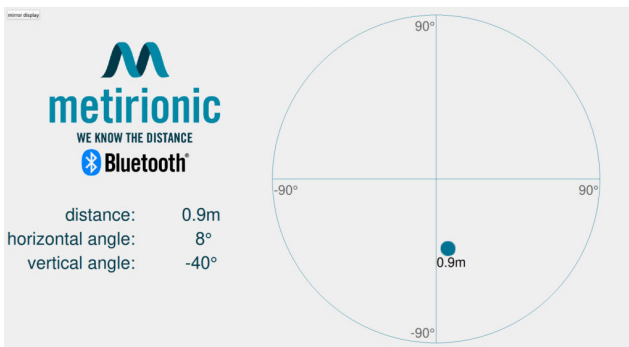


MARS RADAR running on Bluetooth® and BLE

- MARS system with Bluetooth® Low Energy (BLE) based positioning system.
- Search&Find applications at real environmental conditions even in complex indoor environments with walls.
- For wireless distances and angle measurements.
- Based on standard Bluetooth® / BLE chipset.
- Other applications: tracking assets in indoor or outdoor critical and complex environments.

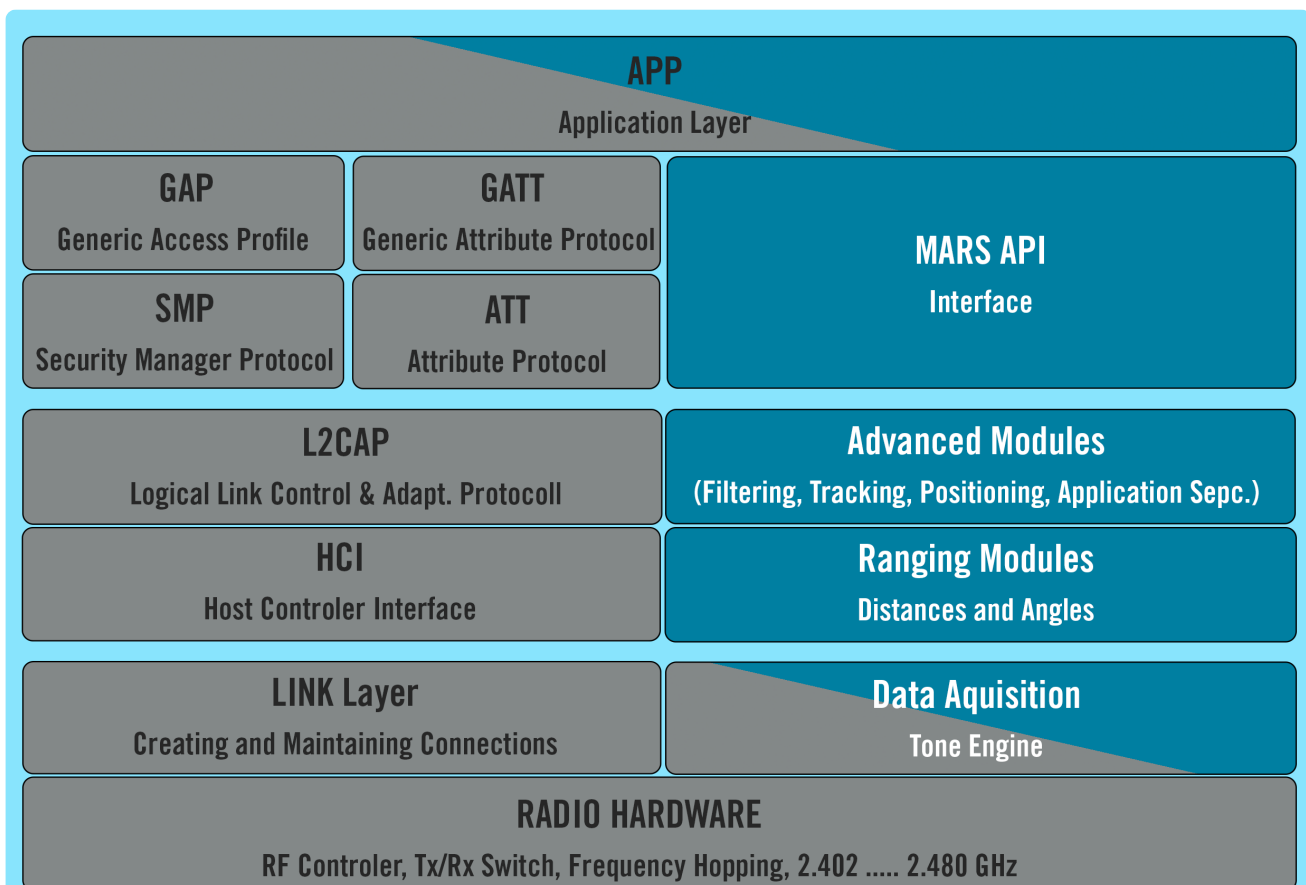


MARS is an End-to-End fully modular middle-ware (stack), based on a secondary pulse-stepped frequency modulation (PSFM) radar.

MARS is fully parametrizable, so that it can be featured to specific applications and optimize the performance (range, increase number of tags (reflectors), accuracy, measurement time).

The 2.4 GHz standardized communication frequency band is used as the base, enabling the high performance in complex environments. Many 2.4 GHz communication standards, i.e. ZigBee, ISA100.11a, WirelessHART, 6LoW-PAN are based on IEEE 802.15.4 where MARS is already an established ranging technology.

This demonstrator shows the full MARS functionality to determine distance and angle for the first time running on standard Bluetooth® / BLE chips.



Basic RADAR parameter

Start of frequencies	2.400 GHz
Step of frequencies	2.0 / 1.0 / (0.5) MHz
End of frequencies	2.483 GHz
Full range without ambiguity	0.....75 / 0.....150 / (0.....300) m
Range resolution	7 cm
Performance (display refresh rate)	3 Hz
Horizontal AoA range	-90° to +90°
Horizontal AoA resolution	~1°
Vertical AoA range	-90° to +90°
Vertical AoA resolution	~1°
RF power emission (max.)	+6 dBm
Power supply	5V through USB (or external battery)
Mechanical dimension	34cm x 20cm (9cm x 9cm with re-design)

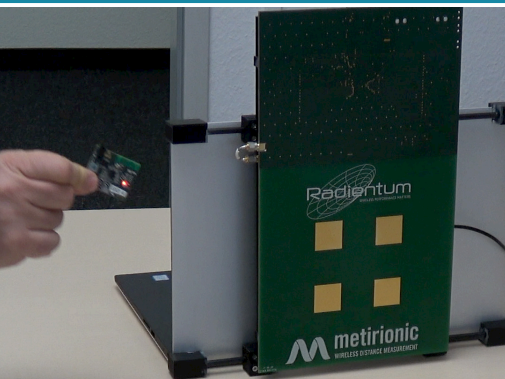
Software and measurement principle

Metirionic IP provides superior wireless measuring of distance and angles. MARS Ranging Modules are based on secondary PSFM approach.

Pulse-Stepped Frequency Modulation (PSFM) technology or also called Multi-Carrier Phase Difference (MCPD). The signal of PSFM radar is a pulse train of sinusoidal waves signals/tones in different frequencies.

Secondary radar principle implies that tone exchanges between all nodes are performed. Here the node starts the tone exchanges is called "Initiator", and the node receives the tone from "Initiator" and response to it is called "Reflector".

Hardware Components



Reflector: Tag with PCB antenna. The size of PCB board is 4.1cm x 3.5cm. The position information of reflector relative to initiator is provided by computer connected to initiator through USB. The raw sampling data can also be provided with different configurations in the positioning system (raw data, angle + distance, position,...).

Initiator: Same PCB board as the reflector assembled to the development board with the antenna array and RF switch. The Antenna array has been custom designed for demo purposes under the scope of Radium-Metirionic partnership. 2by2 antenna array 34cm x 20cm (it can be minimized to the size of antenna array, which is 9cm x 9cm)

Bluetooth® Chipset: RENESAS DA14695

Typical results (demo system)

Range in cycles	75 / 150 / (300) m
Range indoor (typ.)	150 m (300 m with line of sight)
Range outdoor (typ.)	300 m (> 1000 m with power amplifier, radio approval country-specific)
Time for measurement (signal transmission)	5 ms (typ.)
Time for measurement (including calculation time)	300 ms (typ.) with 4 antennas at the initiator

System Configuration

PC with Linux or Windows operating system, PYTHON 3 development environment

METIRIONIC: Your wireless ranging partner

Wireless engineering & Architecture consulting.

Our engineering team works with you to fulfil particular IoT/RTLS needs for several components of the firmware stack, from specification, development and testing to product launch.

We provide further support to make your solution Bluetooth® compliant.