

## IC-7300MK2 – Test Report



The IC-7300 was unique when it was released in 2016. It was the first SDR transceiver at an affordable price and remains the best-selling transceiver of all time. However, the technology and performance of other manufacturers have since caught up, and ICOM is attempting to regain this position with the IC-7300MK2. Externally, the IC-7300MK2 looks almost identical to its predecessor but boasts significantly more features, such as the ability to connect an external monitor via HDMI, a built-in CW decoder/decoder, a separate antenna connector, a high-speed USB Type-C port, and perhaps most importantly, an integrated server with an Ethernet LAN connection. Additionally, the receiver features improved dynamic ranges (RMDR), and the transmitter has reduced sideband noise (SBN).

**The following section tests the RF characteristics of the transceiver and the remote control using the RS-BA1 software.**

### Measurements at the receiver

#### **Sensitivity (MDS)**

MDS (Minimum Detectable Signal) corresponds to the smallest detectable signal that is still perceptible within the background noise of a receiver. To measure the sensitivity, the generator and receiver (operating in CW mode, B=500Hz) are tuned to the same frequency, resulting in a superimposed tone of approximately 600Hz. The generator signal is then reduced until the audio output voltage on the voltmeter increases by a factor of only 1.414 ( $20\log U_2/U_1$ ), which corresponds to a (S+N)/N of +3dB. The receiver's sensitivity (MDS) then corresponds to the set level of the RF generator. For example, at f=7.1MHz, this results in an MDS of -131dBm/500Hz.



**Figure 1: Measurement of sensitivity**

The following sensitivities were determined in the bands from 1.9 to 50.1 MHz:

**Settings: CW, RBW=500Hz, ATT off, NR off, NB off**

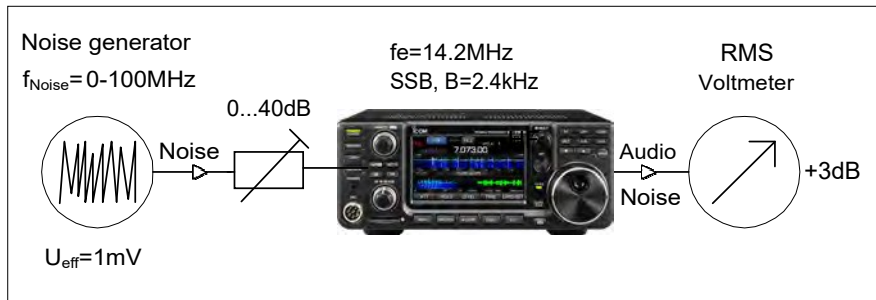
	1.9MHz	3.7MHz	7.1MHz	14.1MHz	21.1MHz	50.1MHz
<b>AMP off</b>	- 131dBm	- 130dBm	- 132dBm	- 132dBm	- 132dBm	- 131dBm
<b>AMP 1 on</b>	- 141dBm	- 140dBm	- 141dBm	- 141dBm	- 141dBm	- 141dBm
<b>AMP 2 on</b>	- 141dBm	- 142dBm	- 143dBm	- 143dBm	- 142dBm	- 142dBm
<b>IP+ on, AMP off</b>	- 126dBm	- 127dBm	- 131dBm	- 131dBm	- 132dBm	- 131dBm

**Table 1: Sensitivity (MDS) with/without preamplifier (AMP1/2) and IP+**

**Noise figure (NF) and noise factor (F)**

Noise figure and noise factor are determined using a noise generator that produces a constant noise band from 0-100MHz with a noise voltage of  $1\text{mV}_{\text{eff}} / 0\text{-}100\text{MHz} = -47\text{dBm} / 0\text{-}100\text{MHz}$ .

As an example, the receiver's noise figure is determined at  $f_e = 14.2\text{ MHz}$ , SSB,  $B = 2.4\text{ kHz}$ . To do this, set the frequency to  $f_e = 14.2\text{ MHz}$  and adjust the receiver's output noise to a fixed value (reference) of, for example,  $100\text{ mV}$  (or  $0\text{ dB}$ ) on the RMS voltmeter using the volume control. Then connect the noise generator to the receiver and reduce the noise level using the attenuator until the voltage reading on the RMS voltmeter increases by a factor of  $\sqrt{2} = 1.414$ , i.e., from  $100\text{ mV}$  to  $141.4\text{ mV}$ , or on a logarithmic scale from  $0\text{ dB}$  to  $3\text{ dB}$  ( $20\log 1.414 = 3\text{ dB}$ ). The noise generator level then corresponds to the receiver's noise level.



**Figure 2: Determination of noise measure and noise factor**

This was done with a set attenuation of  $30\text{dB}$ , resulting in a noise power of  $P_{\text{Noise}} = -47\text{dBm}/100\text{MHz} - 30\text{dB attenuation} = -77\text{dBm}/100\text{MHz}$  and based on a  $1\text{Hz}$  bandwidth

$$P_{\text{Noise}} = -77\text{dBm} - 10\log 100000000 = -157\text{dBm}/\text{Hz}$$

The resulting noise figure of the receiver is then calculated from the difference between the injected noise power of  $-158\text{dBm}/\text{Hz}$  and the theoretical noise limit of  $-174\text{dBm}/\text{Hz}$ .

**Noise figure =  $-158\text{dBm}/\text{Hz} - (-174\text{dBm}/\text{Hz}) = 16\text{dB}$**

corresponding to a noise factor to be calculated of

**Noise factor (F) =  $10^{\text{Noise figure}/10} = 10^{16/10} = 40$**

In other words, the signal-to-noise ratio of a received signal deteriorates by  $16\text{dB}$ , or a factor of  $40$ , between the input and output of the receiver.

By adding preamplifiers (AMP 1/2), the noise figure is significantly reduced.

**Settings:  $f_e=14.2\text{MHz}$ , SSB, RBW=2.4kHz**

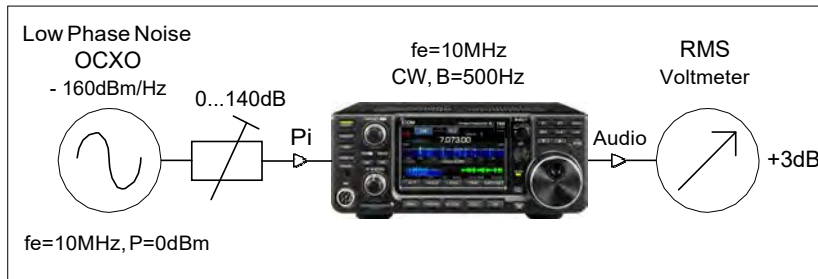
	AMP off	AMP1 on	AMP2 on
<b>Noise figure (FdB)</b>	16dB	6dB	3dB
<b>Noise factor (F)</b>	40	4	2

**Table 2: Noise figure and noise factor in the 20m band with and without amplifier**

Note: The noise figure can only be determined using a calibrated noise signal. If a noise generator is not available, in practice the noise figure is often calculated using the sensitivity (MDS) and the equation "Noise Figure =  $\text{MDS} - 10\log \text{RBW} - (-174\text{ dBm}/\text{Hz})$ " or, simplified for  $B=2.4\text{ kHz}$ , "Noise Figure =  $\text{MDS} + 140\text{ dB}$ ". When using these equations, it is assumed that the "resolution bandwidth" and the "noise bandwidth" is the same, which is not the case in most instances. If these equations are used, errors of up to  $2\text{dB}$  can occur.

**Sideband noise (RMDR and SBN)**

The RMDR (Reciprocal Mixing Dynamic Range) and SBN (Sideband Noise) values are among the most important criteria for a receiver. They describe the dynamic range loss of a receiver due to unwanted sideband noise. High levels of sideband noise can mask a small signal next to a large signal, effectively rendering a receiver "deaf." Increased sensitivity or improved selectivity are of no help in this situation. During the sampling process, the clock generator's SBN mixes with the received signal, potentially masking it with noise. Therefore, the clock generator's phase noise should be as low as possible (<-130 dBc/Hz) and the resulting RMDR as high as possible (>110 dB).



**Figure 3: Measurement of RMDR and SBN**

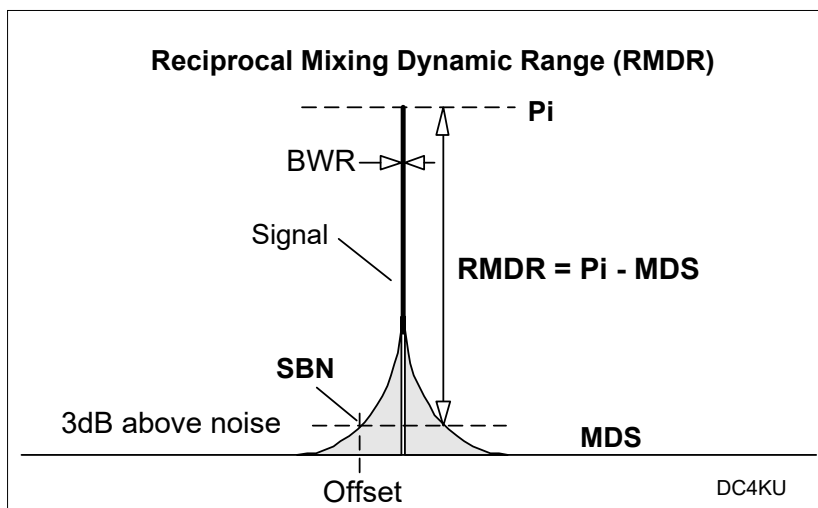
To determine the RMDR in the 40m band, a low-noise 10MHz signal (OCXO from KVG) is fed into the receiver and the receiver frequency is adjusted to  $f_e=10\text{MHz} \pm 1\text{kHz}$ . Then the signal power ( $P_i$ ) is increased until the  $(S+N)/N$  at the voltmeter reached a value of +3dB above the receiver background noise of  $MDS=-132\text{dBm/Hz}$  (see Table 1).

This was done at a  $P_i$  of **-23dBm** from which a RMDR was calculated of

$$\text{RMDR} = P_i - MDS = -23\text{dBm} - (-132\text{dBm}) = 109\text{dB}$$

and a sideband noise (SBN) of

$$\text{SBN} = \text{RMDR} + 10\log B = 109\text{dB} + 27\text{dB} = 136\text{dBc/Hz}$$



**Figure 4: Determination of SBN and RMDR using a low-noise CW signal**

Similarly, the RMDR and SBN are also determined at larger frequency offsets to the carrier (**Table 3**), from which the curves in **Image 5** and **6**. The result is: the larger the RMDR or the smaller the SBN, the greater the receiver's dynamic range.

**Settings IC7300MK2: CW, B=500 Filter, Preamp off, Att. off, NR off, NB off, AMP off**

Offset (kHz)	Pi (dBm)	RMDR (dB)	SBN (dBc/Hz)
1	- 23	109	- 136
2	- 22	110	- 137
3	- 18	114	- 141
5	- 15	117	- 144
10	- 12	120	- 147
20	- 10	122	- 149

Table 3: RMDR and SBN in carrier spacings from 1 to 20 kHz

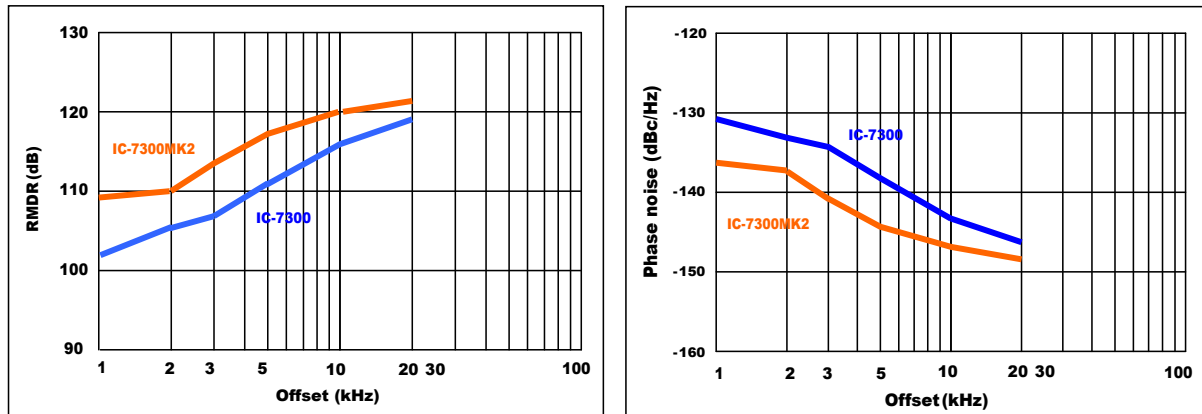


Figure 5: Curve of RMDR and phase noise as a function of carrier spacing (offset)

Result: The RMDR of the IC-7300MK2 is 7dB higher than that of the IC-7300 at a distance of 1 kHz.

**IMD3 test, dynamics and IP+**

The usable dynamic range of a receiver is limited by the noise floor for small signals and by the presence of intermodulation products for large signals. To determine the receiver's intermodulation immunity, two CW signals of the same level and small frequency separation ( $f_1 = 14.100 \text{ MHz}$ ,  $f_2 = 14.102 \text{ MHz}$ ,  $\Delta f = 2 \text{ kHz}$ ) are combined with the receiver's RF input via a combiner and attenuator.

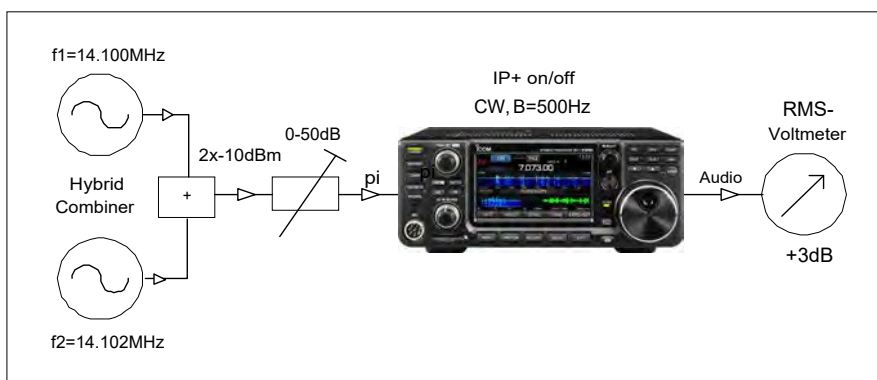


Figure 7: Measurement of 3rd order intermodulation ( $\text{IMD}_3$ ) with a 2-tone signal

An audio voltmeter is located at the receiver's audio output, which measures the levels of the interference signals during a 600 Hz superposition tone. The level of the two-tone signal ( $P_i$ ) is then increased until the third-order intermodulation interference (IM interference) at  $2x f_1 - f_2$  and  $2x f_2 - f_1$  appears at +3 dB above the background noise of  $\text{MDS} = -132 \text{ dBm/Hz}$  (see Table 1) and, according to  $(S+N)/N=2$ , thus corresponds to the level of the background noise.

This was done at  $P_i = 2 \times -56\text{dBm}$ , from which a DR was calculated.<sub>3</sub>(3<sub>rd</sub>-order IMD Dynamic Range) results from

$$DR_3 = P_i - MDS = -56\text{dBm} - (-132\text{dBm}) = 76\text{dB} \text{ (blue curve).}$$

The 2-tone level ( $P_i$ ) is then gradually increased in 1dB steps and the resulting  $IMD_3$ -levels are measured and noted, from which the  $IMD_3$ -curve (blue curve) in **Figure 8** results.

When "IP+" is activated, dithering/randomization occur in the A/D converter, causing the IM products to decorrelate and disappear into the noise. The first  $IMD_3$  products with +3dB above the noise floor only occur at  $P_i=2x-39\text{dBm}$ , resulting in a dynamic range of

$$DR_{3\text{ IP+}} = P_i - MDS = -39\text{dBm} - (-131\text{dBm}) = 92\text{dB} \text{ (green curve).}$$

The IM stability is therefore increased by 16dB with IP+. Another positive aspect is that the receiver noise only increases by 1dB (8dB for the IC-7300) when IP+ is activated. The highest dynamic range is achieved only in the so-called "sweet spot," at an input level of  $P_i = 2x -25\text{dBm}$ .

$$DR_{3\text{ IP+max}} = P_i - IMD = -25\text{dBm} - (-123\text{dBm}) = 98\text{dB} \text{ (green curve, red dot)}$$

*Settings IC-7300MK2: CW, BW 500Hz, Notch off, NB off, NR off, AGC off, IP+ on/off*

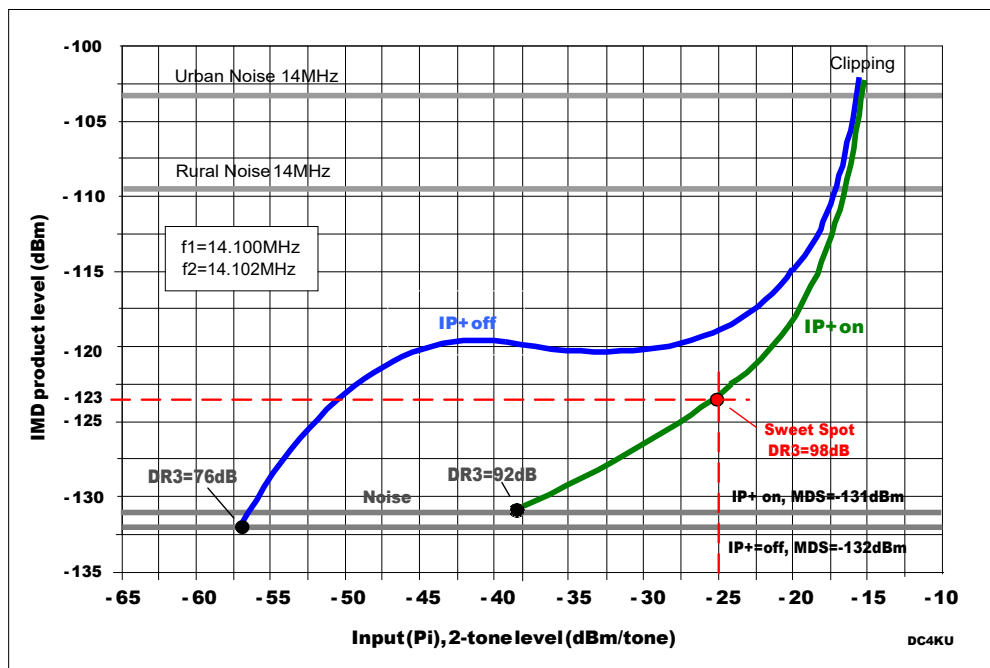


Figure 8: Interference-free dynamics as a function of the modulation ( $P_i$ )

Preamplifier	IP+ off	IP+ on
off	76dB	92dB
P.AMP1	76dB	93dB
P.AMP2	78dB	92dB

Table 4: DR3 as a function of IP+ and P.AMP

In the course of the curves, it is fundamentally important that both curves are below the Rural Noise (urban noise) or Urban Noise (rural noise), i.e. with the antenna switched on, the resulting IM products are always below the background noise and only appear as an interference product at levels greater than -15dBm (S9+58).

Note: Unlike analog receivers, direct sampling SDR receivers do not have "1dB compression" or a "3rd order intercept point" (IP3). These features do not exist.

### Dynamic range measurement using NPR (Noise Power Ratio)

Instead of a two-tone signal, the receiver uses a noise generator with white light. Noise leveled above a certain noise level (4), the receiver becomes overloaded and generates intermodulation in the form of additive noise. To make this noise increase measurable and visible, a narrowband, steep notch filter (in this example, 2.4 MHz, B=10 kHz) is placed between the noise generator and the receiver. This filter completely suppresses the noise at its cutoff frequency (attenuation >100 dB), so that in the unloaded state, only the receiver's inherent noise (MDS = -131 dBm) is measurable at the filter's base. However, as soon as the receiver produces distortion (IM, harmonics, etc.), this becomes visible as a slight noise increase of 3 dB at the notch filter's base or on the RMS voltmeter.

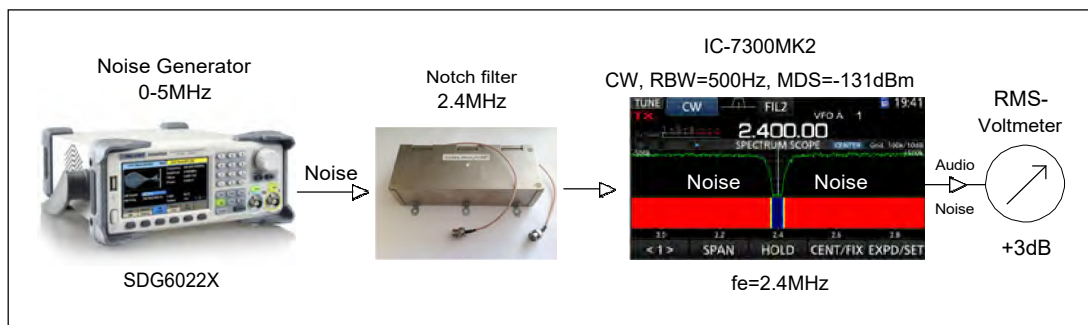


Figure 9: Measurement setup

The NPR of the IC-7300MK2 is determined below; the measurement setup is shown **Image 9**. For this purpose, a noise band from 0 to 5 MHz is generated (SDG6022X) and its power ( $P_{TOT}$ ) increased until the noise at the bottom of the notch filter rises by 3 dB, thus indicating the receiver's output limit. At a noise level of  $P_{DEAD}$  at -14 dBm/0-5 MHz, the receiver generates distortion products that are +3 dB above its noise floor and, according to  $(S+N)/N=2$ , correspond to the determined sensitivity of -131 dBm/500 Hz. The difference between the injected noise power ( $P_{DEAD}$ ) and the sensitivity (MDS) of the receiver, corresponds to the NPR.

$$\text{NPR} = P_{TOT} - \text{MDS} = -54\text{dBm} - (-131\text{dBm}) = 77\text{dB}$$

with:  $P_{TOT} = -14\text{dBm}/5\text{MHz} = -54\text{dBm}/500\text{Hz}$  and  $\text{MDS} = -131\text{dBm}/500\text{Hz}$

### Measurements at the transmitter

#### RF output power of the transmitter

To determine the maximum RF output power (PEP), an 800Hz AF sine wave (CW signal) is applied to the microphone input and the RF output power (PEP) is measured across a 100W load resistor with -50dB coupling using a spectrum analyzer (**Image 10**). Since the selected filter bandwidth of the transmitter is 2.4 kHz and the analyzer operates with a span of 10 kHz. The harmonics of the modulation signal can also be measured within the filter, with a suppression of >60 dBc at 1600 Hz and 83 dBc at 2400 Hz.

This high harmonic separation shows that the transmitter's modulation is highly linear, resulting in clean and clear signal transmission (speech). At  $f = 14.1\text{ MHz}$ , the transmitter generates a maximum power of

$$P_a (\text{PEP}) = 0.22\text{dBm} + 50\text{dB attenuation} = 50.22\text{dBm} = 105.2\text{ Watts}$$

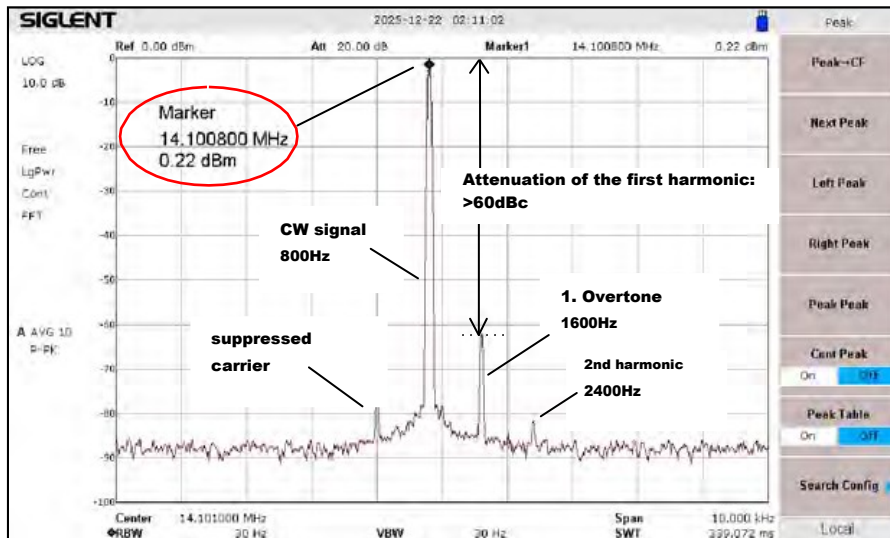


Figure 10: Max. RF output power in the 20m band, span 10kHz

Settings IC-7300MK2: SSB 2.4kHz, RF Power 100%, Mic Gain 20%, supply 13.8VDC

Frequency	3.6 MHz	14.1 MHz	28.1 MHz	50.1MHz
Maximum Power (PEP)	109.5	105.2W	102.3W	87.5W

Table 5: Maximum RF output power on the bands

### Harmonic suppression of the transmitter

For this purpose, the analyzer's span is increased to 30MHz, so that the transmitted signal of  $f=14.1\text{MHz}$  and its first harmonic at  $28.2\text{MHz}$  become visible on the screen (Image 11). In this measurement

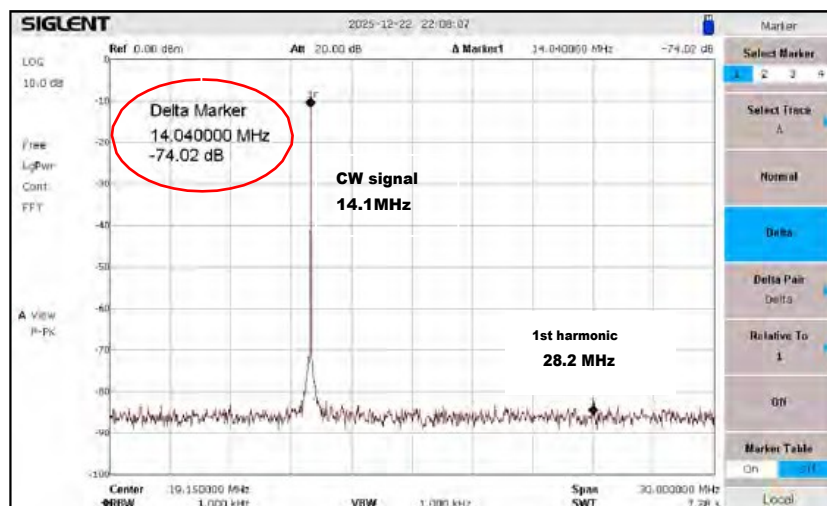


Figure 11: Useful signal of 14.1 MHz and 1st harmonic at 28.2 MHz, span 0-30 MHz

Care must be taken to ensure that the analyzer itself does not generate any harmonics that could distort the result. The harmonic separation of the analyzer itself must be at least 80 dBc. Therefore, an attenuation of 60 dB is inserted between the transmitter and the analyzer, ensuring that the analyzer operates in the linear region. The first harmonic of the carrier signal at 28.2 MHz is shown in the noise, with a suppression of >74 dBc. The harmonic suppression in the bands from 3.7 MHz to 50.1 MHz shows Table 6.

Settings: NF signal 800Hz, SSB 2.4kHz, RF power 100%, supply 13.8VDC, HF power 100Watt

Frequency	3.7MHz	14.1MHz	21.1MHz	28.1MHz	50.1MHz
suppression of 1. Overtone	80dBc	74dBc	68dBc	65dBc	80dBc

Table 6: Suppression of the transmitter's first harmonic on different bands

### Intermodulation of the transmitter

The intermodulation of the transmitter is determined using a 2-tone audio frequency generator (f1=800Hz, f2=1200Hz, Delta f = 400Hz) (**Image 12**). To do this, connect the 2-tone generator to the microphone input of the IC-7300MK2 and increase its summed level until the transmitter reaches its maximum power (PEP). A dummy load with a -50dB output (1mW) is connected to the transmitter's output, which routes the attenuated signal to a spectrum analyzer or oscilloscope.

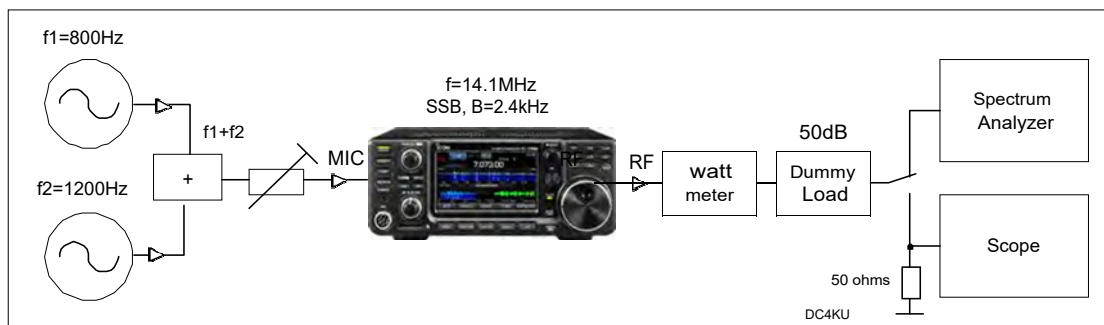


Figure 12: Measurement of transmitter intermodulation

Since the transmitter is driven by two closely adjacent AF sine signals of the same level, a so-called beat frequency occurs, in which the signals add up or cancel each other out (**Image 13**). The average power of a 100W transmitter therefore only reaches 2 x 25 watts = 50 watts at its peak, which is 6dB below the transmitter's maximum power of PEP = 100 watts. Only at the maximum of the during beating, the voltage doubles, thus generating four times the power of a single tone, and only now does the transmitter produce a maximum power of 100 watts PEP.

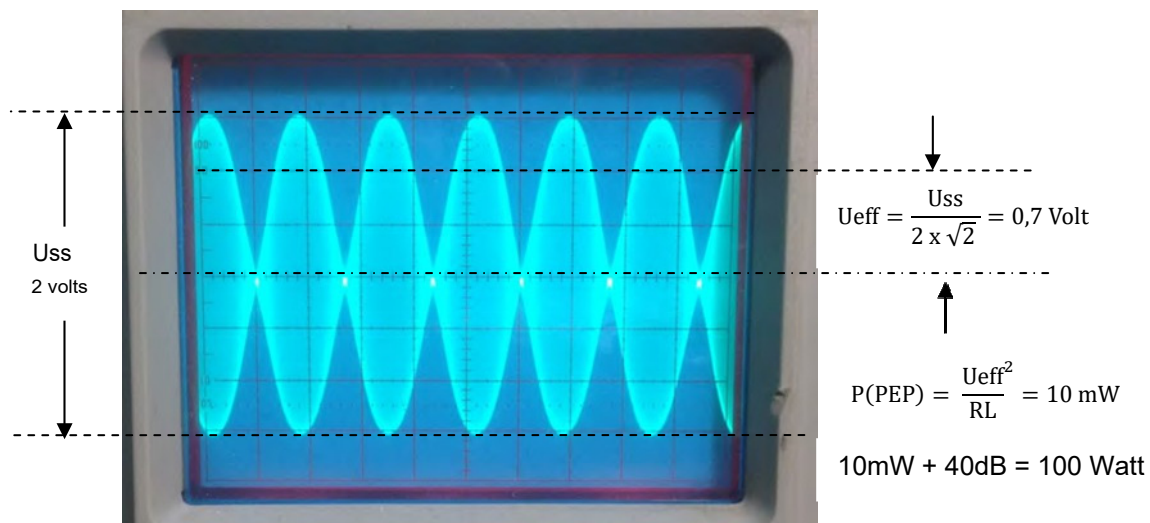
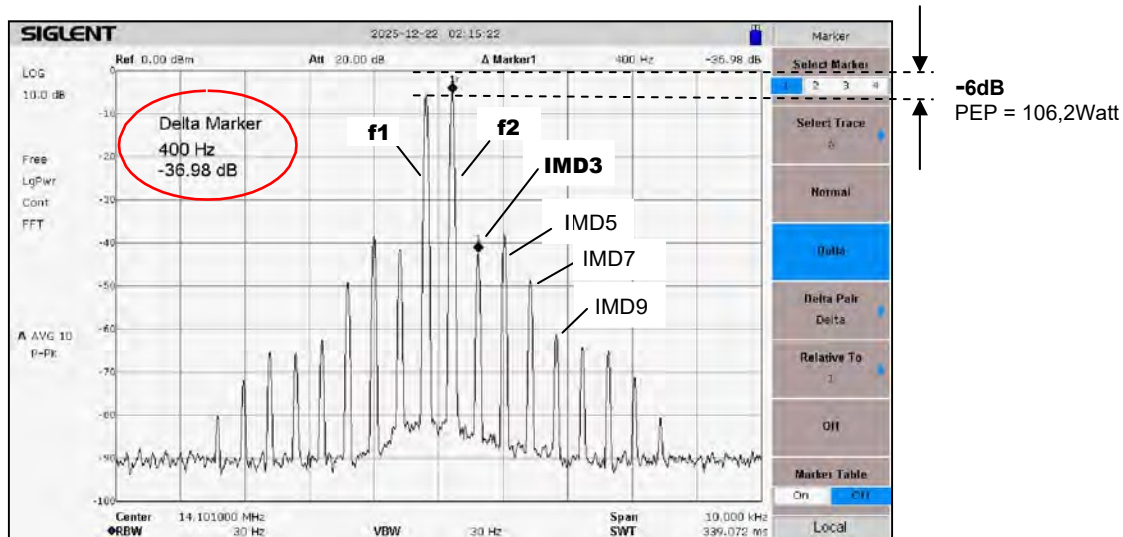


Figure 13: RF 2-tone signal with PEP = 100 watts on the oscilloscope



**Figure 14: Intermodulation of the 2-tone transmitted signal at f=14.1MHz, span=10kHz**

Note: If using a wattmeter to measure power, you must check whether the The wattmeter is calibrated in Average or PEP mode. If the wattmeter is set to Average, it will not display the peak value of 100 watts during this measurement, but only 50 watts.

*Settings: Audio signals 800Hz and 1200Hz, SSB 2.4kHz, RF power 100%, supply 13.8VDC*

Frequency	3.6MHz	7.1MHz	14.1MHz	21.1MHz	28.1MHz	50.1MHz
IMD3 spacing	38dBc	41dBc	37dBc	35dBc	30dBc	31dBc

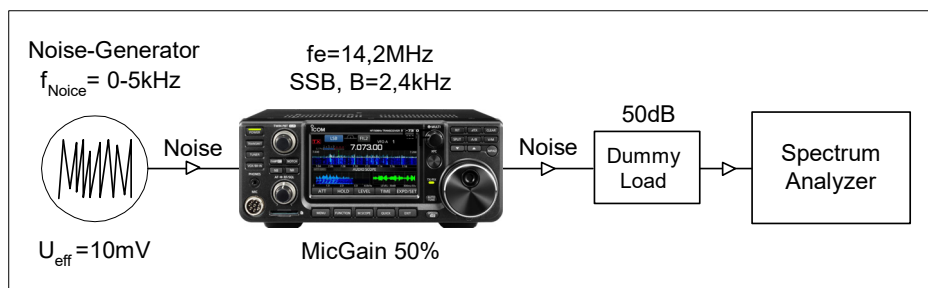
**Table 7: IMD<sub>3</sub> - Distances of the transmitter on the bands**

The resulting intermodulation distortion of the transmitter at fs=14.1MHz shows **Image 14**. The IMD<sub>3</sub>These products are of particular importance because they are generated very close to the carrier signal, in this case at a distance of only 400 Hz. Good transmitters suppress IMD<sub>3</sub>-Products at full control around

For IMD values greater than or equal to 30 dBc, higher-order IM products should decay relatively quickly to avoid interfering with adjacent channels. For the IC-7300MK2, IMD is...<sub>3</sub>At a spacing of 37dBc, the other IM products (IMD 5, 7, 9...) decays faster than with the IC-7300. Even at a small frequency spacing of +/-4 kHz, the IMD products are suppressed by >90dB and disappear into the noise. **Table 7** shows the determined IMD<sub>3</sub>-Spacing on the different bands.

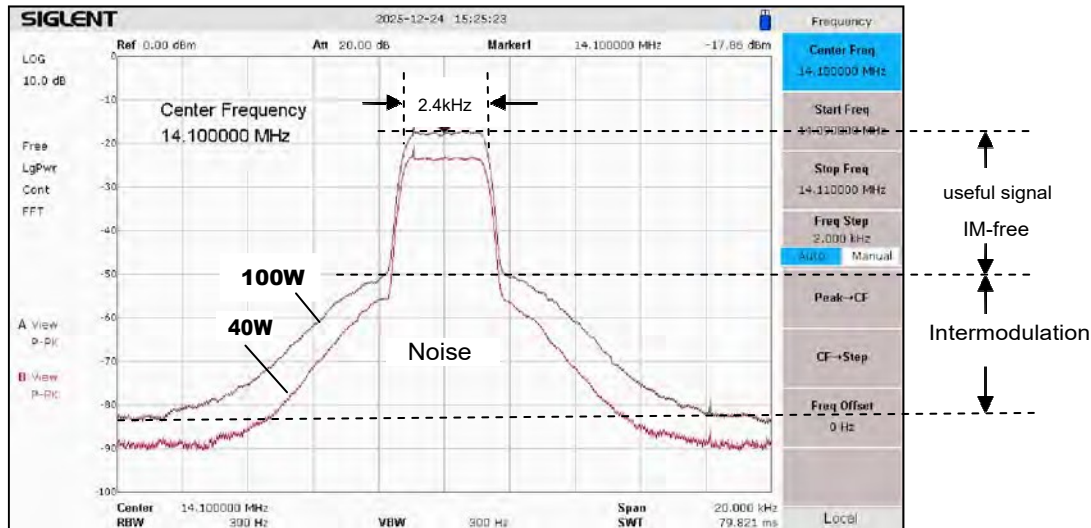
**Measurement of intermodulation with a noise signal**

The intermodulation of a transmitter can also be determined via a noise signal (**Image 15**). For this purpose, a white noise band of, for example, 0-5 kHz is fed into the microphone input, and the transmitter is adjusted for maximum power by setting the noise amplitude. The result



**Figure 15: Measurement of transmitter intermodulation with noise**

of the measurement with  $P=100\text{W}$  (yellow) and  $P=40\text{W}$  (violet) power shows **figure 16**. The almost rectangular block (envelope) in the middle of the spectrum shows the bandwidth of the SSB filter used (2.4 kHz), driven by white noise. At the base of the envelope, the IMD products start at intervals of approximately 32 dBc, their levels decreasing relatively rapidly towards higher and lower frequencies.

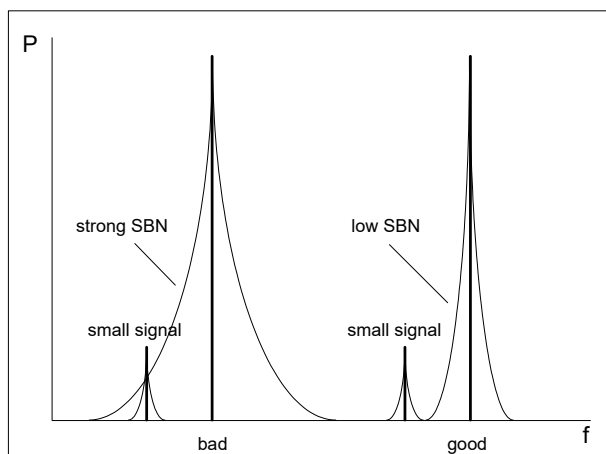


**Figure 16: Noise signal at 100 watts (yellow) and 40 watts (violet), span 20 kHz**

The measurement result with noise is much more informative than just two spectral lines because, in principle, a continuous spectrum with infinitely many spectral lines is displayed. The important aspect here is that the IM products to the left and right of the desired channel decay relatively quickly so that adjacent channels are not affected, which is the case with the IC-7300MK2. The IM distortion curves decay somewhat faster here than with the IC-7300.

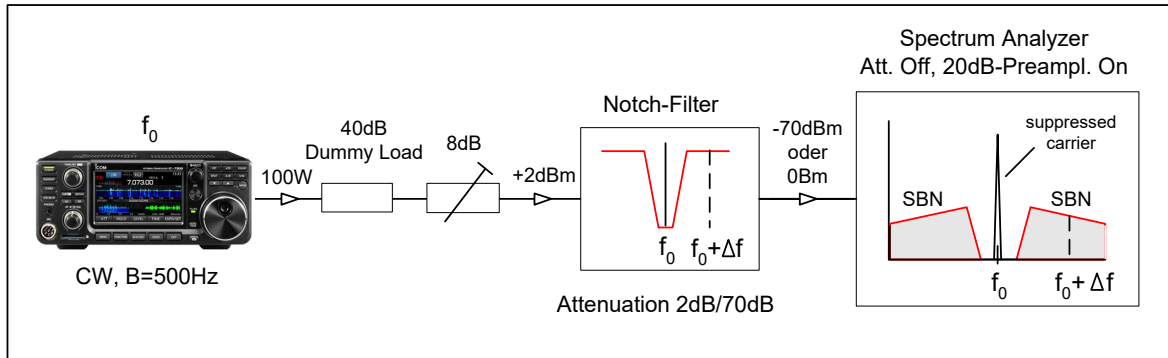
**TX sideband noise**

The SBN (sideband noise, phase noise) of the transmitter is another important criterion for evaluating its quality. In the frequency domain, the phase noise of a CW signal becomes visible as noise sidebands to the right and left of the carrier (**Image 17**). If a transmitter has significant sideband noise, a nearby, weak signal can be masked in the reception range, causing the affected receiver to lose sensitivity. Therefore, the SBN of a transmitter (TX-SBN) should be as low as possible.



**Figure 17: Water level loss in the adjacent canal due to SBN**

A direct SBN measurement using a spectrum analyzer is unfortunately not possible because its dynamic range is insufficient. However, the measurement becomes possible using a narrowband notch filter, which suppresses only the carrier signal by up to 70 dB. In this example, I am using a **quartz notch filter (3)** in the 40m band ( $f_0=7.1617\text{MHz}$ ,  $B=\pm 1.2\text{kHz}$ ) which only suppresses the carrier signal and allows the sideband noise to pass freely to the right and left of the filter stopband at a distance of  $\geq \pm 1\text{kHz}$  (**Image 18**).

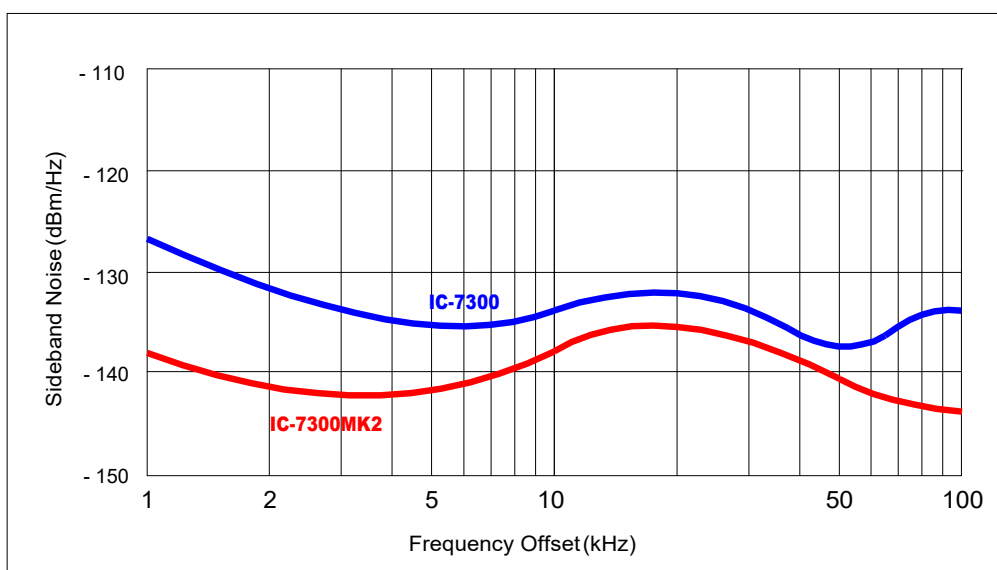


**Figure 18: SBN measurement using a notch filter**

First, the transmitter's 100W CW signal (RTTY) must be reduced to a low power of approximately 1mW using attenuators to prevent damage to the downstream electronics. Then, the carrier signal frequency must be adjusted to the filter's passband, for example,  $f_0+1\text{kHz}$  and adjust the resulting level at the output of the notch filter to a reference level of 0dBm via an adjustable attenuator.

Then adjust the transmitter's frequency to the center frequency ( $f_0$ ) of the notch filter, which suppresses the signal by 70dB. Due to the strong signal suppression, the analyzer is now set to its maximum sensitivity of -162dBm/Hz with 0dB attenuation and the +20dB preamplifier preamplifier engaged, without being overloaded. Everything that is now measurable to the left and right of the notch filter's cutoff frequency is the transmitter's sideband noise.

In the test, I used an IC-7300MK2 and an IC-7300, whose SBN was measured and recorded at intervals of 1, 3, 5, 10, 20, 50 and 100Hz relative to the carrier (**Table 8**). The resulting SBN curve shows **Image 19**.



**Figure 19: TX-SBN from the IC-7300MK2 and IC-7300 at an offset of 1...100kHz**

Offset (kHz)	1	3	5	10	20	50	100
<b>TX-SBN (dBm/Hz)</b>	- 138	- 143	- 142	- 138	- 136	- 141	- 144

Table 8: TX-SBN in offset from 1 to 100 kHz

The waveforms of both transmitters show that the IC-7300MK2 exhibits significantly less noise near the carrier frequency than the IC-7300. At a 1 kHz offset, the difference is 11 dB, which is advantageous in practical operation. ICOM specifies a 12 dB improvement in its "TX Phase Noise" at this point in the IC-7300MK2 datasheet.

### IC-7300MK2 with Icom RS-BA1

Installing RS-BA1 on the IC-7300 is quite complex and time-consuming. The main reason is that a server, such as a PC or Raspberry Pi, has to be connected between the IC-7300's USB port and the router, and errors often occur during the numerous configuration steps. These problems are solved with the IC-7300MK2, as Icom has finally managed to integrate a server into the transceiver, which connects directly to the home router via a LAN interface (**Image 20**).

This significantly simplifies the installation of the RS-BA1. Due to the direct LAN (Ethernet) connection between the router and the IC-7300MK2, the data transfer speed is also increased, which is noticeable during operation.

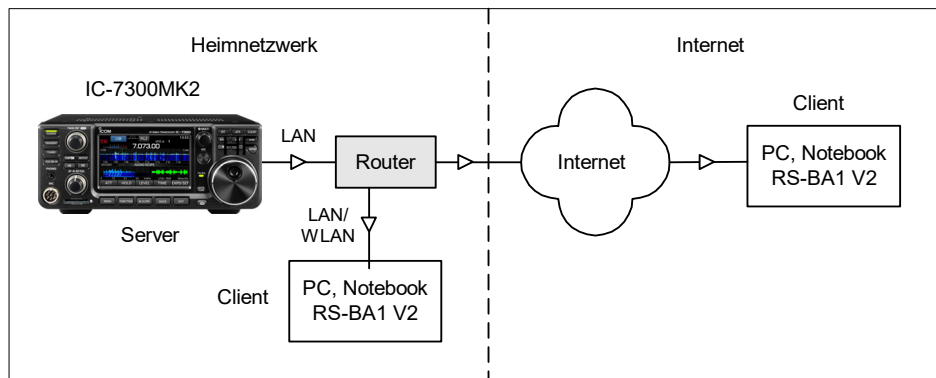


Figure 20: Remote Control of the IC-7300MK2 - Locally and via the Internet

Before starting the installation, RS-BA1 must be upgraded to version 2.80, if it hasn't not already been done. For this, open [https://www.icomjapan.com/support/firmware\\_driver/4490/](https://www.icomjapan.com/support/firmware_driver/4490/) and download and install the RS-BA1 Version 2.80 update. After the update is complete, connect the IC-7300MK2 to the router (in my case, a Fritz 7490) using a LAN cable and switch on the IC-7300MK2. Then open the router and go to the...*Network settings*. The IP address of the IC-7300MK2, which was recognized by the

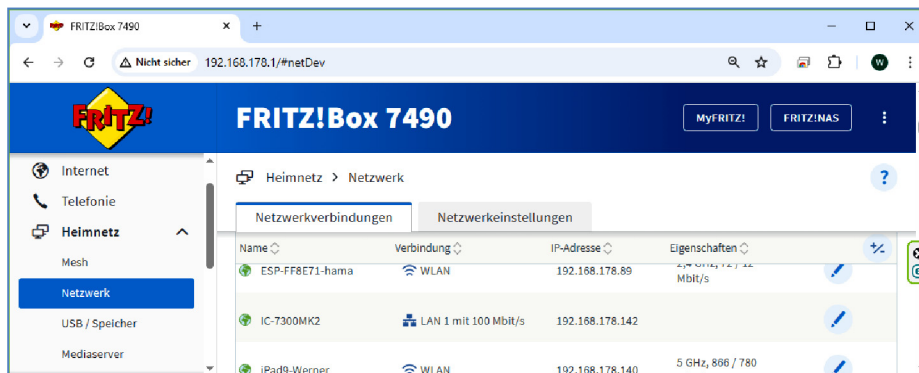


Figure 21: IP address of the IC-7300MK2 in the router

router as a new device on the network, can be found on my system at the IP address 192.168.178.142. **(Image 21)**. Since the router doesn't recognize the TRX's name, it refers to it as PC-00-90-C7-16-69-44. This designation should be changed to "IC7300MK2" so that it can be found later in the router settings.

### IC-7300MK2 default settings

On the IC-7300MK2, under SET, select "Network" where under DHCP the IP address assigned to the IC-7300MK2 by the router is displayed, in this example 192.168.178.142 **(Image 22)** and under the Network Name: IC7300MK2 **(Image 23)** stands.

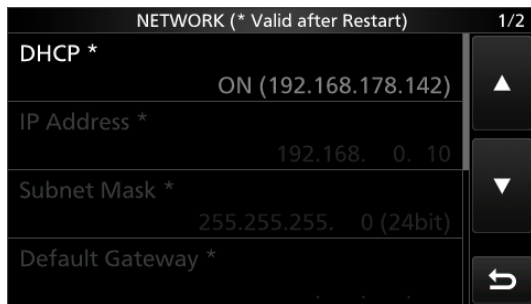


Figure 22: IP-Adresse of the IC-7300MK2

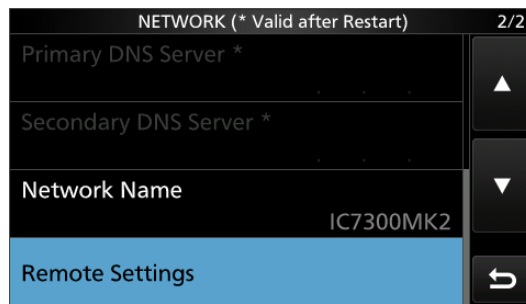


Figure 23: Open Remote Settings

Next, open Remote Settings, where the default ports 50001, 50002, and 50003 are displayed **(Image 24)**. Since I am already using these ports for another transceiver, I will change them to 50031, 50032, and 50033 **(Image 25)**. If this is not necessary, leave the default settings as they are.

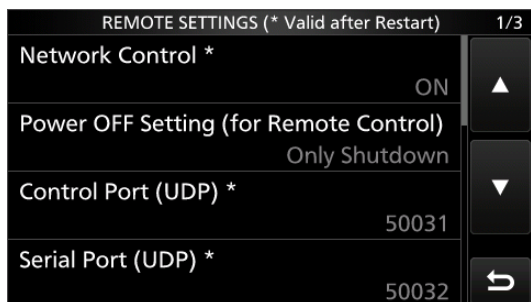


Figure 24: Default Ports

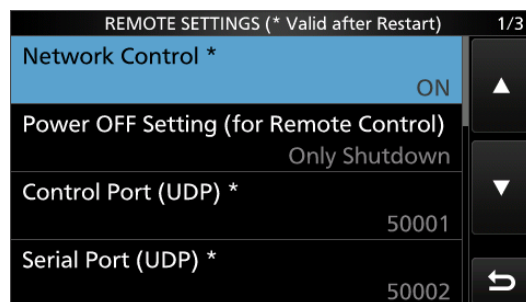


Figure 25: Changing the ports (if necessary)

Next, open Network User 1 **(Image 26)**, enter a password of your choice under "Network User 1 Password" (write it down!), and set "Network User 1 Administrator" to YES **(Image 27)**.

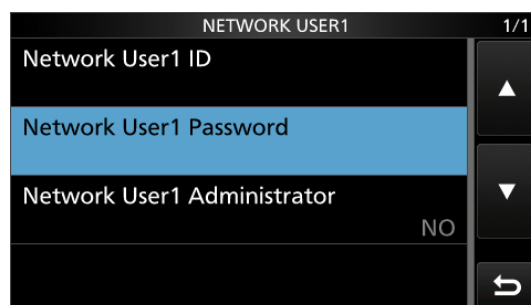


Figure 26: Enter Network User 1 Password

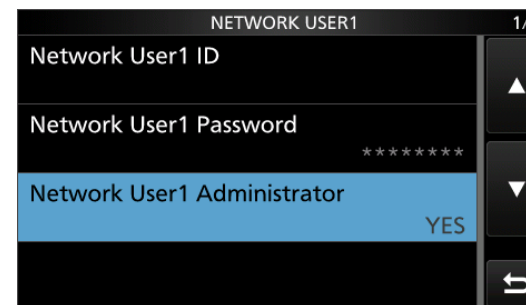


Figure 27: Network User 1 Administrator: YES

### Installation of RS-BA1

After installing and updating RS-BA1 V2, two icons appear on the PC screen labeled "Icom Remote Utility" (red) and "RS-BA1 Remote Control Ver2". (Image 28). With *Icom Remote Utility*. The connection between the router and the server of the IC-7300MK2 is established and with *RS-BA1 Remote Control Ver2* The software was started.

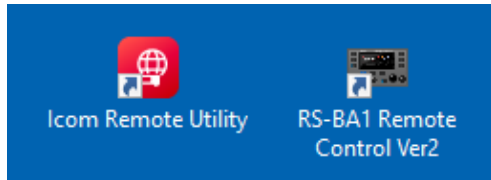


Figure 28: Remote Utility and Remote Control

### Launch the RS-BA1 Remote Control Ver2 software

First, open the Icom Remote Utility and select the Server List (Image 29). From there, select "Add" to locate the server within the IC-7300MK2. Under "Add Server," enter the Server Address (192.168.178.142) and the Control Port (50033 or 50001) (Image 30); in the subsequent menu, enter the User ID (identifier) and a password of your choice (Administrator Password) - which you should be sure to write down (Image 31). After clicking "Next," the program searches for the server, and after a few seconds, the message "Add Completed" appears (Image 32).

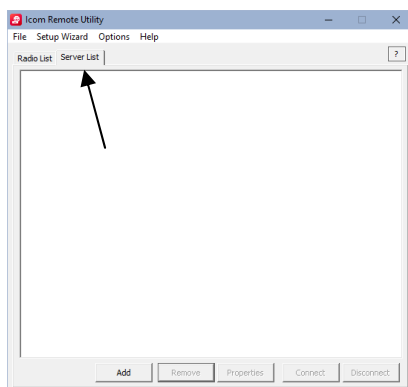


Figure 29: Remote Utility, Server List

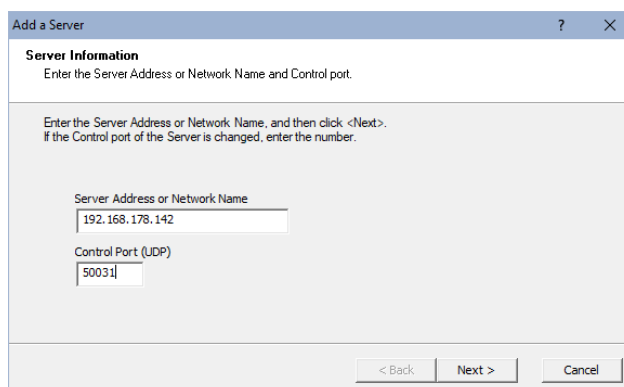


Figure 30: Entering Server Address and Control Port

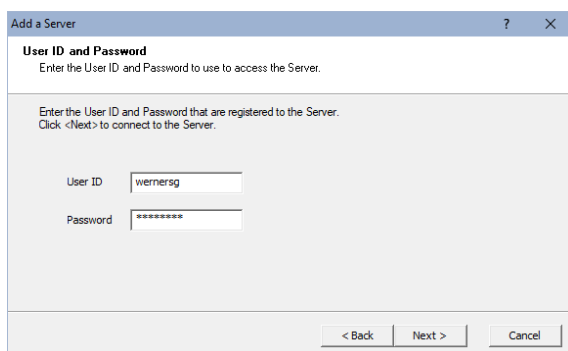


Figure 31: Entering User ID and Password

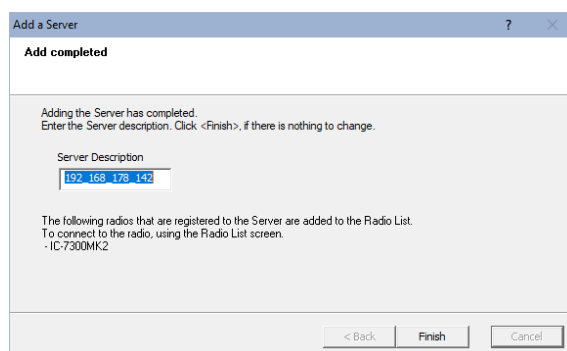


Figure 32: Add Completed

After clicking "Finish," the Icom Remote Utility reopens and displays the detected IC-7300MK2 - along with its IP address (192.168.178.142) - as "Connected" under the Server List (Image 33). Under the Radio List (Image 34) the IC-7300MK2 appears with its details and after clicking "Connect" it is displayed as << Connected >>. All settings within the Icom Remote Control utility are now complete.

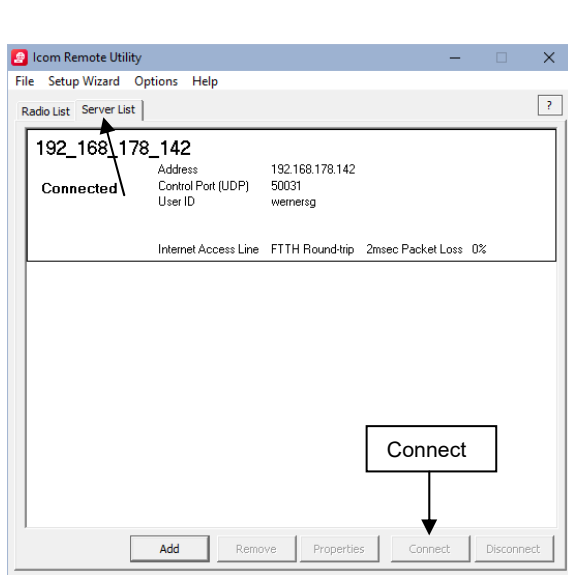


Figure 33: Server List, Connected

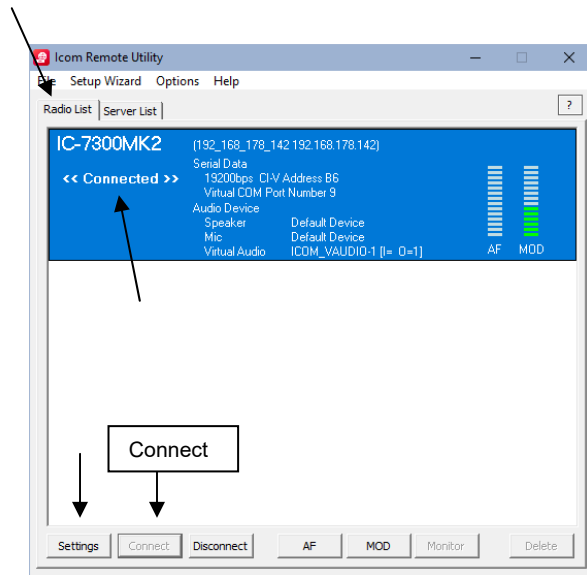


Figure 34: Radio List, <<Connect>>

If the server cannot be found, you should open the settings under "Radio List" and "Server List" to double-check the configuration data. It may be necessary to specify a missing Virtual COM Port; in this example, Port 9 was selected.

Finally, launch the RS-BA1 Remote Control Ver. 2 software (Image 35). Upon the initial launch, an error message will appear because the settings have not yet been configured.

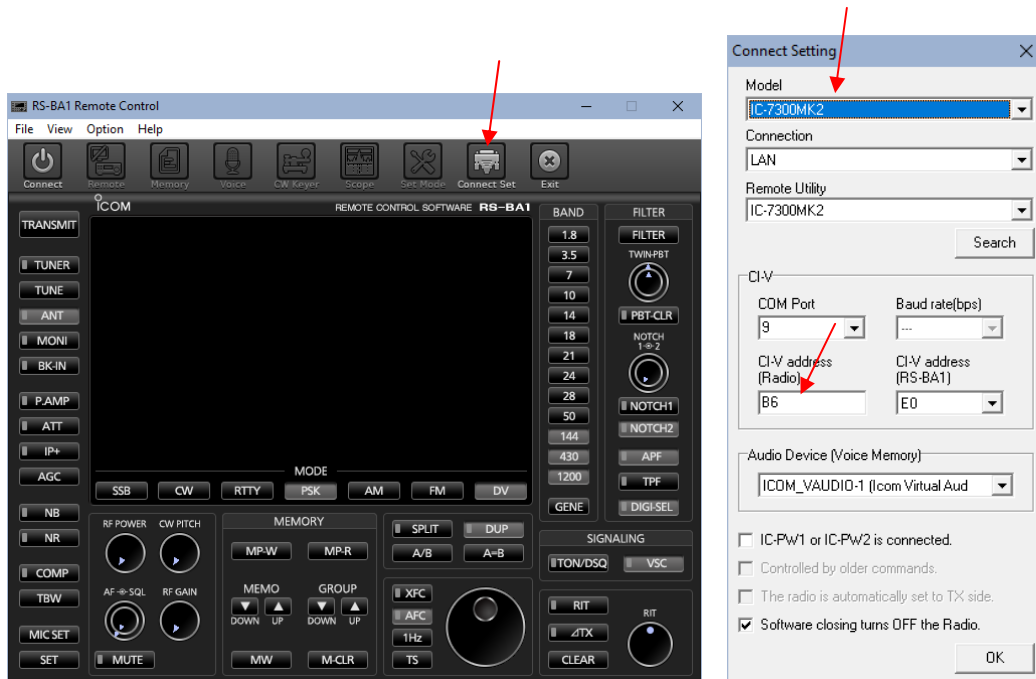


Figure 35: RS-BA1 powered on (not yet started) with open "Connect Set" (right)

To resolve this, open "Connect Settings" and proceed as follows: Under "Model" and "Remote Utility," select "IC-7300MK2"; under "Connection," select "LAN." The appropriate CI-V Address (Radio) can be found on the transceiver itself by navigating to Menu -> Set -> Connectors -> CI-V -> CI-V Address; the default value is "B6". Under "Audio Device," select "Icom\_VAUDIO-1" to ensure that audio transmission functions correctly later on.

This completes the installation process. Launch RS-BA1 once more; the IC-7300MK2 will power on, and signal transmission to the PC/notebook (client) will begin (Image 36).

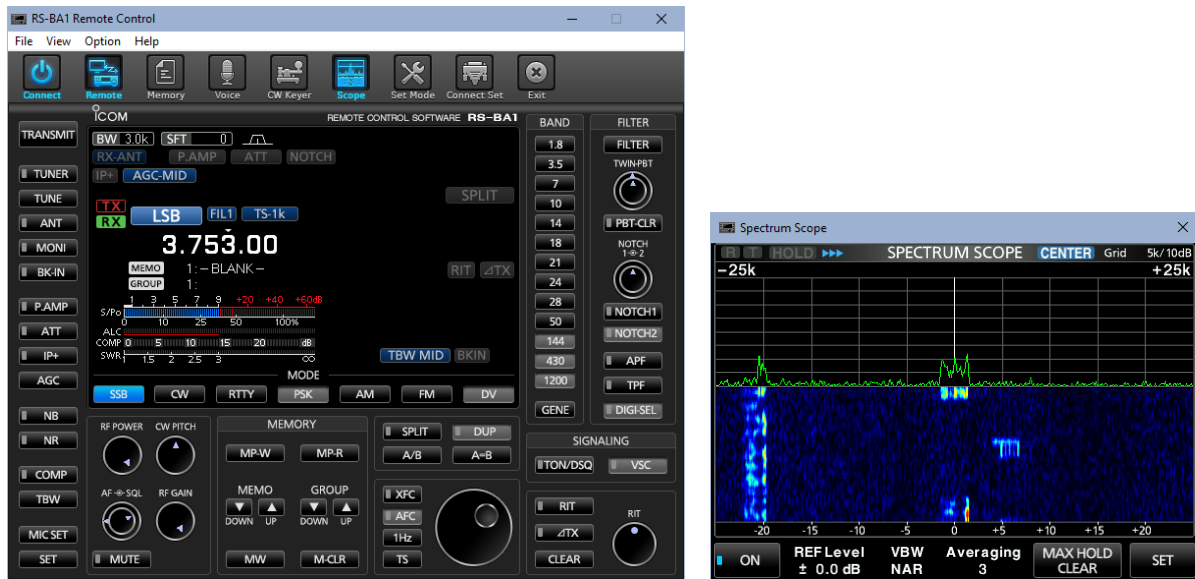


Figure 36: Display of the remotely controlled IC-7300MK2 shown on the PC/Notebook in the Shack

Note: RS-BA1 is compatible with a wide variety of Icom transceivers. In the example shown in **Image 37**, an IC-705 is configured via Wi-Fi, an IC-7300 via a server PC, and an IC-7300MK2 via LAN. The installation process is slightly more complex only for the IC-7300, as its USB port cannot be connected directly to the router; consequently, an intermediate server PC equipped with a LAN/Wi-Fi connection must be placed between the IC-7300 and the router.

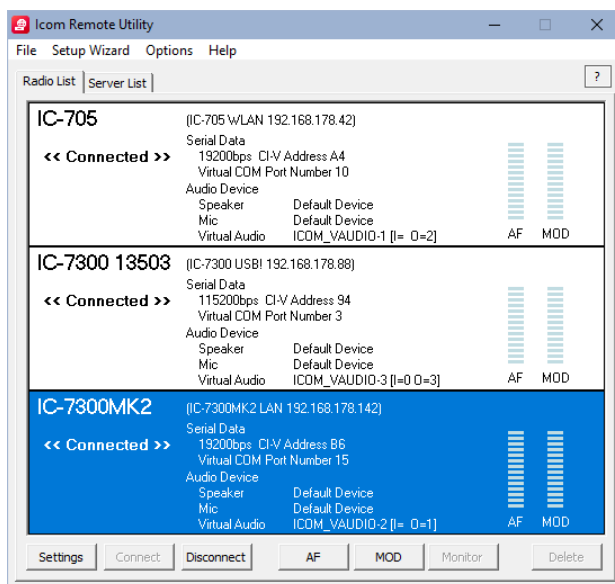
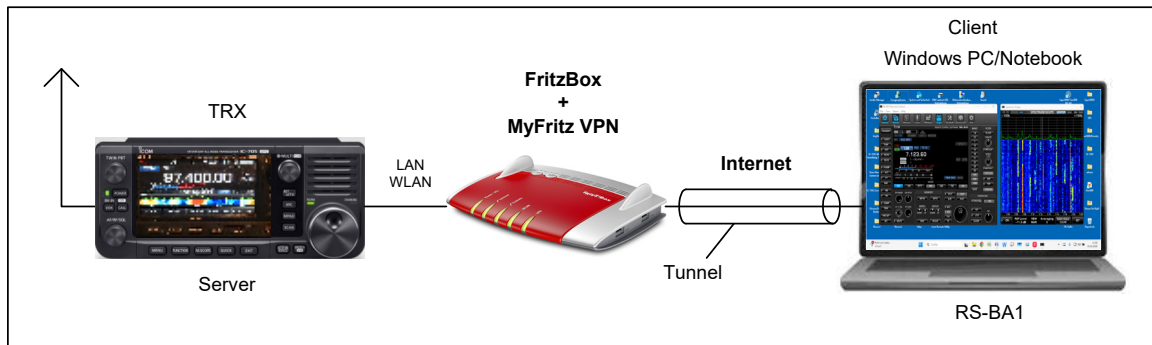


Figure 37: Various TRXs connected via WLAN, USB, and LAN

### Remote Control via the Internet

After installing RS-BA1, remote control functions within the local network but not yet over the Internet. To access the transceiver from outside your home network, three specific ports on your router must be opened for Internet access. Once configured, the transceiver can be reached via the router's public IP address. Since routers typically change their public IP address on a daily basis, you must look up your current public address (e.g., using a service like "whatsmyip") every day before you can resume remote control of the transceiver. To bypass this inconvenience, you

can utilize services such as <https://dyn.com>. These services allow you to generate a fixed IP address, enabling you to access the transceiver at an address like xxx.dynDNS.org. However, I advise against this method of remote control. Since it relies on a public IP address, the Internet connection offers only limited security; anyone who knows the transceiver's IP address and port number could potentially access and activate the device. Even if the device itself is password-protected, it poses no significant challenge for a hacker to infiltrate the router and wreak havoc within the network. To effectively safeguard your router and network against unauthorized access, the only reliable solution is a "Virtual Private Network" (VPN). With a VPN, data from the Internet is routed to your router as if passing through a private tunnel (**Image 38**), thereby remaining protected against external attacks. Under this configuration, port forwarding is no longer required.



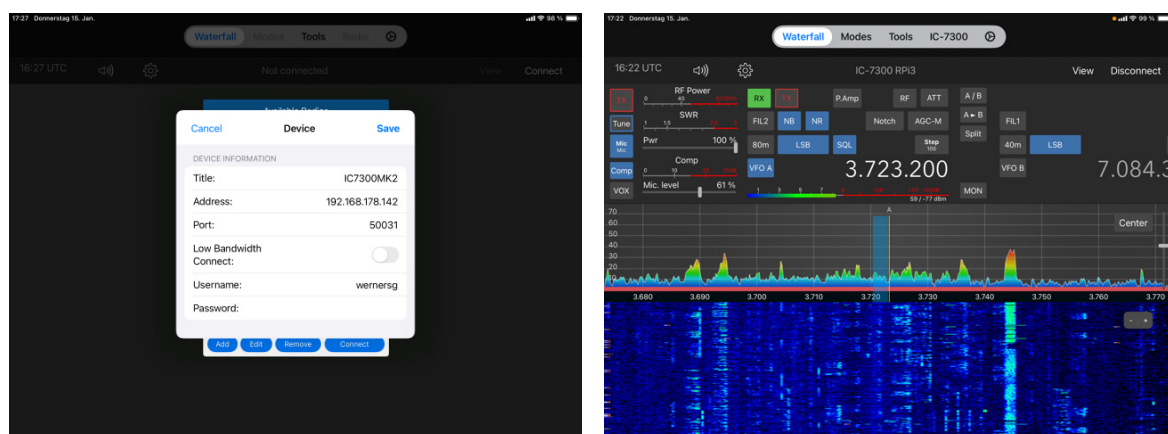
**Figure 38: Secure Data Transmission via MyFRITZ! and VPN**

The VPN installation process was described in (5); furthermore, those who own a Fritz!Box enjoy an additional advantage, as Fritz provides the setup and operation of a VPN via the Fritz server completely free of charge.

After successful VPN installation, the IC-7300MK2 (like other transceivers) can be accessed worldwide via the Internet by simply by entering the transceiver's IP address into your remote control software (any software). Because the signal is routed through the VPN tunnel to the router and the transceiver, it behaves as if the connection were established at home on your home network! If the VPN is deactivated, the IC-7300MK2 can no longer be accessed; instead, the error message "Unknown" appears.

### Remote Control with SDR-Control

With the App "SDR Control", the IC-7300MK2 can also be controlled remotely using an Apple iPhone or iPad. The installation process is extremely simple. Install and launch the app on your



**Figure 39: Remote control of the IC-7300MK2 with an Apple iPad**

iPhone or iPad, then simply enter the IP address, port, username, and password (**Image 39**). That's all there is to it. The app works both within your home network and globally via the internet.

Werner Schnorrenberg  
DC4KU  
Jan. 17, 2026, Rev. 5.2026

## Literatur

### **(1) IC-7300MK2-Basic Manual (German) Download**

<https://www.icomjapan.com/support/manual/4463/>

### **(2) IC-7300MK2-Advanced Manual Download**

<https://www.icomjapan.com/support/manual/4487/>

### **(3) Kerbfilter für Messzwecke**

CQ DL 5-2021, DC4KU

[https://dc4ku.darc.de/Aufbau\\_Notchfilter.pdf](https://dc4ku.darc.de/Aufbau_Notchfilter.pdf)

### **(4) Siglent SDG6022X Arbitrary Signal Generator**

Funkamateur 5-2020, DC4KU

[https://dc4ku.darc.de/SDG6022X-Test\\_DC4KU.pdf](https://dc4ku.darc.de/SDG6022X-Test_DC4KU.pdf)

### **(5) Transceiver-Fernsteuerung mit MyFritz und VPN**

CQ DL 2-2025, DC4KU

[https://dc4ku.darc.de/Transceiver-Fernsteuerung\\_mit\\_MyFritz\\_und\\_VPN\\_DC4KU.pdf](https://dc4ku.darc.de/Transceiver-Fernsteuerung_mit_MyFritz_und_VPN_DC4KU.pdf)