DX Engineering NCC-2 Receive Antenna Phasing Systems

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The DX Engineering NCC-2 is identified as a Receive Antenna Phasing System on the manufacturer's website, but you will find out with this review that it is way more than that. The NCC-2 is an upgraded version of the previous model, the NCC-1.

At the 2013 Hamvention, I was looking for a way to protect a second receiver using the same HF antenna system. I started asking questions to a few manufacturers, who referred me to the DX Engineering booth. So, I went, and they brought up a solution using the RTR-1A Modular Receive-Transmit Interfaces. A few days after Hamvention, I received the unit and started to figure out how to connect it. There are so many ways to connect it that you need to sit down and figure out the best setup for what you want to do. I drew a diagram and sent it to DX Engineering support; they answered promptly with a different suggestion. After I proceeded with all the connections, everything worked as expected.

I've had the RTR-1A in the shack for several years, and it serves its purpose well. I had another brand of noise canceler and an HF beam for 10, 15, and 20 meters with an inverted **V** dipole on 80 meters. The setup worked well with the second receiver, but to use the noise canceling system I needed a second receive antenna that was a long wire around 10 feet above the ground. For the receive antenna I also had an external preamp to be efficient on most bands. At some point I had the local utility resolve many interference issues. The noise cancellation system was not required anymore, so I removed everything to reduce all the cabling behind the desk, as there were many devices involved — the RTR-1A, the noise canceler, the RX antenna preamp, and a protection relay to protect the RX antenna from transmitted RF.

Remember, the NCC-2 is way more than a noise canceler. It can include all the functionalities of my previous setup in one piece of equipment, reducing considerably the cables needed for the connections and the error risk associated with too many of these.

The NCC-2 now has a built-in receive-transmit interface relay system (equivalent to the RTR-1A), and the

unit has six plug-in modular circuit board sockets (three for each receive antenna), allowing the unit to serve many purposes. By default, there are six bypass modules installed, and you will need to remove one to install any of the optional modules (more on this later). The options are the Receive Preamplifier Plug-In Module (DXE-RPA-2-PM), the Receiver Guard 5000HD Plug-In Module (DXE-RG5000HD), the 75 to 50 Ω Impedance Transformer Plug-In Module (passive) to match 75 Ω RX ANT feed lines to NCC-2 50 Ω internal impedance, and the NCC-2 Receive Filter Sets (passive, non-switchable): high-pass, band-pass, and low-pass filters.

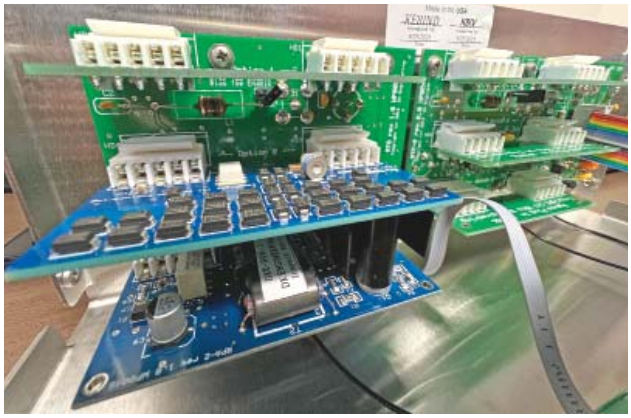

Figure 10 — The NCC-2 internal add-on modules: the DXE-RG5000HD Receiver Guard located in option 2 (middle module on the left side) and the DXE-RPA-2-PM preamplifier module located at the bottom.

Bottom Line

The DX Engineering NCC-2 is more than just a noise canceler. It provides an all-in-one solution for different applications while reducing the external connections.

You can also combine the NCC-2 with the DX Engineering Active Vertical Receive Antenna System. Because of my limited space (6500-square-foot lot), for this review I used a 40-meter dipole about 15 feet above the ground. I also added two optional modules for the receive antenna: the DXE-RG5000HD Receiver Guard and the DXE-RPA-2-PM preamplifier module (see Figure 10). Also, the NCC-2 can provide Bias Tee for its two receive antenna ports for coax-fed active verticals and other accessories.

Physical Description

The first thing you will notice is the overall quality, with its steel enclosure, sturdy knobs, and weight (more than 8 pounds). Keep in mind that this unit frequency coverage is 0.3 to 30 MHz, and it cannot be used on 6 meters.

On the front panel (see the lead photo), starting from the left, you have the **POWER** switch. When the unit is off, it is bypassed with your main antenna (TX) going to your rig directly. Above the **POWER** switch, you have a three-position switch with an LED just above showing the receive/transmit relay (RTR) feature status. When in the **NORM** position, the RTR is active and the LED is blue. In the **MAIN ON** position, the RTR is off and the LED is red. The bottom **MAIN ON** position is the same as the previous top one, but it's a momentary switch to quickly monitor the main antenna while holding it down.

The next set of controls is for channel A (**CH A**). In my setup, this is for the main antenna, as I have only one receive antenna on channel B (**CH B**). There is an **A dB** rotary attenuator switch to reduce the antenna signal for **CH A** from –10 to –30 dB; this is useful to match the received antenna signal strength. Below the attenuator switch there is an **OPTION** switch for **CH A** with a yellow status LED above when it's in the **ON** position; this is used to turn on and off the optional preamplifier module, if installed for **CH A**. In my case, there is none, so switching this one has no effect. The **BALANCE** knob is for balancing the signal between **CH A** and **CH B** antennas for noise cancellation. Next is the rotary switch attenuator for **CH B**, and just below is the **CH B OPTION** switch; in my case, this switches the preamp on for my receive antenna. On your right, you have the **PHASE** knob for the noise cancellation. Below, on the left, you have the **B PHASE** switch, **NORM** and **REV** position; in some cases, you will need to switch the phase in order to null a noise. The last one on the right is the **BAND** switch; **L** position is for the low band, 40 meters and above, and **H** is for below 20 meters.

Figure 11 — The NCC-2 rear panel.

On the rear panel (see Figure 11), you have two SO-239 antenna ports — one is to connect your main transmit antenna (**MAIN ANT IN**), and the other is for the **RADIO**. For both **CH A** and **CH B** receive antenna inputs, you have the option of using either the 50 Ω BNC or the F-style connector (you can use either of these). Using a 75 Ω input, you need the optional transformer module. When I was making the connection, I wondered why they were using these types of connectors for the receive antenna because most of us will need to use adaptors. Well, the answer is in the manual — it is to prevent any accidental connection to the transmitting equipment. I mentioned earlier the risk of my previous setup — having three different boxes to achieve the same result. This is what I was talking about, so it's a good thing they used these to reduce any risk. When the RTR is on, the receive signal from the main antenna is sent to the **MAIN ANT OUT** connector that you can use to connect a second receiver. In the middle of the rear panel, you have two RCA connectors for the **RADIO PTT** and the **ACC PTT** to connect an accessory such as an HF amplifier. Beside the RCA connectors you have the **+12 TO 21 VDC** input.

Connecting the NCC-2

This is where the fun begins. First, you will need to figure out how to connect your antennas and equipment depending on your intended use. In the user manual, you will find six setup examples, from pages 27 to 32. You can download the manual from the following link: **www.dxengineering.com/parts/dxe-ncc-2#InstructionArea**.

There are many ways to connect the NCC-2, and you will need to identify the best way for your setup — you may plan to use the RTR feature to feed a second receiver, like a software-defined radio (SDR), or you may have one or two receive antennas. If you need to provide power via the coax to either one or two receive active antennas, you will have to open the NCC-2 cover and change the jumper of one or two

channels to enable the Bias Tee; by default, both are disabled.

My connections are a mix and match of different diagrams shown in the manual. In case of any doubt, contact the DX Engineering technical support to ensure your setup is okay, as there are many possibilities.

I have only one receive antenna, which is not active, and no Bias Tee was needed. I also have an amplifier, which is the reason I got the receiver guard module for the receive antenna. Keep in mind that if you have an amplifier, it needs to be connected after the NCC-2, as the maximum power through this unit is 200 W. All my HF transmit antennas come into the station using only one coax from a remote switch located in the tower.

I started with diagram 1 on page 27 of the manual ("Phasing a Transmit Antenna with a single Active Receive Antenna using the RTR function"). My antenna is not active, as mentioned previously, but other than the Bias Tee being disabled, the connections are the same. The NCC-2 has two receive antenna inputs for the antenna phasing system. When you have only one receive antenna and one transmit antenna, you will need to feed the **CH A ANT IN** with the **MAIN ANT OUT** using the included BNC-to-BNC jumper. If you want to feed a second SDR receiver using the RTR function, you can insert a splitter between the **CH A ANT IN** and the **MAIN ANT OUT**, as shown in diagram 4 on page 30 of the manual.

In my station, I have a coax switch to switch between the antenna to different HF radios. I also have a 1 kW amplifier and a station monitor that has two RF couplers, one before the amplifier and one after, so the coax output of the radio's coax switch connects to the input of the first RF coupler, and the output of this coupler is connected to the **RADIO** input of the NCC-2.

The **MAIN ANT IN** input on the NCC-2 is connected to my HF amplifier RF input, the amplifier RF output is connected to the second RF coupler input, and the output of this coupler is connected to the outside antenna's coax switch. The RF power going through the NCC-2 will be a maximum of 100 W.

I used the included BNC jumper to connect the **MAIN ANT OUT** to the **CH A RX ANT IN** on the NCC-2, and I connected my RX dipole antenna to the **CH B ANT IN** using an SO-239 to a BNC adapter. I hope I didn't lose you with all these connections — it's easier when you have the units in front of you.

I connected the PTT coming from the radio to the **RADIO PTT** on the NCC-2, and the **ACC PTT** on the NCC-2 to the amplifier PTT input. And I connected the dc power from one of my shack power supplies to the NCC-2. To power the NCC-2, you will need a well-filtered 2 A dc source from +13 to 21 V dc. The dc connector is included, but you will have to build your cable.

Before I made all these connections, I opened the NCC-2 and installed the optional DXE-RG5000HD-PM Receiver Guard and the DXE-RPA-2-PM Receive Preamplifier modules. This is important, as both modules can be installed on either channel A or B or even both. I have only one of each of these optional modules, and in my case, these needed to be installed in-line only on my RX antenna, channel B. There are three optional slots for each channel. From top to bottom, you have option 1, option 2, and option 3. The receiver guard goes into option 2, and the preamplifier goes in the option 3 slot. See the online manual for more details, as these have their specific positions.

On-the-Air Operations

Before I could use the NCC-2, I had to wait for winter to arrive. I don't usually have any interference during summer, and I install my receive antenna only in winters, because it's installed low above the ground and close to the pool.

Now that everything was installed, I could try the NCC-2. The RTR feature is the best way to protect a second receiver from unwanted RF; it allows you to share your antenna and the phasing system with your main receiver. It's great that this feature is included with the NCC-2, and this works very well.

When it comes to noise cancellation, your results will vary depending on the performance of your receive antenna system. Having the preamplifier option built in is a great addition if you're using an antenna that does not perform equally on all the bands. My receive dipole antenna works best on 40 meters, and the preamplifier is needed when I want to null a noise on 80 meters, because to efficiently null a noise you will need to be able to match the signal strength of both antennas as close as possible using the **BALANCE** knob. If there's too much of a difference, you won't be able to obtain a great result. That's the reason you also have a variable attenuator for each receive antenna. As for the preamplifier, on 80 meters my radio signal meter shows a difference of +4 dB when I turned this option on, and on 40 meters it's up to 8 dB. The other bands show similar results. Keep in

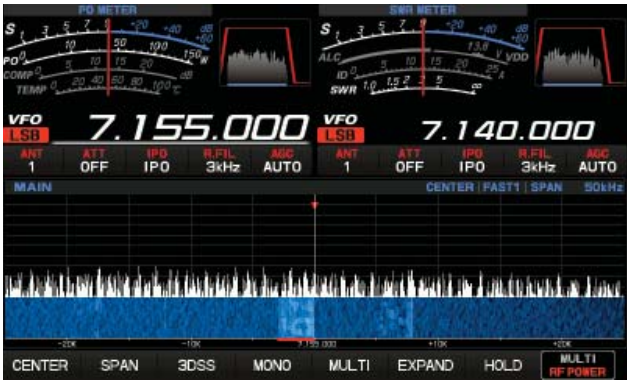

Figure 12 — The Yaesu FTDX101D waterfall screen capture showing noise interference before using the NCC-2 noise canceler.

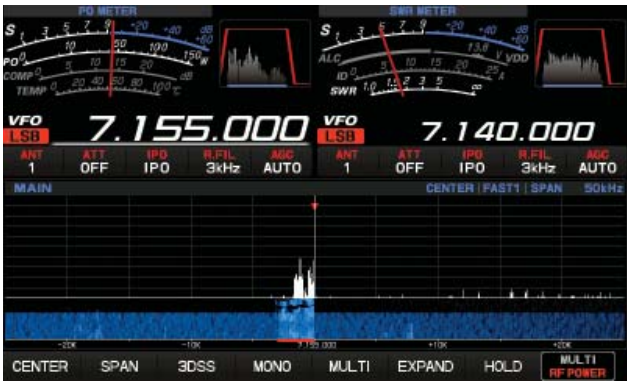

Figure 13 — The Yaesu FTDX101D waterfall screen capture just after switching on the pre-adjusted NCC-2 noise canceler.

mind that this is not a laboratory measurement; it's just my observation with my current setup. The DXE-RPA-2-PM specifications on the manufacturer's website mentioned a gain of 16 dB, and ± 1.5 dB, from 300 kHz through 35 MHz. In my case, the preamplifier of my receive antenna was necessary, and it works very well.

My lot is small, and I didn't install an external protection relay on the receive antenna, so I was a bit worried that if I was using the amplifier, the RF picked up by the receive antenna could damage the NCC-2. That's the reason I installed the optional receiver guard module. It looks like it survives a 1 kW transmission test even with the preamp on. The preamplifier LED stays on when I transmit, but I'm pretty sure it's deactivated. This is great, as no external relay is needed when using the NCC-2 with the optional receiver guard module.

I had to wait for noise interference on a cold winter day to really test the efficiency of the noise canceling system of the NCC-2. One morning in January, it happened on 40 meters; the noise peaked up to 20 dB over S-9. Keep in mind that the NCC-2 is able to null the noise before it even gets into your receiver, which is way better, as it won't add distortion on the received strong signal audio. To null the noise, I set the **PHASE** knob in the middle (5) and started to play with the **BALANCED** knob. I was unable to null the noise right away, so I switched the **B PHASE** switch to **REV** and played with the **PHASE** knob, and the noise was almost gone. Then I fine-tuned using the **BALANCED** and **PHASE** knob. I was able to make the noise disappear completely. You will need to play with the knobs very slowly to fine-tune and achieve the best performance. The NCC-2 made the difference between turning off the radio (as I couldn't hear anything) and listening to an interference-free quality signal. You can see the signal difference in the screen captures from my Yaesu FTDX101D when I switched the NCC-2 on and off (see the transition in Figures 12 and 13). In Figure 12, the NCC-2 is off. Look at the noise on the S-meters in both VFOs. In Figure 13, we can see when the NCC-2 was turned on (it was pre-adjusted). On the main VFO (left) the desired station signal is actually stronger than before, and I can now hear it clearly. If you compare sub VFO signal in Figures 12 and 13 (right), you can actually see the noise drop to the receive signal at this frequency when the NCC-2 was in-line.

I noticed that after nulling a noise that is present on most of the band, you have to adjust the **PHASE** knob if you move more than 40 kHz from where you've made the first adjustment, but this can be achieved very quickly.

Conclusion

If I had enough room in my backyard, I would have loved to test the NCC-2 with two of the active receive antennas from DX Engineering. The results must be astonishing with this setup. Nevertheless, using the NCC-2 with a non-active antenna combined with the preamplifier will give you the ability to null most of the noise.

The NCC-2 provides an all-in-one solution for different applications while reducing the risk by using fewer external connections.

Manufacturer: DX Engineering, 1200 Southeast Ave., Tallmadge, OH 44278, **www.dxengineering.com**. Price: $949.99 for the main unit, $64.99 for the optional DXE-RPA-2-PM Receive Preamplifier modules, $79.99 for the optional DXE-RG5000HD-PM Receiver Guard 5000HD module. Other options are available on the manufacturer's website.