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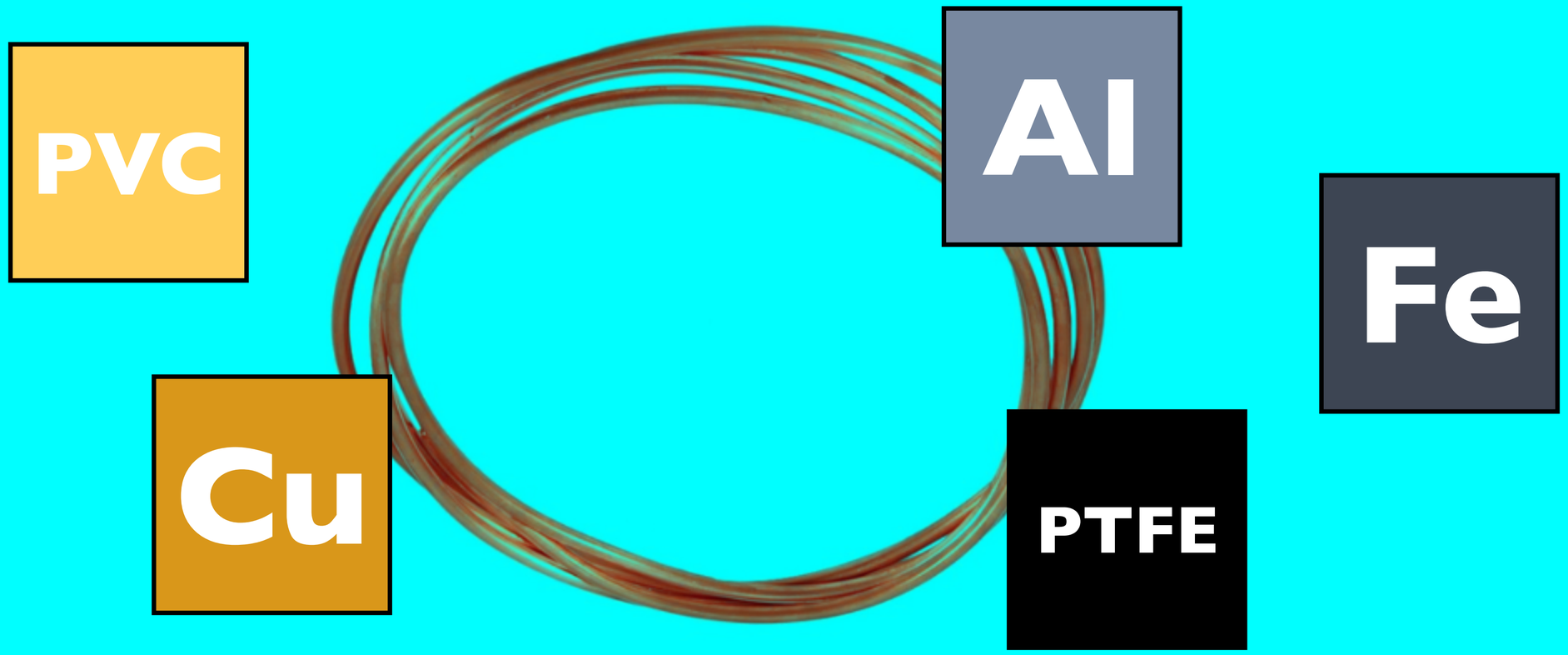
LORA / LORAWAN TUTORIAL 36

Velocity Factor



v1.0.0

INTRO

- In this tutorial I will explain what the velocity factor is.
- This will be a very short video.
- It is important that you know what the velocity factor is because it will be used in other tutorials.

VELOCITY FACTOR

- An antenna is made of a conductive material, such as copper or aluminium.
- Electric current can easily flow through copper which allows the RF signal to propagate through the antenna.
- Some conductive materials slows down the signal in the antenna compared to others.
- The Velocity Factor (VF) is calculated as follows:

$$\mathbf{VF = \frac{Speed\ of\ a\ signal\ through\ a\ medium}{Speed\ of\ a\ light\ in\ vacuum}}$$

- The Velocity Factor will vary from material to material.

VELOCITY FACTOR

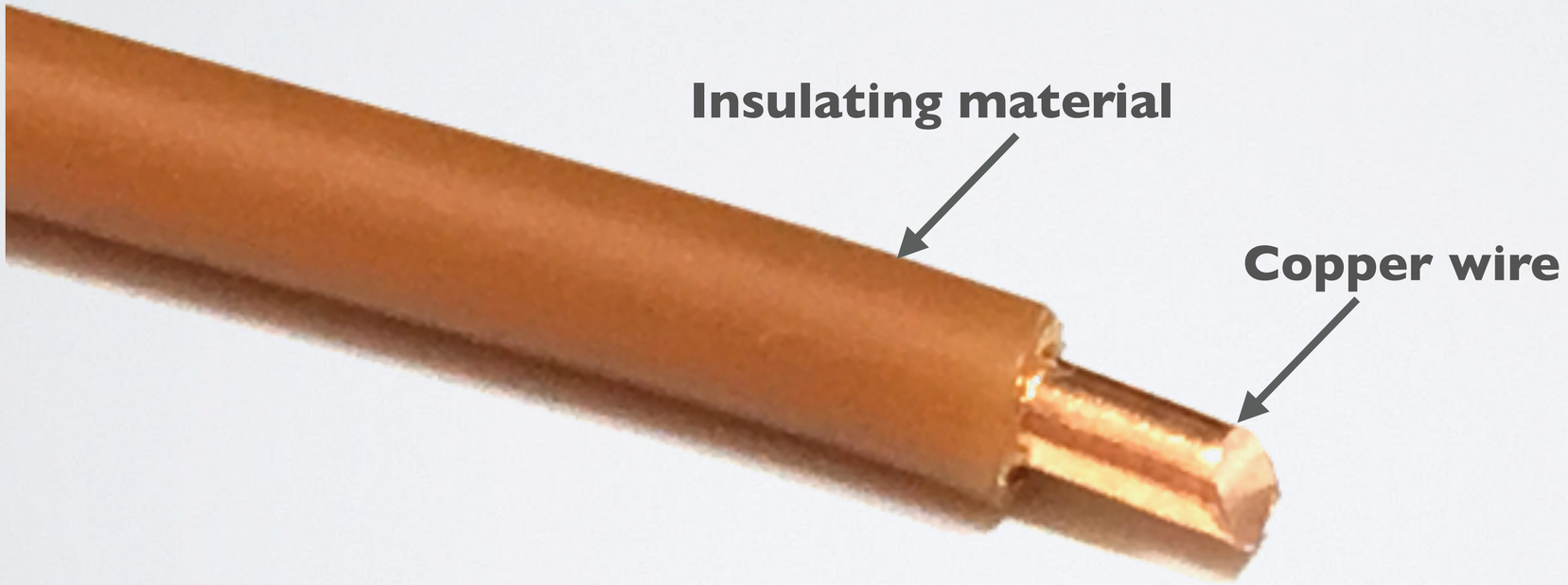
- Velocity factor of various materials, these are rough estimates:

Material	VF
Aluminium	0.94
Brass	0.95
Copper	0.95
Insulating materials (PVC, Polyethylene, Teflon)	0.95-0.98
Iron	0.9
Steel	0.9

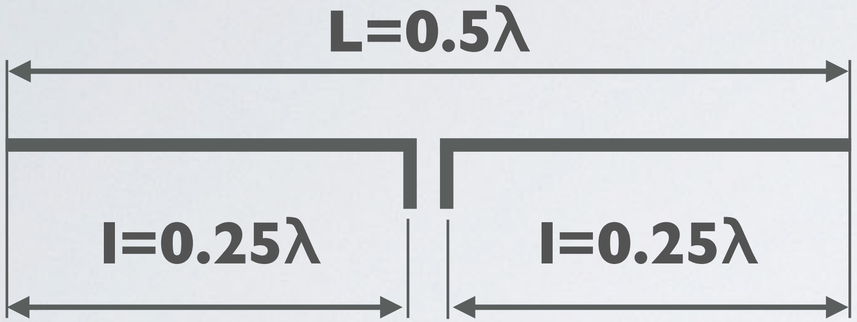
VELOCITY FACTOR

- For example copper has a VF=0.95, it means copper slows down the propagation of RF signals to 95% of the speed of light.

- If the antenna is covered by an insulating material this also impacts the RF signal when propagating out the antenna.



VELOCITY FACTOR



- If f = 868 MHz and **λ** = 345.38 mm, l = 0.25 x 345.38 = 86.345 mm
- If the antenna is made of bare copper: l = 86.345 x 0.95 = 82.028 mm
- If the antenna is made of insulated copper:
  l = 86.345 x 0.95 (VF of copper) x 0.98 (VF of insulated material) = 80.387 mm