

## Wireless Inter-Carriage Link with Neratec WLAN products

In refurbishment projects there are typically no possibility to install additional cables for high speed inter-carriage connectivity. Neratec WLAN products offer an optimized solution for high speed wireless inter-carriage coupling avoiding the need of additional cable installation.

Neratec has a long history in designing and delivering IEEE 802.11 technology based products for railway industry and its applications. Neratec wireless carriage coupling solution offers easy installation, high speed communications, reliability and optional redundancy features for all kinds of trains.



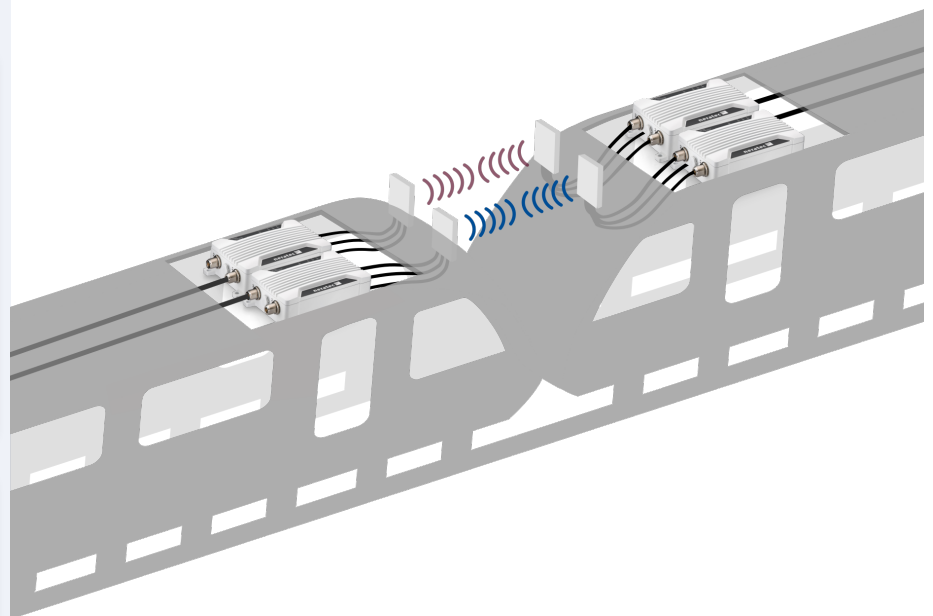
### Wireless Inter-Carriage Link

Increasingly intelligent transportation solutions are requiring IP-based train backbones with high data throughput. However, especially in refurbishment projects it is often very difficult or even impossible to add additional cables between the train carriages or compositions. As an alternative for additional cables, Neratec offers a wireless carriage coupling solution.

Wireless carriage coupling requires an intelligent automatic bridged connection establishment between the carriages. It is important that the connection is only established between the carriages that are facing each others. Especially important it is to avoid erroneous connections to carriages that are located at the nearby tracks.

### Solution highlights

- Automatic coupling and decoupling process with easy configuration
- Reliable locationing for link establishment during coupling
- Automatic failure recovery
- Completely transparent cable replacement feature
- Support of advanced encryptions (WPA2-PSK, 802.1X)
- Configurable operation in 2,4 or 5 GHz channels
- Data rate up to 450 Mbit/s with 380 Mbit/s user payload
- Redundant and aggregated systems possible
- Supports operation on 5GHz outdoor DFS frequencies



Enables reliable and high speed consist network

## Neratec Inter-Carriage Link

Neratec's inter carriage wireless link offers high throughput wireless connection between the carriages. The maximum speed is achieved by using 40MHz channel bandwidth and making use of multiple streams of MIMO technology. Efficiently using multiple streams in a short distance application is not easy, but Neratec has implemented a solution for this. That means that the customers can benefit from high speed and reliable links that offer average user data throughput of 360..380Mbit/s for each link.

Neratec solution also implements a true cable replacement feature. This feature enabled users to make use of the onboard switches to built redundant and transparent topologies.

Operation on 5GHz DFS frequency band is supported. With Neratec's highly optimized radar detection, the problems related to false radar detections are solved.

## Prepared for redundancy and aggregation

It is possible to install one wireless bridge with two Neratec products. However, if redundancy is required there is an option to multiply the hardware and have two parallel wireless bridges between the carriages. The benefit of using a second Neratec wireless bridge as a backup is that the higher connection data rates and

throughput provided by Neratec wireless link can be maintained even in case of a hardware defect.

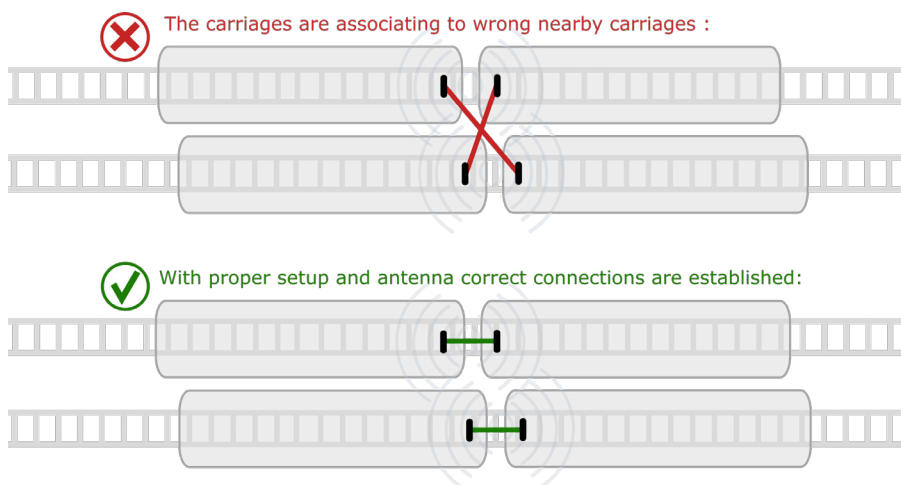
Alternatively the second link can be used for link aggregation when used together with Neratec ICL antenna. This solution offers the needed RF isolation between the links and enables simultaneous operation of the two links.

## Installations and antennas

From carriage to carriage the signal is transmitted using the standard IEEE 802.11n data rates. Neratec DT50 products allows using 2.4 GHz or 5 GHz band. In order to prevent interferences between the other communication networks employed within a train environment, the inter-carriage antenna system is usually configured to use the 5 GHz band. The use of MIMO antennas allows a higher data rates to be transmitted. With 3x3 MIMO antennas and 40 MHz channel

bandwidth data rates up to 450 Mbit/s (380Mbit/s user data throughput) can be achieved.

The directional antennas can be installed inside the carriage in a variety of ways. In order to achieve the best results the antennas must point towards each others and the distance between the antennas should be minimized. This increases the signal levels in comparison to interfering signals and with proper antennas allows the use of higher data rates thanks to multiple MIMO streams.



Example of the incorrect and correct automatic link establishment

### Neratec – wireless & embedded for more

Neratec Solutions AG is an independent Swiss technology company that specializes in industrial WLAN pro-

ducts and customized product developments. Neratec's industrial WLAN products meet the very highest standards for applications in the rail, automotive and production industries, as well as in process automation, security

and surveillance. Based on own wireless platforms Neratec also supports customers to create customer specific wireless sensor network solutions.