Technical Requirements for PWD wearable tracker

# Sender requirements

The sender is embedded in the logo tag of the clothes so it has a very reduced size, is composed of:

GPS + GPS antenna + LORA chip + LORA antenna 🡪 SIP package

Battery – (possibly flexible), of long life (1 year) ???mA or allow induction charging - ???mA

Flexible PCB

Has to be waterproof (IP 68) with nano particle protection from nanoflowX -V3 solution

# Receiver requirements

The receiver can be attached to the case of the cell phone or just put in a key chain it does not have same size restriction and is composed of:

* Bluetooth + Lora chip + Lora Antenna
* Bluetooth connectivity is so that mobile phone App can receive the Lora messages and provide users with location information
* Battery – induction charging - ???mA
* Display to indicate information on sender activation and reception

Be waterproof (IP 68) with nano particle protection from nanoflowX -V3 solution

# Possible solutions

Two possible SIP solutions:

## S76G/S78G from ACSIP

* Variants:
  + S76G: SX1276 (Lora chip) + STM32L073x (STM Arm cortex-M0 CPU)+ GNSS chip (SONY CXD5603GF)
  + S78G: SX1278 (Lora chip) + rest is identical

**Note:** difference between 76/78 chips is the Lora Semtech transceiver

<https://www.semtech.com/products/wireless-rf/lora-transceivers/sx1276>

SX1278 can operate in 137-525MHz while SX1276 supports frequency 137-1020 MHz so for our purposes (use of 868MHz band we should select SX1276 or similar variants)

* Form factor: 13mm X 11mm X 1.55 mm
* Datasheet on CPU STM32L073x:

<https://www.st.com/content/ccc/resource/technical/document/reference_manual/2f/b9/c6/34/28/29/42/d2/DM00095744.pdf/files/DM00095744.pdf/jcr:content/translations/en.DM00095744.pdf>

* Product datasheet:

<http://www.acsip.com.tw/index.php?action=products-detail&fid1=19&fid2=&fid3=&id=41>

* Development board:

<http://www.acsip.com.tw/index.php?action=products-detail&fid1=21&fid2=&fid3=&id=103>

## ATSAMR35J16BT from Microchip

* Variants:
  + SAMR35 has several variants R35 has no USB (vs.R24) and J16 is the lowest memory variant with :LoRa SiP Transceiver 64K Flash 8K SRAM, 4KB LP SRAM, T&R
  + Need to add a GNSS SiP module. Example: <https://www.u-blox.com/en/product/zoe-m8b-module> (4.5 x 4.5 x 1.0mm) or <https://www.u-blox.com/en/product/eva-m8-series>
* Form factor: 6 mm x 6 mm
* Product datasheet:

<http://ww1.microchip.com/downloads/en/DeviceDoc/SAM-R34-R35-Low-Power-LoRa-Sub-GHz-SiP-Data-Sheet-DS70005356C.pdf>

* Development board: <https://www.microchip.com/DevelopmentTools/ProductDetails/dm320111>

# Component analysis

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| Component | Form factor | Costs | Links |
| SAMR35JXX | 6 mm x 6 mm | 5,22 eur (250 pcs) | https://pt.farnell.com/search?st=SAMR34 |
| GPS ZOE-M8B | 4.5 x 4.5 x 1.0 mm | 12.99 eur (100-480 pcs) | <https://www.u-blox.com/en/product/zoe-m8b-module> |
| S76G | 13mm X 11mm X 1.55 mm | Could only find prices for S76S with no GPS ($13.00) | <https://techship.com/products/acsip-lorawan-module-s76s/> |
| Battery (just a starting point) | 20mmX20mm | 0,433 eur per unit (consumer market) | Example for a 40mAh: <https://bit.ly/2lVmXZR> |

# Other notes:

* IP68: No ingress of dust/ Immersion, 1 m up to 3m: https://en.wikipedia.org/wiki/IP\_Code
* Limits on Lora radio power emitted to: <https://stackoverflow.com/questions/50395087/lora-point-to-point-limitations>
* LoraWAN specification: <https://lora-alliance.org/resource-hub/lorawanr-specification-v11>
* Details on Lora: https://fenix.tecnico.ulisboa.pt/downloadFile/1126295043835530/Nuno%20Nico.pdf