Sherwood Engineering HF Test Results

Model TS-590S Serial # B0A00386 Test Date: 12/15/2010

IF BW 2400 –6 / -60, Hz	2510/3590	Ultimate	100*	dB
IF BW 500 –6 /-60, Hz	490/977	Ultimate	92*	dB

* Phase noise limited, 2 to 4 filter bandwidths away

Front End Selectivity (A – F)	B	
First IF rejection 11374 kHz	77	dB
Image rejection 2x24 kHz	90	dB

Dynamic Range, no preamp, 20 meters (down conversion)

Dynamic Range 20 kHz	104#	dB	IP3	+28	dBm
Dynamic Range 5 kHz	97#	dB	IP3	+18	dBm
Dynamic Range 2 kHz	88*	dB	IP3		dBm
Dynamic Range 1 kHz	85*	dB	IP3		dBm

Combination of phase noise and 3rd order product
* Phase noise limited

Dynamic Range, alternate conversion scheme, 17 meters (up conversion)

Dynamic Range 20 kHz	102	dB	IP3	+21	dBm
Dynamic Range 2 kHz	76*	dB	IP3		dBm

* Phase noise limited

Blocking above noise floor, 1uV signal @ 99 kHz, AGC On, 3 Hz filter	144^	dB
Blocking above noise floor, 1uV signal @ 99 kHz, AGC On, 3 Hz filter	133^^	dB

^ 20 meters (down conversion)
^^ 17 meters (up conversion)

Phase noise (normalized) at 2.5 kHz spacing:	118	dBc
Phase noise (normalized) at 5 kHz spacing:	130	dBc
Phase noise (normalized) at 10 kHz spacing:	140	dBc
Phase noise (normalized) at 20 kHz spacing:	144	dBc
Phase noise (normalized) at 40 kHz spacing:	146	dBc
Phase noise (normalized) at 80 kHz spacing:	147	dBc
Phase noise (normalized) at 100 kHz spacing:	147	dBc
Phase noise (normalized) at 200 kHz spacing:	147	dBc
Phase noise (normalized) at 300 kHz spacing:	148	dBc
Phase noise (normalized) at 400 kHz spacing:	148	dBc
Phase noise (normalized) at 500 kHz spacing:	148	dBc

Noise floor, SSB bandwidth 14.2 MHz, no preamp	-125	dBm
Noise floor, SSB bandwidth 14.2 MHz, Preamp 1 On	-133	dBm
Sensitivity at 14.2 MHz, no preamp	0.43	uV
Sensitivity at 14.2 MHz, Preamp 1 On	0.15	uV
Noise floor, 500 Hz, 14.2 MHz, no preamp	-128	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 1 On	-137	dBm
Noise floor, SSB bandwidth 18.1 MHz, no preamp	-127	dBm
Noise floor, SSB bandwidth 18.1 MHz, Preamp 1 On	-134	dBm
Sensitivity at 18.1 MHz, no preamp	0.28	uV
Sensitivity at 18.1 MHz, Preamp 1 On	0.13	uV
Noise floor, 500 Hz, 18.1 MHz, no preamp	-132	dBm
Noise floor, 500 Hz, 18.1 MHz, Preamp 1 On	-139	dBm
Noise floor, SSB, 50.125 MHz, no preamp	-126	dBm
Noise floor, SSB, 50.125 MHz, Preamp 1	-137	dBm
Sensitivity at 50.125 MHz, no preamp	0.35	uV
Sensitivity at 50.125 MHz, Preamp 1 On	0.10	uV
Noise floor, 500 Hz, 50.125 MHz, no preamp	-130	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 1 On	-142	dBm
Signal for S9, no preamp	53	uV
Signal for S9, Preamp 1	15	uV
Gain of preamp	11	dB
AGC threshold at 3 dB, no preamp 20 meters (down conversion)	1.8	uV
AGC threshold at 3 dB, Preamp 1 On 20 meters (down conversion)	0.5	uV
AGC threshold at 3 dB, no preamp, 17 meters (up conversion)	1.4	uV
AGC threshold at 3 dB, Preamp 1 On, 17 meters (up conversion)	0.42	uV

Comparison between down-conversion and up-conversion modes on 20 meters.
Gain change, +2 dB on up-conversion mode.
Measurements made with the preamp OFF.
Sensitivity 2700 Hz bandwidth: 0.41 uV
Sensitivity 3100 Hz bandwidth: 0.34 uV
Noise floor 2700 Hz bandwidth: -124 dBm
Noise floor 3100 Hz bandwidth: -126 dBm

IF filter bandwidth vs. IF shift
When the bandwidth on CW is 500 Hz or less, the DSP bandwidth only lines up with the roofing filter when the IF shift is set to one offset. Moving the IF shift reduces the net bandwidth significantly. The choice of an 800 Hz beatnote is the default, and this can be changed in menu 34. Bandwidths below were measured with menu 34 at the default.

IF Shift Setting	Net Bandwidth
1000 Hz	400 Hz
900 Hz	490 Hz
800 Hz	500 Hz
700 Hz	460 Hz
600 Hz	360 Hz
500 Hz	260 Hz
400 Hz	170 Hz
300 Hz	120 Hz

Notes:

The TS-590S was used in the December 2010 ARRL 10 meter CW and SSB contest. Signals were not really strong until Sunday afternoon for a sporadic E opening when some signals exceeded S9 + 30 dB. While the signal density between 28,350 and 28, 510 kHz was not as bad as CQ WW SSB, there were lots of signals and many that were splattering. There was no indication that the receiver was ever in overload, even with the preamp ON. Unfortunately I did not use it on CW during the E opening.

The transceiver was also used during the W1BB 160 meter CW contest in December. It performed well, including the use of the DSP at 50 Hz. The FTdx-5000D was also used in the same contest. The Yaesu DSP at 50 Hz appeared to have less ringing, but both provided narrow bandwidths when needed.

Later I used the 590S and the Ten-Tec Eagle in the CQ 160 meter CW contest at the end of January. The ergonomics of the 590S were superior to those of the Eagle. Neither, however, suffered from overload, and the 100 Hz BW of the Eagle was useful in being able to work CE1/K7CA, as the 50 Hz bandwidth was with the Kenwood in December.

ALC:
There is a significant ALC overshoot problem that affects both CW and SSB when driving a linear. The overshoot approaches as much as 20% with firmware 1.00. This can either clip the amp when starting to talk after a slight pause, or saturate on the first "dit" on CW, possibly causing a key click on the air. A new firmware update improved, but did not eliminate the problem.

Overshoot issue. Firmware 1.02
On a single "dit", with the ALC set to read one bar on the meter, the measured rise time was 2.2 msec, fall time was 3.2 msec, and overshoot about 13%. This was with the menu set for a default rise time of 6 msec.

Transmit IMD:

The SSB signal was observed by W6XX with a K3 and LP-PAN during a 3 minute transmission, with the LP-PAN on Max Peak Hold. Intermodulation "shoulders" were clearly visible on 20 meters, down approximately 25 dB. The S/N ratio at that time was 50 dB. Two tone tests were run in the lab, with rather normal IMD for the odd-order products 5^{th} and higher. The 3^{rd} order products nulled out at least 10 dB below the 5^{th} order at 90 and 100 watts PEP. The odd-order distortion was normal at 50 watts PEP, with the 3^{rd} order higher than the higher order products, which is more common.

White noise IMD tests were made on the transceiver, along with the new Ten-Tec Eagle and the Yaesu Ftdx-5000D. The IMD from the white noise being fed in the mic jack of the 590S was down 60 dB at approximately 5 kHz from the edge of the passband. The Eagle was down 60 dB approximately 7 kHz from the edge of its passband. The Yaesu distortion products were down 60 dB about 2 kHz away in class A and 4 kHz away in class B. Note: On the Yaesu these numbers were with no ALC. With the Yaesu in class B, and with about 3 dB of ALC, the distortion was much worse. The distortion was down about 60 dB 7 kHz from the edge of the passband, about as bad as the Eagle.

Ergonomics:
Ergonomics are generally good, with a nice feel to the main tuning knob. Many functions, however, need three actions to adjust: push a button, turn the multi-function knob, and then push the same button again to cancel the function.

The LCD S meter is easy to read and has enough granularity to reasonable approximate an analog meter. Above S9, the S meter generally tracked properly up to 50 over. Below S7, each S unit is approximately 3 dB.

EQ:
The EQ granularity is not adequate. One can treble boost 1 or 2 as an option or bass boost 1 or 2, but not both. This is significantly less flexible than the K3 with its parametric 8-band equalize, which can boost or cut any of the eight bands.

It is possible to program a multi-band EQ in the TS-590S via a computer and software provided by Kenwood using a USB interface. One wonders why this level of adjustment is not accessible via a menu.

The 590S worked fine with N1MM logger and the serial port when N1MM was configured as a TS-2000. The serial port sex is backwards, just like the Yaesu products, requiring a "gender bender". No attempt to use the USB port was made, due to lack of time and likely lack of support as of December 2010 by N1MM.

The receive audio was quite pleasing via an external Icom SP-20 speaker, or Radio Shack headphones.

The size of the Kenwood is similar to an Elecraft K3 or a Ten-Tec Eagle. The Eagle and the K3 significantly exceed the close-in dynamic range on the bands where the 590S is in "up conversion" mode. If the K3 isn't filled with options, all three radios are in a similar price range. The Kenwood is significantly heavier than the other two, and unlikely to move around while one is pushing buttons.

The TS-590S is significantly more robust in features than the Eagle. It has an RX antenna input, plus two transmit antenna jacks. It has direct access to any band via the keyboard without having ratchet up through the bands or down through the bands. The Eagle is worst in this respect due to its cumbersome function key to reverse direction. At least the K3 has a dedicated up and down button.

Another oddity on the Eagle, there is no button to push on the front panel to go into transmit mode. My Heil GM-5 mic has a PPT button, but it does not lock. There appears to be no way to stay in transmit mode if one doesn't want the VOX to drop out.

The Kenwood has the proper audio taper volume control, while the Eagle has a linear taper, making fine adjustments at modest volume levels tedious.

The gain of the radio is about 2 dB hotter when in up-conversion mode. The added insertion loss when the 500 Hz CW roofing filter switches in was 2 dB on this unit. Reports from the field indicate these values are very inconsistent, with the gain difference between up-conversion and down-conversion as much as 6 dB.

Likewise the added insertion loss of the CW roofing filter has been reported to be as much as 7 dB, though my sample only measured 2 dB added loss when the 500 Hz roofing filter switched.

It appears that quality control may be rather loose in respect to gain and loss. There does not appear to be any spec on these values.

There have been some issues with internal fuses blowing, and when repaired by Kenwood, a higher value fuse was used as the replacement.

Rev 1h