**Draft Proposal for FS\_VMR consolidation – Proposal for additional changes (rev1)**

*Note: showing changes (rev marks) on top of proposal in S1-211248r1 (i.e. text for sec.7, on final consolidated requirements).*

*Two main changes:*

* *Replace “mobile base station/BS relay” with “vehicle relay node”*
* *Simplify requirements wording, by removing repeated instances of “(e.g. mounted on a vehicle)” / “UEs inside/outside the vehicle”…covered by an introductory paragraph*

# 7 Consolidated Potential Requirements

**============================= Proposed text ==============================**

The requirements below refer to a “*vehicle relay node”*, which is a mobile access node acting as a relay between a UE and the 5G network, i.e. providing a NR access link to UEs and connected wirelessly (using NR radio) to a donor NG-RAN node and 5GC. Such relay node is assumed to be mounted on a moving vehicle and serve UEs that can be located inside or outside the vehicle (or entering/leaving the vehicle).

General requirements

[PR 5.1-1] The 5G system shall support efficient operation of vehicle relay nodes, i.e. relays mounted on board of moving vehicles, connected wirelessly to the NG-RAN and serving nearby 5G NR UEs (inside and/or outside the vehicle).

[PR 5.1-2] The 5G system shall support means, for a mobile network operator, to configure, provision and dynamically control the operation of a vehicle relay node, including

* authorization, activation and/or deactivation of vehicle relay operation;
* configuration of 5G spectrum (licensed or unlicensed) used by the vehicle relay, over the radio links toward UE and RAN;
* configuration of relay operating conditions e.g. based on permitted geographic areas or locations, specific time period(s), vehicle’s speed, itinerary, etc.

NOTE: besides the MNO, a 3rd party entity could also be enabled to provision and control some of the vehicle relay node operation, e.g. (de)activation, location restrictions, or other operating conditions.

[PR 5.4-1] The 5G system shall support provisioning and configuration mechanisms to control UEs’ access to the 5G network via a vehicle relay node, based on

* User/UE subscription and/or authorization (can be specific to each preferred relay, or a group of users, e.g., vehicle owner’s family members, friends, etc);
* User/UE or relay geographical location, time of the day, load, speed

[PR 5.5-1] The 5G system shall support mechanisms to control UEs selection of vehicle relay nodes and UEs access to the 5G network via a vehicle relay node, based on user preference, e.g. for manual selection of a specific relay.

[PR 5.6-2] The 5G system shall provide means to ensure that UEs, once provided with 5G access and connectivity via a vehicle relay node, remain connected via the relay (e.g. for UEs located inside the vehicle).

[PR 5.8-1] The 5G system shall be able to provide a means to perform load balancing among vehicle relay nodes.

NOTE: This requirement is intended to provide the capability for the 5G system (UEs/ vehicle relay nodes) to be able to optimize the load of network resources whenever possible

[PR 5.9-1]: The 5G system shall support providing location service for the UEs accessing to the 5GS network via a vehicle relay node.

[PR 5.9-2]: The 5G system shall support providing location information to a requesting UE or other location entity, for UEs accessing the 5GS network via a vehicle relay node, considering e.g. specific location granularity, and efficient UE power consumption.

[PR.5.15.6-1] The 5G System shall be able to support dynamic deployment and configuration of one or more vehicle relay nodes (e.g. mounted on vehicles) for providing ad-hoc indoor coverage extension in specific locations.

[PR5.16.6-1] The 5G System shall be able to support vehicle relay nodes using NR satellite access to connect to a remote donor RAN node via a satellite link.

[PR-5.17-1] The 5G system shall be able to support RAN sharing between multiple PLMNs for UEs connected to 5G network via vehicle relay nodes, where the donor RAN node is able to inter-connect to the multiple 5G core networks sharing the RAN.

NOTE: the above requirement assumes that the vehicle relay nodes broadcast all PLMN-Ids of the sharing PLMN operators.

Mobility and Service Continuity

[PR.5.12.6-1] The 5G system shall provide means for a UE to select a suitable vehicle relay node (e.g., that has a similar trajectory as the UE)

[PR 5.7-1] The 5G system shall be able to provide a means to optimize cell selection and minimize unnecessary cell reselection (between vehicle relay nodes or between vehicle relay nodes and macro RAN) in the presence of vehicle relay nodes .

NOTE: This requirement is intended to provide the capability for the 5G system (UEs/ vehicle relay nodes) to be able to optimize selection of a vehicle relay node, e.g., in a vehicle where the UE is on board (or that moved together so far or that is expected to move together).

[PR 5.7-2] The 5G system shall be able to provide a means to minimize unnecessary handover (between vehicle relay nodes, or between vehicle relay nodes and macro RAN) for a UE while served via an vehicle relay node, e.g., based on UE and relay relative mobility or speed.

[PR.5.14.6-1] The 5G system shall be able to support mechanisms to optimize mobility (e.g. re-selection, handover) and energy efficiency for a UE camped or connected via a vehicle relay node (e.g. for UEs located inside a vehicle, equipped with a relay node)

[PR 5.11.1-2] The 5G system shall be able to support efficient handover when a UE active communication changes from the macro network to a vehicle relay node and vice versa, ensuring end-to-end service continuity during mobility of the relay and/or the UE.

[PR 5.11.2-2] The 5G system shall be able to support efficient handover of a UE active communication when a vehicle relay node changes between macro network nodes, ensuring end-to-end service continuity during mobility of the relay.

[PR 5.11.3-2] The 5G system shall be able to support efficient handover when a UE active communication changes between vehicle relay nodes, ensuring end-to-end service continuity during mobility of the relay and/or the UE.

[PR5.16.6-2] The 5G System shall be able to support a vehicle relay nodes using NR satellite access with service continuity in the scenario where there is a transition from one serving satellite to another serving satellite

[PR-5.17-2] The 3GPP System shall support end-to-end service continuity for a UE having active connection with a RAN via a vehicle relay node when there is a change between a shared RAN and a non-shared RAN, or when RAN sharing changes (for the same vehicle relay) between different sharing PLMNs.

NOTE: the service continuity requirements above intend to apply to a vehicle relay node serving one or multiple active UEs.

Charging

[PR 5.10-1] The 5G system shall be able to identify and differentiate the traffic relayed via a vehicle relay node, e.g. to apply specific charging policies.

[PR 5.10-2] Online and offline charging shall be supported for UEs connected via a vehicle relay node.

[PR 5.10-3] The 5G system shall be able to provide and collect charging information for UEs using a vehicle relay node, including e.g.:

* Identification of UEs/users involved;
* Initiation/termination time of relay communication;
* Duration and amount of data transmitted and received;
* Type of service, QoS, other allocated resources (e.g. spectrum);
* Geographic location(s) served by the relay;
* Other relay mobility information (e.g. itinerary, speed).

Other aspects

[PR 6-1] The 5G system shall support mechanisms, for the HPLMN and/or VPLMN controlling a vehicle relay node, to enable/disable vehicle relay operation if/when the relay is roaming in a VPLMN.

[PR 6-2] The 5G system shall be able to fulfil necessary regulatory requirements (e.g. for support of emergency services) when UEs access the 3GPP network via a vehicle relay node.

[PR 6-3] The 5G system shall be able to support priority services (e.g. MPS) when UEs access the 3GPP network via a vehicle relay node.

[PR 6-4] The 5G system shall ensure that end-to-end 5G security between the UE and 3GPP network is supported when the UE accesses the 3GPP network via a vehicle relay node.

[PR 6-5] The 5G system shall be able to minimize radio interference possibly caused by vehicle relay nodes.