New NR-1 Noise Blanker

DD Amtek, the distributor, provided me with a new product for testing. It is a small device, the NR-1 Antenna Noise Blanker. In this article we will look at what this interesting accessory is and what benefits it can bring to the ham shack.

There are many ways of reducing noise and interference present in received signals in amateur-radio practice, and these methods naturally evolve as interference in the received spectrum evolves. Technical and theoretical development has brought the advent of digital DSP technology in signal processing and, in particular, SDR receiver technology, where it is possible to work with a wide spectrum and more easily distinguish between a wanted signal and interference. In principle, however, noise-reduction techniques can be divided into the following areas:

1) Processing at the receiver input (conditioning of the antenna signal). This also includes noise reduction using selective preselectors and, of course, diversity reception methods.
2) Processing of the signal in the received channel at baseband. This is a very broad field and today benefits especially from DSP methods in the frequency domain as well as statistical processing of the baseband signal. In fact, practically every transceiver incorporates such functions under names such as NB, NR, and similar.
3) A special category consists of sophisticated solutions in SDR receivers, where noise processing uses not only the baseband signal but also the overall state of the wide spectrum visible in the panadapter window. The latest developments include algorithms using artificial intelligence applied to the interfering background, as well as statistical algorithms working with the energy values and characteristics of a broader portion of the received spectrum.

The NR-1 was designed and is manufactured by Kostas, SV3ORA. It has been on the market for less than a year. For this test I received NR-1 serial number 266. What we have here is a small device. The manual describes its operation as follows:

The NR-1 is a type of impulse-interference suppressor (Noise Blanker). It therefore removes only impulse noise. This noise usually takes the form of short-duration, high-amplitude pulses or “spikes.” Its repetition rate may range from a few Hz to several kHz. On the waterfall display of an SDR monitor, this noise may appear as repeating horizontal lines covering most (if not all) of the band, provided that it does not overload the receiver's A/D converter. Such noise may be caused by anything that produces radiated interference from electrical equipment, for example:

- Faulty nearby power-line transformers and insulators,
- Motor brushes/commutators (elevators, household electrical appliances, etc.),
- Spark plugs in internal-combustion engines (cars, motorcycles, electric-fence generators, etc.),

• Faulty or inadequately suppressed inverters and switching power supplies (solar-panel systems, chargers, LED lamps, routers, etc.),

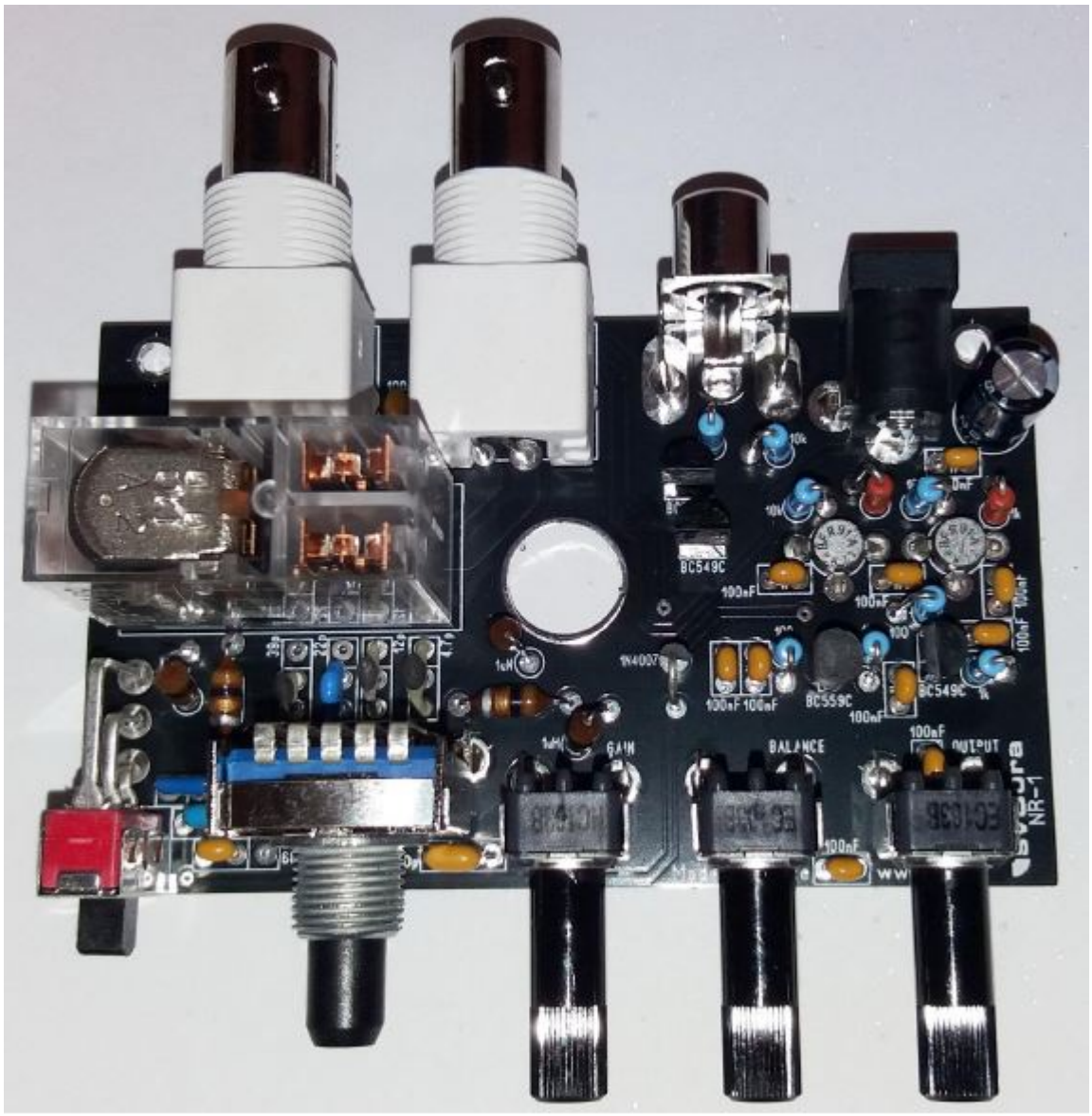
• Any other device (faulty or otherwise) that produces and radiates impulses and sparking.

The NR-1 is exceptionally effective against noise originating from the power grid, a type of interference that other noise-removal devices often have difficulty dealing with.

The frequency range over which the NR-1 has been tested is from 1.6 MHz to more than 70 MHz (modification for lower frequencies is possible). It is broadband and can be used both inside and outside the amateur bands (for example, for listening to commercial shortwave stations). No additional noise-sensing antenna is required for operation.

- It removes RF noise arriving directly from the antenna (unlike DSP methods), thereby improving the signal-to-noise ratio and dynamic range.
- No separate antenna and feedline are required (as they are with some QRM eliminators).
- It removes noise arriving simultaneously from any direction (interference from the power grid, appliances, etc.).
- Its operation does not distort the received signal (as most noise blankers do).
- It reduces noise visible in the displayed spectrum of SDR receivers.
- It works in all receive modes.

The designer supplies a detailed manual with the device. It describes the basic characteristics of the unit and how to use it. However, it reveals little about the technical implementation. The designer protects this information, although the device itself is not particularly complex. It is built using conventional technology on a single-layer PCB with components mounted on one side.



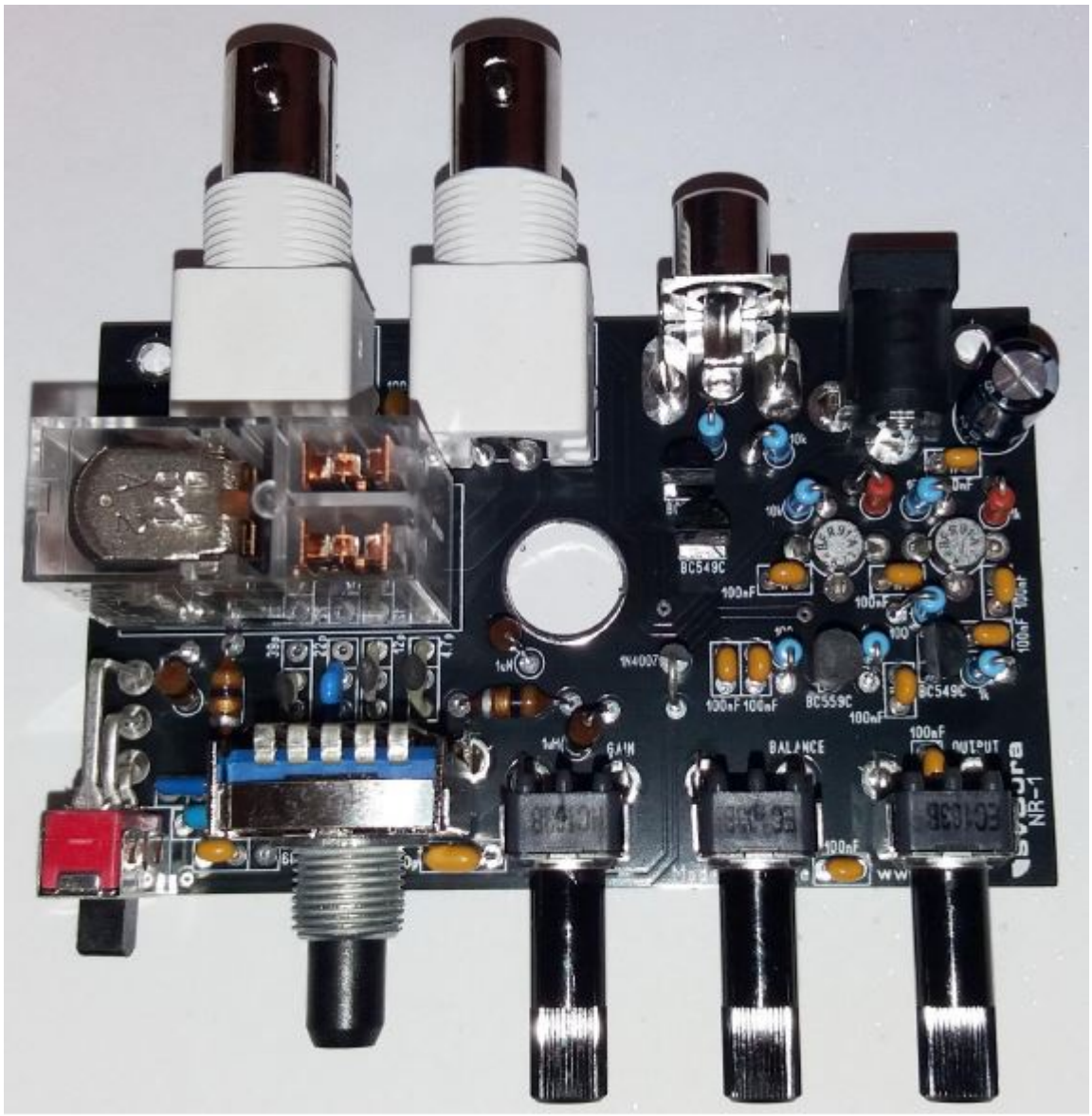
By looking at the printed circuit board, we can at least describe some of the circuitry. The upper side carries the BNC connectors for the antenna and transceiver connections, followed by an RCA connector for PTT and the power connector. On the left, the dominant component is a double changeover relay, in our unit an OMRON G2RL-2. Its contacts in the bypass/transmit path are rated for 8 A.

The lower side of the board faces the front panel. On the left are the power switch, an 8-position selector marked IMD, and three Alps potentiometers used to control the operating parameters according to the labels on the panel. Around the selector we can identify inductors and capacitors forming the RF band-pass filter. We can also distinguish three BC-series transistors and two BFR91 transistors belonging to the RF amplifier. The components are identified on the board.

When the unit is switched off, one half of the relay galvanically connects the two BNC connectors, so the device is completely bypassed in the signal path. When switched on, the relay changes over to the receive state. During transmission, PTT is activated by pulling the control line to ground and the relay drops out, once again providing a direct through-path for the transmitted signal. It is worth

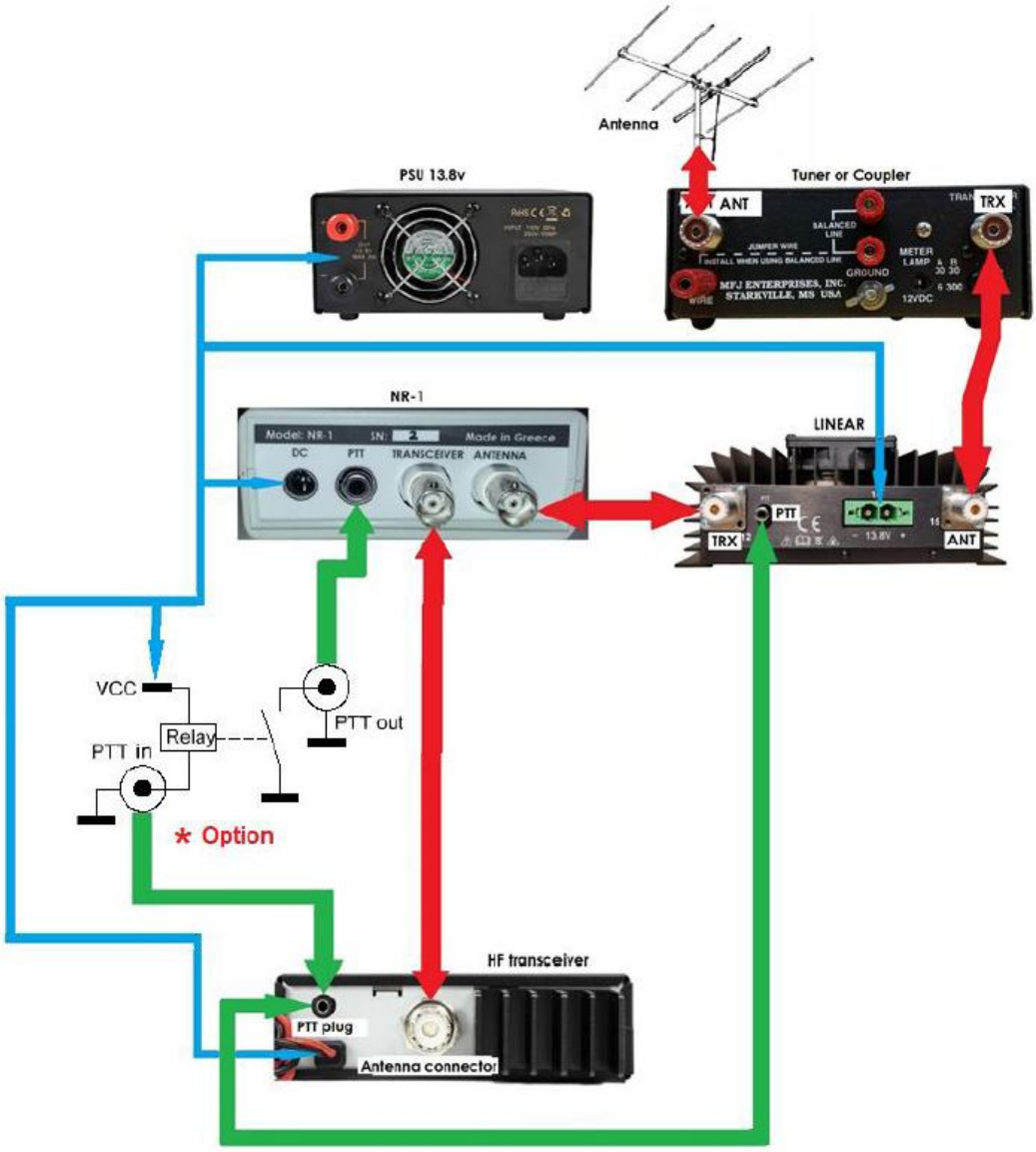
noting that setting a TX delay in the transceiver (approximately 10 ms) is certainly advisable to protect the relay and the circuitry in the receive signal path. The relay is safely rated for 100 W operation.

The NR-1 is housed in a plastic enclosure with metal front and rear panels, measuring 90 × 35 × 64 mm and weighing 152 g. The supply voltage is the standard 13.8 V, with a current consumption of 68 mA; with PTT keyed, consumption falls to 36 mA.



I also measured several additional parameters: Insertion loss in bypass (unit off or PTT active) is better than 0.2 dB.
The band-pass filter positions are as follows: position 1 = 1.85 MHz, 2 = 3.7 MHz, 3 = 7 MHz, 4 = 10 MHz, 5 = 15 MHz, 6 = 21 MHz, 7 = 24 MHz, 8 = 28.7 MHz. The GAIN control affects the frequency and Q of the passband.

The user manual (1) contains essential operating information for using this unusual device. It is highly advisable to become familiar with it. Attention should also be paid to how the unit is connected into the station system.



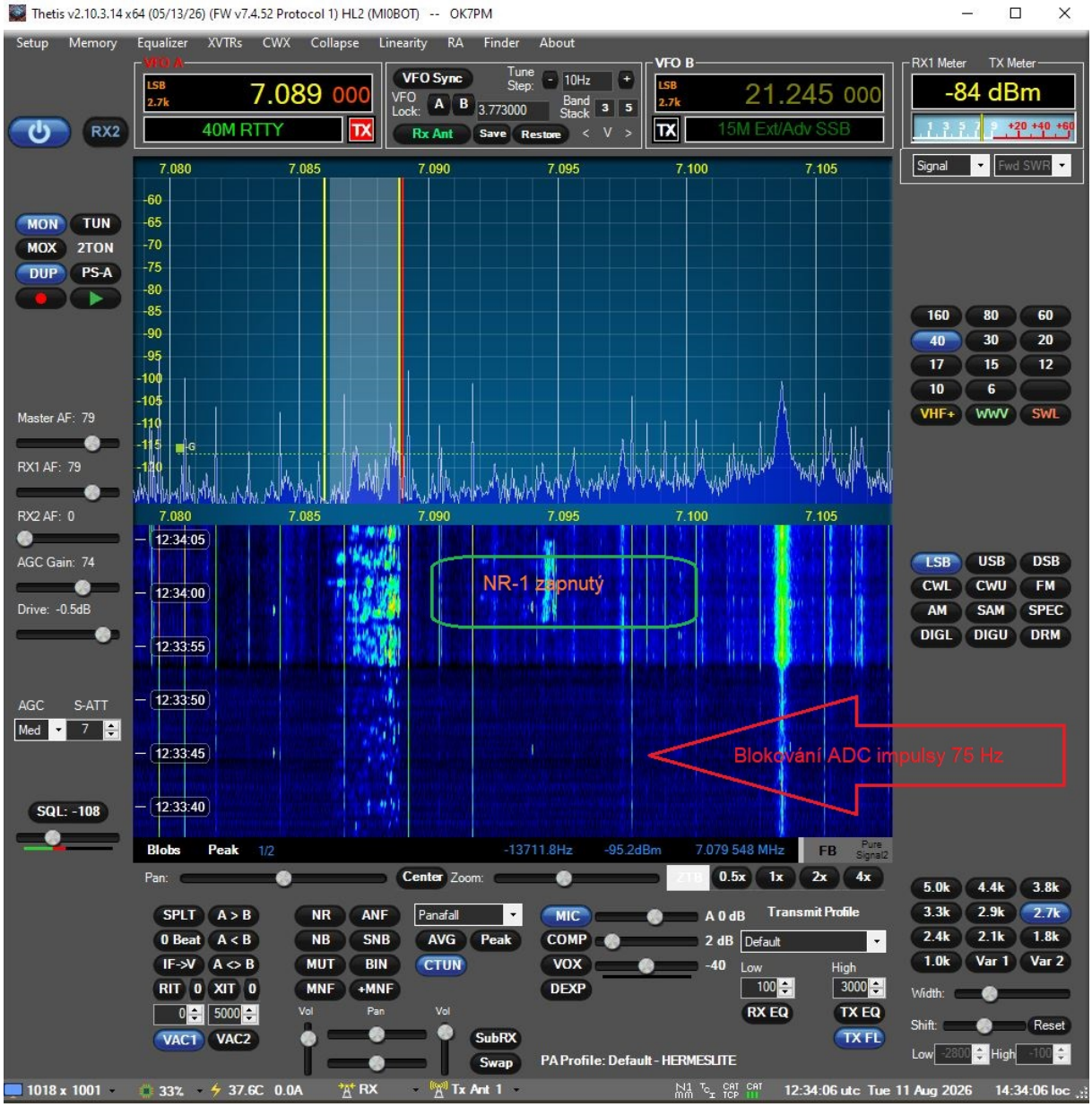
The diagram, however, is clear and simple. In the manual (page 7), the designer also gives additional instructions. In particular, he recommends protecting the PTT cable against induced RF energy by using suitable ferrites. In the diagram above, a relay PTT interface is included as an option, although it may not be necessary; this depends on how the PTT output is implemented in the particular transceiver.

Operating experience:

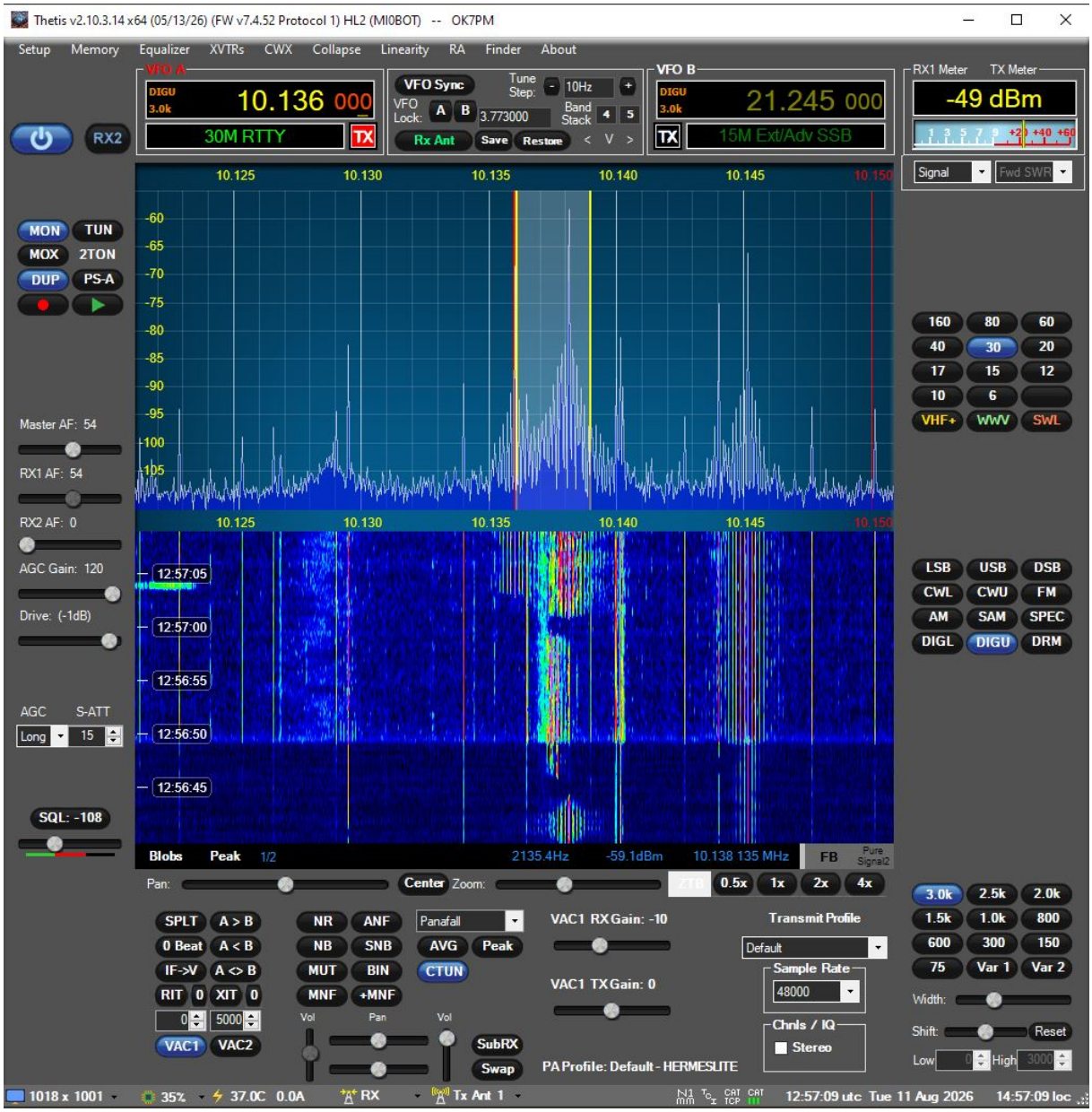
For testing I used an SDR transceiver running Thetis software. This allowed me not only to hear the effect of the NR-1 but also to see it. (The designer demonstrates the device in a similar way in the manual and in references (1) and (2).) To make the interference clearly defined, a pulse generator

was combined with the antenna signal using a splitter. The interfering pulses were 100 to 200 µs wide, with a repetition rate of 70 to 160 Hz and an amplitude exceeding the receiver's dynamic range. I worked mainly on the 40 m daytime band in sunny weather. The designer recommended the following basic settings: the IMD selector in the third position from the left (for 40 m), BALANCE fully clockwise, OUTPUT approximately halfway, and GAIN between the 9 and 14 o'clock positions. The device has an overall transfer gain of approximately 1.

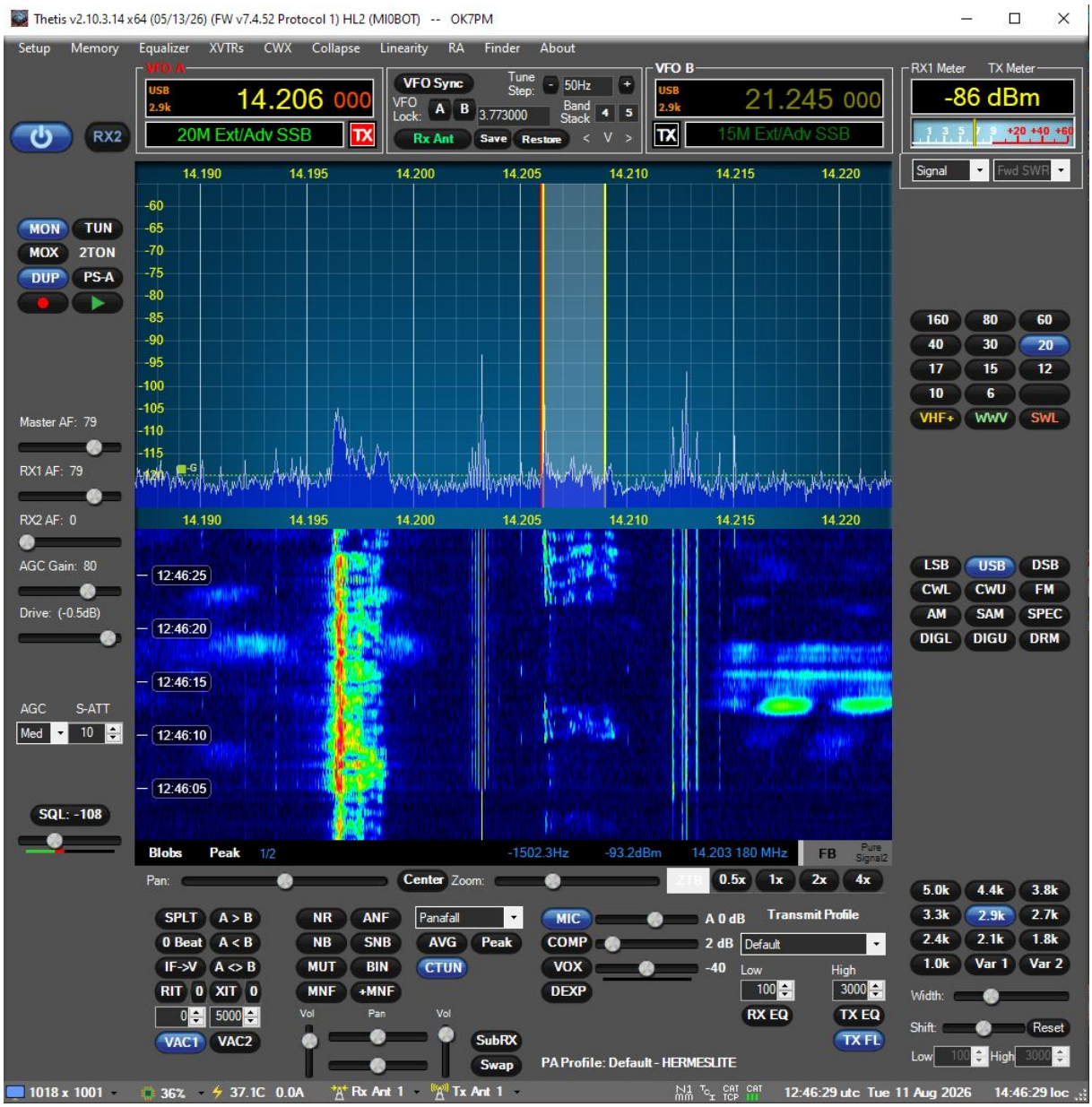
Under actual band conditions, the controls need to be adjusted appropriately. Fortunately, the settings do not need frequent correction. Operation is straightforward. The unit is light, and the knobs are small and close together. They would also benefit from more visible position markers.



In the dark portion of the spectrum, the wanted signal is blocked by strong interference that is already limiting the receiver's dynamic range. The dynamic range has not been adjusted using the receiver's input attenuator. When the device is inserted into the signal path (switched on), the interference is removed and the receiver's dynamic range is restored. The wanted signal stands out clearly, and the intelligibility of the received signal is not affected in any way. The signal strength itself is not particularly important.



Although the FT8 channel here is full of signals, the external interfering signal (noise generator) blocks the receiver and completely prevents reception of weak signals. After the NR-1 is switched on, reception becomes possible.



Tests on the higher bands also demonstrated its effectiveness. The improvement was less obvious on the panadapter, but clearly audible. The wanted signal was unquestionably enhanced.
I used the Kenwood TS-480 transceiver with equally successful results.

I recommend that anyone interested also view the many demonstrations on YouTube (2) and read the user experiences in (3).

Conclusion

This new product is certainly an unusual and welcome addition among devices of this type. Its advantage is that it works with the signal from a single antenna, improves signal readability, and does not interfere with the wanted signal spectrum. It suppresses interfering impulse noise before it reaches the receiver's input circuitry, thereby improving both blocking and intermodulation performance. Most importantly, it simply works - and works better than the NB filters built into some

transceivers.
The designer protects his technical know-how and is also continuing development in this field.

I would like to thank DD Amtek for importing this new product and providing it for testing. The NR-1 Antenna Noise Blanker is expected to sell for around CZK 6,000.

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(1) Manual: http://qrp.gr/nr1/sv3ora_NR-1_Antenna_Noise_Blanker_manual_EN.pdf
(2) YouTube demonstrations: https://www.youtube.com/playlist?list=PL0KwxiKZqJ1TzQpscf3voh5CR1c30WLD_
(3) Reviews: https://www.eham.net/reviews/view-product/16072

13/8/2026

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