

WHY IS MOBILE COMMUNICATION AND WIFI IN RAILWAY WAGONS SO POOR?

Poor Wi-Fi and mobile coverage on trains is the result of a mixture of reasons:

- the scarce number of operator base-stations along railways.
- physical obstructions along rural tracks.
- overloaded networks.

Together, these issues block signals from reaching your device and make your connection drop out.

1-WIFI

These connectivity problems happen especially when WIFI is used, the internet provided through WIFI is coming from a 4 or 5G router with the antenna on the roof of the wagon and is depending usually on the network of one single mobile operator. Depending on the speed of the train this router is switching over a least every minute from one outside operator base station to another, this happens for all passengers at the same moment and creates a big congestion both in the router and on the operator network. In addition to that, at the speed of a train the real data throughput of a router is less than half the normal capacity.

2-GSM 4G & 5G

The main culprits causing these connectivity issues include:

The Faraday Cage Effect: Train carriages are essentially giant metal boxes that block, reflect, and absorb radio frequencies. Modern trains often feature specialized metallic window tints for energy efficiency and sun protection, which can decrease the penetration of outside signals by up to more than 30dB. (a factor 1000)

Lasering those windows is only bringing a very low improvement because electromagnetic waves are anyway completely bouncing off on glass if the incoming angle is lower than 45°. This is the case on more than 90% of any railway track.

The Faraday effect is at the origin that only a very limited number of frequency bands out of the 6 used by the mobile network operators are penetrating the wagon, and all inside users create a giant traffic congestion on these few bands.

High Speeds and Network Handoffs: As a train travels at high speeds, your phone is forced to rapidly disconnect and reconnect to different cell towers (a process called a "handover"). In crowded areas, hundreds of passengers are switching towers almost simultaneously.

Rural Dead Zones: Cell towers are built where the majority of people live and work, rather than sparsely populated open landscapes where many rail lines are routed. However, frequent coverage blackouts happen not only in deep countryside and remote but also on very busy tracks like Ghent to Brussels or Utrecht to Amsterdam.

THERE IS ONLY ONE SINGLE GOOD SOLUTION FOR THIS PROBLEM:

A HAM international GSM 2G 4G & 5G low latency signal amplifier to be installed in each wagon.

This amplifier is providing indoor signal on all 6 frequency bands for all national mobile operators spreading the frequency occupation from the users way more than 10 times and avoids congestion. This economic and easy to install solution reduces also drastically the transmit power and RF radiation of the user devices and is the only one to be 100% cyber-safe.