Tutorial 13 Rules and Regulations.

LoRa operates in Unlicensed ISM (Industrial / Scientific & Medical) radio bands that are available worldwild.

Region	Frequency
Asia	433
Europe, Russia, India	863 — 870
Africa / parts	902 — 928
United States	915 — 928
Australia	779 — 787
Canada	779 — 787 / 470 — 510
China	

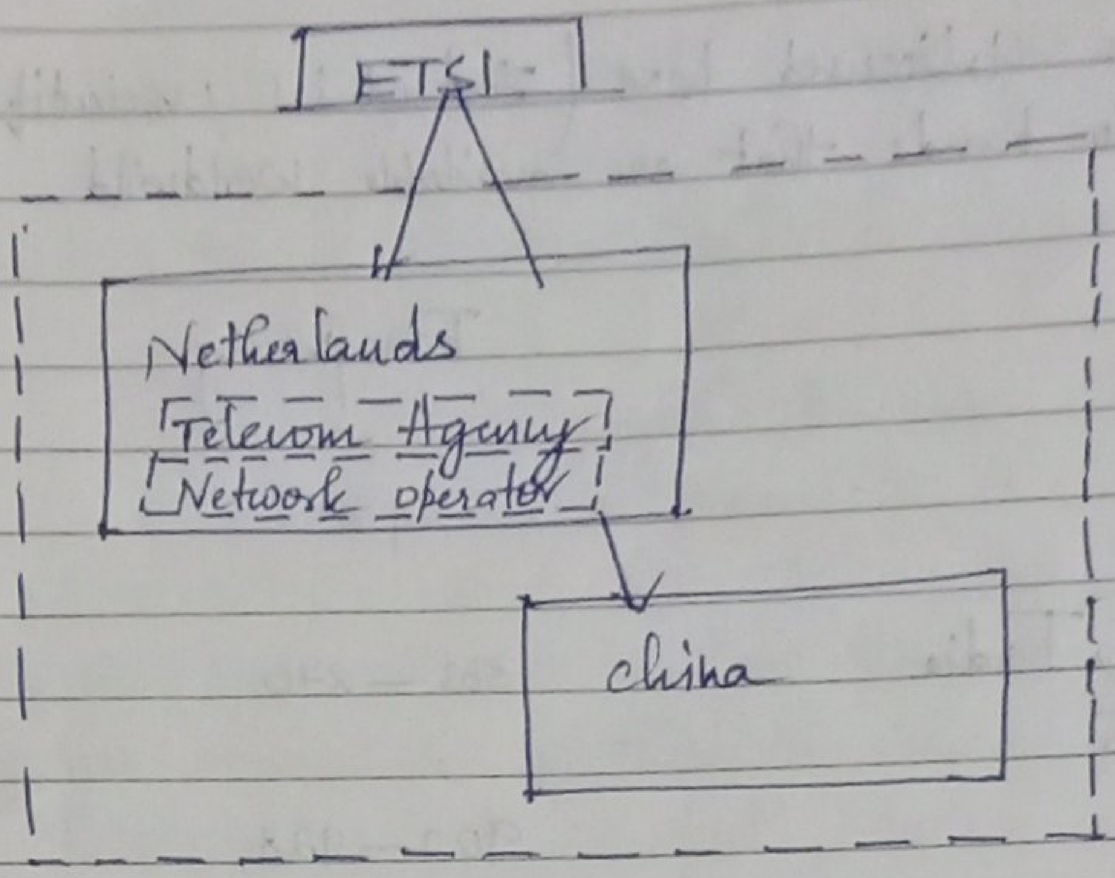
uplink has specific Range and downlink also has specific Range.

ISM is open to all, there must be some rules and regulations setup.

There are several International organizations which manage the radio spectrum to ensure proper utilization.

- In Europe they have (ETSI)
- In US they use (FCC)
  - → All country uses these standards set by them Except Japan and Korea.

JAPAN → TELEC
South Korea → KCC



Europe ISM band frequencies [863 MHz — 870 MHz]

1) Uplink
Tx power: 25mW (14 dB)

2) Downlink
Transmission power: 0.5W (27 dBm)

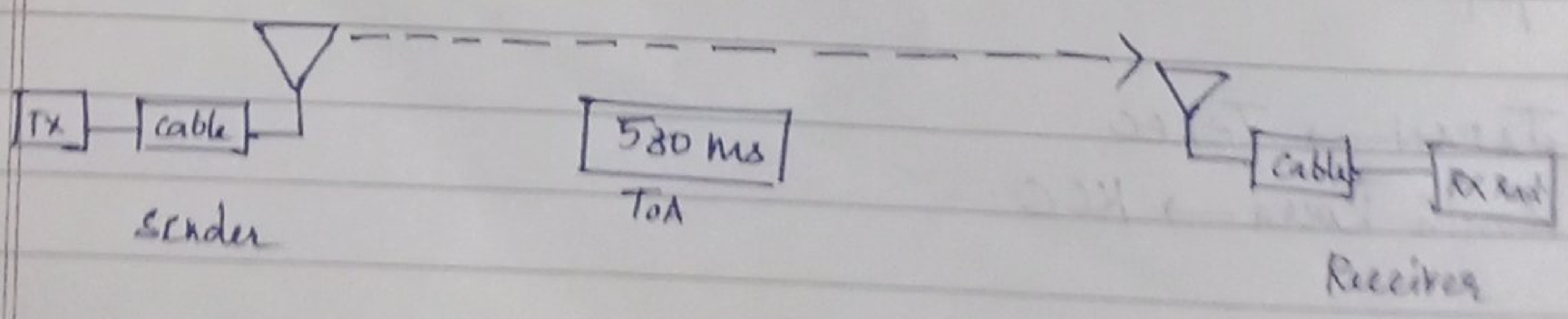
3) 0.1% & 1.0% duty cycle depending on the channel

4) Maximum allowed Antenna Gain + 2.15 dBi

5) Braide these rules, The network Agency, TTN (the things network) can also fix some rules.

5a) The uplink airtime is limited to 30 seconds per (24hr) para
5b) The downlink message are limited to 10 message per (24hr) per node

ToA (Time on Air)



Duty cycle.

- The Duty cycle is the ratio of time device turned on to the today time

Europe has 0.1% or 1.0% duty cycles per day.

Calculation.

Time on Air = 530 ms

Duty cycle = 1%.
(applied)

$\frac{530\,ms}{24\,hr} \times 100\ \%$.

$\frac{530\,ms}{8.64 \times 10^5\,ms} \times 100\ \%$.

signal ---------- signal

ToA: 530 ms $99 \times 530 = 52470\ ms = 52.475$.

D.C: 1%.

signal ---------- signal.

ToA 400ms. $999 \times 400 = 399600\ ms = 399.6s$.

D.C 0.1%.