

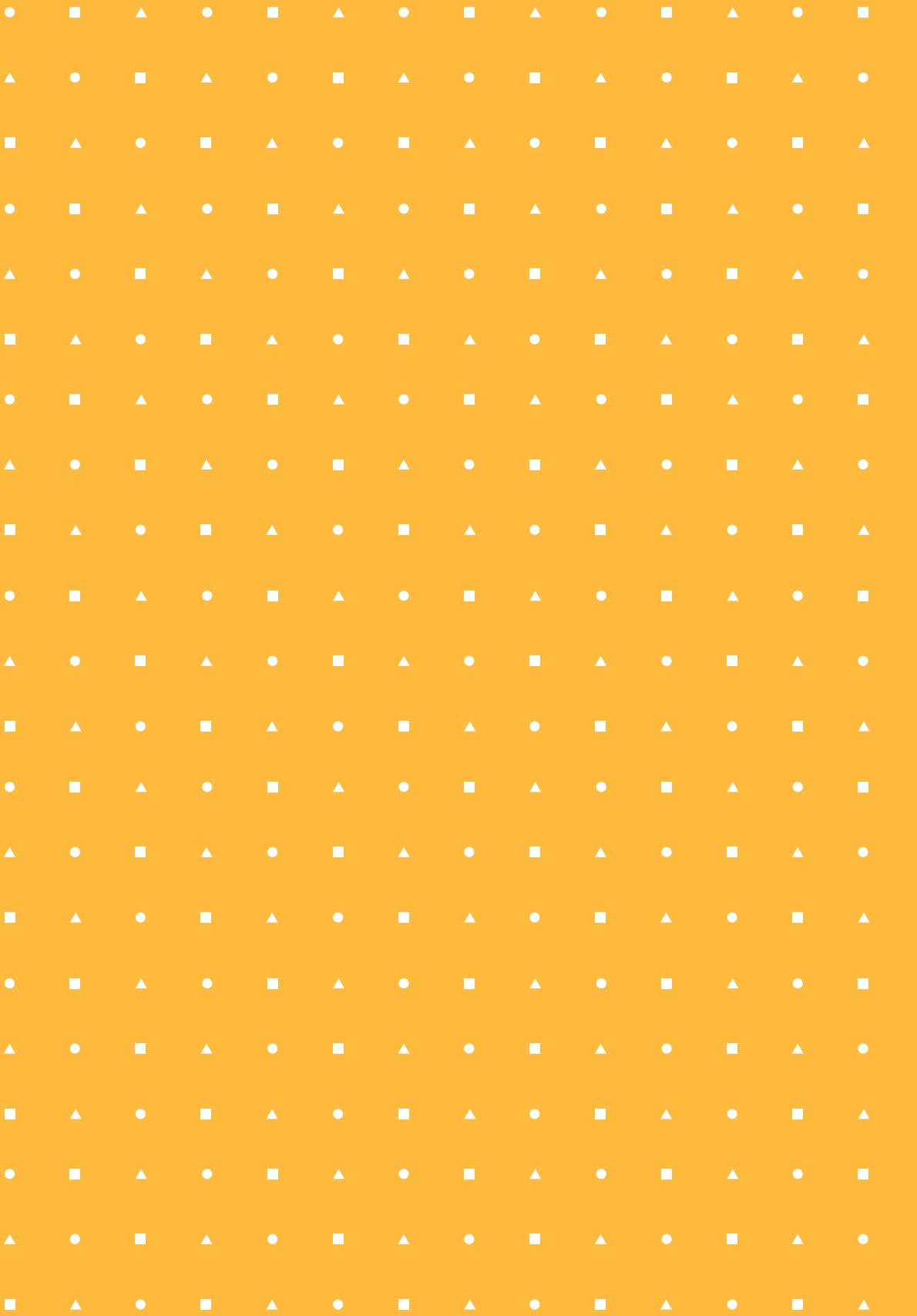
Q Project - Techequation.org

LoRaWAN Protocol & Procedures

Week 2 - Part 2

Presented by Solomon Denning





Today's Overview

Points to Cover

- Recap: LoRa vs. LoRaWAN
- LoRaWAN Protocols & Procedures
- Updates & Reminders
- Office Hours

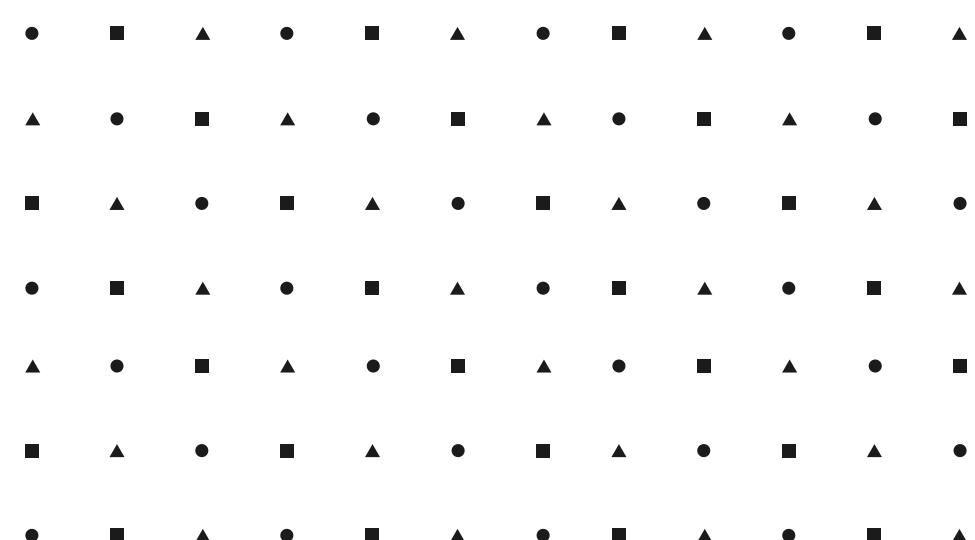
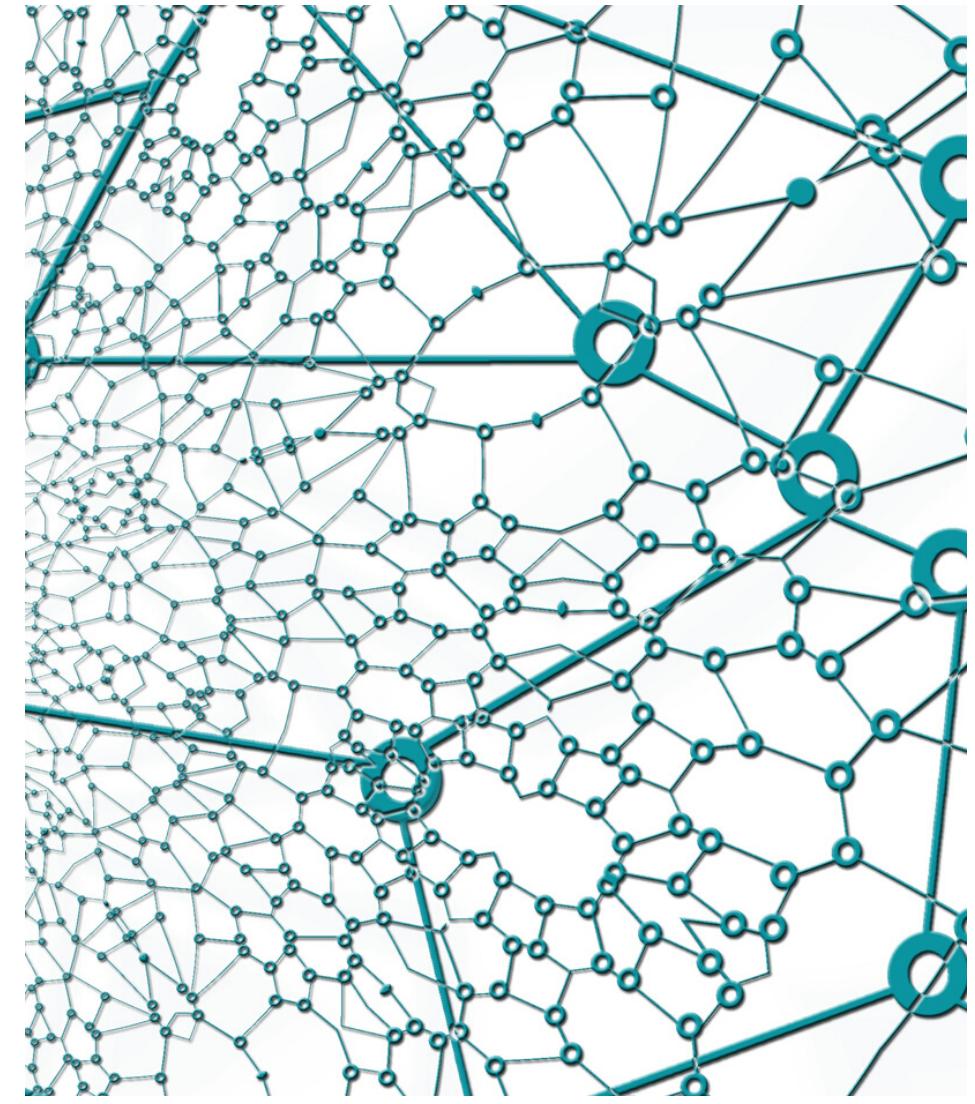


LoRa vs. LoRaWAN

One is the Protocol, One is a Network

Lora is the protocol for how to send data. The protocols are a number of scenarios for how to send and receive data.

LoRaWAN is a network of people that use the LoRa protocol to send data. The network community has guidelines for how to communicate to each other as well.



Architecture

End Node/Device

An object with an embedded low-power communication device.

Gateway

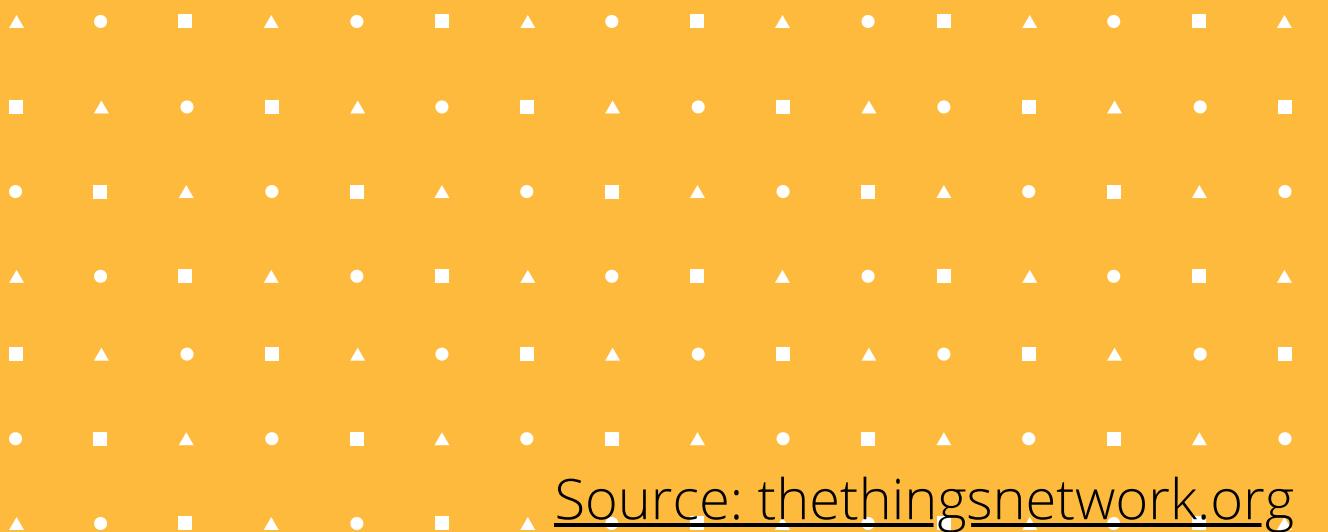
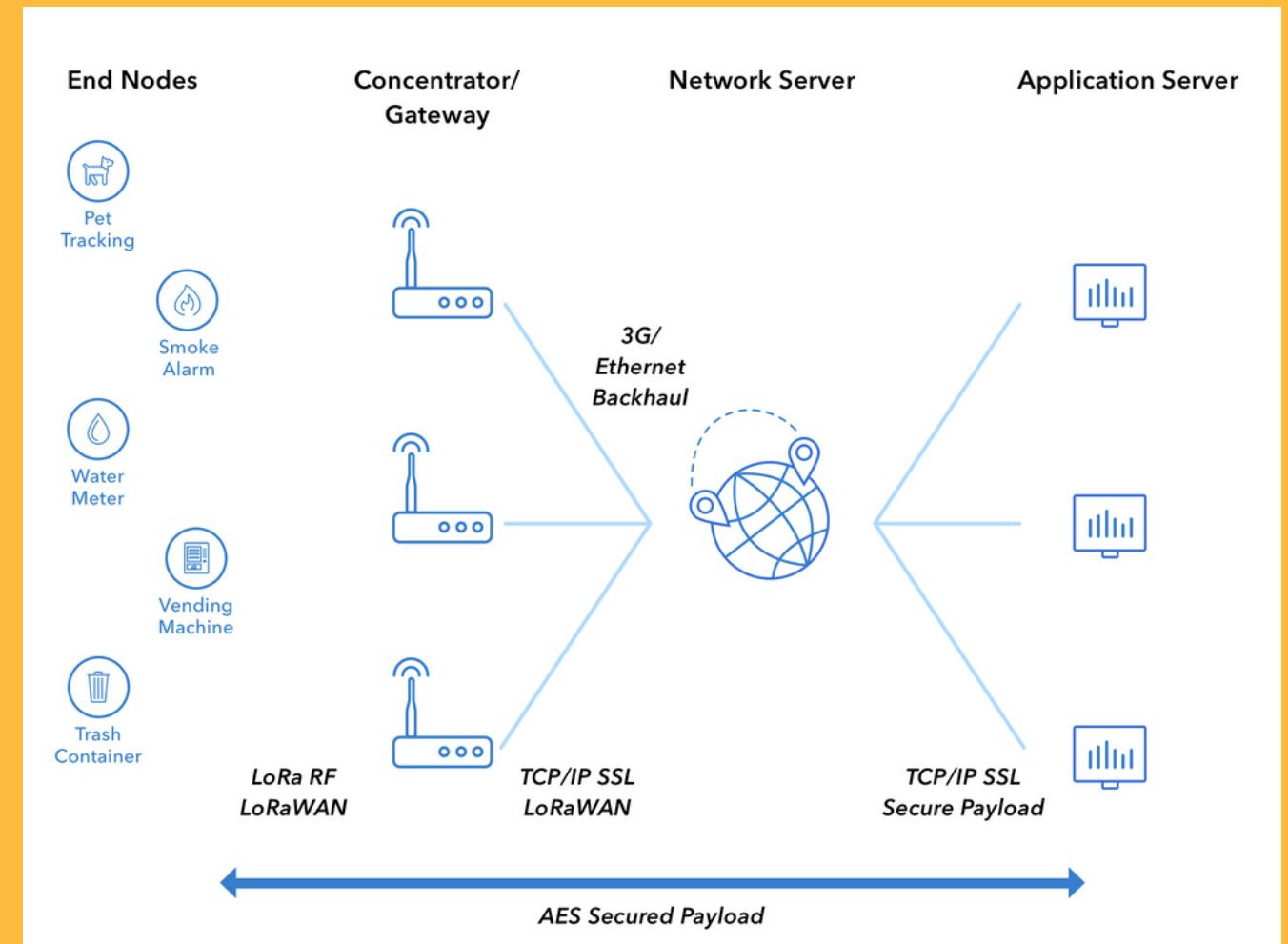
Antennas that receive broadcasts from End Nodes and send data back to End Nodes.

Network Server

Servers that route messages from End Nodes to the right Application.

Application

A piece of software, running on a server.



Source: thethingsnetwork.org

Classes

LoRaWAN defines three device types. All devices need to implement Class A. Class B and Class C are extensions of Class A.



A Class A

Devices support bi-directional communication between devices and gateway. Uplink messages can be sent at any time. After an uplink, the device opens two receive windows at specified times to receive a downlink message.

B Class B

Extends Class A functionality to add a scheduled receive window for downlink messages. The gateway sends time-synchronized beacons while the device opens its receive window.

C Class C

Extends Class A functionality to always keep receive windows open unless device is transmitting. Allows for low-latency communication, but is more energy consuming than Class A devices.

ISM Bands

Reserved Radio Spectrum

ISM radio bands are portions of the radio spectrum reserved internationally for industrial, scientific and medical purposes other than telecommunications.

This is an international standard to prevent interference of radio frequencies.

Frequency Allocation Chart

Each country has a viewable chart that shows every possible radio wave frequency.

This chart color codes the ISM Bands with what use they are reserved/available for.

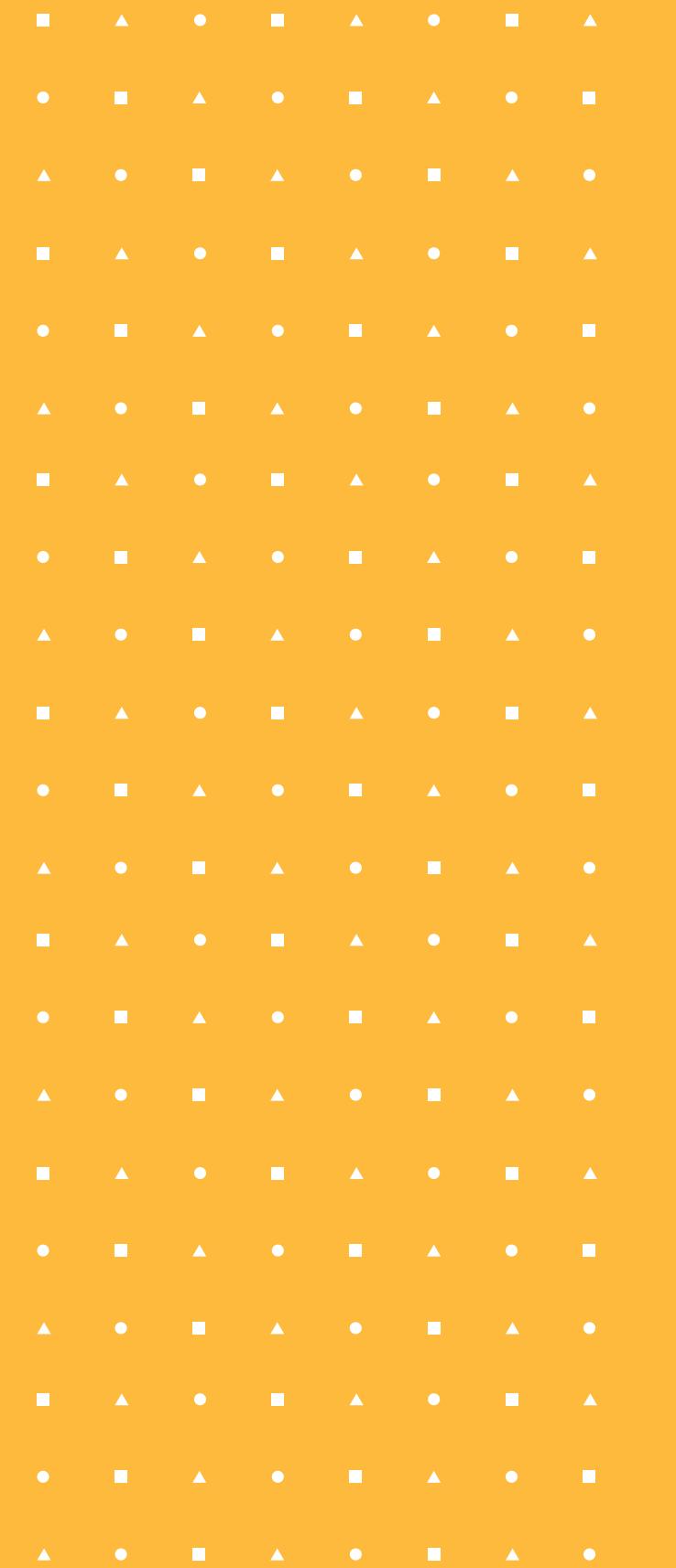
Unlicensed ISM Bands

LoRaWAN operates in unlicensed radio spectrum.

Many low power communication devices are allowed to use ISM free of charge.

WiFi uses 2.4GHz and 5GHz. LoRa uses ranges of 600-900 MHz depending on your region.

Bluetooth, NFC, baby monitors, etc, also use this feature.



UNITED STATES FREQUENCY ALLOCATIONS

THE RADIO SPECTRUM



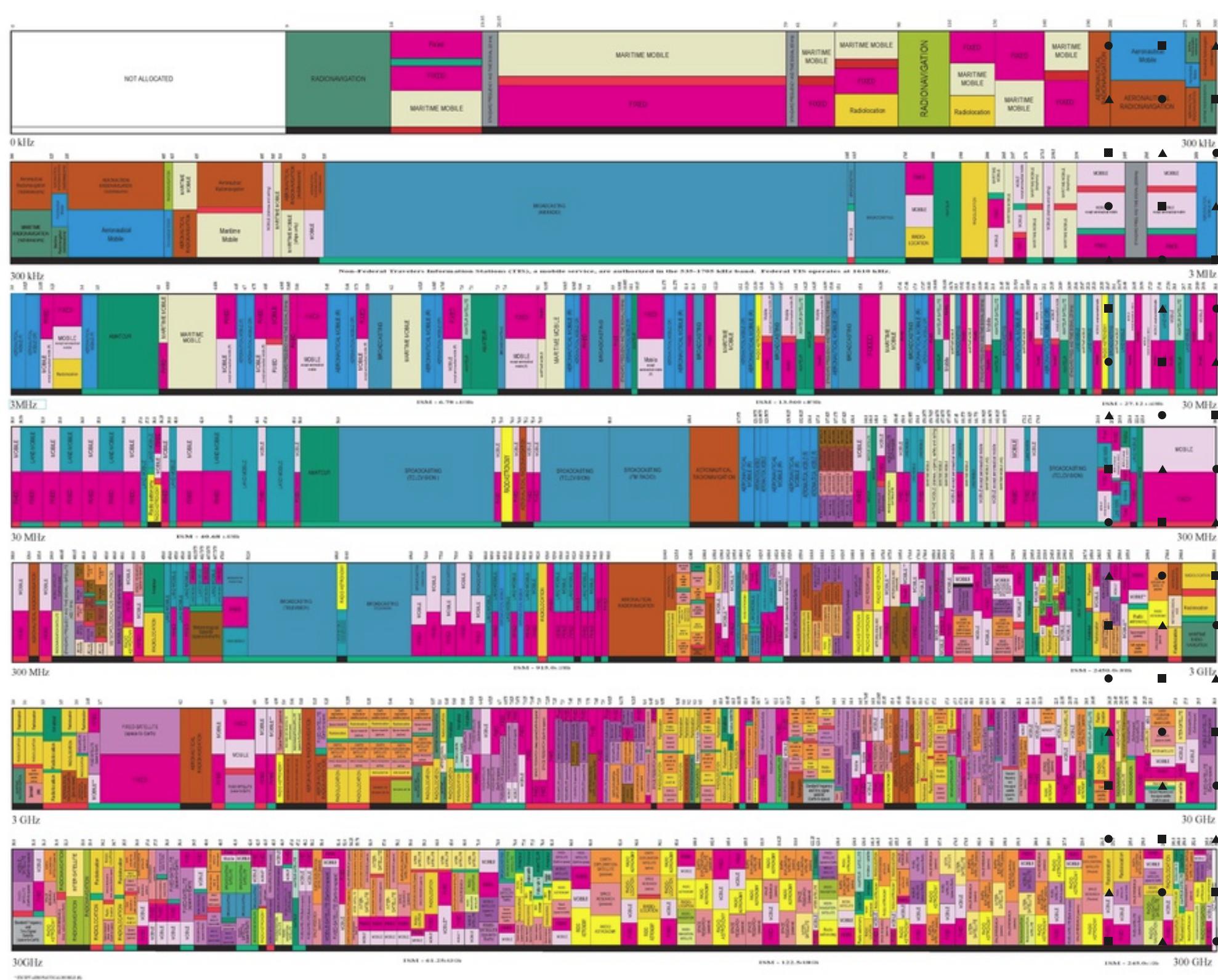
ALLOCATION USAGE DESIGNATION

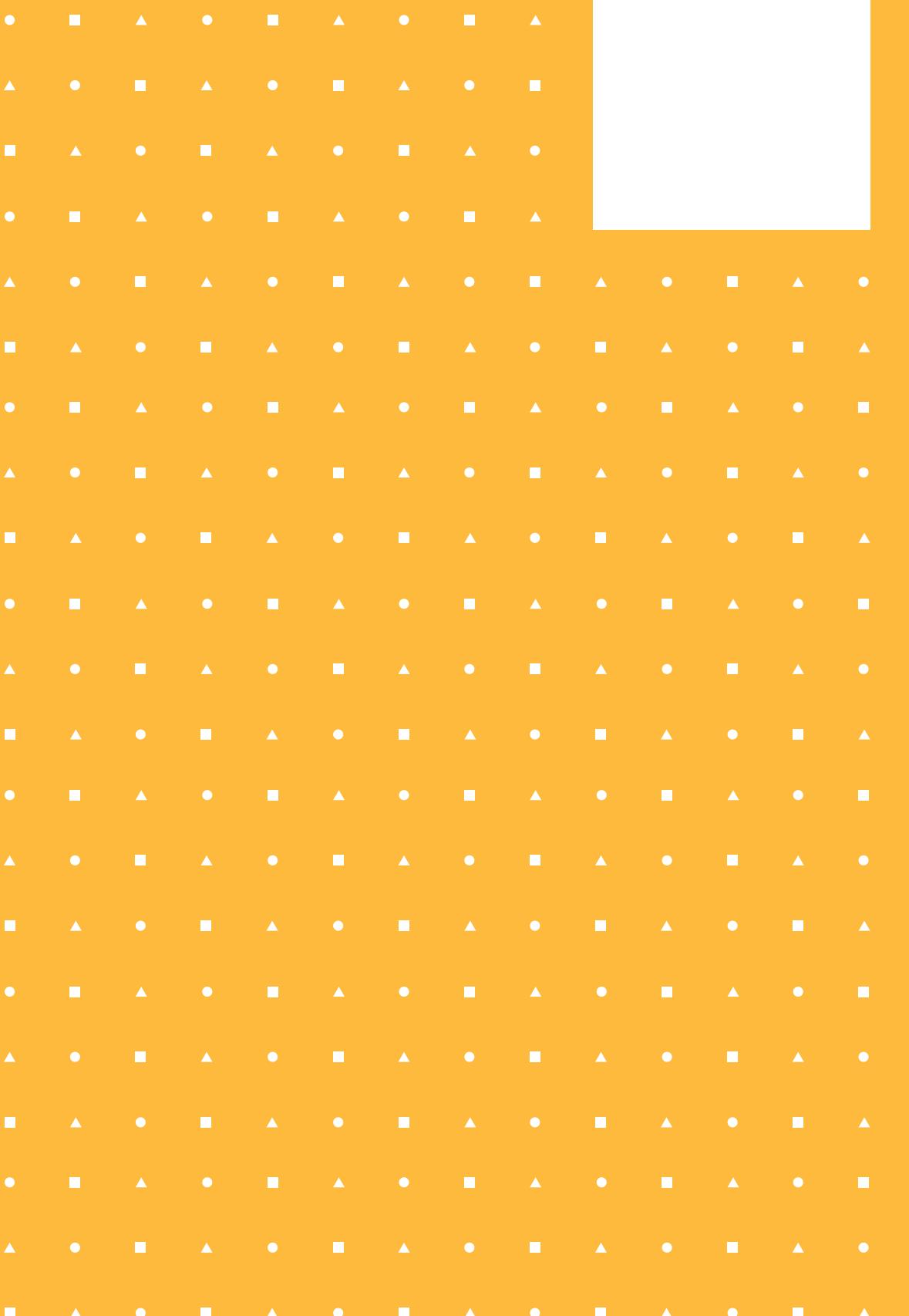
SERVICE	EXAMPLE	DESCRIPTION
Primary	F000	Capital Letter
Secondary	M000	1st Capital with lower-case letters

The chart is a graphic representation of the Radio Frequency Allocations used by the FCC and NTIA. As such, it is not complete or all-inclusive; no license and most changes made to the Radio Frequency Allocations. Therefore, for complete information, users should consult the Radio Frequency Allocations. This chart is for reference purposes only.

U.S. DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Office of Spectrum Management

JANUARY 2016



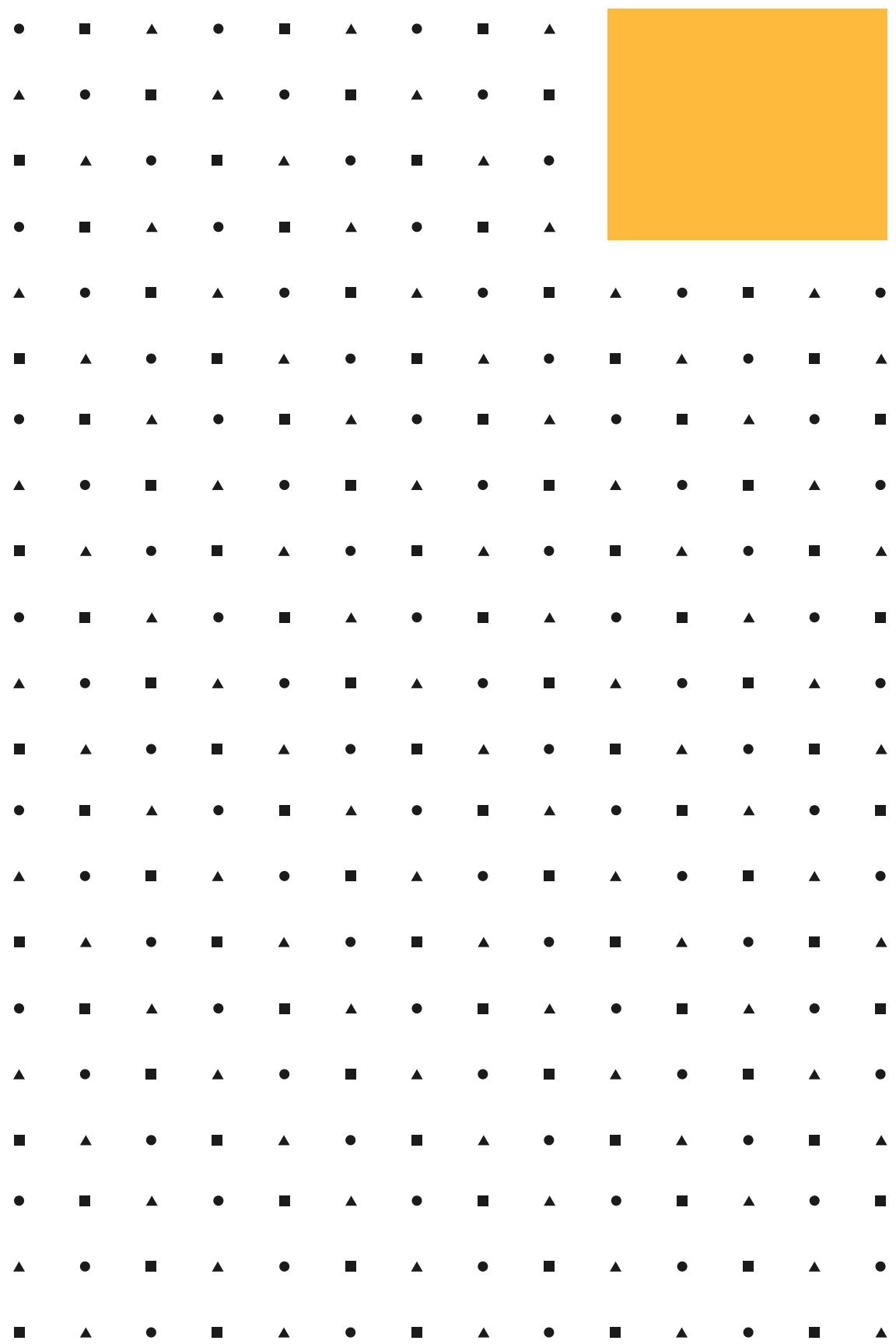


Updates & Reminders



Office Hours





Sources

<https://www.thethingsnetwork.org/docs/lorawan/architecture.html>

https://en.wikipedia.org/wiki/ISM_band

https://en.wikipedia.org/wiki/Frequency_allocation