

AS3933 Demo Kit Manual

AS3933

3D Low Frequency Wakeup Receiver

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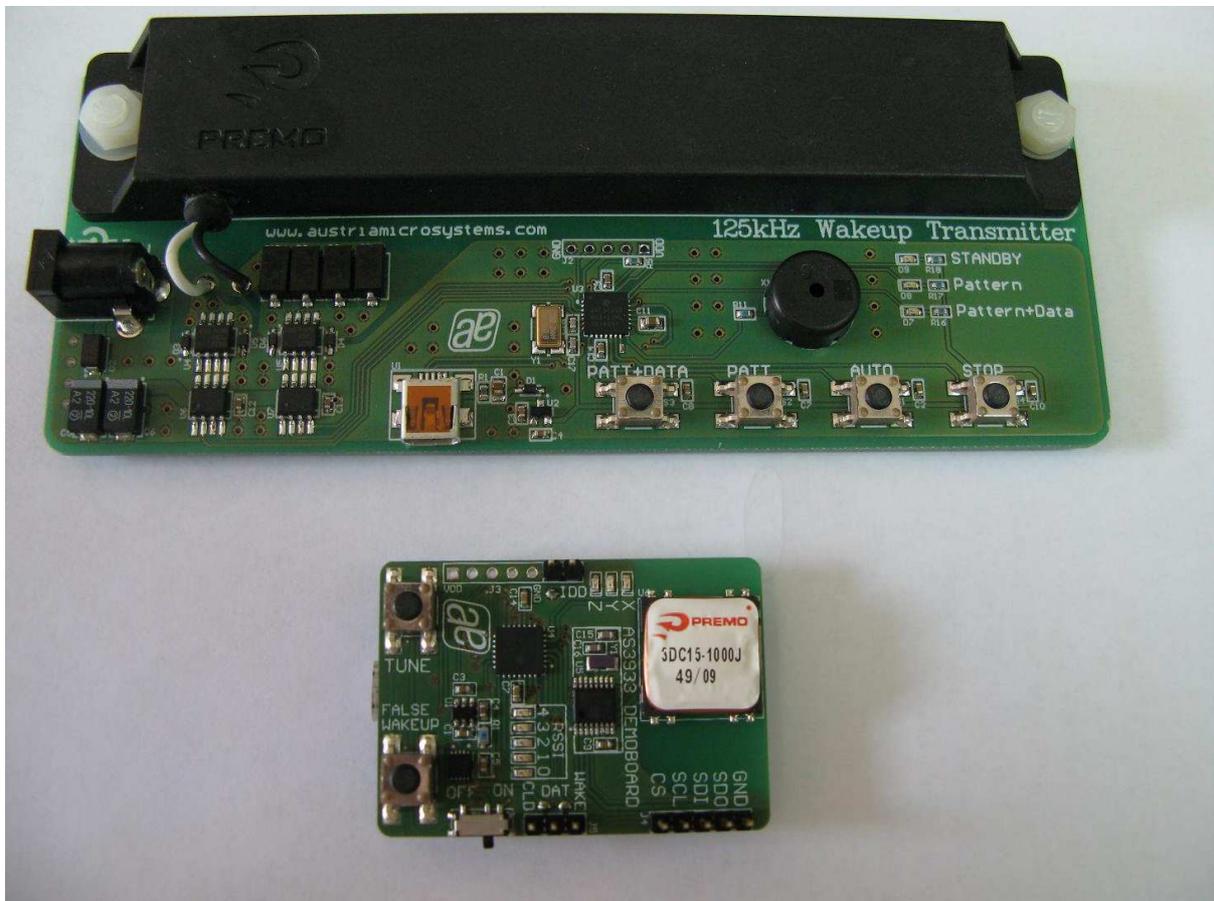


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General Description of AS3933 Receiver Board

Board Description

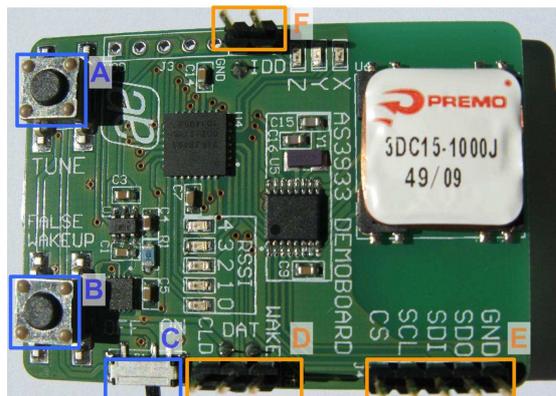


Figure 1: RX Board Description Top – User Interface

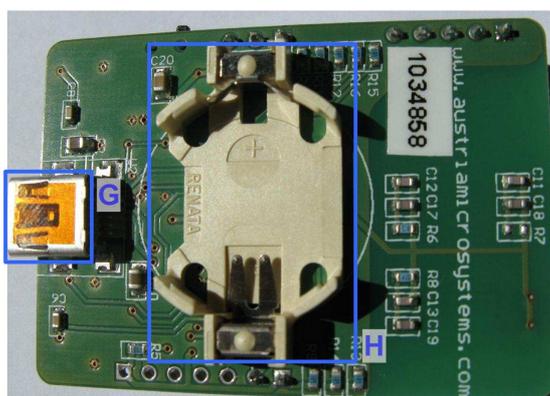


Figure 2: Board Description Bottom – Connectors

User Interface Description

Label	Name	Description	Info
A	TUNE	Tune – Button	All axis (X,Y,Z) of the LF Antenna can be tuned exactly to 125kHz, when pressing this button. The resonance frequency of each channel can be read out via the GUI.
B	FALSE WAKEUP	False Wakeup – Button	The number of False Wakeups can be read out and are displayed via the RSSI – LEDs. Pressing FALSE WAKEUP for more than 1s resets the number of False Wakeups.
C	ON/OFF	ON/OFF – Switch	Power on/off the Demoboard. Source (Battery or USB) is automatically detected.
G	USB – Connector	Mini USB 5-pin Connector	USB Interface for the GUI
H	CR2032 BATTERY	Battery Holder	Insert CR2032 in here.

Indication LEDs

LEDs	Blinking Colour	Info
RSSI (5 bits)	Red LEDs	Received Signal Strength Indication. Displays the actual received signal strength whenever a WAKEUP occurs. When pressing FALSE WAKEUP these LEDs display the number of False Wakeups that occurred.
X	Red LED	Strongest Wakeup Signal received on channel 1 (X)
Y	Red LED	Strongest Wakeup Signal received on channel 2 (Y)
Z	Red LED	Strongest Wakeup Signal received on channel 3 (Z)

Jumper Description

Jumper	Name	Description	Info
F	IDD	Supply Current	The supply current of the AS3933 can be measured. Set this jumper for normal operation.
D		AS3933 specific outputs	
	D1	WAKE	Wake Output Interrupt
	D2	DAT	Data Output
E		Microcontroller - Interface	The SDI –Interface from the microcontroller can be replaced by an proprietary solution
	E1	CS	Serial Digital Interface Chip Select

E2	SCL	Serial Digital Interface Clock
E3	SDI	Serial Digital Interface Input
E4	SDO	Serial Digital Interface Output
E5	GND	Ground (0V)

Note: If the AS3933 should be connected to the GUI it is necessary to RESET the device by turning the AS3933 OFF and ON via switch “C”. Another possibility to prepare the demoboard for USB connection is pressing button “A” and “B” at the same time, before connecting the USB cable.

General Description of 125 kHz Wakeup Transmitter

Board Description



Figure 3: TX Board Description Top – User Interface

User Interface Description

Label	Name	Description	Info
A	PATT+DATA	Pattern + Data – Button	When pressing this button the transmitter sends continuously the Wakeup Pattern plus Data (01010101)
B	PATT	Single Pattern – Button	When pressing this button the transmitter sends a single Wakeup Pattern.
C	AUTO	Automatic Pattern – Button	When pressing this button the transmitter sends every 1s automatically a Wakeup Pattern.
D	STOP	Stop Pattern – Button	This button stops sending the continuous Wakeup Patterns.
E	USB – Connector	Mini USB 5-pin Connector	USB Interface for the GUI
F	Power Supply	+9V DC Power Supply (2A)	Insert main adapter here

Indication LEDs/Buzzer

LEDs	Blinking Colour	Info
G	Buzzer	Whenever a Wakeup Pattern is transmitted, the buzzer goes on for a short time. This feature allows a better range measurement. The buzzer can be disabled via the GUI.
STANDBY	Red LED	Transmitter is on standby. No Wakeup Pattern is send.
Pattern	Red LED	Wakeup Pattern is transmitted.
Pattern+Data	Red LED	Wakeup Pattern plus Data is transmitted.

Note: If the 125kHz Wakeup Transmitter should be connected to the GUI it is necessary to STOP transmitting Wakeup Patterns by pressing button “D”.

How to easily get started with the AS3933 demo kit?

- Connect the +9V DC Power Supply “F” for the 125 kHz Wakeup Transmitter.
- Start to transmit Wakeup Patterns via AUTO “E” or PATTERN “B”.
- Insert the +3V Battery at “H” for the AS3933 Demoboard.
- Turn on the AS3933 Demoboard via the ON/OFF – switch “C”. When turning on the boards all indication-LEDs flash up once.
- As soon as the AS3933 Demoboard receives a Wakeup Pattern, the RSSI LEDs flash up for 0.5s and show the actual Received Signal Strength. At the same time the X,Y or Z LED flash up and indicates which channel got the strongest signal.

Install the GUI

1. Execute the AS3933_EvalSW.msi
2. Follow the installation guide
3. Run the GUI → AS3933_EvalSW.exe

Note: Before connecting the AS3933 Demoboard with the USB-cable press TUNE “A” and FALSE WAKEUP “B” at the same time. This is necessary to save current during the normal operation mode. Before connecting the 125 kHz Wakeup Transmitter Board with the USB cable STOP “D” transmitting Wakeup Pattern.

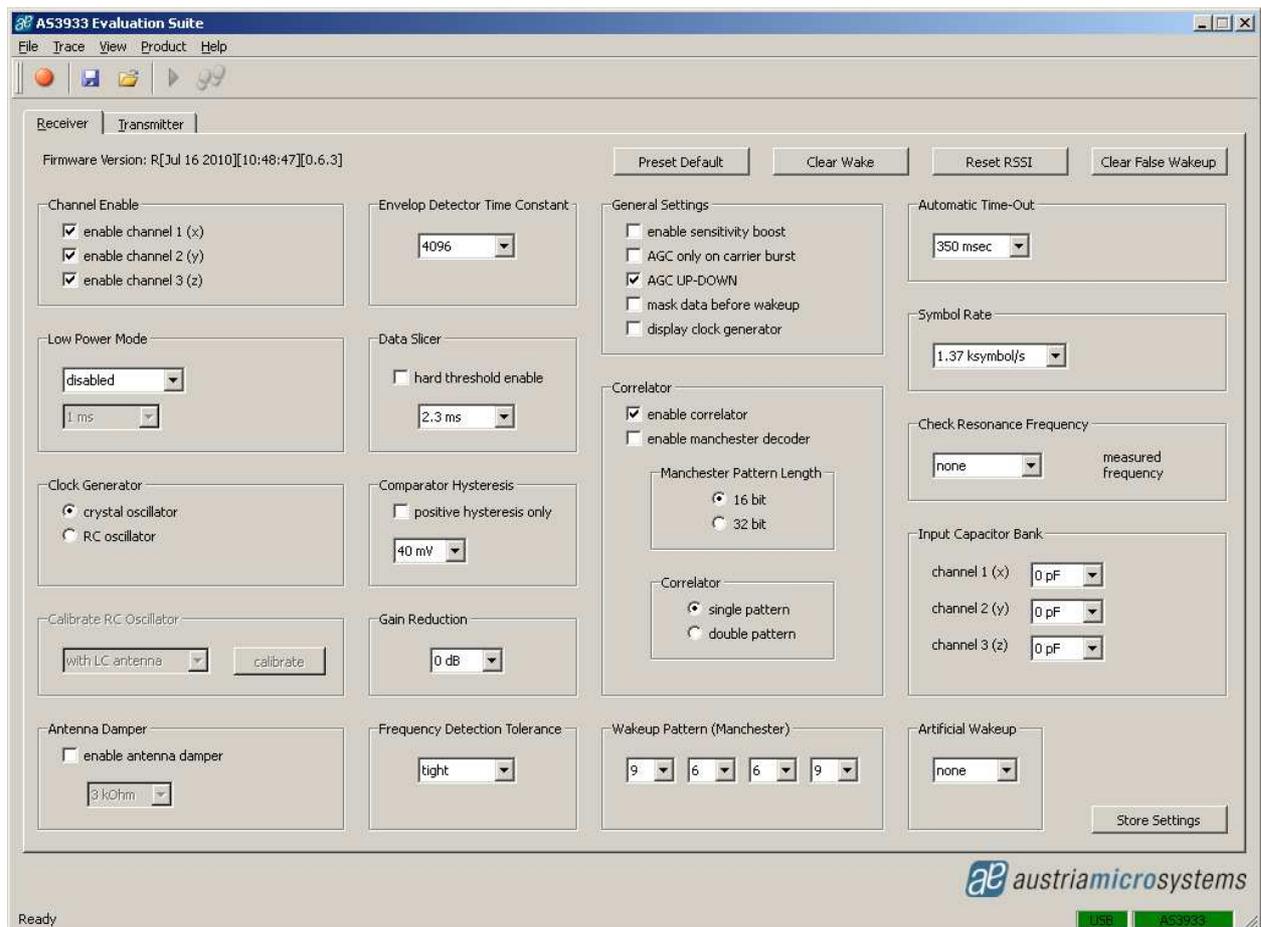


Figure 4: Graphical User Interface of AS3933 Demo Kit

Description of the GUI of the Receiver

All adjustments can be saved via “**Store Settings**” in the lower right corner of the Receiver Tab. If all settings should be reset to the default configuration push the button **Preset Default**. All configurations that are set by the GUI correspond to the Register Map of the AS3933. The Register Map can be viewed via View/Register Map (Ctrl+M). All registers can be updated manually via File/Readout Registers (Ctrl+R) or the update of the registers is done automatically via File/Automatic Update (Ctrl+U).

Note: A possible Firmware Update can be done via Help/Firmware Update (Ctrl+F). Load the latest *.bin File and update the Firmware.

Channel Enable

The AS3933 Demo board has a three dimensional antenna, while each of these three antenna inputs can be enabled or disabled.

Low Power Mode

The AS3933 features two low power modes, which can be selected here. By default no power saving mode is enabled that means all channels are active all the time. At all other modes only one channel is active at one time, in order to save current. For details please see AS3933 datasheet on page 14.

Clock Generator

The clock source for the AS3933 can be selected here. The AS3933 Demoboard has an onboard crystal oscillator that is used by default. When selecting the RC oscillator, it can be additionally calibrated in order to get a bigger precision.

Calibrate RC Oscillator

The RC oscillator can be calibrated via the microcontroller or the LC antenna.

Antenna Damper

The antenna can be damped in order to limit the range. Therefore a resistor inside the AS3933 is switched into parallel to the antenna. The value of the resistor can be selected between **1kΩ to 27kΩ**.

Envelope Detector Time Constant

The performance of the Demodulator can be optimized according to the bit rate and preamble length. If the bit rate gets higher the time constant needs to get lower. Adjust this **ED time constant** according to your **symbol rate**. The recommended time constants for different symbol rates are listed in the datasheet on page 26.

Data Slicer

The level of the threshold of the data slicer can be set to a certain level by setting the **hard threshold enable** bit. This hard threshold can be reduced by setting the **hard threshold reduction** bit.

The performance of the noise immunity of the data slicer can be set via the **Data Slicer time constant**. The bigger this time constant, the bigger its noise immunity but the bigger the minimum preamble length need to be. That's why this data slicer time constant is linked with the minimum preamble length. The recommended minimum preamble lengths for different **DS time constants** are listed in the datasheet on page 26.

Comparator Hysteresis

The **comparator hysteresis** of the Data Slicer can be adjusted between **20mV and 40mV**. Furthermore the data slicer hysteresis can be either selected only for **positive edges** or for both **(positive and negative) edges**.

Gain Reduction

The **Gain Reduction** of the channel amplifier can be selected between **0dB up to -24dB**.

Frequency Detection Tolerance

The **Frequency Detection Tolerance** can be tighter or more relaxed. For details please see the datasheet on page 23.

General Settings

Enable sensitivity boost: The channel amplifier gain is boosted to +3dB.

AGC only on carrier burst: The automatic gain control is acting only on the first carrier burst.

AGC UP-DOWN: The automatic gain control is operating in both directions (up and down). At the beginning the gain of the channel amplifier is set to the maximum and the AGC reduces it according to the received signal input level. If AGC UP-DOWN is disabled the AGC can only decrease the gain for the whole duration of the data reception. In this mode the system holds the RSSI peak.

Mask data before wakeup: During the pattern correlation it is possible to display the data (received preamble + pattern) on the DAT pin, if this bit is enabled. Otherwise this will be masked. In case the user decides to mask the

data before the generation of the interrupt on the pin WAKE, then the data will be displayed only after the generation of the interrupt.

Display clock generation: The clock generator output signal is displayed on CL_DAT pin.

Wakeup Pattern (Manchester)

Select Wakeup Pattern here. Each field defines 4 bit. If the transmitted pattern matches the selected pattern, a wakeup interrupt is generated at the WAKE pin. The WAKE pin goes high.

Correlator

Enable correlator: If the correlator is enabled the chip searches first for the preamble bits and then for data pattern (Manchester encoded Wakeup Pattern). Should the pattern correlation be disabled, the AS3933 goes directly in data receiving mode.

Enable Manchester decoder: If the Manchester decoder is enabled the data on the DAT pin can be directly read binary. The data is provided on the DAT pin and in case the Manchester decoder is enabled, the recovered clock is presented on the CL_DAT pin.

Manchester Pattern Length: If the Manchester Pattern length can be selected between 16bit and 32bit. The possible selection of the Wakeup Pattern (Manchester) is changed accordingly.

16 bit pattern length: Each field of the Wakeup Pattern identifies 4 bit, which are directly Manchester encoded. Each bit defines one Bit and is already conform to the Manchester Standard.

Example: 9 6 6 9 (Manchester) → 1001 0110 0110 1001 (binary, Manchester conform); sum = 16bit

32 bit pattern length: Each field of the Wakeup Pattern identifies 4 bit, which are hexadecimal encoded. Each bit defines one Symbol and is converted to Manchester by the microcontroller in the second step.

Example: 7 B A 5 (Symbol) → 0111 1011 1010 0011 (binary) → 10010101 01100101 01100110 10100101 (binary Manchester conform); sum = 32 bit

Single pattern: The wakeup pattern is send as single string.

Double pattern: The wakeup pattern is doubled.

Automatic Time-Out

The **Automatic Time-Out** resets the WAKE pin automatically after a certain time. This time can be selected between 0ms and 350ms.

Clear Wake

The **Clear Wake Button** resets the WAKE pin manually.

Symbol Rate

The **Symbol Rate** can be adjusted between **512 Symbols/s and 4096 Symbols/s**. The Symbol Rate defines the duration of one bit via the 32.768 kHz Clock, in order to recover the data.

Check Resonance Frequency

The Resonance Frequency of all three channels of the antenna can be measured. This help to find the correct capacitance to bring the LC circuit in resonance.

Note: It is important to note, to set the measurement to none again in order to continue with other settings.

Input Capacitor Bank

The **Internal Capacitor Bank** can be changed on each channel between 0pF and 32pF in order to tune the antenna to the desired resonance frequency. The AS3933 Demo board provide a switch to tune the antenna automatically to 125 kHz. The internal capacitor bank is changed until the resonance frequency of 125 kHz is achieved. After this procedure the register map can be updated manually via File/Readout Registers (Ctrl+R) in order to see the added capacitors at each channel.

Artificial Wakeup

It is possible to enable the Artificial Wakeup, which period can be adjusted between 1s and 2 hours.

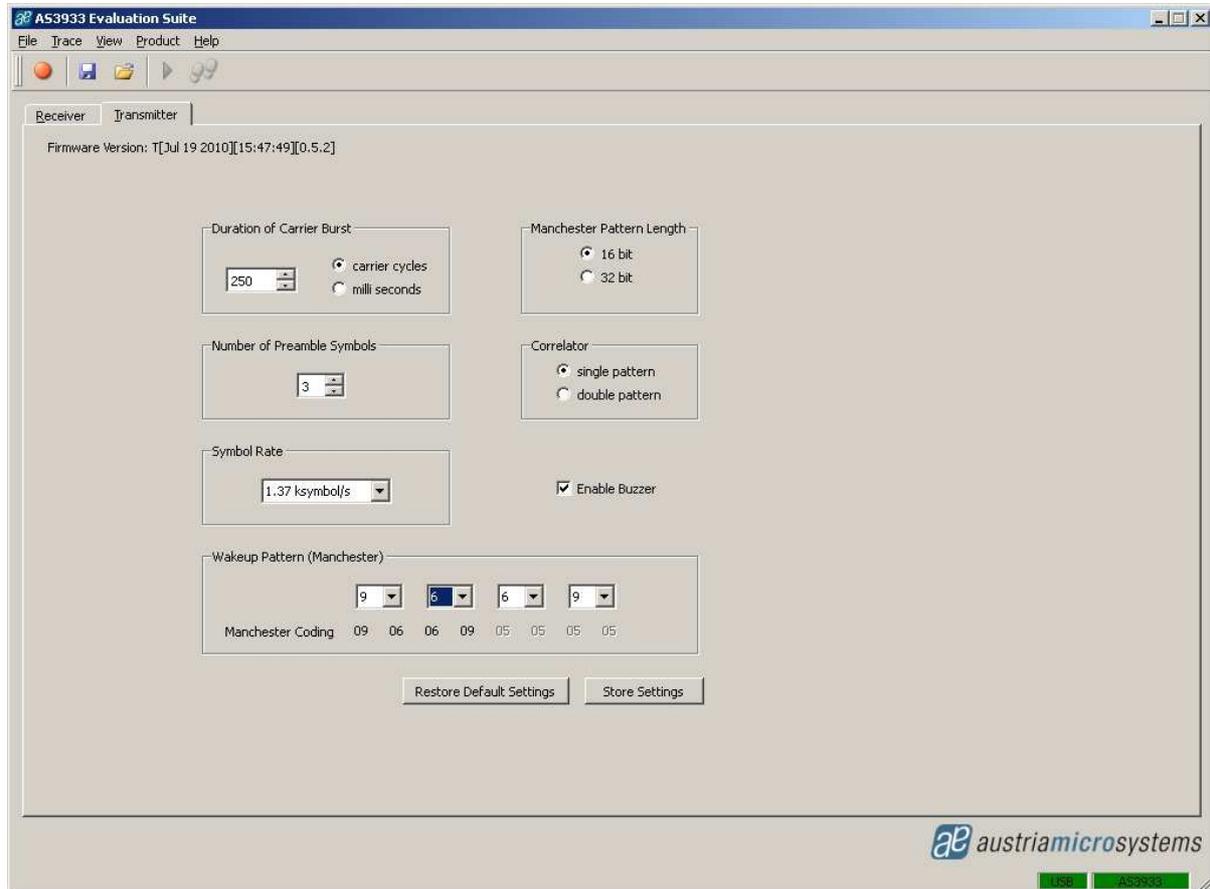
Clear False Wakeup

The False Wakeup Register counts the number of frequency detections that do not match the wakeup pattern. The actual number of False Wakeups can be deleted via the **Clear False Wakeup** button.

Reset RSSI

Reset the actual RSSI measurement.

Description of the GUI of the Transmitter



All adjustments can be saved via “**Store Settings**” in the lower right corner of the Receiver Tab. If all settings should be reset to the default configuration push the button **Restore Default Settings**.

Duration of Carrier Burst

The Duration of the Carrier Burst can be set in multiples of carrier cycles (0-500 x 8 μ s) or in milli seconds (1-3).

Number of Preamble Symbols

The carrier burst must be followed by a separation bit and at least 3 Symbols Preamble. The actual number of Preamble Symbols can be adjusted here.

Symbol Rate

The **Symbol Rate** can be adjusted between **512 Symbols/s** and **4096 Symbols/s**. The Symbol Rate must be the same as at the AS3933.

Enable Buzzer

The Transmitter Demoboard sends out a tone whenever a packet is transmitted. This tone can be disabled here.

Wakeup Pattern (Manchester)

Please see description above

Manchester Pattern Length

Please see description above

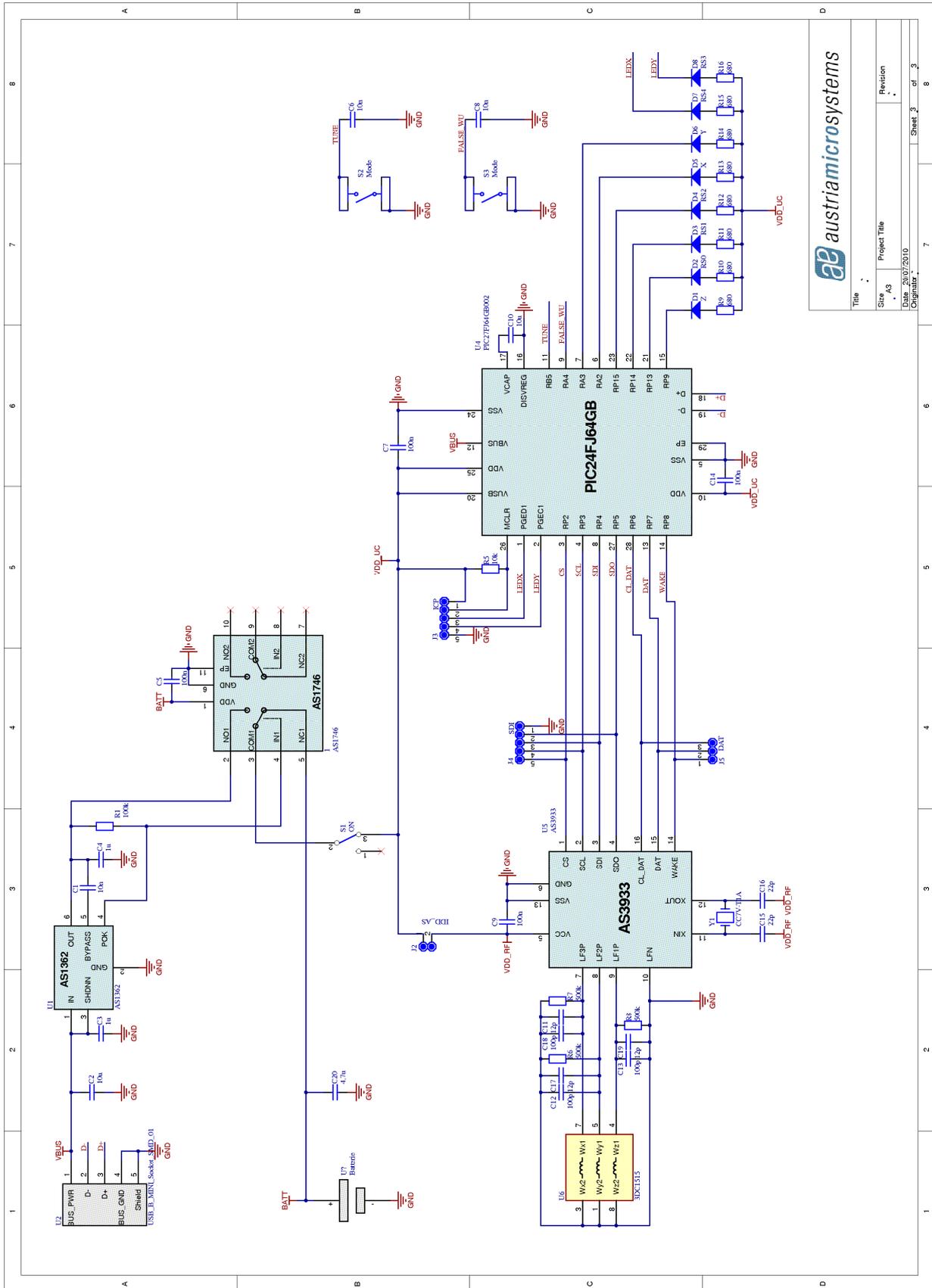
Correlator

Please see description above

Note: It is important to note, that the Symbol Rate, Wakeup Pattern, Pattern Length and the Correlator have the same settings. Otherwise the receiver would not recognize the signal that is transmitted by the 125 kHz Wakeup Transmitter. If something does not work, restore the default settings at the receiver and transmitter.

Schematics of Demo Kit

Board schematics of AS3933 Demoboard



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Title	:		
Sheet	AS	Project Title	:
Date	29/07/2010	Revision	:
Signature	:		Sheet 3 of 3

Figure 5: Schematics of Receiver

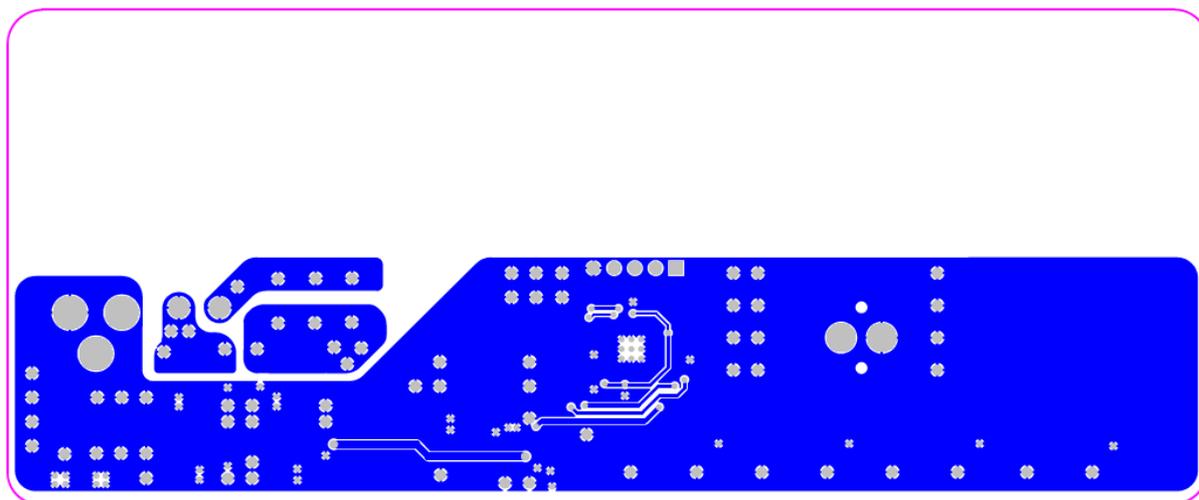


Figure 10: Bottom Layer of Transmitter

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