CML Microcircuits

COMMUNICATION SEMICONDUCTORS

EV9720
Evaluation Kit
User Manual

Features

- **CMX972 Quadrature 20-300MHz Demodulator**

- **Options for on-chip PLL or External LO Sources**

- **C-BUS Interface to Host µC**

- **Easy Interfacing to PE0601-xxx**

Click here for:
- Latest Datasheet
- Product Data Resource

1   Brief Description

The EV9720 is an Evaluation Kit designed for evaluating and demonstrating the capabilities of the CMX972 integrated circuit. All the circuits necessary to demonstrate the facilities provided by the IC, such as matching circuits, power supply regulators, etc are provided on the EV9720 board. Note that as the EV9720 shares a common pcb with the EV9730, the pcb will not be fully populated.

A C-BUS interface connector is provided for control of the EV9720 by a host microcontroller or CML PE0002 interface card.

CONTENTS

<u>Figure</u>   <u>Page</u>

<u>History</u>

Version	Changes	Date
	•	
1	• First Issue	20/3/13

It is always recommended that you check for the latest product datasheet version from the Datasheets page of the CML website: [www.cmlmicro.com].
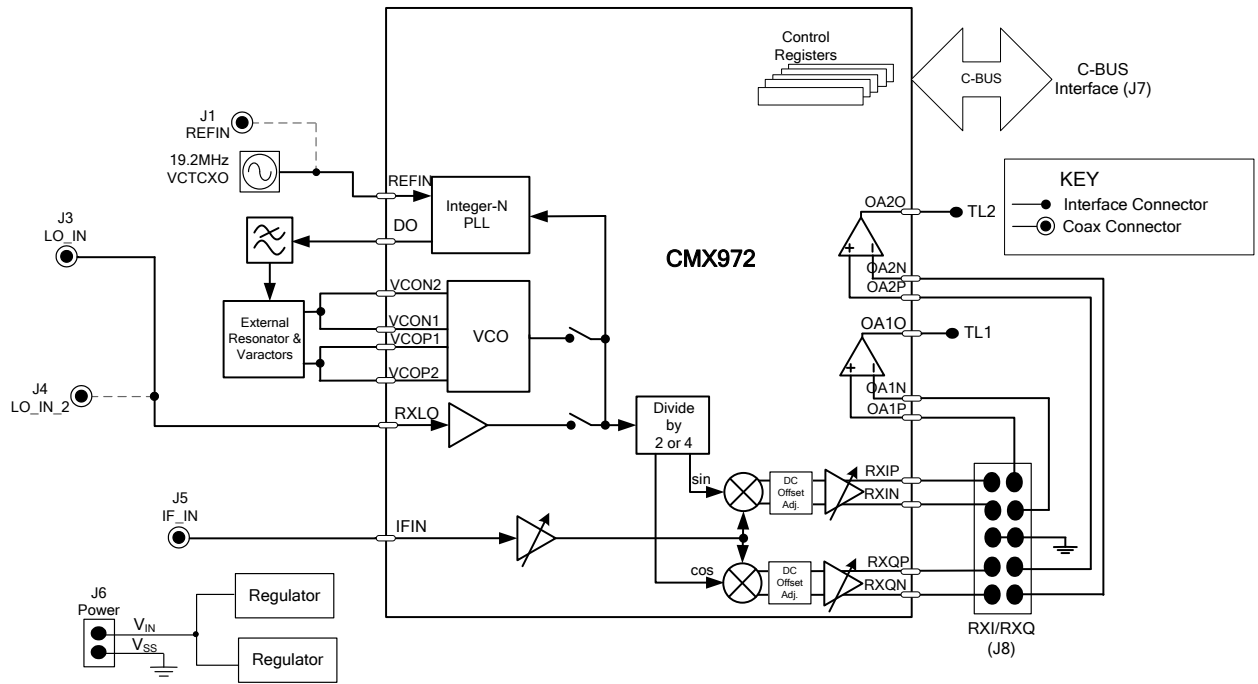
2   Block Diagram

Figure 1 EV9720 Block Diagram

3   Preliminary Information

3.1   Laboratory Equipment

The following laboratory equipment is recommended for use with this Evaluation Kit:

- Power Supply
- Spectrum Analyser
- Signal Generator(s)
- Oscilloscope
- Digital Multi-meter

For more detailed design or investigation work, additional RF test equipment may be required.

3.1.1   Power Supply

The supply input voltage to the PCB is nominally 7.2V (3.6V to 7.6V acceptable). On board regulators are provided to generate all voltage rails used on the PCB (3.3V). The 7.2V supply should be rated at 200mA.

NOTE: Care should be exercised with the supplies as they are not protected for reverse polarity. Operation at 12V will exceed the power dissipation ratings of the internal regulators.

3.1.2   Control Interface

To use the EV9720, the user will need a mechanism to send and receive data and commands via the C-BUS host microcontroller interface on the CMX972, which is brought out on connector J7. The CMX972 datasheet gives details of the registers and commands.

A PE0002 Interface Card (not supplied) can be used to control the EV9720. A user interface program developed specifically for the EV9720 is available from the CML website (see www.cmlmicro.com for details). Use of this GUI is described later in this document.

3.2   Handling Precautions

In common with other Evaluation Kits, this product is designed for use in office and laboratory environments. The following practices will help ensure its proper operation.

3.2.1   Static Protection

This product uses low power CMOS circuits that can be damaged by electrostatic discharge. Partially damaged circuits can function erroneously, leading to misleading results. Observe ESD precautions at all times when handling this product.

3.2.2   Contents - Unpacking

Please ensure that you have received all of the items detailed on the separate information sheet (EK9720) and notify CML within 7 working days if the delivery is incomplete.

3.3   Approvals

This product is not approved to any EMC or other regulatory standard. Users are advised to observe local statutory requirements, which may apply to this product and the radio frequency signals that may emanate from it.

4   Quick Start

This section provides instructions for users who wish to experiment immediately with the EV9720 Evaluation Kit. A more complete description of this kit and its use appears later in this document. The user should read the CMX972 datasheet before using this kit.

4.1   Hardware/Software Installation (for PE0002)

- Copy the file `ES9700xx.zip'`, which is downloaded from the CML website following registration, to the hard drive of your host PC.
- Extract the files to the hard drive of your host PC.
  - Connect a 5V dc supply to the PE0002 Interface.
  - Connect a 7.2V dc supply to the EV9720.
  - Attach a USB cable from connector J2 of the PE0002 Interface Card to the PC USB port.
- Turn on the power supply to the PE0002. The PE0002 power-on indicator D6 will light
- Install the USB driver when requested. The driver is in the same folder where the `ES9700xx.zip'` files were extracted to, in directory '.\Driver'. Follow instructions on the screen to install the USB driver. Click the 'Continue Anyway' button when the Message Box in Figure 2 is shown.

Figure 2 USB Driver Installation Message Box

4.2   First – Initial Setup - EV9720 Quadrature IF Demodulator

4.2.1   Make External Connections and Apply Power

An example of typical connections to the EV9720 is shown in Figure 3. Perform the following steps in sequence:

1. Connect test leads as shown in Figure 3, except the power to J6.
2. Connect a controller to C-BUS interface J7 (PE0002 can be used - see section 4.1. Note: J3 or J5 can be used on PE0002, but ensure the correct C-BUS port is selected when programming data).
3. Install PE0002 hardware/software and apply power to PE0002 - see section 4.1.
4. Power should be applied to the main supply input J6 (7.2V nominal). The CMX972 device will be reset on power-up.

The board is now ready for operation.
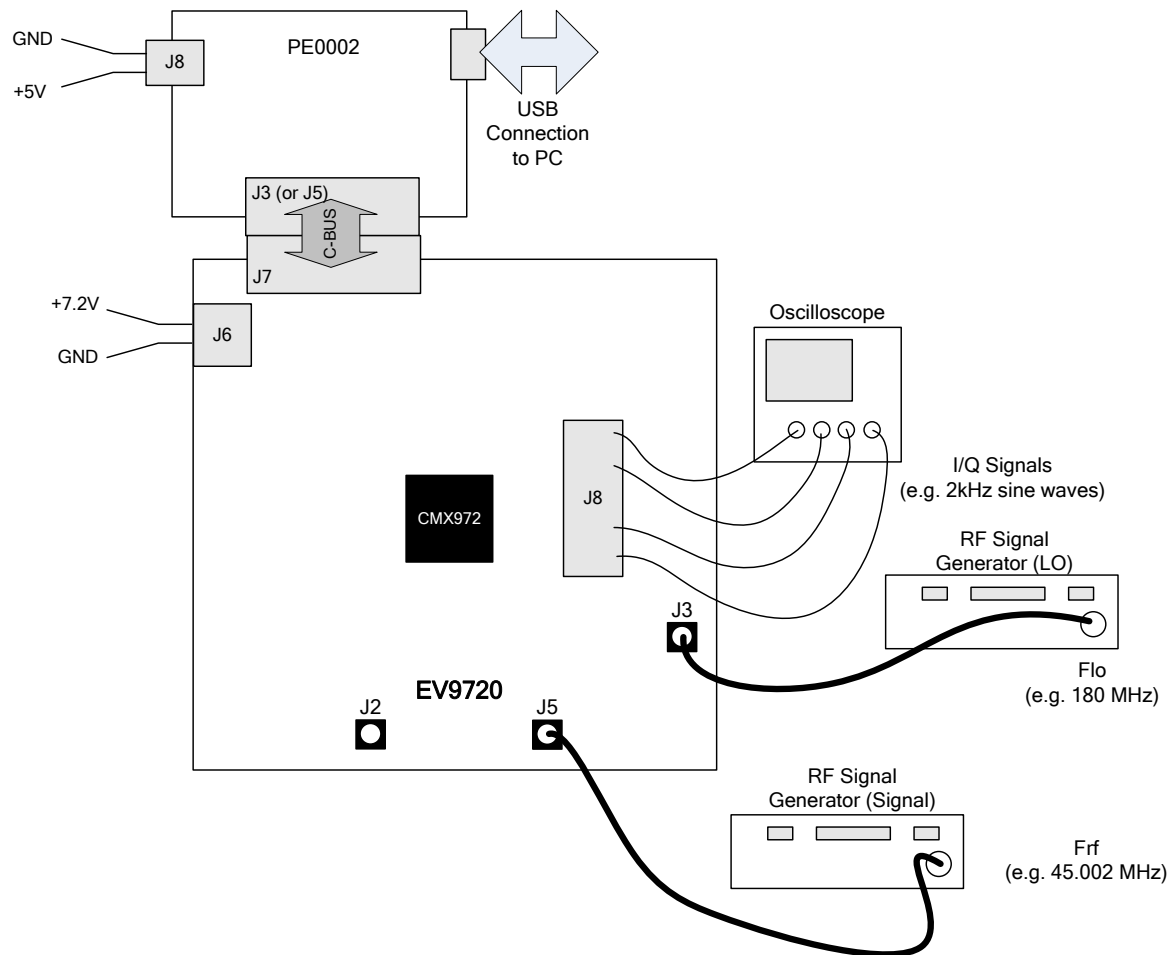
Figure 3 Typical Connections for EV9720 as a Quadrature IF Demodulator

4.3   Second – Configure - EV9720 Quadrature IF Demodulator

In this second step the EV9720 Quadrature Demodulator is configured for receive operation at 45MHz input frequency.

4.3.1   EV9720 Configuration

The following steps should be undertaken to configure the EV9720 to receive at 45MHz with an I/Q output. Set the applied signals and register values as shown in the following table.

Note: Setting the CMX972 registers requires the use of the PE0002 host connected as above. The CMX972 datasheet give details of the registers and commands.

Signal or Register	Setting	Note
LO_IN (J3)	180MHz @-10dBm	This frequency is four times the RF input frequency.
IF_IN (J5)	45.002MHz	The input level here may be user defined: for example an input signal of –60dBm at J5 the typical single ended output level would be 220mVp-p at J8 pin 2. The output should be 2kHz sine and cosine waves on I and Q when the configuration in this table is completed.
General Reset register ($1A)	To ensure the device and hardware are in known states issue the General Reset command	See lower right of GUI tab "C-BUS Control".
General Control register ($1B)	The General Control register should be set to enable the following: • Bias generator • Rx Select Rx LO/4 mode.	Write $12 to register $1B.
Rx Control register ($1C)	Set Rx Gain to maximum, output drive to low and phase correction circuit off.	Write $00 to register $1C, this enables maximum gain, with low output drive capability and no phase correction. This gives the lowest power consumption mode.
Rx Mode register ($1D)	Enable I and Q outputs. The general purpose op-amps are enabled/disabled in this register.	Write $00 to register $1D, op-amps disabled. Write $30 to register $1D, op-amps enabled.
Rx Offset register ($1F)	The value written to this register will vary between devices, the default value ($00) is a good starting point.	Check the dc levels on J8 (I and Q) to ensure that the dc offsets are less than 25mV; adjust the value written to $1F as required.
VCO Control register ($2F)	For initial testing the default value ($00) can be used so there is no need to write to this register.	The value written to this register can be adjusted to give the optimal intermod (IMD) performance, see CMX972 datasheet for further details.
RXI/Q (TL1 and TL2)	Single ended Rx I/Q output.	The single ended I and Q signals can be taken from TL1 and TL2 if the jumper/links are fitted to J8. Ensure op-amps are enabled in register $1D.
RXI/Q (J8)	Differential Rx I/Q output.	The differential I and Q signals can be taken from J8, remove jumpers when using the differential output.

4.4   Third – Operate - EV9720 Quadrature IF Demodulator

Following the configuration procedures given in sections 4.2 and 4.3, the EV9720 should be operating as a receiver at 45MHz. Various evaluation tests can now be performed.

5   Signal Lists

The input power supply connection is via a 2-way snap socket J6. J2, J3 and J5 are RF signals and use SMA 50 Ohm sockets. J8 is a 10-pin header for differential RXI/RXQ modulation outputs from the demodulator. These connectors can interface signals easily to the PE0601-xxx Evaluation Kit.

The PCB will be configured with jumper links fitted to J8. This converts the differential demodulator output signals to single ended outputs, available on test loops, using the on chip general purpose op-amps.

Signal	Signal Type	PCB Connector
Ground	DC	J6 Pin 1
+Vin (7.2V nominal)	DC	J6 Pin 2
Quadrature Demodulator RF input	RF	J5
Local Oscillator RF input 1	RF	J3
Local Oscillator RF input 2 (optional)	RF	J4 (PCB pads)
Reference Clock input (optional). To use this input C4 needs to be fitted to the PCB and C3, R1 removed.	RF	J1 (PCB pads)
Differential Quadrature Demodulator outputs	Baseband	J8
Single ended Quadrature Demodulator outputs	Baseband	TL1 (RXI) TL2 (RXQ)
C-BUS interface (e.g. to PE0002)	Logic	J7

Table 1 Signal List

Connections to the host C-BUS interface J7 are as follows. All are 3.3V logic levels unless otherwise stated.

CONNECTOR PINOUT for J7			
Connector Pin No.	**Signal Name**	**Signal Type**	**Description**
1	-	-	Spare pin. Leave unconnected.
2	CSN	I/P	C-BUS Chip Select.
3	-	-	Spare pin. Leave unconnected.
4	CDATA	I/P	C-BUS Data Input.
5	-	-	Spare pin. Leave unconnected.
6	SCLK	I/P	C-BUS Clock.
7	-	-	Spare pin. Leave unconnected.
8	RDATA	O/P	C-BUS Data Output
9	-	-	Spare pin. Leave unconnected.
10	IRQN	I/P	Interrupt request - if required. Not used, so remains unconnected on EV9720.
11	GNDD	Power	Connection to Digital Ground.
12	GNDD	Power	Connection to Digital Ground.
13	-	-	Spare pin. Leave unconnected.
14	-	-	Spare pin. Leave unconnected.
15	-	-	Spare pin. Leave unconnected.
16	-	-	Spare pin. Leave unconnected.
17	-	-	Spare pin. Leave unconnected.
18	-	-	Spare pin. Leave unconnected.
19	-	-	Spare pin. Leave unconnected.
20	-	-	Spare pin. Leave unconnected.

Table 2 C-BUS Interface

The differential output I/Q signals from the demodulator (interface connector J8) are described in Table 3, along with the connections for single ended I/Q outputs, by using the general purpose op-amps, in Table 4.

CONNECTOR PINOUT for J8			
Connector Pin No	**Signal Name**	**Signal Type**	**Description**
2	RXI+	Baseband	Positive Rx I Output
4	RXI-	Baseband	Negative Rx I Output
8	RXQ+	Baseband	Positive Rx Q Output
10	RXQ-	Baseband	Negative Rx Q Output
1	OA1N	Baseband	Negative I/P to Differential Amplifier 1
3	OA1P	Baseband	Positive I/P to Differential Amplifier 1
7	OA2N	Baseband	Negative I/P to Differential Amplifier 2
9	OA2P	Baseband	Positive I/P to Differential Amplifier 2
5,6	GNDA	-	Ground (Analogue)

Table 3 Quadrature Demodulator Output Connector

JUMPERS/LINKS			
Test Point Ref.	**Positions**	**Default**	**Description**
JP1	1-2	1-2	+3V3D
JP2	1-2	1-2	+3V3A
RXI+, J8	1-2	1-2	Connect RXI+ to differential to signal ended amplifier
RXI-, J8	3-4	3-4	Connect RXI- to differential to signal ended amplifier
RXQ+, J8	7-8	7-8	Connect RXQ+ to differential to signal ended amplifier
RXQ-, J8	9-10	9-10	Connect RXQ- to differential to signal ended amplifier

Table 4 Jumpers/Links

TEST LOOPS/POINTS		
Test Point Ref.	**Typical Value**	**Description**
TL1	-	RXI Single ended output
TL2	-	RXQ Single ended output
TL3	0V	GNDA
TL4	0V	GNDD
TP1	1.6V	VCTCXO Control Voltage
TP2	3.3V	VDD – CMX972 Digital Supply Pin
TP3	-	Tuning voltage for the PLL
TP4	3.3V	+3V3 regulator output (+3V3D - digital supplies)
TP5	3.3V	+3V3 regulator output (+3V3A - analogue supplies)
TP6	-	C-BUS connector: IRQN
TP7, 8, 9, 10	-	Test points to spare pins on J9

Table 5 Test Loops and Points

Notes: I/P   = Input   BI   = Bidirectional
                O/P   = Output   TL   = Test Loop   TP   = Test Point

Note that the voltages are typical for their active state.

As the EV9720 shares a common pcb with the EV9730, the pcb will not be fully populated. In particular, connectors J2, J9, along with trimpot VR1, are not fitted. The pcb pads for J4 are underneath the board.

6   Circuit Schematics and Board Details

For clarity, circuit schematics are available as a separate high-resolution file available from the CML web site as part of the support files package. The layout on each side is shown in Figure 4, below. The PCB is a 4-layer design fabricated with FR4 material and is 1.6mm thick. Full Gerber and Drill files are available on request.
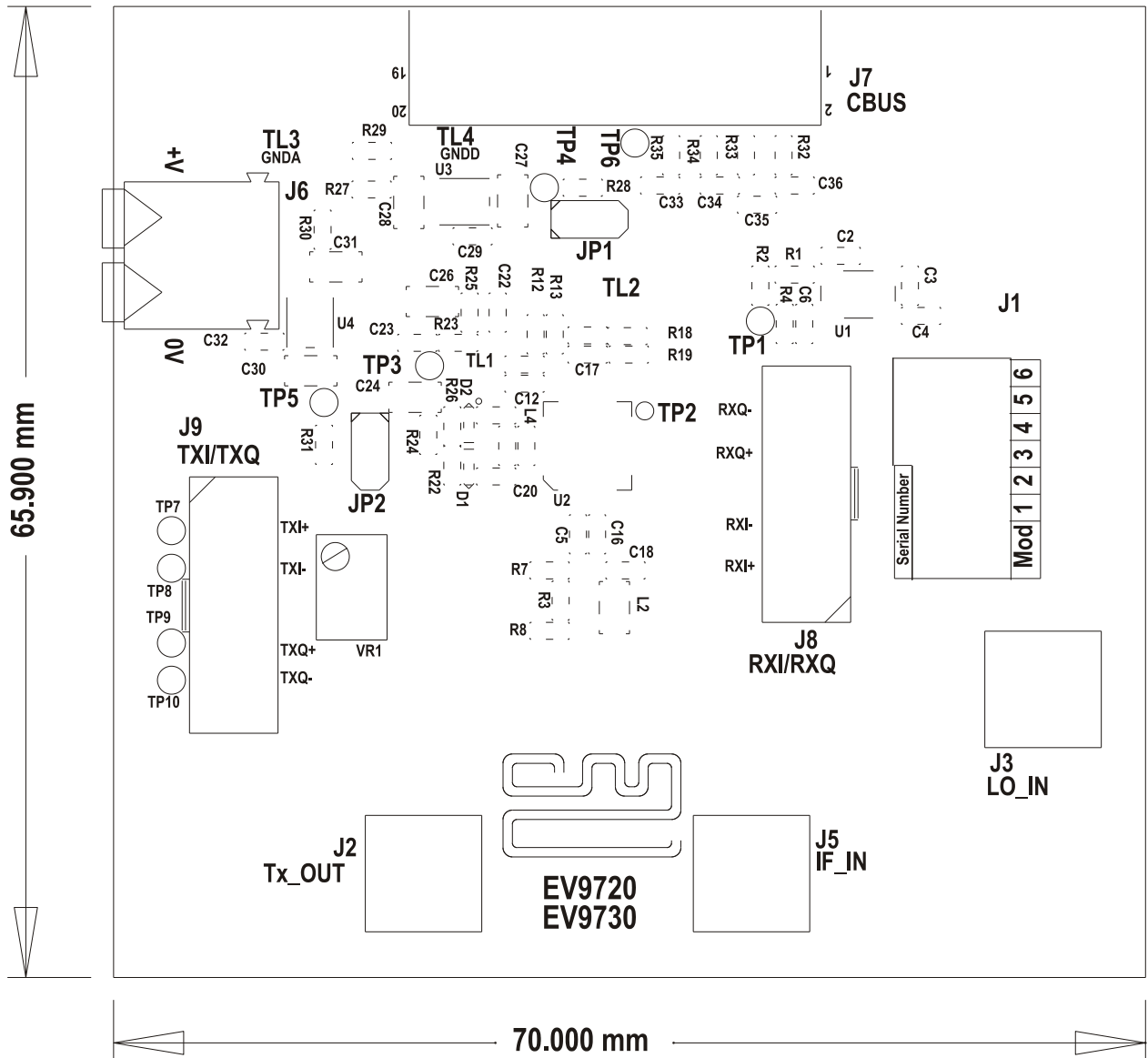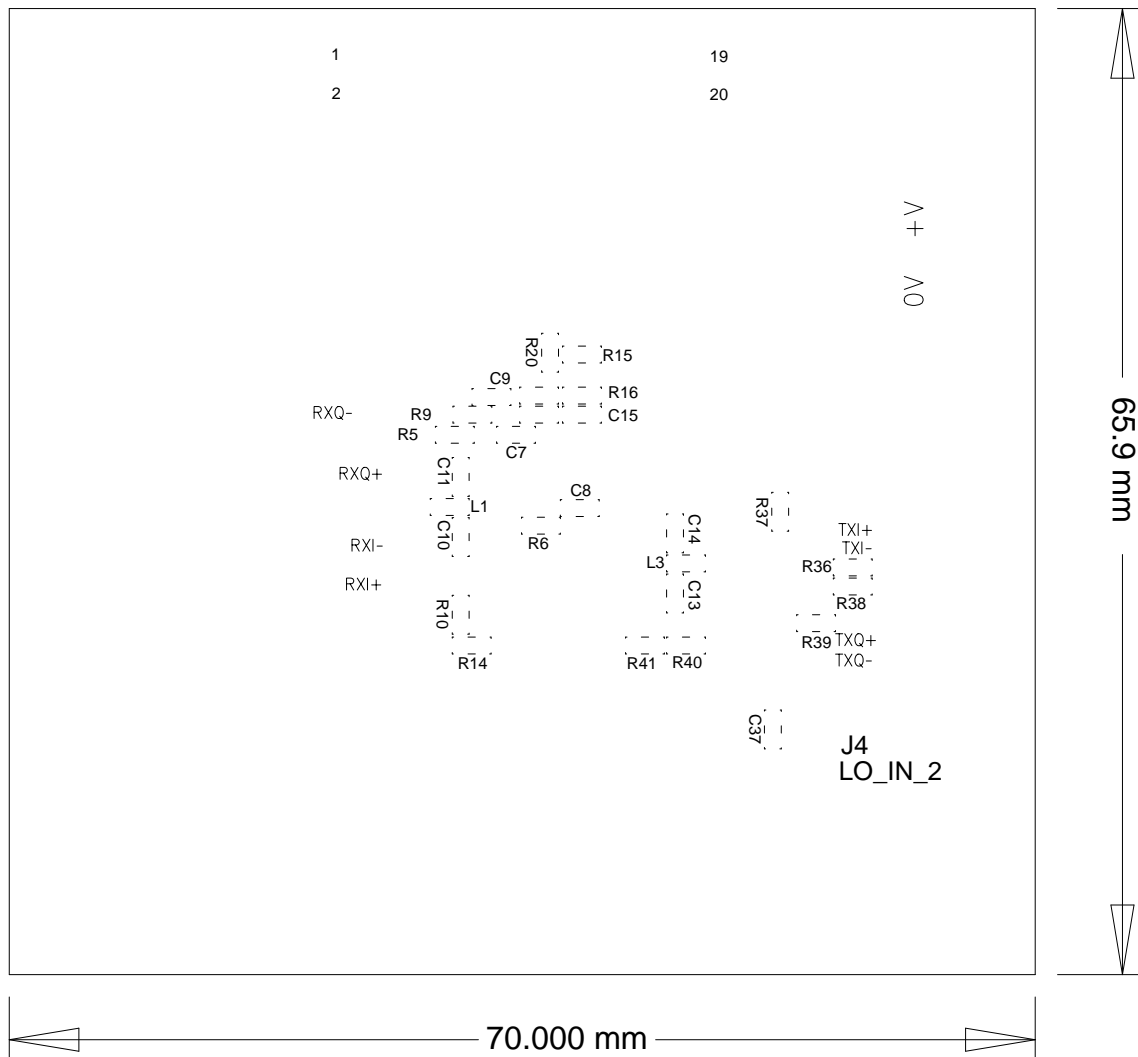

Figure 4a PCB Layout: top

Figure 4b PCB Layout: bottom

7   Detailed Description

The CMX972 datasheet (available from www.cmlmicro.com) should be referred to for a detailed description of the CMX972 device.

The EV9720 functionality includes:

- Evaluation and demonstration of the CMX972 Quadrature IF demodulator
- VCO, Integer-N PLL and divider
- 19.2MHz VCTCXO
- Interface to CMX7163 or CMX7164 evaluation boards (PE0601-7163/PE0601-7164, not included) to allow demonstration/test of QAM and 2-FSK/4-FSK demodulation.
- An interface that allows the card to be connected to a host µController, to allow real-time control. A PC user interface can be provided using a PE0002 and ES9700 software.

If further design support is required, please contact your regional CML office or an approved CML distributor.

7.1   Hardware Description

7.1.1   Quadrature IF Demodulator

The Evaluation Kit is configured to allow the CMX972 Quadrature Demodulator to operate over a broad range of input frequencies (20 to 300MHz) i.e. no matching has been applied at the IFIN input (L2, C16 and C18). Matching can be applied to the IFIN input; this will increase the gain, improve the noise figure and degrade the IIP3.

The RxLO input (L3, C13 and C14) can be used with an external source and there is no matching on this input so a broad range of LO frequencies can be applied.

The RXI/RXQ outputs can be accessed differentially for direct connection to a PE0601-xxx kit, for example, or the general purpose op-amps on the CMX972 can be used to convert the Rx outputs from differential to single ended. Jumpers need to be fitted to J8 when using the op-amps (see Table 4 for details of jumper positions).

7.1.2   Oscillator

The EV9720 provides components to use the VCO amplifier and PLL contained within the CMX972 device. As supplied, the resonator circuit (L4, C21, C20, C25, D1, D2) is configured for 180MHz operation with a tuning sensitivity of approximately 8MHz/V. The oscillator is usable up to about 1GHz, for further details consult the CMX972 datasheet.

The component values used for the PLL loop filter provide a bandwidth of approximately 500Hz for a comparison frequency of 25kHz. The loop filter is a passive 3rd order type. The user may change the values dependent upon the comparison frequency spur suppression, lock time and operating frequency requirements.

The Quadrature Demodulator can make use of the internal VCO by ensuring the correct LO path has been selected (see CMX972 datasheet).

7.1.3   Reference Oscillator

A 19.2MHz VCTCXO (U1) is provided on the PCB. This is specified as a 1.5ppm part over –20 to +70°C. If C3 and R1 is removed and C4 (1nF) fitted, an alternative clock source can be applied to J1.

7.1.4   Power Supply

Two 3.3V regulator supplies are generated on the PCB. U3 provides supply for digital circuits and U4 for analogue circuits. Current drawn from each supply rail may be measured by connecting an ammeter across JP1 (digital) or JP2 (analogue), after removing the corresponding jumper.

7.2   PC Control Software Description

The EV9720 itself does not require any embedded firmware, however, it does require C-BUS control from an external microcontroller. The CML product, PE0002, can be used with the EV9720 and PC software files (`'ES9700xx.zip'`). To use the software, connect the EV9720 as shown in Figure 3. First ensure the drivers supplied for the PE0002 are installed correctly. The executable must be in the same folder on the PC as the `'EF0002xx.hex'` file. Run the `ES9700xx.exe` and the main application window will open with a request for the Reset button to be pressed on the PE0002 board, see Figure 5. The window then displays a progress bar for the initialisation stage.
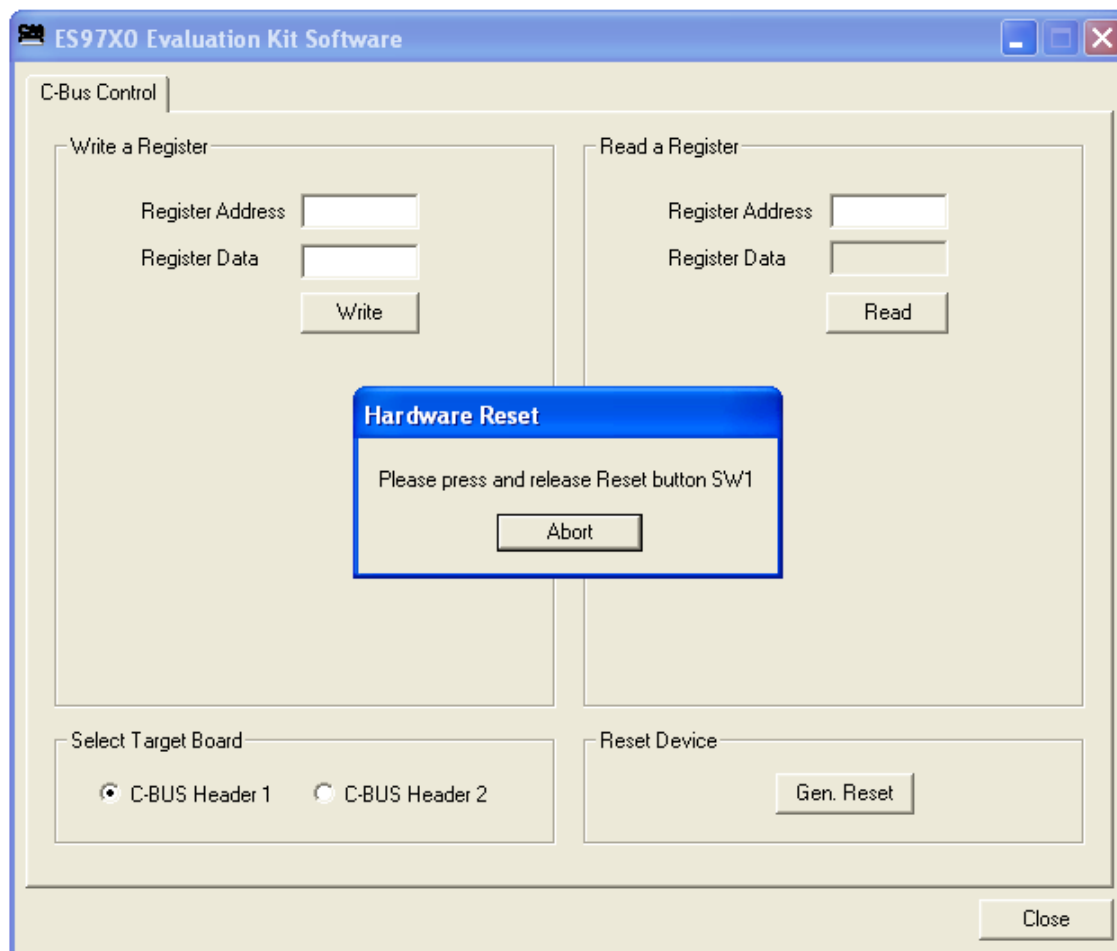
Figure 5 Reset Dialog Box

This software is common to a number of Evaluation Kits, so the appropriate kit must then be selected in a new dialog box, see Figure 6.
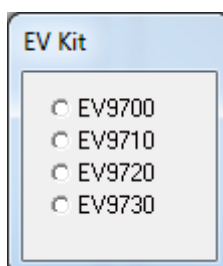

Figure 6 Product Selection Dialog Box

Once the initialisation and kit selection process is complete, one of four tabs can be selected, as shown in Figure 7 to Figure 10. The four tabs represent a particular set of registers or a particular function of the CMX972. To select a tab simply click on the corresponding name in the row at the top of the program window. Setting or clearing the check box associated with a bit of a register will cause that bit to be set or cleared when the register is next written to. If the 'Auto Write' check box is set a register will be written whenever a check box or list box associated with it is modified. This removes the need to click the 'Write' button associated with that register. The program can be closed at any time by clicking the '<u>C</u>lose' button or by pressing 'Alt' and 'F4' keys simultaneously.

7.2.1   The C-BUS Control Tab

The C-BUS Control Tab allows the user to read from or write to any register or to issue a General Reset command, see Figure 7. The C-BUS header which is used can also be selected on this tab.
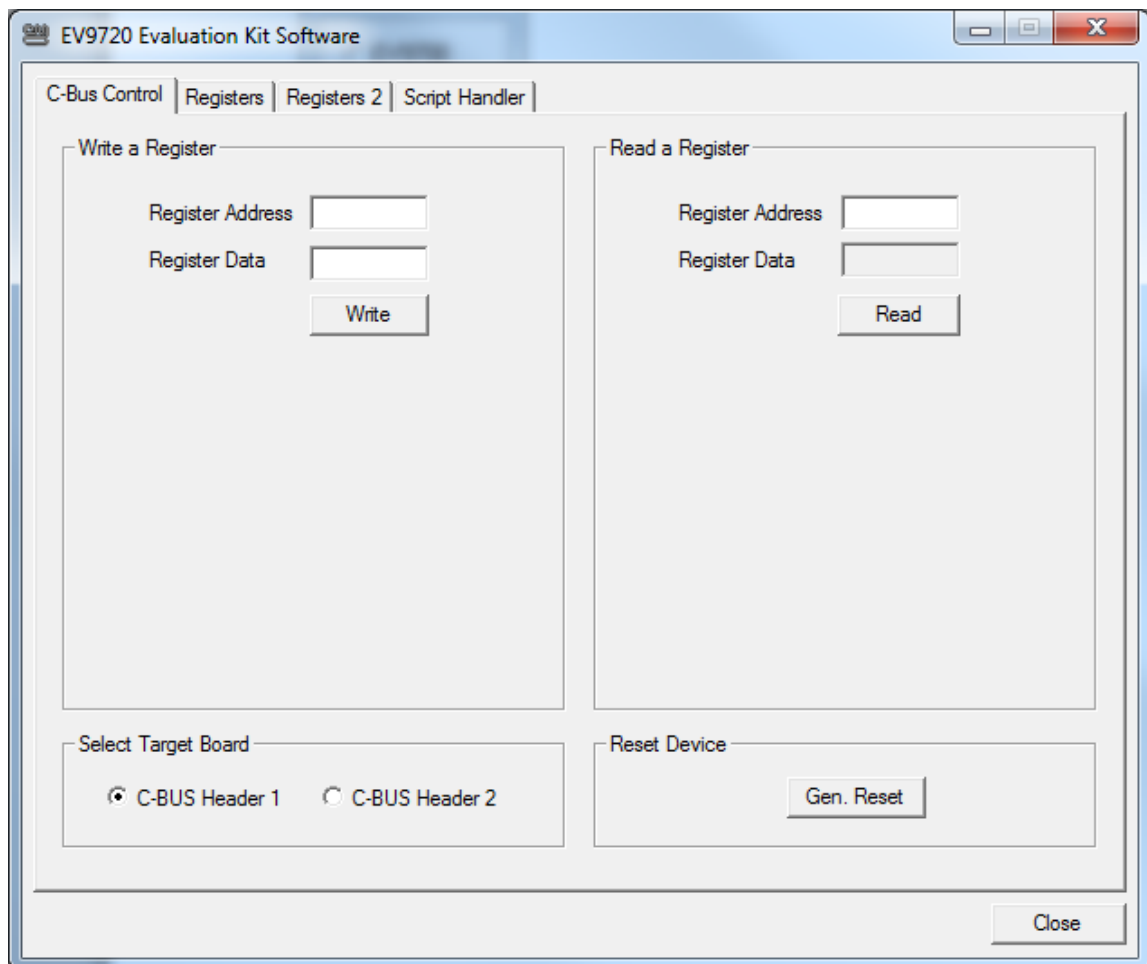

Figure 7 The CBUS Control Tab

To perform a General Reset on the CMX972, either the Gen. Reset button can be clicked or a single write can be made to register $1A. The following script (see section 7.2.4), which may be used with the **ES9700xx** software, is recommended:

```
;General Reset.pes
;This script will send a C-BUS General reset.
;Reset C-BUS (assigns register RESET a zero length parameter to get a single 8-bit write)
;format: register <device (1 or 2)> <C-BUS address> <# parameter bytes (0 to 2)>

RESET const $1A
        register 1 RESET 0
        copy 0 *RESET
```

```
               ;If using C-BUS port 2 then use the following lines
               ;       register 2 RESET 0
               ;       device 2
;       copy 0 *RESET
```

7.2.2   The Registers Tab

The Registers tab gives the user access to the general control, Rx control and Rx mode registers, see Figure 8. Note that registers can be written to individually or as a whole mass register write ("Write All" in the bottom left hand corner of window). If Auto Write is checked, the register is changed as the user makes changes to the register window.
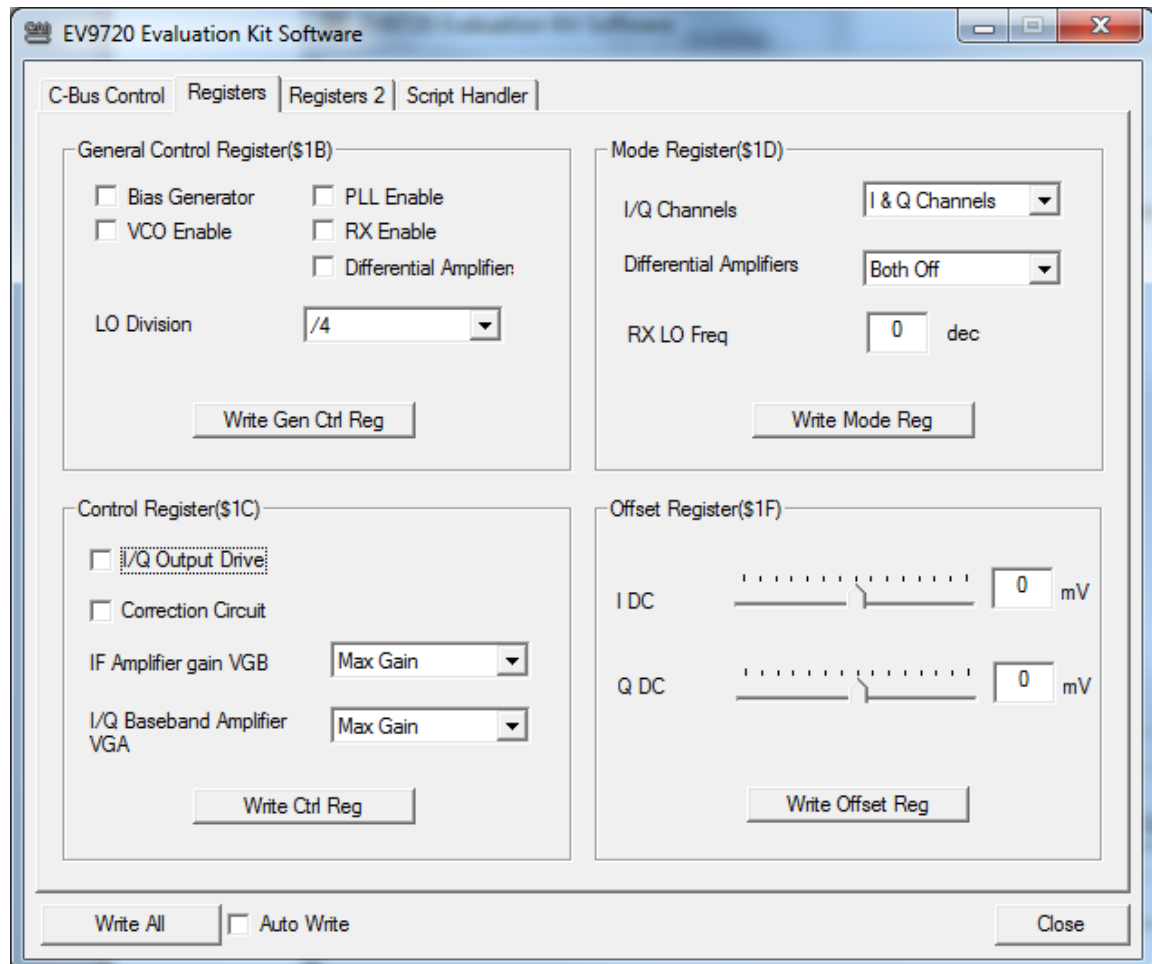

Figure 8 The Registers Tab

7.2.3   The Registers 2 Tab

The Registers 2 tab gives the user access to the Rx Offset, VCO Control and PLL Divider Registers, see Figure 9. Note that registers can be written to individually or as a whole mass register write ("Write All" in the bottom left hand corner of window). If Auto Write is checked, the register is changed as the user makes changes to the register window.

The PLL M/R Divider register window has a box which indicates the PLL lock detect states. The lock detect is read each time the PLL divider values are written and the status updated. The box will be blank to indicate PLL is out of lock and when the PLL is in lock the box will have an L in it.
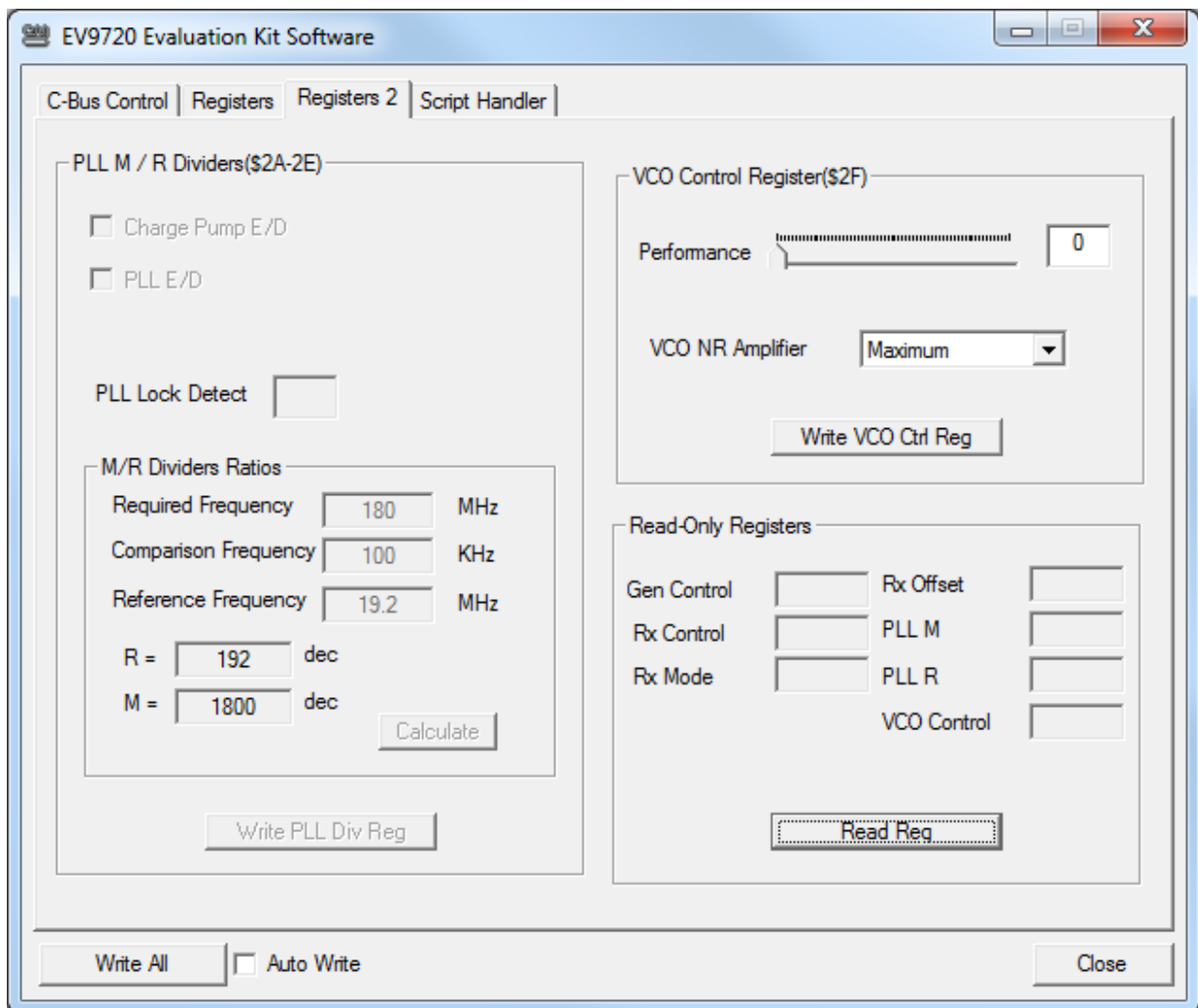
Figure 9 The Registers 2 Tab

7.2.4   The Script Handler Tab

The Script Handler Tab allows the execution of script files consisting of register write, read, and delay commands, see Figure 10. These are plain text files on the PC, which are compiled via the GUI but executed by the E2 Microprocessor on the PE0002 board. The script language is documented separately in the "Script Language Reference" document, which can be downloaded with the PE0002 support package from the CML website. Control of the EV9720 does not require the use of script files.
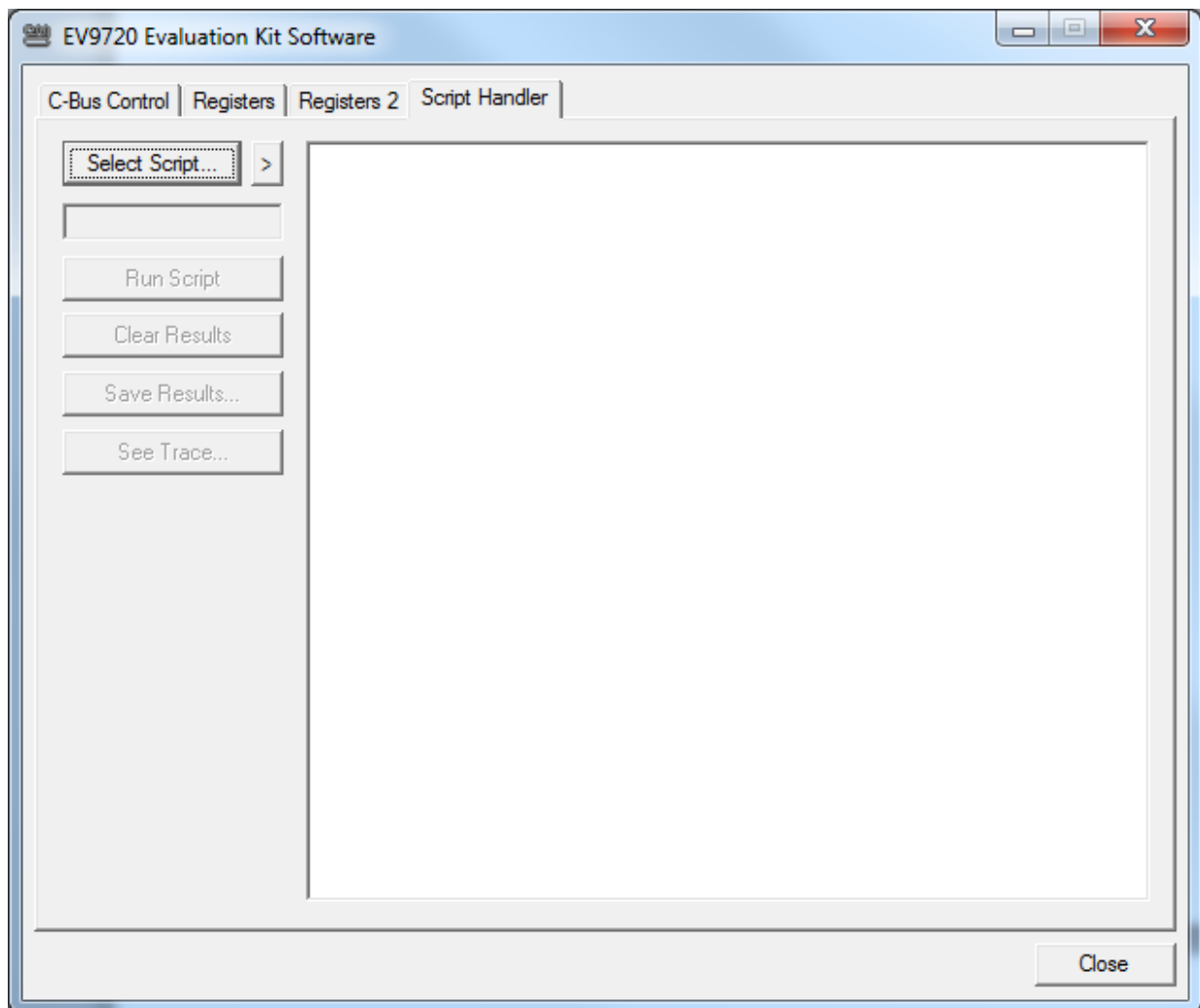
Figure 10 The Script Handler Tab

To select a script file, click on the 'Select Script' button. The Open File Dialog is displayed. Browse and select the script file. The folder that contains the script file will be the working folder of the script (i.e. all the files referenced in the script will be searched in this folder). Alternatively, select a script file from the recent files list. Click on the '>' button to display the list.

The results window displays the values returned by the script. These results can be saved to a text file or discarded by clicking on the 'Save Results' or 'Clear Results' buttons, respectively. When a script file is being executed the 'Run Script' button will change to become the 'Abort' button, the rest of the tab will be disabled and the other tabs cannot be selected.

After a script has finished running and when trace data is available, the 'See Trace…' button will be enabled. Up to 131072 C-BUS transactions can be logged in the PE0002 board. Click in the 'See Trace…' button to display the Trace dialog box. Note that the C-BUS transactions are only logged if the feature has been enabled in the script. See the "Script Language Reference" document for details.

7.3   Evaluation Tests

The EV9720 is intended to allow evaluation and demonstration of the CMX972 device. The following is a list of tests which can be performed, along with the typical EV9720 performance.

7.3.1   Quadrature IF Demodulator

7.3.1.1   I/Q Signals

Apply a LO signal (J3) of 90MHz, -10dBm and a RF signal (J5) of 45.002MHz, -53dBm. Observing the results on an oscilloscope, the baseband I/Q outputs (J8) should look like the results shown in Figure 11. From this trace the peak to peak voltage of the RXQ- pin is 0.56V (RXQ = 1.12V differential) so the gain of the CMX972 can be calculated as 58dB.

From Figure 11, the 180 degree phase relationship between the RXn- and RXn+ signals can be observed and the 90 degree phase relationship been I and Q channels is also apparent.
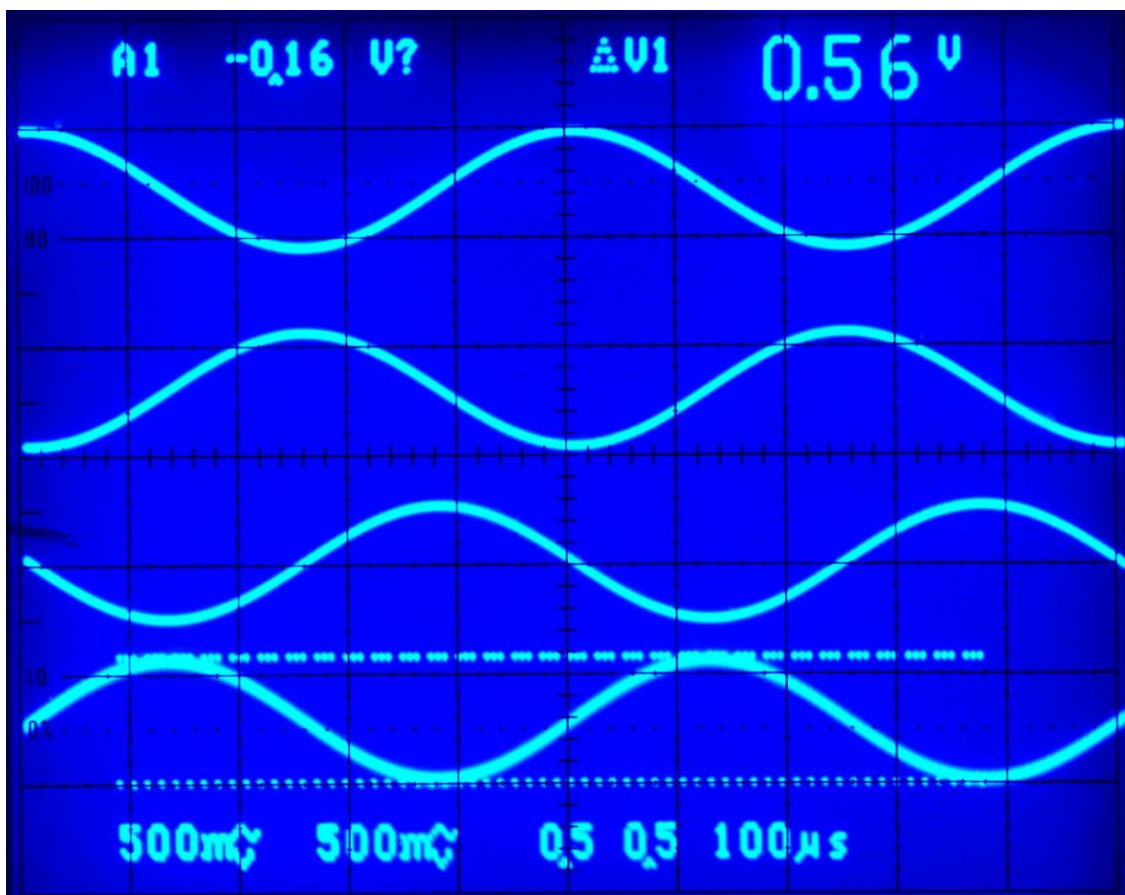

Figure 11 I/Q Output Signals

The signals, from bottom to top, are RXQ-, RXQ+, RXI-, RXI+

7.3.1.2   Noise Figure

By applying a –100dBm signal to the EV9720 receiver input (J5) it is easy to evaluate the system noise figure by measuring the signal to noise on either I/Q output.

For example, apply a LO signal (J3) of 90MHz, -10dBm and a RF signal (J5) of 45.002MHz, -100dBm. With these conditions the output I/Q signal is evaluated (Figure 12) and the noise figure can be calculated as follows (including an I/Q measurement correction factor of 3 dB):

$$\text{Noise figure} = \text{SNR dB} - (-174 \text{ dBm/Hz} - (-100 \text{ dBm})) - 3\text{dB}$$
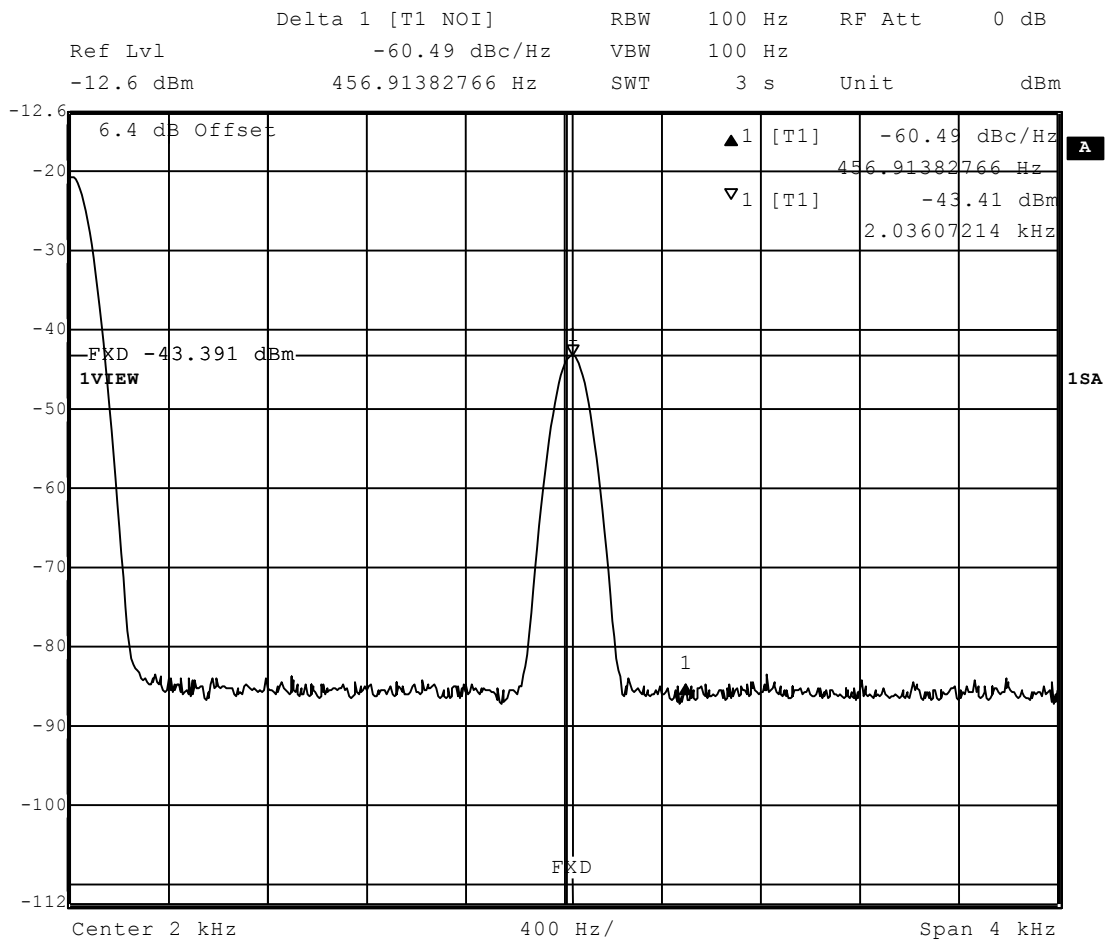$$= -60.5 + 74 - 3$$
$$= 10.5\text{dB}$$

Figure 12 I/Q Signal to Noise Measurement

7.4 Troubleshooting

The CMX972 is a complex RF system. If incorrectly programmed or modified, results will be at variance from datasheet performance. Please study the CMX972 datasheet, this manual and the associated schematics and layout drawings carefully when troubleshooting.

This section provides suggestions to help users resolve application issues they might encounter.

7.4.1 General

Error Observed	Possible Cause	Remedy
`'ES9700xx.exe'` software fails to run correctly and reports an error during start up.	Faulty USB port or cable.	Check USB cable to your PC.
	PE0002 or EV9720 is not powered up during start up.	Power up PE0002 (5.0V) and EV9720 (7.2V).
	Incorrect software for PE0002.	Contact: techsupport@cmlmicro.com
Programming data to EV9720 does not appear to work.	The data is being programmed to the wrong C-BUS port on PE0002.	Check whether EV9720 is connected to PE0002 Port 1 (J5) or Port 2 (J3) and ensure the correct window is used for programming data. (See PE0002 user manual for further information).

Table 6 Possible General Errors

7.4.2 Quadrature IF Demodulator Operation

Error Observed	Possible Cause	Remedy
No output from the demodulator.	The demodulator and/or the bias has not been enabled. C-BUS Rx enable ($1B, b1). C-BUS Bias enable ($1B, b4).	Set C-BUS Rx enable ($1B, b1='1') and set C-BUS Bias enable ($1B, b4='1').
	No LO signal applied.	Check LO signal is present at sufficient drive level.
	The wrong Rx divider ratio has been selected ($1B, b7)	Check CMX972 data sheet for details on register $1B to ensure correct divider ratio is selected.
	The wrong LO path has been selected.	Check CMX972 data sheet for details on LO connections (Table 13) to ensure correct divider ratio is selected.

Table 7 Possible Quadrature IF Demodulator Errors

7.4.3   PLL/VCO Operation

Error Observed	Possible Cause	Remedy
PLL does not lock. (Lock detect bit = '0').	VCO or PLL is not enabled. M and R Divider setting are incorrect.	Check values of PLL registers $2A to 2D. Check general control register $1B.
	VCO has been programmed to a frequency outside its operating range.	Check VCO control voltage on CMX972 signal DO (pin 13 or TP3). If the voltage is at either supply rail, try a different frequency and observe the effect.

Table 8 Possible PLL/VCO Errors

8   Performance Specification

8.1   Electrical Performance

8.1.1   Absolute Maximum Ratings
Exceeding these maximum ratings can result in damage to the Evaluation Kit.

	Min.	Max.	Units
Supply Voltage (V_{IN} - V_{SS})	0.0	8.4	V
Current into or out of V_{IN} and V_{SS} pins	0	+200	mA
Current into or out of any other connector pin	-20	+20	mA

8.1.2   Operating Limits
Correct operation of the EV9720 Evaluation Kit outside these limits is not implied.

	Notes	Min.	Max.	Units
Supply Voltage (V_{IN} - V_{SS})		3.6	7.6	V

8.1.3   Operating Characteristics

For the following conditions unless otherwise specified: V_{IN} - V_{SS} = 7.2V, T_{AMB} = +25°C.

	Notes	Min.	Typ.	Max.	Units
DC Parameters					
I_{DD} (CMX972 Powersaved)	1	–	1.5	–	mA
I_{DD} (CMX972 Demodulator, PLL and VCO)	1	–	28	–	mA
AC Parameters					
Demodulator					
Input					
Frequency Range		20	–	300	MHz
I/Q Output Signal					
Differential Amplitude	3	–	440	–	mVp-p
DC Level		–	1.6	–	Vdc
45MHz Operation					
Gain	4	56	57	58	dB
Noise Figure		–	10	–	dB
Input Third Order Intercept Point		–	-15	–	dBm
LO Input					
Frequency Range	5	40	–	2000	MHz
Input Level		–	-10	–	dBm
Frequency Reference (U1)					
Frequency		–	19.2	–	MHz
Stability		–	1.5	–	ppm
C-BUS Interface					
See CMX972 data sheet					

Notes: 1. Total PCB current consumption, not current consumption of the CMX972 alone.
3. 45MHz input at -60dBm at J5.
4. Gain is measured from an unmatched IFIN to differential voltage measured at output of I or Q channels.
5. Local oscillator input frequency twice or four times the required operating frequency.

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