



# Review of the New NCE Radio Base Station and Repeater



by Don Fiehmman

*This new upgrade, according to Don Fiehmman, provides much faster response times.*

There was a great improvement in model railroad operation when we went from stationary throttles to walk-around control. But the walk-around had one minor problem. The attachment cord was either too short or got tangled up if it was long! The answer to this was wireless connections. But the radio wireless had problems of its own. Here is a history of the development of the latest big improvement with the second generation wireless system from NCE.

## WIRELESS HISTORY

The NCE wireless cabs work in the ISM (Industrial Scientific Medical) radio band at 916.5 MHz. All wireless devices that use radio waves must be approved by the FCC. The FCC controls both the frequency and the amount of power the device can emit. Extensive testing is required for final FCC approval. When NCE started to design the wireless system the amount of power allowed was greater than was allowed in the final product. Somewhere along the way the power was reduced to 0.00035 watts (350µ watts). The NCE wireless uses two way or duplex transmission. The handheld cabs both transmit and receive data so commands can be sent to the command station and the system send back the change in status to the display. You know the signal got to the command station when the display is updated. Many DCC systems use simplex or one-way transmission and only send out the commands from handheld throttles. The only way to tell the signal was received is by the response of the locomotive or accessory decoder.



1/4 Wave      1/2 Wave

The FCC rules are different for simplex and duplex transmission. The rule is based on the average amount of power emitted by a transmitter. With simplex the only time there is a signal transmitted is when a signal is sent from throttle or cab. With duplex the signal is transmitted almost constantly. Thereby the amount of power that can be emitted from a duplex system is far less than a simplex system. For NCE this meant great reduction of the output power compared to simplex systems. Reduced power meant reduced range of operation.

One of the first improvements was the change from a 1/4 wave to a 1/2 wave (longer) antenna. Other improvements were using an aluminum pie tin for a ground plane under the antenna. Changing antenna locations also helped. But all of these improvements still left holes in coverage in some layouts. Some of these holes were caused by multi-path reception. This is the same type of problem that causes TV ghosts and flicker when a plane flies overhead. Even when the system checked out OK there could be dropouts when added people soaked up the RF energy between the handheld and the base station. Another complaint about the

wireless system was the response was much slower than when operating wired.

## THE SOLUTION

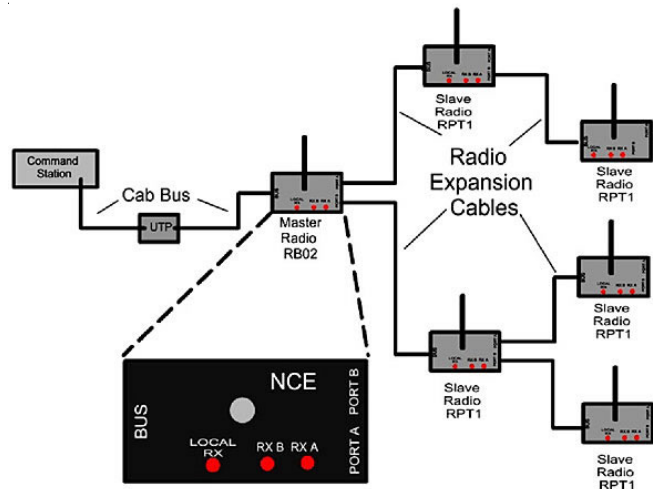
If multiple transmitters and receivers could be placed around a layout the coverage would improve. The solution was the combination of RB02 base station and the RPT1 repeater. The connections on the RB02 master allow it to communicate with the RPT1(s) repeaters. Up to 30 RPT1s can be added. Each RPT1 has one output connection and two (A & B) Inputs. The RPT1s to expand up to four levels, five levels if your start with the RB02. Each RPT1 can be wired to two RPT1s. The cables from unit to unit can be up to 40 feet. This would allow a run of 160 feet with RPT1s every 40 feet. If the RB02 is in the center you could cover an area of over 300 feet. The power requirement from the Cab Bus is 70ma for the RB02 and only 35ma for each RPT1. Adding more than 10 RPT1s may require added power to the Cab Bus.

(Check the manual for power requirements when expanding with a many of PRT1s.) Three LEDs on the top of both units are used to indicate which input (A or B) is active and one for local activity.



A significant change in the RB02 was the improvement in response time. The difference between wireless and wired has been reduced to the point where they are almost the same, that is fast!

Both the RB02 and RPT1 are the same size case and come with the 1/2 wave antenna. A 7 foot cab bus cable comes with the RB02 and a 40 foot cable is supplied with each RPT1. The cable has both power and signal wires. The Cab Bus and the Radio Expansion cables are the same type cables. But the expansion cables from the RPT1s must be connected thru an RB02 to connected to the Cab Bus.



The new RB02 supports the setting of the Layout ID number. The ID number allows more than one NCE system to operate in an area and keep the commands separated for each NCE system. See the manual for instructions for the RB02. The wireless cabs must be set to a corresponding layout number.

There have been a few complaints about the length of the longer 1/2 wave antenna in a crowded layout room. With the improved coverage you might try using the 1/4 wave antenna. The receivers in both the RB02 and PRT1 are very sensitive and can be overloaded when the Cab is too close. When placing these units make sure they are at least 2 feet or more space between the unit and area where wireless cabs are used.

## TESTING

I started my testing by putting the new RB02 in place of my old RB01. I used a wireless ProCab and a wireless CAB-04e for the tests. Signal strength can be observed by watching the LED pulse on the top of the cab. Another way to check the system response is to watch the display change on the ProCab after you enter a command. The RB02 alone worked as well as the older RB01 in my first tests with one big exception. The response of the new RB02 was very close to a cab that was plugged in! It put the fun back into running wireless. The fast response and ability to operating DCC controlled turnouts made switching movements very workable. With the RB01 switching was best done when plugged in to the Cab Bus. The faster response makes operating new sound systems with added sound functions more controllable. I'll have to admit that I avoided using the older wireless due to the slow response. Now I grab the wireless when running the layout. No more stretching the cord to get to an area almost out of reach.

My layout is in an area about the size of a two car garage. The RB02 is near one corner of the room. The PRT1 was installed at the opposite corner. The 40 foot cable was run along the wall and just fit. I replaced the 1/2 wave antennas on

both cabs with 1/4 wave antennas. I tired to find a location in the layout room where the signal was weak. I even held the cab flat which puts the antennas at right angles. This should reduce the signal strength between the cab and the RB02/RPT1. The signal stayed solid and response fast in all locations in the layout room and most of the rest of the house.

The location of the LEDs have been moved to the top of the RB02 from the side on the RB01. My base station is at about eye level. At eye level it was easier to see the LEDs on the side than the new location the top. I put both new units at a slight angle for better visibility while testing.



When the system was turned on the RB02 would startup each time until the RPT1 was plugged into Bus A. The RB02 would then fail to startup on power up. Plugging the RPT1 into Bus B of the RB02 solved the problem. NEC found a bug in the software that affects some RB02s. This problem has been fixed. If you have this startup problem with RB02 contact NEC for this fix.

## UPGRADE

If you have an older NCE RB01 base station the improvement in response it is worth the money to replace it with the new RB02. There is a coupon that comes with the RB02 for a free repeater upgrade of your old RB01. Only charge is \$5.00 for S&H. Adding the RB02 and upgrading RB01 the would give you both a base and a repeater for much better coverage.