
DARK TERRITORY
Abusing legacy railroad signaling systems

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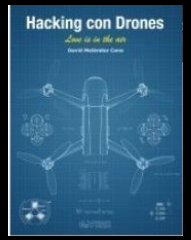


DARK TERRITORY

In the railway sector, "dark territory" refers to a section of railway track that lacks remotely controlled railway signals or automatic block systems. In these areas, communication and coordination of train traffic rely exclusively on railway operators through radio communication and other non-automated methods, instead of using electronic signals or automated control systems to manage the safety and movement of trains.

The term has also gained popularity outside the railway context, especially in popular culture and information technology, to describe areas or sectors that lack supervision, regulation, or control, often symbolizing an environment of uncertainty, danger, or lack of control.


REC
FUN WITH
trains

Railway Block: A block is a section of railway track in which normally no more than one train can be present at a time, in order to prevent a collision between two trains.

Block Section Between Stations: a section of railway track in which normally no more than one train can be present at a time, in order to prevent a collision between two trains

Block Section Between Signals: A block section between signals is a section of railway track in which normally no more than one train can be present at a time, in order to prevent a collision between two trains.

Axle Counter

A railway axle counter is a system of sensors installed on train tracks to detect and count the axles of the train cars.

Fun with trains

Track Blocking

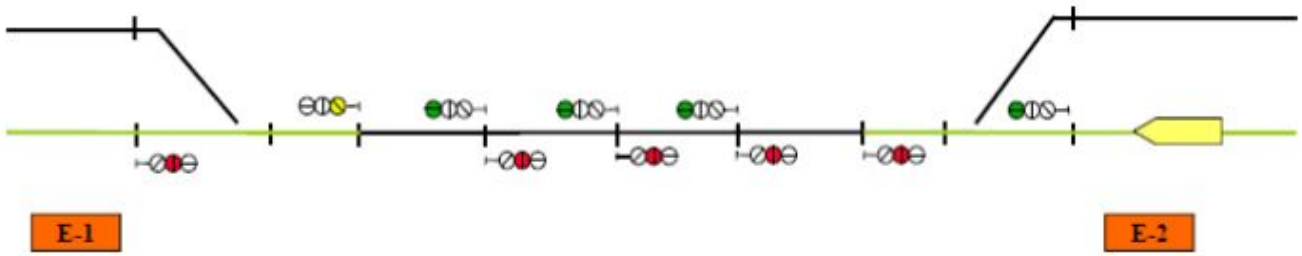
A procedure by which the movement of trains on a track in a specific direction is authorized.

Token Block


Telephone Block

Fun with trains

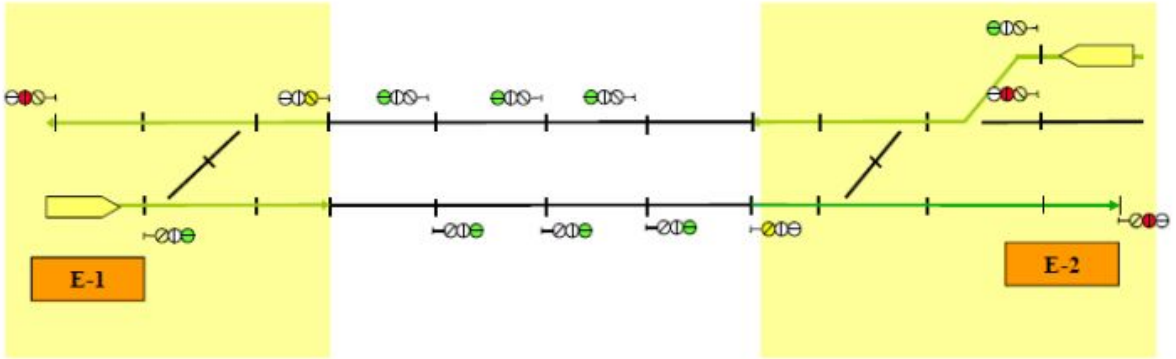
Electronic Track Blocking



Automatic Blocking on Single Track (B.A.U.)

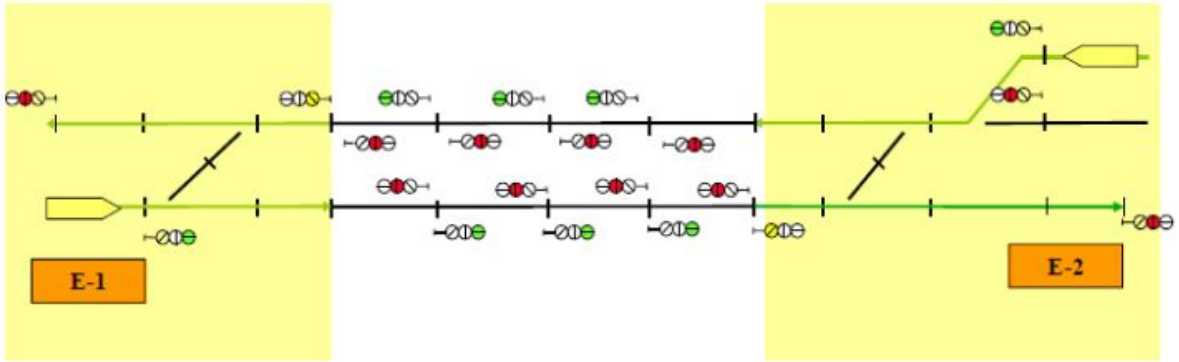
Fun with trains

Electronic Track Blocking



Automatic Blocking on Double Track (B.A.D.)

Electronic Track Blocking



Bidirectional Automatic Blocking (B.A.B.)

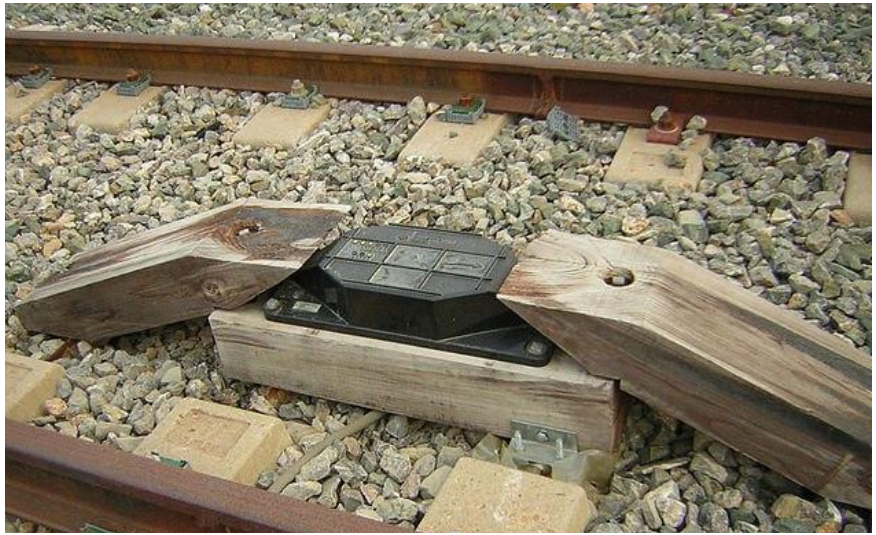
Fun with trains

Centralized Traffic Control

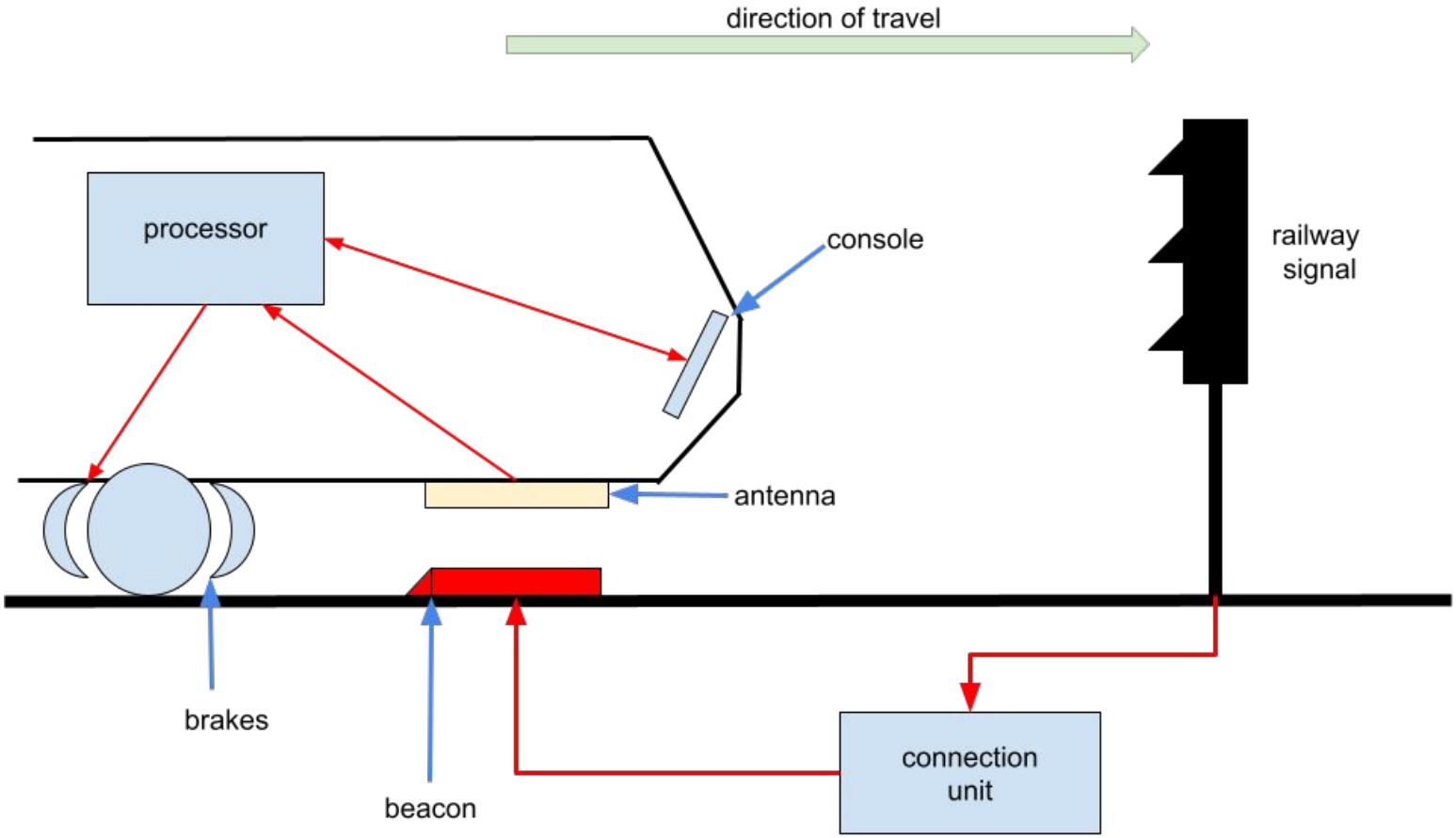
Fun with trains

ASFA (Anuncio de Señales y Frenado Automático)
Announcement of Signals and Automatic Braking

This is the oldest support system for train circulation and is installed on almost the entire Spanish railway network. It is designed to reduce human errors. The system is based on a coil-capacitor circuit connected to the signal, which, depending on the signal aspect, transmits one frequency or another to the onboard equipment.



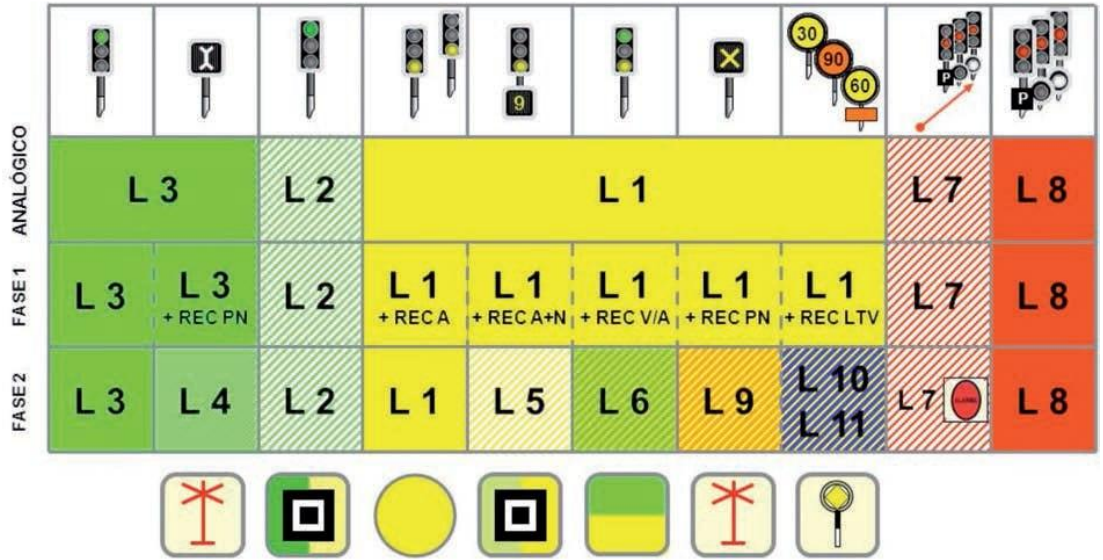
Fun with trains


direction of travel
processor
console
railway signal
antenna
brakes
beacon
connection unit

ASFA - Types

Beacons with Fixed Aspect - Example: Level Crossing Beacon

Beacons with Variable Aspect - Example: Signal Beacon

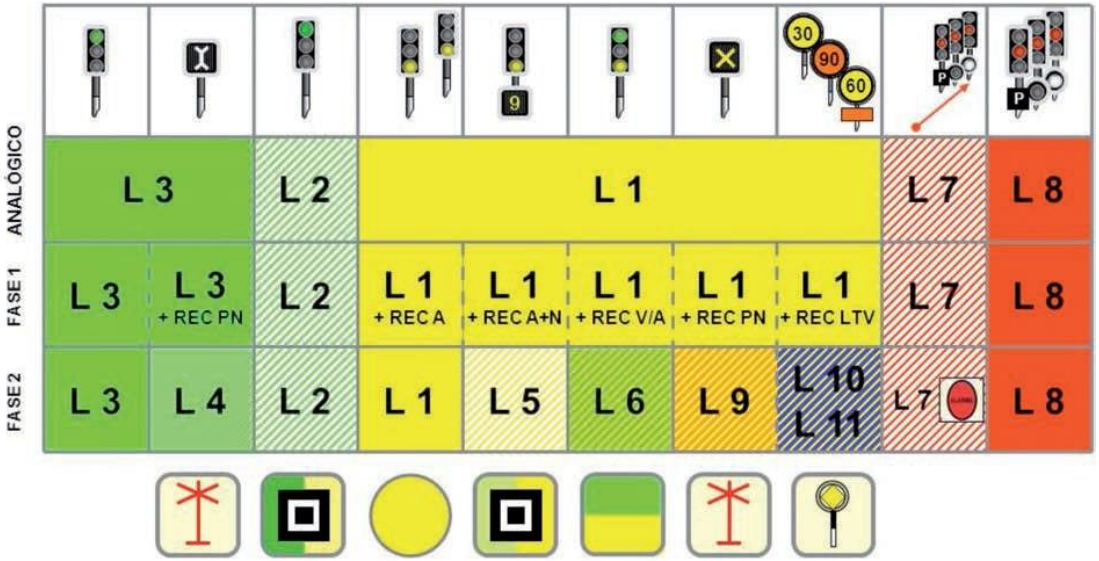


ASFA - Signal Frequencies

6.2. Frecuencias utilizadas en el sistema A.S.F.A.

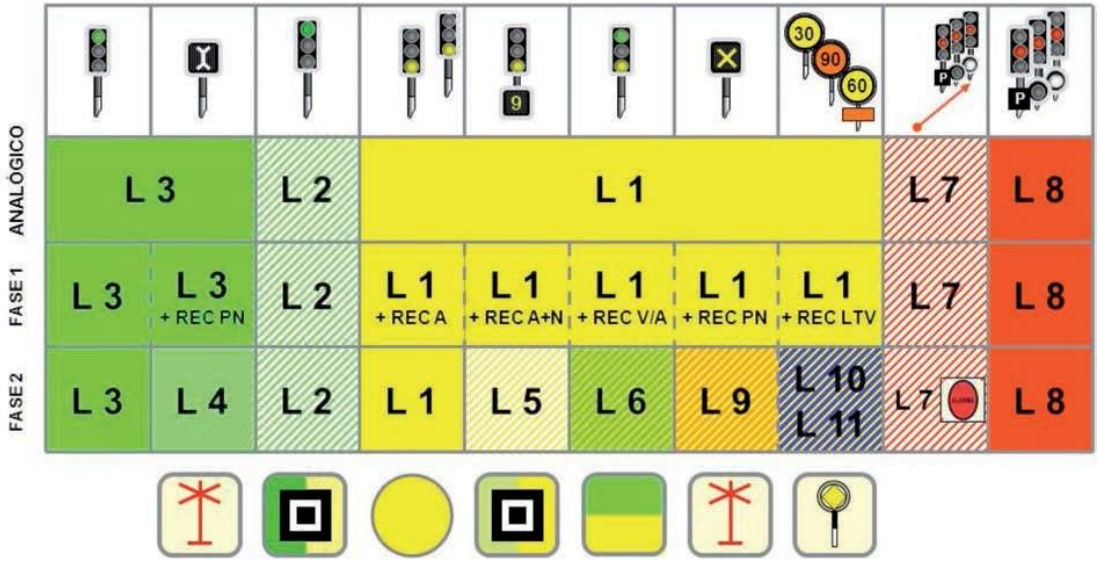
Las frecuencias actualmente utilizadas son las siguientes:

L1—AMARILLO; VERDE-AMARILLO; AMARILLO DESTELLANTE	60.000 Hz.
L2—VERDE DESTELLANTE	64.020 Hz.
L3—VERDE	68.310 Hz.
L7—CONTROL DE VELOCIDAD	88.540 Hz.
L8—ROJO	95.500 Hz.



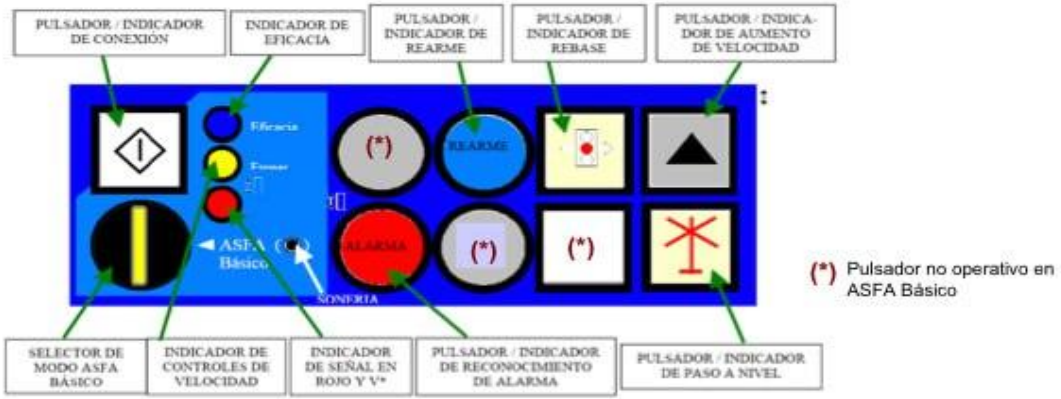
ASFA (Anuncio de Señales y Frenado Automático) - *Announcement of Signals and Automatic Braking*

Problem 1 - In Analog ASFA, the Same Aspect (e.g., L1 or L3) Indicates Multiple Signals



ASFA - What the Train Driver Sees

Panel ASFA Digital



Pulsadores adicionales de reconocimiento

L1: Anuncio de parada, anuncio de parada inmediata, preanuncio de parada, anuncio de precaución, paso a nivel desprotegido, anuncio de limitación temporal de velocidad.

Fun with trains

ASFA - What the train driver sees


DARK TERRITORY

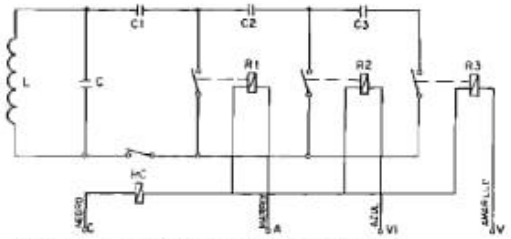
DN NAVARRA ACTUALIDAD DEPORTES OPINIÓN CULTURA Y OCIO VIVIR SERVICIOS DN Iniciar Sesión Suscríbete

Uharte Arakil: 25 años del mayor desastre ferroviario de Navarra

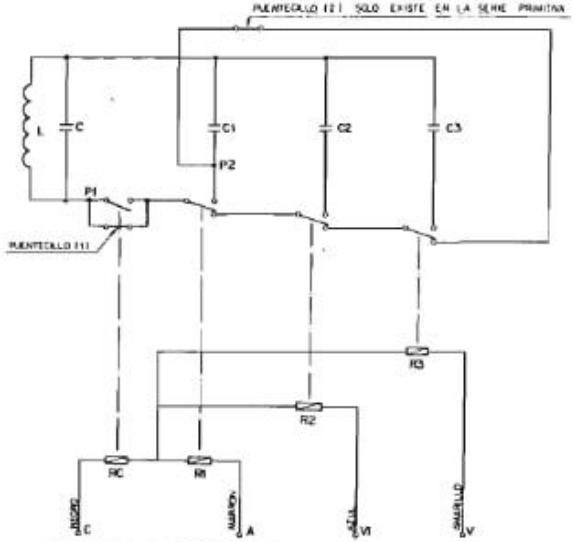
El intercity 'Miguel de Unamuno' descarriló en Uharte Arakil con 248 pasajeros, de los que 18 fallecieron. La tragedia marcó a una generación

CIRCUITOS TIPICOS DE BALIZAS

Fig. 2

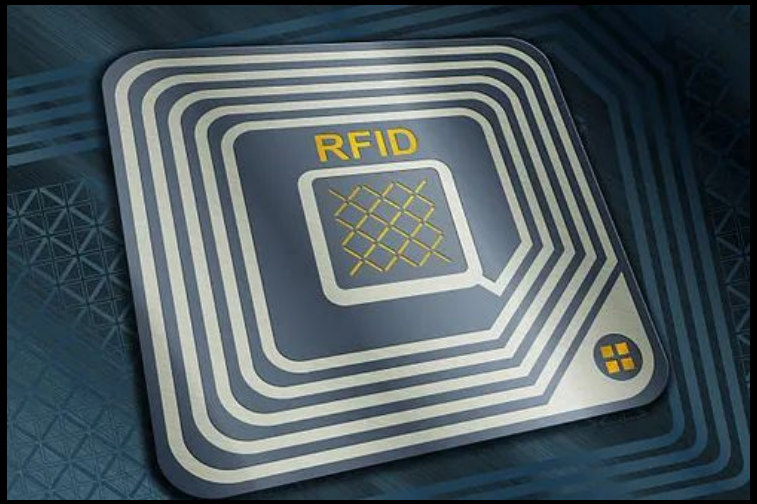


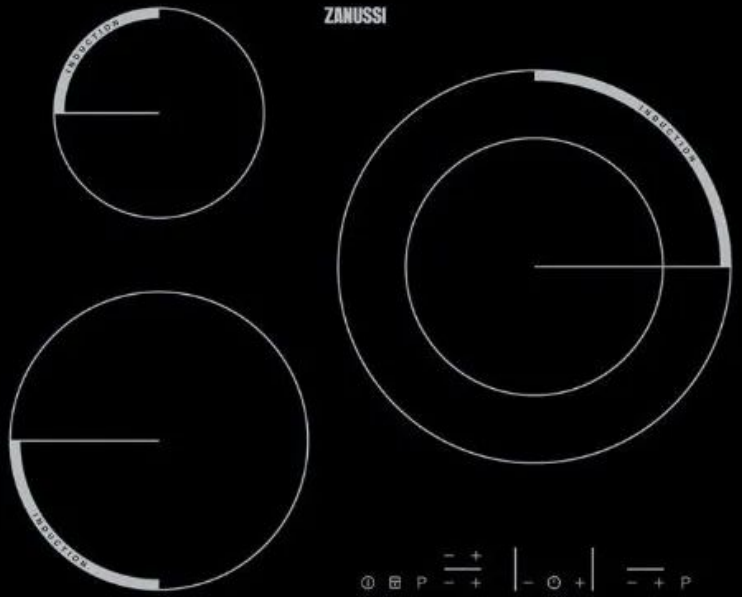
a) BALIZAS DE FONDO ROJO O CONTROL DE VELOCIDAD



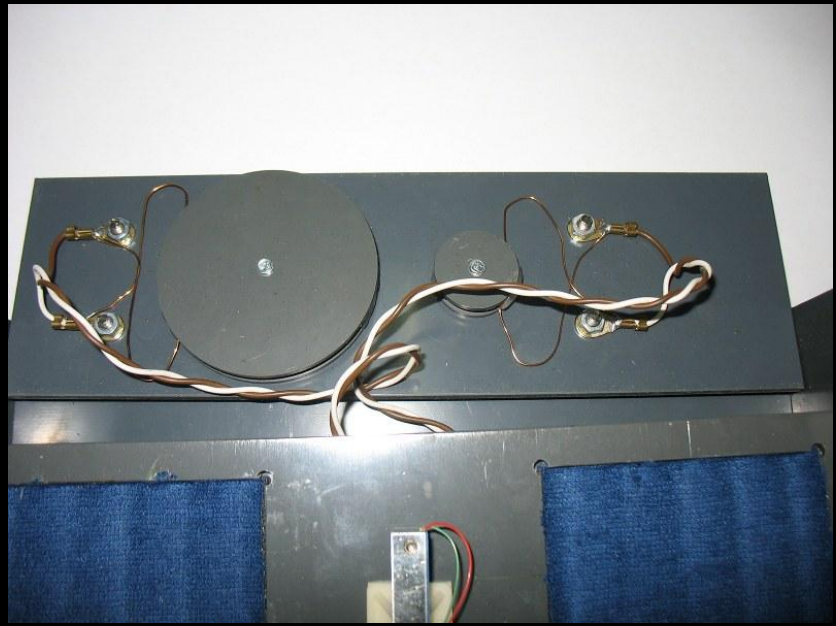
b) BALIZAS DE FONDO DOBLE

NOTA.- En las balizas de fondo doble que no son de la serie primitiva están unidos los puntos P1 y P2 con tan sólo el puentecillo (1), coincidiendo el punto P1 con la posición de un contacto en reposo de RC y no pasando el camino hacia P2 por los contactos de R1, R2 y R3.


RFID


ZANUSSI


ON/OFF
Equipo
Comprobador
Balizas
CARGADOR
SEÑAL
LED
DME TRONIC

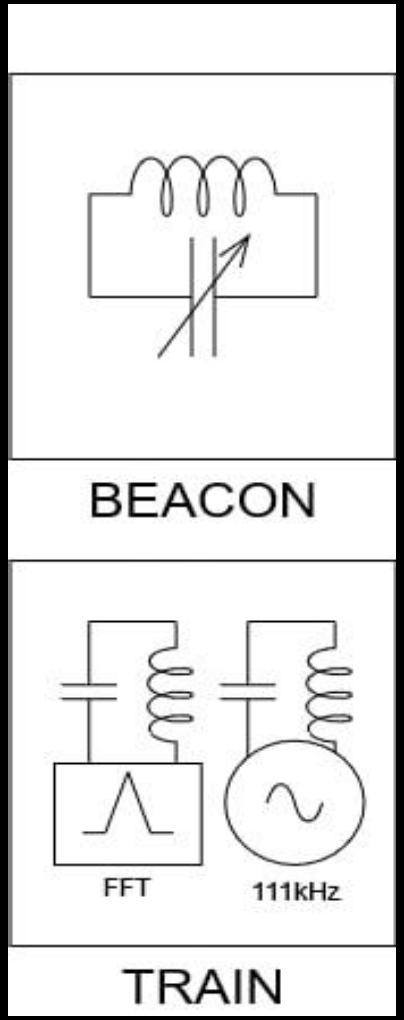


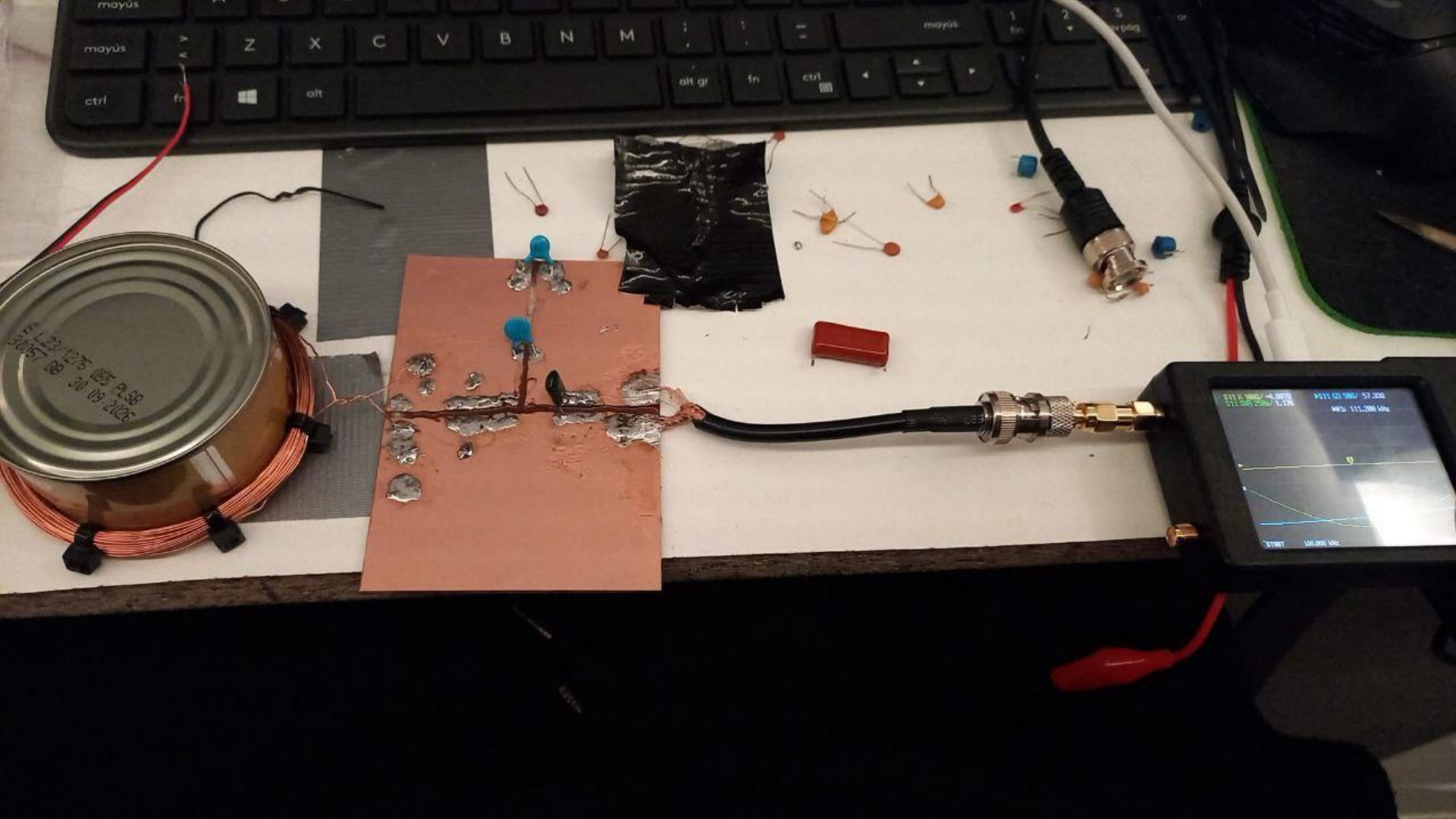
Possible Attacks:

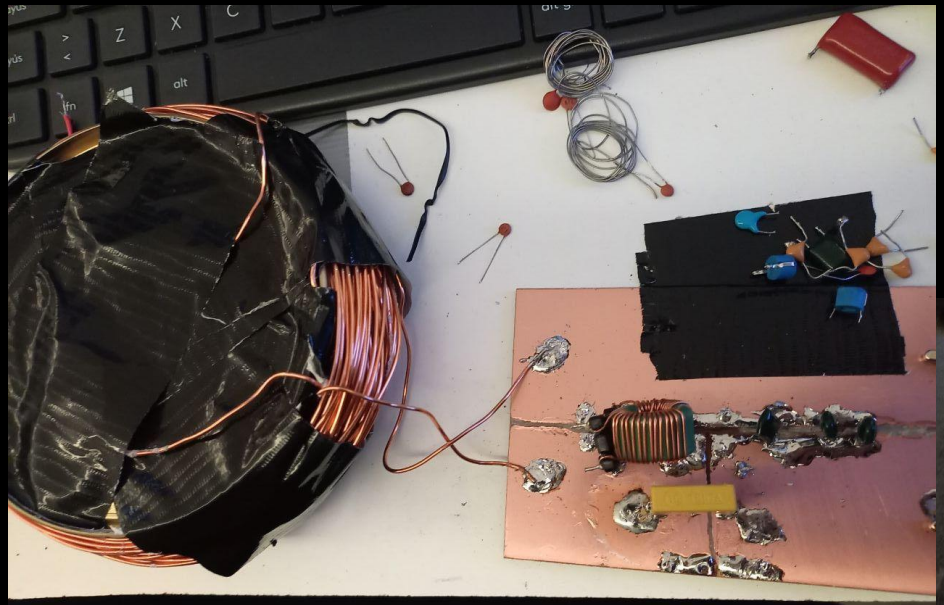
- Use a circuit with a coil and capacitor to induce the frequency we want the train to pick up to emulate a beacon.
- Replicate the beacon.

Requirements:

- Inductance of the coil
- Capacitance of the capacitor

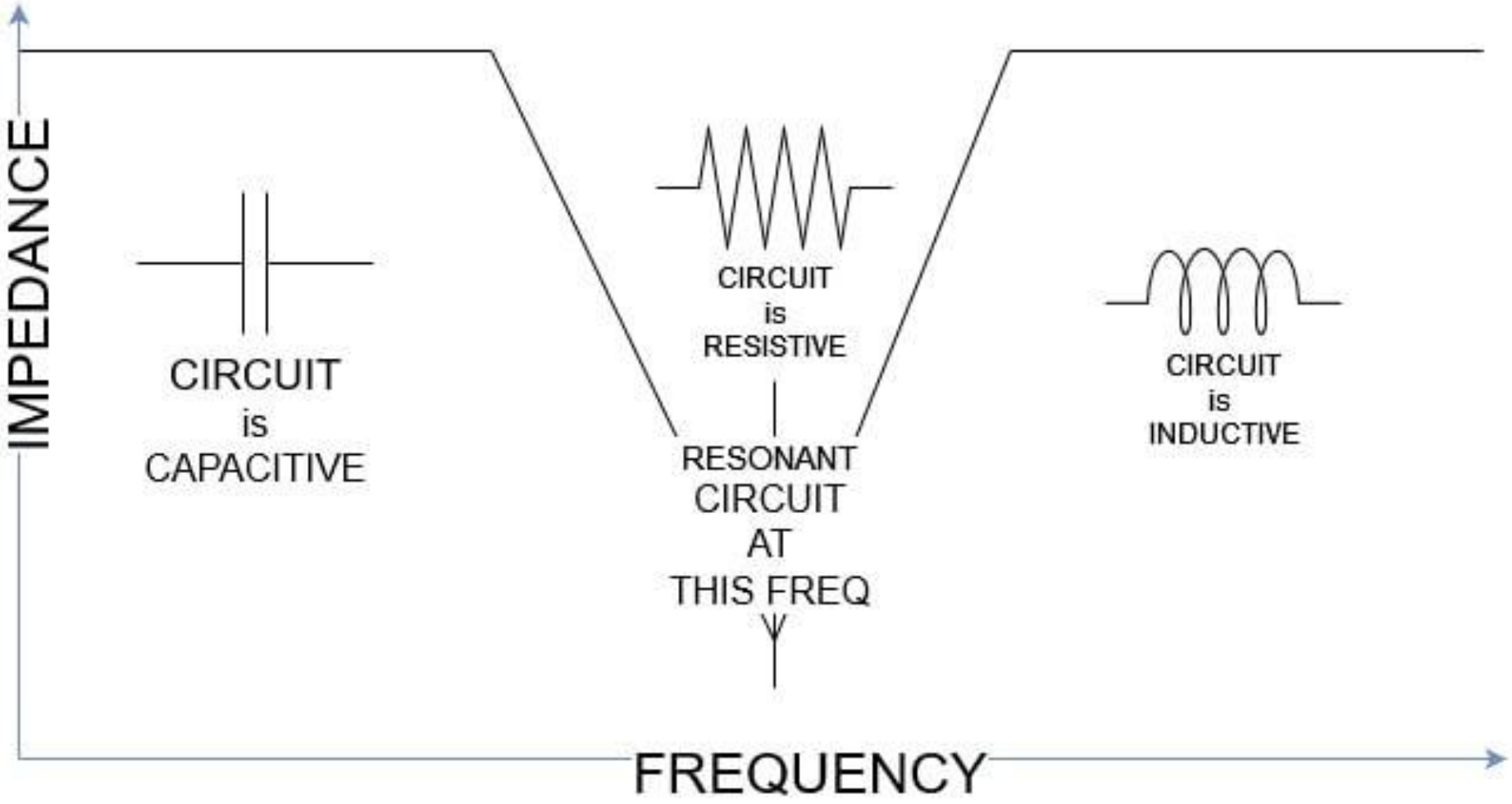

BEACON
FFT
111kHz
TRAIN



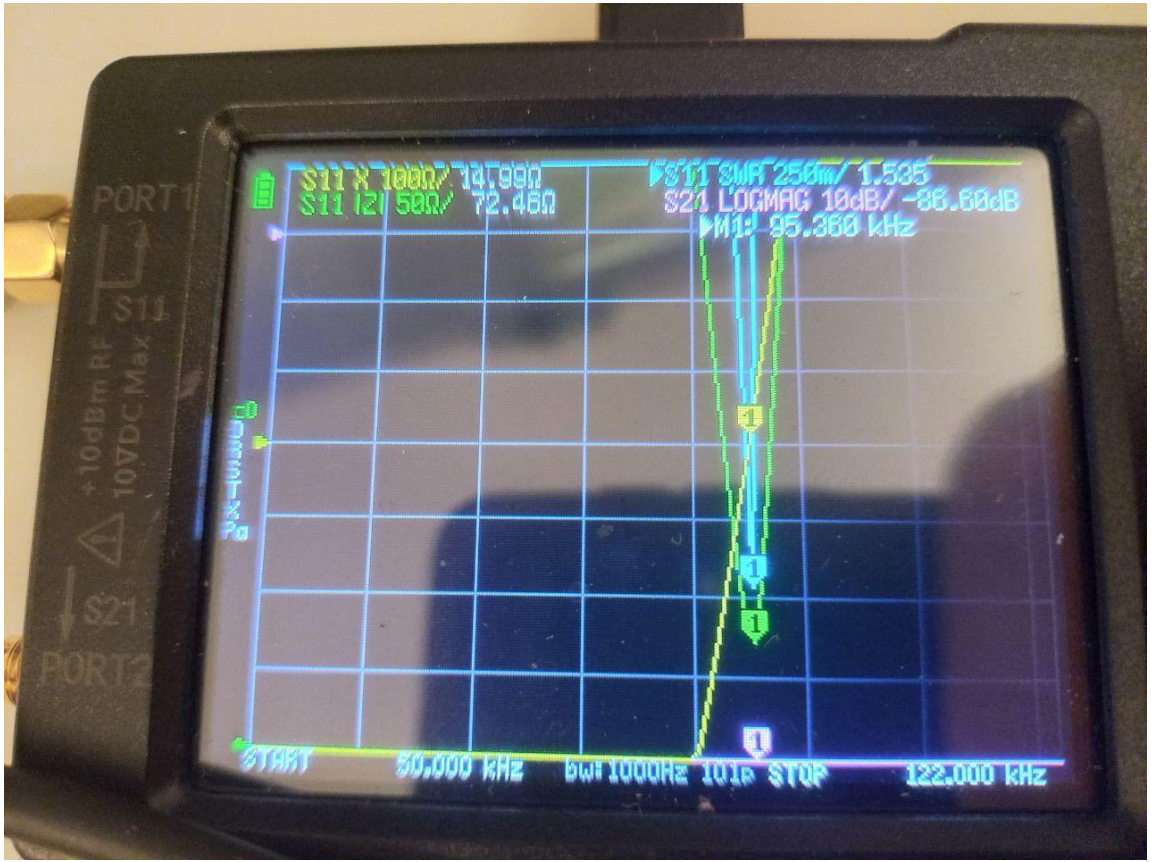



S11 X 100Ω/ 13.68Ω
S11 SWR 250m/ 1.580
▶S11 IZI 500/ 75.89Ω
▶M1: 74.050 kHz
START 50.000 kHz
bw:1000Hz 101p STOP 115.000 kHz

AND WHAT IF . . .

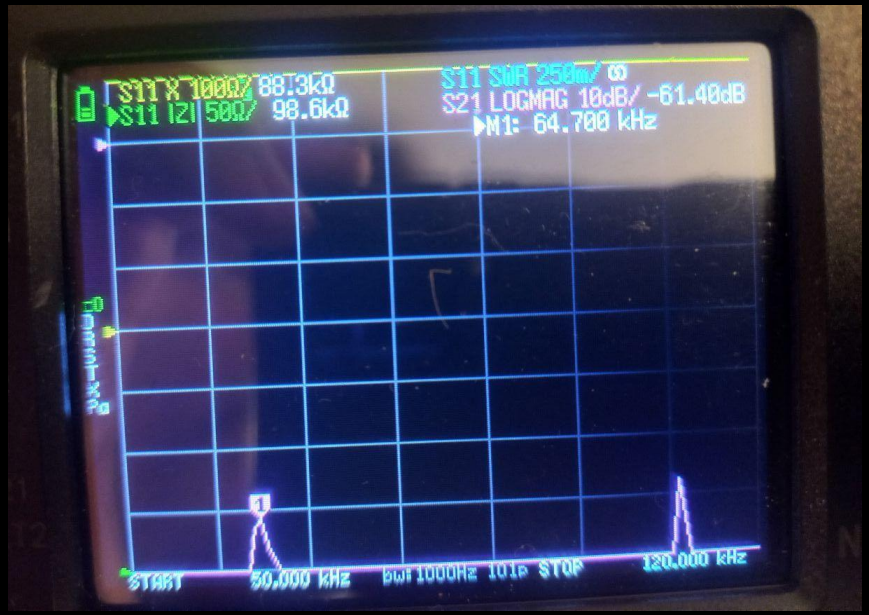

IMPEDANCE
CIRCUIT
is
CAPACITIVE
CIRCUIT
is
RESISTIVE
RESONANT
CIRCUIT
AT
THIS FREQ
CIRCUIT
is
INDUCTIVE
FREQUENCY

Performance of the beacon in terms of impedance (|Z|), resonance (X), and SWR (Standing Wave Ratio).

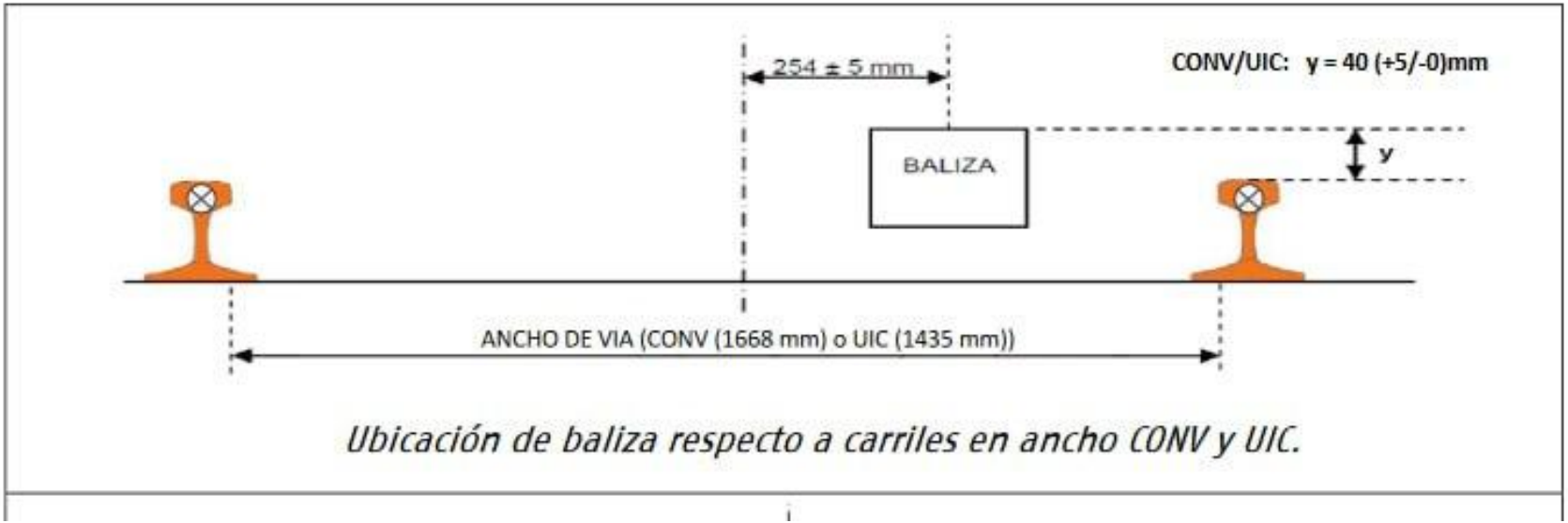



production line and onto the feet
reputation for durability has become fo
in making things to last is as strong as it's eve


S11 X 100Ω/ 138kΩ
▶S11 |Z| 50Ω/ 144kΩ
S11 SWR 250m/ ω
S21 LOGMAG 10dB/ -61.69dB
▶M1: 110.900 kHz
START 30.000 kHz
BW 1000Hz 101p STOP 120.000 kHz

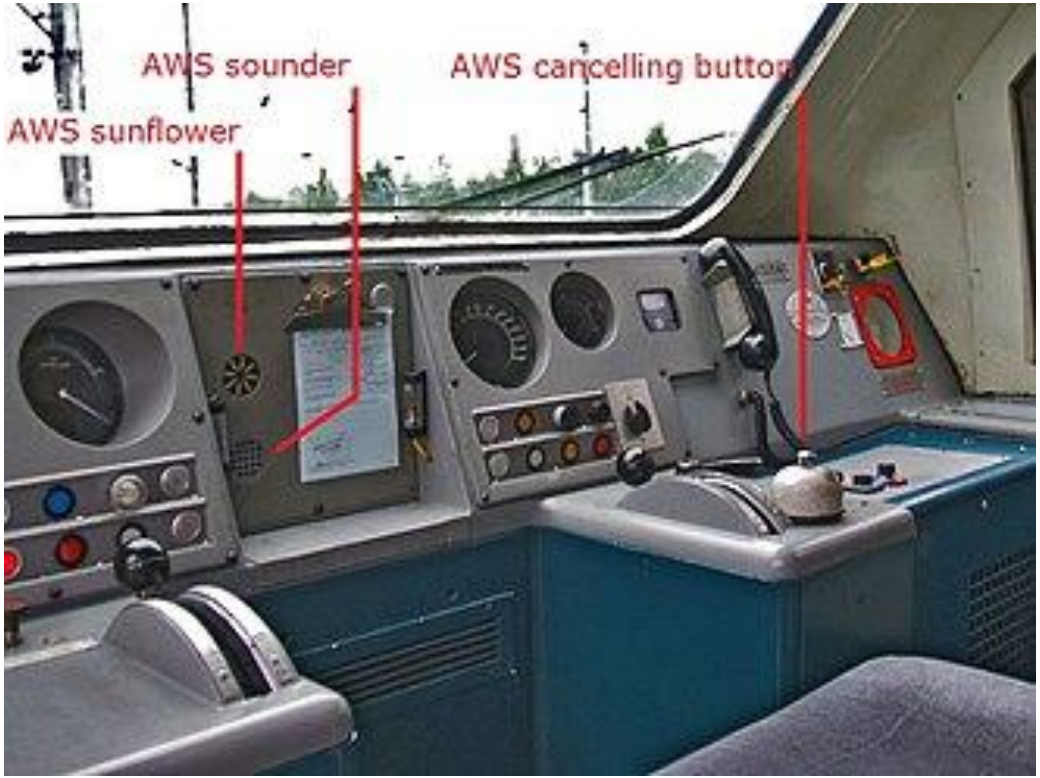

S11 X 100Ω/ 88.3kΩ
▶S11 |Z| 50Ω/ 98.6kΩ
S11 SWR 250m/ ω
S21 LOGMAG 10dB/ -61.40dB
▶M1: 64.700 kHz
START 30.000 kHz
BW 1000Hz 101p STOP 120.000 kHz

Where should I place my fake beacon?



Ubicación de baliza respecto a carriles en ancho CONV y UIC.

Can this happen in other countries?

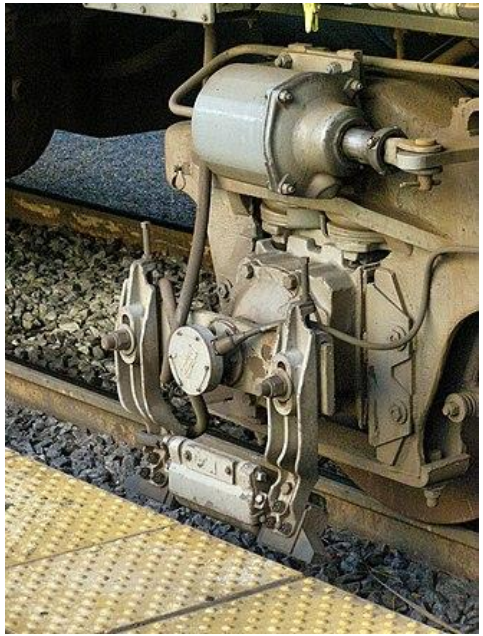


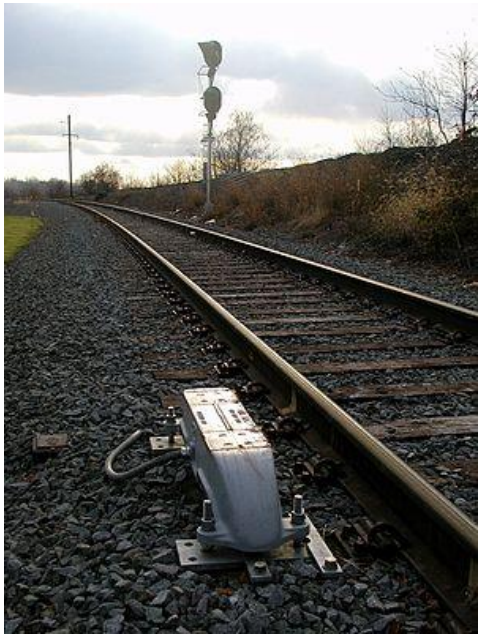
AWS Systems (UK)

Can this happen in other countries?

PZB or Indusi - Germany, Austria, Slovenia, Croatia, Romania, Israel, Serbia, on two lines in Hungary, on the Tyne and Wear Metro in the UK, and formerly on the Trillium Line in Canada.

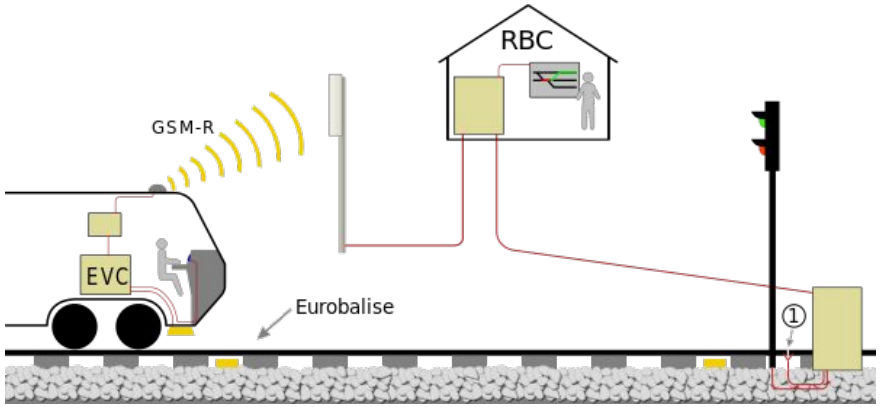
Can this happen in other countries?





IIATS - North American mainline railroad and rapid transit systems

Adoption of new systems - ETCS (European Train Control System)



Security Measures:

Thank You!

Acknowledgments:

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Rebeca Sanz
Pedro Candel (Saur0n)

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@constrainterror