

RFID tags and reader to measure physical parameters in glacial environment

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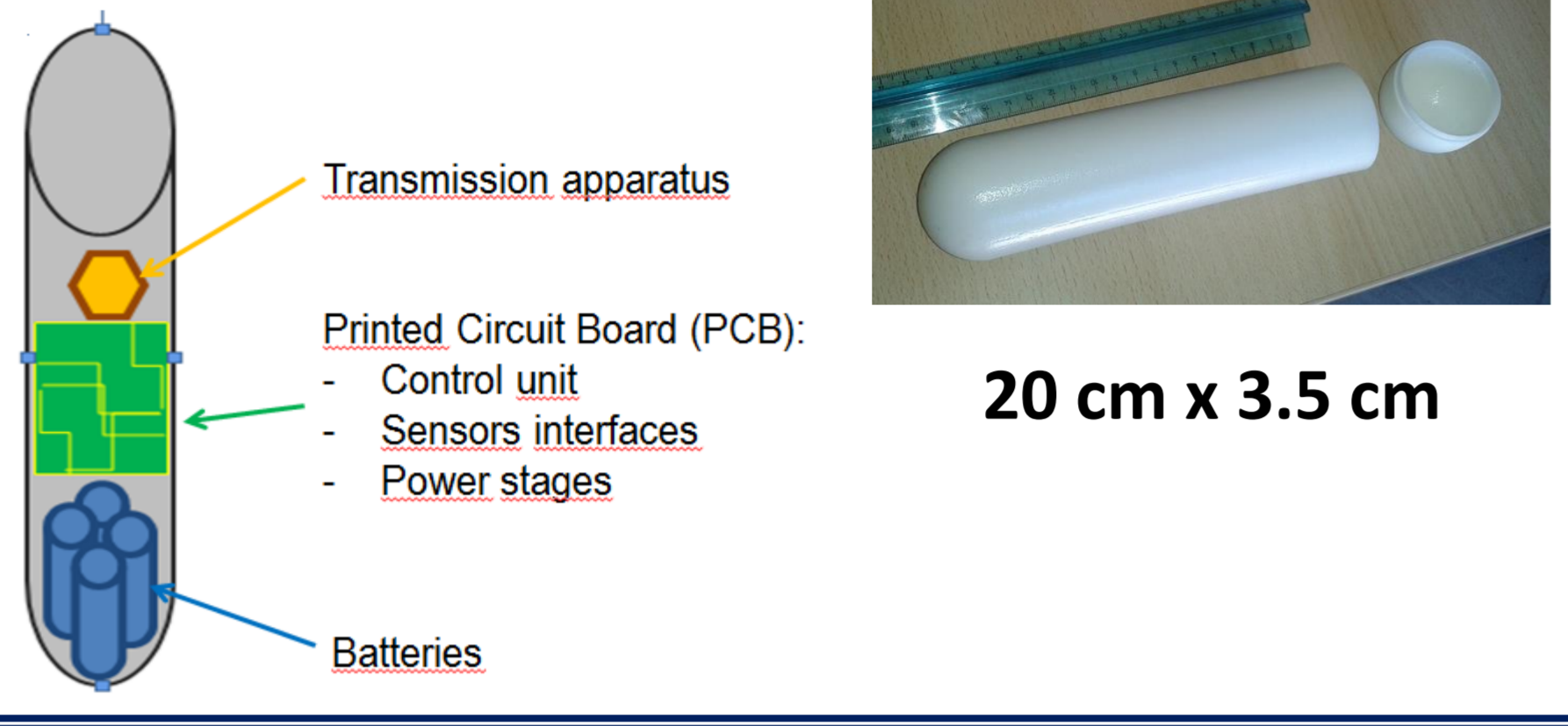
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RFID tags and reader to measure physical parameters in glacial environment

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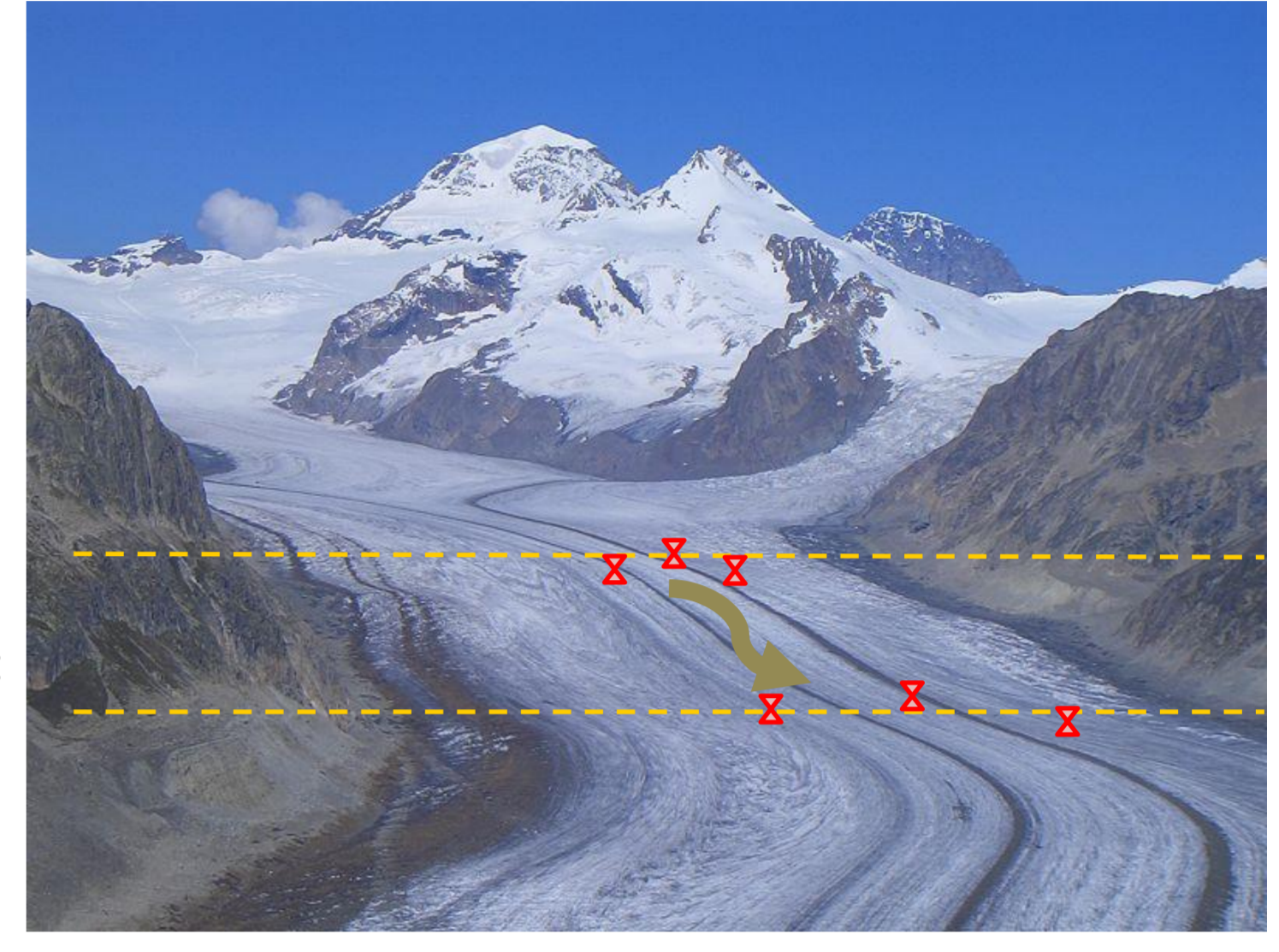
TAG DESIGN



20 cm x 3.5 cm

EXAMPLE OF APPLICATION

✗ Sensore

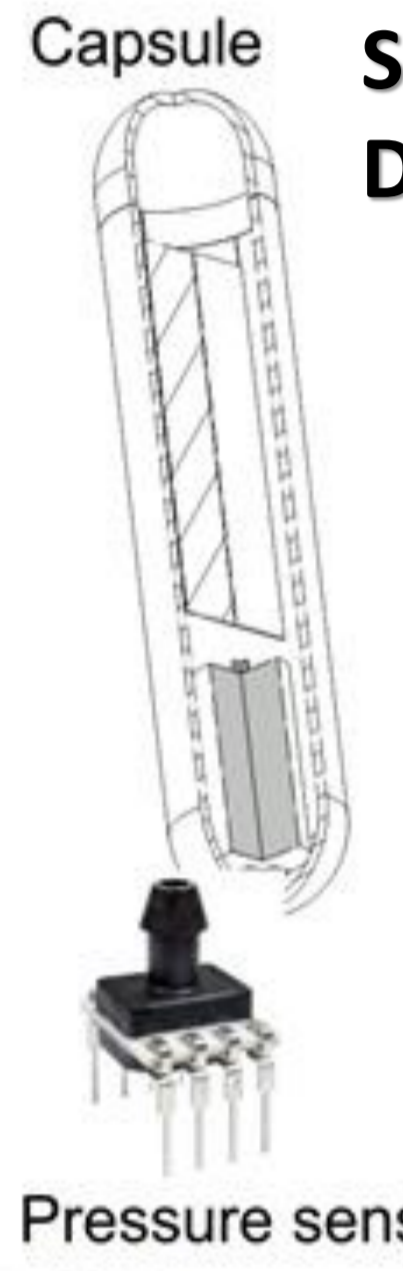


Tag



Reader with USB for laptop connection

SYSTEM DESCRIPTION



TAG

Accelerometer

Magnetometer

Battery

Temperature sensor

Pressure sensor

Antenna

Microcontroller

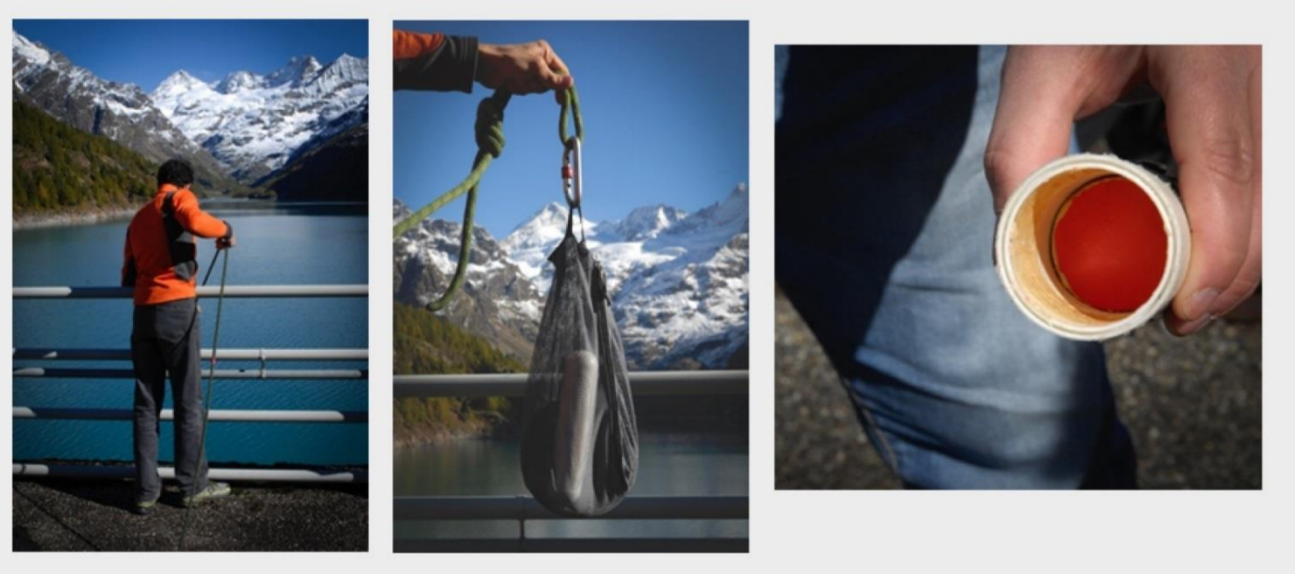
Flash memory

Printed Circuit Board (PCB)

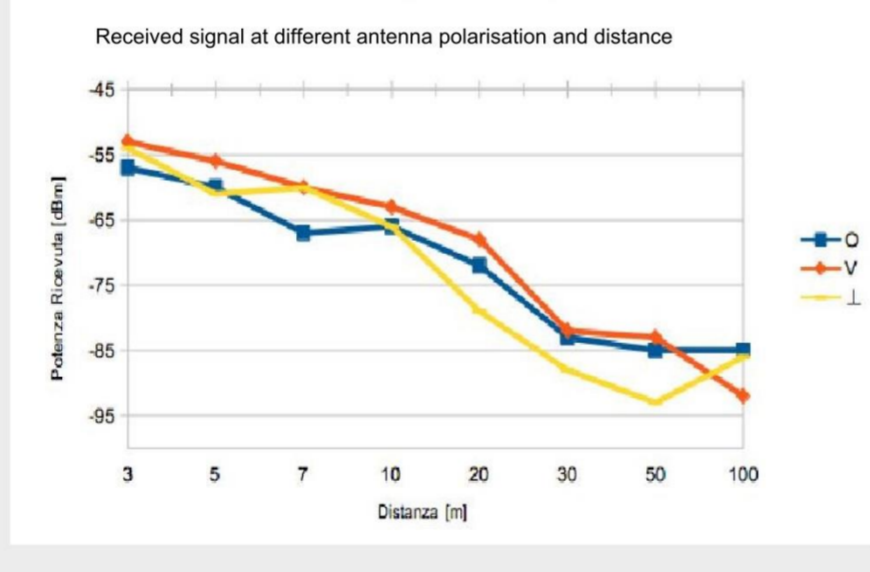
READER

CHARACTERIZATION TESTS

1. Test of capsule impermeability, mechanical strength, transparency to electromagnetic waves



2. Signal strength measurement in free space



Estimated error at 15 m distance in free space condition

	Delta Gain [dB]	Errore d MAX [m]
Azimuth POL V	4.28	1.6
Elevazione POL V	8.81	2.8
Azimuth POL O	3.06	1.4
Elevazione POL O	12.89	4.4



3. Radio frequency measurements through the detection of the RSSI (Received Signal Strength Indicator) in air, snow, ice

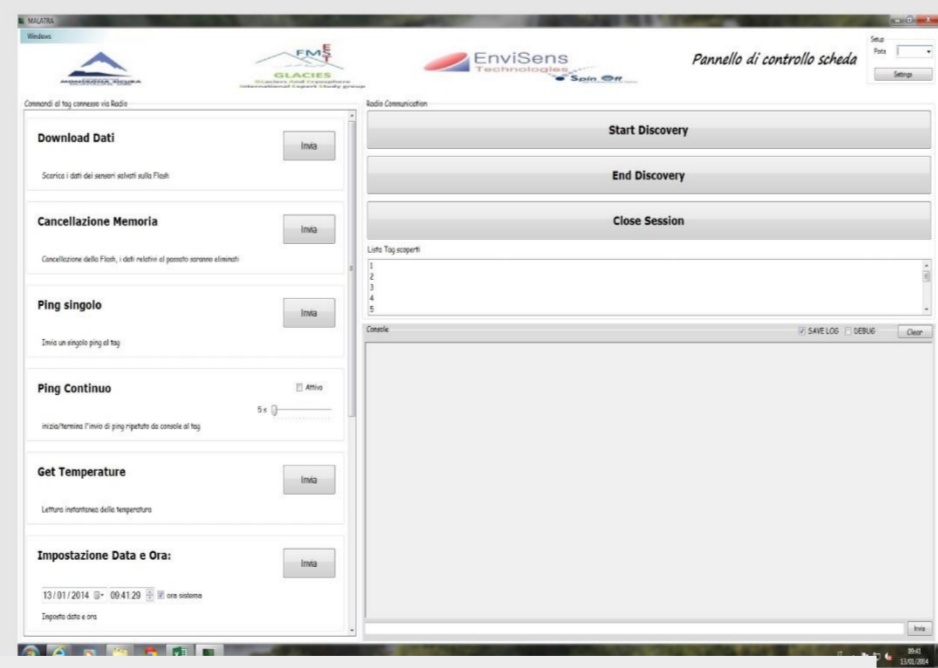


4. Power link estimation over free air

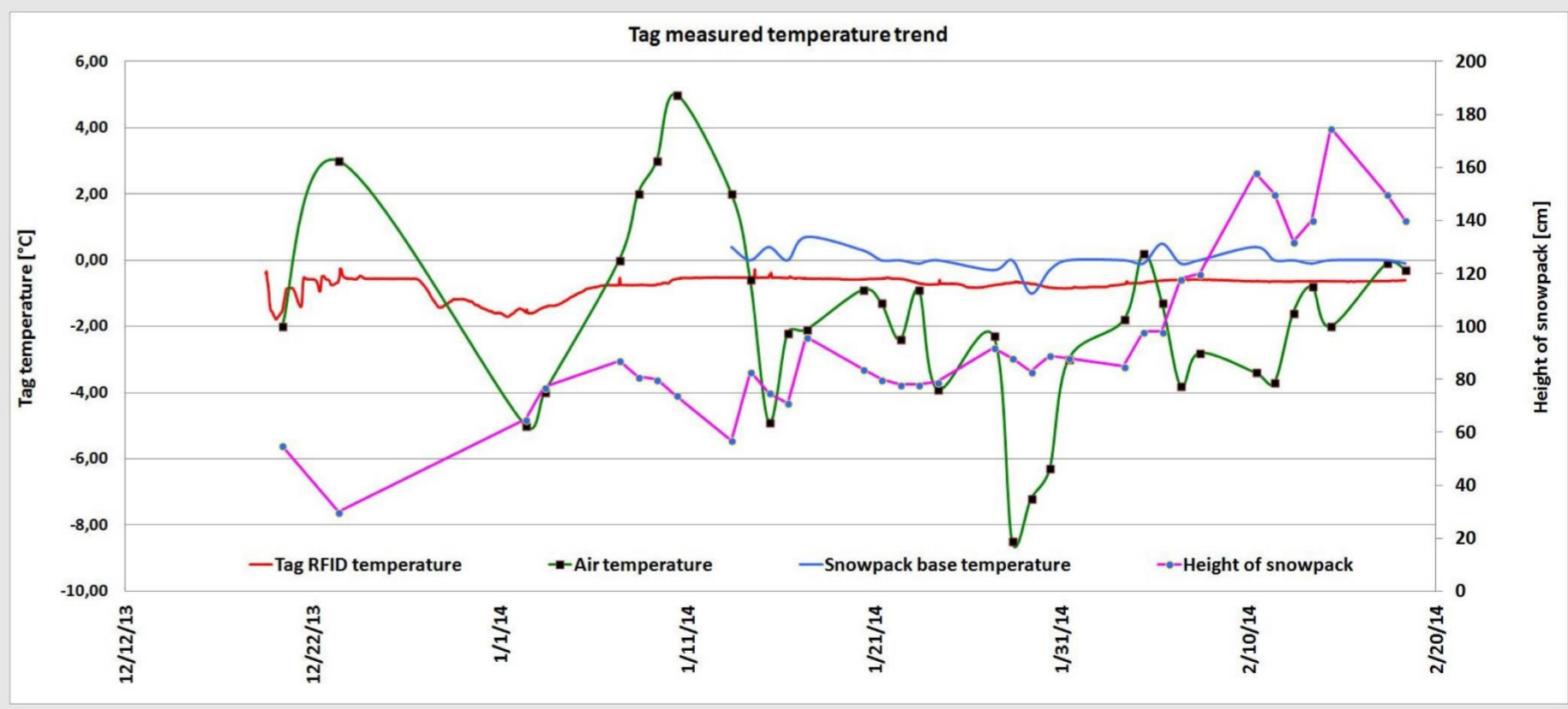
5. Characterization of temperature sensor in environmental chamber

FIELD TEST

Installation: capsule with tag+sensors at ground surface
 Measured parameters: temperature (bottom of snowpack), pressure - hourly; RSSI - daily.
 Control measures (manually executed): temperature (air, bottom of snowpack) - daily; snow depth - daily; snow density - weekly.



graphic interface that allows communication between reader and tag



Temperature at the base of snowpack has a trend similar to air temperature until the thickness of snowpack is lower than 60 cm. When the cover increase, the temperature is stable and equal to about 0,6°C, according to manual measurements.

REF N. 1: O. Rorato et. al. , *An ad-hoc RFID tag for glaciers monitoring*, IEEE APWC 2014, Palm Beach, Aruba, 3 – 9 August 2014, pp. 864-867
 REF N. 2: C. Lucianaz et. al., *RFID technology applied to glacial environment: MALATRA electronic system design and experimental data*, International Symposium on Contribution of Glaciers and Ice Sheets to Sea Level Change, Chamonix (FRA), 26-30 May 2014