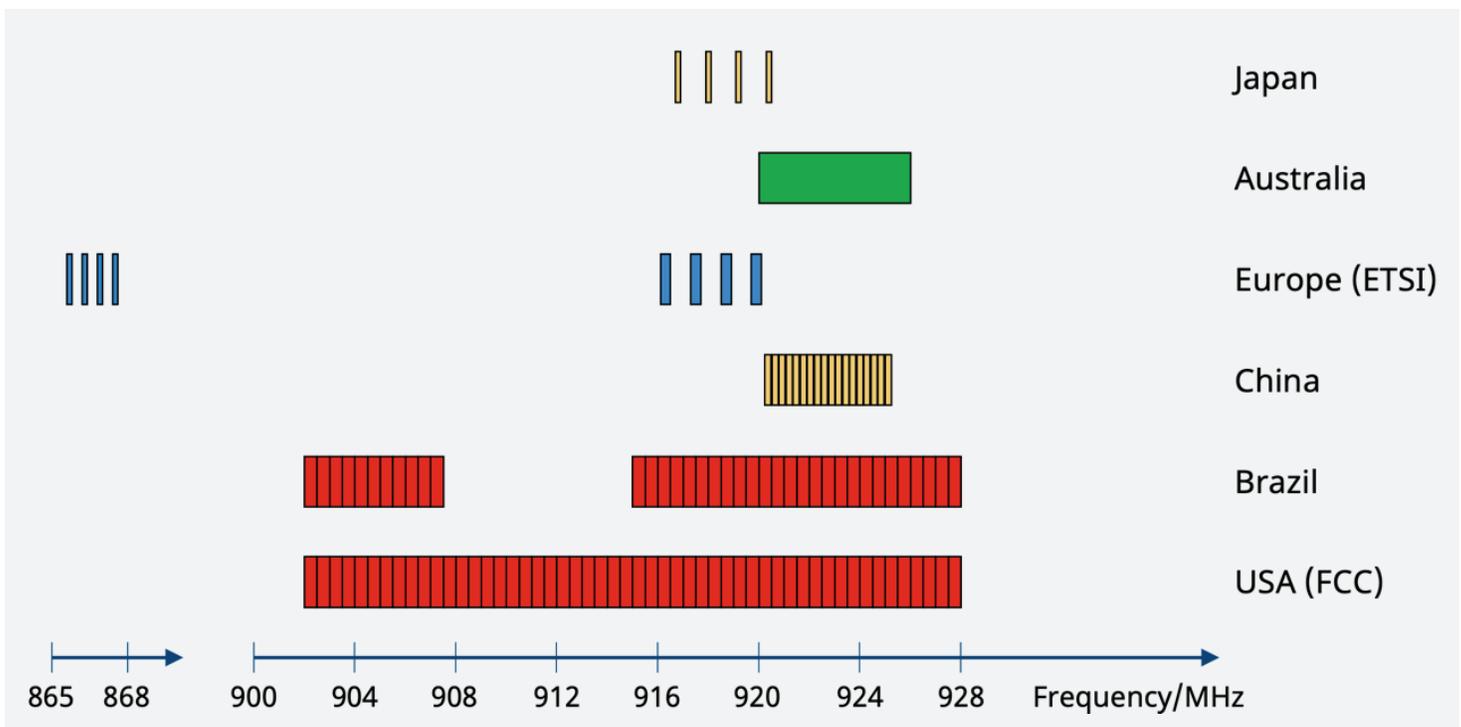


# RAIN Alliance Recommendations on UHF RFID radio spectrum

**RAIN RFID (UHF RFID) is one of the most important new technologies of the 21st century.** RAIN RFID has become the de facto method for identifying objects in logistics, manufacturing, freight and counterfeit-detection, to name a few. 28 billion UHF RFID tags have been shipped in 2021 alone, which is more than 4 tags per human in one year. The projected growth is strong with more than 50 billion predicted for 2025.<sup>1</sup>

For RAIN RFID, the global UHF radio spectrum was historically spread from 860 to 960 MHz, when passive UHF RFID started around 20 years ago. Since then there was global interest to narrow the global band in order to make product design and global shipment easier. In many regions and countries it was possible to get UHF RFID bands in the 900 – 930 MHz range.

Europe set up a frequency band for UHF RFID in the so-called GSM-gap from 915 – 921 MHz. The figure below shows an overview of several counties including the second band in Europe from 865 – 868 MHz.



<sup>1</sup> <https://rainrfid.org/rain-rfid-market-research-report/>

## UHF RFID spectrum harmonisation has the following positive impacts:

- **Reduction in equipment costs** since vendors do not need to cater for special cases with the associated compliance test costs and multi-model costs to cater for many regions. This means less costs for end-users to reap the benefits of UHF RFID.
- **Simplify and streamline regulatory compliance** which results in increased efficiency and effectiveness of the RF Regulator.
- **Economic harmonisation internally and globally**, i.e. tags and readers which works in one country works in another country in the same way assisting in global supply lines, will provide economic growth.
- **Enable the tagging of products at the source** as required by the Digital Product Passport and circularity through easier global product design due to the smaller 900-930 MHz band.

As the radio spectrum for passive UHF RFID is still under movement and development in some regions and countries, the RAIN Alliance put together the following recommendations for future plans to revise or create new frequency bands for RAIN RFID technology.

## RAIN Alliance radio spectrum recommendations

Parameter	Recommendation
Frequency band	The preferred band is 900 – 930 MHz The band shall be as wide as possible (If available, then the GSM gap from 915-921 MHz shall be used)
Transmit channel width Channel spacing	<b>For ≤ 2 MHz band available:</b> 200 kHz channels with 600 kHz spacing and AFA <sup>2</sup> <b>For ≤ 8 MHz band available:</b> 400 kHz channels with 1200 kHz spacing and AFA <sup>2</sup> <b>For &gt; 8 MHz band available:</b> 500 kHz channels with FHSS
Transmit power (radiated)	≥ 4 Weirp <sup>4</sup> (or ≥ 2 Werp <sup>5</sup> , if definition in erp is required)

The RAIN Alliance has an experienced team that put together additional documentation, and which may be consulted for questions and recommendations.

More details and background information are available in the RAIN RFID System Design Guidelines, Air Interface and Protocol Considerations V2.0 – in particular chapter 2.7 – at [rainrfid.org/resources](http://rainrfid.org/resources).

Questions and comments may be issued to the RAIN Alliance though [rainrfid.org/contact-us](http://rainrfid.org/contact-us).

<sup>2</sup> Adaptive frequency agility

<sup>3</sup> Frequency hopping spread spectrum

<sup>4</sup> Equivalent isotropically radiated power

<sup>5</sup> Effective radiated power