Sherwood Engineering HF Test Results

Model IC-705 Serial # 12003232 Test Dates: 11/04-14/2020

IF BW 2400 –6 / -60, Hz	/	Ultimate	100	dB
IF BW 500 –6 /-60, Hz	/	Ultimate	100	dB
Front End Selectivity (A – F)		Half Octave		C

Dynamic Range of radio, no preamp 20 meters

Dynamic Range 20 kHz	89	dB
Dynamic Range 10 kHz	89	dB
Dynamic Range 5 kHz	89	dB
Dynamic Range 2 kHz	88	dB

Dynamic Range of radio, no preamp 2 meters

Dynamic Range 20 kHz	84	dB
Dynamic Range 10 kHz	84	dB
Dynamic Range 5 kHz	82#	dB
Dynamic Range 2 kHz	78*	dB

Dynamic Range of radio, no preamp 70cm

Dynamic Range 20 kHz	84#	dB
Dynamic Range 10 kHz	82#	dB
Dynamic Range 5 kHz	78#	dB
Dynamic Range 2 kHz	74*	dB

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

Blocking above noise floor, 1uV signal @ 100 kHz, AGC On, (Or ADC overload for DS SDR radios) Measured on 20 meters — 122 dB

Reciprocal Mixing Dynamic Range (RMDR) 20 meters

Spacing kHz	dB	
2.5	109	dB
5	110	dB
10	111	dB
20	112	dB
30	114	dB
40	114	dB
50	115	dB
75	117	dB
100	118	dB

200	119	dB	
300	120	dB	
400	120	dB	
500	122	dB	Note: OVF flickering

Phase noise (normalized) at 2.5 kHz spacing:	-136	dBc/Hz	20 meters
Phase noise (normalized) at 5 kHz spacing:	-137	dBc/Hz	
Phase noise (normalized) at 10 kHz spacing:	-138	dBc/Hz	
Phase noise (normalized) at 20 kHz spacing:	-139	dBc/Hz	
Phase noise (normalized) at 30 kHz spacing:	-141	dBc/Hz	
Phase noise (normalized) at 40 kHz spacing:	-141	dBc/Hz	
Phase noise (normalized) at 50 kHz spacing:	-142	dBc/Hz	
Phase noise (normalized) at 100 kHz spacing:	-145	dBc/Hz	
Phase noise (normalized) at 200 kHz spacing:	-146	dBc/Hz	
Phase noise (normalized) at 300 kHz spacing:	-147	dBc/Hz	
Phase noise (normalized) at 400 kHz spacing:	-147	dBc/Hz	
Phase noise (normalized) at 500 kHz spacing:	-149	dBc/Hz	

Noise floor, SSB bandwidth 14.2 MHz, no preamp	-120	dBm
Noise floor, SSB bandwidth 14.2 MHz, Preamp 1 On	-131	dBm
Noise floor, SSB bandwidth 14.2 MHz, Preamp 2 On	-132	dBm
Sensitivity SSB at 14.2 MHz, no preamp	0.67	uV
Sensitivity SSB at 14.2 MHz, Preamp 1 On	0.20	uV
Sensitivity SSB at 14.2 MHz, Preamp 2 On	0.16	uV
Noise floor, 500 Hz, 14.2 MHz, no preamp	-127	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 1 On	-137	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 2 On	-139	dBm
Noise floor, SSB, 50.125 MHz, no preamp	-120	dBm
Noise floor, SSB, 50.125 MHz, Preamp 1	-131	dBm
Noise floor, SSB, 50.125 MHz, Preamp 2	-133	dBm
Sensitivity, SSB, 50.125 MHz, no preamp	0.65	uV
Sensitivity, SSB, 50.125 MHz, Preamp 1	0.18	uV
Sensitivity, SSB, 50.125 MHz, Preamp 2	0.15	uV
Noise floor, 500 Hz, 50.125 MHz, no preamp	-127	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 1 On	-137	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 2 On	-139	dBm

Noise floor, SSB, 144.2 MHz, no preamp			-127	dBm
Noise floor, SSB, 144.2 MHz, preamp ON			-138	dBm
Sensitivity, SSB, 144.2 MHz, no preamp			0.31	uV
Sensitivity, SSB, 144.2 MHz, preamp ON			0.087	uV
Noise floor, 500 Hz, 144.2 MHz, no preamp			-133	dBm
Noise floor, 500 Hz, 144.2 MHz, preamp ON			-144	dBm
Noise floor, SSB, 432.1 MHz, no preamp			-123	dBm
Noise floor, SSB, 432.1 MHz, preamp ON			-137	dBm
Sensitivity, SSB, 432.1 MHz, no preamp			0.49	uV
Sensitivity, SSB, 432.1 MHz, preamp ON			0.095	uV
Noise floor, 500 Hz, 432,1 MHz, no preamp			-129	dBm
Noise floor, 500 Hz, 432.1 MHz, preamp ON			-142	dBm
Signal for S9, no preamp, 20 meters	-73	dBm	50	uV
Signal for S9, Preamp 1	-80	dBm	26	uV
Signal for S9, Preamp 2	-83	dBm	12	uV
Gain of preamps (Determined by OVF change) 20 meters				
Preamp 1			13	dB
Preamp 2			18	dB
AGC threshold at 3 dB, no preamp 20 meters			4.2	uV
AGC threshold at 3 dB, Preamp 1 On			1.5	uV
AGC threshold at 3 dB, Preamp 2 On			0.87	uV
OVF with preamp OFF, 20 meters			-6 dBm	

Notes:

After lab testing was completed in Denver, I had a 20 minute QSO with a station in South Carolina at 10 watts on 20m SSB. His signal was S9+15, and my antenna was a Hy-gain 204BA at 50 feet. The following day I had a 15 minute QSO with KL7QOW in Palmer, Alaska. He was about S9+10 and I was S7. Good skip, no QRM and a 4-element Yagi on transmit helps when running 10 watts.

Contest observations: Bottom line, on HF the IC-705 operates like an IC-7300.
Note: I did not run QRP, as I was evaluating RX capabilities while running legal limit at 1500 watts using a Ten-Tec 418 amp to drive an Alpha 89.

I operated the IC-705 during Sweepstakes, ARRL 160m CW and ARRL 10m on both CW and SSB. For Sweepstakes I ordered a Heil HT headset which plugged in OK, but didn't work on VOX, thus I had to use PTT for the 100 contacts I made. I operated the entire 160m CW contest with the 705, making 392 Qs including 2 JA contacts. For the ARRL 10m contest I operated both CW and SSB, and there were no issues with lack of sensitivity. I did not operate the entire 10m contest with the IC-705 since lack of a headset and VOX is very inefficient.

On receive when not charging the internal lithium battery with a 13.8 volt supply, the IC-705 draws about 200mA. When the battery is enabled to charge when the radio is ON and is charging, the current draw is about 340mA. Charging while the radio is ON can be turned off. The radio appears to have a smart internal charger that cuts off charging the lithium battery once it has reached full charge. Hopefully this will extend battery life.

Transmit key down on CW/RTTY/FM on 13.8 volts, the current draw is about 2 amps on 20m, and is similar on 160, 80 & 40m. The current increases up to 2.6 amps on the higher HF and VHF/UHF bands. On SSB the LCD current meter shows voice peaks similar to key down.

The IC-705 does not have Icoms IP+ feature that does linearize the ADC chip to some extent on the IC-7300 and IC-7610. While the IC-9700 has an IP+ feature, it doesn't do anything useful.

The IC-705 has no IP+ feature, and considering the receiver only draws about 200mA on receive, the dynamic range is only a few dB lower than a 7300 with IP+ OFF on 20 meters. In comparison on receive, the IC-7300 draws 1 amp or more.

It is somewhat tedious to insert and remove the MicroSDHC card for updating firmware and saving all settings. I had to use small needle nose pliers or tweezers as my thumb and finger had difficulty inserting or removing the SD card. I was still able to buy a SanDisk 32GB MicroSDHC card at Best Buy, with a normal sized SD adapter for under $15.00. Most SD cards of any format are much larger in capacity than 32GB, so I am not sure what happens if one tries to format a 64GB, 128GB or 256GB MicroSDXC card. I updated the firmware from 1.10 to the current 1.12 before lab testing.

Transmit EQ starting point. My suggestion for setting transmit EQ in the menu is to adjust the bass cut and treble boost so the transmit spectrum as observed on the band scope is relatively flat. Using the supplied hand microphone, my setting is -2 dB on bass and +5 dB on treble. This is how I do initial EQ on my 7300, 7610 and 9700. Final tweaking of EQ is later done with the help of friends who know my voice.

I recommend ¼ tuning speed on CW, easily set using the function button. On SSB the LCD button for transmit bandwidth becomes the CW button for ¼ tuning speed.

If a user is familiar with any current Icom direct sampling rigs, basic operation of the IC-705 is identical. There are many features I haven't used, and likely will never use. N1MM+ contest logger does support the IC-705.

I didn't measure the DSP filter bandwidths for two reasons. Filter shape factor Sharp and Soft significantly changes the value. Also the bandwidth can be user selected with the dual passband tuning or the filter default settings. Presently I have the three SSB filters set for 2.8, 2.4 and 2.1 kHz. For CW my three default bandwidths are 500, 250 and 150 Hz, just like my 7300 and 7610. These are easily changed by mode.

On AM when listening to normal medium wave broadcasts, I had to enable the 20 dB attenuator with a large outdoor antenna. The 9 kHz filter bandwidth sounded quite good. The digital sidebands of those few AM stations running HD (IBOC) are easily observed on the band scope and waterfall.

AGC time constant decay speeds are easily adjusted as in the other Icom rigs.

It will be interesting to see if SOTA operators choose the IC-705, as it weighs about 2.5 pounds compared to slightly more than one pound for the KX3 and less than a pound for the KX2. I found using the IC-7300 at 10 pounds a non-issue on Field Day. My batteries vastly outweighed the 7300. Of course the frequency coverage of the IC-705 includes VHF and UHF unlike the Elecraft KX line.

The color LCD display is identical in size as the IC-7300, and larger than any other QRP rig I have operated.

From an ergonomic standpoint, it is very annoying that the IC-705 is not stable when set at an angle of about 30 degrees. Even though the radio has a flat case area that portends to allow an improved viewing angle when sitting on a desk, the radio tips back to land on the four rubber stick-on feet. The larger PB-307 battery with 3150 mA rating helps to keep the radio stable when tilted for better LCD viewing. The cost of the larger battery is $129.00. Icom offers a tilted desk stand MBF-705 at a cost of $30.00. There are now several aftermarket companies offering tilt stands, and at least one company offering a carrying handle. Picking up the IC-705 with all the cables on each end is cumbersome without a handle. I/O ports include external 13.8 volts, antenna, speaker / microphone or headset, USB for digital FT8, tuner jack and amp key line.

https://www.icomjapan.com/lineup/options/MBF-705/

Subsequently the IC-705 has driven an Alpha 99 with 10 watts, outputting about 230 watts. Later a Ten-Tec 418 IPA (intermediate power amp) was used to drive an Alpha 89 to full legal limit. The IC-705 was set at 1.8 watts, the IPA displaying about 55 watts on voice peaks for 1500 out on the Alpha. An Elecraft KXP100 would also be a good IPA choice with better long term factory support. Wayne Burdick from Elecraft confirms it will work with the IC-705.

Transmit composite noise (Phase + AM noise) is what we hear on the air.

AM noise at 10 kHz dominates phase noise by about 10 dB on the lower bands only.

Transmit composite noise measured with Perseus in dBc/Hz

Above 10m, output mixed down to 20m using a +17 dBm mixer

Note: There is an unstable noise “bump” between 100 kHz and 200 kHz on all bands.

Offset	80m 10W	3W
2 kHz	-119.4	
5	-120.5	
10	-120.7	-119.4
15	-121.3	
20	-122.0	
50	-125.1	-123.5
100	-129.8	-127.5
188	-115.6	
200	-130.8	
300	-127.4	
400	-128.4	
500	-129.1	

Offset	20m 10W	3W
2 kHz	-120.1	-118.5
5	-121.3	-119.5
10	-121.5	-119.7
15	-121.8	-120.0
20	-122.3	-120.4
50	-124.9	-122.5
100	-128.3	-126.4
180	-111.3	-106.2
200	-132.7	-130.7
300	-133.9	-130.9
400	-130.9	-129.7
500	-132.3	-127.4

Offset	10m 10W	3W
2 kHz	-118.7	
5	-119.9	
10	-119.1	-116.7
15	-119.1	
20	-119.1	
50	-121.1	-118.7
100	-125.0	-122.2

178	-110.9
200	-128.1
300	-128.7
400	-126.4
500	-126.4

Offset 6m	10W	3W
2 kHz	-118.4	
5	-120.6	
10	-120.0	-117.7
15	-120.3	
20	-120.3	
50	-122.5	-119.4
100	-124.7	-121.5
175	-115.9	
200	-128.4	
300	-129.7	
400	-126.8	
500	-127.2	

Offset 2m	10W	3W
2 kHz	-113.1	
5	-115.8	
10	-118.0	-117.3
15	-118.0	
20	-117.2	
50	-119.2	-118.3
100	-119.8	-119.2
164	-109.0	
200	-128.1	
300	-129.5	
400	-122.4	
500	-123.5	

Offset 70cm	10W	3W
2 kHz	-110.4	
5	-112.3	
10	-113.3	-112.8
15	-111.6	
20	-112.6	
50	-112.2	-112.1
100	-113.8	-113.4

159	-109.8
200	-122.7
300	-124.8
400	-124.0
500	-124.0

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