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Product Review

Xiegu X6100 HF/6-Meter QRP Transceiver

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At first glance, the X6100 appears to be a newer version of the X5105 — which is still being sold. The X6100 is about the same size as the X5105. Like the X5105, the X6100 transmits on all ham bands 160 – 6 meters, and has a general-coverage receiver that tunes from 500 kHz – 30 MHz and 50 – 54 MHz. But there are some significant differences. First, while transmit power is adjustable up to 5 W using the internal battery, up to 10 W is available when using an external power source. And the X6100 has a 2 × 3.4-inch color display with a resolution of 400 × 800 pixels. Besides displaying the normal operating parameters, the spectrum and waterfall displays are also displayed, along with the absolute receive signal level. The full X6100 specifications are shown in Table 1.

Interfaces and Controls

The X6100 is loaded with controls and interface connectors, yet everything is easily accessible. On the left side (see Figure 1) is the BNC antenna connector, and connectors for an I/Q output (3.5 millimeter, three-conductor), and dc power (5.5 × 2.5 millimeter). On the right side (see Figure 2) you'll find a microSD memory card slot, USB-C slave and host ports, an RJ-45 microphone jack, and 3.5 millimeter jacks for an external speaker or headphone (three-conductor), a CW key (three-conductor), and an XPA125B amplifier interface (four-conductor — amp key, ALC and Band Data). On the top of the radio are 12 buttons for changing modes and bands, tuning step setting, ATU enabling — and even a PTT switch so you can use the radio as a handheld. All the buttons are backlit and are easy to read.

The front panel includes 15 buttons and knobs. The five buttons under the display are soft keys whose functions change based on the menu item selected by the MFK (Multi Function Knob). The soft key functions are displayed on the LCD screen. The functions of all other buttons are clearly marked. The tuning knob is dual purpose in that it is also used to change parameters when a menu item is selected. Other than the soft keys and the six buttons at topside right, the other buttons are not multi-purpose — what is labeled is what you get, which makes operating the radio very straightforward.

Power Requirements

The X6100 can be powered from an external 13.8 V dc 3 A power supply, or from the internal 7.2 V dc 3000 mAh lithium battery. A dc power cable terminated by a 5.5 × 2.5 millimeter dc plug is supplied for connecting external power. When an external power supply is connected, the X6100 automatically powers itself from that power supply. A low current charging adapter is provided with the radio, however the internal battery will also be charged when the radio is off and an external 13.8 V supply is connected. During the charging process, a front panel green LED flashes about once per second. When charging is complete, the LED stays on continuously if the adapter or external power supply is connected. I found that I could get about 2 hours of casual operating at 5 W before the X6100 shut down due to a low battery. A fully discharged battery takes about 6 hours to charge.

Bottom Line

With up to 10 W of output power, and an internal auto-tuner and lithium battery, the Xiegu X6100 is a self-contained transceiver in a rugged, compact package that will appeal to portable operators.

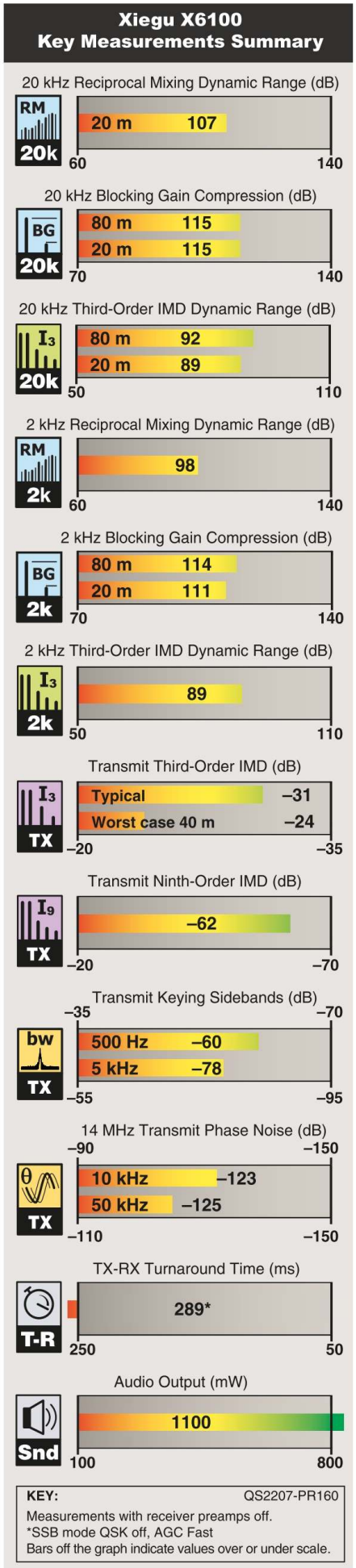

Table 1
Xiegu Communication X6100, serial no. V1A#K31279

Manufacturer's Specifications

Frequency coverage:
Receive: 0.5 – 30 MHz; 50 – 54 MHz;
Transmit: 1.8 – 2 MHz; 3.5 – 3.9 MHz;
7 – 7.2 MHz; 10.1 – 10.5 MHz;
14 – 14.35 MHz; 18.068 – 18.168 MHz;
21 – 21.45 MHz; 24.89 – 24.99 MHz;
28 – 29.7 MHz; 50 – 54 MHz

Power requirement: 9 – 15 V dc
Transmit: 3 A max.
Receive: 330 mA max.

Modes of operation: SSB, CW, AM, FM.

Measured in the ARRL Lab

Receive: 0.5 – 55 MHz continuous.
Transmit: As specified, plus 5.331 – 5.405 MHz.

At 13.8 V dc:
Transmit: 2.35 A (max).
Receive:
570 mA, (no signal, max. volume, max. lights).
570 mA (backlight off).
570 mA (Off, charging internal battery).

As specified.

Receiver

SSB/CW sensitivity:
Noise floor (MDS): –138 dBm.
1.8 – 2 MHz (SSB/CW): 0.35 µV
2 – 30 MHz (SSB/CW): 0.2 µV
50 – 54 MHz (SSB/CW): 0.2 µV

AM sensitivity:
0.5 – 2 MHz (AM): 10 µV
2 – 30 MHz (AM): 2 µV
50 – 54 MHz (AM): 2 µV

FM sensitivity: For 12 SINAD
28 – 30 MHz (FM): 0.22 µV
50 – 54 MHz (FM): 0.22 µV

Blocking gain compression dynamic range:
Not specified.

Reciprocal mixing dynamic range:
Not specified.

Receiver Dynamic Testing[1,2]

Noise floor (MDS), 500 Hz BW:

Preamp	*Off*	*On*
1.02 MHz	–126 dBm	–131 dBm
3.52 MHz	–125 dBm	–132 dBm
14 MHz	–128 dBm	–133 dBm
50.2 MHz	–119 dBm	–127 dBm

For 10 dB (S+N)/N, 1-kHz tone, 30% mod. 6 kHz BW:

Preamp	*Off*	*On*
1.02 MHz	3.59 µV	1.48 µV
3.885 MHz	4.51 µV	2.54 µV
50.4 MHz	4.89 µV	1.88 µV

For 12 dB SINAD, 3 kHz deviation, NFM, 15 kHz BW:

Preamp	*Off*	*On*
29 MHz	2.6 µV	0.73 µV
52 MHz	4.84 µV	2.57 µV

Blocking gain compression dynamic range, 500 Hz BW:

	20 kHz offset Preamp off/on	*5/2 kHz offset Preamp off*
3.5 MHz	115/109 dB	114/114 dB
14 MHz	115/110 dB	112/111 dB
50 MHz	107/103 dB	106/103 dB

14 MHz, 20/5/2 kHz offset: 107/101/98 dB.

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	–125 dBm	–33 dBm	92 dB
		–97 dBm	–25 dBm	
		–6 dBm	–20 dBm[3]	
14 MHz/off	20 kHz	–128 dBm	–39 dBm	89 dB
		–97 dBm	–30 dBm	
		–6 dBm	–20 dBm	
14 MHz/on	20 kHz	–133 dBm	–50 dBm	83 dB
		–97 dBm	–39 dBm	
14 MHz/off	5 kHz	–128 dBm	–38 dBm	90 dB
		–97 dBm	–31 dBm	
		–6 dBm	–20 dBm	
14 MHz/off	2 kHz	–128 dBm	–39 dBm	89 dB
		–97 dBm	–31 dBm	
		–6 dBm	–20 dBm	
50 MHz/on	20 kHz	–127 dBm	–60 dBm	67 dB
		–97 dBm	–52 dBm	

Manufacturer's Specifications	Measured in the ARRL Lab
Second-order intercept point: Not specified.	Preamp off/on: 14 MHz, +39/+39 dBm 50 MHz, +39/+33 dBm
FM adjacent channel rejection: Not specified.	Preamp on: 29 MHz, 70 dB 50 MHz, 59 dB
FM two-tone, third-order IMD dynamic range:	Preamp on: 20 kHz offset 29 MHz, 59 dB 52 MHz, 66 dB 10 MHz offset 29 MHz, >100 dB 52 MHz, >100 dB
S-meter sensitivity: Not specified.	For S-9 signal, preamp off/on: 14 MHz, 65.2/10.0 µV 50 MHz, 70.7/12.3 µV
Squelch sensitivity: Not specified.	At threshold: Preamp on, FM 29 MHz, 1.32 µV 52 MHz, 1.35 µV At threshold, Preamp off/on, SSB 14 MHz, 0.66/0.11 µV
Receiver processing delay time: Not specified.	116 ms
Spurious and image rejection: IF rejection: Not specified. Image rejection: Not specified. Image rejection: Not specified.	14 MHz, 96 dB 50 MHz, 60 dB 69 dB 86 dB
Audio output: 0.4 W into 8 Ω at 10% T.H.D.	1.1 W into 8 Ω at 10% T.H.D.
IF/audio response (default settings): CW: 550 – 1050 Hz; 675 – 925 Hz; 725 – 875 Hz SSB:150 – 2850 Hz: 300 – 200 Hz; 600 – 2400 Hz AM: ±4500 Hz; ±3000 Hz; ±1500 Hz	As specified for all filters and modes. The filter bandwidth can be narrowed to 0 Hz for each filter.

Transmitter	Transmitter Dynamic Testing
Power output: 10 W (SSB, CW, FM) at 13.8 V dc 5 W (SSB, CW, FM) battery 2.5 W (AM carrier) at 13.8 V dc 1.5 W (AM carrier, battery)	At 13.8 V dc: HF, 0.1 to 10 W (CW, SSB, FM) 50.2 MHz, 10 W (CW, SSB, FM) At 9 V dc: HF, 4.7 W; 50.2 MHz, 2.6 W
Spurious and harmonic suppression: HF: >50 dB; 50 – 54 MHz: >60 dB	HF: 10 M (worst case), –53 dBc 50.2 MHz: –62 dBc Meets the FCC limits for spurious emissions.
Transmit intermodulation distortion (IMD) products: Not specified.	3rd/5th/7th/9th order, 10 W PEP: –31/–52/–52/–62 dB PEP (HF, typical) –23/–40/–52/–65 dB PEP (worst case, 40 m) –24/–39/–36/–40 dB PEP (50 MHz)
CW keyer range: Not specified.	Tested at 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.	SSB & CW, QSK off, AGC off, fast or slow, 314 ms, AGC off, 289 – 415 ms[4]
Receive-transmit turnaround time (tx delay): Not specified.	SSB, 14 MHz, 75 ms; FM, 29 MHz, 77 ms; FM, 52 MHz, 75 ms
Transmit phase noise: Not specified.	See Figure C.

Size (height, width, depth): 1.9 × 7.1 × 3.4 inches, not including protrusions. Weight, 1.9 pounds.

[1]A and B receivers identical.
[2]Note: A number of weak receiver spurious responses were observed. Test frequencies were adjusted slightly to avoid them.
[3]At the 0 dBm used for this test, the A/D converter in the unit under test was in clipping. For all cases in this table, the 0 dBm test level was reduced to –20 dBm to obtain a useful reading.
[4]Depending on QSK setting.

Firmware Updates

I recommend checking for the latest firmware before you begin using the X6100, as updates seem to be coming at a rapid pace. As an example, this X6100, as received from ARRL, had firmware version 1.1.0, but the most recent firmware was 1.4.1. Radioddity maintains the latest X6100 firmware on their website, as well as good step-by-step instructions for the update procedure. However, if you don't have them, you will need to purchase a microSD card and a microSD-to-USB adapter. Basically, you must copy the latest firmware to the microSD card, and then insert the microSD card into a slot on the X6100. This is a much easier process than that required by the G90 and X5105, and only took me about 5 minutes — plus the time waiting for Amazon to deliver my microSD card and USB adapter!

Some Additional Testing

Transmit power is adjustable in 0.1 W increments from 0.1 – 1 W, and in 1 W increments from 1 – 5 W on internal battery and 1 –10 W with an external 13.8 V power supply. The first test I did is transmit power versus the transmit power setting, along with the transmit current when using an external power supply. The power setting is quite accurate, especially when using an external power supply. See Table A at **www.arrl.org/qst-in-depth**.

Next, I tested the internal automatic antenna tuner. The X6100 auto tuner is specified to match up to a 4.5:1 SWR. See Table B at **www.arrl.org/qst-in-depth**.

Finally, I checked the signal level reading against my Elecraft XG3 signal generator on 20, 10, and 6 meters. The X6100 displayed levels are quite accurate. The S-meter readings are also quite accurate, dropping ~6 dB/S-unit when going from S9 to S3. The results are shown in Table C at **www.arrl.org/qst-in-depth**.

Lab Notes: Xiegu X6100

The ARRL Lab test engineer reports that the radio was a bit of a challenge to test. There were numerous weak receiver birdies (stronger on 6 meters) that were not necessarily strong enough on most bands to present a problem in operation because most were lower than typical band noise, but they made it a challenge to make measurements at the noise floor of the receiver. Some of the test frequencies had to be adjusted by a hundred Hz or so to prevent weak receiver spurious responses from interfering with an accurate measurement of the receiver parameter being tested. The Lab also noticed that although the CW signal rise and fall times are shaped well enough that they will not cause key clicks under most circumstances, when the Lab set the QSK delay to 0 ms, the minimum of the range for which it can be set, the output waveshape changed to almost a square wave, which would generate objectionable key clicks up and down the band. There is no real reason to set the setting lower than 100 ms in CW, as we did not see any improvement in break-in time. Figures A and B show how well the transmitter performs under most circumstances, but don't set the QSK to 0 ms or you will not be a good neighbor to other hams. (This is the kind of thing the Lab often picks up during the extensive testing it does for all of the transmitters that go through the Product Review process.) — *Ed Hare, W1RFI, ARRL Lab Manager*

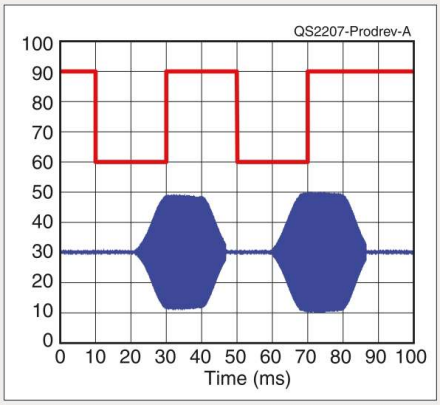

Figure A — CW keying waveform for the Xiegu X6100 showing the first two dits using external keying. Equivalent keying speed is 60 WPM. The upper trace is the key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 10 W output on the 14 MHz band, using QSK set to 10 ms. The first-dit rise time is 6.6 ms and the fall time is 5.9 ms. The second-dit rise time is 6.4 ms and the fall time is 5.7 ms. The first-dit on delay is 15.9 ms; off delay, 13.8 ms. The second-dit on delay is 14 ms; off delay, 13.7 ms.

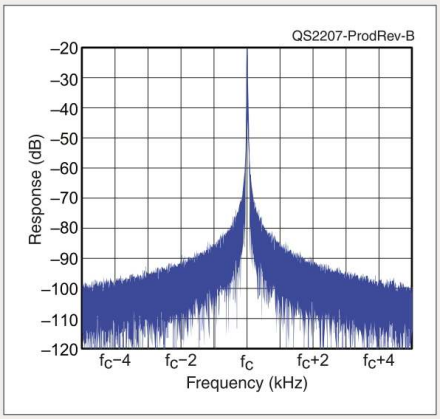

Figure B — Spectral display of the Xiegu X6100 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying and the default rise time setting. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 10 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.

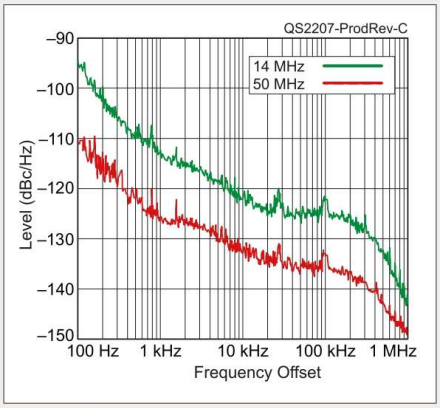

Figure C — Spectral display of the Xiegu X6100 transmitter output during phase-noise testing. Power output is 10 W on the 14 MHz band (green trace), and 10 W on the 50 MHz band (red trace). The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is –80 dBc/Hz, and the vertical scale is 10 dB per division.

Operating the X6100

As you can see in Figure 3, the display is quite easy to read and provides a tremendous amount of simultaneous information. Virtually everything you need to know is shown — including the receive spectrum, filter bandwidth, waterfall, and all the different operating parameters. The controls and buttons are pretty much self-explanatory, though the dual-function buttons and controls need a bit more explaining.

The six buttons at topside right (see Figure 4) are dual function. The normal function, displayed on the button, is enabled by tapping the button. The secondary function, as labeled above or below the button, is enabled by pressing and holding the button. As an example, to enable the ATU (Automatic Tuner), tap the **ATU** button. For the ATU to tune, press and hold the **ATU** button. The volume control, when tapped, changes function from AF Gain to RF Gain, to Squelch.

CW Operation

Then it was time to have fun with the X6100. I began with my favorite mode — CW. Tapping the **KEY** button permits you to adjust keying speed, key type, iambic

Figure 1 — Left side view of the Xiegu X6100.

Figure 2 — Right side view of the Xiegu X6100.

Figure 3 — The Xiegu X6100's 4-inch (800 × 480) high-resolution display.

keyer mode, CW tone frequency, and monitor tone level. Tap **KEY** again and you can set the break-in time delay, the dot/dash ratio, and turn the CW trainer on and off. The internal keyer speed range is 5 – 50 WPM. Since I adjust keying speed frequently, I normally leave the **KEY1** menu up. You can select either CW or CWR (reverse) with the **CW** mode key on the top of the radio. There are three default filter bandwidths: 500 Hz, 250 Hz, and 150 Hz. Each of these filter bandwidths can be readjusted to suit the user. Break-in delay can be set from 0 – 1 seconds in 10 ms increments. However, the delay will never be less than 100 ms due to the SDR signal processing latency. I set the break-in delay to 250 ms to minimize the T/R relay clicking. I operated CW on 40, 30, and 20 meters. The CW reports were all excellent, with no reports of key clicks or chirps.

Figure 4 — Top view of the Xiegu X6100. The six buttons at right are dual function.

SSB Operation

I operated SSB a bit on 40 meters, but mostly on 20 and 17 meters. Ten W is a pretty marginal power level for SSB on 40 meters, but it is reasonably effective on the higher bands. The three SSB default receive filter bandwidths are 2700 Hz, 2400 Hz, and 1800 Hz. Again, the filter bandwidths can be modified easily if desired. All transmit audio reports were complimentary. There is no speech processor yet, and the only transmit adjustment you can make is microphone gain.

Digital Modes

The X6100 can be operated with a computer and sound card for RTTY, PSK, JT65, or any of the other popular digital modes. The computer interface is via the **DEV** port on the X6100, using the supplied USB-C/USB-A cable. There is a built-in decoder for RTTY, CW, and BPSK. The RTTY and BPSK decoders work well, but the CW decoder is still a work in process.

Conclusion and Final Thoughts

I found the X6100 to be a very easy and enjoyable transceiver to operate. And because of the SDR architecture, more capabilities and features will undoubtedly be added over time. Finally, for some reason there are two user groups: **https://groups.io/g/x6100**, and **https://groups.io/g/xiegu-x6100**. It's worth joining both groups to keep up with operating information and firmware updates. You can also join a Xiegu X6100 Facebook group at **https://www.facebook.com/groups/339307487629712**.

Manufacturer: Xiegu. Distributed and supported in the US by a few US distributors. Price: X6100 HF transceiver $639.