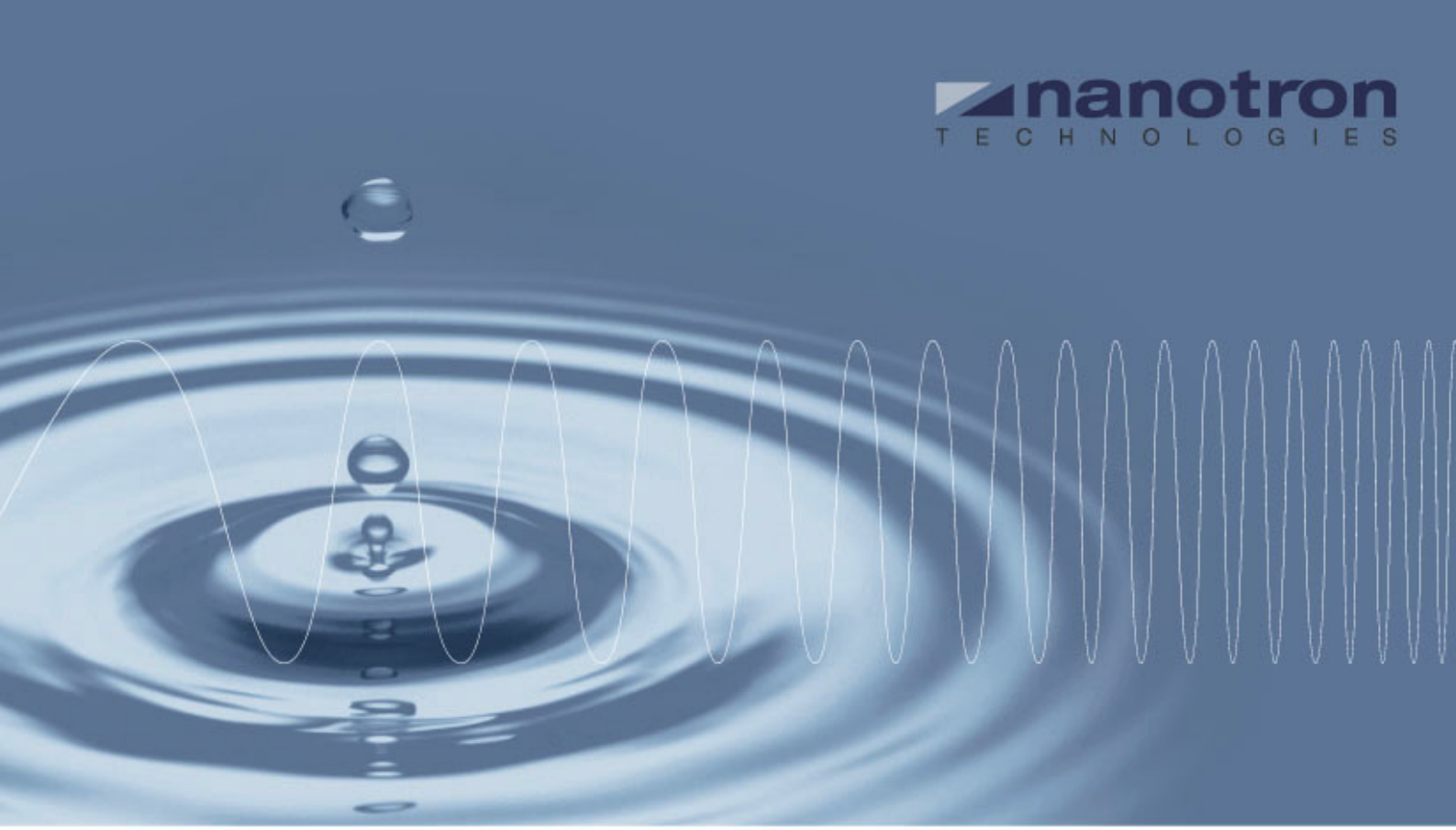

nanoPAN 5360
RF Module

Technical Description

Version 1.00

NA-05-0119-0339-1.00

Chirp it.

Document Information

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Regulatory Information

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. *Nanotron Technologies GmbH* customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify *Nanotron Technologies GmbH* for any damages resulting from such improper use or sale.

Electromagnetic Interference / Compatibility

Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed, or otherwise configured for electromagnetic compatibility.

To avoid electromagnetic interference and/or compatibility conflicts, do not use this device in any facility where posted notices instruct you to do so. In aircraft, use of any radio frequency devices must be in accordance with applicable regulations. Hospitals or health care facilities may be using equipment that is sensitive to external RF energy.

With medical devices, maintain a minimum separation of 15 cm (6 inches) between pacemakers and wireless devices and some wireless radios may interfere with some hearing aids. If other personal medical devices are being used in the vicinity of wireless devices, ensure that the device has been adequately shielded from RF energy. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

EC Declaration of Conformity

The *2.4GHz Chirp Spread Spectrum (CSS) Low-Power RF Transceiver*, model number *nanoNET TRX,* has been certified to comply with the requirements of the R&TTE Directive 1999/5/EC and the standards EN 300 328 V 1.4.1:2003, EN 301 489-17 V1.2.1, and
EN 60950-1:2001.

CE 0681

CAUTION! Electrostatic Sensitive Device. Precaution should be used when handling the device in order to prevent permanent damage.

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1 Overview

The *nanoPAN 5360 RF Module* contains the *nanoNET TRX* transceiver along with external circuitry required for its operation. It provides basic RF functionality including transmission (TX) and reception (RX) as well as basic digital operations. It also includes a bandpass filter for filtering signal disturbances.

Note: If the filter against signal disturbances is unnecessary, the *nanoPAN 5361 RF Module,* which does not include a bandpass filter, is available.

Figure 1: nanoPAN 5360 RF Module

The *nanoPAN 5360 RF Module* consists of the following components:

- *nanoNET TRX* Transceiver

  The *nanoNET TRX* transceiver has extremely low power consumption, operates over a wide range of temperatures, and performs effortlessly in robust wireless networks operating in the *2.45 GHz* ISM band. The new transmission technology *Chirp Spread Spectrum* (CSS) developed by Nanotron has Upchirps and Downchirps with a symbol duration of T_{symbol} *= 1 µs* and an effective bandwidth of B_{chirp} *= 64 MHz*. The chip offers three different data rates: *500 kbps*, *1 Mbps,* and *2 Mbps*.

- Antenna Port

  The asymmetrical antenna port is used to connect a 50 Ω antenna to the *nanoPAN 5360 RF Module.*

- ISM Bandpass filter

  For an improved robustness against out of band inferences the *nanoPAN 5360 RF Module* contains an ISM bandpass filter at antenna port.

- Matching Circuits

  At the RF interface of the TRX, there is a differential impedance of 150 Ω, which is matched to the 50 Ω impedance of the ISM bandpass filter and the antenna port by a 150 Ω / 50 Ω RF balun. Additional external components at the RF interface have a power and noise matching function that allows a sharing of the antenna without an external RX/TX – RF switch.

- CDDL – Complementary Dispersive Delay Line

  The CDDL is a highly sophisticated SAW filter which incorporates two filters within a single device. Within the *nanoNET* system, the SAW Filter is responsible for distinguishing between two possible incoming signals that are generated by another *nanoNET* transceiver. This received signal is either an Upchirp, a Downchirp, or a folded pulse (Upchirp and Downchirp

at the same time). All of these signals have the same center frequency and the same bandwidth. The difference between an Upchirp and a Downchirp occurs only in the phase information. This phase information is sufficient for the CDDL to compress a pulse at one output port and expand it at the other (that is, to extend the incoming signal to the doubled duration). In this way the CDDL acts like a matched filter for one of the possible transmitted pulses.

- 32.768 kHz Quartz

  The 32.768 kHz Quartz is used for the Real Time Clock oscillator.

- 16 MHz Quartz

  To provide the required 16 MHz clock, the *nanoPAN 5360 RF Module* uses a 16 MHz Quartz that works with the internal oscillator circuitry.

- Connectors

  Pads along the module borders allow the *nanoPAN 5360 RF Module* to be soldered as an SMD device onto different carrier boards.

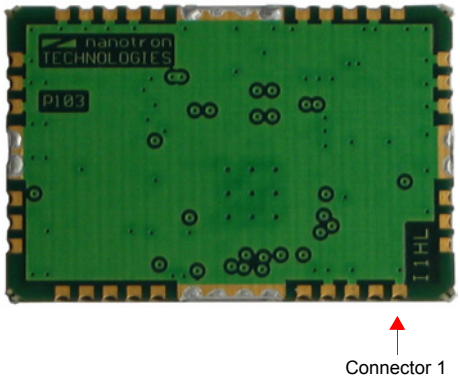

Figure 2: nanoPAN 5360 RF Module - bottom side

2 Schematics

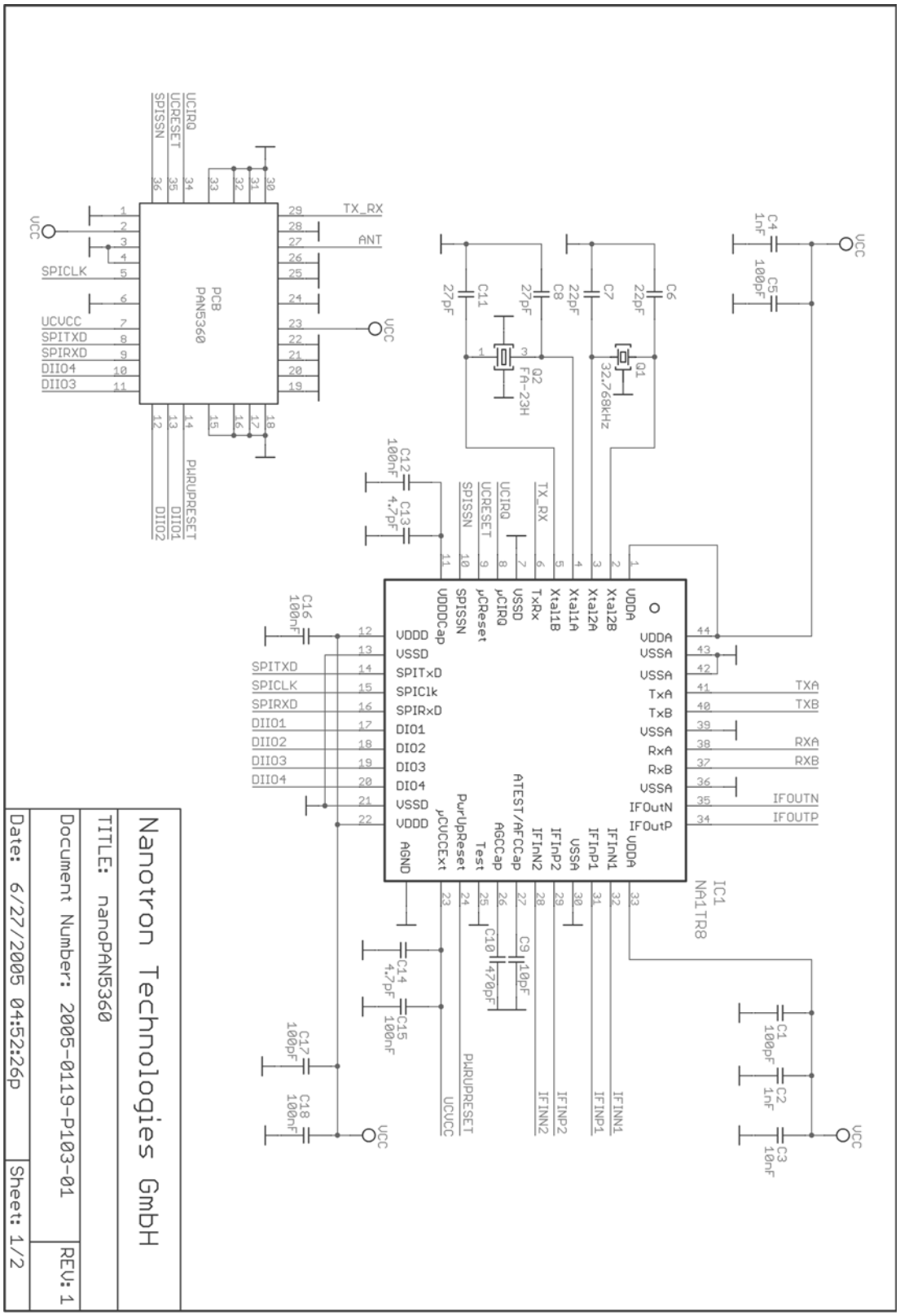

Figure 3: nanoPAN 5360 RF Module - schematic 1 of 2

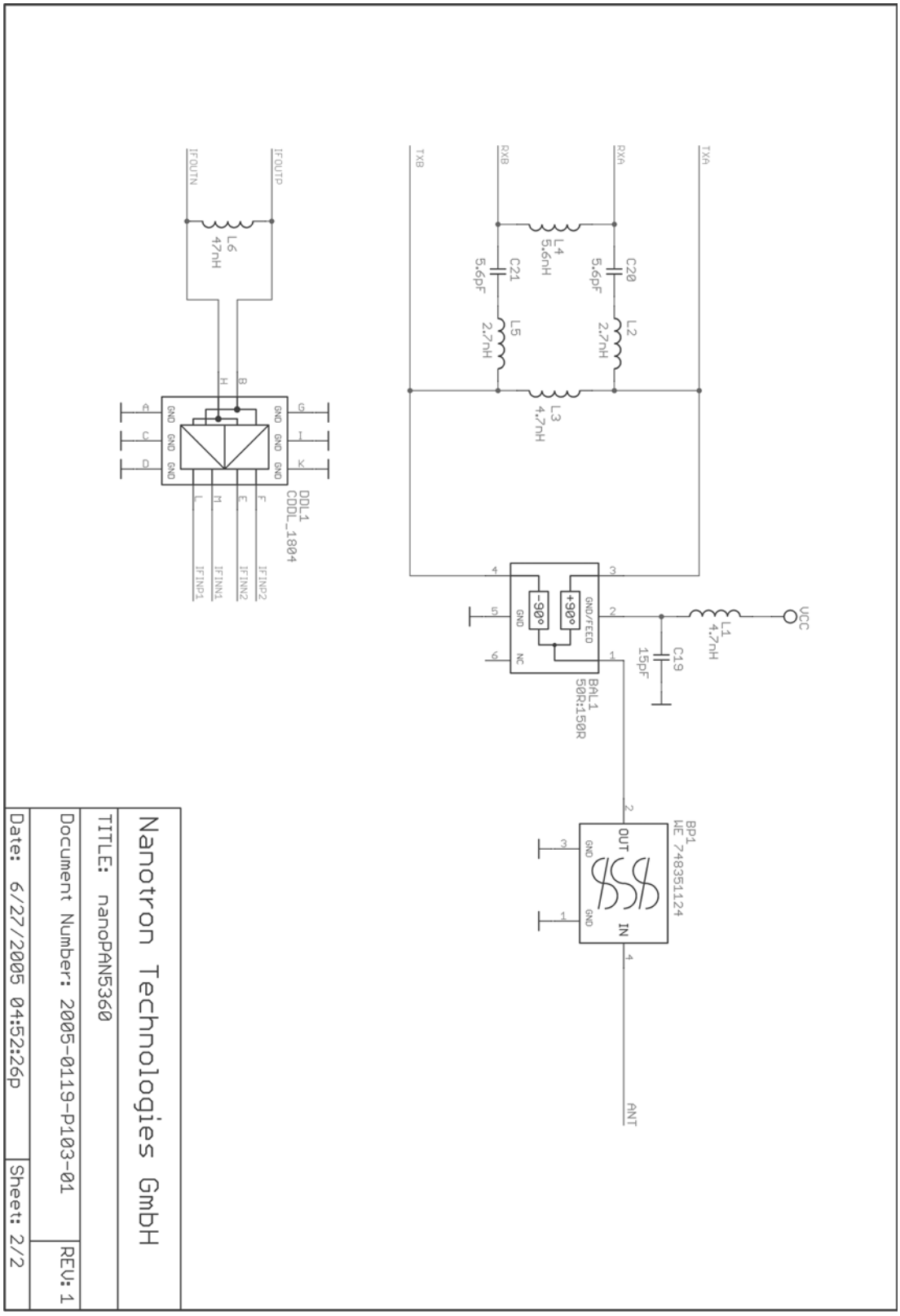

Figure 4: nanoPAN 5360 RF Module - schematic 2 of 2

3 PCB Layout

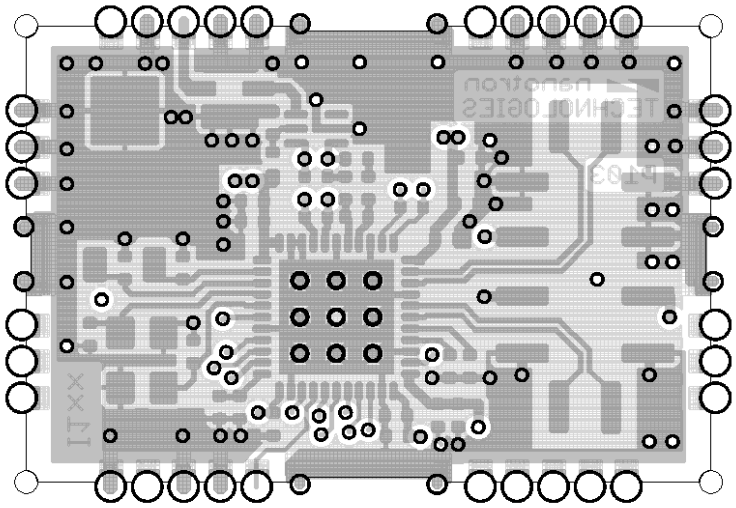

Figure 5: nanoPAN 5360 RF Module - overview

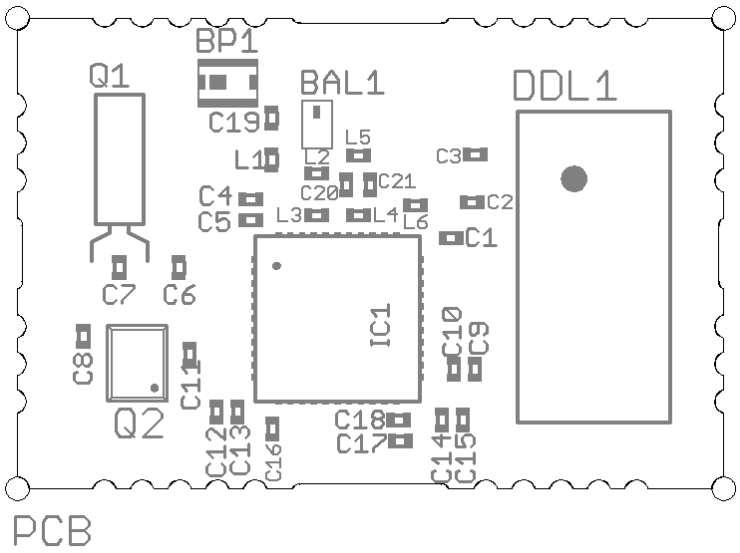

Figure 6: nanoPAN 5360 RF Module - names

4 Bill of Materials

Table 1: nanoPAN 5360 RF Module bill of materials

Part					Manufacturer	
Description	**Label**	**Value**	**Qty**	**Package**	**Company**	**Product number**
Capacitors	C13, C14	4.7pF	2	0402	MURATA	GRM1552C1H4R7BZ47E
	C20, C21	5.6pF	2	0402	MURATA	GRM1552C1H5R6CZ47E
	C9	10pF	1	0402	MURATA	GRM1552C1H100RZ47E
	C19	15pF	1	0402	MURATA	GRM1552C1H150JZ47E
	C6,C7	22pF	2	0402	MURATA	GRM1552C1H220JZ47E
	C8, C11	27pF	2	0402	MURATA	GRM1552C1H270JZ47E
	C1, C5, C17	100pF	3	0402	MURATA	GRM1552C1H101JDA2E
	C10	470pF	1	0402	MURATA	GRM155B11H471KA01E
	C2,C4	1nF	2	0402	MURATA	GRM155B11H102KA01E
	C3	10nF	1	0402	MURATA	GRM155B11E103KA01E
	C12, C15, C16, C18	100nF	4	0402	MURATA	GRM155B31C104KA87E
Inductors	L2, L5	2.7nH	2	0402	Wuerth	744784027
	L1, L3	4.7nH	2	0402	Wuerth	744784047
	L4	5.6nH	1	0402	Wuerth	744784056
	L6	47nH	1	0402	Wuerth	74478447
Balun	BAL1	50R:150R	1	BAL0805	Wuerth	748420245
Bandpass filter	BP1	WE 748351124	1	WE-BPF1008	Wuerth	748351124
CDDL	DDL1	CDDL_1804	1	13.3 x 6.5	Nanotron	DS1804C
Quartz	Q1	32.768 kHz	1	MS1V-TK	GOLLEDGE	MS1V-TK/I 32.768 kHz, ±20ppm
	Q2	16.000 MHz	1	FA-23H	EPSON	Q24FA23H0018600
nanoNET TRX transceiver	IC1	NA1TR8	1	VFQFPN7X7	Nanotron	NA0108B
PCB	PCB	PAN5360	1	PAN5360	HMP	P103

5 Module Layout

5.1 Measures (Shielded RF Module)

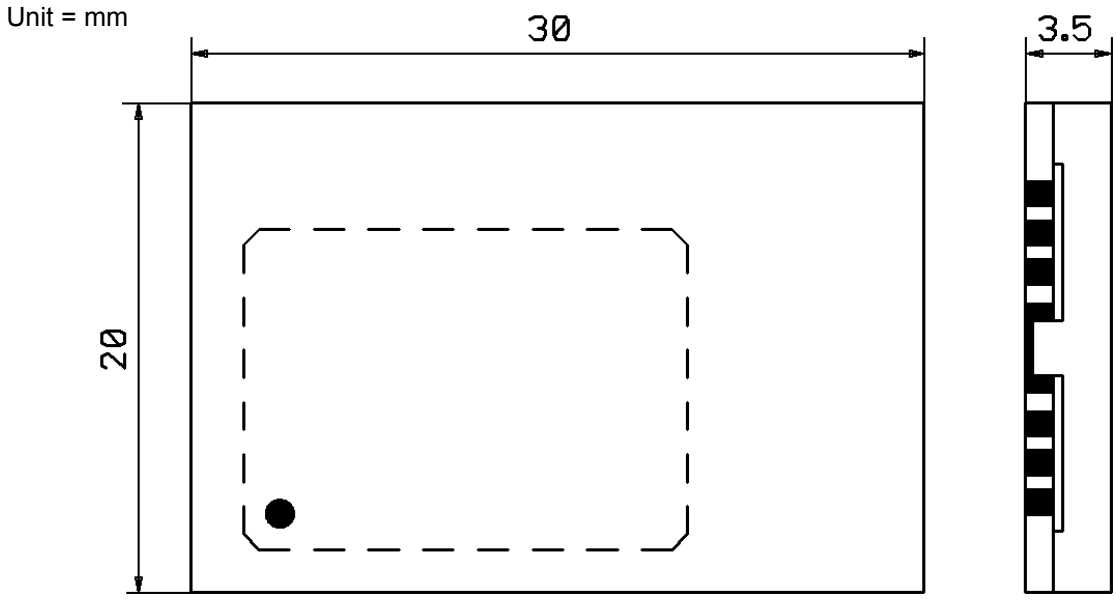

Figure 7: nanoPAN 5360 RF Module - measures

5.2 Terminal Layout

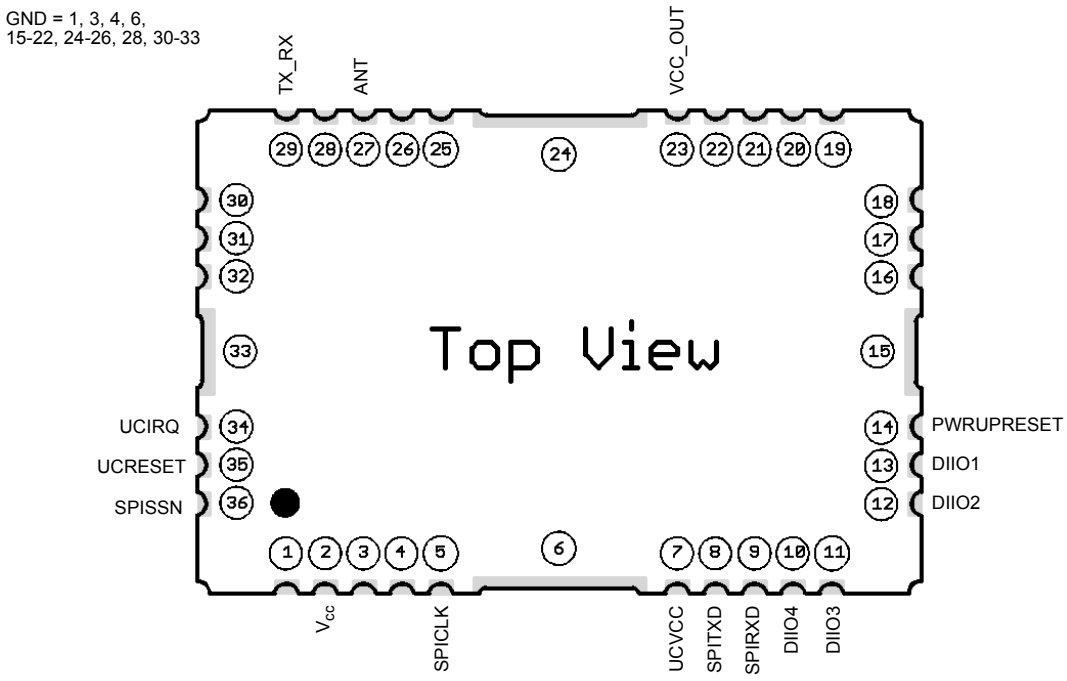

Figure 8: nanoPAN 5360 RF Module - terminal layout

5.3 Terminal Description

Table 2: nanoPAN 5360 RF Module terminal description

Pin	Signal	Description	Direction
1	GND	Ground connection (0Vdc)	Blank
2	VCC	Positive supply	Input
3	GND	Ground connection (0Vdc)	Blank
4	GND	Ground connection (0Vdc)	Blank
5	SPICLK	SPI: CLK	Input
6	GND	Ground connection (0Vdc)	Blank
7	UCVCC	Power Supply for µc	Output
8	SPITXD	SPI: TX	Input
9	SPIRXD	SPI: RX	Output
10	DIIO4	General Purpose Input/Output	I / O
11	DIIO3	General Purpose Input/Output	I / O
12	DIIO2	General Purpose Input/Output	I / O
13	DIIO1	General Purpose Input/Output	I / O
14	PWRUPRESET	Power Up Reset from µc	Input
15	GND	Ground connection (0Vdc)	Blank
16	GND	Ground connection (0Vdc)	Blank
17	GND	Ground connection (0Vdc)	Blank
18	GND	Ground connection (0Vdc)	Blank
19	GND	Ground connection (0Vdc)	Blank
20	GND	Ground connection (0Vdc)	Blank
21	GND	Ground connection (0Vdc)	Blank
22	GND	Ground connection (0Vdc)	Blank
23	VCC_OUT	internally connected to VCC	Output
24	GND	Ground connection (0Vdc)	Blank
25	GND	Ground connection (0Vdc)	Blank
26	GND	Ground connection (0Vdc)	Blank
27	ANT	50 Ohm RX/TX connection to antenna	I / O
28	GND	Ground connection (0Vdc)	Blank
29	TX_RX	Status Tx / Rx	Output

Table 2: nanoPAN 5360 RF Module terminal description

Pin	Signal	Description	Direction
30	GND	Ground connection (0Vdc)	Blank
31	GND	Ground connection (0Vdc)	Blank
32	GND	Ground connection (0Vdc)	Blank
33	GND	Ground connection (0Vdc)	Blank
34	UCIRQ	Interrupt for µc	Output
35	UCRESET	Reset for µc	Output
36	SPISSN	SPI: Slave Select	Input

6 Soldering Information

6.1 Recommended Reflow Soldering Temperature-Time Profile

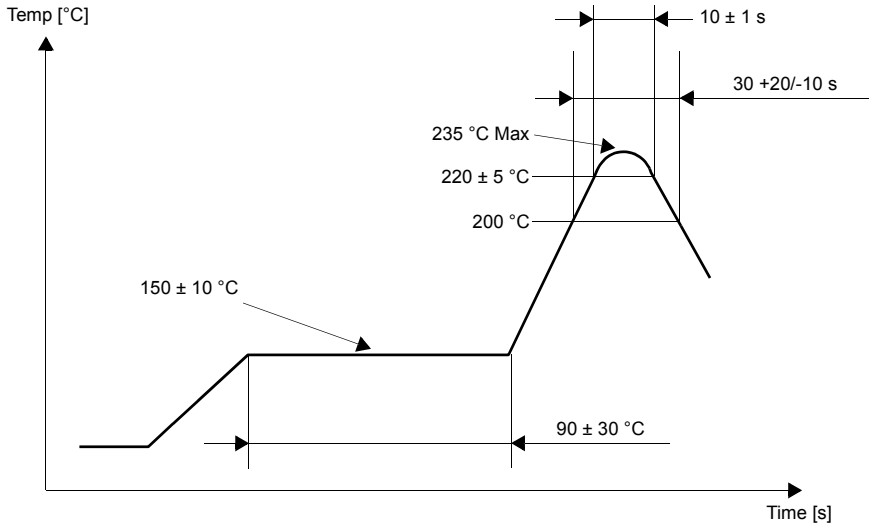

Figure 9: Recommended temperature profile for the nanoPAN 5360 RF Module

6.2 Recommended Foot Pattern

The same dimensions for the solder paste screen are recommended, depending on the solder screen thickness.

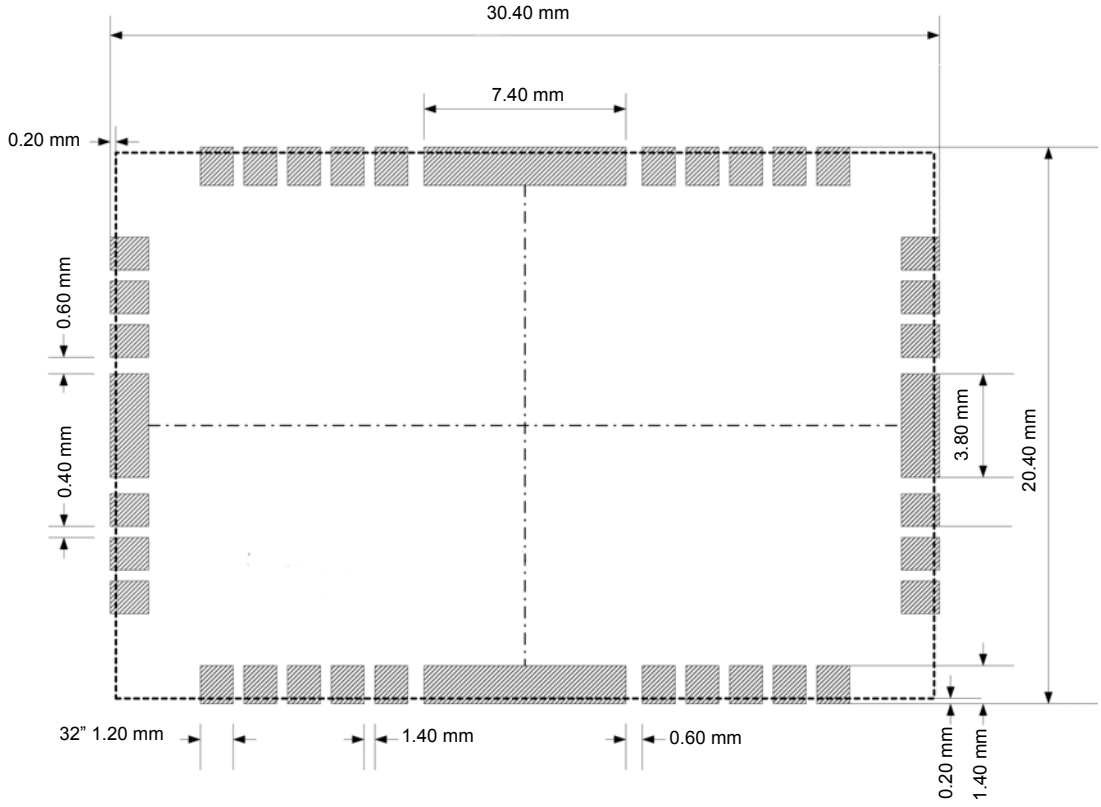

Figure 10: Recommended foot pattern for the nanoPAN 5360 RF Module

7 nanoPAN 5360 RF Module Adapter Board

The *nanoPAN 5360 RF Module* can be used with the *nanoNET RF Performance Evaluation Kit* by soldering it on to an adapter board, as shown in the following illustration.

Figure 11: nanoPAN 5360 RF Module Adapter Board

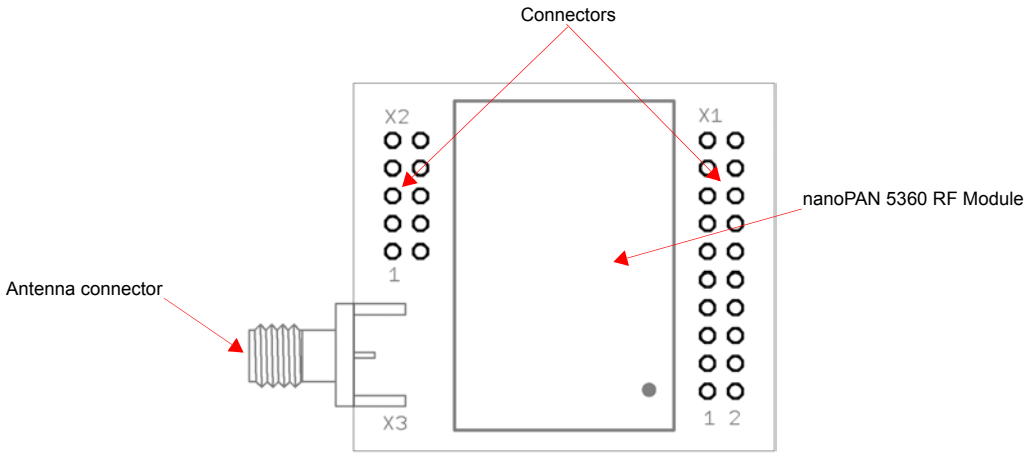

Figure 12: nanoPAN 5360 RF Module Adapter Board - components

7.1 Connector X1

Table 1: nanoPAN 5360 Adapter Board - connector X1 pin description

Pin	Signal	Description	Direction
1	SPICLK	SPI:CLK	Input
2	TX_RX	Status TX/RX	Output
3	SPITXD	SPI:TX	Output
4	SPISSN	SPI: Slave Select, [low active]	Input
5	SPISSN2	SPI: Slave Select (EEPROM)	Input
6	SPIRXD	SPI:RX	Input
7	UCRESET	Reset for µc	Output
8	UCIRQ	µc interrupt	Output
9	DIIO2	Digital I/O 2	I/O
10	GND	Digital ground	Blank
11	DIIO4	Digital I/O 4	I/O
12	DIIO1	Digital I/O 1	I/O
13	PWRUPRESET	Power up reset from µc	Input
14	DIIO3	Digital I/O 3	I/O
15	UCVCC	Power supply for µc; +3.3 V	Output
16	GND	Digital ground	Blank
17	TEST	N.A.	Input
18	GND	Digital ground	Blank
19	GND	Digital ground	Blank
20	GND	Digital ground	Blank

7.2 Connector X2

Table 2: nanoPAN 5360 Adapter Board - connector X2 pin description

Pin	Signal	Description
1	GND	Ground
2	–	Not connected
3	GND	Ground
4	V_AN	Supply voltage, analog = 3.3 V
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	VDD	Supply voltage for EEPROM = 3.3 V
10	V_DIG	Supply voltage, digital = 3.3 V

7.3 Schematics

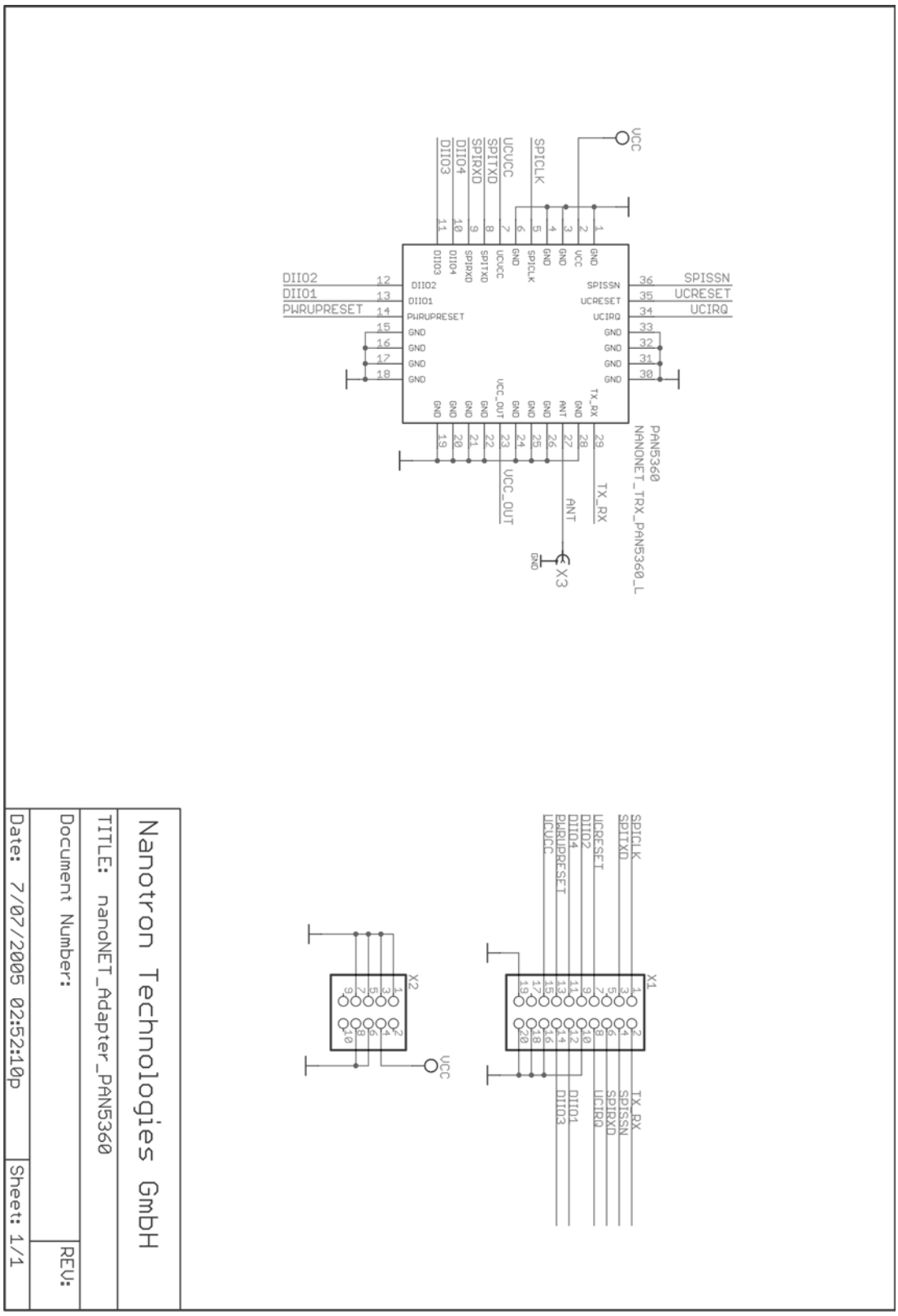

Figure 13: nanoPAN 5360 RF Module Adapter Board - schematics

8 RF Performance Evaluation Kit

The *nanoNET TRX RF Performance Evaluation Kit* enables the evaluation of wireless communication using the *nanoNET TRX* transceiver in real world conditions. The *nanoPAN 5360 RF Module Adapter Board* is connected to the MCF microcontroller boards included in the Evaluation Kit, as shown below.

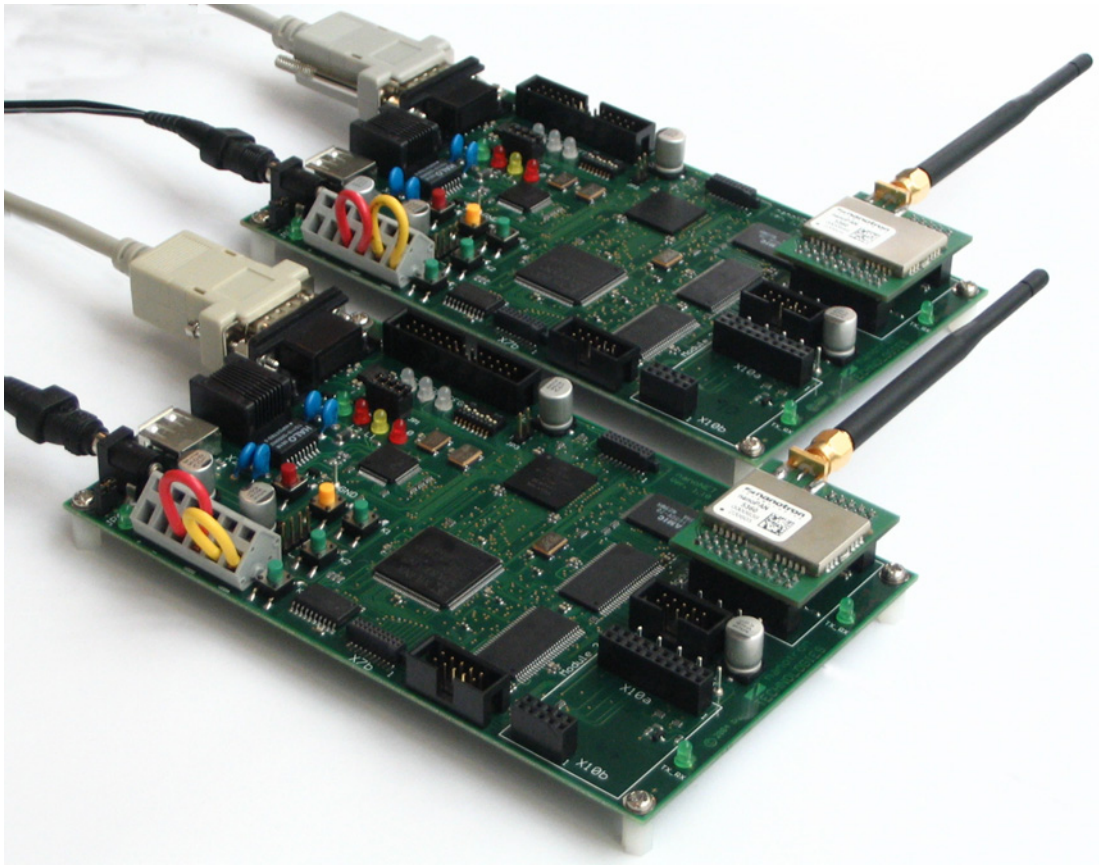

Figure 14: RF Performance Evaluation Kit hardware

For more details about the *RF Performance Evaluation Kit*, refer to the documents *nanoNET TRX RF Performance Evaluation Kit Quick Start Guide* and *nanoNET TRX RF Performance Kit User Manual*.

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Revision History

Version	Date	Description/Changes
2005-07-15	1.00	Initial Version.

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