

Milestone REPORT

Project Title: Miniaturized structural monitoring system with autonomous readout micro-technology and fiber sensor network

Project Acronym: SMARTFIBER

Milestone Title: MS5 - First design of subsystem and estimation of target specification feasibility: wireless system

Lead partner: Fraunhofer IIS

Contributing partners: -

Milestone No: MS 5 Due Date: month 12 Delivery Date: month 12

Description (Objective/Result/Impact on other tasks)(max 1 page):

Objective: Design of subsystems ready and theoretical estimation of specifications

Status:

A first design of the wireless data/power communication link has been completed. The influence of FRP materials on the system performance has been assessed and the target specifications feasibility defined in D6.1 has been confirmed.

The design process of the wireless system is mainly divided into three blocks, as follows:

Wireless data transmission

- The wireless communication protocol between the external readout unit and the embedded system has been defined, including the data frame structure, the different types of packets and commands as well as the communication/transmission modes.
- In principle two different data transmission modes have been defined: continuous data monitoring and single data monitoring. However, the protocol and the data frame have been designed to be flexible enough to easily further expand the functionalities.
- The interfaces between the different sub-modules, including the wireless sub-modules and the optical interrogator have been defined (Fraunhofer – Xenics interfaces).
- We are already working in a first low data rate version to demonstrate the functionality of the communication protocol and the proper interfaces definition (expected in Month 13), prototypes in progress.
- First HF antenna coils are being tested

Wireless power transmission

- First simulation models for a power transmitter at 125 kHz ready in LTspice and Agilent ADS

- First evaluation board for power transmission at 125 kHz in progress, we are working in a first 1 Watt version
- First antenna coils at LF are being tested

Influence of FRP materials on the system performance

- Characterization of the influence of CFRP and GFRP materials on the system performance carried out (both at LF and HF frequencies)
 - Influence of CFRP materials very high, as expected
 - Lower influence of GFRP materials, therefore is the preferred material.
 - Lower influence of materials at LF than at HF frequencies, as expected.
- Two different approaches have been proposed for embedding the SmartFiber system: Kovar Alloy and Epoxy. Both materials have been characterized:
 - Kovar alloy: is a metal material and therefore has a high influence on the system performance (i.e. on the antennas). Using this material can greatly complicate the wireless system design.
 - Epoxy material: has a low influence on the system performance and therefore is the preferred solution to protect the SmartFiber system as well as to integrate the corresponding antenna coils.

Targeted specifications feasibility

The specifications defined in Deliverable 6.1 are confirmed, as shown in the following table:

Specification	Targeted value	Feasibility
Wireless power transmission	1.5 W @ 3.3 V	OK
Data rate	< 500 Kbps	OK
Transmission distance	< 10 cm	OK
Size	< 10 x 10 x 3 mm	OK
Materials	GFRP, Epoxy	OK