CHALLENGE OWNER BRIEF

AI-Driven EMF Exposure Mapping & Hotspot Identification

Malta Communications Authority · Malta · 5G-DiGITs Accelerator Programme

Challenge Owner: Malta Communications Authority (MCA)
Country: Malta
Sector: Public Administration — National Regulatory Authority
Website: www.mca.org.mt
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BACKGROUND

The deployment of modern mobile networks, particularly 5G and beyond technologies employing adaptive antenna systems and beamforming technologies, has increased the complexity of assessing and monitoring radio frequency electromagnetic field (RF-EMF) exposure in urban environments.

The Malta Communications Authority (MCA), as the national regulatory authority for electronic communications in Malta, is responsible for monitoring and ensuring compliance with RF-EMF exposure limits established in national legislation. To support evidence-based regulatory oversight, MCA is seeking innovative approaches that combine real-world measurements, network deployment information and geospatial data to improve the prediction, visualisation and assessment of RF-EMF exposure across urban environments.

THE CHALLENGE

Participants are challenged to develop an AI-driven RF-EMF exposure analysis platform that improves the ability to identify, predict and characterise spatial exposure patterns and potential hotspots in urban environments through the integration of measurement, network and geospatial data.

> Core Challenge: Develop an AI-centric methodology and toolset for improved modelling, mapping and prediction of RF-EMF exposure across a national territory, with a particular focus on identifying potential hotspots in locations that are difficult or impractical to measure directly.

The solution should address the following key challenges:

- **Data integration** — Combine real-world RF-EMF measurement data with geospatial and network topology data to build a comprehensive exposure model
- **Hotspot identification** — Identify and predict RF-EMF exposure hotspots in inaccessible or under-measured locations, including rooftops and elevated sites
- **Adaptive antenna modelling** — Account for the dynamic beamforming behaviour of 5G and beyond antenna systems in RF-EMF exposure assessments by taking into account dynamic changes to the antenna pattern characteristics.

- **Validation framework** — Develop an approach to validate model outputs against available measurement data, addressing limitations in data availability and measurement accuracy, along with explainability where relevant.
- **Scalability** — Ensure the methodology is scalable and repeatable for ongoing compliance monitoring purposes

SCOPE — 3-MONTH ACCELERATOR PROGRAMME

- **Baseline analysis** — Review and analyse existing RF-EMF measurement datasets, GIS datasets and network topology data available from MCA
- **AI model development** — Develop or adapt AI-prediction techniques to predict RF-EMF exposure, incorporating beamforming characteristics
- **Hotspot mapping** — Apply the model to identify and visualise potential exposure hotspots across the Maltese territory
- **Validation** — Validate model outputs against available reference measurements and document accuracy, limitations, and confidence levels
- **Regulatory applicability assessment** — Evaluate the feasibility of deploying the approach as a decision-support tool for MCA's ongoing compliance monitoring framework
- **Documentation & recommendations** — Deliver a technical report with methodology, results, and a roadmap for operational deployment along with an AI-risk assessment.

WHAT MALTA COMMUNICATIONS AUTHORITY OFFERS

- **Real regulatory data** — Access to existing RF-EMF measurements, GIS datasets and indicative network topology information maintained by MCA. Where data may not be disclosed due to privacy or confidentiality, MCA will endeavor to support in the creation of synthetic data.
- **Regulatory expertise** — Direct engagement with MCA technical staff to understand compliance requirements, data constraints, and validation standards
- **National testbed** — Malta as a uniquely compact, high-density national territory offers an ideal-scale environment to develop and test a scalable methodology
- **Deployment pathway** — MCA is genuinely interested in adopting a validated approach operationally, providing a clear and credible real-world impact pathway
- **European regulatory context** — Insights into the broader EU regulatory landscape in the area of RF-EMF exposure monitoring.

WHY THIS CHALLENGE MATTERS

As mobile networks evolve, regulators require more sophisticated tools to understand, predict and assess RF-EMF exposure in increasingly complex network environments. An AI driven approach capable of combining measurement data, network information and geospatial intelligence could significantly improve exposure assessment, hotspot identification and evidence-based compliance monitoring, not just for Malta, but as a replicable model for regulators and potentially also industry across Europe and globally.

A team that delivers a validated, compliance-grade approach in this programme creates a proof-of-concept with relevant real-world impact, as well as a strong foundation for academic publication, further R&D investment, and commercial application across the growing regulatory technology market.

ABOUT MALTA COMMUNICATIONS AUTHORITY

The Malta Communications Authority (MCA) is the independent national regulatory authority responsible for regulating electronic communications networks and services in Malta.

In the area of electromagnetic fields, MCA monitors and assesses compliance with RF-EMF exposure limits established in national legislation and applicable regulatory frameworks. The Authority also plays an important role in spectrum management, network oversight and the development of regulatory approaches that support the continued evolution of electronic communications networks.

Malta, as a small island state with a compact but high-density communications infrastructure, offers a unique and tractable environment for developing and testing scalable regulatory methodologies.

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Programme: 5G-DiGITs Accelerator — ERASMUS-EDU-2024-PI-ALL-INNO — Grant 101186590

CHALLENGE OWNER BRIEF

Safer Public Spaces with 5G, Sensors & Digital Twins

Karlstad Municipality · Sweden · 5G-DiGITs Accelerator Programme

Challenge Owner: Karlstad Municipality
Country: Sweden
Sector: Public Sector / Smart City
Website: www.karlstad.se
Correspondence: Mikael Holmgren, Strategist — mikael.holmgren@karlstad.se

BACKGROUND

Cities today deploy a wide range of safety technologies — cameras, sensors, communication systems — but these tools rarely operate as an integrated system. The result is fragmented situational awareness, slower response times, and a limited ability to anticipate and prevent incidents in public spaces.

Karlstad Municipality, as part of its Smart & Sustainable Karlstad initiative, is seeking to change this by offering a real-world urban testbed for innovation at the intersection of 5G connectivity, IoT sensing, and digital twin technology. With a population of approximately 100,000 and a strong commitment to sustainable urban development, Karlstad is ready to provide access to live environments, municipal data, and stakeholder engagement to support the development and validation of solutions.

THE CHALLENGE

Participants are challenged to design and prototype a digital twin of a public space, powered by real-time 5G-enabled sensor data, that enables the following capabilities:

- **Real-time risk detection** — identify safety risks and anomalies in public environments as they emerge
- **Shared situational awareness** — provide a common operating picture across relevant municipal response teams
- **Coordinated incident response** — enable fast, data-driven decision-making through integrated visualisation

> The solution should demonstrate how 5G connectivity, IoT sensors, and digital twin architecture can work together as a unified safety management system — moving beyond isolated tools toward an integrated platform that municipalities can operate and scale.

SCOPE — 3-MONTH ACCELERATOR PROGRAMME

- **Location** — Focus on 1 defined public space within Karlstad

- **Scenarios** — Cover 2–3 defined real-world safety scenarios
- **Prototype** — Deliver a working prototype covering data ingestion, analytics and visualisation
- **Scalability concept** — Produce a governance, data ownership and privacy framework for wider deployment

WHAT KARLSTAD MUNICIPALITY OFFERS

- **Live testbed** — Access to a real urban environment within Smart & Sustainable Karlstad
- **Data & infrastructure** — Municipal datasets and defined use cases for development and testing
- **Stakeholder engagement** — Direct access to municipal decision-makers and operational teams throughout the programme
- **Co-creation** — Active partnership with a municipality committed to deploying validated solutions

WHY THIS CHALLENGE MATTERS

Urban safety is a global priority. A solution validated in a live city environment such as Karlstad has direct potential for replication across European and global municipalities. Participants gain access to a real deployment context, genuine co-creation with public sector stakeholders, and the opportunity to build a scalable product for a significant and growing market.

ABOUT KARLSTAD MUNICIPALITY

Karlstad is a mid-sized Swedish city of approximately 100,000 inhabitants, known for its quality of life, innovation culture, and close proximity to Karlstad University. The municipality actively pursues digital transformation across public services, infrastructure, and urban management under the Smart & Sustainable Karlstad framework. Karlstad has a strong track record of piloting and scaling technologies that improve quality of life for its residents and has positioned itself as a living lab for smart city innovation in the Nordic region.

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Programme: 5G-DiGITs Accelerator — ERASMUS-EDU-2024-PI-ALL-INNO — Grant 101186590

CHALLENGE OWNER BRIEF

5G/6G ISAC & Digital Twin Sensing: Bridges, Safety & Beyond

Tieto Tech Consulting R&D · Sweden · 5G-DiGITs Accelerator Programme

Challenge Owner: Tieto Tech Consulting R&D
Country: Sweden
Sector: R&D / Telecoms
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BACKGROUND

The convergence of sensing and communication is one of the defining frontiers of next-generation wireless networks. Integrated Sensing and Communication (ISAC) — a core pillar of emerging 6G standards — enables mobile network infrastructure to simultaneously transmit data and sense the physical environment using the same radio signals. This dual capability opens transformative possibilities for smart cities, critical infrastructure monitoring, and public safety applications.

Tieto Tech Consulting R&D, a Swedish organisation specialising in telecoms R&D, is proposing a challenge at the frontier of ISAC technology, digital twin simulation, and real-world infrastructure monitoring. The primary use case is bridge structural health monitoring — a critical and underserved domain — with an optional extension into fire detection as a further demonstration of ISAC's environmental sensing potential.

THE CHALLENGE

Participants are challenged to use a digital twin environment — leveraging tools such as Sionna RT (NVIDIA's GPU-accelerated ray-tracing channel simulator) or equivalent frameworks — to simulate and implement ISAC-based sensing of real-world physical phenomena. The challenge is structured in two tracks:

> Core Track — Bridge Structural Health Monitoring: Simulate 5G/6G ISAC sensing of a vibrating bridge structure using a digital twin. Analyse vibration frequency and amplitude from reflected radio signals, demonstrating the feasibility of non-intrusive structural health monitoring via wireless sensing.

> Extended Track (optional / advanced) — Fire Detection: Implement a simulation of a fire scenario detectable within the digital twin environment using ISAC sensing techniques, exploring 5G/6G networks as distributed environmental sensing infrastructure.

Both tracks require participants to demonstrate how 5G/6G radio signals, modelled through accurate channel simulation, can serve as a sensing medium for physical-world events — bridging the gap between network simulation research and deployable infrastructure applications.

SCOPE — 3-MONTH ACCELERATOR PROGRAMME

- **Digital twin setup** — Configure a simulation environment (e.g. Sionna RT or equivalent) representing a bridge or urban infrastructure scenario
- **ISAC sensing model** — Implement signal transmission and reflection modelling to capture structural vibration data from radio channel responses
- **Signal processing & analysis** — Develop methods to extract structural health indicators (frequency, amplitude) from simulated radio channel data
- **Extended scenario (optional)** — Model and demonstrate fire detection using environmental changes sensed via ISAC within the digital twin
- **Proof of concept & documentation** — Technical report and PoC demonstrating feasibility and a credible path toward real-world deployment

WHAT TIETO TECH OFFERS

- **Domain expertise** — Direct access to senior R&D expertise in 5G/6G system architecture, ISAC and channel modelling
- **Technical mentoring** — Hands-on guidance on simulation toolchains, Sionna RT, and ISAC methodology throughout the programme
- **Research resources** — Access to relevant technical literature, problem framing and R&D knowledge assets
- **Industry validation** — Expert evaluation of outputs from a telecoms R&D perspective, strengthening the credibility and publishability of results

WHY THIS CHALLENGE MATTERS

Structural health monitoring of bridges and critical infrastructure is a global challenge. Traditional sensor installations are costly, require physical access, and offer limited spatial coverage. ISAC-enabled sensing via 5G/6G network infrastructure could eliminate these barriers, enabling continuous, non-intrusive, large-scale monitoring at dramatically lower cost.

This challenge positions participants at the cutting edge of both academic research and commercial application. A credible simulation-based demonstration creates a direct foundation for real-world trials with network operators, infrastructure owners, municipalities, and smart city programmes — representing a significant and growing commercial opportunity in a field where few validated solutions yet exist.

ABOUT TIETO TECH CONSULTING R&D

Tieto Tech Consulting R&D is a Swedish R&D organisation with deep expertise in 5G and next-generation wireless systems. The organisation contributes to the advancement of network technology through applied research, system analysis, and industry collaboration. Bengt Hallinger, Lead System Analyst, brings extensive experience in telecoms R&D and is an active contributor to the technical community in advanced wireless communications and 6G research.

Challenge Owner: Tieto Tech Consulting R&D — tieto.com

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Programme: 5G-DiGITs Accelerator — ERASMUS-EDU-2024-PI-ALL-INNO — Grant 101186590

CHALLENGE OWNER BRIEF

AI-Driven Situational Awareness for Emergency Response on Private 5G Networks

Opticoms GmbH · Germany · 5G-DiGITs Accelerator Programme

Challenge Owner: Opticoms GmbH
Country: Germany
Sector: Telecommunications — Private 5G Networks
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BACKGROUND

First responders — firefighters, paramedics, search and rescue teams, and disaster management coordinators — operate in some of the most demanding and data-intensive environments imaginable. Yet the communications infrastructure available to them in crisis scenarios is frequently unreliable, fragmented, or entirely absent. When buildings collapse, wildfires spread, or flood events unfold, the ability to maintain real-time shared situational awareness across a dispersed response team can be the difference between effective coordination and operational breakdown.

Opticoms GmbH is a German telecommunications SME developing SARP — an agile, deployable Private 5G network infrastructure purpose-built for emergency response, first responder operations, and disaster management scenarios. At the heart of the SARP ecosystem is OTAG, a unified Network and Operations Management Platform that translates raw data from the 5G network and connected field devices into actionable, real-time operational intelligence for incident commanders.

THE CHALLENGE

Participants are challenged to design and build a prototype AI-driven situational awareness module for the OTAG platform, demonstrating how a secure, high-bandwidth Private 5G network can power next-generation operational management for emergency response teams. The solution should enable incident commanders to maintain a comprehensive, real-time operational picture and respond proactively to rapidly evolving field conditions.

> Core Challenge: Build a prototype operational intelligence module for a Private 5G emergency response network that integrates real-time telemetry, AI-driven predictive alerting, and automated incident workflow management — turning raw field data into actionable decisions for incident commanders.

The solution should address three interconnected capabilities:

- **Real-time operational dashboard** — An intuitive, high-performance map-based interface that tracks the real-time location and status of personnel, equipment, and active 5G network nodes across the incident area

- **AI-driven predictive alerting** — An analytics engine that processes incoming sensor telemetry — IoT device health, environmental metrics, personnel biometrics, network status — and generates proactive, prioritised safety and operational warnings for the incident commander
- **Automated incident workflow management** — Dynamic response logic that reacts automatically to field changes — such as re-routing rescue team workflows, triggering escalation protocols, or pushing critical updates when a device, node, or personnel unit goes offline or enters a hazard zone

SCOPE — 3-MONTH ACCELERATOR PROGRAMME

- **Platform architecture** — Design the data ingestion and processing architecture for the module, compatible with Private 5G network data streams
- **Dashboard prototype** — Build a functional real-time operational dashboard with map-based situational display and multi-entity tracking
- **AI alerting engine** — Develop a prototype analytics engine for processing sensor telemetry and generating prioritised, real-time safety alerts
- **Workflow automation** — Implement at least one automated incident response workflow demonstrating dynamic reaction to a field event
- **Integration concept** — Document how the module would integrate with the OTAG platform and the SARP Private 5G network infrastructure
- **Demonstration & documentation** — Deliver a working prototype demonstration and technical report suitable for further development and investor presentation

WHAT OPTICOMS GMBH OFFERS

- **Technical platform access** — Relevant technical context and documentation to support prototype development
- **Domain expertise** — Operational context and guidance on emergency response use cases from the Opticoms team
- **Real-world deployment context** — A real-world product development context with a genuine interest in taking compelling solutions further
- **Pilot opportunity** — Opticoms will review and evaluate all prototype solutions presented at Demo Day
- **Commercial ecosystem visibility** — Exposure to Opticoms' broader network of partners and stakeholders in the private 5G and emergency services space

WHY THIS CHALLENGE MATTERS

Effective emergency response coordination saves lives. The gap between the communications technology available to commercial enterprises and that deployed in crisis scenarios represents one of the most consequential digital divides in public safety. Private 5G networks offer the bandwidth, latency, and reliability to close that gap — but only if the software layer can translate network capability into operational intelligence in real time.

A team that builds a compelling prototype in this programme creates a directly commercialisable module for a market that is growing rapidly across Europe and globally, as governments and emergency services increasingly invest in next-generation communications infrastructure for public safety. The combination of AI, real-time data processing, and Private 5G is at the frontier of both technology and societal impact.

ABOUT OPTICOMS GMBH

Opticoms GmbH is a German telecommunications SME specialising in Private 5G network infrastructure and operational management platforms. The company is developing SARP — a modular, deployable Private 5G system designed for high-demand, mission-critical environments including emergency response, disaster management, and first responder operations. Opticoms combines deep telecoms engineering expertise with a strong focus on real-world operational applicability, building solutions that function in the demanding conditions where connectivity matters most.

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CHALLENGE OWNER BRIEF

5G Network Slicing & Telco API Platform for Dynamic, Demand-Based Premium Services

TürkTelekom (TT Mobil) · Turkey · 5G-DiGITs Accelerator Programme

Challenge Owner: TürkTelekom — TT Mobil İletişim Hizmetleri A.Ş.
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BACKGROUND

Fifth-generation (5G) mobile networks represent a fundamental paradigm shift in wireless communications. Beyond delivering significantly higher data speeds for enhanced mobile broadband, 5G introduces two additional pillars that open transformative new service possibilities: ultra-reliable low latency communications (URLLC) and massive machine-type communications (mMTC).

Two key innovations sit at the heart of 5G's commercial potential. The first is **network slicing** — a virtualisation technique that divides a single shared physical network into multiple independent virtual networks, each custom-tailored to specific performance requirements such as bandwidth, latency, and security. This allows different applications and services to run optimally without interfering with one another. The second is **global telco APIs**, developed through the Linux Foundation CAMARA open-source project, which form the fundamental building blocks of Network-as-a-Service (NaaS). Together, these capabilities position mobile network operators to create and deliver differentiated, premium services dynamically on demand.

The commercial opportunity is significant. Subscribers using data-intensive applications — gaming, video streaming, remote work, AR/VR — at locations where standard service quality falls short of optimum performance are willing to pay for differentiated connectivity. However, since subscribers engage with applications and services directly, rather than with the network operator, it is the application and service layer that must detect the need, request the enhanced service, and deliver the premium experience.

THE CHALLENGE

TürkTelekom challenges participants to design and build a platform that enables applications and services to dynamically connect with and integrate into mobile network operators' capabilities — leveraging network slicing and global telco APIs to deliver premium, value-added services to subscribers on a need basis.

> Core Challenge: Build a platform and formulate use cases for applications and services that facilitate their dynamic connection and integration with network operators, enabling the delivery of premium services to subscribers by taking into account: the availability of

improved connectivity, the location of users, past user behaviour, and network information accessible through global telco APIs.

The platform should address the full service delivery chain:

- **Context-aware connectivity detection** — Identify when a subscriber's application requires enhanced network performance based on location, usage pattern, and available 5G capabilities
- **Dynamic API integration** — Connect to network operator systems via CAMARA-standard global telco APIs to request and activate the appropriate network slice or premium service tier
- **Demand-based service orchestration** — Activate, manage, and release premium connectivity dynamically based on real-time subscriber need, ensuring seamless user experience without unnecessary cost
- **Use case development** — Define and demonstrate 2–3 concrete application use cases where the platform delivers measurable performance improvements for end users through dynamic network integration

SCOPE — 3-MONTH ACCELERATOR PROGRAMME

- **Platform architecture** — Design and prototype a platform capable of integrating with network operator APIs using CAMARA / NaaS standards
- **Telco API integration** — Implement at least one live or simulated integration with a global telco API to request dynamic service differentiation
- **Use case prototypes** — Develop and demonstrate 2–3 application use cases showing real-world premium service activation based on subscriber context and network availability
- **Business model analysis** — Outline the commercial model through which applications and services could offer and charge for premium experiences enabled by dynamic network integration
- **Documentation** — Deliver a technical specification, working prototype demonstration, and recommendations for scaling and commercial deployment

WHAT TÜRKTELEKOM OFFERS

- **Industry expertise** — Technical guidance from TürkTelekom's R&D and network engineering teams on 5G network slicing, CAMARA APIs, and NaaS architecture
- **Network knowledge** — Insights into real-world 5G deployment configurations, service tiers, and operator API capabilities from one of Europe and Asia's leading integrated telecoms groups
- **Use case context** — Guidance on commercially relevant service scenarios where network-aware, demand-based premium services can generate real subscriber value
- **Evaluation & feedback** — Expert review of prototypes and use cases at Demo Day from TürkTelekom's technical team

WHY THIS CHALLENGE MATTERS

The ability for applications to dynamically request and consume differentiated network resources is the fundamental value proposition of 5G for operators, developers, and end users alike. Without a robust application-layer integration platform, the commercial potential of network slicing and telco APIs remains largely unrealised. A working solution in this space addresses one of the most significant commercial gaps in the 5G ecosystem.

A team that builds a compelling platform prototype opens a direct pathway to commercialisation across all markets where 5G operators are actively seeking ways to monetise their network investment — a global opportunity spanning telecoms, enterprise, gaming, media, healthcare, and smart city applications.

ABOUT TÜRKTELEKOM

TürkTelekom, with more than 180 years of history, is the first integrated telecommunications operator in Turkey and one of the largest in the region. Operating through TT Mobil İletişim Hizmetleri A.Ş. (mobile network operator) and TTNET A.Ş. (broadband services), TürkTelekom offers a comprehensive range of individual and corporate services including mobile, internet, fixed-line and TV under a single integrated brand. With extensive 5G deployment experience and one of the region's most advanced network infrastructures, TürkTelekom is at the forefront of next-generation network innovation and commercialisation.

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