Sherwood Engineering HF Test Results

Model Yaesu FT-710 Serial # 2J020104 Test Date: 10/01/2022

IF BW 2400 -6 / -60 Hz	2415/3073	Ultimate	109	dB
IF BW 500 -6 / -60 Hz	505/709	Ultimate	108	dB
IF BW 250 -6 / -60 Hz	253/355	Ultimate	108	dB

Front End Selectivity (A – F)		B
First IF rejection +/- kHz	N/A	dB

Dynamic Range no preamp (IPO)		
Dynamic Range 20 kHz	107	dB
Dynamic Range 10 kHz	106.5	dB
Dynamic Range 5 kHz	106.5	dB
Dynamic Range 2 kHz	106.5	dB

Combination of phase noise and 3rd order product
* Consisted of phase noise only

Dynamic Range preamp #1		
Dynamic Range 20 kHz	105	dB
Dynamic Range 10 kHz	105	dB
Dynamic Range 5 kHz	105	dB
Dynamic Range 2 kHz	105	dB

Combination of phase noise and 3rd order product
* Consisted of phase noise only

Dynamic Range preamp #2		
Dynamic Range 20 kHz	101	dB
Dynamic Range 10 kHz	101	dB
Dynamic Range 5 kHz	101	dB
Dynamic Range 2 kHz	101	dB

Combination of phase noise and 3rd order product
* Consisted of phase noise only

Blocking or ADC overload above noise floor		
-104 dBm reference signal, AGC threshold -95 dBm		
100 kHz blocking signal, AGC On, 3 dB audio level drop	129	dB
At +2 dBm (IPO no preamp) ADC overload protection triggered		

Reciprocal Mixing Dynamic Range (RMDR)
Noise floor -126 dBm, 500 Hz BW, 7.000 MHz Wenzel Oven Oscillator

Spacing kHz		
2.5	115	dB
5	119	dB
10	123	dB
15	124	dB
20	126	dB
25	127	dB
30	127	dB

Above 1 dBm test level ADC overload protection triggered.

Phase noise (normalized) at 2.5 kHz spacing:	-142	dBc/Hz
Phase noise (normalized) at 5 kHz spacing:	-146	dBc/Hz
Phase noise (normalized) at 10 kHz spacing:	-150	dBc/Hz
Phase noise (normalized) at 15 kHz spacing:	-151	dBc/Hz
Phase noise (normalized) at 20 kHz spacing:	-153	dBc/Hz
Phase noise (normalized) at 25 kHz spacing:	-154	dBc/Hz
Phase noise (normalized) at 30 kHz spacing:	-154	dBc/Hz

Beyond -154 dBc/Hz overload protection triggered

Noise floor SSB 2.4 kHz BW 14.2 MHz, no preamp	-120	dBm
Noise floor SSB 2.4 kHz BW 14.2 MHz, Preamp 1	-129	dBm
Noise floor SSB 2.4 kHz BW 14.2 MHz, Preamp 2	-135	dBm
Sensitivity SSB 2.4 kHz BW 14.2 MHz, no preamp	0.66	uV
Sensitivity SSB 2.4 kHz BW 14.2 MHz, Preamp 1	0.23	uV
Sensitivity SSB 2.4 kHz BW 14.2 MHz, Preamp 2	0.13	uV
Noise floor CW 500 Hz BW 14.2 MHz, no preamp	-127	dBm
Noise floor CW 500 Hz BW 14.2 MHz, Preamp 1	-135	dBm
Noise floor CW 500 Hz BW 14.2 MHz, Preamp 2	-141	dBm
Noise floor SSB 2.4 kHz BW 50.125 MHz, no preamp	-122	dBm
Noise floor SSB 2.4 kHz BW 50.125 MHz, Preamp 1	-132	dBm
Noise floor SSB 2.4 kHz BW 50.125 MHz, Preamp 2	-134	dBm
Sensitivity SSB 2.4 kHz BW 50.125 MHz, no preamp	0.54	uV
Sensitivity SSB 2.4 kHz BW 50.125 MHz, Preamp 1	0.18	uV
Sensitivity SSB 2.4 kHz BW 50.125 MHz, Preamp 2	0.12	uV
Noise floor CW 500 Hz BW 50.125 MHz, no preamp	-128	dBm
Noise floor CW 500 Hz BW 50.125 MHz, Preamp 1	-138	dBm
Noise floor CW 500 Hz BW 50.125 MHz, Preamp 2	-140	dBm

Signal for S9, no preamp	-68	dBm	80	uV
Signal for S9, Preamp 1	-78	dBm	28	uV
Signal for S9, Preamp 2	-88	dBm	8	uV
Gain of preamp(s)				
Preamp 1			10	dB
Preamp 2			20	dB
AGC threshold at -3 dB, no preamp			4	uV
AGC threshold at -3 dB, Preamp 1 ON			1.4	uV
AGC threshold at -3 dB, Preamp 2 ON			0.38	uV

Notes:

The two 10 dB preamps are normal on 20 meters, but on 6 meters preamp 1 has more effect than expected and preamp 2 has a minimal improvement in noise floor compared to preamp 1. Likely the gains of the two preamps are not the same on 6m compared to 20m.

The basic numbers of the FT-710 are almost identical to the FTdx10 on 20m, such as noise floor, AGC threshold, sensitivity and dynamic range. FTdx10 blocking is higher than the ADC overload protection level of the FT-710.

Moving the volume control to the right of the tuning knob compared to the left of the tuning knob is a big improvement for right handed operators compared to the FTdx10.

Initial impressions are the user interface is identical to the FTdx10. Overall the ergonomics of the 710 are better than the FTdx10. Physical buttons have been added to the top front edge of the radio.

The band scope is jumpy as with the 101D, 101MP and 10. Averaging should be an option. If scope gain is set carefully to minimize “grass” at the bottom of the scope, the annoyance of the jumpy scope is minimized.

Receive setup during NY QSO Party 2022 on 10m CW used preamp 1 only, and the scope gain was set to +7.5 dB. Any signal that could be copied could be seen on the scope. Weak signals resulted in a one pixel wide display on the scope 20 kHz span. The measured antenna noise gain at my rural QTH was 18 dB with no need for preamp 2.

I expect a mouse would be helpful as it is with the FTdx10.

Looking at only the published block diagram, the noise floor values would seem to imply there is some non-listed gain block in front of both ADC chips, possibly an ADC driver chip.

There appears to be an AGC circuit to protect the ADC chips from reaching 0 dBFS (overload). Distortion increases beyond the measured dynamic range, but the ADC does not crash (over-range). A signal stronger than +1 dBm at the antenna input triggers the protection circuit. +1 dBm is nominally S9+74 dB if S9 is -73 dBm (which it isn't).

1 Hz "fine" tuning was very handy for measuring the DSP filter bandwidths.

Firmware: Main V01-00, Display V01-00, DSP V01-00, SDR V01-03

Transmit composite noise Yaesu FT-710 (Composite noise = phase noise + AM noise)

Offset	100 watts	45 watts	30 watts
2.5 kHz	-124 dBc/Hz	-120 dBc/Hz	-120 dBc/Hz
5 kHz	-127	-122	-121
10 kHz	-129	-124	-123
20 kHz	-131	-125	-124
50 kHz	-134	-128	-127
100 kHz	-136	-130	-130
200 kHz	-140	-134	-134
300 kHz	-143	-137	-136

Yaesu published spec for "phase noise only" at 2 kHz is -143 dBc/Hz.

Even if the measurement is phase noise only, that value isn't believable.

My 10 MHz Wenzel OCXO at 2 kHz offset measures -141.5 dBc/Hz.

Harmonic measurements 100 watts using HP 3585A:

2nd harmonic was down 69 dB on 20m.

2nd harmonic was down 78 dB on 40m and 3rd harmonic down 76 dB on 40m.

Rev B1