Sherwood Engineering HF Test Results

Model IC-7700 Serial # 0201012 Test Date: 12/11/2012

IF BW 2400 –6 / -60, Hz	/	Ultimate	85	dB
IF BW 500 –6 /-60, Hz	/	Ultimate	90	dB

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

All measurements made with 3 kHz roofing filter unless otherwise noted.

Dynamic Range with radio, no preamp

Dynamic Range 20 kHz	105#	dB	IP3	dBm
Dynamic Range 5 kHz	89*	dB	IP3	dBm
Dynamic Range 2 kHz	78*	dB	IP3	dBm

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

Dynamic Range with radio, Preamp 1

Dynamic Range 20 kHz	105	dB	IP3	dBm
Dynamic Range 5 kHz	90	dB	IP3	dBm
Dynamic Range 2 kHz	78*	dB	IP3	dBm

* Consisted of phase-noise only

Dynamic Range with radio, Preamp 2

Dynamic Range 20 kHz	103	dB	IP3	dBm
Dynamic Range 5 kHz	90	dB	IP3	dBm
Dynamic Range 2 kHz	78*	dB	IP3	dBm

*Consisted of phase-noise noise only

Blocking above noise floor, 1uV signal @ 100 kHz, AGC On, 140* dB
* Phase-noise limited

Phase noise (normalized) at 2.5 kHz spacing:	-108	dBc
Phase noise (normalized) at 5 kHz spacing:	-120	dBc
Phase noise (normalized) at 10 kHz spacing:	-129	dBc
Phase noise (normalized) at 20 kHz spacing:	-137	dBc
Phase noise (normalized) at 30 kHz spacing:	-141	dBc
Phase noise (normalized) at 40 kHz spacing:	-143	dBc
Phase noise (normalized) at 80 kHz spacing:	-148	dBc
Phase noise (normalized) at 100 kHz spacing:	-149	dBc
Phase noise (normalized) at 200 kHz spacing:	-151	dBc
Phase noise (normalized) at 300 kHz spacing:	-153	dBc
Phase noise (normalized) at 400 kHz spacing:	-153	dBc
Phase noise (normalized) at 500 kHz spacing:	-153	dBc

Noise floor, SSB bandwidth 14 MHz, no preamp	-120	dBm
Noise floor, SSB bandwidth 14 MHz, Preamp 1 On	-133	dBm
Noise floor, SSB bandwidth 14 MHz, Preamp 2 On	-137	dBm
Sensitivity SSB at 14 MHz, no preamp	0.69	uV
Sensitivity SSB at 14 MHz, Preamp 1 On	0.15	uV
Sensitivity SSB at 14 MHz, Preamp 2 On	0.1	uV
Noise floor, 500 Hz, 14.2 MHz, no preamp	-127	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 1 On	-140	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 2 On	-143	dBm
Noise floor, SSB, 50.125 MHz, no preamp	-122	dBm
Noise floor, SSB, 50.125 MHz, Preamp 1	-134	dBm
Noise floor, SSB, 50.125 MHz, Preamp 2	-137	dBm
Sensitivity, SSB, 50.125 MHz, no preamp	0.50	uV
Sensitivity, SSB, 50.125 MHz, Preamp 1	0.13	uV
Sensitivity, SSB, 50.125 MHz, Preamp 2	0.10	uV
Noise floor, 500 Hz, 50.125 MHz, no preamp	-129	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 1 On	-140	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 2 On	-143	dBm

Signal for S9, no preamp, 15 kHz roofing filter	-73	dBm	50	uV
Signal for S9, no preamp, 3 kHz roof	-68	dBm	89	uV
Signal for S9, Preamp 1, 3 kHz roof	-80	dBm	22	uV
Signal for S9, Preamp 2, 3 kHz roof	-86	dBm	11	uV

Gain of preamp(s) 20 meters

Preamp 1	12	dB
Preamp 2	18	dB

Very little change in preamp gain from 1.8 MHz to 50 MHz
See table below

AGC threshold at 3 dB, no preamp		6.5	uV
AGC threshold at 3 dB, Preamp 1 On	1.6	uV	
AGC threshold at 3 dB, Preamp 2 On	0.8	uV	

S9, 3 kHz roofing	1.8 MHz	14.1 MHz	28.1 MHz	50.1 MHz
No preamp	-68 dBm	-68 dBm	-66 dBm	-68 dBm
Preamp 1	-79 dBm	-80 dBm	-79 dBm	-78 dBm
Preamp 2	-86 dBm	-86 dBm	-85 dBm	-83 dBm

MDS with frequency, 500 Hz DSP, 3 kHz roofing filter

Preamp gain	1.8 MHz	14.1 MHz	28.1 MHz	50.1 MHz
No preamp	-127 dBm	-127 dBm	-125 dBm	-129 dBm
Preamp 1	-140 dBm	-140 dBm	-139 dBm	-140 dBm
Preamp 2	-143 dBm	-143 dBm	-142 dBm	-143 dBm

Noise floor vs roofing filter with 500 Hz DSP bandwidth, no preamp:
15 kHz roofing: -131 dBm
6 kHz roofing: -129 dBm
3 kHz roofing: -127 dBm

Notes:

All measurements for dynamic range with with a 500 Hz DSP bandwidth, and measured with an HP 3400A RMS analog volt meter. No measurements were made using the ARRL 3-Hz or similar very narrow bandwidth using a swept or FTT spectrum analyzer.

All measurements and on-air operation of the radio were with the DSP bandwidth filters and the APF filters set to “soft”.

The IC-7700 was used extensively at my rural QTH east of Ft. Collins (as seen on QRZ.com) during CQ WW SSB, ARRL 160 CW and ARRL 10 meter contests this Fall / Winter. The radio performed admirably on both modes.

The only annoyance noted on SSB was the AGC is easily captured by any transient noise spike (click, tick or pop). This does not occur on my IC-756 Pro III, nor my IC-781, IC-765 or any similar vintage analog radio. On CW this was less of an issue since narrow bandwidths reduce the rise time of the impulse noise, and thus the effect on the AGC.

The APF of the 7700 was superb in digging out weak signals on 160 meter CW during the contest. The only issue is the net loss or gain when engaging the APF. On my 781 there is a net gain of 4 dB when using the APF. This is very helpful, as it requires no adjustment of the volume control. The net audio level stays virtually constant when engaging the APF with the 781. Noise goes down and signal goes up.

On the other hand, the 7700 has a net loss of 1.3 dB when the APF is enabled, and I generally needed to turn up the volume control when punching in the APF. I also enabled the Digi control knob to adjust the center frequency of the APF, a very desirable feature. I would suggest it is desirable to increase the gain on the 7700 APF to a similar amount as with the 781.

Tim Duffy, K3LR, asked me to measure any dynamic range effects of the APF. At 20 kHz I measured a 2 dB decrease in dynamic range from 105 to 103, and insignificant change. From my perspective, the purpose of the APF is to reduce noise and improve the signal to noise ratio for weak signals, particularly as the signals approach the level of band noise. The APF improves S/N significantly on very weak signals. It also reduced close-in QRM in several instances, allowing the contact to be made. I only used the Wide APF setting, but others may well find the Medium and Narrow APF bandwidths additionally useful.

Since the radio is phase-noise limited at 5 and 2 kHz, using the normal 500 Hz DSP filter bandwidth, there was not way to measure the effect of the AFP since there was no audible third-order intermod signal present.

The phase noise of the radio using the reciprocal-mixing method was measured at -137 dBm / Hz at 20 kHz. At 5 kHz, however, the measurement drops to -120 dBc / Hz and at 2.5 kHz it measures -108 dBc / Hz. Thus the phase noise is completely dominant over the third-order product at the closer spacings.

Most of the time a receiver is not stressed to its third-order limit, and very close in, transmitted phase noise from an interfering station can also be a factor. Overall the features, filtering, ergonomics on both modes, and talk-power and EQ on SSB were impressive. The band scope was a great help during the 10 meter ARRL contest, as I was running S&P the whole time.

Receive audio is clean and pleasant with the filters on “soft”, with no fatigue-factor issues noted, unlike some other brands. (I used Sony 28 ohm headphones during the contests.) A comment from KL7QOW the past Saturday on 20 meters, with whom I talk weekly, was the 7700 had as good a punch and processing as my IC-781. (I use a D-104 on my 781 and I used a Heil GM-5 on the 7700.)

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Rev A