Sherwood Engineering HF Test Results

Model IC-7300 Serial # 02001408 Test Date: 4/5/2016

IF BW 2400 –6 / -60, Hz 2344 / 3469	Ultimate	85	dB
IF BW 500 –6 /-60, Hz 515 / 666	Ultimate	85	dB
Front End Selectivity (A – F)	15 bandpass filters		B
Dynamic Range with radio, no preamp			
Dynamic Range 20 kHz		81	dB
Dynamic Range 10 kHz		81	dB
Dynamic Range 5 kHz		81	dB
Dynamic Range 2 kHz		81	dB
Dynamic Range of radio with IP+ dynamic-range enhancement enabled			
Dynamic Range 20 kHz		103	dB
Dynamic Range 10 kHz		101	dB
Dynamic Range 5 kHz		95	dB
Dynamic Range 2 kHz		94	dB
Blocking above noise floor, 1uV signal @ 100 kHz, AGC On, See notes below on blocking, limited by ADC clip point.		123	dB
Phase noise (normalized) at 2.5 kHz spacing:		-127	dBc
Phase noise (normalized) at 5 kHz spacing:		-132	dBc
Phase noise (normalized) at 10 kHz spacing:		-137	dBc
Phase noise (normalized) at 20 kHz spacing:		-140	dBc
Phase noise (normalized) at 30 kHz spacing:		-144	dBc
Phase noise (normalized) at 40 kHz spacing:		-145	dBc
Phase noise (normalized) at 50 kHz spacing:		-147	dBc
Phase noise (normalized) at 80 kHz spacing:		-144	dBc
Phase noise (normalized) at 100 kHz spacing:		-140	dBc
Phase noise (normalized) at 200 kHz spacing:		-149	dBc
Phase noise (normalized) at 300 kHz spacing:		-149	dBc
Phase noise (normalized) at 400 kHz spacing:		-149	dBc
Phase noise (normalized) at 500 kHz spacing:		-149	dBc
Noise floor, SSB bandwidth 14 MHz, IP+ enabled		-116	dBm
Noise floor, SSB bandwidth 14 MHz, no preamp		-128	dBm
Noise floor, SSB bandwidth 14 MHz, Preamp 1 On		-136	dBm
Noise floor, SSB bandwidth 14 MHz, Preamp 2 On		-137	dBm

Sensitivity SSB at 14 Mhz, IP+ enabled			1.0	uV
Sensitivity SSB at 14 MHz, no preamp			0.27	uV
Sensitivity SSB at 14 MHz, Preamp 1 On			0.11	uV
Sensitivity SSB at 14 MHz, Preamp 2 On			0.10	uV
Noise floor, 500 Hz, 14.2 MHz, IP+ enabled			-122	dB,
Noise floor, 500 Hz, 14.2 MHz, no preamp			-133	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 1 On			-141	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 2 On			-142	dBm
Noise floor, SSB, 50.125 MHz, no preamp			-125	dBm
Noise floor, SSB, 50.125 MHz, Preamp 1			-134	dBm
Noise floor, SSB, 50.125 MHz, Preamp 2			-135	dBm
Sensitivity, SSB, 50.125 MHz, no preamp			0.37	uV
Sensitivity, SSB, 50.125 MHz, Preamp 1			0.13	uV
Sensitivity, SSB, 50.125 MHz, Preamp 2			0.113	uV
Noise floor, 500 Hz, 50.125 MHz, no preamp			-131	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 1 On			-139	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 2 On			-140	dBm
Signal for S9, no preamp	-73	dBm	50	uV
Signal for S9, Preamp 1	-80	dBm	22	uV
Signal for S9, Preamp 2	-85	dBm	12	uV
Gain of preamp(s)				
Preamp 1			7	dB
Preamp 2			11	dB
AGC threshold at 3 dB, no preamp			1.9	uV
AGC threshold at 3 dB, Preamp 1 On			0.85	uV
AGC threshold at 3 dB, Preamp 2 On			0.5	uV

Notes:

Blocking measurement was limited by the ADC overload indicator “OVF”
Overload with a single signal occurs at -10 dBm
While dynamic range is increased significantly with IP+ enabled, the overload point remains -10 dBm.

S meter linearity
S1 - S5: 2.8 dB / S unit
S5 - S9: 3.3 dB / S unit
From S9 to S9+60, each 10 dB reading was actually +9.5 dB
Rev A

Sherwood Engineering HF Test Results

Model IC-7300	Serial # 02001408	Test Date: 04/05/2016
Model IC-7300	Serial # 02012272	Test Date: 02/10/2018

Data is for sample #1 unless otherwise noted.

IF BW 2400 –6 / -60, Hz 2344 / 3469	Ultimate	>100	dB*
IF BW 500 –6 /-60, Hz 515 / 666	Ultimate	>100	dB*

* Previous value of 85 dB was in error. Both samples measure >100 dB.
See Notes section for additional comments on ultimate rejection.

Front End Selectivity (A – F)	15 bandpass filters	C

Dynamic Range with radio, no preamp, IP+ OFF	Sample #2	Sample #1	
Dynamic Range 20 kHz	84	81	dB
Dynamic Range 10 kHz	84	81	dB
Dynamic Range 5 kHz	84	81	dB
Dynamic Range 2 kHz	84	81	dB

Dynamic Range of radio with IP+ dynamic-range enhancement enabled			
Dynamic Range 20 kHz	106	103	dB
Dynamic Range 10 kHz	100	101	dB
Dynamic Range 5 kHz	97	95	dB
Dynamic Range 2 kHz	97	94	dB

Blocking above noise floor, 1uV signal @ 100 kHz, AGC On, See notes below on blocking, limited by ADC clip point.	123	dB

Phase noise (normalized) at 2.5 kHz spacing:	-127	dBc
Phase noise (normalized) at 5 kHz spacing:	-132	dBc
Phase noise (normalized) at 10 kHz spacing:	-137	dBc
Phase noise (normalized) at 20 kHz spacing:	-140	dBc
Phase noise (normalized) at 30 kHz spacing:	-144	dBc
Phase noise (normalized) at 40 kHz spacing:	-145	dBc
Phase noise (normalized) at 50 kHz spacing:	-147	dBc
Phase noise (normalized) at 80 kHz spacing:	-144	dBc
Phase noise (normalized) at 100 kHz spacing:	-140	dBc
Phase noise (normalized) at 200 kHz spacing:	-149	dBc
Phase noise (normalized) at 300 kHz spacing:	-149	dBc
Phase noise (normalized) at 400 kHz spacing:	-149	dBc
Phase noise (normalized) at 500 kHz spacing:	-149	dBc

	Sample #2	Sample #1	
Noise floor, 2400 Hz, 14 MHz, no preamp, IP+ On	-126	-116	dBm
Noise floor, 2400 Hz, 14 MHz, no preamp	-127	-128	dBm
Noise floor, 2400 Hz, 14 MHz, Preamp 1 On	-135.5	-136	dBm
Noise floor, 2400 Hz, 14 MHz, Preamp 2 On	-136.5	-137	dBm
	Sample #2	Sample #1	
Sensitivity SSB at 14 Mhz, no preamp, IP+ On	0.35	1.0	uV
Sensitivity SSB at 14 MHz, no preamp	0.30	0.27	uV
Sensitivity SSB at 14 MHz, Preamp 1 On	0.12	0.11	uV
Sensitivity SSB at 14 MHz, Preamp 2 On	0.11	0.10	uV
Noise floor, 500 Hz, 14.2 MHz, IP+ On*	-132	-122	dB,
Noise floor, 500 Hz, 14.2 MHz, no preamp	-133	-133	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 1 On	-140.5	-141	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 2 On	-141.5	-142	dBm

*SSB or CW Noise floor with IP+ On, and either preamp On, is only degraded 0.5 dB.

Noise floor, SSB, 50.125 MHz, no preamp	-125	dBm
Noise floor, SSB, 50.125 MHz, Preamp 1	-134	dBm
Noise floor, SSB, 50.125 MHz, Preamp 2	-135	dBm
Sensitivity, SSB, 50.125 MHz, no preamp	0.37	uV
Sensitivity, SSB, 50.125 MHz, Preamp 1	0.13	uV
Sensitivity, SSB, 50.125 MHz, Preamp 2	0.113	uV
Noise floor, 500 Hz, 50.125 MHz, no preamp	-131	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 1 On	-139	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 2 On	-140	dBm

Signal for S9, no preamp	-73	dBm	50	uV
Signal for S9, Preamp 1	-80	dBm	22	uV
Signal for S9, Preamp 2	-85	dBm	12	uV

Gain of preamp(s)		
Preamp 1	7	dB
Preamp 2	11	dB

AGC threshold at 3 dB, no preamp	1.9	uV
AGC threshold at 3 dB, Preamp 1 On	0.85	uV
AGC threshold at 3 dB, Preamp 2 On	0.5	uV

Notes on following page.

My first IC-7300 was obtained in April of 2016 and has an early serial number 02001408. Icom usually starts US and Canada S/N at 02001001. The two main issues with the 7300 were a poor implementation of "dither" (called IP+), and an "RF Tail" on key-up after the linear key line had gone high. This can cause hot switching of the amplifier, particularly with QSK on CW.

While "dither" should only degrade receiver noise floor a few dB, the 7300 measured degradation in the range of 9 to 13 dB. While this may be of little significance on the lower HF bands due to the higher level of band noise, an approximate 10 dB increase in noise floor with IP+ is certainly undesirable on 6, 10, 12 and possibly 15 meters.

A second sample 7300 was obtained in early February 2018 with S/N 02012272. There is no longer a significant degradation in noise floor with present production 7300s. When the production change was made is not known at this time. Over 20,000 IC-7300s have been sold to amateurs worldwide in fewer than two years.

While I have not found the need to run IP+ on my early 7300 on any band, the significant improvement of that feature is a welcome enhancement. Degradation in noise floor with IP+ is now approximately 1 dB. There is likely some sample variation, and another ham measured a unit with S/N of 02010125 with a 2.5 dB degradation due to IP+.

My original filter ultimate rejection measurement appears to have been incorrect. Both 7300s were measured again, and both measure over 100 dB. When these updated measurements were in progress, I noted a difference in what I would call a "clock" ticking sound between the two units. With a signal injected 110 dB above the receiver noise floor, the ticking sound is much faster by an order of magnitude on the second sample than on the first sample. At 1 kHz offset with a 500-Hz CW bandwidth, the "clock" sound is obvious, but at 2 kHz offset, it is just noticeable. I must emphasize this is with a clean test signal 110 dB above CW receiver noise floor.

To load my settings from sample #1 into sample #2, I had to update firmware from 1.14 to 1.20. The only difference was the main CPU version number.

Blocking measurement was limited by the ADC overload indicator "OVF".
Overload with a single signal occurs at -10 dBm. While dynamic range is increased significantly with IP+ enabled, the overload point remains at -10 dBm.

S meter linearity
S1 - S5: 2.8 dB / S unit
S5 - S9: 3.3 dB / S unit
From S9 to S9+60, each 10 dB reading was actually +9.5 dB

Two-sample Rev D

Transmit phase noise measurements IC-7300 with Perseus

Measurements made with three different resolution bandwidths

Attenuation between rig at 100 watts and Persues 53 dB.

Level into Perseus -3.1 dBm. Frequency 14.2 MHz

Offset	RBW Hz	Phase Noise dBc	Transmit noise key up dBc
2	30.5	-122	
5	30.5	-126	
10	30.5	-125	-131
20	30.5	-124	
2	61	-123	
5	61	-125	
10	61	-124	-131
20	61	-123	
5	122	-124	
10	122	-125	-131
20	122	-124	
50	122	-129	
70	122	-131	
90	122	-129	

Note: At 70 kHz offset, key up / key down phase noise difference unresolvable.

Icom IC-7300 CW Rise Time

The rise time was default at 4 ms, and increased to 8 ms (slowest).

Screen capture of a single “dit”.

Note the rise time is less than half specified in the menu setting.

Also the transitions are rather abrupt.