Test and Review of an Inexpensive Arbitrary Function (signal) Generator

Model: FeelTech FY-6600-60

PROS: Easy to figure out, even with the sketchy manual. Appears to be accurate enough for HAM radio. The frequency being displayed is spot-on with my frequency meters, and if I connect a short whip antenna to either of the output connectors and set the frequency to 14.250 MHz my TS-930S will pick up the signal right at 14.250. This is lightweight and easy mount under a shelf with double-sided tape, or to store between uses.

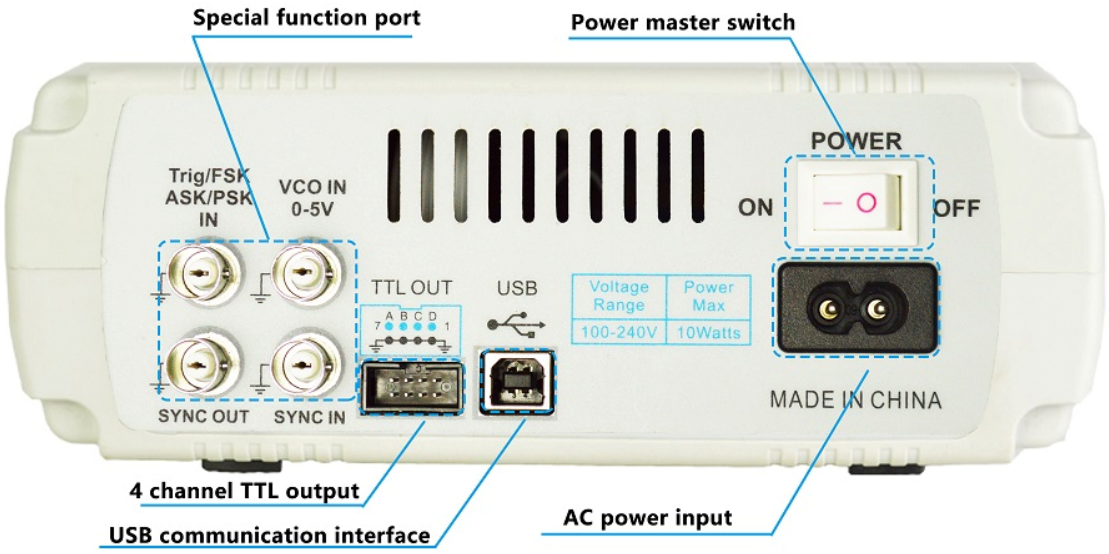
CONS: Longevity may be an issue compared to older "boatanchor" units, like those made HP, Agilent, or Wavetek. This is lightweight and cheaply made. The front knob can be "slippery". Also, while the manufacturer states that one of the functions is a frequency counter, it's very insensitive. The allowable voltage range as a frequency meter is 2 to 20V P-P. The pictures show that the Max safe input as a frequency counter is 5Volts "DC + AC".

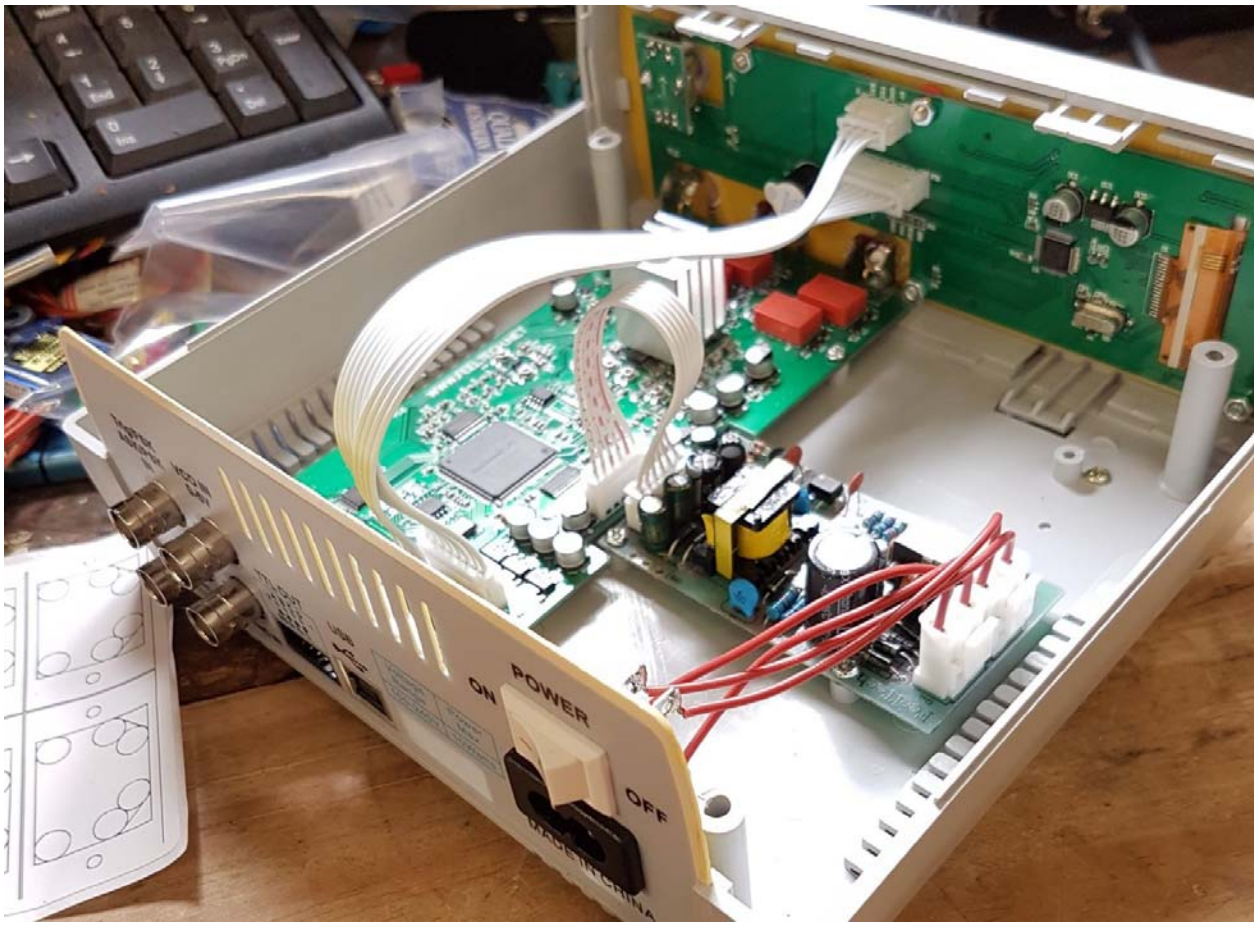
Bottom line: If you're looking for an inexpensive multi-function Sweep/Signal Generator that can be used for aligning equipment, testing filters, and other HAM shack functions, this will do the job.

REVIEW

I bought one of those inexpensive "Arbitrary Waveform" generators to see if it would be a useful addition to a HAM radio shack. I wanted to buy something "serious" like a Wavetek 166, but it was just too large and heavy and I'm trying to downsize. There's been a fairly recent influx of inexpensive "Arbitrary Waveform" generators online, mostly build around a single chip.

The one I bought is the FY-6600-60. The "60" indicates that its maximum frequency is 60MHz. These are sold under several brand names, and some operate from a "wall-wart". The FY-6600 however uses an AC cord instead, and it has input and output jacks on the back for Trig, VCO, Sync out, Sync in, and a USB output for a computer hookup. I haven't tested those functions yet. It's built like a toy, but it has a lot of capability. First, some photos. The first one is mine. The other two were copied from the web. The last one is from EEVblog – someone violated their warranty! I haven't done that yet, but I will. I'll replace these with photos of my own.





The controls on this unit are fairly intuitive which is good because the “manual” isn’t.

Here are the manufacturer's specifications. I've made some comments in red along the way.

Frequency

Model FY6600-15M FY6600-30M FY6600-50M FY6600-60M

Sine 0~15MHz 0~30MHz 0~50MHz 0~60MHz (This unit will perform full-range sweeps over these ranges)
Square 0~15MHz 0~25MHz 0~25MHz 0~25MHz
Ramp/Triangle 0~10MHz 0~10MHz 0~10MHz 0~10MHz
Pulse 0~10MHz 0~10MHz 0~10MHz 0~10MHz
TTL/CMOS 0~10MHz 0~10MHz 0~10MHz 0~10MHz
Random 0~10MHz 0~10MHz 0~10MHz 0~10MHz
Minimum pulse width: 20ns(All models of pulse wave minimum width can reach 20ns)
Min. Resolution on all frequency range: 1μHz (Min. resolution can reach 1μHz on all frequency range to ensure adjusting accuracy under high frequency. For example, it can output a 10.000000000001 MHz signal).
Accuracy ±20ppm (I don't have the equipment to verify this, but my frequency counters agree with its dial setting)
Stability ±1ppm/ 3hours

Waveform Characteristics

Waveforms

Sine, Square (Duty Cycle adjustable), Pulse (Pulse width and cycle time can be set accurately), Triangle/Ramp, Sawtooth Wave, CMOS, Four channels TTL, DC, Half wave, Full wave, Positive Step, Inverse Step, Positive Exponent, Inverse Exponent, Lorenz Pulse, Multitone, Noise, ECG, Trapezoidal Pulse, Sync Pulse, Narrow Pulse, Gauss White Noise, AM, FM, and other 64 sets customer-defined waveform.
Nonvolatile Storage: Can store 64 user-defined arbitrary waveforms. Waveform Length 8192 Dots * 14Bit
Sampling Rate 250MSa/s **Vertical Resolution** 14 Bits
Sine Harmonic Suppression: ≥45dBc(<1MHz);≥40dBc(1MHz~20MHz);

Total Harmonic Distortion: <0.8% (20Hz~20kHz,0dBm)
Square Wave Rise/Fall Time ≤7ns(VPP<5v)
Overshoot ≤5%
Duty Cycle 0.1%~99.9%
Sawtooth Linearity ≥98% (0.01Hz~10kHz)

Output characteristics Amplitude（VPP）

Frequency≤10MHz: 1mVpp~20Vpp ； 10MHz<Frequency≤20MHz: 1mVpp~10Vpp,
Frequency>20MHz: 1mVpp~5Vpp
Amplitude Resolution: 1mV
Amplitude Stability ±0.5%/ 5 Hours
Amplitude flatness ±5%(<10MHz) ； ±10%(>10MHz);
Waveform Output
Impedance 50Ω±10%（Typical）
Protection: All channels can work more than 60 seconds when the load is short-circuited.

Dc Offset

Offset Range Frequency≤20MHz: ±10V ； **Frequency>20MHz**: ±2.5V; **Offset Resolution** 1mV

Phase Feature

Phase range 0~359.9°
Phase resolution 0.1°

TTL Output

Electrical Level Amplitude: >3Vpp
Fan-out >8 TTL LOAD: Rise/Fall Time ≤10ns

CMOS Output
Low Electric Level <0.3V
High Electric Level 1V~10V
Rise/Fall Time ≤20ns
External Measurement
Frequency Meter: Range 0.01Hz~100MHz

Sensitivity
Gate Time 3 grades(1S, 10S, 100S) adjustable
Counter Range 0-4294967295
Coupling DC , AC
Working Mode Manual
Voltage Input Range: 2Vpp~20Vpp **(not really suitable for Ham radio)**

Pulse Width measurement
Resolution 5 nS. Max. 20S
Period Measurement
Resolution 5ns, Max. Limit 20s

Sweep
Sweep Type Linear or Logarithm
Sweep Objects Frequency, Amplitude, Offset, Duty Cycle
Sweep Time 0.01S~999.99S/Step
Parameters Range Starting position and Finishing position can be set arbitrarily. Sweep Range Decided by Parameters setting. **IN SIMPLE ENGLISH, THIS CAN DO "HOME RUN" (Full Bandwidth) SWEEPS. My unit will sweep all the way from a fraction of a Hz to 60 MHz or from whatever start and end point I choose. This is ideal for creating filter networks, aligning radios, and so forth. Even the 30 MHz Wavetek 164 or the 50 MHz 166 can't sweep through their entire range.**

VCO (Voltage Control Output) **I haven't tried this feature yet.**
Modulation signal range to input: 0~5V
VCO signal frequency range: 0-1000Hz
VCO control object voltage controlling frequency (VCF), voltage controlling amplitude (VCA), voltage controlling offset, voltage controlling duty cycle.
VCO special function
Can Amplitude Modulate (AM) or Frequency Modulate (FM) by external analog signal.

Digital Modulation (Modulate analog signal by digit) **I haven't tried this feature yet either.**
Modulation Mode ASK, FSK, PSK
Signal Carrier Sine, Square, Triangle/Ramp, Sawtooth, Random (DC excluded)
Source CH2, External, Manual
Modulation wave Square with 50% duty cycle (1μHz~10MHz).

Burst Function
Pulse Quantity 1-1048575
Burst Mode Manual, CH2, External
General Specifications

Display Mode 2.4 inch TFT Color Lcd.
Save & Load
Amount 20
Position 01 to20 (01 for start default value)
Interface
Type USB to Serial interface.

Communicating Speed: 9600bps (Industrial standard)
Protocol Command line mode, protocol complete open.
Power Voltage Range: AC100V~240V
Technic SMD, LSI, Reliable and durable. Buzzer Can be turned on/off by setting.
Operation Buttons and knob continuously.
Environment Temp.：0~40□ Humidity： 80%
Dimensions 200mm （Length）×190mm（Width） ×90mm（Height）
Weight Machine（700 g）， Accessories（150 g）**(this means it's light, so fasten it down)**

There are lengthy video reviews of this and others like it online, so I'll get right to the point.

1. It WILL do "Home Run" sweeps (full bandwidth) at speeds as fast as 0.01S. That won't compete with laboratory-grade equipment, but it will let you test filters, align HAM gear, etc. As I write this, I'm finding out some interesting things about a few filters I designed and built for the input of my Swan 1200-W linear amplifier (in the Swan section of my web page). I also used this gadget to align my Hammarlund HQ-170.

2. Expanding on item 1, if you have an elliptical filter with one or more peaks, and you don't have a Spectrum Analyzer or post injector in your shack, you can use this gadget to find out where your peaks are located. It's super easy to change the sweep start and/or end range until the peaks in your filter waveform are split, which will be the approximate center frequencies of the peaks.

3. The menu system is common-sense. I figured out most of the functions without the manual.

4. One of the advertising points of this unit is its ability to serve as a Frequency counter, but it falls well short of my expectations there. It's very insensitive, requiring a signal level of 1.5V before it will even register. And despite the fact that the manual says the MAX input is 20V, my unit says 5V. Even with a long whip antenna connected, it can't read the frequency that I'm tuning up on with any of my transceivers. By contrast, my Elenco F-1300 displays my transmit frequency instantly even without an antenna connected.

   On the PLUS side, if you have this connected either to the DRV cable from your TS-930S, or R174 next to the DRV/XVT relay, and you're getting a reading on this unit, then your Signal Unit is almost certainly working. If your Transmit isn't, then your problem in most likely somewhere else (probably the Power Amp). Check out the pictures at the end of this review.

5. It WILL let you perform MANY of the alignments shown in the TS-930S service manual, but not ALL of them. Step 13 (VCO-BPF) of the PLL alignment requires a sweep from 50-90MHz. Buy I paid less than $100 with shipping for this, all functions work as stated, and it serves as both a standard signal generator and a sweeper. And it can generate White Noise, required for many receiver alignments.

6. It allowed me to align my Hammarlund HQ-170 completely, including the 60 Khz 1st IF stage.

7. Theoretically, it should let one feed a low-level sine wave into their 930S PA to verify that it works. More to come on that.

8. The waveforms that it produces are very clean. I don't have a lab-grade spectrum analyzer, but the patterns lock right in on all my scopes.

9. The accuracy of the displayed output voltage doesn't agree with my Tek TDS360, but again - it cost $100, with free shipping.

10. It's an excellent "calibrator" for analog HAM rigs/receivers. Just connect a 6 to 8 inch "racetrack" rubber whip antennas to either channel 1 or 2 and set the frequency to whatever you need. My vintage rigs pick up the signal with ease. You can also use this to align your vintage rig's built-in calibrator if it has one.

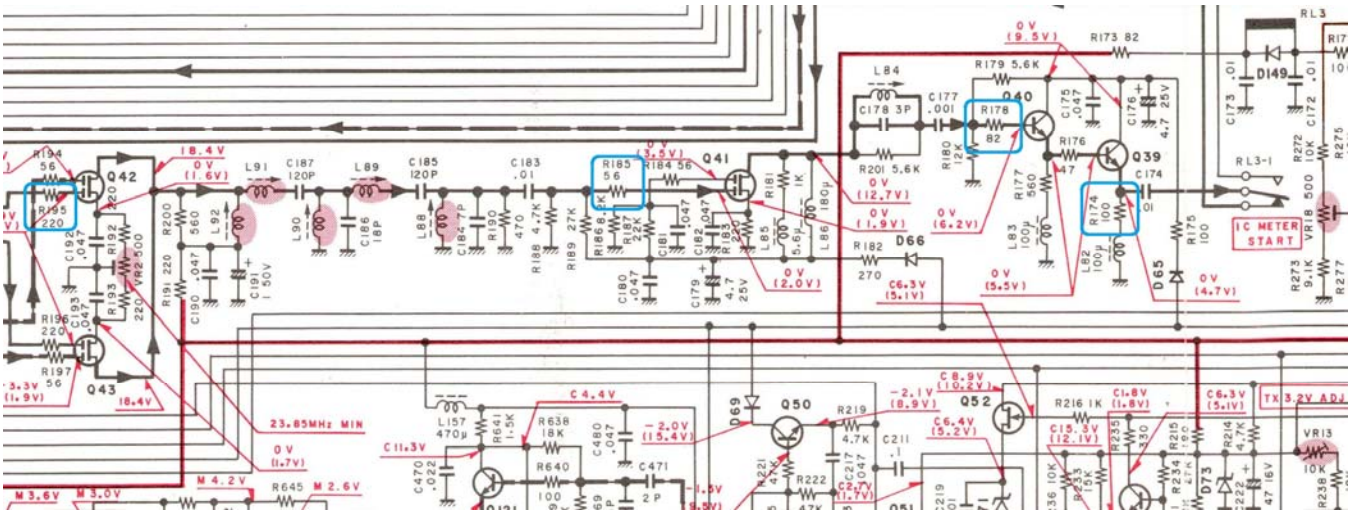
See some photos of this unit in action on the following pages

Aligning my Hammarlund HQ170 (with my EICO 249 VTVM)

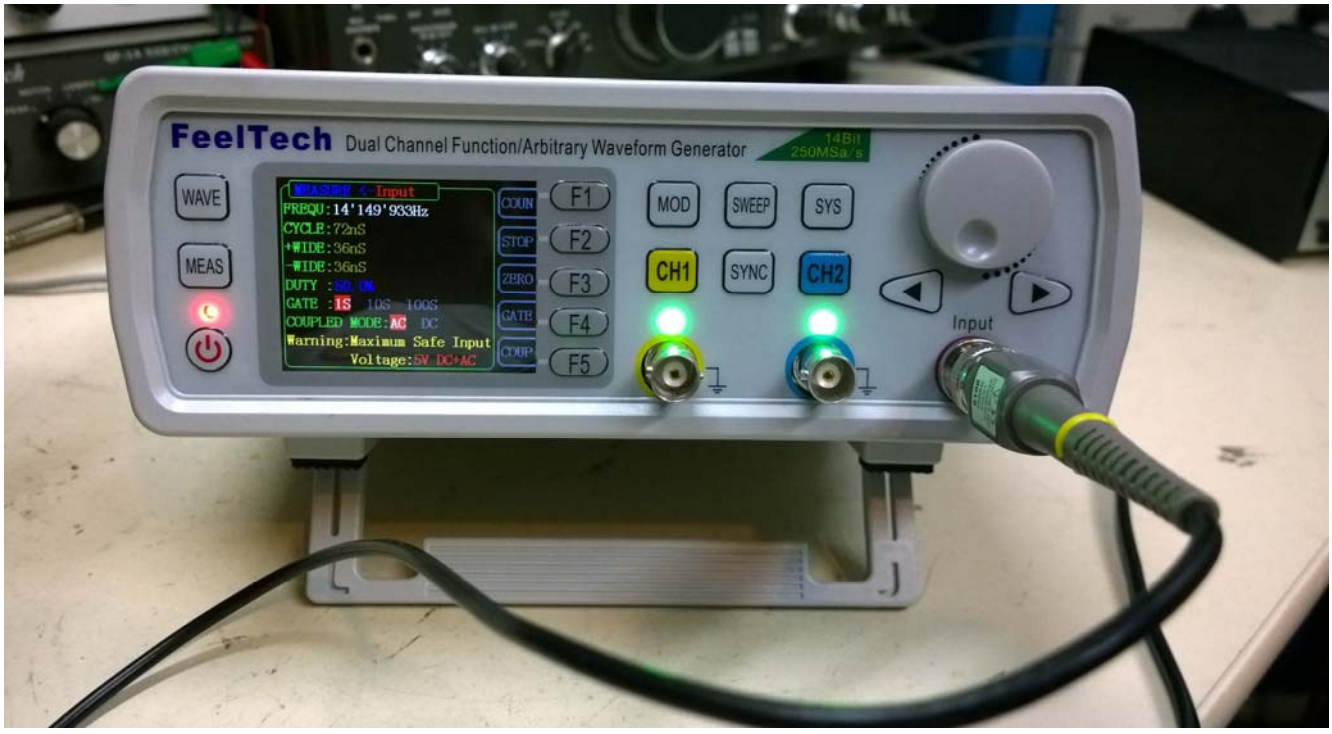
Testing a pair of DMMs for frequency response at 5 & 30 MHz

Testing the Output Stages of a TS-930S.

There are four convenient test points on the Signal Unit in a Kenwood TS-930S where one might obtain the transmit signal as shown below. Resistor R174 has the same approximate output level as the cable and connector from the Signal Unit DRV terminal to the input connector on the PA.



With the 930S set to 14.150 MHz (yes I know – that's technically out of band), the FeelTech 6600-60 CAN pick up the output from the Signal Unit at either R174, or the output connector. It reads 14.149.933, however,



The Elenco F-1300, on the other hand, is spot-on…….

The Feeltech 6600 could NOT display a reading at R178 or any other test point, limiting its usefulness to simply verifying that the Signal Unit IS producing an output level of 2.0V P-P or greater.