



## Case Study

Intel® Architecture  
Processors

Q-Free ASA

Transportation Industry

# Improving Transportation Safety, Efficiency and the Environment

## Q-Free contributes communications technology to CVIS 2.0



**“We can support five radios using a compact board with the Intel® Atom™ processor.”**

*– Knut Evensen,  
Chief Architect, Q-Free*

Engineers at Q-Free have been developing communication and transaction technology deployed by Intelligent Transport Systems (ITS) for over twenty five years. Their electronic toll collection and traffic surveillance systems are used by traffic authorities worldwide to battle city congestion and pollution, and help finance transportation infrastructure. In addition, Q-Free is an active member of the Cooperative Vehicle-Infrastructure Systems (CVIS) project consortium, that is designing, developing and testing the technologies needed to allow cars to communicate with each other and with the nearby roadside infrastructure.

CVIS, co-funded by the European Commission and managed by ERTICO-ITS Europe, a multi-sector partnership dedicated to the development and deployment of ITS, has gone live at its first European test site in Helmond, the Netherlands. CVIS technologies and applications developed over the last few years are now moving out of the laboratory and onto the road, including real-life applications using 5.9 GHz wireless LAN and cellular 3G communication media. “The availability of this open platform is expected to lead to the development of many new and enhanced in-vehicle and cooperative services for increased road safety, efficiency and traveler convenience,” says Hermann Meyer, CEO of ERTICO-ITS Europe.

Q-Free is providing the communications software and vehicle and roadside antennas for CVIS infrastructure testing. The latest CVIS platform, CVIS 2.0, pictured in Figure 1, presented some new challenges for Q-Free’s developers, who had to design a power- and space-efficient rooftop antenna unit containing five individual antennas, listed below.

- **Dedicated short-range communications (DSRC)**, wireless channels specifically designed for automotive
- **Global Positioning System (GPS)**
- **Broadband GSM/UMTS antenna**, named CALM 2G/3G
- **Two broadband WLAN antennas**, named CALM M5, provide on- and off-road Wi-Fi connections

### Reducing cabling complexity by implementing a router

The Q-Free design team made dramatic improvements to the prior vehicle communications system, which consumed too much power and required a cumbersome cable, about 5 centimeters (two inches) wide. They eliminated discrete wiring for each radio type by turning the platform into a router with five output channels (DSRC, GPS, GSM, and two CALM M5), all requiring real-time processing. “We are able to reduce the cabling complexity because the Intel® Atom™ processor satisfies the network processing and low-latency requirements of a complex router,” says Knut Evensen of Q-Free.



Figure 1. CVIS 2.0 Antenna and Touch Screen

By increasing the information available about the vehicle and its environment, CVIS enables the following benefits:

**Improved traffic safety** by helping drivers keep a safe distance from one another, thereby preventing accidents and consequently reducing road congestion.

**Increased efficiency** of the transportation system by allowing vehicles to communicate directly with the infrastructure and one another, enabling drivers to make better decisions about their routes with respect to congestion and accidents.

**Improved energy efficiency and better environment** by helping drivers choose the most environment-friendly journey, and traffic managers reduce fuel consumption in the network.

The universal platform based on the Intel Atom processor connects vehicles and roadside systems continuously and seamlessly using a wide range of communication media, including mobile cellular and wireless local area networks, short-range microwave or infrared.

## CVIS 2.0 Communication Architecture

CVIS is designed for vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications based on five in-vehicle radios. In this example, vehicles communicate with each other via a DSRC channel, sharing information on vehicle speed and proximity. Vehicles communicate with the transportation infrastructure, such as gas station and toll booths, using the infrared link. Drivers can monitor their location using GPS, make phone calls over UMTS and connect to the Internet with CALM M5. "This architecture improves the quality and reliability of information available to drivers about their immediate environment and other vehicles and enables new commercial and consumer services," says Knut Evensen.

## Benefits of using the Intel® Atom™ Processor

- The board supporting the CVIS 2.0 platform is smaller than the prior generation because of the low power and small footprint of the Intel® processor and chipset.
- The cabling is less complex since the computing power of the processor is used to implement a router that multiplexes the wiring for the five radios.
- Intel supplies the processors, chipsets and radios, which simplifies the supply chain and development for equipment manufacturers.
- Intel's long life cycle product support (seven years) protects equipment manufacturers' development investments.

## An Open System

CVIS is an open platform, meaning board drawings are readily available, and the basic core software and middleware are open and run on Linux.\* "Although equipment manufacturers are not obliged to use these components, those that do may benefit from reduced development effort and faster certification," says Q-Free project leader Runar Sorasen. Application software and other software components, like firmware in field programmable gate arrays (FPGAs), are not open, so manufacturers can protect their intellectual property (IP).

## A Scalable Platform

"We chose Intel and Linux so we could easily port to future platforms without losing openness and compatibility. The Intel Atom processor roadmap and integration are very good, and this provides a solid development platform that can deliver comparable results from test sites throughout the world," says Knut Evensen.

## Driving Forward

CVIS 2.0 Beta testing is well underway and field operation tests (FOTs) are expected to start at various test site locations across Europe from 2010 onwards. "The public demonstration of the CVIS platform is a major step towards mature vehicle-to-vehicle and vehicle-to-infrastructure communication and services," says Hermann Meyer.

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