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AND9402/D

AX5043 0 dBm / 8 mA TX and 9.5 mA RX Configuration for the 868 MHz Band

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APPLICATION NOTE

Introduction

This application note describes how to use AX5043 to design a 0 dBm / 8 mA transmit and 9.5 mA receive configuration for the 868 MHz band. Both hardware and software configurations are discussed.

The configuration targets wide band and category 2 or 3 receiver usage as regulated by ETSI EN 300 220−1 V2.4.1 (2012−05). Performance is given for 50 kbps FSK operation in the 868.0 – 868.6 MHz band.

AX5043 has a differential and a single ended power amplifier (PA). To get the highest possible output power the differential PA must be used. 0 dBm output power which is far below the maximum possible output power can be achieved with both PAs. However, using the single ended power amplifier allows 0 dBm output power to be achieved with less power consumption.

The differential PA is internally multiplexed with the receive path. The single ended PA is output on a dedicated pin and must be externally connected to the receiver if a single antenna configuration is to be used. A low component count, purely passive configuration to achieve this goal is presented in this application note.

Hardware Configuration

Summary of Changes vs. Standard DVK−2 Add−on Modules

Table 1. MODULE CHANGES

Module	AX5043 DVK−2b V1.4
Antenna Interface	Use configuration shown in Figure 2.
RF Reference Clock	16 MHz XTAL instead of 48 MHz TCXO Direct connection of the XTAL to the device pins CLK16P and CLK16N without TCXO network as shown in Figure 1. Disconnect VAUX (TCXO supply) from J2 to avoid shorting it to GND across the XTAL

RF Reference Clock

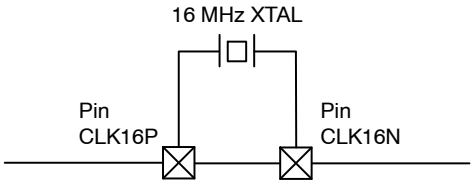

Figure 1. XTAL Configuration

Antenna Interface

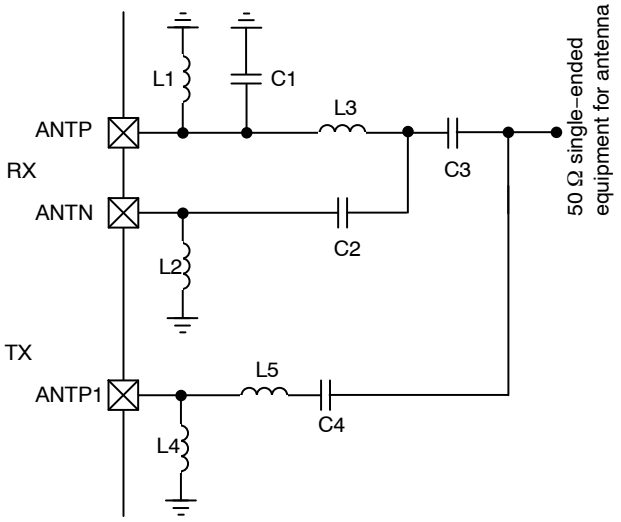

Figure 2. Structure of the Antenna Interface for a Single−ended Antenna and Single−ended Internal PA, without RX/TX Switch

Table 2. COMPONENT VALUES

Frequency Band	L1 [nH]	L2 [nH]	L3 [nH]	L4 [nH]	L5 [nH]	C1 [pF]	C2 [pF]	C3 [pF]	C4 [pF]
868 MHz	18	7.2	12	12	27	2.7	2.7	10	2.7

Software Configuration

For software setup AX−RadioLab for AX5043 V2.2 is used. Table 3 gives the register values that were changed vs. the RadioLab generated configuration.

It is recommended to use FSK as modulation, not GFSK, as the shaping logic for the GFSK output consumes additional current and ETSI EN 300 220−1 V2.4.1 (2012−05) wide band regulatory requirements can easily be met with FSK.

Table 3. REGISTER SETTINGS

Register	Register Address	Parameter	Value TX	Value RX
AX5043_TXPWRCO-EFFB1	0x14A	Output Power	0x02	
AX5043_TXPWRCO-EFFB0	0x16B		0x80	
AX5043_F11	0xF11	XTAL config.	0x84	
AX5043_POWCTRL1	0xF08	VDD_ANA	0x02	0x03
AX5043_POWCTRL0	0xF09	VDD_MODEM	0x01	

Performance

Table 4. PERFORMANCE

Measurement equipment TX	0.5 m RG−58 cable from SMA to R&S FSEB spectrum analyzer (Note 1)
Measurement equipment RX	Pair of AX5043 modules with variable attenuation chain and shielding box
Mainboard and debug adapter	DVK−2b
Carrier Frequency	868.3 MHz
Bit rate	50 kbps
Modulation	FSK
FSK deviation $(f_{mark}-f_{space})/2$	h=0.667, 16.667 kHz
IDD for TX P_{out} = 0 dBm random data	7.8 mA (Note 2)
IDD for RX	9.5 mA
VDD_IO range with P_{out} = 0 dBm	1.6 V − 3.6 V
RX sensitivity Input sensitivity at PER = 1% for 868 MHz operation, 144 bit packet data, without FEC	−105 dBm (Note 3)
ETSI EN 300 220−1 V2.4.1 (2012−05)	TX : wide band operation 868.0 − 868.6 pass RX : class 2 or 3

1. 0 dBm is the spectrum analyzer reading. Cable losses are not compensated
2. Without RX/TX combination P_{out} = 0 dBm is achieved with 300 μA less current with the same TX network
3. Without RX/TX combination the sensitivity is 3 dB better

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