UM10472

OL2381 Demo kit

Rev. 1 — 14 December 2011 **User manual**

Document information

Info	Content
Keywords	OL2381, User manual, GUI
Abstract	This user manual describes the architecture and functionalities of the OL2381 Demo kit including the use of the Graphical User Interface GUI.

Revision history

Rev	Date	Description
v.1	20111214	initial version

Contact information

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1. Introduction

This user manual describes the architecture and functionalities of the OL2381 demo kit. The user manual also describes the hardware included in OL2381 demo kit and step-by-step setup of the OL2381 in both the transmit and receive mode. It demonstrates the OL2381 IC performance in an application-like environment. It is based on two boards: a Control Board and an OL2381 RF board shown in Figure 1.

The Control Board contains an NXP P89LPC936 microcontroller and features:

- A user interface comprising 4 DIP switches, 4 tactile switches, 2 LEDs and 1 buzzer.
- Two possibilities for power supply of the Control Board are a 3 V battery and an external power supply.
- A serial interface (TXD, RXD) which allows in-system programming of the microcontroller and the use of the HyperTerminal to control the microcontroller and/or receive information from it.
- A GUI interface which allows a direct control of the registers with a transparent mode of the microcontroller.
- 1 MB EEPROM memory with an I^2C interface.
- A full port OL2381 connection named RF interface. It comprises an SPI interface and three additional lines (P10/DATA, P11/INT and P12/CLOCK) used for sending and/or receiving data during TX and RX operation of OL2381.

The OL2381 RF Board contains an OL2381 and features:

- An RF switch
- A 50 Ω connector to choose between an antenna printed on the PCB or an external antenna. It allows the RF signal to be monitored using standard lab equipment.

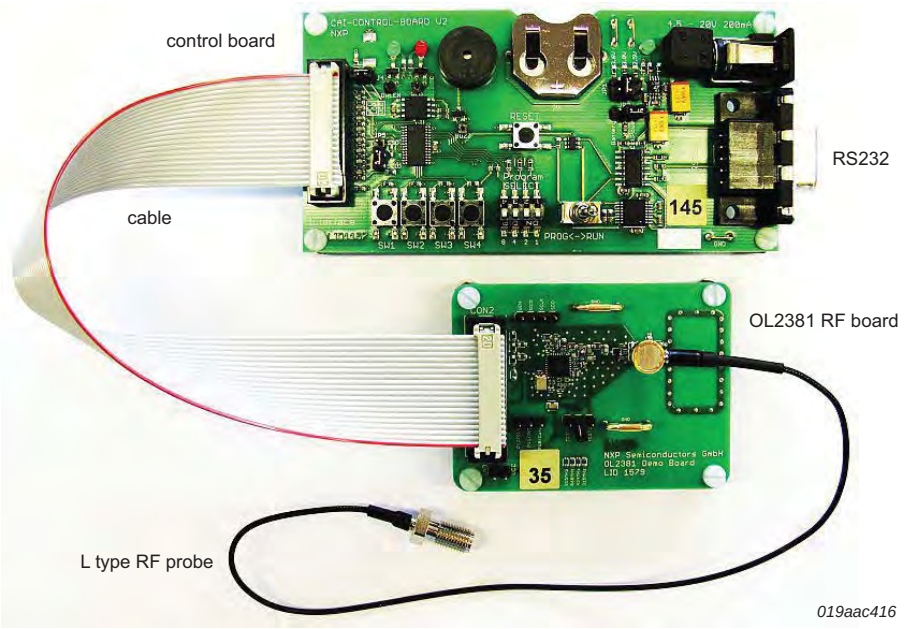

Fig 1. Complete OL2381 demo kit hardware

2. Hardware description

2.1 Deliverables

The OL2381 Demo Kit is delivered with the following hardware as shown in Figure 1:

- A Control Board
- An RF Board containing OL2381 IC (matched for frequency 315 MHz, 434 MHz or 868 MHz)
- A 20 wire flat cable for connection between boards
- An L-type RF probe with locking function from Murata

2.2 Control board description

2.2.1 On-board microcontroller

The serial flash In-System Programming (ISP) feature of the P89LPC936 microcontroller allows coding while the device is connected with a computer via an RS-232 interface.

2.2.2 OL2381 RF board interface

The minimum connection between the microcontroller and OL2381 RF Board comprises SPI lines SDIO, SCLK and SEN. The full four-line SPI mode can be configured using jumper JP5. In this case, line SDIO serves as data input and line P13/SDO as data output.

The SPI lines can be configured for shared transmit/receive data and clock, together with SPI communication. Alternatively, the device can also be configured for separate SPI lines and transmit/receive data (P10/Data) and Clock (P12/Clock).

Figure 2 presents the signal of the RF interface on the control board.

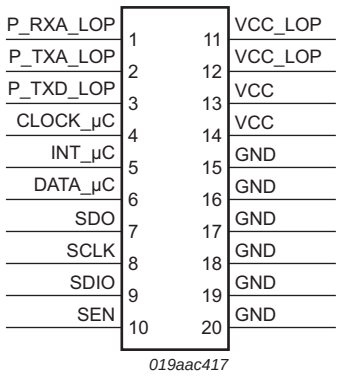

Fig 2. RF Interface of the control board

2.2.3 Jumpers

Several Jumpers are present on the control board to configure it and to observe some signals from the OL2381 as shown in Table 3. Each jumper is described in Table 1:

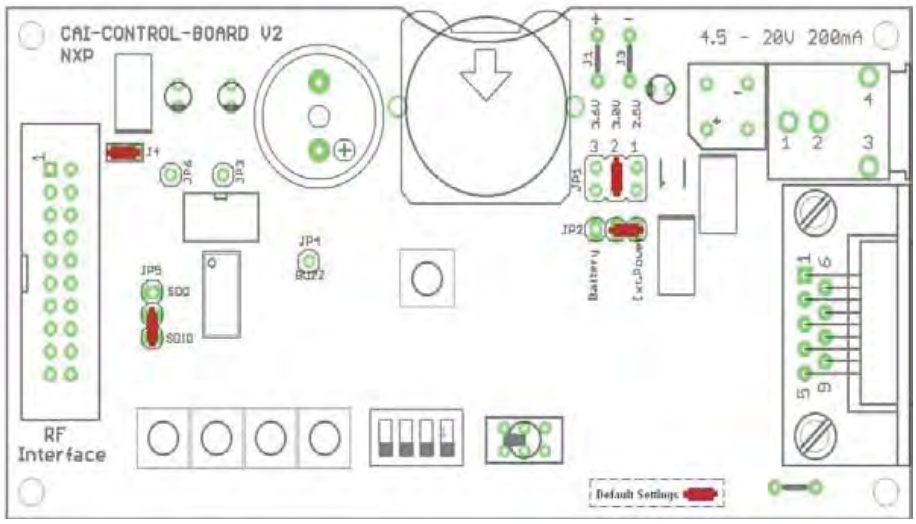

Fig 3. Control board jumper settings (default in RED)

Table 1. List of jumpers and connectors

Designation	Description
JP1 2.5 V/ 3.0 V /3.6 V	Selects the control board input voltage, when using an external input voltage. **Default** = center position (3.0 V)
JP2	Selects the supply for the control board. Connecting the two pins on the right, selects the external input voltage as the control board power supply. Connecting the two pins on the left, selects the battery as the control board power supply. **Default** = open
JP3	Enables a probe to be connected to the red LED voltage input.
JP4	Connects VCC_LOP and VCC to supply the RF board. **Default** = connected
JP5	Connecting the two pins at the bottom takes the SPI output data from the SDIO pin. Connecting the two pins on the top takes the output data from the SDO pin. **Default** = SDIO
JP6	Enables a probe to be connected to the green LED voltage input.
BUZZER	Enables a probe to be connected to the BUZZER voltage input.
RS232	RS-232 interface connector. Enables the microcontroller to be programmed and the hyper terminal interface to be used.

2.2.4 P89LPC936 Pin configuration

Table 2 provides an overview of the pin assignment of the microcontroller P89LPC936.

Table 2. P89LPC936 pin assignment

Pin reference	Configuration	Description
P0.0	input only (high impedance)	DIP switch S1
P0.1	input only (high impedance)	DIP switch S2
P0.2	input only (high impedance)	DIP switch S3
P0.3	input only (high impedance)	DIP switch S4
P0.4	input only (high impedance)	tactile switch SW4
P0.5	input only (high impedance)	tactile switch SW5
P0.6	input only (high impedance)	tactile switch SW6
P0.7	input only (high impedance)	tactile switch SW7
P1.0	quasi-bidirectional	RS-232 output - TXD
P1.1	quasi-bidirectional	RS-232 input - RXD
P1.2	open drain	serial clock (EEPROM)
P1.3	open drain	serial clock (EEPROM)
P1.4	input only (high impedance)	interface with OL2381 P11/INT/TEST5
P1.5	-	RESET
P1.6	quasi-bidirectional	configurable input/output P_TXD_LOP
P1.7	quasi-bidirectional	configurable input/output P_TXA_LOP
P2.0	quasi-bidirectional	configurable input/output P_RXA_LOP
P2.1	push-pull	green LED
P2.2	input only OR Push-pull	interface to OL2381 SDIO
P2.3	input only (high impedance)	interface to OL2381 SDIO or SDO
P2.4	push-pull	interface to OL2381 SEN
P2.5	input only OR push-pull	interface to OL2381 SCLK
P3.0	push-pull	red LED
P3.1	push-pull	buzzer
V_{SS}	-	0 V reference
V_{DD}	-	power supply

2.3 RF board description

This section briefly describes the RF board. The two-layer RF board contains the OL2381 IC, printed antenna, important test pins, 16 MHz crystal, switch connector for RF probe and transmit and receive matching components.

2.3.1 RF board schematic

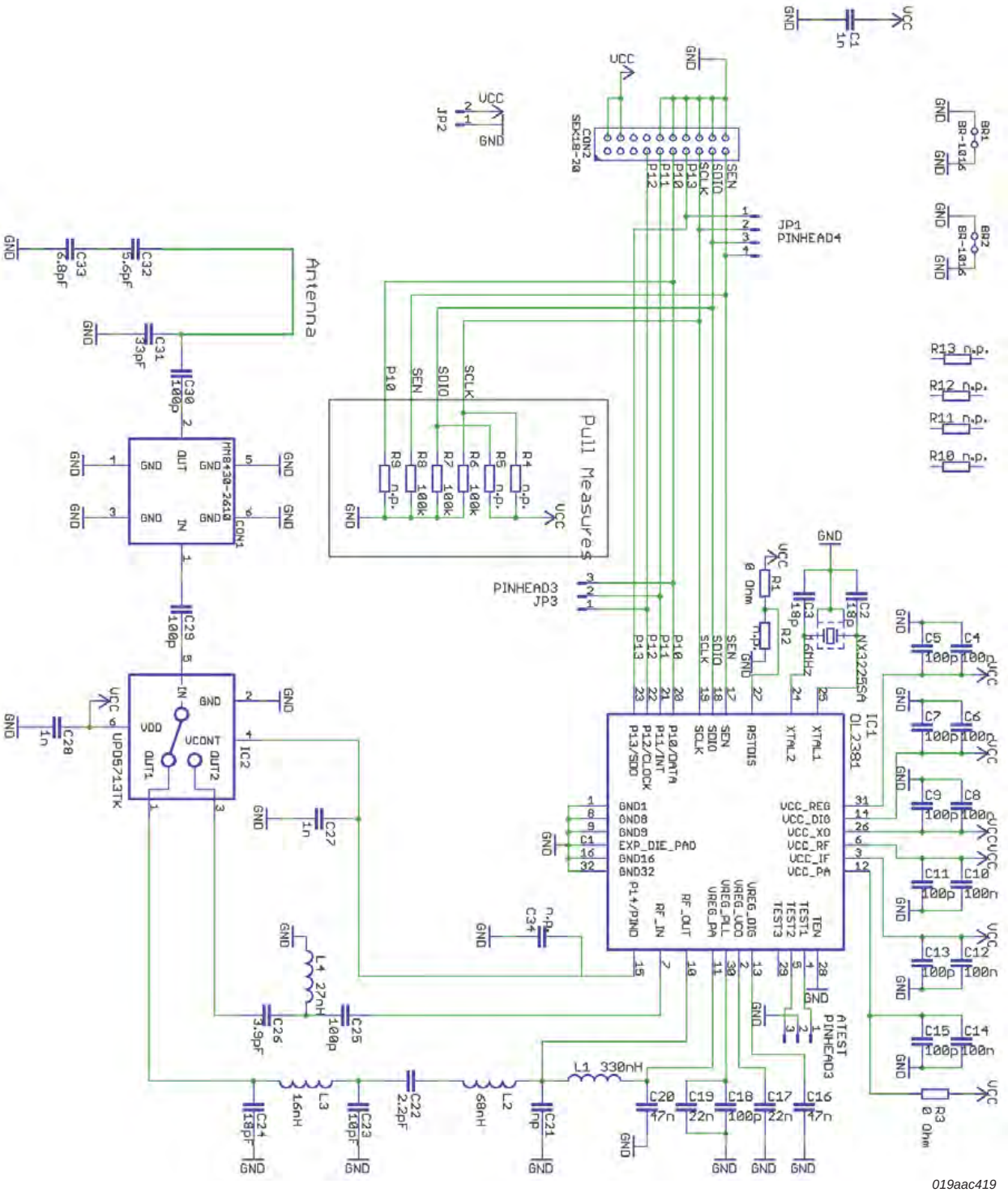

Fig 4. Schematic of OL2381 RF board

2.3.2 RF board layout

The layout is realized using a 2-layer technique. The rear-side is mainly the ground layer. The eagle files are available for customers.

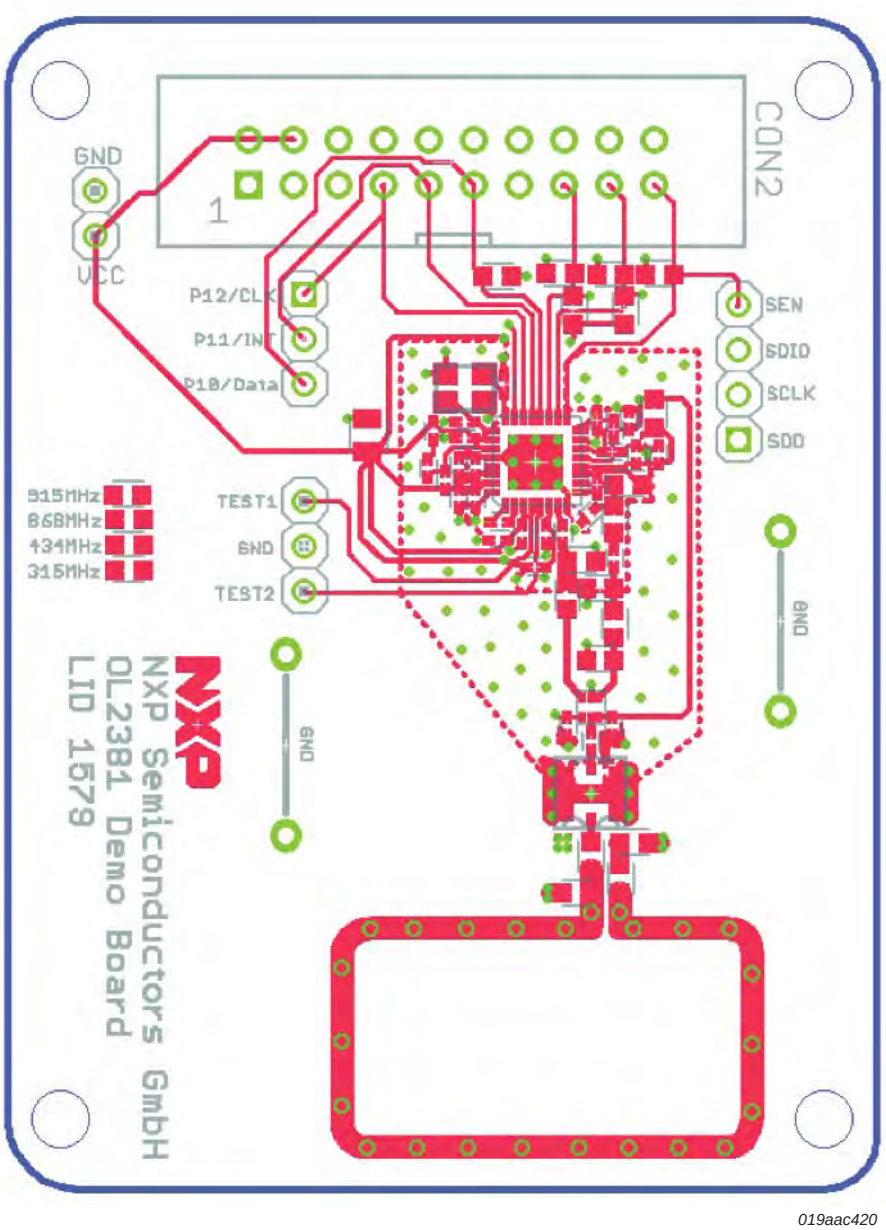

Fig 5. OL2381 RF board layout

2.3.3 Power supply distribution

The supply voltage applied to the RF Board from the Control Board is split into several paths. Each supply path is routed from the star connection to the different supply pins of the OL2381. The supply voltage is the same as the supply voltage of the control board. This jumper (JP2) is used for monitoring the current consumption of the OL2381 which is quick and reliable indication of the OL2381 operation mode. In the standard receive configuration, current consumption is between 16 mA and 17 mA, and in the transmit operation, between 15 mA and 22 mA.

Each supply path is routed to the individual functional blocks of the OL2381 and uses separate bypass capacitors of 100 nF and 100 pF.

OL2381 has four built-in voltage regulators, which are required to stabilize and isolate the supply of functional blocks such as the power amplifier, VCO, PLL, and digital circuitry. Each regulator needs external bypassing capacitors for improved high frequency rejection and to ensure stability.

2.3.4 Test pins

The RF board contains several test pins for important signals as described in Table 3 and shown in Figure 6:

Table 3. P89LPC936 pin assignment

Test pins	Description
SPI SDO, SCLK, SDIO, SEN	SPI communication pins, enabling communication between the microcontroller (on control board) and OL2381 (on RF Board). These pins can also be used to connect the RF board with another control board.
P10/DATA, P11/INT, P12/CLOCK	Enables a probe to be connected to the three outputs P10/DATA, P11/INT, P12/CLOCK of OL2381. Allows internal digital signals to be measured.
TEST1/TEST2	Allows internal analog signals of OL2381 to be measured.
VCC	Positive power supply for OL2381 and RF switch.

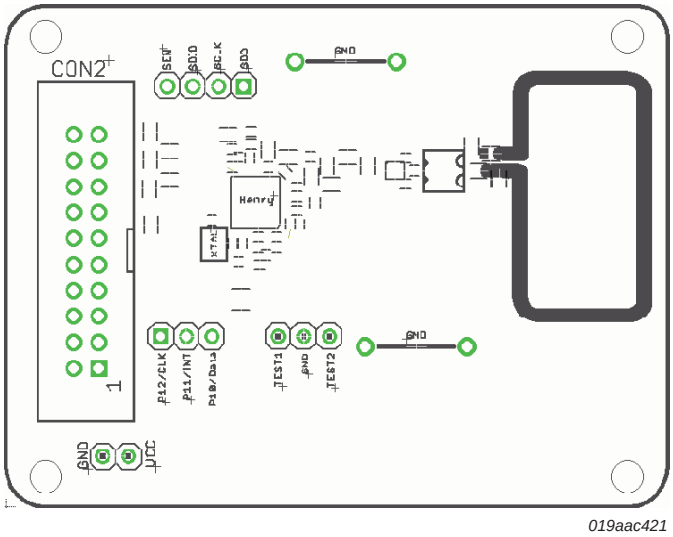

Fig 6. OL2381 RF board test pins

2.3.5 Pin description

Table 4: OL2381 pin description

Symbol	Pin	Description
GND	1	ground
VREG_VCO	2	VCO regulator output voltage
VCC_IF	3	IF power supply
TEST1	4	RX test I output
TEST2	5	RX test Q output
VCC_RF	6	LNA power supply
RF_IN	7	receive RF signal input (antenna or RX connector)
GND	8	ground
GND	9	ground
RF_OUT	10	transmitted RF signal output (antenna or TX connector)
VREG_PA	11	PA regulator output voltage
VCC_PA	12	PA power supply.
VREG_DIG	13	digital regulator output voltage
VCC_DIG	14	digital supply
P14/PIND	15	antenna switch control
GND	16	ground
SEN	17	serial interface enable, connected to P2.4 of microcontroller
SDIO	18	serial interface input/output connected to P2.3 (MISO) and P2.4 (MOSI) of microcontroller
SCLK	19	serial interface clock, connected to P2.5 of microcontroller
P10/DATA/TEST4	20	TX data input/RX data output, connected to P2.6 of microcontroller
P11/INT/TEST5	21	interrupt line connected to pin P1.4/INT of microcontroller
P12/CLOCK	22	TX/RX clock output connected to P2.7 of microcontroller

Table 4: OL2381 pin description *...continued*

Symbol	Pin	Description
P13/SDO	23	serial interface data output connected to P2.3 (MISO) of microcontroller when the 4-wire communication is selected
XTAL2	24	2-pin crystal oscillator
XTAL1	25	1-pin crystal oscillator
VCC_XO	26	crystal oscillator supply
RSTDIS	27	reset disable, connected either to ground or to VCC depending on the position of its dedicated jumper
TEN	28	test enable, set to ground
P15/RSSI/TEST3	29	not connected
VREG_PLL	30	PLL regulator output voltage
VCC_REG	31	PLL, VCO regulators power supply
GND	32	ground

3. Demo kit setup

This chapter describes the step-by-step approach to set up the OL2381 for transmit and receive operation using the demo kit and GUI. The description starts with demo kit hardware connections followed by a brief discussion on GUI setup and GUI windows.

3.1 Hardware connections

The OL2381 demo kit includes the following items (shown in Figure 1):

- Control board
- OL2381 RF board, configurable to operate in one of three frequencies:
  - 315 MHz
  - 434 MHz
  - 868 MHz

  The transceiver chip is almost the same. The RX path, TX path and antenna are matched differently to attain optimal performance at each frequency.
- A 20-pin flat cable connector
- A coax antenna cable (L-type RF probe)

Perform the following actions:

1. Jumper setting on controller board:
   - make the default jumper setting on controller board as described in Section 2.2.2 on page 4.

   Jumper number 4 is important. This jumper allows only the use of one supply for both boards. For high performance measurements, see Section 6.1 on page 41.
2. Connections:
   - Connect PC and control board with RS-232 Cable (cable not included)
   - Connect control board and RF board with 20-pin flat cable connector
   - Connect RF board and RF-analyzer, or RF-generator with coax antenna cable
3. Power supply:
   - Connect +3 V as shown in Figure 7

An overview of all connections is provided in Figure 7.

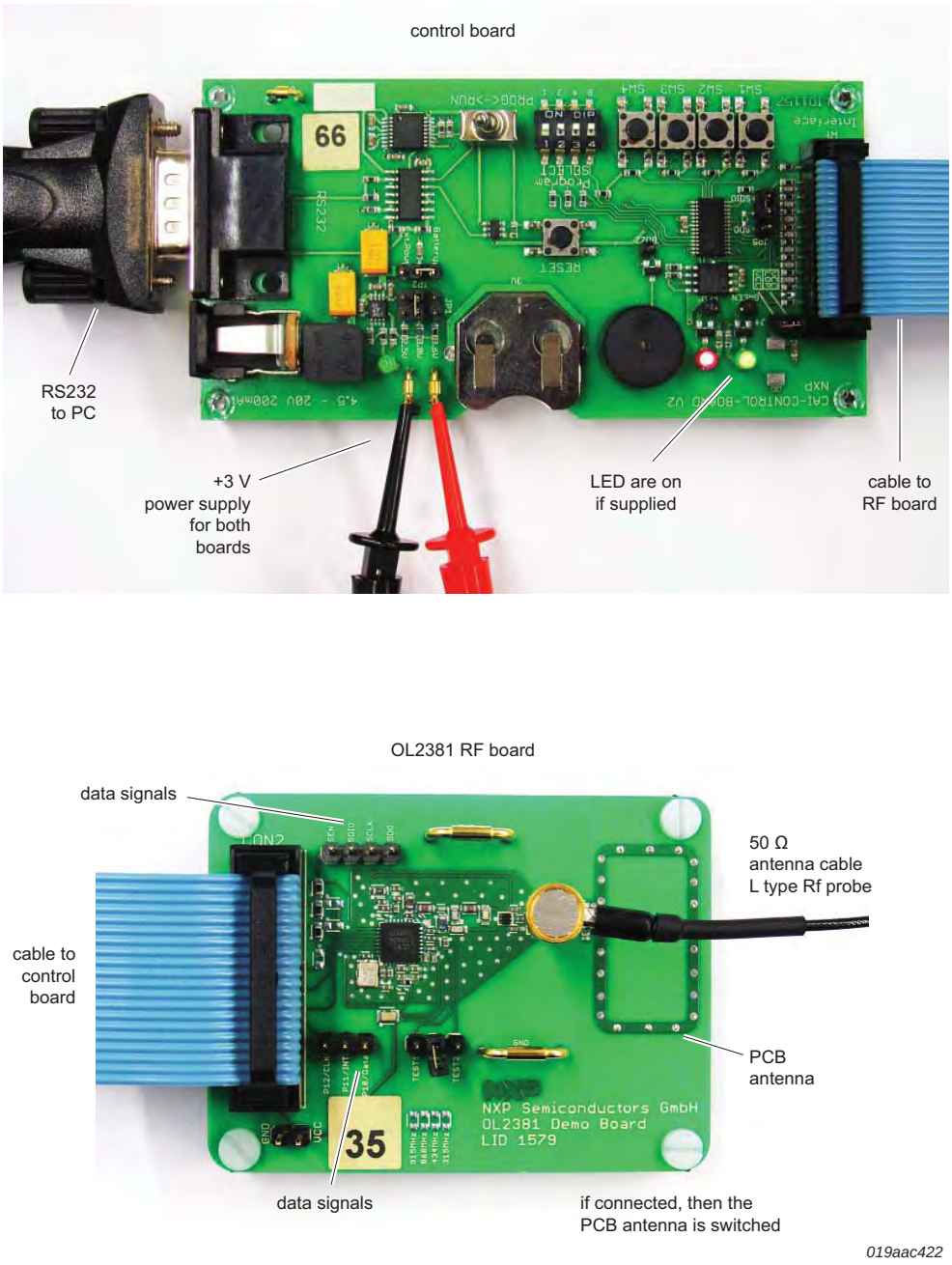

Fig 7. Control board and RF board connections

3.2 OL2381 Graphical User Interface (GUI)

The OL2381 demo kit includes Graphical User Interface (GUI) which enables easy real-time user access to the OL2381 registers for desired settings. The user can set several transmitter and receiver parameters such as:

- operating frequency
- data rate
- data coding and decoding
- modulation setting
- baseband and channel filter settings
- transmit and receive command settings together with enable or disable transmit and/or receive operation

3.2.1 GUI installation

Install the OL2381 GUI as follows:

1. Copy the whole folder named "OL2381 SW Graphical User Interface GUI" to a desired location on a local PC.
2. Copy the contents of the folder Assemblies\WinSxS into the windir\WinSxS\ folder.
3. Select “Yes” when asked whether to overwrite the “Manifests” folder and select “No” for all other overwrite questions.
4. In the folder "LoPSTerConfig", click the file name "LoPSTerConfig.exe" (see Figure 8) and the OL2381_GUI with all three windows opens.

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Fig 8. GUI start-up

3.2.2 RS-232 port configuration check

The GUI connection status with the control board and OL2381 RF board can check by clicking "Check now" button in OL2381 control window. The status message for connection is displayed as shown in Figure 9.

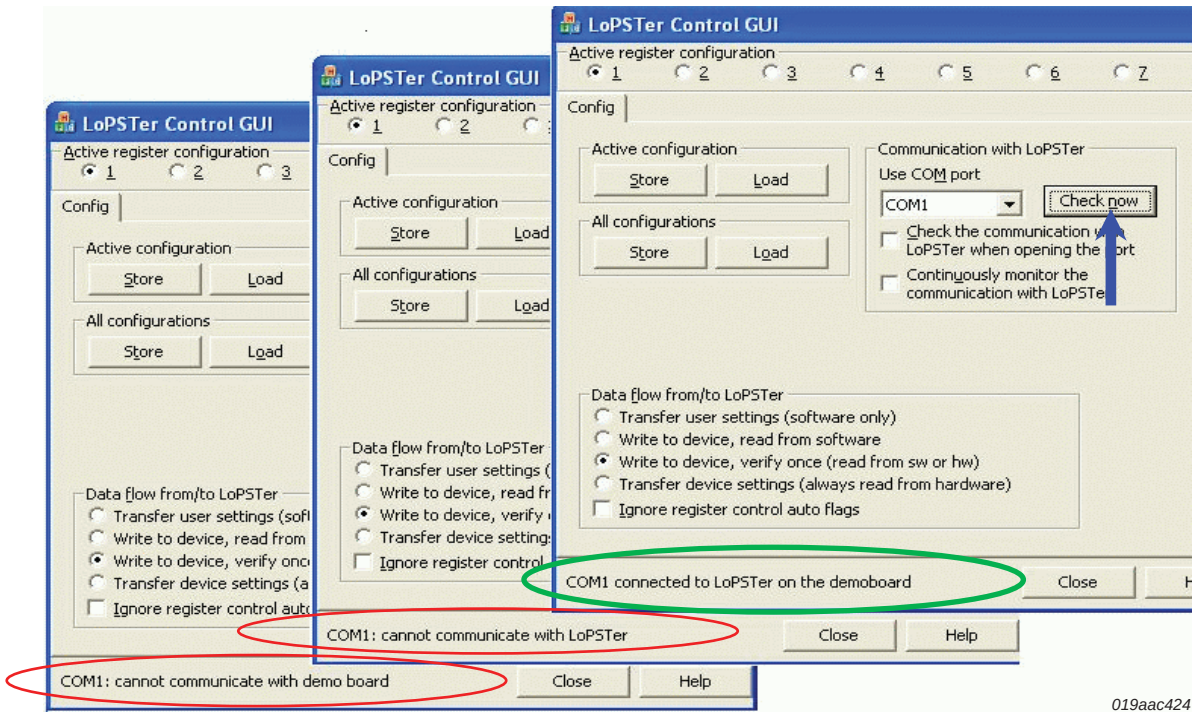

Fig 9. Communication status shown on Control GUI

- **"COMx connected to LoPSTer on Demoboard"** reflects communication is made:
  - The GUI can communicate with the control board and with OL2381 RF board

Failure to communicate with the GUI could be due to problems with either the control board or the RF board. The following cases provide quick checks to resolve potential problems:

- **"Cannot communicate with demo board"** reflects a control board failure.

  Quick check:
  - RS-232 port configuration/selection
  - Jumper settings for power supply
  - Knob set to RUN position
  - If all above PASS, although unlikely, it is possible that one of the devices has failed. If so, request a new board

- **"Cannot communicate with LoPster"** reflects RF board failure.

  Quick check:
  - Power supply check: pins VCC and Vreg
  - SPI Check: probe SPI pins, write and read registers, SEN works accordingly
  - Crystal check for reference frequency, i.e. 16 MHz for OL2381
  - Check current consumption for: TX PA off, TX PA on and RX
  - RF switch set to in-line for TX and RX configuration

3.2.3 GUI windows description

During start-up of OL2381, the GUI shows three different windows (see Figure 10) entitled:

- LoPSTer Control GUI
- LoPSTer Register Control
- LoPSTer Config GUI

These three windows are discussed in the following sections.

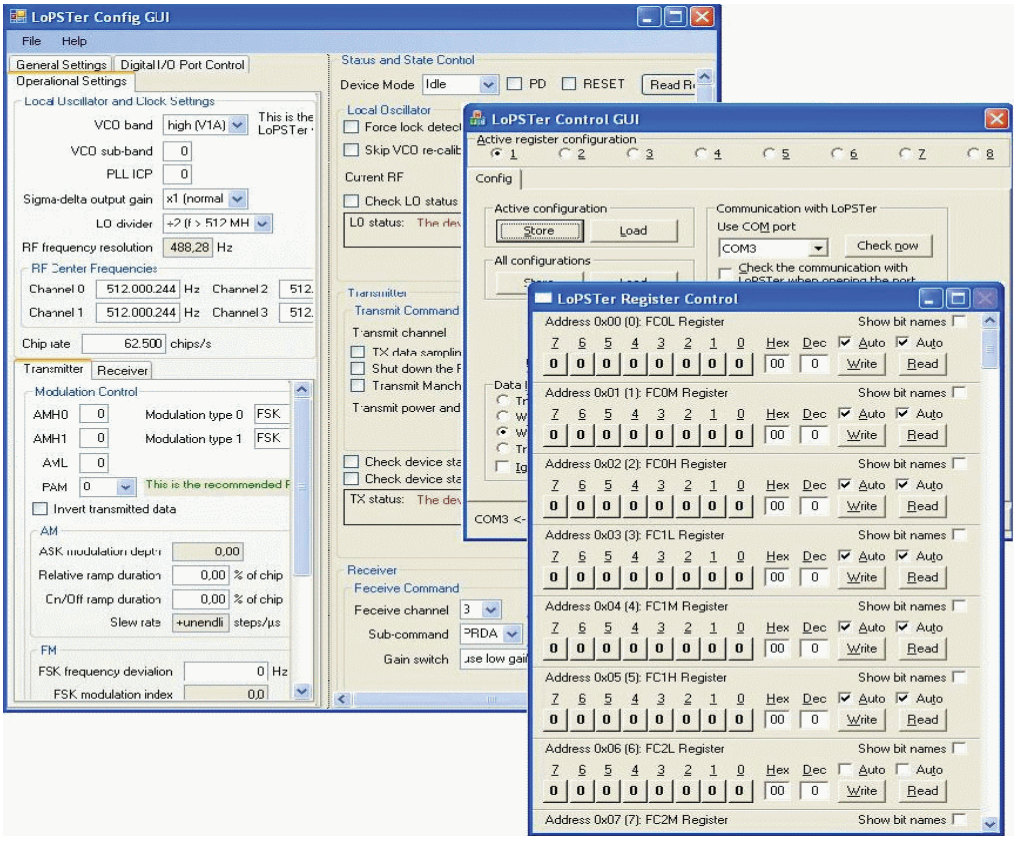

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Fig 10. GUI windows

3.2.3.1 LoPSTer control GUI

The LoPSTer control GUI, shown in Figure 11, enables the user to:

- Check connection between the GUI and hardware (control board and RF board) by clicking the “Check now” button. This action displays the status message at the bottom of the window.
- Load and store OL2381 configuration files using “Store” and “Load” buttons, where:
  - **Load** writes configuration file values to the OL2381 registers
  - **Store** saves the OL2381 register values as the configuration file
- Switch between eight different stored configurations - Active register configuration

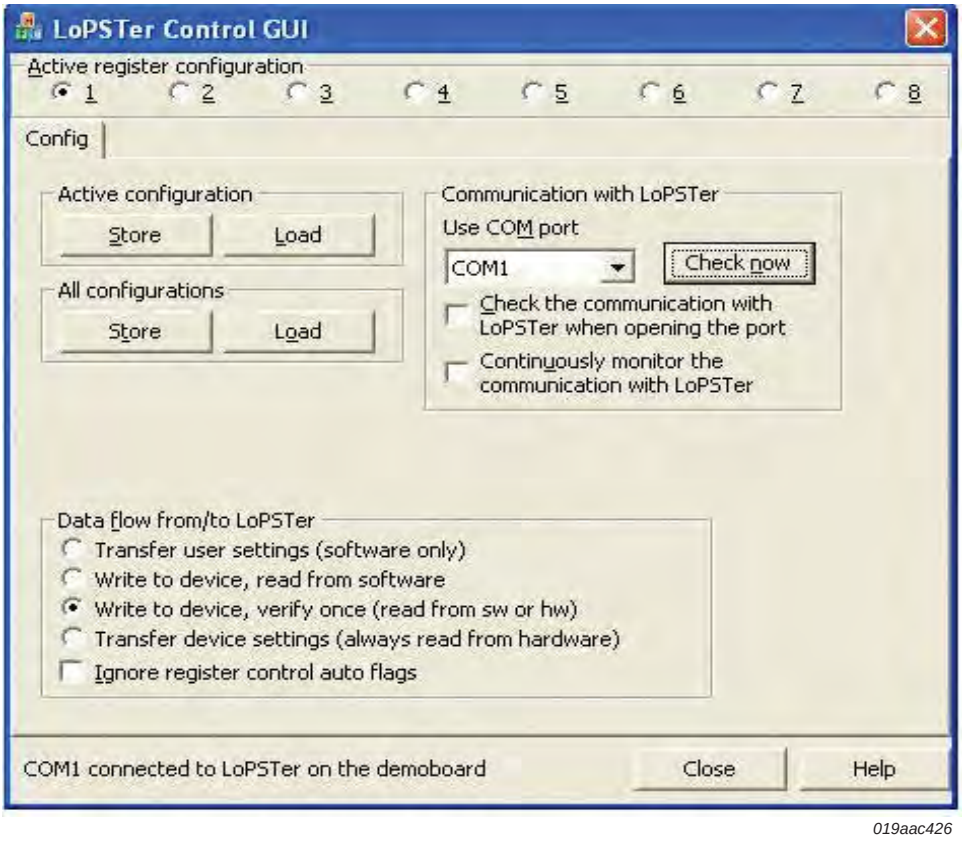

Fig 11. GUI control window

3.2.3.2 LoPSTer register control GUI

The LoPSTer register control GUI, shown in Figure 12, enables the user to:

- Read and write the OL2381 registers in real-time by clicking **Read** and **Write** buttons
- Show complete register bits by name by clicking **Show Bit names**
- Show each register with name, address and content in hexadecimal and decimal
- Update registers with the parameter changes made in LoPSTer control GUI
- Enable or disable auto read and write OL2381 registers

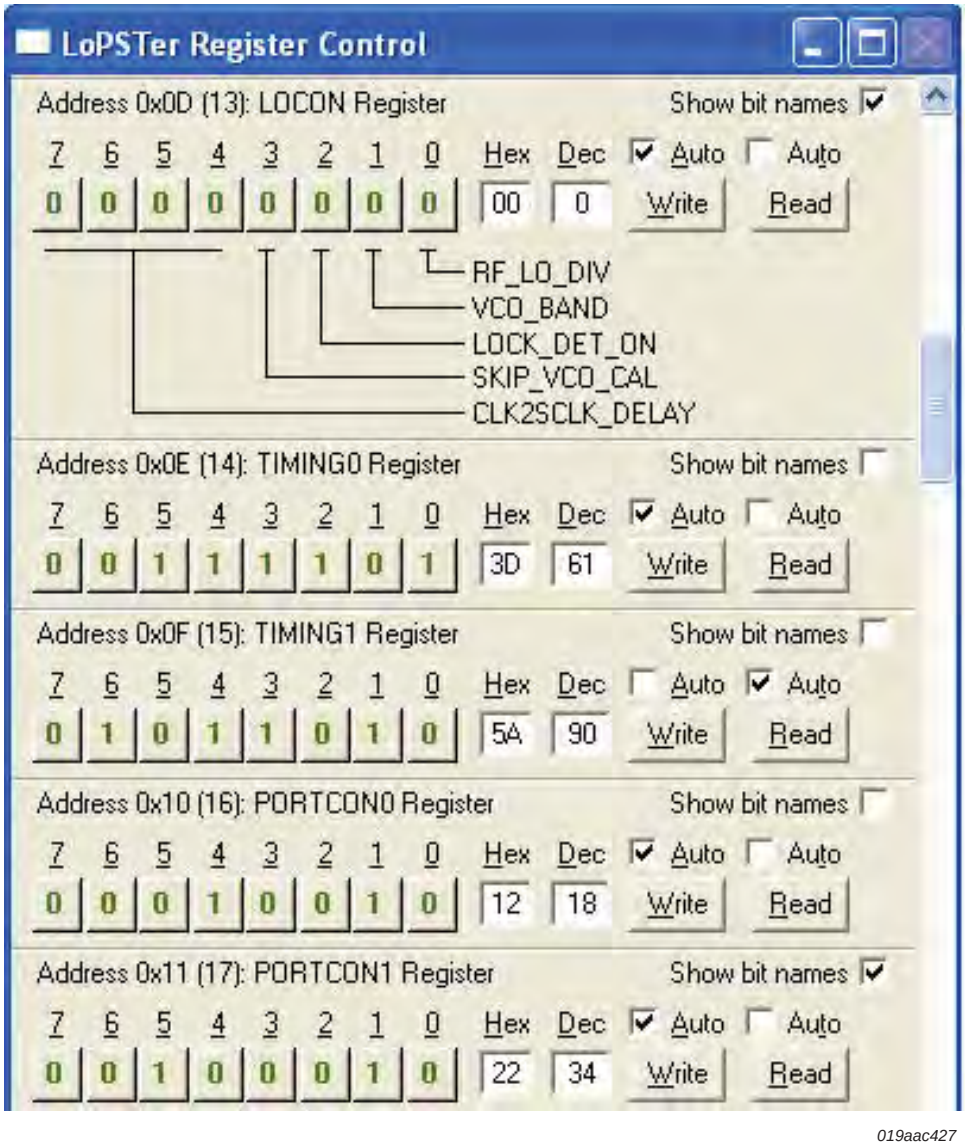

Fig 12. GUI register window

3.2.3.3 LoPSTer Config GUI

The LoPSTer configuration GUI, shown in Figure 13, provides an easy-to-use real-time interface. This interface enables the user to configure a wide range of transmit and receive parameters. The LoPSTer config GUI contains the following three tabs:

- General Settings
- Digital I/O Port Control
- Operational Settings

General Settings (see **1** in Figure 13) - enables the user to:

- Select **LoPSTer version**, an option for predecessor OL2380 that is no longer valid for OL2381 as it supports all frequencies.
- Calibrate reference XTAL frequency (if necessary)
- Select reset disable (RSTDIS) pin setting. For detailed information regarding RSTDIS, refer to the *Data sheet OL2381* or *Application note AN11039* .

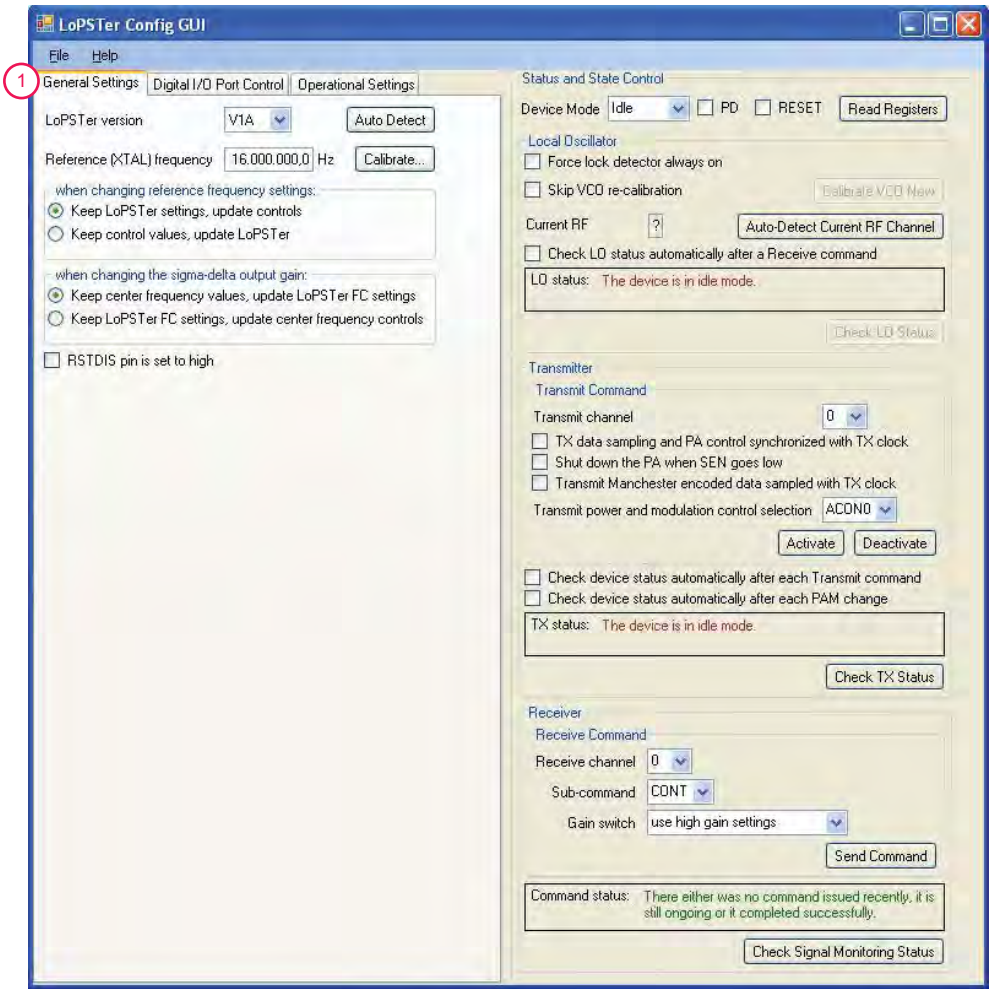

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Fig 13. Configuration window for general settings

Digital I/O port control (see **2** in Figure 14) - allows the user to:

- Control port connection
- Configure either 3-wire or 4-wire SPI communication
- Configure SPI or separate pins (P10/DATA, P12/CLOCK) for TX/RX data and clock
- Scroll different options for pins Data, Clock and INT, i.e. TX/RX/chip/bit clock on P12/Clock, LO_RDY/RX_RDY/PA_ON status on P11/INT
- Configure P13/SDO and P14/PIND

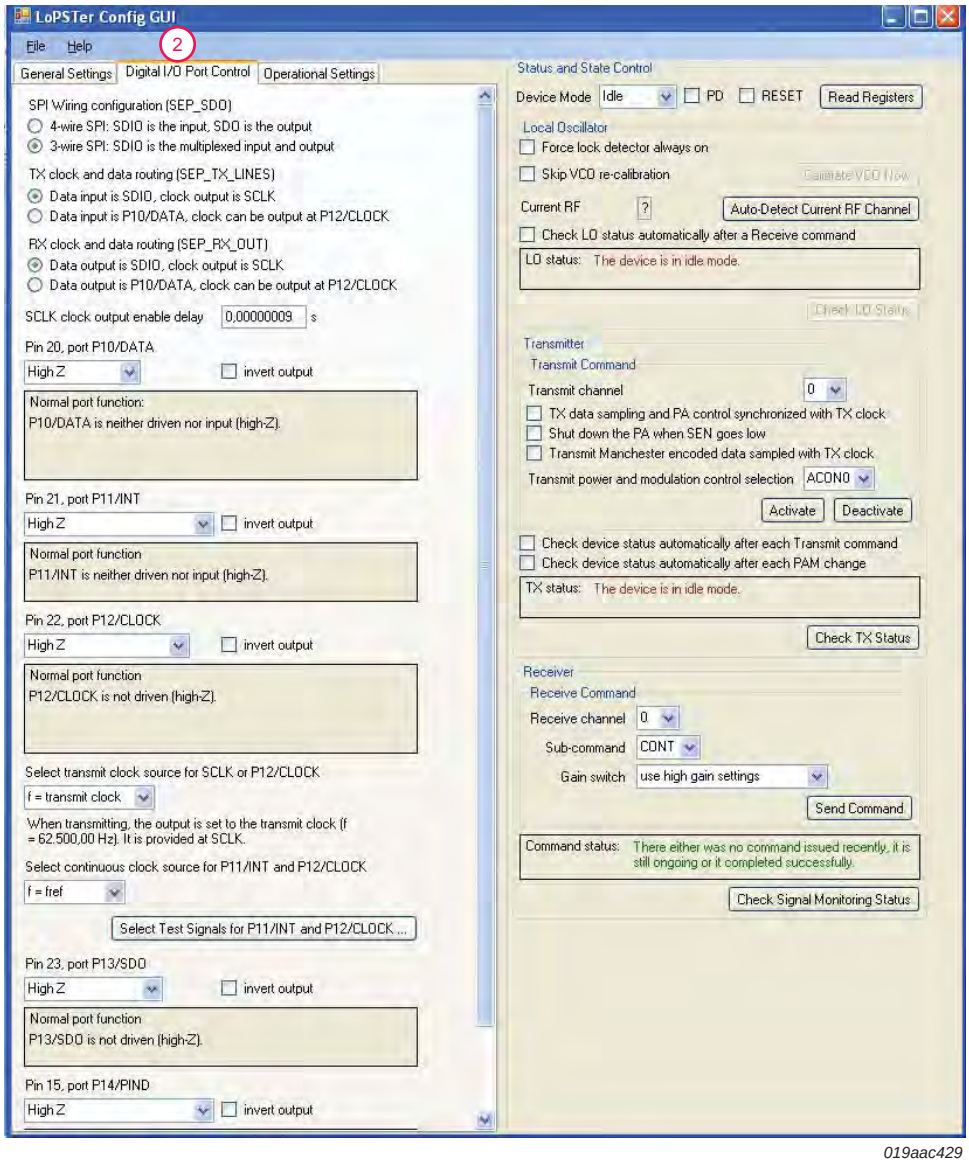

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Fig 14. Configuration window for digital I/O port control

Operational settings (see **3** in Figure 15):

- Separate section for transmitter parameter settings and receiver parameter settings on left-hand side (LHS)
- Separate section for transmit command and receive command settings on LHS
- Common sections for RF center frequencies and device status and state control
- A choice between four different channels for TX and RX operation with the help of transmit channel and receive channel option block
- Status for local oscillator, PLL, transmit state and receive state can be checked at anytime by clicking the appropriate status button

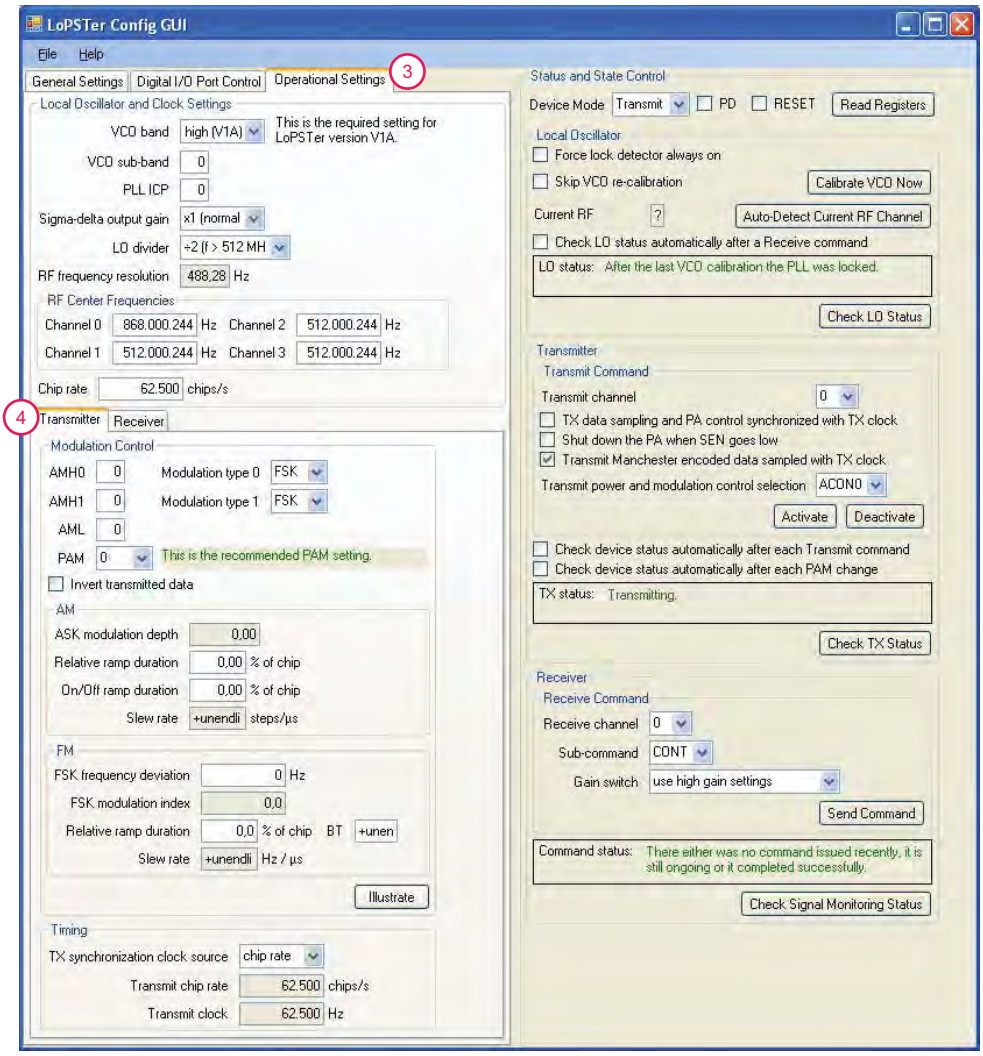

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Fig 15. Configuration window for transmitter settings

3.2.4 GUI transmitter and receiver parameters

3.2.4.1 Transmitter parameters

The transmitter parameters, indicated by **4** in Figure 15, are discussed briefly in this section.

- **Modulation Control** section allows the user to:
  - Select **Modulation type** either ASK or FSK
  - Set output power **AMH0/AMH1/AML** for modulated signal
  - Set power amplifier output power (**PAM**), PAM0 is recommended setting
- **AM** and **FM** blocks allows ASK and FSK settings
  - Amplitude modulation depth for ASK signal
  - Frequency deviation for FSK signal
  - Ramp control for soft ASK and FSK to achieve narrow signal bandwidth
- **Timing** block allows the chip or bit clock to be selected for TX synchronization
- **Transmit Command** block on right side allows the user to:
  - Select the desired **Transmit Channel**, i.e. Channel 0, 1, 2 or 3
  - Configure the transmit command for PA control
  - Enable or disable **Manchester** coding for TX Data
  - Select either ACON0 or ACON1 for output power and modulation selection.
  - Enable or disable PA by clicking **Activate** or **Deactivate** buttons.

3.2.4.2 Receiver parameters

The receiver parameters, shown by **5** in Figure 16 and Figure 17, are discussed briefly in this section.

- **Gain Settings** defines the front-end gain, **LNA** and **IF** filter, where high gain, shown in Figure 16, is the recommended setting
- **Channel Filter** defines demodulation type (ASK or FSK) applied on receive signal and channel filter bandwidth.
- **Baseband Filter** defines the BBF corner frequency; the corner frequency must keep close to the expected data rate.
- **Slicer and Coding** defines the data slicer settings:
  - Implementation of edge or level slicer
  - **Recommendation: level slicer for ASK and edge slicer for FSK modulated signal
  - **Recommendation: edge slicer initial value as 70 % frequency deviation
  - **Recommendation: enable auto Initialization for edge Slicer
- **Receive Command** on right side allows the user to:
  - Select different receive subcommand, i.e. CONT, WUPS, PRDA or DATA
  - Select desire Receiver Channel, i.e. Channel 0, 1, 2 or 3
  - Select LNA gain control in **Gain Switch** option
  - Enable user send/receive command by clicking **Send Command** button

- The appropriate settings for signal monitor, wake-up, preambles, polling timer together with data and clock sections are scrolled down sections as shown in Figure 17. Examples of the types of data shown are:
  - Manchester decoding enable/disable in data and clock section
  - preambles definition in preamble settings
  - several signal monitors that can be enabled or disabled in the signal monitoring section

Any change performed in the LoPSTer config GUI is reflected in the corresponding registers in the LoPSTer register GUI.

** Only for Initial start-up. For specific applications, the user performs final optimization.

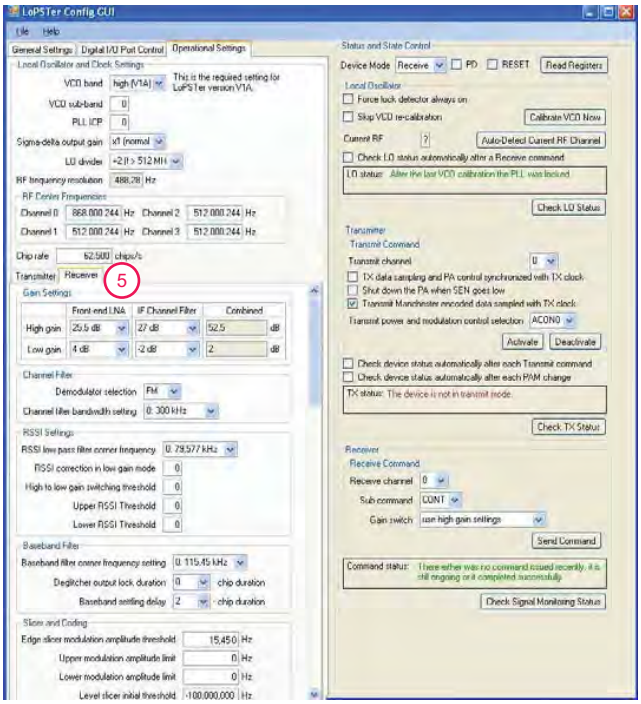

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Fig 16. Configuration window for receiver gain

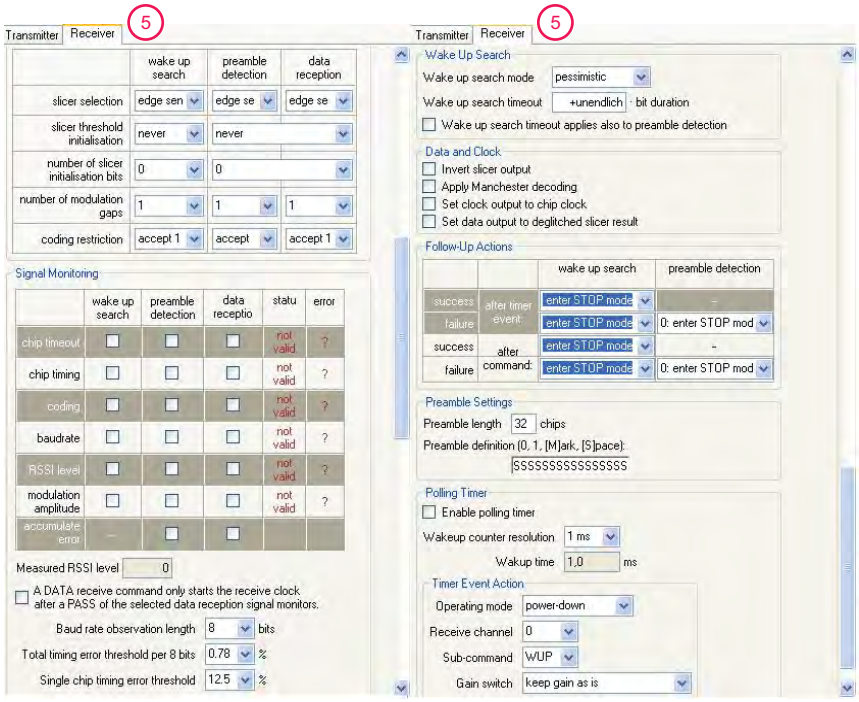

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Fig 17. Configuration window for receiver settings

4. RF measurements using the demo kit

This section describes how to measure certain OL2381 RF parameters such as RF transmission power, receiver sensitivity, using a single demo kit set.

4.1 Transmission measurement

This section describes how to perform a transmission measurement. It uses the 868 MHz configuration but measurements at other frequencies can be done in a similar way.

The software package included in the demo kit contains OL2381 transmission configuration files for 315 MHz, 434 MHz and 868 MHz bands.

Click the “Load” button that appears in the OL2381 control GUI window. To configure OL2381 for 868 MHz transmission, select and load the file named "Config_868Mhz_FSK.lrg" (see Figure 18).

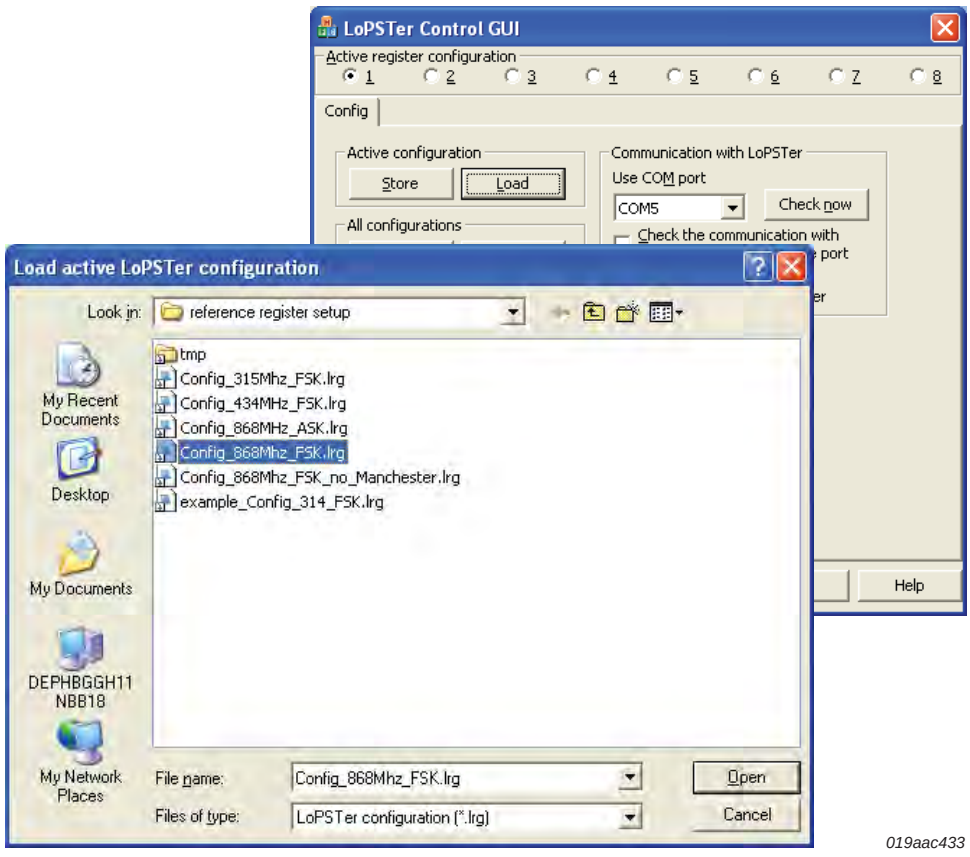

Fig 18. LoPSTer control GUI - loading a configuration file

The OL2381 register content is seen in the OL2381 register window. The register can be read and written at anytime.

The OL2381 configuration file is set up for a 868 MHz Continuous Wave (CW) transmission, i.e. an unmodulated carrier.

A CW transmission can be set when frequency deviation (register Fdev) in FSK is 0 and the transmitter parameters appear in the transmitter section of OL2381 Config GUI window.

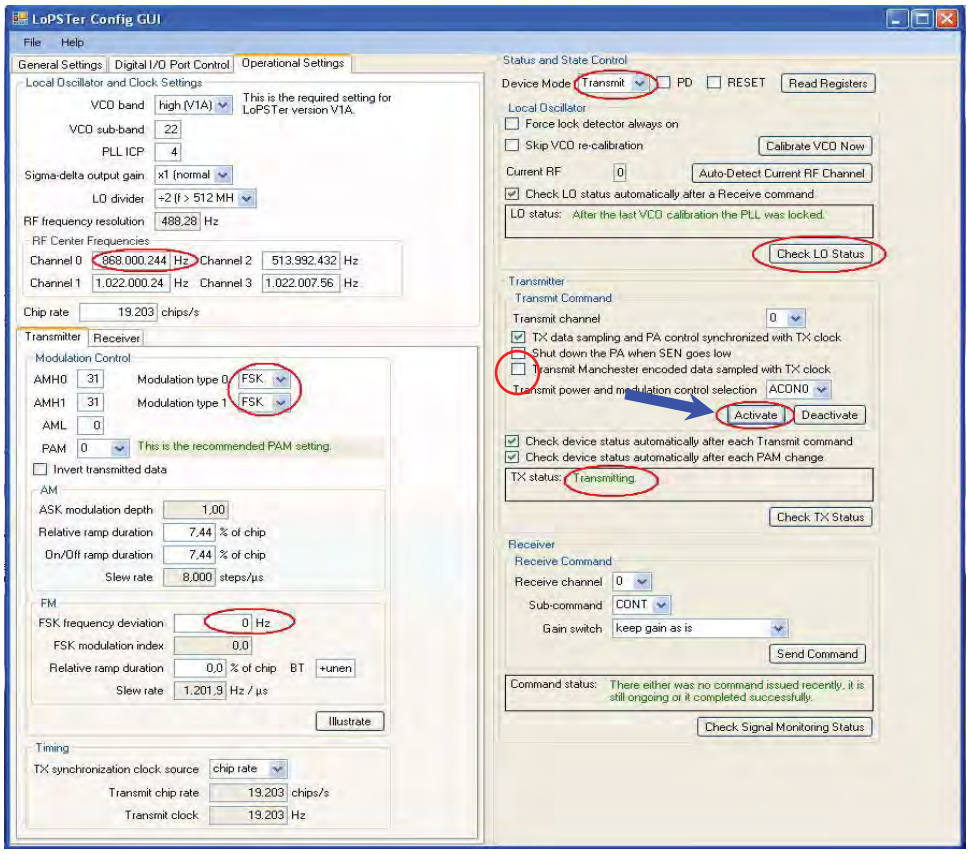

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Fig 19. LoPSTer control GUI - loading a configuration file

There are a number of important data captures shown in Figure 19 that have been circled in red. These data captures are for OL2381 transmission and represent the following:

- Channel frequency set to 868 MHz
- Modulation type is FSK
- Frequency deviation for FSK
- Device mode is “Transmit”
- “Activate” button sends TX command
- Final status of transmission

4.1.1 Output power and harmonics

The L-type RF probe is connected between the RF board and spectrum analyzer to display the OL2381 output signal on the spectrum analyzer (see Figure 20).

Marker 1 points to the operating frequency, whereas marker 2 and marker 3 indicate the harmonics.

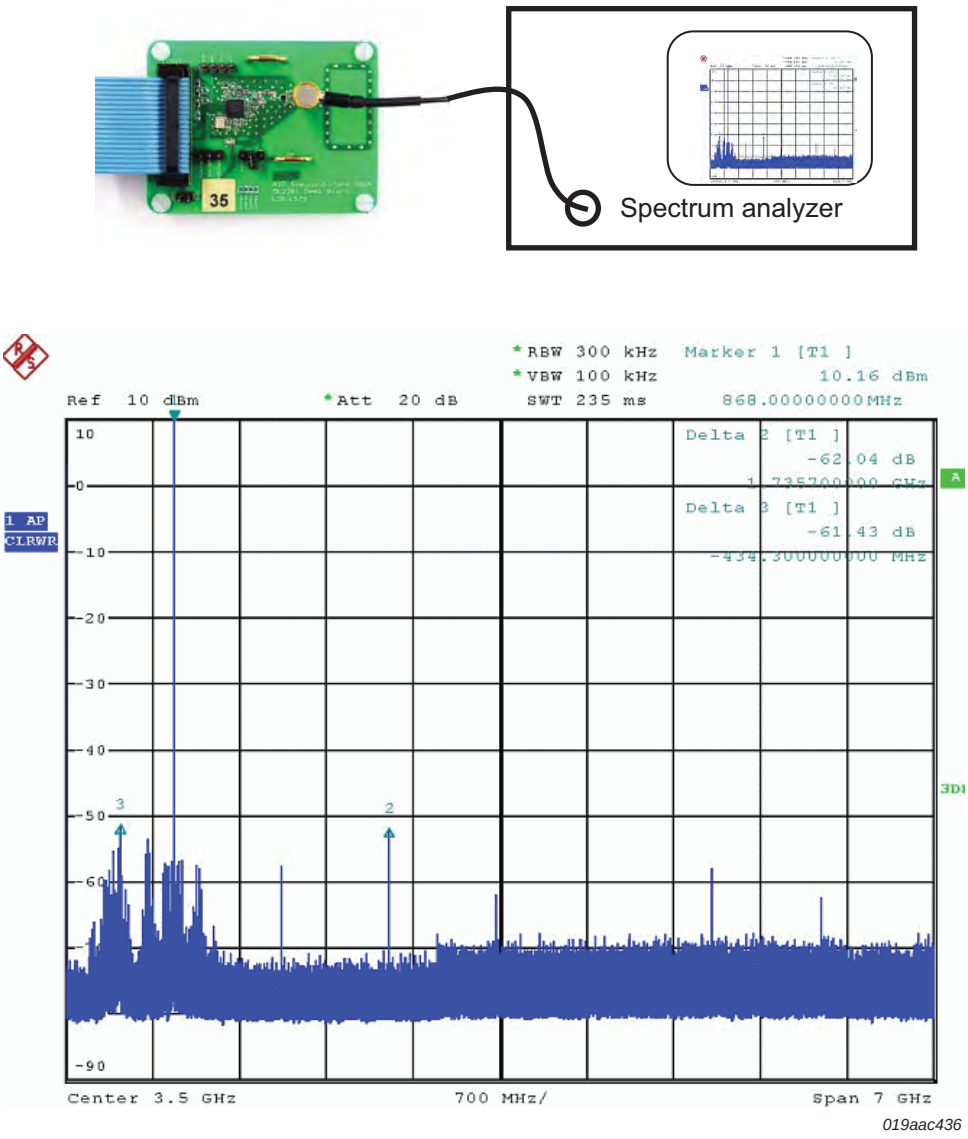

Fig 20. OL2381 spectrum analysis for 868 MHz transmission

The TX clock and data can also be observed with the help of data and clock pins on the RF board.

Changes in output spectrum can be observed by changing the following TX parameters:

- PAM setting
- RF frequency
- Data rate
- Modulation
- Coding
- Baud rate

Typical current consumption of RF board - 18 mA for an output power of 8 dBm.

4.2 Reception measurement

This section provides an example explaining how to perform reception measurements.

In this example, the 868 MHz configuration is used, but the same procedure applies to other configuration files.

The software package included in the demo kit contains OL2381 reception files for 315 MHz, 434 MHz and 868 MHz bands.

To configure the OL2381 for 868 MHz reception, click the “Load” button in the OL2381 control GUI window, select the "Config_868Mhz_FSK.lrg" file and then open it (see Figure 21).

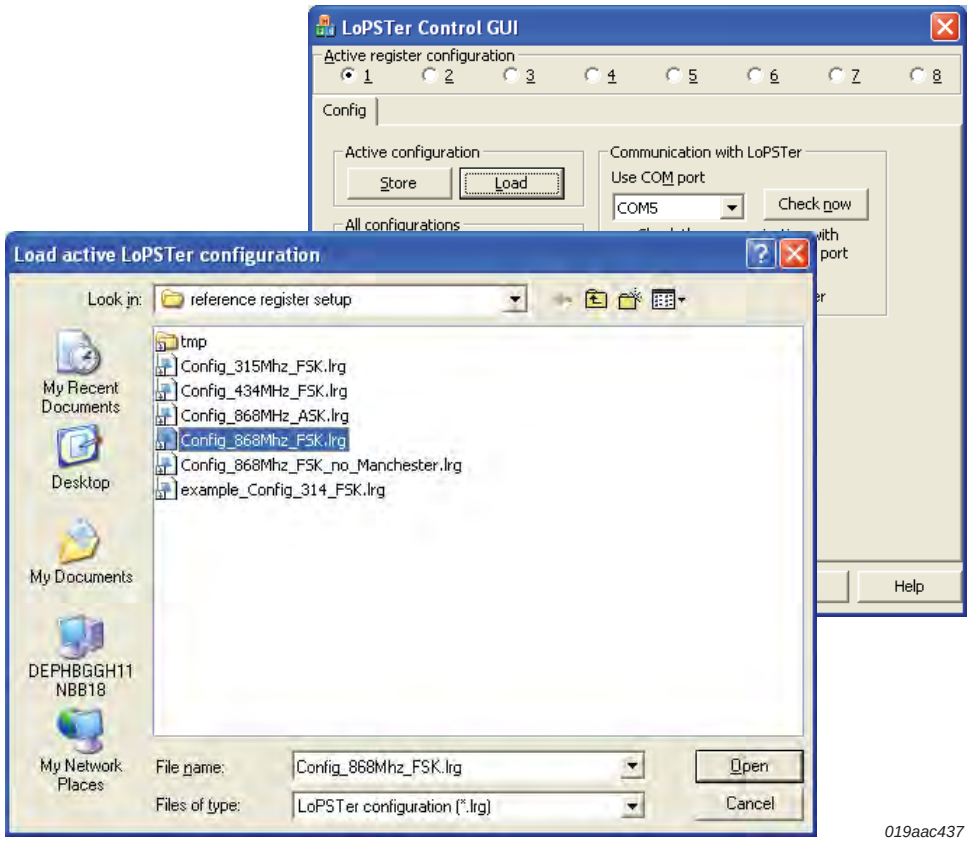

Fig 21. Loading the 868 MHz configuration file

The receiver is activated by clicking the "Send command" button in the receive command section of OL2381 Config GUI as shown in Figure 22.

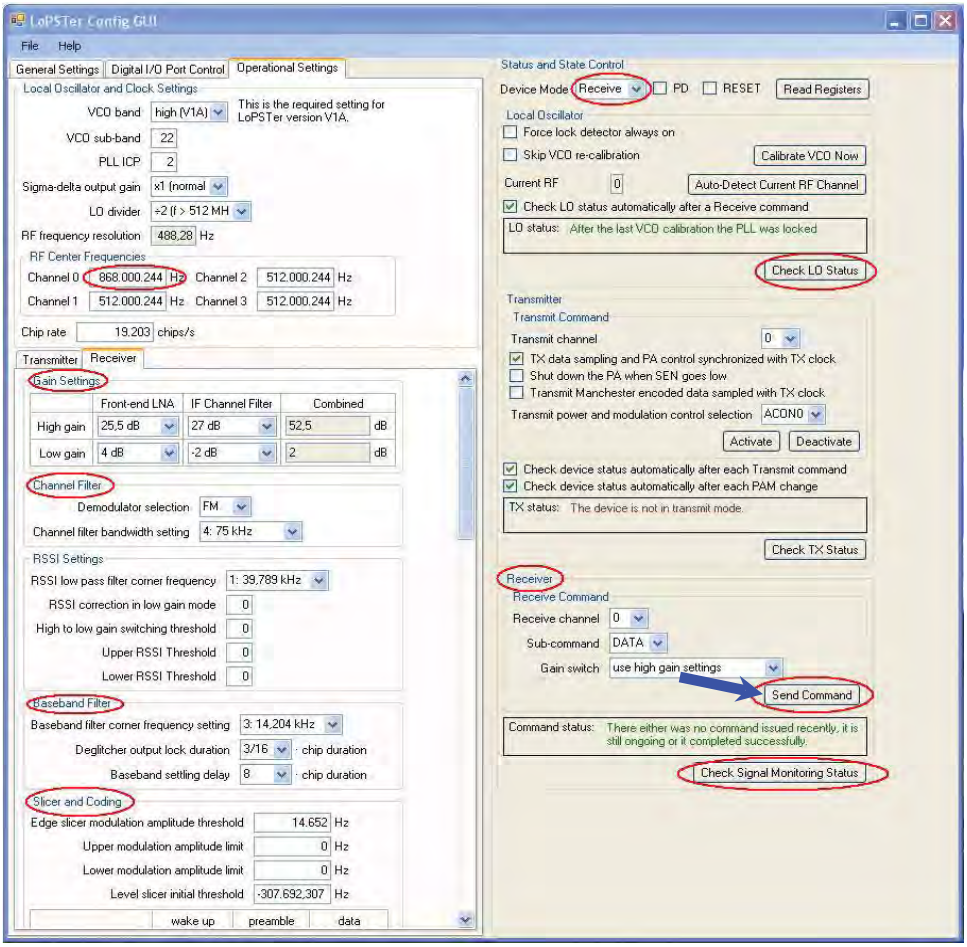

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Fig 22. LoPSTer Configuration GUI for 868 MHz receiver settings

There are a number of important data captures shown in Figure 22 that have been circled in red. These data captures are for the OL2381 reception and represent the following:

- Channel frequency
- LNA gain setting
- Channel and baseband filter bandwidth
- Modulation type
- Slicer setting
- Device mode
- LO and PLL status
- Device is in data reception mode after sending receive command

For detailed information regarding receiver parameters, refer to *Data sheet OL2381* or *Application note AN11039*.

An R&S signal generator is used to generate the frequency of the expected signal, for this example, 868 MHz with:

- F_{dev} = 15 kHz
- Manchester coded data = 19200 chips/s
- Data = ..,0,1,0,1,0,1,0,…

Using an L-type RF probe, establish a connection between the signal generator and RF board and inject the RF signal from the signal generator to OL2381 on the RF board.

Using an oscilloscope, observe the data and clock pins on the RF board for received data and clock (see Figure 23).

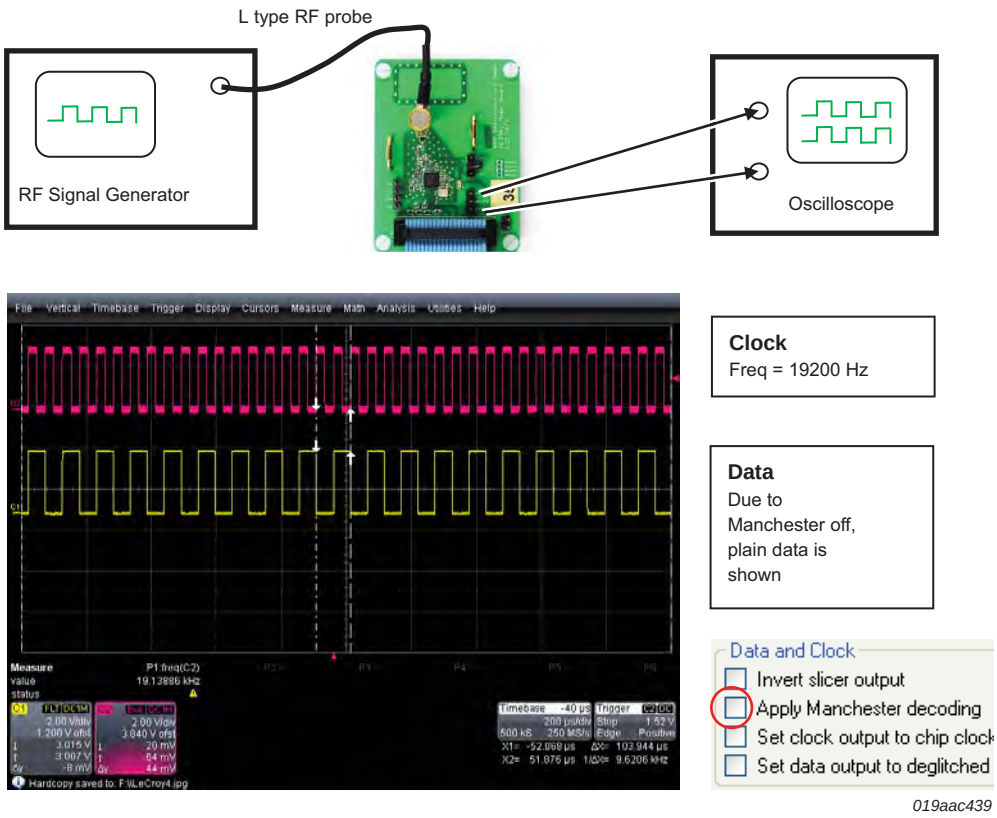


Fig 23. Receiver signals without Manchester decoding

4.2.1 Sensitivity measurement

The receiver is set to Manchester decoding for sensitivity measurements. As a result, the data output shows either constant "0" or constant "1" (see Figure 24) and the clock signal is divided by two.

The signal power from the signal generator can now be gradually reduced until noise replaces the data shown on the oscilloscope (see Figure 25).

This inserted power, is the minimum power the OL2381 receiver can receive and it represents the sensitivity of the receiver. The exact RF frequency of the RF generator is important and it may be necessary to fine-tune it.

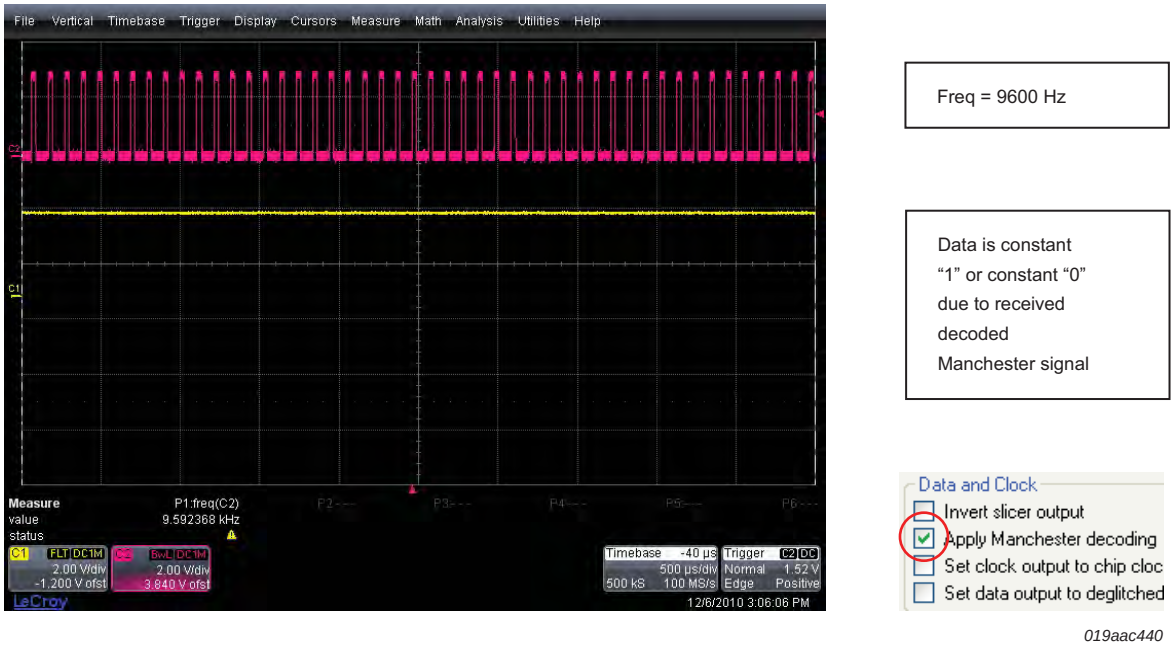


Fig 24. Receiver signals with Manchester decoding

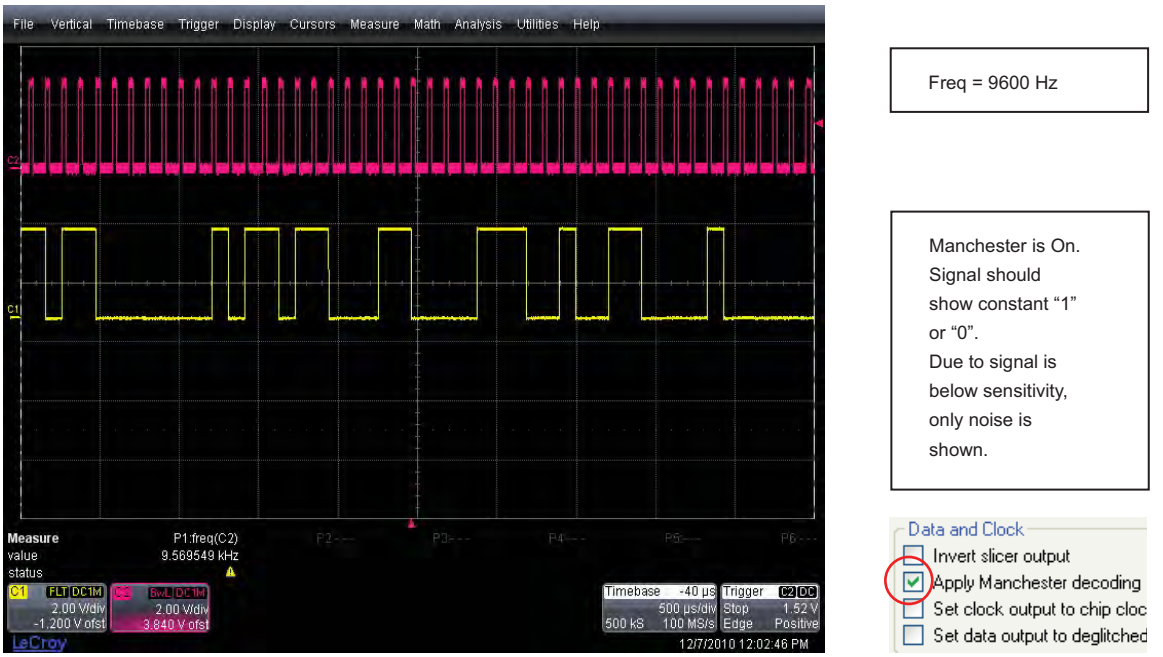


Fig 25. Receiver signals showing noise

5. Configuration files

This section containsa brief description of OL2381 configuration files. It covers both transmission and reception at frequencies of 315 MHz, 434 MHz and 868 MHz. The same configuration files are included in the software package supplied with the OL2381 demo kit.

The following three configuration files are discussed briefly, together with GUI captures for TX and RX.

- TX/RX configuration file 315 MHz (FSK transmission/FSK reception)
- TX/RX configuration file 434 MHz (FSK transmission/FSK reception)
- TX/RX configuration file 868 MHz (FSK transmission/FSK reception)

5.1 315 MHz TX/RX configuration file (FSK)

Table 5 is an extract from *Data sheet OL2381* for the 315 MHz TX/RX FSK configuration file.

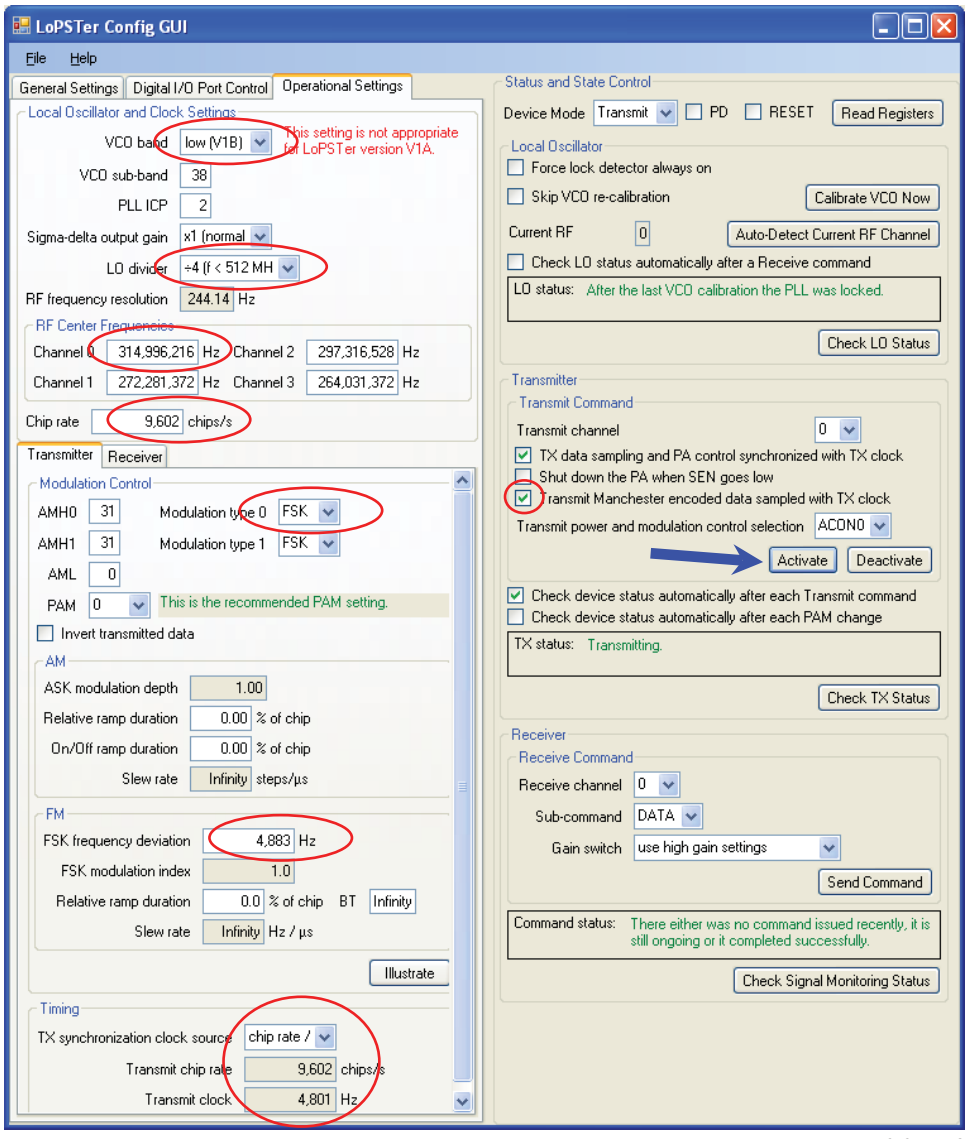
Table 5. Table extract

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
S_{RX}	receiver sensitivity	Manchester encoded data rate = 2.4 kbit/s; deviation = 2.4 kHz; channel filter B = 50 kHz	−109	−112	-	dBm

5.1.1 315 MHz transmission

- Center frequency: 315 MHz
- Data rate: 4.8 kbit/s Manchester coded (symbol rate = 9600 chips/s)
- Modulation type: FSK
- Frequency deviation: 4.8 kHz

Figure 26 is a compilation to enable all the relevant information to be visible on one page.



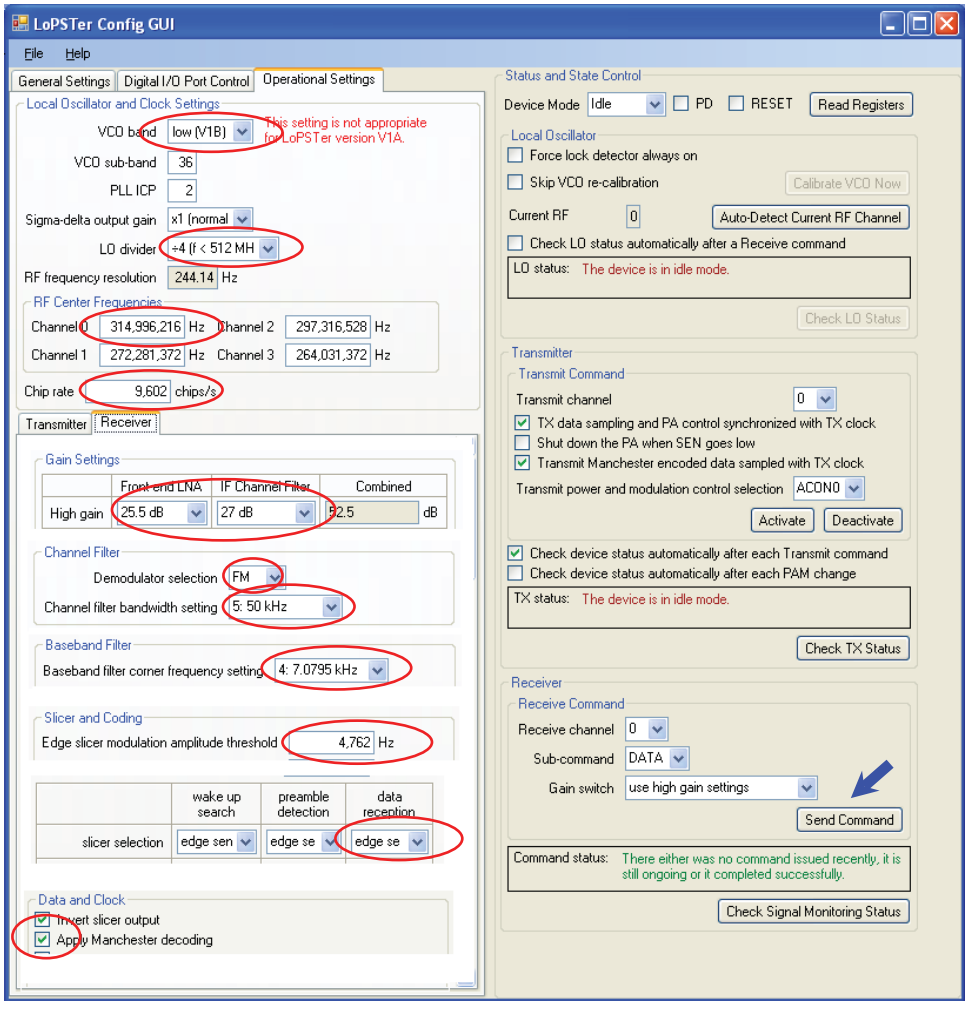
019aac442

Fig 26. 315 MHz FSK transmission settings

5.1.2 315 MHz reception

- Center frequency: 315 MHz
- Data rate: 4.8 kbit/s Manchester coded (symbol rate = 9600 chips/s)
- Modulation type: FSK
- Frequency deviation: 4.8 kHz
- OL2381 performed Manchester decoding

Figure 27 is a compilation to enable all the relevant information to be visible on one page.



019aac443

Fig 27. 315 MHz FSK reception settings

5.2 434 MHz TX/RX configuration file (FSK)

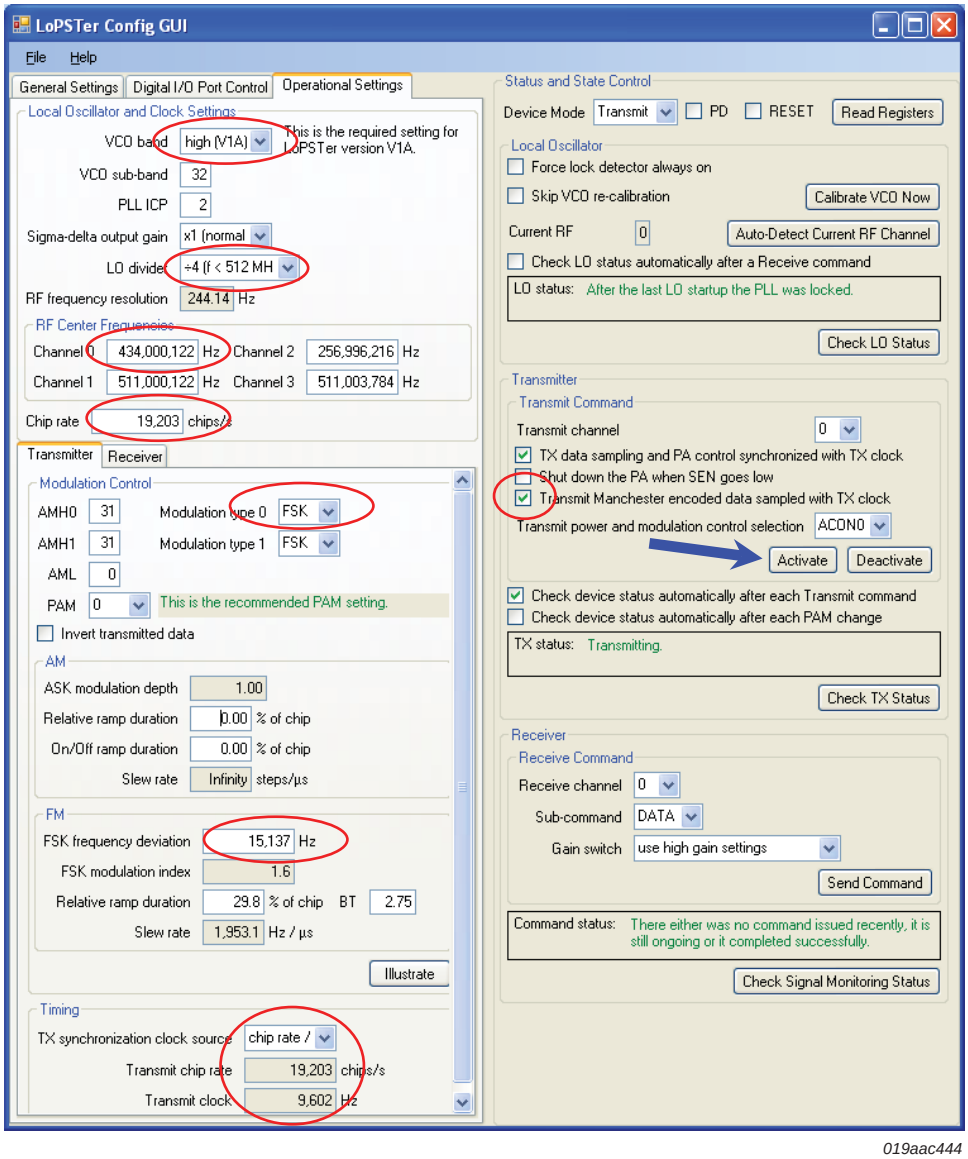
Table 6 is an extract from *Data sheet OL2381* for the 434 MHz TX/RX FSK configuration file.

Table 6. Table extract

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
S_{RX}	receiver sensitivity	Manchester encoded data rate = 9.6 kbit/s; deviation = 15 kHz; channel filter B = 75 kHz	–106	–109	-	dBm

5.2.1 434 MHz transmission

- Center frequency: 434 MHz
- Data rate: 9.6 kbit/s Manchester coded (symbol rate = 19200 chips/s)
- Modulation type: FSK
- Frequency deviation: 15 kHz



019aac444

Fig 28. 315 MHz FSK transmission settings

5.2.2 434 MHz reception

- Center frequency: 434 MHz
- Data rate: 9.6 kbit/s Manchester coded (symbol rate = 9600 chips/s)
- Modulation type: FSK
- Frequency deviation: 15 kHz
- Channel filter bandwidth: 75 kHz
- OL2381 performed Manchester decoding

Figure 29 is a compilation to enable all the relevant information to be visible on one page.

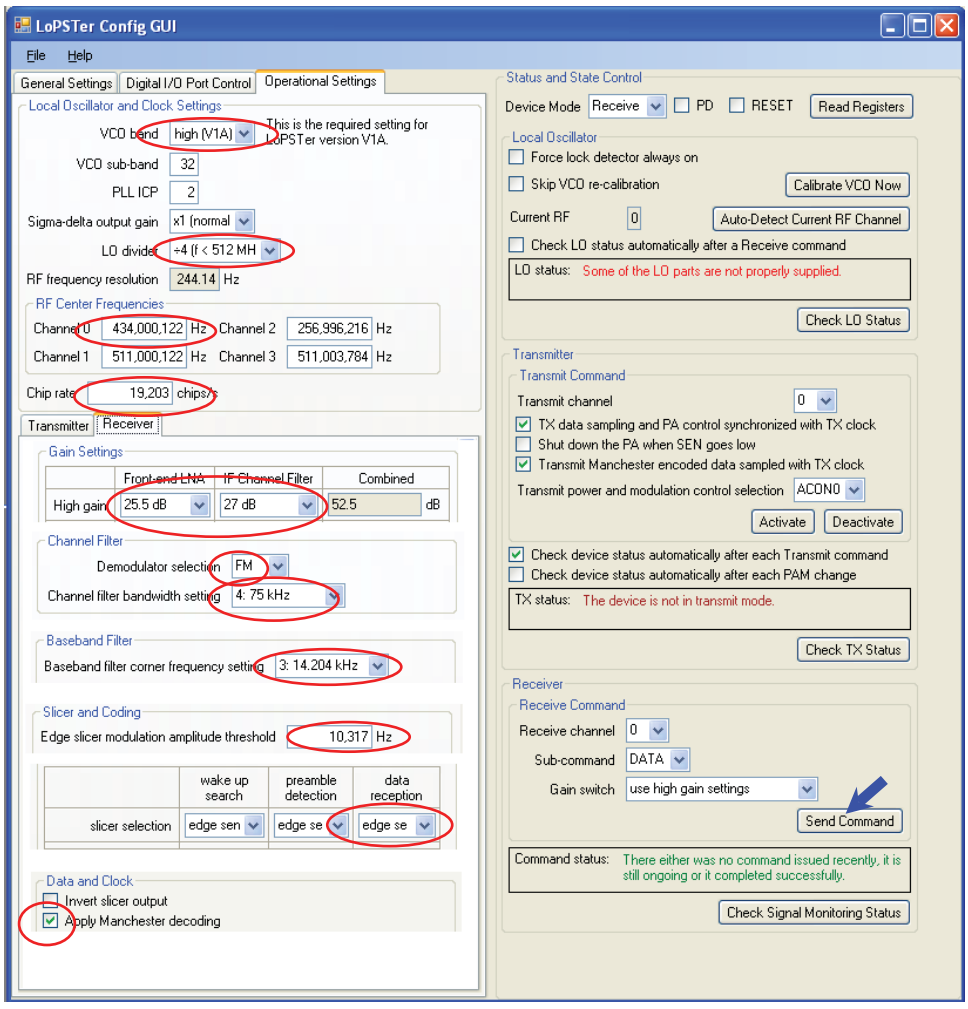


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Fig 29. 434 MHz FSK reception settings

5.3 868 MHz TX/RX configuration file (ASK)

Table 7 is an extract from *Data sheet OL2381* for the 868 MHz TX/RX ASK configuration file.

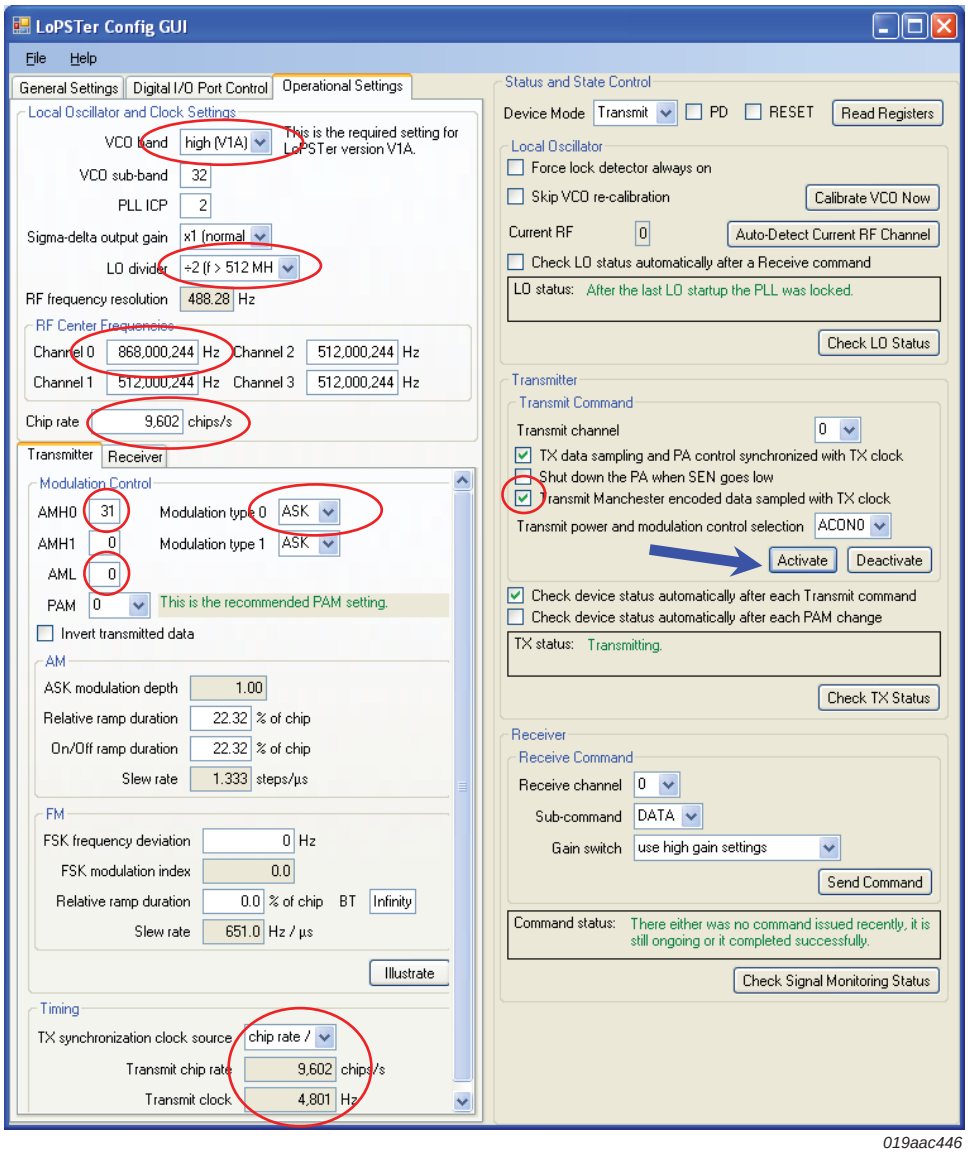
Table 7. Table extract for 868 MHz

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
S_{RX}	receiver sensitivity	Manchester encoded data rate = 4.8 kbit/s; channel filter B = 50 kHz.	-	–117	-	dBm

5.3.1 868 MHz transmission

- Center frequency: 868 MHz
- Data rate: 4.8 kbit/s Manchester coded (symbol rate = 9600 chips/s)
- Modulation type: ASK
- Modulation = 100 % (see AMH0 = 31 and AML = 0)

Figure 30 is a compilation to enable all the relevant information to be visible on one page.



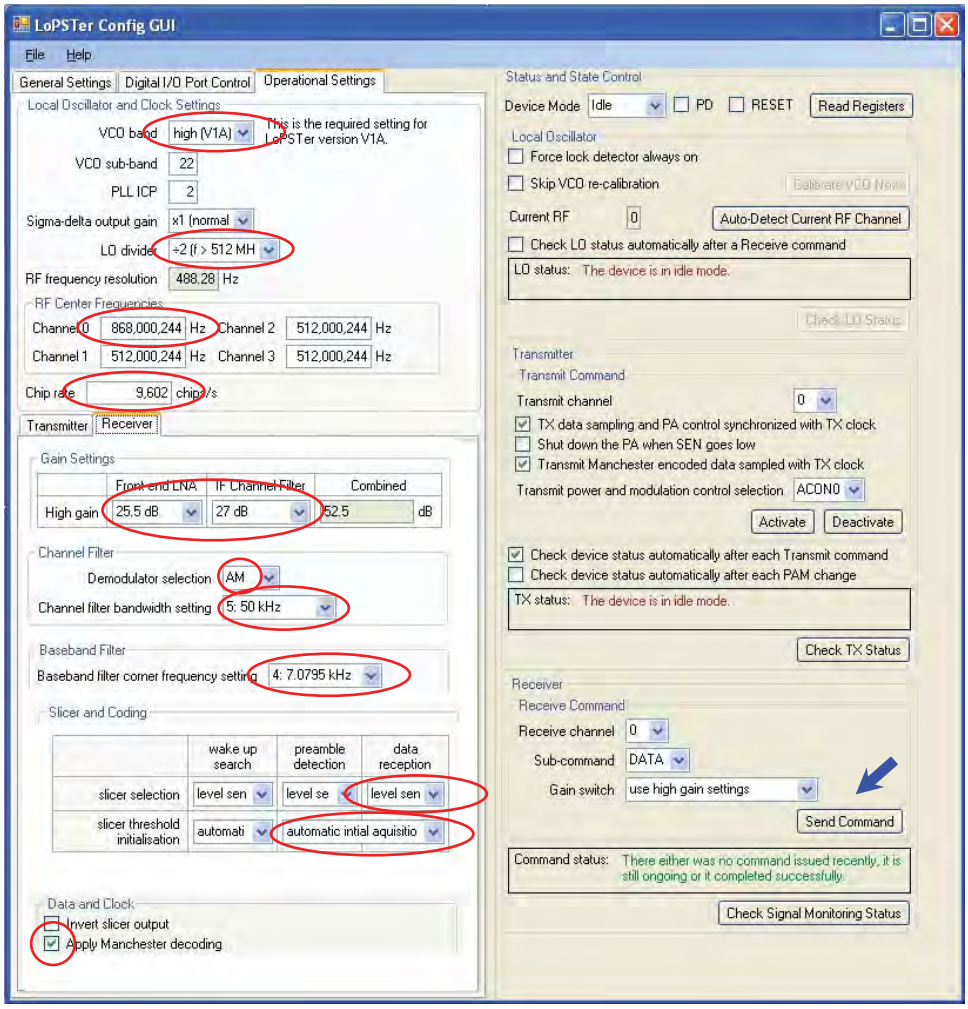
019aac446

Fig 30. 868 MHz ASK transmission settings

5.3.2 868 MHz reception

- Center frequency: 868 MHz
- Data rate: 4.8 kbit/s Manchester coded (symbol rate = 9600 chips/s)
- Modulation type: ASK
- Channel filter bandwidth: 50 kHz
- OL2381 performed Manchester decoding

Figure 31 is a compilation to enable all the relevant information to be visible on one page.



019aac447

Fig 31. 868 MHz ASK reception settings

6. Improving RF performance

6.1 Supply voltage noise

The control board of the demo kit board uses the Maxim MAX3221 IC to raise the RS-232 interface output signal voltage up to the required level. To raise the output signal voltage, an internal charge pump working at a frequency of approximately 100 kHz, is used. The 100 kHz frequency is detectable on the board supply voltage.

In the default configuration, the control board supply voltage drives the OL2381. The noise on the supply causes interference on the RF output signal of the power amplifier. The signal shown in Figure 32 is the OL2381 CW output spectrum in the range of ±500 kHz.

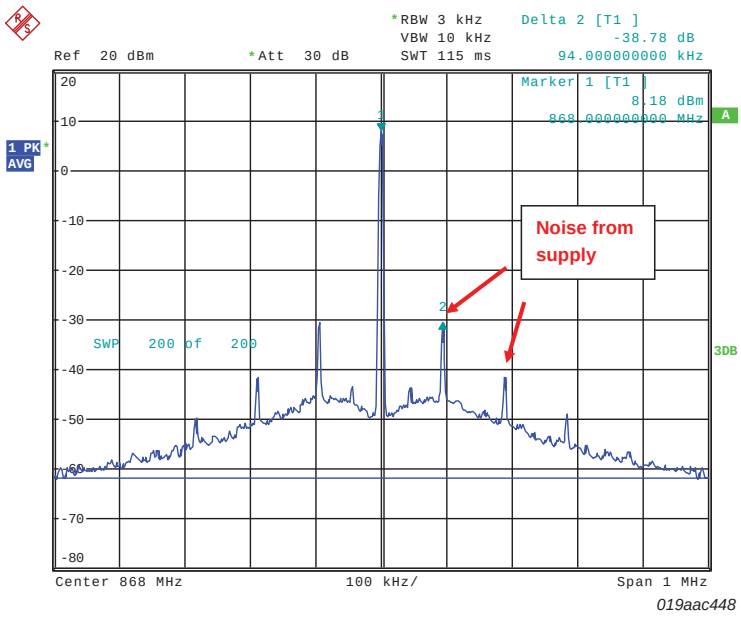


Fig 32. CW output spectrum of OL2381

The interference is visible at a distance from the carrier of n * 94 kHz with n = [–4, –3, –2, –1, 1, 2, 3 and 4].

To avoid interference, and to make precise measurements, it is recommended that a separate source supplies OL2381. To provide a separate supply, open jumper J4 on the control board and connect a power supply to pins VCC and GND on the OL2381 RF board. The adapted supply connections for OL2381 are illustrated in Figure 33.

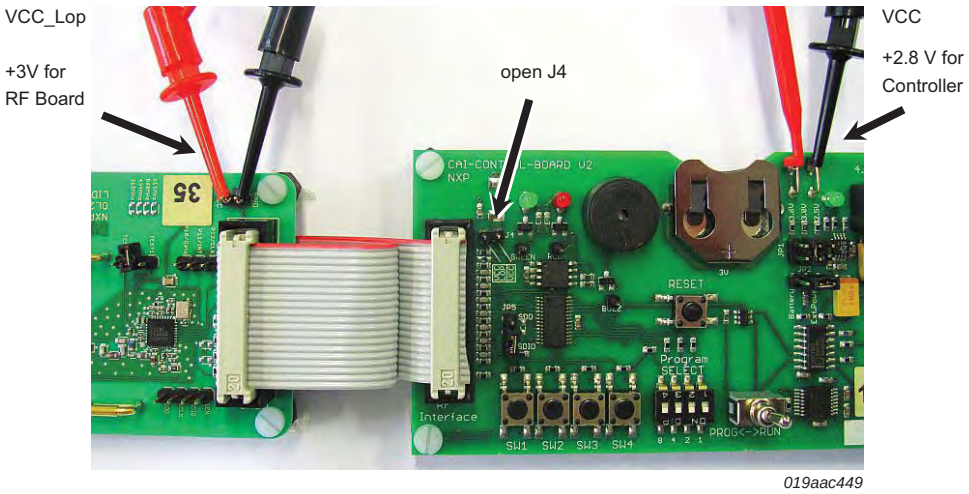


Fig 33. Changed supply connections for OL2381

Take care to avoid the supply from the ports being reversed when the OL2381 RF board is supplied by a source other than the control board. For this purpose, VCC_Lop must be greater or equal to VCC. In order to achieve the correct port input signal, VCC must be at least 0.8 * VCC_Lop.

For example, if VCC of the control board is set to 2.5 V, the supply voltage of OL2381 (VCC_Lop) must be between 2.5 V and 3.125 V.

Figure 34 depicts the CW output signal when OL2381 is supplied by an external source.

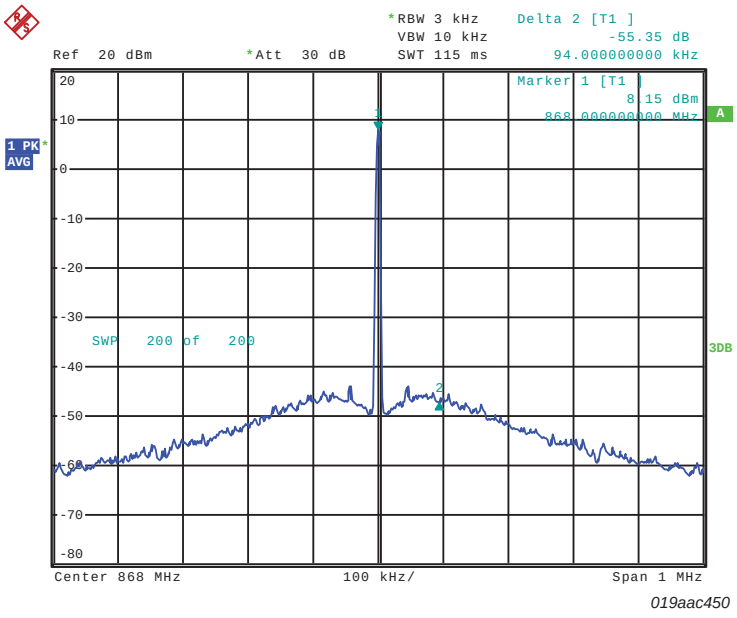


Fig 34. CW output spectrum. (OL2381 supplied externally)

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