Proptivity

Shared indoor infrastructure

The Nordic regulatory landscape

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About this paper

This paper examines the regulatory and market status of indoor mobile infrastructure across Sweden, Norway, Denmark and Finland. It is addressed primarily to national regulators (PTS, Nkom, Energistyrelsen and Traficom) with the aim of supporting informed regulatory analysis and, where relevant, policy development in this area. Operators and property owners with an interest in the Nordic regulatory environment will also find it relevant.

This paper is a companion to Closing the indoor connectivity gap: a policy and market case for neutral host infrastructure (Proptivity, 2025). That paper sets out the full structural and technical case for dedicated indoor mobile infrastructure: why outdoor networks cannot reliably serve modern buildings, why the operator-led deployment model is structurally insufficient, and why neutral host infrastructure is the necessary response. This paper takes those conclusions as a starting point and applies them to the specific regulatory and market context of the four Nordic countries. Readers who want the technical and economic foundation should consult the companion paper alongside this one.

The central finding

No Nordic country has a regulatory barrier preventing the deployment of shared indoor mobile infrastructure. The obstacles are structural and commercial, not regulatory. The question is whether regulation will remain passive as the market transitions, or whether targeted intervention, particularly around public safety coverage and operator cooperation obligations, can accelerate deployment.

How to read this paper

The paper opens with a brief background section establishing the minimum technical and structural context needed to make the regulatory analysis legible. It then examines each market in turn, covering regulatory status, spectrum access, industry frameworks, and crucially the specific factors that explain why each market is at its current stage of development. It closes with a comparative summary and a set of cross-market observations relevant to regulators across the region.

Readers familiar with the technical and market case for indoor mobile infrastructure can move directly to the country chapters. The background section is kept brief by design.

Executive Summary

Mobile connectivity has become one of the most critical utilities in modern buildings, not just for calls and messaging, but for how people work, how services are delivered, and how buildings themselves operate. At the same time, outdoor mobile networks are not designed to serve indoor environments reliably. Modern buildings, with energy-efficient materials such as low-emissivity glass and dense insulation, can reduce indoor signal strength by a factor of 100 to 10,000 relative to the outdoor environment. The transition to 5G, which relies on higher-frequency spectrum with weaker penetration characteristics, makes this worse.

The result is a structural gap between expectation and reality that is growing, not shrinking. **According to third-party analyst research, fewer than 5% of commercial buildings across European markets currently have purpose-built indoor mobile infrastructure.** The operator-led model, in which individual operators deploy indoor coverage for their own subscribers, cannot close this gap at scale. The economic incentive to invest in indoor infrastructure sits primarily with property owners, whose asset value, rental income and tenant retention are directly affected by connectivity quality, while operators capture relatively little incremental revenue from improved indoor performance regardless of the building. This structural misalignment is the root cause of under-delivery, and it is the reason independent shared infrastructure (neutral host) has emerged as the appropriate response.

Across the Nordics, the regulatory picture is broadly consistent: no country has specific legislation governing neutral host or shared indoor infrastructure. Neutral host deployment is possible in all four markets under general telecom and spectrum regulation. The differences lie not in what is prohibited, but in what is enabled, incentivised or driven by specific national circumstances.

Sweden is the most commercially advanced market, driven by organised property owner demand for high-performance 5G indoor systems. The gap between the intended model and actual operator adoption is the defining tension. Norway has the most structured industry framework, with active regulator engagement and operators broadly open to a range of technical solutions. Denmark is at an earlier stage, with the market still centred on proven passive DAS solutions and limited demand for next-generation shared systems. Finland is shaped by a distinctive driver that does not exist in the other three markets: the transition of public safety communications from TETRA to commercial 4G/5G networks, which creates an indirect but tangible regulatory requirement for indoor coverage in certain building categories.

The cross-market observation is that the transition to shared, high-performance indoor mobile infrastructure is underway but unevenly distributed, and that its pace is determined primarily by commercial alignment between operators and property owners rather than by regulatory requirements. Regulation has a supporting role to play, particularly in ensuring operator cooperation cannot block deployment and in addressing the public safety coverage gap as TETRA networks are retired, but it is not the primary lever.

Summary of cross-market regulatory considerations

1. Clarify the regulatory status of neutral host infrastructure operators, including registration and compliance obligations.

2. Establish enforceable cooperation timelines for operator integration into shared indoor systems.

3. Address the public safety indoor coverage gap as TETRA networks transition to commercial 4G/5G.

4. Consider building regulation requirements for indoor infrastructure readiness in new commercial construction.

5. Publish clear guidance on spectrum leasing and transfer as it applies to shared indoor systems.

Background: the indoor connectivity problem

This section provides the technical and structural context needed to make the regulatory analysis in the following chapters legible. It summarises the key reasons why outdoor mobile networks cannot reliably serve modern indoor environments, why the incentive structure of the operator-led model produces under-delivery, and what neutral host infrastructure is and how it operates. More detailed treatment of each of these topics is available in the companion paper.

Why indoor coverage cannot be delivered from outside

The assumption that outdoor mobile networks provide adequate indoor coverage has become structurally unsound. Two independent developments have combined to make outdoor-to-indoor signal propagation increasingly unreliable in modern buildings.

First, modern energy-efficient construction materials act as effective radio barriers. Measurements by 3GPP and ETSI indicate that **low-emissivity (low-E) glass alone introduces attenuation of 20 to 40 dB, compared with 2 to 5 dB for standard glass.** This difference can reduce indoor signal levels by a factor of 100 to 10,000 relative to the immediate outdoor environment. Dense concrete, insulated facades and composite cladding materials compound this effect. The buildings that are most energy-efficient are, as a result, most difficult to serve from outdoor networks.

Second, the transition to 5G increases structural dependence on indoor-hosted infrastructure. **The 3.5 GHz band, now the primary 5G deployment band across Sweden, Norway, Denmark and Finland, has materially weaker indoor penetration than legacy 2G and low band 4G spectrum.** The networks designed to deliver the highest performance are also the ones that struggle most to reach inside buildings.

Why the operator-led model cannot close the gap

The structural cause of the indoor coverage gap is not a shortage of technology or a lack of willingness to pay. It is a misalignment of incentives between the parties with the strongest need to solve the problem and those traditionally responsible for solving it.

For mobile operators, indoor coverage quality in a specific building does not directly generate incremental revenue. Whether a user has excellent or poor indoor coverage does not meaningfully change their subscription fee. For property owners, the situation is fundamentally different. Connectivity directly affects tenant satisfaction, rental levels, occupancy rates and long-term asset value. Third-party research indicates this value differential is in the range of 50 to 100 times per occupant, with property owners capturing far more value per person in a building than the operator whose network serves them.

This incentive gap explains why the operator-led model consistently under-delivers indoor connectivity across all four Nordic markets. Property owners are willing to fund solutions; operators have limited commercial motivation to prioritise them. The neutral host model, in which an independent infrastructure operator deploys and operates shared indoor infrastructure serving all operators, resolves this misalignment by separating infrastructure provision from service provision.

Definition: Neutral host infrastructure operator

An entity that deploys, owns and operates shared active indoor radio access infrastructure, making it available to two or more mobile network operators (MNOs) under equal, non-discriminatory terms.

The neutral host holds no retail spectrum licence and is not a mobile operator. It operates as a wholesale infrastructure provider between the building owner and the licensed operators.

Technically, a neutral host typically deploys a shared antenna layer (digital DAS or small-cell architecture) connected to operator-provided baseband units via standardised fronthaul interfaces (CPRI, eCPRI or O-RAN compliant). Each MNO connects its own licensed spectrum and core network independently. The neutral host manages the shared physical layer; operators retain full control of radio configuration, traffic and authentication.

This is distinct from an MVNO (which resells capacity without independent infrastructure), from single-operator in-building systems, from passive DAS (which distributes rather than independently hosts operator RAN nodes), and from roaming arrangements.

Common indoor mobile solutions

Three technical approaches are in use across the Nordic markets. Understanding their characteristics is necessary context for the regulatory analysis that follows.

Passive DAS

A network of antennas and coaxial cabling distributes signals from operator base stations or repeaters throughout the building. The dominant multi-operator solution across all four markets. Supports multiple frequency bands and operators on shared passive infrastructure. Limitations: coaxial cabling is more complex to install than Ethernet, systems are not natively designed for high-performance 5G, and capacity is constrained by analogue signal distribution. Widely deployed in large commercial buildings, airports, transport infrastructure and stadiums.

Active DAS

Introduces active electronics to transport and distribute signals digitally, typically over fibre, before conversion back to radio signals near the user. Better coverage control than passive systems, but more complex to design and operate, less energy-efficient due to multiple signal conversion steps, and constrained in 5G capacity. Used in larger or more complex venues but not the optimal path for high-performance 5G environments.

Small cell-based shared infrastructure

Networks of small digital radio units distributed throughout the building. Signals remain in digital form throughout. Enables high-perfromance 5G including advanced features such as massive MIMO and network slicing, better spectrum efficiency, and greater scalability. When deployed as shared infrastructure managed by a neutral host operator, a single system supports all operators. The most future-proof approach commercially and technically but requires operator alignment on integration interfaces and is still in early stages of large-scale adoption across the region.

Sweden

Regulatory context

Sweden has no specific regulation governing indoor mobile infrastructure. The market has developed through industry initiative rather than regulatory direction. The primary regulatory question is whether PTS needs to act, on operator cooperation, spectrum guidance, or building standards, to unlock deployment at scale, or whether commercial pressure alone will eventually do so.

Why Sweden is where it is

Sweden's position as the leading Nordic market for indoor 5G is not primarily the result of regulation. It reflects the commercial sophistication of the Swedish property sector and a series of coordinated industry initiatives that translated property owner demand into a concrete technical and commercial model.

Swedish property owners, particularly the large institutional landlords organised through Fastighetsägarna and initiatives such as REDI and the Epicenter network, have been unusually active in defining what they want from indoor mobile infrastructure. The 2018 passive DAS model established a workable baseline for multi-operator coverage. The subsequent push for a next-generation model, covering higher capacity, full 5G functionality and a single infrastructure operator rather than bilateral operator engagements, reflected a genuine evolution in what tenants and building operators were demanding.

The fundamental obstacle is operator behavior. Swedish operators have consistently been reluctant to integrate into fully shared active indoor systems, regardless of who operates them. The reasons are both commercial and technical: operators have limited incentive to fund or enable infrastructure that serves competitors on equal terms, and active system integration requires a level of core network coordination that operators have been slow to standardise. The result is that the Swedish model for indoor 5G is well defined on paper but has not yet been deployed at scale.

The planned transition of public safety communications from TETRA to public 4G/5G networks will add a new dimension to this. Unlike in Finland, where this transition is already creating active demand for indoor coverage, the Swedish transition timeline is not yet finalised and indoor coverage obligations tied to it have not been defined. When they are, they will create a regulatory floor for indoor performance in buildings with public

access, and this will change the commercial calculus for operators and property owners alike.

Regulatory status

Sweden does not have specific regulation governing indoor mobile infrastructure or neutral host systems. Regulatory obligations for mobile network operators are focused on outdoor coverage. Indoor connectivity is treated as outside the scope of telecom regulation and is addressed by property owners and market actors.

The sole identified indoor-related regulatory requirement relates to coverage inside trains, introduced as a condition of recent spectrum allocations. This is a narrow precedent but an important one: it establishes that regulators are willing to specify indoor coverage performance as a spectrum condition, even if they have not yet applied this logic to buildings.

PTS, the Swedish regulator, has not published specific guidance on indoor connectivity or neutral host operations. Public sector guidance from SKR (the Association of Local Authorities and Regions) acknowledges that indoor coverage is largely unregulated and that property owners must plan and fund solutions themselves. This framing of indoor connectivity as a building responsibility analogous to electricity or heating is increasingly accepted in Sweden, though it has not yet been translated into building regulation requirements.

Spectrum access

Radio spectrum in Sweden is licensed to mobile network operators. Swedish regulation allows operators to transfer or lease spectrum rights to third parties, subject to PTS approval. This creates the legal basis for neutral host operations: the infrastructure operator transmits using licensed spectrum under operator authorisation, while the operator retains the license.

The regulatory logic follows the historical treatment of repeaters, where third-party equipment retransmits operator spectrum under authorisation. For more advanced shared systems, where operators connect their baseband equipment to a shared radio layer, the spectrum authorisation question is more complex. Each operator is effectively transmitting its own licensed spectrum through shared infrastructure, which does not require spectrum transfer as such, but does require clear operational agreements on interference, performance and liability.

Regulatory obligations for infrastructure operators

Third-party indoor infrastructure operators in Sweden may need to register as access operators under the Electronic Communications Act (LEK) and comply with applicable telecom regulation. The infrastructure operator is responsible for ensuring the indoor solution meets regulatory requirements, while mobile operators remain responsible for end-user services including security and lawful interception obligations.

There is no specific regulatory category for neutral host operators. The applicable framework is derived from general telecom legislation rather than from dedicated rules. This creates some legal ambiguity, particularly around the boundary between the infrastructure operator's obligations and those of the connected mobile operators, which becomes more relevant as deployments scale and involve mission-critical services.

Industry frameworks

The 2018 passive DAS model

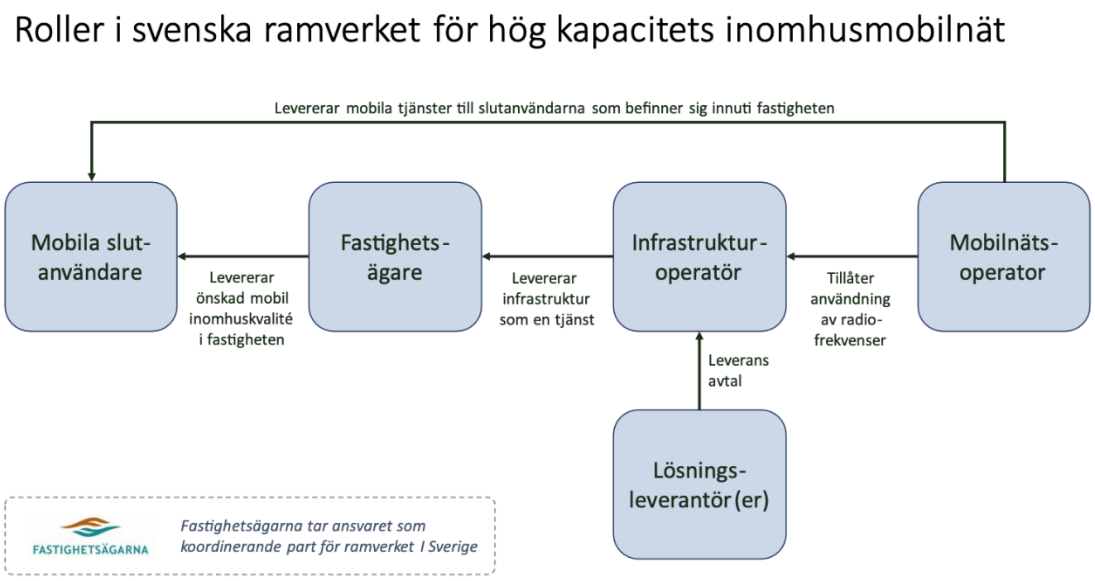
In 2018, Vasakronan and other major property owners, together with Swedish operators, developed a technical support document defining how passive DAS systems should be deployed in buildings. This established the dominant multi-operator model: property owners install passive antenna infrastructure; operators connect their own equipment under separate commercial agreements; operators retain ownership of their radio equipment. The document has been widely used as a procurement requirement in large office developments and remains the baseline for multi-operator indoor coverage in Sweden.

The Swedish model for indoor 5G

From approximately 2021 onwards, Swedish property owners organised through REDI and Fastighetsägarna developed a more ambitious model. The goal was to move beyond passive DAS and enable infrastructure supporting higher capacity, full 5G functionality, improved energy efficiency and long-term upgradeability, on a single shared active system operated by a neutral host.

The model specifies digital integration of operators rather than analogue signal combining, a single infrastructure operator responsible for the end-to-end system, and equal access for all operators. In practice, adoption has been very limited. Operators have

been unwilling to commit to active system integration on the terms proposed. Where active infrastructure has been deployed, it has typically involved analogue integration or separate operator equipment co-located on site rather than a genuinely shared active layer. As of 2025, there are no widely known deployments in Sweden where all major operators are connected to a fully shared high-performance indoor 5G system as defined by the model.



Stakeholder map in the “Swedish model for indoor 5G”

The core Swedish tension

Property owners have defined what they want. The technology exists to deliver it. Regulation does not prevent it. The obstacle is operator commercial behaviour, and the question is whether market pressure, public safety requirements or regulatory intervention will ultimately change it.

Typical deployment models

Passive DAS: widely deployed in premium office developments, transport infrastructure and large commercial venues. The only solution currently deployed at multi-operator scale.

Active DAS and small cell systems: deployed in pilot or single-operator configurations. Not yet established in multi-operator deployments.

Shared active neutral host systems: defined but not yet deployed at scale. The intended direction of the Swedish model for indoor 5G.

Regulatory considerations

PTS to clarify the regulatory status of neutral host infrastructure operators under LEK, including registration obligations and the boundary between infrastructure operator and mobile operator responsibilities.

Consider whether indoor coverage performance thresholds should be introduced as conditions of future spectrum allocations, building on the precedent set for train coverage.

Define indoor coverage obligations tied to the TETRA-to-5G public safety transition before the transition timeline is finalised, to create a clear floor for indoor performance in buildings with public access.

Assess whether building regulation amendments are needed to require infrastructure readiness in new commercial construction, consistent with the direction already taken for EV charging.

Key takeaways

Indoor mobile connectivity is largely unregulated in Sweden.

Spectrum leasing and transfer are possible with PTS approval, enabling third-party indoor infrastructure operations.

Infrastructure operators may need to operate under LEK as access operators, but the regulatory boundary is not clearly defined.

Property owners are the primary drivers of indoor investment and have defined a next-generation model for shared 5G infrastructure.

The passive DAS model from 2018 remains the only solution deployed at multi-operator scale.

Operator reluctance to integrate into shared active systems is the primary barrier to the intended model.

The planned TETRA-to-5G public safety transition will create new indoor coverage drivers, but obligations have not yet been defined.

Norway

Regulatory context

Norway has no specific regulation for indoor mobile infrastructure, but Nkom is the most actively engaged regulator in the Nordics on this topic. The regulatory question is whether the current approach of guidance and facilitation rather than enforceable requirements is sufficient as the market moves toward more complex digital shared systems, and as the TETRA-to-5G public safety transition creates new performance expectations indoors.

Why Norway is where it is

Norway's relative maturity in indoor mobile infrastructure reflects a distinctive collaborative culture across the Norwegian telecoms and property sectors, reinforced by active regulator engagement. Nkom, the Norwegian regulator, has taken a more explicit interest in indoor connectivity than its counterparts in Sweden, Denmark or Finland. Nkom has published guidance on the challenge, run market consultations and positioned itself as a facilitator of solutions rather than a passive observer.

The Norwegian industry framework for indoor DAS, developed jointly by Telia, ICE and Telenor, is the most comprehensive operator-level coordination document in the Nordics. It defines installation workflows, operational responsibilities, standardised agreements and technical interfaces in a level of detail that goes well beyond what exists in Sweden or Denmark. This has created a predictable operating environment for infrastructure providers and property owners, even without formal regulation.

The Norwegian market is also distinguished by operator openness. Unlike in Sweden, where operators have resisted active shared system integration, Norwegian operators are generally willing to engage with passive DAS, active DAS and small cell-based solutions. This openness has not yet translated into large-scale deployment of fully digital shared 5G systems, but it means the commercial preconditions are more favorable than in Sweden.

The key gap in Norway is on the property owner side rather than the operator side. Norwegian property owners are active and willing to invest, but they have been less focused on specifying next-generation 5G capabilities than their Swedish counterparts. Requirements tend to be defined project by project, reflecting coverage needs rather than a forward-looking infrastructure strategy. The Swedish property owner coalition that drove

the 5G model (Vasakronan, Jernhusen, REDI) has no direct equivalent in Norway but there seems to be activities underway to establish similar cooperation also in Norway

Norway's announced transition from TETRA to public 4G/5G for public safety communications will change this dynamic significantly. Unlike Sweden, where the timeline is uncertain, Norway has published a clear transition plan. When indoor coverage obligations tied to this transition are defined, which they have not yet been, they will create a regulated minimum for indoor performance in buildings with significant public access and will likely accelerate operator cooperation on shared indoor infrastructure.

Regulatory status

Norway does not have a dedicated regulatory framework governing neutral host or indoor mobile infrastructure. Regulation is focused on spectrum licensing and national network obligations. Indoor connectivity inside buildings is largely outside the scope of formal regulation.

Nkom's engagement with indoor connectivity is at the level of guidance and market facilitation rather than binding obligations. Its consultation on indoor coverage, which examined building attenuation challenges, operator responsibilities and potential frameworks, is the most substantive regulator-led engagement with the indoor connectivity problem in the Nordics. The consultation process produced a draft guidance document that has shaped industry practice without creating enforceable requirements.

This approach reflects a deliberate choice: Nkom has positioned itself as an enabler rather than a prescriber, seeking to create shared understanding and align market participants rather than impose obligations. The risk is that without enforceable requirements, deployment pace remains dependent on commercial alignment, and as the Swedish experience shows, this can stall.

Spectrum access

Radio spectrum is licensed to mobile network operators. Third-party indoor infrastructure relies on operator authorisation to transmit using licensed spectrum. Spectrum sharing mechanisms are available under Norwegian regulation, consistent with the general Nordic model.

For neutral host deployments, the practical model is that each operator authorises the use of its spectrum within the shared indoor system. The neutral host manages the physical infrastructure; operators retain full control of their services and subscriber relationships. No independent spectrum rights exist for neutral host operators.

Regulatory obligations for infrastructure operators

Norway does not define a specific regulatory category for neutral host operators. Third-party infrastructure providers are recognised in industry practice as infrastructure operators (driftsoperatører) and their role is defined through the industry framework and operational agreements rather than formal regulation.

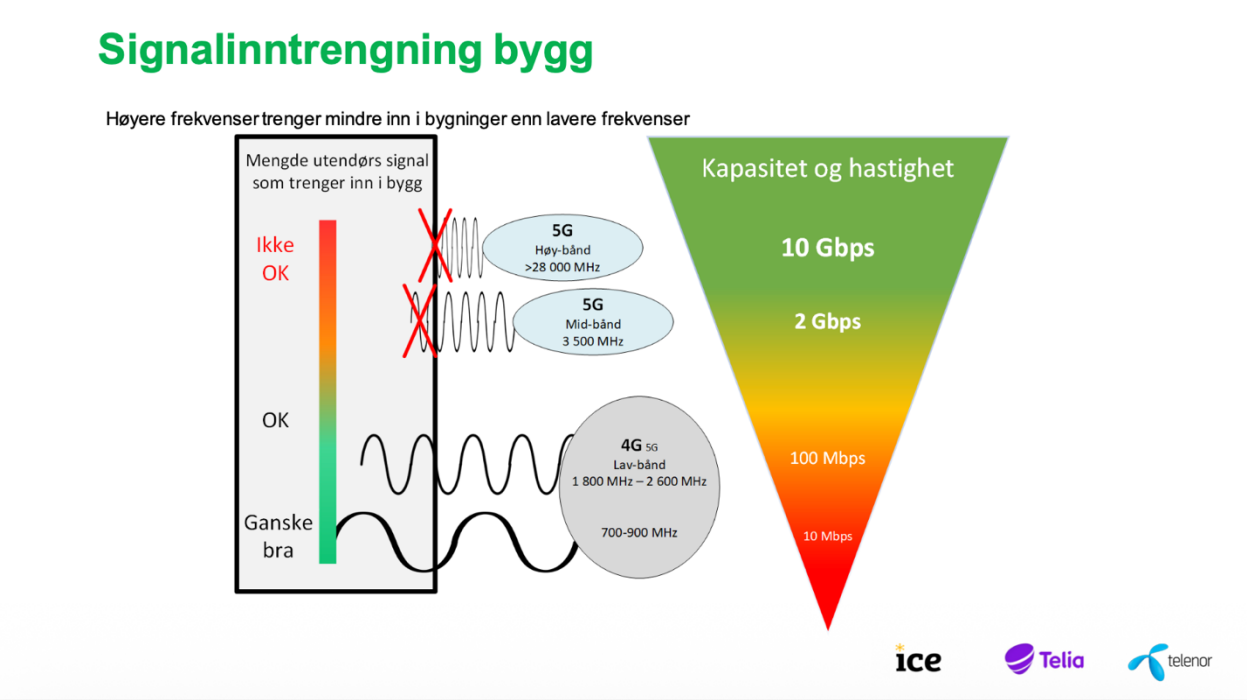
General telecom regulation applies. Infrastructure operators delivering electronic communications services are subject to applicable compliance, security and lawful interception obligations, though the boundary between operator and infrastructure provider responsibilities is defined primarily by commercial agreement rather than regulatory prescription.

Industry frameworks

The Norwegian industry framework for indoor mobile infrastructure is the most developed in the Nordics. Developed jointly by the three major operators (Telia, ICE and Telenor), it defines a comprehensive set of documents covering installation processes and workflows, operational procedures and responsibilities, standardised commercial agreements, documentation requirements, and defined roles between property owners, infrastructure operators and mobile operators.

The framework establishes a single-operator model: one infrastructure operator manages the system, mobile operators connect through defined processes, and property owners interact with a single primary counterpart. This is the closest any Nordic market has come to formalising the neutral host model in practice, even without explicit regulation.

A limitation of the current framework is that it was designed around passive and active DAS architectures. It does not fully address the interface requirements of fully digital small cell-based shared systems, which have different fronthaul architectures and operator integration mechanisms. As the market transitions toward these systems, the framework will need to evolve. This is an area where regulator engagement could be constructive.



Frequency challenge description in the Norwegian DAS model

Typical deployment models

Passive DAS: dominant and well established. Widely used in commercial buildings, transport infrastructure and public venues.

Active DAS: deployed and supported by the industry framework. Used in larger or more complex environments.

Small cell-based shared systems: technically supported in principle. Not yet deployed at scale. The next frontier for the Norwegian market.

Regulatory considerations
Nkom to advance from guidance to more formal frameworks for operator cooperation in shared indoor deployments, including defined response timelines for integration requests.
Update the industry framework to explicitly address fully digital small cell-based architectures and the operator integration interfaces they require.
Define indoor coverage obligations in connection with the TETRA-to-5G public safety transition, before the transition creates coverage gaps in buildings with public safety relevance.

Consider whether the driftsoperatør role should be formally defined in regulation, clarifying the compliance boundary between infrastructure operator and mobile operator.

Key takeaways
Norway does not have specific regulation for neutral host or indoor mobile infrastructure.
Nkom plays an active facilitation role through guidance and consultations, and is the most engaged regulator in the Nordics on this topic. Spectrum remains fully operator-controlled. Sharing mechanisms are available.
The Norwegian industry framework is the most comprehensive in the Nordics but is designed around DAS and does not fully address digital small cell architectures.
Operators are broadly open to passive DAS, active DAS and small cell solutions.
Property owner demand is active but less forward-looking than in Sweden, tending to be project-by-project rather than strategy-led.
A clear TETRA-to-5G transition plan has been announced. Indoor coverage obligations tied to it have not yet been defined.

Denmark

Regulatory context

Denmark has no specific regulation for neutral host infrastructure and Energistyrelsen has not published guidance on indoor mobile connectivity. The market functions within a technically sound but limited framework centred on passive DAS. The regulatory question is whether the absence of any coordinating signal from the regulator is the reason the market has not progressed further, and what guidance or facilitation would change that.

Why Denmark is where it is

Denmark's position as the most conservative Nordic market for indoor mobile infrastructure reflects a combination of operator culture, property owner demand patterns and a regulatory approach that has been enabling without being actively facilitating.

Danish operators have taken a pragmatic, incremental approach to indoor coverage. Where problems exist, they are solved with proven technologies, primarily passive DAS and to a lesser extent active DAS, rather than with next-generation systems that require new commercial models. This is not primarily driven by technical reluctance: Danish operators are capable of deploying advanced systems. It reflects a commercial judgement that the business case for full active shared infrastructure has not yet been clearly established in the Danish market.

Danish property owners have been less assertive than their Swedish counterparts in specifying indoor connectivity requirements. Where Swedish property owners have organised collectively to define a common model for indoor 5G, Danish property owners have largely engaged on a project-by-project basis, without the coordinated industry push that has driven the Swedish model. This means that the commercial pressure on operators to offer next-generation solutions is weaker in Denmark.

The result is a market that functions effectively within its current frame of reference. Passive DAS for multi-operator coverage is well established, the POI framework is technically sound, and the regulatory environment is clear. But the market has not yet built the commercial or institutional momentum needed to move to the next generation of shared active infrastructure.

Denmark has no equivalent of the TETRA-to-5G public safety driver that is reshaping Finland and, increasingly, Norway and Sweden. Without that additional demand signal, the transition to high-performance shared 5G indoor infrastructure is likely to be driven by commercial factors alone, meaning it will follow Sweden and Norway rather than lead them.

Regulatory status

Denmark does not have a dedicated regulatory framework for neutral host infrastructure. Telecom regulation is primarily focused on spectrum usage and national coverage obligations. Neutral host solutions are not explicitly regulated but are not prohibited and can be implemented within the existing framework provided they comply with spectrum licensing conditions and general telecom law.

The regulatory approach is enabling rather than prescriptive. Energistyrelsen, the Danish regulator, has not published specific guidance on indoor mobile connectivity or neutral host operations. The industry has developed its own standards through the POI framework, which has been sufficient to support the passive DAS model in use.

Spectrum access

Radio spectrum is licensed to mobile network operators. The Danish framework allows transfer and leasing of spectrum licences, either in full or in part, including by frequency band or geographic scope. For licences awarded by auction or tender, additional conditions may apply to transfers.

For neutral host deployments, the practical mechanism is the same as elsewhere: operators authorise use of their spectrum within the shared indoor system, retaining the licence itself. The regulatory framework supports this without requiring dedicated neutral host provisions.

Regulatory obligations for infrastructure operators

Denmark does not define a specific regulatory category for neutral host operators. Telecom regulation is based on a broad provider concept: any entity making electronic communications networks or services commercially available may fall under its scope, without requiring prior authorisation.

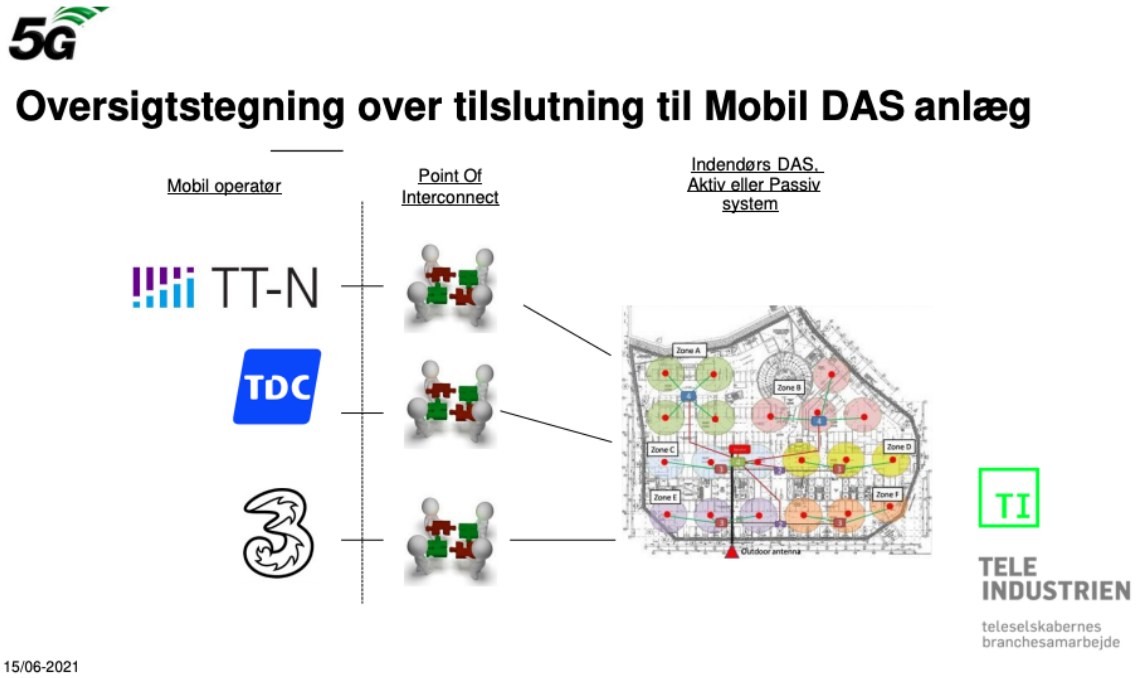
Infrastructure operators must comply with applicable regulations including security and lawful interception requirements. The boundary between infrastructure operator and mobile operator obligations is defined by commercial agreement rather than regulatory specification. As deployments become more complex and involve mission-critical services, this ambiguity may require clarification.

Industry frameworks

The POI model for DAS

The Danish industry guideline, Vejledning til Point of Interface (POI) for DAS, published in 2021, defines how mobile operators connect to shared antenna systems through standardised interconnection points. It covers both passive and active DAS, includes technical requirements for multiple frequency bands including 5G spectrum at 3.5 GHz, defines coverage and sectorisation requirements, and specifies documentation requirements prior to integration.

The POI model is technically sound and provides a clear framework for multi-operator DAS deployments. Its limitation is that it was designed for DAS architectures and does not address the interface requirements of fully digital small cell-based shared systems. As the market evolves, the framework will need to extend to cover these architectures.



Interconnect map in the Danish Mobil DAS POI model.

Typical deployment models

Passive DAS: dominant and most requested. Well understood by operators and property owners, aligned with established procurement processes.

Active DAS: used and supported by the POI framework. More limited adoption, typically in larger or complex environments.

Fully digital shared small cell systems: not yet established across all operators. No equivalent of the Swedish 5G model or Norwegian operator openness to these architectures.

Regulatory considerations
Energistyrelsen to consider publishing guidance on indoor mobile connectivity, clarifying the regulatory status of neutral host operators and the applicable compliance framework.
Extend the POI framework to explicitly cover fully digital small cell-based architectures, preparing the market for the next generation of shared indoor systems.
Assess whether property owner coordination mechanisms, similar to Sweden's REDI initiative or Norway's industry frameworks, could be encouraged to build demand-side pressure for next-generation solutions. Monitor the TETRA transition in Norway and Finland and assess whether Denmark will face equivalent public safety indoor coverage requirements as public safety networks in the region migrate to commercial mobile infrastructure.

Key takeaways
Denmark does not have specific regulation for neutral host infrastructure.
Neutral host deployment is possible under general telecom and spectrum regulation.
Spectrum licences can be transferred or leased, supporting shared infrastructure models.
The POI framework provides a technically solid model for DAS deployments but does not cover next-generation digital shared systems.
The market is centred on passive DAS with slower adoption of more advanced solutions.

Operator engagement is pragmatic but not forward-looking toward active shared 5G systems.
Property owner demand for next-generation indoor 5G is limited compared to Sweden and Norway.
No specific public safety driver currently exists in Denmark comparable to the TETRA transitions in Finland, Norway and Sweden.

Finland

Regulatory context

Finland is the only Nordic country where a specific national programme, the VIRVE 2 public safety transition, creates an indirect but tangible performance expectation for indoor mobile coverage in certain building categories. This is not yet formal regulation for buildings, but it functions as one in practice. The regulatory question is whether Traficom and Erillisverkot will formalise these expectations before the transition creates visible coverage gaps, and whether doing so will accelerate the development of a proper shared indoor infrastructure market.

Why Finland is where it is, and why it matters

Finland's indoor mobile infrastructure landscape is shaped less by commercial property owner demand and more by the intersection of public safety policy and mobile network architecture. Understanding the VIRVE 2 transition is essential to understanding the Finnish market.

The VIRVE to VIRVE 2 transition

Finland's public safety communications network, VIRVE, has historically been based on TETRA technology operating in low-frequency spectrum, typically below 500 MHz, with strong indoor propagation characteristics. TETRA signals penetrate buildings effectively, meaning that first responders, security services and emergency personnel could rely on consistent indoor coverage without dedicated indoor infrastructure.

VIRVE 2 changes this fundamentally. The new system is delivered over commercial 4G and 5G networks, using licensed mobile spectrum operated by commercial network operators. The frequency bands used for 5G, particularly the 3.5 GHz band, have significantly weaker indoor penetration than legacy TETRA spectrum. A building that was reliably served by VIRVE may not be reliably served by VIRVE 2 without dedicated indoor infrastructure, particularly if it uses modern energy-efficient construction materials.

Erillisverkot, the Finnish agency responsible for government and security network infrastructure, has explicitly identified building owners as having responsibility for ensuring VIRVE 2 reliability within their premises. This creates a compliance-driven demand for indoor mobile infrastructure in a category of buildings, including hospitals, government facilities, transport hubs, large public venues and critical infrastructure sites, that would not otherwise be a priority for commercial indoor investment.

Finland is the only Nordic country where this transition has already progressed to the point of creating active market behavior. The VIRVE 2 requirement is already influencing which buildings are prioritised for indoor infrastructure deployment and what technical specifications are required. Norway and Sweden have announced equivalent transitions, but their timelines are less advanced and indoor coverage obligations have not yet been defined.

The Finnish precedent is therefore important not just for Finland. It provides the clearest available model in the Nordics of how the TETRA-to-5G transition creates a regulatory floor for indoor coverage, and of what happens when a compliance driver intersects with a commercial infrastructure market that is not yet mature enough to respond at scale.

Regulatory status

Finland does not have explicit regulation specifically governing indoor mobile infrastructure or neutral host systems as a category. General telecom regulation applies, focused on spectrum licensing and national network obligations.

The VIRVE 2 framework creates the most significant indirect regulatory driver for indoor coverage in the Nordics. While it does not mandate neutral host deployments directly, it creates a performance expectation that commercial mobile networks must deliver reliable coverage in buildings with public safety relevance, and this expectation cannot be met in many modern buildings without dedicated indoor infrastructure. The question of who is responsible for funding and deploying that infrastructure, and what technical standards apply, is not yet fully resolved.

Traficom, the Finnish communications regulator, oversees spectrum licensing and general telecom compliance. Its engagement with indoor connectivity as a specific regulatory challenge is less developed than Nkom's in Norway, but the VIRVE 2 transition is likely to drive closer regulator attention to indoor performance requirements in the coming years.

Spectrum access

Radio spectrum in Finland is licensed to mobile network operators, consistent with the Nordic model. VIRVE 2 is delivered using commercial mobile spectrum, meaning that

public safety services depend on the same frequency bands as consumer and enterprise mobile services.

This has a significant structural implication. Indoor infrastructure deployed to support VIRVE 2 must support the same spectrum bands used by commercial operators, including the 3.5 GHz 5G band. Passive DAS is well suited to multi-band support and has therefore remained a preferred solution. But as 5G deployments evolve, the capacity and performance limitations of passive systems may push the market toward active shared infrastructure to meet VIRVE 2 quality requirements.

Regulatory obligations for infrastructure operators

No Finland-specific obligations uniquely target indoor infrastructure operators beyond general telecom regulation. Where indoor systems support VIRVE 2 services, however, the effective obligations are more demanding: the infrastructure must support priority and availability requirements for public safety communications, comply with operator and authority requirements for service continuity, and meet the performance specifications set by Erillisverkot for VIRVE 2 reliability.

In practice, this means that indoor infrastructure serving public-safety-relevant buildings in Finland carries a higher compliance burden than equivalent systems elsewhere in the Nordics, even without explicit regulation. The gap between this expectation and the current state of the market, where most buildings lack purpose-built indoor infrastructure, is the defining tension in the Finnish context.

Industry frameworks

Finland does not have a unified industry framework for indoor mobile infrastructure equivalent to the Norwegian coordinated DAS model or the Swedish property owner initiatives. The market has developed pragmatically, shaped by operator-led deployments, public safety requirements and project-specific solutions in large or critical buildings.

The VIRVE 2 transition has increased awareness of indoor coverage challenges, particularly among public sector stakeholders and operators, but has not yet produced a widely adopted national framework for shared indoor infrastructure. This is a gap. As the transition progresses and the coverage consequences of VIRVE 2 become visible in practice, a more structured framework, ideally one that aligns with the approaches taken in Norway and Sweden, will be needed.

Typical deployment models

Passive DAS: the dominant solution, particularly valued for its multi-band capability supporting both commercial and legacy public safety frequency bands.

Active DAS: deployed in larger and more complex environments, typically with operator-specific rather than shared configurations.

Fully digital shared small cell systems: limited adoption. The public safety driver creates demand for reliable multi-operator coverage but has not yet driven adoption of next-generation shared architectures.

Regulatory considerations
Traficom and Erillisverkot to jointly define explicit indoor coverage performance standards for buildings with VIRVE 2 public safety relevance, specifying what constitutes adequate indoor performance and who bears responsibility for achieving it.
Clarify the compliance obligations for indoor infrastructure operators serving VIRVE 2, including the priority, availability and continuity requirements that apply when mission-critical services depend on the indoor system.
Assess whether the VIRVE 2 indoor coverage requirement should be defined in regulation or building standards, rather than left to bilateral agreements between building owners and Erillisverkot.
Develop a national framework for shared indoor infrastructure aligned with the Norwegian and Swedish models, to provide operators and property owners with a standardised deployment path.
Traficom to publish guidance on the regulatory status of neutral host operators and the spectrum authorisation mechanism applicable to shared indoor systems.

Key takeaways
Finland does not have explicit regulation for indoor mobile or neutral host solutions as a category.
VIRVE 2, the transition of public safety communications from TETRA to commercial 4G/5G, is the most significant indirect regulatory driver for indoor coverage in the Nordics.
Building owners with public safety-relevant premises are expected to ensure VIRVE 2 reliability indoors, creating compliance-driven demand for indoor infrastructure.
Commercial mobile spectrum (including 3.5 GHz 5G) is used for VIRVE 2, making modern building attenuation a direct public safety risk.

Passive DAS is dominant due to its multi-band capability, but may not meet VIRVE 2 quality requirements as 5G performance standards evolve.
No unified national framework for shared indoor infrastructure exists.
Finland provides a live model of what happens when a TETRA-to-5G transition intersects with an immature indoor infrastructure market. This is directly relevant to Norway and Sweden as their own transitions progress.

Nordic comparison

The table below summarises the key dimensions across all four markets. The following observations draw out the cross-market patterns that are most relevant for regulators and operators.

Dimension	Sweden	Norway	Denmark	Finland
Neutral host regulation	No specific framework	No specific framework	No specific framework	No specific framework
Spectrum model	Operator-controlled. Leasing and transfer possible with PTS approval	Operator-controlled. Sharing mechanisms available	Operator-controlled. Leasing and transfer possible	Operator-controlled. Public safety (VIRVE 2) runs on commercial spectrum
Dominant solution	Passive DAS. Growing interest in active shared 5G	Passive DAS dominant. Active DAS and early small cell deployments	Passive DAS, primarily 4G-focused	Passive DAS, multi-band support for commercial and public safety
Operator stance	Cautious toward active shared systems	Open to passive DAS, active DAS and small cells	Primarily passive DAS focus	Supports multiple technologies including advanced integrations
Market maturity	Most advanced. Strong property owner drive	Structured and collaborative	Earlier stage, pragmatic	Mixed. Shaped by public safety
Role of property owners	Highly active, driving 5G demand	Active, less coordinated	Limited demand for advanced solutions	Moderate, partly compliance-driven
Industry frameworks	Strong. Property owner initiatives, defined 5G models	Strong. Coordinated DAS model, regulatory engagement	Moderate. Technical DAS guidelines	Limited unified frameworks
Fully digital multi-operator systems	Defined but not yet widely deployed	Technically supported, limited large-scale deployment	Not yet established	Limited adoption
Public safety driver	TETRA to public 4G/5G transition planned, not yet regulated	TETRA to public 4G/5G announced, not yet regulated	No specific public safety driver identified	VIRVE 2 already driving indoor coverage demand
Key market driver	Commercial demand, future-proof buildings	Industry collaboration, gradual evolution	Operator-led pragmatism	Public safety transformation

Cross-market observations

No regulatory barrier, but significant structural obstacles

The most important cross-market finding is that regulation is not the binding constraint on indoor mobile infrastructure deployment in any of the four Nordic markets. All four regulatory frameworks are enabling: neutral host deployment is possible everywhere, spectrum can be authorised for shared indoor use everywhere, and there are no prohibitions that need to be removed. The obstacles are structural: operator incentive misalignment, commercial model uncertainty and coordination complexity. They are not regulatory in origin.

This does not mean regulation is irrelevant. It means the role of regulation is different from what a traditional telecoms regulatory lens might suggest. The question is not whether to permit neutral host operations, but whether regulation should actively facilitate them, by defining operator cooperation obligations, creating indoor coverage floors, or enabling building regulation to require infrastructure readiness.

The TETRA transition is the most significant near-term driver

Finland's experience with VIRVE 2 is a preview of what Norway and Sweden will face as their own TETRA-to-5G transitions progress. In each case, the fundamental issue is the same: TETRA operated on spectrum with strong indoor penetration; commercial 5G operates on spectrum with weak indoor penetration. Buildings that were reliably served by TETRA will not be reliably served by VIRVE 2 or its equivalents without dedicated indoor infrastructure. The question is whether indoor coverage obligations will be defined before or after this gap becomes visible in practice.

Finland has reached this point first. Norway has announced a transition plan but not defined indoor coverage obligations. Sweden has signalled a transition without a clear timeline. Denmark has no equivalent driver currently. Regulators in all four markets should treat the Finnish experience as a reference point for designing the regulatory response to their own transitions.

Operator behavior is the decisive variable

Across all four markets, operator willingness to integrate into shared active indoor systems is the variable that most directly determines deployment pace. Norway demonstrates that even without regulation, operators can be moved toward cooperation through structured industry frameworks and active regulator facilitation. Sweden

demonstrates that even with strong property owner demand and a defined model, operator reluctance can stall deployment indefinitely.

The implication for regulators is that soft facilitation, meaning guidance, frameworks and consultation, may be sufficient in markets with a collaborative operator culture, but will not be sufficient in markets where operators have structural incentives to delay. Enforceable cooperation obligations, modelled on the access regulation frameworks applied to fixed-line infrastructure, may ultimately be needed to ensure that shared indoor infrastructure can be deployed when property owners have committed funding and infrastructure providers are ready.

Building regulation is an underused lever

None of the four Nordic markets has yet used building regulation to require indoor infrastructure readiness in new commercial construction. Denmark's building regulations require conduit infrastructure for telecommunications in new buildings, a partial precedent, but this has not been extended to active indoor mobile infrastructure. Several European markets have introduced building regulation requirements for EV charging infrastructure, establishing a precedent that is directly applicable to indoor mobile.

Requiring conduit pathways, dedicated equipment spaces and standardised connectivity pathways in new commercial construction would significantly reduce the cost and disruption of subsequent indoor infrastructure deployment. This is a building standards question as much as a telecom regulation question, and it requires coordination between communications regulators and building standards authorities.

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