Coordinator

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InDrive

InDrive project

Automotive EGNSS Receiver for High Integrity Applications on the Drive

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1 Introduction

This document describes the VANET module developed by ISMB and its role in the final hardware architecture of InDrive system.

1.1 Scope

This document is intended to introduce the physical aspects of the VANET module within the InDrive architecture.

In particular, since, as requested by H2020 ECAS portal, one needs to upload a document also when a deliverable different from a report is due, the present deliverable D4.2 is not an exhaustive document explaining technicalities, but rather a synthetic document demonstrating of the maturity of the VANET component and some physical details which have not been shown elsewhere.

2 VANET module

The VANET module holds the communications part of the architecture since it allows the vehicle to be visible to other vehicles via the ITS-G5 standard packets and gives InDrive visibility of other ITS-enabled vehicles, such as the connected vehicle in the case of the InDrive demonstrator.

The VANET module makes use of the hardware interfaces available in order to perform its tasks. A simple diagram of the possible connections is depicted in the **Fehler! Verweisquelle konnte nicht gefunden werden.**.

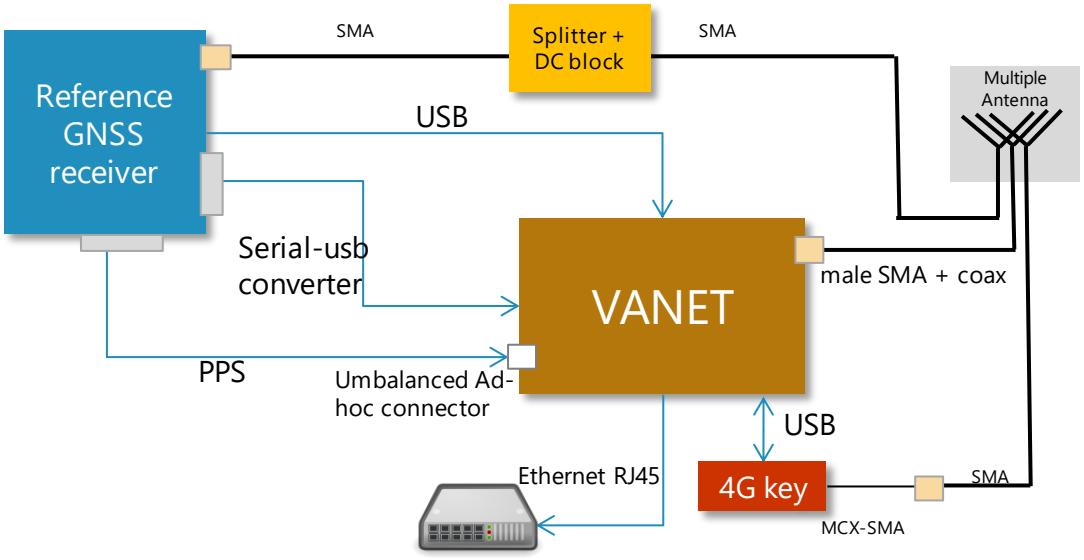

Figure 1: VANET module connections

The VANET module uses 3 USB ports, one for the 4G modem Key, another for GNSS NMEA sentences and another one from the serial-USB converter. The VANET module has two USB ports on-board and other two exposed via an extension cable with usb outlets; there is no difference between the uses of any of these two types for the purposes of the VANET module, since all ports are equivalent on the operating system.

The PPS connector is an ad-hoc connector, made to adapt the ribbon connector in the GNSS receiver (where the PPS output is available) and the GPIO input of the VANET module board. A two-wire socket is available on the VANET module box to connect the PPS input.

The 4G modem is connected to the multiple Antenna through an MCX-SMA adapter; the Antenna has three ports with their expected usage tagged into the cables. The V2X interface can be connected directly to the antenna into the 6GHz band port.

The GNSS receiver has an RS232 port where the NMEA sentences are written. The output arrives as USB port connected to the VANET module. The system will automatically configure all ports and services at start up.

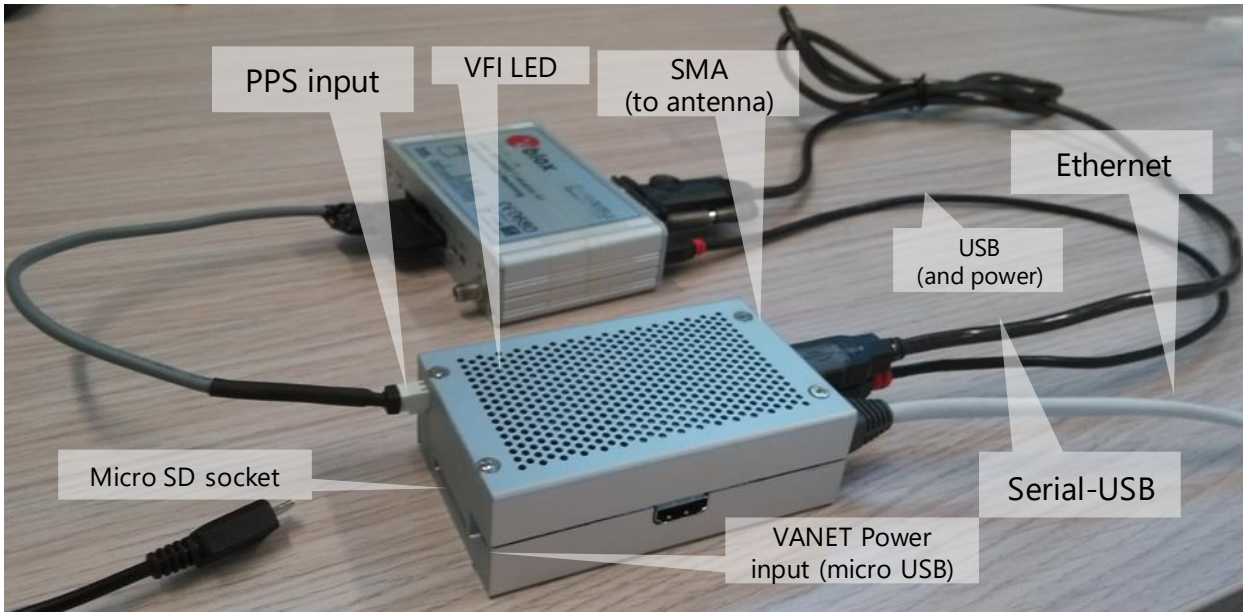

Figure 2: VANET module external connections.

In **Fehler! Verweisquelle konnte nicht gefunden werden.**, the external connections are visible in the final VANET module. Only the 4G modem is not shown given that the USB extension was not yet installed. Additionally, the class-10 SD card socket allows to have access to the main VANET storage in order to perform updates or for debugging. The VANET module is powered by a micro USB power input located in the rear panel. An HDMI port is also available for low debugging and console viewing, but it is not used in InDrive.

The VANET module's Single-Board-computer board was enclosed into a general purpose aluminium case with the aim to protect internals from movement and accidental short circuits. It keeps the main board cooled and fixed when installed into the vehicle.

2.1 Visual Feedback Interface

In order to check that critical routines and services are running, such as the synchronization and logging, the VANET module has been equipped with a visual feedback interface (VFI), located in the top of the VANET module box, near the PPS input outlet. The VFI encodes the status of 5 main services in PWM every 5 seconds. On each cycle, the LED is turned on five times to report the ordered the status of:

1. Reachability of GNSS NMEA time source [Reachable|Unreachable]
2. Reachability of PPS time pulse information [Reachable|Unreachable]
3. Status of the GNSS logging [working|not Working]
4. Status of Internet Connectioncv [working|not Working]
5. Status of the ITS router [Running|not Running]

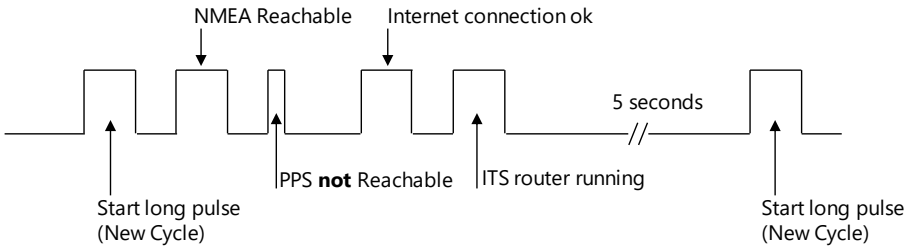

Figure 3 VFI LED behavior

The LED behaviour is depicted in Figure 3. All status bits are spaced the same amount of time. Every status bit can be 1 or 0 for each corresponding status [working|not working]: The "1" is encoded with a long LED blink duration, and "0" is encoded with a short LED blink duration. So every 5 seconds, the VFI will show: one initial sample long blink, marking the start of a new monitoring cycle and five other short/long blinks following the services status described above. As an example, when six long blinks are observed, it means that all five services are working fine. When observing the first three long blinks, it means that at the VANET system time base is synchronized with the stratum-0 time source (GNSS time).

The VFI allows a rapid monitoring of the services at any time and it is useful to know when the VANET module is ready to serve time to the rest of the InDrive subsystems.

END OF DOCUMENT