Application Brief

Using the MSP430FR5969 EVM to Program the LMX2594 PLL Synthesizer

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This brief covers on how to interface RF synthesizers with Microcontroller. In general, USB2ANY is used for this interfacing. But USB2ANY has some limitations namely low frequency SPI write and wait-time between two SPI writes in burst mode. For some applications, this low frequency SPI and wait-time might not be acceptable. For this brief, register writes present in the script shared is applicable for LMX2594 Synthesizer. In general, same approach can be used for all RF synthesizers.

Components Required:

- LMX2594EVM
- USB2ANY with 10-pin JTAG cable
- TICS Pro GUI (Downloadable from ti.com)
- Code Composer Studio (CCS) – Latest Version downloadable from ti.com
- MSP430W are (Downloadable from ti.com)
- LMX2594_MSP430 Script (extractable from TI Drive)
- Programmable DC Power Supply (Output should be capable to give 3.3V at 0.6A current limit)
- 40GHz SMA Cable (Optional)
- Spectrum Analyzer/Phase Noise Analyzer (Optional)
- 100MHz Wenzel/Clean reference input source (optional if crystal is mounted on the LMX2594 EVM)

Test Setup:

Connect the MSP430FRxxxx EVM to the LMX2594EVM through the JTAG connection pins as per the figure below:

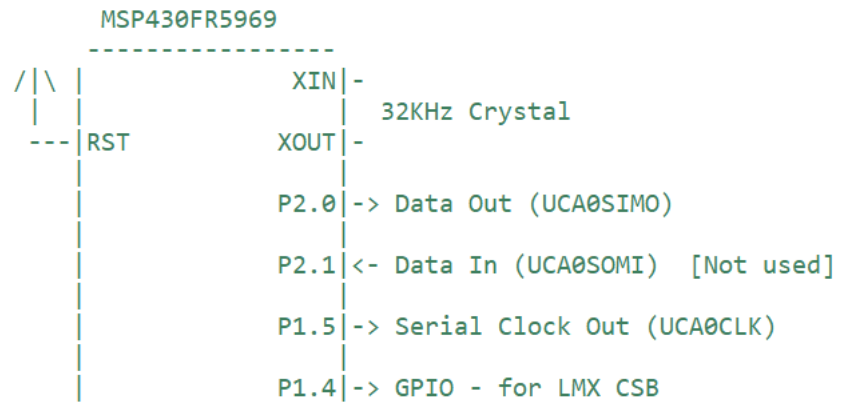

Figure 1. MSP430FR5969 Pins on EVM

The USB2ANY 10-pin adapter cable pinout is shown below for reference. The connections are summarized in the following table:

Table 1. Mapping of JTAG to MSP EVM pins

MCU Pins	JTAG Adapter Pinout	LMX2594EVM Header
P1.4 GPIO	SPI_CS, Pin 2	Right Row, Header 1

Table 1. Mapping of JTAG to MSP EVM pins (continued)

MCU Pins	JTAG Adapter Pinout	LMX2594EVM Header
GND	GND, Pin 6	Right Row, Header 3
P1.5 GPIO	SPI_SCLK, Pin 8	Right Row, Header 4
P2.0 GPIO	SPI_SIMO, Pin 4	Right Row, Header 2

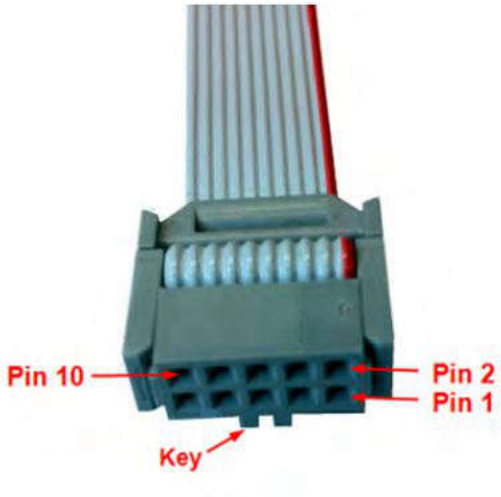

Figure 2. 10-Pin Cable Pinouts

Table 2. 10-Pin Cable Pinouts

Schematic Pin Number	Cable Pin Number	Signals Available
J4-10	1	GPIO7, PWM0, INT2, OW2, OW5
J4-9	2	GPIO6, PWM1, RFFE:SCLK, SPI:CS, INT1, µWIRE:CS, OW1
J4-8	3	GPIO5, SPI:SOMI, UART:RXD, µWIRE:SOMI
J4-7	4	GPIO4, SPI:SIMO, UART:TXD, µWIRE:SOMI
J4-6	5	3.3VEXT
J4-5	6	GND
J4-4	7	GPIO3, PWM2, RFFE:SDATA, INT0
J4-3	8	GPIO2, ES:DOUT, SPI:SCLK, µWIRE:SCLK

Procedure:

1. Connect the USB2ANY to a host PC/laptop with the 10-pin adapter cable connected to the LMX2594EVM.
2. Supply power to the LMX2594EVM with the output set to 3.3V and 0.6A current limit.
3. If a 100MHz crystal is not mounted on the EVM, then use a 100MHz Wenzel to give a reference input to the EVM through the OSCINP pin. A signal generator set to 10dBm at 100MHz also works here.
4. With the TICS Pro GUI installed, select the LMX2594 device under the PLL+VCO section. Set the desired output frequency in full assist mode as per the EVM instructions given here.
5. In the “Raw Registers” section, record the following register values:

Table 3. LMX2594 Register Mapping

Register Name	Corresponding Function
R36	N Divider
R38	Denominator
R39	
R42	Numerator
R43	

Table 3. LMX2594 Register Mapping (continued)

Register Name	Corresponding Function
R45	OUT_ISET
R20	VCO_SEL_FORCE
R19	VCO_CAPCTRL
R16	VCO_DACISET

6. Open CCS and enter the recorded values of the register into the LMX_MSP430 script shared via TI Drive as shown below. You can use the shared excel sheet on TI Drive to quickly copy and paste the writeLMX commands:

config_LMX_v1.c

```
466 #if 1
467
468             __delay_cycles(2000);
469
470 //            writeLMX(0x0F,0x065F);
471 //            // Call function to lock at 7 GHz
472             writeLMX(42,0x0000);
473             writeLMX(43,0x0000);
474             writeLMX(39,0xDA80);
475             writeLMX(38,0xFD51);
476             writeLMX(45,0xC0DF);
477             writeLMX(36,0x0046);
478             writeLMX(20,0xF448);
479             writeLMX(19,0x2725);
480 //            __delay_cycles(5);
481
482 //            writeLMX(36,0x0098);
483             writeLMX(0x0F,0x065F);
484             writeLMX(16,0x00AE);
485             __delay_cycles(5);
486             writeLMX(0x0F,0x064F);
487
488
```

Figure 3. Sequence of Register Writes for Switching Between Two Frequencies.

7. Remove the USB2ANY connection from the laptop/PC and connect the MSP430 to the LMX2594EVM as per the Test Setup section given in this document.
8. Run the CCS script and check the device LED to verify the lock state of the PLL Synthesizer to the desired output frequency.

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