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Features and Benefits

- 2 High power independent drivers (2.5A_{peak} in square and 1A_{peak} in sine mode)
- Full bridge drive capabilities
- Built-in protection features (antenna fault detection, over current and T°) for safe operation in all conditions
- Easy-to-use through SPI interface
- Built-in ASK and FSK immobilizers

Application Examples

- Passive Start system
- TPMS Initiator
- LF door opener
- Active RFID initiator RFID Initiator

Ordering Information

Part Code	Option Code
EVB74190	ABA-000

General Description

The EVB74190 is the evaluation board used for a quick and easy performance evaluation of the MLX74190 IC. The board embeds the device MLX74190 with all the required hardware.

The EVB74190 is composed of one mother board including the power supplies, the filtering capacitors and the antenna connection. The EVB74190 is also composed on one daughter board including the MLX74190 IC with all critical components around it (e.g. decoupling capacitors, ceramic resonator ...).

The EVB74190 is provided together with a USB-to-SPI adapter board, to be able to control and configure the IC from a computer, with the use of a specific User Interface: MLX7419x Configuration.

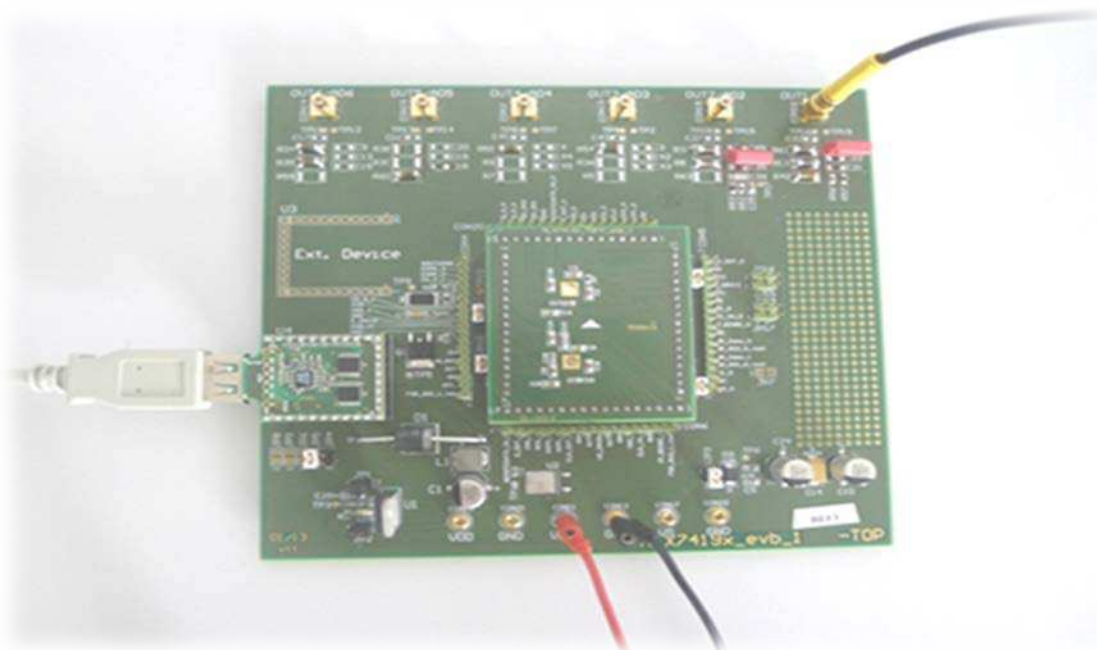


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1 EVB74190 global description

The evaluation board EVB74190 is composed of one mother board, the **MLX7419x_evb** and two smaller boards:

- The **MLX7419x_TQFP_adp**, embeds the device **MLX74190** as well as a few components like decoupling capacitors and reference resistors,
- The **MLX-SPIUSB** embeds the Microcontroller PIC18F4550 as well as Level Shifters and all necessary passive external components

1.1 MLX7419x_evb

The MLX7419x_evb embeds:

- The connection to 2 different antennas through SMB connectors and the possibility for the user to solder its own antenna's related passive components: capacitor(s) for tuning the LF frequency and resistor(s) to fix the Q factor.
Note: FULL bridge connection is also possible by using 2 SMB connectors
- The connectors to the boards **MLX7419x_TQFP_adp** and **MLX-SPIUSB**
- A regulator allowing to convert the 12V from the battery to a 5V DC signal necessary for supplying the MLX74190
- A flexible power management with a set of separated connectors, allowing to supply separately the High Voltage line VS (from 9 to 40V) used to supply the output drivers of MLX74190 and the VDD line at 5V. More information in the chapter [Power Management](#)
- Capacitor divider for ASK-Immobilizer feature (only available for OUT2/AD2) and connection for FSK-Immobilizer feature (only available for OUT1/AD1) of device MLX74190

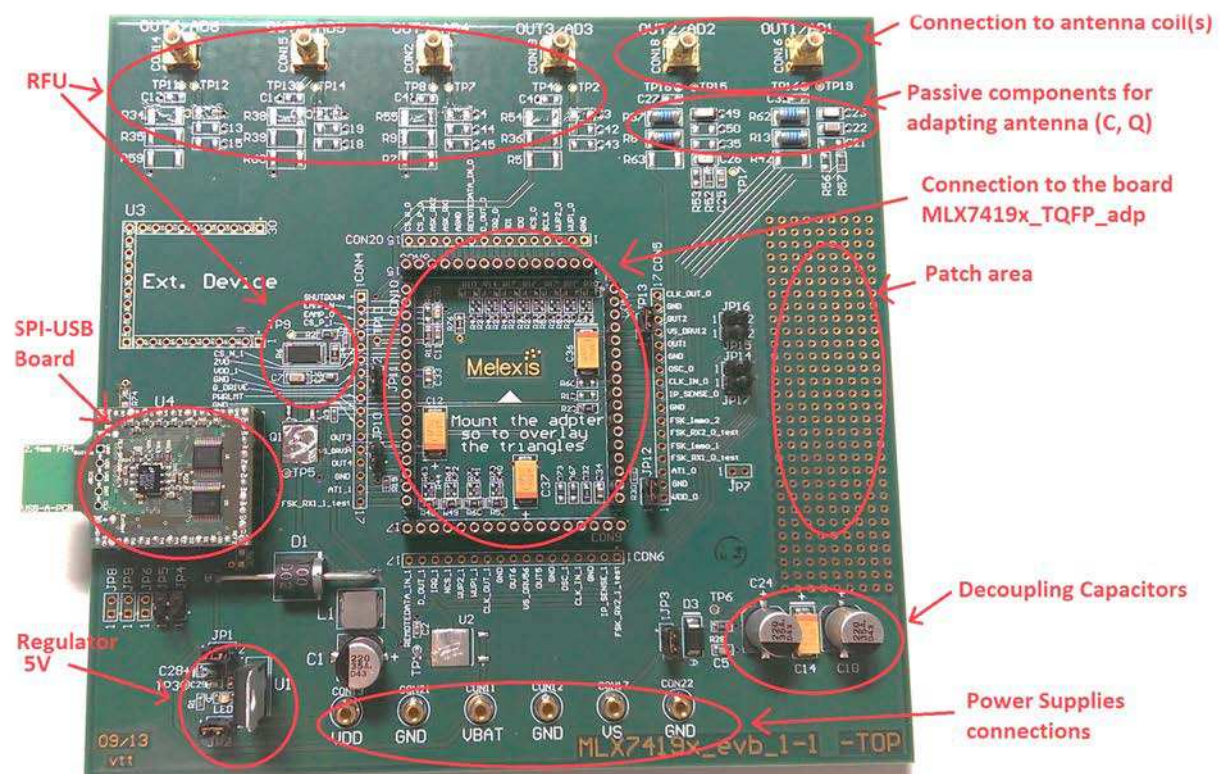


Figure 1: MLX7419x_evb top view

1.2 MLX7419x_TQFP_adp

The MLX7419x_TQFP_adp embeds:

- the device MLX74190 (DUT0)
- Decoupling capacitors for every pin supplies.
- A 5.23kOhm reference resistor, R7, for internal device trimming
- A 4MHz ceramic resonator, XT1, directly connected to the device. In case an external 2MHz CLK (for instance a 2MHz from the microcontroller) is used, XT1 has to be removed and R10 (0-ohm resistor) has to be soldered
- 2 resistor networks for FSK Immobilizer feature (R2,R3 and R5,R6, for both FSK1 and FSK2 inputs)

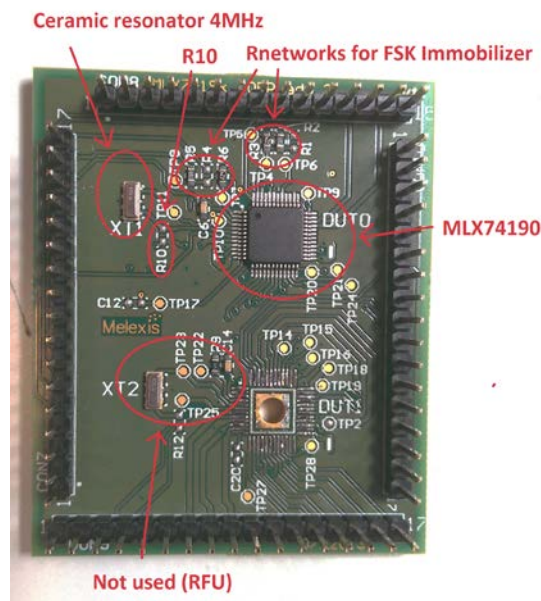


Figure 2: MLX7419x_TQFP_adp top view

Note: the adapter board **MLX7419x_TQFP_adp** is provided with 1 ceramic resonator. It is possible to replace it by a 2MHz signal clock from the microcontroller. However this possibility is not embedded in the Firmware version of the provided Microcontroller.

1.3 MLX- SPIUSB

The MLX-SPIUSB Board embeds:

- The Microcontroller PIC18F455 from Microchip, already flashed for easy handling of the EVB74190 via the User Interface **MLX7419x Configuration**
- A USB interface to be connected directly to the PC
- Two Level Shifter ICs for driving/receiving i/o signals

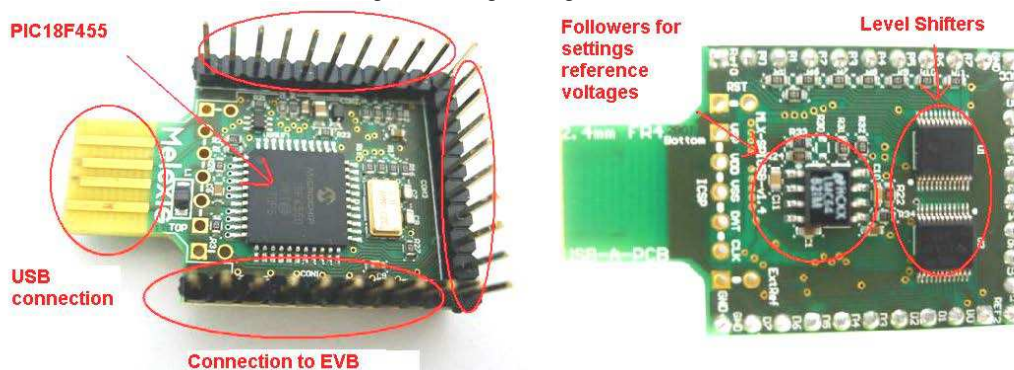


Figure 3: MLX-SPIUSB top and bottom view

2 EVB Schematics and Bill of Materials

2.1 MLX7419x_evb

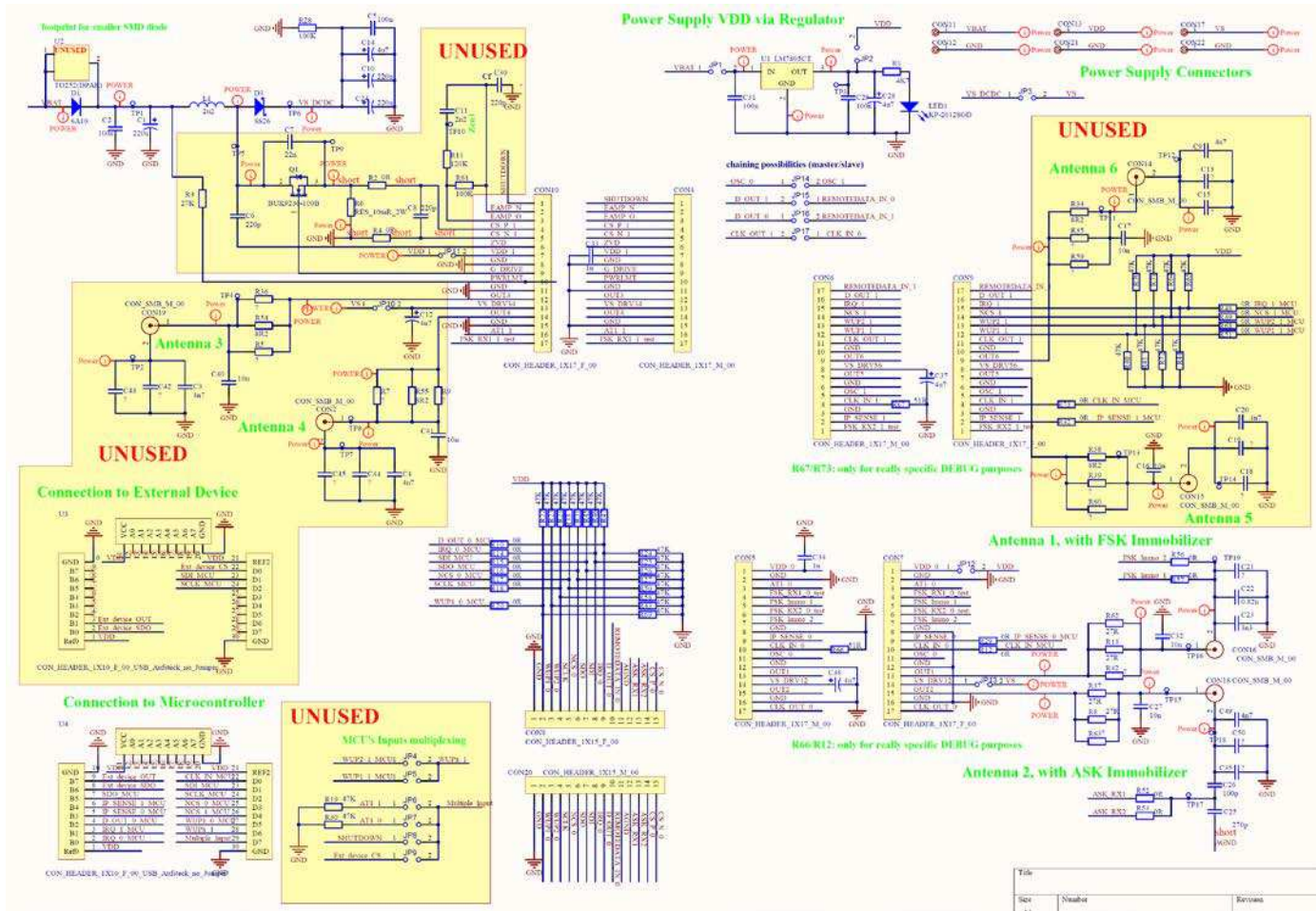


Figure 4: EVB Schematics

Reference	Value	Description
C1, C10, C24	220u	decoupling capacitors (for VBAT and VS)
C11	2n2	Not used
C12, C14, C36, C37	4u7	decoupling capacitors for VS_DRV (VS)
C27, C32	10n	Not connected. Filtering capacitor before antenna coil
C2, C29, C31	100n	decoupling capacitors (for VBAT and VDD)
C25	270p	Capacitive divider for ASK Immobilizer
C26	100p	Capacitive divider for ASK Immobilizer
C28	4u7	Decoupling capacitor for Regulator
C49	4.7n	Tuning Capacitor for RLC antenna linked to OUT2/AD2
C22	0.82n	Tuning Capacitor for RLC antenna linked to OUT1
C23	3.3n	

C3,C4,C9, C13, C15, C16, C17, C18, C19,C20, C21, C35, C40, C41, C42, C43, C44, C45, C50	-	Not connected.
C33, C34	1u	decoupling capacitors for VDD
C5	100n	decoupling capacitors (for VS)
C6, C8, C30	220p	not used (RFU)
C7	22n	not used (RFU)
CON11, CON12, CON13, CON17, CON21, CON22	CON_MC-2mm_F_00	Connectors for supplies. See chapter " Power management"
CON16, CON18	CON_SMB_M_00	Connectors for Antenna Coils
CON2, CON14, CON15, CON19	CON_SMB_M_00	not used
CON7, CON9, CON10	HEADER_1X17_F_00	Connection to MLX7419x_TQFP_adp
CON8	HEADER_1X15_F_00	Connection to MLX7419x_TQFP_adp
D1	6A10	Diode If=6.0A, Vr=1000V: RFU but need to be present on the board
D3	SS26	Schottky Rectifier If=2A, Vr=60V, : RFU but need to be present on the board
JP1, JP2	JUMPER	In case of using the Regulator and VBAT power supply, no additional external power supply should be connected on VDD
JP3	JUMPER	set by default, must be removed if an external VS source is used
JP12, JP13	JUMPER	to supply the MLX74190(pins VDD and VS)
JP4,JP5,JP6,JP7,JP8,JP9 JP10, JP11 ,JP14, JP15, JP16, JP17	JUMPER	not used
L1	INDUCTOR SMT Vishay IHLP Series; 3.3uH, 5A, 0,051ohm,	Load coil: RFU but need to be present on the board
LED1	LED SMD green	For regulator
Q1	-	Not connected
R1	4K7	For regulator
R10,R14,R15,R16,R17,R18,R20, R29, R32, R48, R49, R51, R68	0R	to bring i/o signals to/from the Microcontroller
R11	120K	not used (RFU)
R12, R73	0R	To bring the 2MHz CLK from Microcontroller to the pin CLK_IN of MLX74190. Not connected by default (use of XT1)
R19,R30	47K	pull down
R2, R4, R74, R75	0R	not used (RFU)
R21, R22, R23, R24, R31, R45, R46, R47, R50, R65, R70, R71, R72	47K	not connected
R25, R26, R27, R33, R40, R41, R43, R44, R58, R64, R69,	47K	pull up/pull down for digital signals
R28, R61	100K	not used (RFU)
R3	27K	not used (RFU)
R8, R13, R37, R62	27 Ohm	Resistive Load to fix the Q factors of RLC Antennas on OUT1/AD1, OUT2/AD2
R5,R7,R9,R34,R35,R36,R38 R39,R42,R54,R55,R59,R60,R63	-	Not connected.
R52	0R	ASK Immobilizer: connection of Antenna Driver AD2 to ASK_RX1
R53	0R	Not connected. (ASK Immobilizer: connection of Antenna Driver AD2 to ASK_RX2)

R56	0R	Not connected. (FSK Immobilizer: connection of Antenna Driver AD1 to input 1, FSK_Immo1)
R57	0R	FSK Immobilizer: connection of Antenna Driver AD1 to input 2, FSK_Immo2
R6	RES_39mR_2W	not used (RFU)
R66, R67	51R	not connected
U1	LM7805CT	Regulator 5V
U2	TO252(DPAK)	not connected
U3	3xHEADER_1X10	not used
U4	3xHEADER_1X10	Connection to MLX-SPIUSB board

Table 1: **EVB- Bill of materials**

2.2 MLX7419x_TQFP_adp

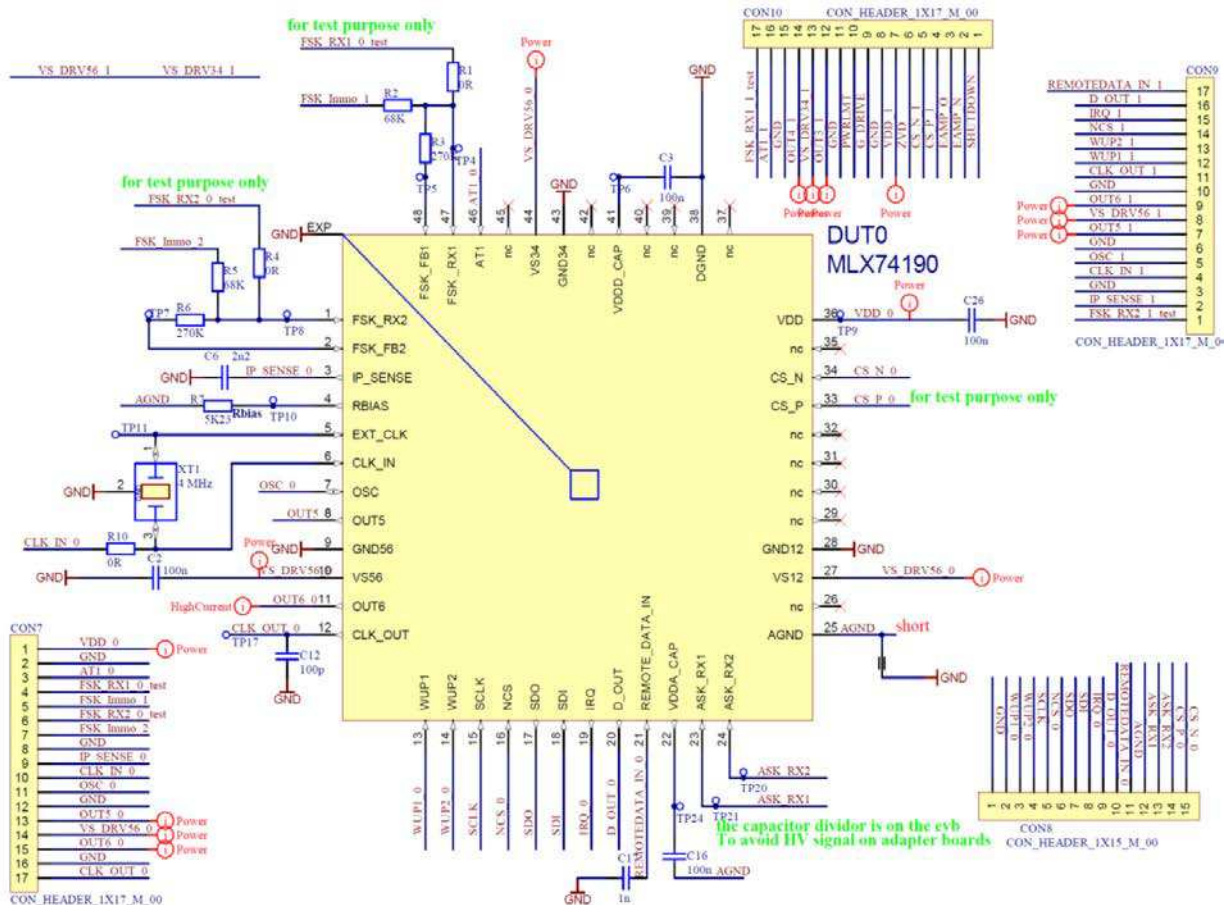


Figure 5: TQFP_adp Schematics

Reference	value	Description
C10, C14, C25	2n2	not used (RFU)
C12, C20	100p	not connected
C17, C22	1n	filtering capacitor for REMOTEDATA_IN pins
C2,C3,C8,C9,C16,C18, C21, C24,C26	100n	decoupling capacitor for supply pins
C6	2n2	Filtering capacitor for IPSense pin
CON7, CON9, CON10	HEADER_1X17	Connection to EVB74190
CON8	HEADER_1X15	
DUT0	MLX74190	MLX74190, soldered, TQFP48 7x7 EP
DUT1	-	Not connected
R1, R4, R12	0R	not used (RFU)
R10	0R	Not connected – but have to be connected in case of using 2MHz CLK from Microcontroller
R2,R5	68K	Resistor network for FSK immobilizer
R3, R6	270K	
R7	5K23	Reference resistor for internal trimming
R9	5K23	not used (RFU)
XT1	4MHz	(disconnected in case of using 2MHz CLK from MCU)
XT2	4MHz	not used (RFU)

Table 2: TQFP_adp - Bill of materials

2.3 MLX-SPIUSB

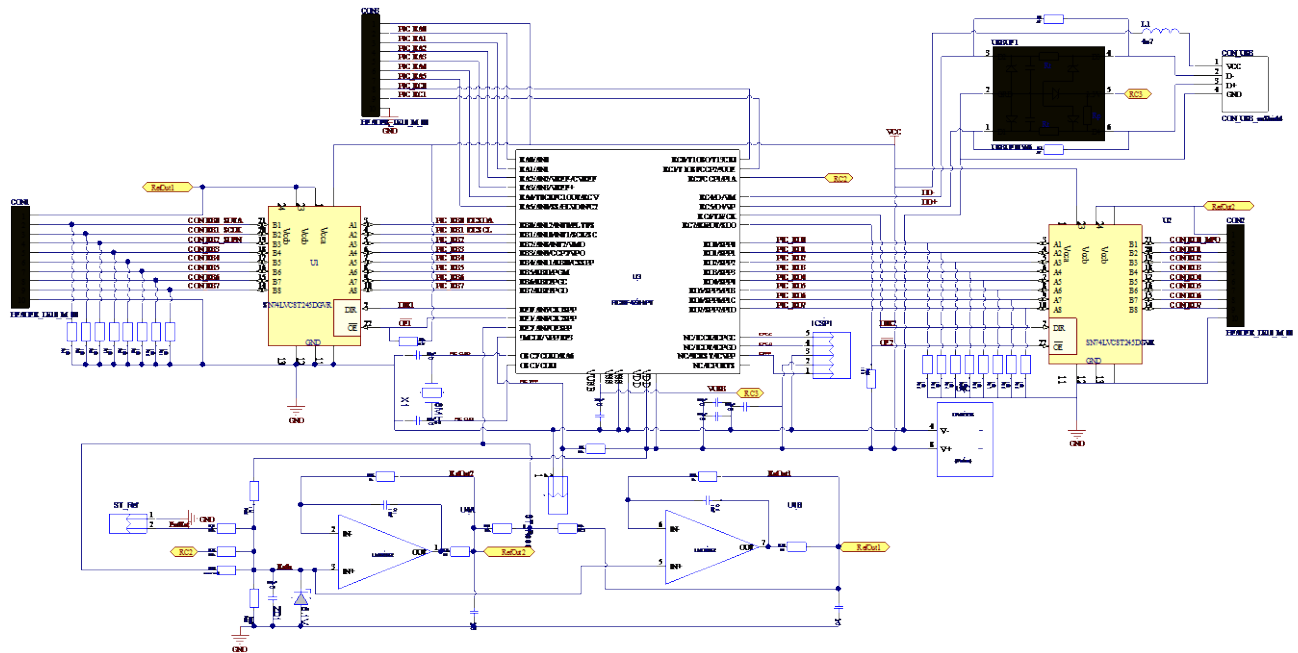


Figure 6: SPI-USB Schematics

Reference	Value	Description
USBUF1	USBUF01W6	USB interface
U1, U2	SN74LVC8T245DGVR	bus Transceivers, used as level shifters
U3	PIC18F4550-I/PT	USB Microcontroller
U4	LMC6482	Dual FET OPV
X1	8MHz	Quartz for PIC18F455
C1, C2, C6, C9	100nF	
R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R31, R32	10k	For level shifter i/o signals
R3, R19, R21, R23, R27, R28	10k	
C10, C11	10nF	
C7, C8	18pF	
R20	1M	
C4, C5	1uF	
R1, R2	47	
R26	560k	
C3	220nF	
ZD1	Zener diode 5.1V	
L1	4u7	
CON1, CON2, CON3	HEADER_1X10_M_00	Connection to the MLX7419x_evb
CON_USB	CON_USB_noShield	USB Connector
ST_Ref, ST_Reset	STECKER 2-POLIG	HW reset
ICSP1		HW reset
R30		not connected
R22, R24	10	
R33, R34	1k	

Table 3: SPIUSB - Bill of materials

2.4 Example

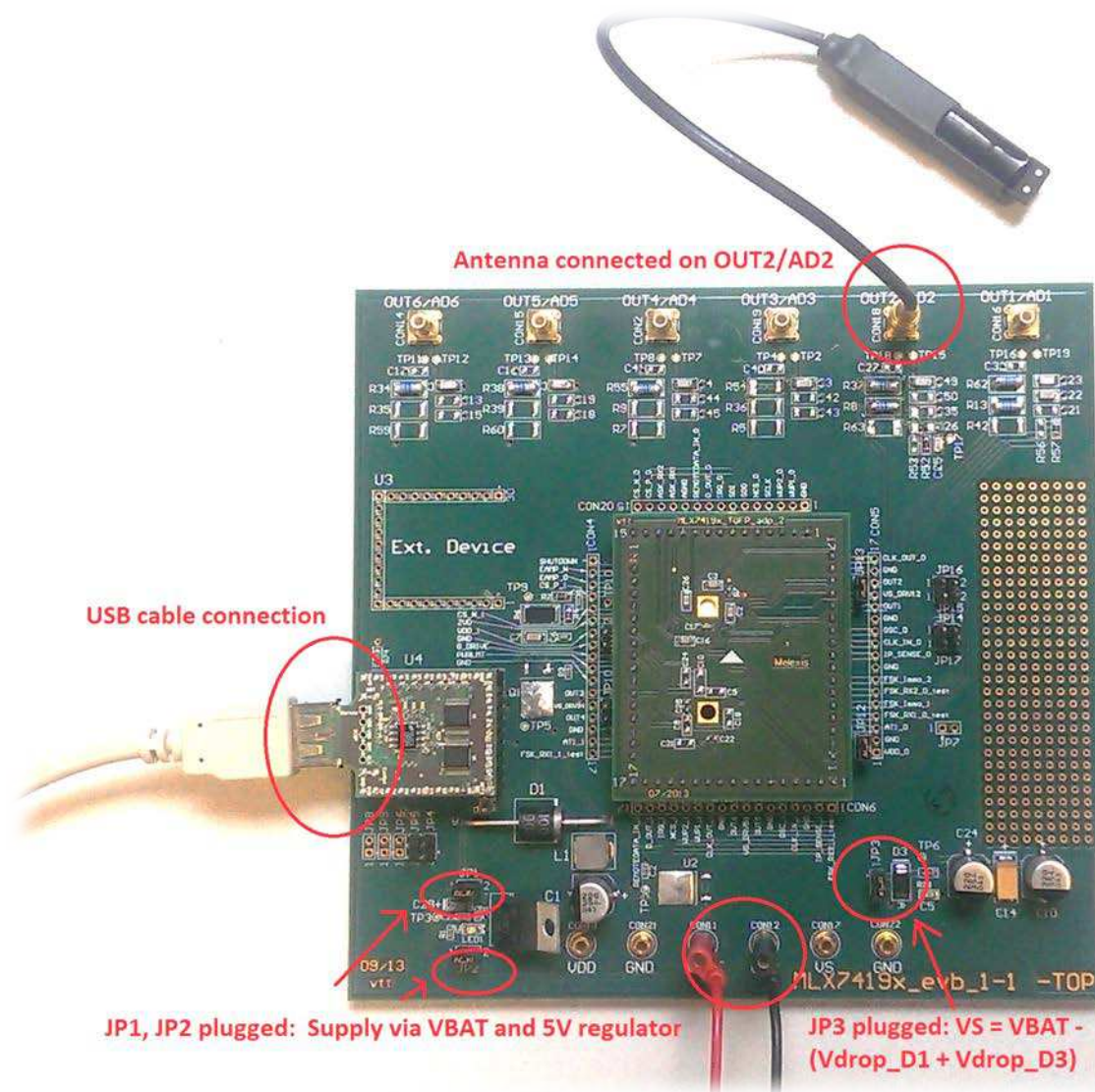


Figure 7: EVB Example

2.4.1 Antenna drivers matching: provided example

The inductance value of the antenna coils provided with the EVB74190 is 345uH.

- Choice of capacitors:

The output OUT1/AD1 is used to generate a 125kHz LF signal (the ASK immobilizer input is connected on this antenna). Therefore, the tune capacitor is set to 4.7nF.

The output OUT2/AD2 is used to generate a 135kHz LF signal (the FSK immobilizer input is connected on this antenna). Therefore, the tune capacitor is set to 4.1nF (3.3nF + 0.8nF).

- Choice of serial resistor:

For both antenna drivers OUT1/AD1 and OUT2/AD2, (linked respectively to FSK and ASK Immobilizer functions), the serial resistors are fixed to 13.5 Ohm (2 times 27 Ohm in parallel) giving a factor Q around 20.

3 Power Management

In any case JP12 and JP13 have to be set to connect the MLX74190 supply pins to generate the supplies VDD and VS. There are different possibilities to supply the Evaluation Board, as explained below.

3.1 VDD Supply

- *Direct Supply:*

VDD can be supplied directly via CON13. In this case the jumpers JP1 and JP2 should NOT be set. Note that minimum and maximum applied voltages on VDD are 4.5V and 5.5V

- *Use of regulator :*

By setting the jumpers JP1 and JP2 the 5V supply for VDD can be generated by the regulator L7805 (U1) from the battery voltage VBAT applied on connector CON11.

In such case no external supply must be connected to CON13

Note: The embedded regulator L7805 can support 35V max on its input, so that the DC level applied on VBAT (CON11) should not overpass 35V.

3.2 VS Supply

- *Default supply (VBAT through D1, L1, D3)*

By setting the jumper JP3 and connecting an external power supply on VBAT via connector CON11, the VS supply will establish itself at: $VS = VBAT - Vdrop_D1 - Vdrop_D3$.

- *Direct supply:*

The VS line, i.e. all the HV pins (VS_DRV56_0 ...), can be supplied directly via the connector CON17.

In that case JP3 should NOT BE set it could provoke damage to the components of the Hardware.

In every cases the voltage applied on VS should remain in range 6 to 40V

3.3 Default Supply Configuration

The EVB74190 is provided with the following Hardware setup:

- **JP12 is set:** the VDD supply line is connected to VDD pin of MLX74190
- **JP13 is set:** the VS Supply line is connected to VS_DRV pins of MLX74190
- **JP1 and JP2 are set:** the regulator L7805 is connected
- **JP3 is set:** VBAT is connected to VS line via D1, L1 and D3

In this HW configuration, applying VBAT = 12V allows to cover every features MLX74190

Note that the maximum voltage allowed on VBAT will be 35V due to the use of the 5V regulator

4 Getting started with the User Interface: MLX7419x Configuration

The firmware uploaded in the PIC18F4550 allows using the specific User Interface: MLX7419x configuration. This User Interface allows to handling fully the EVB74190 and developing a large field of applications. Some examples are provided within the EVB74190

- Perform a 100ms burst at 125 kHz, in square mode, on OUT1/AD1
- Perform a 100ms burst at 125 kHz, in sine mode, on OUT1/AD1
- Perform an ASK Immobilizer sequence on antenna driver OUT2/AD2
- Perform a FSK Immobilizer sequence on antenna driver OUT1/AD1
- Send a dedicated telegram to the MLX73290, on antenna driver OUT2/AD2
- Perform Diagnosis Antenna to verify correct or incorrect connection and tuning of antenna coil on OU1/AD1 and OUT2/AD2

4.1 Software installation

4.1.1 Install MLX7419x User Interface

The MLX7419x User Interface consists of 3 parts: the USB driver for the MLX SPI-USB board and the User Interface itself MLX7419x Configuration

4.1.2 Install USB driver

To install it manually open the driver installation dialogue that pops up after plug in the USB-SPI adapter. Browse to the Melexis Framework installation folder (e.g. *C:\Program Files\Melexis\MLX-Python*) and choose the *MLX_SPIUSB_Driver* folder. If automatic detection for the USB-SPI adapter fails you have to open *System Properties* and choose *Device Manager*. Select the device *MLX-SPI-Adapter* and click right mouse button on it if there is an exclamation mark. Choose *Update driver* and browse to the path for *MLX_SPIUSB_Driver*.

In some particular case you have to run *install_pyusb.bat* from the Framework installation folder once only.

4.1.3 Install MLX7419x Configuration

The installation file is available on **Melexis SoftDist**, in the directory:

MLX7419x/MLX7419x_Evaluation_software/MLX7419x_UserInterface

Once downloaded the file *MLX7419x_UI_install.7z*, open the zip file and double click on the file *MLX7419x_Setup_Vx_yy.exe*. The UI will be installed automatically



MLX7419x_Setup_V1_04.exe

By default, the SW7419x is installed under the directory *C:\Programme Files\Melexis\MLX7419x*.

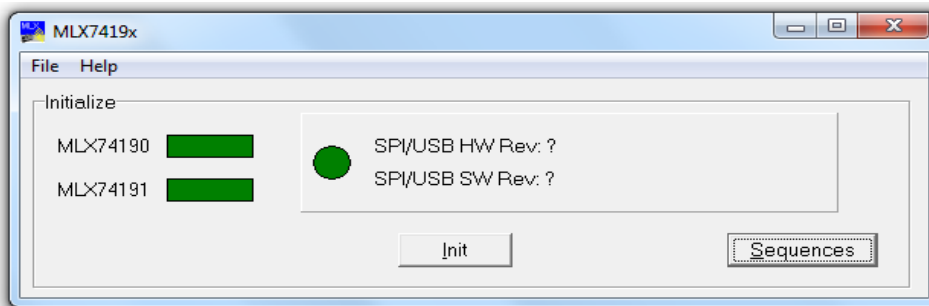
4.2 User Interface description

4.2.1 The Main window

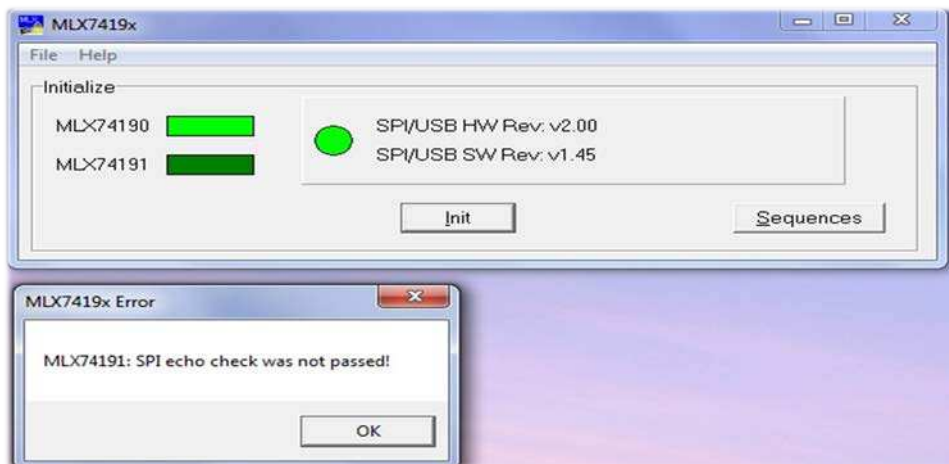
Once installed, the User Interface is launched by double clicking on the following icon:



And then the main window, called **MLX7419x**, will pop up:

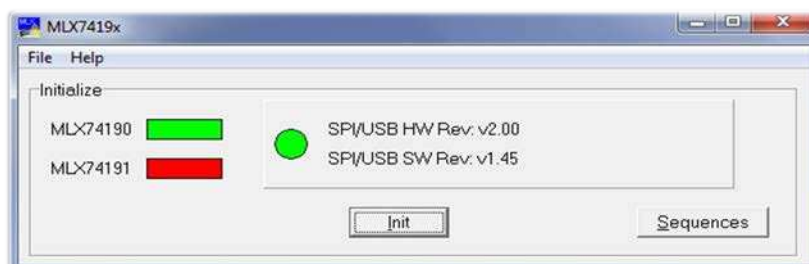


To start press on **Init**, it will update the window with the revision number of HW and SW of SPI USB board and the following message “MLX74191:SPI echo check was not passed” will pop-up:

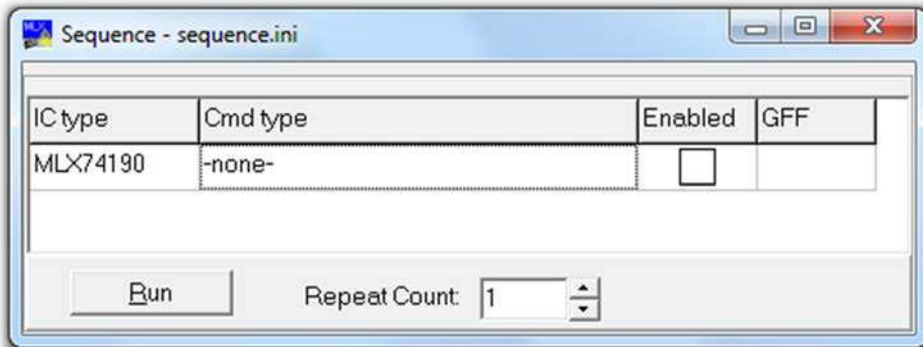


Press on **OK**.

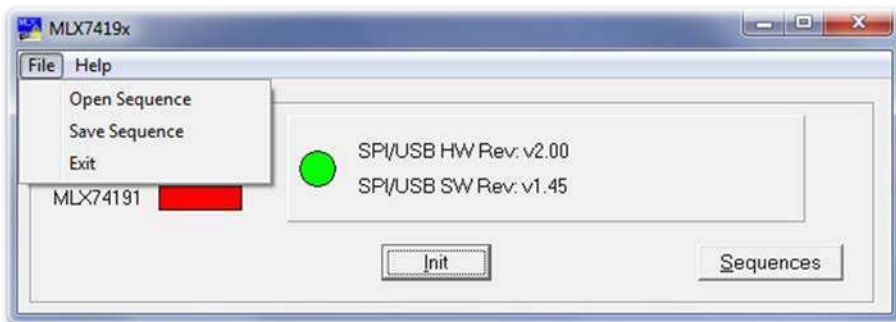
Note: this message is normal and only express that the DUT1 on adp_board is empty. This has no impact at all of the sequence development and MLX74190 evaluation, except the rectangular frame in front of MLX74191 which will remain red.



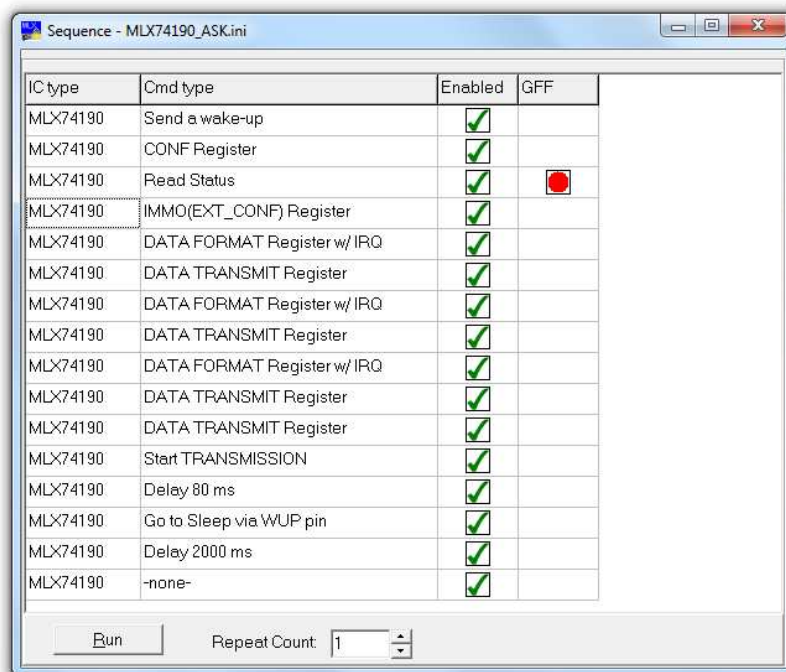
Then press on **Sequence** and a new window, called Sequences, will pop-up:



It is also possible to open an existing sequence by going on File/Open sequence (with extension.ini):

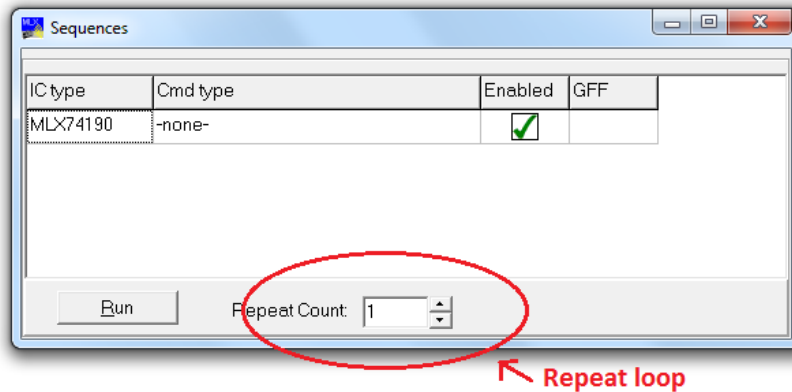


In such case just browse the sequence, open the required example and a new window Sequence (followed by the name of your sequence) will pop-up.



Note: A set of predefined examples are provided with the user interface on Softdit (file named “MLX74190_UI_Examples.zip”).

4.2.2 The Sequence window



The Sequences window shows the complete sequence of command sent to the EVB through the SPI/USB board. The device name MLX74190 appears in the first column, **IC type**.

The second column is the command itself which can be enabled (will be executed) or disable (will be skipped) in the third column (named Enabled)

The fourth column, **GFF**, displays the General Failure Flag of MLX74190 when the command **Read Status** is sent

It is possible to repeat the execution of a sequence in loop, by filling the frame **Repeat Count** with the wished number of successive repetitions.

4.2.3 Commands

Here is the list of commands available in the User Interface.

Command name	Opcode	Description
Send a Wake-up	N.A.	To perform a HW wake up (set the WUP1 pin to 1)
CONF register	0000LLLL	To fill in the CONFIGURATION Register
IMMO(EXT-CONF) Register	0001LLLL	To fill in the IMMOBILIZER Register
DATA FORMAT Register	00100LLL	To define the format register of the data to be transmitted
DATA FORMAT Register w/IRQ	00101LLL	To define the format register of the data to be transmitted + perform an IRQ at each packet of data transmitted
DATA TRANSMIT Register	01LLLLLL	Define the data to be transmitted (in bits or in byte)
RSSI	0x38	Perform a RSSI
Start TRANSMISSION	0xF0	Start Transmission (SPI command)
CTRL Register	00110LLL	To fill in the CONTROL Register of the chosen device. This is mandatory before performing a diagnosis
Start DIAGNOSIS	0x3F	Perform a diagnosis on the chosen antenna driver
Go to Standby	0xF9	Set the device in standby mode (only available from diagnosis or transmission state)
Go to Sleep	0xF8	Set the device in sleep mode by SPI command
Go to Sleep via WUP pin	N.A.	Set the device in sleep by pulling down the WUP1 pin
Set SDO to SDI	0xF1	Configure the SPI to send SDI data on SDO (for next SPI frame)
Start 2MHz clock	N.A.	Not available. (<i>Start the 2MHz CLK of the Microcontroller</i>)
Stop 2MHz clock	N.A.	Not available. (<i>Stop the 2MHz CLK of the Microcontroller</i>)
NOP	11000LLL	No operation
Read Status	0xC7	To read back the Status Register of the MLX74190
Reset Pointers and Circular Buffer	0x3B	Reset read & write pointers of circular buffer
Read Working Register	10LLLLLL	Reading the specified addressed working register. (on pin SDO for the next SPI frame)
Delay	N.A.	Add a delay (in ms) before performing the next command
Read IPSense	N.A.	Not available.
Read TAG	N.A.	Not available.

Note:

1. The commands in **bold** are described more in details below.
2. The variable "L" indicates the length of the data following the Opcode command. For the command "Read Working Register", it indicates the register's address to be read

4.2.3.1 Command CONF Register

Once selected, it is possible to edit the CONF Register command by right-clicking on the command "CONF register" and then clicking on **Edit**. The following window pops-up:



The following configuration settings are available:

- Output Selection and PGA Gain

The antenna drivers, **OUT1** and **OUT2** can be set to:

- **Hi-Z**: it will let the driver in high impedance state
- **TX 0°**: for the next transmission, the driver will transmit the LF signal with a starting phase of 0°
- **TX 180°**: for the next transmission, the driver will transmit the LF signal with a starting phase of 180°
- **Pulldown**: the driver is pulled down to GND
- **Destroy 0°, Destroy 180°, Destroy 0/180°, Destroy 180/0°**: Depending on the choice of Destroy bit, the driver is set in Hi-z, 0 deg or 180 deg starting phase for the next transmission. For more information please refer to the Datasheet of MLX74190.

The Voltage peak to peak for the sine transmission shall be set in the second field. The value set will not be taken in account in case of transmission in square mode. (In square mode the LF is always transmitted rail to rail, i.e. Voltage peak-to-peak = VS)

- Wave Generation Frequency

By default the transmission is sent in sine mode, to have transmission in square mode it is necessary to enable the option **SQUARE**.

By default the frequency is set to 125 kHz; by disabling the option **125 kHz**, the frequency set in the IMMOBILIZER Register will be considered.

See below the description of the command IMMO(EXT_CONF) Register

In case of square mode, it is possible to set the **Duty Cycle** to the 4 following values: **6.5%**, **12%**, **25%** and **50%**

- IP Sense

The current flowing through a transmitting output driver can be monitored by selecting in the field **IP Sens Selection**.

The Sensitivity can be adjusted in the field **IP Sens Sensitivity** in mA/V.

Note that the choice of the sensitivity values is different depending on the signal wave: square or sine.

- SPI Frames

The first field **Sending Mode** determines the trigger event for the start of transmission, it can be:

- **SPI command**: the SPI command "Start Transmission"
- **Data reg.filled** : the end of filling in the data register

The length of telegram per block can be defined in the field **Len of Telegram Block**. Please refer to the datasheet for more information (description of the **Configuration Register**). By default it can be set to '1'

The field **Delay between frames** is used to add some delays between two successive frames.

The value "dbf" entered here corresponds to a delay: $dbf \times \frac{8}{Frequency} + 1$

- Modulator

The carrier Frequency can be modulated in **ASK** or in **PSK**, this is set by filling the field **Modulation**.

The source of modulation is defined in the field **LF mode**.

- **NORMAL**: the modulated signal comes from the content of the **Data Register**.
- **REMOTE DATA IN**: the modulated signal source is the signal pin REMOTE_DATA_IN.
- **RSSI**: no modulation, the input remains to '1' during transmission.

- General

The field **END of TX** defines the state of the device after transmission has been finished:

- **GOTO STAND-BY**: the device remains in standby mode (but it does not disable the 100ms SPI Time out)
- **GO TO SLEEP**: the device enters immediately in sleep mode

The field **RDI** is used to define when the activation of output driver should be activated, this is only valid for mode REMOTE_DATA_IN. (For more information please refer to the datasheet of MLX74190)

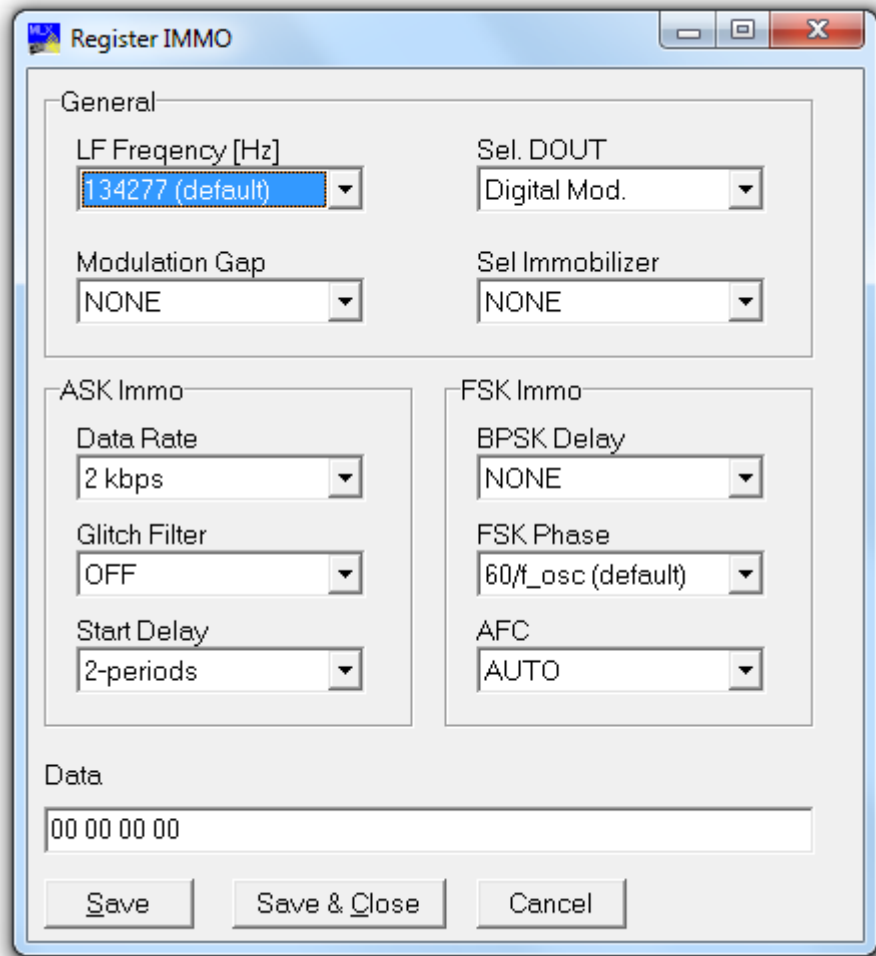
The field **OSC output** configure the pin OSC.

- **OSC: input**: the device is set in slave mode: the pin OSC is then defined as an input and the LF signal becomes the frequency applied on this OSC pin.
- **OSC: output**: default case: from every other functional mode.

The last field, **Register Data**, shows the 14 bytes of the encoded command. It is also possible to modify the command at this stage by writing directly these bytes; the fields above will be automatically updated. The command must be saved to be updated (press on **Save** or **Save & Close**).

4.2.3.2 Command IMMO(EXT_CONF) Register: the IMMOBILIZER Register

Once selected, it is possible to edit the IMMO(EXT_CONF) command by right clicking on the command "IMMO(EXT_CONF) Register" and then click on **Edit**. The following window pops-up:



The following fields are available:

- **General**
 Set the Low Frequency (in Hz) for the field **LF Frequency**.
 →Prerequisite: in the field **Wave Generation Frequency** in command **CONF Register**, the option **125 kHz** has to be disabled.
 The **Modulation Gap** defines the number of period (between 0 and 7) for setting the antenna driver(s) in High Impedance just after a modulation deep.
 →Prerequisite: in the frame **Modulation** in command **CONF Register**, the field **Modulation Gap** shall be set to “**Hi-Z (n-period in IMMO register)**”

The field **Sel. DOUT** (only available for device MLX74190) allows to choose which signal is set out on pin D_OUT.

- **Digital Mod.** : the internal modulation signal (used to modulate the LF signal)
- **Immobilizer Output**: the digitalized signal from ASK or FSK Immobilizer block, depending on which Immobilizer block has been selected in the **Sel. Immobilizer**

Sel. Immobilizer defines which immobilizer block is used:

- **ASK1**: ASK immobilizer on pin ASK_RX1,
- **ASK2**: ASK immobilizer on pin ASK_RX2,
- **FSK1**: FSK immobilizer on pins FSK_RX1 and FSK_FB1
- **FSK2**: FSK immobilizer on pins FSK_RX2 and FSK_FB2
- **NONE**: the immobilizer is not used

- **ASK Immo**
To define the parameters for the ASK Immobilizer.
Data Rate defines the Baud rate. It can be set to **2, 4, or 8 kbps**

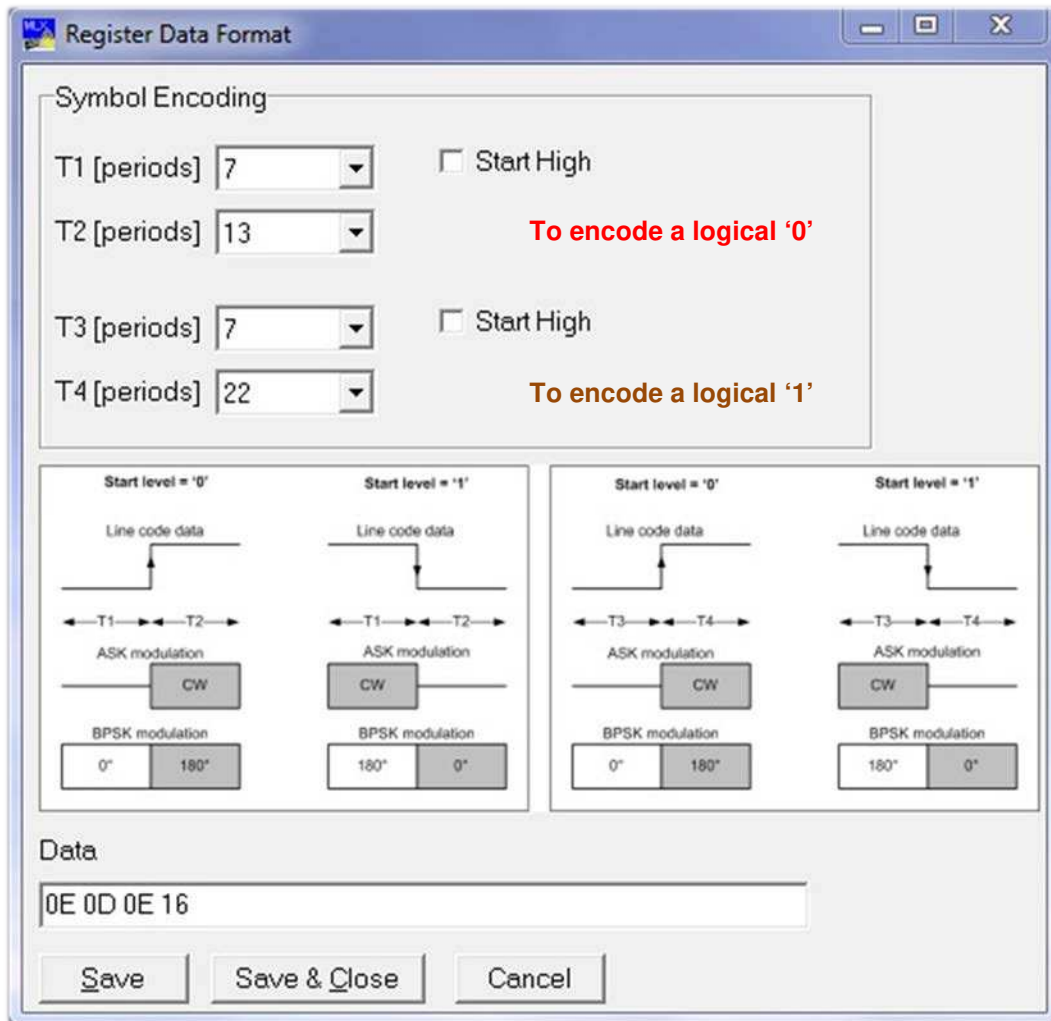
Glitch Filter determines the digital filter to be applied on ASK signal. It can be set to: **no filter** or **1/16, 2/16 and 4/16** of the period of the LF signal

Start Delay is used to set the delay before starting decoding the information. It can be set to: **2, 8, 188 or 194** periods of the LF signal (For more information please refer to the datasheet of MLX74190)
- **FSK Immo**
To define the parameters for the FSK Immobilizer
BPSK Delay, FSK Phase and **AFC** allow to define the settings for the optimization of the FSK decoding (For more information please refer to the datasheet of MLX74190)

The last field, **Data**, shows the 4 bytes of the encoded command. It is also possible to modify the command at this stage by writing directly these bytes; the fields above will be automatically updated. The command must be saved to be updated (press on **Save** or **Save & Close**).

4.2.3.3 Command DATA FORMAT Register / DATA FORMAT Register w/IRQ

Once selected, it is possible to edit the Register Data Format by right clicking on the command "DATA FORMAT Register" or "DATA FORMAT Register w/IRQ" and then clicking on **Edit**. The following window pops-up:



Note that this window will be identical for the command “DATA FORMAT Register w/IRQ”. The only difference between both commands is the automatic generation of an IRQ pulse at each transmission of packet data for the second command. With the first command, the IRQ is generated only during the first start of transmission.

These commands define the format of the data to be transmitted:

- **T1** sets the number (in period) of the first coded part of a “0”, (between 0 and 127)
- **T2** sets the number (in period) of the second code part of a “0” (between 0 and 255)
- **T3** sets the number (in period) of the second code part of a “0” (between 0 and 127)
- **T4** sets the number (in period) of the second coded part of a d “1”, (between 0 and 255)

The first button **Start High** sets the start level of a logical “0”. If not set, all logical “0” will start with a low level (no modulation during the first part of the symbol),. If set, all logical “0” will start with a high level (i.e. modulation during the second part of the symbol).

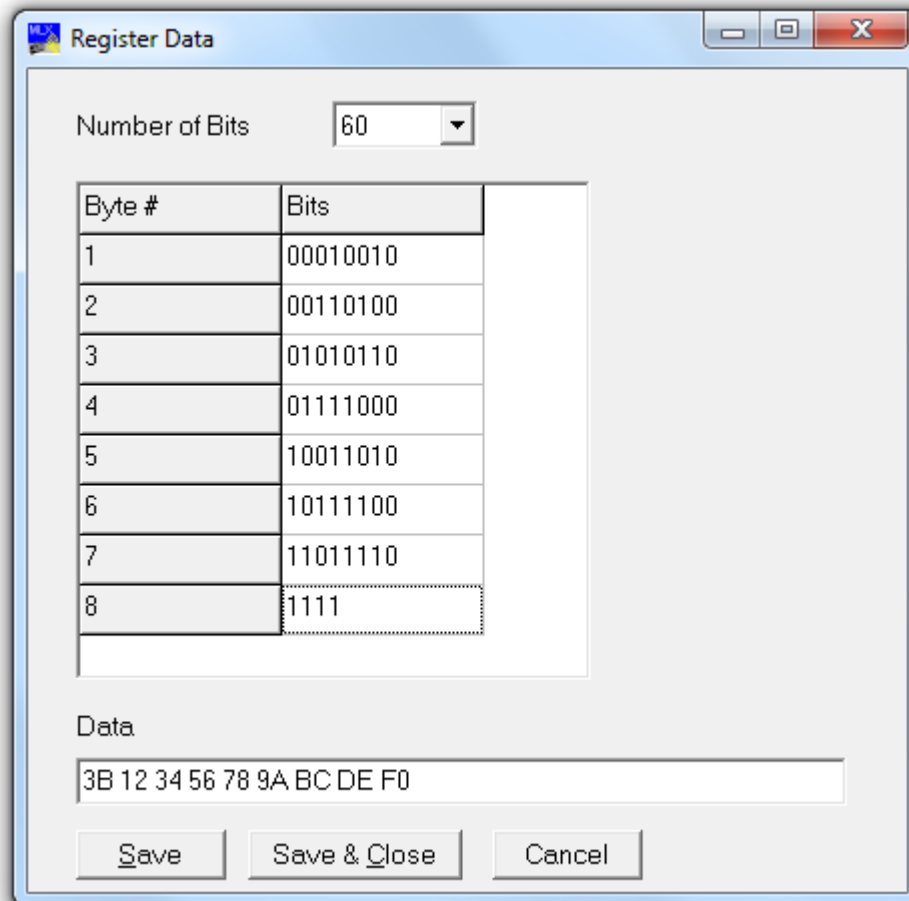
The second button **Start High** performs the same operation as described above but for all logical “1”.

The last field, **Data**, shows the 4 bytes of the encoded Data Format. It is also possible to modify the command at this stage by writing directly these bytes; the fields above will be automatically updated. The command must be saved to be updated (press on **Save** or **Save & Close**).

After sending this command the next Data to be transmitted will be encoded with this current defined data format.

4.2.3.4 Command DATA Transmit Register

Once selected, it is possible to edit the Register Data by right clicking on the command “DATA Transmit Register” and then clicking on **Edit**. The following window pops-up:



The Register Data window is used to enter the Data to be transmitted.

The first field, **Number of bits**, sets the length of the data **in number of bits**.

The Data can be entered **in bit** directly in the 8 field lines, or in hexadecimal in the field **Data**, note that the first byte in this field is the length of data (equal to the field **Number of Bits** defined above).

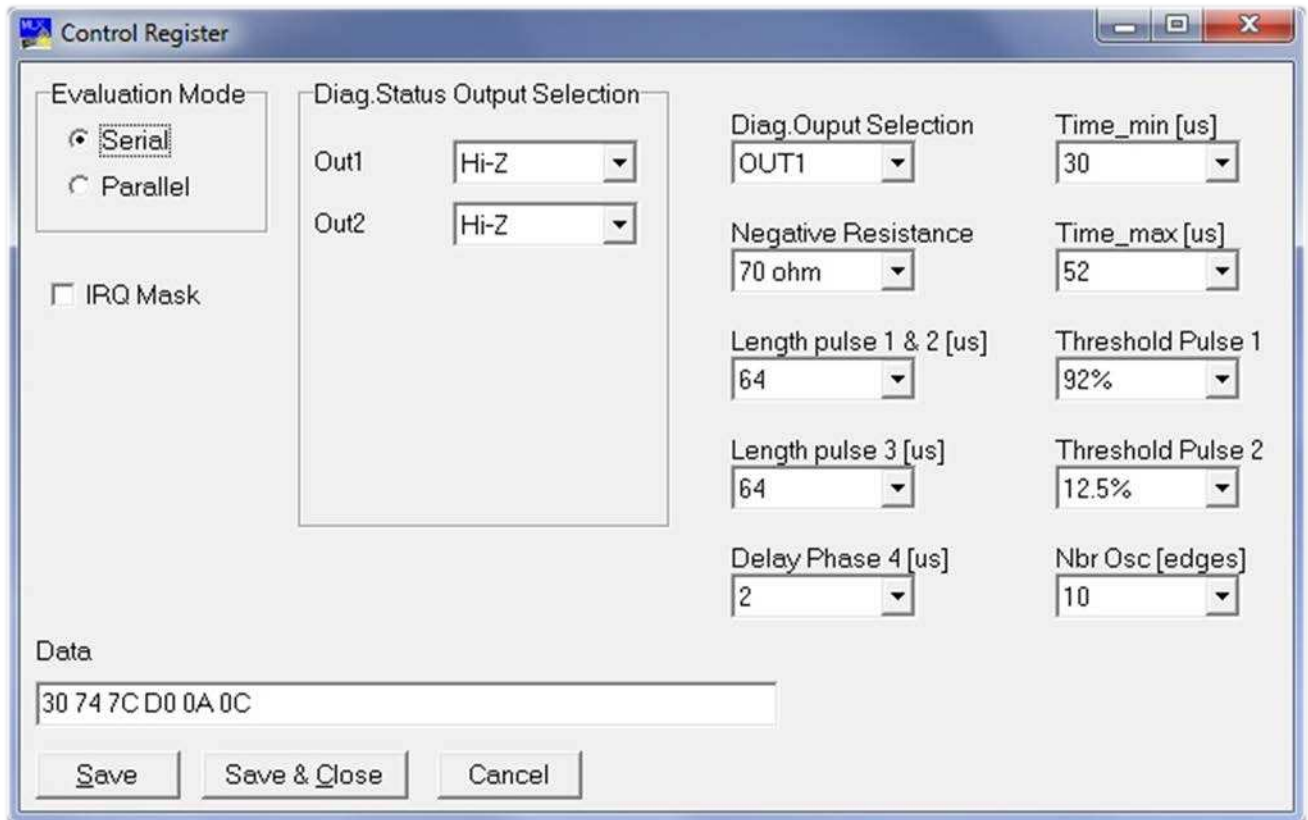
The maximum length for one telegram is 64 bits. To send more data it is needed to create an additional commands Data Transmit Register.

The command must be saved to be updated (press on **Save** or **Save & Close**).

The data defined in the Data Register will be coded using the current configured **Data Format Register**.

4.2.3.5 Command CTRL Register

Once selected, it is possible to edit the Control Register by right clicking on the command “CTRL Register” and then clicking on **Edit**. The following window pops-up:



The following fields are available:

- **Evaluation Mode:** sets the diagnosis mode. There are two possibilities:
 - **Serial:** only a RLC serial antenna will be diagnosed
 - **Parallel:** the diagnosis will take into account the presence of a filtering after the serial R
- **Diag. Status Output Selection:** sets the default level of all driver output: **GND** or **Hi-Z** (high impedance)
- **Diag. Output Selection:** To select the driver on which the diagnosis check will be performed: **Out1** or **Out2**
- **Negative Resistance:** For the resonance check (called diagnosis pulse 3) it is necessary to indicate the resistive value of the RLC antenna (or the closest possible value). During the diagnosis process, a negative resistor, equal (in absolute value) to the resistive value set here, will be connected on the antenna driver, making the whole system purely LC, and so self-resonant.
- **Length pulse 1&2:** The length pulses of the 2 first diagnosis checks (called diagnosis pulse 1 and pulse 2, which consist of checking any potential short-circuit to GND and short-circuit to VS) should be high enough to cover the transient and loading phase of the antenna, so it depends on the total capacitor of the antenna.
- **Length pulse3:** this is linked to the diagnosis pulse 3 (check of presence and resonant frequency of the antenna), and like for the field **Length pulse 1&2**, it should be high enough to cover the transient and loading phase of the antenna. Note that the programmable value will be different depending on the selected **Evaluation Mode** (Serial or Parallel), due to the presence or not of a filtering capacitors after the serial R of the antenna

- Delay Phase 4: This delay can be added before the evaluation of the resonance frequency in order to eliminate the first transient pulses

Time_min and Time_max: Linked to the diagnosis pulse 3 (check of presence and resonant frequency of the antenna). These timings criteria are used to validate if the diagnosis process is a PASS or a FAIL (for more information please refer to the Datasheet of MLX74190).
- Threshold Pulse1 and Threshold Pulse2: These threshold levels are the criteria applied for the 2 first diagnosis checks (short-circuit to GND and short-circuit to VS)
The Threshold Pulse1 is defined as a percentage of VS voltage, the Threshold Pulse2 is defined as a percentage of VDD voltage.
- Nbr Osc[edges]: indicates the number of edges to be counted for diagnosis pulse 3 (check of presence and resonant frequency of the antenna). For more information please refer to the Datasheet of MLX74190)
- IRQ Mask: when enabled, the IRQ will be masked during diagnosis check

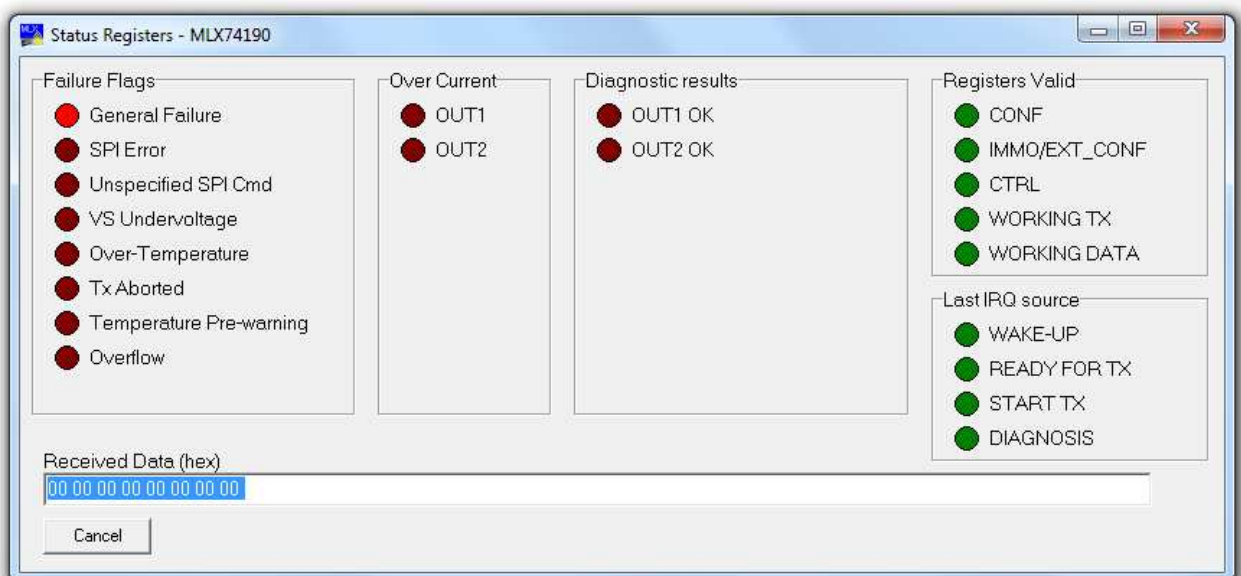
The last field, **Data**, shows the 6 bytes of the encoded command. It is also possible to modify the command at this stage by writing directly these bytes; the fields above will be automatically updated
After filling-in the command shall be saved (press on **Save** or on **Save & Close**) to be updated
After sending this command, the next time the command diagnosis is called, it will be performed with these settings. Note again that only one output driver can be diagnosed in the same time

4.2.3.6 Read status

The command **Read Status** is used to read back the content of the **Status Register** of the MLX74190. It allows the detection of any potential problem of the device like **under-voltage**, **over-current** and **SPI issue**. It shows information about the last diagnosis check too. So, for instance, it is particularly useful to use this command after a command Diagnosis.

Once the command is added in the sequence, a red button appears in column GFF. It is linked to the Status of the General Failure Flag. As long as this command is not sent, it will remain to its default colour: red. Once the command has been executed, and if the result is ok, (GFF is correctly reset, i.e. no general failure seen) the button will become green, if the result is not ok (GFF is set) the colour will remain red.

By double-clicking on this button the following window pops-up:



On the first column the different potential Failure Flag are displayed. A highlight button means that the related failure was detected.

The second column shows the status of the over current failure flags for every available output.
The third column displays the diagnosis result. Note that the information on this column is set-up only if a diagnosis check has been previously performed
The fourth column shows the validity of the different registers (if they have been filled it in) in the frame Registers Valid, as well as the source of the last IRQ event (frame Last IRQ source)

The field **Received Data** displays the complete Status Register in hexadecimal, as it is received from SPI communication.

The user can leave the window by clicking on **Cancel**

Note: concerning the red button in the window sequences, once the command has been performed, the button should become green in case of the General Failure has been reset correctly and no problem has appeared.

4.2.3.7 Delay

The command **Delay** allows to add a delay in the sequence between two successive commands.
Once the command is selected, the delay's value (in ms) can be set by right-clicking on the command and by filling it the field of the pop-up window shown below:



Note: this delay does not induce any SPI command so it does not interrupt the 100ms SPI Time-out of the device.