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Product Review

Xiegu G106 5 W QRP Transceiver

Reviewed by Phil Salas, AD5X
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I have had the opportunity to review the Xiegu X5105, X6100, and G90 transceivers. So I was pleased to be able to review the G106, the latest QRP radio from Xiegu.

The Xiegu G106 is a compact transceiver covering the 80- through 10-meter ham bands, along with a general-coverage receiver that tunes continuously from 550 kHz to 29.7 MHz (see Table 1). It also covers the 88 – 108 MHz FM broadcast band (receive only). The cast aluminum metal case has a solid feel to it. Operating modes are CW, SSB, and AM. Included with the G106 is the speaker/microphone, a power cord, and the manual. If you wish to operate digital modes, and/or provide a computer interface for computer control and firmware updates, you must purchase the optional DE-19 interface unit. The G106 has a built-in speaker. An external speaker or headphones must be plugged into a 3.5-millimeter mono jack on the speaker/microphone. All normal operating parameters, including a spectrum display, are displayed on a 1.7-inch diagonal black-and-white screen. The spectrum display is 48 kHz wide and is centered on your tuned frequency. There is no waterfall display.

The G106 includes split-frequency operation (both within a band and on separate bands) and has a receiver preamplifier. While it has fixed bandwidth filters for AM and SSB, it has 50 Hz, 250 Hz, and 500 Hz selectable filters for CW. There are 50 memory channels available. There is no RIT, receiver attenuator, noise blanker, or digital noise reduction. The G106 does not display SWR, nor does it have VOX for SSB or AM. And it does not include an internal auto-tuner.

Interfaces and Controls

All operating controls are on the front and top of the G106, as you can see in the lead photo and Figure 1. An RJ11 (four-pin) speaker/microphone jack is on the front panel, along with the volume control, main tuning knob, and four multi-function buttons. On the top of the G106 are the power, mode, and band-switch buttons. Figure 2 shows the rear of the G106, where you will find the BNC RF connector, a 3.5-millimeter key interface, a 3.5-millimeter COM port, a mini-DIN8 accessory port, and a 2.5 × 5.5-millimeter dc power interface.

The volume and tuning controls are multi-function. A metal rim around these two controls provides some protection for the controls and the front panel. When

Figure 1 — Topside controls.

Bottom Line

The Xiegu G106 is a rugged, compact, 5 W portable transceiver. While it has fewer features than other QRP transceivers, it is also priced below much of the competition.

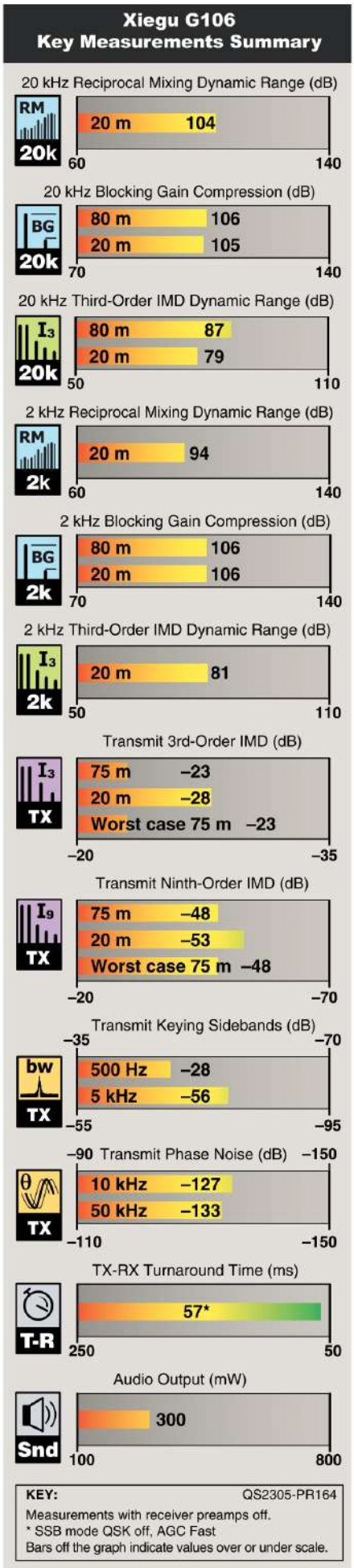

Table 1
Xiegu Communication G106, serial no. V8W#Q81055
Firmware: V1.2 Sept 20, 2022

FCC ID# 2ANLH-G106

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive: 0.5 – 30 MHz; 88 – 108 MHz (WFM). Transmit: 3.5 – 4.0 MHz; 7 – 7.3 MHz; 10.1 – 10.15 MHz; 14 – 14.35 MHz; 18.068 – 18.168 MHz; 21 – 21.45 MHz; 24.89 – 24.99 MHz; 28 – 29.7 MHz.	As specified. Transmit: As specified, plus 5.331 – 5.405 MHz.
Power requirement: 9 – 15 V dc. Transmit: 2.8 A max. Receive: 370 mA max.	At 13.8 V dc: Transmit: 2 A (max). Receive: 320 mA, (no signal, max. volume, max. lights) 314 mA (backlight off).
Modes of operation: SSB, CW, AM, FM.	As specified.
Receiver	**Receiver Dynamic Testing**
CW sensitivity:	Noise floor (MDS), 500 Hz BW:
Noise floor (MDS): Not specified; 3.5 – 30 MHz (CW): 0.25 µV (–119 dBm).	3.52 MHz: *Preamp Off* –115 dBm / 0.39 µV; *Preamp On* –132 dBm / 0.06 µV 14.020 MHz: –112 dBm / 0.54 µV; –130 dBm / 0.07 µV
AM sensitivity: 3.5 – 30 MHz (AM): 10 µV (–87 dBm).	For 10 dB (S+N)/N, 1 kHz tone, 30% mod. 3.885 MHz: *Preamp Off* –86 dBm / 11.9 µV; *Preamp On* –102 dBm / 1.70 µV
Blocking gain compression dynamic range: Not specified.	Blocking gain compression dynamic range, 500 Hz BW: 20 kHz offset *Preamp off/on*: 3.5 MHz 106 / 105 dB; 14 MHz 105 / 105 dB 5/2 kHz offset *Preamp off*: 3.5 MHz 106 / 106 dB; 14 MHz 106 / 106 dB
Reciprocal mixing dynamic range: Not specified.	14 MHz, 20/5/2 kHz offset: 104 / 100 / 94 dB

Lab Notes: Xiegu G106 5 W QRP Transceiver

The ARRL Lab encountered a few quirky issues while testing this radio. It is standard procedure for the Lab to update the firmware to the latest version on any radio we purchase for Product Review testing. We strongly recommend that hams do the same when they get their new rig home, to benefit from any improvements that the manufacturer included in the update. A new firmware update came out just after we started testing, so I updated from V1.0 to V1.2 (the latest version available at the time of testing).

I noticed that the power output had changed! Although it was still within Xiegu's specifications, the power was reduced by about 1 W on all bands and modes of operation. Another issue I observed was that by adjusting the mic gain to more than 20, the IMD products drastically increased, which would cause splatter on the air. I would be cautious setting the gain significantly higher, keeping the output below the rated power of 5 W PEP.

I also observed during the blocking gain compression dynamic range test several receiver spurious responses (birdies). Most were weak, but a few were strong enough that they could interfere with actual received signals, especially at closer spacings. These birdies did not prevent proper measurements from being made, but they were there.

Manufacturer's Specifications — Measured in the ARRL Lab

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

Band/Preamp	*Spacing*	*Measured IMD Level*	*Measured Input Level*	*IMD DR*
3.5 MHz/off	20 kHz	–115 dBm –97 dBm	–28 dBm –22 dBm	87 dB
14 MHz/off	20 kHz	–112 dBm –97 dBm	–33 dBm –27 dBm	79 dB
14 MHz/on	20 kHz	–130 dBm –97 dBm	–43 dBm –30 dBm	87 dB
14 MHz/off	5 kHz	–112 dBm –97 dBm	–31 dBm –20 dBm	81 dB
14 MHz/off	2 kHz	–112 dBm –97 dBm	–31 dBm –20 dBm	81 dB

Second-order intercept point: Not specified.*	Preamp off/on: 14 MHz, +53/+51 dBm.
S-meter sensitivity: Not specified.	For S-9 signal, preamp off/on: 14 MHz, 86.0/43.6 µV.
Receiver processing delay time: Not specified.	25 ms.
Audio output: 0.3 W into 8 Ω @10% T.H.D.	0.1 W into 8 Ω at <1% T.H.D.
IF/audio response: Not specified.	CW: 515 – 1105 Hz, SSB: 59 – 2200 Hz, AM: 38 – 3900 Hz.

Transmitter — Transmitter Dynamic Testing

Power output: >5 W @ 13.8 V dc.	At 13.8 Vdc 5.2 to 10.4 W. At 9 Vdc: 14 MHz, 0.07 W.
Spurious and harmonic suppression: HF: >50 dB.	>–57 dBc Meets the FCC limits for spurious emissions.
Third-order intermodulation distortion (IMD) products: Not specified.	3rd/5th/7th/9th order, 5 W PEP: –28/–41/–55/–53 dB PEP 20 m –23/–42/–41/–48 dB PEP (worst case, 75 m).
CW keyer range: Not specified.	5 to 50 WPM, default = 20 WPM iambic modes A and B.
CW keying characteristics: Not specified.	See Figures A and B.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	57 ms.
Receive-transmit turnaround time (TX delay): Not specified.	SSB, 10 ms.
Transmit phase noise: Not specified.	See Figure C.

Size (height, width, depth): 1.6 × 4.7 × 5.3 inches, not including protrusions.

Weight: 1.6 pounds.

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

During testing, the frequency and mode get changed quite a bit depending on the test being performed. To save some time, I saved the commonly used frequency/mode pairs in memory locations. While switching from VFO to memory channel modes, the operating mode frequently did not change to the mode that was stored in the memory channel. Changing to a different memory channel and then back to the desired channel seemed to fix this problem most of the time, though the behavior was somewhat inconsistent.

This rig is far from stellar on CW transmit. Most modern rigs use internal DSP to shape the CW keying to obtain a reasonable waveform that does not generate key clicks. This transmitter does not, and as you can see in Figure A, the RF envelope rises very quickly at the beginning of each keying element. Figure B shows the resultant keying sidebands of this poorly shaped waveform. This rig has keying sidebands that are 20 – 40 dB worse than some of the better rigs we have tested lately. Fortunately, this is a QRP rig, so most of the time, the key clicks won't cause interference to other users, but when conditions are right, QRP can be loud. In that case, you may get some reports of key clicks from other users, or from an ARRL Official Observer! This would be especially likely if an external amplifier is used with this radio. The transmit third-order IMD on 75 meters is also poor, which will generate splatter on adjacent channels. — *George Spatta, W1GKS, ARRL Assistant Lab Manager*

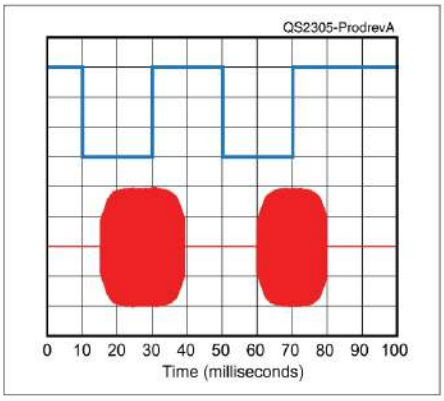

Figure A — CW keying waveform for the G106 showing the first two dits using external keying. Equivalent keying speed is 60 WPM. The upper trace is the key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 5 W output on the 14 MHz band, using QSK set to **ON**. The first-dit rise time is 3.7 ms; the fall time is 3.5 ms. The second-dit rise time is 3.9 ms; the fall time is 3.5 ms. The first-dit on delay is 5.7 ms; the off delay is 8.8 ms. The second-dit on delay is 10.4 ms; the off delay is 9.5 ms.

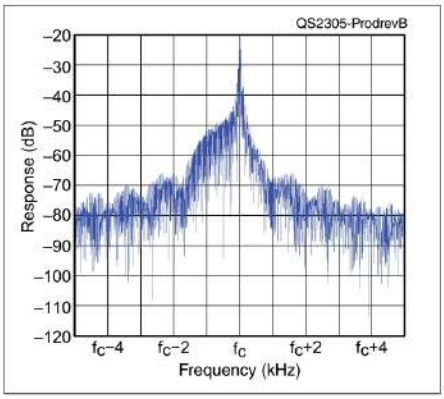

Figure B — Spectral display of the Xiegu G106 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying and the default rise time setting. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 200 ms. The transmitter was being operated at 5 W 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 decibels.

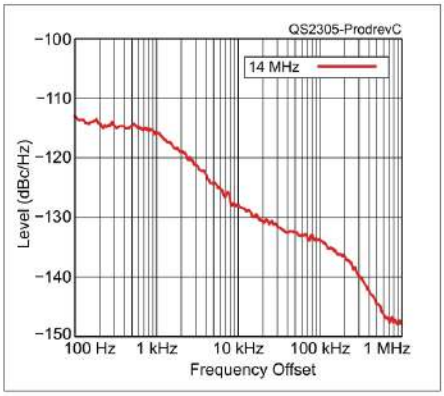

Figure C — The spectral display of the Xiegu G106 transmitter output during phase-noise testing. Power output is 5 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows phase noise 100 Hz to 1 MHz from the carrier. The reference level is –100 dBc/Hz, and the vertical scale is 10 dB per division.

Figure 2 — Rear panel connectors.

tapped, the volume control selects between the internal speaker and the speaker in the speaker/microphone. Besides tuning, the main tuning control is also used to select any one of the five menu pages, and to adjust menu parameters. On the top side of the radio, tapping the **MODE** button cycles through the **AM**, **LSB**, **USB**, and **CW** modes. Pressing and holding the **MODE** button turns the preamplifier on and off. Tapping the **BAND** buttons cycles the radio through the different ham bands, and pressing and holding the **BAND** buttons changes the tuning step. All of the buttons have an excellent tactile feel, and the two controls feel solid and are wobble-free.

Firmware Update

The latest firmware is available from **https://xiegu.eu**. At the time of this writing, the latest update was labeled "V1.2B03." This added three transmit power settings (low, medium, and high). As this review unit had an earlier firmware version, I went through the G106 firmware update procedure. This procedure is included with the firmware update download and requires that you download and install the *Tera Term* terminal emulator software. While not as simple as my Elecraft KX3 update procedure, it is not difficult. As mentioned earlier, Xiegu states that the DE-19 is required to interface the G106 with your computer. However, I found that an FTDI 3.3 V TTL USB-to-serial 3.5-millimeter adapter works fine. You can find this adapter for less than $20 at **www.amazon.com**.

A Bit More Testing

You will find my test results in Tables 3 – 6 at **www.arrl.org/qst-in-depth**. As the G106 now has three power settings, I first checked the actual power on several of the bands (see Table 3). Because the specified voltage range is 9 – 15 V dc, I also checked

Solid-State Keying Interface for Xiegu Transceivers

The Xiegu DE-19 accessory provides a keying interface that will work with most external amplifiers. However, unless you are using the Xiegu XPA125B amplifier, the DE-19 is overkill, as the ALC and band data interface is not compatible with non-Xiegu amplifiers. Therefore, I decided to build my own interface, which is applicable for keying any device with an open-circuit keying input up to 80 V dc, and a maximum enable current of 0.5 A. I have verified that this interface works with the G106, the G90, and the X5105.

The Xiegu ACC connector is a miniDIN8 female with the pinouts shown in Figure 3. I found that the PTT output measured 8 V dc on receive, and 0 V dc when transmitting. Figure 4 shows the schematic of the keying interface. The LED is not necessary, but I like visual indication when the PTT output is active, and Figure 5 shows the Xiegu amplifier-keying interface schematic.

Construction

The parts list is shown in Table 2. The keying interface uses a miniDIN8 cable with one connector cut off. While the circuit is easily built on a small piece of perf board, I implemented the circuit on a small printed circuit board (PCB). The connection points and component locations for my PCB are shown in Figure 5, and the completed unit is shown in Figure 6. The #4 hole provides for a PCB mount if desired.

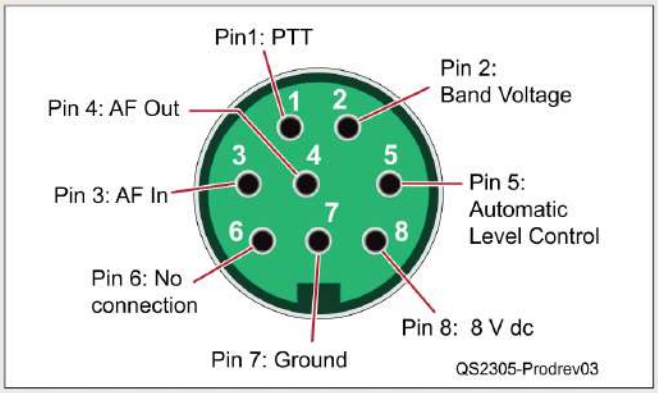

Figure 3 — Xiegu accessory port pinouts and descriptions.

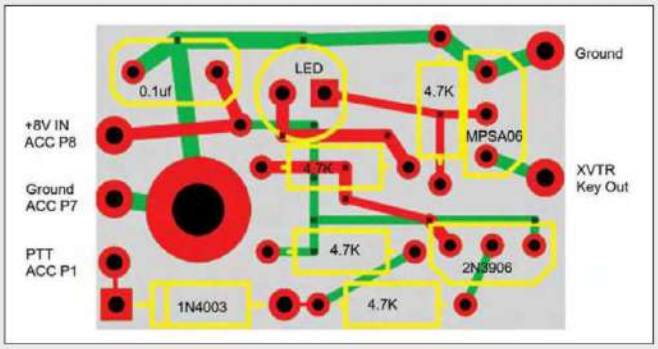

Figure 4 — Keying interface PCB layout.

the maximum output power at 9, 13.8, and 15 V dc. Table 4 shows the test results.

Because the G106 does not have an internal auto-tuner, I wanted to see how it would do with some reasonable mismatches. Table 5 shows the output power when transmitting at high power into high-impedance and low-impedance 2:1 and 3:1 SWR resistive loads. It is interesting that the G106 seems to have no problem with low-impedance loads — at least up to a 3:1 SWR.

Finally, I checked the S-meter reading against my Elecraft XG3 signal generator and a precision step attenuator on 40, 20, and 10 meters. The Elecraft XG3 level of accuracy specification is ± 1 dB. The results are shown in Table 6. Note that the G106 does a nice job of tracking signals at the rate of 6 dB per S-unit.

General Operation

When adding your power connector of choice (a Powerpole® in my case) to the supplied dc cable, keep in mind that the G106 does not have reverse polarity protection.

I found the G106 easy to operate. You will need to get into the menu for some settings, such as memory save and recall, transmit power, CW filters, CW speed, break-in delay, and some other less-used settings. Once you go through the menu a time or two, it will become second nature. Tapping any of the four multi-function buttons below the display brings up the menu, and the tuning control is then used to select between the five menu screens. There is no internal antenna tuner; however, the menu permits cycling from a paddle to a straight key, so you can use your paddle to put out a carrier for tuning an external antenna tuner if needed. Or you can use the AM mode.

CW Operation

The G106 internal keyer speed range is 5 to 50 WPM, and the CW pitch is adjustable from 500 to 1000 Hz (800 Hz default). You cannot select the opposite CW sideband; however, I have rarely used this feature on other transceivers. I could not hear ringing on even the narrow 50 Hz CW filter. T/R switching uses an internal relay, and you can hear the relay click. The break-in delay is settable from 0 to 1000 ms; however, the T/R delay is no shorter than about 50 ms. I wound up preferring about a 500 ms break-in delay to minimize relay clicking.

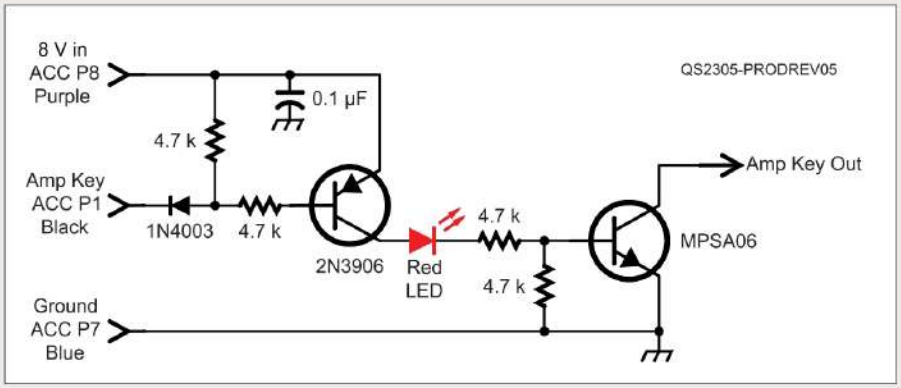

Figure 5 — Xiegu amplifier-keying interface schematic.

Table 2
The DIY Parts List:
Flexible Amp-Key Interface

QTY	Description	Mouser/ Part Number
1	0.1 µf 100 V capacitor	81-SR211C104KAR
1	MPSA06 transistor	512-MPSA06
1	1N4003 diode	63-1N4003G
1	2N3906 PNP transistor	512-2N3906TA
4	4.7 K resistor	660-MF1/4LCT52R472J
1	Red LED (3000 mcd)	755-SLI-570UT3F
1	Plastic box 1.97 × 1.38 × 0.79 inches	546-1551GBK
1	Phono jack	534-580
1	MiniDIN8 cable	**www.amazon.com**

Figure 6 — The DIY Xiegu keying interface.

SSB Operation

The microphone gain can be adjusted in the menu, though the default setting is fine for the supplied speaker/microphone. You may need to change this setting if you change microphones. There are no receive and transmit audio equalization filters or transmit speech processing. The receive filter bandwidth is fixed at about 2400 Hz.

Digital Modes

The G106 can be operated with a computer for RTTY, PSK, JT65, or any of the other popular digital modes. However, you must purchase the optional DE-19 interface unit. Use the **L-D** or **U-D** modes for lower or upper sideband data transmission. The **L-D** and **U-D** modes disable the microphone, and permit external audio input only through the ACC interface.

On the Air

I did not test the G106 on digital modes, as I am primarily a CW and SSB QRP operator. I operated on 40, 30, 20, and 17 meters using my 43-foot vertical. At the maximum power level (~5 W), I had no problems making CW contacts on any of the bands. I like to use headphones, especially when operating CW, so I did not like having to use the speaker/microphone for the headphone interface. A headphone jack on the radio would have been nice.

SSB operation was a bit more of a challenge at the 5 W level. However, by focusing on calling strong stations, I could normally make contacts, especially on 20 and 17 meters. The audio reports were all quite good. I noticed one interesting little glitch. When operating either SSB or AM, pressing the PTT button produces a momentary full-output power spike. This is a very short-duration spike. Receiving stations heard it as a click.

Conclusion

The G106 is a minimally featured SDR 5 W radio. However, this makes operation easier than more complex radios. For more information, you can download the G106 user manual from **www.radioddity.com**.

Manufacturer: Xiegu. Distributed and supported in the US by select US distributors. Price: G106 HF transceiver, $320; DE-19 keying interface, $70.

Lynovation CTR2-Mini+ Radio Controller

Reviewed by Sean Klechak, W9FFF
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In the September 2022 issue of *QST*, an article featured the CTR2-Mini, a radio controller designed by Lynn Hansen, KU7Q. To briefly summarize the CTR2-Mini, it's a convenient way to control an HF transceiver via CAT control. Controlling a radio via the Mini has many benefits, including a colorful screen and easy-to-access menus. The CTR2 project piqued my interest, as I believe that some of the items used in this project will continue to evolve and be developed for amateur radio use. The use of Wi-Fi and an application programming interface (API) allows for multiple systems to communicate with each other and provide control, such as is the case with FlexRadio systems, which utilize an API to get and send commands and get information about the current status of the radio.

Subsequently, I was provided an opportunity to test the CTR2-Mini+, their latest of the CTR2 series. I

Bottom Line

The CTR2-Mini+ is everything you want it to be. It can be used to control your radio locally or remotely, and you can use it for its programmable keys or even to practice Morse code.