5G-ACIA White Paper

# Spectrum Licensing Harmonization around 3.8–4.2 GHz in Europe and Globally

5G Alliance for Connected Industries and Automation

# 1 Executive Summary

5G not only enhances the performance and efficiency of public mobile networks, but also addresses machine-type communications and the Internet of Things (IoT). In particular, 5G enables communication with unprecedented reliability and extremely low latency, while also supporting massive IoT connectivity. This paves the way for numerous new use cases and applications across a wide range of vertical industries, including automotive, healthcare, agriculture, energy, and manufacturing. In manufacturing specifically, 5G may have a disruptive impact, as related building blocks – such as wireless connectivity, edge computing, and network slicing – are integrated into future smart factories.

Many applications in a manufacturing environment are best served by local non-public networks (NPNs). Any type of NPN – whether standalone, shared, or public network integrated – requires access to suitable spectrum, typically in the mid-band range, offering substantial RF bandwidth on the order of 100 MHz and favorable propagation characteristics for local coverage. Over the years, different spectrum access models have evolved across jurisdictions worldwide, making harmonization increasingly beneficial.

With a mandate to CEPT, the EU Commission initiated a process to harmonize the technical conditions for Wireless Broadband Low and Medium Power networks in the 3.8–4.2 GHz frequency range CEPT-wide, covering its 46 Members, and certain implementation harmonization guidelines for the 27 EU Member States. Based on the outcome of this mandate, the European Commission, in December 2025, issued a Commission Implementing Decision on the harmonization of the 3800–4200 MHz frequency band for the shared use by terrestrial wireless broadband systems capable of providing local-area network connectivity. This Decision harmonizes the technical conditions in the 3.8–4.2 GHz range, requires Member States to designate and make the band available on a non-exclusive basis, and obliges them to report on the implementation to the Commission by 31 December 2026.

This paper discusses the recent harmonization measures in CEPT and the EU and compares them to regulatory examples from other regions. It further provides recommendations for regulatory harmonization in this highly relevant frequency range.

## About 5G-ACIA

The 5G Alliance for Connected Industries and Automation (5G-ACIA) was established to serve as the central and global forum for addressing, discussing, and evaluating relevant technical, regulatory, and business aspects with respect to 5G for the industrial domain. It reflects the entire ecosystem and all relevant stakeholder groups, including the operational technology (OT) industry (industrial automation companies, engineering companies, production system manufacturers, end users, etc.), the ICT industry (chip manufacturers, network infrastructure vendors, mobile network operators, etc.), academia, research institutes, and other relevant players. The paramount objective of 5G-ACIA is to ensure the best possible applicability of 5G technology and 5G networks to the industrial domain. 5G-ACIA's mission is to make sure the interests and needs of the industrial domain are adequately considered in 5G standardization and regulation and that ongoing 5G developments are understood by and effectively transferred to the industrial domain.





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# 3 Introduction

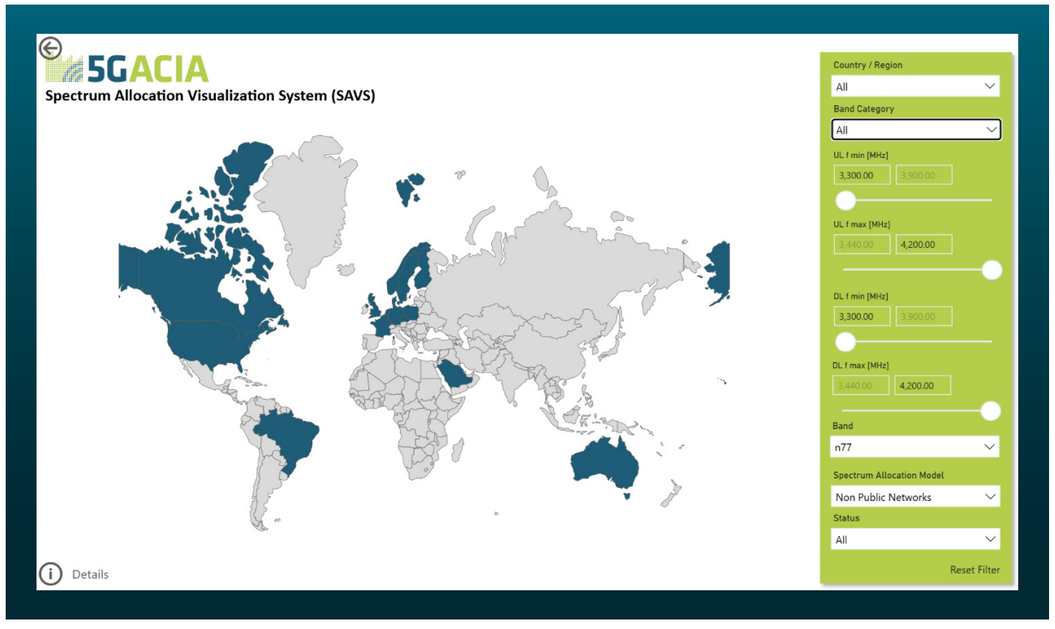
5G-ACIA has performed extensive work on Non-Public Networks (NPNs) [1] using 5G, typically with low- and medium-power base stations in industrial environments to provide wireless connectivity with Quality of Service, typically in licensed spectrum. Access to suitable spectrum is essential for such NPNs. A variety of spectrum access models exist, ranging from local licensing schemes for interested parties, to leasing spectrum from nationwide spectrum users – typically Mobile Network Operators (MNOs) – to cooperation models with MNOs that offer the deployment and/or operation of such NPNs.

Spectrum must fall within frequency bands supported by the 3GPP ecosystem to ensure device availability. Mid-band spectrum around 3 to 4 GHz can provide suitable RF bandwidths of 100 MHz and more for demanding industrial applications, as well as favorable propagation conditions for coverage in indoor and local outdoor deployments.

Globally, many countries provide some level of spectrum access for industrial verticals in this range, with substantial differences in carrier frequency ranges, technical parameters, and licensing regimes. 5G-ACIA maintains data from selected countries around the world for its members, including details on access conditions and relevant official documents from the respective administrations. An example of countries providing local licenses for NPNs in the 3GPP band n77 (3.3-4.2 GHz), or announcing such plans, is shown in Figure 1.

In this fragmented context, CEPT, under a mandate from the European Commission, has worked on the technical harmonization of the 3.8-4.2 GHz band for low- and medium-power terrestrial wireless broadband systems (WBB LMP) across its 46 Members. The European Union (EU) issued implementation guidelines, binding for its 27 Member States, for the band outlined in Section 3.1. Subsequently, several EU Member States initiated consultations, inviting stakeholders to provide input on intended usage models and regulatory proposals, which are analyzed in Section 5.3 of this document.

**Figure 1:** Snapshot from spectrum data globally accessible for 5G-ACIA members




Source: 5G-ACIA





Following this introduction, Section 4 describes examples of industrial 5G use cases, followed by considerations on bandwidth requirements for such use cases in downlink (DL) and uplink (UL). Section 5 analyses various recent regulatory documents at CEPT, EU, and national levels, as well as selected examples of regulations from around the world. Section 6 outlines 5G-ACIA's views and recommendations.

## 3.1 Work in the EU and CEPT on Harmonizing Implementation in CEPT ECC PT1, CEPT ECC WG FM60, and the EU Commission Implementing Decision

In late 2021, the European Commission (EC) issued a Mandate to CEPT

- Mandate to CEPT on technical conditions regarding the shared use of the 3.8-4.2 GHz frequency band for terrestrial wireless broadband systems providing local-area network connectivity in the Union [2].

It triggered technical work within CEPT ECC PT1 [3], which is responsible for mobile network-related topics, as well as frequency management work within the dedicated project team WG FM FM60 [4], in order to deliver a response to the European Commission in November 2024, resulting in CEPT Report 88.

- CEPT Report to the European Commission in response to the Mandate on the shared use of the 3800–4200 MHz frequency band by low/medium power terrestrial wireless broadband systems (WBB LMP) providing local-area network connectivity [5].

CEPT/ECC developed, in parallel, the related harmonized technical conditions, which were published in late 2024 in ECC Decision ECC/DEC/(24)01.

- Harmonized technical conditions for the shared use of the 3800–4200 MHz frequency band by low/medium power terrestrial wireless broadband systems (WBB LMP) providing local-area network connectivity [6].

Having delivered the material required by the European Commission (EC), FM60 has been working on three ECC Recommendations to provide national guidance for protection and to enable future evolution and development through coordination between WBB LMP and the following services:

- In-band FSS and FS, ECC Recommendation (25)03 [7]
- Adjacent-band radio altimeters, ECC Recommendation (26)02 [8]
- Adjacent-band MFCN and national planning of WBB LMP networks, ECC Recommendation (26)03, ongoing

The European Commission (EC) has released a Commission Implementing Decision

- on the harmonization of the 3800–4200 MHz frequency band for shared use by terrestrial wireless broadband systems capable of providing local-area network connectivity in the Union [9].

This Decision stipulates that, by 30 September 2026, Member States shall designate and make available on a non-exclusive basis the 3800–4200 MHz frequency band for WBB LMP systems in compliance with the harmonized technical conditions, and that Member States shall report to the Commission on the implementation of this Decision by 31 December 2026.

# 4 Industrial Needs and Ways to Address These

## 4.1 Use Cases

The evolution of industrial connectivity toward 5G and beyond has introduced a set of local use cases characterized by high or very high bandwidth demands, often combined with stringent latency and reliability requirements. These scenarios are central to enabling advanced automation, immersive technologies, and real-time analytics in smart factories and connected industries.

Across these use cases, data rate requirements typically range from hundreds of megabits per second to multiple gigabits per second, with latency targets below 20 milliseconds and reliability levels exceeding 99.999%. These performance parameters align with 3GPP's Enhanced Mobile Broadband (eMBB) and Ultra-Reliable Low-Latency Communication (URLLC) service classes and are further refined in 3GPP Releases 17 and 18 for industrial deployments.

To support these industrial applications, spectrum allocations must provide wide, contiguous bandwidth blocks, typically 100 MHz or more per operator. This requirement underscores the strategic importance of the 3.8–4.2 GHz band for future industrial deployments, as it offers an optimal balance between coverage and capacity.

Leveraging this mid-band spectrum enables local 5G networks to deliver deterministic performance for eMBB and URLLC profiles, ensuring a robust connectivity foundation for next-generation smart factories and connected industries.

- **Machine Vision for Quality Control:** Industrial machine vision systems require continuous transmission of high-resolution video streams for defect detection and process monitoring. According to 5G-ACIA (2021) [10], these applications often demand uncompressed HD or 4K video to maintain inspection accuracy, requiring bandwidth levels comparable to wired Ethernet solutions, while benefiting from the flexibility of wireless connectivity.

- **Immersive Augmented and Virtual Reality (AR/VR/XR):** AR and VR applications in industrial environments—such as remote maintenance, operator training, and immersive visualization—fall under Enhanced Mobile Broadband profiles. According to 5G-ACIA (2019) [11], these services require multi-gigabit throughput and latency below 20 ms to ensure a seamless user experience. Similarly, 3GPP Release 18 introduces XR-specific enhancements to support 2K–8K resolution at 60–120 fps, reflecting the increasing bandwidth demands of these scenarios (3GPP, 2023) [12].

- **Remote Control of Production Lines:** Teleoperation of machinery and production systems combines real-time video feedback with control signaling, generating dual-stream traffic patterns that require both high bandwidth and ultra-low latency. These requirements are explicitly addressed in 5G-ACIA's key use case documents and reinforced by 3GPP's URLLC and eMBB integration strategies for industrial automation (5G-ACIA, 2019 [13]; 3GPP, 2024 [14]).

- **Mobile Robots and Automated Guided Vehicles (AGVs):** AGVs and mobile robots rely on live HD video feeds, LiDARs and 3D sensor data for navigation and collision avoidance. 5G-ACIA showcases highlight the need for high-capacity private networks to support these data streams. Complementing this, ETSI ISG F5G specifies optical transport solutions for similarly bandwidth-intensive applications in fixed industrial networks (ETSI, 2023) [15].

- **Integrated Sensing and Communication (ISAC):** Emerging ISAC use cases combine radar or LiDAR sensing with communication over shared spectrum resources. This integration requires wideband channels to accommodate simultaneous sensing and data transmission, as outlined in 5G-ACIA's ISAC white paper and anticipated in 3GPP's future study items for 6G evolution (5G-ACIA, 2025) [16].

- **Multisensor Process Monitoring:** High-frequency vibration and acoustic data streams–like those used in turbine blade milling – require significant uplink capacity. A case study by Fraunhofer IPT demonstrates sampling rates of up to 50 kHz, which, when aggregated across multiple sensors, leads to substantial bandwidth demands (Fraunhofer IPT, 2024) [17].





- **Fixed Wireless Access and Optical Transport:** ETSI F5G introduces enhanced fixed broadband to support ultra-HD video and cloud VR in industrial contexts (ETSI, 2023) [18].

- **Unmanned Aircraft Systems** (UAS): UAS can operate locally or over broader areas. Beyond applications by emergency services and governmental authorities, there is a growing number of professional and industrial use cases—such as package delivery, mapping, search and rescue, long-range infrastructure inspections, and surveillance flights—that require beyond visual line of sight (BVLOS, typically max a few kilometers) operations. These operations may involve short-term, nomadic access in specific areas or long-term, location-specific services. There is a clear trend toward automated flight operations, including unmanned traffic management, urban air mobility, and integration into non-segregated airspace. This evolution drives a shift from reliance on unlicensed spectrum toward licensed bands, which provide broader coverage, higher bandwidth, protection against harmful interference, and guaranteed spectrum access.
  UAS operations are subject to comprehensive regulations to ensure safety and mitigate risks. These regulations cover aviation, radio equipment, and spectrum domains, encompassing unmanned aerial vehicles, associated equipment, operational procedures, and personnel qualifications. Aviation regulations directly influence spectrum selection and usage. Licensed bands enable robust radio links through interference protection and reliable access, while supporting coverage and mobility. Within the EU, licensed spectrum is required for higher Specific Assurance and Integrity Levels (SAIL), particularly for command-and-control links. Achieving these higher SAIL levels necessitates detailed network planning and validated link performance.

  As noted in an earlier section, the EC has issued an Implementing Decision requesting EU Member States to designate and make available the 3800–4200 MHz frequency band for WBB LMP systems capable of providing local-area network connectivity across the Union. Aerial Terminal Stations (UASs, or drones) were not included in the studies, and their use may be restricted by individual countries. Seven mobile frequency bands are currently available for Aerial Terminal Stations within CEPT, as specified in ECC/DEC/(22)07 [19], and an EC Implementing Decision covering the same bands is expected.

Spectrum harmonization for industrial use cases enables the deployment of the same equipment across different locations worldwide. In addition, certain equipment may be used at multiple locations along the supply chain or during transport, further increasing the need for spectrum harmonization. Examples of industrial use cases that require spectrum harmonization to support such roaming scenarios include:

- Multi-region production: A device is produced and tested in one region, then integrated into a system and tested again in another region, before the complete system is finally installed at a customer site, potentially anywhere in the world.

- Marine shipping: Vessels transport goods and containers globally, moving from one port on one continent to another port on a different continent. At each port, they must connect to the local 5G network to support the loading and unloading of goods and containers.

## 4.2 Bandwidth Considerations

Currently, most local network implementations in mid-band spectrum use 100 MHz of RF bandwidth or less. 5G ACIA investigated the spectrum requirements for selected industrial use cases – controller-to-device (C2D), controller-to-controller (C2C), and mobile robots – in an internal, in-depth study under Work Item 64. The simulations were conducted, for example, at a carrier frequency of 4 GHz with a bandwidth of 100 MHz. The study found that the C2D use case, which has the most stringent performance requirements and high device density, demands the largest spectrum resources. Based on 3GPP simulation results, by virtue of 5G URLLC features, 100 MHz in Frequency Range 1 (FR1) below 6 GHz is sufficient to meet these service requirements. The spectrum needs for C2C and mobile robots are comparatively moderate and can be readily supported by 5G systems from a spectrum perspective.

To estimate the required frequency bandwidth, it is important to note that most installed private local 5G systems support multiple use cases over time, rather than a single one. This results in higher bandwidth requirements compared to a single (initial) use case, and additional capacity should be planned to accommodate future applications.

- Based on simulation results and practical experience, it is evident that many networks require an FR1 frequency bandwidth of 80–100 MHz.
- The typical 5G NR TDD frame structure uses a 4:1 downlink-to-uplink (DL:UL) ratio. However, industrial use cases often require greater flexibility in the DL:UL ratio, with additional UL slots to support applications with heavy UL traffic. Such use cases include high-resolution video feeds from multiple inspection cameras, thermal imaging, 3D scanners, and the transmission of massive volumes of sensor data for smart cities, predictive maintenance, and similar applications.
- Since DL bandwidth is typically not the limiting factor, alternative TDD time splits with a higher UL share can be used to balance UL and DL bandwidth. However, this may expose UL time slots in the local network to interference from DL transmissions of public macro-cellular networks on adjacent channels.
- Protecting UL slots in local networks from interference by public mobile network DL transmissions requires the use of guard bands and/or filters. Using filters, in particular, necessitates harmonized band edges to enable consistent device implementation.

# 5 Harmonization in 3.8-4.2 GHz

## 5.1 Technical Harmonization in CEPT by ECC Decision (24)01

- In 2024, through ECC Decision (24)01 [6], CEPT harmonized the technical conditions for the shared use of 3800–4200 MHz frequency band for low/medium-power Wireless Broadband Systems (WBB LMP) providing local-area network connectivity. These technical conditions are summarized below.

**Table 1:** EIRP density for Low/Medium power WBB LMP systems

| Category | e. i. r. p. per cell (Note 1 and Note 2) |
|---|---|
| Low power base station | ≤ 24 dBm/channel for BW ≤ 20 MHz<br>≥ 18 dBm/5 MHz for BW > 20 MHz |
| Medium power base station | ≤ 44 dBm/channel for BW ≤ 20 MHz<br>≥ 38 dBm/5 MHz for BW > 20 MHz |

Note 1: In a multi-sector site, the value per 'cell' corresponds to the value for one of the sectors.

Note 2: Higher e. i. r. p. levels may be authorized by national administrations in exceptional and duly justified cases, provided that protection of FSS receiving earth stations and FS links (where appropriate nationally) in the band as well as MFCN below 3.8 GHz and radio altimeters above 4.2 GHz is ensured, taking into account their future development, including in the neighbouring countries. Coverage shall remain local, i. e. no nationwide networks.

Source: CEPT [6]





**Table 2:** Maximum unwanted emission levels above 4200 MHz for WBB LMP Base Stations

| Frequency range | Non-AAS base station e. i. r. p. limit dBm/5 MHz per cell (Note 1) | AAS MP base station t. r. p. limit dBm/5 MHz per cell |
|---|---|---|
| 4200–4205 MHz | 11 | 1 |
| 4205–4240 MHz | 8 | -3 |

Note 1: In a multi-sector site, the value per 'cell' corresponds to the value for one of the sectors.

Source: CEPT [6]

Regarding terminals, ECC Decision (24)01 specifies that the maximum terminal station power must not exceed 28 dBm TRP, including a 2 dB tolerance.

## 5.2 Implementation Harmonization in EU

The Commission Implementing Decision (EU) 2025/2425, published on 2 December 2025, adopts the harmonized technical conditions for the shared use of the **3800–4200 MHz frequency band** across the European Union for **low- and medium-power terrestrial wireless broadband (WBB LMP) systems** providing local-area network connectivity.

It recognizes the critical role of 5G in the digitalization of vertical industries (–– transport, logistics, smart factories, etc.) and the need for harmonized spectrum to support innovative business models, including locally licensed access.

Key provisions for EU Member States include:

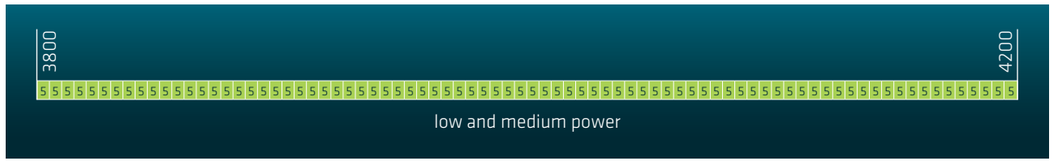
- **Harmonization and availability:** Member States are mandated to designate and make available the 3800–4200 MHz frequency band for WBB LMP systems on a non-exclusive basis by **30 September 2026**, in compliance with the decision's harmonized least restrictive technical conditions.
- **Protection of Incumbent Services:** Member States should ensure the protection of existing incumbent services in band and in adjacent bands such as Fixed Satellite Service Earth Stations, Fixed Services, WBB Electronic Communications Services (including cross border coordination), Radio Altimeters and Radio Astronomy (Very Long Baseline Interferometry Global Observing System stations).
- **Co-existence and Planning:** Member States must ensure careful planning, conduct case-by-case analyses, and consider applying appropriate mitigation techniques for the shared use of the band.
- **Allocation of frequencies:** Member States are encouraged to allocate consistent portions of the band for WBB LMP across the EU, starting from the upper part of the band, facilitating a future review of the spectrum.

## 5.3 Examples of Existing Regulation and Consultations in CEPT

The illustrations below focus on which parts of the 3.8-4.2 GHz band are proposed for different types of services, with particular emphasis on how much bandwidth is proposed for industrial NPNs and where it could be located within the band. Less emphasis is placed on other aspects of the licensing frameworks, such as licensing conditions and geographical considerations, for example population density or restricted areas.

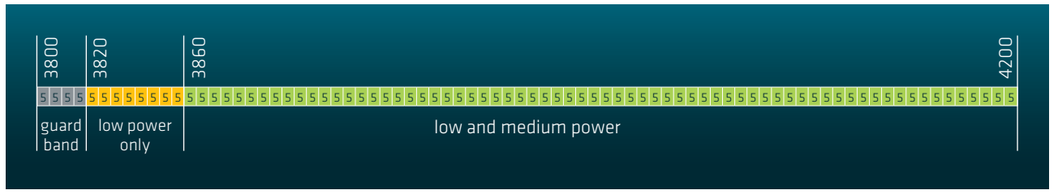
As a general concept, CEPT Report 88 proposes that the entire 3.8-4.2 GHz band can be used for low- and medium-power networks when TDD operation is synchronized with public MNOs' (MFCNs) networks below 3.8 GHz. In cases where other TDD patterns are used, a guard band and reduced transmit power levels in the adjacent portion of the 3.8-4.2 GHz band are required to protect the public MFCN networks. Local networks may still experience interference from MFCN DL transmissions during NPN UL timeslots if not protected by receive (RX) filters.

**Figure 2:** Synchronized with MFCN




Source: 5G-ACIA

**Figure 3:** Unsynchronized with MFCN



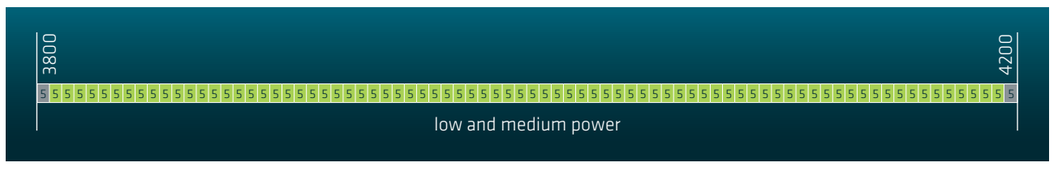

Source: 5G-ACIA

Several CEPT and EU countries have already allocated the 3.8-4.2 GHz band range for local networks, or are now planning new or updated regulations in the band in light of the recent harmonization measures. Their band plans are illustrated below.

### 5.3.1 UK

In 2019, the UK introduced its "Shared Access Licence Framework" including licensing options in the 3.8-4.2 GHz band range for either individual medium-power transmitters or for license areas defined by 50 m radius circles, allowing an arbitrary number of low-power base stations.

**Figure 4:** UK, "Shared Access Licence" (5 MHz guard band at the top and the bottom of the band)




Source: 5G-ACIA

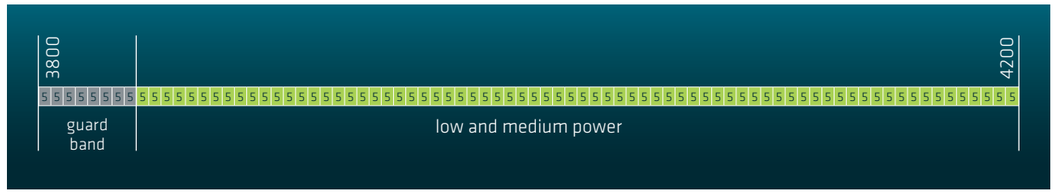




### 5.3.2 Norway

In 2023, Norway issued regulations for local networks in the 3.8-4.2 GHz band, largely following the UK example but adding a guard band above 3.8 GHz.

**Figure 5:** Norway with 40 MHz guard band at the bottom of the band




Source: 5G-ACIA

### 5.3.3 Poland

In March 2026, Poland launched a consultation on updated regulations for the 3.8-4.2 GHz band, considering a band split that reserves spectrum for local authorities, as well as for medium- and low-power networks. The current Polish band plan, issued in 2023, is illustrated below.

**Figure 6:** Poland band plan for the 3.8-4.2 GHz band

Source: 5G-ACIA

## **5.3.4** Belgium

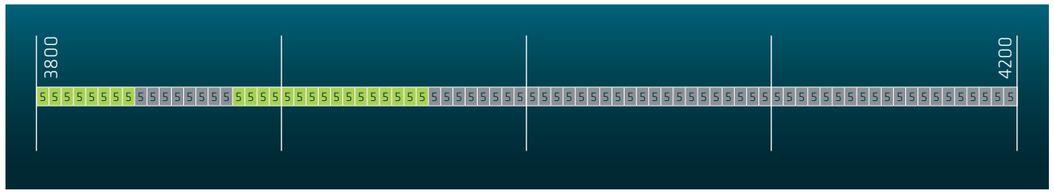
IBPT issued a decision in December 2023 to authorize private networks. The 3800–3840 MHz and 3880–3960 MHz were opened with 20 or 40 MHz bandwidth blocks. So far, only four companies have applied for and been granted licenses, all within the 3880–3960 MHz range.

Following the publication of the EC Implementing Decision, IBPT issued a consultation in December 2025 [20] on a draft amended decision, with technical conditions aligned with the EC Decision. They are now considering assigning the 4080–4200 MHz band range in 40 MHz licenses for NPNs, in reference to the EU implementation decision. No synchronization scheme is mandated.

On 7 April 2026, BIPT published the amended 2023 decision. It is fully compliant with the technical conditions of the EC Implementing Decision (EU) 2025/2425. The main points are:

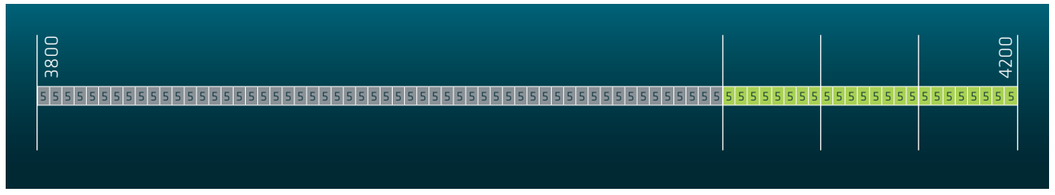
- The 4080–4200 MHz sub-band is designated for private local networks
- Authorizations granted in the 3880–3920 MHz band after December 2023 remain valid and may be migrated to the 4080–4200 MHz range at a later stage
- No synchronization with public networks is required above 3860 MHz
- Maximum unwanted emission levels below 3800 MHz don't apply when synchronized (Non-AAS –40 dBm/MHz and AAS –50 dBm/MHz)
- See IBPT Decision [21]

**Figure 7:** Belgium original band plan of 2023 with max 40 MHz + 80 MHz bandwidth in the lower half of the band




Source: 5G-ACIA

**Figure 8:** Belgium band plan of 2026 for NPN in 4080–4200 MHz as per consultation of December 2025




Source: 5G-ACIA



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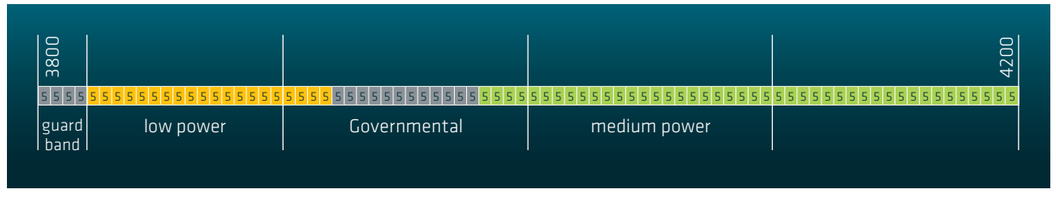
## **5.3.5** Denmark

Denmark consulted on five draft executive orders for the 3.8–4.2 GHz frequency range. The upper 100 MHz may remain unallocated, while the 3820–3920 MHz range is proposed for low-power, nomadic, temporary licenses, for example for electronic news gathering or agricultural use cases.

**Figure 9:** Denmark with band split for different services, temporary nomadic use in 3820–3920 MHz




Source: 5G-ACIA

## **5.3.6** France

On 9 December 2025, ARCEP opened access to local licenses in the 3.8-4.2 GHz band [22]. Licenses are valid for a maximum of 10 years, and the entire 3800–4200 MHz band is available, as illustrated in Figure 2.

In addition to the technical conditions outlined in the Commission Implementing Decision (EU) 2025/2425, ARCEP has defined mitigation measures to protect incumbent users:

- 5G WBB LMP systems operating in the 3.8-3.9 GHz band must be synchronized with 5G public networks.
- In the 3.9-4.2 GHz band, 5G WBB LMP systems may use any synchronization scheme, provided that local base stations comply with out-of-band emission limits and blocking levels.
- To protect radio altimeters, coordination measures are required in the 4.1-4.2 GHz band near airports and heliports.
- Coordination is required with ten Fixed Satellite Service (FSS) stations.

## 5.4 Global Trends and Opportunities

Globally, the 3–4 GHz spectrum range is also being considered for NPNs.

- In 2024, Saudi Arabia auctioned the 3.8-4.0 GHz band to public mobile networks, in addition to the 3.4–3.8 GHz range, and reserved spectrum in the 4.0–4.2 GHz band for local enterprise networks.

- In the US, the 3.8–3.98 GHz spectrum is allocated for public mobile networks. Within the 3GPP n77 band (3.3-4.2 GHz), and hence within the same global ecosystem, the CBRS band occupies 3.55-3.7 GHz. In 2025, CBRS re-banding proposals were submitted to the US Government and are currently under consideration. Additionally, the FCC has announced plans to auction at least 100 MHz of Upper C-band spectrum (3.98-4.2 GHz) by 2027.
  CBRS is a tiered model, where incumbents such as naval radars and satellite ground stations are protected from services operating under Priority Access Licenses (PALs) per US county or under General Authorized Access (GAA), all dynamically managed by Spectrum Access System (SAS) databases. Local licenses can be obtained by leasing from a PAL licensee and complemented with spectrum under GAA. While an NPN can rely on a certain RF bandwidth being available at all times, this spectrum may not necessarily be contiguous within the 150 MHz total bandwidth, and exact carrier frequencies may change on short notice due to incumbent spectrum use. This arrangement may not meet the requirements for stable and reliable spectrum access for use cases demanding very high reliability and availability, but it can still support industrial applications with less stringent needs.

In Asia, several countries use (parts of) the 4600–4900 MHz frequency range for local enterprise networks, including Japan, the Republic of Korea, and Taiwan.

# 6 5G-ACIA Considerations and Recommendations

5G-ACIA welcomes the European activities within CEPT and at EU level aimed at harmonizing conditions for local use, and sees relevant use cases for its members in wireless connectivity for discrete manufacturing and process industries. The harmonized 3800–4200 MHz band, covered by 3GPP band n77, enables scalability in both infrastructure and device-side solutions. Harmonized conditions also allow 5G-ACIA members to transfer implementation blueprints from one site and country to other sites in different countries.

5G-ACIA has reviewed a number of national proposals in consultations and notes significant differences among them. In some proposals, 5G-ACIA observes a lack of consideration, as outlined in the EU implementation decision, for assigning spectrum for local low-power needs near the top of the band. A harmonized approach for all assignments in CEPT above e. g. 4 GHz could allow for UL-heavy TDD patterns protected from public network interference by filters, at least for non-AAS small base stations typically deployed in factory environments. Supporting this potential harmonized EU approach, CEPT studies have shown that transmissions from low- and medium-power non-AAS enterprise networks at the top end of the band (i.e., near the 4.2 GHz limit) do not cause harmful interference to radio altimeters above 4.2 GHz [23].

5G-ACIA proposes the following key points for regulators to consider when making the 3.8–4.2 GHz band available for WBB LMP systems:

- Member States should make the 3.8–4.2 GHz band available for private local networks, starting from the upper end of the band and extending towards the lower end according to market demand. EC Decision 2025/2425 recommends this approach to provide flexibility for a future review of spectrum use under this Decision. Since the expected spectrum demand per user does not exceed 100 MHz, this approach achieves a balance between the requirements of local networks and a potential future review for public WBB ECS networks.

- A bandwidth of up to 100 MHz per license should be assigned on request starting within the 4000–4200 MHz sub-band.

- Non-synchronized private local networks should be permitted, provided they do not cause harmful interference to public WBB ECS networks below 3800 MHz. Where non-synchronized private mobile networks are licensed closer to 3800 MHz, appropriate mitigation measures need to be applied.

- For co-channel operation of neighboring networks (WBB low-power base stations), the field strength limit for low-power base stations should be 32 dBµV/m/5 MHz (unless mutually agreed otherwise between neighbors), measured at 3 m height at the local area network licensed area border for unsynchronized operation.

- License duration should be 10 years on request, with an option for renewal.

# 7 Conclusion

At the CEPT level, ECC Decision (24)01 and CEPT Report 88 provide strong technical harmonization for WBB LMP systems in the 3.8-4.2 GHz band across its 46 Members. At EU level, Implementing Decision (EU) 2025/2425 sets certain requirements – such as a deadline of September 2026 for the 27 EU Member States – while leaving much of the detailed licensing framework to national administrations. Examples from existing and planned regulations in CEPT and EU countries reveal significant differences in terms of applicable services, available bandwidths, and positions within the band. Expanding the scope globally shows even greater diversity in approaches.

5G-ACIA recommends certain elements for harmonized licensing. It sees a need for up to 100 MHz of licensed bandwidth for non-public local networks, which is not currently available in all jurisdictions analyzed. Assigning spectrum to local non-public networks starting from the top of the 3.8-4.2 GHz band can support a harmonized approach across the EU, CEPT, and even other regions. This also helps mitigate potential interference from non-synchronized private local networks – which is critical for many vertical applications – with MNO operations below 3.8 GHz, while maintaining flexibility for future use in the lower portion of the 3.8-4.2 GHz. As non-public local networks are designed to operate for long periods of time, license durations should allow for 10 years with extension options.



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# 8 Abbreviations

| | |
|---|---|
| **3GPP** | 3rd Generation Partnership Project |
| **5G-ACIA** | 5G Alliance for Connected Industries and Automation |
| **AAS** | Adaptive Antenna Systems |
| **AR** | Augmented Reality |
| **AGV** | Automated Guided Vehicle |
| **ARCEP** | Autorité de régulation des communications électroniques, des postes et de la distribution de la presse |
| **BS** | Base Station |
| **BVLOS** | Beyond Visual Line of Sight |
| **C2C** | controller-to-controller |
| **C2D** | controller-to-device |
| **CBRS** | Citizens Broadband Radio Service |
| **CEPT** | European Conference of Postal and Telecommunications Administrations |
| **DL** | Downlink |
| **EC** | European Commission |
| **ECC** | CEPT Electronic Communications Committee |
| **eMBB** | enhanced Mobile Broadband |
| **EIRP** | effective isotropic radiated power |
| **ETSI** | European Telecommunications Standards Institute |
| **EU** | European Union |
| **FM60** | CEPT ECC WG FM Project Team FM60 |
| **fps** | frames per second |
| **FR1** | Frequency Range 1 |
| **FS** | Fixed Service |
| **FSS** | Fixed Satellite Service |
| **GAA** | General Authorized Access (in CBRS) |
| **GHz** | Gigahertz |
| **HD** | High Definition |
| **IBPT** | Institut belge des services postaux et des télécommunications |
| **ICT** | Information and Communication Technology |
| **IoT** | Internet of Things |
| **ISAC** | Integrated Sensing and Communication |
| **kHz** | Kilohertz |
| **LiDAR** | Light Detection and Ranging |
| **MFCN** | Mobile/Fixed Communication Networks |
| | MHz Megahertz |
| **MNO** | (public) Mobile Network Operator |
| **ms** | millisecond |
| **NPN** | Non-Public Network |
| **NR** | (5G) New Radio |
| **OT** | Operational Technology |
| **PAL** | Priority Access License (in CBRS) |
| **PT1** | CEPT ECC Project Team 1 |
| **RF** | Radio Frequency |
| **RX** | Receiver |
| **SAIL** | Specific Assurance and Integrity Level |
| **SAS** | Spectrum Access System (in CBRS) |
| **TDD** | Time Division Duplex |
| **TR** | Technical Report |
| **TRP** | total radiated power |
| **TX** | Transmitter |
| **UE** | User Equipment |
| **UAE** | United Arab Emirates |
| **UAS** | Unmanned Aircraft Systems |
| **UL** | Uplink |
| **URLLC** | Ultra-Reliable Low-Latency Communication |
| **VR** | Virtual Reality |
| **WBB** | Wireless Broadband |
| **WBB LMP** | Wireless Broadband Low and Medium Power |
| **WG FM** | CEPT ECC Working Group Frequency Management |
| **XR** | eXtended Reality |





# 9 References


[1] 5G-ACIA (2024). NPNs for industrial scenarios [Online]. Last accessed 15 September 2026. https://5g-acia.org/whitepapers/npns-for-industrial-scenarios/

[2] European Commission. (2021). Mandate to CEPT on technical conditions regarding the shared use of the 3.8-4.2 GHz frequency band for terrestrial wireless broadband systems providing local-area network connectivity in the Union [Online]. Last accessed 15 September 2026. https://ec.europa.eu/newsroom/dae/redirection/document/82230

[3] CEPT ECC (n.d.). ECC PT1 – Project Team 1 (Introduction) [Online]. Last accessed 15 September 2026. https://www.cept.org/ecc/groups/ecc/ecc-pt1/client/introduction

[4] CEPT ECC (n.d.). ECC WG FM FM60 (Introduction) [Online]. Last accessed 15 September 2026. https://www.cept.org/ecc/groups/ecc/wg-fm/fm-60/client/introduction

[5] CEPT (2024). CEPT Report 88: Report from CEPT to the European Commission in response to the Mandate on shared use of the 3800–4200 MHz frequency band by low/medium power terrestrial wireless broadband systems (WBB LMP) providing local-area network connectivity [Online]. Last accessed 15 September 2026. https://docdb.cept.org/document/28629

[6] CEPT ECC (2024). ECC Decision (24)01: Harmonised technical conditions for the shared use of the 3800–4200 MHz frequency band by low/medium power terrestrial wireless broadband systems (WBB LMP) providing local-area network connectivity [Online]. Last accessed 15 September 2026. https://docdb.cept.org/document/28628

[7] CEPT ECC (2025). ECC Recommendation (25)03: Guidance on protection of FSS and FS for WBB LMP in 3800–4200 MHz [Online]. Last accessed 15 September 2026. https://docdb.cept.org/document/28659

[8] CEPT ECC (2026). ECC Recommendation (26)02: Guidelines for the coexistence between low and medium power terrestrial wireless broadband systems (WBB LMP) in the 3800-4200 MHz band and radio altimeters in the 4200-4400 MHz band, and the protection of radio altimeters when deploying medium power AAS base stations in the 4100-4200 MHz band [Online]. Last accessed 19 September 2026. https://docdb.cept.org/document/28673

[9] European Commission (2025). Commission Implementing Decision (EU) 2025/2425 on the harmonisation of the 3 800–4 200 MHz frequency band for the shared use by terrestrial wireless broadband systems capable of providing local-area network connectivity in the Union [Online]. Last accessed 15 September 2026. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32025D2425&qid=1764840141624

[10] 5G-ACIA (2025). Architecture and technology for machine vision in industrial applications with 5G [Online]. Last accessed 15 September 2026. https://5g-acia.org/whitepapers/architecture-and-technology-for-machine-vision-in-industrial-applications-with-5g/

[11] 5G-ACIA (2019). 5G for connected industries and automation (Second edition) [Online]. Last accessed 15 September 2026. https://5g-acia.org/whitepapers/5g-for-connected-industries-and-automation-second-edition/

[12] 3GPP (2023, July 23). eXtended Reality for NR [Online]. Last accessed 15 September 2026. https://www.3gpp.org/technologies/xr-nr

[13] 5G-ACIA (2020). Key 5G use cases and requirements [Online]. Last accessed 15 September 2026. https://5g-acia.org/whitepapers/key-5g-use-cases-and-requirements/

[14] 3GPP (2025). TR 21.918: Release 18 Description; Summary of Rel-18 Work Items (v18.0.0) [Online]. Last accessed 15 September 2026. https://www.3gpp.org/ftp/Specs/archive/21_series/21.918/

[15] ETSI (2023). ETSI GS F5G 014 V1.1.1: Fifth Generation Fixed Network (F5G); F5G Network Architecture Release 2 [Online]. Last accessed 15 September 2026. https://www.etsi.org/

deliver/etsi_gs/F5G/001_099/014/01.01.01_60/gs_F5G014v010101p.pdf

[16] 5G-ACIA (2025). Use cases and requirements for integrated sensing and communication (ISAC) in connected industries and automation [Online]. Last accessed 15 September 2026. https://5g-acia.org/whitepapers/use-cases-and-requirements-for-integrated-sensing-and-communication-isac-in-connected-industries-and-automation-2/

[17] König, N. (2024, April 26). 5G-ACIA Overview (Fraunhofer IPT, HMI24) [Online]. Last accessed 15 September 2026. https://publica.fraunhofer.de/bitstreams/17935bf5-7150-4c9b-a8d2-7c2f2c029753/download

[18] ETSI (2023). ETSI GR F5G 021 V1.1.1: ISG F5G Activity Report 2023 [Online]. Last accessed 15 September 2026. https://www.etsi.org/deliver/etsi_gr/F5G/001_099/021/01.01.01_60/gr_f5g021v010101p.pdf

[19] CEPT ECC (2026). ECC Decision (22)07: Harmonised technical conditions for the usage of aerial UE for communications based on LTE and 5G NR in the bands 703-733 MHz, 832-862 MHz, 880–915 MHz, 1710–1785 MHz, 1920–1980 MHz, 2500–2570 MHz and 2570–2620 MHz harmonised for MFCN [Online]. Last accessed 15 September 2026. https://docdb.cept.org/document/28575

[20] IBPT/BIPT (Belgian Institute for Postal Services and Telecommunications) (2025). Consultation on draft amended decision à 3800–4200 MHz (French) [Online]. Last accessed 15 September 2026. https://www.ibpt.be/file/cc73d96153bbd5448a56f19d925d05b1379c7f21/48532dca19f0763f103828d16f397a2d7fe2bbe5/consultation-3800-4200-mhz.pdf

[21] IBPT/BIPT (Belgian Institute for Postal Services and Telecommunications) (2026). Décision: Réseaux locaux privés à bande 3800–4200 MHz et attribution de codes réseau mobiles (E.212) (French) [Online]. Last accessed 15 September 2026. https://ibpt.be/file/cc73d96153bbd5448a56f19d925d05b1379c7f21/832b29a71ff2c259d3117c8ddb866f91a4751262/decision-reseaux-locaux-prives-bande-3800-4200-mhz-et-attribution-codes-reseau-mobiles-e-212.pdf

[22] ARCEP (2025). Guichet d'attribution de fréquences à bande 3,8-4,2 GHz (TDD) (French) [Online]. Last accessed 15 September 2026. https://www.arcep.fr/mes-demarches-et-services/entreprises/fiches-pratiques/transformation-numerique-des-entreprises/guichet-attribution-frequences-bande-38-42-ghz-tdd.html

[23] CEPT ECC (2024). ECC Report 362: Compatibility between MFCN operating in 3400–3800 MHz and wireless broadband systems in low/medium power operating in the frequency band 3800–4200 MHz with radio altimeters operating in 4200–4400 MHz [Online]. Last accessed 15 September 2026. https://docdb.cept.org/document/28630





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