SRD Module Integration

EZ13-00102

V 1.07

Hermann Sewerin GmbH

Contents

1. Related Documents

1.1 Contact

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2. Important User information

NOTE:

This equipment is sensitive to electro-static discharge. Use an ESD-safe workstation for handling and use suitable packaging.

• The SDR module must be supplied by a limited power source according to EN 60950-1.

• The clearance and creepage distances required by the end product must be withheld when the module is installed.

• The cooling of the end product shall not negatively be influenced by the installation of the module.

2.1 Note for Users in Canada

General Notes:

This device complies with Industry Canada licence-exempt RSS standard(s) and part 15 of the FCC Rules. 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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

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

(2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

To reduce potential radio interference to other users, the antenna type and its gain should be chosen so that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

Following Antennas are certified and can be used with the RF Module:

2.1dBi quarter wave antenna SEWERIN EA15-Z0400
5.0dBi Patch antenna 2,45GHz SEWERIN EA20-00901

Additional antennas may be used provided they are from same type, having less or equal gain and have similar in-band and out-of-band characteristics than one of the above listed antenna.

Attention
For the usage of the RF module inside the special host condition (Water leakage detection device / Aquaphon) the transmitter power of the RF module with the 5.0 dBi Patch antenna must be reduced (TXPWR = 0 ; -10dBm) to assure compliance for the simultaneous transmission with the same RF Module using the 2.1 dBi quarter wave antenna.

Integration into a Host System:

This radio module is designed for professional use and must be integrated into a host system by qualified personel only.

The module is granted a limited modular approval, i.e. it can be integrated in host systems if the following requirements are met:

- The supply voltage specifications in this document must be met.

- Following Antennas are certified and can be used with the RF Module:

2.1dBi quarter wave antenna SEWERIN EA15-Z0400
5.0dBi Patch antenna 2,45GHz SEWERIN EA20-00901

Additional antennas may be used provided they are from same type, having less or equal gain and have similar in-band and out-of-band characteristics than one of the above listed antenna.

Attention
For the usage of the RF module inside the special host condition (Water leakage detection device / Aquaphon) the transmitter power of the RF module with the 5.0 dBi Patch antenna must be reduced (TXPWR = 0 ; -10dBm) to assure compliance for the simultaneous transmission with the same RF Module using the 2.1 dBi quarter wave antenna.

The outside of the host device into which the module is installed must display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module IC:7994A-EZ1300102" or "Contains IC:7994A-EZ1300102"

2.2 Note for Users in the USA

General 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 rated RF power (conducted) of the device is 0.0079 W.
The antenna must not be co-located and operated in conjunction with any other antenna or transmitter.

Integration into a Host System:

This radio module is designed for professional use and must be integrated into a host system by qualified personel only.

The module is granted a limited modular approval, i.e. it can be integrated in host systems if

the following requirements are met:

- The supply voltage specifications in this document must be met.
- Following Antennas are certified and can be used with the RF Module:

2.1dBi quarter wave antenna SEWERIN EA15-Z0400
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Additional antennas may be used provided they are from same type, having less or equal gain and have similar in-band and out-of-band characteristics than one of the above listed antenna.

Attention
For the usage of the RF module inside the special host condition (Water leakage detection device / Aquaphon) the transmitter power of the RF module with the 5.0 dBi Patch antenna must be reduced (TXPWR = 0 ; -10dBm) to assure compliance for the simultaneous transmission with the same RF Module using the 2.1 dBi quarter wave antenna.

The outside of the host device into which the module is installed must display a label referring to the enclosed module. This exterior label can use wording such as the following:
“Contains Transmitter Module FCC ID: WSP-EZ1300102” or
“Contains FCC ID: WSP-EZ1300102.”

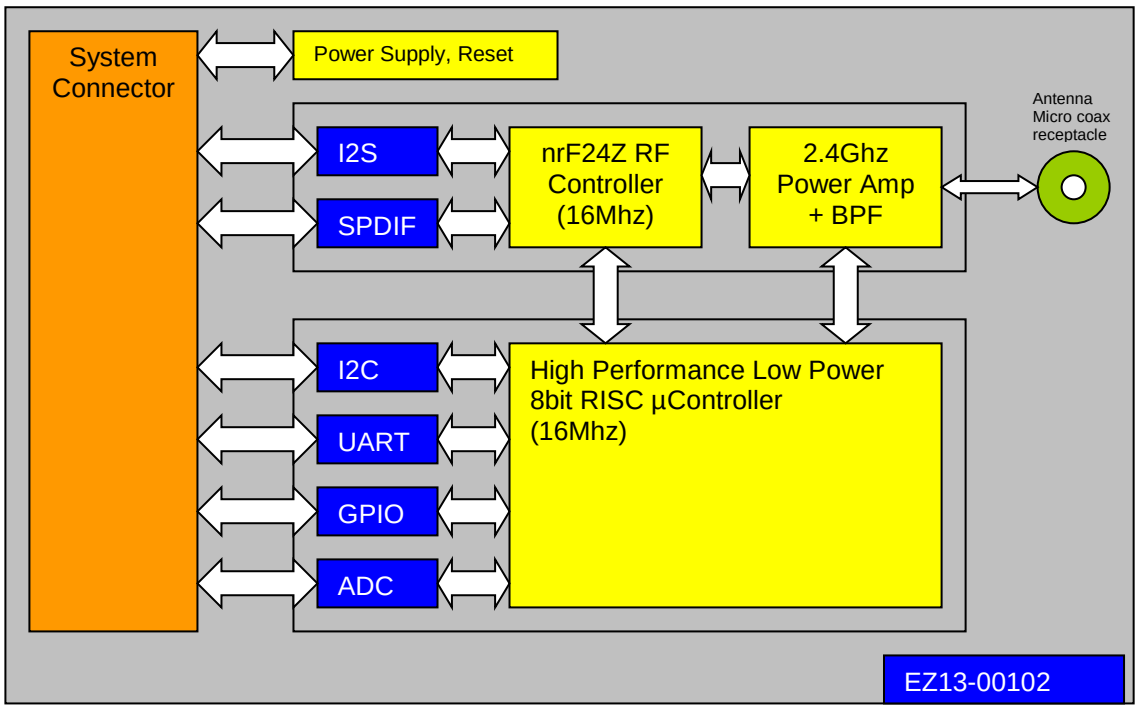
On the host application a label shall show the following wording:

„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.“

Refer to Part 2 and Part 15 of FCC Rules for details.

3. Introduction

3.1 System diagram



4. Conformity

The SRD module complies with the essential requirements of §3 and the other relevant provisions of Article 3 of the R&TTE directive when used for its intended purpose and is labelled with the CE conformity mark. It has obtained a limited modular approval according to FCC (USA) and IC (Canada) regulations.

Certification and Approvals

EN 300328	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive
EN 301489-1	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
EN 301489-17	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for 2,4 GHz wideband transmission systems and5 GHz high performance RLAN equipment
EN 61000-4-3	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
EN 60950-1	Safety of information technology equipment
FCC regulations § 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.

5. Hardware Description

5.1 Mechanical Characteristics

5.1.1 Dimensions

Parameter	Typ.	unit
Length	52.75	mm
Width	19.75	mm
Height	5.5	mm

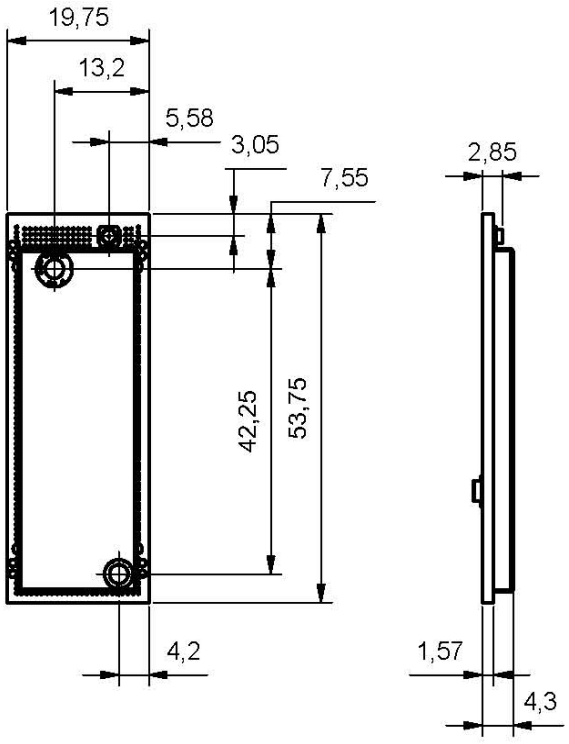


Figure 1: Mechanical drawing of SDR module

5.1.2 Weight

Parameter	Typ.	unit
Weight	6	g

5.2 Electrical Characteristics

5.2.1 Pinout

I/O	Pin	Function	Description	Initial I/O state
I/O	1	*TF*	I2S Frame	I
I/O	2	*TD*	I2S Data In / Out	I
PWR	3	*V3P3*	Power supply	
PWR	4	*V3P3*	Power supply	
I/O	5	*PA0*	I/O port / analog input	I
I/O	6	*PA1*	I/O port / analog input	I
I/O	7	*PA2*	I/O port / analog input	I
I/O	8	*PA3*	I/O port / analog input	I
I/O	9	*RD*	I2S Data Out (not used!)	I
I/O	10	*TK*	I2S Clock	I
PWR	11	*GND*		
I/O	12	*TDI*	JTAG	
PWR	13	*GND*		
I/O	14	*TCK*	JTAG	
I/O	15	*RES Input*	Reset input activ low	
PWR	16	*GND*		
I/O	17	*TMS*	JTAG	
PWR	18	*GND*		
I/O	19	*TDO*	JTAG	
PWR	20	*GND*		
PWR	21	*V3P3*	Power supply	
PWR	22	*V3P3*	Power supply	
PWR	23	*GND*		
PWR	24	*GND*		
O	25	*MCLK*	Codec Clock (Bitclock * 255)	O
I/O	26	*SPDIF*	Serial Audio Stream	I
O	27	*TXD0*	RS232 Control Port	O
I/O	28	*RXD0*	RS232 Control Port	I
I/O	29	*TWCK*	I2C Port	I
I/O	30	*TWD*	I2C Port	I

5.2.2 Absolute Maximum Ratings

Parameter	Remarks	Conditions	Min	Max	unit
V3P3	Digital supply voltage		-0.3	3.85	V
Iiosum	Current through all IO pins			200	mA
Iio	Current through IO pin			40	mA
Vdigin	Max Voltage on any digital inputs	V3P3>=3.3V	-0.3	3.6	V
Vanain	Max voltage on any analogue inputs		-0.3	3.5	V

NOTE: Absolute maximum ratings may be applied to the module for a short period of time. Applying values greater than those mentioned will damage the module.

5.2.3 Electrical Specifications

5.2.3.1 Power Supply

Parameter	Remarks	Conditions	Min	Typ.	Max	unit
V3P3	Digital supply voltage		3.15	3.5	3.85	V
I3P3	Digital supply current	RX SLAVE MODE TX MASTER MODE [10dBm output pwr]		45 56		mA

5.2.3.2 Digital I/O

Parameter	Remarks	Conditions	Min	Typ.	Max	unit
Vin_dig_high	Digital in high level		0.6			V
Vin_dig_low	Digital in low level				0.2	V
Vout_dig_low_5m	Digital out low level	5mA			0.6	V
Vout_dig_high_5m	Digital out high level	5mA	2.3			V

5.2.3.3 UART interface

Parameter	Remarks	Conditions	Min	Typ.	Max	unit
UART data rates	Default: 19.2 kbps			19.2		kBd
UART framing				8N1		
UART buffer				software controlled		

5.2.3.4 I2S interface

Parameter	Remarks	Conditions	Min	Typ.	Max	unit
I2S sample rates	Steps: 32, 44.1 , 48Khz		32	32	48	Khz
I2S bits	2 Channels			16		Bits
I2S clock period			150			ns
I2S ws setup time			20			ns
MCLK locking range vs nominal frequency			-500		+500	ppm
RMS Jitter 0 – 25Khz				250	310	ps
Note : - Master and slave mode support by firmware is possible, MCLK in Master mode is generated. - Nominal MCLK frequency is 576 times fS for fS in [32kHz, 44.1kHz, 48kHz] programmable - I2S 24 to 16 bit audio compression is possible						

5.2.2.5 Radio Frequency Interface

Parameter	Remarks	Conditions	Min	Typ.	Max	unit
Frequency range			2408		2476	MHz
Channel spacing				1.0		MHz
Hopping channels				38		
Δf	Frequency deviation			+/-640		kHz
R_{GFSK}	GFSK data rate			4000		kbps
Δf_{XTAL}	Xtal frequency tolerance + temperature drift				+/-30	ppm
P_{RF}	Transmitter output power			9.0		dBm
RX_{sens}	Receiver sensitivity			-80		dBm
RX_{max}	Maximum received signal		0			dBm
Antenna port impedance				50		Ohm
Modulation				Gaussian Frequency Shift Keying GFSK		

5.3 Environmental Conditions

Parameter	Remarks	Conditions	Min	Typ.	Max	unit
Ta_op	Operational temperature		-20	+25	+60	℃
Ta_st	Storage temperature		-25		+80	℃
H	Humidity	Non condensing	15		95	%

5.4 Interface Description

5.4.1 System connector

The interface to the host system is implemented as a 30 pin 0.5mm grid male connector. The part used on the SRD module is a MOLEX 55560-307.

It is recommended to connect the module with MOLEX 54722-0307.

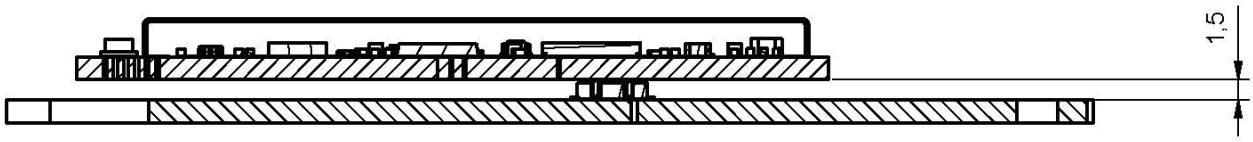


Figure 2: Distance between PCBs depend on component heights (here: 1.5 mm)

5.4.2 RF Interface

RF Interface provides one aerial connection.

This port is used for the connection of an external antenna.

The coaxial connector used on the module is a Hirose U.FL series connector, type U.FL-R-SMT, reference no. CL331-0471-0. Please refer to www.hirose.com for details.

Figure 3: Antenna Ports

NOTE:

Use ESD safe environments for connecting on antenna ports.

6. SRD module integration example

This example shows a typical application for Sewerin SRD module in a headphone design.
The module is used to transfer audio data at given sample rates.
In this application the aerial SEW EA15-Z0400 is connected to the module.
Audio data is transferred through the I2S interface.
Some ports are used to drive LED's and for reading keyboard values.

Figure 4: Integration in headphone module with external antenna

7. SRD Hardware description

7.1 Description of internal module components top view

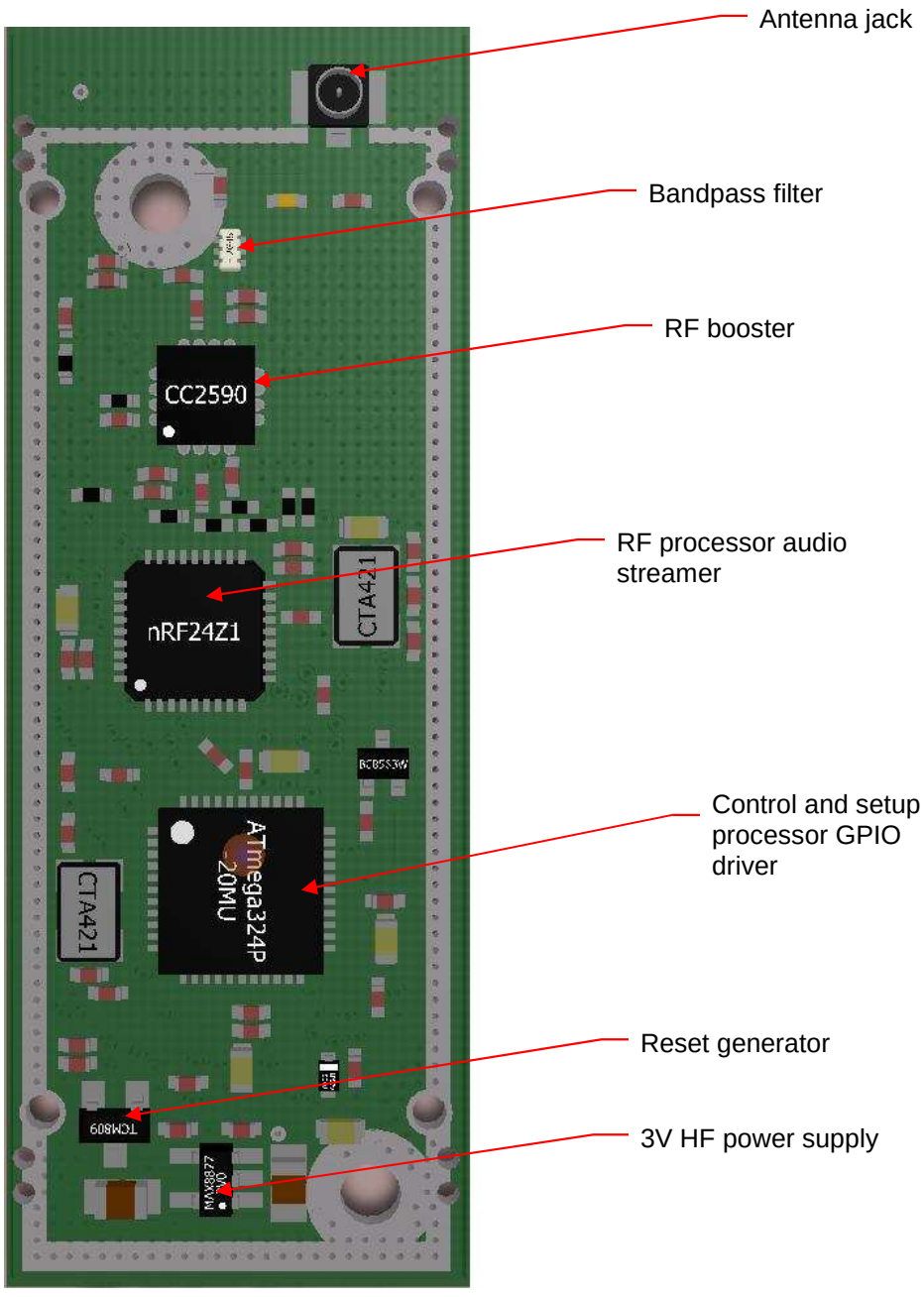


Figure 5: SRD module top view

7.2 Description of internal module components bottom view

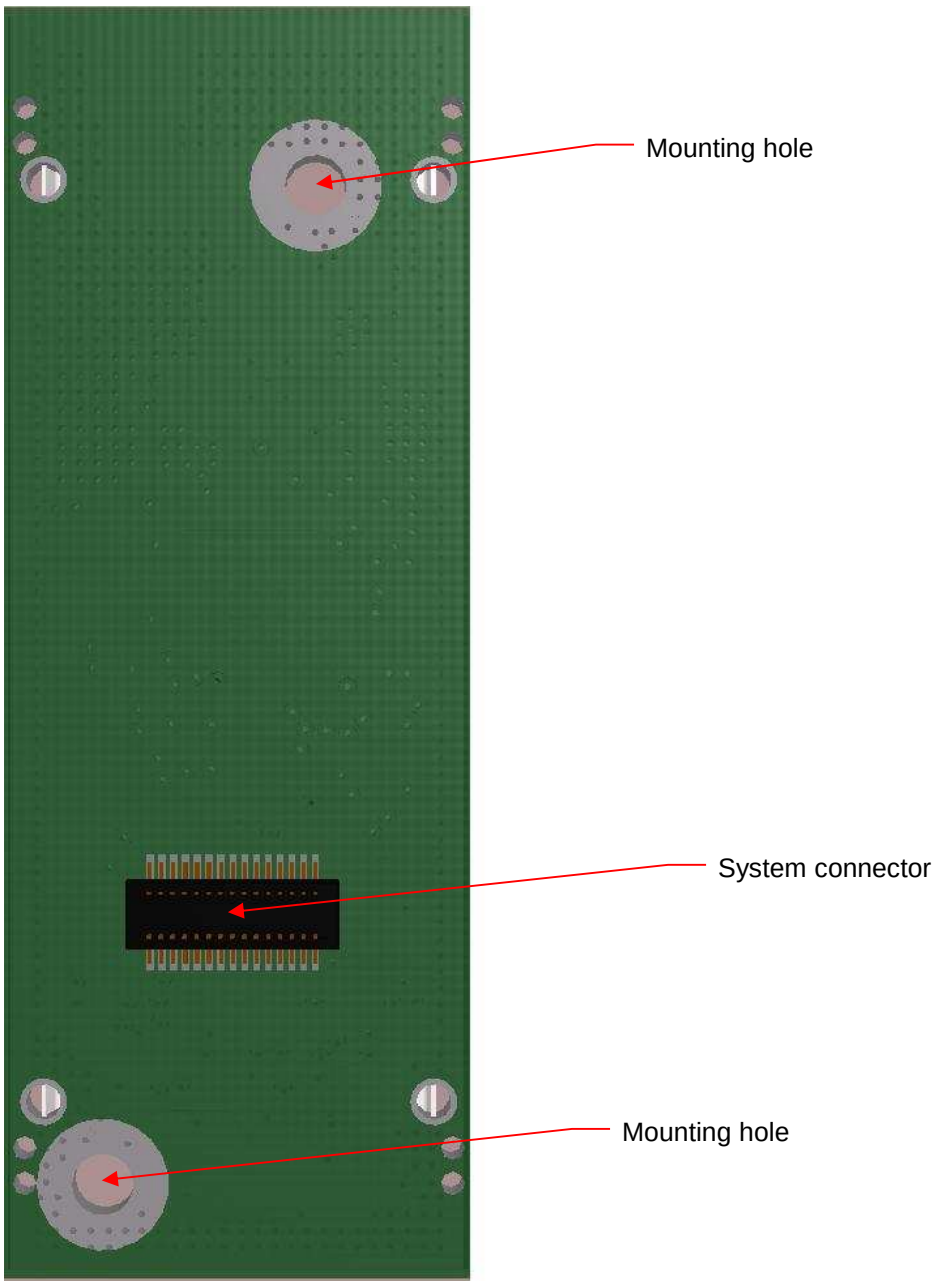
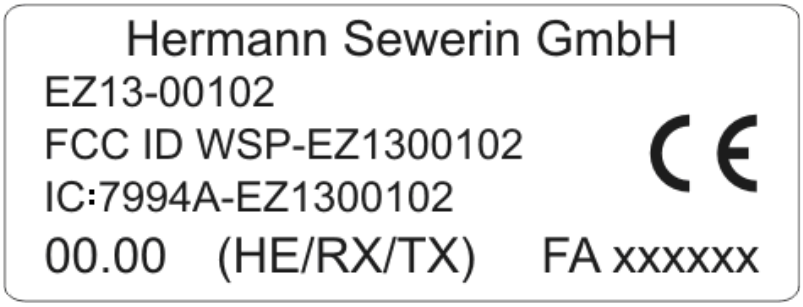


Figure 5: SRD module bottom view

7.3 Design of module label



7.4 Functional description of SRD module

The SRD module provides a true CD quality audio streaming of up to 16 Bit 48kSPS audio, supporting up to 24 bit 48 kSPS input. I2S and S/PDIF interfaces are supported for audio I/O. Seamless interfacing of A/D and D/A for analog audio input and output. Serial and I2C control interfaces are supported. Embedded 3.0V voltage regulator for rf part yield maximum noise immunity and allows operation from a single 3.3V supply.

This SRD module is a 4 Mbit/s RF transceiver that operates int the world wide 2.4Ghz license-free ISM band. The SRD module is based on proven nrF24Z radio- and Shockburst(TM) platforms built by Nordic Semiconductor. For further information please refer to www.nordicsemi.com.

The device offers a wireless channel for seamless streaming of LPCM or compressed audio in parallel with a low data rate control channel. To enable this, the device offers the following features in addition to the nRF24xx RF platform:
• Standard digital audio interfaces (I2S, S/PDIF)
• Fully embedded Quality of Service engine handling all RF protocol and RF link tasks.
• SPI and 2-wire master and slave control interfaces
• GPIO pins

As all processing related to audio I/O, RF protocol and RF link management is embedded, the device offers a transparent audio channel with capacity of up to 1.54 Mbit/s, with no true time processing needed.

In this system a DSP or micro controller feeds data from a storage device to an nRF24Z1 using standard audio format (I2S). An nRF24Z1 pair transfers audio data from the source and presents it to a stereo DAC on the receiving side. Application wise, the nRF24Z1 link will appear as an open channel (like a cable).

Initial configuration of nRF24Z1 is done by the ATmega324p through an SPI control interface.

The CC2591 amplifies the RF output to 9dBm including RX / TX switches and Input amlipfier.

It is possible to switch input sensitivity using HGM (high gain mode flag).

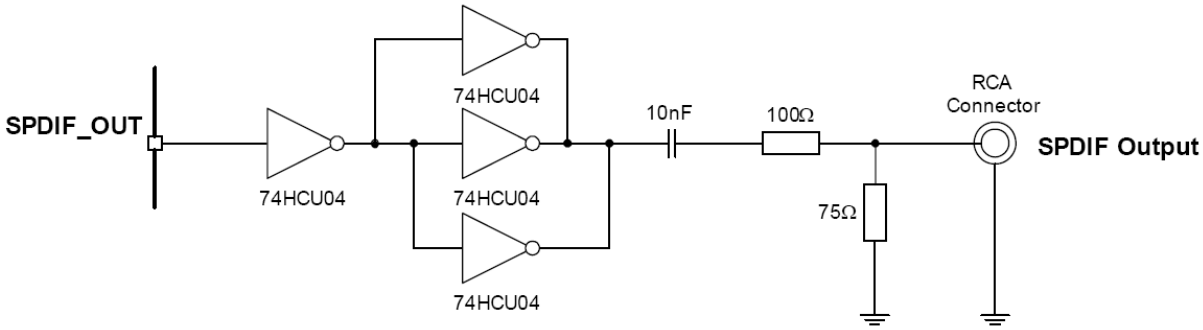
All module configuration is done using embedded RS232 connection.

The serial parameters are 19200 baud,8 bits, no parity, 1 stopbit.

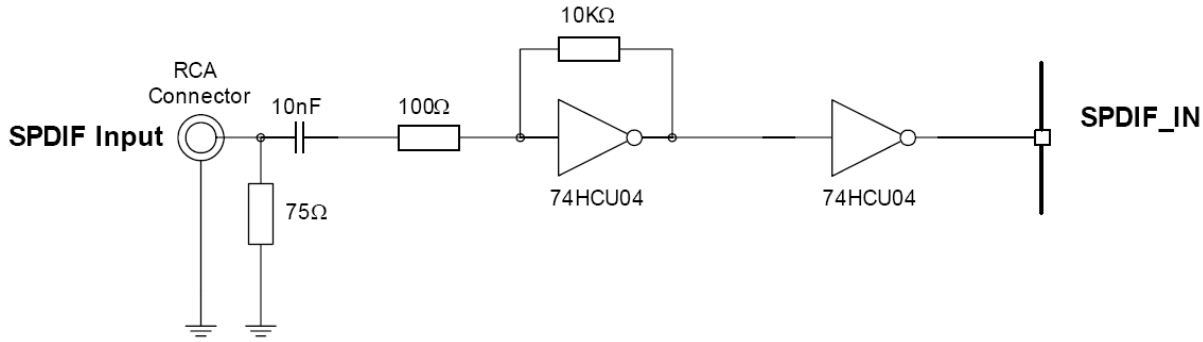
7.5 SPDIF Interface example circuits

Example circuit for SPDIF Interface with coaxial output

Note: The 100Ω and 75Ω resistors are dependent on the supply voltage and therefore subject to change.



Example circuit for SPDIF Interface with coaxial input



8. Document Revision History

- V1.06 (14.07.2015)

Section 2.1	and 2.2	Antenna added
Section 5.2.2	and 5.2.3.1	V3P3 change from Typ 3.3V to 3.5V

- V1.07 (26.10.2015)

Section 2.1	and 2.2	modified antennas description

Integration_Manual_SRDmodule.doc