Technology Transfer in Computing Systems

D3.44: Individual TTP44 abstract

Project no.:	609491
Funding scheme:	Collaborative project
Start date of the project:	1st September 2013
Duration:	36 months
Work programme topic:	FP7-ICT-2013-10
Deliverable type:	Report
Deliverable reference number:	ICT-609491 / D3.44
WP and tasks contributing:	WP 3 / all
Due date:	30/06/2016
Actual submission date:	10/06/2016
Responsible Organization:	TUCLUJ
Dissemination Level:	Public
Revision:	1.0

TETRACOM D3.44: Sub 1 GHz ISA100 technology for low cost and low power consumption embedded systems (ISA100)

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The increased interest in the enhancement of factory monitoring and process control applications with wireless technology has led to the emergence of open protocols and standards for industrial automation. Recently, the ISA100 wireless (ISA100.11a), WirelessHART, and IEEE 802.15.4.e standards, aiming to fulfill the demanding requirements of industrial wireless networks, have been approved. However, the vast majority of the developed solutions operate in the unlicensed 2.4 GHz industrial, scientific and medical band, and their coexistence raises concerns regarding communication reliability.

CDS, as a developer of wireless products and technologies for industrial applications in areas such as aerospace, oil & gas and environmental monitoring, participated in several research contracts (**ESA - European Space Agency, BiTherm, Spirax Sarco, Ikusi, LG Sonic, Environmental Protection Agency**), and has developed an ISA100 radio communication module for different 2.4 GHz wireless tracking applications. The company identified the range provided by existing solutions as a problem in implementing different monitoring applications, such as smart meters. Other issues consist of the high cost and limited access of existing radio modules to specific applications fields, such as industrial control.

This TTP aims **to develop a sub 1 GHz ISA100 wireless radio module, operating at 868 MHz**. The achievement of a simpler, more reliable and power-efficient design was targeted, with the ultimate goal of providing lower production costs and the possibility of approaching new markets and application domains.

In order to achieve the TTP main goal, the following activities have been carried out:

- The development of a hardware platform operating at 2.4 GHz, with similar components as the targeted sub 1 GHz solution;
- The porting of the ISA100 stack to this hardware platform;
- The testing of the ISA100 stack on the newly developed 2.4 GHz design;
- The development of the hardware for operation at sub 1 GHz frequency;
- The adaptation of the ISA100 stack for sub 1 GHz operation on the new hardware;
- The performing of range measurements, which proved that the distance as compared to previous 2.4 GHz implementations is increased by a factor up to three.

The sub 1 GHz board with the mounted components is shown below. This represents the main result achieved through the project.

The 2.4 GHz board with the mounted components, developed as an intermediary step, is shown below. It uses the same microcontroller (STM32), and a similar transceiver (Atmel) as the previous one. This platform was used for porting the software implementation, and for simplifying the testing activities, eliminating the uncertainties related to new hardware.

As a secondary result, a VN210A board (replacement for VN210) was obtained. The existing VN210 module produced by the company had to be replaced, because the central IC (microcontroller and transceiver) are no longer manufactured and they disappeared from the market. The new module operating at 2.4 GHz, with the mounted components is shown in the figure below. As soon as ISA100 wireless operating at sub 1 GHz is

standardized, a module operating at this frequency will be developed starting from the design of VN210A, in a way similar to the one in which the main result of this TTP was achieved.

The performed tests validate the design and highlight the advantages of implementing sub 1 GHz ISA100: longer range, lower power consumption, lower design complexity and lower manufacturing costs. Tests for verifying the compliance of the developed system were also performed and the results indicate that the module is compliant with existing standards.

Motivated by the encouraging TTP results, the company is interested in obtaining the extension of the transmission power domain for sub 1 GHz implementations from the Romanian authorities.

The entire design, the schematics, bills of materials, and layouts have been successfully delivered by the university partner to CDS.