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nanoANQ EA

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Contents

1. Introduction

The *nanoANQ EA* is an anchor for Nanotron's 2.4 GHz wireless Real Time Locating System (RTLS). It has been developed for use with nanotron's high throughput location and monitoring solutions in harsh environments. Together with nanoLOC based tags and Nanotron's Location Server, it forms the basis for location-aware monitoring and management solutions.

The anchor precisely detects the time of arrival (ToA) and received signal strength (RSSI) of tag blinks required for TDOA location applications. nanoANQ EA is able to range with other anchors to automatically determine anchor separation distances – a key capability to enable automatic system set-up and maintenance.

Together with nanoLOC-based tags and nanotron's Location Server, the embedded anchor module forms the basis for high throughput tracking and monitoring applications in harsh environments. The housing supports any 2.4 GHz antenna through its SMA connectors. There is one connector for each of the two independent radio channels.

Through its Ethernet port, the anchor utilizes IP-based data and management protocols and features a built-in DHCP client. Thus it can be configured remotely through its API over the network.

Bidirectional payload exchange between the Location Server and individual tags is supported over the air.

In compliance with CE and other regulations the RF output power is adjustable between 0 and +19 dBm.

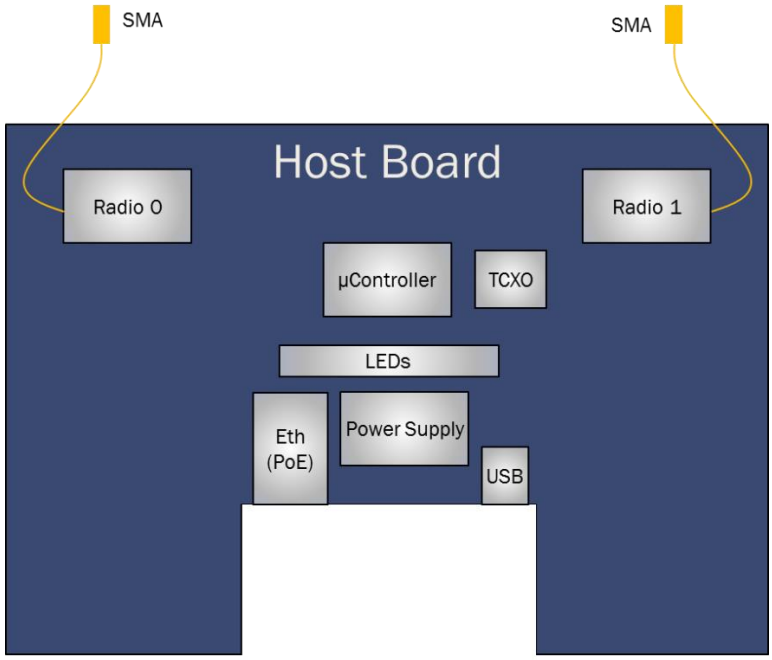

Figure 1-1: Structure of the nanoANQ EA anchor module

2. Features

Frequency range ..... ISM-band 2.4 GHz, 2.400 … 2.4835 GHz

Modulation ..... Chirp Spread Spectrum (CSS)

Signal detection rate ..... up to 900 per second

ToA capture accuracy ..... < 1 ns (better than 30 cm)

Number of RF channels 2

RF output power ..... configurable 0 to +19 dBm

RF sensitivity ..... -89 dBm typ., 80 MHz mode, 1Mbps

RF interface ..... 2 SMA connectors

Data interface: ..... Ethernet 10BaseT/100BaseTX,
..... USB, full speed 480 Mbit/s (maintenance only)

Supply voltages: ..... +48 V Power over Ethernet (recommended),
..... +5 V USB

Power consumption: ..... Power over Ethernet: 5 W max.
..... Classified as PD Class2 according to IEEE 802.3af (3.84 W… 6.49 W)
..... USB 1000 mA max *

Connectors: ..... 1 x RJ45 Ethernet with PoE
..... 1 x Mini USB Type B

Operating temperature ..... -30°C to +70°C

Dimensions ..... 202 mm x 194 mm x 75 mm
..... without mounting options

Weight ..... 800 g
..... without mounting options

* Requires a power device able to deliver 1 A and a cable not longer than 1 m

3. Functional Description

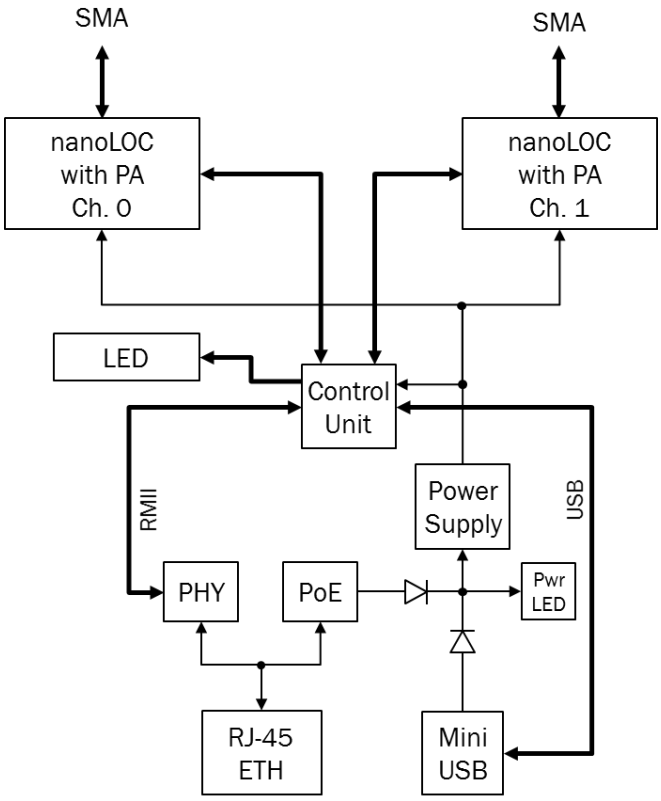

Figure 3-1: Block diagram of nanoANQ EA anchor module

3.1. Dual Channel Core Locating Unit

The core locating unit consists of two independent RF channels and the control unit. It captures incoming chirp spread spectrum (CSS) tag broadcasts and determines their time of arrival (ToA).

3.2. Antenna Connectors

Each of the two RF channels features a SMA connector to allow any other external antenna connector to be used with the anchor module.

Important Note: Before assembling or disassembling the antenna(s), it is imperative that the device is completely switched –off and disconnected from any power source. Nor shall the antenna be handled during operation. Otherwise, damage to circuitry may occur for which nanotron does not assume any liability.

3.3. Status LEDs

Four onboard status LEDs are used to signal different operation modes of the anchor module such as transmit or receive. The assignment of the LEDs to certain operating states is done by software (cf. nanoANQ User Guide [1]). Other five status LEDs are used to signal different operation modes of the anchor such as transmit, receive, alive or power on/off. The other eight LEDs are freely configurable via software.

3.4. Power Supply and Clock Sources

The anchor module can be operated via two alternative power supply sources either via the recommended PoE (Power over Ethernet) or optionally via USB. All required supply voltages are derived internally from the power supply unit. All clocks are generated on board. The USB power supply must be able to deliver at least 1 A at 5 Volts and cable not longer than 1 m to operate properly.

3.5. Interfaces and API

The anchor module is equipped with the required nanoANQ RTLS firmware to enable the module to operate in nanotron's RTLS solution. The firmware can be updated via the module's Ethernet interface using the pre-flashed anchor firmware bootloader. For detailed information on how to upgrade anchor module firmware see the nanoANQ user guide [1].

3.5.1. RF interface

The RF interface for channel 0 (A) and channel 1 (B) consists of SMA connectors. The nominal output power of typical +19 dBm is provided into a 50 Ω load impedance. Deviating loads can cause lower output power and higher operating current. Directly connected antennas should have a reflection factor not higher than 2. To be comliant to local regulations it is recommended to measure the radiated output power including the antenna and to adjust it accordingly.

See also the note in section 3.2.

3.5.2. Ethernet interface

The host board provides an Ethernet 10BaseT/100BaseTX interface via a RJ-45 connector. Further, it provides Power over Ethernet (PoE) 48 V which is the recommended as power source of the anchor.

Table 3-1: RJ-45 signals, pin description

Pin No.	Pin Name	Pin Description
1	TX +	Data
2	TX -	Data
3	RX +	Data
4	VDC +	PoE
5	VDC +	PoE
6	RX -	Data
7	VDC -	PoE
8	VDC -	PoE

3.5.3. USB interface

The anchor includes an USB 2.0 full speed interface for **maintenance** purposes **only**. It provides an alternative 5 V power supply source when PoE is not available. Therefore it has a mini USB-B type connector. Except optional external protection circuits the USB interface needs no additional components. Except optional external protection circuits against surge and lightning, the USB interface needs no additional components.

Table 3-2: USB signals, pin description

Pin No.	Pin Name	Pin type	Pin Description
1	USB_OTG_FS_VBUS	I	USB Bus voltage
2	USB_OTG_FS_DM	I/O	USB differential serial data line
3	USB_OTG_FS_DP	I/O	USB differential serial data line

Pin No.	Pin Name	Pin type	Pin Description
4	USB_OTG_FS_ID	I	USB connector identification
5	GND	-	circuit ground

3.6. Over-the-Air Anchor Synchronization

The anchor module supports nanotron's synchronization method "Sea-of-Anchors" required for operating the device as part of a TDOA localization solution in conjunction with the appropriate location engine and server software.

3.7. Detection of Location Broadcasts

Tags that are part of the nanotron RTLS platform can send out location broadcasts periodically in three different modes: 80 MHz with 1 µs symbol length (80/1), 80 MHz with 4 µs symbol length (80/4), and 22 MHz with 4 µs symbol length (22/4). 1 µs symbols require only one fourth of the airtime of 4 µs symbols. The 80/4 and 22/4 transmission modes provide 6 dB more link budget. Hence 80/1 is recommended for high tag densities and 80/4 or 22/4 is used when maximizing the anchor to tag range is the most important requirement.

The time of arrival (ToA) of tag broadcasts are captured by the anchor module with better than 1 ns resolution and detection rate of more than 900 per second. Through the air, radio waves travel 30 cm in 1 ns. So, ToAs from different anchor modules are used to calculate the time difference of arrival (TDoA). Several TDoAs results are combined to estimate the tag position.

4. Installation Instructions

Unless the anchor is installed in accordance with this installation guide the IP Rating cannot be guaranteed.

Installation steps:

1) Install bracket at desired location using appropriate screws for point of attachment.
2) Connect each antenna to the two SMA connectors
3) Connect required cables into the anchor.
   The cable shall have a diameter of 6 mm (± 10%)
4) Ensure cables are in cable slots and close rear cover.
5) Secure cover using screws supplied. Tighten screws to a torque of 0.65 Nm
6) Connect anchor to the bracket installed in 1 above

The IP rating of this anchor will be invalid if the cable access cover is removed and re-installed. As with any IP rating, the seal should only be compressed once. Otherwise, there is no guarantee of maintaining the IP status."

5. Housing

Figure 5-1: nanoANQ EA housing with antennas

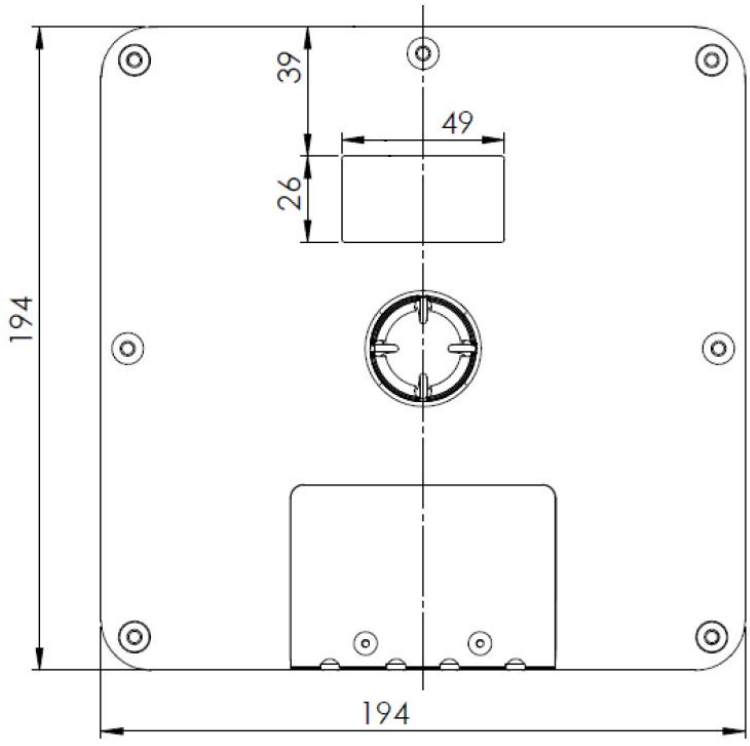

Figure 5-2: nanoANQ EA housing without SMA connectors

6. References

[1] Nanotron nanoANQ User Guide

Document History

Date	Author	Version	Description
2019-05-07	MBO	1.0	Initial version
2019-06-21	MBO	1.1	• Added required performance of the USB power supply • Note how to handle antenna(s) added in sect. 3.2 • Editorial improvements
2019-09-09	MBO	1.2	• Added Ordering Information in header

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