



Optimising Dual-Use Controls for European Quantum Technologies

POSITION PAPER

QulC contribution to the Open Public Consultation and Call for Evidence on the Overall Evaluation of Regulation (EU) 2021/821

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EXECUTIVE SUMMARY

Quantum technologies, spanning computing, communication and sensing, have moved from the laboratory to the market and are now a pillar of Europe's economic security and strategic autonomy. The evaluation of Regulation (EU) 2021/821¹⁵ comes at a decisive moment. Since November 2025, quantum computers and their cryogenic enabling technologies are controlled at EU level under Annex I,² and the Union is preparing a Quantum Act to turn scientific leadership into industrial scale. Predictable export controls are a precondition for that ambition.

The European quantum industry is mindful of the dual-use character of its technologies and supports targeted controls on genuinely sensitive items. Its central concern is **not the existence of controls, but the complexity of navigating them**. The same EU list is processed at different speeds and interpreted in different ways by national authorities, and it is not always matched by equivalent facilitation from trusted partners. For start-ups and scale-ups, this means long and unpredictable lead times, duplicated classification work and legal uncertainty, which divert scarce resources away from R&D and international market deployment.

QuIC's recommendations therefore focus on what the Regulation and its implementation can realistically deliver, in line with the evaluation's own objectives of minimising unnecessary burden, ensuring a level playing field in the single market and supporting innovation and international research collaboration.³ **QuIC does not ask for new obligations on exporters**. Where clarity is missing, notably in view of remote access and intangible transfers, we ask for guidance developed with industry rather than new controls.

Key recommendations

- **Make the single market work:** fully digital, interoperable e-licensing in every Member State, published processing times, mutual recognition of classification decisions and fast expert support for licensing and customs authorities.
- **Close the gaps in allied trade:** extend EU001 further to trusted partners such as South Korea, cover quantum communication in EU008 or a dedicated authorisation, define trusted partner destinations once, and secure equal treatment of all Member States under partners' licence exceptions.
- **Clarify, rather than expand, intangible transfer rules:** Commission guidance, developed with industry, on cloud access and on the remote operation and maintenance of deployed quantum systems.
- **Clarify guidance for exporters and customs:** guidance covering all quantum domains, a capability-based distinction between systems and components, alignment with the multilateral regimes and consistent application of existing catch-all provisions.

QuIC and its members stand ready to support the Commission with technical expertise throughout the evaluation, including follow-up interviews and in the work of the Dual-Use Coordination Group.

¹ Regulation (EU) 2021/821 of the European Parliament and of the Council of 20 May 2021 setting up a Union regime for the control of exports, brokering, technical assistance, transit and transfer of dual-use items (recast), OJ L 206, 11.6.2021.

² Commission Delegated Regulation (EU) 2025/2003 of 8 September 2025 updating the list of dual-use items in Annex I to Regulation (EU) 2021/821, in force since 15 November 2025.

³ European Commission, DG TRADE, Open Public Consultation and Call for Evidence – Overall Evaluation of Regulation (EU) 2021/821, https://policy.trade.ec.europa.eu/consultations/open-public-consultation-and-call-evidence-overall-evaluation-regulation-eu-2021821_en.

1. Quantum Technologies and the Dual-Use Framework

Export controls must protect critical European know-how while keeping commercial and research avenues open with trusted partners. For quantum technologies, striking this balance is now an industrial question as much as a security one. Europe's quantum companies are predominantly start-ups, scale-ups and research spin-offs that must sell internationally to reach scale, and they compete with firms in jurisdictions that may face lighter or faster procedures. Today's regulations meant that European quantum companies are losing revenue, paying extremely high legal fees; and some reported of already having lost customers due to delays in shipments due to cumbersome export control enforcement schemes in Member States. Others report that it has become increasingly hard to land commercial contracts at a time when certifications do not yet exist (and which require cross-border exchanges and licenses in the first place). If left unaddressed, the young quantum industry faces significant hurdles in growing their business as the industry's momentum grows. Instead, dual use implementation should enable European suppliers to turn R&D investment into customer contracts, reference installations and recurring service revenues, while protecting sensitive know-how. Export control friction therefore bears directly on the commercialisation goals of the forthcoming EU Quantum Act. QuIC stresses the importance of ensuring coherence between EU trade and industrial policies to support the development and competitiveness of the European quantum industry.

The 2025 update of Annex I introduced EU-autonomous controls on quantum computers, electronic components designed for cryogenic temperatures, parametric signal amplifiers, cryogenic cooling systems and cryogenic wafer probers,⁴ following national controls introduced by several Member States in 2024. QuIC welcomes this step towards a common European list. However, a single EU list implemented in 27 different ways still fragments the single market. Harmonised controls must be matched by harmonised implementation.

Important Notes

- The 2025 listing of quantum items at EU level makes harmonised implementation more urgent, not less.
- The recommendations in this paper apply to all quantum domains, not only to quantum computing.
- Simplicity is an asset: clear and predictable rules serve both security and commercialisation.

Quantum is also not a single technology. Communication and sensing items are controlled under different entries, and following a different logic, than quantum computing, and enabling components, semiconductor process development, fabrication and integration providers are often far removed from any end use. Table 1 summarises where members experience friction across the main domains.

⁴ Commission Delegated Regulation (EU) 2025/2003, cited above.

QUANTUM TECHNOLOGY DOMAINS

Table 1. Main quantum technology domains and where members experience export control friction (illustrative, not a legal classification).

Domain	Examples of items in scope	Where friction arises
Quantum computing	Quantum computers, cryogenic electronics, parametric amplifiers, cryogenic cooling systems and wafer probers (EU-autonomous entries since 2025)	Lead times to partners; cloud access and remote operation; components subject to the same scrutiny as complete systems
Quantum communication	QKD systems, key management and network orchestration software (Category 5 Part 2: controlled when designed for quantum cryptography, no performance threshold)	Unclear scope for network components; remote maintenance of deployed nodes; gaps in general authorisations
Quantum sensing and timing	Quantum-enabled magnetometers, gravimeters and atomic clocks, which may fall under existing entries in Categories 3 and 6	Classification of novel architectures; divergent national interpretation
Enabling technologies and software	Cryogenics, lasers and photonics, precision optics, vacuum systems, RF and microwave electronics, control and calibration software. It also includes semiconductor process technologies, wafer fabrication, chip integration and advanced packaging, and helium-3 as part of the supply chain.	Component-level licensing; exposure to foreign extraterritorial rules through non-EU sub-components

2. Recommendations on the Dual-Use Regulation

The recommendations in this section fall within the reach of the Regulation, its general authorisations and the cooperation mechanisms it establishes. They are guided by three principles shared across QuIC's membership.

Guiding principles

- **No new obligations.** Improvements should come from better implementation, guidance and facilitation, not from additional requirements on exporters.
- **Symmetry with partners.** EU measures should be aligned with the multilateral regimes – the Wassenaar Arrangement for quantum systems and components, and the Nuclear Suppliers Group for Helium-3 and other listed materials and precursors – and mirrored by trusted partners. The EU should not act alone in ways that disadvantage European companies.
- **Simplicity and speed.** A new mechanism is only worth creating if it delivers faster and more predictable outcomes than today.

2.1 Make the Single Market Work for Dual-Use Exporters

The issue

Licensing remains a national competence. National authorities process applications at different speeds, request different documentation and at times interpret the same control entry differently. Members report that customs officers often lack the technical means to verify a classification and return the file to the exporter, adding weeks to a single shipment. A company whose supply chain spans several Member States may have to engage several authorities, each with its own procedure, for the same item.

Intra-EU transfers licensing generally concerns Annex IV items, subject to the exceptions in Article 11. The friction members experience therefore lies less in intra-EU transfer licensing than in the divergent national treatment of exports that leave an integrated European supply chain. **This is the most important issue raised by QuIC members**, and the one where the evaluation can make the greatest difference.

What QuIC recommends

- **Digital, interoperable e-licensing in every Member State.** Accelerate the roll-out of fully electronic licensing portals, building on best practice such as the e-services of Finland's Ministry for Foreign Affairs,⁵ with common data fields so that information submitted once can be reused across Member States. Austria's PAWA portal provides another practical example, allowing applicants to reuse previous application data and retrieve electronically-issued authorisations and decisions.
- **Transparent notifications of approvals.** Current practice is that Member States have to notify when export licenses are rejected. This should also be the case for approval, so that national authorities can check whether a product has already been approved by another Member State.
- **Transparent processing times.** Publish licence processing times per Member State and per type of authorisation in the Commission's annual report under Article 26, and agree indicative EU benchmarks for standard applications.

- **Mutual recognition of product classification.** A technical classification issued by one national authority for a given item should be recognised by the authorities of other Member States, so that companies do not have to classify the same product several times.
- **Convergent enforcement and customs practice.** Use the Enforcement Coordination Mechanism and the Dual-Use Coordination Group to align customs and enforcement practice for emerging technology items, including shared classification guidance for customs officers and fast-track handling of quantum hardware at all major points of exit, rather than in a few dedicated hubs that would force re-routing. Questions on how multilaterally agreed parameters should be read belong in the Wassenaar Arrangement, so that allies apply the same interpretation.
- **Expert support without a new layer.** Rather than creating a new body, task the existing Emerging Technology Expert Group, which has already worked on risk assessment for quantum technologies,⁶ with issuing non-binding technical classification opinions on quantum items within a fixed timeframe of no more than 30 days. National licensing and customs authorities should also be able to draw on quantum specialists on demand, as Finland's Export Control Advisory Board does under national law, so that SMEs and start-ups receive reliable answers quickly. Member States should offer advance assessments of whether a planned export could be authorised, building on Germany's and Austria's *Voranfrage*, France's *Demande de Classement* or the Netherlands' *indelingsverzoeken*, with clear information requirements and swift response targets to support companies before they commit to bids or delivery dates. Such assessments would not replace the required export authorisation.

⁵ Ministry for Foreign Affairs of Finland, Export authorisations for dual-use items (e-services), <https://um.fi/applying-for-export-authorisation>.

⁶ Council of the European Union, Outcome of proceedings of the Working Party on Dual-Use Goods, ST 7560/23 (2023), reporting on the Emerging Technology Expert Group's risk assessment work on quantum technologies.

2.2 Close the Gaps in Allied Trade

The issue

Union General Export Authorisation EU001 already covers most Annex I items to Australia, Canada, Iceland, Japan, New Zealand, Norway, Switzerland including Liechtenstein, the United Kingdom and the United States.⁷ The remaining problems are narrower, but material:

- Important partners with comparable control regimes, notably South Korea, are outside EU001, so exports to them require individual or national authorisations.
- The encryption authorisation EU008 covers only selected entries, essentially 5A002.a.2 and 5A002.a.3 with related software and technology. Items whose primary function is information security (5A002.a.1) and items designed to use or perform quantum cryptography (5A002.c) therefore fall outside of it. QKD equipment, key management systems and network software need individual and national authorisations, even to destinations where comparable conventional encryption products can ship under EU008.
- Partners do not treat EU Member States equally. Since September 2024, the United States has granted its license exception IEC country by country and item by item to countries that implement equivalent controls.⁸ Although equivalent controls now apply across the EU, members report that only some Member States benefit for certain items. For example, the US IEC list includes exemptions for cryogenics (3A904) for Germany, Italy, Finland, the Netherlands, Norway and the UK. Companies in the same single market therefore face different conditions when trading with the same partner.

What QuIC recommends

- **Extend EU001 to additional trusted partners**, starting with South Korea and other economies that maintain equivalent control regimes. Finland's national general export authorisation FI003 for dual-use exports to South Korea⁹ provides a practical precedent. It can inform similar measures in

other Member States and an EU-level extension, with clearly defined item coverage, conditions and exclusions.

- **Confirm the coverage of newly listed quantum items.** Guidance should confirm that the quantum items added to Annex I in 2025 benefit from EU001 on the same basis as other Annex I items or, where this is not the case, EU001 should be extended accordingly, so that exports to the closest partners do not become subject to new individual licensing.
- **Cover quantum communication.** Extend EU008, or establish a dedicated Union general export authorisation, to cover QKD equipment, key management systems and network orchestration software, with their related software and technology, under the same destination scope and safeguards as EU008. Its conditions should recognise published quantum communication standards, such as the ETSI QKD specifications, in the same way that EU008 recognises standard encryption algorithms. Because EU008 excludes items approved to process classified information, the Commission should also clarify how this exclusion applies to products accredited for EuroQCI and national government networks.
- **One definition of trusted partner destinations.** Use a single definition, namely the EU001 destinations plus named additions such as South Korea, consistently across general authorisations, guidance on intangible transfers and future instruments.
- **Reciprocity through DG TRADE.** Pursue reciprocal licence-exception arrangements and work towards minimal notification requirements with partners that operate them, so that all Member States are treated as one jurisdiction applying the same controls. The EU should also advocate comparable facilitation among Wassenaar (-1) participants, to create a level playing field between allies.

⁷ Regulation (EU) 2021/821, Annex II, Section A (Union General Export Authorisation No EU001).

⁸ United States, Export Administration Regulations, 15 CFR § 740.24, License Exception Implemented Export Controls (IEC), introduced by the BIS interim final rule of 6 September 2024. Eligible items and destinations are published by BIS.

⁹ Ministry for Foreign Affairs of Finland, new national general export authorisations to facilitate exports to South Korea (export control news), https://um.fi/export-control-news/-/asset_publisher/ygyQWQ1LWoQP/content/uudet-kansalliset-yleisluvat-helpottamaan-vientia-etela-korean-seka-viranomaisten-vientija/35732.

2.3 Clarify, Rather than Expand, the Rules on Intangible Transfers

The issue

Quantum systems are increasingly delivered and supported remotely: cloud access to quantum processors, remote calibration and monitoring, firmware and software updates for installed systems, support for deployed QKD nodes and key managers, and cross-border network orchestration. The Regulation's provisions on intangible technology transfer were not drafted with these models in mind. Basic questions remain open: who the exporter is when a user abroad runs a job on an EU-hosted system, whether results returned to that user are controlled, who signs the end-use statement, and what responsibility the provider bears for misuse. Today, providers largely manage these questions through terms and conditions that shift obligations to end users or cloud providers, without assurance that this is sufficient.

At the same time, QuIC members caution against premature regulation. The risks and commercial implications of remote access are not yet well understood, and if the EU acts alone, European providers will be at a disadvantage. Controls should continue to follow the item, and any future approach should be developed step by step, together with industry and in coordination with partners.

What QuIC recommends

- **A safe harbour for remote operation and maintenance.** Clarify through Commission guidance that remote operation, monitoring, calibration, bug fixes and software or firmware updates for lawfully exported quantum systems, whether computers or network equipment, do not constitute a new controlled transfer, provided that no controlled development or production technology is passed on.
- **Distinguish use from know-how.** Clarify the distinction between submitting jobs and receiving results and accessing controlled software, standalone quantum algorithms, source code or technical know-how. Guidance should cover direct cloud access from quantum providers, third-party clouds, HPC-integrated systems, quantum software as well as systems installed at customer sites, with practical examples showing how the actual access and information transferred

affect the assessment. Such guidance should also clarify how export control obligations apply to cross-border cloud access, considering the location of the quantum infrastructure, the end user's location and identity, and the nature of the access provided, particularly when users connect from non-trusted third countries. It should also address the potential applicability of third-country export control regulations.

- **Apply the same logic to quantum communication services.** Confirm that operating a QKD link or network that crosses the EU's external border, delivering keys to users at either end, and managing keys and routing for nodes abroad from a network operations centre in the EU are uses of lawfully exported equipment. They should not count as transfers of controlled technology, provided that no controlled development or production technology is passed on.
- **Practical guidance for providers.** Provide model end-use clauses and proportionate due-diligence guidance clarifying the respective responsibilities of hardware providers, cloud intermediaries and users. Set expectations according to each actor's role and access to information, with clear triggers for further checks and safeguards for confidential customer workloads and provider IP. Model clauses should support compliance without implying that statutory responsibilities can be transferred through contracts.
- **Develop guidance with industry.** Build on the ongoing EU guidance process on intangible technology transfers (ITT) to develop quantum-specific examples with hardware, software and cloud providers [1]. Ensure continued industry involvement through the Dual-Use Coordination Group before considering any regulatory step on cloud-based access, and coordinate with international partners through the relevant multilateral regimes.
- **Apply the same partner definition.** Use the trusted partner definition proposed in Section 2.2 for all guidance on intangible transfers.

2.4 Clarify guidance for exporters and customs

The issue

Debates on quantum export controls often use quantum computing as shorthand. Quantum communication items, however, are controlled under Category 5 Part 2, where control depends on whether an item is designed for quantum cryptography, with no performance threshold. Companies therefore face uncertainty about which network components, such as key management or orchestration software, are captured. The question is sharpest for hybrid products that combine QKD with post-quantum cryptography, where it is unclear whether software that manages QKD keys alongside other keys is itself designed for quantum cryptography. Across all domains, suppliers of enabling sub-assemblies can face the same scrutiny as vendors of complete systems.

Clarity also lacks when it comes to the handling of information provided by exporters. Context-dependent risks are already addressed in practice. When applying for licences, exporters provide detailed information on end use and end users, and several authorities use structured questionnaires on customer due diligence, sanctions circumvention and human rights, such as those of Finland's Ministry for Foreign Affairs.¹⁰ The challenge is not a lack of contextual assessment (as for example provided through Internal Compliance Programmes), but its uneven application across Member States.

What QuIC recommends

- **Guidance for all quantum domains.** Clarify which quantum communication components and software are captured under Category 5 Part 2, and ensure that guidance covers computing, communication and sensing alike. In particular, clarify whether software that manages, stores or routes keys, without itself generating or distributing keys by quantum means, falls under the quantum cryptography entry or the general encryption entries. This would ensure that hybrid QKD and post-quantum products are classified consistently and can use the same general authorisations as comparable encryption products.
- **Capability-based, multilaterally agreed parameters.** In future list reviews, distinguish fully operational systems from enabling components, listed enabling equipment that is controlled in its own right (such as cryogenic cooling systems, parametric amplifiers and cryogenic wafer probers), and the passive sub-assemblies below that level. Any component-level relief should apply to the third tier only; second tier is agreed in the Wassenaar Arrangement, mirrored in partner regimes, and should remain controlled on symmetric parameters so that European suppliers are not pushed from EU licensing into partners re-export rules.
- **Consistent use of existing catch-all provisions.** Instead of new mandatory assessments for exporters, issue Commission guidance to licensing authorities on applying the existing catch-all provisions consistently. Promote standardised questionnaires that draw on existing national practice, and ensure that the contextual justification provided by exporters is taken into account in licensing decisions.
- **Proportionate compliance expectations.** Keep guidance on internal compliance programmes risk-based and proportionate, so that SMEs and research spin-offs can comply without disproportionate cost.

¹⁰ Ministry for Foreign Affairs of Finland, Know Your Customer Form, Sanctions Form and Human Rights Assessment Form for export authorisation applications, available at um.fi.

About QuIC & Contributors

About QuIC

The European Quantum Industry Consortium (QuIC) is a non-profit industry association, founded in 2021, dedicated to the growth of the commercial quantum technology sector. QuIC operates as a collaborative hub throughout Europe, bringing together hundreds of SMEs, large corporations, investors, research and technology organisations, and academic institutes to build a strong, vibrant ecosystem.

Together, members address topics of common interest such as standardisation, intellectual property, trade, and workforce development.

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