Sherwood Engineering HF Test Results

Model Elad FDM-DUO Serial # 5F0007 Test Date: 8/3/2015

IF BW 2400 –6 / -60, Hz 2412 / 4320 *	Ultimate	dB#
IF BW 500 –6 /-60, Hz 411 / 2060 *	Ultimate	dB#

* See notes on actual bandwidth
# See notes on ultimate rejection

Front End Selectivity	LPF only
First & second IF rejection +/- kHz	(Does not apply)

Dynamic Range with radio, no preamp		
Dynamic Range 20 kHz	70	dB
Dynamic Range 10 kHz	70	dB
Dynamic Range 5 kHz	70	dB
Dynamic Range 2 kHz	70	dB

Blocking above noise floor, 1uV signal, 100 kHz, AGC On, 500-Hz BW (Audio level went down 3 dB)	124	dB

Phase noise (normalized) at 2.5 kHz spacing: (Filter leakage, no value)	dBc / Hz
Phase noise (normalized) at 5 kHz spacing:	-132
Phase noise (normalized) at 10 kHz spacing:	-133
Phase noise (normalized) at 20 kHz spacing:	-136
Phase noise (normalized) at 30 kHz spacing:	-139
Phase noise (normalized) at 40 kHz spacing:	-140
Phase noise (normalized) at 80 kHz spacing:	-140
Phase noise (normalized) at 100 kHz spacing:	-141
Phase noise (normalized) at 200 kHz spacing:	-142
Phase noise (normalized) at 300 kHz spacing:	-142
Phase noise (normalized) at 400 kHz spacing:	-142
Phase noise (normalized) at 500 kHz spacing:	-143

For RMDR, subtract 27 dB from the numbers above.

Noise floor, SSB bandwidth 14 MHz, no preamp	-126	dBm
Sensitivity at 14 MHz, no preamp (10 dB S+N/N)	0.33	uV
Noise floor, 500 Hz, 14.2 MHz	-132	dBm
Noise floor, 1000 Hz, 14.2 MHz	-130	dBm
Noise floor, 500 Hz, 50.125 MHz, no preamp	-132	dBm
Noise floor, SSB, 50.125 MHz, no preamp	-125	dBm

Sensitivity, SSB, 50.125 MHz, no preamp (10 dB S+N/N)		0.39	uV
Signal for S9, no preamp		50	uV
Signal for S9, no preamp		-73	dBm

Gain of preamp			
Preamp	(No indication of a preamp)	None	dB
Attenuator:		12	dB

AGC threshold at 3 dB, no preamp			
Threshold = 1	-101 dBm	2	uV
Threshold = 2	-97 dBm	3.3	uV
Threshold = 4	-81 dBm	20	uV*
Threshold = 6	-75 dBm	41	uV
Threshold = 8	-68 dBm	83	uV
Threshold =10	-56 dBm	335	uV

* Default = 4

Notes:

S meter linearity and dBm meter linearity is as close to perfect as one could ask for. Each S unit from S1 to S9 is 6 dB. The dBm scale is within 1 dB from -120 dBm to -30 dBm, and is often perfect. There is an occasional error of up to 2 dB when decreasing the signal in 5 dB steps vs. increasing the level in 5 dB steps. The S meter / dBm readings are not significantly affected by the 12 dB attenuator. These readings are corrected in software to give the true signal level, which should be commended.

Optimum AGC threshold would best be adjustable and memorized by band. The default value of 4 in the menu was far too high in my estimation for 20 meters and up. With no preamp, I prefer an AGC threshold between 2 and 3 uV on 20 meters and up. This was obtained by adjusting menu #4 from the default value of 4 to a value of 1. On the lower bands, where band noise is much higher, increasing the threshold would be desirable.

In the PDF manual, there is an indication of a "Pre" on the LCD display when looking at the front-panel picture. A search for the word "preamp" in the same manual yielded no hits, and I was unable to find any way to enable a preamp within the menu system. The attenuator does show up in menu #1. The status of a possible preamp, or lack of same, will be confirmed with the Elad factory.

The ergonomics of this radio will be dependent on the user's fondness for deep menus and multi-touch buttons and knobs. There are only three knobs on the radio, and they do multiple functions if pressed quickly or slowly. There are 85 menus that can be accessed. Once the operator becomes steeped in what all the button and knob pushes do, I would assume the ergonomics score would improve. From the standpoint of quickly being able to adjust settings, which is very important in a contest or DX pile-up, the radio is likely lacking. The Elad is a QRP radio, and a lot of contesters operate QRP. I found the

Elecraft KX3 significantly easier to operate from an ergonomic standpoint, having operated the KX3 in two 160-meter CW contests and from Easter Island on SSB and CW.

The strangest aspect of the Elad is the DSP selectivity. The radio has both a bandwidth DSP that shows up on the S meter and dBm meter, and an audio DSP functionality that does not show up on the S meter.

For instance, if one measures the bandwidth of the 2.4 kHz SSB filter using the dBm meter, the -6 dB bandwidth is 3350 Hz wide, while the audio bandwidth measures 2412 Hz wide. Similarly if one measures the 500-Hz CW filter bandwidth on the dBm meter, the -6 dB bandwidth is 1150 Hz wide, while the audio bandwidth is 411 Hz.

The -60 dB bandwidth at 2400 Hz SSB, using the dBm meter, is 4320 Hz.
The -60 dB bandwidth at 500 Hz CW, using the dBm meter, is 2060 Hz.

Today one expects the RF selectivity on CW to have a shape factor of at least 2:1, and preferably 1.5:1. This kind of performance allows copy of a weak CW signal within one or two filter bandwidths of a very strong signal. When a strong QRMing signal is within one or two filter bandwidths, all one should hear are the key clicks (keying sidebands) of the interfering signal. It remains to be seen if the Elad will function to this level of performance in a CW contest or pile-up.

Even more strange is the leakage in the stopband. No phase noise measurement could be made in a 500-Hz bandwidth when tuned 2.5 kHz offset from the test signal due to filter leakage. Additionally, one can clearly hear high-pitched leakage out to 9.5 kHz with the 500-Hz CW bandwidth when injecting an S9+40 dB signal (-33 dBm). On SSB this is much less noticeable, possibly due to the wider noise bandwidth, plus the effect of the audio DSP filtering. It can be noted that when tuned 3.24 kHz below an S9+40 dB signal on 20 meter USB, the S meter reads S9 even though nothing is heard from the speaker but noise. The audio DSP rejects the signal that is still in the RF passband.

The measured dynamic range of the radio was lower than expected. The Perseus, that came out years ago, measured nearly 100 dB using the classical test methods used with legacy radios. In this case, the dynamic range of the Elad was 70 dB at all measured spacings. An increase of 1 dB in the test signal level increased the third-order IMD product from 3 dB above the noise floor to 5 dB above the noise floor at all test spacings.

Phase noise, or reciprocal mixing dynamic range (RMDR), is not an issue with the Elad. While the phase noise is about 10 dB worse than the top four radios on the Sherwood website, the numbers are quite respectable for a $1250 QRP transceiver. Whatever limitations the radio will demonstrate on-air, phase noise will not be one of them.