it and secure it. The Nano-AE, by comparison, is an open ecosystem. On request, you can get the root password that will let you fully customize the node. I would strongly recommend that you do this, and, if you're not already familiar with *Linux*, that you get a *Linux*-savvy friend to help you secure and update the node. (My suggestions: change the root password, change the username and password for the *Allmon* web client that lets you control connections through a web browser, and update the system to install security updates.) Be sure that you back up the system to your own inexpensive 8 GB USB flash drive so that you can restore the system if you accidentally break things. I appreciate that Micro-Node has given users the ability to do this.

While I didn't try it, it is possible to install EchoLink on AllStar nodes. As always, make a backup first. This could be a very convenient dual-purpose system to use during travel.

As a side comment, I've found telephone and e-mail support from Micro-Node to be very good. I'd definitely recommend contacting the company if you have any difficulties.

Final Thoughts

I was pleased with this node. It's quite simple to use, and I'm already sold on the portability and convenience of the node given my experiences with its IRLP predecessor. If you're looking for a nearly plug-and-play AllStar solution in your shack, in the field, or on the road, the Nano-AE will serve you well.

Manufacturer: Micro-Node International, Henderson, Nevada; **www.micro-node.com**. Price: $495; Wi-Fi option, $30; GPS/APRS option, $125; radio interface cable (for use with an external high-power radio), $40.

Efactor Dual-Band 144/432 MHz Antenna

Reviewed by Steve Ford, WB8IMY
QST *Editor*
wb8imy@arrl.org

If you're exploring so-called "weak signal" SSB, digital, or CW operating on 2 meters and 70 centimeters, a directional gain antenna, such as a Yagi, is almost always best. However, directional antennas are not always practical. Even a long-boom 432 MHz Yagi can take up a fair amount of room. Directional antennas must also be rotated, unless you're only interested in working stations along a single point on the compass.

The alternative is an *omnidirectional* antenna that radiates in all directions (more or less) at the same time. The result is lower gain in a particular direction compared to a Yagi, of course, but the benefit is a compact antenna that doesn't require a rotator. You simply attach the antenna to a mast, connect a feed line, and you're on the air.

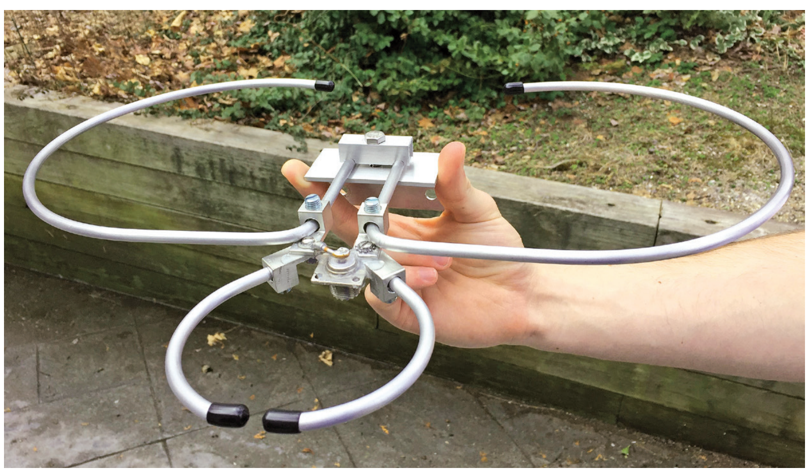
The Efactor Dual-Band Solution

Most VHF/UHF transceivers these days are multiband models, so the convenient antenna solution is one that makes two or more bands available on a single feed line. Otherwise, you're faced with having to run several feed lines to your antennas, or use an antenna switching scheme.

The Efactor Dual-Band 144/432 MHz omnidirectional antenna offers two bands in a horizontally polarized design, so you need only install a single, low-loss feed line. Dual-band VHF/UHF antennas can be tricky to

Bottom Line

Compact and lightweight, the Efactor Dual-Band 144/432 MHz antenna offers an intriguing horizontally polarized solution for 144 and 432 MHz SSB, CW, or digital operation from home, portable, or mobile stations.



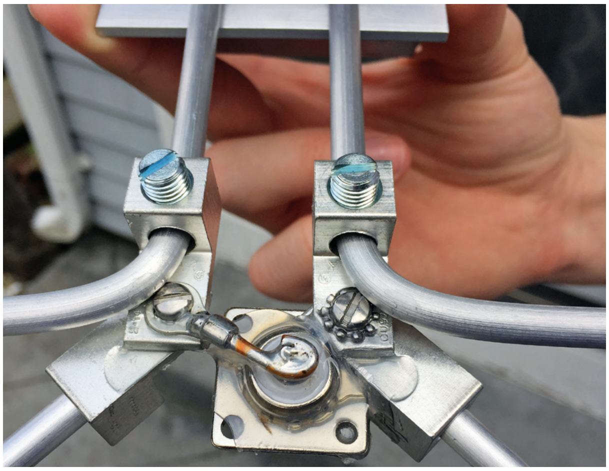


Figure 15 — A close-up of the feed point shows the excellent workmanship.

construct; the feed point must present something close to a 50 Ω impedance on both bands to ensure an acceptable SWR. The Efactor Dual-Band antenna achieves this with an elegantly designed single-feed arrangement (see Figure 15). Efactor rates the antenna for up to 500 W. A single-band 144 MHz version is also available for those who don't need dual-band capability.

With the antenna atop a 10-foot mast, I measured an SWR of 1.2:1 at 144 MHz, rising to 2:1 at 146 MHz. Because 2-meter weak-signal operating takes place below 145 MHz, this is ideal. At the weak-signal watering hole on the 70-centimeter band around 432 MHz, the antenna presented an SWR of 1.3:1. It is worth noting that the SWR remained below 1.6:1 across the rest of the 70-centimeter band.

As you can see in the lead photo, the Efactor Dual-Band antenna is highly compact. With the two dipoles curling into semicircular profiles, the antenna is only about 17 × 13 inches. It is built from 6061 aluminum tubing and stainless steel for weather-resistant durability. You could use the antenna in a home, portable, or even mobile station.

On the Air

The Efactor Dual-Band antenna is so small and lightweight, you can toss it into the back seat of your car, along with a few PVC mast sections, and hit the road for some portable operating — which was exactly what I did. I don't own a tower, so my substitute was a nearby hilltop. The antenna was on the air in minutes, and the performance was impressive.

Using my Kenwood TS-2000 transceiver (100 W on 2 meters and 50 W on 70 centimeters), I made a number of 2-meter SSB contacts over distances of more than 100 miles and also eavesdropped on a 70-centimeter SSB group that was located about 150 miles away. The antenna is easily stackable for more gain and Efactor Antennas sells a stacked set, but I didn't test that configuration for this review.

I should point out that the Efactor Dual-Band antenna may also provide opportunities for satellite operating. My transceiver has a 2-meter and 70-centimeter receive preamplifier, so I decided to give it a try with several CubeSats. Again, the performance was surprising with decent signal levels and infrequent fading. Also, during one outing, the International Space Station zoomed overhead with its digipeater active on 70 centimeters. The antenna delivered S-9+ signals throughout much of the pass.

Manufacturer: Efactor Antennas, P.O. Box 280, Collierville, TN, 38027; **www.efactorantennas.com**. Price: $69.

Xuron TK3500 Home Electronics Tool Kit

Reviewed by Mark Wilson, K1RO
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Like many hams, I appreciate good tools — the kind that feel just right in your hand and perform tasks without excuses. Although they have been around for many years, I recently became acquainted with Xuron, which manufactures a wide variety of hand tools for industrial users and consumers. Tools are made at Xuron's facility in Maine.

The TK3500 Home Electronics Tool Kit includes three tools: Model 170-IIAS Micro-Shear flush cutter, Model 450AS tweezer-nose pliers, and the Model 501AS wire stripper. The kit also includes a fabric carrying case.

All three tools have hand grips designed to protect components against electrostatic discharge (ESD). Tools without the ESD-safe grips are available as well. All three tools are roughly the same size and have a return spring to open the jaws automatically. When the jaws are open, the handles are just the right distance apart for my hands.

Bottom Line

The Xuron flush cutter, tweezer-nose pliers, and wire stripper with ESD-safe handles are well made and would be at home in any electronics workshop.

The Model 170-IIAS flush cutter worked great for trimming component leads on a PC board after soldering. It makes a nice, clean cut very close to the board. I also used it to trim the braid when installing a coax connector — again, a nice, clean cut with the very fine braid strands.

The Model 501AS can be used for stripping and cutting #10 to #26 AWG stranded and solid wire. The size of the opening in the stripper section is controlled by an adjustable cam. It's not a precise adjustment with marked slots for various wire sizes as on some tools. Set it for the approximate wire size, and carefully squeeze the handles to bite through the insulation. The tool also has a bypass shear for cutting wire. I have other tools for stripping large wire, but this one worked fine on some #18 AWG stranded and #24 AWG solid hookup wire I was using in my project.

The Model 450AS tweezer-nose pliers are interesting. The tips of the non-serrated blades come to a fine point and, unlike similar pliers I have been using, the tips are flat rather than round. They offer a secure grip on small-gauge wire and tiny components in tight spots.

They worked great for forming wire and component leads to attach to switches and connector lugs.

I found these three Xuron tools to be very well made, comfortable to handle, and useful for building and working on electronic equipment. Xuron offers these and many similar tools separately and in kits designed for various hobbyist applications.

Manufacturer: Xuron Corp., 62 Industrial Park Rd., Saco, ME 04072; **xuron.com**; Tel. 207-283-1401. Xuron consumer products are available from Amazon and other sources. The review kit was purchased from **www.qsource.com** for $37.

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Elected March 15, 2017

Frank R. Aguilar, N5SSH
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