Figure 1.
Downlink representation where Base Station synchronize the information for N sensor elements, spreading each symbol by a code and module each bin-code on a subcarrier. All subcarriers transmit information to all sensors. The receiver, using its particular code, can recover its information.

The existing HF modem described by MILSTD-II8-11OA standard is a single tone modem which is able follows fast channel's changes. The performance of this modem can be compared to that of ours OFDM-CDMA modem in the downlink. A more interesting implementation can be found in [6] where an OFDM-CDMA modem, with sampling rate of 9600 Hz and 73 subcarriers, uses a bandwidth of 2700 KHz. This system has 60 information subcarriers, and 13 of them are used to carry pilot symbols for the channel estimation; a QPSK modulation is applied and is used for channel codification channel coding the Reed Solomon scheme (15/9) providing error protection. The symbol duration is approximately of 30ms.

2. Objective
Our objective goal is to parametrize all these designs and to develop a method for downloading the prototypes to the Nallatech platform. Further, we can take field measures under real conditions with real channels. Once the process is completed, modifications can be introduced easily by modifying some block parameters. After that the system can quickly be adapted to different kinds of channels, or different data rates, or limited power consumption. Crucial parameters such as bandwidth, cyclic prefix length, number or subcarriers, and the type of modulations, can be optimized depending on the channel and operation conditions.[7-8]

3. Conclusions
We suppose that the WSN has a cellular structure. The reason for suggesting the OFDMCDMA technology is the advantage that this multiple access strategy offers in the down-link channel. This is, the link from the BS (Base Station) to MS (Mobile Stations) or sensor point. We first we the only suppose one BS and some sensors spread around the BS. MSs can be or not, any way we call them MSs.

In most wireless sensor networks the BS has no low-power limitations which could be used in the down-link to send a synchronous signal formed by OFDM symbols. These symbols have to be extended using cyclic prefixes. Cyclic prefixes avoid ISI (Inter Symbol Interference) and ICI (Inter Carrier Interference). Some of this symbols regularly provide some known dada to help the MS to obtain time and frequency synchronization and to provide support to channel equalization. Introduction of known dada or pilot symbols enables the system to operate with low-complex receivers. In the OFDM-DCMA, multiple access is performed using WH (Walsh Hadamard) codes that are orthogonal between them. The MAI (Multiple Access Interference) is avoided only in the downlink.

The OFDM-DCMA modulations do not have the same good properties in the uplink. It is very difficult to obtain a perfect synchronization between the different MSs signals in the uplink. This means that WH codes are not perfectly aligned, and MAI appears. A further paper will deal with a strategy to be used in the uplink.

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PHOTONIC TECHNOLOGIES FOR NON-INVASIVE SEXUAL IDENTIFICATION: THE CASE STUDY OF SALAMANDRINA PERSPICILLATA (AMPHIBIA, URODELA)

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1. Introduction
The genus Salamandrina (Fitzinger, 1826) is unique to peninsular Italy. S. perspicillata (Savi, 1821) occurs in north and central Italy. There are no external sexual characters which permit to sex individuals. However, there are statistical biometric differences between male and females samples [1]. Further, one can sex females since these are the only that enter in water (during oviposition). In this contribution we report the results of three different techniques used to assess the sex of 21 unsexed individuals, presumed males (i.e., those that in successive years we never recorded in water) in comparison to a sample of 21 females: Termography, Spectral imaging and Biometric comparison.

2. Results and Discussion
Termography - Thermal images of 21 couples of animals (female / unkwnon, presumed male) were filmed with a thermocamera (Flir Systems S40, thermal sensitivity 0.08 °C) inside a box, after 1 hour of thermalization at constant room condition (20 °C, 50 % RH). Through the thermal image software (ThermaCAM Researcher Pro 2.7), the minimum, the maximum and the mean temperatures of three ROI (Region Of Interest) were extracted from head, trunk and vent body regions. Total infrared radiance was transformed in temperature [2] using a emissivity value of 0.97 (established with a specific test). The differences between females and presumed males (an example in figure 1) were tested by means of repeated measures ANOVA for each body region.

Figure 1. Thermal image of one couple of animals; the presumed male on the right, the female on the left.

Mean temperatures of presumed males were higher than females (Tab. I) for each body area considered.

	pres. male	females	$F_{1,2}$; p
H	18.87+/- 0.26	18.53+/-0.24	11.3;0.01
T	19.03+/-0.26	18.69+/-0.24	19.3;0.001
V	19.06+/-0.26	18.66+/-0.24	17.7;0.01

Table I. Mean temperature (°C) in each body area (Head, Trunk, Vent) and significance of differences.

Presumed males have significant higher both minimum and maximum temperatures(p < 0.01 in all cases).

Spectral imaging - After anestethization, each individual, was scannerized on both the dorsal and ventral side with an Imaging Spectral Scanner (INSPEC, Specim V1000). For each side image, 3 ROI (head, trunk and vent) were extracted. For each ROI, the mean reflectance curve was calculated ranging from 450 to 950 nm each 5 nm (Fig. 2). To classify the sex differences in spectral characteristics, PLS analysis was performed for each ROI per side. 26 individuals were randomly selected from the whole sampe, (N = 42) in order to extract the model of sexual attribution and to test the model with the remaining. Results demonstrated the good performance of the model for each ROI and on both the ventral and the dorsal side (from 100% to 80.8% of correct classification), with better results for the ventral side (from 100% to 92.3% of correct classification). The two test sets showed better results of correct classification for the ventral trunk (73.3%). The ranges of wavelength holding most information in the ventral trunk were between 560-660nm (Visible: Yellow-Orange) and between 830-835nm (Near Infra Red).

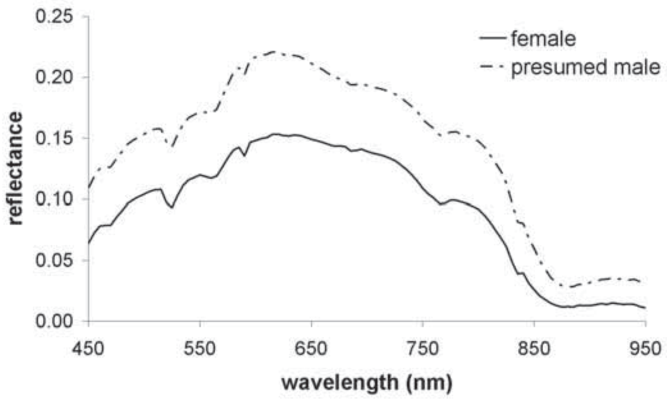

Figure 2. Mean reflectance spectral values for the ventral trunk of female and presumed male.

Biometric comparison - Fifteen females and 21 presumed males were measured: snout-vent length (SVL), tail length (tL), distance between hind and fore limbs, height and width of tail in vent region, length of both fore and hind limbs. A PCA was performed on these measurements (but tL/SVL ratio instead of tL). The plot of individual scores on the plan F1 and F2 (Fig. 3) shows that presumed males actually are different from females regarding biometric features.

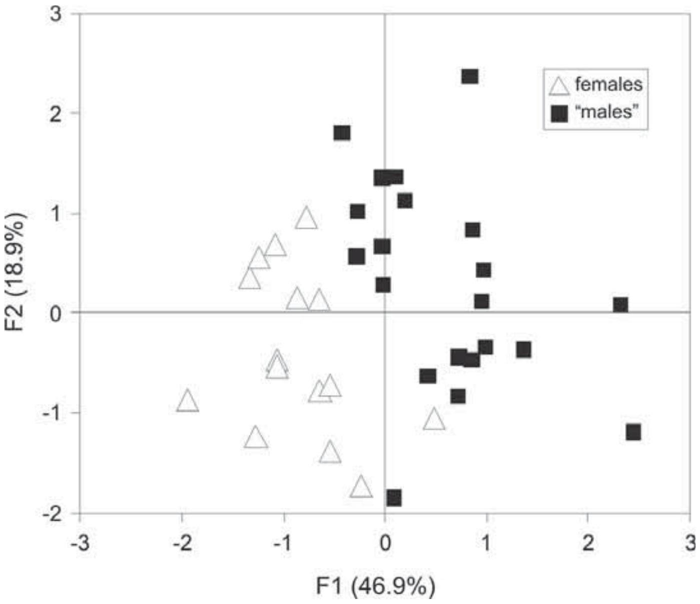

Figure 3. Individual scores on plan F1-F2 from PCA on biometric features.

3. Conclusions

The results from photonic technologies, already applied with success in other biological and agrifood fields, revealed marked differences between females and presumed males of Salamandrina, and support the result of biometric comparison. The matching of these three techniques makes the sexing of living specimens of Salamandrina more feasible.

Besides, photonic techniques show positive features such as: rapidity in the analysis, non-invasivity and possibility to be remotely applied directly on field.

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