



# **Digirail Project and Junakalusto - Request for Information 2022**

## **Fitment of Sm5 for ERTMS tests and ATO and rolling stock integration**





## REQUEST FOR INFORMATION

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## REQUEST FOR INFORMATION

# 1 THE DIGIRAIL PROJECT DESCRIPTION

## 1.1 FOUNDING OF THE DIGIRAIL PROJECT AND MEMBERS

Finland has committed to the implementation of ERTMS on its national railway network. The ERTMS implementation is to be carried out by a national ERTMS program called the Digirail project. The Digirail project is an important part of the 12-year National Transport System Plan.

The Digirail project has been established by Finnish Ministry of Transport and Communications (LVM) and Finnish Transport Infrastructure Agency (Väylä). Key players in the Finnish Railway sector are members of the project, these include Fintraffic (Traffic management), Traficom (NSA), HSL (local PTA), rolling stock owners and railway undertakings.

## 1.2 FUNDING OF THE DIGIRAIL PROJECT

The Finnish parliament has granted LVM the required funding (€130 million) for the project to reach the end of the development and verification phase, including the implementation of the first commercial ETCS line, and the start of the rollout phase. This should be completed by 2027. The budget includes an allowance for fitment of test vehicles for the test track.

The total value of the procurements is estimated to be around €1.7 billion. This includes purchasing equipment for infrastructure and rolling stock. Preparations for the first procurements are already underway. Currently it is envisioned that as rollout happens, also most (or all) of the current interlockings and traffic management systems are replaced to ensure future proof and efficient modernisation program. In addition, in the future there will be ETCS greenfield projects if current plans for the new highspeed tracks materialise.

## 1.3 IMPLEMENTATION OF ETCS AND ATO TEST TRACK

As part of the Digirail project, an ETCS and ATO test track is being implemented. The estimated completion date is Q4 / 2023. The test track will be implemented between Kouvola – Kotka/Hamina which has a track length of 80 km.

The line will be fitted with ETCS according to baseline 3 release 2 under a contract between Finnish Transport Infrastructure Agency and Thales Finland / Deutschland signed in 2021. The scope of the contract involves the provision and installation of IXLs and RBCs. The aim is that RBC and ETCS OBU would communicate through pre-FRMCS utilizing of networks of commercial MNOs. This is the preferred communication method for ATO as well (ATO-OB – ATO-TS).

### 1.4 THE FIRST COMMERCIAL ETCS LINE IN FINLAND

The rollout of the radio based ETCS signalling will start from the track section Lielähti-Rauma/Pori. The first RFQs for Lielähti-Rauma/Pori ETCS hybrid level 3 solutions are planned to be send out during the year 2023. The line is consisting of 191 track kilometres. The line is situated at western Finland (see the red line on Figure 1).

The implementation of the ERTMS wayside system for the line will fulfil the specifications of the new ERTMS baseline according to CCS TSI 2022.

### 1.5 ROLLOUT

The goal of the Digirail is to introduce a modern radio based European train control system for the entire Finnish rail network by the 2040s. Please see map of rollout below. This plan presents the schedule for the implementation, procurement strategy of the infrastructure for the rollout is still to be decided i.e., whether one or several suppliers will be tendered.

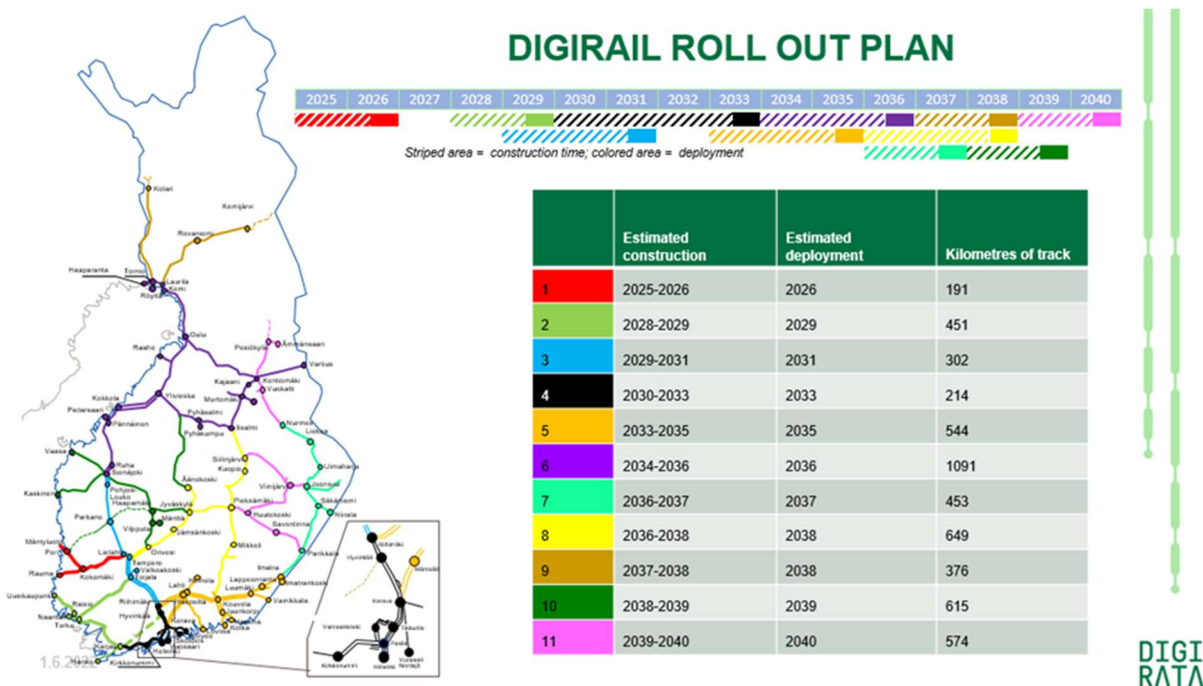


Figure 1. ETCS rollout plan (initial plan, subject to change)

For the rollout the Digirail project aims for a technically advanced solution, the key features of which are:

- Hybrid level 3
- ETCS and ATO data transmission utilising the FRMCS network, instead of GSM-R, using commercial 5G networks
- ATO GoA2 level, also utilising selected features from higher grades of automation later
- The latest baseline of CCS TSI 2022

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## 1.6 MODERN Sm5 EMUS AS TEST VEHICLES FOR ETCS AND ATO

For the Digirail project, two Stadler Flirt-type Sm5 train units are planned to be equipped with necessary test equipment such as ETCS, STM, ATO and FRMCS. Before the start of the actual procurement of the equipment for two Sm5 train units Junakalusto, as vehicle owner, and the Digirail project are gathering information about potential suppliers and their solutions. At this stage no further procurements are directly linked to the procurement of the test equipment.

The two Sm5 units will be used for tests on the ETCS test track and on the first commercial ETCS line starting year 2026. The testing emphasis will initially be at the test track but will continue on the first commercial track when it's ready. Homologation of ETCS and other equipment for Sm5 train units is not needed either for the test track or for the first commercial ETCS line. Between the tests the trains will operate in commercial service with the test systems isolated.

The Sm5 EMUs are the only rolling stock which will be equipped with ATO for the test track. The ambition of the Digirail project is not to just develop a test track, but to complete a national rollout of an ATO solution. Therefore, any potential solutions for the test trains must move Digirail towards that goal. ATO-TS of the test track will not be connected to a TMS. The plan for the test track is to test the EMUs and virtual/emulated TMS interface. The upcoming procurement for the Sm5 fitment for test purpose will include ATO-TS for the test track.

The first commercial track will be commissioned in the end of 2026. The objective is to gain knowledge about ETCS Level 3 / Hybrid level 3 and ATO-TS to TMS interface.

In the development and verification phase of the project, the implementation of the Finnish ERTMS rollout, in terms of technology, will be defined. The test vehicles will have an important role as they provide input for the preparation of the procurement specification for the rollout. Therefore, the supplier of the equipment will get a unique opportunity to influence solutions that will be of considerable future importance for the railway sector in Finland. The Digirail project is also openly interested in utilising the supplier's current and future product development to maximise project benefits.

It is expected that the supplier of the test equipment for the two Sm5 train units will have an in-country presence during the laboratory and at field tests. The Digirail project has an important objective to increase ERTMS-related expertise in Finland and as such is not willing to enter a pure remote relationship with the supplier.

News about the progress of the Digirail project can be read from <https://digirata.fi/en/>.

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## 2 REQUEST FOR INFORMATION

### 2.1 FITMENT OF SM5 UNITS FOR TEST AND PROCUREMENT OF THE EQUIPMENT

There is an ambition that the original train manufacturer would act as the integrator of the equipment in cooperation with Junakalusto. The integration of the equipment would include necessary design and installation. The aim is also to implement a TSI 2022 compliant interface for ATO on the TCMS of Sm5 trains.

We're interested in receiving supplier's feedback as to the level of interest for the supply of Sm5 test equipment in the following two scenarios (Q1 and Q2).

Q1: The original train manufacturer acts as integrator of the equipment

The scope of the procurement would include the equipment delivery and partnership until the end of 2027 according to target of the Digirail project (see Q4 for more details), including updates and error corrections for the delivered equipment and local presence of the experts of a supplier at limited extent.

As a supplier, are you interested in offering according to the above in the coming procurement that is being prepared? Please indicate preferred conditions and possible remarks.

Q2: A Supplier acts as integrator of the equipment (the original train manufacturer is not involved)

Otherwise, the delivery content is the same as in Q1.

ATO interface is implemented with an ATO adapter instead of TCMS interface.

As a supplier, are you interested in offering according to the above in the coming procurement that is being prepared? Please indicate preferred conditions and possible remarks.

Q3: Do you identify any other possible scope(s) for the delivery?

Q4: The test equipment that is planned to be procured for the two Flirt Sm5 trains will be defined by the needs of the Digirail project.

The following positions (1-12) together represent the delivery content in line with the objectives of the Digirail project.

Junakalusto and the Digirail project are interested in what equipment a supplier can offer for the two Sm5 units and what is a potential delivery date for those.

For each position below, a supplier is asked to complete the following information:

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- a) Does a supplier see that it could commit to supply the element as part of the procurement? *Yes or no*, if no, please give reasoning.
- b) Is it possible to offer this element for a fixed price? *Yes or no*
- c) Is it possible to commit to a fixed delivery time (accuracy of a few months)? *Yes or no*, if yes, what would be the earliest delivery date assuming the potential agreement would be signed in May 2023? (*mm/yyyy*)
- d) If a) is possible but b) and / or c) are not possible, does a supplier have a proposal on the commercial and other terms under which the element in question could be however included in the agreement?
- e) Any additional comments from the supplier
  1. ETCS OBU L2, BL3 R2
    - To be used in tests at the test track
  2. ETCS OBU L2, the latest baseline of CCS TSI 2022
    - To be used at the first commercial ETCS line for testing
    - Is there a need also for a hardware change when updating BL3 R2 -> the latest baseline of CCS TSI 2022?
  3. ETCS OBU L3, the latest baseline of CCS TSI 2022 and TIMS
    - To be used at the first commercial ETCS line for testing
  4. STM, BL3 R2
    - To be used in tests at the test track
  5. STM, the latest baseline of CCS TSI 2022
    - To be used at the first commercial ETCS line for testing
  6. ATO-OB basic delivery
    - To be used in tests at the test track
    - To be used at the first commercial ETCS line for testing
    - GoA2
    - Compliant to TSI 2022
  7. ATO-OB future delivery
    - software development until 2028
      - error corrections
      - possibility to test updates which a supplier has developed in its development process
      - update the system according to the next TSI version after TSI 2022
  8. ATO-TS for test track
    - To be used in tests at the test track

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- Intended only for tests with Sm5 units
  - GoA2
  - Compliant to TSI 2022
  - No TMS interface
9. ETCS data over pre-FRMCS
- To be used in tests at the test track
  - delivery shall contain pre-FRMCS onboard equipment for ETCS data
    - compliance with the specification of the Digirail project
    - pre-FRMCS wayside is out of scope
  - As a non-preferred backup option, the onboard equipment could be provided by the Digirail project
  - Upgrades might be necessary for the first commercial track
10. ATO-OB data over pre-FRMCS
- Delivery shall contain pre-FRMCS onboard equipment for ATO-OB data (can be same multi-channel router)
    - compliance with the specification of the Digirail project
11. Presence of experts of a supplier in Finland in the Digirail laboratory and field tests
- Local presence of supplier's technical specialists
  - Billing on daily basis
  - Limited amount of days
    - max. e.g. 90 days during years 2025-2027 (please comment at subsection e))
  - NOTE: Items c) and d) are not applicable for this position.
12. Expert work
- For potential needs of the Digirail project, e.g. support for:
    - setting up a test facility relating to supplier's equipment at the Digirail laboratory
    - preparing technical documents such as technical specifications
  - Billing on hourly basis
  - Limited amount of hours
    - max. e.g. 500 hrs (please comment at subsection e))
    - work could be organized remotely e.g. via MS-Teams by default
  - NOTE: Items c) and d) are not applicable for this position.

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## 2.2 ATO

The purpose of the questions in the following section is to increase ATO-related understanding in the Digirail project. Responses are also considered as input when preparing the procurement of the Sm5 test equipment.

### 2.2.1 ERTMS references

Q5: How your organisation is involved in the development of the ATO standards, for example Shift-2-Rail, EU-Rail or other development projects related to ATO?

Q6: What are the most significant ERTMS/ATO (ATO over ETCS) projects that your organisation has been involved with?

Q7: Have you installed ETCS and/or ATO on Stadler FLIRT trains? Please describe the project(s) briefly.

### 2.2.2 Maturity of the Subsets

Q8: Have you already identified some shortcomings in the drafts of coming TSI and subsets, or do you see that the current versions enable implementation of efficient ATO, and are detailed enough?

### 2.2.3 ATO On-board – TCMS Interface

As described above, Digirail's aim is to install an ATO-Onboard (ATO-OB) system on the Stadler Sm5 test trains. A major interface of this system will be between the ATO-OB and the Sm5 TCMS (Train Control & Management System).

The ATO-OB – TCMS interface is expected to be compliant with the 2022 release of the ATO TSI. There are currently two possible solutions to implement this interface identified by the Digirail project, although it is important to note that the Digirail project remains open to ideas and suggestions of alternative approaches from the supplier. The two suggested ideas are:

- 1) Modification of the Sm5 TCMS by rolling stock manufacturer
- 2) The induction of an ATO-adapter, which would abstract the ATO supplier from the TCMS software.

Preliminary feasibility study regarding technical implementation of ATO adapter in Sm5 has been done by Digirail project. The analysis shows that this solution is feasible as well.

Q9: Would you as a supplier prefer ATO-OB – TCMS interface according to TSI 2022 or the implementation of an ATO adapter? What do you see as the advantages and disadvantages of each approach?

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Q10: If the implementation is based on the ATO adapter it would be provided by either a supplier or the Digirail project. Do you prefer as a supplier that the Digirail project would provide the ATO adapter or whether the supplier would prefer to implement the adapter itself? What do you see as advantages and disadvantages of each approach?

#### 2.2.4 ATO On-board – ETCS Onboard Interface

Q11: Will this interface (Subset-130) be included in your ETCS OBU as a standard or will it be optional?

#### 2.2.5 Low Adhesion

We have identified management of low adhesion as one of the challenging features for our project. Due to the climate and tree coverage in Finland, it is very common for trains to experience low adhesion. We are keen to understand best practices for low adhesion control with ATO systems, not only for the ATO-OB but also TMS and how low adhesion information can be shared and utilised between train units.

Q12: Do you have suggestion of how to transfer information about low adhesion from the rolling stock systems to the ATO-OB system?

#### 2.2.6 Sanding

Currently sanding is frequently used in Finland as a mitigation to improve both acceleration and braking characteristics. The rolling stock doesn't have all information to apply sand optimally because it doesn't know whether it is running late against the timetable or whether it is overshooting the braking points. The decision whether to apply sand or reduce traction requests must be undertaken in ATO based on current driving profile and timetable. We are keen to understand if and how this can be utilised by ATO.

Q13: Do you have plans to include sanding functionality into your ATO-OB system? If yes, how have you planned the implementation of the optimisation between applying sand

- or reducing tractive effort? (use of sanding consumes sand and causes higher wheel wear)
- or reducing braking effort (use of sanding might be needed during braking if there is a risk of overshooting the braking point of MA)

#### 2.2.7 Traction and Brake Control

The brake control of a Sm5 train is so called C type. Nevertheless, the drivers are applying manually pneumatic brake in parallel to blended brake controlled by a computer, for example when a train is approaching to neutral sections. This helps to avoid high jerks and improves passenger comfort. Digirail is keen to understand how ATO can be customised to enable similar functionality.

Q14: Does your ATO-OB system support both C- and S-type control of brakes?

Q15: How does ATO-OB optimise the brake control on demanding situations to maximise passenger comfort?

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Q16: How can your ATO-OB be customised and optimised for the traction and braking characteristics of different rolling stock?

### 2.2.8 Automatic Turnback and higher grades of automation

The Digirail project sees Helsinki station as a critical node on the Finnish network due to both the frequency of the service pattern and the fact that it is a terminal station with no through platforms. Therefore, the Digirail project is keen to optimize traffic in Helsinki and ERTMS provides some interesting features which we are aiming to test, in addition to the mentioned GoA2 functionalities. Such features include e.g. perception, automatic turnback, positioning, supervision, and optimization of door closure to reduce dwell times etc.

Q17: What is your roadmap for higher automation grades? And are you interested in testing upcoming features in the Digirail project already based on drafts of standards, prior to publication of them, for example automatic turnback?

Q18: What is your timeline and pre-requests for implementing and testing automatic turnback?

Q19: Have you implemented automatic turnback in any of your ETCS projects (commercial or non-commercial) already and if so, please provide a short description of the solution(s).

Q20: Do you have any experience of solutions which monitor and predict passenger movements at stations to optimize door control to reduce dwell times? If yes, please give a short description of the solution(s).

### 2.2.9 Laboratory

Digirail is planning to develop a lab for the CCS testing for both the test track and national rollout. It is currently proposed that this is an integrated lab with ATO, TMS, ETCS with real “hardware in the loop”

Q21: What are your lessons learnt from using laboratories in other ATO projects? What could be tested and what couldn't? Can you provide some good example projects?

Q22: if the customer requires testing of the delivered equipment in his laboratory, what are the requirements for the lab? Do you have any recommendations for the customer lab?

Q23: Does your equipment provide some additional interfaces to aid automatic testing?

Q24: What kind of lab do you have? Could the lab be used for customer testing?

## 2.3 GENERAL ROLLING STOCK-RELATED QUESTIONS

The purpose of the questions of the following section is to increase understanding of the rolling stock owners when they are preparing for the procurement of onboard ETCS. Responses are also considered as input when preparing the procurement of Sm5 test equipment, excluding 2.3.1 and 2.3.7.

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### 2.3.1 Double-fitment of ETCS and class B (JKV) with a common DMI and without STM

It is under investigation in the Digirail project whether it could be possible to avoid need for STM in the retrofit of the existing rolling stock equipped with JKV to limit cost for RS owners. At the system level the key question is whether exchange between ATP systems is possible in motion automatically i.e. controlled by the JKV balises and ETCS balises. Feasibility in each vehicle type depends on available space for antennas in underframe. The target is that retrofitted rolling stock would have both ETCS and JKV (EBICAB 900) equipment and no STM, and there would be a common DMI for both ATP systems.

For a supplier of the ETCS this would mean that it would need to provide a detailed description of the communication protocol between EVC and DMI. This would be utilized by the developer of the concept of a combined DMI. This would be EKE Electronics (partially owned by Mitsubishi Electric Corporation) <https://www.eke-electronics.com/>. The common DMI would be supplied by EKE Electronics as per our tentative plan. This would limit the supplier's scope as ETCS DMI is left out.

The preference of the rolling stock owners procuring ETCS is that the complete onboard system, including the common DMI, is delivered under responsibility of ETCS supplier.

Q25: How does the supplier see the concept, and would you be willing to offer ETCS equipment in the procurements where double-fitment is a starting point and a common DMI are required?

Q26: Would a supplier accept providing a detailed description of the communication protocol to EKE Electronics (with the appropriate arrangements such as NDA) and how does the supplier see cooperation with EKE Electronics happening?

Q32: How does the supplier view a role as an integrator, where the supplier would have to take overall delivery responsibility?

Q33: How does a supplier see the price impact of the concept on the ETCS delivery (without considering the price of EKE's equipment)? For EKE's equipment, the Digirail project could possibly have a framework agreement with a fixed price for suppliers.

Q34: Does a supplier have any suggestions how cost for RS owners due to ETCS fitment could be limited?

Q35: How does the supplier see the required additional effort in approval of such system (compared to the approval of the complete OBU of the supplier)? In your system is DMI approved as a part of OBU, or approved as a separate component?

### 2.3.2 ETCS integration without involvement of the original rolling stock supplier

Technically it may be preferable to involve the original rolling stock or subsystem supplier for the implementation of ETCS integration in a retrofit project.

Q36: How does the supplier see the potential for successful integration into existing rolling stock without the involvement of the original rolling stock or subsystem supplier?

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Q37: Does the supplier recognize any critical issues? For example, the need for TCMS update, technical documents as an input for design.

### 2.3.3 Recommendation of an ETCS-supplier for the scope of its own delivery

Q38: What scope of supply does an ETCS supplier recommend? For example, does it make sense to include in the scope of supply, not only the equipment itself, but also responsibility for integration and possibly also the installations, considering cost-effectiveness and responsibility aspects?

Q39: RS owners may wish that a supplier is also fully responsible for the approval including Nobo process. How does the supplier feel about this?

### 2.3.4 Homologation and lead time of the first vehicle of class

Q40: What is the lead time of the first of class based on experience of supplier?

Q41: The Digirail project aims for a technically advanced solution for the rollout including the latest baseline of CCS TSI 2022, level 3. Does the supplier see a significant impact from the fact that notified bodies and other relevant bodies do not have experience regarding new features?

Q42: Data communication over FRMCS is a key target of the Digirail for the first commercial ETCS line. As FRMCS is not envisaged to be a part of TSI 2022, a need for a derogation could not be avoided. How does a supplier see impact of this for the approval of the onboard equipment?

### 2.3.5 ETCS level 3 TIMS and implementation in the retrofit projects

Q43: What is your roadmap for TIMS?

Q44: How does the supplier envisage how TIMS can be implemented in existing passenger trains (push-pull trains including a locomotive and EMUs)? How the existing architecture (wiring, etc.) can be utilized and which kind of new solutions are needed?

### 2.3.6 Temperature range

Q45: Is a supplier able offer ETCS equipment that meets the temperature requirement T2 (-40 ° C to +35 ° C) of EN 50125-1? If all the equipment (e.g., equipment to be placed inside cabinets) does not fulfil the requirement, please identify the equipment in question. If there is such equipment, what is the solution of the supplier for those, e.g. pre-heating?

### 2.3.7 Low braked weight percentages

According to the TSIs, the lowest permitted braked weight percentage for the conversion model of lambda trains is 30 %. Currently on Finnish railway network there are units with a braked weight percentage lower than 30 %. These units will not be able to operate with ETCS on-board equipment on Finnish railway network.

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Potentially the units having lower percentage could be managed by using gamma model. Another option is that the conversion model could be extended to allow lower percentages, but this is not preferred due to the need of customization of an OBU and due to need for national validation and approval process.

Q46: Do you have such application of an OBU which enables switchable data entry, i.e. allows operating both gamma and lambda trains?

Q47: If a buyer is fully responsible for the approval of the extension of the conversion model, how challenging would it be to extend the validity of the conversion model to allow values starting from 18%?

### 2.3.8 Constraints

Q48: Does the OBU of the supplier have some limitations, e.g. for a cable lengths? For example, can 75 a meter long EMU be equipped with one set of components, or do some of the components, such as BTM, need to be doubled?

### 2.3.9 Positioning and odometry

It has been identified, that in some circumstances radar solutions are facing challenges in measuring speed. This applies especially for harsh winter conditions.

Q49: Can the supplier offer an odometry solution that does not include radar? If so, could you describe the concept and some use cases of the solution?

Q50: How does a supplier see the future development of the on-board positioning?

Q51: Does your ATO-OB system only utilise ETCS odometry information or does it utilise other sensors/information? Is your ATO-OB system able to receive positioning information from other sources?