aconno™

DATASHEET

ACN52832

Fully integrated, ultra-low power, Bluetooth Smart module

2 cm

MA:DE IN GERMANY

Datasheet
aconno ACN52832 V1.2

The ACN52832 is a fully integrated, ultra-low power, Bluetooth Smart (former BLE) module in a small form factor which features the advanced Nordic Semiconductor nRF52832 SoC. Its capabilities are tailored for the upcoming demands of sophisticated IoT devices where small size, low power, application performance and radio-range are essential.

Unlike many competitors it features a maker-friendly PCB scale package which allows a fast and easy integration without sacrificing access to its advanced peripherals and capabilities. The ACN52832 features a large number of GPIOs. Thanks to an on-board antenna its RF performance is excellent. To provide quick access to the programming interface of the SoC, the module also features a Tag-Connect connector.

Table of Contents

1. Overview and Features

- Based on Nordic Semiconductor's nRF52832 Bluetooth Smart SoC
- 32-bit ARM® Cortex™ M4F high performance 64 MHz processor core with 512kB Flash / 64 kB RAM
- On-board precision 32 MHz and 32.768 kHz crystal clocksources
- Tag-Connect SWD easy-to-use programming interface
- Up to 28 GPIOs with flexible module pin mapping
- Programmable peripherals for CPU-less operation
- SPI / UART / TWI (I^2C)
- 200 ksps 12-bit ADC
- Low Power Comparator
- I²S and PDM peripherals for Audio
- Quadrature demodulator
- RGB LED
- Fully tuned RF on-board antenna for excellent performance and range
- -20 dBm to +4 dBm output power
- Ultra-low power consumption
- Dimensions: 20.2 x 25 x 3 mm
- Temperature Range: -40°C to +85°C
- Wide supply voltage range: 1.7V to 3.6V
- 3V Lithium battery supported
- NFC-A tag for OOB Bluetooth Smart pairing and wakeup on field
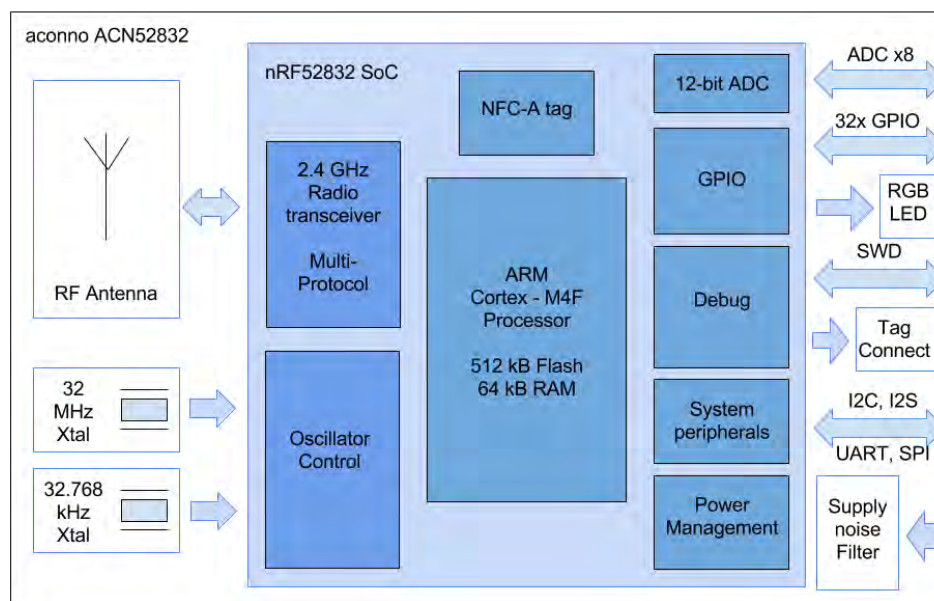- Multiprotocol 2.4 GHz radio

2. Applications

- IoT connected devices
- Bluetooth Smart Sensors
- Home Automation and Control
- Lighting
- Beacons
- Battery driven applications such as wearables

3. Block Diagram

The heart of the ACN52832 module is Nordic's highly integrated nRF52832 BLE SoC which contains a 2.4 GHz transceiver, a 32-bit ARM® Cortex™-M4F CPU, a 512 kB flash memory, 64 kB RAMas well as analog anddigital peripherals.

It can support BLE, ANT/ANT+ and a range of proprietary 2.4 GHz protocols through so called SoftDevices from Nordic Semiconductor, which can be downloaded freely from Nordic's website.

Ultra low power consumption and advanced power management enables a battery lifetime up to several years on a coin cell battery. The 20.3 x 25 x 3 mm sized module integrates power supply decoupling capacitors, 32 MHz and 32.768 kHz crystals, load capacitors, a DC-DC converter, a RF matching circuit and an antenna in addition to the wireless SoC.The module also features a small RGB LED for optical feedback.

Solely the addition of a suitable DC power source is necessary for BLE and/or ANT connectivity. As a result of its Tag-Connect capabilities, the ease of application is further increased. Sensor applications require additional appropriate sensors.
NFC functionality requires anexternallyconnected antenna.

4. Pin Description

The module uses a user-friendly PCB with surrounding solder pads (1.4 mm pitch) in order to provide flexible, "through hole mounting" for rapid prototyping or, furthermore, a SMD mounting technique for a permanent implementation.

I/O Pins sorted by port name:

Pin	Name	Pin function	Description
1, 13, 35	GND	Ground	Should be connected to the ground potential of the application board
12, 23, 24, 32	VDD	Power	Power supply (1.7 V – 3.6 V)
33	SWDIO	Digital I/O	Serial Wire Debug I/O for debugging and programming
34	SWDCLK	Digital Input	Serial Wire Debug clock input for debugging and programming
9	P0.02 / AIN0	Digital I/0 Analog In	GPIO / Analog Input 0
10	P0.03 / AIN1	Digital I/0 Analog In	GPIO / Analog Input 1
11	P0.04 / AIN2	Digital I/0 Analog In	GPIO / Analog Input 2
14	P0.05 / AIN3	Digital I/0 Analog In	GPIO / Analog Input 3
15	P0.06	Digital I/O	GPIO
16	P0.07	Digital I/O	GPIO
17	P0.08	Digital I/O	GPIO
18	P0.09 / NFC1	Digital I/O NFC	GPIO / Connection to NFC-coil
19	P0.10 / NFC2	Digital I/O NFC	GPIO / Connection to NFC-coil
20	P0.11	Digital I/O	GPIO
21	P0.12	Digital I/O	GPIO
22	P0.14	Digital I/O	GPIO / Trace Data 3
25	P0.15	Digital I/O	GPIO / Trace Data 2
26	P0.16	Digital I/O	GPIO / Trace Data 1
27	P0.17	Digital I/O	GPIO / Trace Data 0

Pin	Name	Pin function	Description
28	P0.18	Digital I/O	GPIO
29	P0.19	Digital I/O	GPIO
30	P0.20	Digital I/O	GPIO / Trace Clock
31	P0.21	Digital I/O RESET	GPIO / System Reset / Low Drive / Low Frequency
2	P0.25	Digital I/O	GPIO / Low Drive / Low Frequency
3	P0.26	Digital I/O	GPIO / Low Drive / Low Frequency
4	P0.27	Digital I/O	GPIO / Low Drive / Low Frequency
5	P0.28	Digital I/0 Analog In	GPIO / Analog Input 4 / Low Drive / Low Frequency
6	P0.29	Digital I/0 Analog In	GPIO / Analog Input 5 / Low Drive / Low Frequency
7	P0.30	Digital I/0 Analog In	GPIO / Analog Input 6 / Low Drive / Low Frequency
8	P0.31	Digital I/0 Analog In	GPIO / Analog Input 7

5. Module Specifications

The specifications of the aconno ACN52832 module follow those of the nRF52832 SoC.
The following high-level parameters are valid for the module.

5.1 Absolute Maximum Ratings

	Min	Typ	Max	Unit
Supply Voltages				
VDD	-0.3		+3.9	V
VSS			0	V
I/O Pin Voltage				
$V_{I/O}$, VDD < 3.6V	-0.3		VDD + 0.3	V
$V_{I/O}$, VDD > 3.6V	-0.3		3.9	V
NFC antenna pin current				
$I_{NFC\ 1/2}$			80	mA
Radio				
RF input level			10	dBm
Environmental[1]				
Storage Temperature	-40		+125	°C
Moisture Sensitivity Level			2	
ESD Human Body Model			4	kV
ESD Charged Device Model			1	kV

Flash memory[2]				
Endurance	10.000			cycles
Retention	10 years at 40°C			

1) Ratings are accurate for the nRF52832 QFN48, 6x6mm package
2) At Endurance and Retention periods are estimated at sea level

5.2 RecommendedOperating Conditions

	Min	Typ	Max	Unit
Supply Voltages				
VDD (LDO Regulator Operation)	1.7	3.0	+3.6	V
VDD (DC/DC Regulator Operation)	2.1	3.0	+3.6	V
Supply rise time (OV to 1.7V) [1]				
t_R_VDD			60	ms
Operating Temperature				
TA	-40	25	85	°C

1) The on-chip power-on reset circuitry may not function properly for rise times longer than the specified maximum.

5.3 Current Consumption

The measurements below were taken under following common conditions:

VDD: 3V **Temperature:** 25°C **CPU:** WFI / WFE Sleep

Regulator: DC/DC **Peripherals:** All idle **Clock:** Not running

	Min	Typ	Max	Unit
Radio				
0 dBm TX @ 1Mb/s Bluetooth Low Energy mode, Clock = HFXO		7.1		mA
-40 dBm TX @ 1Mb/s Bluetooth Low Energy mode, Clock = HFXO		4.1		mA
Radio RX @ 1Mb/s Bluetooth Low Energy mode, Clock = HFXO		6.5		mA
Radio and CPU running CoreMark				
CPU running CoreMark from Flash, Radio 0 dBm TX @ 1 Mb/s Bluetooth Low Energy mode, Clock = HFXO, Cache enabled		9.6		mA
CPU running CoreMark form Flash, Radio RX @ 1 Mb/s Bluetooth Low Energy Mode, Clock = HFXO, Cache enabled		9.0		mA
Ultra-low power				
System ON, No RAM retention, Wake on any event		1.2		µA
System ON, Full RAM retention, Wake on any event		1.5		µA
System OFF, No RAM retention, Wake on LPCOMP		1.9		µA
System OFF, No RAM retention, Wake on GPIO		1.2		µA
System OFF, Full RAM retention, Wake on reset		0.7		µA
System OFF, No RAM retention, Wake on NFC		0.7		µA
System OFF, No RAM retention, Wake on reset		0.3		µA

5.4 Clock Sources

	Min	Typ	Max	Unit
Internal High Frequency Clock for RF Stability: 32 MHz Crystal Frequency Tolerance			± 50	ppm
Internal Low Frequency Clock for BLE Sync: 32,768 kHz Crystal Frequency Tolerance			± 100	ppm
Internal Low Frequency Clock for BLE Sync: RC Oscillator [1]			± 250	ppm
RF Frequency Tolerance: For BLE operation Channels 0 to 39			± 100	ppm

1) Frequency tolerance after calibration

5.5 Radio Specifications

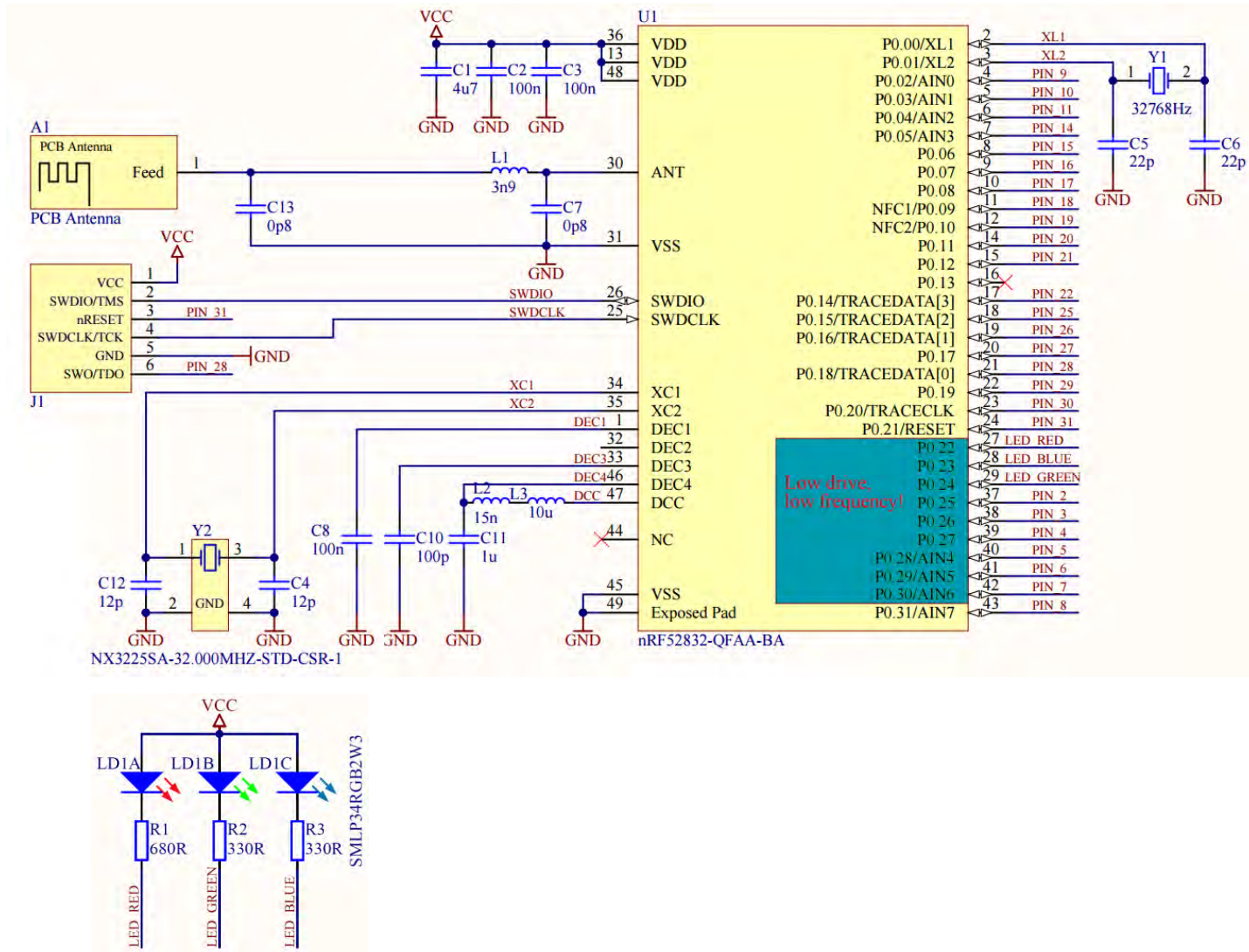|	Min	Typ	Max	Unit
Frequency Range	2402		2480	MHz
Channel 0 to 39 Spacing		2		MHz
Output Power[1]	-20		+4	dBm
Receiver Sensitivity - BLE			-96 dBm	
Data Rate[2]	250	1000	2000	kbps
RSSI Range	-90		-20	dBm
RSSI Resolution		1		dBm

1) Transmit output power is specified by design
2) 1Mbps is the only modulation available for Bluetooth LE. 250kbps used in proprietary mode.
   2Mbps can be used for proprietary and is available for future BLE PHY specifications.

5.6 GPIO Specifications

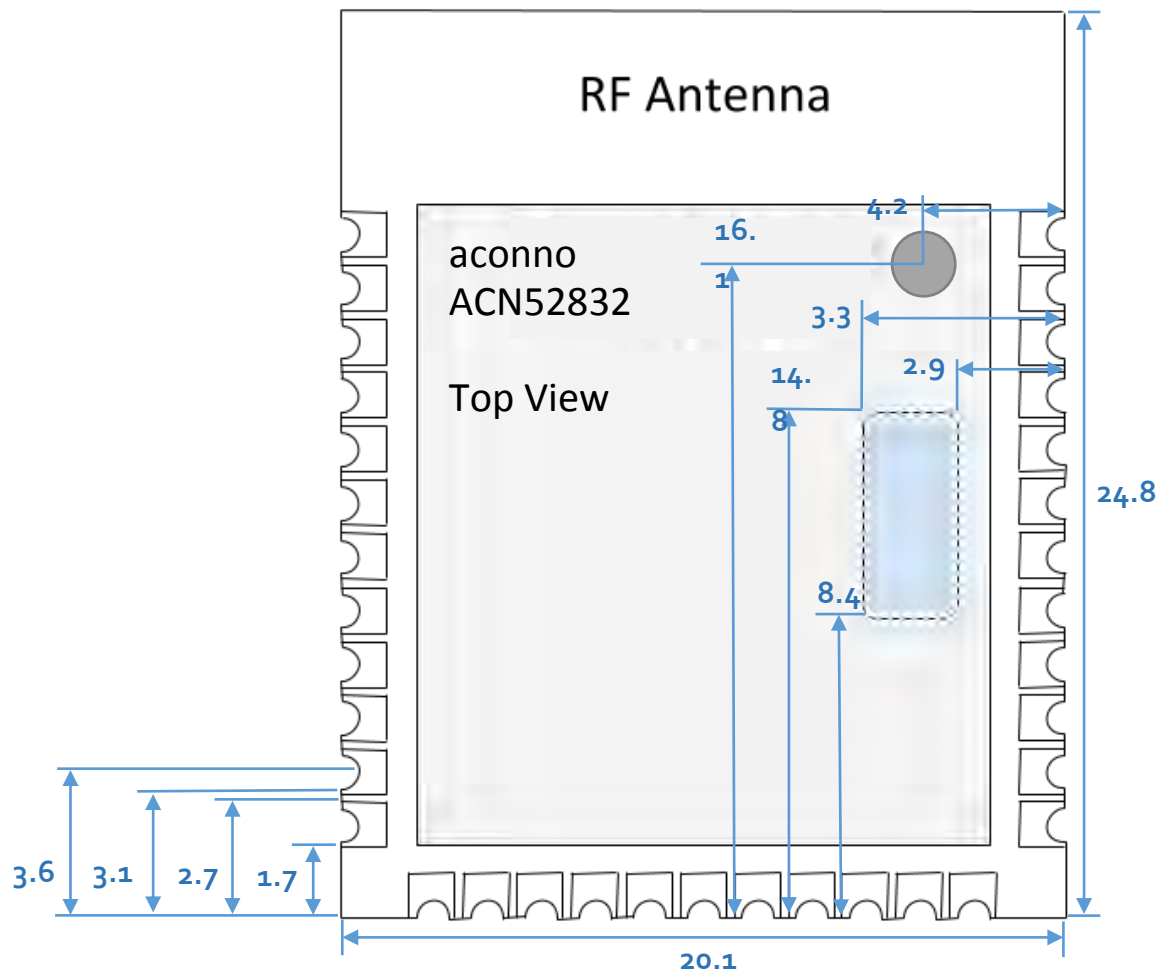|	Min	Typ	Max	Unit
Input High Voltage	0.7 * VDD	-	VDD	V
Input Low Voltage	VSS	-	0.3 * VDD	V
Drive Current, standard drive (VDD = 3.0V)		6.2		mA
Drive Current, high drive (VDD = 3.0V)		25		mA
Sink Current, standard drive (VDD = 3.0V)		6.2		mA
Sink Current, high drive (VDD = 3.0V)		25		mA
Pull Up Resistance	11	13	16	kOhm
Pull Down Resistance	11	13	16	kOhm

6. Electrical Schematic

7. Mechanical Outlines

All measurements are in mm.

Tolerances are ±0.2mm.

7.1 Marking on metal shielding

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Model No: ACN52832
FCC ID: 2AL2N-ACN52832
IC ID: 22709-ACN52832

Manufacturer: aconno GmbH
Made in Germany

CE RoHS COMPLIANT

8. Firmware

The ACN52832 module can be used for various applications, it supports an extensive array of protocols. For Bluetooth LE applications the Bluetooth stack and other functionality is provided by the S132 SoftDevice.

A SoftDevice is a binary image provided and certified by Nordic Semiconductor to comply with the Bluetooth Specifications. The SoftDevice runs along with the application. Using a standardized interface and APIs, the application can configure and run the Bluetooth or another stack.

Considering that the ACN52832 supports multiple protocols, several SoftDevices are available:

SoftDevice	
S132	BLE Concurrent Peripheral + Central
S212 (1)	ANT Protocol Stack
S312 (2)	ANT and BLE

(1) S212 ANT Protocol Stack is available directly from ANT: www.thisisant.com

(2) S312 is preliminary and not yet available. Please contact Nordic Semiconductor for further information:

   http://www.nordicsemi.com/

8.1   S132 BLE SoftDevice

The S132 SoftDevice is used to create a full Single Mode BLE solution and has the following features:

- Bluetooth 4.2 compliant low energy single-mode protocol stack suitable for Bluetooth Smart products
    - Concurrent Central, Observer, Peripheral, and Broadcaster roles with up to:
        - Three connections as a central
        - One connection as a peripheral
        - Observer
        - Broadcaster
    - Link layer
    - L2CAP, ATT, and SM protocols
    - GATT and GAP APIs
    - GATT Client and Server
- Memory isolation between application and protocol stack for robustness and security
- Thread-safe supervisor-call based API
- Asynchronous, event-driven behavior
- No RTOS dependency (any RTOS can be used)
- No link-time dependencies
    - Standard ARM® Cortex™ M4F project configuration for application development
- Support for concurrent and non-concurrent multiprotocol operation
    - Concurrent with the Bluetooth stack using concurrent multiprotocol timeslot API
    - Alternate protocol stack in application space

8.2   S212 ANT SoftDevice

The S212 is a fully ANT compliant stack enabling customers to create mesh networks with extremely low power. ANT and ANT/Bluetooth Smart combo SoftDevices for the nRF52 series are obtained directly from ANT.

For more information on this please contact: ANTstacks@thisisant.com

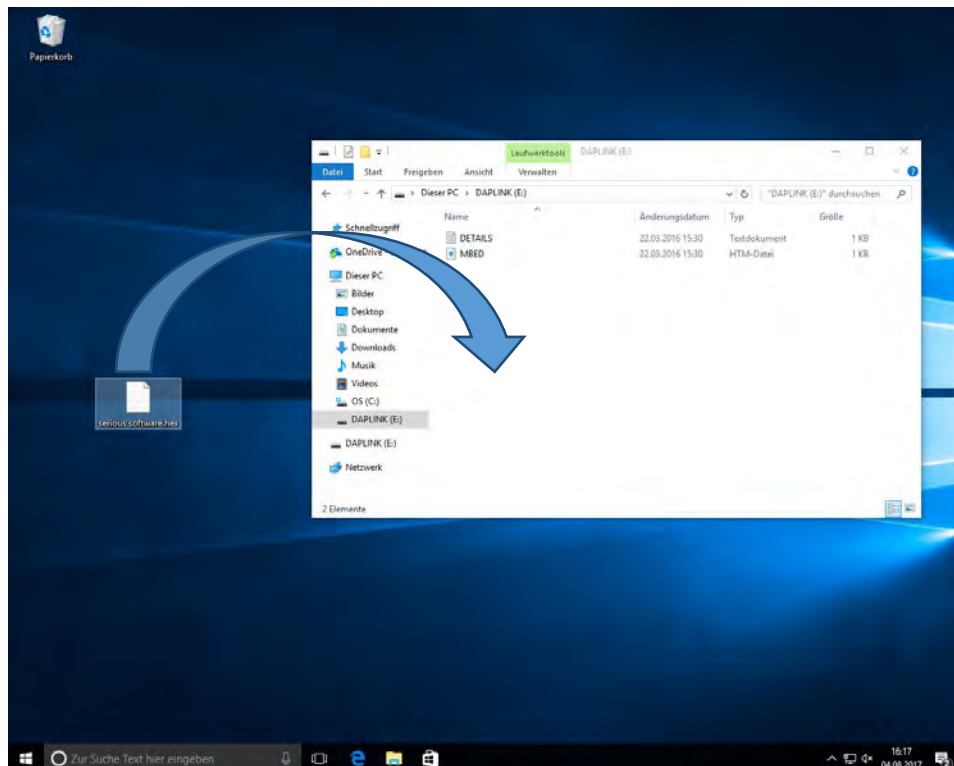A few features of the ANT stack and its capabilities:

- Advanced ANT stack
  - Simple to complex network topologies:
    - Peer-to-peer, Star, Tree, Star-to-star and more
  - Up to 15 logical channels, each with configurable:
    - Channel type, ID and period
    - Networks
  - Broadcast, Acknowledged, and Burst Data modes
  - Device search, pairing and proximity support
  - Enhanced ANT features:
    - Advanced Burst Transfer mode (up to 60 kbps)
    - Up to 15 channels encryption (AES-128) support
    - Additional networks – up to 8
    - Event Filtering and Selective Data Updates
    - Asynchronous Transmission
    - Fast Channel Initiation
- Built-in NVM access and radio coexistence management
- Memory isolation between application and protocol stack for robustness and security
- Thread-safe supervisor-call based API
- Asynchronous, event-driven behavior
- No RTOS dependency (any RTOS can be used)
- No link-time dependencies
  - Standard ARM® Cortex™ M4F project configuration for application development
- Support for concurrent and non-concurrent multiprotocol operation
  - Concurrent multiprotocol timeslot API
  - Alternate protocol stack in application space

9. Programming/ Flashing with Tag Connect

Since the ACN52832 incorporates a Tag-Connect connector allowing fast debugging and drag & drop programming together with our ACNPROG programmer (available separately). There are two ways of programming the module with our programmer:
Using drag &drop in your OS or within a programming suite.

Without a programming suite, it is still possible to create your firmware e.g. using the mbed online developing tool. After you created the compiled binary *.hex file, simple put it into the "DAP Link" called mass storage device and the download to the module begins immediately. During the programming process, the mass storage device will shortly disappear. When it shows up again, the programming process is finished and your module is ready to go.
For programming, inside a programming suite please refer to the manual of this software.

10. Certification

10.1 FCC (USA)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different
   from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.
The device has been evaluated to meet general RF exposure requirement.
The device can be used in portable exposure condition without restriction.

FCC ID: 2AL2N-ACN52832

This device is intended only for OEM integrators under the following conditions:
1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) This device and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures. Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without C2P.
3) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

USERS MANUAL OF THE END PRODUCT:
In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.
If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of FCC rules.
Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

LABEL OF THE END PRODUCT:
The final end product must be labeled in a visible area with the following "Contains FCC ID: **2AL2N-ACN52832**". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

10.2 IC (Canada)

RSS-Gen Issue 4 December 2014 & CNR-Gen 4e Décembre 2014:

- English:

This device complies with Industry Canada license-exempt RSS standard(s).

Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

- French:

Le présent appareilestconforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitationestautorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillageradioélectriquesubi, mêmesi le brouillageest susceptible d'encompromettre le fonctionnement.

The final end product must be labeled in a visible area with the following: "Contain IC ID: **IC:22709-ACN52832**"

11. Revision History

Here you will find the current and the previous version of the document you are now reading. Also, the web-site for your device is listed. Be sure to check it after your purchase for the latest available updates and examples.

Revision	Changes	Modified page #
1.0	Initial release	all
1.1	Power consumption, schematic	11 , 14
1.2	FCC, IC statements added	20 ,21
1.3	Power consumption, Title, mechanical outlines	1 , 11 , 15

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